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Service Manual

2.7L Diesel Service Manual

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JEEP®

SERVICE MANUAL

2002 WG
GRAND CHEROKEE

DaimlerChrysler Corporation reserves the right to make changes in design or to make additions to or improvements in its products without imposing any obligations upon itself to install them on its products previously manufactured.

FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information describing the operation and use of standard and optional equipment is included in the Owner's Manual provided with the vehicle.

Information in this manual is divided into groups. These groups contain description, operation, diagnosis, testing, adjustments, removal, installation, disassembly, and assembly procedures for the systems and components. To assist in locating a group title page, use the Group Tab Locator by clicking to the following page. The first page of the group has a contents section that lists major topics within the group.

A Service Manual Comment form is included at the rear of this manual. Use the form to provide DaimlerChrysler Corporation with your comments and suggestions.

Tightening torques are provided as a specific value throughout this manual. This value represents the midpoint of the acceptable engineering torque range for a given fastener application. These torque values are intended for use in service assembly and installation procedures using the correct OEM fasteners. When replacing fasteners, always use the same type (part number) fastener as removed.

DaimlerChrysler Corporation reserves the right to change testing procedures, specifications, diagnosis, repair methods, or vehicle wiring at any time without prior notice or incurring obligation.

GROUP TAB LOCATOR

INTRODUCTION

TABLE OF CONTENTS

BODY CODE PLATE

DESCRIPTION

A metal Body Code plate is located in the engine compartment and attached to the top of the right frame rail. The information listed on the plate (Fig. 1) is used for manufacturing and service purposes.

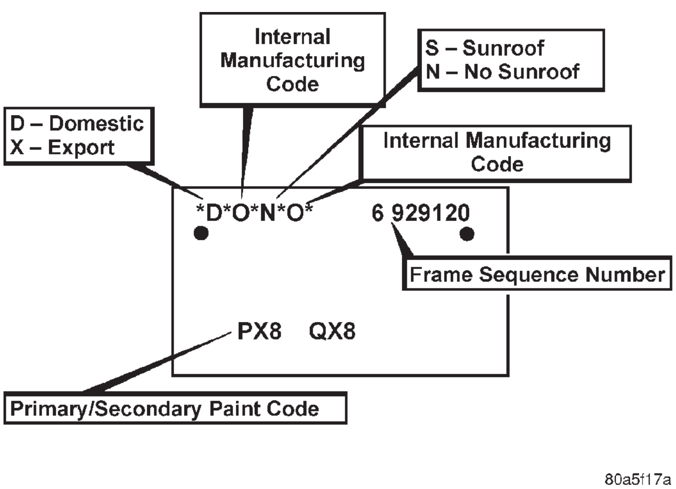


Fig. 1 Body Code Plate

FASTENER IDENTIFICATION

DESCRIPTION

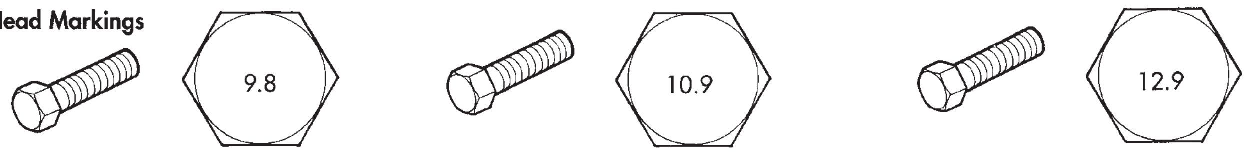
The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts (Fig. 2) and (Fig. 3).

FASTENER IDENTIFICATION (Continued)

Bolt Markings and Torque - Metric

Commercial Steel Class: 9.8, 10.9, 12.9

Bolt Head Markings

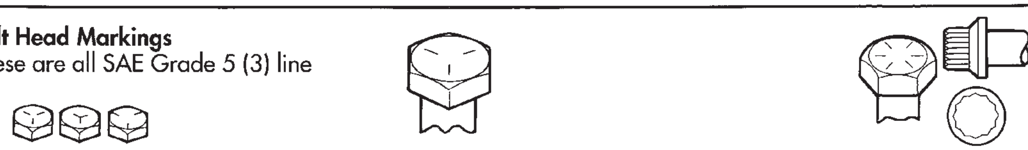


Body Size Diam.	9.8 Torque				10.9 Torque				12.9 Torque			
	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35	70	50	55	40
12	70	55	55	40	105	75	80	60	125	95	100	75
14	115	85	90	65	160	120	125	95	195	145	150	110
16	180	130	140	100	240	175	190	135	290	210	220	165
18	230	170	180	135	320	240	250	185	400	290	310	230

Bolt Markings and Torque Values - U.S. Customary

SAE Grade Number: 5, 8

Bolt Head Markings
These are all SAE Grade 5 (3) line



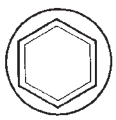
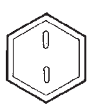
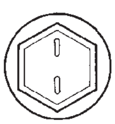
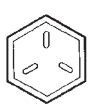
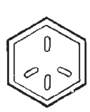
Body Size	Bolt Torque - Grade 5 Bolt				Bolt Torque - Grade 8 Bolt			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40	30
- 24	40	30	35	25	60	45	45	35
7/16 - 14	60	45	45	35	90	65	65	50
- 20	65	50	55	40	95	70	75	55
1/2 - 13	95	70	75	55	130	95	100	75
- 20	100	75	80	60	150	110	120	90
9/16 - 12	135	100	110	80	190	140	150	110
- 18	150	110	115	85	210	155	170	125
5/8 - 11	180	135	150	110	255	190	205	150
- 18	210	155	160	120	290	215	230	170
3/4 - 10	325	240	255	190	460	340	365	270
- 16	365	270	285	210	515	380	410	300
7/8 - 9	490	360	380	280	745	550	600	440
- 14	530	390	420	310	825	610	660	490
1 - 8	720	530	570	420	1100	820	890	660
- 14	800	590	650	480	1200	890	960	710

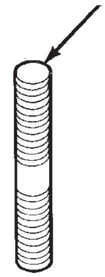
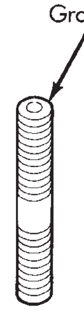
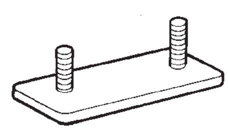
80bdbd8c

Fig. 2 FASTENER IDENTIFICATION

FASTENER IDENTIFICATION (Continued)

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class
Hexagon head bolt	 Bolt head No. 4 — 5 — 6 — 7 — 8 — 9 — 10 — 11 —	4T 5T 6T 7T 8T 9T 10T 11T
	 No mark	4T
Hexagon flange bolt w/washer hexagon bolt	 No mark	4T
Hexagon head bolt	 Two protruding lines	5T
Hexagon flange bolt w/washer hexagon bolt	 Two protruding lines	6T
Hexagon head bolt	 Three protruding lines	7T
Hexagon head bolt	 Four protruding lines	8T

	Mark	Class
Stud bolt	No mark 	4T
	Grooved 	6T
Welded bolt		4T

95IN-4

Fig. 3 FASTENER STRENGTH

FASTENER USAGE

DESCRIPTION - FASTENER USAGE

WARNING: USE OF AN INCORRECT FASTENER MAY RESULT IN COMPONENT DAMAGE OR PERSONAL INJURY.

Fasteners and torque specifications references in this Service Manual are identified in metric and SAE format.

During any maintenance or repair procedures, it is important to salvage all fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification must be used.

THREADED HOLE REPAIR

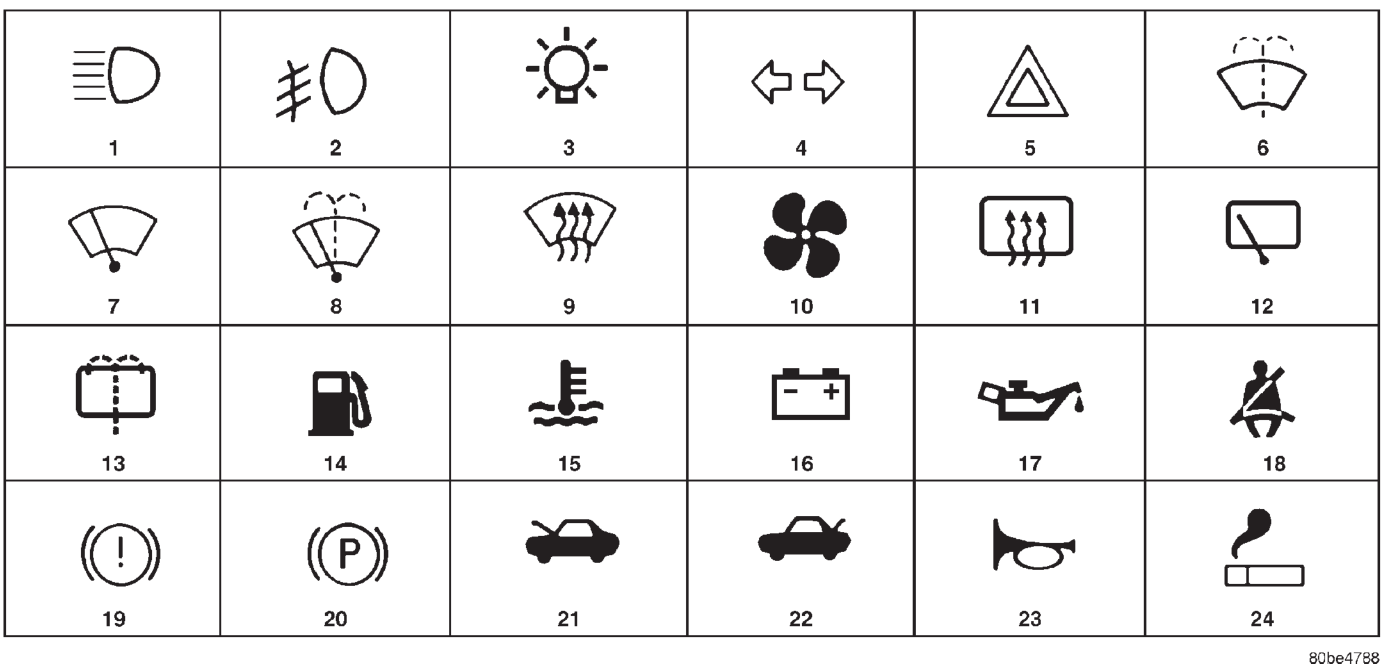
DESCRIPTION - THREADED HOLE REPAIR

Most stripped threaded holes can be repaired using a Helicoil®. Follow the vehicle or Helicoil® recommendations for application and repair procedures.

INTERNATIONAL SYMBOLS

DESCRIPTION - INTERNATIONAL SYMBOLS

The graphic symbols illustrated in the following International Control and Display Symbols Chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.



INTERNATIONAL SYMBOLS

1	High Beam	13	Rear Window Washer
2	Fog Lamps	14	Fuel
3	Headlamp, Parking Lamps, Panel Lamps	15	Engine Coolant Temperature
4	Turn Warning	16	Battery Charging Condition
5	Hazard Warning	17	Engine Oil
6	Windshield Washer	18	Seat Belt
7	Windshield Wiper	19	Brake Failure
8	Windshield Wiper and Washer	20	Parking Brake
9	Windscreen Demisting and Defrosting	21	Front Hood
10	Ventilating Fan	22	Rear hood (Decklid)
11	Rear Window Defogger	23	Horn
12	Rear Window Wiper	24	Lighter

METRIC SYSTEM

DESCRIPTION

The metric system is based on quantities of one, ten, one hundred, one thousand and one million.

The following chart will assist in converting metric units to equivalent English and SAE units, or vise versa.

CONVERSION FORMULAS AND EQUIVALENT VALUES

MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
in-lbs	x 0.11298	= Newton Meters (N·m)	N·m	x 8.851	= in-lbs
ft-lbs	x 1.3558	= Newton Meters (N·m)	N·m	x 0.7376	= ft-lbs
Inches Hg (60° F)	x 3.377	= Kilopascals (kPa)	kPa	x 0.2961	= Inches Hg
psi	x 6.895	= Kilopascals (kPa)	kPa	x 0.145	= psi
Inches	x 25.4	= Millimeters (mm)	mm	x 0.03937	= Inches
Feet	x 0.3048	= Meters (M)	M	x 3.281	= Feet
Yards	x 0.9144	= Meters	M	x 1.0936	= Yards
mph	x 1.6093	= Kilometers/Hr. (Km/h)	Km/h	x 0.6214	= mph
Feet/Sec	x 0.3048	= Meters/Sec (M/S)	M/S	x 3.281	= Feet/Sec
mph	x 0.4470	= Meters/Sec (M/S)	M/S	x 2.237	= mph
Kilometers/Hr. (Km/h)	x 0.27778	= Meters/Sec (M/S)	M/S	x 3.600	Kilometers/Hr. (Km/h)

COMMON METRIC EQUIVALENTS

1 inch = 25 Millimeters	1 Cubic Inch = 16 Cubic Centimeters
1 Foot = 0.3 Meter	1 Cubic Foot = 0.03 Cubic Meter
1 Yard = 0.9 Meter	1 Cubic Yard = 0.8 Cubic Meter
1 Mile = 1.6 Kilometers	

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton- meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.) (Fig. 4).

METRIC SYSTEM (Continued)

in-lbs to N•m

in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966

N•m to in-lbs

N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb
.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882
.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584
.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287
.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989
1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691
1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393
1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096
1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798
1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500
2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202
2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.5	163.7458
2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714
2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970
2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225
3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480
3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736
3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247
3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759
3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	24	212.4270
4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781

ft-lbs to N•m

ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8888
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820

N•m to ft-lbs

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425
2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801
3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177
4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552
5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928
6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303
7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679
8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545
9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430
10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806
11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181
12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557
.13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933
14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308
15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684
16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060
17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435
18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811
19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187
20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562

in. to mm

in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146
.20	5.080	.40	10.160	.60	15.240	.80	20.320	1.00	25.400

mm to in.

mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465
.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504
.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898
.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937

J901N-10

Fig. 4 METRIC CONVERSION CHART

TORQUE REFERENCES

DESCRIPTION

Individual Torque Charts appear within many or the Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts (Fig. 5).

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N•m	kgf-cm	ft-lbf	N•m	kgf-cm	ft-lbf
4T	6	1	5	55	48 in.-lbf	6	60	52 in.-lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.-lbf	7.5	75	65 in.-lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.-lbf	9	90	78 in.-lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

Fig. 5 TORQUE SPECIFICATIONS

VEHICLE EMISSION CONTROL INFORMATION (VECI)

DESCRIPTION

All vehicles are equipped with a combined vehicle emission control information (VECI) label(s). The label is located in the engine compartment on the vehicle hood (Fig. 6). Two labels are used for vehicles built for sale in the country of Canada.

The VECI label(s) contain the following:

- Engine family and displacement
- Evaporative family
- Emission control system schematic
- Certification application
- Spark plug and gap

The label also contains an engine vacuum schematic. There are unique labels for vehicles built for sale in the state of California and the country of Canada. Canadian labels are written in both the English and French languages. These labels are permanently attached and cannot be removed without defacing information and destroying label.

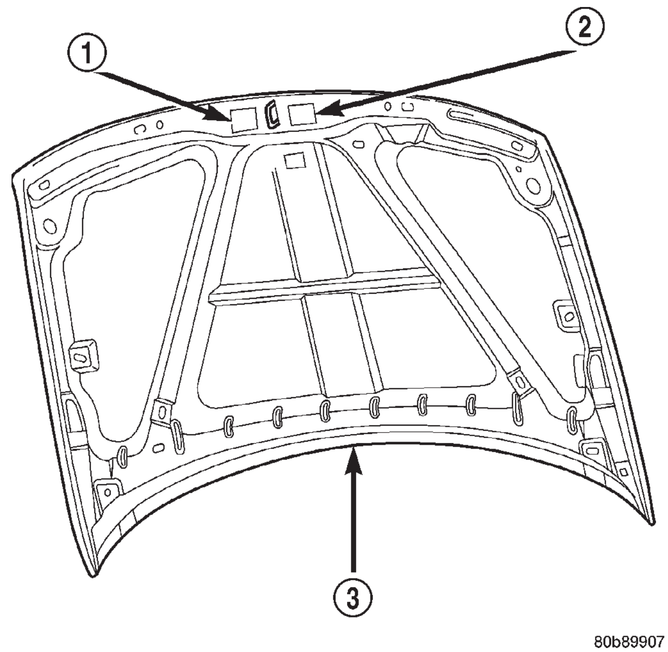


Fig. 6 VECI Label Location

1 - VECI LABEL (CANADIAN)
2 - VECI LABEL
3 - HOOD

VEHICLE IDENTIFICATION NUMBER

DESCRIPTION

The Vehicle Identification Number (VIN) plate is attached to the top left side of the instrument panel. The VIN contains 17 characters that provide data concerning the vehicle. Refer to the decoding chart to determine the identification of a vehicle.

VEHICLE IDENTIFICATION NUMBER DECODING CHART

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = United States
2	Make	J = Jeep
3	Vehicle Type	4 = MPV
4	Gross Vehicle Weight Rating	G = 5001-6000 lbs.
5	Vehicle Line	X = Grand Cherokee 4X2 (LHD) W = Grand Cherokee 4X4 (LHD)
6	Series	3 = Sport 4 = Laredo 5 = Limited 6 = Overland
7	Body Style	8 = 4dr Sport Utility
8	Engine	S = 4.0 Liter Gasoline N = 4.7 Liter Gasoline
9	Check Digit	0 through 9 or X
10	Model Year	2=2002
11	Assembly Plant	C = Jefferson Assembly
12 thru 17	Vehicle Build Sequence	

VEHICLE SAFETY CERTIFICATION LABEL

DESCRIPTION

A vehicle safety certification label (Fig. 7) is attached to every DaimlerChrysler Corporation vehicle. The label certifies that the vehicle conforms to all applicable Federal Motor Vehicle Safety Standards. The label also lists:

- Month and year of vehicle manufacture.
- Gross Vehicle Weight Rating (GVWR). The gross front and rear axle weight ratings (GAWR's) are based on a minimum rim size and maximum cold tire inflation pressure.
- Vehicle Identification Number (VIN).
- Type of vehicle.
- Type of rear wheels.
- Bar code.
- Month, Day and Hour (MDH) of final assembly.
- Paint and Trim codes.
- Country of origin.

The label is located on the driver-side door shut-face.

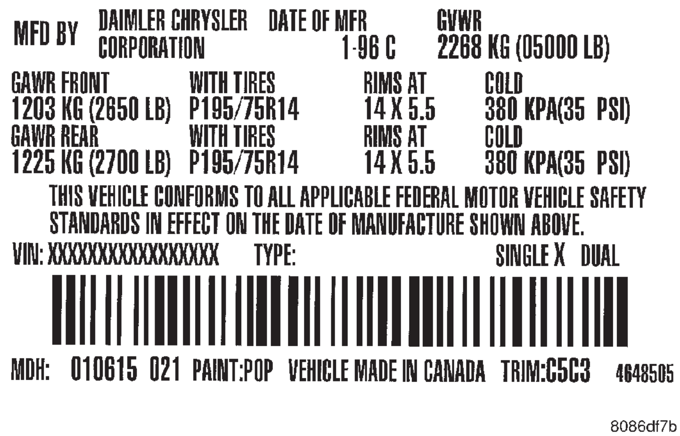


Fig. 7 VEHICLE SAFETY CERTIFICATION LABEL - TYPICAL

LUBRICATION & MAINTENANCE

TABLE OF CONTENTS

LUBRICATION & MAINTENANCE

SPECIFICATIONS - FLUID CAPACITIES

DESCRIPTION	SPECIFICATION
FUEL TANK	20 U.S. Gallons (76 Liters)****
Engine Oil - with Filter - 2.7L Diesel	6.5L (6.9 qts.)
Engine Oil - with Filter - 4.0L	5.7 L (6.0 qts.)
Engine Oil - with Filter - 4.7L	5.7 L (6.0 qts.)
Cooling System - 2.7L Diesel	14.2L (15 qts.)***
Cooling System - 4.0L	14.1 L (15 qts.)***
Cooling System - 4.7L	13.7 L (14.5 qts.)***
AUTOMATIC TRANSMISSION	
Service Fill - 42RE	3.8 L (4.0 qts.)
Service Fill - 545RFE	2WD - 5.2 L (11 pts.) 4WD - 6.2 L (13 pts.)
O-haul Fill - 42RE	9.1-9.5 L (19-20 pts.)
O-haul Fill - 545RFE	13.33 L (28.0 pts.)
Dry fill capacity Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. (Refer to appropriate 21 - TRANSMISSION/TRANSAXLE/ AUTOMATIC/FLUID - STANDARD PROCEDURE).	
TRANSFER CASE	
NV242	1.35L (2.85 pts.)
NV247	1.6L (3.4 pts.)
FRONT AXLE ± 0.3 L (1 oz.)	
186 FBI (Model 30)	1.18 L (2.5 pts.)*
* With Vari-Lok add 0.07 L (2.5 oz.) of Friction Modifier.	
REAR AXLE ± 0.3 L (1 oz.)	
198 RBI (Model 35)	1.66 L (3.5 pts.)*
226 RBA (Model 44)	2.24 L (4.75 pts.)**
* With Trac-lok add 0.07 L (2.5 oz.) of Friction Modifier.	
** With Trac-lok or Vari-Lok, add 0.07 L (2.5 oz.) of Friction Modifier.	
*** Includes 0.9L (1.0 qts.) for coolant reservoir.	
****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.	

INTERNATIONAL SYMBOLS

DESCRIPTION

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations (Fig. 1).

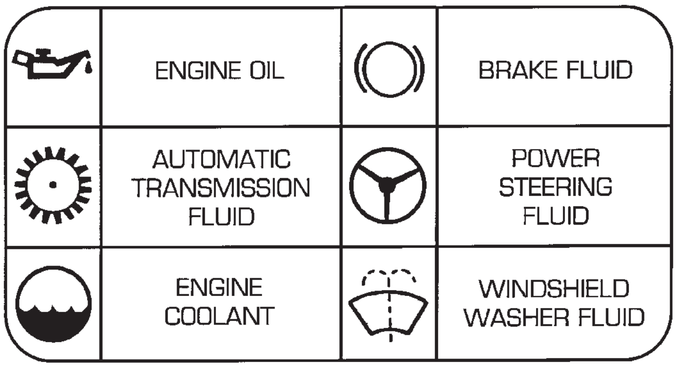


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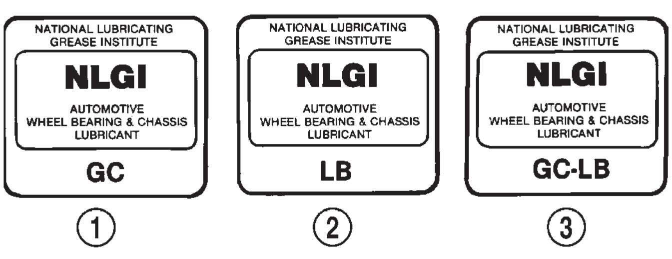
Fig. 1 INTERNATIONAL SYMBOLS

PARTS & LUBRICANT RECOMMENDATION

STANDARD PROCEDURE - PARTS & LUBRICANT RECOMMENDATIONS

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 2) on the label. At the bottom NLGI symbol is the usage and quality identification letters. Wheel bearing lubricant is identified by the letter “G”. Chassis lubricant is identified by the latter “L”. The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.



9200-7

Fig. 2 NLGI Symbol

1 - WHEEL BEARINGS
2 - CHASSIS LUBRICATION
3 - CHASSIS AND WHEEL BEARINGS

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

FLUID TYPES

DESCRIPTION

DESCRIPTION - ENGINE COOLANT

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300) deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

It’s overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol’s freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

FLUID TYPES (Continued)

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

DESCRIPTION - ENGINE COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified (non-HOAT or other HOAT), may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.

COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

Pure Water-Water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

100 percent Ethylene-Glycol-The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22°C (-8°F).

50/50 Ethylene-Glycol and Water-Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

COOLANT SELECTION AND ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or

FLUID TYPES (Continued)

becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 3).

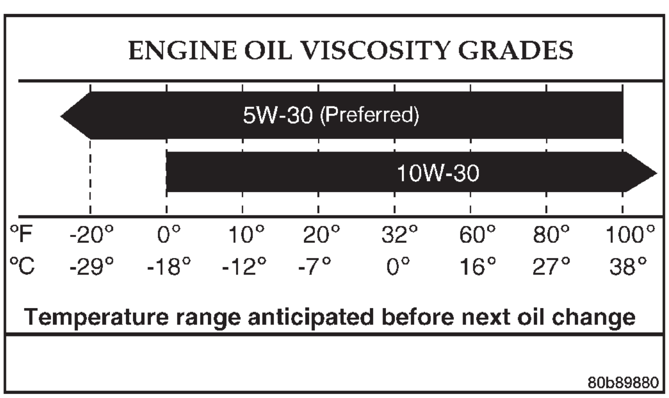


Fig. 3 Temperature/Engine Oil Viscosity - 4.7L

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 4).

Fig. 4 API SYMBOL

DESCRIPTION - ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These oils are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 5).

FLUID TYPES (Continued)

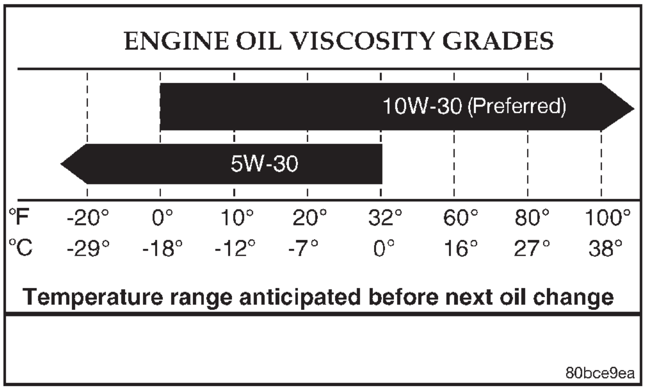


Fig. 5 Temperature/Engine Oil Viscosity - 4.0L

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 6).

Fig. 6 API Symbol

DESCRIPTION

A multi-purpose, hypoid gear lubricant which conforms to MIL-L-2105C and API GL 5 quality specifications should be used. Mopar Hypoid Gear Lubricant conforms to these specifications.

FRONT AXLE

- Lubricant is SAE 75W-140 SYNTHETIC.

REAR AXLE

- Lubricant is a thermally stable SAE 80W-90 gear lubricant.
- Lubricant for heavy-duty or trailer tow use is SAE 75W-140 SYNTHETIC.

NOTE: Trac-lok® and Vari-lok® equipped axles require a friction modifier be added to the lubricant.

DESCRIPTION - TRANSFER CASE - NV242

Recommended lubricant for the NV242 transfer case is Mopar® ATF+4, type 9602 Automatic Transmission Fluid.

DESCRIPTION - TRANSFER CASE - NV247

Mopar® Transfer Case Lubricant (P/N 05016796) is the only lubricant recommended for the NV247 transfer case.

DESCRIPTION - AUTOMATIC TRANSMISSION FLUID

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

Mopar® ATF +4, type 9602, Automatic Transmission Fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF +4, type 9602, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

FLUID TYPES (Continued)

DESCRIPTION - ENGINE OIL - DIESEL ENGINES

Use only Diesel Engine Oil meeting standard **MIL-2104C** or API Classification **CD or higher** or **CCML D4, D5**.

SAE VISCOSITY GRADE

CAUTION: Low viscosity oils must have the proper API quality or the CCMC G5 designation.

To assure of properly formulated engine oils, it is recommended that SAE Grade 10W-40 engine oils that meet Chrysler material standard MS-6395, be used. European Grade 10W-40 oils are also acceptable.

Oils of the SAE 5W-40 or 8W-80 grade number are preferred when minimum temperatures consistently fall below -12°C.

OPERATION - AUTOMATIC TRANSMISSION FLUID

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

FLUID FILL/CHECK LOCATIONS

INSPECTION - FLUID FILL/CHECK LOCATIONS

The fluid fill/check locations and lubrication points are located in each applicable group.

MAINTENANCE SCHEDULES

DESCRIPTION

″Maintenance Schedule Information not included in this section, is located in the appropriate Owner's Manual.″

LIFT POINTS

STANDARD PROCEDURE - HOISTING AND JACKING RECOMMENDATIONS

FLOOR JACK

When properly positioned, a floor jack can be used to lift a WJ vehicle (Fig. 7). Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

CAUTION: Do not attempt to lift a vehicle with a floor jack positioned under:

- **An axle tube.**
- **Aluminum differential.**
- **A body side sill.**
- **A steering linkage component.**
- **A drive shaft.**
- **The engine or transmission oil pan.**
- **The fuel tank.**
- **A front suspension arm.**

HOIST

A vehicle can be lifted with:

- A single-post, frame-contact hoist.
- A twin-post, chassis hoist.
- A ramp-type, drive-on hoist.

NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly (Fig. 7).

WARNING: THE HOISTING AND JACK LIFTING POINTS PROVIDED ARE FOR A COMPLETE VEHICLE. WHEN A CHASSIS OR DRIVETRAIN COMPONENT IS REMOVED FROM A VEHICLE, THE CENTER OF GRAVITY IS ALTERED MAKING SOME HOISTING CONDITIONS UNSTABLE. PROPERLY SUPPORT OR SECURE VEHICLE TO HOISTING DEVICE WHEN THESE CONDITIONS EXIST.

LIFT POINTS (Continued)

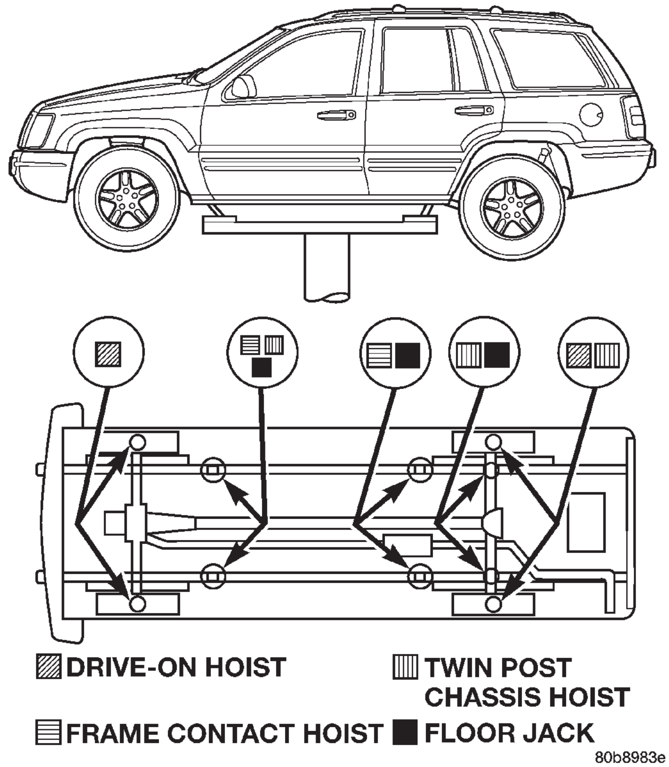


Fig. 7 Correct Vehicle Lifting Locations

JUMP STARTING

STANDARD PROCEDURE - JUMP STARTING

WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN GROUP 8A, BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS. DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT. DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR. DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS BELOW THE TOP OF LEAD PLATES. DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE. DO NOT USE OPEN FLAME NEAR BATTERY. REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT. WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.

CAUTION: When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.

TO JUMP START A DISABLED VEHICLE:

(1) Raise hood on disabled vehicle and visually inspect engine compartment for:

- Battery cable clamp condition, clean if necessary.
- Frozen battery.
- Yellow or bright color test indicator, if equipped.
- Low battery fluid level.
- Generator drive belt condition and tension.
- Fuel fumes or leakage, correct if necessary.

CAUTION: If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.

(2) When using another vehicle as a booster source, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.

(3) On disabled vehicle, place gear selector in park or neutral and set park brake. Turn off all accessories.

(4) Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result. Review all warnings in this procedure.

(5) On disabled vehicle, connect RED jumper cable clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground as close to the ground cable attaching point as possible (Fig. 8).

(6) Start the engine in the vehicle which has the booster battery, let the engine idle a few minutes, then start the engine in the vehicle with the discharged battery.

CAUTION: Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will overheat and could fail.

(7) Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 min.), before cranking again.

JUMP STARTING (Continued)

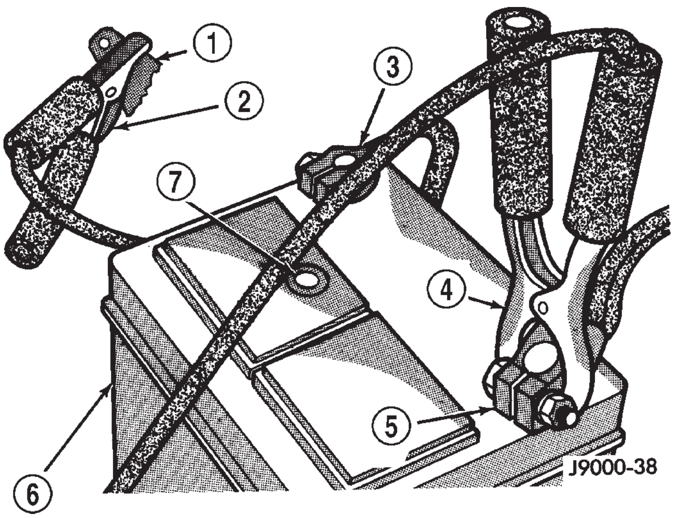


Fig. 8 Jumper Cable Clamp Connections

1 - ENGINE GROUND
2 - NEGATIVE JUMPER CABLE
3 - BATTERY NEGATIVE CABLE
4 - POSITIVE JUMPER CABLE
5 - BATTERY POSITIVE CABLE
6 - BATTERY
7 - TEST INDICATOR

DISCONNECT CABLE CLAMPS AS FOLLOWS:

• Disconnect BLACK cable clamp from engine ground on disabled vehicle.

• When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal. Disconnect RED cable clamp from battery positive terminal.

• Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

EMERGENCY TOW HOOKS

DESCRIPTION

WARNING: REMAIN AT A SAFE DISTANCE FROM A VEHICLE THAT IS BEING TOWED VIA ITS TOW HOOKS. THE TOW STRAPS/CHAINS COULD BREAK AND CAUSE SERIOUS INJURY.

Some Jeep vehicles are equipped with front emergency tow hooks (Fig. 9). The tow hooks should be used for **EMERGENCY**purposes only.

CAUTION: DO NOT use emergency tow hooks for tow truck hook-up or highway towing.

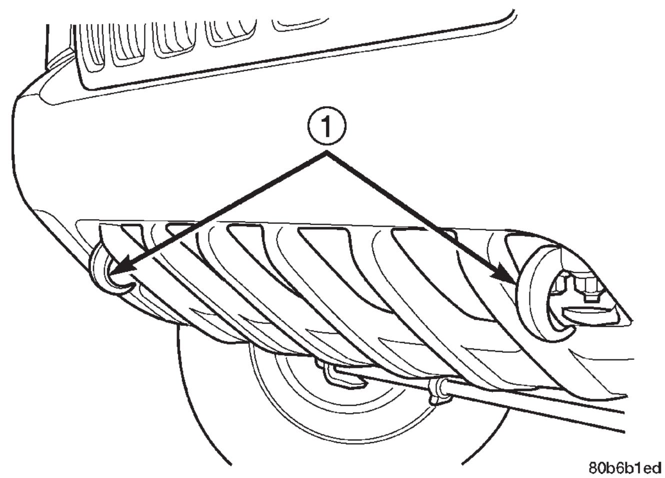


Fig. 9 Emergency Tow Hooks

1 - TOW HOOK

TOWING

STANDARD PROCEDURE - TOWING RECOMMENDATIONS

A vehicle equipped with SAE approved wheel lift-type towing equipment can be used to tow WJ vehicles. When towing a 4WD vehicle using a wheel-lift towing device, use tow dollies under the opposite end of the vehicle. A vehicle with flatbed device can also be used to transport a disabled vehicle (Fig. 10).

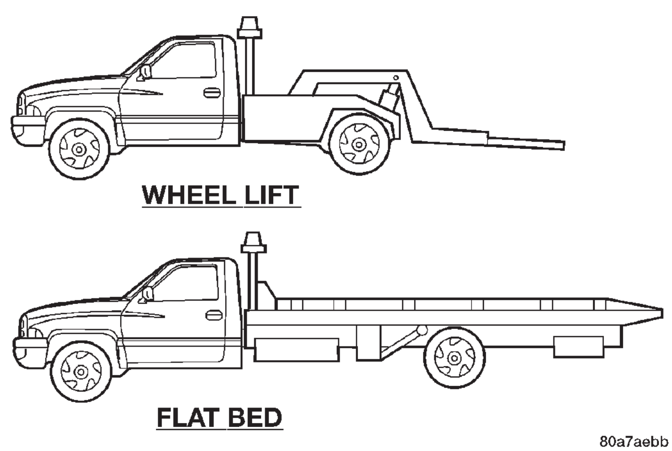


Fig. 10 Tow Vehicles With Approved Equipment

SAFETY PRECAUTIONS

CAUTION: The following safety precautions must be observed when towing a vehicle:

• Secure loose and protruding parts.

• Always use a safety chain system that is independent of the lifting and towing equipment.

TOWING (Continued)

• Do not allow towing equipment to contact the disabled vehicle's fuel tank.
• Do not allow anyone under the disabled vehicle while it is lifted by the towing device.
• Do not allow passengers to ride in a vehicle being towed.
• Always observe state and local laws regarding towing regulations.
• Do not tow a vehicle in a manner that could jeopardize the safety of the operator, pedestrians or other motorists.
• Do not attach tow chains, T-hooks, or J-hooks to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.
• Do not tow a heavily loaded vehicle. Use a flat-bed device to transport a loaded vehicle.

TWO-WHEEL-DRIVE VEHICLE TOWING

DaimlerChrysler Corporation recommends that a vehicle be towed with the rear end lifted, whenever possible.

WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION (AUTOMATIC TRANSMISSION) OR A FORWARD DRIVE GEAR (MANUAL TRANSMISSION).

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

TWO WHEEL DRIVE TOWING-REAR END LIFTED

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

2WD vehicles can be towed with the front wheels on the surface for extended distances at speeds not exceeding 48 km/h (30 mph).

(1) Attach wheel lift device to rear wheels.
(2) Place the transmission in neutral.
(3) Raise vehicle to towing position.
(4) Attach safety chains. Route chains so not to interfere with tail pipe when vehicle is lifted.
(5) Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(6) Secure steering wheel in straight ahead position with a clamp device designed for towing.
(7) Place transmission in park.

TWO WHEEL DRIVE TOWING-FRONT END LIFTED

CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.

(1) Attach wheel lift device to rear wheels.
(2) Place the transmission in neutral.
(3) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
(4) Attach wheel lift device to front wheels and raise vehicle to towing position.
(5) Attach the safety chains.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(6) Turn the ignition switch to the OFF position to unlock the steering wheel.
(7) Secure steering wheel in straight ahead position with a clamp device designed for towing.
(8) Place transmission in park.

FOUR-WHEEL-DRIVE VEHICLE TOWING

DaimlerChrysler Corporation recommends that a 4WD vehicle be transported on a flat-bed device. A Wheel-lift device can be used provided **the trailing wheels are off the ground and positioned in tow dollies.**

WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION.

CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.

FOUR WHEEL DRIVE TOWING—REAR END LIFTED

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

(1) Attach wheel lift device to front wheels.
(2) Place the transmission in neutral.
(3) Raise the front of the vehicle off the ground and install tow dollies under front wheels.
(4) Attach wheel lift device to rear wheels and raise vehicle to towing position.
(5) Attach safety chains. Route chains so not to interfere with tail pipe when vehicle is lifted.

TOWING (Continued)

(6) Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(7) Secure steering wheel in straight ahead position with a clamp device designed for towing.
(8) Place transmission in park.

FOUR WHEEL DRIVE TOWING—FRONT END LIFTED

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

(1) Attach wheel lift device to rear wheels.
(2) Place the transmission in neutral.
(3) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
(4) Attach wheel lift device to front wheels and raise vehicle to towing position.
(5) Attach the safety chains.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(6) Turn the ignition switch to the OFF position to unlock the steering wheel.
(7) Secure steering wheel in straight ahead position with a clamp device designed for towing.
(8) Place transmission in park.

SUSPENSION

TABLE OF CONTENTS

SUSPENSION

DIAGNOSIS AND TESTING - SUSPENSION AND STEERING SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Adjust or replace steering gear.
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tires worn or out of balance.	3. Replace or balance tires.
	4. Alignment.	4. Align vehicle to specifications.
	5. Leaking steering dampener.	5. Replace steering dampener.
VEHICLE INSTABILITY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
EXCESSIVE STEERING EFFORT	1. Loose or worn steering gear.	1. Adjust or replace steering gear.
	2. Power steering fluid low.	2. Add fluid and repair leak.
	3. Column coupler binding.	3. Replace coupler.
	4. Tire pressure.	4. Adjust tire pressure.
	5. Alignment.	5. Align vehicle to specifications.

SUSPENSION (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
VEHICLE PULLS TO ONE SIDE DURING BRAKING	1. Uneven tire pressure.	1. Adjust tire pressure.
	2. Worn brake components.	2. Repair brakes as necessary.
	3. Air in brake line.	3. Repair as necessary.
VEHICLE LEADS OR DRIFTS FROM STRAIGHT AHEAD DIRECTION ON UNCROWNED ROAD	1. Radial tire lead.	1. Cross front tires.
	2. Brakes dragging.	2. Repair brake as necessary.
	3. Weak or broken spring.	3. Replace spring.
	4. Uneven tire pressure.	4. Adjust tire pressure.
	5. Wheel Alignment.	5. Align vehicle.
	6. Loose or worn steering or suspension components.	6. Repair as necessary.
	7. Cross caster out of spec.	7. Align vehicle.
KNOCKING, RATTLING OR SQUEAKING	1. Worn shock bushings.	1. Replace shock.
	2. Loose, worn or bent steering/ suspension components.	2. Inspect, tighten or replace components as necessary.
	3. Shock valve.	3. Replace shock.
IMPROPER TRACKING	1. Loose, worn or bent track bar.	1. Inspect, tighten or replace component as necessary.
	2. Loose, worn or bent steering/ suspension components.	2. Inspect, tighten or replace components as necessary.

WHEEL ALIGNMENT

TABLE OF CONTENTS

WHEEL ALIGNMENT

DESCRIPTION

Wheel alignment involves the correct positioning of the wheels in relation to the vehicle. The positioning is accomplished through suspension and steering linkage adjustments. An alignment is considered essential for efficient steering, good directional stability and to minimize tire wear. The most important measurements of an alignment are caster, camber and toe position (Fig. 1).

CAUTION: Never attempt to modify suspension or steering components by heating or bending.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

NOTE: Periodic lubrication of the front suspension/steering system components may be required. Rubber bushings must never be lubricated, Refer to Lubrication And Maintenance for the recommended maintenance schedule.

OPERATION

- **CASTER** is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle rearward provides positive caster. Tilting the top of the knuckle forward provides negative caster. Caster is a directional stability angle. This angle enables the front wheels to return to a straight ahead position after turns (Fig. 1).
- **CAMBER** is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire. The angle is not adjustable, damaged component(s) must be replaced to correct the camber angle (Fig. 1).
- **WHEEL TOE POSITION** is the difference between the leading inside edges and trailing inside edges of the front tires. Incorrect wheel toe position is the most common cause of unstable steering and uneven tire wear. The wheel toe position is the **final** front wheel alignment adjustment (Fig. 1).
- **STEERING AXIS INCLINATION ANGLE** is measured in degrees and is the angle that the steering knuckles are tilted. The inclination angle has a fixed relationship with the camber angle. It will not change except when a spindle or ball stud is damaged or bent. The angle is not adjustable, damaged component(s) must be replaced to correct the steering axis inclination angle.
- **THRUST ANGLE** is the angle of the rear axle relative to the centerline of the vehicle. Incorrect thrust angle can cause off-center steering and excessive tire wear. This angle is not adjustable, damaged component(s) must be replaced to correct the thrust angle (Fig. 1).

STANDARD PROCEDURE

STANDARD PROCEDURE - CAMBER

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

To obtain an accurate alignment, a 4 wheel alignment machine must be used and the equipment calibration verified.

The wheel camber angle is preset. This angle is not adjustable and cannot be altered.

WHEEL ALIGNMENT (Continued)

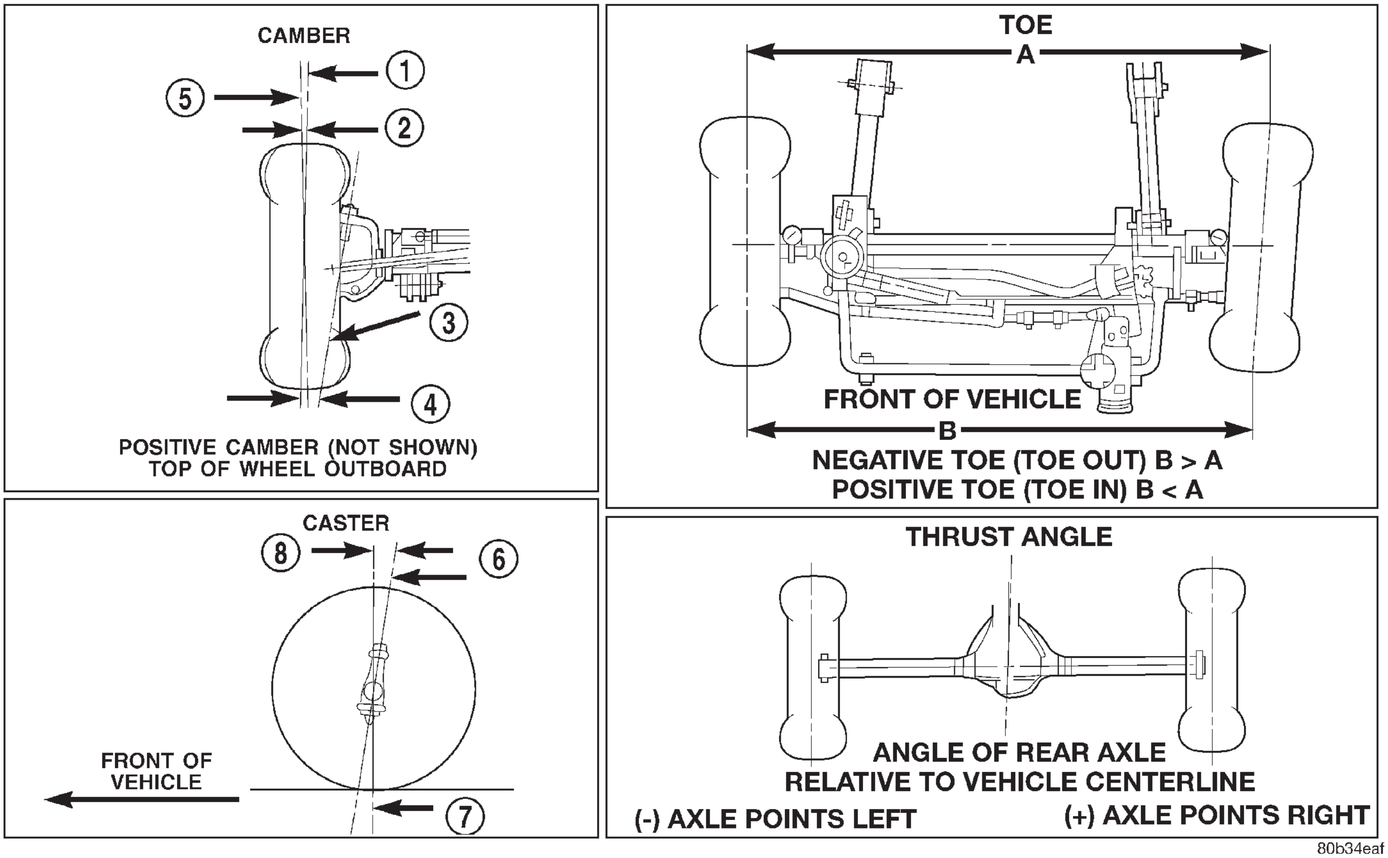


Fig. 1 Wheel Alignment Measurements

1 - WHEEL CENTERLINE
2 - NEGATIVE CAMBER ANGLE
3 - PIVOT CENTERLINE
4 - SCRUB RADIUS
5 - TRUE VERTICAL
6 - KING PIN
7 - VERTICAL
8 - POSITIVE CASTER

STANDARD PROCEDURE - CASTER

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

To obtain an accurate alignment, a 4 wheel alignment machine must be used and the equipment calibration verified.

The wheel caster angle is preset. This angle is not adjustable and cannot be altered.

STANDARD PROCEDURE - TOE POSITION

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

To obtain an accurate alignment, a 4 wheel alignment machine must be used and the equipment calibration verified.

NOTE: For an accurate wheel toe position adjustment the engine must be engine running.

(1) Apply parking brakes.

(2) Start the engine and turn wheels both ways before straightening the steering wheel. Center and secure the steering wheel.

(3) Loosen the tie rod adjustment sleeve clamp bolts (Fig. 2).

(4) Turn the sleeve to obtain the preferred positive TOE-IN specification. Position the clamp bolts as shown (Fig. 2) for proper clearance.

(5) Tighten the clamp bolts to 68 N·m (50 ft. lbs.).

WHEEL ALIGNMENT (Continued)

NOTE: Make sure the toe setting does not change during clamp tightening.

(6) Verify alignment specifications, then turn the engine off.

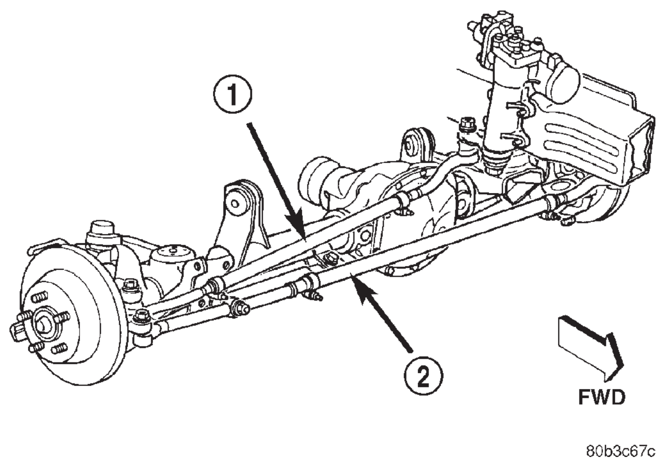


Fig. 2 Steering Linkage

1 - DRAG LINK ADJUSTMENT SLEEVE
2 - TIE ROD ADJUSTMENT SLEEVE

STEERING WHEEL CENTERING

NOTE: The steering wheel can be centered without affecting the toe position.

(1) Loosen the drag link adjustment sleeve clamp bolts.
(2) Turn the adjustment sleeve to center the wheel.
(3) Position the clamp bolts as shown (Fig. 2)for proper clearance.
(4) Tighten the clamp bolts to 68 N·m (50 ft. lbs.).
(5) Road test the vehicle to verify the wheel is centered.

SPECIFICATIONS

ALIGNMENT

NOTE: Specifications are in degrees.

FRONT WHEELS - STANDARD SUSPENSION

SPECIFICATIONS

DESCRIPTION	SPECIFICATION		
PREFERRED	CASTER + 6.75°	CAMBER − 0.37°	TOTAL TOE-IN + 0.20°
RANGE	+ 6.0° to + 7.5°	− 0.75° to + 0.5°	+ .14° to + .26°
MAX RT/LT DIFFERENCE	0.5°	0.5°	0.5°

FRONT WHEELS - UP-COUNTRY SUSPENSION

SPECIFICATIONS

DESCRIPTION	SPECIFICATION		
PREFERRED	CASTER + 6.5°	CAMBER − 0.37°	TOTAL TOE-IN + 0.20°
RANGE	+ 5.7° to + 7.2°	− 0.75° to + 0°	+ 0.0° to + .36°
MAX RT/LT DIFFERENCE	0.5°	0.5°	0.06°

REAR AXLE

SPECIFICATIONS

DESCRIPTION	SPECIFICATION		
PREFERRED	CAMBER –.37°	THRUST ANGLE 0°	TOTAL TOE-IN +.37°
RANGE	0° to –.75°	± 0.25°	0° to +.70°

FRONT

TABLE OF CONTENTS

FRONT

DESCRIPTION

The front suspension (Fig. 1) is a link/coil design comprised of :

- Drive axle
- Shock absorbers
- Coil springs
- Upper and lower suspension arms
- Stabilizer bar
- Track bar
- Jounce bumpers

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

CAUTION: Suspension components with rubber bushings must be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort will be affected and cause premature bushing wear.

STANDARD PROCEDURE - SERVICE WARNINGS AND CAUTIONS

CAUTION: Suspension components with rubber bushings must be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort will be affected and cause premature bushing wear.

FRONT (Continued)

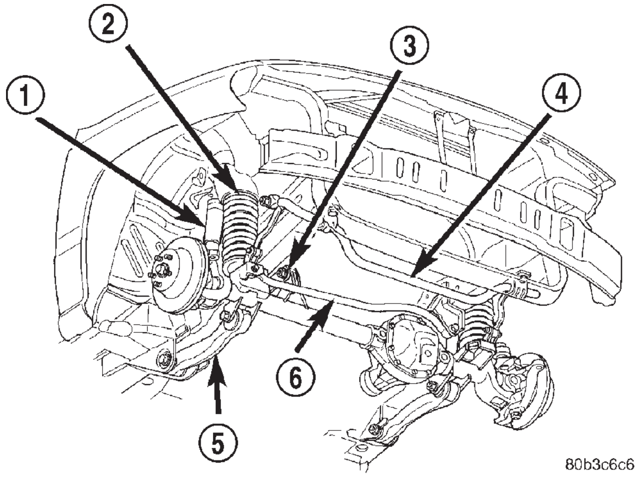


Fig. 1 Front

1 - SHOCK
2 - COIL SPRING
3 - UPPER SUSPENSION ARM
4 - STABILIZER BAR
5 - LOWER SUSPENSION ARM
6 - TRACK BAR

SPECIFICATIONS

TORQUE CHART

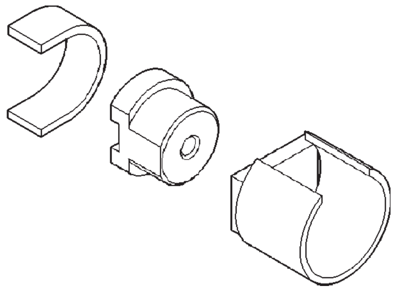
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Nut	35	26	—
Shock Absorber Lower Nut	28	—	250
Suspension Arm Upper Axle Bracket Nut	61	45	—
Suspension Arm Upper Frame Bracket Bolt	61	45	—
Suspension Arm Lower Axle Bracket Nut	163	120	—
Suspension Arm Lower Frame Bracket Bolt	156	115	—
Stabilizer Bar Retainer Bolts	92	68	—
Stabilizer Bar Link Upper Nut	106	78	—
Stabilizer Bar Link Lower Nut	106	78	—
Track Bar Frame Bracket Nut	108	80	—
Track Bar Axle Bracket Bolt	100	74	—
Hub Bearing Knuckle Bolts	102	75	—

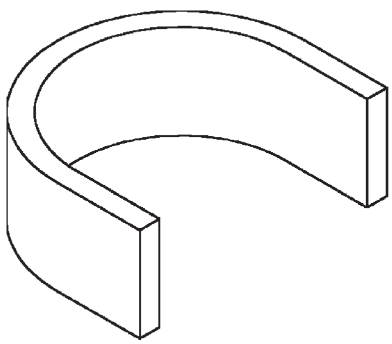
FRONT (Continued)

SPECIAL TOOLS

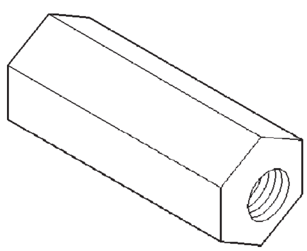
FRONT SUSPENSION



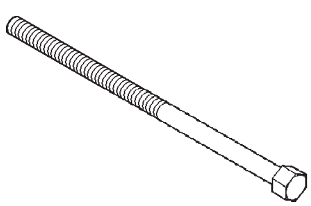
Remover/Installer Suspension Bushing 7932



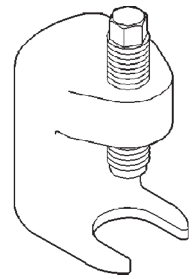
Spacer 8279



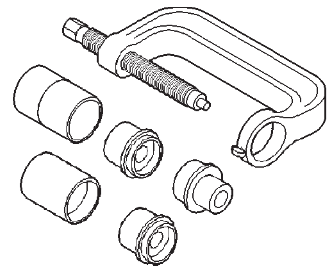
Nut, Long 7603



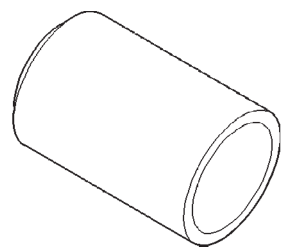
Bolt, Special 7604



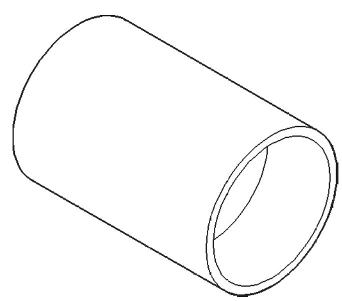
Remover C-4150A



Remover/Installer 6289



Reciever 6761



Installer 6752

BUSHINGS

REMOVAL

(1) Remove the upper suspension arm from axle.
(2) Position Spacer 8279 over the axle bushing on a 4x2 vehicle and right side on a 4x4 vehicle.
(3) Place Receiver 7932-1 over flanged end of the bushing. (Fig. 2).
(4) Place small end of Remover/Install 7932-2 against other side of the bushing.
(5) Install bolt 7604 through remover, bushing and receiver.
(6) Install Long Nut 7603 and tighten nut too pull bushing out of the axle bracket.

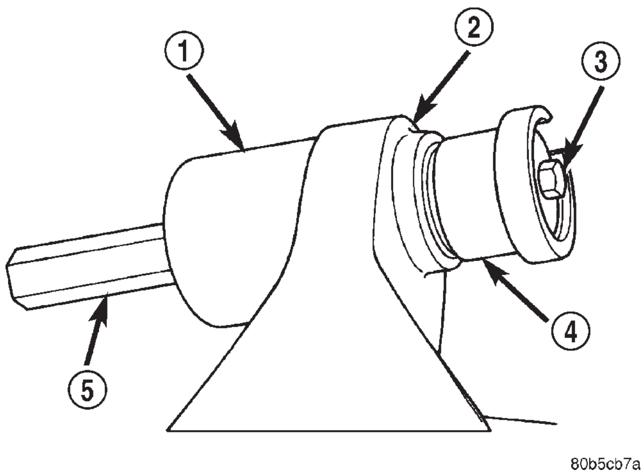


Fig. 2 Bushing Removal

1 - RECEIVER
2 - AXLE BRACKET
3 - BOLT
4 - REMOVER/INSTALLER
5 - LONG NUT

(7) Remove nut, bolt, receiver, remover and bushing.

NOTE: On 4x2 vehicle and right side of 4x4 vehicle, leave Spacer 8279 in position for bushing installation.

INSTALLATION

(1) Place Receiver 7932-1on the other side of the axle bracket.
(2) Position new bushing up to the axle bracket., and large end of Remover/Install 7932-2 against the bushing (Fig. 3).
(3) Install bolt 7604 through receiver, bushing and installer.
(4) Install Long Nut 7603 and tighten nut to draw the bushing into the axle bracket.

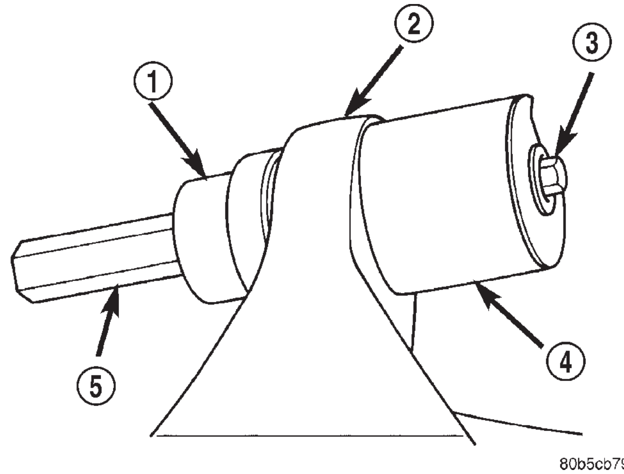


Fig. 3 Bushing Installation

1 - REMOVER/INSTALLER
2 - AXLE BRACKET
3 - BOLT
4 - RECEIVER
5 - LONG NUT

(5) Remove tools and install the upper suspension arm.

HUB / BEARING

DESCRIPTION

The bearing used on the front hub of this vehicle is the combined hub and bearing unit type assembly. This unit assembly combines the front wheel mounting hub (flange) and the front wheel bearing into a one piece unit. The wheel mounting studs are the only replaceable component of the hub/bearing assembly.

OPERATION

The hub/bearing assembly is mounted to the steering knuckle and is retained by three mounting bolts accessible from the back of the steering knuckle. The hub/bearing unit is not serviceable and must be replaced as an assembly if the bearing or the hub is determined to be defective.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the wheel and tire assembly.
(3) Remove the brake caliper, caliper anchor, rotor and ABS wheel speed sensor,(Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - REMOVAL).
(4) Remove the cotter pin, nut retainer and axle hub nut.
(5) Remove the hub bearing mounting bolts from the back of the steering knuckle. Remove hub bear-

HUB / BEARING (Continued)

ing (Fig. 4) from the steering knuckle and off the axle shaft.

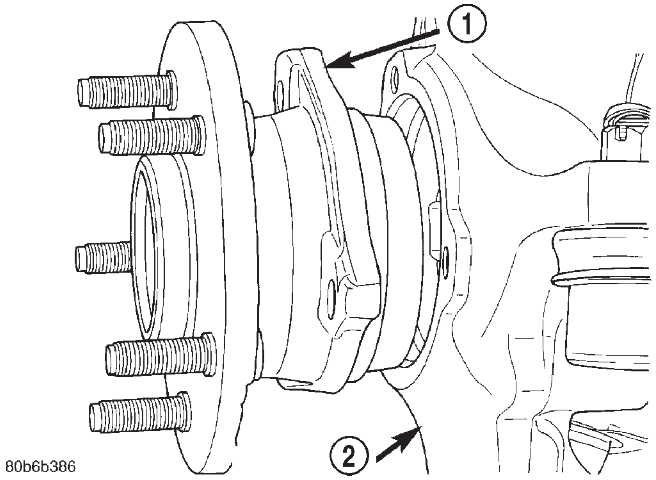


Fig. 4 Hub Bearing & Knuckle

1 - HUB BEARING
2 - KNUCKLE

INSTALLATION

(1) Install the hub bearing to the knuckle.

(2) Install the hub bearing to knuckle bolts and tighten to 102 N·m (75 ft. lbs.).

(3) Install the hub washer and nut. Tighten the hub nut to 237 N·m (175 ft. lbs.). Install the nut retainer and a new cotter pin.

(4) Install the brake rotor, caliper anchor, caliper and ABS wheel speed sensor,(Refer to 5 - BRAKES/ ELECTRICAL/FRONT WHEEL SPEED SENSOR - INSTALLATION).

(5) Install the wheel and tire assembly (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE).

(6) Remove the support and lower the vehicle.

KNUCKLE

DESCRIPTION

The knuckle is a single casting with legs machined for the upper and lower ball joints. The knuckle also has machined mounting locations for the front brake calipers and hub bearing.

OPERATION

The steering knuckle pivot between the upper and lower ball joint. Steering linkage attached to the knuckle allows the vehicle to be steered.

REMOVAL - STEERING KNUCKLE

Ball stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Remove hub bearing and axle shaft.

(2) Disconnect the tie-rod or drag link from the steering knuckle arm,(Refer to 19 - STEERING/ LINKAGE/TIE ROD END - REMOVAL) .

(3) Remove the cotter pins from the upper and lower ball studs.

(4) Remove the upper and lower ball stud nuts.

(5) Strike the steering knuckle with a brass hammer to loosen knuckle from the ball studs. Remove knuckle from ball studs (Fig. 5).

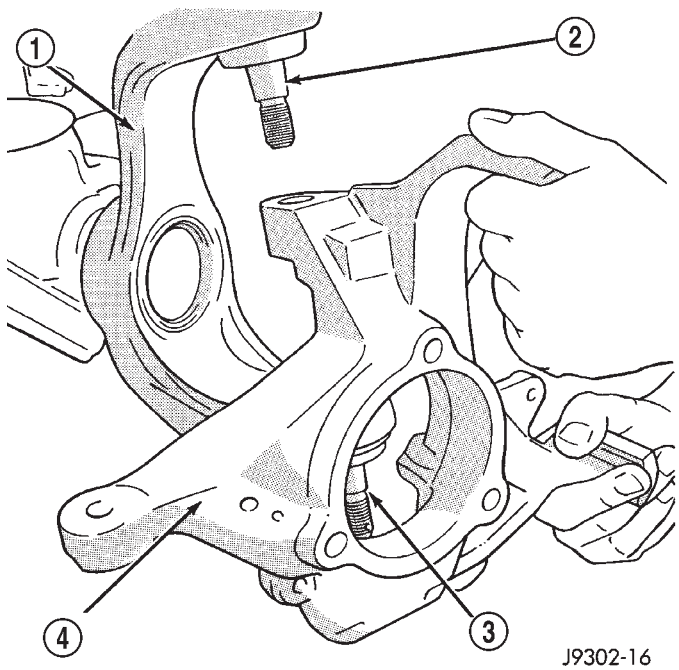


Fig. 5 Steering Knuckle Removal/Installation

1 - AXLE YOKE
2 - UPPER BALL STUD
3 - LOWER BALL STUD
4 - STEERING KNUCKLE

INSTALLATION

(1) Position the steering knuckle on the ball studs.

(2) Install and tighten the bottom retaining nut to 109 N·m (80 ft. lbs.) torque. Install new cotter pin.

(3) Install and tighten the top retaining nut to 101 N·m (75 ft. lbs.) torque. Install new cotter pin.

(4) Install the hub bearing and axle shaft.

(5) Connect the tie-rod or drag link end to the steering knuckle arm.,(Refer to 19 - STEERING/ LINKAGE/TIE ROD END - INSTALLATION) .

LOWER BALL JOINT

REMOVAL

Ball stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Position tools as shown to remove and install ball stud (Fig. 6).

LOWER CONTROL ARM

DESCRIPTION

The lower suspension arms are hydroformed steel and use voided oval bushings at one end of the arm.

OPERATION

The bushings provide isolation from the axle. The arms mount to the unibody frame rail bracket and the axle brackets. The arm and bushings provide location and react to loads from the axle.

REMOVAL

(1) Raise the vehicle and support the front axle.

(2) Remove the lower suspension arm nut and bolt from the axle bracket (Fig. 7).

(3) Remove the nut and bolt from the frame rail bracket and remove the lower suspension arm (Fig. 7).

INSTALLATION

(1) Position the lower suspension arm in the axle bracket and frame rail bracket.

NOTE: The end of the arm with the oval bushing attaches to the axle bracket.

(2) Install the axle bracket bolt and nut finger tight.

(3) Install the frame rail bracket bolt and nut finger tight.

(4) Remove support and lower the vehicle.

(5) With the vehicle on the ground tighten the frame bracket bolt to 156 N·m (115 ft. lbs.). Tighten the axle bracket nut to 163 N·m (120 ft. lbs.).

(6) Check the alignment if new parts were installed.

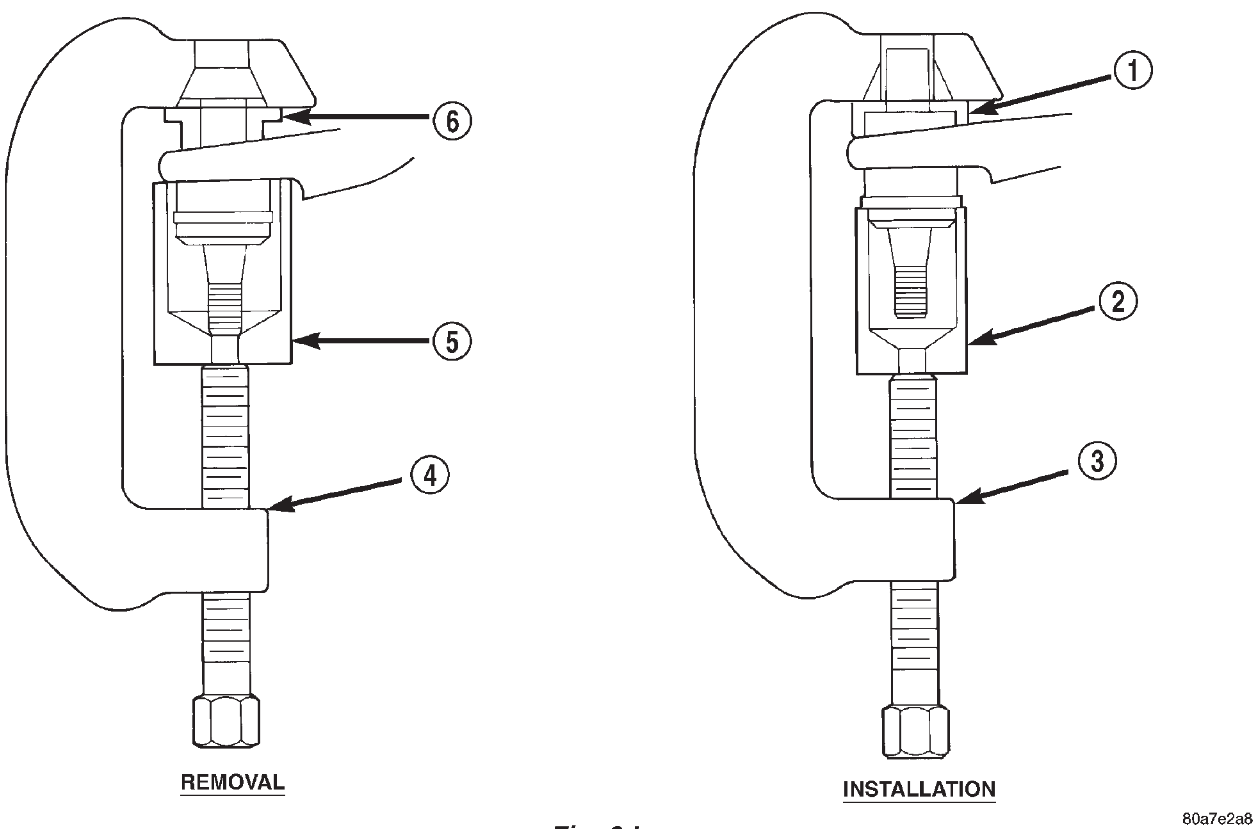


Fig. 6 Lower

1 - SPECIAL TOOL 6289–12
2 - SPECIAL TOOL 6289–4
3 - SPECIAL TOOL 4212F
4 - SPECIAL TOOL 4212F
5 - SPECIAL TOOL 6289–1
6 - SPECIAL TOOL 6289–3

LOWER CONTROL ARM (Continued)

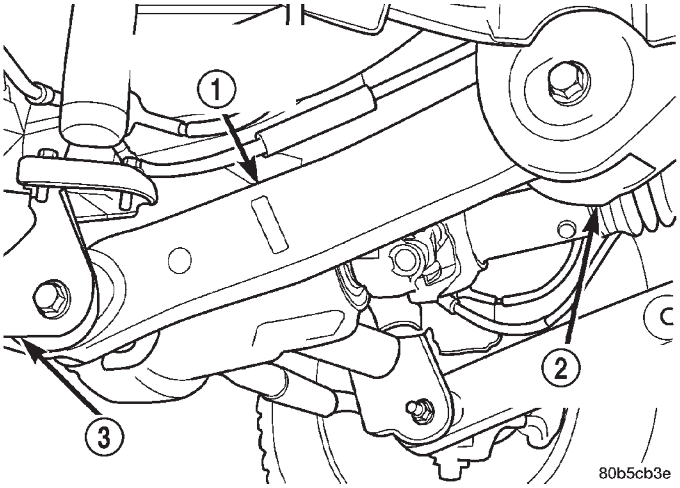


Fig. 7 Lower Suspension Arm

1 - LOWER SUSPENSION ARM
2 - FRAME RAIL BRACKET
3 - AXLE BRACKET

SHOCK

DESCRIPTION

The top of the shock absorbers are bolted to the body. The bottom of the shocks are bolted to the axle brackets. The standard shocks have conventional twin tube construction and are low pressure gas charged. Gas charging prevents cavitation during rough road operation. Up-Country shocks are mono tube design and are high pressure gas charged.

OPERATION

The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions and limit suspension rebound travel.

REMOVAL

(1) Remove the nut, retainer and grommet from the shock stud in the engine compartment (Fig. 8).

(2) Raise and support the front axle.

(3) Remove the lower mounting nuts from the axle bracket (Fig. 9). Remove the shock absorber.

INSTALLATION

(1) Position the lower retainer and grommet on the shock stud. Insert the shock absorber through the shock tower hole.

(2) Install the lower shock studs into the axle bracket.

(3) Install the mounting nuts and tighten to 28 N·m (250 in. lbs.).

(4) Remove support and lower the vehicle.

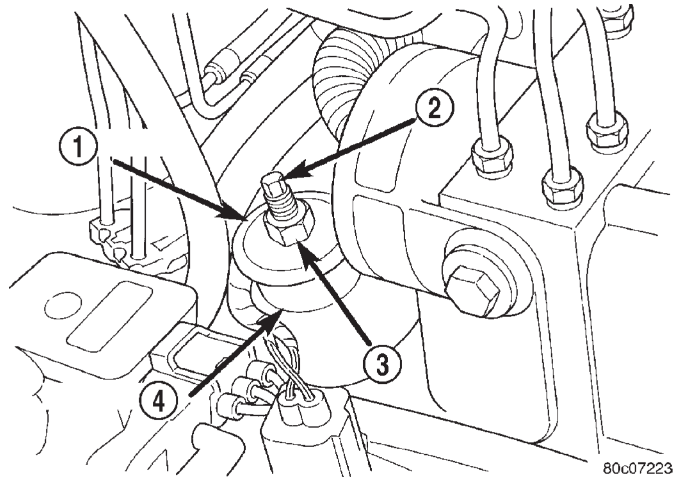


Fig. 8 Upper Shock Mounting

1 - RETAINER
2 - STUD
3 - NUT
4 - GROMMET

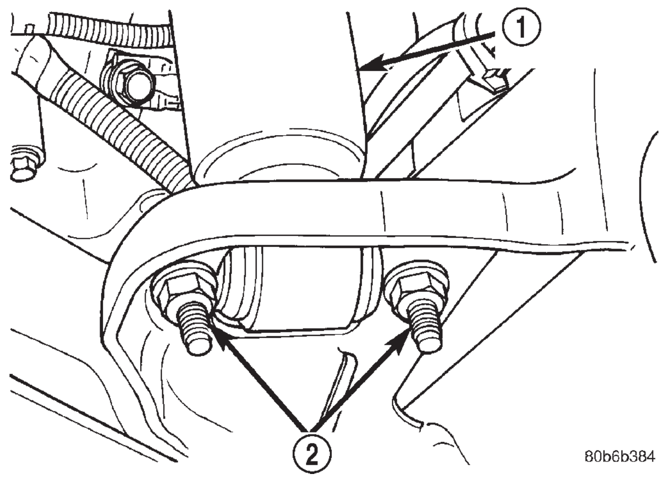


Fig. 9 Lower Shock Mounting

1 - SHOCK ABSORBER
2 - MOUNTING NUTS

(5) Install the upper grommet, retainer and nut on the stud in the engine compartment. Hold the shock stud with a 8 mm wrench and tighten the nut to 35 N·m (26 ft. lbs.).

SPRING

DESCRIPTION

The coil springs mount up in the wheelhouse which is part of the unitized body bracket. A rubber doughnut isolator is located between the top of the spring and the body. The bottom of the spring seats on a axle isolator made of rubber with a steel insert.

SPRING (Continued)

OPERATION

The coil springs control ride quality and maintain proper ride height. The isolators provide road noise isolation.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assemblies.

(3) Position a hydraulic jack under the axle to support it.

(4) Remove shock absorbers lower mounting nuts from the axle brackets.

(5) Remove the track bar mounting bolt from the axle bracket.

NOTE: Make sure the lower part of the shock does not hold tension on the brake lines at the axle tube housing located at the lower shock mounting area.

(6) Lower the axle until the spring is free from the upper mount and isolator (Fig. 10).

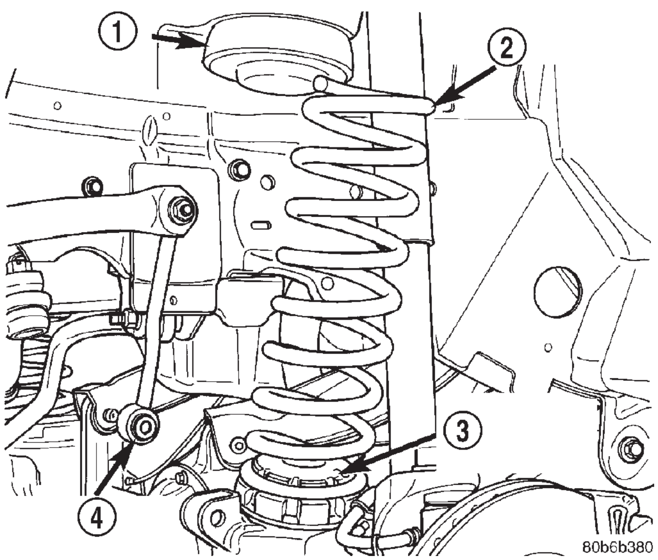


Fig. 10 Front Coil Spring

1 - UPPER ISOLATOR
2 - COIL SPRING
3 - LOWER ISOLATOR
4 - STABILIZER LINK

(7) Remove the spring from the vehicle.

(8) Remove and inspect the upper and lower spring isolators.

INSTALLATION

(1) Install the upper isolator.

(2) Install the lower isolator with the isolator locator nub in the axle pad hole (Fig. 11).

(3) Position the coil spring on the axle spring pad.

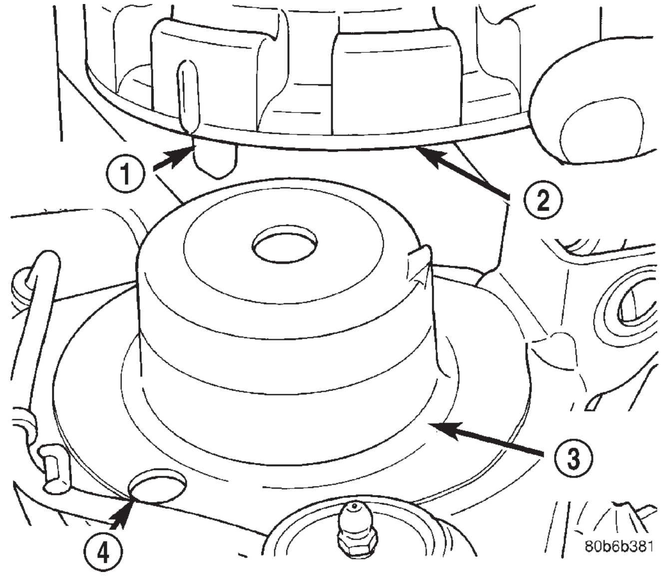


Fig. 11 Lower Isolator

1 - LOCATING NUB
2 - LOWER ISOLATOR
3 - AXLE SPRING PAD
4 - LOCATING HOLE

CAUTION: Ensure the spring is positioned on the lower isolator with the end of the spring coil against the isolator spring locator (Fig. 12).

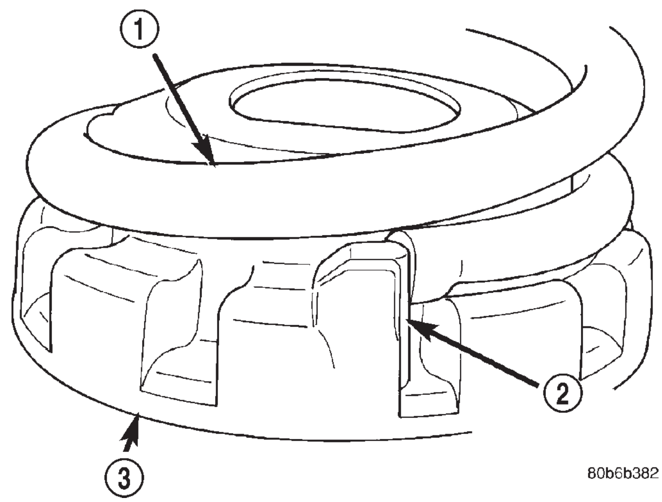


Fig. 12 Isolator Spring Locator

1 - COIL SPRING
2 - SPRING LOCATOR
3 - LOWER ISOLATOR

(4) Raise the axle and guide the springs onto the spring upper mounts and lower shock studs into the axle brackets.

(5) Install the shock absorbers lower mounting nuts.

SPRING (Continued)

(6) Install the track bar to the axle bracket and install the mounting bolt.

NOTE: It may be necessary to pry the axle assembly over to install the track bar bolt.

(7) Remove the hydraulic jack from under the vehicle.
(8) Tighten all suspension components to proper torque.
(9) Install the wheel and tire assemblies.
(10) Remove support and lower vehicle.

STABILIZER BAR

DESCRIPTION

The bar extends across the front underside of the chassis and is mounted to the frame rails. Links are connected from the bar to the axle brackets. The stabilizer bar and links are isolated by rubber bushings.

OPERATION

The stabilizer bar is used to control vehicle body roll during turns. The spring steel bar helps to control the vehicle body in relationship to the suspension.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove link nuts and bolts (Fig. 13) and remove the links.
(3) Remove the stabilizer bar retainer bolts (Fig. 13)from the frame rails and remove the stabilizer bar.

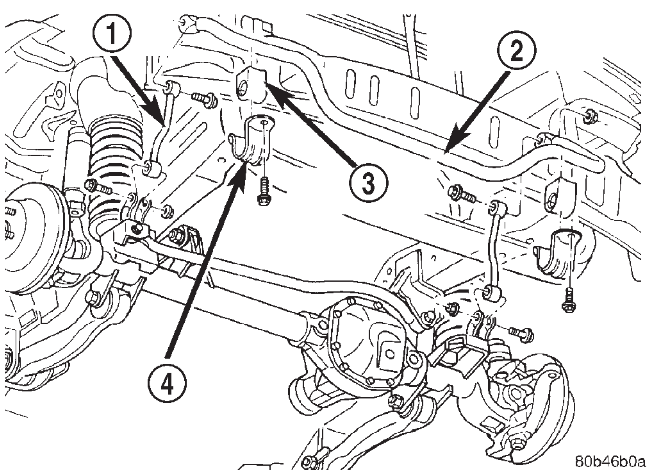


Fig. 13 Stabilizer Bar

1 - LINK
2 - STABILIZER BAR
3 - BUSHING
4 - RETAINER

INSTALLATION

(1) Position the stabilizer bar on the frame rail and install the retainers and bolts. Ensure the bar is centered with equal spacing on both sides. Tighten the bolts to 92 N·m (68 ft. lbs.).
(2) Install the links onto the stabilizer bar and axle brackets and install the bolts and nuts finger tight.
(3) Remove the supports and lower the vehicle.
(4) With the vehicle on the ground tighten the stabilizer bar link nuts to 106 N·m (78 ft. lbs.).

TRACK BAR

DESCRIPTION

The bar is attached to a frame rail bracket and axle bracket. The bar is forged and has non replaceable isolator bushings at both ends.

OPERATION

The track bar is used to control front axle lateral movement and provides cross car location of the axle assembly.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the nut and bolt from the frame rail bracket (Fig. 14).

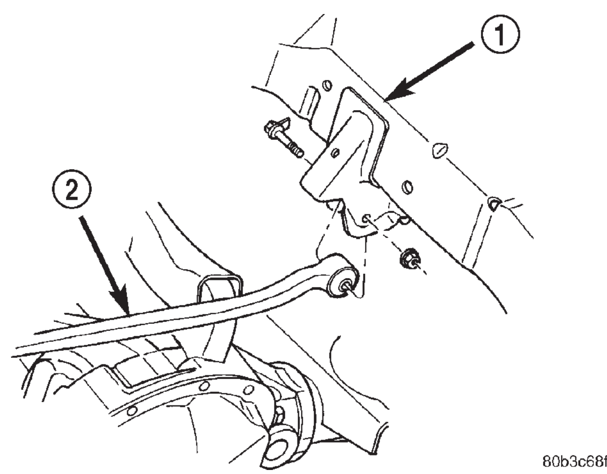


Fig. 14 Track Bar Frame Rail Bracket

1 - FRAME RAIL
2 - TRACK BAR

(3) Remove the bolt from the axle shaft tube bracket (Fig. 15). Remove the track bar.

INSTALLATION

(1) Install the track bar to the axle tube bracket. Install the retaining bolt finger tight.

TRACK BAR (Continued)

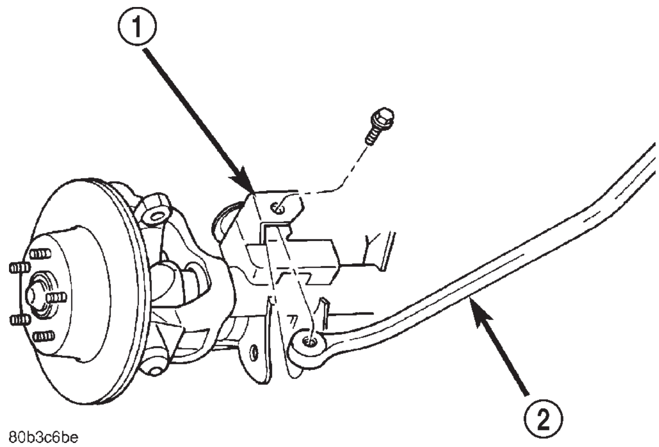


Fig. 15 Track Bar Axle Bracket

1 - AXLE BRACKET
2 - TRACK BAR

(2) Install track bar to the frame rail bracket. Install the bolt and nut finger tight.

NOTE: It may be necessary to pry the axle assembly over to install the track bar to the frame rail bracket.

(3) Remove the supports and lower the vehicle.

(4) With the vehicle on the ground tighten the nut at the frame rail bracket and to the bolt at the axle bracket to 100 N·m (74 ft. lbs.).

(5) Check alignment specifications if a new track bar was installed.

UPPER BALL JOINT

REMOVAL

Ball stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Position tools as shown to remove and install ball stud (Fig. 16).

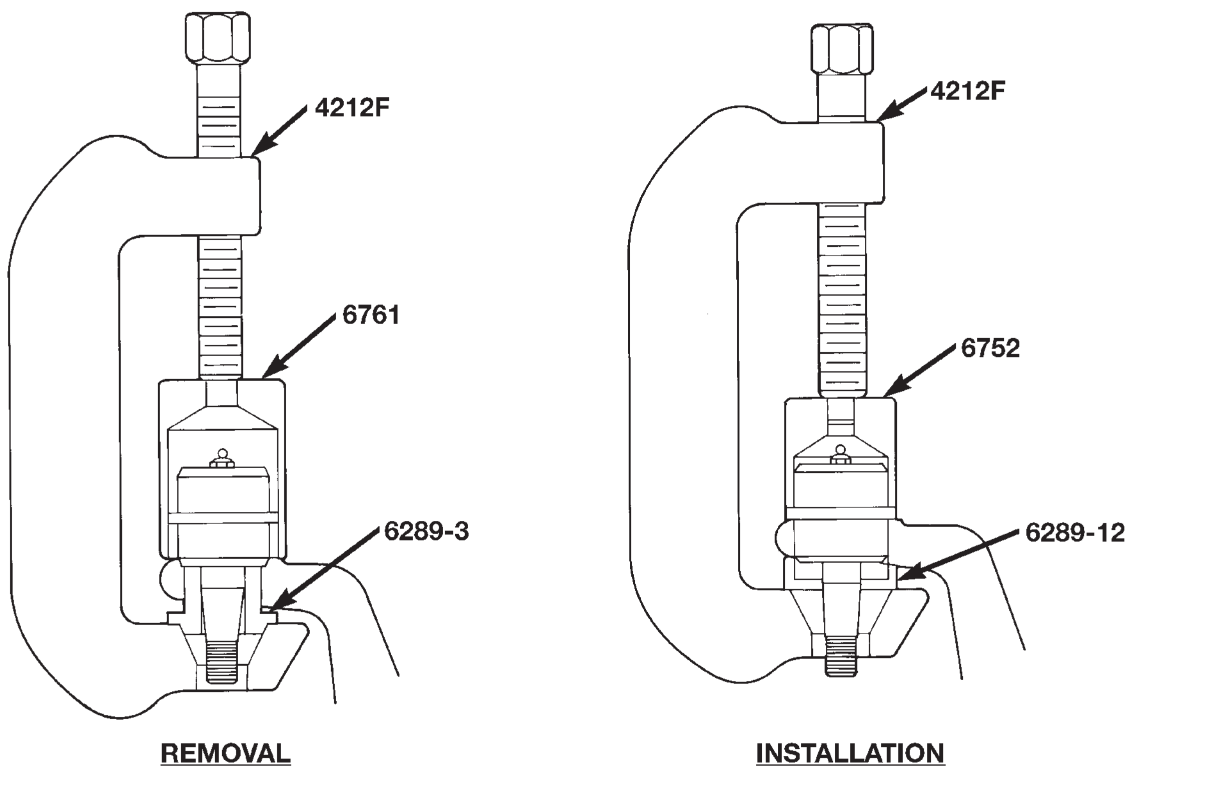


Fig. 16 Upper

UPPER CONTROL ARM

DESCRIPTION

The upper suspension arms are hydroformed steel and use rubber bushings at each end of the arm.

OPERATION

The arms mount to the unibody frame rail bracket and the axle brackets. The arm and bushings provide location and react to loads from the axle. The bushings provide isolation from the axle.

REMOVAL

(1) Raise vehicle and support the axle.

(2) Remove the upper suspension arm mounting nut and bolt (Fig. 17) from the axle bracket.

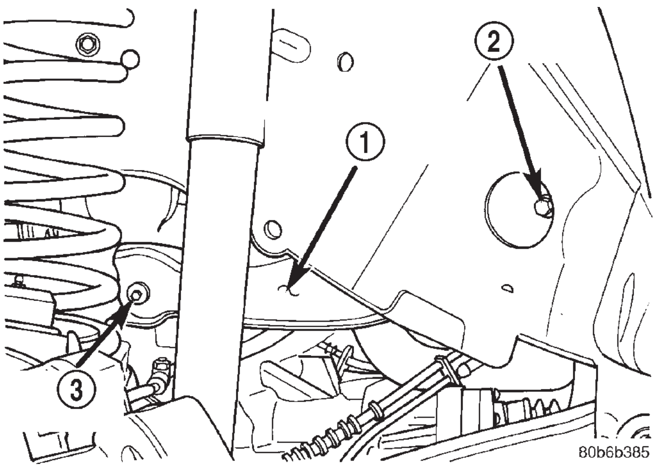


Fig. 17 Upper Suspension Arm

1 - UPPER SUSPENSION ARM
2 - FRAME BOLT
3 - AXLE BOLT

(3) Remove the nut and bolt (Fig. 17) at the frame rail and remove the upper suspension arm.

INSTALLATION

(1) Position the upper suspension arm at the axle and frame rail.

(2) Install the bolts and finger tighten the nuts.

(3) Remove the supports and lower the vehicle.

(4) With the vehicle on the ground tighten the axle bracket nut and the frame bracket bolt to 61 N·m (45 ft. lbs.).

(5) Check the alignment if new parts were installed.

REAR

TABLE OF CONTENTS

REAR

DESCRIPTION

The rear suspension (Fig. 1) is comprised of :

- Drive axle
- Shock absorbers
- Coil springs
- Lower suspension arms
- Upper suspension arm
- Stabilizer bar

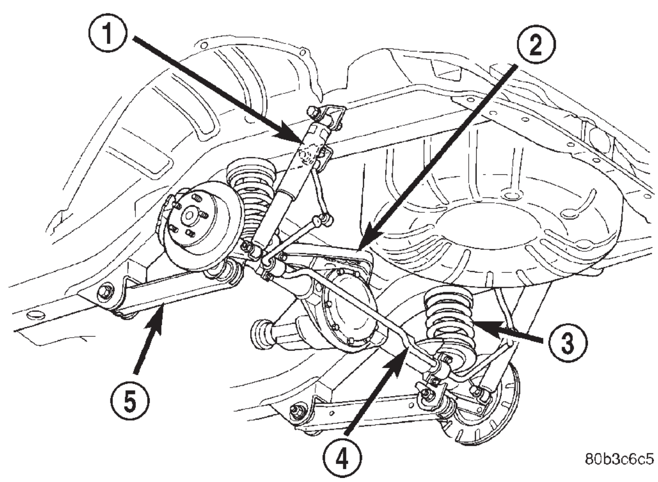


Fig. 1 Rear Suspension

1 - SHOCK
2 - UPPER SUSPENSION ARM
3 - COIL SPRING
4 - STABILIZER BAR
5 - LOWER SUSPENSION ARM

CAUTION: Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. This will maintain vehicle ride comfort and prevent premature bushing wear.

WARNING

WARNING:: Suspension components with rubber bushings must be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort will be affected and cause premature bushing wear.

REAR (Continued)

DIAGNOSIS AND TESTING - REAR SUSPENSION

CONDITION	POSSIBLE CAUSES	CORRECTION
VEHICLE INSTABILITY	1. Loose or worn wheel bearings. 2. Loose, worn or bent suspension components. 3. Tire pressure.	1. Replace wheel bearings. 2. Inspect, tighten or replace components as necessary. 3. Adjust tire pressure.
VEHICLE PULLS TO ONE SIDE	1. Weak or broken spring. 2. Alignment. 3.Tires. 4. Brakes.	1. Replace spring. 2. Align vehicle to specifications. 3. Replace tires. 4. Repair as necassary.
KNOCKING, RATTLING OR SQUEAKING	1. Worn shock bushings. 2. Loose shock mounting. 3. Shock valve. 4. Loose upper ball joint. 5. Loose, worn or bent suspension components.	1. Replace shock. 2. Tighten to specifications. 3. Replace shock. 4. Replace ball joint. 5. Inspect, tighten or replace components as necessary.
IMPROPER TRACKING	1. Loose, worn or bent suspension components. 2. Bent axle.	1. Inspect, tighten or replace components as necessary. 2.Replace axle.

SPECIFICATIONS

TORQUE CHART

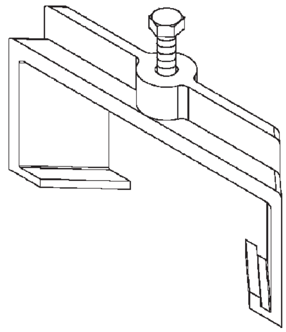
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Nut	108	80	—
Shock Absorber Lower Nut	115	85	—
Suspension Arm Upper Ball Joint Nut	142	105	—
Suspension Arm Upper Frame Bolts	100	74	—
Ball Joint Plate Bolts	136	100	—
Suspension Arms Lower Axle Bracket Nut	163	120	—
Suspension Arms Lower Frame Bracket Nut	156	115	—
Stabilizer Bar Retainer Bolts	54	40	—
Stabilizer Bar Bar Link Nut	54	40	—
Stabilizer Bar Bracket Link Nut	92	68	—

REAR (Continued)

SPECIAL TOOLS

REAR SUSPENSION



Remover 8278

LOWER CONTROL ARM

DESCRIPTION

The lower suspension arms are hydroformed steel and use voided oval bushings at each end of the arm.

OPERATION

The bushings provide isolation from the axle. The arms mount to the unibody frame rail bracket and the axle brackets. The arm and bushings provide location and react to loads.

REMOVAL

(1) Raise the vehicle and support the rear axle.

(2) Remove the lower suspension arm nut and bolt from the axle bracket (Fig. 2).

(3) Remove the nut and bolt (Fig. 2) from the frame rail and remove the lower suspension arm.

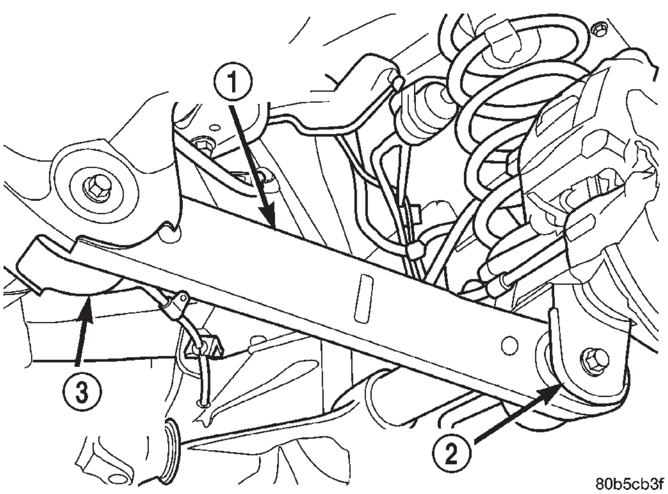


Fig. 2 Lower Suspension Arm

1 - LOWER SUSPENSION ARM
2 - AXLE BRACKET
3 - FRAME BRACKET

INSTALLATION

(1) Position the lower suspension arm in the axle bracket and frame rail bracket.

NOTE: The end of the arm with the oval bushing attaches to the axle bracket.

(2) Install the axle bracket bolt and nut finger tight.

(3) Install the frame rail bracket bolt and nut finger tight.

(4) Remove the supports and lower the vehicle.

(5) With the vehicle on the ground tighten the nut at the frame to 156 N·m (115 ft. lbs.). Tighten the nut at the axle bracket to 163 N·m (120 ft. lbs.).

SHOCK

DESCRIPTION

The top of the shock absorbers are bolted to the body. The bottom of the shocks are bolted to the axle brackets. The standard shocks have conventional twin tube construction and are low pressure gas charged. Gas charging prevents cavitation during rough road operation. Up-Country shocks are mono tube design and are high pressure gas charged.

OPERATION

The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions and limit suspension rebound travel.

REMOVAL

(1) Raise and support the vehicle. Position a hydraulic jack under the axle to support the axle.

CAUTION: Do not allow the axle to hang from the upper suspension arm ball joint.

(2) Remove the upper nut and bolt from the frame bracket (Fig. 3).

(3) Remove the lower nut and bolt from the axle bracket. Remove the shock absorber.

INSTALLATION

(1) Install the shock absorber in the frame bracket and install the bolt and nut.

(2) Install the shock absorber in the axle bracket and install the bolt and nut.

(3) Tighten the upper mounting nuts to 108 N·m (80 ft. lbs.). Tighten the lower mounting nuts to 115 N·m (85 ft. lbs.).

(4) Remove the supports and lower the vehicle.

SHOCK (Continued)

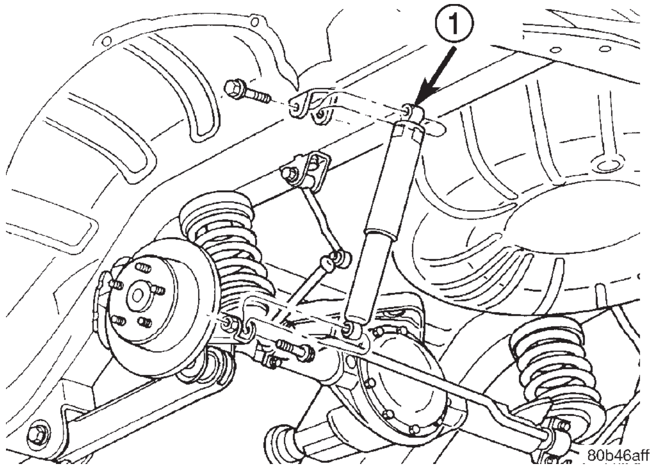


Fig. 3 Shock Absorber

1 - SHOCK

SPRING

DESCRIPTION

The coil springs mount up in the wheelhouse which is part of the unitized body bracket. A rubber dough-nut isolator is located between the top of the spring and the body. The bottom of the spring seats on a axle isolator made of rubber with a steel insert. The isolators provide road noise isolation

OPERATION

The coil springs control ride quality and maintain proper ride height.

REMOVAL

(1) Raise and support the vehicle. Position a hydraulic jack under the axle to support the axle.

(2) Remove the wheel and tire assemblies.

(3) Remove the stabilizer bar link from the stabilizer bar (Fig. 4).

(4) Remove the shock absorber lower bolt from the axle bracket.

(5) Lower the hydraulic jack and tilt the axle and remove the coil spring (Fig. 4).

(6) Remove and inspect the upper and lower spring isolators (Fig. 4).

INSTALLATION

(1) Install the upper isolator.

(2) Install the lower isolator with the isolator locator nub in the axle pad hole (Fig. 5).

(3) Pull down on the axle and position the coil spring in the lower isolator.

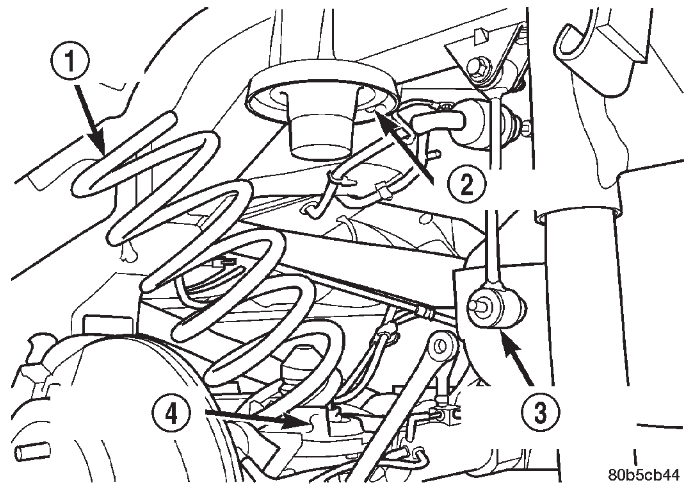


Fig. 4 Coil Spring

1 - COIL SPRING
2 - ISOLATOR
3 - STABILIZER LINK
4 - ISOLATOR

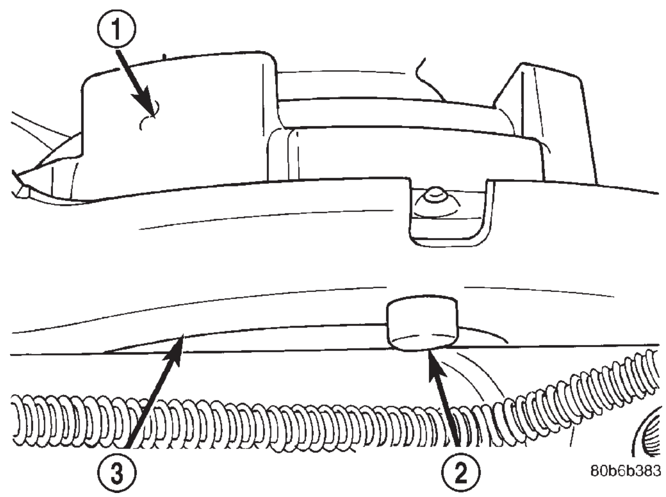


Fig. 5 Isolator Locator Nub

1 - LOWER ISOLATOR
2 - LOCATOR NUB
3 - AXLE SPRING PAD

CAUTION: Ensure the spring is positioned on the lower isolator with the end of the spring coil against the isolator spring locator (Fig. 6).

(4) Raise the axle with the hydraulic jack.

(5) Install the shock absorber to the axle bracket and tighten to specification.

(6) Install the stabilizer bar link to the stabilizer bar.

(7) Install the wheel and tire assemblies.

(8) Remove the supports and lower the vehicle.

(9) Tighten the stabilizer bar links to specification.

SPRING (Continued)

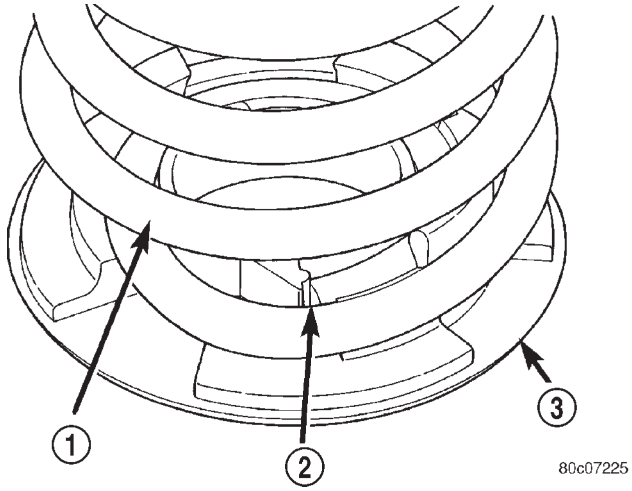


Fig. 6 Isolator Spring Locator - Typical

1 - LOWER ISOLATOR
2 - SPRING LOCATOR
3 - COIL SPRING

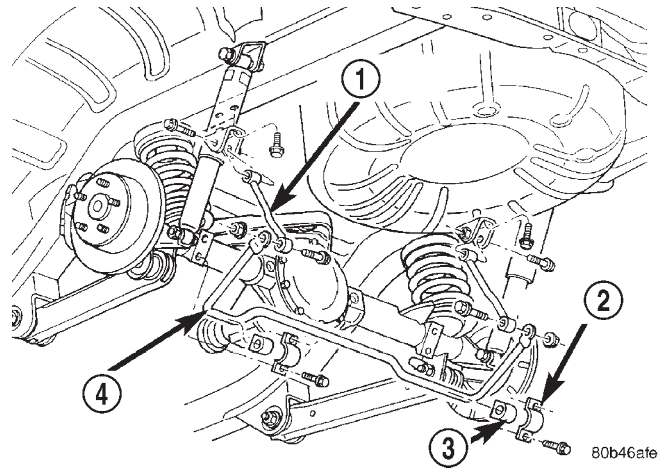


Fig. 7 Rear Stabilizer Bar

1 - LINK
2 - RETAINER
3 - BUSHING
4 - STABILIZER BAR

STABILIZER BAR

DESCRIPTION

The stabilizer bar extends across the back side of the rear axle. Links are connected between the bar and frame rail brackets. The stabilizer bar and links are isolated by rubber bushings.

OPERATION

The stabilizer bar is used to control vehicle body roll, during turns. The bar helps control the vehicle body in relationship to the suspension.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the stabilizer bar links from stabilizer bar and frame mount. (Fig. 7).
(3) Remove the stabilizer bar retainer bolts.
(4) Remove the stabilizer bar.

INSTALLATION

(1) Position the stabilizer bar on the axle and install the retainers and bolts. Ensure the bar is centered with equal spacing on both sides. Tighten the bolts to 54 N·m (40 ft. lbs.).
(2) Install the links to the stabilizer bar and frame brackets.
(3) Tighten the nuts at the stabilizer bar to 54 N·m (40 ft. lbs.).
(4) Tighten the nuts at the frame brackets to 92 N·m (68 ft. lbs.).
(5) Remove support and lower the vehicle.

UPPER BALL JOINT

DESCRIPTION - UPPER SUSPENSION ARM, BUSHINGS, AND BALL JOINT

The suspension arm uses vertical spool bushings to isolate road noise. The suspension arm is bolted through bushings to cage nuts in the body and a ball joint plate to the top of the differential housing.

OPERATION - UPPER SUSPENSION ARM, BUSHINGS, AND BALL JOINT

The upper suspension arm provides fore/aft and lateral location of the rear axle. The suspension arm travel is limited through the use of jounce bumpers in compression and shock absorbers in rebound.

REMOVAL

(1) Raise and support the vehicle.
(2) Support the rear axle with a hydraulic jack.
(3) Remove the ball joint nut from the top of the upper suspension arm (Fig. 8).
(4) Separate ball joint from the arm with Remover 8278 (Fig. 9).

NOTE: It may be necessary to strike the upper control arm with a hammer to separate the ball joint from the arm.

(5) Remove the ball joint mounting bolts (Fig. 10)from the differential housing.
(6) Remove the ball joint from the differential housing.

UPPER BALL JOINT (Continued)

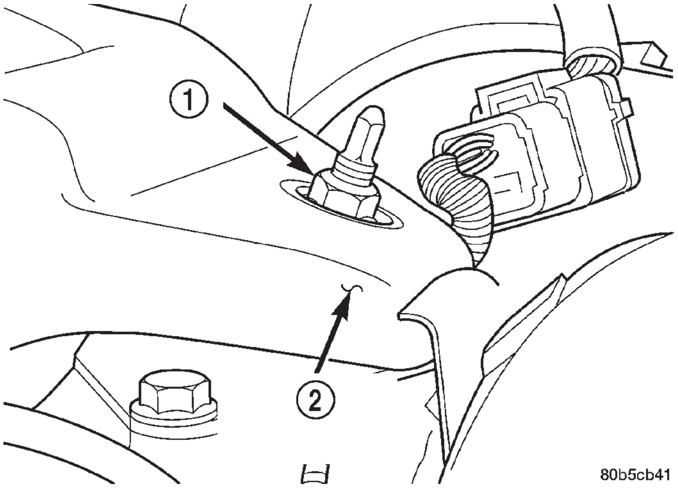


Fig. 8 Ball Joint Nut

1 - BALL JOINT NUT
2 - UPPER SUSPENSION ARM

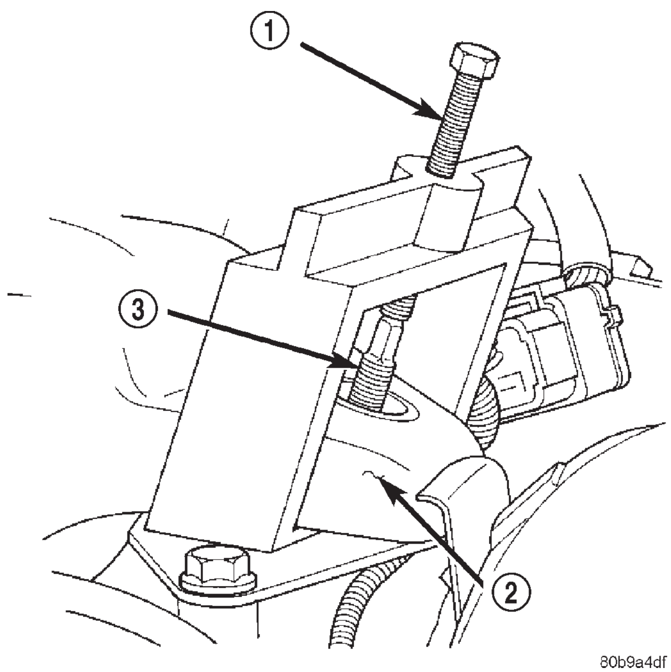


Fig. 9 Separate Ball Joint

1 - REMOVER
2 - UPPER SUSPENSION ARM
3 - BALL JOINT STUD

INSTALLATION

(1) Install the ball joint on the differential housing.

(2) Install the ball joint mounting bolts and tighten to 136 N·m (100 ft. lbs.).

(3) Raise the rear axle with a hydraulic jack to align the upper arm with the ball joint.

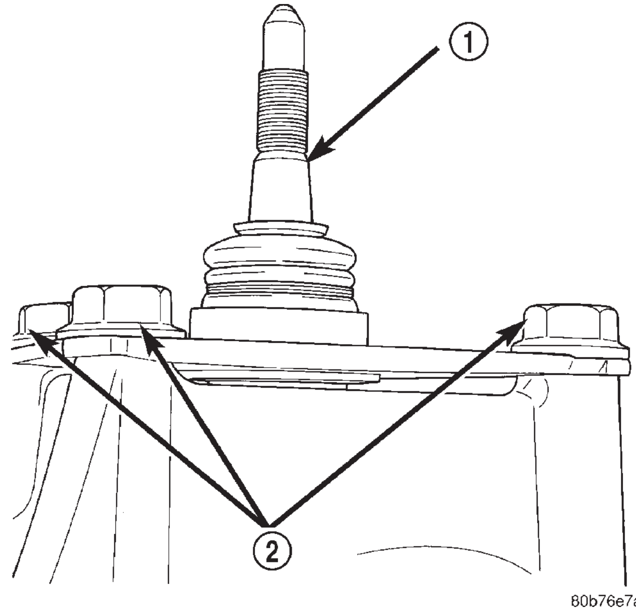


Fig. 10 Ball Joint Mounting Bolts

1 - BALL JOINT
2 - MOUNTING BOLTS

(4) Pull the arm down on the ball joint stud and install a **new** nut. Tighten the nut to 142 N·m (105 ft. lbs.).

(5) Remove the supports and lower the vehicle.

UPPER CONTROL ARM

DESCRIPTION

The suspension arm uses vertical spool bushings to isolate road noise. The suspension arm is bolted through bushings to cage nuts in the body and a ball joint plate to the top of the differential housing.

OPERATION

The upper suspension arm provides fore/aft and lateral location of the rear axle. The suspension arm travel is limited through the use of jounce bumpers in compression and shock absorbers in rebound.

REMOVAL

(1) Raise and support the vehicle.

(2) Support the rear axle with a hydraulic jack.

(3) Remove the park brake cables and brake hose from the arm (Fig. 11).

(4) Remove the ball joint nut from the top of the upper suspension arm (Fig. 12).

(5) Separate ball joint from the arm with Remover 8278 (Fig. 13).

UPPER CONTROL ARM (Continued)

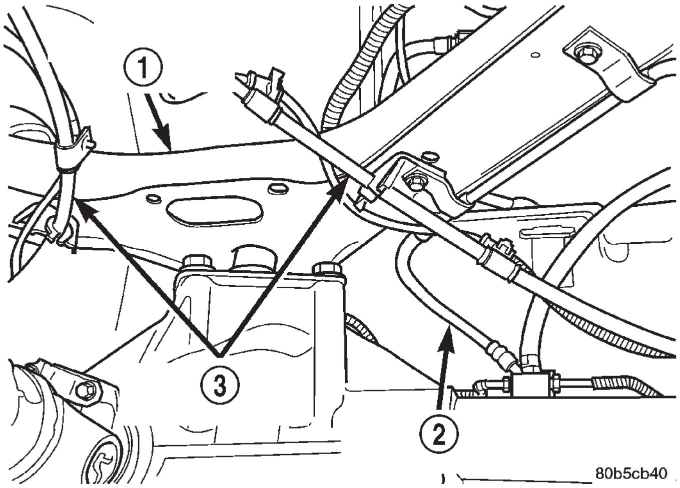


Fig. 11 Park Brake Cables And Brake Hose

1 - UPPER SUSPENSION ARM
2 - REAR BRAKE HOSE
3 - PARK BRAKE CABLES

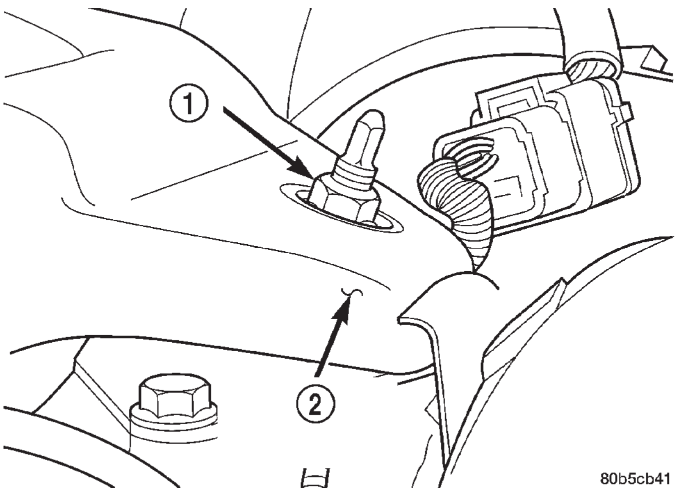


Fig. 12 Ball Joint Nut

1 - BALL JOINT NUT
2 - UPPER SUSPENSION ARM

NOTE: It may be necessary to strike the upper control arm with a hammer to separate the ball joint from the arm.

(6) Remove the upper suspension arm mounting bolts and remove the arm (Fig. 14).

INSTALLATION

(1) Position the upper suspension arm in the frame rail brackets.

(2) Install the mounting bolts and tighten to 100 N·m (74 ft. lbs.).

(3) Pull the arm down on the ball joint stud and install a **new** nut. Tighten the nut to 142 N·m (105 ft. lbs.).

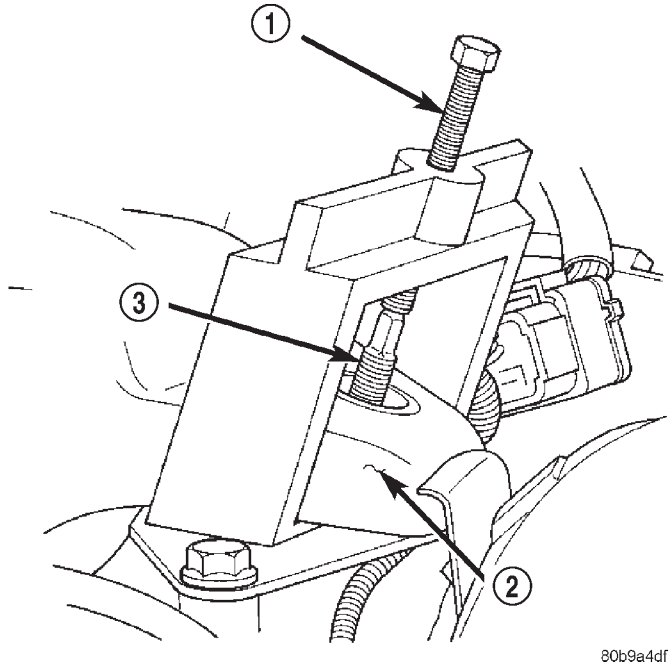


Fig. 13 Separate Ball Joint

1 - REMOVER
2 - UPPER SUSPENSION ARM
3 - BALL JOINT STUD

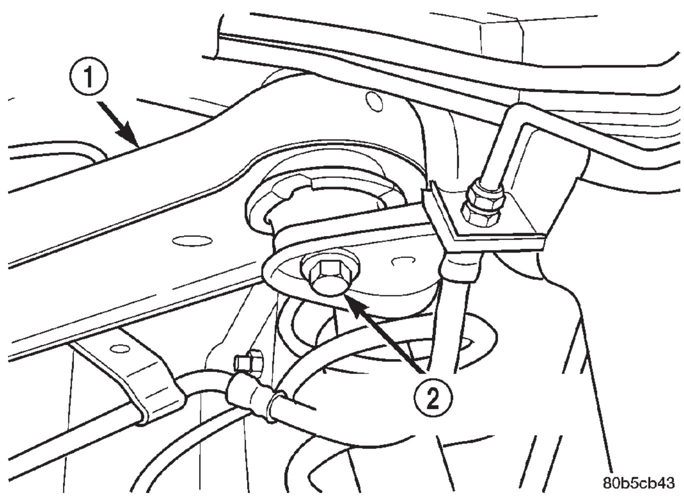


Fig. 14 Upper Suspension Arm Mounting Bolt

1 - UPPER SUSPENSION ARM
2 - MOUNTING BOLT

(4) Install the park brake cables and brake hose to the arm.

(5) Remove the supports and lower the vehicle.

DIFFERENTIAL & DRIVELINE

TABLE OF CONTENTS

PROPELLER SHAFT

TABLE OF CONTENTS

PROPELLER SHAFT

DIAGNOSIS AND TESTING

VIBRATION

Tires that are out-of-round, or wheels that are unbalanced, will cause a low frequency vibration. (Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING)

Brake rotors that are unbalanced will cause a harsh, low frequency vibration. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

Driveline vibration can also result from loose or damaged engine mounts.

Propeller shaft vibration increases as the vehicle speed is increased. A vibration that occurs within a specific speed range is not usually caused by a propeller shaft being unbalanced. Defective universal joints, or an incorrect propeller shaft angle, are usually the cause of such a vibration.

PROPELLER SHAFT (Continued)

DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
Propeller Shaft Noise	1) Undercoating or other foreign material on shaft.	1) Clean exterior of shaft and wash with solvent.
	2) Loose U-joint clamp screws.	2) Install new clamps and screws and tighten to proper torque.
	3) Loose or bent U-joint yoke or excessive runout.	3) Install new yoke.
	4) Incorrect driveline angularity.	4) Measure and correct driveline angles.
	5) Rear spring center bolt not in seat.	5) Loosen spring u-bolts and seat center bolt.
	6) Worn U-joint bearings.	6) Install new U-joint.
	7) Propeller shaft damaged or out of balance.	7) Installl new propeller shaft.
	8) Broken rear spring.	8) Install new rear spring.
	9) Excessive runout or unbalanced condition.	9) Re-index propeller shaft, test, and evaluate.
	10) Excessive drive pinion gear shaft runout.	10) Re-index propeller shaft and evaluate.
	11) Excessive axle yoke deflection.	11) Inspect and replace yoke if necessary.
	12) Excessive transfer case runout.	12) Inspect and repair as necessary.
Universal Joint Noise	1) Loose U-joint clamp screws.	1) Install new clamps and screws and tighten to proper torque.
	2) Lack of lubrication.	2) Replace U-joints as necessary.

BALANCE

NOTE: Removing and re-indexing the propeller shaft 180° relative to the yoke may eliminate some vibrations.

If propeller shaft is suspected of being unbalanced, it can be verified with the following procedure:

(1) Raise the vehicle.

(2) Clean all the foreign material from the propeller shaft and the universal joints.

(3) Inspect the propeller shaft for missing balance weights, broken welds, and bent areas. **If the propeller shaft is bent, it must be replaced.**

(4) Inspect the universal joints to ensure that they are not worn, are properly installed, and are correctly aligned with the shaft.

(5) Check the universal joint clamp screws torque.

(6) Remove the wheels and tires. Install the wheel lug nuts to retain the brake drums or rotors.

(7) Mark and number the shaft six inches from the yoke end at four positions 90° apart.

(8) Run and accelerate the vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.

(9) Install a screw clamp at position 1 (Fig. 1).

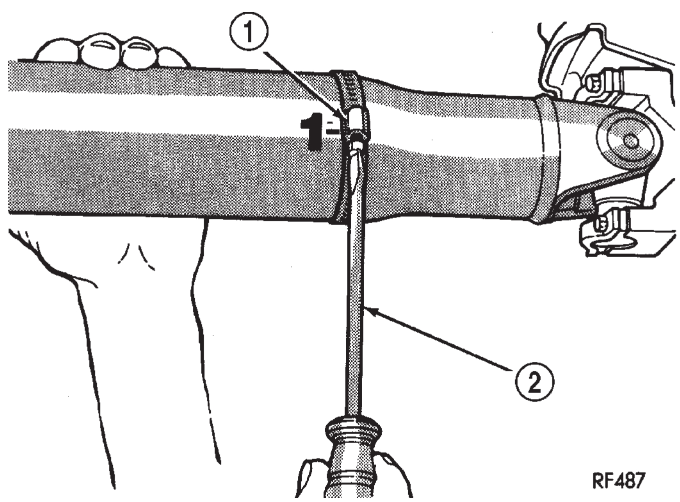


Fig. 1 CLAMP SCREW - POSITION 1

1 - CLAMP
2 - SCREWDRIVER

PROPELLER SHAFT (Continued)

(10) Start the engine and re-check for vibration. If there is little or no change in vibration, move the clamp to one of the other three positions. Repeat the vibration test.

(11) If there is no difference in vibration at the other positions, the source of the vibration may not be propeller shaft.

(12) If the vibration decreased, install a second clamp (Fig. 2) and repeat the test.

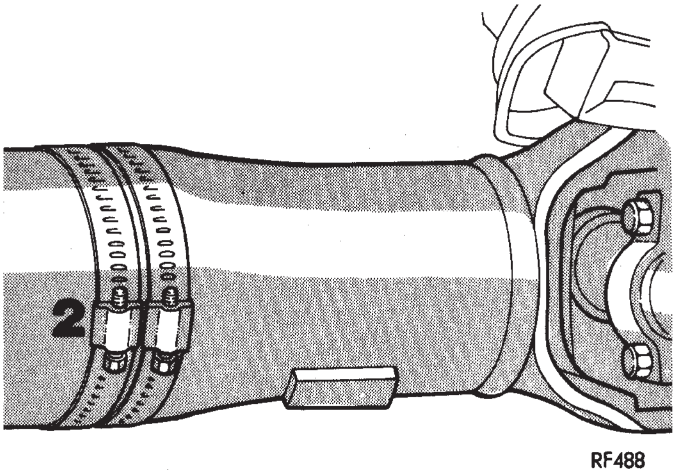


Fig. 2 TWO CLAMP SCREWS

(13) If the additional clamp causes an additional vibration, separate the clamps (1/4 inch above and below the mark). Repeat the vibration test (Fig. 3).

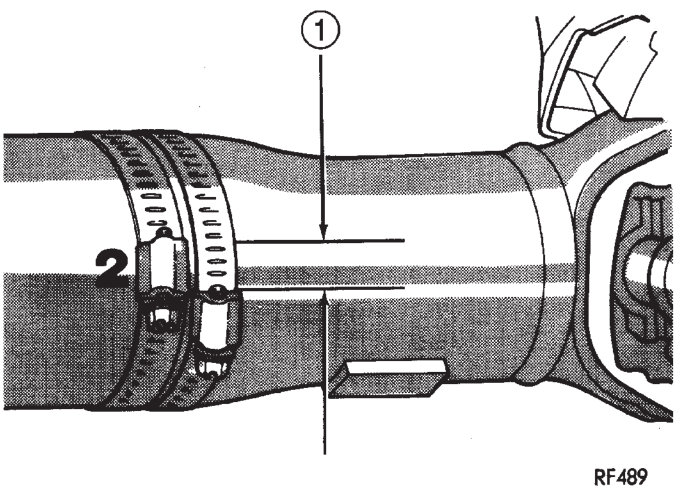


Fig. 3 CLAMP SCREWS SEPARATED

1 - ½ INCH

(14) Increase distance between the clamp screws and repeat the test until the amount of vibration is at the lowest level. Bend the slack end of the clamps so the screws will not loosen.

(15) If the vibration remains unacceptable, apply the same steps to the front end of the propeller shaft.

(16) Install the wheel and tires. Lower the vehicle.

RUNOUT

(1) Remove dirt, rust, paint, and undercoating from the propeller shaft surface where the dial indicator will contact the shaft.

(2) The dial indicator must be installed perpendicular to the shaft surface.

(3) Measure runout at the center and ends of the shaft sufficiently far away from weld areas to ensure that the effects of the weld process will not enter into the measurements.

(4) Refer to Runout Specifications chart.

(5) If the propeller shaft runout is out of specification, remove the propeller shaft, index the shaft 180°, and re-install the propeller shaft. Measure shaft runout again.

(6) If the propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.

(7) If the propeller shaft runout is not within specifications, verify that the runout of the transmission/transfer case and axle are within specifications. Correct as necessary and re-measure propeller shaft runout.

(8) Replace the propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

Front of Shaft	0.020 in. (0.50 mm)
Center of Shaft	0.025 in. (0.63 mm)
Rear of Shaft	0.020 in. (0.50 mm)
note: Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.	

STANDARD PROCEDURES

This procedure applies to both the front propeller shafts and the rear propeller shaft. To obtain the front (output) angle on the C/V front propeller shaft, the inclinometer is placed on the machined ring of the pinion flange. To obtain the propeller shaft angle measurement on the C/V front propeller shaft, the inclinometer is placed on the propeller shaft tube.

PROPELLER SHAFT ANGLE

(1) Raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn.

(2) Remove any external bearing snap rings from universal joint if equipped, so the inclinometer base will sits flat.

PROPELLER SHAFT (Continued)

(3) Rotate the shaft until transmission/transfer case output yoke bearing cap is facing downward, if necessary.

NOTE: Always make measurements from front to rear.

(4) Place Inclinometer on yoke bearing cap, or the pinion flange ring, (A) parallel to the shaft (Fig. 4). Center bubble in sight glass and record measurement.

NOTE: This measurement will give you the transmission or Output Yoke Angle (A).

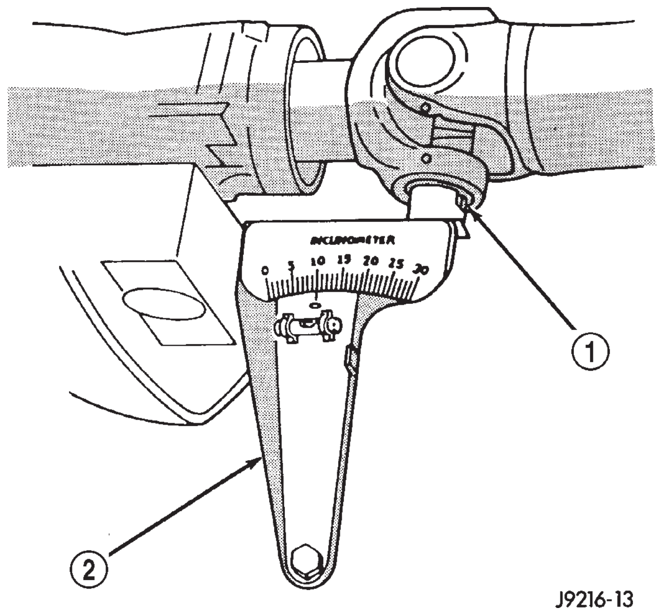


Fig. 4 OUTPUT YOKE ANGLE (A)

1 - SLIP YOKE BEARING CAP
2 - INCLINOMETER

(5) Rotate propeller shaft 90 degrees and place Inclinometer on yoke bearing cap, or propeller shaft tube on C/V propeller shaft, parallel to the shaft (Fig. 5). Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft.

NOTE: This measurement will give you the propeller shaft angle (C).

(6) Subtract smaller figure from larger (C minus A) to obtain transmission output operating angle.

(7) Rotate propeller shaft 90 degrees and place Inclinometer on pinion yoke bearing cap parallel to the shaft (Fig. 6). Center bubble in sight glass and record measurement.

NOTE: This measurement will give you the pinion shaft or input yoke angle (B).

(8) Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.

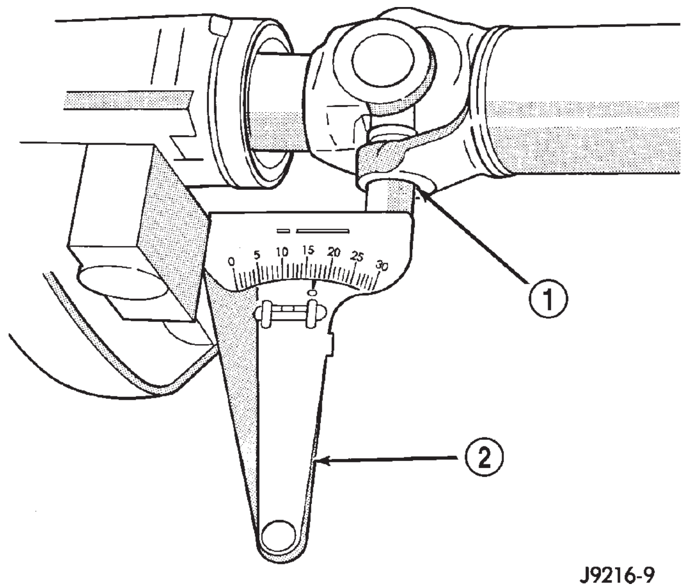


Fig. 5 PROPELLER SHAFT ANGLE (C)

1 - SHAFT YOKE BEARING CAP
2 - INCLINOMETER

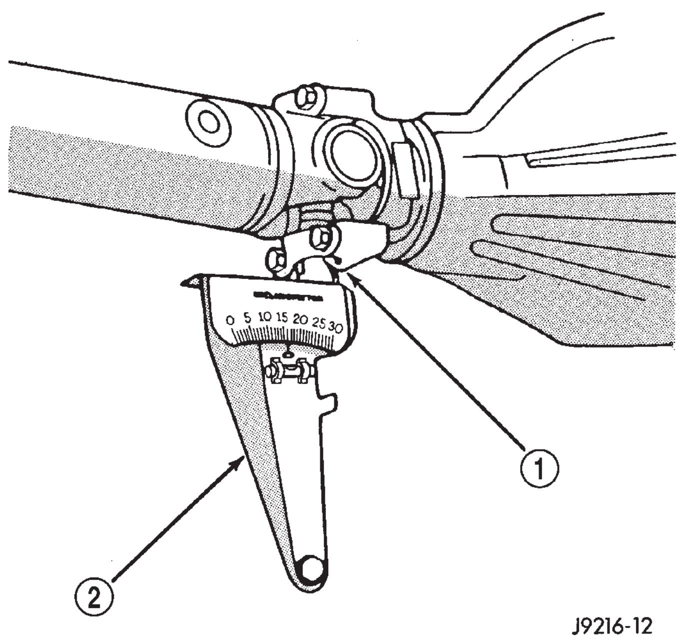


Fig. 6 INPUT YOKE ANGLE (B)

1 - PINION YOKE BEARING CAP
2 - INCLINOMETER

Refer to rules given below and the example in (Fig. 7) for additional information.

- Good cancellation of U-joint operating angles (within 1°).
- Operating angles less than 3°.
- Operating angles less than 10° for double cardan U-joint.
- At least 1/2 of one degree continuous operating (propeller shaft) angle.

PROPELLER SHAFT (Continued)

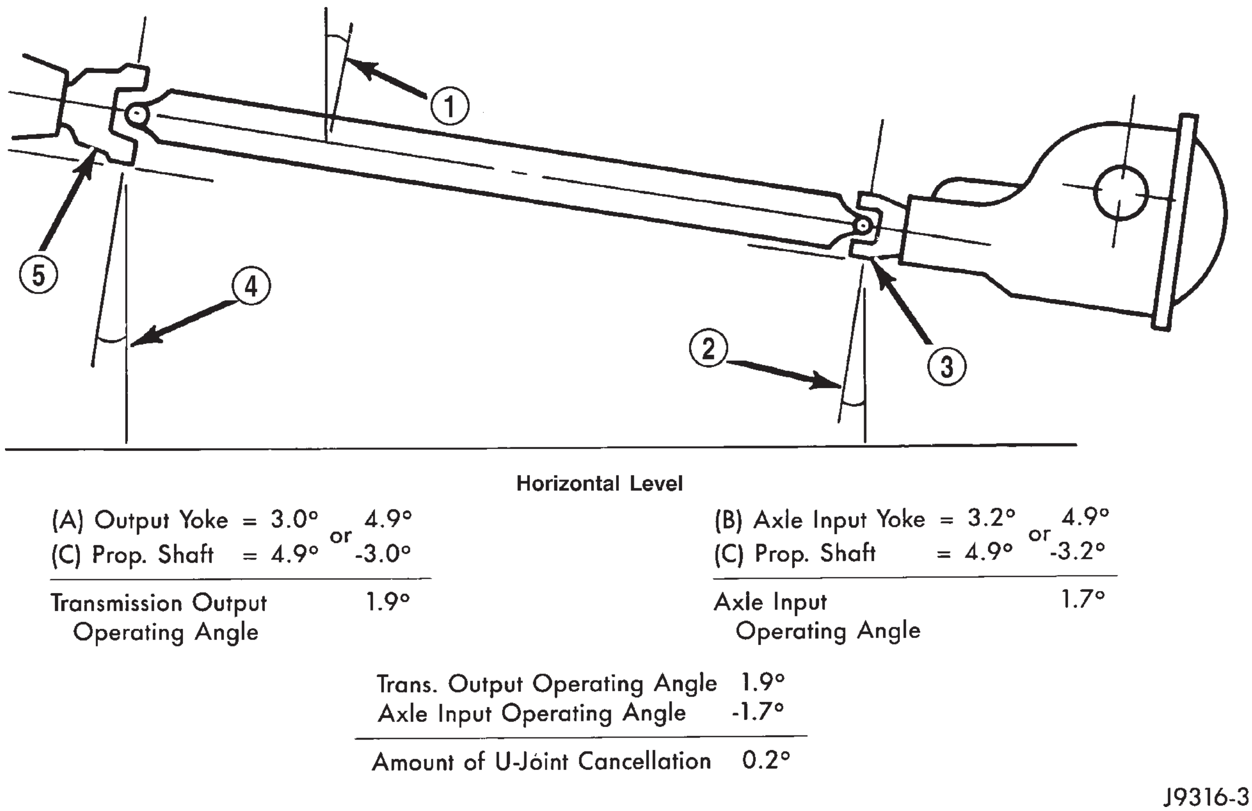


Fig. 7 U-JOINT ANGLE EXAMPLE

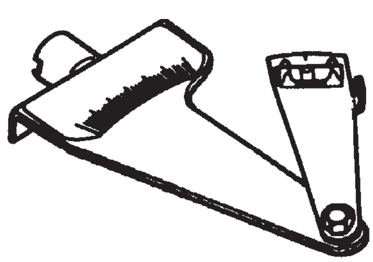
1 - 4.9° Angle (C)
2 - 3.2° Angle (B)
3 - Input Yoke
4 - 3.0° Angle (A)
5 - Output Yoke

SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Front Shaft - Companion Flange Bolts	32	24	-
4.7L Front Shaft - Axle Yoke Nuts	19	14	-
4.7L Front Shaft - Transfer Case Bolts	27	20	-
Rear Shaft - Yoke Nuts	19	14	-

SPECIAL TOOLS



Inclinometer 7663

PROPELLER SHAFT - FRONT

REMOVAL

NOTE: Different length propeller shafts are used for different drivetrain applications. Ensure that the correct propeller shaft is used.

(1) Place vehicle on floor or drive-on hoist with full weight of vehicle on suspension.

(2) Shift the transmission and transfer case, if necessary, into the Neutral position.

(3) Measure the distance from the face of the C/V joint cup to the end of the C/V joint boot (Fig. 8).

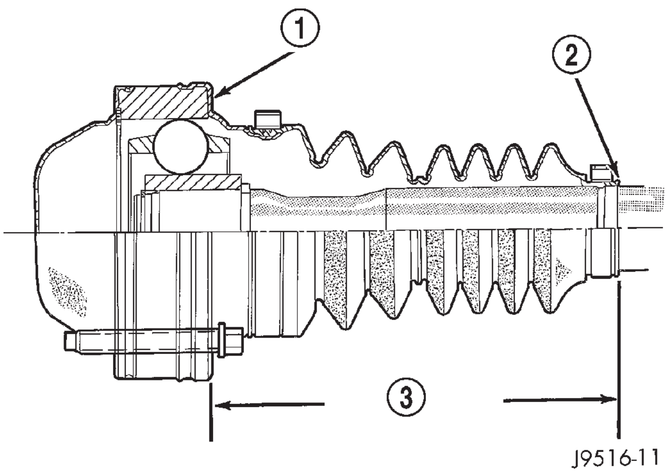


Fig. 8 MEASUREMENT

1 - C/V JOINT CUP
2 - C/V BOOT END
3 - MEASUREMENT

(4) The correct length is 142.7 mm (5.61 in.).

NOTE: If the measurement is not correct, the wrong shaft may have been installed or a mating component (front axle or transfer case) may be installed incorrectly. Investigate and correct as necessary.

(5) Mark a line across the companion flange at the transfer case and C/V joint at the rear of the front propeller shaft for installation reference.

(6) Mark a line across the C/V joints and the pinion companion flanges for installation reference.

(7) Remove bolts from the front C/V joint to the pinion companion flange.

(8) Remove bolts from the rear C/V joint to the transfer case companion flange.

(9) Push the propeller shaft forward to clear transfer case companion flange and remove the shaft.

INSTALLATION

NOTE: Different length propeller shafts are used for different drivetrain applications. Ensure that the correct propeller shaft is used.

(1) Install the shaft between companion flanges.

(2) The shaft should rotate freely in the pinion flange.

(3) Align marks on the companion flanges with the marks on the C/V joints.

(4) Install bolts to the front C/V joint and tighten bolts to 32 N·m (24 ft. lbs.).

(5) Install the bolts to the rear C/V joint and tighten bolts to 32 N·m (24 ft. lbs.).

(6) Verify propeller shaft length.

(7) Lower vehicle.

PROPELLER SHAFT - FRONT 4.7L

REMOVAL

(1) Raise and support vehicle.

(2) Remove crossmember/skid plate as necessary to gain access to the propeller shaft.

(3) Shift transmission and transfer case, if necessary into Neutral.

(4) Mark a line across the yoke at the transfer case, link yoke and propeller shaft yoke at the rear of the front propeller shaft for installation reference (Fig. 9).

(5) Mark a line across the propeller shaft yoke and pinion shaft yoke for installation reference.

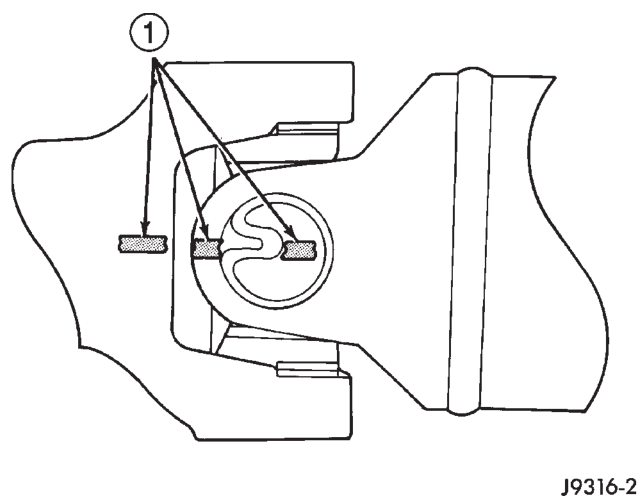


Fig. 9 REFERENCE MARKS ON YOKES

1 - REFERENCE MARKS

PROPELLER SHAFT - FRONT 4.7L (Continued)

(6) Remove the U-joint strap bolts at the pinion shaft yoke (Fig. 10).

(7) Remove bolts holding rear universal joint to the transfer case yoke.

(8) Separate the rear universal joint from the transfer case yoke.

(9) Push rear of propeller shaft upward to clear transfer case yoke.

(10) Separate front universal joint from front axle.

(11) Separate propeller shaft from vehicle.

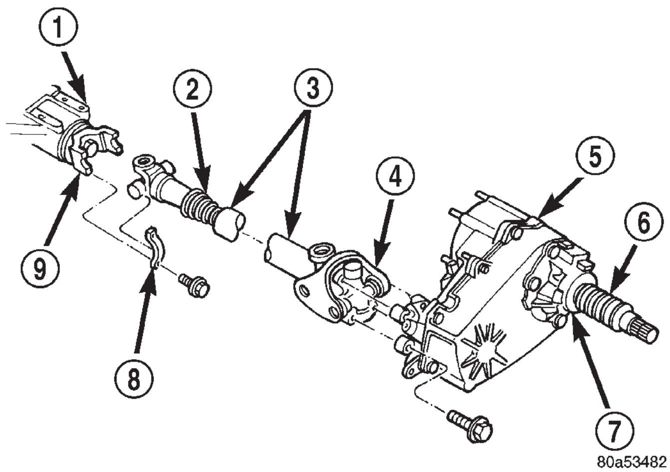


Fig. 10 FRONT PROPELLER SHAFT - 4.7L

1 - FRONT AXLE
2 - BOOT
3 - PROPELLER SHAFT
4 - DOUBLE CARDAN U-JOINT
5 - TRANSFER CASE
6 - BOOT
7 - SLINGER
8 - CLAMP
9 - YOKE

INSTALLATION

(1) Position front propeller shaft under vehicle with rear universal joint over the transfer case yoke.

(2) Place front universal joint into the axle pinion yoke.

(3) Align mark on the rear link yoke and universal joint to the mark on the transfer case yoke.

(4) Loosely install bolts to hold universal joint to transfer case yoke.

(5) Align mark on front universal joint to the mark on the axle pinion yoke.

(6) Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.).

(7) Tighten the universal joint to transfer case bolts to 27 N·m (20 ft. lbs.).

(8) Lower the vehicle.

PROPELLER SHAFT - REAR

REMOVAL

(1) Raise and support vehicle on safety stands.

(2) Shift the transmission and transfer case if necessary, to their neutral positions.

(3) Mark a line across the axle pinion yoke and the propeller shaft yoke for installation reference.

(4) Remove the bolts holding the universal joint clamps to the pinion yoke.

(5) Slide the slip yoke off of the transmission, or transfer case, output shaft and remove the propeller shaft (Fig. 11).

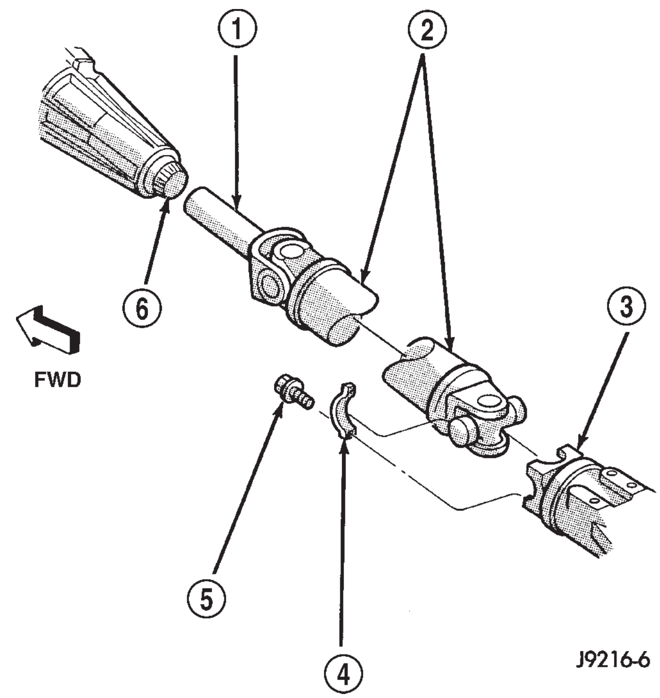


Fig. 11 REAR PROPELLER SHAFT

1 - SLIDING YOKE
2 - PROPELLER SHAFT
3 - PINION YOKE
4 - CLAMP/STRAP
5 - BOLT
6 - OUTPUT SHAFT

INSTALLATION

(1) Slide the slip yoke on the transmission, or transfer case, output shaft.

(2) Align the installation reference marks made on the propeller shaft and pinion yoke.

(3) Position universal joint into pinion yoke.

(4) Install the universal joint clamp and clamp bolts to the pinion yoke. Tighten bolts to 19 N·m (14 ft. lbs.).

(5) Lower the vehicle.

SINGLE CARDAN UNIVERSAL JOINTS

DISASSEMBLY

NOTE: Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.

(1) Remove the propeller shaft.
(2) Tap the outside of the bearing cap assembly with a drift to loosen snap ring.
(3) Remove snap rings from both sides of yoke (Fig. 12).

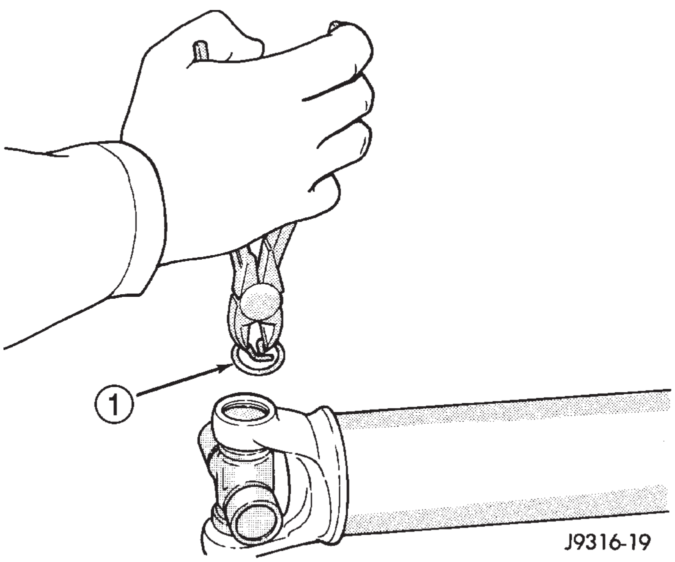


Fig. 12 REMOVE SNAP RING

1 - SNAP RING

(4) Set the yoke in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the yoke.
(5) Position the yoke with the grease fitting, if equipped, pointing up.
(6) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and press the cap through the yoke to release the lower bearing cap (Fig. 13).
(7) If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.
(8) To remove the opposite bearing cap, turn the yoke over and straighten the cross in the open hole. Then, carefully press the end of the cross until the remaining bearing cap can be removed (Fig. 14).

CAUTION: If the cross or bearing cap are not straight during installation, the bearing cap will

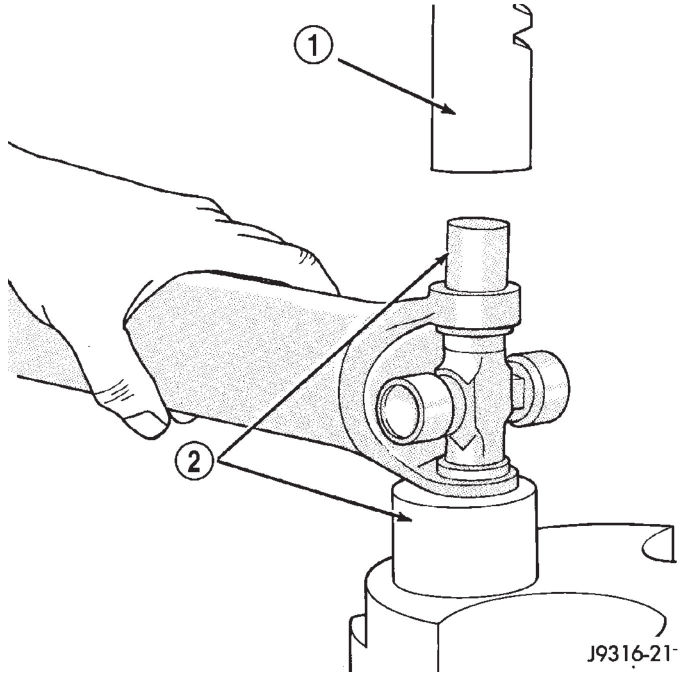


Fig. 13 PRESS OUT BEARING

1 - PRESS
2 - SOCKET

score the walls of the yoke bore and damage can occur.

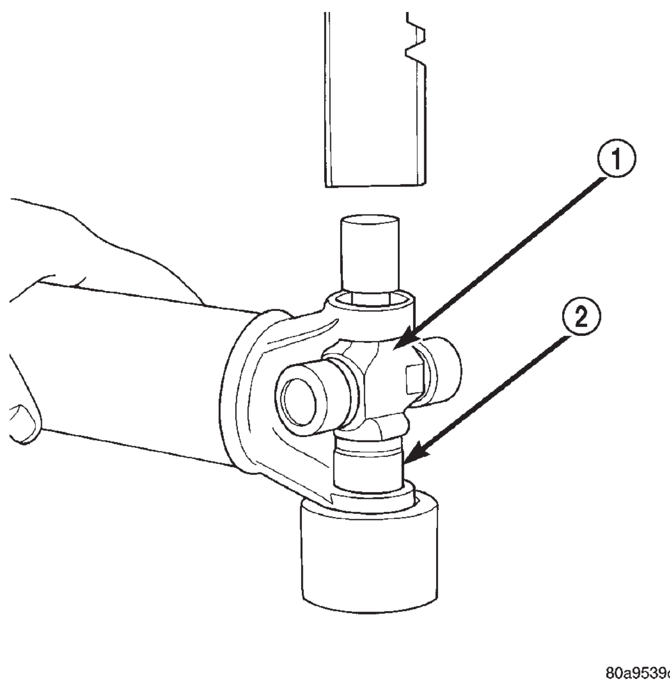


Fig. 14 PRESS OUT REMAINING BEARING

1 - CROSS
2 - BEARING CAP

SINGLE CARDAN UNIVERSAL JOINTS (Continued)

ASSEMBLY

(1) Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores.

(2) Position the cross in the yoke with its lube fitting, if equipped, pointing up (Fig. 15).

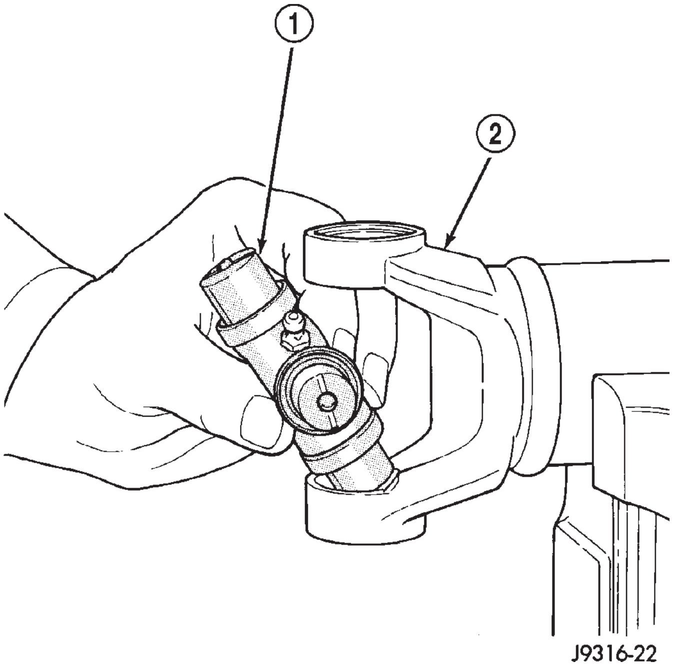


Fig. 15 CROSS IN YOKE

1 - CROSS
2 - YOKE

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 16). Keep the needle bearings upright in the bearing cap.

(4) Press the bearing cap into the yoke bore enough to clear snap ring groove.

(5) Install a snap ring.

(6) Repeat Step 3 and Step 4 to install the opposite bearing cap.

NOTE: If the joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.

(7) Add grease to lube fitting, if equipped.

(8) Install the propeller shaft.

DOUBLE CARDAN UNIVERSAL JOINTS

DISASSEMBLY

NOTE: Individual components of cardan universal joints are not serviceable they must be replaced as an assembly.

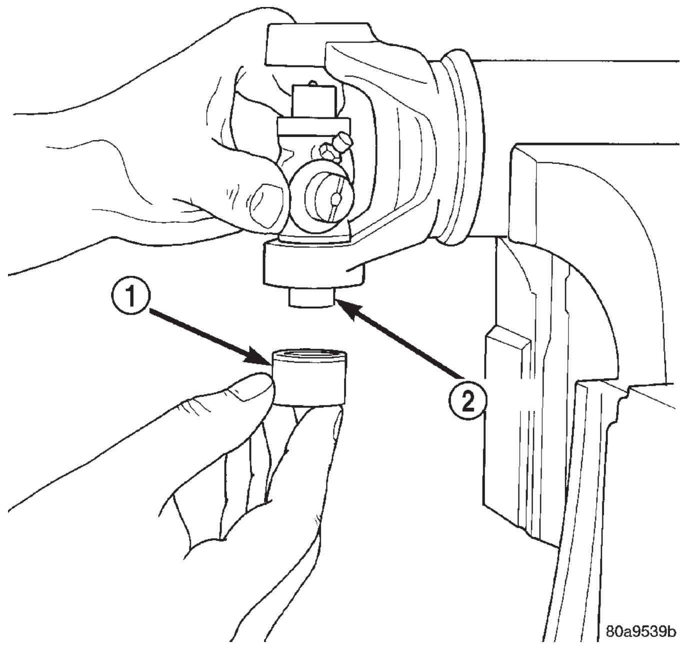


Fig. 16 INSTALL BEARING ON TRUNNION

1 - BEARING CAP
2 - TRUNNION

(1) Remove the propeller shaft.

(2) Mark the propeller shaft yoke and link yoke for assembly reference.

(3) Tap the outside of the bearing cap assembly with drift to loosen snap rings.

(4) Remove all the bearing cap snap rings (Fig. 17).

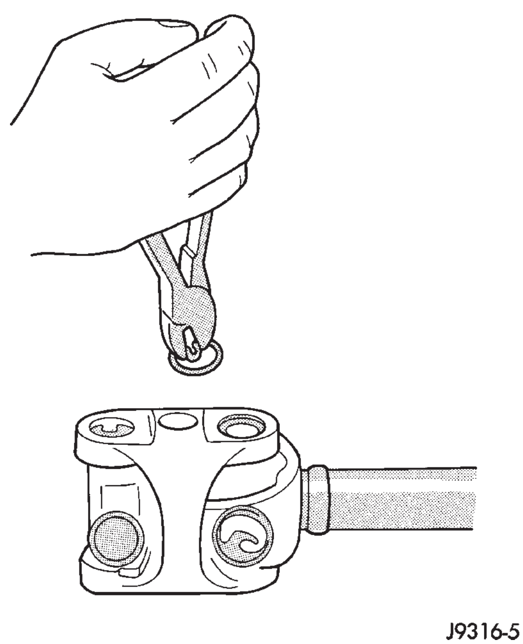


Fig. 17 SNAP RINGS

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(5) Remove any grease fittings if equipped.

(6) Position a socket on the press with an inside diameter large enough to receive the bearing cap under the link yoke.

(7) Place another socket with an outside diameter smaller than the bearing cap on the upper bearing cap.

(8) Press one bearing cap from the outboard side of the link yoke enough to grasp the cap with vise jaws (Fig. 18).

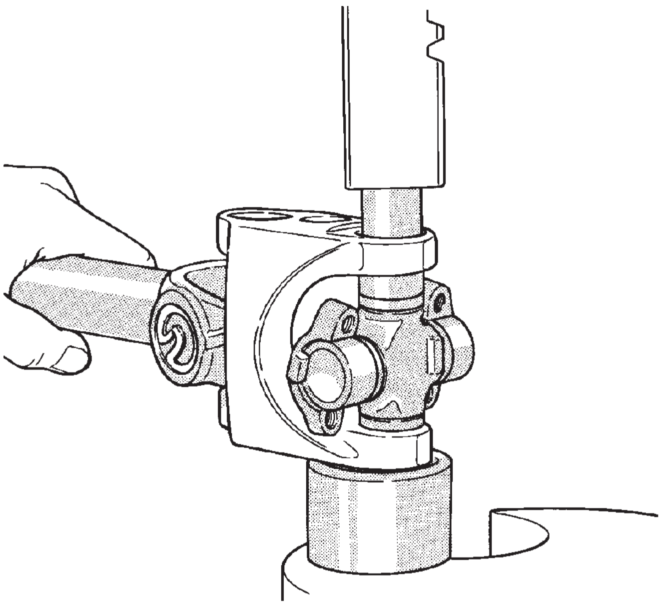


Fig. 18 PRESS OUT BEARING

(9) Grasp protruding bearing cap with vise jaws and tap link yoke with a mallet and drift to remove bearing cap (Fig. 19).

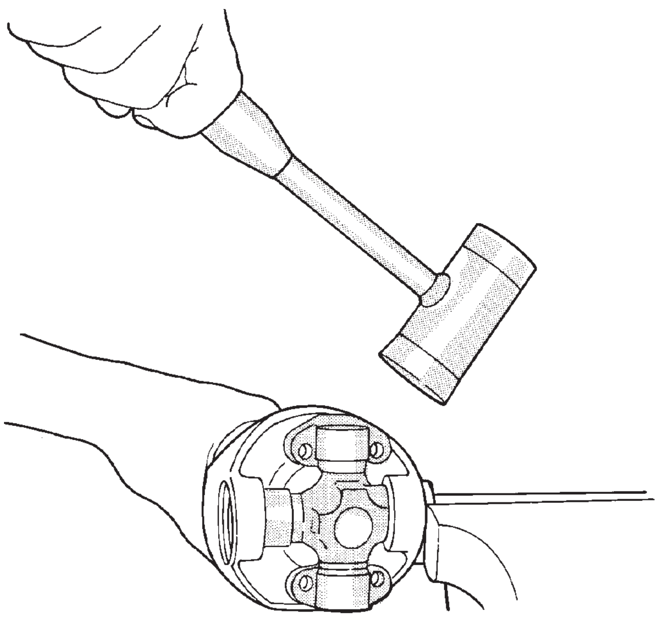


Fig. 19 REMOVE BEARING FROM YOKE

(10) Flip assembly and repeat Step 6, Step 7, Step 8 and Step 9 to remove the opposite bearing cap.

(11) Remove the cross centering kit assembly and spring (Fig. 20).

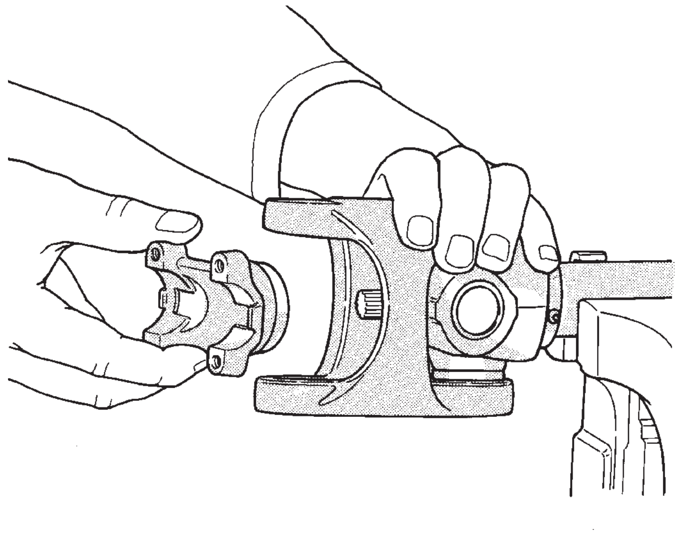


Fig. 20 REMOVE CENTERING KIT

(12) Press the remaining bearing caps out the other end of the link yoke as described above to complete the disassembly.

ASSEMBLY

CAUTION: All alignment marks on the link yoke and propeller shaft yoke must be aligned during assembled.

(1) Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores.

(2) Fit a cross into the propeller shaft yoke (Fig. 21).

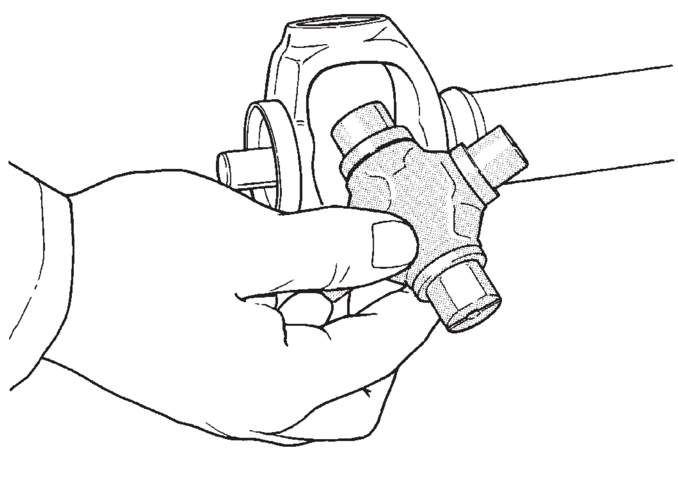


Fig. 21 INSTALL CROSS IN YOKE

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 22). Keep needle bearings upright in the bearing cap.

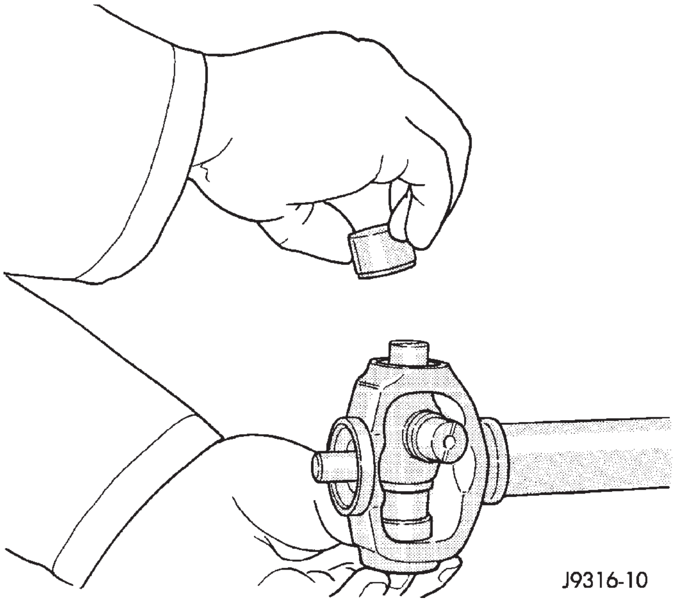


Fig. 22 INSTALL BEARING CAP

(4) Press bearing cap into the yoke bore enough to clear snap ring groove (Fig. 23).

(5) Install a snap ring.

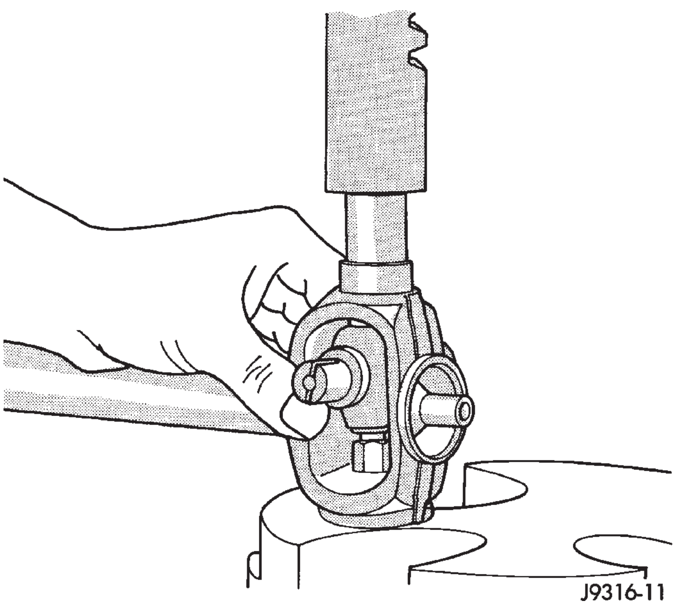


Fig. 23 PRESS BEARING CAP

(6) Flip propeller shaft yoke and install other bearing cap onto the opposite trunnion and install a snap ring (Fig. 24).

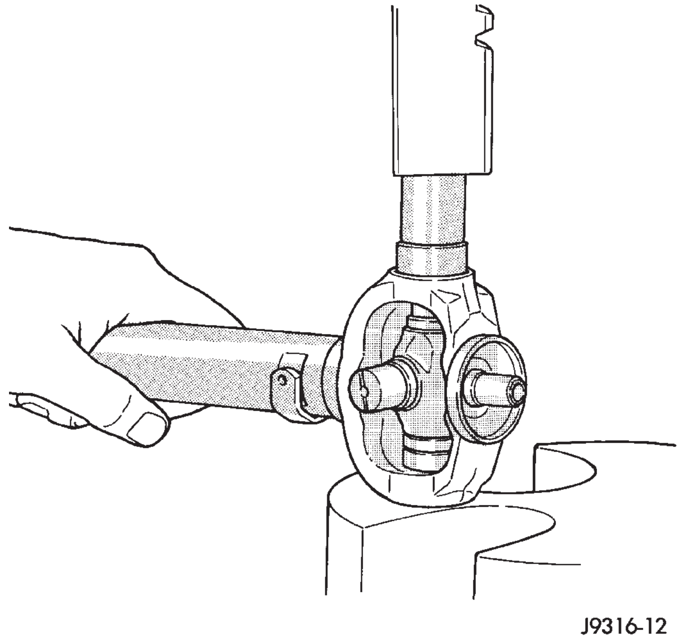


Fig. 24 PRESS BEARING CAP

(7) Fit the link yoke onto the remaining trunnions and press both bearing caps into place and install snap rings (Fig. 25).

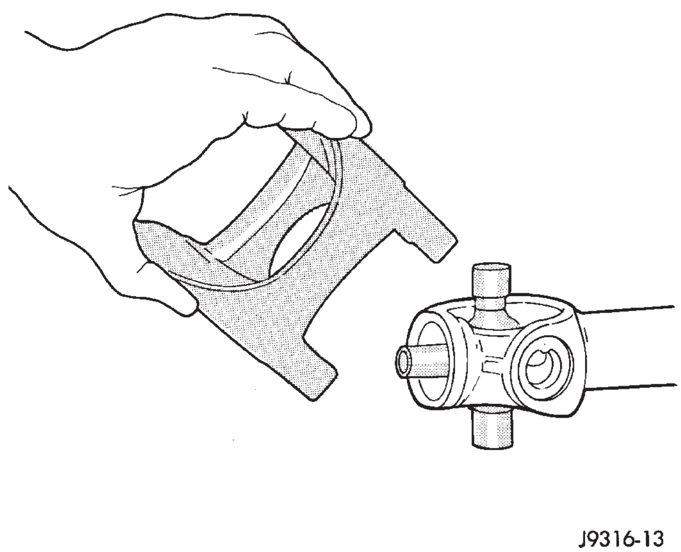


Fig. 25 INSTALL LINK YOKE

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(8) Install centering kit assembly inside the link yoke (Fig. 26).

NOTE: Making sure the spring is properly positioned.

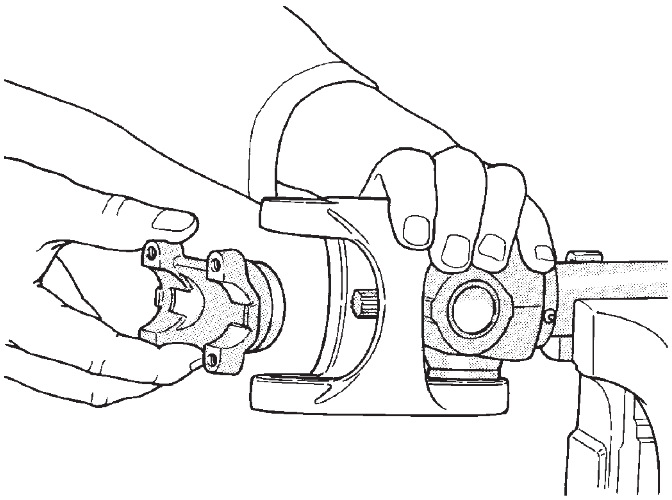


Fig. 26 CENTERING KIT

(9) Place two bearing caps on opposite trunnions of the remaining cross. Fit the open trunnions into the link yoke bores and the bearing caps into the centering kit (Fig. 27).

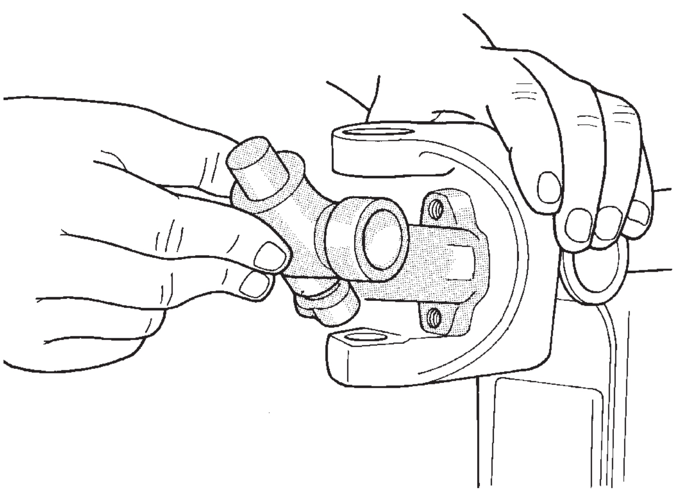


Fig. 27 REMAINING CROSS

(10) Press the remaining two bearing caps into place and install snap rings (Fig. 28).

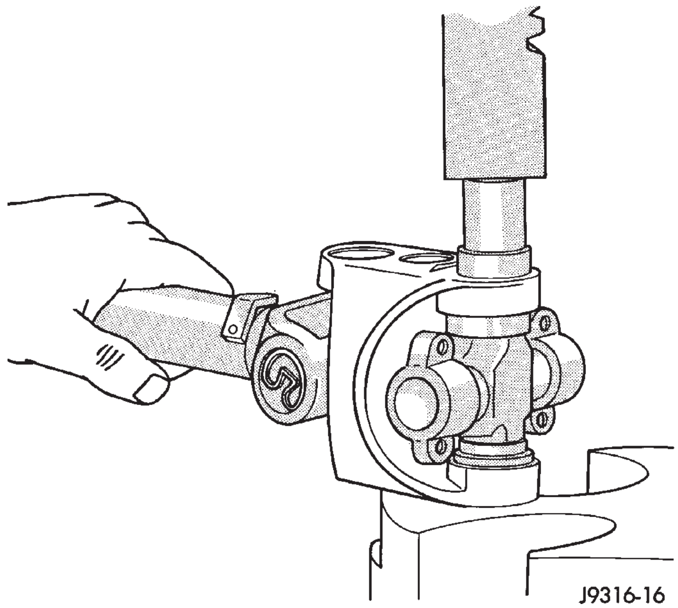


Fig. 28 PRESS BEARING CAP

(11) Tap the snap rings to seat them into the grooves (Fig. 29).

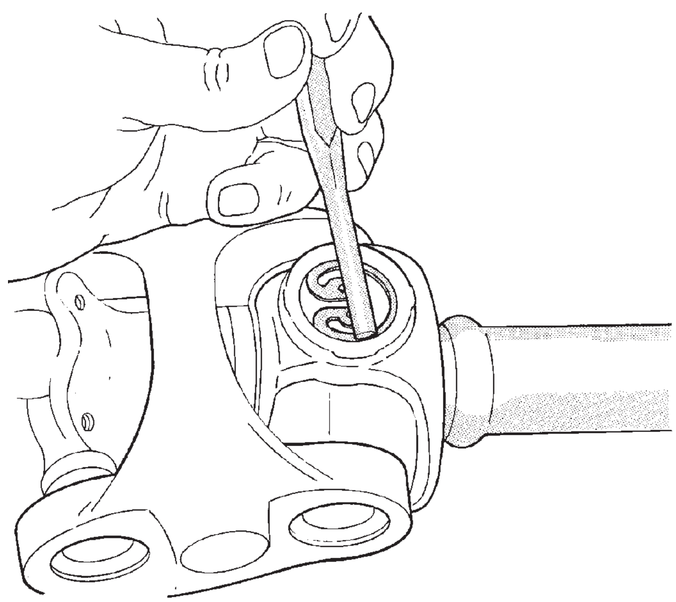


Fig. 29 SEAT SNAP RINGS

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(12) Verify for proper assembly. Flexing the joint beyond center, the joint should snap over-center in both directions if correctly assembled (Fig. 30).

(13) Install the propeller shaft.

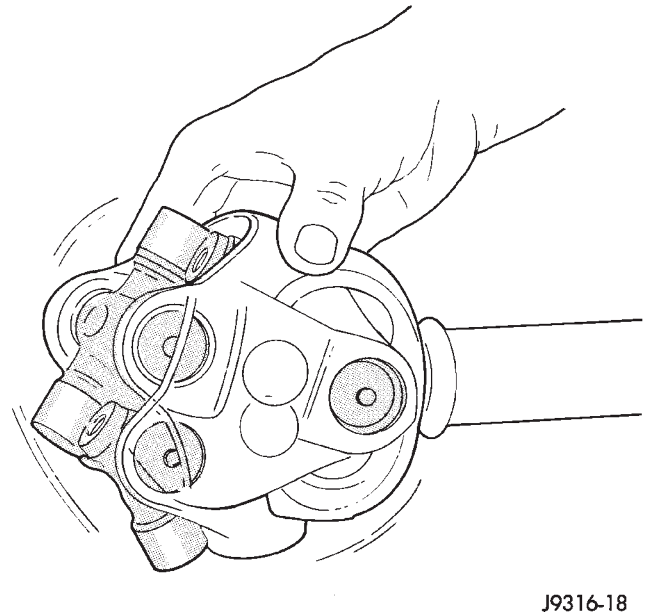


Fig. 30 VERIFY ASSEMBLY

FRONT TUBE AXLE

TABLE OF CONTENTS

FRONT TUBE AXLE

REMOVAL

(1) Raise and support the vehicle.

(2) Position a lifting device under the axle and secure axle to lift.

(3) Remove the wheels and tires.

(4) Remove the brake rotors (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL) and calipers.

(5) Disconnect wheel sensor wiring harness from the vehicle wiring harness.

(6) Remove stabilizer bar links at the axle.

(7) Remove shock absorbers from axle brackets.

(8) Removet track bar.

(9) Remove tie rod and drag link from the steering knuckle.

(10) Remove steering damper from the axle bracket.

(11) Remove upper and lower suspension arms from the axle brackets.

(12) Lower the lift enough to remove the axle. The coil springs will drop with the axle.

(13) Remove the coil springs from the axle.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners are tightened. If not at their normal ride position, ride height and handling could be affected.

(1) Install springs and retainer clips and tighten retainer bolts to 21 N·m (16 ft. lbs.).

(2) Lift and position axle under the vehicle and align it with the spring pads.

(3) Position upper and lower suspension arms in the axle brackets and loosely install bolts and nuts.

(4) Install track bar to the axle bracket and loosely install bolt.

(5) Install shock absorbers and tighten bolts to 23 N·m (17 ft. lbs.).

(6) Install stabilizer bar links to the axle brackets and tighten nuts to 95 N·m (70 ft. lbs.).

(7) Install drag link and tie rod to the steering knuckles.

(8) Install steering damper to the axle bracket and tighten nut to 75 N·m (55 ft. lbs.).

(9) Install the brake rotors and calipers.

(10) Connect wheel speed sensor wiring harness, if equipped.

(11) Install the wheel and tire assemblies.

(12) Remove lift from the axle and lower the vehicle.

(13) Tighten upper suspension arm nuts to 75 N·m (55 ft. lbs.). Tighten lower suspension arm nuts to 115 N·m (85 ft. lbs.).

(14) Tighten track bar bolt at the axle bracket to 100 N·m (74 ft. lbs.).

(15) Check the front wheel alignment.

FRONT AXLE - 186FBI

TABLE OF CONTENTS

FRONT AXLE - 186FBI

DESCRIPTION

The Front Beam-design Iron (FBI) axle consists of a cast iron differential housing with axle shaft tubes extending from either side. The tubes are pressed into the differential housing and welded. The axles are semi-floating axle shafts, meaning the loads are supported by the hub bearings. The axle shafts are retained by nuts at the hub bearings.

The differential case is a one-piece design. Differential bearing preload and ring gear backlash is adjusted by the use of shims located between the differential bearing cups and housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer. A differential cover provides a means for inspection and servicing.

An optional Vari-Lok® differential has a one-piece differential case which contains the gerotor pump assembly and the clutch mechinism. This unit is serviced as an assembly.

OPERATION

The axle receives power from the transfer case through the front propeller shaft. The front propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

STANDARD DIFFERENTIAL

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 1).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

FRONT AXLE - 186FBI (Continued)

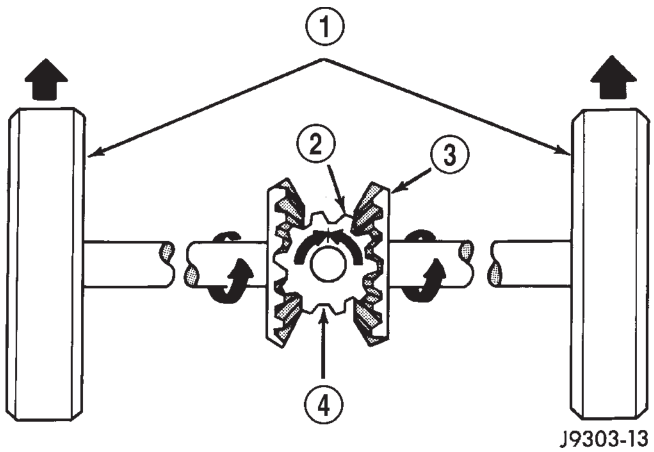


Fig. 1 DIFFERENTIAL-STRAIGHT AHEAD DRIVING

1 - IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 - PINION GEAR
3 - SIDE GEAR
4 - PINION GEARS ROTATE WITH CASE

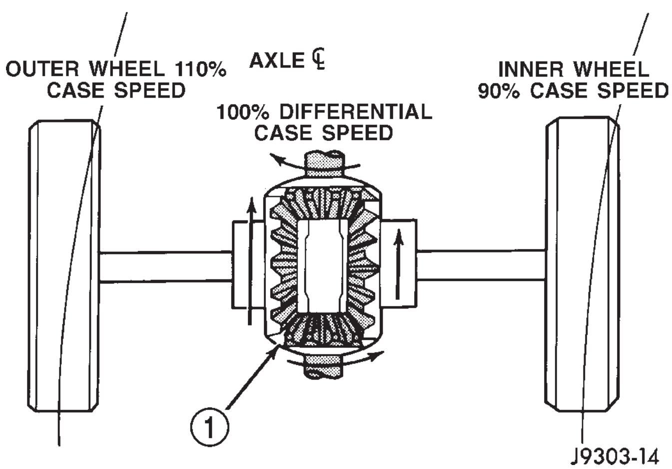


Fig. 2 DIFFERENTIAL-ON TURNS

1 - PINION GEARS ROTATE ON PINION SHAFT

VARI-LOK® DIFFERENTIAL

In a standard differential if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

A gerotor pump and clutch pack are used to provide the torque transfer capability. One axle shaft is splined to the gerotor pump and one of the differential side gears, which provides the input to the pump. As a wheel begins to lose traction, the speed differential is transmitted from one side of the differential to the other through the side gears. The motion of one side gear relative to the other turns the inner rotor of the pump. Since the outer rotor of the pump is grounded to the differential case, the inner and outer rotors are now moving relative to each other and therefore creates pressure in the pump. The tuning of the front and rear axle orifices and valves inside the gerotor pump is unique and each system includes a torque-limiting pressure relief valve to protect the clutch pack, which also facilitates vehicle control under extreme side-to-side traction variations. The resulting pressure is applied to the clutch pack and the transfer of torque is completed.

Under conditions in which opposite wheels are on surfaces with widely different friction characteristics, Vari-lok® delivers far more torque to the wheel on the higher traction surface than do conventional Trac-lok® systems. Because conventional Trac-lok® differentials are initially pre-loaded to assure torque transfer, normal driving (where inner and outer wheel speeds differ during cornering, etc.) produces torque transfer during even slight side-to-side speed variations. Since these devices rely on friction from this preload to transfer torque, normal use tends to cause wear that reduces the ability of the differential to transfer torque over time. By design, the Vari-lok® system is less subject to wear, remaining more consistent over time in its ability to transfer torque. The coupling assembly is serviced as a unit. From a service standpoint the coupling also benefits from using the same lubricant supply as the ring and pinion gears.

DIAGNOSIS AND TESTING

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

FRONT AXLE - 186FBI (Continued)

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front–end components or engine/transmission mounts. These components can contribute to what appears to be a rear-end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

(Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING)

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

FRONT AXLE - 186FBI (Continued)

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion yoke nut.	6. Tighten the pinion yoke nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.

FRONT AXLE - 186FBI (Continued)

Condition	Possible Causes	Correction
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.

FRONT AXLE - 186FBI (Continued)

Condition	Possible Causes	Correction
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

VARI-LOK®

(1) Park the vehicle on a level surface or raise vehicle on hoist so that the vehicle is level.

(2) Remove the axle fill plug.

(3) Verify that the axle fluid level is correct. The fluid level is correct if the fluid is level with the bottom of the fill hole.

(4) Shift the transfer case into the 4WD full-time position.

(5) Drive the vehicle in a tight circle for 2 minutes at 5mph to fully prime the pump.

(6) Block the tires opposite the axle to be tested to prevent the vehicle from moving.

(7) Shift the transfer case into the 4WD Low position and the transmission into the Park position.

(8) Raise both the wheels of the axle to be tested off of the ground.

(9) Rotate the left wheel by hand at a minimum of one revolution per second while an assistant rotates the right wheel in the opposite direction.

(10) The left wheel should spin freely at first and then increase in resistance within 5 revolutions until the wheels cannot be continuously rotated in opposite directions.

(11) The Vari-lok® differential has engaged properly if the wheels cannot be rotated in opposite directions for a moment. After the wheels stop rotating for a moment, the fluid pressure will drop in the differential and the wheels begin to rotate once again.

(12) If the system does not operate properly, replace the Vari-lok® differential.

REMOVAL

(1) Raise and support the vehicle.

(2) Position a suitable lifting device under the axle.

(3) Secure axle to lift.

(4) Remove the wheels and tires.

(5) Remove the brake calipers and rotors (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL) from the axle.

(6) Disconnect the wheel sensor wiring harness from the vehicle wiring harness.

(7) Disconnect the vent hose from the axle shaft tube.

(8) Mark propeller shaft and yoke/pinion flange for installation alignment reference.

(9) Remove propeller shaft.

(10) Disconnect stabilizer bar links at the axle.

(11) Disconnect shock absorbers from axle brackets.

(12) Disconnect track bar.

(13) Disconnect the tie rod and drag link from the steering knuckle.

(14) Disconnect the steering damper from the axle bracket.

(15) Disconnect the upper and lower suspension arms from the axle brackets.

(16) Lower the lifting device enough to remove the axle. The coil springs will drop with the axle.

(17) Remove the coil springs from the axle.

FRONT AXLE - 186FBI (Continued)

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. If springs are not at their normal ride position, ride height and handling could be affected.

(1) Install the springs and retainer clips. Tighten the retainer bolts to 21 N·m (16 ft. lbs.).

(2) Support the axle on a lifting device and position axle under the vehicle.

(3) Raise the axle and align it with the spring pads.

(4) Position the upper and lower suspension arms in the axle brackets. Loosely install bolts and nuts to hold suspension arms to the axle brackets.

(5) Install vent hose to the axle shaft tube.

(6) Install track bar in the axle bracket and install the bolt loosely.

(7) Install shock absorbers and tighten the bolts to 23 N·m (17 ft. lbs.).

(8) Install stabilizer bar links to the axle brackets and tighten the nuts to 95 N·m (70 ft. lbs.).

(9) Install drag link and tie rod to the steering knuckles.

(10) Install steering damper to the axle bracket and tighten the nut to 75 N·m (55 ft. lbs.).

(11) Install the brake rotors (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION) and calipers.

(12) Connect the wheel speed sensor wiring harness to the vehicle wiring harness.

(13) Align the previously made marks on the propeller shaft and the yoke/pinion flange.

(14) Install propeller shaft to pinion flange bolts , if equipped.

(15) Install propeller shaft to yoke straps and bolts, if equipped.

(16) Check and fill axle lubricant.

(17) Install the wheel and tire assemblies.

(18) Remove the lifting device from the axle and lower the vehicle.

(19) Tighten the upper suspension arm nuts to 75 N·m (55 ft. lbs.). Tighten the lower suspension arm nuts to 115 N·m (85 ft. lbs.).

(20) Tighten the track bar bolt at the axle bracket to 100 N·m (74 ft. lbs.).

(21) Check the front wheel alignment.

ADJUSTMENTS

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched onto each gear (Fig. 3). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 92.1 mm (3.625 in.). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern Analysis paragraph in this section for additional information.

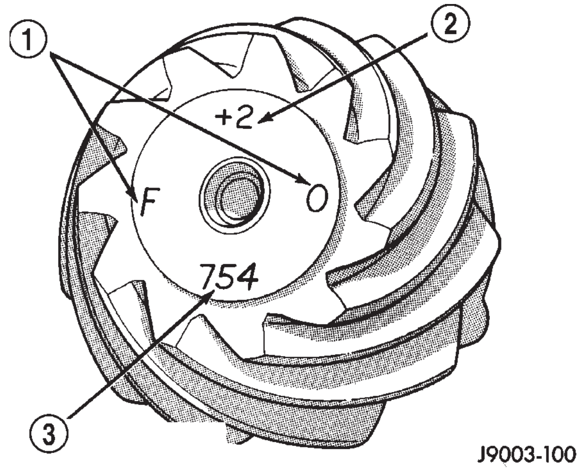


Fig. 3 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - DRIVE PINION GEAR DEPTH VARIANCE
3 - GEAR MATCHING NUMBER

Compensation for pinion depth variance is achieved with a select shim/oil slinger. The shims are placed between the rear pinion bearing and the pinion gear head (Fig. 4).

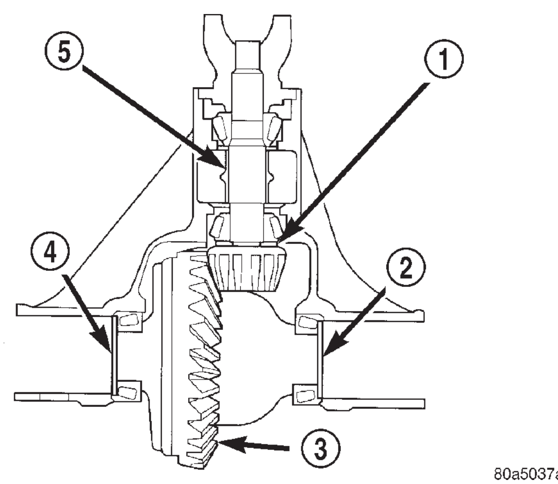


Fig. 4 ADJUSTMENT SHIM LOCATIONS

1 - PINION DEPTH SHIM/OIL SLINGER
2 - DIFFERENTIAL BEARING SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING SHIM
5 - COLLAPSIBLE SPACER

FRONT AXLE - 186FBI (Continued)

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim/oil slinger to compensate for the difference in the depth variances. Refer to the Pinion Gear Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the pinion gear head (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

PINION DEPTH MEASUREMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 5).

(1) Assemble Pinion Height Block 6739, Pinion Block 8804 and rear pinion bearing onto Screw 6741 (Fig. 5).

(2) Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups (Fig. 6).

(3) Install front pinion bearing and Cone-nut 6740 hand tight (Fig. 5).

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position, in the housing side bearing cradles (Fig. 7). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

NOTE: Arbor Discs 6732 has different step diameters to fit other axles. Choose proper step for axle being serviced.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Posttion Scooter Block/Dial Indicator so dial probe and scooter block are flush on the surface of the pinion height block (Fig. 5). Hold scooter block and zero the dial indicator.

(7) Hold scooter block against the pinion height block and slowly slide across the pinion height block to the arbor (Fig. 8). Move the scooter block till the dial probe crests the arbors and record the highest reading.

(8) Select a shim/oil slinger equal to the dial indicator reading plus the pinion depth variance number etched in the face of the pinion (Fig. 3). For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

FRONT AXLE - 186FBI (Continued)

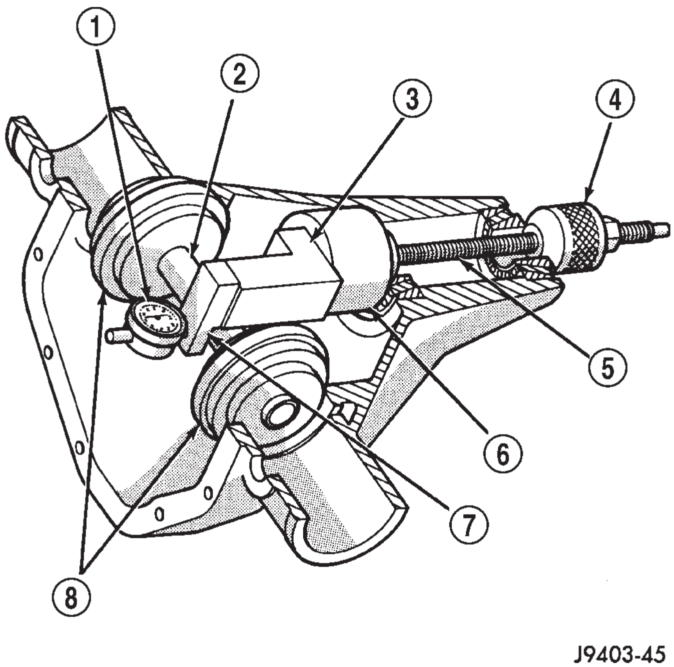


Fig. 5 PINION GEAR DEPTH TOOLS

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

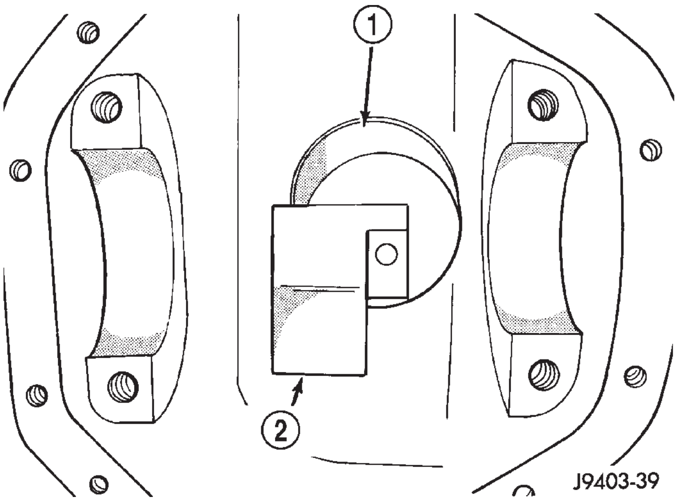


Fig. 6 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

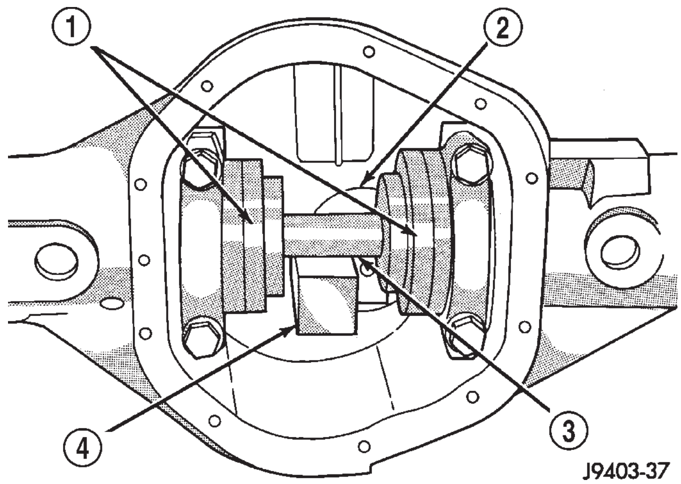


Fig. 7 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

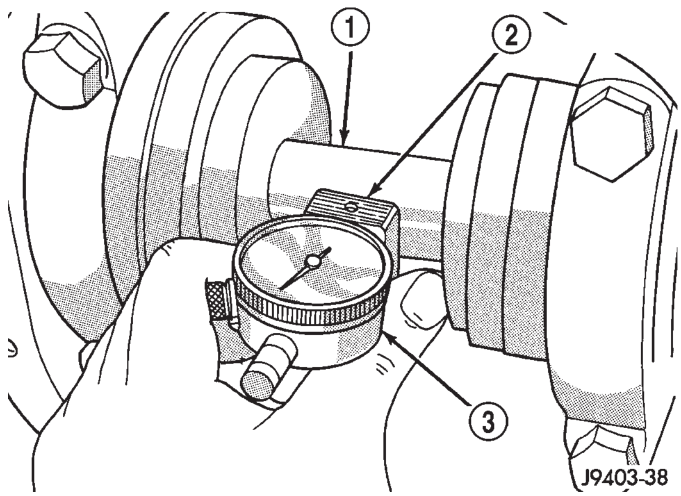


Fig. 8 PINION GEAR DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

FRONT AXLE - 186FBI (Continued)

DIFFERENTIAL

Differential side bearing preload and gear backlash is achieved by selective shims positioned behind the differential side bearing cones. The proper shim thickness can be determined using slip-fit Dummy Bearings D-348 in place of the differential side bearings and a Dial Indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 9). Differential shim measurements are performed with spreader W-129-B removed.

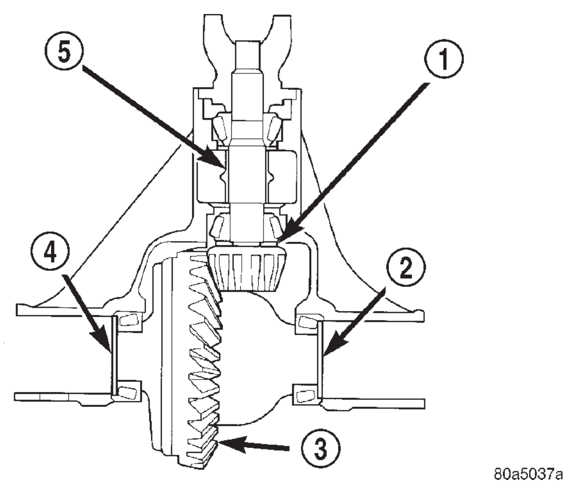


Fig. 9 ADJUSTMENT SHIM LOCATIONS

1 - PINION DEPTH SHIM/OIL SLINGER
2 - DIFFERENTIAL BEARING SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING SHIM
5 - COLLAPSIBLE SPACER

SHIM SELECTION

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

(1) Remove differential side bearings from differential case.
(2) Install ring gear on differential case and tighten bolts to specification.
(3) Install dummy side bearings D-348 on differential case.
(4) Install differential case in the housing.

CAUTION: When installing a Vari-Lok® differential, the oil feed tube must point to the bottom of the housing. If differential is forced in with the oil feed towards the top, the anti-rotation tabs will be damaged.

(5) Record the thickness of Dummy Shims 8107. Insert the shims between the dummy bearings and the differential housing (Fig. 10).

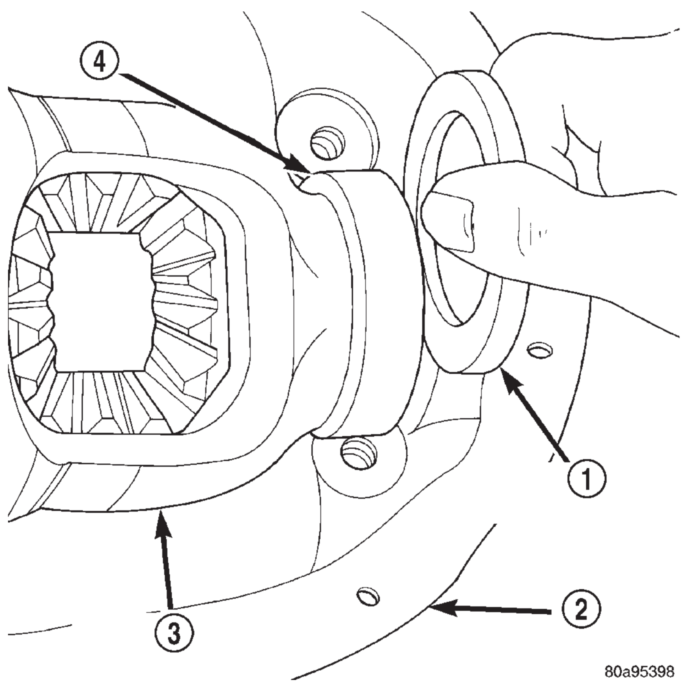


Fig. 10 DUMMY SHIM LOCATION

1 - DUMMY SHIM
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE
4 - DUMMY BEARINGS

FRONT AXLE - 186FBI (Continued)

(6) Install the bearing caps in their correct positions and snug the bolts (Fig. 11).

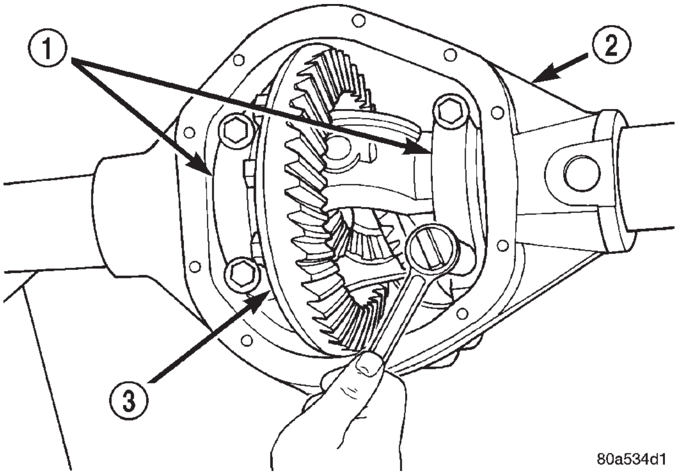


Fig. 11 BEARING CAP BOLTS

1 - BEARING CAP
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

(7) With a dead-blow hammer, seat the differential dummy bearings to each side of the housing (Fig. 12) and (Fig. 13).

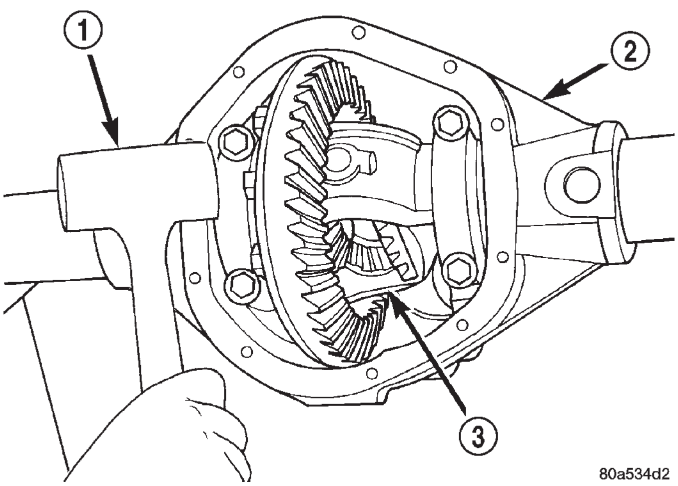


Fig. 12 SEAT DUMMY BEARING PINION SIDE

1 - HAMMER
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

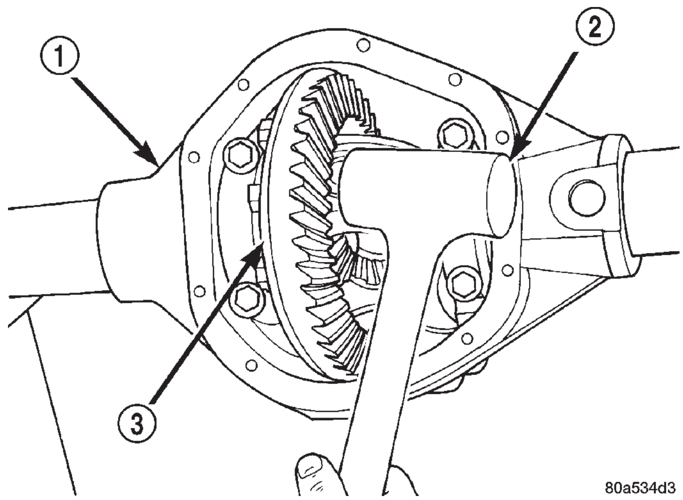


Fig. 13 SEAT DUMMY BEARING RING GEAR SIDE

1 - DIFFERENTIAL HOUSING
2 - HAMMER
3 - DIFFERENTIAL CASE

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 14).

(9) Attach a dial indicator C-3339 to Pilot Stud. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 14).

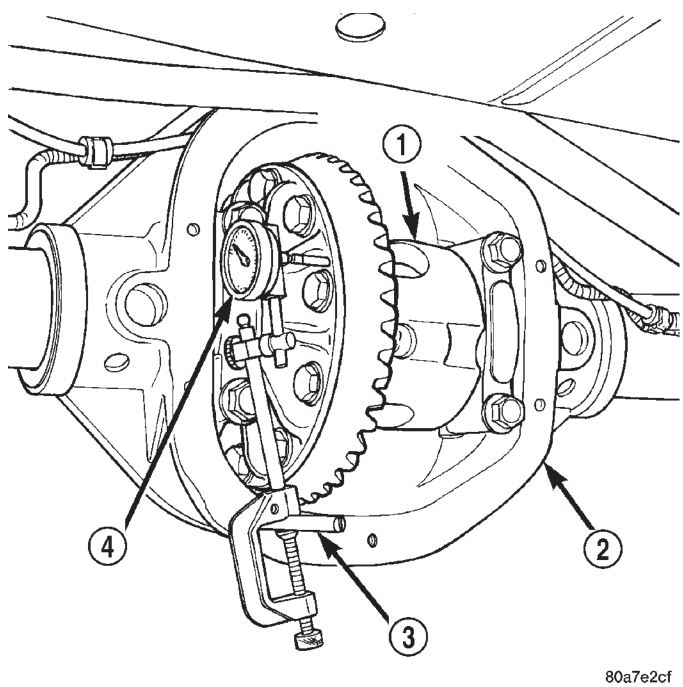


Fig. 14 DIFFERENTIAL SIDE PLAY MEASUREMET

1 - DIFFERENTIAL CASE
2 - DIFFERENTIAL HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

FRONT AXLE - 186FBI (Continued)

(10) Push and hold differential case to pinion gear side of the housing and zero dial indicator (Fig. 15).

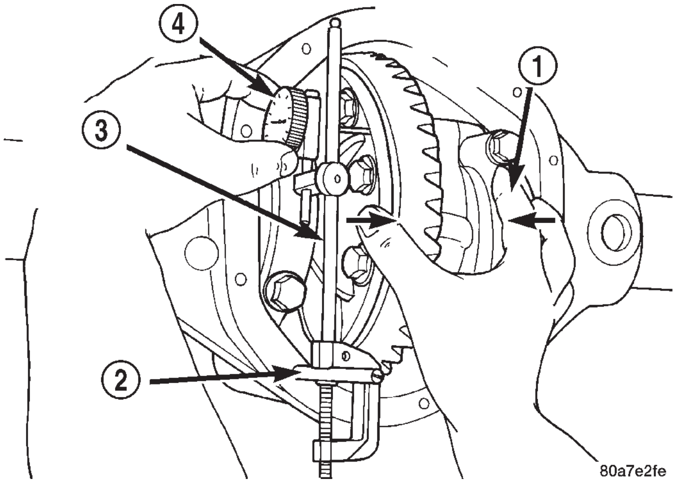


Fig. 15 ZERO DIAL INDICATOR

1 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
2 - PILOT STUD
3 - INDICATOR EXTENSION
4 - DIAL INDICATOR FACE

(11) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 16).

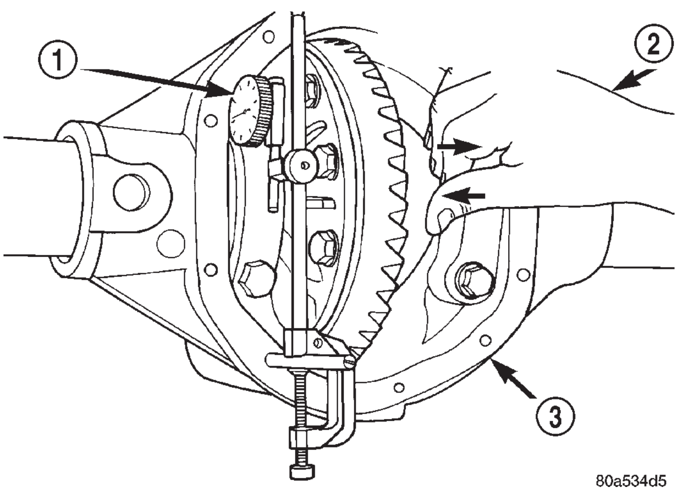


Fig. 16 RECORED DIAL INDICATOR READING

1 - DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(12) Add 0.152 mm (0.006 in.) to the zero end play total. This new total represents the thickness of shims to compress or preload the new bearings when the differential is installed.

(13) Rotate dial indicator out of the way on the pilot stud.

(14) Remove differential case and dummy bearings from the housing.

(15) Install the pinion gear in the housing. Install the pinion yoke and establish the correct pinion rotating torque.

(16) Install differential case and Dummy Bearings D-348 in the housing.

(17) Install a single dummy shim in the ring gear side. Install bearing caps and tighten bolts snug.

(18) Seat ring gear side dummy bearing (Fig. 13).

(19) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 14).

(20) Push and hold differential case toward pinion gear and zero dial indicator (Fig. 17).

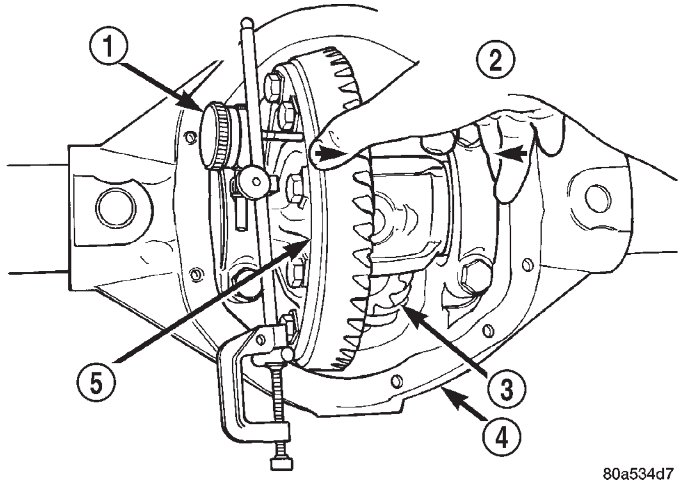


Fig. 17 ZERO DIAL INDICATOR

1 - DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

FRONT AXLE - 186FBI (Continued)

(21) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 18). Add dummy shim thickness to this reading. This will be the total shim thickness to achieve zero backlash.

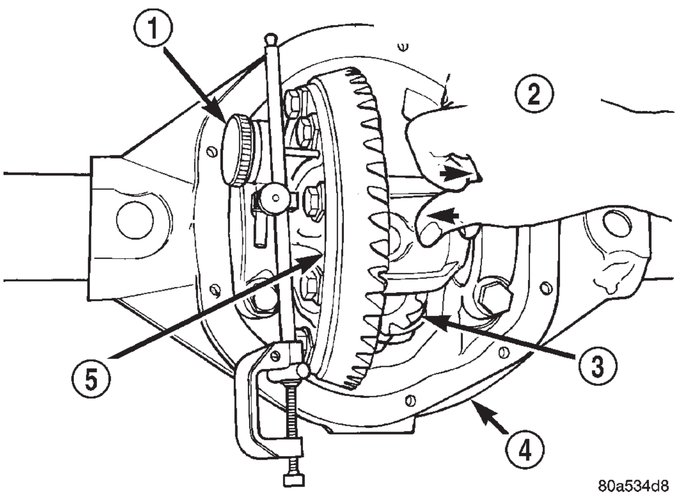


Fig. 18 RECORED DIAL INDICATOR READING

1 - DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

(22) Subtract 0.076 mm (0.003 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.

(23) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.

(24) Rotate dial indicator out of the way on pilot stud.

(25) Remove differential case and dummy bearings from the housing.

(26) Install side bearings and cups on differential case.

(27) Install spreader W-129-B with Adapter Set 6987 on the housing and spread axle opening enough to receive differential case.

(28) Place the bearing preload shims in the axle housing, against the axle tubes.

(29) Install differential case into the housing.

CAUTION: When installing a Vari-Lok® differential, the oil feed tube must point to the bottom of the housing. If differential is forced in with the oil feed towards the top, the anti-rotation tabs will be damaged.

(30) Remove spreader from the housing.

(31) Rotate the differential case several times to seat the side bearings.

(32) Position the indicator plunger against a ring gear tooth (Fig. 19).

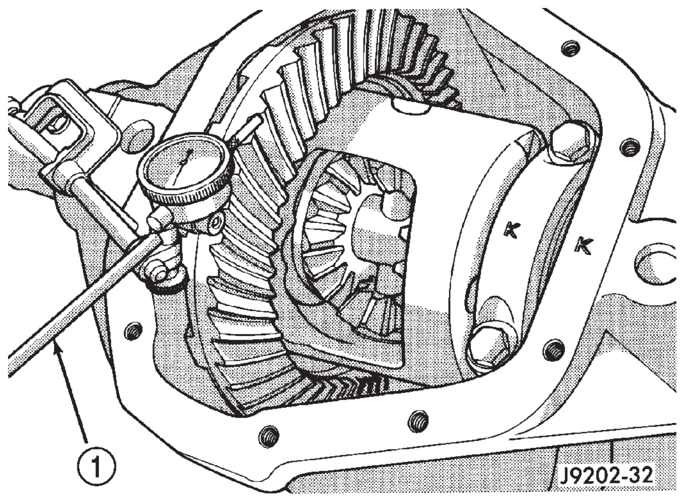


Fig. 19 RING GEAR BACKLASH

1 - DIAL INDICATOR

FRONT AXLE - 186FBI (Continued)

(33) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(34) Zero dial indicator face to pointer.

(35) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other (Fig. 20).

(36) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.

GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) With a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

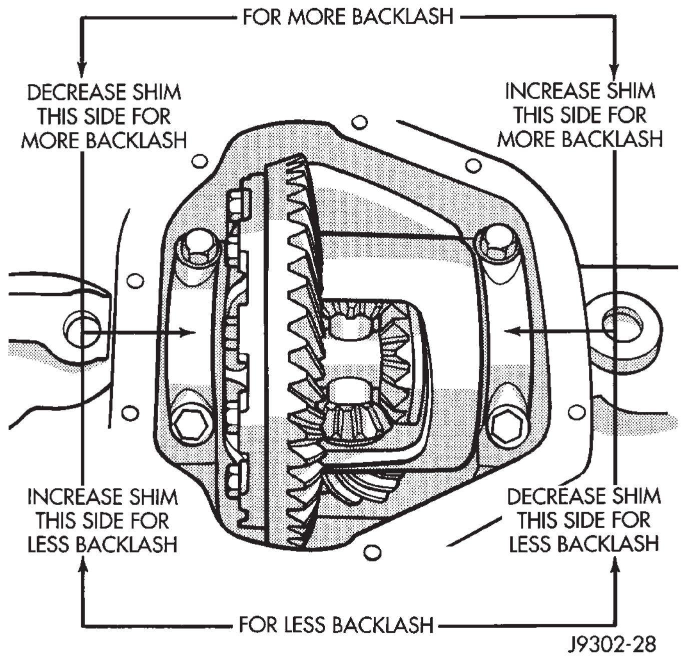


Fig. 20 BACKLASH SHIM ADJUSTMENT

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 21)and adjust pinion depth and gear backlash as necessary.

FRONT AXLE - 186FBI (Continued)

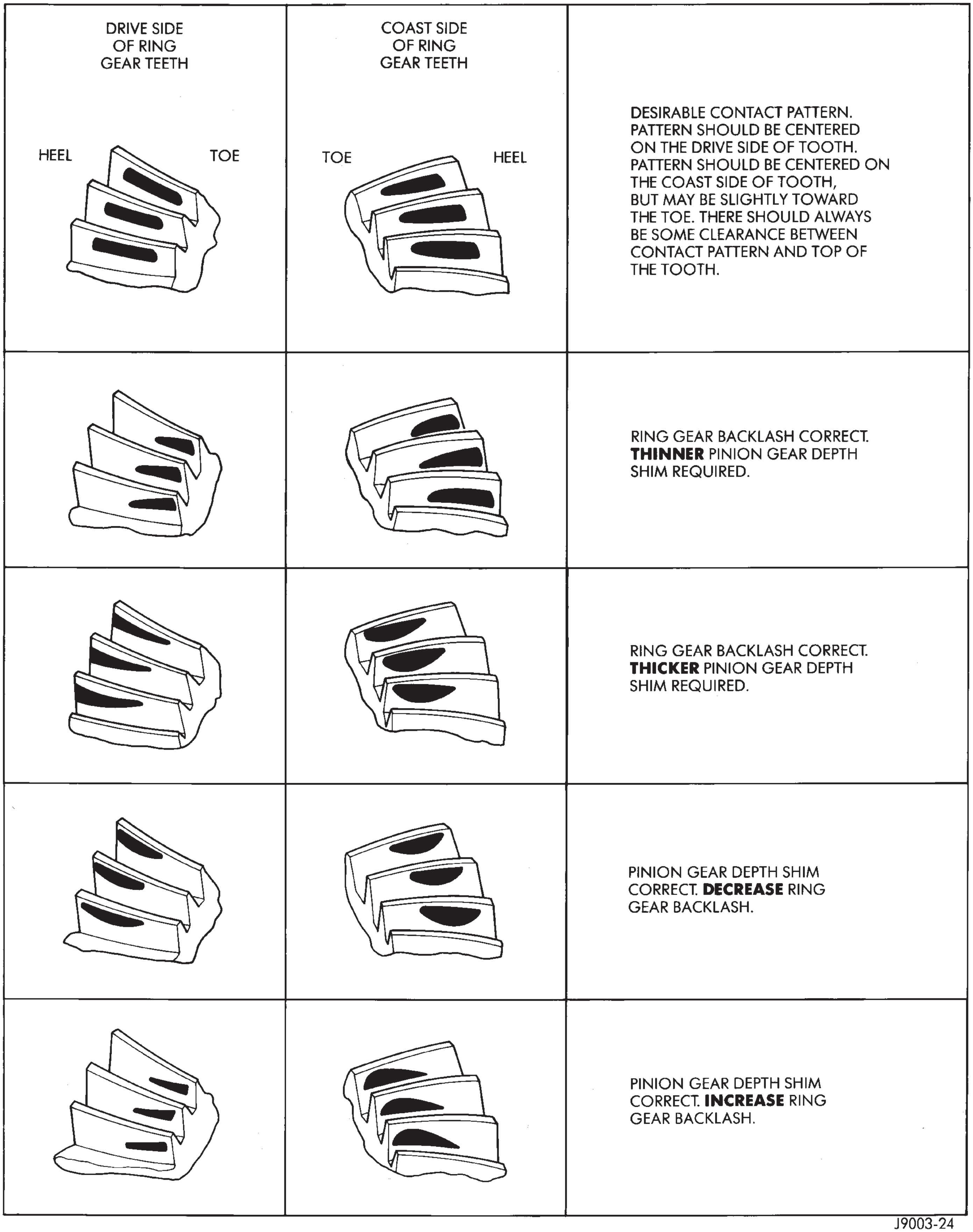


Fig. 21 GEAR TOOTH CONTACT PATTERNS

FRONT AXLE - 186FBI (Continued)

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

SPECIFICATIONS

AXLE SPECIFICATIONS

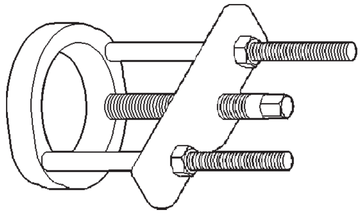
DESCRIPTION	SPECIFICATION
Axle Ratio	3.31, 3.55, 3.73, 3.91
Differential Side Gear Clearance	0.13-0.20 mm (0.005-0.008 in.)
Differential Bearing Preload	0.152 mm (0.006 in.)
Ring Gear Diameter	186 mm (7.33 in.)
Ring Gear Backlash	0.13-0.20 mm (0.005-0.008 in.)
Pinion Gear Std. Depth	92.08 mm (3.625 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	1.7-3.4 N·m (15-30 in. lbs.)

TORQUE SPECIFICATIONS

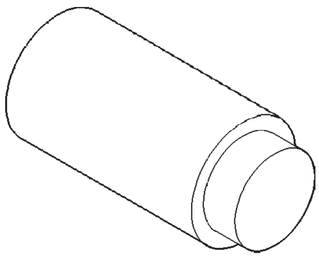
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Hole Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	61	45	-
Ring Gear Bolts	108	80	-
Axle Nut	237	175	-
Hub Bearing Bolts	102	75	-

FRONT AXLE - 186FBI (Continued)

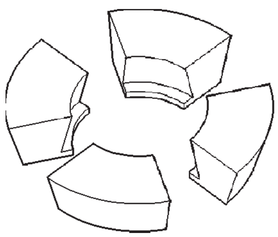
SPECIAL TOOLS



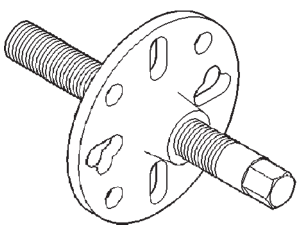
PULLER C-293-PA



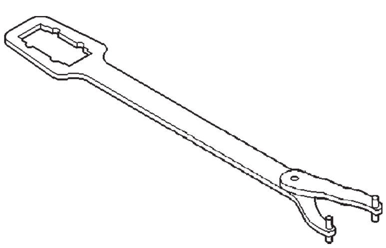
PLUG SP-3289



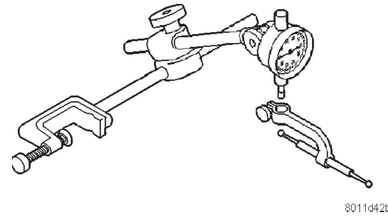
ADAPTER C-293-42



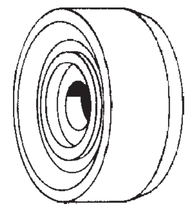
PULLER C-452



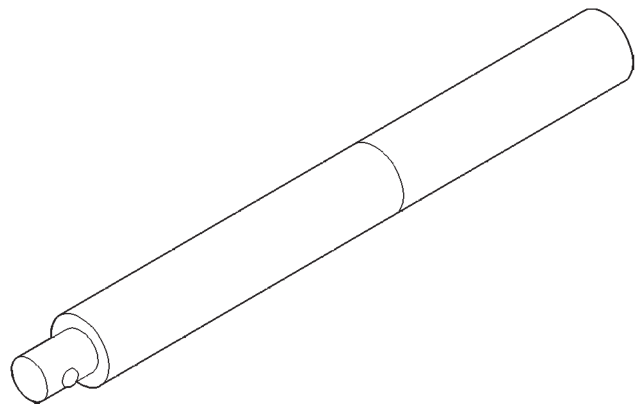
FLANGE WRENCH C-3281



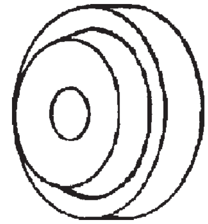
DIAL INDICATOR C-3339



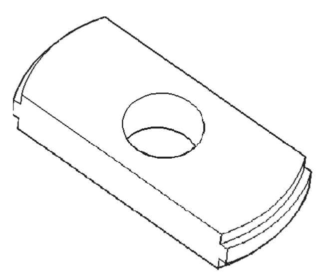
INSTALLER C-3716-A



HANDLE C-4171

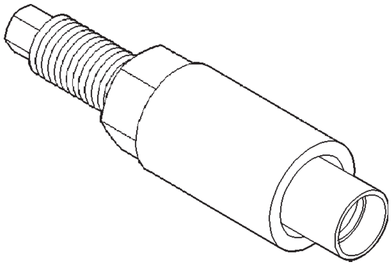


INSTALLER C-4308

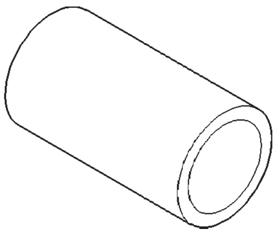


REMOVER C-4307

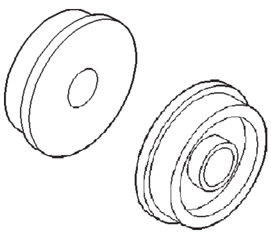
FRONT AXLE - 186FBI (Continued)



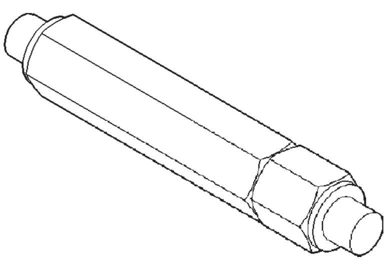
INSTALLER W-162-D



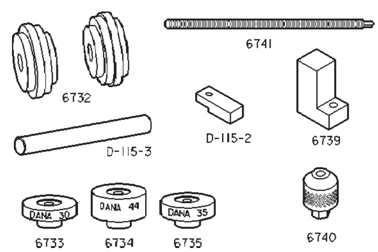
CUP 8109



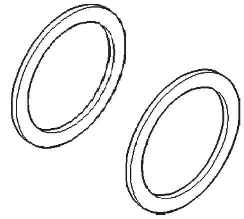
SEAL INSTALLER 8110



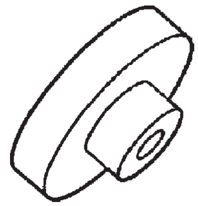
TURNBUCKLE 6797



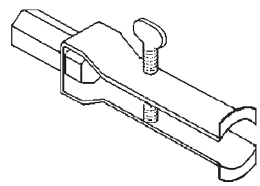
PINION DEPTH SET 6774



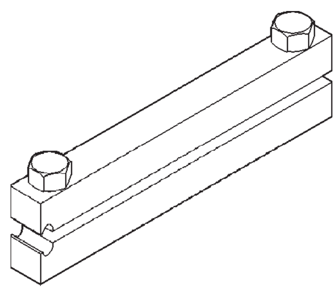
DUMMY SHIMS 8107



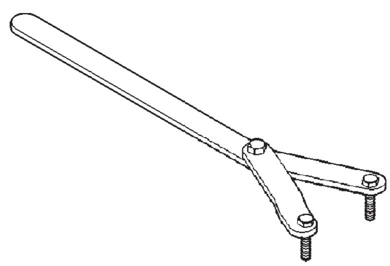
PINION BLOCK 8804



SEAL REMOVER 7794-A

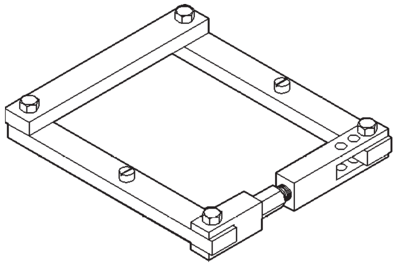


CLAMP INSTALLER C-4975-A

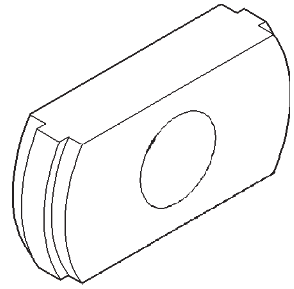


SPANNER WRENCH 6958

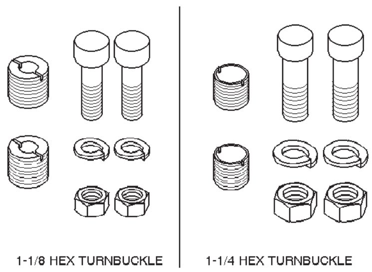
FRONT AXLE - 186FBI (Continued)



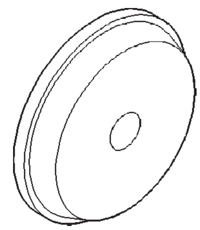
SPREADER W-129-B



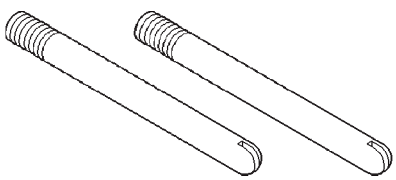
REMOVER D-158



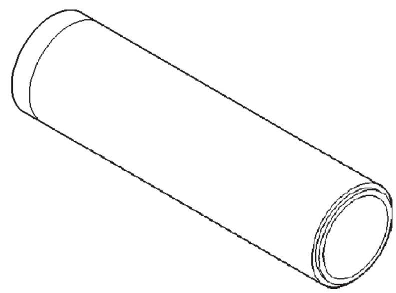
ADAPTER KIT 6987B



INSTALLER D-144



PILOT STUD C-3288-B



INSTALLER 6448

AXLE SHAFTS

REMOVAL

If the axle shaft and hub bearing are being removed in order to service another component, the axle shaft and hub bearing can be removed as an assembly.

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove brake caliper, rotor and ABS wheel speed sensor.

(4) Remove cotter pin, nut retainer and axle nut.

(5) Remove the hub bearing bolts (Fig. 22).

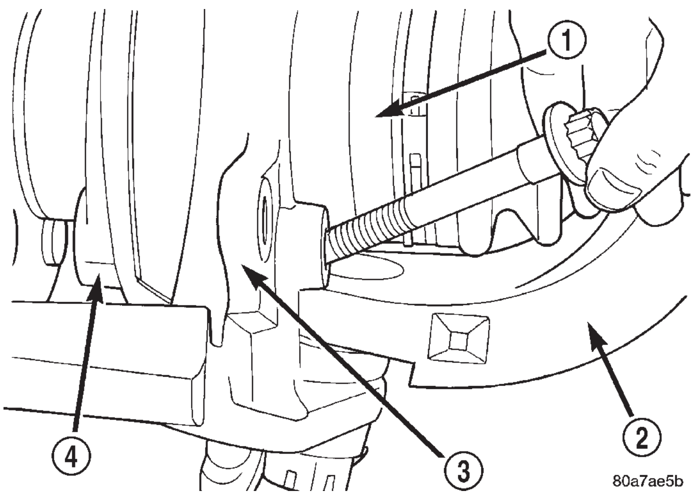


Fig. 22 HUB BEARING BOLTS

1 - AXLE SHAFT
2 - AXLE
3 - KNUCKLE
4 - HUB BEARING

(6) Remove hub bearing and axle shaft assembly (Fig. 23). **Avoid damaging the axle shaft oil seals in the axle housing.**

(7) Remove brake rotor shield from the hub bearing or knuckle.

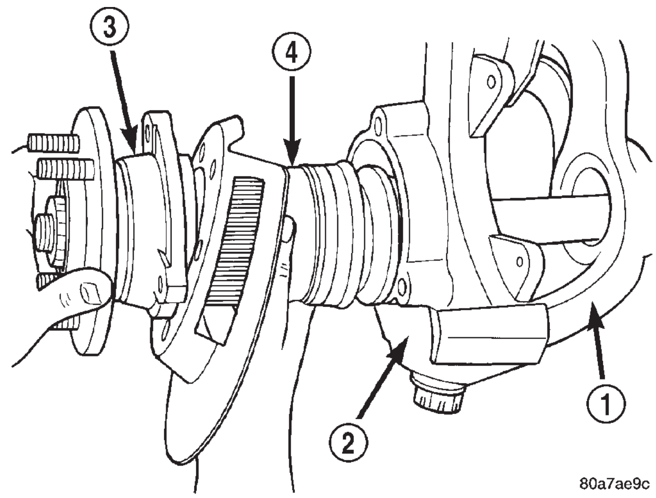


Fig. 23 HUB BEARING AND AXLE ASSEMBLY

1 - AXLE
2 - KNUCKLE
3 - HUB BEARING
4 - AXLE SHAFT

INSTALLATION

(1) Thoroughly clean the axle shaft and apply a thin film of Mopar Wheel Bearing Grease or equivalent to the shaft splines, seal contact surface and hub bore.

(2) Install brake rotor shield to the knuckle.

(3) Install hub bearing and axle shaft assembly or axle shaft into the housing and differential side gears. Avoid damaging the axle shaft oil seals in the axle housing.

(4) Install the hub bearing.

(5) Install hub bearing bolts and tighten to 102 N·m (75 ft. lbs.).

(6) Install axle hub washer and nut and tighten nut to 237 N·m (175 ft. lbs.). Install the nut retainer and a new cotter pin.

(7) Install ABS wheel speed sensor, brake rotor and caliper.

(8) Install the wheel and tire assembly.

(9) Remove support and lower the vehicle.

AXLE SHAFT SEALS

REMOVAL

(1) Raise and support vehicle.
(2) Remove axle shafts.
(3) Remove differential assembly.
(4) Remove inner axle shaft seals with a pry bay.

INSTALLATION

(1) Remove any sealer remaining from original seals.

(2) Install oil seals with Discs 8110 and Turnbuckle 6797 (Fig. 24). Tighten tool until disc bottoms in housing.

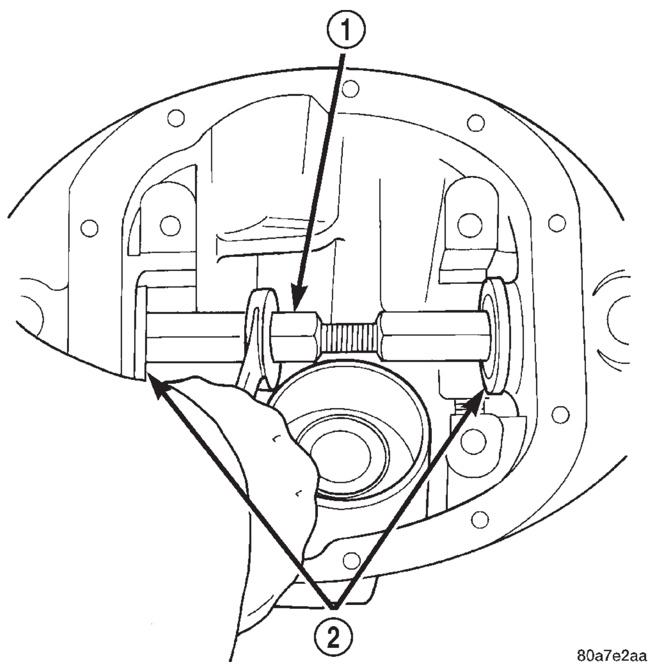


Fig. 24 AXLE SEAL TOOLS

1 - TURNBUCKLE
2 - DISCS

(3) Install differential and axle shafts.
(4) Fill differential with lubricant.
(5) Remove support and lower vehicle.

AXLE - C/V JOINT

REMOVAL

NOTE: The only service procedure to be performed on the axle C/V joint, is the replacement of the joint seal boot. If any failure of internal axle shaft components is diagnosed during a vehicle road test, the axle shaft must be replaced as an assembly.

(1) Remove axle shaft.

(2) Remove large and small C/V boot clamps (Fig. 25) and discard.

(3) Slid boot off the C/V joint housing and slide it down the axle shaft.

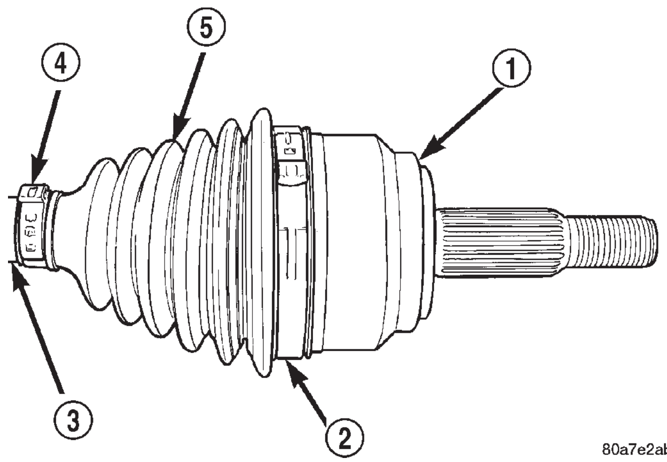


Fig. 25 OUTER C/V BOOT CLAMPS

1 - C/V JOINT HOUSING
2 - LARGE CLAMP
3 - AXLE SHAFT
4 - SMALL CLAMP
5 - SEALING BOOT

(4) Remove C/V joint from axle then slid boot off the axle.

(5) Thoroughly clean and inspect axle C/V joint assembly and axle shaft for any signs of excessive wear.

INSTALLATION

(1) Slide **new** boot over axle shaft.

(2) Install C/V joint onto the axle shaft.

(3) Distribute 1/2 the amount of grease provided in seal boot service package **(DO NOT USE ANY OTHER TYPE OF GREASE)** into axle C/V joint assembly housing. Put the remaining amount into the sealing boot.

(4) Position boot on the axle locating grove and on the C/V joint.

AXLE - C/V JOINT (Continued)

CAUTION: Boot must not be dimpled, stretched or out of shape in any way. If not shaped correctly, equalize pressure in boot and shape it by hand.

(5) Install the two boot clamps.

(6) Crimp the boot clamps with Clamp Installer C-4975A. Place clamp tool over bridge of clamp (Fig. 26).

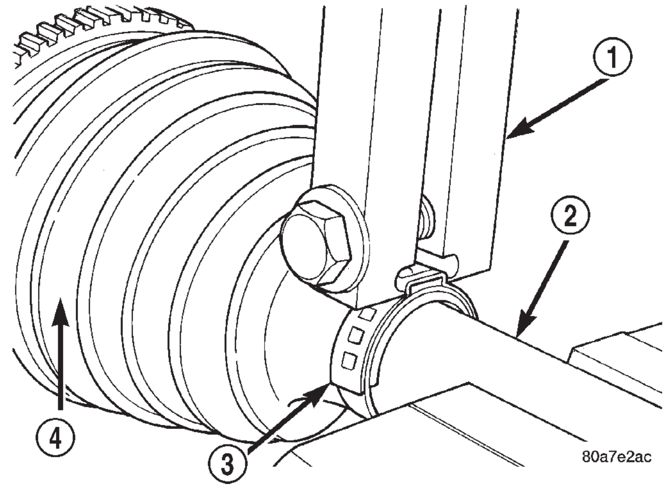


Fig. 26 CRIMPING TOOL

1 - INSTALLER
2 - AXLE SHAFT
3 - CLAMP
4 - SEALING BOOT

(7) Tighten nut on the tool until jaws on tool are closed completely together (Fig. 27) and (Fig. 28).

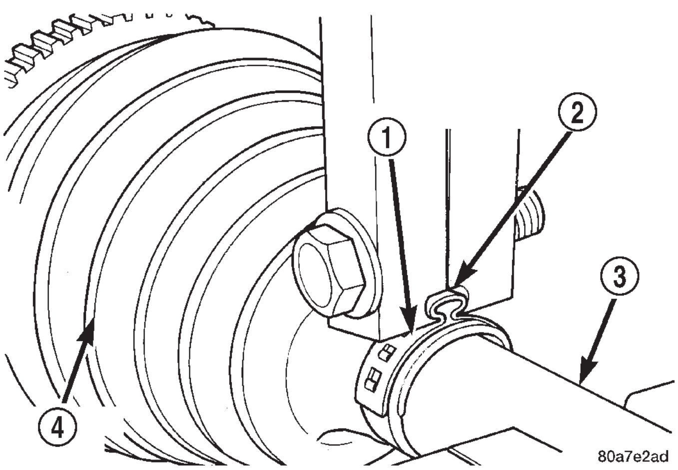


Fig. 27 SMALL BOOT CLAMP

1 - CLAMP
2 - INSTALLER
3 - AXLE SHAFT
4 - SEALING BOOT

(8) Install the axle shaft.

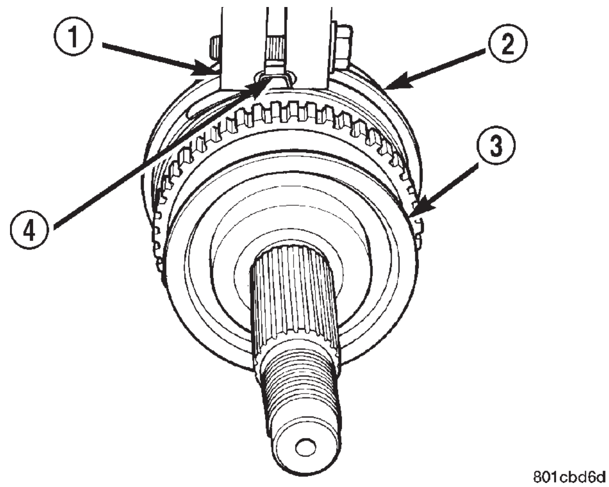


Fig. 28 LARGE BOOT CLAMP

1 - CLAMP TOOL
2 - SEALING BOOT
3 - OUTER C/V JOINT
4 - BOOT CLAMP

AXLE - U-JOINT

REMOVAL

CAUTION: Clamp only the narrow forged portion of the yoke in the vise. Do not over tighten the vise jaws, to avoid distorting the yoke.

(1) Remove axle shaft.

(2) Remove the bearing cap retaining snap rings (Fig. 29).

NOTE: Saturate the bearing caps with penetrating oil prior to removal.

(3) Locate a socket with an inside diameter is larger than the bearing cap. Place the socket (receiver) against the yoke and around the perimeter of the bearing cap to be removed.

(4) Locate a socket with an outside diameter is smaller than the bearing cap. Place the socket (driver) against the opposite bearing cap.

(5) Position the yoke with the sockets in a vise (Fig. 30).

(6) Tighten the vise jaws to force the bearing cap into the larger socket (receiver).

(7) Release the vise jaws. Remove the sockets and bearing cap that was partially forced out of the yoke.

(8) Repeat the above procedure for the remaining bearing cap and remove spider from the propeller shaft yoke.

AXLE - U-JOINT (Continued)

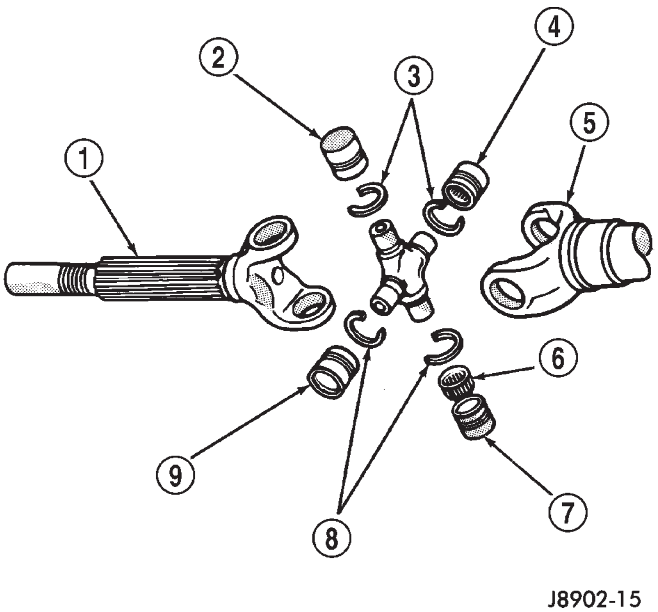


Fig. 29 AXLE SHAFT OUTER U-JOINT

1 - SHAFT YOKE
2 - BEARING CAP
3 - SNAP RINGS
4 - BEARING CAP
5 - SPINDLE YOKE
6 - BEARING
7 - BEARING CAP
8 - SNAP RINGS
9 - BEARING CAP

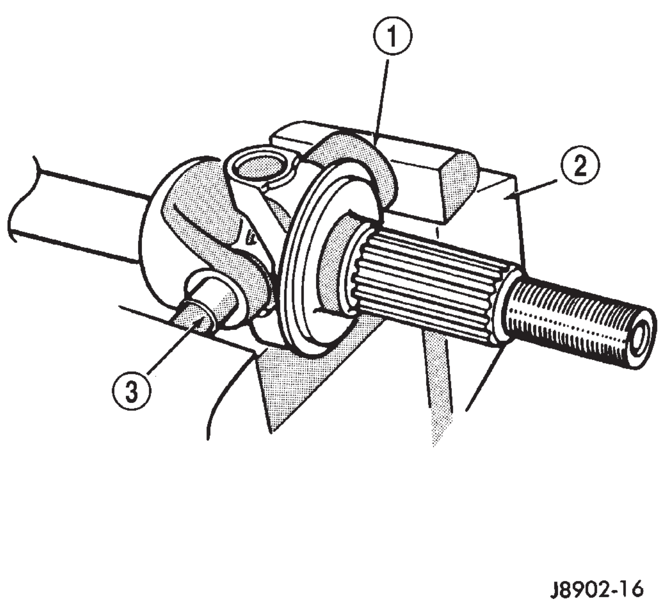


Fig. 30 YOKE BEARING CAP

1 - LARGE-DIAMETER SOCKET
2 - VISE
3 - SMALL-DIAMETER SOCKET

INSTALLATION

(1) Pack the bearing caps 1/3 full of wheel bearing lubricant. Apply extreme pressure (EP), lithium-base lubricant to aid in installation.

(2) Position the spider in the yoke. Insert the seals and bearings, then tap bearing caps into the yoke bores far enough to hold the spider in position.

(3) Place the socket (driver) against one bearing cap. Position the yoke with the socket in a vise.

(4) Tighten the vise to force the bearing caps into the yoke. Force the caps enough to install the retaining clips.

(5) Install the bearing cap retaining clips.

(6) Install axle shaft.

PINION SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove brake rotors and calipers, refer to 5 Brakes for procedures.

(4) Mark propeller shaft and pinion companion flange for installation reference.

(5) Remove the propeller shaft from the pinion companion flange.

(6) Rotate the pinion gear a minimum of ten times and verify the pinion rotates smoothly.

(7) Record torque necessary to rotate the pinion gear with a inch pound torque wrench.

(8) Using a short piece of pipe and Spanner Wrench 6958 to hold the pinion companion flange and remove the pinion nut and washer.

(9) Remove pinion companion flange with Remover C-452 and Flange Wrench C-3281.

(10) Remove pinion seal with Remover 7794-A and a slide hammer (Fig. 31).

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate installer (Fig. 32).

(2) Install pinion companion flange on the pinion gear with Installer W-162-D, Cup 8109 and Wrench 6958.

CAUTION: Never exceed the minimum tightening torque 298 N·m (220 ft. lbs.) while installing pinion nut at this point. Damage to collapsible spacer or bearings may result.

(3) Install the pinion washer and a **new** nut on the pinion gear. **Tighten the nut only enough to remove the shaft end play.**

PINION SEAL (Continued)

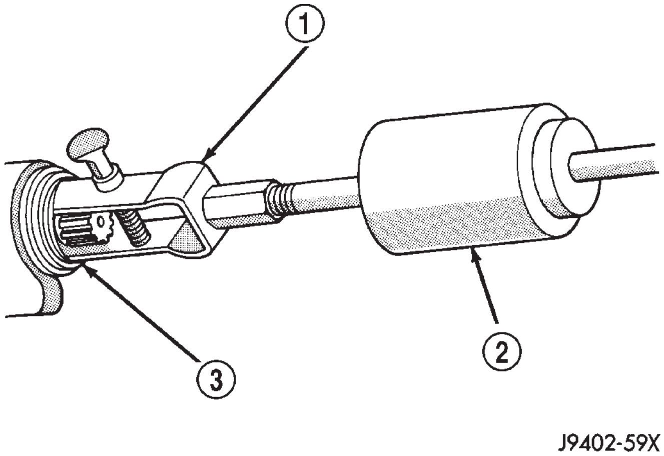


Fig. 31 PINION SEAL

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

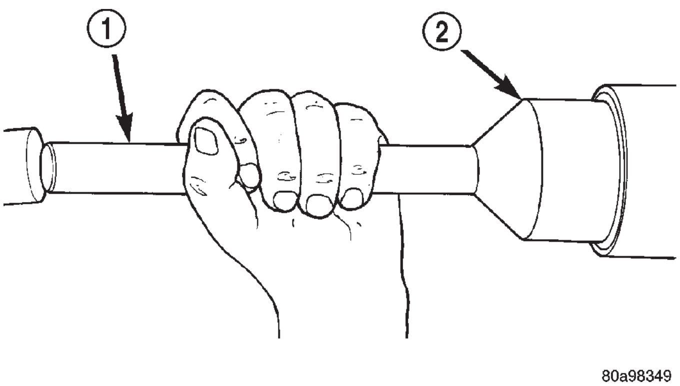


Fig. 32 PINION SEAL

1 - HANDLE
2 - INSTALLER

CAUTION: Never loosen pinion nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

(4) Rotate pinion a minimum of ten time and verify pinion rotates smoothly. Rotate the pinion shaft with an inch pound torque wrench. Rotating torque should be equal to the reading recorded during removal plus 0.56 N·m (5 in. lbs.) (Fig. 33).

(5) If the rotating torque is low, use Spanner Wrench 6958 to hold the pinion companion flange (Fig. 34), and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

CAUTION: If maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

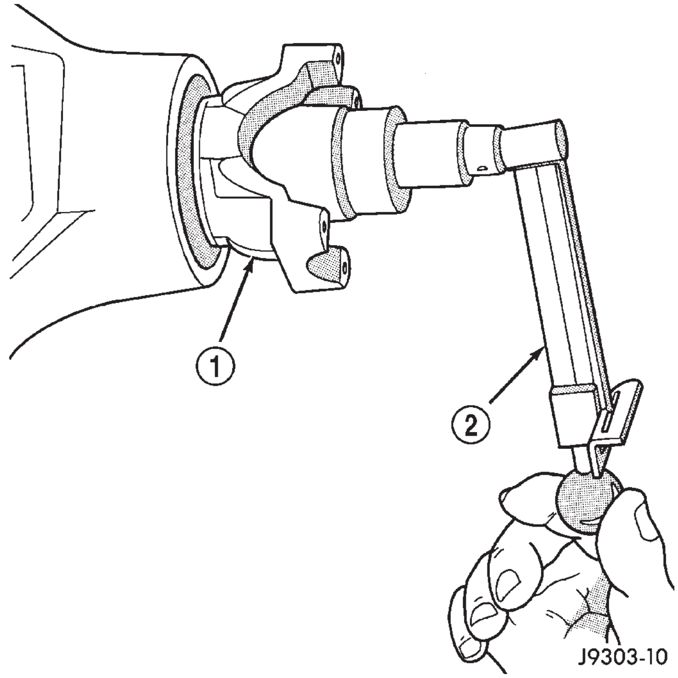


Fig. 33 PINION ROTATION TORQUE

1 - PINION YOKE/COMPANION FLANGE
2 - INCH POUND TORQUE WRENCH

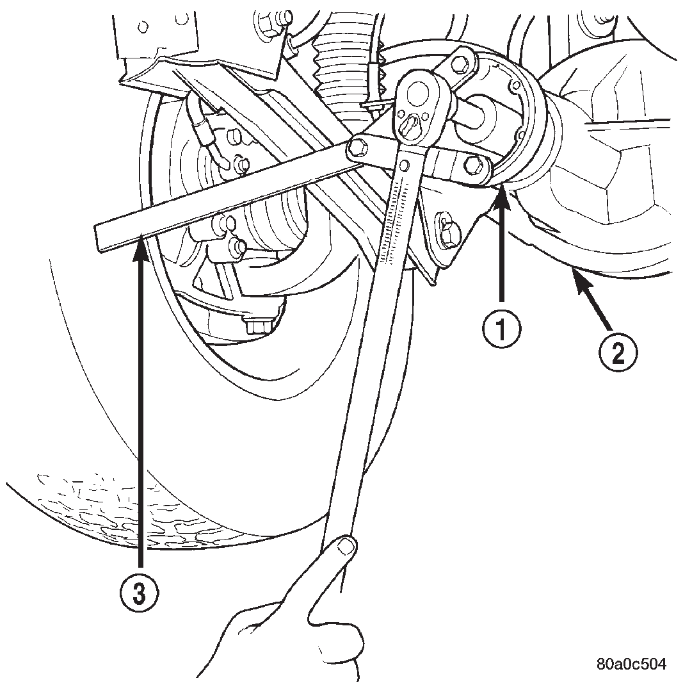


Fig. 34 PINION SHAFT NUT

1 - PINION FLANGE
2 - FRONT AXLE
3 - SPANNER WRENCH

PINION SEAL (Continued)

(6) Install propeller shaft with installation reference marks aligned.
(7) Fill differential with gear lubricant.
(8) Install brake rotors and calipers.
(9) Install wheel and tire assemblies.
(10) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL

(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove brake rotors and calipers. Refer to 5 Brakes for procedures.
(4) Mark the propeller shaft and pinion companion flange for installation reference.
(5) Remove propeller shaft from the pinion companion flange.
(6) Rotate pinion gear a minimum of ten times and verify pinion rotates smoothly.
(7) Record pinion gear rotating torque with a torque wrench for installation reference.
(8) Remove pinion nut and washer. Using a short piece of pipe and Spanner Wrench 6958 to hold the pinion companion flange.
(9) Remove pinion companion flange with Remover C-452 and Flange Wrench C-3281.
(10) Remove pinion shaft seal with Remover 7794-A and slide hammer (Fig. 35).

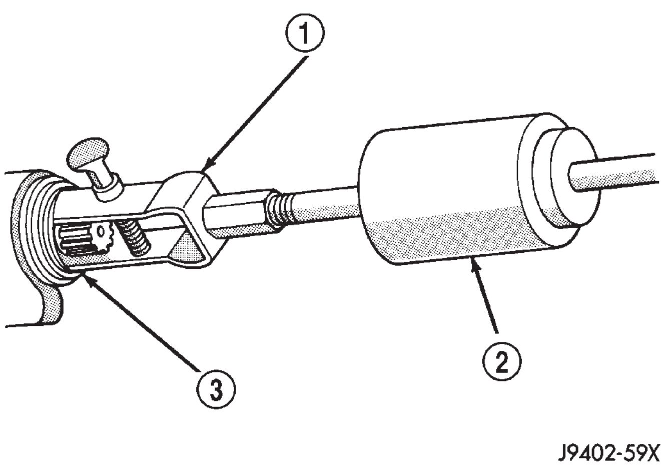


Fig. 35 PINION SEAL PULLER

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

(11) Remove front pinion bearing using a pair of pick tools to pull the bearing straight off pinion shaft.

NOTE: If bearing becomes bound on the pinion shaft, lightly tap the end of the pinion gear with a rawhide/rubber mallet.

(12) Remove the collapsible spacer.

INSTALLATION

(1) Install a **new** collapsible preload spacer on pinion shaft.
(2) Install pinion front bearing.
(3) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate installer (Fig. 36).

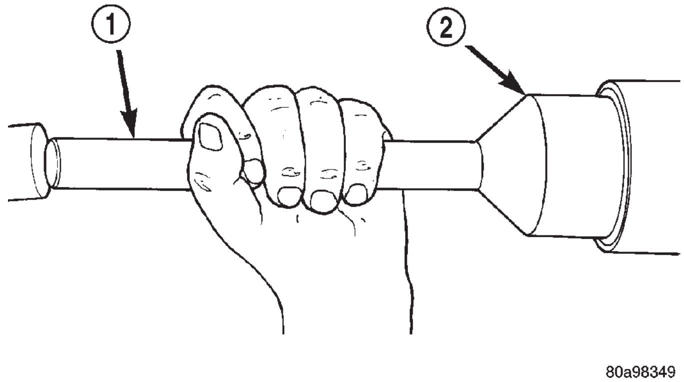


Fig. 36 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(4) Install pinion companion flange with Installer W-162-D, Cup 8109 and Flange Holder 6958.
(5) Install pinion washer and a **new** nut on the pinion gear. Tighten the nut to 298 N·m (220 ft. lbs.) minimum. **Do not overtighten.** Maximum torque is 500 N·m (368 ft. lbs.).

CAUTION: Never loosen pinion nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque is exceeded a new collapsible spacer must be installed.

(6) Using Spanner Wrench 6958, a length of 1 in. pipe and a torque wrench set at 500 N·m (368 ft. lbs.) crush collapsible spacer until bearing end play is taken up (Fig. 37).
(7) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer.
(8) Rotate pinion gear a minimum of ten times and verify pinion rotates smoothly. Check rotating torque with an inch pound torque wrench. The rotating torque should be the amount recorded during removal plus:

- Original Bearings: 0.56 N·m (5 in. lbs.).

COLLAPSIBLE SPACER (Continued)

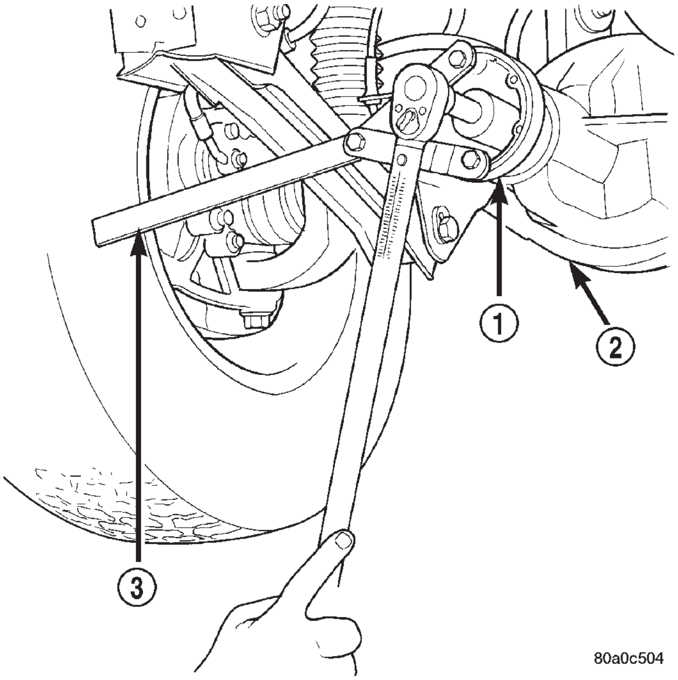


Fig. 37 PINION COMPANION FLANGE

1 - COMPANION FLNAGE
2 - DIFFERENTIAL HOUSING
3 - SPANNER WRENCH

- New Bearings: 1.7 to 3.4 N·m (15 to 30 in. lbs.).

(9) Install propeller shaft with reference marks aligned.

(10) Install brake rotors and calipers.

(11) Add gear lubricant if necessary.

(12) Install wheel and tire assemblies.

(13) Lower vehicle.

DIFFERENTIAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove lubricant fill hole plug from the differential housing cover.

(3) Remove differential cover and drain lubricant.

(4) Clean the housing cavity with a flushing oil, light engine oil or lint free cloth. **Never use water, steam, kerosene or gasoline for cleaning.**

(5) Remove hub bearings and axle shafts.

(6) Note installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 38).

(7) Loosen the differential bearing cap bolts.

(8) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 39). Install hold down clamps and tighten the tool turnbuckle finger-tight.

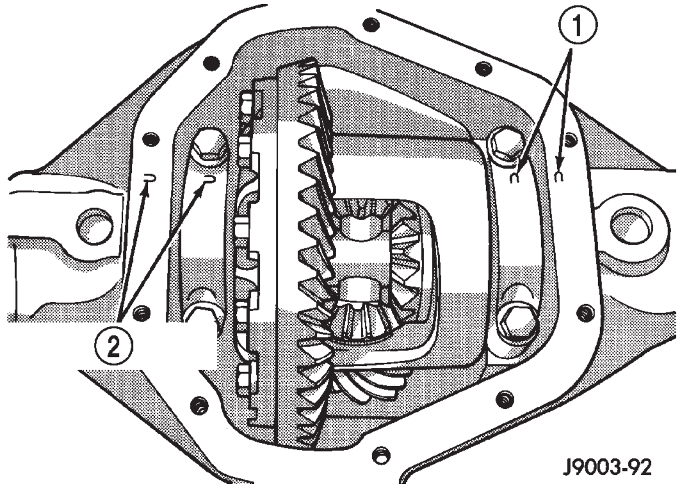


Fig. 38 BEARING CAP IDENTIFICATION

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

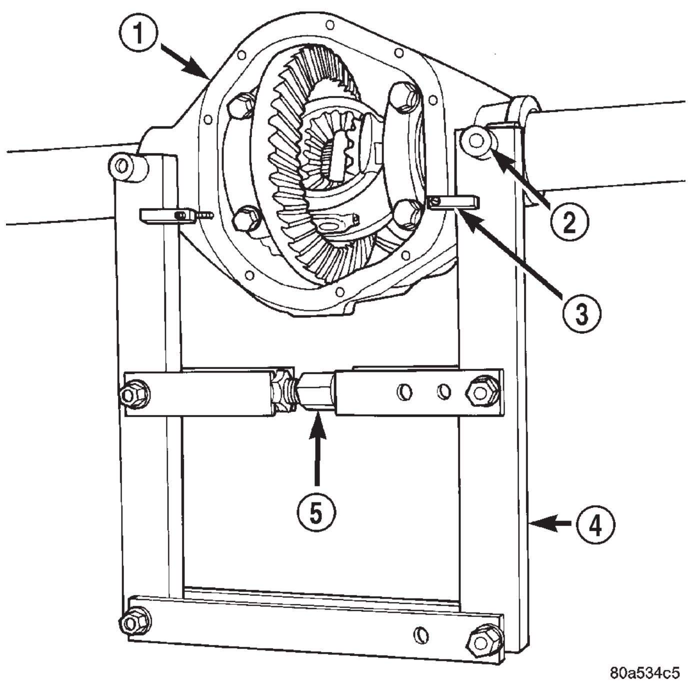


Fig. 39 DIFFERENTIAL SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - ADAPTER
3 - HOLD DOWN CLAMPS
4 - SPREADER
5 - TURNBUCKLE

DIFFERENTIAL (Continued)

(9) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to stud. Load the lever adapter against the opposite side of the housing (Fig. 40) and zero the indicator.

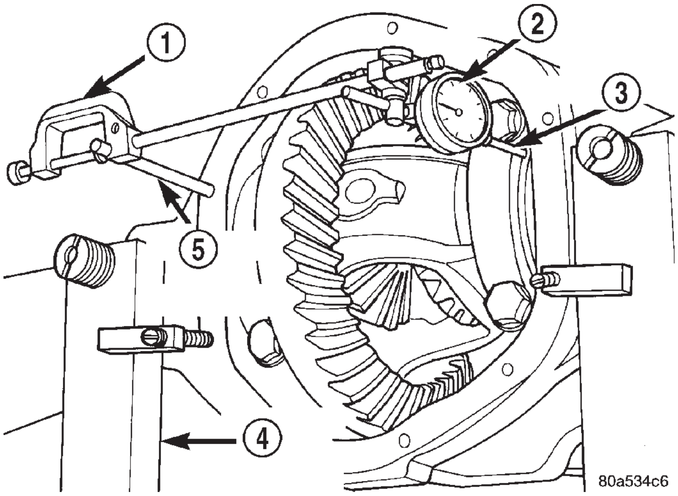


Fig. 40 DIAL INDICATOR LOCATION

1 - CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

(10) Spread housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 41).

CAUTION: Never spread the housing over 0.50 mm (0.020 in). If housing is over-spread, it could distorted and damaged the housing.

(11) Remove the dial indicator.

(12) Hold differential case in position and remove differential bearing cap bolts and caps.

(13) Remove differential from the housing and tag differential bearing cups to ensure location (Fig. 42).

(14) Remove differential case preload shims from the axle housing.

(15) Remove spreader from housing. Tag differential bearing preload shims to ensure correct location.

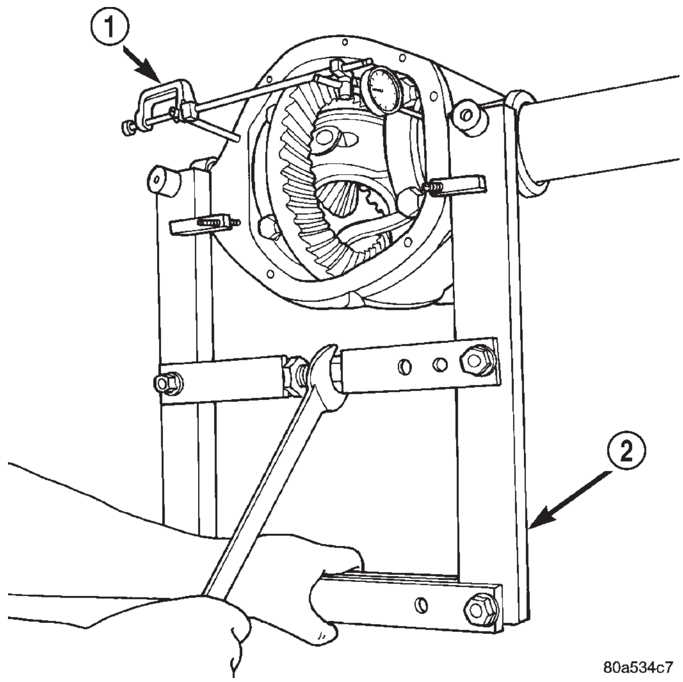


Fig. 41 SPREAD DIFFERENTIAL HOUSING

1 - DIAL INDICATOR
2 - SPREADER

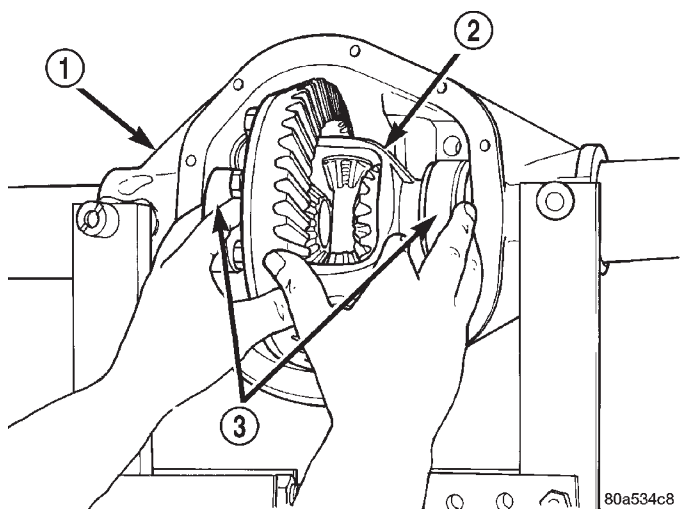


Fig. 42 DIFFERENTIAL CASE REMOVAL

1 - DIFFERENTIAL HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

DIFFERENTIAL (Continued)

DISASSEMBLY

(1) Remove the ring gear.

(2) Drive out the roll pin holding pinion gear mate shaft with a hammer and punch (Fig. 43).

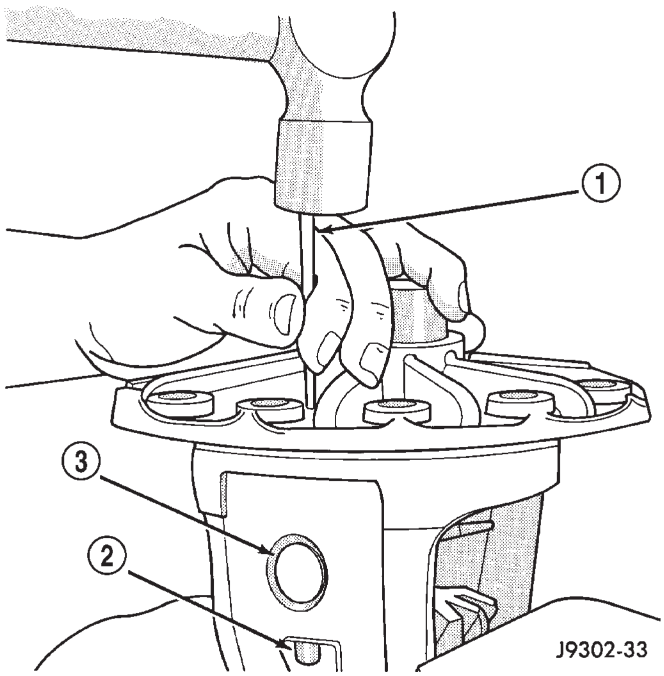


Fig. 43 MATE SHAFT ROLL PIN

1 - PUNCH
2 - LOCKPIN
3 - MATE SHAFT

(3) Remove pinion gear mate shaft from the differential case and the pinion mate gears.

(4) Rotate differential side gears and remove the pinion mate gears and thrust washers (Fig. 44).

(5) Remove differential side gears and thrust washers.

ASSEMBLY

(1) Install differential side gears and thrust washers.

(2) Install pinion mate gears and thrust washers.

(3) Install pinion gear mate shaft. Align the roll pin holes in shaft and the differential case.

(4) Install the roll pin in the differential case (Fig. 45).

(5) Install the ring gear.

(6) Lubricate all differential components with hypoid gear lubricant.

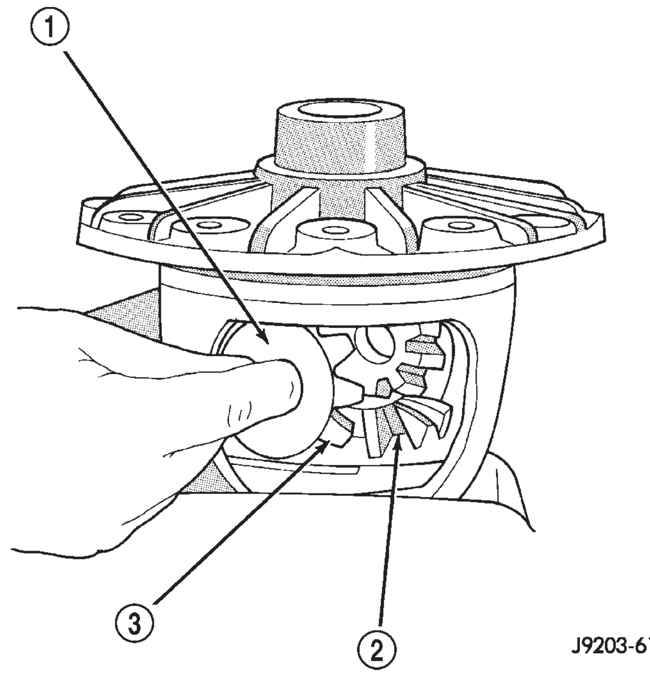


Fig. 44 PINION MATE GEAR

1 - THRUST WASHER
2 - SIDE GEAR
3 - PINION MATE GEAR

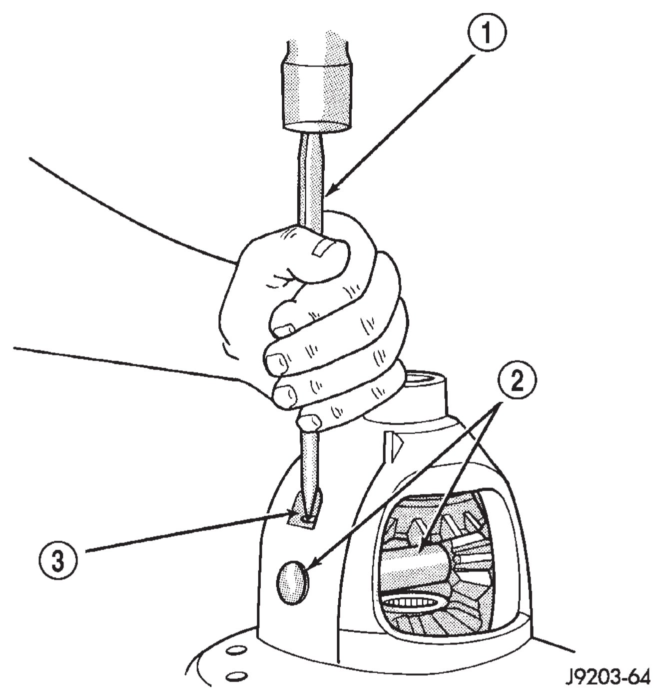


Fig. 45 MATE SHAFT ROLL PIN

1 - PUNCH
2 - PINION MATE SHAFT
3 - MATE SHAFT LOCKPIN

DIFFERENTIAL (Continued)

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes. Install hold down clamps and tighten the tool turnbuckle finger-tight.

(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator.

CAUTION: Never spread the housing over 0.50 mm (0.020 in). If housing is over-spread, it could distorted and damaged the housing.

(4) Remove the dial indicator.

(5) Install differential case in the housing (Fig. 46). Make sure the differential bearing cups remain on the bearings and the preload shims remain between the face of the bearing cup and housing. Tap the differential case to ensure the bearings cups and shims are fully seated in the housing.

CAUTION: On a Vari-lok® differential the oil feed tube must be pointed at the bottom of the housing. If differential is installed with the oil feed tube pointed at the top, the anti-rotation tabs will be damaged.

(6) Install the bearing caps at their original locations (Fig. 47).

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten the bearing cap bolts to 61 N·m (45 ft. lbs.).

(10) Install the hub bearings and axle shafts.

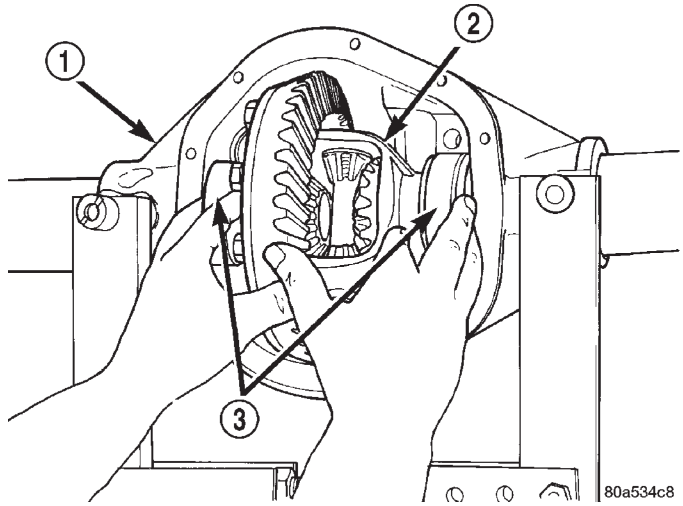


Fig. 46 DIFFERENTIAL CASE REMOVAL

1 - DIFFERENTIAL HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

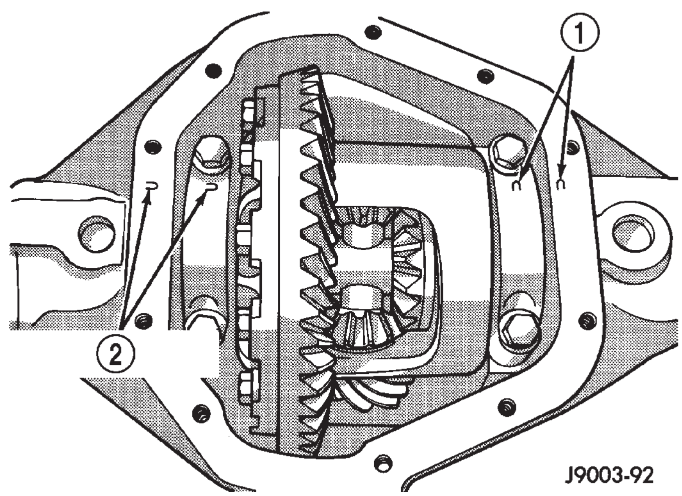


Fig. 47 Bearing Cap Reference

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

DIFFERENTIAL (Continued)

(11) Apply a bead 6.35mm (1/4 inch) of red Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 48).

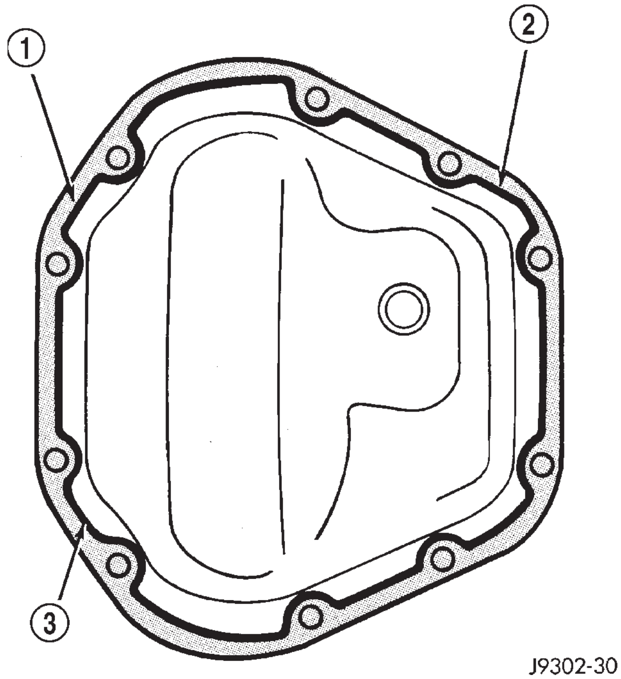


Fig. 48 DIFFERENTIAL COVER

1 - COVER
2 - SEALANT
3 - SEALANT BEAD

CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied or adhesion quality will be compromised.

(12) Install differential cover and tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).
(13) Fill differential with gear lubricant to bottom of the fill plug hole.
(14) Tighten fill plug to 34 N·m (25 ft. lbs.).
(15) Remove support and lower the vehicle.

DIFFERENTIAL CASE BEARINGS

REMOVAL

(1) Remove differential case from housing.
(2) Remove bearings from the differential case with Puller C-293-PA, Adapters 8352 and Plug SP-3289 (Fig. 49).

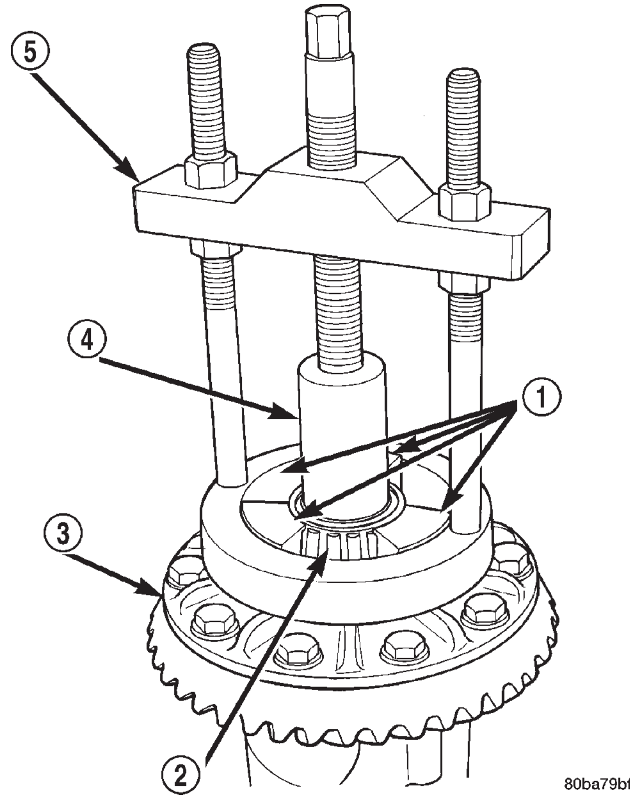


Fig. 49 DIFFERENTIAL CASE BEARING

1 - ADAPTERS
2 - BEARING
3 - DIFFERENTIAL
4 - PLUG
5 - PULLER

INSTALLATION

NOTE: If replacement differential side bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

CAUTION: Vari-lok® plenum must be fully seated against the differential case prior to installing the ring gear side differential bearing.

(1) Install differential side bearings with Handle C-4171 and Installer C-3726-A (Fig. 50).
(2) Install differential in housing.

DIFFERENTIAL CASE BEARINGS (Continued)

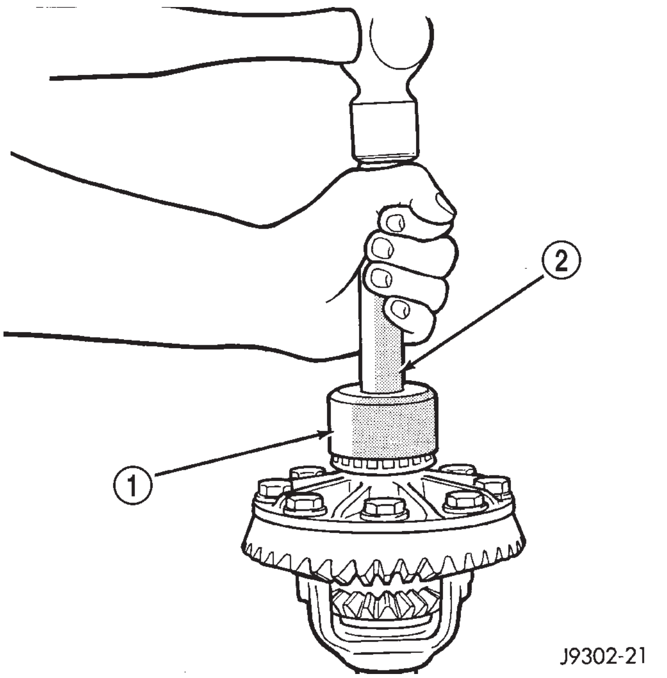


Fig. 50 DIFFERENTIAL CASE BEARING

1 - INSTALLER
2 - HANDLE

PINION GEAR/RING GEAR

REMOVAL

NOTE: The ring gear and pinion are serviced as a matched set. Nevar replace one gear without replacing the other matching gear.

(1) Raise and support vehicle

(2) Mark pinion companion flange and propeller shaft for installation alignment.

(3) Remove propeller shaft from pinion companion flange and tie propeller shaft to underbody.

(4) Remove differential from axle housing.

(5) Place differential case in a vise with soft metal jaw (Fig. 51).

(6) Remove bolts holding ring gear to differential case.

NOTE: On Veri-Lok® differential the side bearing and oil feed plenum must be removed before removing the ring gear bolts.

(7) Driver ring gear off the differential case with a rawhide hammer (Fig. 51).

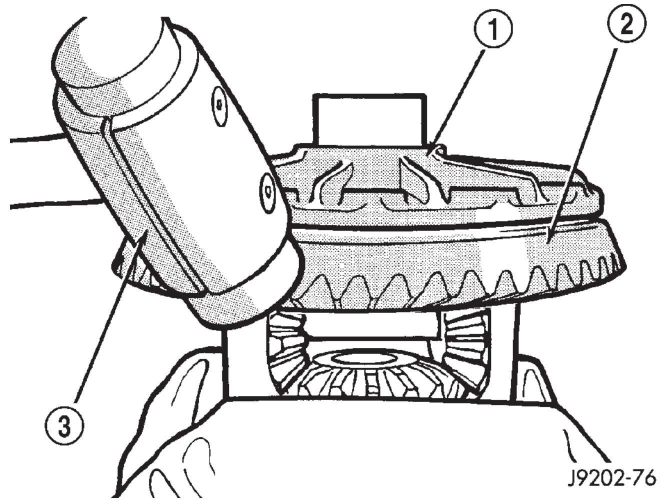


Fig. 51 RING GEAR

1 - DIFFERENTIAL CASE
2 - RING GEAR
3 - HAMMER

(8) With Spanner Wrench 6958 and a short length of 1 in. pipe, hold pinion companion flange and remove pinion nut and washer (Fig. 52).

(9) Remove pinion companion flange from pinion shaft with Remover C-452 and Flange Wrench C-3281.

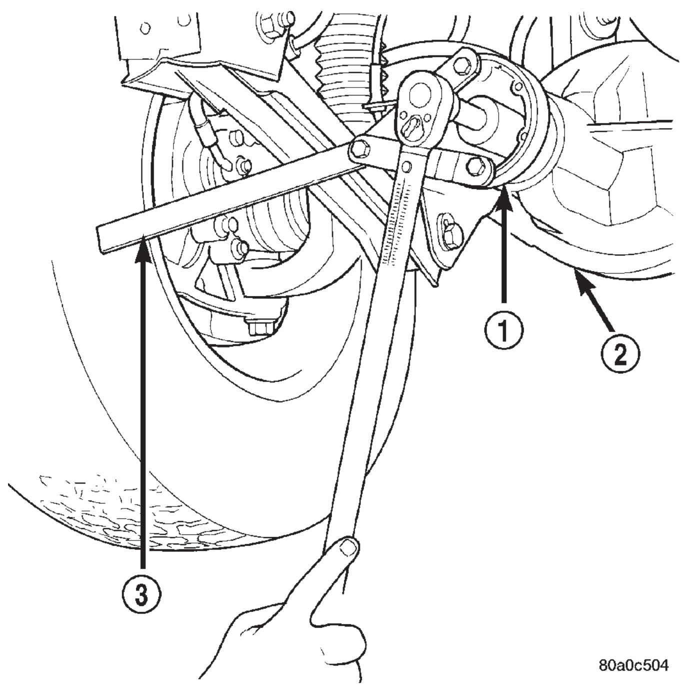


Fig. 52 Pinion Flange

1 - PINION FLANGE
2 - FRONT AXLE
3 - SPANNER WRENCH

PINION GEAR/RING GEAR (Continued)

(10) Remove pinion gear and collapsible spacer from housing (Fig. 53).

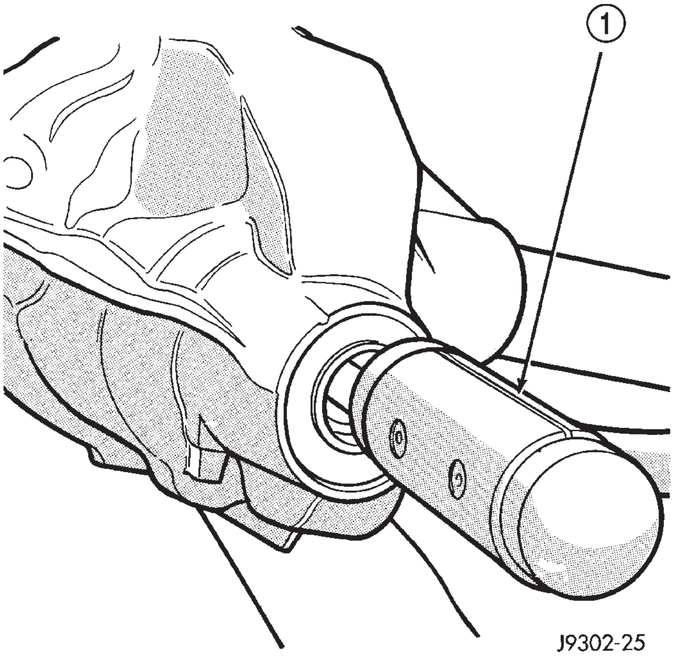


Fig. 53 REMOVE PINION GEAR

1 - RAWHIDE HAMMER

(11) Remove front pinion bearing cup, bearing, oil slinger and pinion seal with Remover D-158 and Handle C-4171 (Fig. 54).

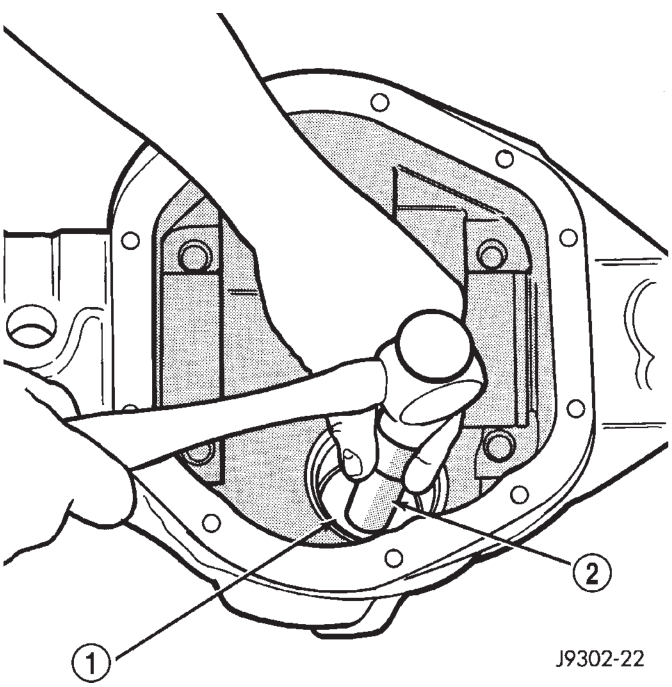


Fig. 54 FRONT PINION BEARING CUP

1 - REMOVER
2 - HANDLE

(12) Remove rear pinion bearing cup (Fig. 55) with Remover C-4307 and Handle C-4171.

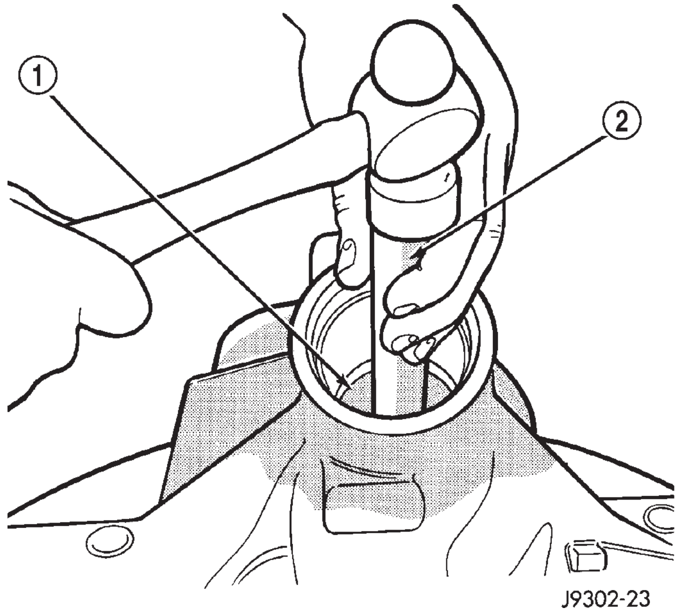


Fig. 55 REAR PINION BEARING CUP

1 - REMOVER
2 - HANDLE

(13) Remove collapsible preload spacer from pinion gear (Fig. 56).

(14) Remove rear pinion bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-42 (Fig. 57). Remove oil slinger/pinion depth shim from the pinion shaft and record thickness.

INSTALLATION

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and the pinion head to achieve proper ring and pinion gear mesh. If ring and pinion gears are reused, the pinion oil slinger/ depth shim should not require replacement. Refer to Adujstments (Pinion Gear Depth) to select the proper thickness shim before installing pinion gear.

(1) Apply Mopar Door Ease or equivalent lubricant to outside surface of pinion bearing cups.

(2) Install rear bearing cup with Installer C-4308 and Handle C-4171 and verify cup is seated (Fig. 58).

(3) Install bearing cup with Installer D-144 and Handle C-4171 (Fig. 59) and verify cup is seated.

(4) Install front pinion bearing, and oil slinger if equipped.

PINION GEAR/RING GEAR (Continued)

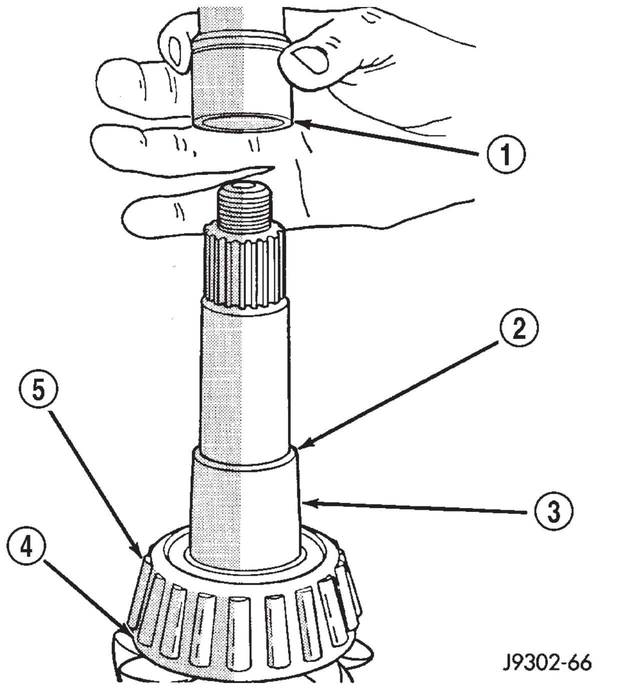


Fig. 56 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - DEPTH SHIM
5 - REAR BEARING

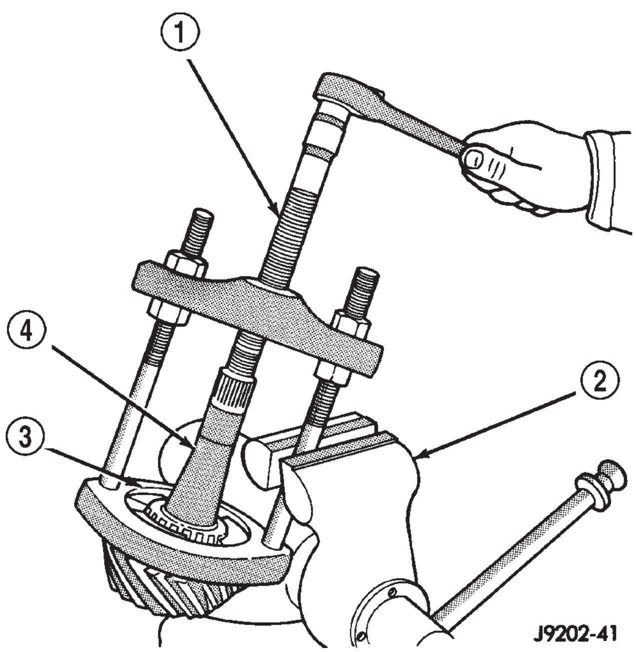


Fig. 57 REAR PINION BEARING

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - PINION GEAR SHAFT

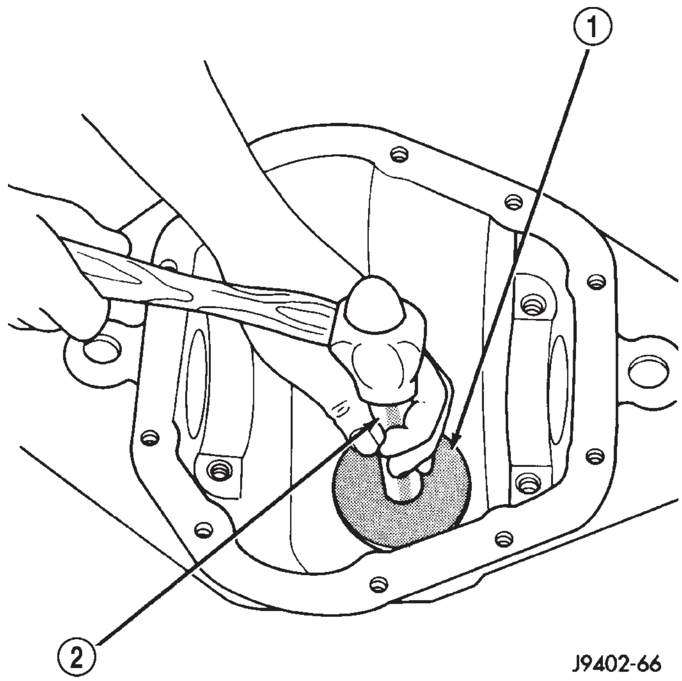


Fig. 58 REAR PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

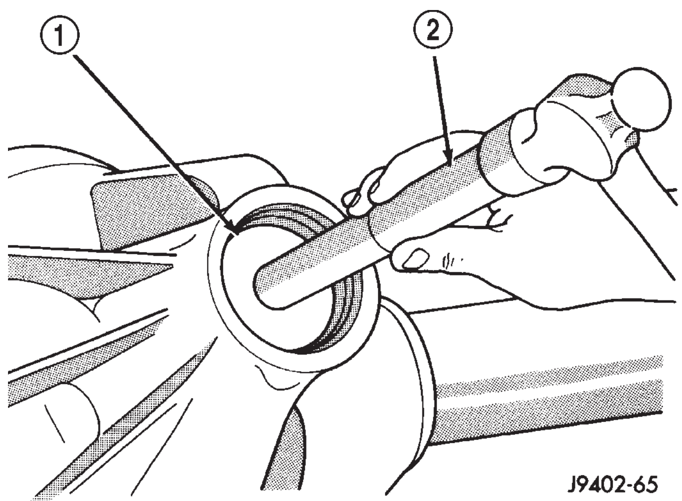


Fig. 59 FRONT PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

PINION GEAR/RING GEAR (Continued)

(5) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 60).

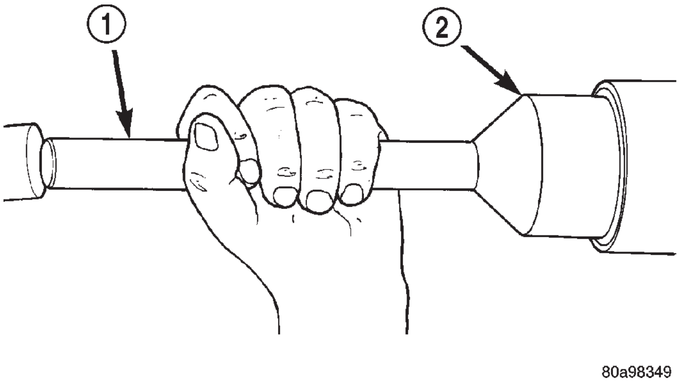


Fig. 60 PINION SEAL

1 - HANDLE
2 - INSTALLER

(6) Install rear pinion bearing and oil slinger/depth shim onto the pinion shaft with Installer 6448 and a press (Fig. 61).

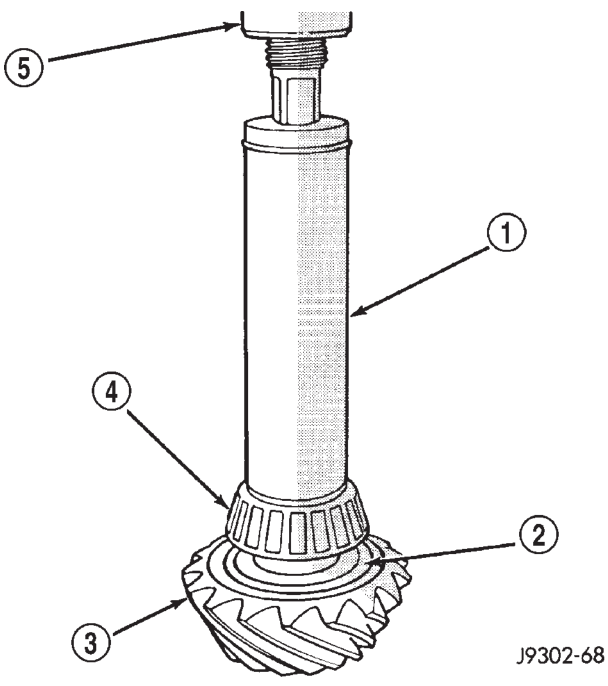


Fig. 61 REAR PINION BEARING

1 - INSTALLER
2 - OIL SLINGER
3 - PINION GEAR
4 - REAR PINION BEARING
5 - PRESS

(7) Install a **new** collapsible spacer on pinion shaft and install the pinion into the housing (Fig. 62).

(8) Install pinion companion flange, with Installer W-162-B, Cup 8109 and Spanner Wrench 6958.

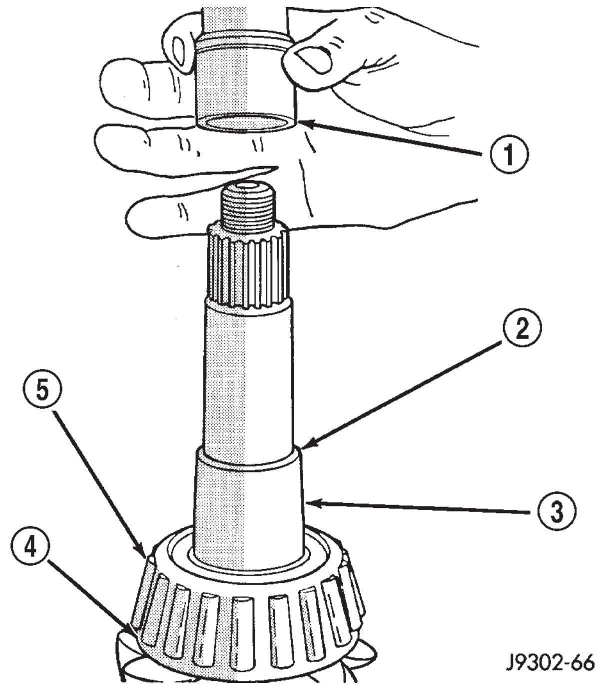


Fig. 62 COLLAPSIBLE PRELOAD SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - DEPTH SHIM
5 - REAR BEARING

(9) Install pinion washer and a **new** nut onto the pinion gear and tighten the nut to 298 N·m (220 ft. lbs.). **Do not over-tighten.**

CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque is exceeded a new collapsible spacer must be installed.

(10) Use Flange Wrench 6958, a length of 1 in. pipe and a torque wrench set at 500 N·m (368 ft. lbs.) and crush collapsible spacer until bearing end play is taken up (Fig. 63).

(11) Slowly tighten the nut in 6.8 N·m (5 ft. lb.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 64).

(12) Rotate the pinion a minimum of ten times. Verify pinion rotates smoothly and check rotating torque with an inch pound torque wrench (Fig. 64). Pinion gear rotating torque is:

- Original Bearings: 1 to 2.25 N·m (10 to 20 in. lbs.).
- New Bearings: 1.7 to 3.4 N·m (15 to 30 in. lbs.).

(13) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

PINION GEAR/RING GEAR (Continued)

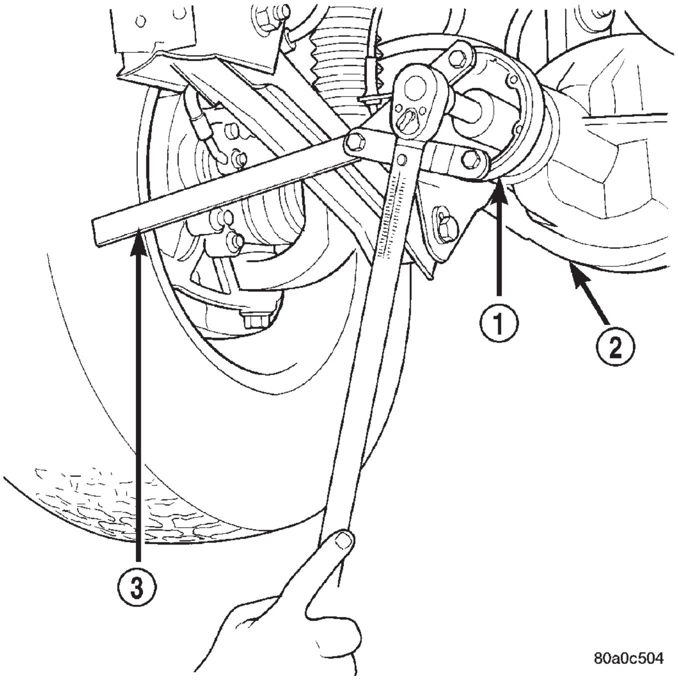


Fig. 63 Pinion Nut

1 - PINION FLANGE
2 - FRONT AXLE
3 - SPANNER WRENCH

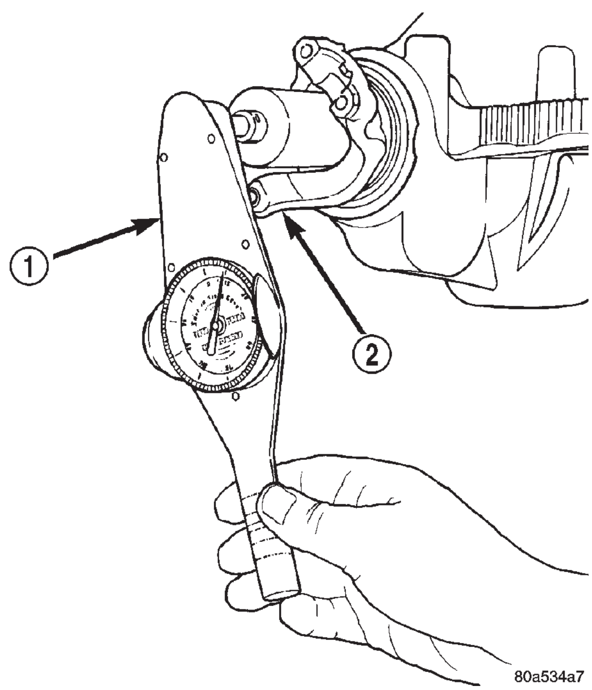


Fig. 64 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE/FLANGE

(14) Invert the differential case in the vise.

(15) Install new ring gear bolts and alternately tighten to 108 N·m (80 ft. lbs.) (Fig. 65).

CAUTION: Never reuse the ring gear bolts. The bolts can fracture causing extensive damage.

NOTE: If equipped with Veri-Lok® differential install oil feed plenum and side bearing.

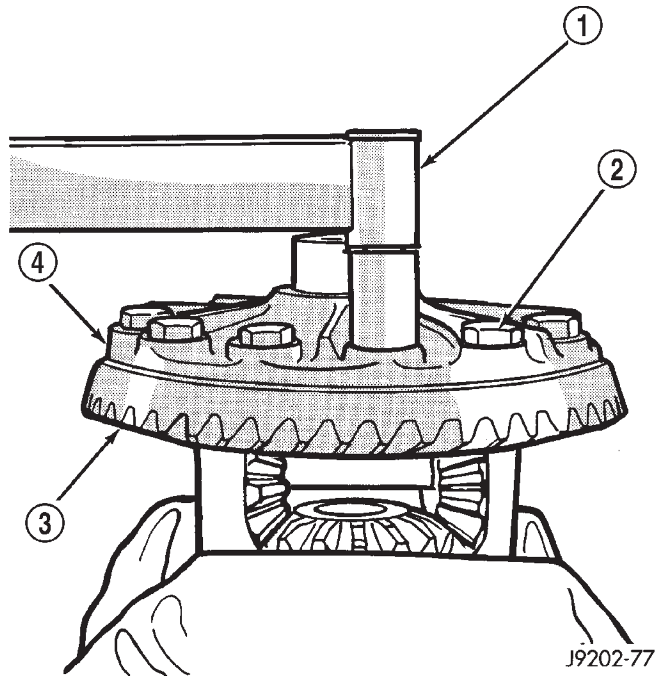


Fig. 65 RING GEAR BOLTS

1 - TORQUE WRENCH
2 - RING GEAR BOLTS
3 - RING GEAR
4 - DIFFERENTIAL CASE

(16) Install differential in housing and verify differential bearing preload, gear mesh and contact pattern. Refer to Adjustment for procedure.

(17) Install differential cover and fill with gear lubricant.

(18) Install propeller shaft with reference marks aligned.

(19) Remove supports and lower vehicle.

REAR AXLE - 198RBI

TABLE OF CONTENTS

REAR AXLE - 198RBI

DESCRIPTION

The Rear Beam-design Iron (RBI) axle housing has an iron center casting with axle shaft tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing. The axles has semi-floating axle shafts, meaning that loads are supported by the axle shaft and bearings. The axle shafts are retained by bearing retainer plates on the axles which are bolted to flanges at the outboard end of the axle tubes.

The differential case is a one-piece design. Differential bearing preload and ring gear backlash is adjusted by the use of selective spacer shims. Pinion bearing preload is set and maintained by the use of a collapsible spacer. A differential cover provides a means for inspection and service.

Axles with optional Trac-Lok® differential have a one-piece differential case, and the same internal components as a standard differential, plus two clutch disc packs.

OPERATION

The axle receives power from the transmission/transfer case through the rear propeller shaft. The rear propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

STANDARD DIFFERENTIAL

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 1).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

REAR AXLE - 198RBI (Continued)

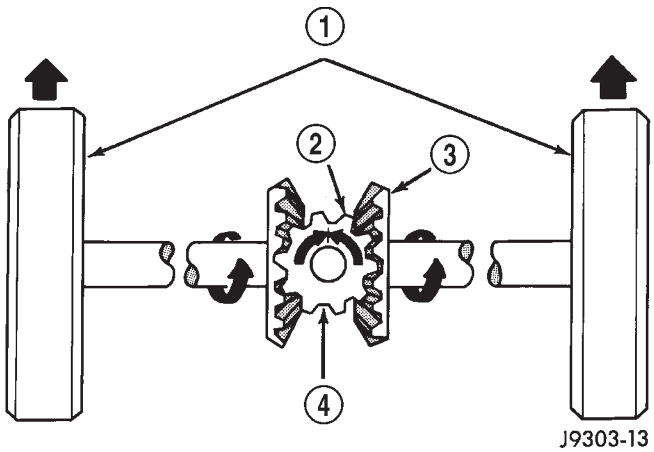


Fig. 1 STRAIGHT AHEAD DRIVING

1 - WHEELS ROTATE AT CASE SPEED
2 - PINION GEAR
3 - SIDE GEAR
4 - PINION GEARS ROTATE WITH CASE

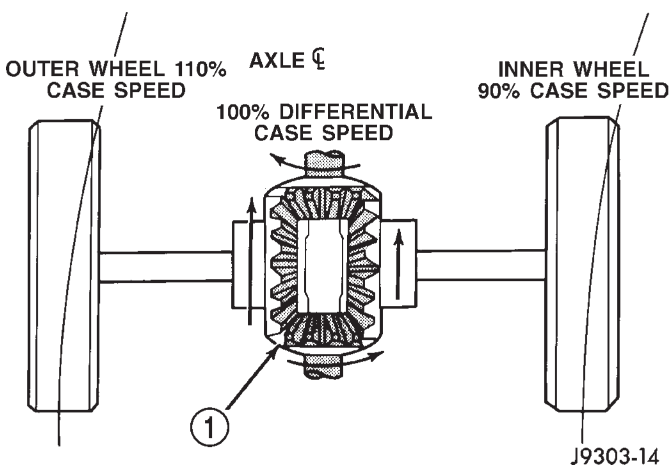


Fig. 2 DIFFERENTIAL ON TURNS

1 - PINION GEARS ROTATE ON PINION SHAFT

TRAC-LOK® DIFFERENTIAL

This differentials clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 3).

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. This differential resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok™ operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

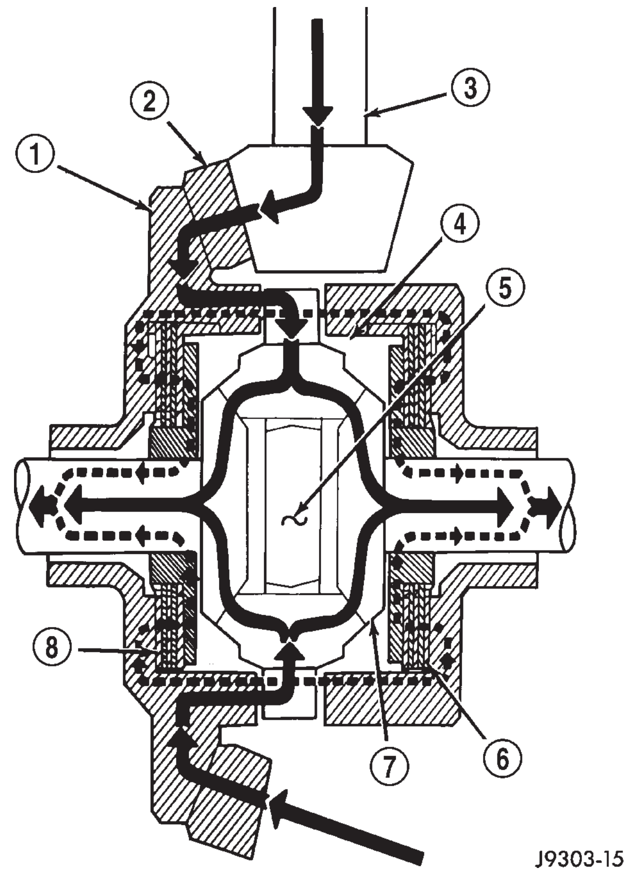


Fig. 3 TRAC-LOK LIMITED SLIP DIFFERENTIAL

1 - CASE
2 - RING GEAR
3 - DRIVE PINION
4 - PINION GEAR
5 - MATE SHAFT
6 - CLUTCH PACK
7 - SIDE GEAR
8 - CLUTCH PACK

DIAGNOSIS AND TESTING

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the

REAR AXLE - 198RBI (Continued)

peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be a rearend vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

(Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING)

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

REAR AXLE - 198RBI (Continued)

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion yoke nut.	6. Tighten the pinion yoke nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.

REAR AXLE - 198RBI (Continued)

Condition	Possible Causes	Correction
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.

REAR AXLE - 198RBI (Continued)

Condition	Possible Causes	Correction
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

VARI-LOK®

(1) Park the vehicle on a level surface or raise vehicle on hoist so that the vehicle is level.

(2) Remove the axle fill plug.

(3) Verify that the axle fluid level is correct. The fluid level is correct if the fluid is level with the bottom of the fill hole.

(4) Shift the transfer case into the 4WD full-time position.

(5) Drive the vehicle in a tight circle for 2 minutes at 5mph to fully prime the pump.

(6) Block the tires opposite the axle to be tested to prevent the vehicle from moving.

(7) Shift the transfer case into the 4WD Low position and the transmission into the Park position.

(8) Raise both the wheels of the axle to be tested off of the ground.

(9) Rotate the left wheel by hand at a minimum of one revolution per second while an assistant rotates the right wheel in the opposite direction.

(10) The left wheel should spin freely at first and then increase in resistance within 5 revolutions until the wheels cannot be continuously rotated in opposite directions.

(11) The Vari-lok® differential has engaged properly if the wheels cannot be rotated in opposite directions for a moment. After the wheels stop rotating for a moment, the fluid pressure will drop in the differential and the wheels begin to rotate once again.

(12) If the system does not operate properly, replace the Vari-lok® differential.

REMOVAL

(1) Raise and support the vehicle.

(2) Position a lifting device under the axle and secure axle.

(3) Remove the wheels and tires.

(4) Remove brake calipers and rotors.

(5) Disconnect parking brake cables from brackets and lever.

(6) Remove wheel speed sensors.

(7) Remove brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the calipers.

(8) Disconnect the vent hose from the axle shaft tube.

(9) Mark propeller shaft and yokes for installation reference.

(10) Remove propeller shaft.

(11) Disconnect stabilizer bar links.

(12) Remove upper suspension arm rear axle ball joint nut.

REAR AXLE - 198RBI (Continued)

(13) Separate rear axle ball joint from the upper suspension arm with Remover 8278 (Fig. 4).

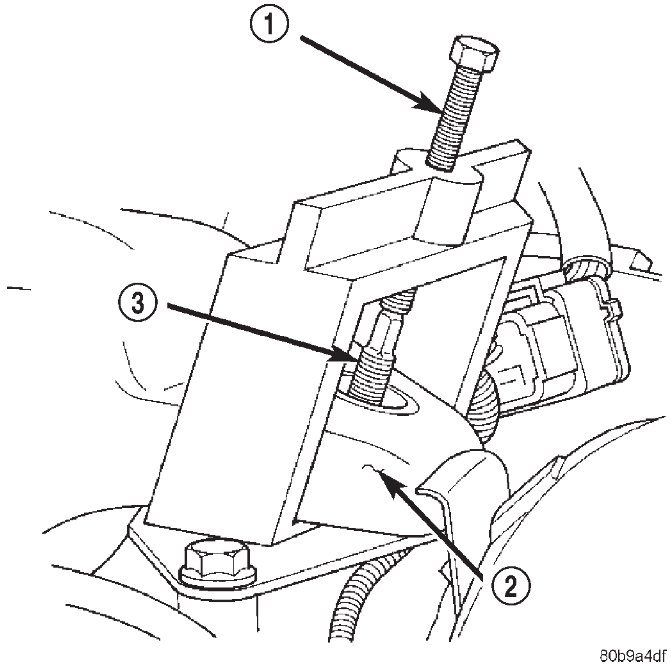


Fig. 4 REAR BALL JOINT

1 - REMOVER
2 - UPPER SUSPENSION ARM
3 - BALL JOINT STUD

(14) Disconnect shock absorbers from axle.
(15) Disconnect track bar.
(16) Disconnect lower suspension arms from the axle brackets.
(17) Separate the axle from the vehicle.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners are tightened. If springs are not at their normal ride position, vehicle ride height and handling could be affected.

(1) Raise axle with lift and align coil springs.
(2) Install lower suspension arms in axle brackets. Install nuts and bolts, do not tighten bolts at this time.
(3) Install upper suspension arm on rear axle ball joint.
(4) Install rear axle ball joint nut and tighten to 122 N·m (90 ft.lbs.) (Fig. 5).
(5) Install track bar and attachment bolts, do not tighten bolts at this time.
(6) Install shock absorbers and tighten nuts to 60 N·m (44 ft. lbs.).

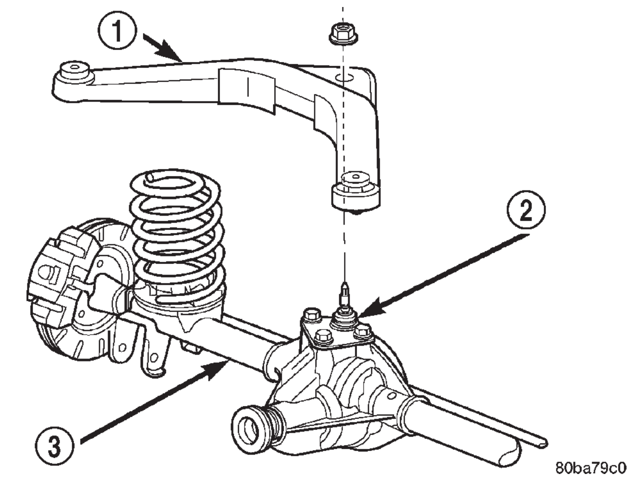


Fig. 5 REAR BALL JOINT NUT

1 - UPPER SUSPENSION ARM
2 - REAR AXLE BALL JOINT
3 - REAR AXLE

(7) Install stabilizer bar links and tighten nuts to 36 N·m (27 ft. lbs.).
(8) Install wheel speed sensors.
(9) Connect parking brake cable to brackets and lever.
(10) Install brake rotors and calipers.
(11) Install the brake hose to the axle junction block.
(12) Install axle vent hose.
(13) Align propeller shaft and pinion yoke reference marks. Install U-joint straps and nuts tighten to 19 N·m (14 ft. lbs.).
(14) Install the wheels and tires.
(15) Add gear lubricant, if necessary.
(16) Remove support and lower the vehicle.
(17) Tighten lower suspension arm bolts to 177 N·m (130 ft. lbs.).
(18) Tighten track bar bolts to 100 N·m (74 ft. lbs.).

ADJUSTMENTS

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 6). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 96.850 mm (3.813 in.). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern Analysis paragraph in this section for additional information.

REAR AXLE - 198RBI (Continued)

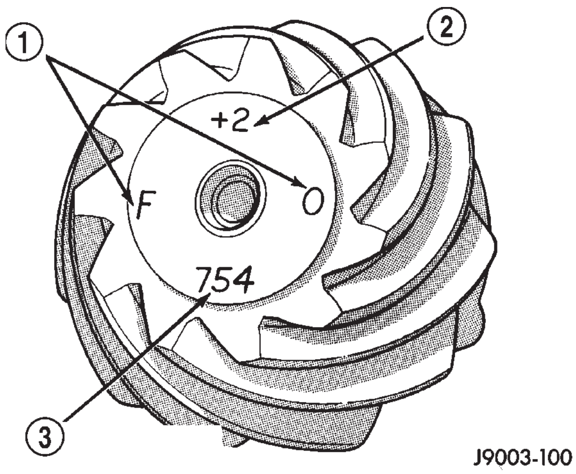


Fig. 6 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - PINION GEAR DEPTH VARIANCE
3 - GEAR MATCHING NUMBER

Compensation for pinion depth variance is achieved with a select shim. The shims are placed between the rear pinion bearing and the pinion gear head (Fig. 7).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim/oil slinger to compensate for the difference in the depth variances. Refer to the Pinion Gear Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

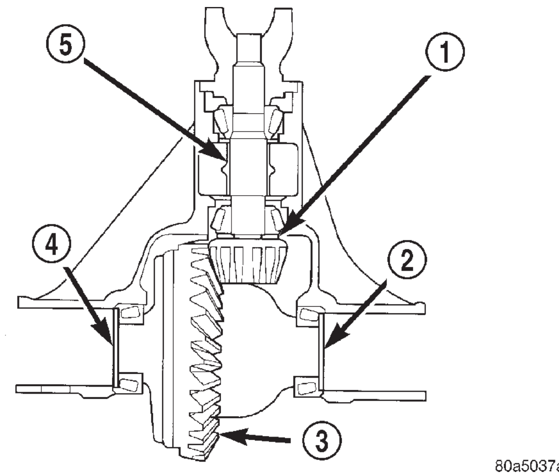


Fig. 7 SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM
2 - DIFFERENTIAL BEARING SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING SHIM
5 - COLLAPSIBLE SPACER

Note the etched number on the face of the pinion gear head (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

REAR AXLE - 198RBI (Continued)

PINION DEPTH MEASUREMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 8).

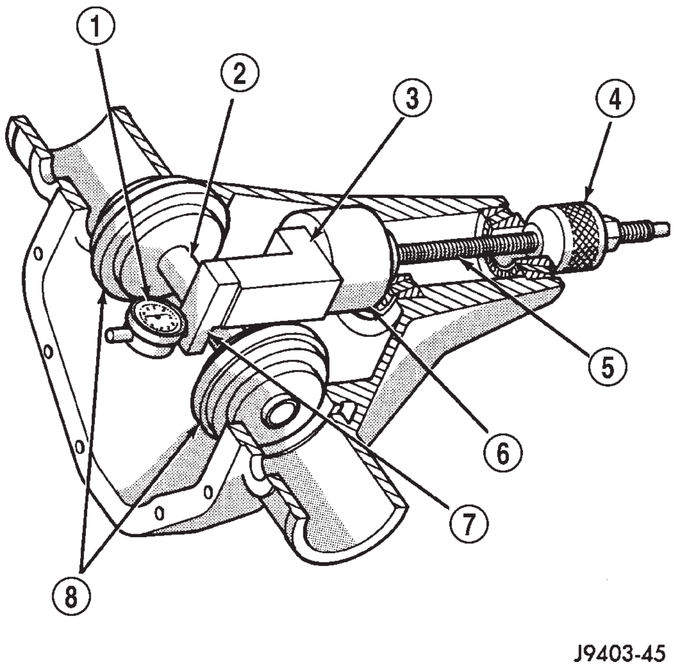


Fig. 8 PINION GEAR DEPTH GAUGE TOOLS

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 6735 and rear pinion bearing onto Screw 6741 (Fig. 8).

(2) Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups (Fig. 9).

(3) Install front pinion bearing and Cone-nut 6740 hand tight (Fig. 8).

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in the housing side bearing cradles (Fig. 10). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

NOTE: Arbor Discs 6732 has different step diameters to fit other axles. Choose proper step for axle being serviced.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

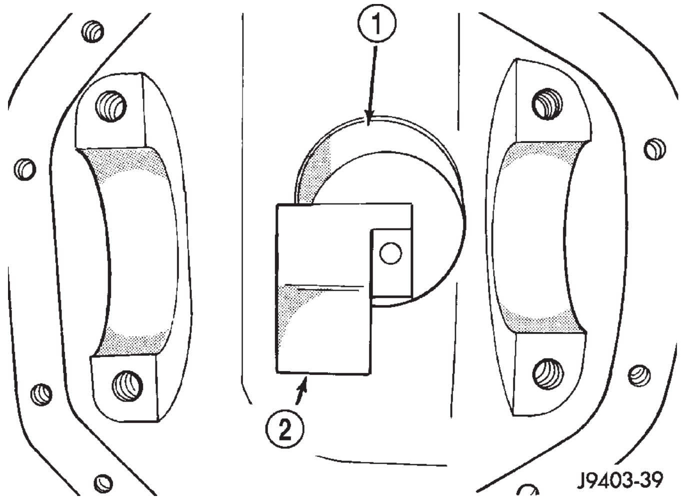


Fig. 9 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

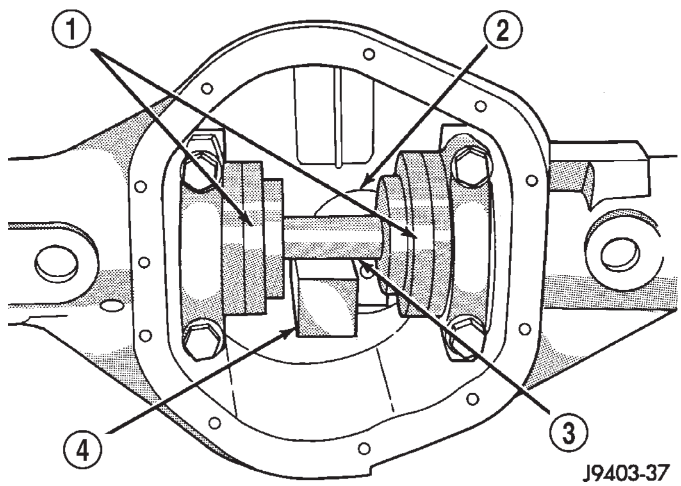


Fig. 10 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

(6) Place Scooter Block/Dial Indicator in position in the housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 8). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

REAR AXLE - 198RBI (Continued)

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 11). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the pinion depth variance number etched in the face of the pinion (Fig. 6). For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

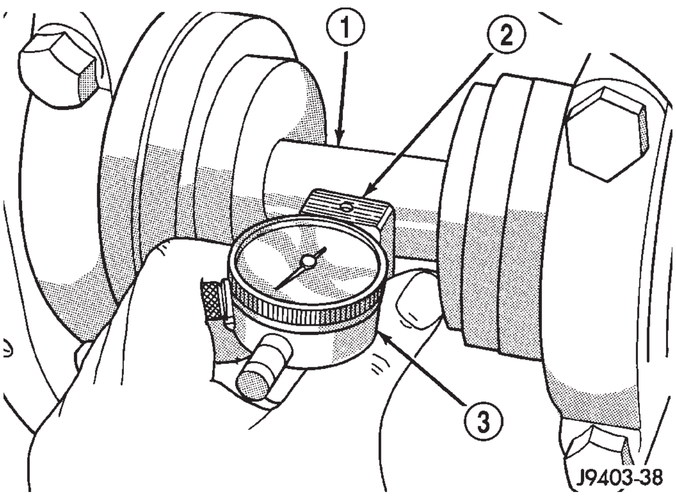


Fig. 11 PINION GEAR DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

DIFFERENTIAL

Differential side bearing preload and gear backlash is achieved by selective shims positioned behind the differential cas bearing cups. The proper shim thickness can be determined using slip-fit Dummy Bearings D-348 in place of the differential side bearings and a Dial Indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 12). Differential shim measurements are performed with the spreader W-129-B removed.

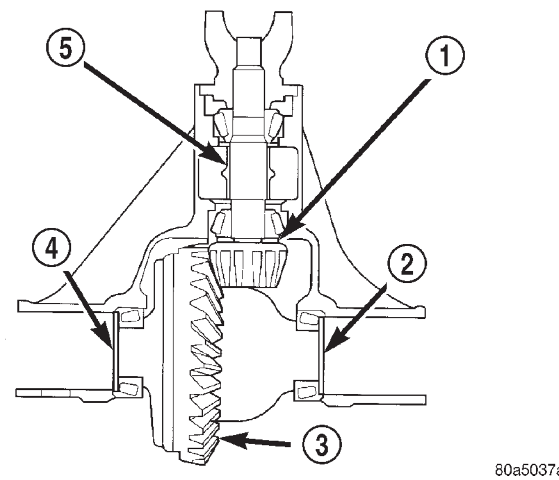


Fig. 12 SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM
2 - DIFFERENTIAL BEARING SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING SHIM
5 - COLLAPSIBLE SPACER

PRELOAD SHIM SELECTION

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

(1) Remove differential side bearings from differential case.

(2) Install ring gear on differential case and tighten bolts to specification.

(3) Install Dummy Bearings D-348 on differential case.

(4) Install differential case in the housing.

REAR AXLE - 198RBI (Continued)

(5) Record the thickness of Dummy Shims 8107. Insert the shims between the dummy bearings and the differential housing (Fig. 13).

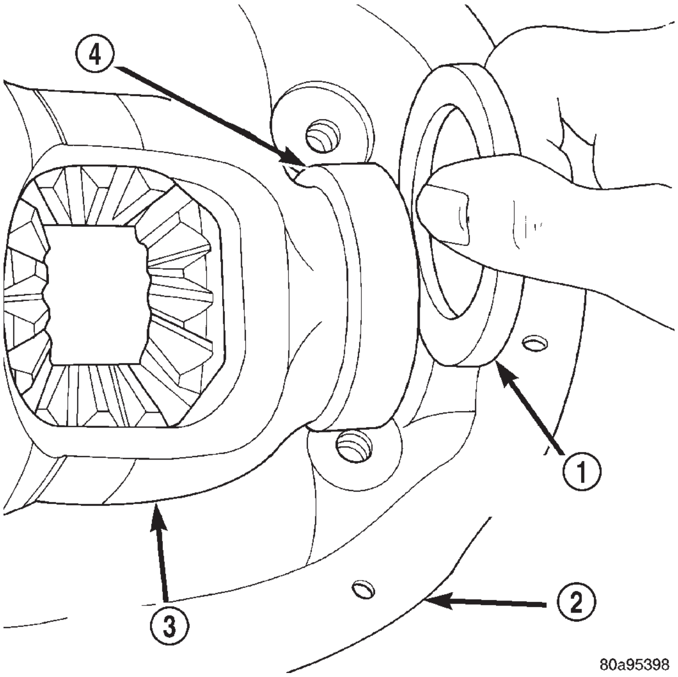


Fig. 13 SHIM POINT

1 - DUMMY SHIM
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE
4 - DUMMY BEARINGS

(6) Install the marked bearing caps in their correct positions. Install and snug the bolts (Fig. 14).

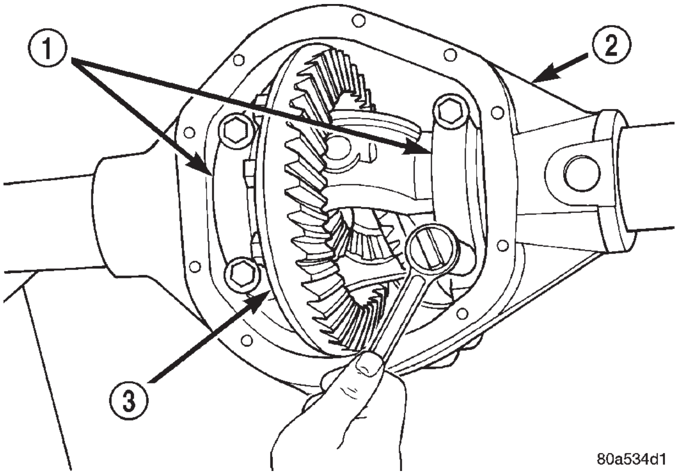


Fig. 14 BEARING CAP BOLTS

1 - BEARING CAP
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

(7) Using a dead-blow type hammer seat the differential dummy bearings to each side of the housing (Fig. 15) and (Fig. 16).

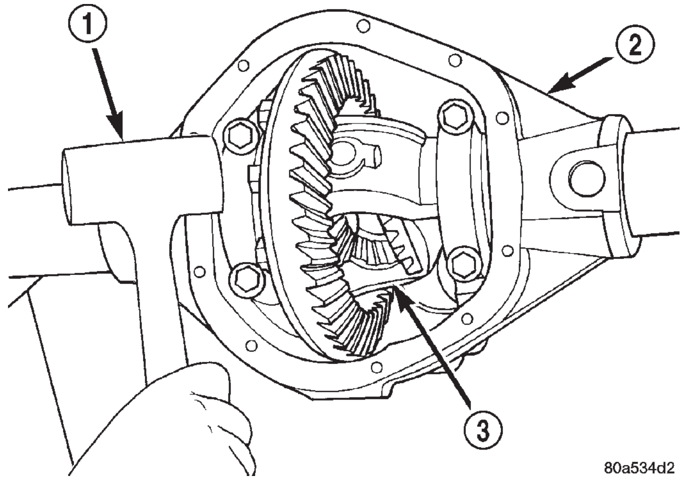


Fig. 15 SEAT PINION SIDE BEARING

1 - MALLET
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

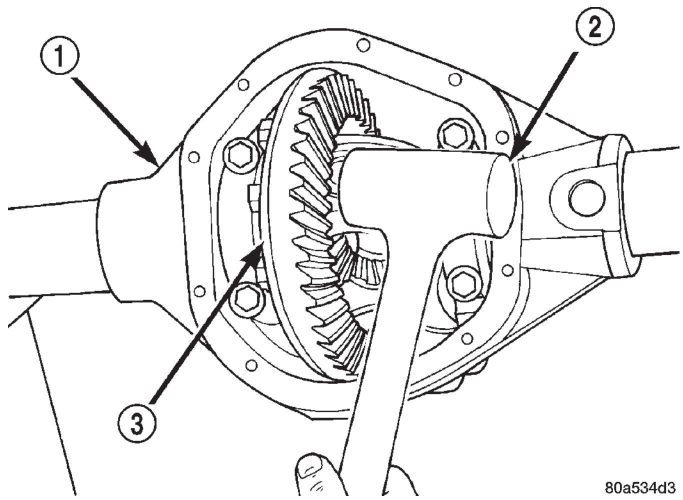


Fig. 16 SEAT RING GEAR SIDE BEARING

1 - DIFFERENTIAL HOUSING
2 - MALLET
3 - DIFFERENTIAL CASE

REAR AXLE - 198RBI (Continued)

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 17).

(9) Attach a Dial Indicator C-3339 to pilot stud. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 17).

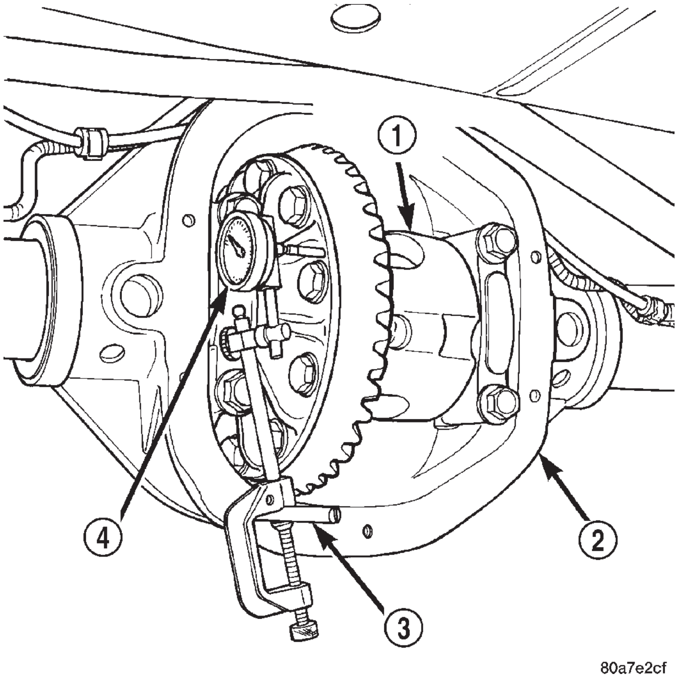


Fig. 17 DIFFERENTIAL SIDE PLAY

1 - DIFFERENTIAL CASE
2 - DIFFERENTIAL HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

(10) Push and hold differential case to pinion gear side of the housing and zero dial indicator (Fig. 18).

(11) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 19).

(12) Add 0.152 mm (0.006 in.) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.

(13) Rotate dial indicator out of the way on the pilot stud.

(14) Remove differential case and dummy bearings from the housing.

(15) Install the pinion gear in axle housing. Install the pinion yoke and establish the correct pinion rotating torque.

(16) Install differential case and Dummy Bearings D-348 in the housing.

(17) Install a single dummy shim in the ring gear side. Install bearing caps and tighten bolts snug.

(18) Seat ring gear side dummy bearing (Fig. 16).

(19) Position the dial indicator plunger on a flat surface between the ring gear bolt heads. (Fig. 17).

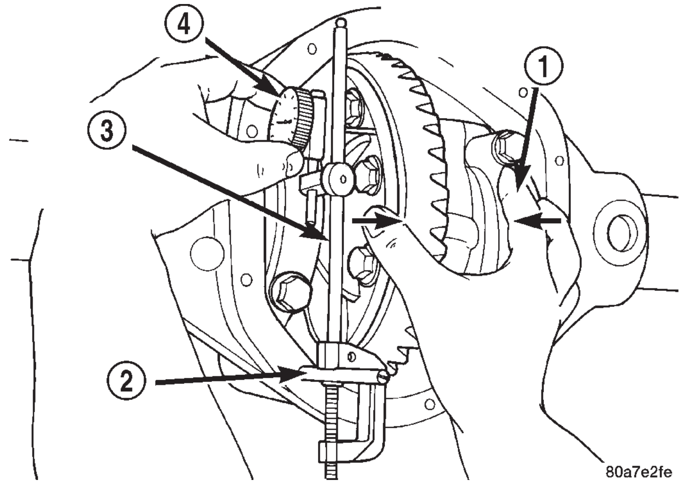


Fig. 18 ZERO DIAL INDICATOR

1 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
2 - PILOT STUD
3 - DIAL INDICATOR
4 - ZERO DIAL INDICATOR FACE

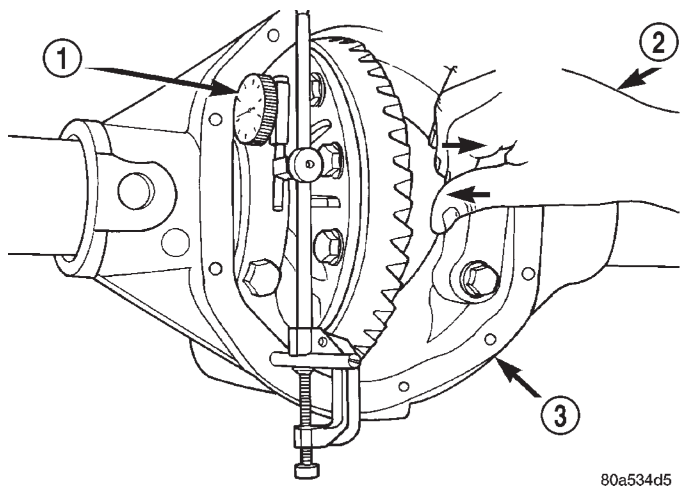


Fig. 19 DIFFERENTIAL TO RING GEAR SIDE

1 - DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(20) Push and hold differential case toward pinion gear and zero dial indicator (Fig. 20).

(21) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 21). Add dummy shim thickness to this reading. This will be the total shim thickness to achieve zero backlash.

(22) Subtract 0.076 mm (0.003 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.

(23) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is

REAR AXLE - 198RBI (Continued)

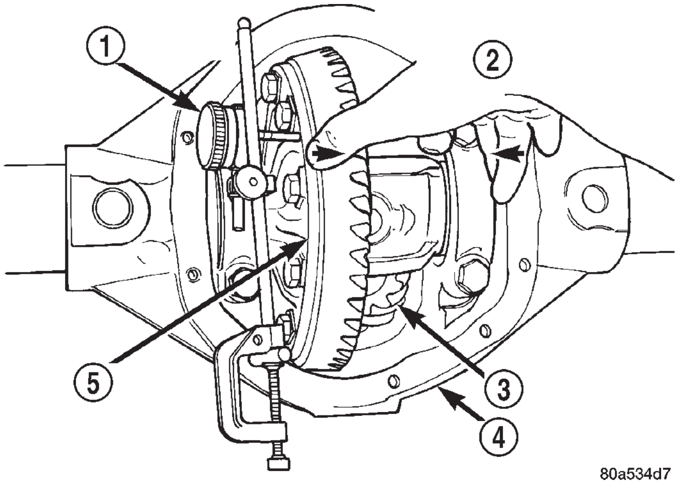


Fig. 20 ZERO DIAL INDICATOR

1 - DIAL INDICATOR FACE
2 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

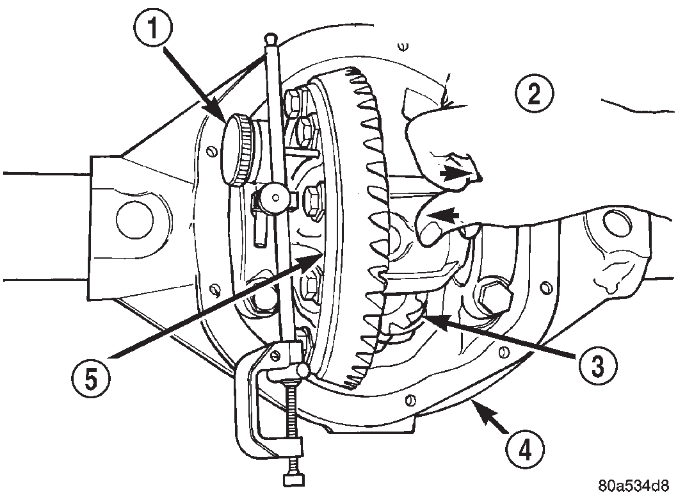


Fig. 21 DIFFERENTIAL TO RING GEAR SIDE

1 - DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

the shim thickness required on the pinion side of the housing.

(24) Rotate dial indicator out of the way on pilot stud.

(25) Remove differential case and dummy bearings from the housing.

(26) Install side bearings and cups on differential case.

(27) Install spreader W-129-B utilizing some items from Adapter Set 6987, on the housing and spread axle opening enough to receive differential case.

CAUTION: Never spread over 0.38 mm (0.015 in.). If housing is over-spread, it could be distorted or damaged.

(28) Place the bearing preload shims in the housing, against the axle tubes.

(29) Install differential case into the housing.

(30) Remove spreader from the housing.

(31) Install differential bearing caps in their original locations.

(32) Install bearing cap bolts and tighten to 77 N·m (57 ft. lbs.).

(33) Rotate the differential case several times to seat the side bearings.

(34) Position the indicator plunger against a ring gear tooth (Fig. 22).

(35) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(36) Zero dial indicator face to pointer.

(37) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12-0.20 mm (0.005-0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the axle housing to the other (Fig. 23).

(38) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.

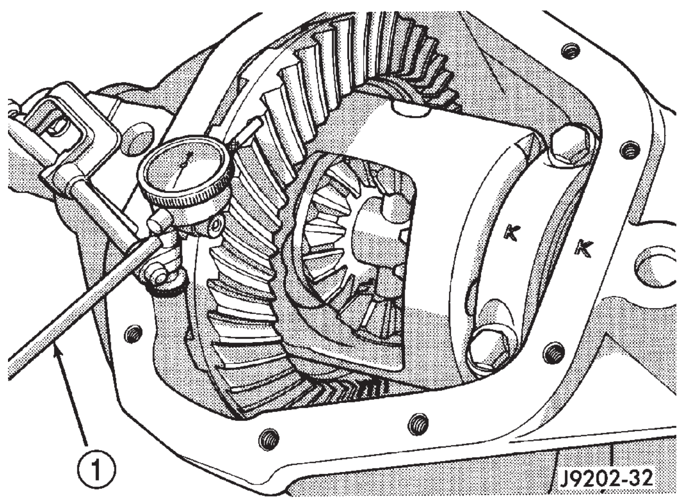


Fig. 22 RING GEAR BACKLASH MEASUREMENT

1 - DIAL INDICATOR

REAR AXLE - 198RBI (Continued)

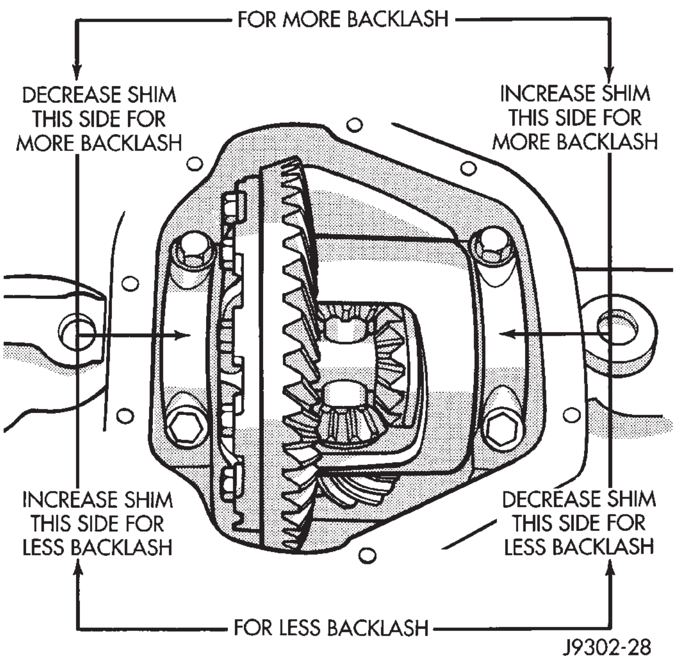


Fig. 23 BACKLASH SHIM

GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) With a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 24) and adjust pinion depth and gear backlash as necessary.

REAR AXLE - 198RBI (Continued)

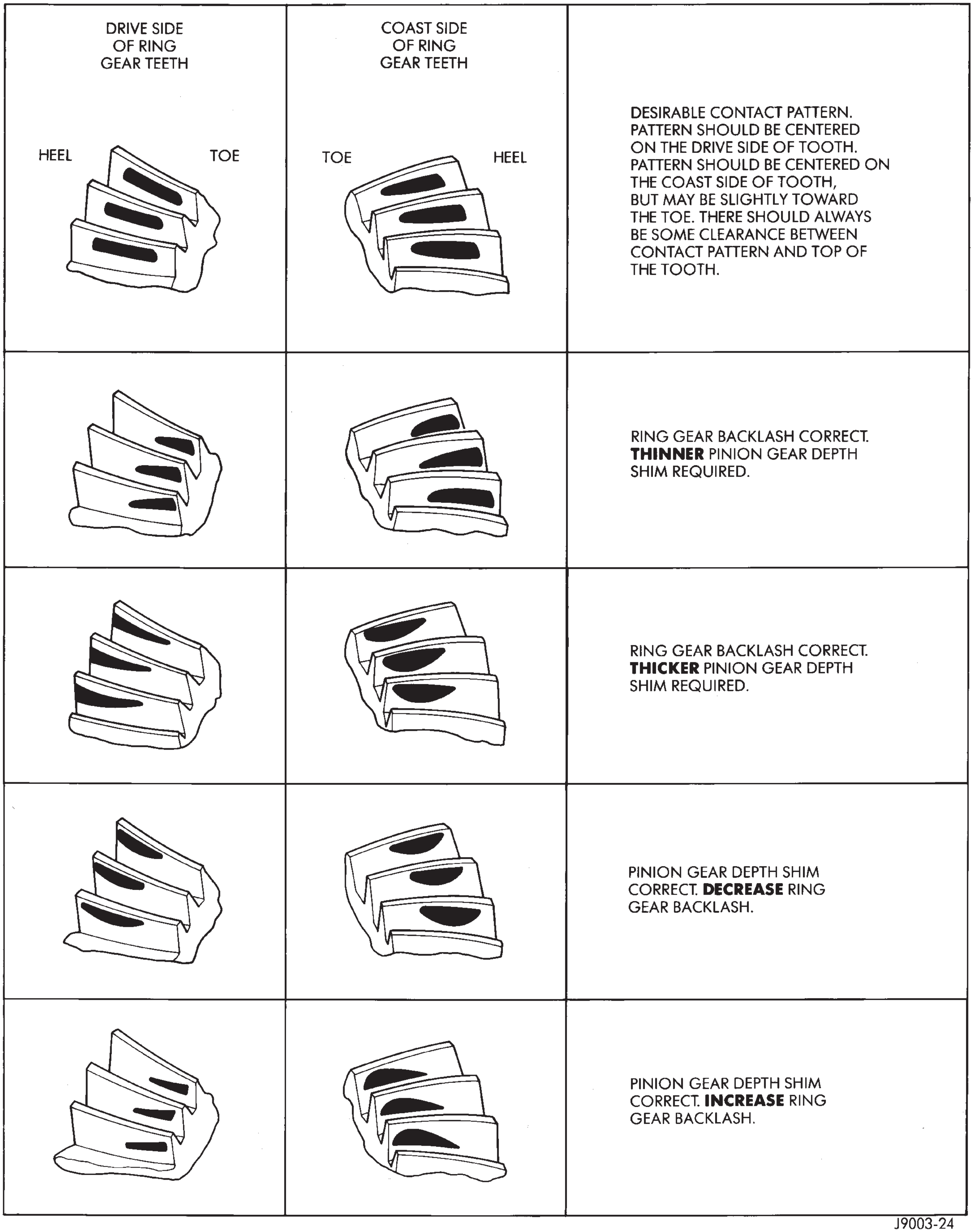


Fig. 24 GEAR TOOTH CONTACT PATTERNS

REAR AXLE - 198RBI (Continued)

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

SPECIFICATIONS

AXLE SPECIFICATIONS

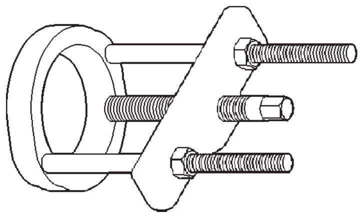
DESCRIPTION	SPECIFICATION
Axle Ratio	3.07, 3.31, 3.55, 3.73, 4.11
Differential Bearing Preload	0.1 mm (0.004 in.)
Ring Gear Diameter	198 mm (7.795 in.)
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Pinion Gear Std. Depth	96.85 mm (3.813 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	1.7-3.9 N·m (15-35 in. lbs.)

TORQUE SPECIFICATIONS

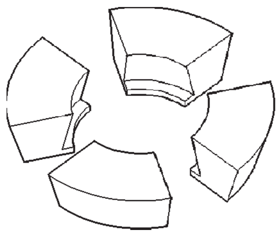
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	77	57	-
Ring Gear Bolts	129-142	95-105	-
Pinion Nut Minimum	272	200	-
Pinion Mate Shaft Screw	16.25	12	-
Axle Bearing Retainer Plate Nuts	61	45	-

REAR AXLE - 198RBI (Continued)

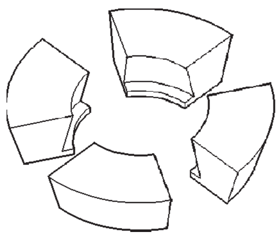
SPECIAL TOOLS



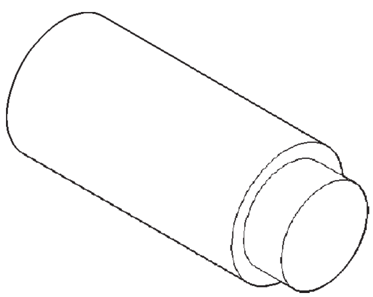
PULLER C-293-PA



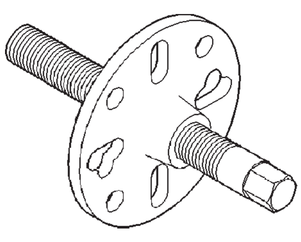
ADAPTER 8352



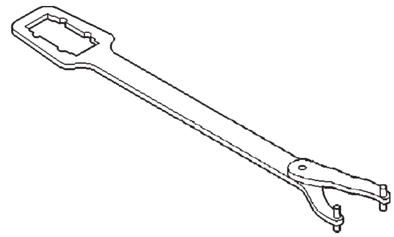
ADAPTER C-293-40



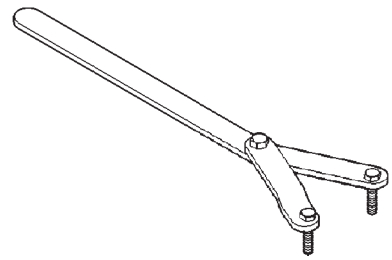
PLUG SP-3289



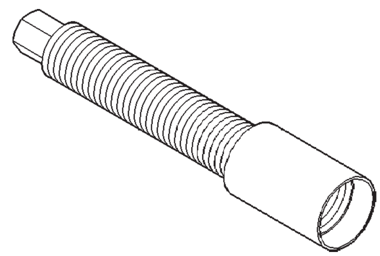
Puller C-452



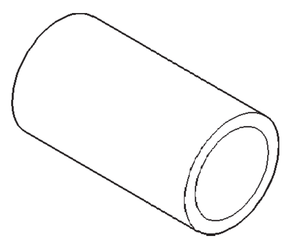
Wrench C-3281



Spanner Wrench 6958

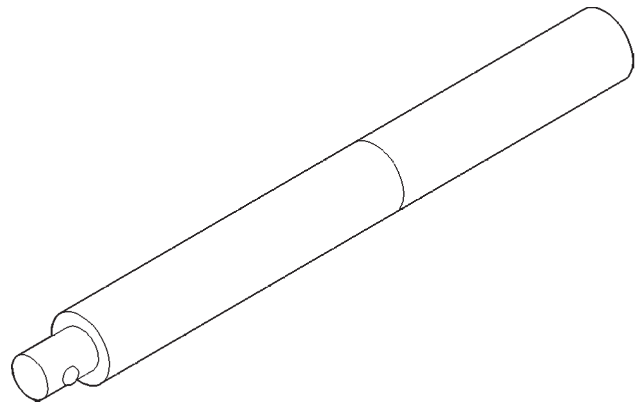


INSTALLER 8112

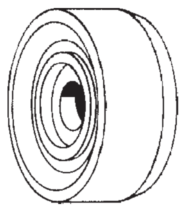


CUP 8109

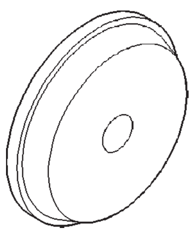
REAR AXLE - 198RBI (Continued)



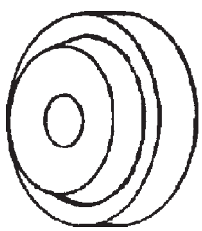
HANDLE C-4171



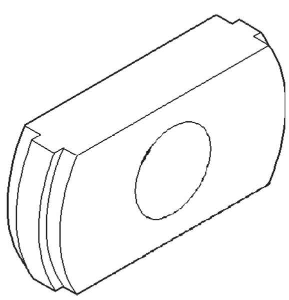
INSTALLER C-3716-A



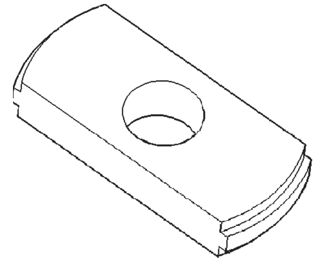
INSTALLER D-130



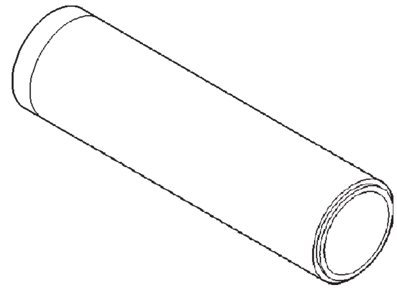
INSTALLER D-146



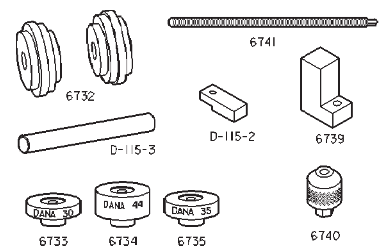
REMOVER C-4345



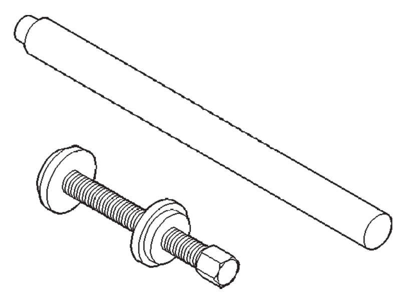
REMOVER D-149



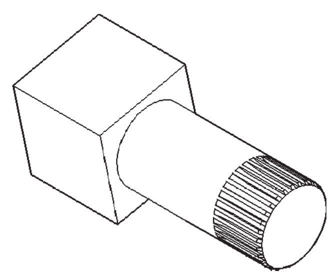
INSTALLER W-262



PINION DEPTH 6774

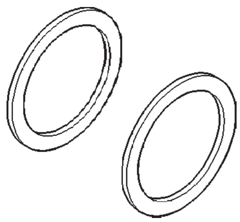


TRAC-LOK TOOLS 6960

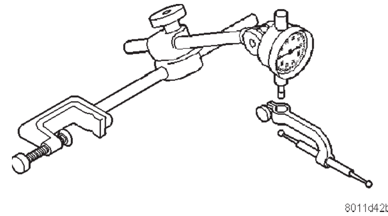


FIXTURE 6965

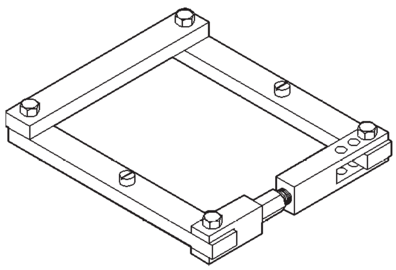
REAR AXLE - 198RBI (Continued)



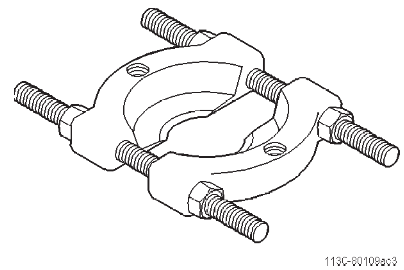
SHIMS DUMMY 8107



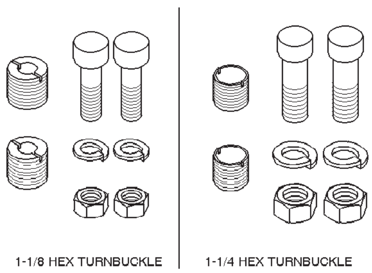
DIAL INDICATOR C-3339



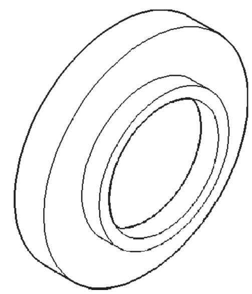
SPREADER W-129-B



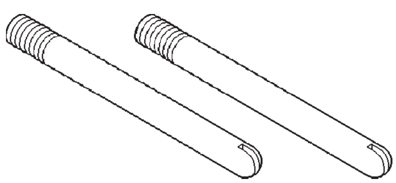
SPLITTER BEARING 1130



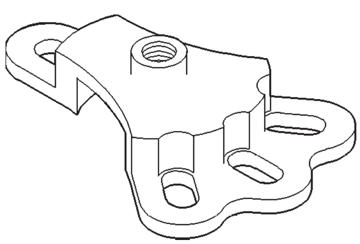
ADAPTER KIT 6987



INSTALLER 7913-A



PILOT STUDS C-3288-B



PULLER 6790

AXLE SHAFTS

REMOVAL

(1) Place transmission in neutral.
(2) Raise and support vehicle.
(3) Remove wheel and tire assembly.
(4) Remove brake caliper and rotor.
(5) Remove nuts holding axle retainer plate to axle tube from the rear of the axle flange.
(6) Pull axle shaft from the axle with Slide Hammer 7420 and Adapter 6790. Mount the adapter to the axle with lug nuts.

NOTE: The axle bearing race is normally loose in the axle tube.

INSTALLATION

(1) Insall axle into the axle tube with the flat area of the retainer plate upward.
(2) Insert retaining plate studs into the brake backing plate and axle tube flange.
(3) Install retainer nuts and tighten nuts to 61 N·m (45 ft. lbs.).
(4) Install the brake rotor and caliper.
(5) Install wheel and tire.
(6) Check and fill the differential with gear lubricant.
(7) Lower vehicle.

AXLE BEARINGS/SEALS

REMOVAL

(1) Remove axle shaft from vehicle.

NOTE: The axle bearing race is normally loose in the axle tube.

(2) Drill a shallow hole into soft steel axle bearing retaining ring with a 3/8 in. drill bit (Fig. 25). Use a drill depth stop to avoid marking the axle.
(3) With a cold chisel cut the retaining ring across drilled hole. (Fig. 26)
(4) Slide retaining ring from axle shaft.

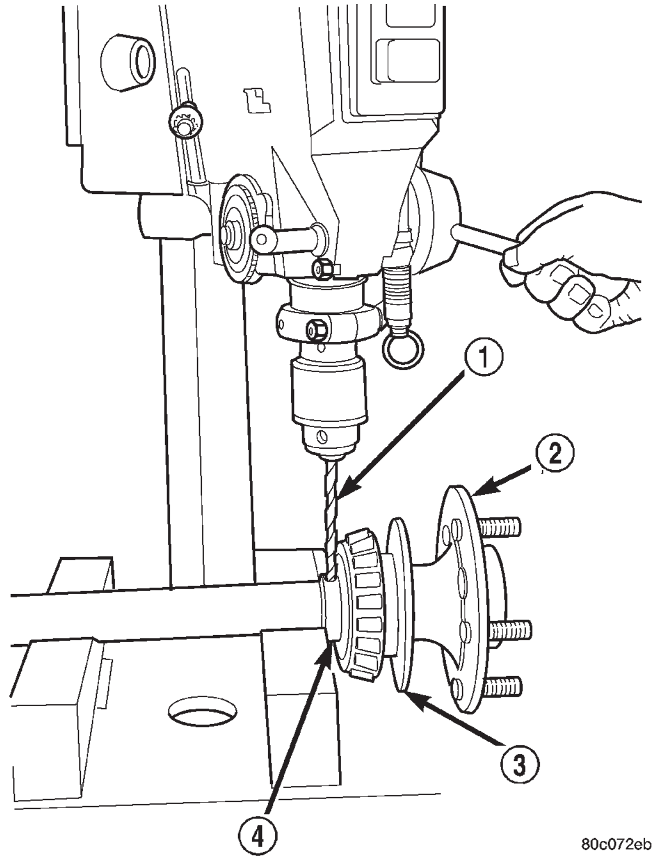


Fig. 25 DRILL RETAINING RING

1 - DRILL BIT
2 - AXLE
3 - RETAINING PLATE
4 - RETAINING RING

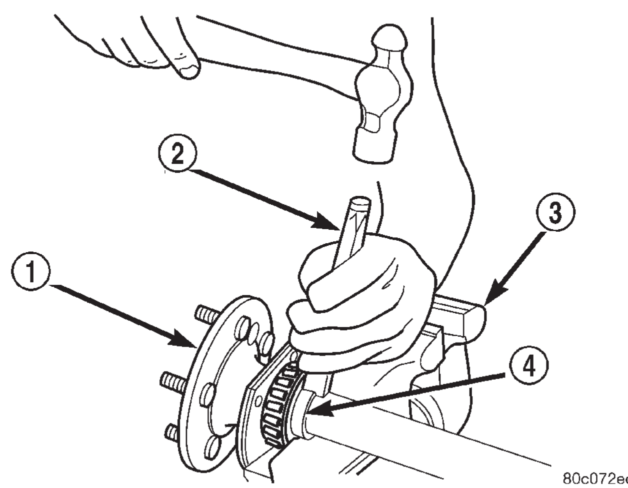


Fig. 26 RETAINING RING

1 - AXLE
2 - COLD CHISEL
3 - VISE
4 - RETAINING RING

AXLE BEARINGS/SEALS (Continued)

(5) Remove axle bearing from the shaft with, a press and Splitter 1130 placed between the seal and bearing (Fig. 27).

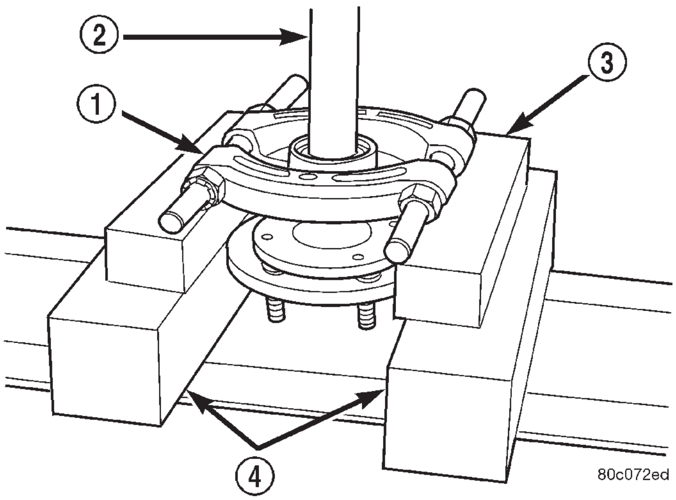


Fig. 27 AXLE BEARING AND SEAL

1 - SPLITTER
2 - AXLE
3 - BLOCKS
4 - PRESS PLATES

(6) Remove seal from axle.
(7) Remove retaining plate from axle shaft.

INSTALLATION

(1) Verify axle shaft retaining plate is flat with a straight edge.

NOTE: If the plate is warped or the studs are loose in the plate replace the retaining plate.

(2) Install retaining plate on the axle shaft (Fig. 28).
(3) Apply a coat of multi-purpose grease on sealing surface of axle seal.
(4) Install seal on the axle shaft with cavity away from retaining plate (Fig. 28).
(5) Lubricate bearing with Mopar Wheel Bearing Grease or equivalent. Wipe excess grease from the bearing.
(6) Install bearing on the axle shaft with Installer 7913 and a press (Fig. 29).

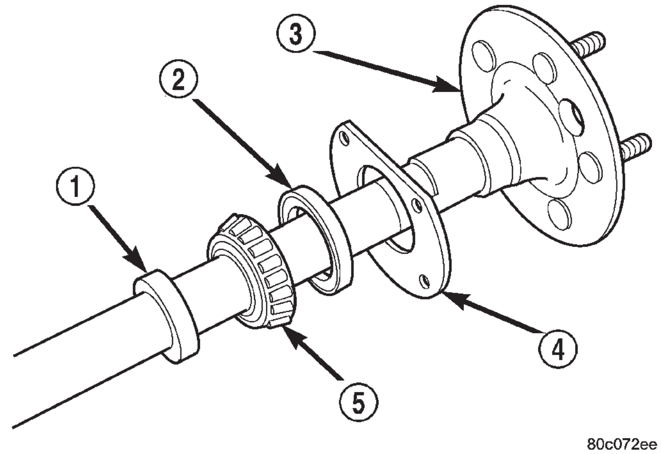


Fig. 28 AXLE BEARING AND SEAL COMPONENTS

1 - RETAINING RING
2 - SEAL
3 - AXLE
4 - RETAINING PLATE
5 - AXLE BEARING

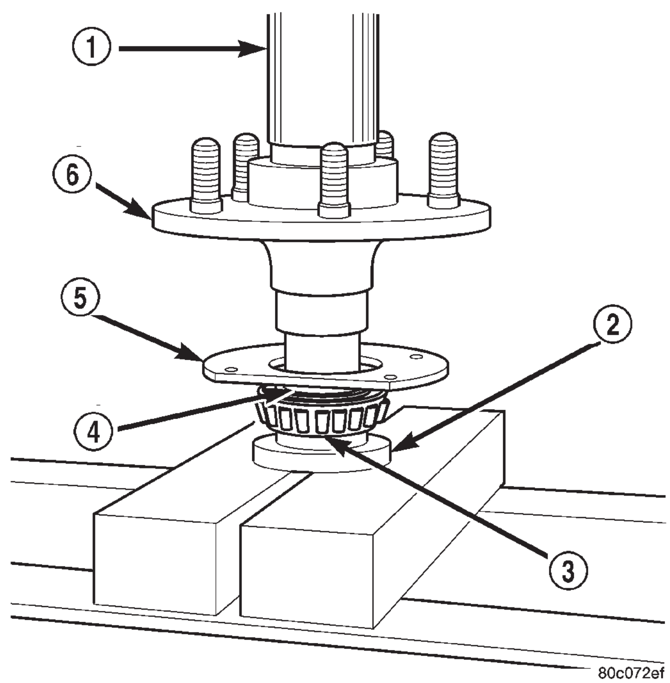


Fig. 29 PRESS BEARING ON AXLE

1 - PRESS RAM
2 - INSTALLER
3 - AXLE BEARING
4 - SEAL
5 - RETAINING PLATE
6 - AXLE

AXLE BEARINGS/SEALS (Continued)

(7) Press metal retaining ring onto axle shaft with Installer 7913 and a press (Fig. 30).

(8) Install axle in vehicle.

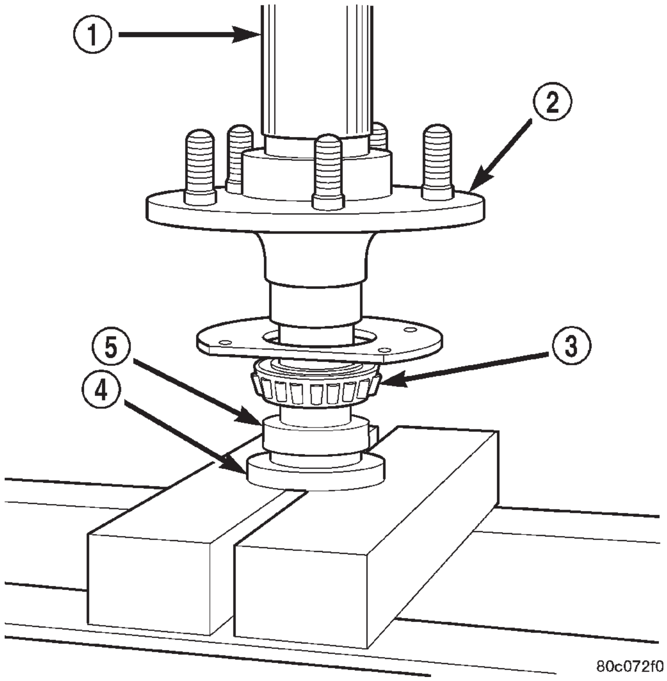


Fig. 30 BEARING RETAINING RING

1 - PRESS
2 - AXLE
3 - AXLE BEARING
4 - INSTALLER
5 - METAL RETAINING RING

PINION SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove brake calipers and rotors.

(4) Mark propeller shaft and pinion yoke for installation reference.

(5) Remove propeller shaft from the yoke.

(6) Rotate pinion gear a minimum of ten times and verify pinion rotates smoothly.

(7) Record rotating torque of the pinion gear with an inch pound dial-type torque wrench, for installation reference.

(8) Hold the pinion yoke with Spanner Wrench 6958 and remove the pinion nut and washer (Fig. 31).

(9) Remove pinion yoke with Remover C-452 and Wrench C-3281 (Fig. 32).

(10) Remove pinion gear seal with Remover 7794-A and slide hammer (Fig. 33).

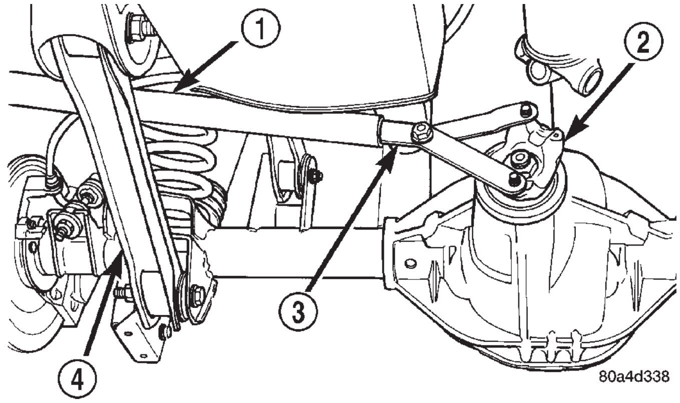


Fig. 31 PINION YOKE HOLDER

1 - PIPE
2 - PINION YOKE
3 - SPANNER WRENCH
4 - LOWER CONTROL ARM

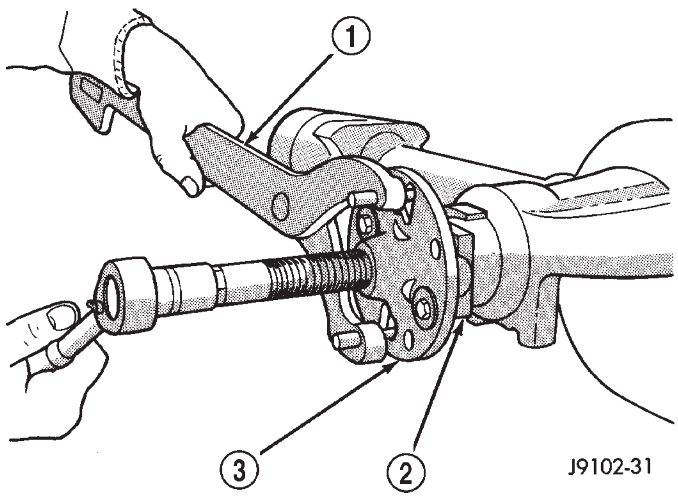


Fig. 32 PINION YOKE

1 - FLANGE WRENCH
2 - YOKE
3 - YOKE PULLER

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 34).

(2) Install yoke on pinion gear with Screw 8112, Cup 8109 and Spanner Wrench 6958 (Fig. 35).

CAUTION: Do not exceed the minimum tightening torque 271 N·m (200 ft. lbs.) when installing the pinion yoke at this point. Damage to the collapsible spacer or bearings may result.

(3) Install yoke washer and a **new** nut on the pinion gear and tighten the nut until there is zero bearing end-play.

PINION SEAL (Continued)

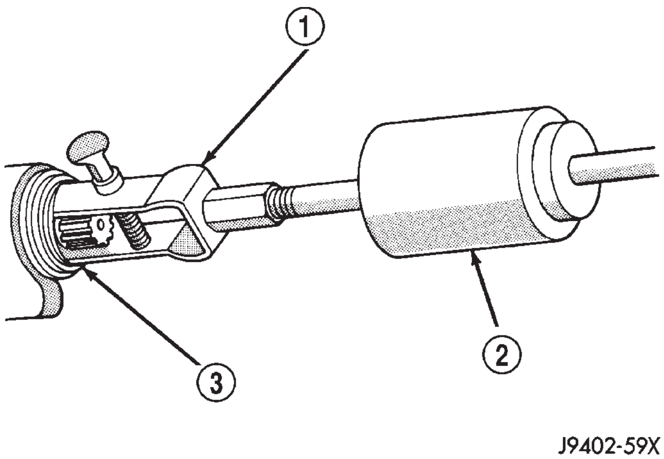


Fig. 33 PINION SEAL

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

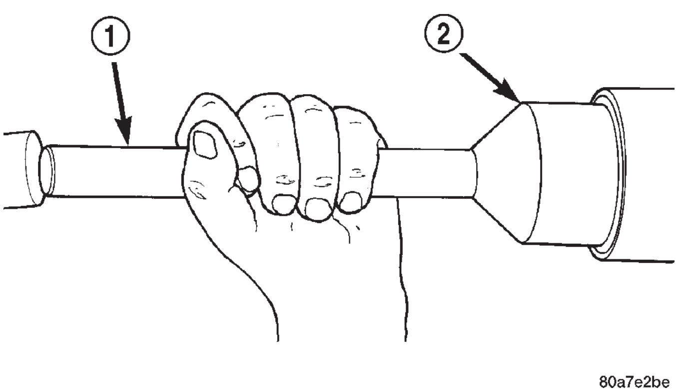


Fig. 34 PINION SEAL

1 - HANDLE
2 - INSTALLER

(4) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

(5) Rotate the pinion gear a minimum of ten times and verify pinion rotates smoothly. Rotate pinion shaft an inch pound torque wrench. Rotating torque should be equal to recorded reading plus an additional 0.56 N·m (5 in. lbs.) (Fig. 36).

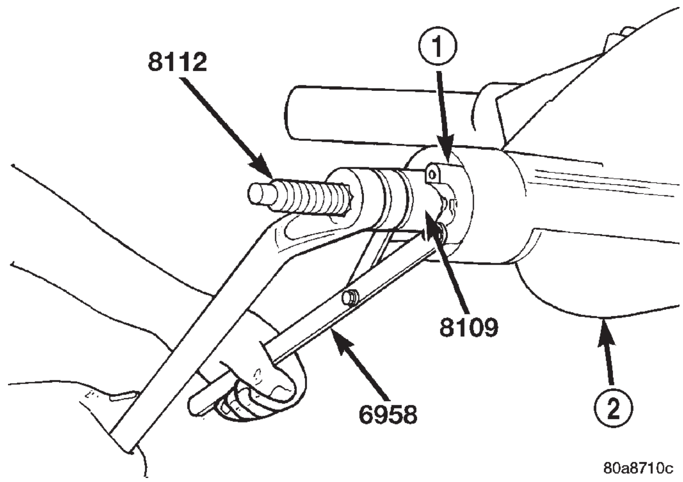


Fig. 35 PINION YOKE

1 - PINION YOKE
2 - DIFFERENTIAL HOUSING

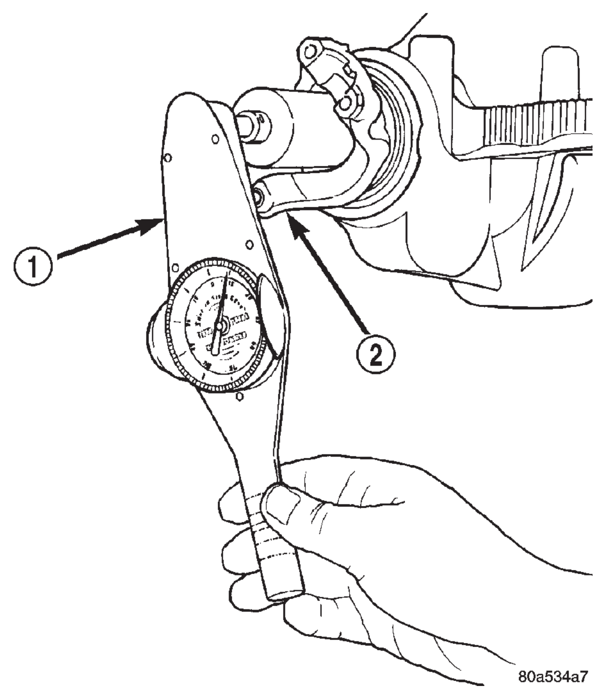


Fig. 36 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

PINION SEAL (Continued)

(6) If the rotating torque is low, use Spanner Wrench 6958 to hold the pinion yoke (Fig. 37), and tighten the pinion nut in 6.8 N·m (5 ft. lbs.) increments until the proper rotating torque is achieved.

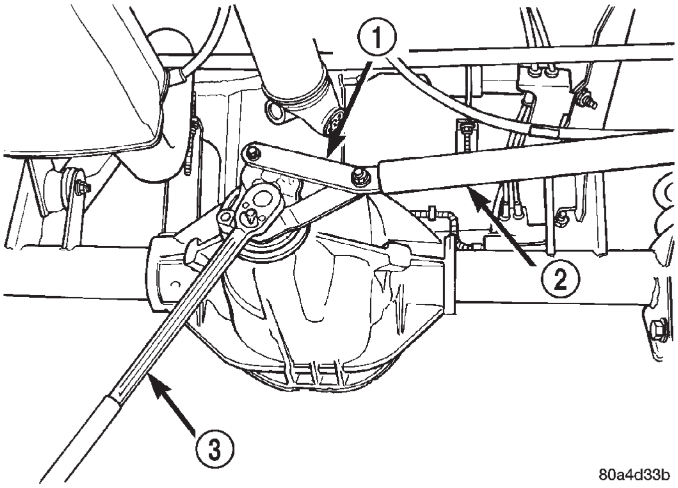


Fig. 37 PINION SHAFT NUT

1 - SPANNER WRENCH
2 - PIPE
3 - TORQUE WRENCH

CAUTION: If maximum tightening torque is reached prior to reaching required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

(7) Install the propeller shaft with reference marks aligned.
(8) Add gear lubricant to the differential if necessary.
(9) Install brake rotors and calipers.
(10) Install wheel and tire assemblies.
(11) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL

(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove rear brake calipers and rotors.
(4) Mark propeller shaft and pinion yoke for installation reference and remove propeller shaft.
(5) Rotate pinion gear a minimum of ten times and verify pinion rotates smoothly.
(6) Record rotate torque of the pinion gear, with an inch pound torque wrench.
(7) Hold pinion yoke with Spanner Wrench 6958 and remove pinion nut and washer (Fig. 38).
(8) Remove pinion yoke with Remover C-452 and Wrench C-3281 (Fig. 39).

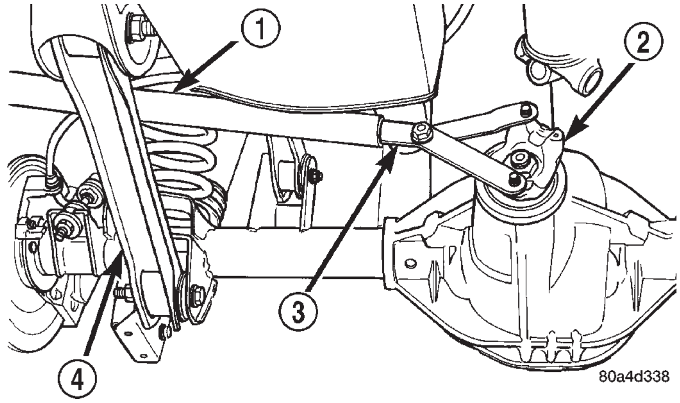


Fig. 38 PINION YOKE HOLDER

1 - 1 in. PIPE
2 - PINION YOKE
3 - SPANNER WRENCH
4 - LOWER CONTROL ARM

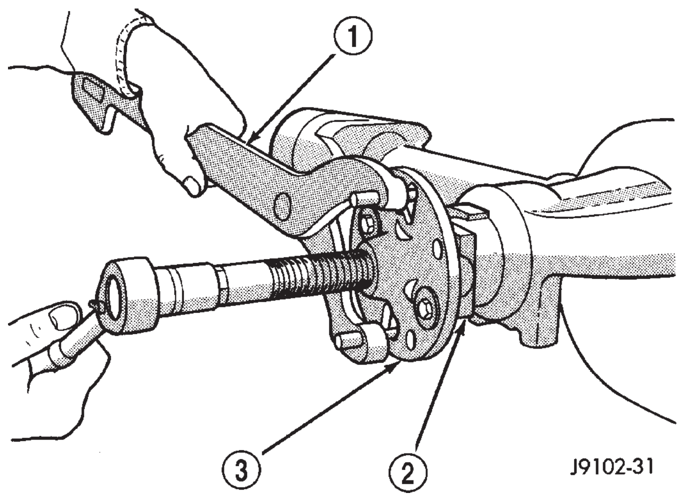


Fig. 39 PINION YOKE PULLER

1 - WRENCH
2 - PINION YOKE
3 - PULLER

(9) Remove pinion shaft seal with Remover 7794-A and slide hammer (Fig. 40).
(10) Remove front pinion bearing using a pair of pick tools to pull the bearing off the pinion gear shaft.

NOTE: If the pinion bearing becomes bound on the pinion shaft, lightly tap the end of the shaft with a rawhide/rubber mallet.

(11) Remove the collapsible spacer.

INSTALLATION

(1) Install a **new** collapsible spacer on pinion shaft.
(2) Install pinion front bearing on the pinion shaft.

COLLAPSIBLE SPACER (Continued)

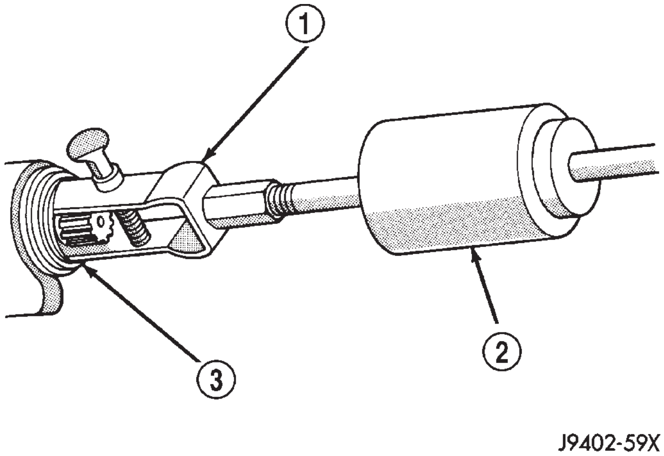


Fig. 40 PINION SEAL REMOVER

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

(3) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 41).

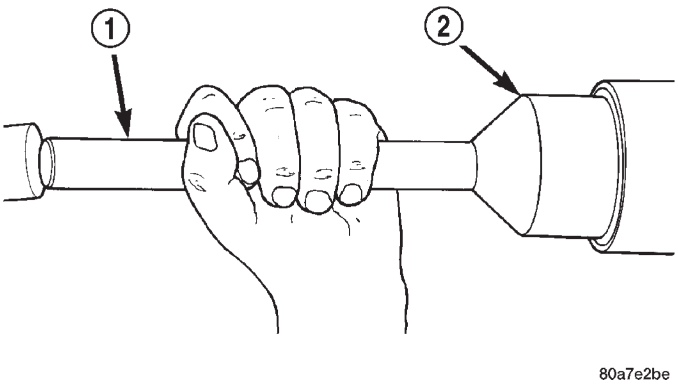


Fig. 41 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(4) Install yoke with Screw 8112, Cup 8109 and Spanner Wrench 6958 (Fig. 42).

(5) Install yoke washer and **new** nut on the pinion gear. Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

(6) Using yoke with Spanner Wrench 6958 and a torque wrench set at 474 N·m (350 ft. lbs.), (Fig. 43) slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 44).

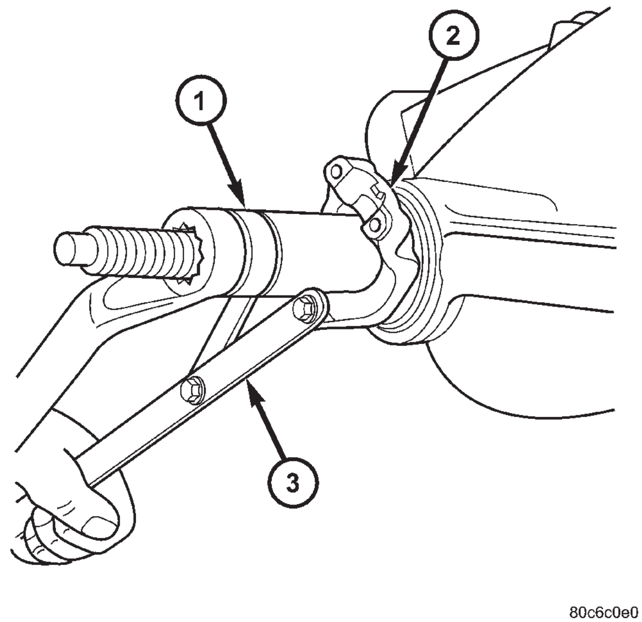


Fig. 42 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

NOTE: If more than 474 N·m (350 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced.

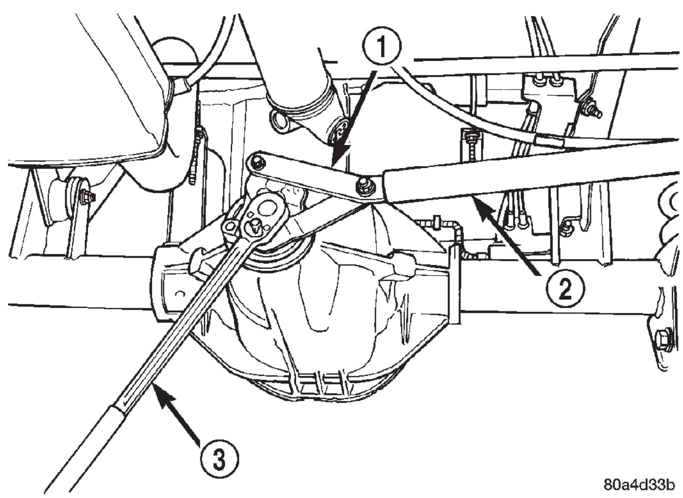


Fig. 43 PINION NUT

1 - SPANNER WRENCH
2 - PIPE
3 - TORQUE WRENCH

COLLAPSIBLE SPACER (Continued)

(7) Check rotating torque with an inch pound torque wrench (Fig. 44). The rotating torque of the pinion gear should be, the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).

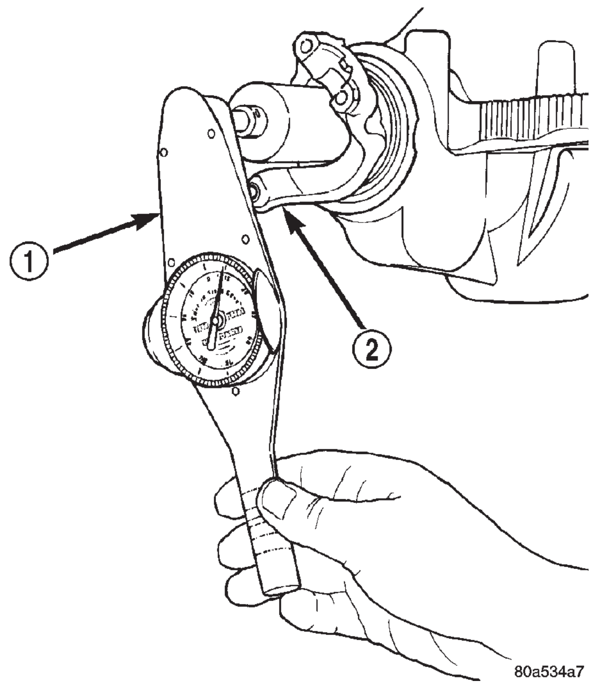


Fig. 44 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

(8) Install propeller shaft with reference marks align.
(9) Install rear brake calipers and rotors (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
(10) Add gear lubricant, if necessary.
(11) Install wheel and tire assemblies.
(12) Remove supports and lower vehicle.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.
(2) Remove fill hole plug from the differential housing cover.
(3) Remove differential housing cover and drain fluid.
(4) Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

(5) Remove axle shafts.
(6) Note the reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 45).

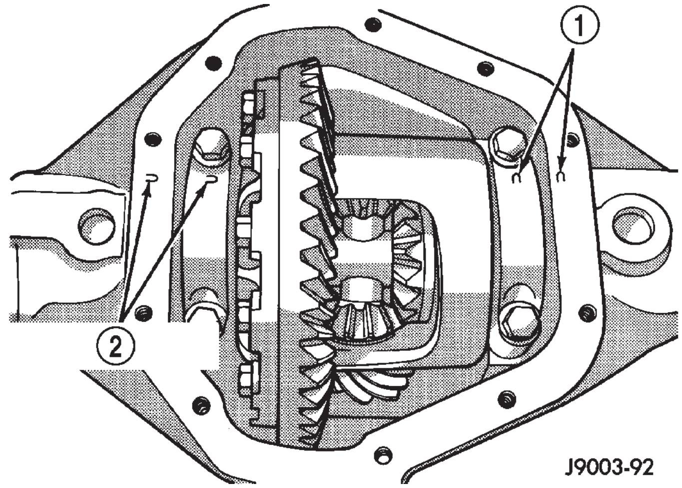


Fig. 45 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(7) Loosen the differential bearing cap bolts.
(8) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 46). Install holddown clamps and tighten the turnbuckle finger-tight.

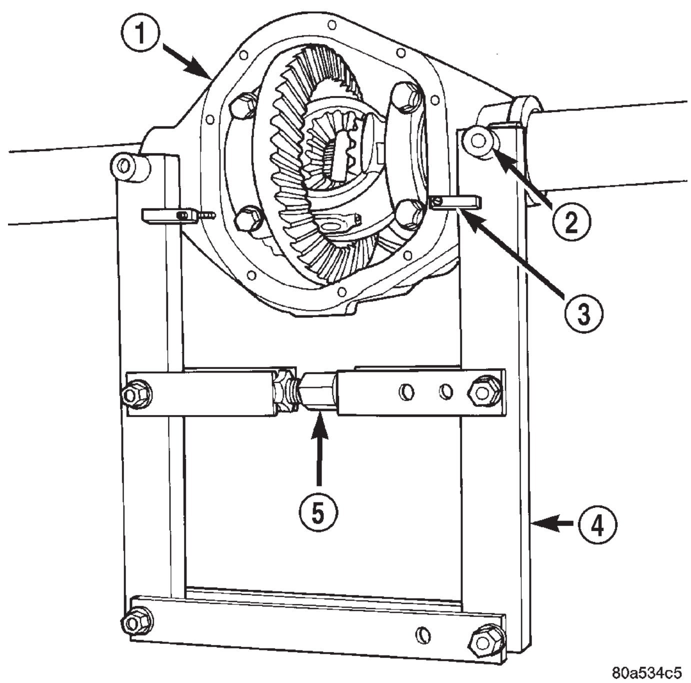


Fig. 46 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

DIFFERENTIAL (Continued)

(9) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 47) and zero the indicator.

CAUTION: Never spread the housing over 0.38 mm (0.015 in). If housing is over-spread, it could distorted and damaged the housing.

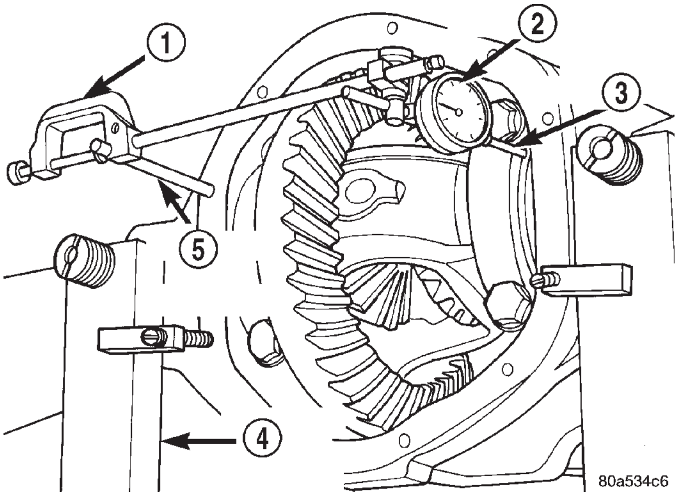


Fig. 47 DIAL INDICATOR LOCATION

1 - CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

(10) Spread housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 48).

(11) Remove the dial indicator.

(12) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(13) Remove differential from the housing and tag differential bearing cups to indicate location (Fig. 49).

(14) Remove spreader from housing.

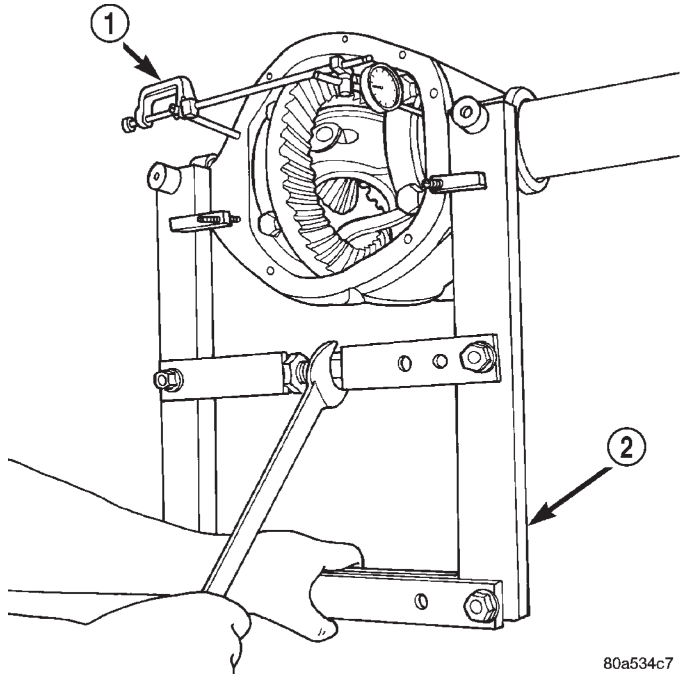


Fig. 48 SPREAD DIFFERENTIAL HOUSING

1 - DIAL INDICATOR
2 - SPREADER

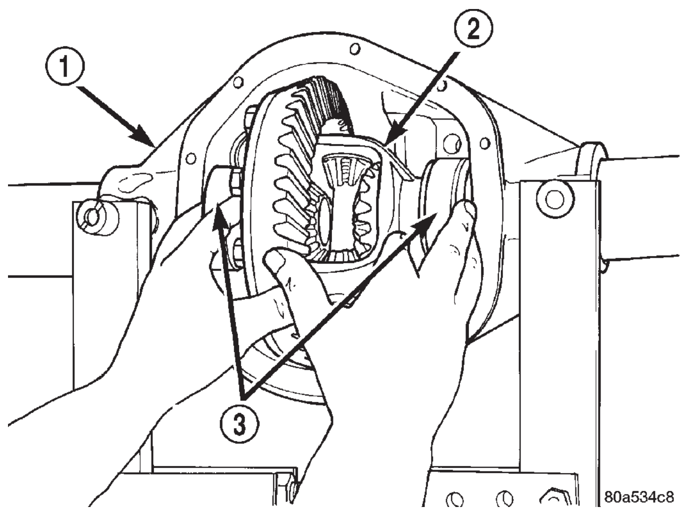


Fig. 49 DIFFERENTIAL CASE REMOVAL

1 - DIFFERENTIAL HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

DIFFERENTIAL (Continued)

DISASSEMBLY

(1) Remove pinion shaft lock screw (Fig. 50).

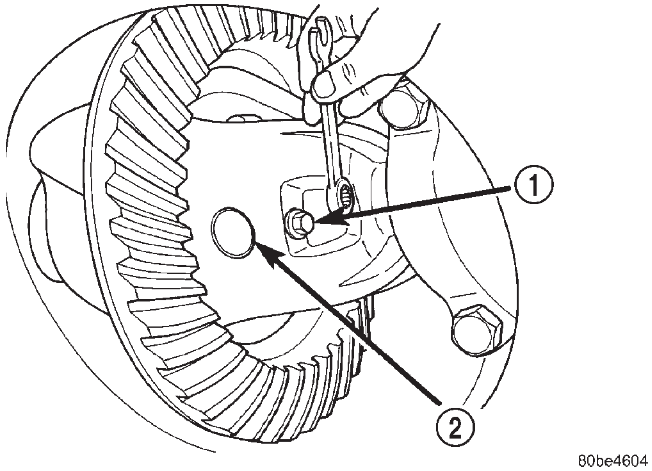


Fig. 50 SHAFT LOCK SCREW

1 - LOCK SCREW
2 - PINION SHAFT

(2) Remove pinion shaft.

(3) Rotate differential side gears and remove differential pinions and thrust washers (Fig. 51).

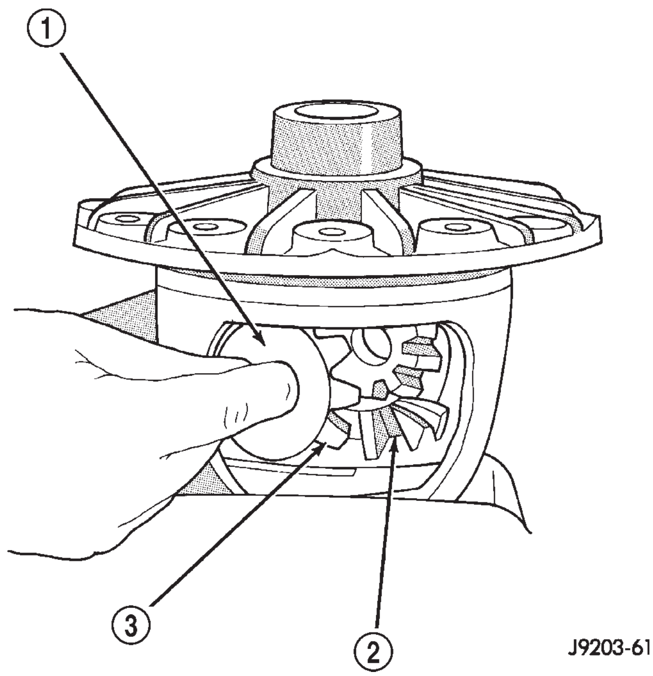


Fig. 51 DIFFERENTIAL GEARS

1 - THRUST WASHER
2 - SIDE GEAR
3 - DIFFERENTIAL PINION

(4) Remove differential side gears and thrust washers.

ASSEMBLY

(1) Install differential side gears and thrust washers.

(2) Install differential pinion gears and thrust washers.

(3) Install the pinion mate shaft.

(4) Align hole in the pinion mate shaft with the hole in the differential case and install the pinion mate shaft lock screw.

(5) Lubricate all differential components with hypoid gear lubricant.

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Position Spreader W-129-B with Adapter set 6987 on differential housing locating holes. Install the holddown clamps and tighten the tool turnbuckle finger-tight.

(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Never spread the housing over 0.38 mm (0.015 in). If housing is over-spread, it could be distorted or damaged.

(3) Spread housing enough to install the case in the housing.

(4) Remove the dial indicator.

(5) Install differential case in housing (Fig. 52). Verify differential bearing cups remain in position on the bearings and preload shims are between the face of the bearing cup and the housing. Tap the differential case to ensure bearings cups and shims are seated in the housing.

CAUTION: On a Vari-lok® differential the oil feed tube must be pointed at the bottom of the housing (Fig. 53). If differential is installed with the oil feed tube pointed at the top, the anti-rotation tabs will be damaged.

(6) Install bearing caps in their original locations (Fig. 54).

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten bearing cap bolts in a criss-cross pattern to 77 N·m (57 ft. lbs.).

(10) Install the axle shafts.

DIFFERENTIAL (Continued)

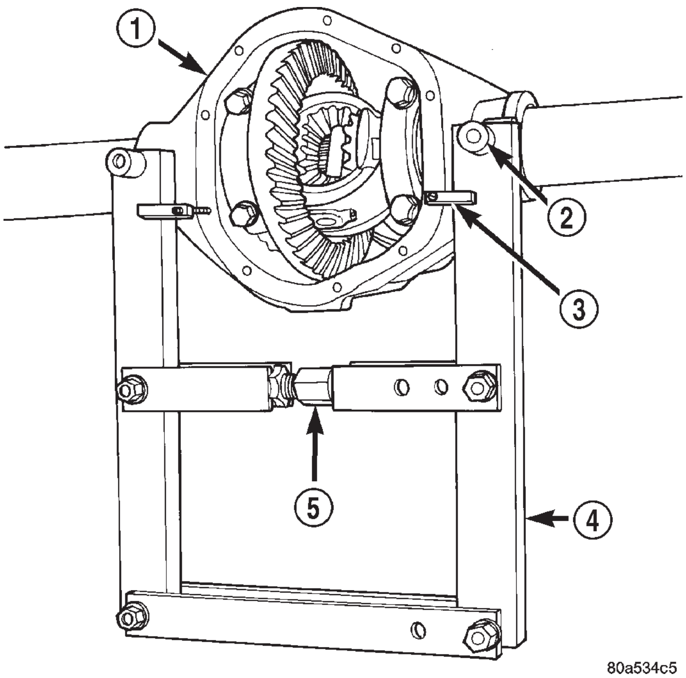


Fig. 52 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

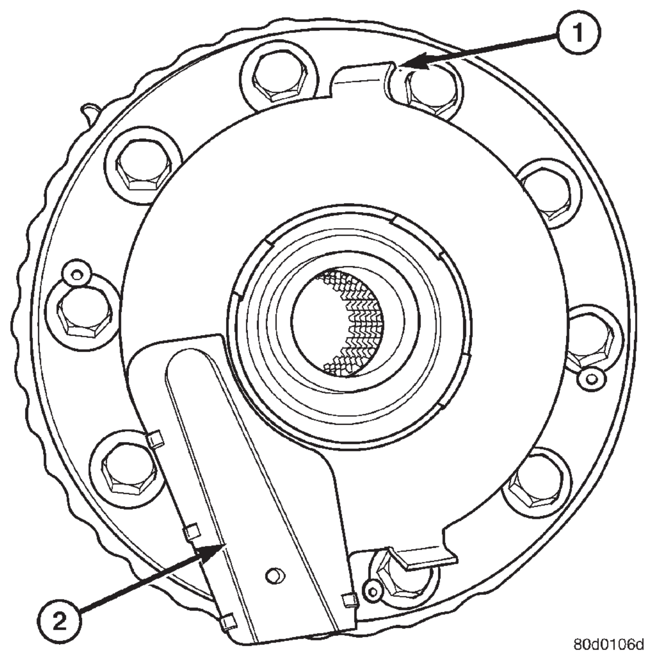


Fig. 53 VARI-LOK

1 - ANTI-ROTATION TAB
2 - OIL FEED TUBE

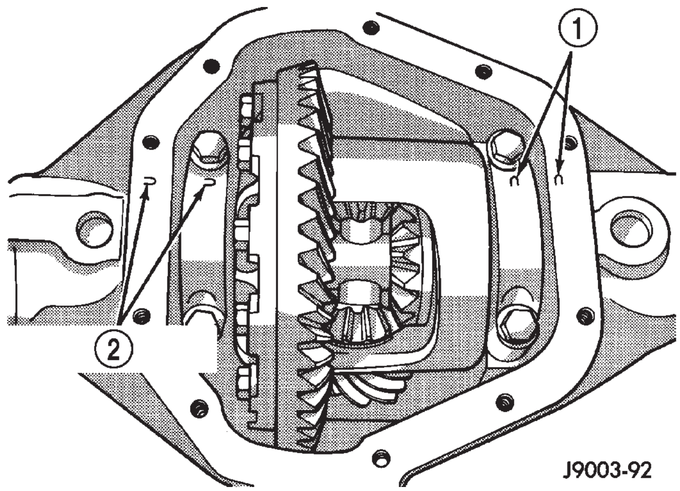


Fig. 54 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(11) Apply a 6.35mm (1/4 in.) bead of red Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 55).

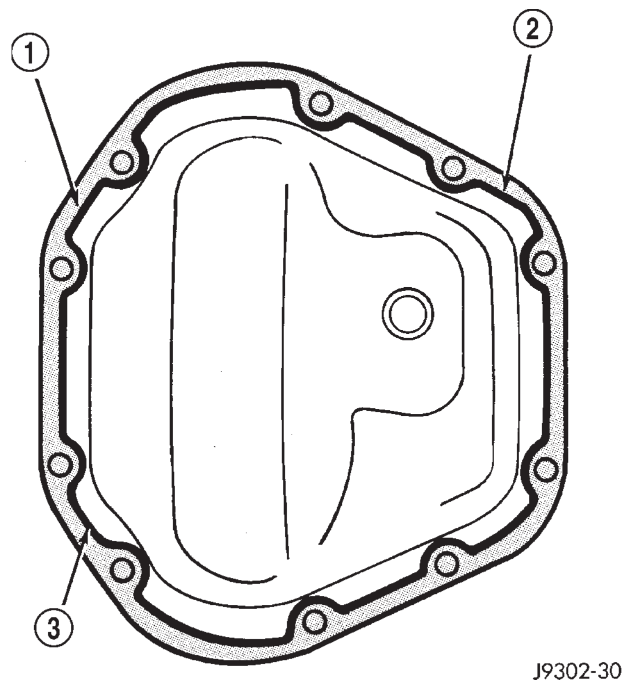


Fig. 55 DIFFERENTIAL COVER - TYPICAL

1 - COVER
2 - SEALANT
3 - SEALANT BEAD

CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied or adhesion quality will be compromised.

DIFFERENTIAL (Continued)

(12) Install cover and tighten bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).

(13) Refill the differential with Mopar Hypoid Gear Lubricant or equivalent to bottom of the fill plug hole.

(14) Install fill hole plug.

(15) Remove support and lower the vehicle.

DIFFERENTIAL-TRAC-LOC

DIAGNOSIS AND TESTING

The most common problem is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. A container of Mopar Trac-lok® Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

DIFFERENTIAL TEST

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(4) Remove wheel and bolt Special Tool 6790 or equivalent tool to studs.

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 56).

(6) If rotating torque is less than 41 N·m (56 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.

DISASSEMBLY

(1) Clamp side gear Holding Fixture 6965 in a vise and position the differential case on the Holding Fixture (Fig. 57).

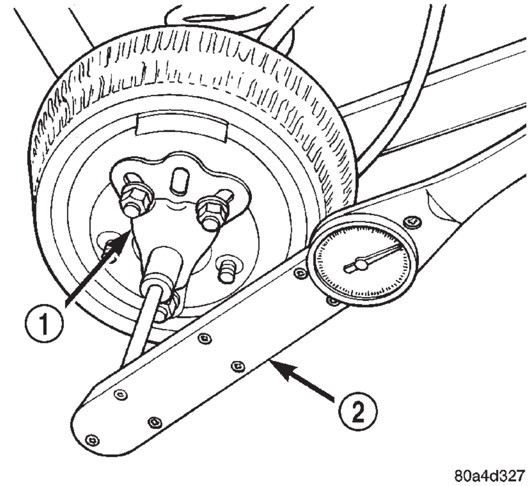


Fig. 56 ROTATING TORQUE TEST

1 - SPECIAL TOOL WITH BOLT IN CENTER HOLE
2 - TORQUE WRENCH

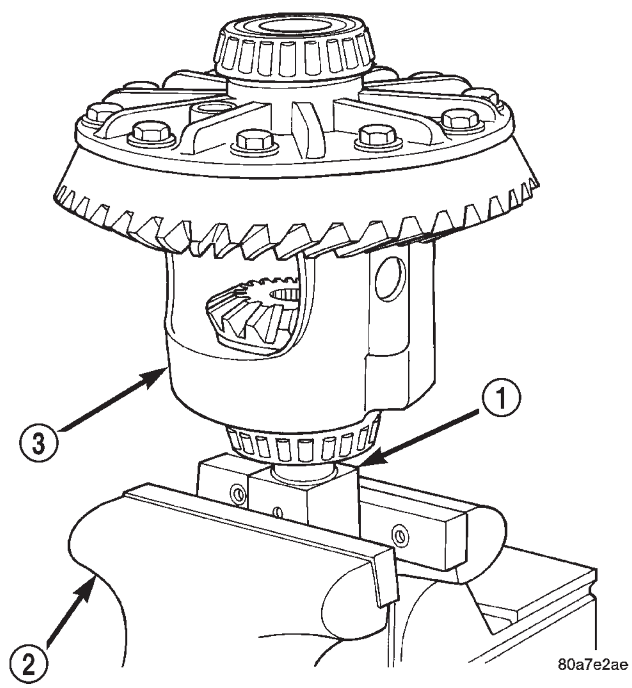


Fig. 57 DIFFERENTIAL CASE FIXTURE

1 - HOLDING FIXTURE
2 - VISE
3 - DIFFERENTIAL

DIFFERENTIAL-TRAC-LOC (Continued)

(2) Remove ring gear if the ring gear is to be replaced. The Trac-lok® differential can be serviced with the ring gear installed.

(3) Remove the pinion gear mate shaft lock screw (Fig. 58).

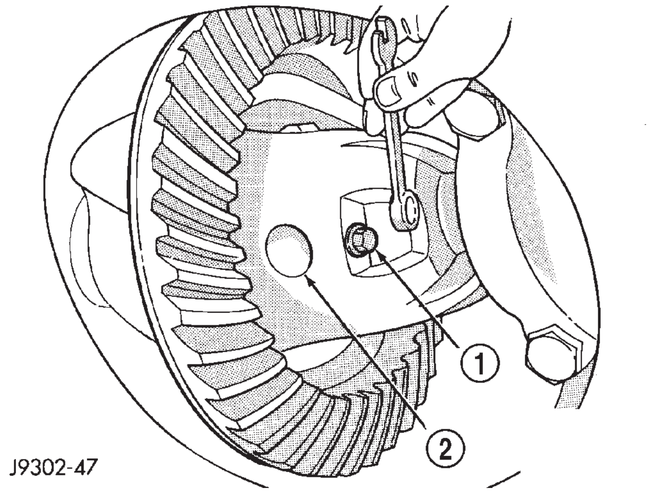


Fig. 58 MATE SHAFT LOCK SCREW

1 - LOCK SCREW
2 - PINION GEAR MATE SHAFT

(4) Remove pinion gear mate shaft with a drift and hammer (Fig. 59).

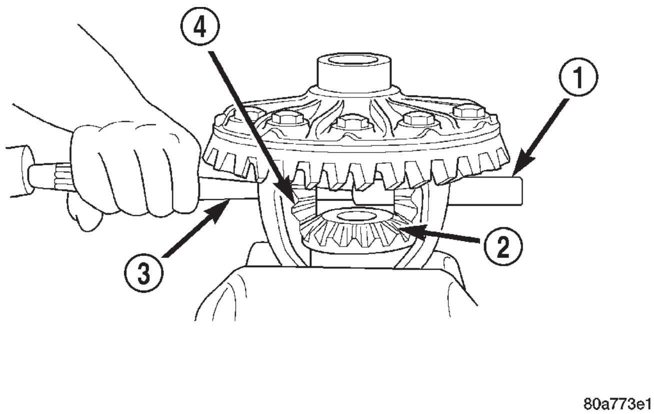


Fig. 59 PINION MATE SHAFT

1 - PINION MATE SHAFT
2 - SIDE GEAR
3 - DRIFT
4 - PINION MATE GEAR

(5) Install and lubricate Step Plate C-6960-3 (Fig. 60).

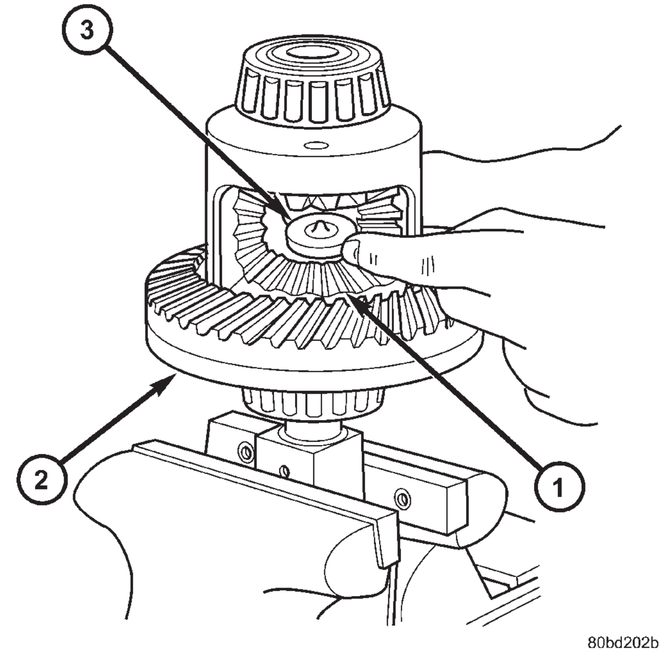


Fig. 60 Step Plate

1 - LOWER SIDE GEAR
2 - DIFFERENTIAL CASE
3 - STEP PLATE

(6) Assemble Threaded Adapter C-6960-1 into top side gear. Thread Forcing Screw C-6960-4 into adapter until it becomes centered in adapter plate.

(7) Position a small screw driver in slot of Threaded Adapter Disc C-6960-1 (Fig. 61) to prevent adapter from turning.

(8) Install Forcing Screw C-6960-4 and tighten screw to 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 62).

(9) With a feeler gauge remove thrust washers from behind the pinion gears (Fig. 63).

(10) Insert Turning Bar C-6960-2 into the pinion mate shaft hole in the case (Fig. 64).

(11) Loosen the Forcing Screw in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar.

(12) Rotate differential case until the pinion gears can be removed.

(13) Remove pinion gears from differential case.

(14) Remove Forcing Screw, Step Plate and Threaded Adapter.

DIFFERENTIAL-TRAC-LOC (Continued)

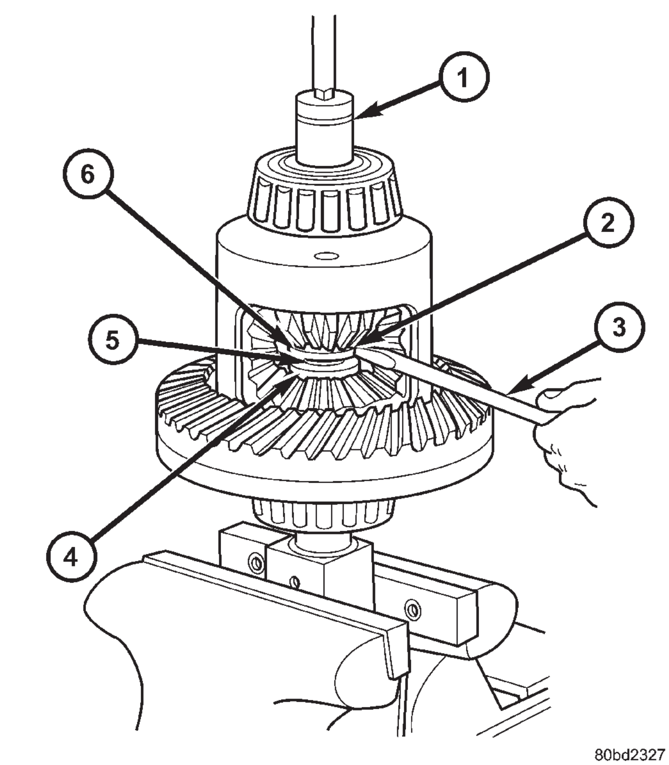


Fig. 61 Threaded Adapter Disc

1 - SOCKET
2 - SLOT IN ADAPTER
3 - SCREWDRIVER
4 - STEP PLATE
5 - FORCING SCREW
6 - THREAD ADAPTER DISC

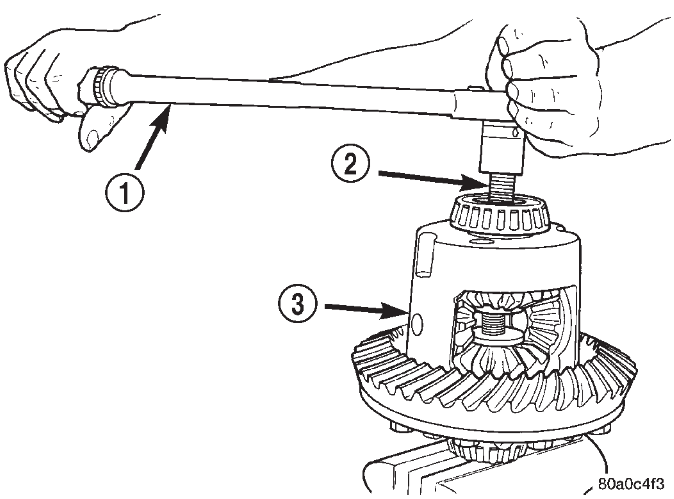


Fig. 62 COMPRESS BELLEVILLE SPRING

1 - TORQUE WRENCH
2 - TOOL ASSEMBLED
3 - DIFFERENTIAL CASE

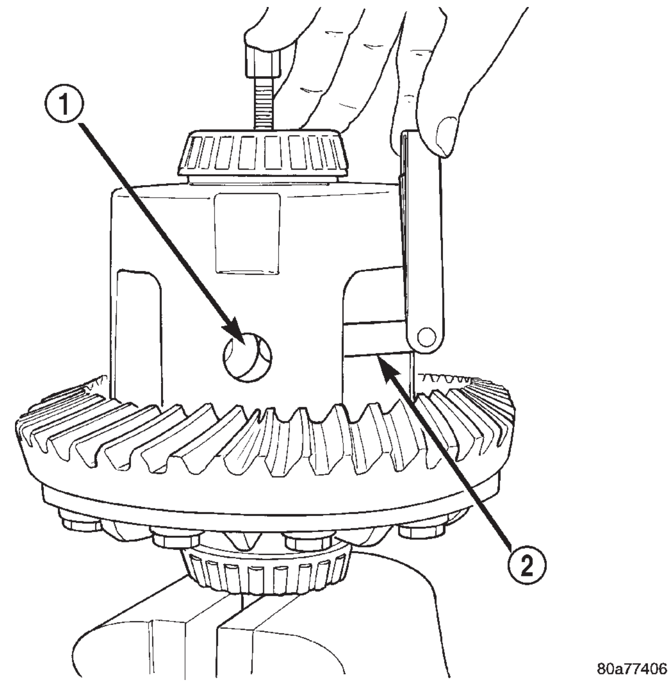


Fig. 63 PINION GEAR THRUST WASHER

1 - THRUST WASHER
2 - FEELER GAUGE

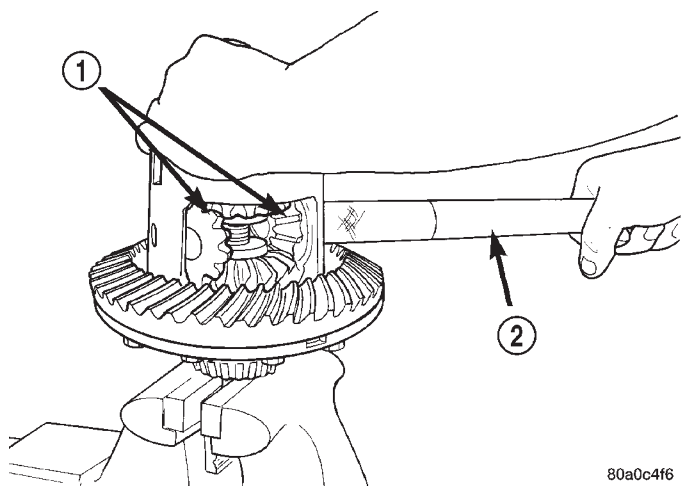


Fig. 64 PINION GEARS

1 - PINION GEARS
2 - TURNING BAR

DIFFERENTIAL-TRAC-LOC (Continued)

(15) Remove top side gear, clutch pack retainer and clutch pack. Keep plates in correct order during removal (Fig. 65).

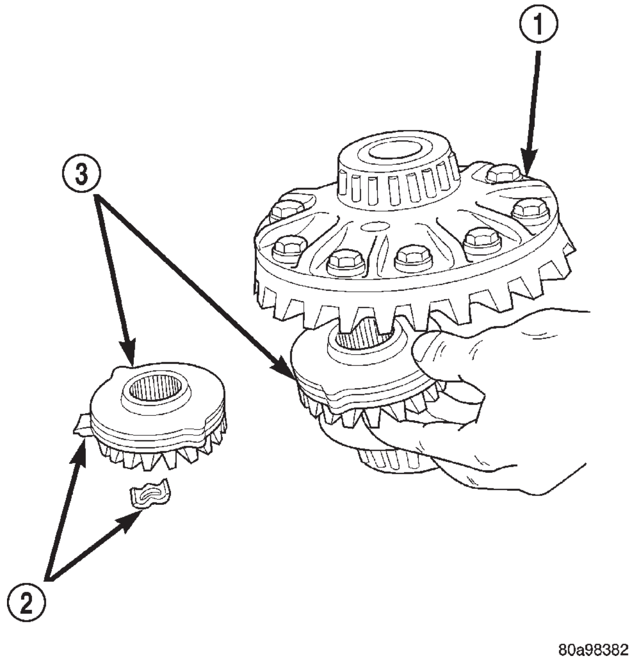


Fig. 65 SIDE GEARS AND CLUTCH DISCS

1 - DIFFERENTIAL CASE
2 - RETAINER
3 - SIDE GEAR AND CLUTCH DISC PACK

(16) Remove differential case from the Holding Fixture. Remove side gear, clutch pack retainer and clutch pack. Keep plates in correct order during removal.

CLEANING

Clean all components in cleaning solvent and dry components with compressed air.

INSPECTION

Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side and pinion gears for cracks chips or damage and replace as necessary. Inspect differential case and pinion shaft and replace if worn or damaged.

ASSEMBLY

NOTE: New Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

(1) Lubricate components with gear lubricant.

(2) Assemble clutch discs into packs and secure disc packs with retaining clips (Fig. 66).

NOTE: Dished plate is position with the convex side against the side gear.

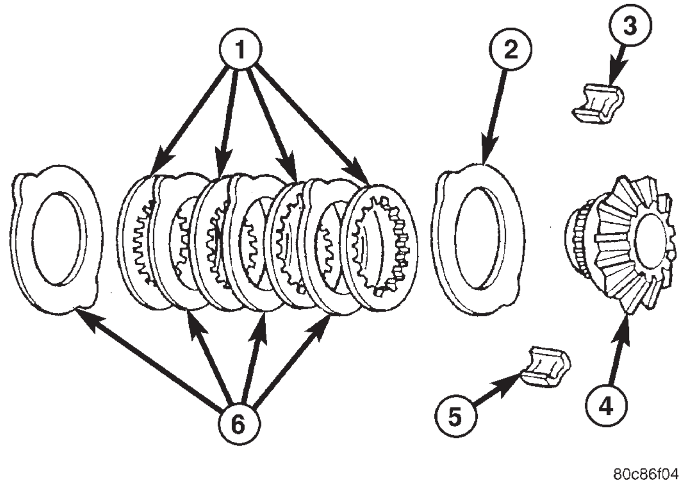


Fig. 66 CLUTCH PACK

1 - DISCS
2 - DISHED PLATE
3 - RETAINER
4 - SIDE GEAR
5 - RETAINER
6 - PLATES

(3) Position assembled clutch disc packs on the side gear hubs.

(4) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 67). **Verify clutch pack retaining clips are in position and seated in the case pockets.**

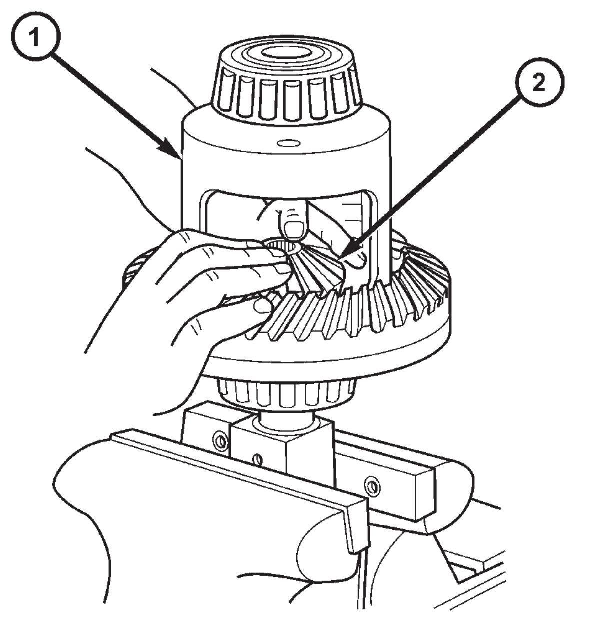


Fig. 67 CLUTCH PACK AND LOWER SIDE GEAR

1 - DIFFERENTIAL CASE
2 - SIDE GEAR AND CLUTCH PACK

DIFFERENTIAL-TRAC-LOC (Continued)

(5) Position the differential case on the Holding Fixture 6965.

(6) Install lubricated Step Plate C-6960-3 in lower side gear (Fig. 68).

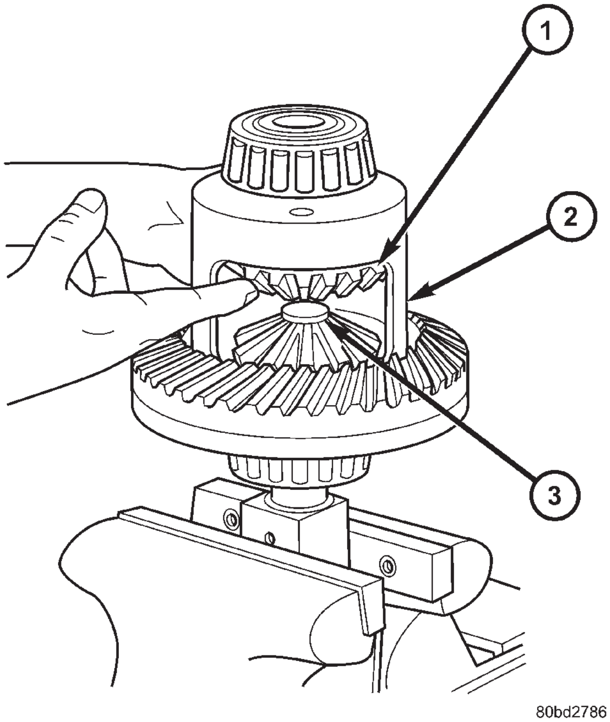


Fig. 68 CLUTCH PACK AND UPPER SIDE GEAR

1 - SIDE GEAR AND CLUTCH PACK
2 - DIFFERENTIAL CASE
3 - STEP PLATE

(7) Install the upper side gear and clutch disc pack (Fig. 68).

(8) Hold assembly in position. Insert Threaded Adapter C-6960-1 into top side gear.

(9) Install Forcing Screw C-6960-4 and tighten screw to slightly compress clutch disc.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.

(11) Rotate case with Turning Bar C-6960-2 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw, Step Plate and Threaded Adapter.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(17) Lubricate all differential components with hypoid gear lubricant.

DIFFERENTIAL CASE BEARINGS

REMOVAL

(1) Raise and support vehicle.

(2) Remove differential case from axle housing.

(3) Remove bearings from the differential case with Puller/Press C-293-PA, Adapter 8352 and Plug SP-3289 (Fig. 69).

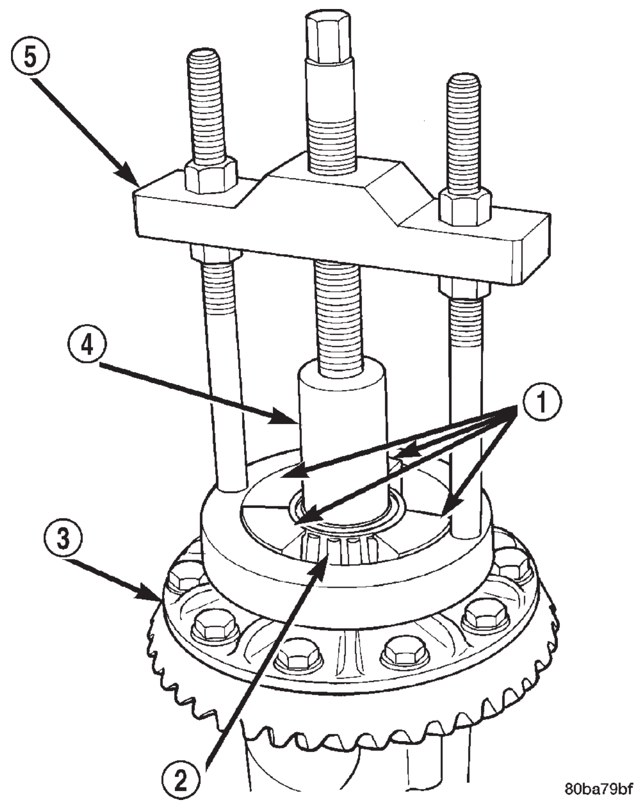


Fig. 69 Differential Bearing

1 - ADAPTERS
2 - BEARING
3 - DIFFERENTIAL
4 - PLUG
5 - PULLER

DIFFERENTIAL CASE BEARINGS (Continued)

INSTALLATION

NOTE: If differential side bearings or differential case are replaced, differential side bearing shim requirements may change. Refer to Adjustments (Differential Bearing Preload and Gear Backlash) for procedures.

(1) Install differential side bearings with Installer C-3716-A and Handle C-4171 (Fig. 70).

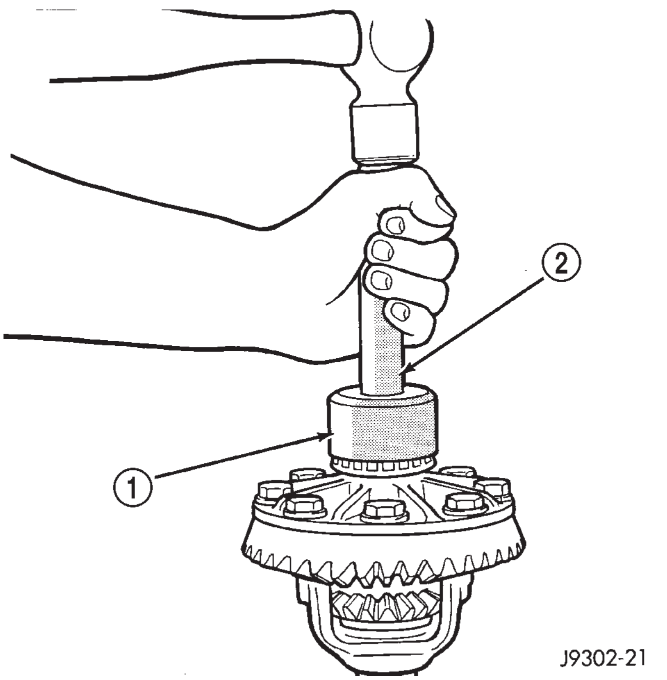


Fig. 70 Differential Side Bearing

1 - INSTALLER
2 - HANDLE

(2) Install differential in axle housing.
(3) Remove support and lower vehicle.

PINION GEAR/RING GEAR

REMOVAL

NOTE: The ring and pinion gears are serviced as a matched set. Never replace one gear without the other gear.

(1) Raise and support vehicle.
(2) Mark pinion yoke and propeller shaft for installation reference.
(3) Disconnect propeller shaft from pinion yoke and tie shaft to underbody.
(4) Remove differential from the housing.
(5) Place differential case in a vise with soft metal jaw.
(6) Remove bolts holding ring gear to differential case.
(7) Drive ring gear from differential case with a rawhide hammer (Fig. 71).

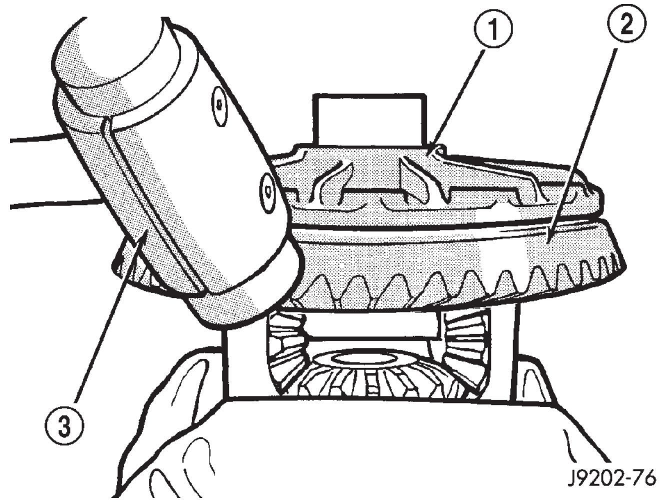


Fig. 71 RING GEAR

1 - DIFFERENTIAL CASE
2 - RING GEAR
3 - HAMMER

(8) Hold the pinion yoke with Spanner Wrench 6958 and remove the pinion yoke nut and washer (Fig. 72).

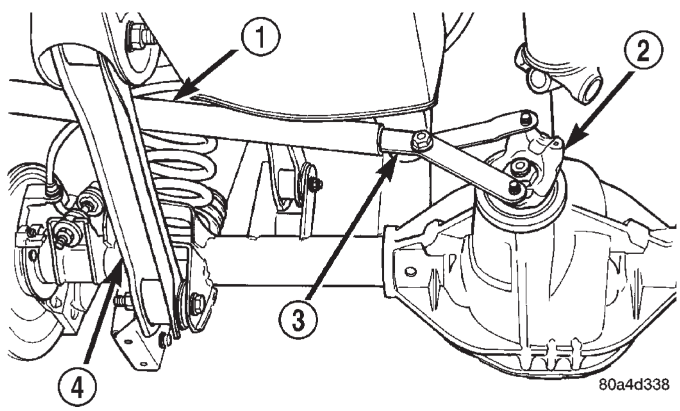


Fig. 72 PINION YOKE HOLDER

1 - 1 in. PIPE
2 - PINION YOKE
3 - HOLDER
4 - LOWER CONTROL ARM

PINION GEAR/RING GEAR (Continued)

(9) Remove pinion yoke from pinion shaft with Remover C-452 and Flange Wrench C-3281 (Fig. 73).

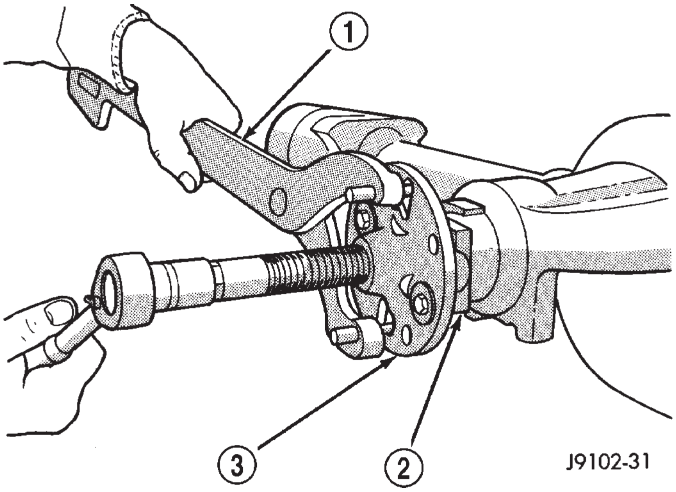


Fig. 73 PINION YOKE REMOVER

1 - FLANGE WRENCH
2 - YOKE
3 - REMOVER

(10) Remove pinion gear from housing (Fig. 74).

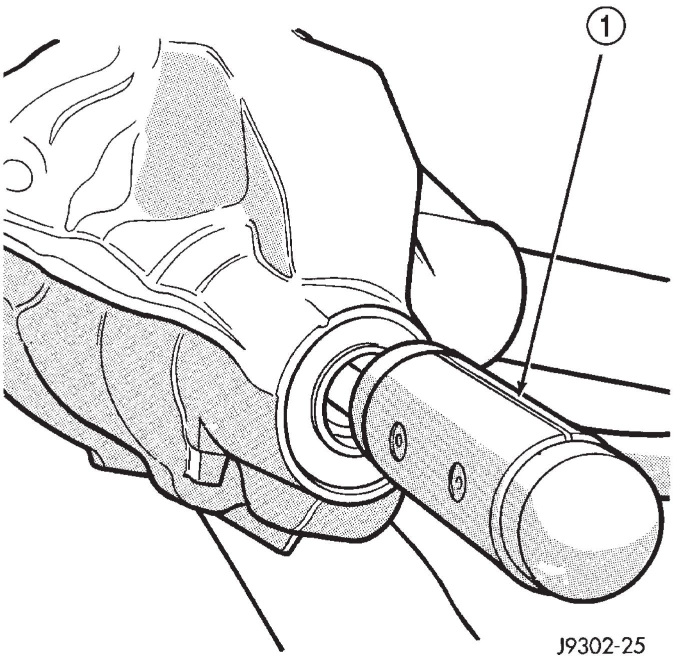


Fig. 74 PINION GEAR REMOVAL

1 - RAWHIDE HAMMER

(11) Remove pinion seal with Remover 7794-A and a slide hammer (Fig. 75).

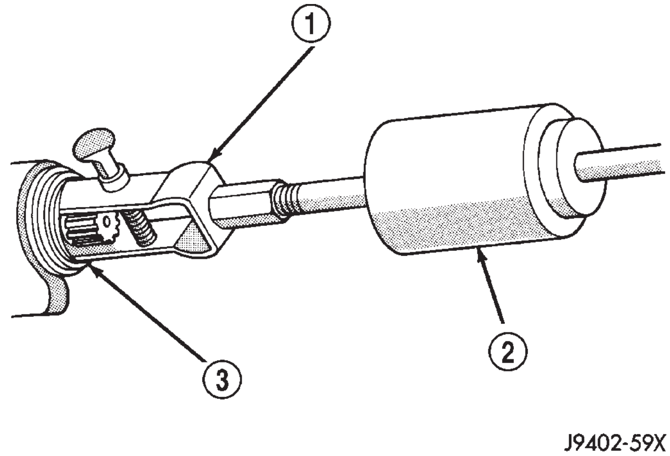


Fig. 75 PINION SEAL

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

(12) Remove oil slinger, if equipped, and front pinion bearing.

(13) Remove front pinion bearing cup with Remover C-4345 and Handle C-4171 (Fig. 76).

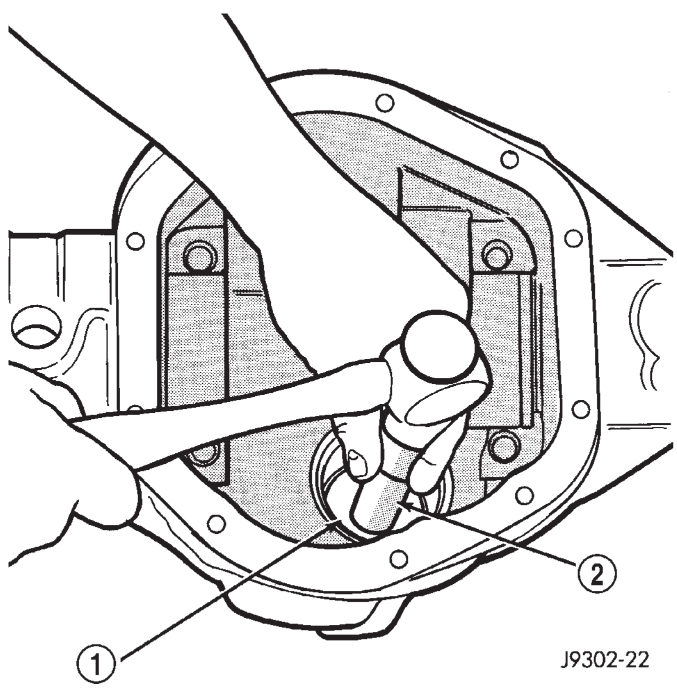


Fig. 76 FRONT PINION BEARING CUP

1 - REMOVER
2 - HANDLE

PINION GEAR/RING GEAR (Continued)

(14) Remove rear bearing cup (Fig. 77) with Remover D-149 and Handle C-4171.

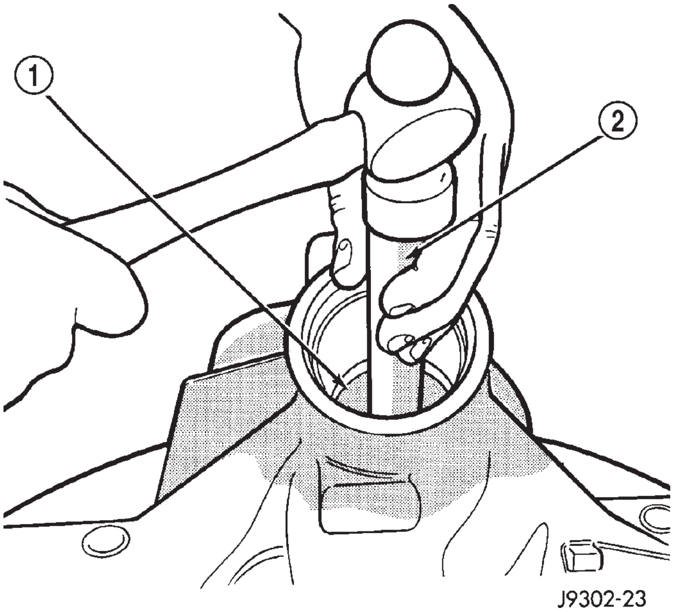


Fig. 77 REAR PINION BEARING CUP

1 - REMOVER
2 - HANDLE

(15) Remove collapsible preload spacer (Fig. 78).

(16) Remove rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-40 (Fig. 79).

(17) Remove depth shims from the pinion gear shaft and record shim thickness.

INSTALLATION

NOTE: A pinion depth shim/oil slinger is placed between the rear pinion bearing cone and the pinion head to achieve proper ring gear and pinion mesh. If ring gear and pinion are reused, the pinion depth shim/oil slinger should not require replacement. Refer to Adjustment (Pinion Gear Depth) to select the proper thickness shim/oil slinger if ring and pinion gears are replaced.

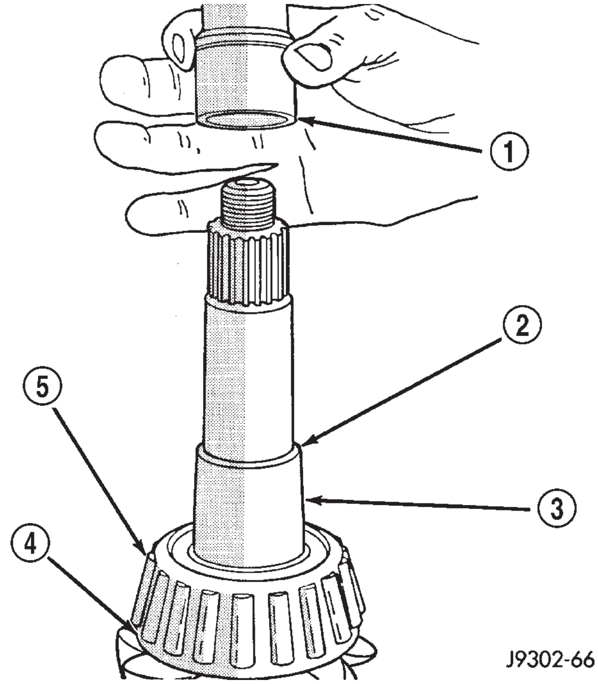


Fig. 78 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - SHIM
5 - REAR BEARING

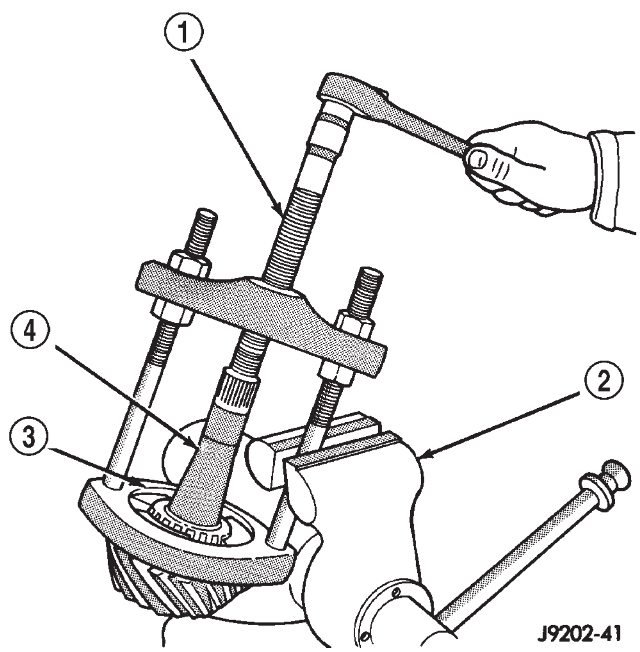


Fig. 79 REAR PINION BEARING

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - PINION GEAR SHAFT

PINION GEAR/RING GEAR (Continued)

(1) Apply Mopar Door Ease or equivalent lubricant to outside surface of the pinion bearing cups.

(2) Install pinion rear bearing cup with Installer D-146 and Driver Handle C-4171 (Fig. 80) and verify cup is seated.

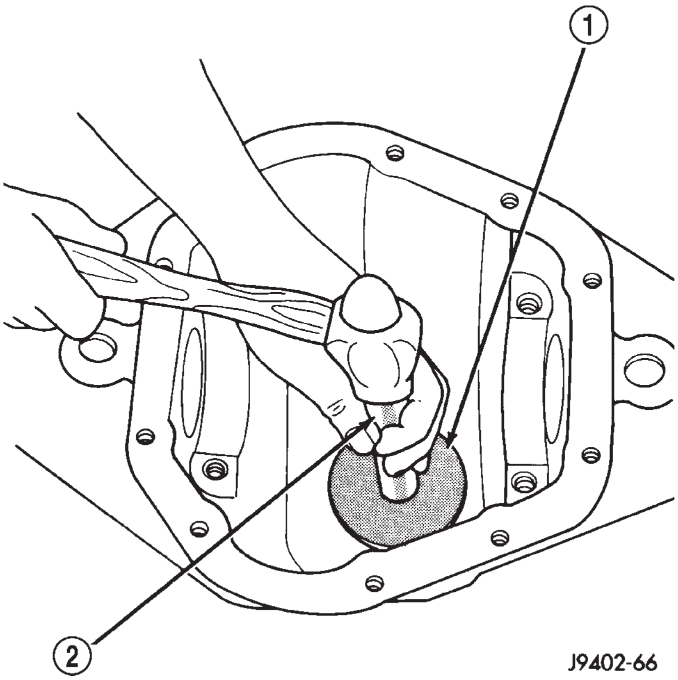


Fig. 80 REAR PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

(3) Install pinion front bearing cup with Installer D-130 and Handle C-4171 (Fig. 81) and verify cup is seated.

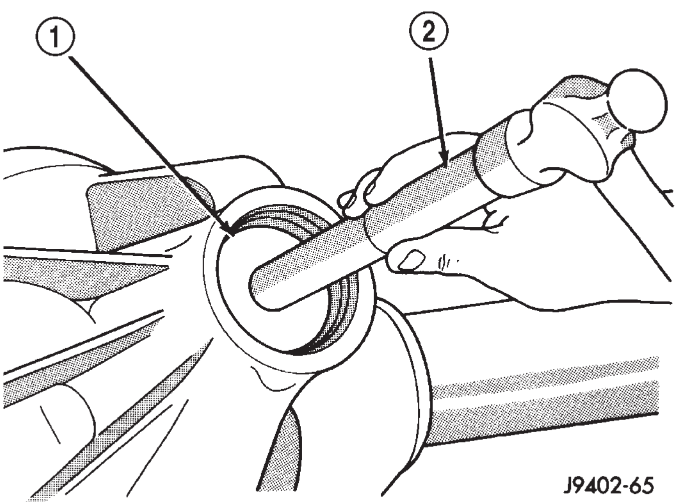


Fig. 81 FRONT PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

(4) Install pinion front bearing and oil slinger, if equipped.

(5) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate installer (Fig. 82).

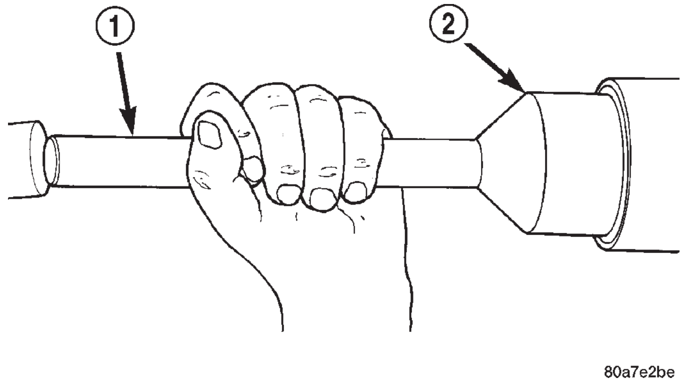


Fig. 82 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(6) Install depth shim on the pinion gear.

(7) Install rear bearing and slinger if equipped, on the pinion gear with Installer W-262 and a press (Fig. 83).

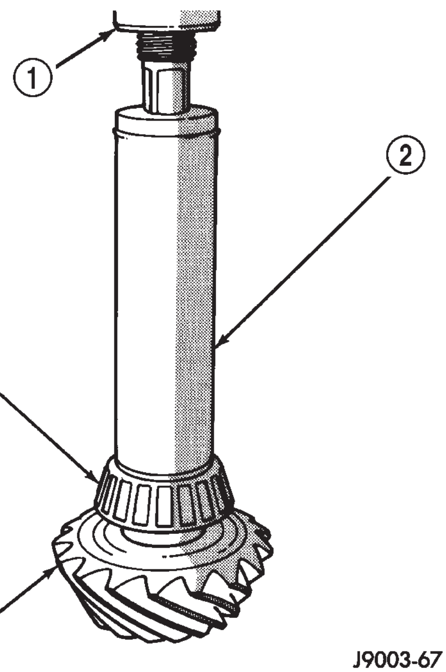


Fig. 83 REAR PINION BEARING

1 - PRESS
2 - INSTALLER
3 - PINION GEAR
4 - PINION BEARING

PINION GEAR/RING GEAR (Continued)

(8) Install a **new** collapsible preload spacer on pinion shaft and install pinion gear in the housing (Fig. 84).

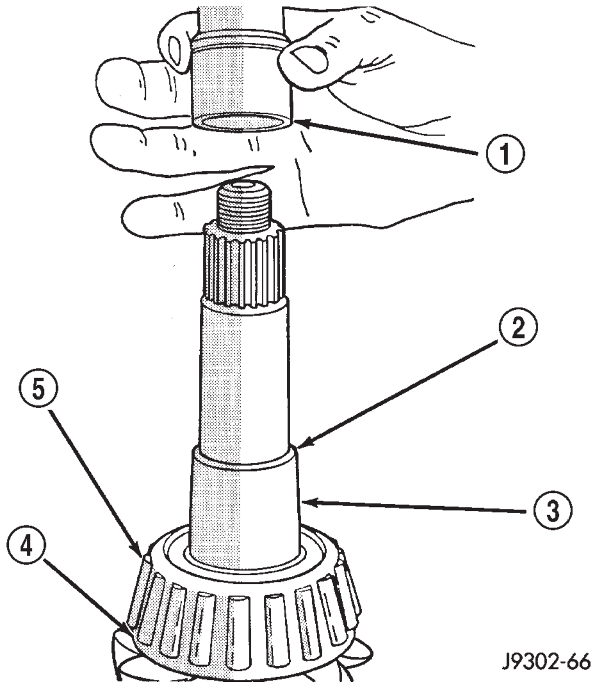


Fig. 84 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - DEPTH SHIM
5 - REAR BEARING

(9) Install yoke with Installer C-3718 and Spanner Wrench 6958 (Fig. 85).

(10) Install the yoke washer and a new nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.

(11) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

(12) Using Spanner Wrench 6958 and a torque wrench set at 474 N·m (350 ft. lbs.), (Fig. 86) slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 87).

NOTE: If more than 474 N·m (350 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced.

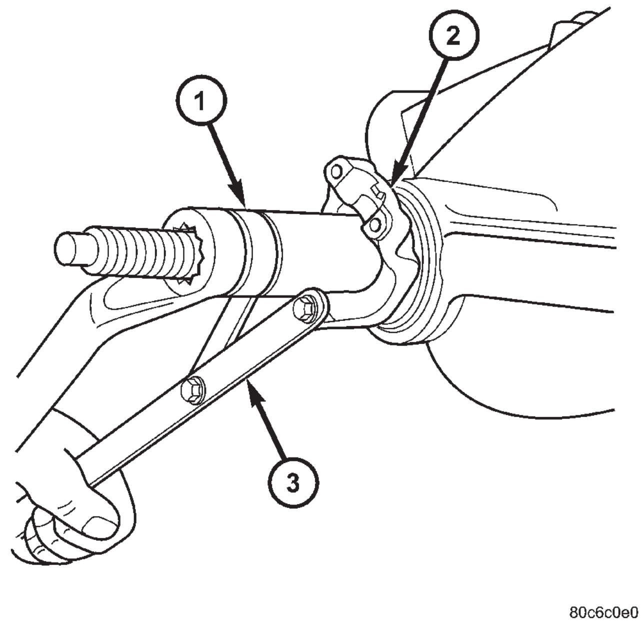


Fig. 85 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE

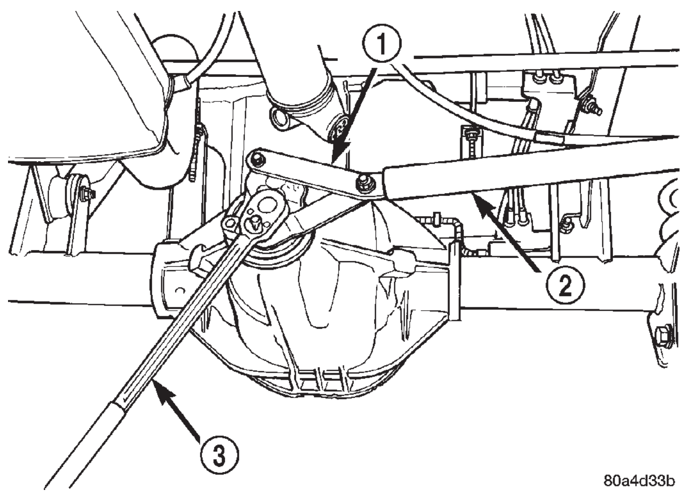


Fig. 86 PINION NUT

1 - SPANNER WRENCH
2 - PIPE
3 - TORQUE WRENCH

(13) Check bearing rotating torque with a inch pound torque wrench (Fig. 87). The pinion gear rotating torque should be:

- Original Bearings: 1 to 2.25 N·m (10 to 20 in. lbs.).
- New Bearings: 1.7 to 3.9 N·m (15 to 35 in. lbs.).

(14) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

PINION GEAR/RING GEAR (Continued)

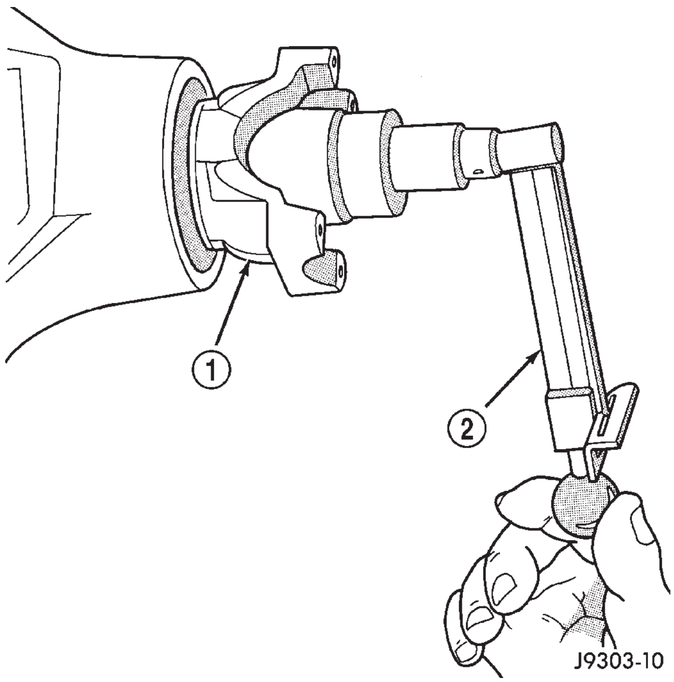


Fig. 87 PINION ROTATING TORQUE

1 - PINION YOKE/COMPANION FLANGE
2 - INCH POUND TORQUE WRENCH

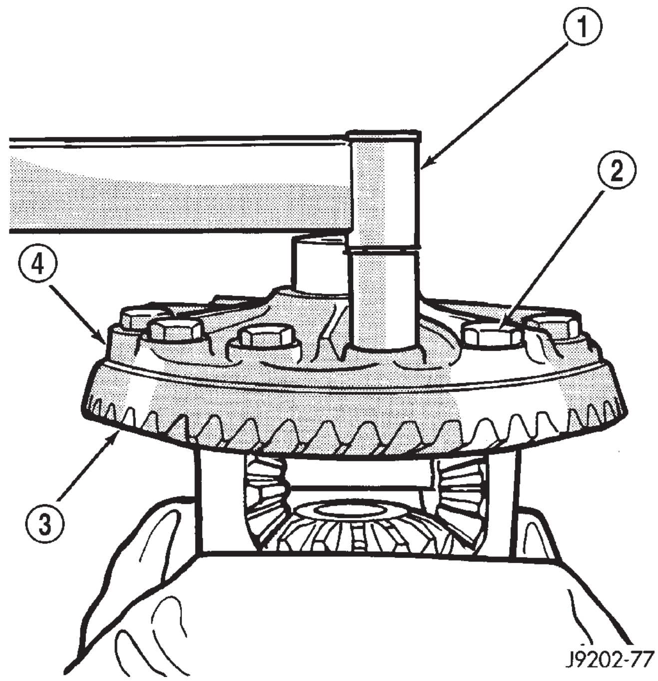


Fig. 88 RING GEAR

1 - TORQUE WRENCH
2 - RING GEAR BOLT
3 - RING GEAR
4 - CASE

(15) Invert the differential case in the vise.

(16) Install **new** ring gear bolts and alternately tighten to 136 N·m (100 ft. lbs.) (Fig. 88).

CAUTION: Never reuse the ring gear bolts. The bolts can fracture causing extensive damage.

(17) Install differential in housing and verify differential bearing preload, gear mesh and contact pattern. Refer to Ajustments for procedure.

CAUTION: When installing a Vari-lok® differential (Fig. 89), the oil feed tube must point to the bottom of the housing. If differential is installed with the oil feed tube pointed toward the top, the anti-rotation tabs will be damaged.

(18) Install differential cover and fill with gear lubricant.

(19) Install the propeller shaft with the reference marks aligned.

(20) Remove supports and lower vehicle.

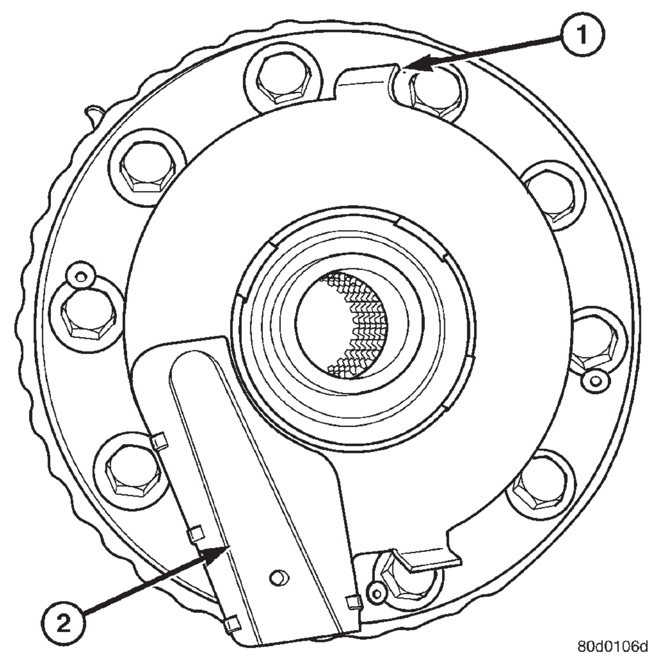


Fig. 89 VARI-LOK

1 - ANTI-ROTATION TAB
2 - OIL FEED TUBE

REAR AXLE - 226RBA

TABLE OF CONTENTS

REAR AXLE - 226RBA

DESCRIPTION

The Rear Beam-design Aluminum (RBA) axle housing has an aluminum center casting (differential housing) with axle shaft tubes extending from either side. The tubes are pressed into the differential housing to form a one-piece axle housing. The axle has semi-floating axle shafts, meaning that vehicle load is supported by the axle shaft and bearings.

The differential case is a one-piece design. Differential bearing preload and ring gear backlash is adjusted with selective shims. Pinion bearing preload is set and maintained by the use of a collapsible spacer. The cover provides a means for inspection and service.

Optional Trac-Lok® differential differential has a one-piece differential case, and the same internal components as a standard differential, plus two clutch disc packs.

Optional Vari-Lok® differential has a one-piece differential case which contains the gerotor pump assembly and the clutch mechinism. The unit is serviced only as an assembly.

OPERATION

The axle receives power from the transfer case through the front propeller shaft. The front propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

STANDARD DIFFERENTIAL

During straight-ahead driving the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 1).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

REAR AXLE - 226RBA (Continued)

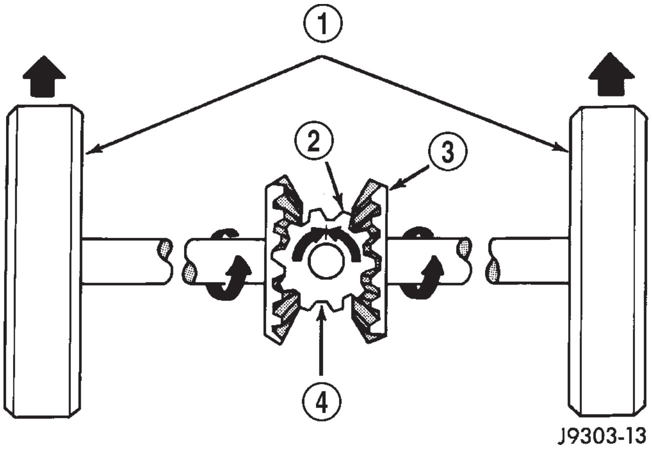


Fig. 1 OPERATION-STRAIGHT AHEAD DRIVING

1 - IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 - PINION GEAR
3 - SIDE GEAR
4 - PINION GEARS ROTATE WITH CASE

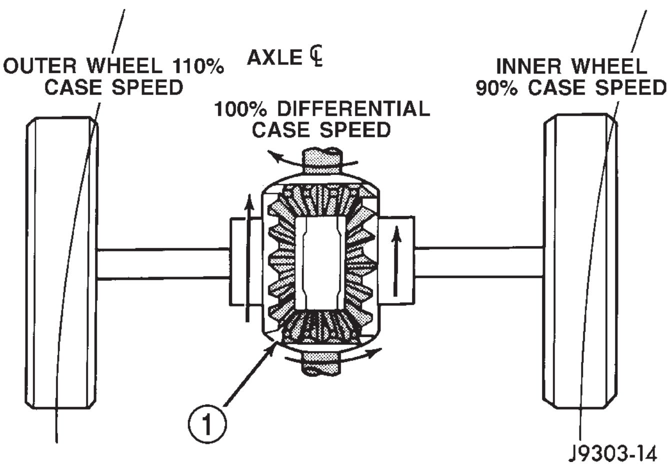


Fig. 2 OPERATION-ON TURNS

1 - PINION GEARS ROTATE ON PINION SHAFT

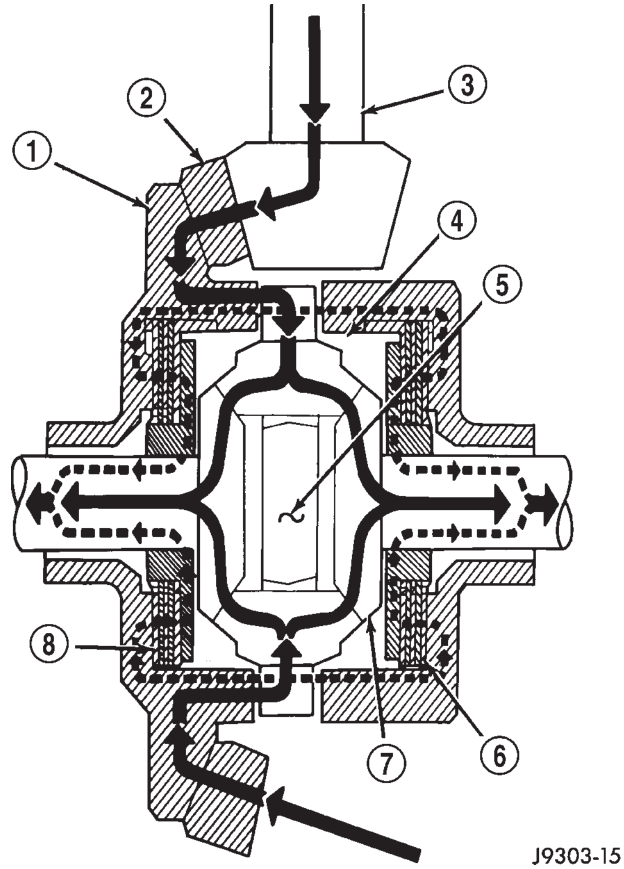


Fig. 3 TRAC-LOK LIMITED SLIP DIFFERENTIAL

1 - CASE
2 - RING GEAR
3 - DRIVE PINION
4 - PINION GEAR
5 - MATE SHAFT
6 - CLUTCH PACK
7 - SIDE GEAR
8 - CLUTCH PACK

TRAC-LOK® DIFFERENTIAL

The differential clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 3).

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. The differential resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, the operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

VARI-LOK® DIFFERENTIAL

In a standard differential, if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

A gerotor pump and clutch pack are used to provide the torque transfer capability. One axle shaft is splined to the gerotor pump and one of the differential side gears, which provides the input to the pump. As a wheel begins to lose traction, the speed differential is transmitted from one side of the differential to the other through the side gears. The motion of one side gear relative to the other turns the inner rotor of the pump. Since the outer rotor of the pump is grounded to the differential case, the inner and outer rotors are now moving relative to each other

REAR AXLE - 226RBA (Continued)

and therefore creates pressure in the pump. The tuning of the front and rear axle orifices and valves inside the gerotor pump is unique and each system includes a torque-limiting pressure relief valve to protect the clutch pack, which also facilitates vehicle control under extreme side-to-side traction variations. The resulting pressure is applied to the clutch pack and the transfer of torque is completed.

Under conditions in which opposite wheels are on surfaces with widely different friction characteristics, Vari-lok® delivers far more torque to the wheel on the higher traction surface than do conventional Trac-lok® systems. Because conventional Trac-lok® differentials are initially pre-loaded to assure torque transfer, normal driving (where inner and outer wheel speeds differ during cornering, etc.) produces torque transfer during even slight side-to-side speed variations. Since these devices rely on friction from this preload to transfer torque, normal use tends to cause wear that reduces the ability of the differential to transfer torque over time. By design, the Vari-lok® system is less subject to wear, remaining more consistent over time in its ability to transfer torque. The coupling assembly is serviced as a unit. From a service standpoint the coupling also benefits from using the same lubricant supply as the ring and pinion gears.

DIAGNOSIS AND TESTING

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be a rearend vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

(Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING)

REAR AXLE - 226RBA (Continued)

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion yoke nut.	6. Tighten the pinion yoke nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.

REAR AXLE - 226RBA (Continued)

Condition	Possible Causes	Correction
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.

REAR AXLE - 226RBA (Continued)

Condition	Possible Causes	Correction
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

VARI-LOK®

(1) Park the vehicle on a level surface or raise vehicle on hoist so that the vehicle is level.

(2) Remove the axle fill plug.

(3) Verify that the axle fluid level is correct. The fluid level is correct if the fluid is level with the bottom of the fill hole.

(4) Shift the transfer case into the 4WD full-time position.

(5) Drive the vehicle in a tight circle for 2 minutes at 5mph to fully prime the pump.

(6) Block the tires opposite the axle to be tested to prevent the vehicle from moving.

(7) Shift the transfer case into the 4WD Low position and the transmission into the Park position.

(8) Raise both the wheels of the axle to be tested off of the ground.

(9) Rotate the left wheel by hand at a minimum of one revolution per second while an assistant rotates the right wheel in the opposite direction.

(10) The left wheel should spin freely at first and then increase in resistance within 5 revolutions until the wheels cannot be continuously rotated in opposite directions.

(11) The Vari-lok® differential has engaged properly if the wheels cannot be rotated in opposite directions for a moment. After the wheels stop rotating for a moment, the fluid pressure will drop in the differential and the wheels begin to rotate once again.

(12) If the system does not operate properly, replace the Vari-lok® differential.

REMOVAL

(1) Raise and support the vehicle.

(2) Position a lifting device under the axle and secure axle.

REAR AXLE - 226RBA (Continued)

(3) Remove the wheels and tires.

(4) Remove brake calipers and rotors.

(5) Disconnect parking brake cables from brackets and lever.

(6) Remove wheel speed sensors.

(7) Remove brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the calipers.

(8) Disconnect the vent hose from the axle shaft tube.

(9) Mark propeller shaft and yokes for installation reference.

(10) Remove propeller shaft.

(11) Disconnect stabilizer bar links.

(12) Remove upper suspension arm rear axle ball joint nut.

(13) Separate rear axle ball joint from the upper suspension arm with Remover 8278 (Fig. 4).

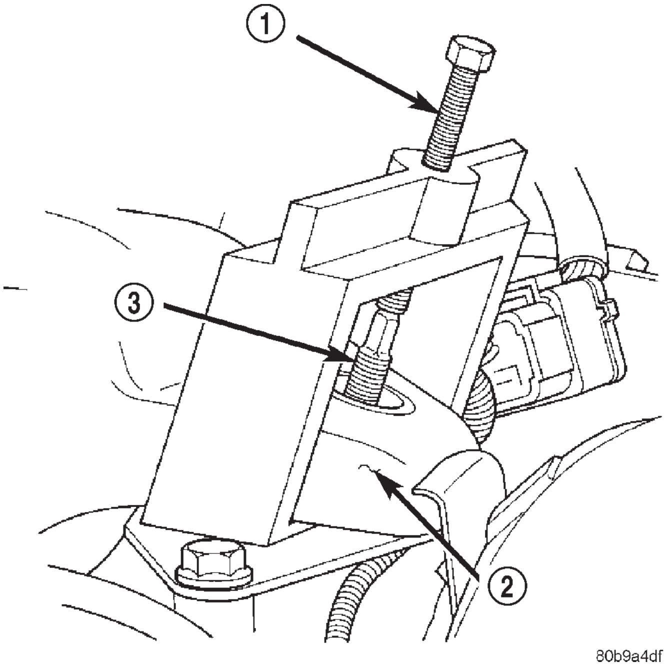


Fig. 4 REAR BALL JOINT

1 - REMOVER
2 - UPPER SUSPENSION ARM
3 - BALL JOINT STUD

(14) Disconnect shock absorbers from axle.

(15) Disconnect track bar.

(16) Disconnect lower suspension arms from the axle brackets.

(17) Separate the axle from the vehicle.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners are tightened. If springs are not at their normal ride position, vehicle ride height and handling could be affected.

(1) Raise axle with lift and align coil springs.

(2) Install lower suspension arms in axle brackets. Install nuts and bolts, do not tighten bolts at this time.

(3) Install upper suspension arm on rear axle ball joint.

(4) Install rear axle ball joint nut and tighten to 122 N·m (90 ft.lbs.) (Fig. 5).

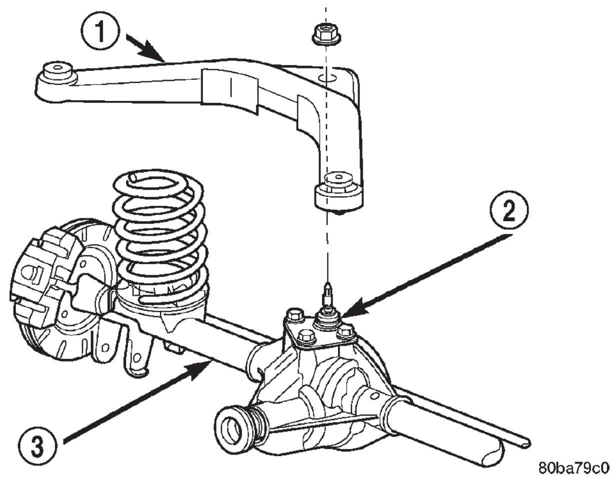


Fig. 5 REAR BALL JOINT NUT

1 - UPPER SUSPENSION ARM
2 - REAR AXLE BALL JOINT
3 - REAR AXLE

(5) Install track bar and attachment bolts, do not tighten bolts at this time.

(6) Install shock absorbers and tighten nuts to 60 N·m (44 ft. lbs.).

(7) Install stabilizer bar links and tighten nuts to 36 N·m (27 ft. lbs.).

(8) Install wheel speed sensors.

(9) Connect parking brake cable to brackets and lever.

(10) Install brake rotors and calipers.

(11) Install the brake hose to the axle junction block.

(12) Install axle vent hose.

(13) Align propeller shaft and pinion yoke reference marks. Install U-joint straps and nuts tighten to 19 N·m (14 ft. lbs.).

(14) Install the wheels and tires.

(15) Add gear lubricant, if necessary.

(16) Remove support and lower the vehicle.

(17) Tighten lower suspension arm bolts to 177 N·m (130 ft. lbs.).

(18) Tighten track bar bolts to 100 N·m (74 ft. lbs.).

REAR AXLE - 226RBA (Continued)

ADJUSTMENTS

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 6). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 109.52 mm (4.312 in.). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern in this section for additional information.

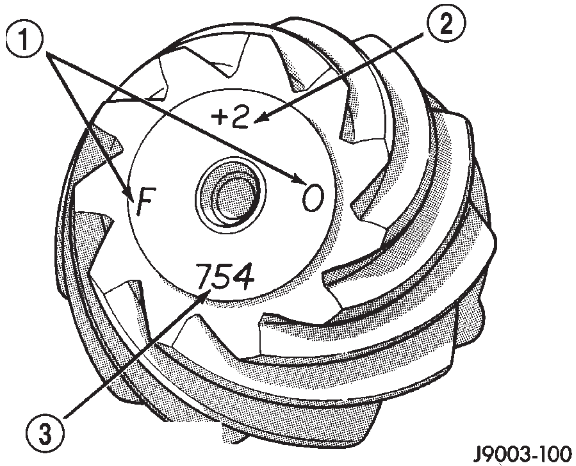


Fig. 6 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - DRIVE PINION GEAR DEPTH VARIANCE
3 - GEAR MATCHING NUMBER (SAME AS RING GEAR NUMBER)

Compensation for pinion depth variance is achieved with a select shim/oil baffle. The shims are placed between the rear pinion bearing and the pinion gear head (Fig. 7).

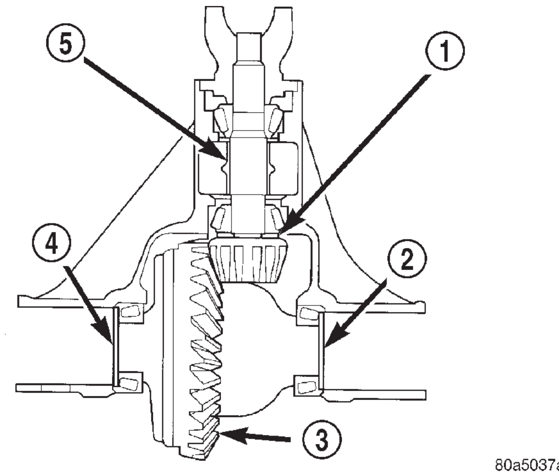


Fig. 7 ADJUSTMENT SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM
2 - DIFFERENTIAL BEARING SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING SHIM
5 - COLLAPSIBLE SPACER

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim/oil slinger to compensate for the difference in the depth variances. Refer to the Pinion Gear Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the pinion gear head (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

REAR AXLE - 226RBA (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

PINION DEPTH MEASUREMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set 6775 and Dial Indicator C-3339 (Fig. 8).

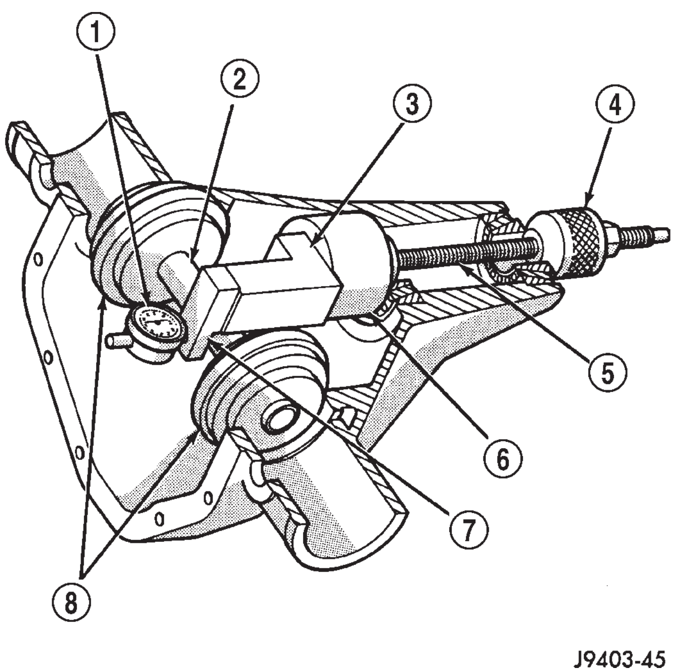


Fig. 8 PINION GEAR DEPTH GAUGE

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 8144 and rear pinion bearing onto Screw 6741 (Fig. 8).

(2) Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups (Fig. 9).

(3) Install front pinion bearing and Cone-nut 6740 hand tight (Fig. 8).

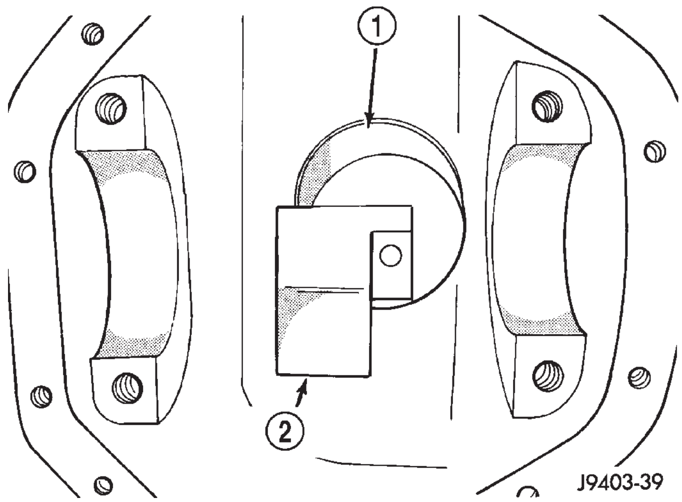


Fig. 9 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

(4) Place Arbor Disc 6927A on Arbor D-115-3 in position in the housing side bearing cradles (Fig. 10). Install differential bearing caps in their original positions on arbor discs and tighten cap bolts to 85 N·m (63 ft. lbs.).

REAR AXLE - 226RBA (Continued)

NOTE: Arbor Discs 6927A has different step diameters to fit other axles. Choose proper step for axle being serviced.

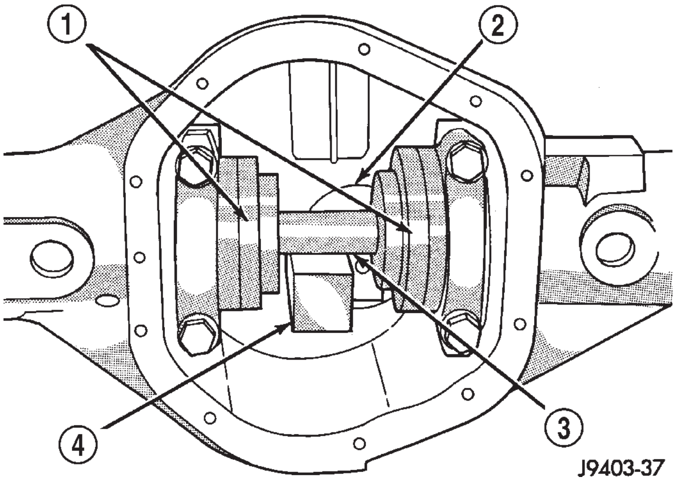


Fig. 10 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 8). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 11). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a depth shim equal to the dial indicator reading plus the pinion depth variance number etched in the face of the pinion (Fig. 6). For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

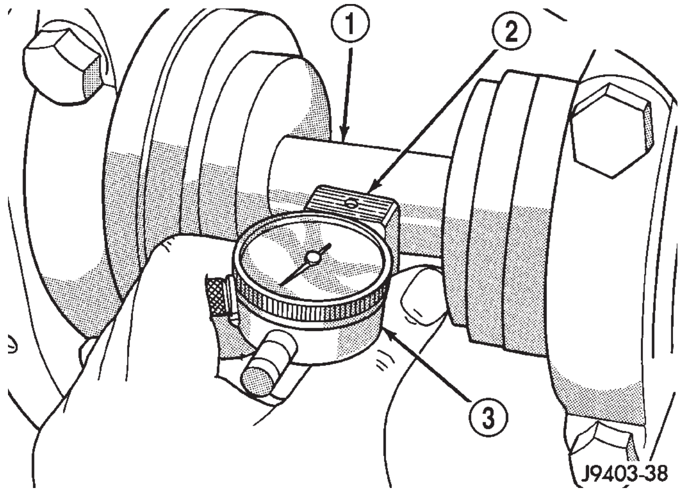


Fig. 11 PINION GEAR DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

DIFFERENTIAL BEARING PRELOAD & GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims positioned behind the differential side bearing cones. The proper shim thickness can be determined using slip-fit Dummy Bearings 6929-A in place of the differential side bearings and a Dial Indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 12). Differential shim measurements are performed with the spreader W-129-B removed.

SHIM SELECTION

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

(1) Remove differential side bearings from differential case.

REAR AXLE - 226RBA (Continued)

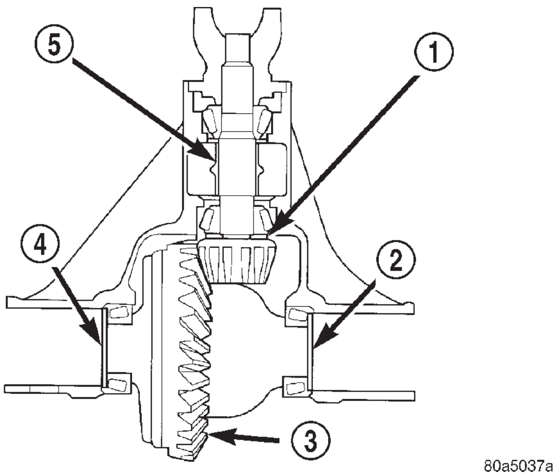


Fig. 12 ADJUSTMENT SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM
2 - DIFFERENTIAL BEARING SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING SHIM
5 - COLLAPSIBLE SPACER

(2) Install ring gear on differential case and tighten bolts to specification.

(3) Install Dummy Bearings 6929-A on differential case.

(4) Install differential case in the housing.

(5) Record the thickness of Dummy Shims 8107, then insert the shims between the dummy bearings and the differential housing (Fig. 13).

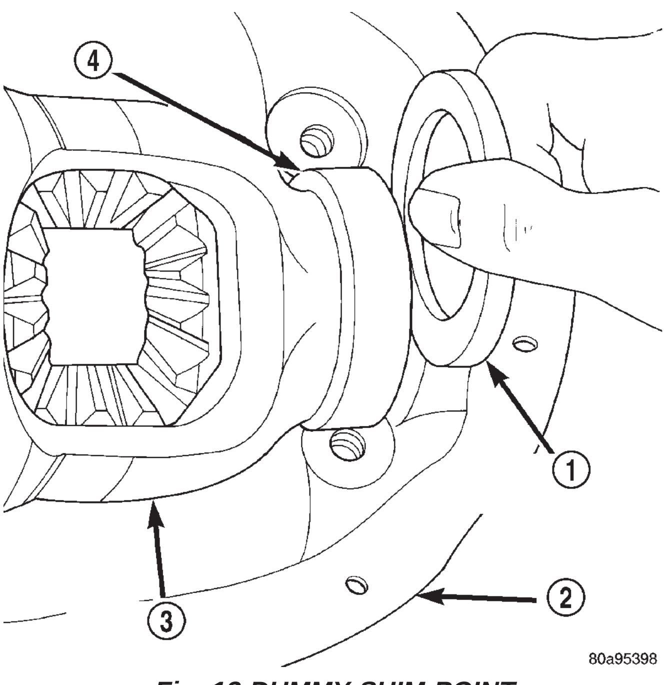


Fig. 13 DUMMY SHIM POINT

1 - DUMMY SHIMS
2 - HOUSING
3 - DIFFERENTIAL CASE
4 - DUMMY BEARINGS

(6) Install the bearing caps in their original positions and snug the bolts (Fig. 14).

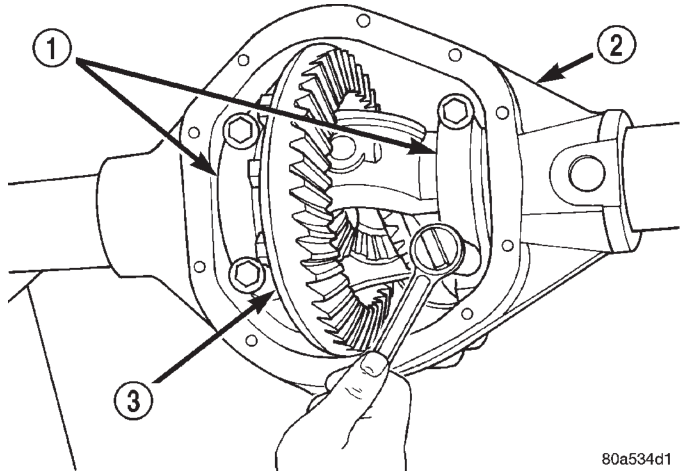


Fig. 14 TIGHTEN BEARING CAP BOLTS

1 - BEARING CAPS
2 - HOUSING
3 - DIFFERENTIAL CASE

(7) With a dead-blow hammer, seat the differential dummy bearings to each side of the housing (Fig. 15) and (Fig. 16).

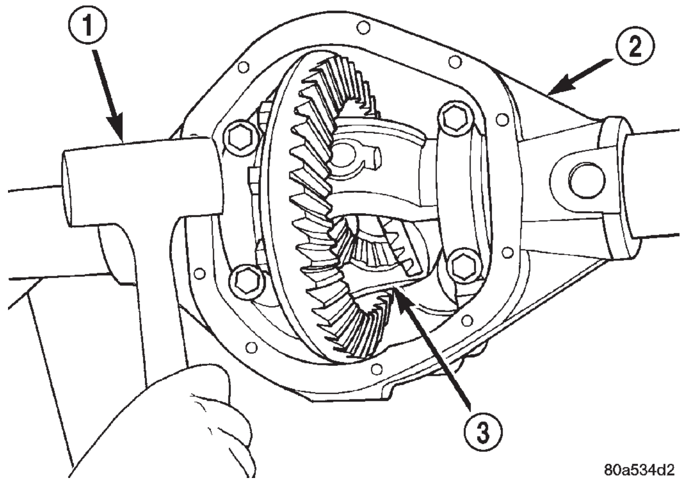


Fig. 15 SEAT DUMMY BEARING

1 - HAMMER
2 - HOUSING
3 - DIFFERENTIAL CASE

REAR AXLE - 226RBA (Continued)

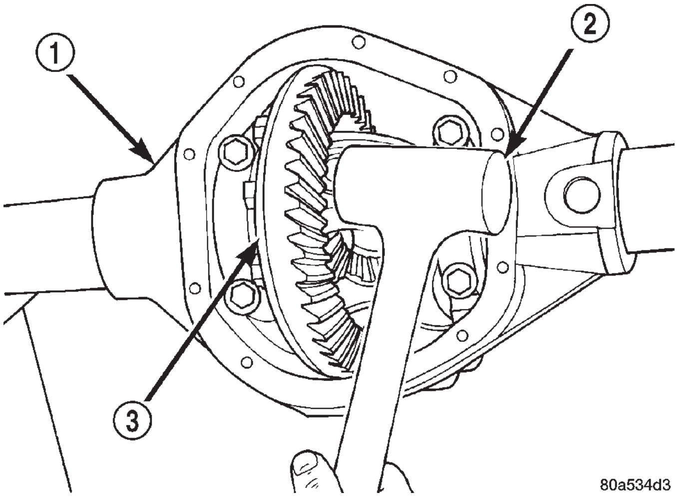


Fig. 16 SEAT DUMMY BEARING

1 - HOUSING
2 - HAMMER
3 - DIFFERENTIAL CASE

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 17).

(9) Attach the Dial Indicator C-3339 to pilot stud and position the indicator plunger on the flat surface between the ring gear bolts (Fig. 17).

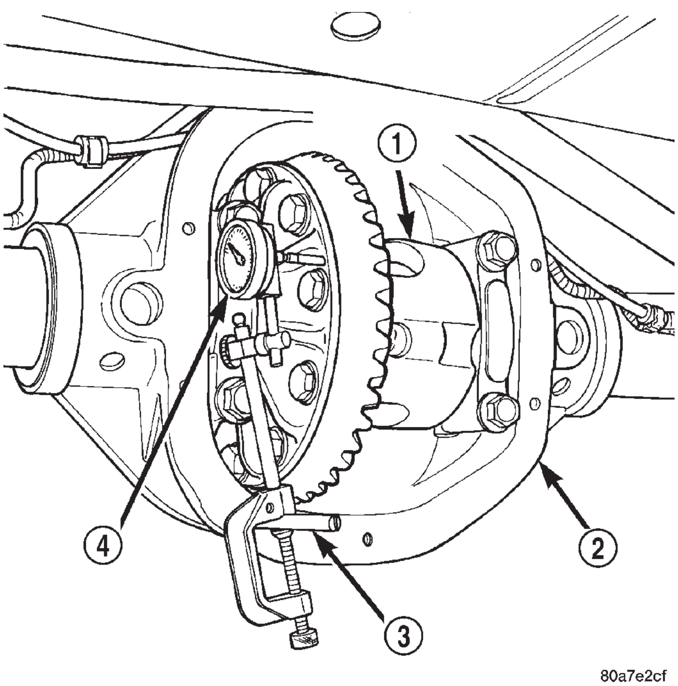


Fig. 17 DIFFERENTIAL SIDE PLAY MEASUREMENT

1 - DIFFERENTIAL CASE
2 - HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

(10) Push and hold differential case to pinion gear side of the housing and zero dial indicator (Fig. 18).

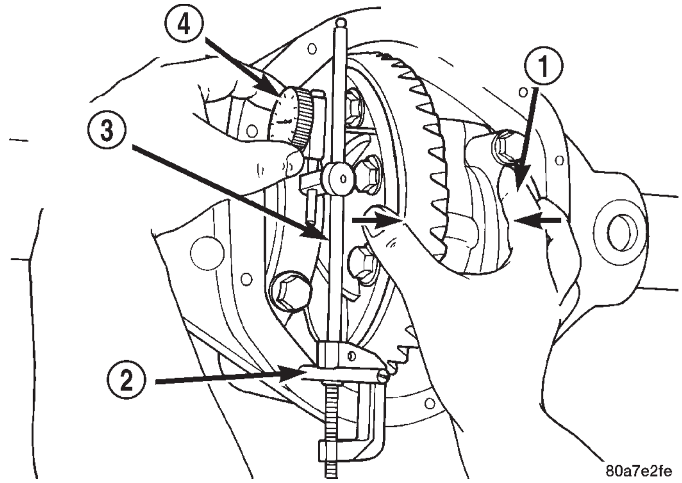


Fig. 18 DIFFERENTIAL CASE PINION GEAR SIDE

1 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
2 - PILOT STUD
3 - DIAL INDICATOR
4 - DIAL INDICATOR FACE

(11) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 19).

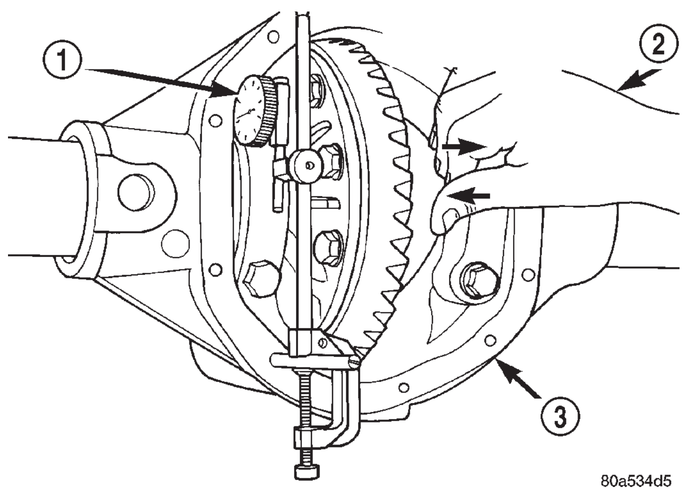


Fig. 19 DIFFERENTIAL CASE RING GEAR SIDE

1 - READ DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(12) Add 0.0254 mm (0.001 in.) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.

(13) Rotate dial indicator out of the way on the pilot stud.

REAR AXLE - 226RBA (Continued)

(14) Remove differential case and dummy bearings from the housing.

(15) Install the pinion gear in the housing. Install the pinion yoke and establish the correct pinion rotating torque.

(16) Install differential case and Dummy Bearings 6929-A in the housing.

(17) Install a single dummy shim in the ring gear side. Install bearing caps and tighten bolts snug.

(18) Seat ring gear side dummy bearing (Fig. 16).

(19) Position the dial indicator plunger on a flat surface between the ring gear bolt heads. (Fig. 17).

(20) Push and hold differential case toward pinion gear and zero dial indicator (Fig. 20).

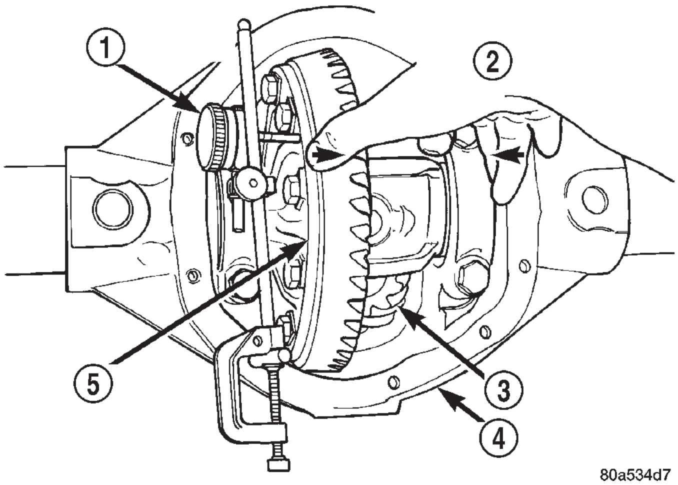


Fig. 20 ZERO DIAL INDICATOR

1 - DIAL INDICATOR FACE
2 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PINION GEAR
4 - HOUSING
5 - DIFFERENTIAL CASE

(21) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 21). Add Dummy Shim thickness to this reading. This will be the total shim thickness to achieve zero backlash.

(22) Subtract 0.152 mm (0.006 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.

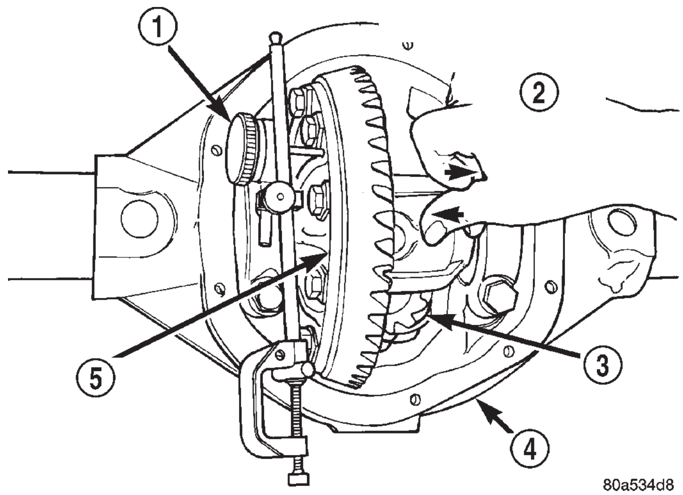


Fig. 21 DIFFERENTIAL CASE RING GEAR SIDE

1 - READ DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

(23) Subtract backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the housing.

(24) Rotate dial indicator out of the way on pilot stud.

(25) Remove differential case and dummy bearings from the housing.

(26) Install side bearings and cups on differential case.

(27) Install spreader W-129-B, utilizing some items from Adapter Set 6987, on the housing and spread axle opening enough to receive differential case.

(28) Place the bearing preload shims in the housing against the axle tubes.

(29) Install differential case into the housing.

(30) Remove spreader from housing.

(31) Rotate the differential case several times to seat the side bearings.

REAR AXLE - 226RBA (Continued)

(32) Position the indicator plunger against a ring gear tooth (Fig. 22).

(33) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(34) Zero dial indicator face to pointer.

(35) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.076 mm (0.003 in.) and 0.15 mm (0.006 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other (Fig. 23).

(36) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform Gear Contact Pattern procedure.

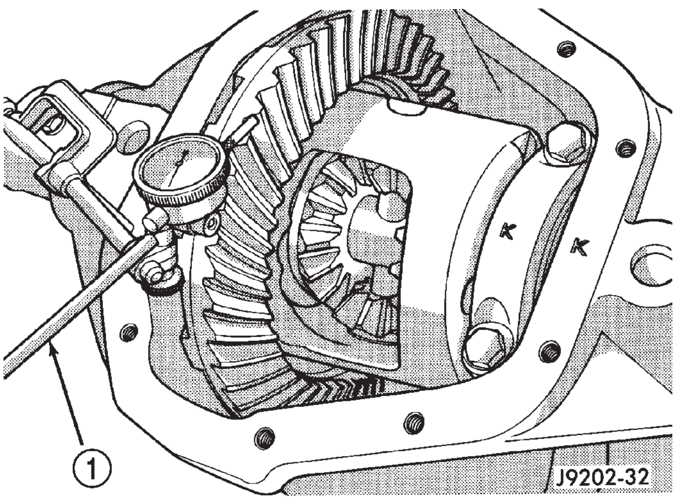


Fig. 22 RING GEAR BACKLASH

1 - DIAL INDICATOR

GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the axle housing. It will also show if the ring gear backlash

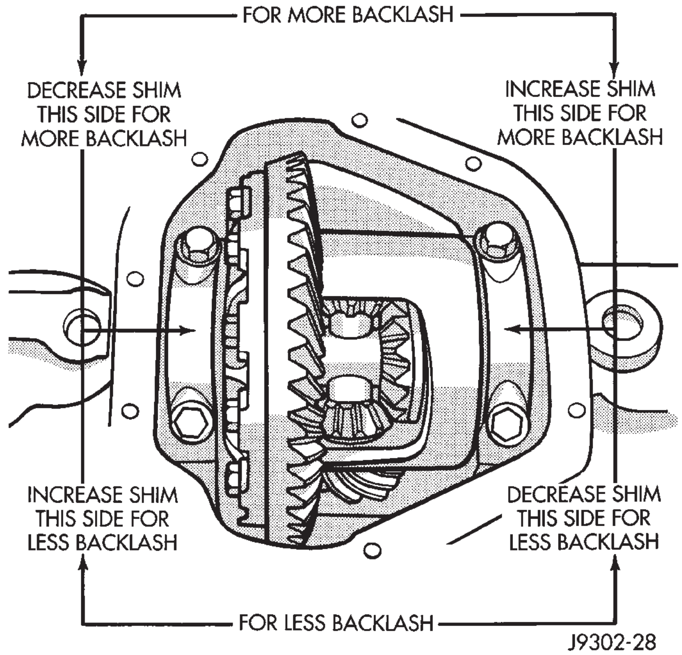


Fig. 23 BACKLASH SHIM

has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) With a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 24) and adjust pinion depth and gear backlash as necessary.

REAR AXLE - 226RBA (Continued)

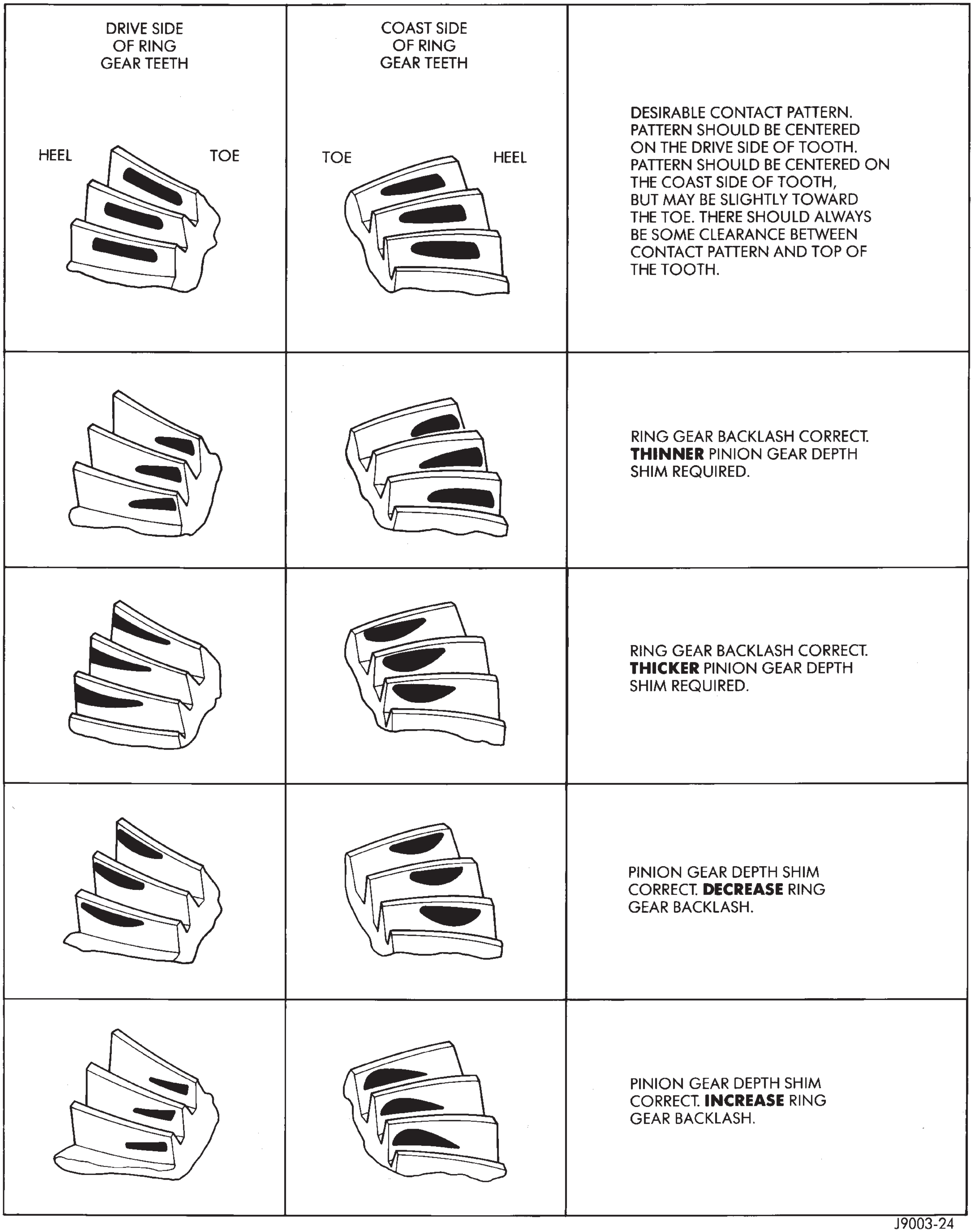


Fig. 24 Gear Contact Patterns

REAR AXLE - 226RBA (Continued)

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

SPECIFICATIONS

AXLE SPECIFICATIONS

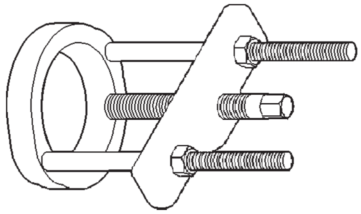
DESCRIPTION	SPECIFICATION
Axle Ratio	3.31, 3.55, 3.73, 3.91
Differential Bearing Preload	0.025 mm (0.001 in.)
Ring Gear Diameter	226 mm (8.9 in.)
Ring Gear Backlash	0.076.-0.15 mm (0.003-0.006 in.)
Pinion Gear Std. Depth	109.52 mm (4.312 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	2.8-4 N·m (25-35 in. lbs.)

TORQUE SPECIFICATIONS

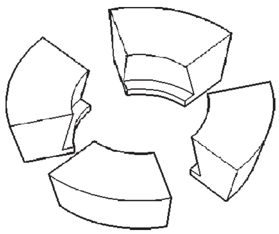
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	85	63	-
Ring Gear Bolts	136	100	-
Pinion Nut	298-380	220-280	-
Pinion Mate Shaft Screw	17.6	13	-
Axle Bearing Retainer Plate Nuts	61	45	-

REAR AXLE - 226RBA (Continued)

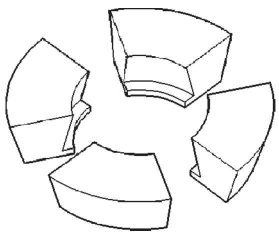
SPECIAL TOOLS



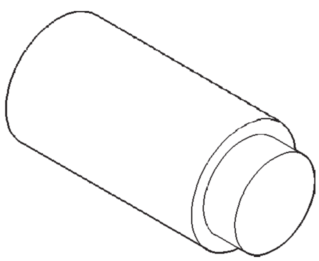
Puller Set C-293-PA



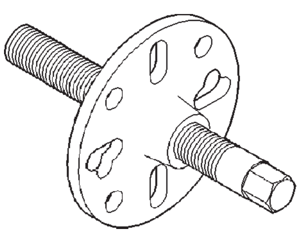
Adapter 8353



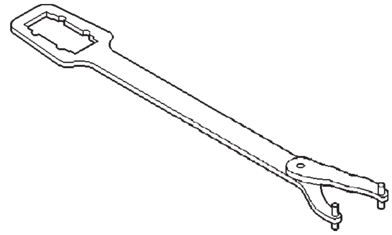
Adapter 8353



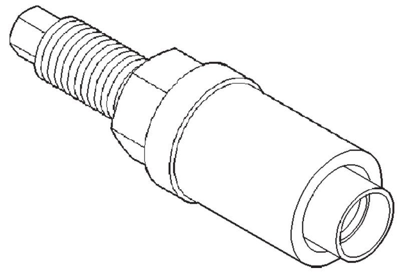
Adapter Plug C-293-3



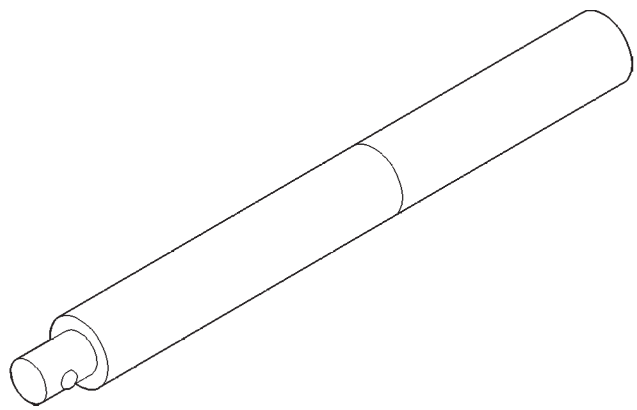
Remover C-452



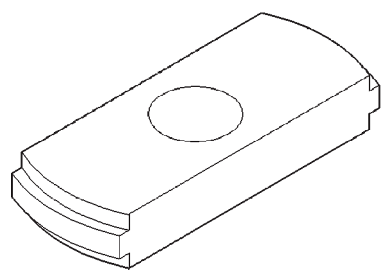
Wrench Flange C-3281



Installer C-3718

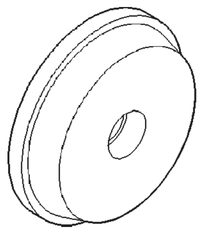


Handle C-4171

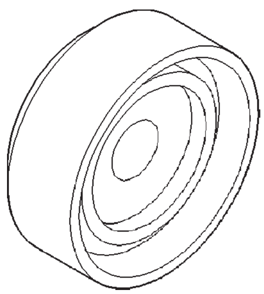


Remover C-4307

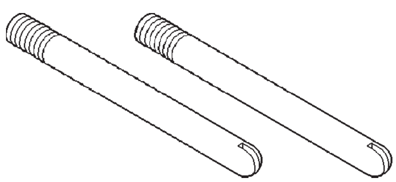
REAR AXLE - 226RBA (Continued)



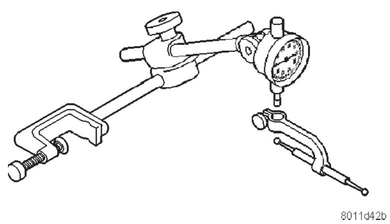
Installer C-4308



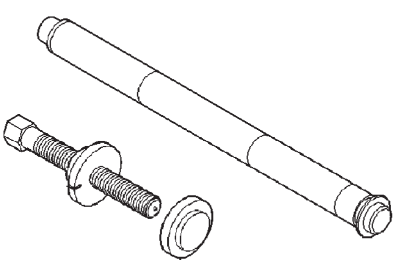
Installer C-4340



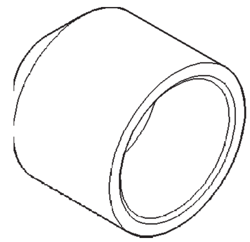
Pilot Studs C-3288-B



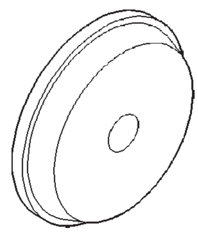
Dial Indicator C-3339



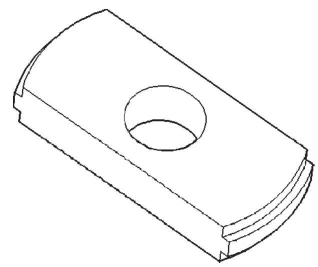
Trac-lok Tool C-4487



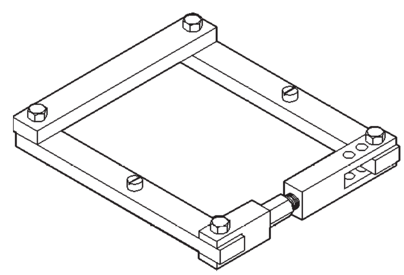
Installer C-3972-A



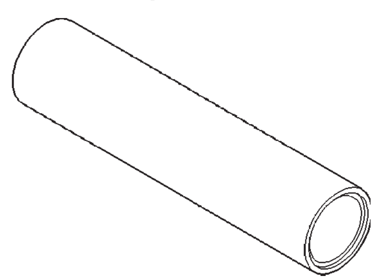
Installer D-129



Remover D-103

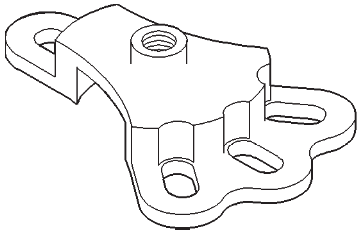


Spreader

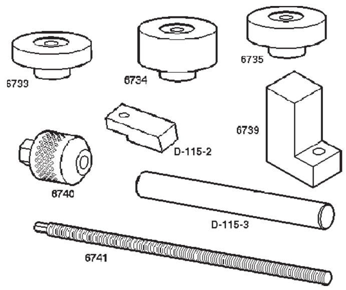


Installer 6448

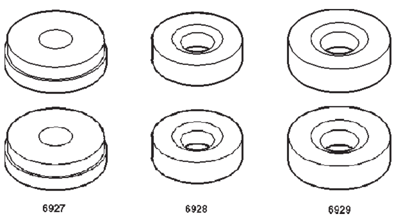
REAR AXLE - 226RBA (Continued)



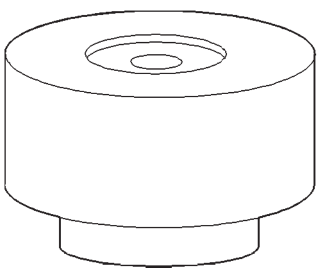
Adapter 6790



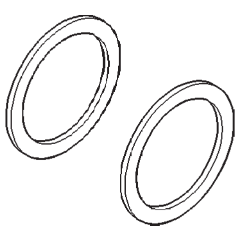
Pinion Depth Set 6955



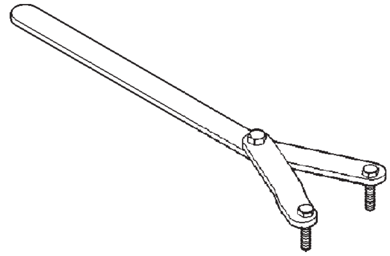
Bearing Dummy Set 6956



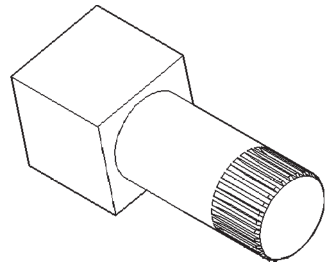
Gauge Block 8144



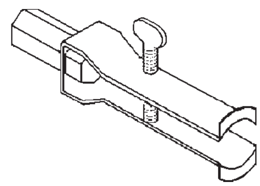
Shims Dummy 8107



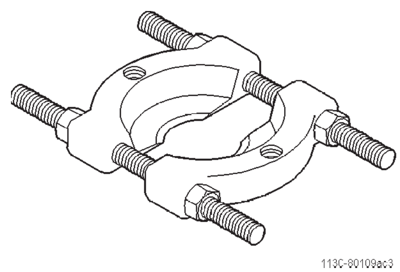
Wrench Spanner 6958



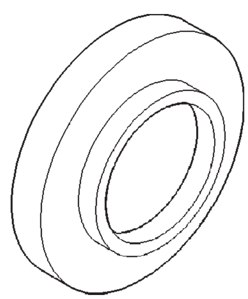
Fixture Holding 6963-A



Remover 7794-A



Splitter Bearing 1130



Installer Gear/Bearing 7913-A

AXLE SHAFTS

REMOVAL

(1) Place transmission in neutral.
(2) Raise and support vehicle.
(3) Remove wheel and tire assembly.
(4) Remove brake caliper and rotor.
(5) Remove nuts holding axle retainer plate to axle tube from the rear of the axle flange.
(6) Pull axle shaft from the axle with Slide Hammer 7420 and Adapter 6790. Mount the adapter to the axle with lug nuts.

NOTE: The axle bearing race is normally loose in the axle tube.

INSTALLATION

(1) Insall axle into the axle tube with the flat area of the retainer plate upward.
(2) Insert retaining plate studs into the brake backing plate and axle tube flange.
(3) Install retainer nuts and tighten nuts to 61 N·m (45 ft. lbs.).
(4) Install the brake rotor and caliper.
(5) Install wheel and tire.
(6) Check and fill the differential with gear lubricant.
(7) Lower vehicle.

AXLE BEARINGS/SEALS

REMOVAL

(1) Remove axle shaft from vehicle.

NOTE: The axle bearing race is normally loose in the axle tube.

(2) Drill a shallow hole into soft steel axle bearing retaining ring with a 3/8 in. drill bit (Fig. 25). Use a drill depth stop to avoid marking the axle.
(3) With a cold chisel cut the retaining ring across drilled hole. (Fig. 26)
(4) Slide retaining ring from axle shaft.

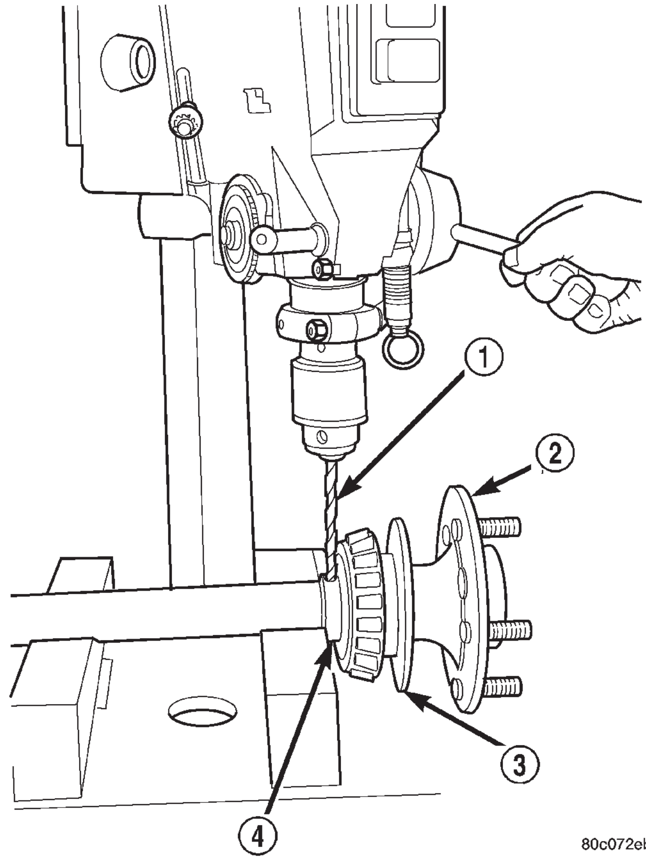


Fig. 25 DRILL RETAINING RING

1 - DRILL BIT
2 - AXLE
3 - RETAINING PLATE
4 - RETAINING RING

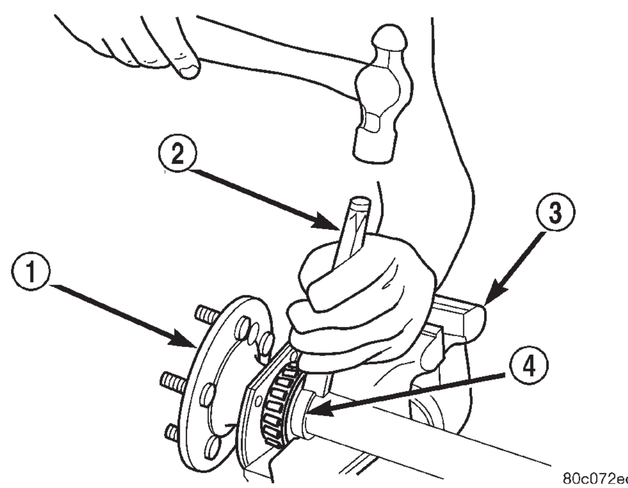


Fig. 26 RETAINING RING

1 - AXLE
2 - COLD CHISEL
3 - VISE
4 - RETAINING RING

AXLE BEARINGS/SEALS (Continued)

(5) Remove axle bearing from the shaft with, a press and Splitter 1130 placed between the seal and bearing (Fig. 27).

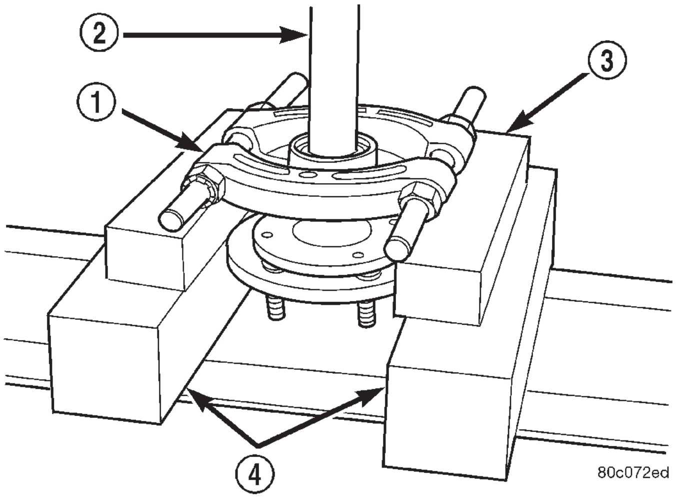


Fig. 27 AXLE BEARING AND SEAL

1 - SPLITTER
2 - AXLE
3 - BLOCKS
4 - PRESS PLATES

(6) Remove seal from axle.
(7) Remove retaining plate from axle shaft.

INSTALLATION

(1) Verify axle shaft retaining plate is flat with a straight edge.

NOTE: If the plate is warped or the studs are loose in the plate replace the retaining plate.

(2) Install retaining plate on the axle shaft (Fig. 28).
(3) Apply a coat of multi-purpose grease on sealing surface of axle seal.
(4) Install seal on the axle shaft with cavity away from retaining plate (Fig. 28).
(5) Lubricate bearing with Mopar Wheel Bearing Grease or equivalent. Wipe excess grease from the bearing.
(6) Install bearing on the axle shaft with Installer 7913 and a press (Fig. 29).

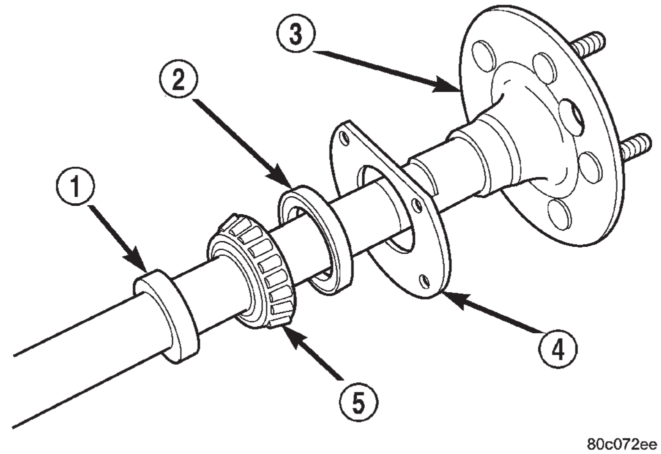


Fig. 28 AXLE BEARING AND SEAL COMPONENTS

1 - RETAINING RING
2 - SEAL
3 - AXLE
4 - RETAINING PLATE
5 - AXLE BEARING

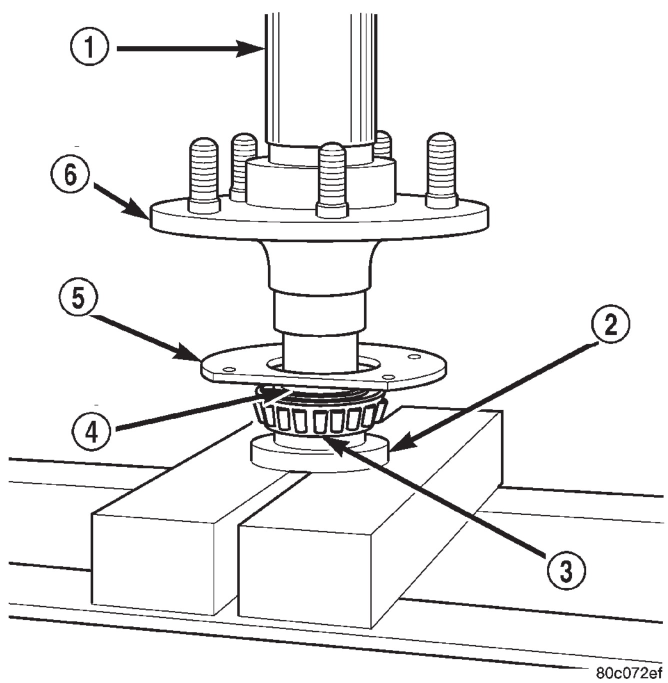


Fig. 29 PRESS BEARING ON AXLE

1 - PRESS RAM
2 - INSTALLER
3 - AXLE BEARING
4 - SEAL
5 - RETAINING PLATE
6 - AXLE

AXLE BEARINGS/SEALS (Continued)

(7) Press metal retaining ring onto axle shaft with Installer 7913 and a press (Fig. 30).

(8) Install axle in vehicle.

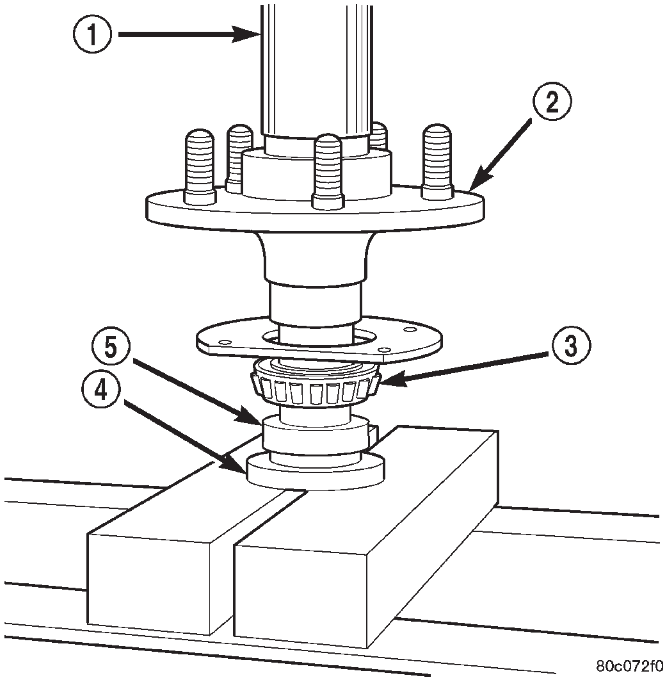


Fig. 30 BEARING RETAINING RING

1 - PRESS
2 - AXLE
3 - AXLE BEARING
4 - INSTALLER
5 - METAL RETAINING RING

PINION SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove rear brake calipers and rotors.

(4) Mark propeller shaft and pinion yoke for installation reference.

(5) Remove the propeller shaft from the yoke.

(6) Rotate pinion gear three or four times and verify that pinion rotates smoothly.

(7) Record torque necessary to rotate the pinion gear with a inch pound dial-type torque wrench.

(8) Using a short piece of pipe and Spanner Wrench 6958 to hold the pinion yoke and remove pinion nut and washer (Fig. 31).

(9) Remove pinion companion flange with Remover C-452 and Flange Wrench C-3281. (Fig. 32)

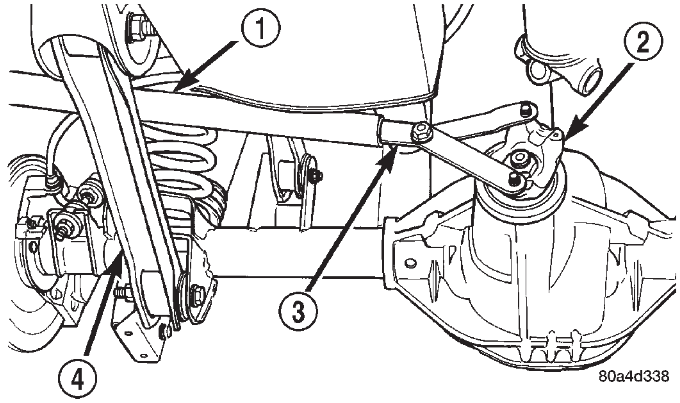


Fig. 31 Pinion Yoke Holder

1 - PIPE
2 - PINION YOKE
3 - SPANNER WRENCH
4 - LOWER CONTROL ARM

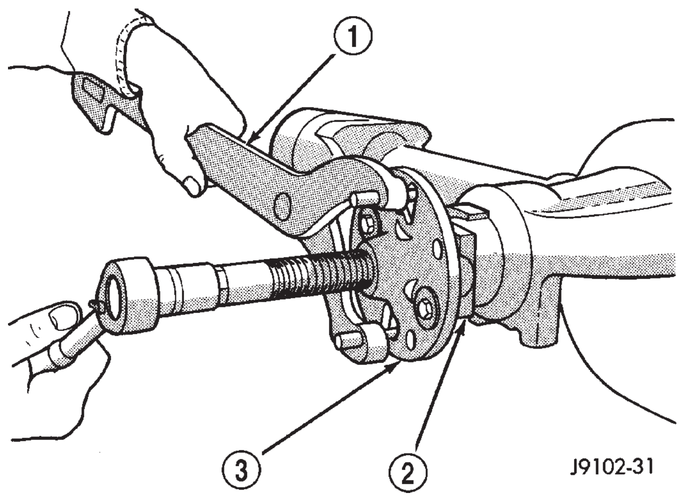


Fig. 32 Pinion Yoke Remover

1 - FLANGE WRENCH
2 - YOKE
3 - YOKE PULLER

PINION SEAL (Continued)

(10) Remove pinion seal with Remover 7794-A and a slide hammer (Fig. 33).

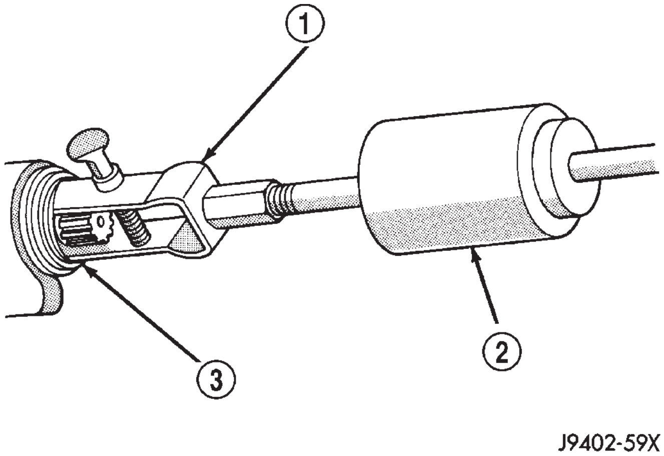


Fig. 33 Pinion Seal Remover

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate in installer (Fig. 34).

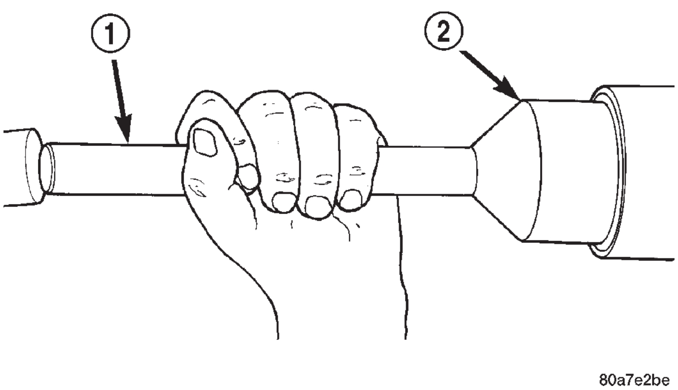


Fig. 34 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(2) Install yoke on the pinion gear with Installer C-3718 and Spanner Wrench 6958 (Fig. 35).

(3) Install a **new** nut on the pinion gear. **Tighten the nut only enough to remove the shaft end play.**

CAUTION: Do not exceed the minimum tightening torque 298 N·m (220 ft. lbs.) when installing the pinion yoke retaining nut at this point. Damage to collapsible spacer or bearings may result.

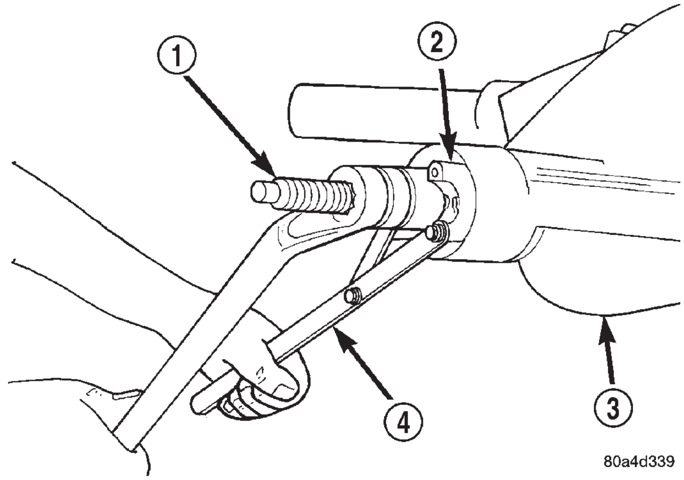


Fig. 35 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - DIFFERENTIAL HOUSING
4 - SPANNER WRENCH

(4) Rotate the pinion a minimum of ten times and verify pinion rotates smoothly. Rotate the pinion shaft using an inch pound torque wrench. Rotating torque should be equal to the reading recorded during removal, plus 0.56 N·m (5 in. lbs.) (Fig. 36).

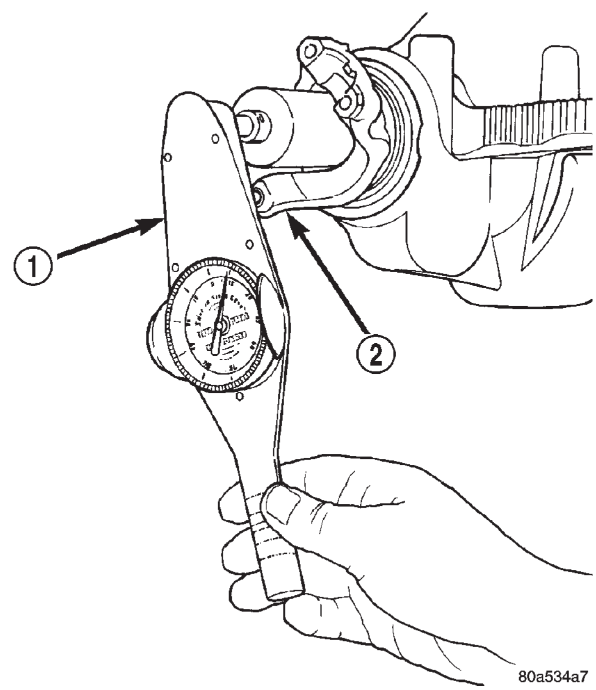


Fig. 36 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

PINION SEAL (Continued)

(5) If rotating torque is low, use Wrench 6958 to hold the pinion yoke (Fig. 37) and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until rotating torque is achieved.

CAUTION: If the maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

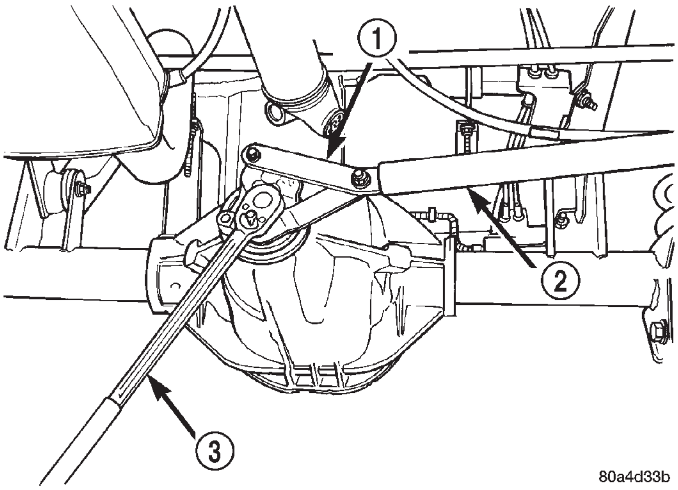


Fig. 37 PINION SHAFT NUT

1 - SPANNER WRENCH
2 - PIPE
3 - TORQUE WRENCH

(6) Install propeller shaft with reference marks aligned.
(7) Fill differential with gear lubricant.
(8) Install the brake rotors and calipers.
(9) Install wheel and tire assemblies.
(10) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL

(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove rear brake calipers and rotors.
(4) Mark propeller shaft and pinion yoke for installation reference and remove propeller shaft.
(5) Rotate pinion gear a minimum of ten times and verify pinion rotates smoothly.
(6) Record rotate torque of the pinion gear, with an inch pound torque wrench.
(7) Hold pinion yoke with Spanner Wrench 6958 and remove pinion nut and washer (Fig. 38).
(8) Remove pinion yoke with Remover C-452 and Wrench C-3281 (Fig. 39).

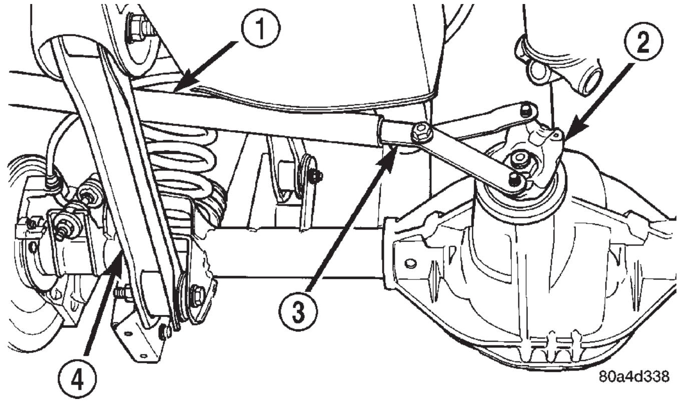


Fig. 38 PINION YOKE HOLDER

1 - 1 in. PIPE
2 - PINION YOKE
3 - SPANNER WRENCH
4 - LOWER CONTROL ARM

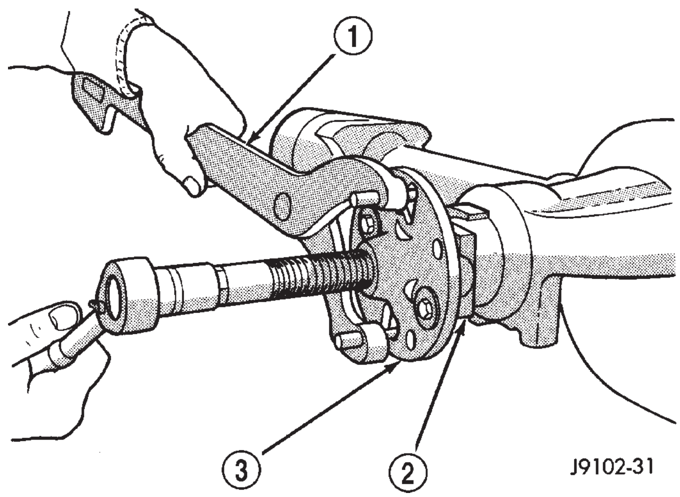


Fig. 39 PINION YOKE PULLER

1 - WRENCH
2 - PINION YOKE
3 - PULLER

COLLAPSIBLE SPACER (Continued)

(9) Remove pinion shaft seal with Remover 7794-A and slide hammer (Fig. 40).

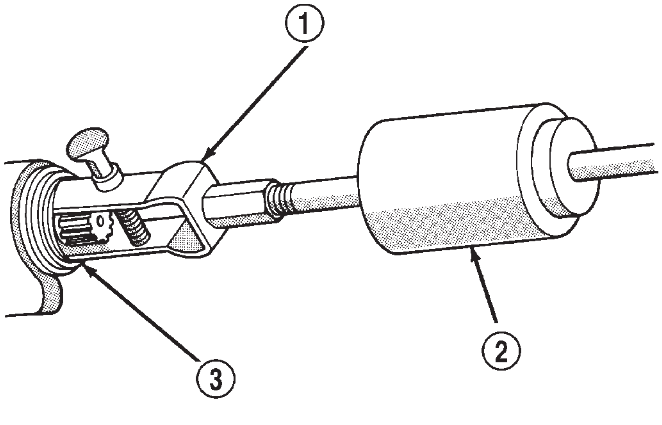


Fig. 40 PINION SEAL REMOVER

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

(10) Remove front pinion bearing using a pair of pick tools to pull the bearing off the pinion gear shaft.

NOTE: If the pinion bearing becomes bound on the pinion shaft, lightly tap the end of the shaft with a rawhide/rubber mallet.

(11) Remove the collapsible spacer.

INSTALLATION

(1) Install a **new** collapsible spacer on pinion shaft.
(2) Install pinion front bearing on the pinion shaft.
(3) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 41).

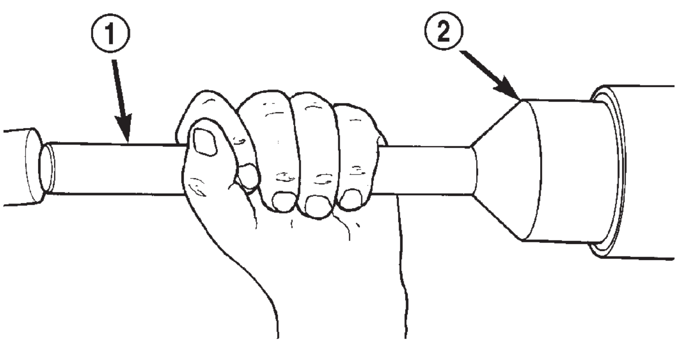


Fig. 41 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(4) Install yoke with Installer C-3718 and Spanner Wrench 6958 (Fig. 42).

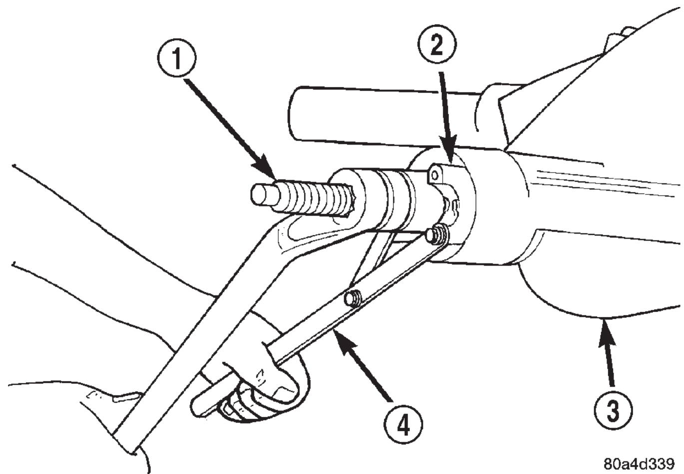


Fig. 42 Pinion Yoke Installer

1 - INSTALLER
2 - PINION YOKE
3 - DIFFERENTIAL HOUSING
4 - SPANNER WRENCH

(5) Install yoke washer and **new** nut on the pinion gear. Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

(6) Using yoke with Spanner Wrench 6958 and a torque wrench set at 380 N·m (280 ft. lbs.), (Fig. 43) slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 44).

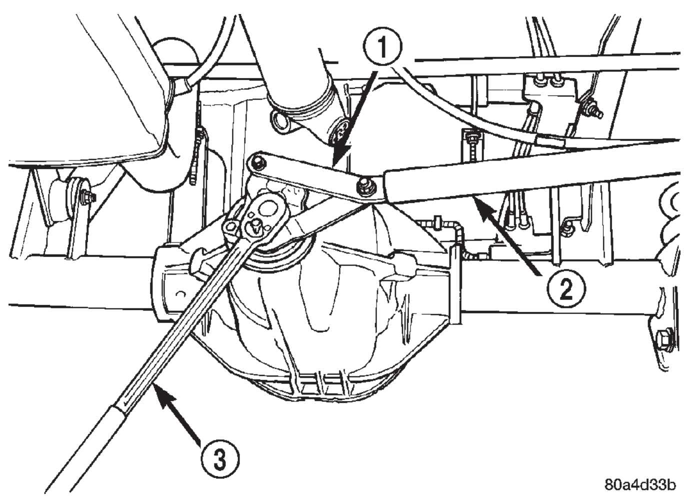


Fig. 43 PINION NUT

1 - SPANNER WRENCH
2 - PIPE
3 - TORQUE WRENCH

COLLAPSIBLE SPACER (Continued)

NOTE: If more than 380 N·m (280 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced.

(7) Check rotating torque with an inch pound torque wrench (Fig. 44). The rotating torque of the pinion gear should be, the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).

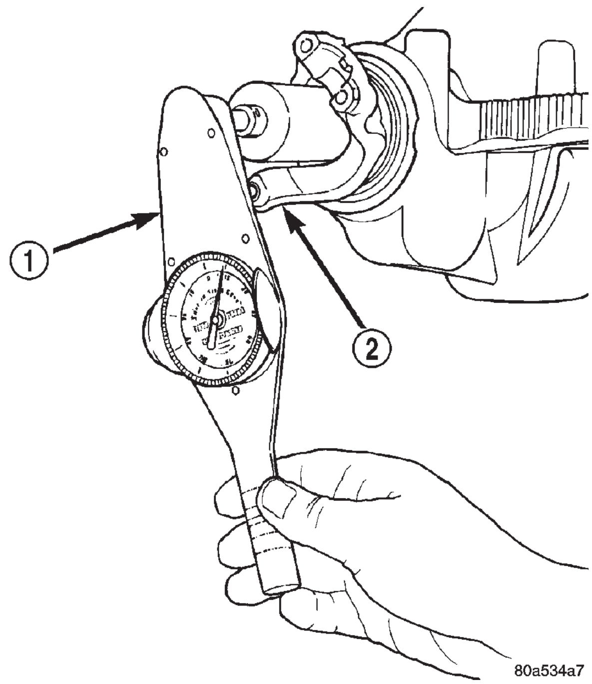


Fig. 44 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

(8) Install propeller shaft with reference marks align.
(9) Install rear brake rotors and calipers.
(10) Add gear lubricant, if necessary.
(11) Install wheel and tire assemblies.
(12) Remove supports and lower vehicle.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.
(2) Remove fill hole plug from the differential housing cover.
(3) Remove differential housing cover and drain fluid.
(4) Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

(5) Remove axle shafts.

(6) Note the reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 45).

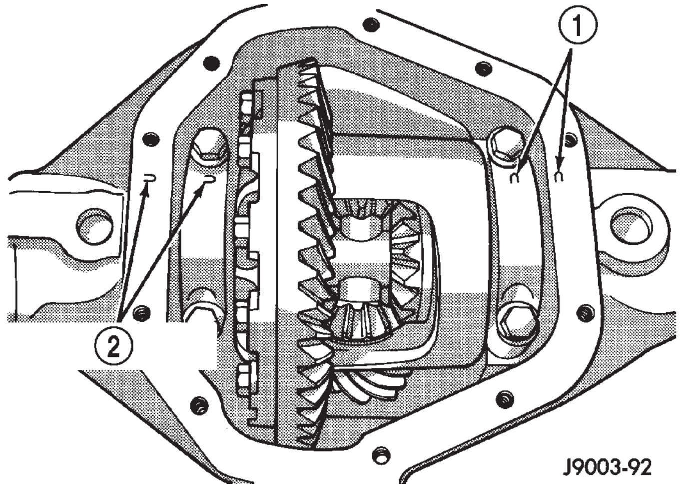


Fig. 45 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(7) Loosen the differential bearing cap bolts.
(8) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 46). Install holddown clamps and tighten the turnbuckle finger-tight.

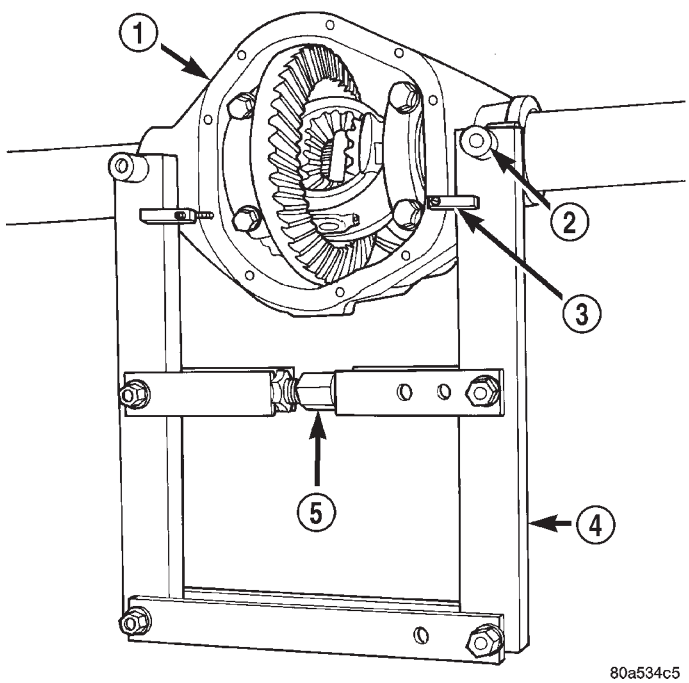


Fig. 46 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

DIFFERENTIAL (Continued)

(9) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 47) and zero the indicator.

CAUTION: Never spread the housing over 0.38 mm (0.015 in). If housing is over-spread, it could distorted and damaged the housing.

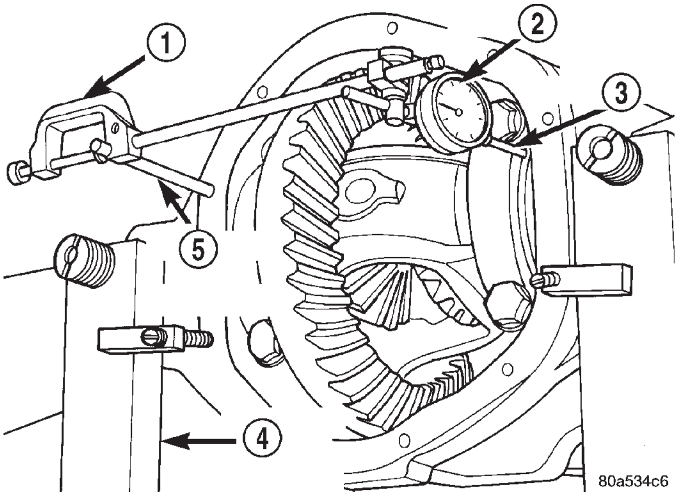


Fig. 47 DIAL INDICATOR LOCATION

1 - CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

(10) Spread housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 48).

(11) Remove the dial indicator.

(12) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(13) Remove differential from the housing and tag differential bearing cups to indicate location (Fig. 49).

(14) Remove spreader from housing.

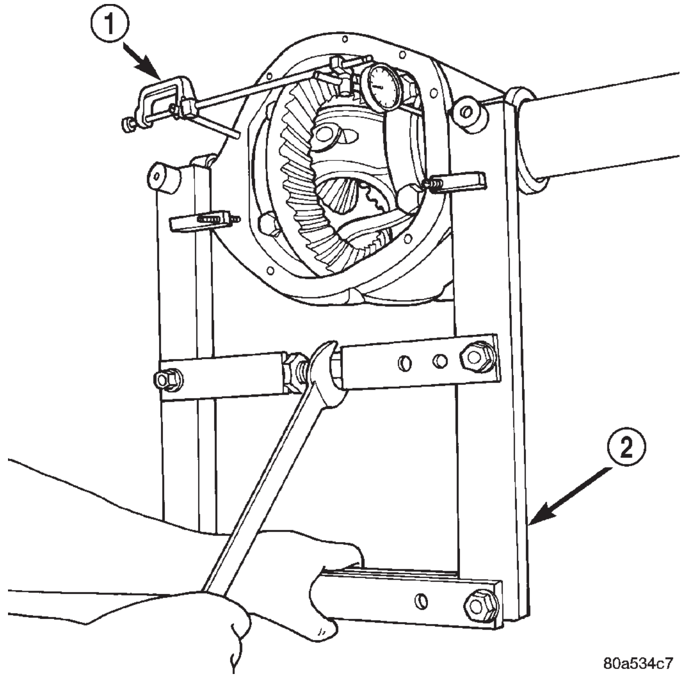


Fig. 48 SPREAD DIFFERENTIAL HOUSING

1 - DIAL INDICATOR
2 - SPREADER

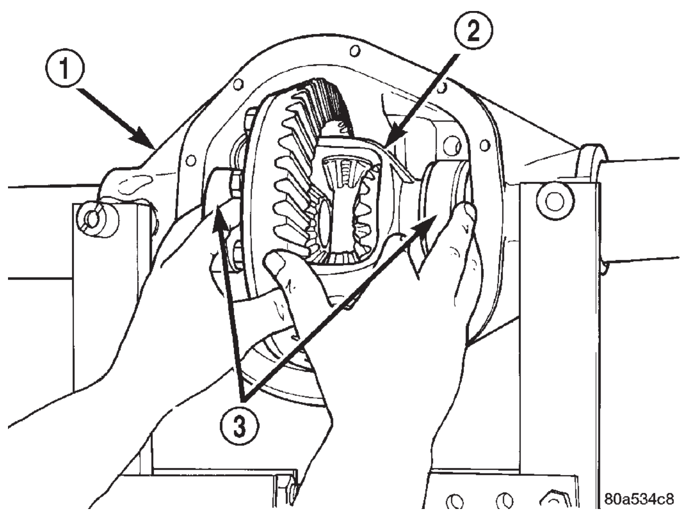


Fig. 49 DIFFERENTIAL CASE REMOVAL

1 - DIFFERENTIAL HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

DIFFERENTIAL (Continued)

DISASSEMBLY

(1) Remove pinion shaft lock screw (Fig. 50).

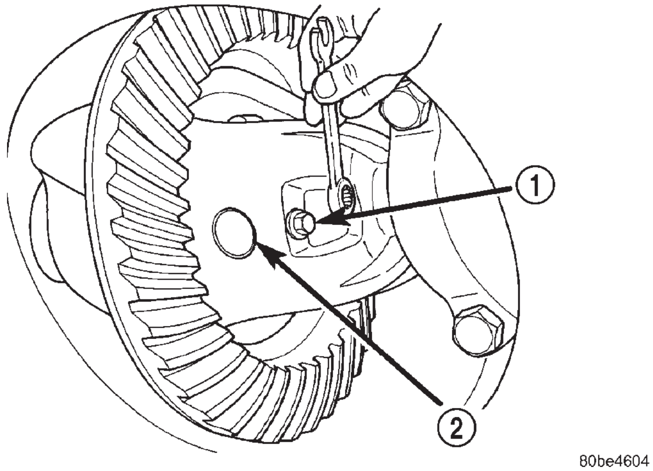


Fig. 50 SHAFT LOCK SCREW

1 - LOCK SCREW
2 - PINION SHAFT

(2) Remove pinion shaft.
(3) Rotate differential side gears and remove differential pinions and thrust washers (Fig. 51).

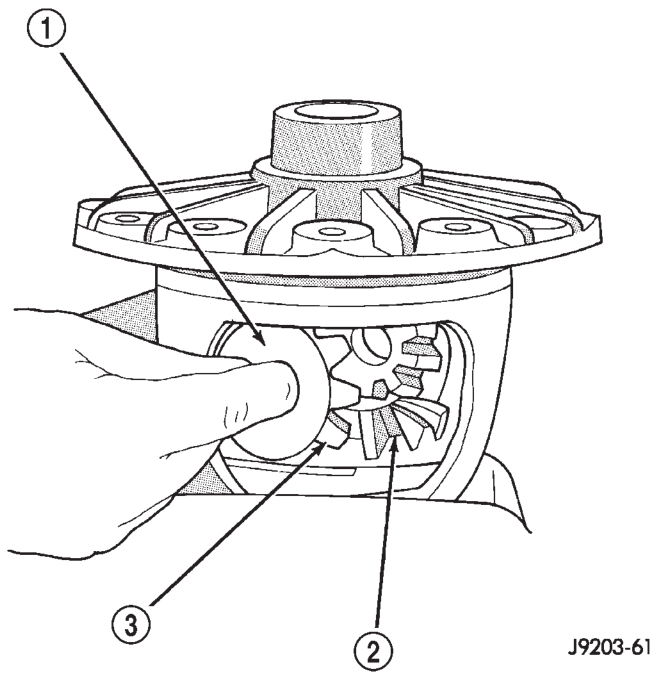


Fig. 51 DIFFERENTIAL GEARS

1 - THRUST WASHER
2 - SIDE GEAR
3 - DIFFERENTIAL PINION

(4) Remove differential side gears and thrust washers.

ASSEMBLY

(1) Install differential side gears and thrust washers.
(2) Install differential pinion gears and thrust washers.
(3) Install the pinion mate shaft.
(4) Align hole in the pinion mate shaft with the hole in the differential case and install the pinion mate shaft lock screw.
(5) Lubricate all differential components with hypoid gear lubricant.

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Position Spreader W-129-B with Adapter set 6987 on differential housing locating holes. Install the holddown clamps and tighten the tool turnbuckle finger-tight.
(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Never spread the housing over 0.38 mm (0.015 in). If housing is over-spread, it could be distorted or damaged.

(3) Spread housing enough to install the case in the housing.
(4) Remove the dial indicator.
(5) Install differential case in housing (Fig. 52). Verify differential bearing cups remain in position on the bearings and preload shims are between the face of the bearing cup and the housing. Tap the differential case to ensure bearings cups and shims are seated in the housing.

CAUTION: On a Vari-lok® differential the oil feed tube must be pointed at the bottom of the housing (Fig. 53). If differential is installed with the oil feed tube pointed at the top, the anti-rotation tabs will be damaged.

(6) Install bearing caps in their original locations (Fig. 54).
(7) Loosely install differential bearing cap bolts.
(8) Remove axle housing spreader.
(9) Tighten bearing cap bolts in a criss-cross pattern to 77 N·m (57 ft. lbs.).
(10) Install the axle shafts.

DIFFERENTIAL (Continued)

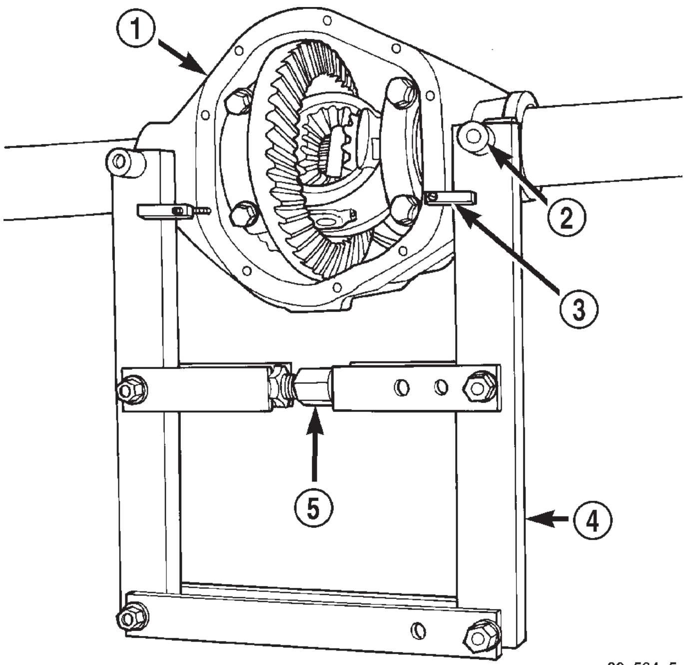


Fig. 52 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

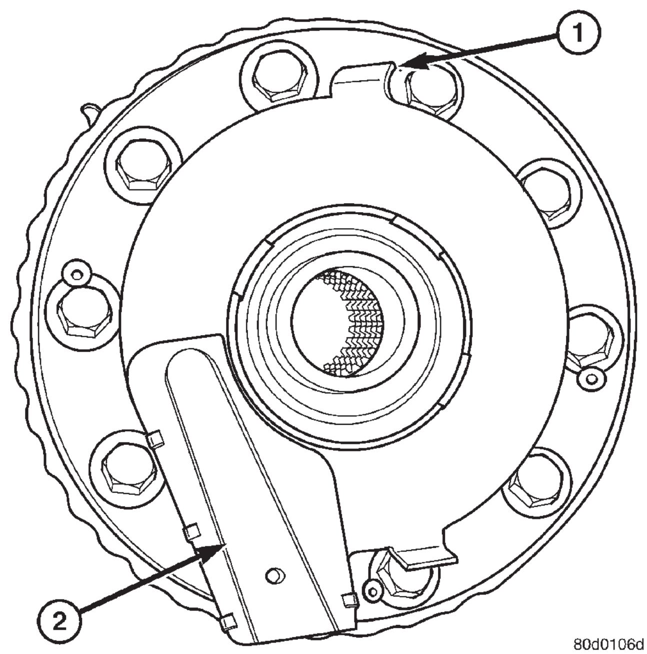


Fig. 53 VARI-LOK

1 - ANTI-ROTATION TAB
2 - OIL FEED TUBE

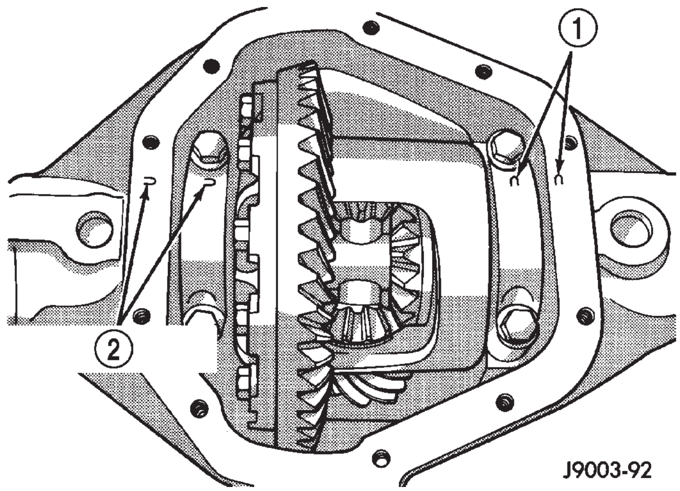


Fig. 54 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(11) Apply a 6.35mm (1/4 in.) bead of red Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 55).

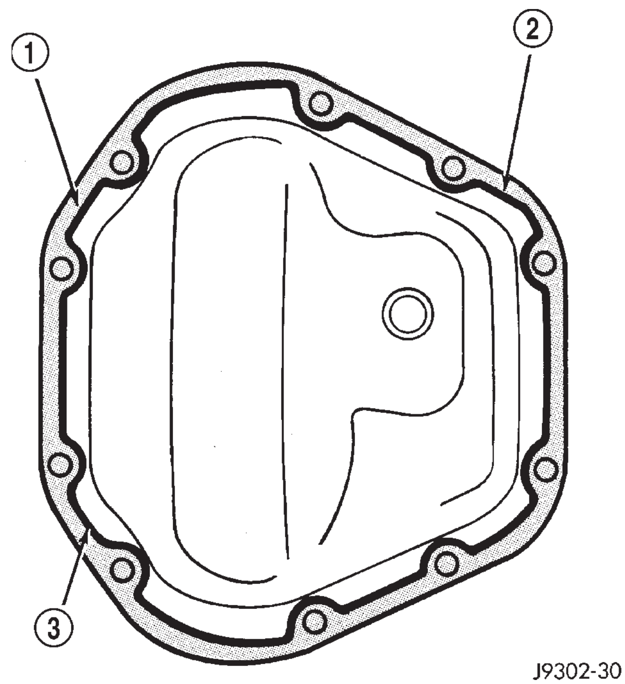


Fig. 55 DIFFERENTIAL COVER - TYPICAL

1 - COVER
2 - SEALANT
3 - SEALANT BEAD

CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied or adhesion quality will be compromised.

DIFFERENTIAL (Continued)

(12) Install cover and tighten bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).

(13) Refill the differential with Mopar Hypoid Gear Lubricant or equivalent to bottom of the fill plug hole.

(14) Install fill hole plug.

(15) Remove support and lower the vehicle.

DIFFERENTIAL - TRAC-LOK

DIAGNOSIS AND TESTING

The most common problem is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. A container of Mopar Trac-lok® Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

DIFFERENTIAL TEST

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(4) Remove wheel and bolt Special Tool 6790 or equivalent tool to studs.

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 56).

(6) If rotating torque is less than 41 N·m (56 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.

DISASSEMBLY

(1) Clamp side gear Holding Fixture 6965 in a vise and position the differential case on the Holding Fixture (Fig. 57).

(2) Remove ring gear if the ring gear is to be replaced. The Trac-lok® differential can be serviced with the ring gear installed.

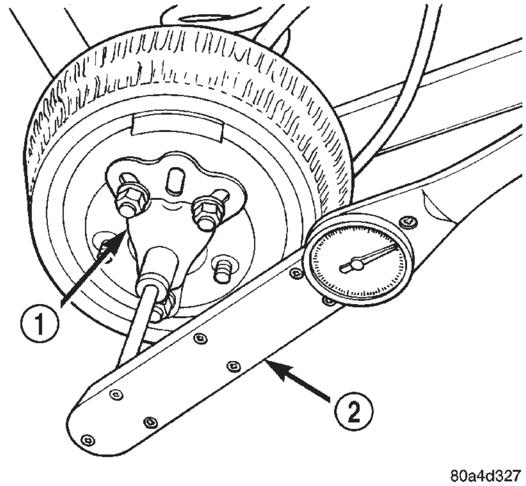


Fig. 56 ROTATING TORQUE TEST

1 - SPECIAL TOOL WITH BOLT IN CENTER HOLE
2 - TORQUE WRENCH

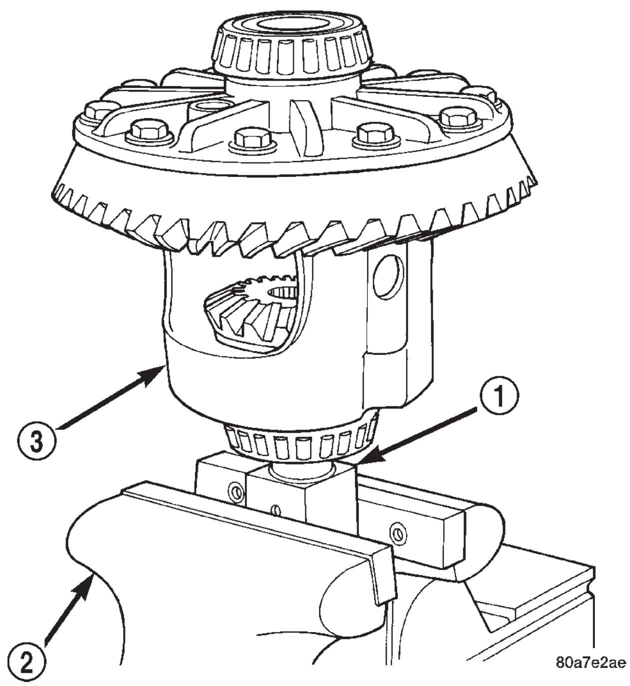


Fig. 57 DIFFERENTIAL CASE FIXTURE

1 - HOLDING FIXTURE
2 - VISE
3 - DIFFERENTIAL

DIFFERENTIAL - TRAC-LOK (Continued)

(3) Remove the pinion gear mate shaft lock screw (Fig. 58).

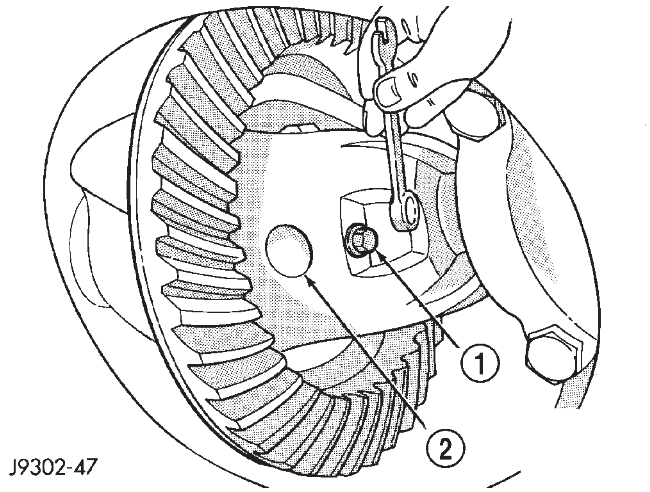


Fig. 58 MATE SHAFT LOCK SCREW

1 - LOCK SCREW
2 - PINION GEAR MATE SHAFT

(4) Remove pinion gear mate shaft with a drift and hammer (Fig. 59).

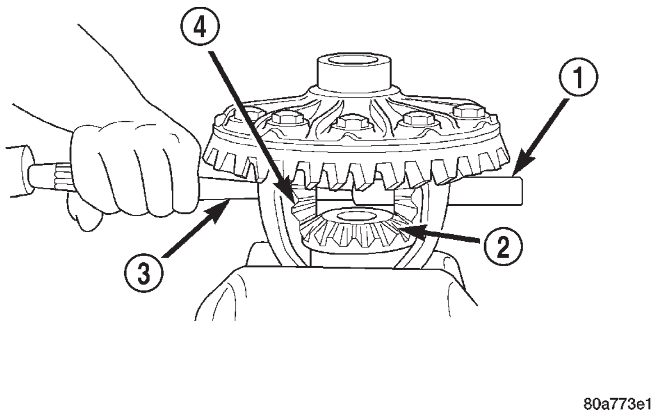


Fig. 59 PINION MATE SHAFT

1 - PINION MATE SHAFT
2 - SIDE GEAR
3 - DRIFT
4 - PINION MATE GEAR

(5) Install and lubricate Step Plate C-6960-3 (Fig. 60).

(6) Assemble Threaded Adapter C-6960-1 into top side gear. Thread Forcing Screw C-6960-4 into adapter until it becomes centered in adapter plate.

(7) Position a small screw driver in slot of Threaded Adapter Disc C-6960-1 (Fig. 61) to prevent adapter from turning.

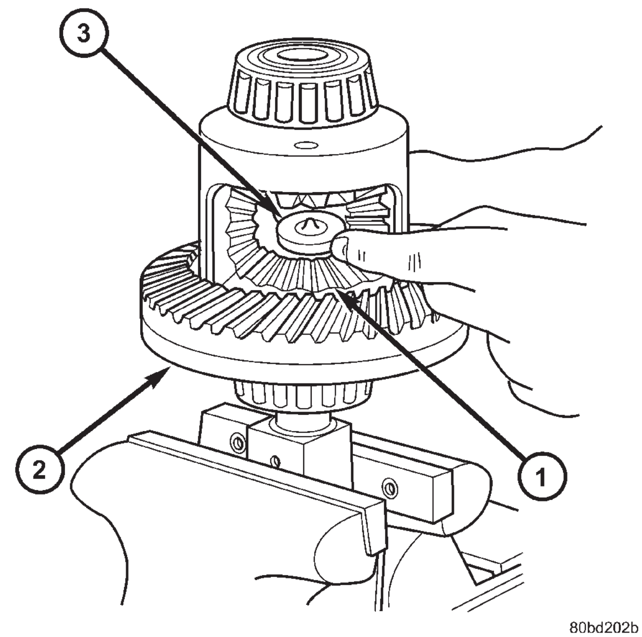


Fig. 60 Step Plate

1 - LOWER SIDE GEAR
2 - DIFFERENTIAL CASE
3 - STEP PLATE

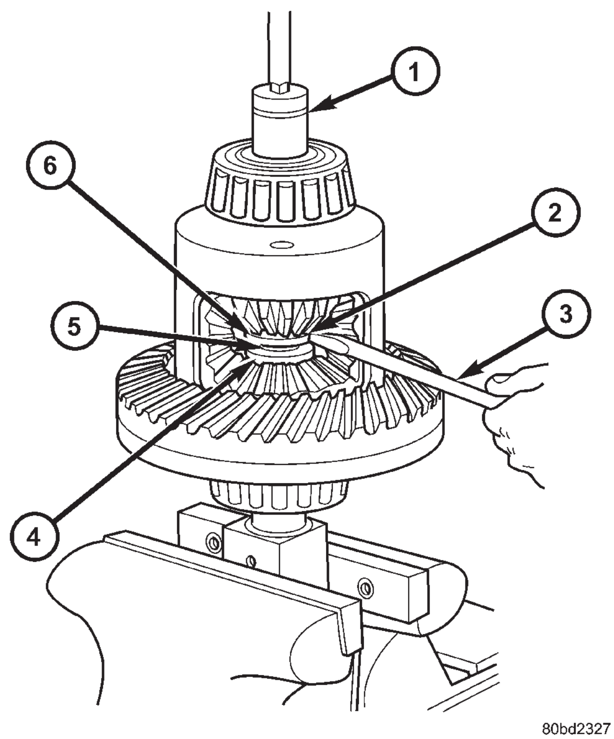


Fig. 61 Threaded Adapter Disc

1 - SOCKET
2 - SLOT IN ADAPTER
3 - SCREWDRIVER
4 - STEP PLATE
5 - FORCING SCREW
6 - THREAD ADAPTER DISC

DIFFERENTIAL - TRAC-LOK (Continued)

(8) Install Forcing Screw C-6960-4 and tighten screw to 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 62).

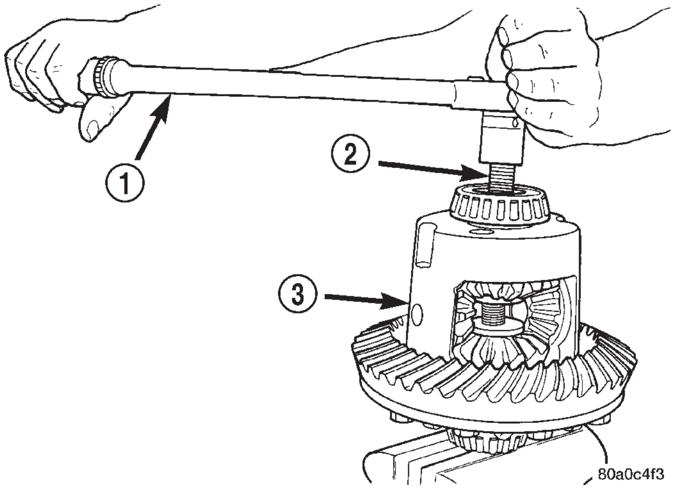


Fig. 62 COMPRESS BELLEVILLE SPRING

1 - TORQUE WRENCH
2 - TOOL ASSEMBLED
3 - DIFFERENTIAL CASE

(9) With a feeler gauge remove thrust washers from behind the pinion gears (Fig. 63).

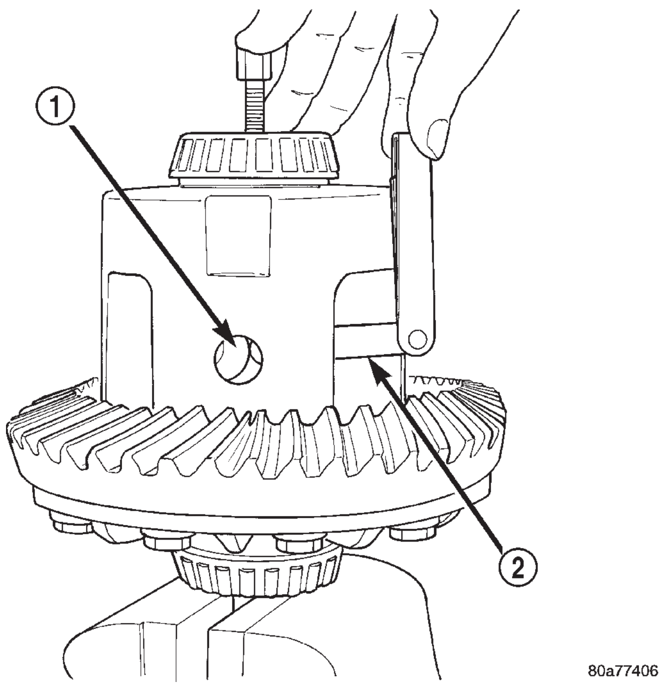


Fig. 63 PINION GEAR THRUST WASHER

1 - THRUST WASHER
2 - FEELER GAUGE

(10) Insert Turning Bar C-6960-2 into the pinion mate shaft hole in the case (Fig. 64).

(11) Loosen the Forcing Screw in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar.

(12) Rotate differential case until the pinion gears can be removed.

(13) Remove pinion gears from differential case.

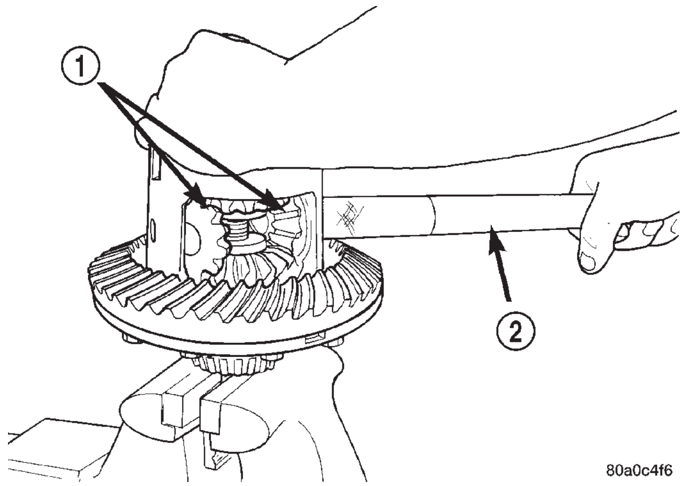


Fig. 64 PINION GEARS

1 - PINION GEARS
2 - TURNING BAR

(14) Remove Forcing Screw, Step Plate and Threaded Adapter.

(15) Remove top side gear, clutch pack retainer and clutch pack. Keep plates in correct order during removal (Fig. 65).

(16) Remove differential case from the Holding Fixture. Remove side gear, clutch pack retainer and clutch pack. Keep plates in correct order during removal.

CLEANING

Clean all components in cleaning solvent and dry components with compressed air.

INSPECTION

Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side and pinion gears for cracks chips or damage and replace as necessary. Inspect differential case and pinion shaft and replace if worn or damaged.

ASSEMBLY

Clean all components in cleaning solvent and dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is

DIFFERENTIAL - TRAC-LOK (Continued)

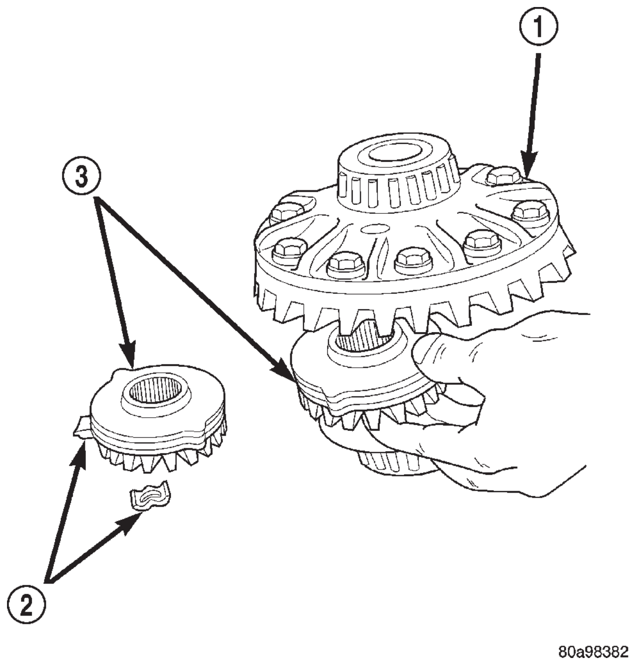


Fig. 65 SIDE GEARS AND CLUTCH DISCS

1 - DIFFERENTIAL CASE
2 - RETAINER
3 - SIDE GEAR AND CLUTCH DISC PACK

damaged. Inspect side gears and pinions. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

NOTE: New Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

(1) Lubricate each component with gear lubricant before assembly.

(2) Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 66).

NOTE: Dished plate is position with the convex side against the side gear.

(3) Position assembled clutch disc packs on the side gear hubs.

(4) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 67). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(5) Position the differential case on the Holding Fixture 6965.

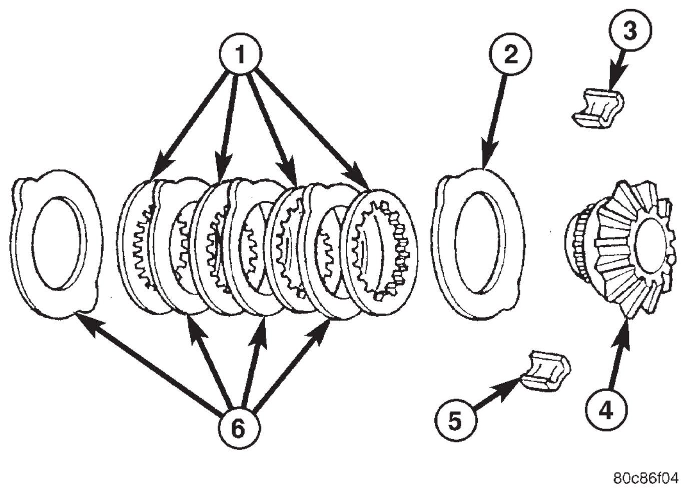


Fig. 66 CLUTCH PACK

1 - DISCS
2 - DISHED PLATE
3 - RETAINER
4 - SIDE GEAR
5 - RETAINER
6 - PLATES

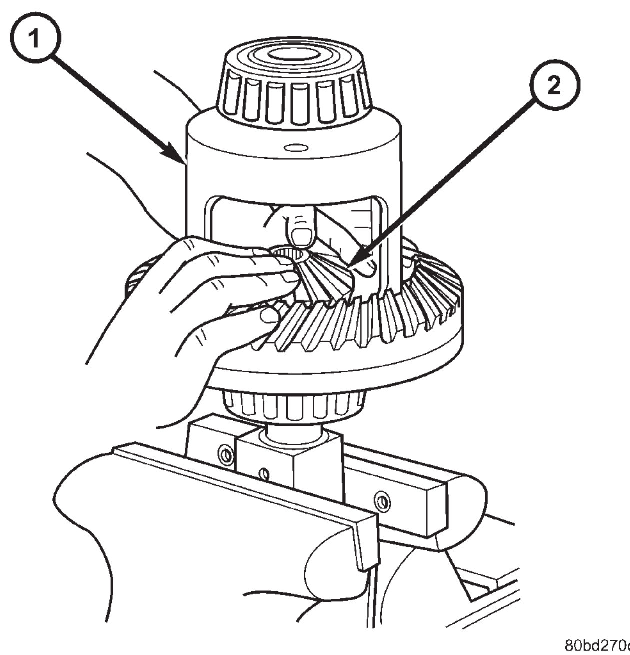


Fig. 67 CLUTCH PACK AND LOWER SIDE GEAR

1 - DIFFERENTIAL CASE
2 - LOWER SIDE GEAR AND CLUTCH DISC PACK

DIFFERENTIAL - TRAC-LOK (Continued)

(6) Install lubricated Step Plate C-6960-3 in lower side gear (Fig. 68).

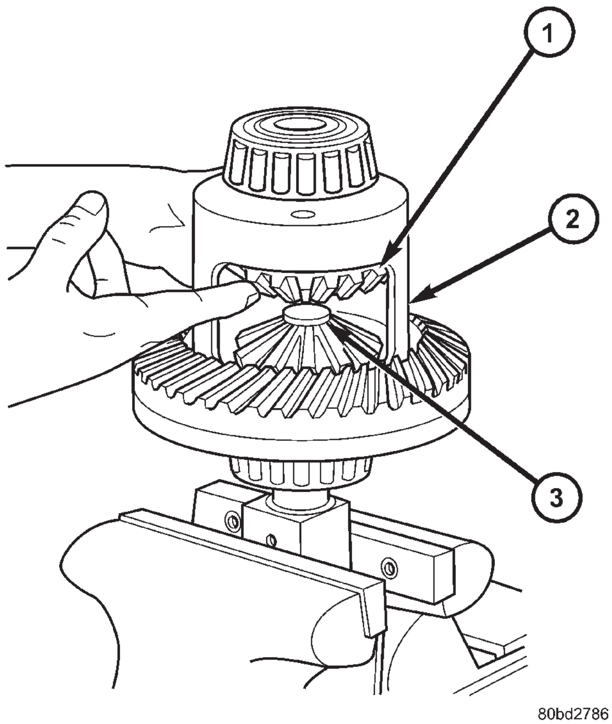


Fig. 68 CLUTCH PACK AND UPPER SIDE GEAR

1 - SIDE GEAR AND CLUTCH PACK
2 - DIFFERENTIAL CASE
3 - STEP PLATE

(7) Install the upper side gear and clutch disc pack (Fig. 68).

(8) Hold assembly in position. Insert Threaded Adapter C-6960-1 into top side gear.

(9) Install Forcing Screw C-6960-4 and tighten screw to slightly compress clutch disc.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.

(11) Rotate case with Turning Bar C-6960-2 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw, Step Plate and Threaded Adapter.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(17) Lubricate all differential components with hypoid gear lubricant.

DIFFERENTIAL CASE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove side bearings from the differential case with Puller/Press C-293-PA, Adapters 8353 and Plug C-293-3 (Fig. 69).

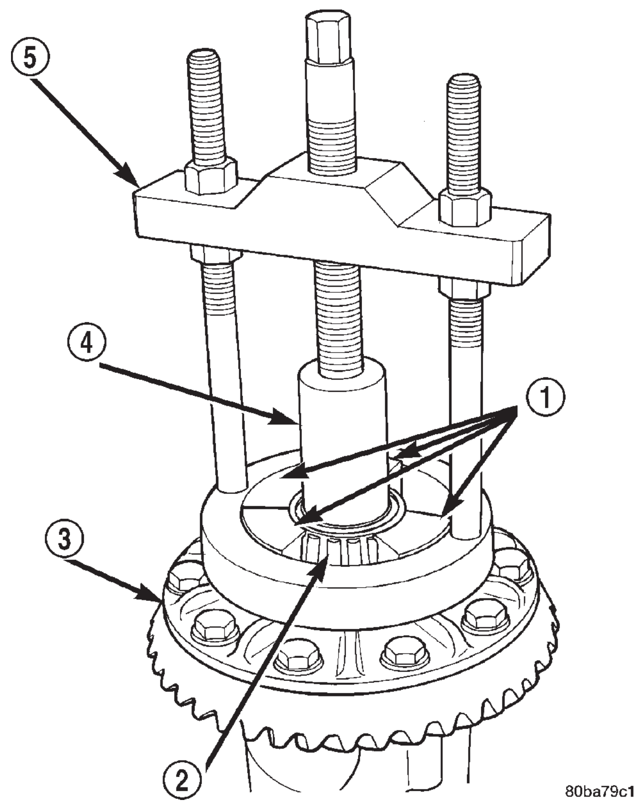


Fig. 69 Differential Bearing Removal

1 - ADAPTERS
2 - BEARING
3 - DIFFERENTIAL
4 - PLUG
5 - PULLER

INSTALLATION

NOTE: If differential side bearings or differential case are replaced, differential side bearing shim requirements may change. Refer to Adjustments (Differential Bearing Preload and Gear Backlash) for procedures.

DIFFERENTIAL CASE BEARINGS (Continued)

CAUTION: Vari-lok® plenum must be seated against the differential case prior to installing the ring gear side differential bearing.

(1) Install differential side bearings with Installer C-4340 and Handle C-4171 (Fig. 70).

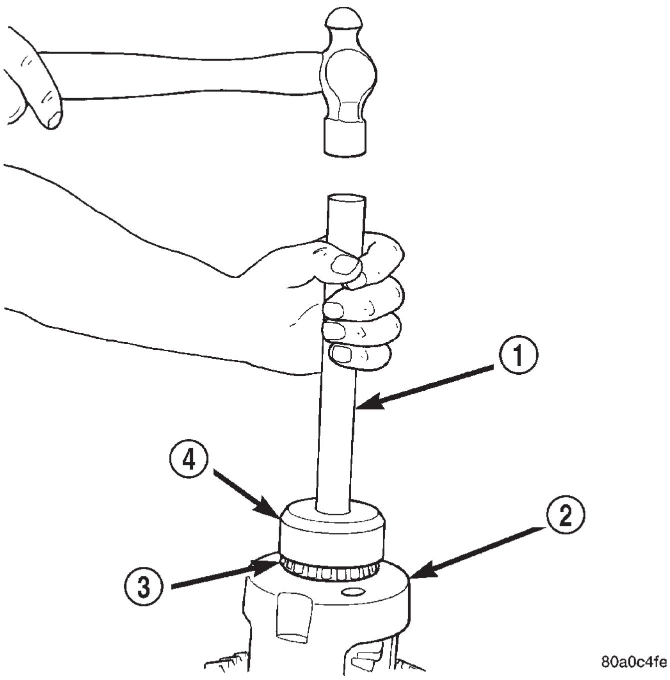


Fig. 70 Install Differential Side Bearings

1 - HANDLE
2 - DIFFERENTIAL
3 - BEARING
4 - INSTALLER

(2) Install differential case into the housing.
(3) Remove support and lower vehicle.

PINION GEAR/RING GEAR

REMOVAL

NOTE: The ring and pinion gears are serviced as a matched set. Never replace one gear without the other matched gear.

(1) Raise and support vehicle.
(2) Mark pinion yoke and propeller shaft for installation reference.
(3) Disconnect propeller shaft from pinion yoke and tie shaft to underbody.
(4) Remove differential from axle housing.
(5) Place differential case in a vise with soft metal jaw.
(6) Remove bolts holding ring gear to differential case.
(7) Drive ring gear from differential case with a rawhide hammer (Fig. 71).

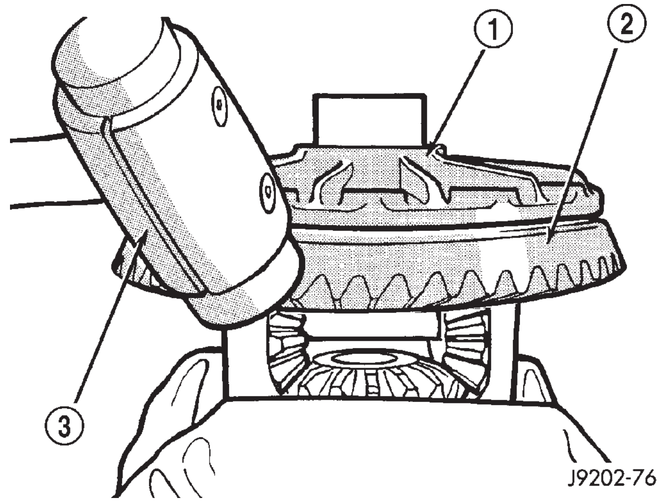


Fig. 71 RING GEAR

1 - DIFFERENTIAL CASE
2 - RING GEAR
3 - RAWHIDE HAMMER

(8) Hold the pinion yoke with Spanner Wrench 6958 and remove the pinion yoke nut and washer (Fig. 72).

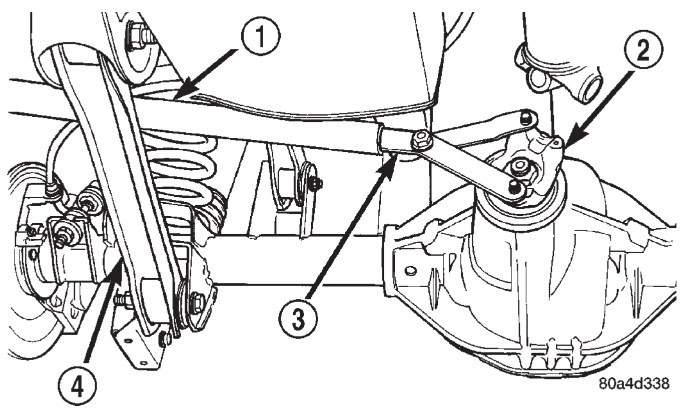


Fig. 72 Pinion Yoke Holder

1 - PIPE
2 - PINION YOKE
3 - SPANNER WRENCH
4 - LOWER CONTROL ARM

PINION GEAR/RING GEAR (Continued)

(9) Remove pinion yoke from pinion shaft with Remover C-452 and Wrench C-3281 (Fig. 73).

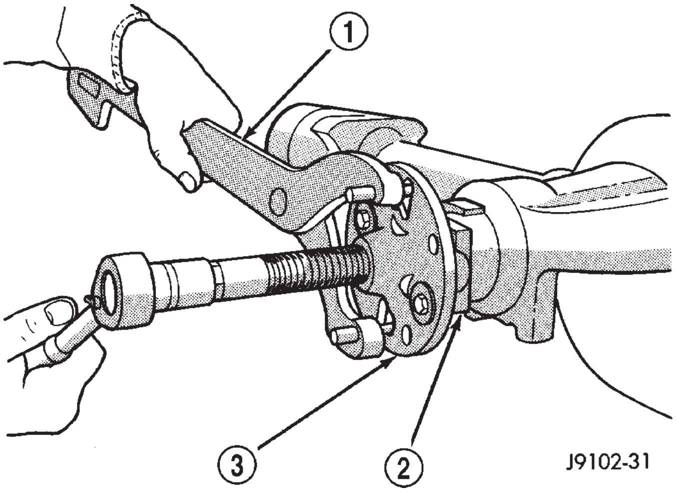


Fig. 73 Pinion Yoke Remover

1 - FLANGE WRENCH
2 - YOKE
3 - YOKE PULLER

(10) Remove pinion gear from housing (Fig. 74).

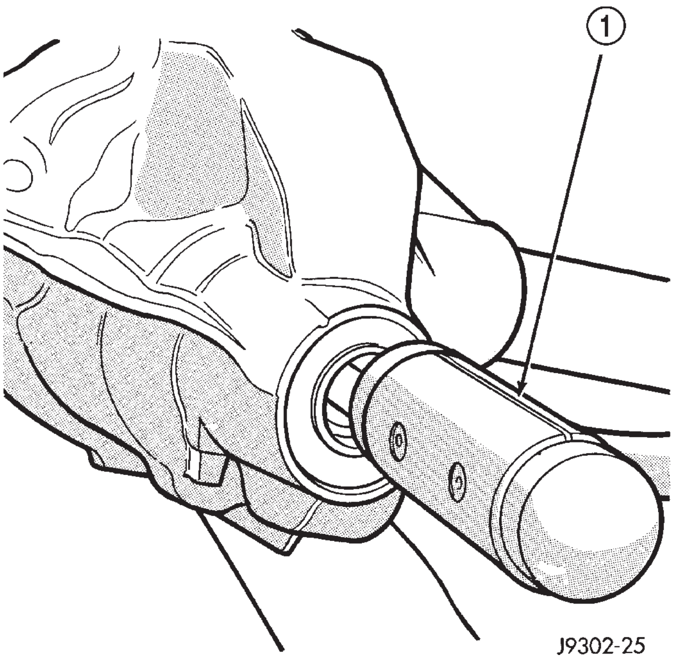


Fig. 74 Pinion Gear

1 - RAWHIDE HAMMER

(11) Remove pinion seal with Remover 7794-A and a slide hammer (Fig. 75).

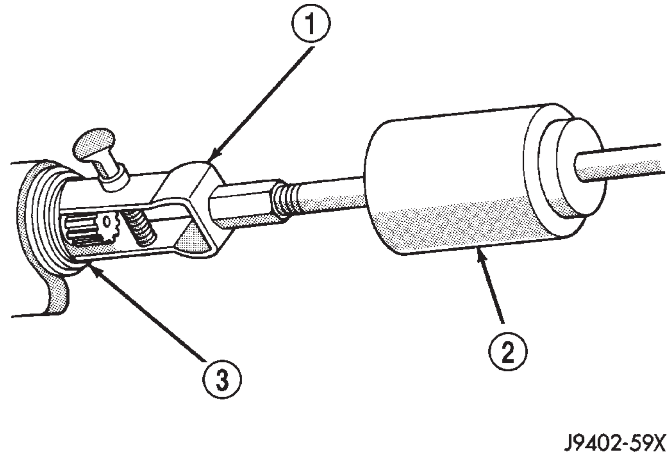


Fig. 75 Pinion Seal Remover

1 - REMOVER
2 - SLIDE HAMMER
3 - PINION SEAL

(12) Remove oil slinger, if equipped, and front pinion bearing.

(13) Remove the front pinion bearing cup with Remover D-103 and Handle C-4171 (Fig. 76).

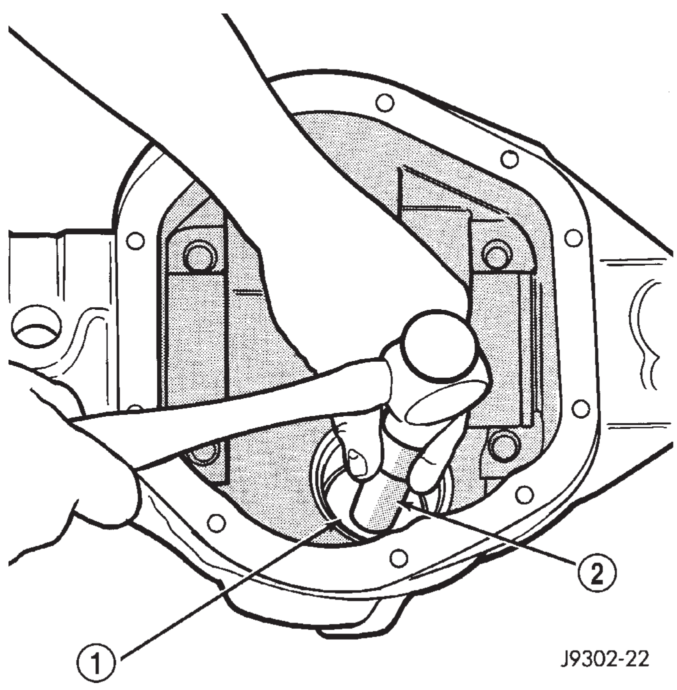


Fig. 76 Front Pinion Bearing Cup

1 - REMOVER
2 - HANDLE

PINION GEAR/RING GEAR (Continued)

(14) Remove rear bearing cup from housing (Fig. 77) with Remover C-4307 and Handle C-4171.

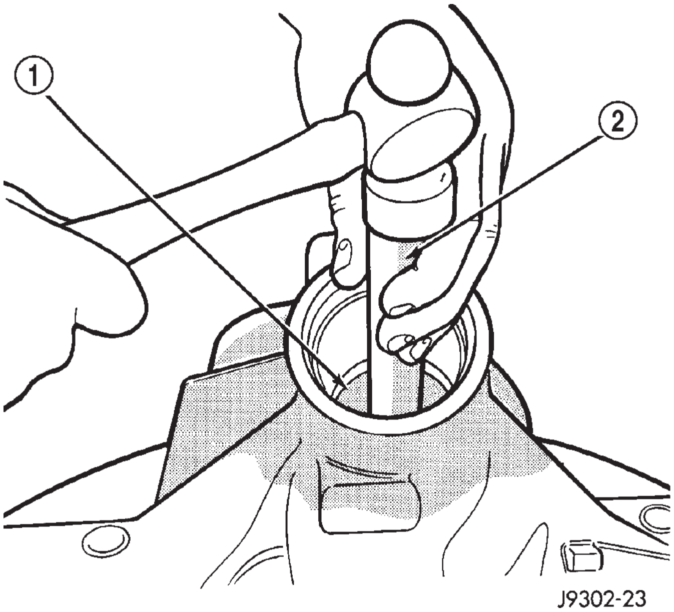


Fig. 77 Rear Pinion Bearing Cup

1 - REMOVER
2 - HANDLE

(15) Remove collapsible preload spacer (Fig. 78).

(16) Remove rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-42 (Fig. 79).

(17) Remove depth shims from the pinion gear shaft and record shim thickness.

INSTALLATION

NOTE: A pinion depth shim/oil slinger is placed between the rear pinion bearing cone and the pinion head to achieve proper ring gear and pinion mesh. If ring gear and pinion are reused, the pinion depth shim/oil slinger should not require replacement. Refer to Adjustment (Pinion Gear Depth) to select the proper thickness shim/oil slinger if ring and pinion gears are replaced.

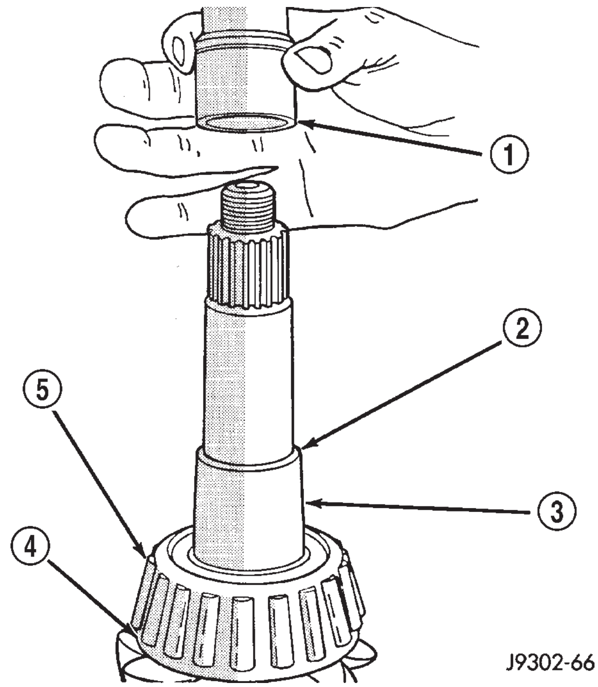


Fig. 78 Collapsible Spacer

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - DEPTH SHIM
5 - REAR BEARING

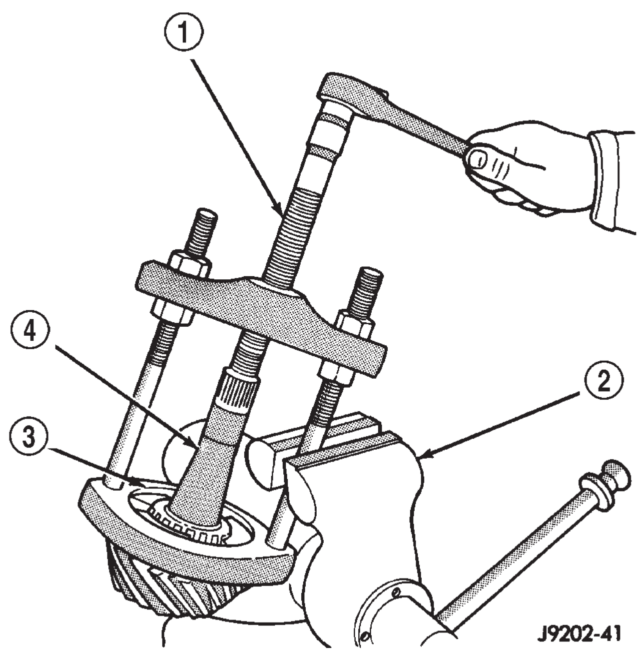


Fig. 79 Rear Pinion Bearing Puller

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - PINION GEAR SHAFT

PINION GEAR/RING GEAR (Continued)

(1) Apply Mopar Door Ease or equivalent lubricant to outside surface of pinion bearing cups.

(2) Install pinion rear bearing cup with Installer C-4308 and Driver Handle C-4171 (Fig. 80) and verify cup is seated.

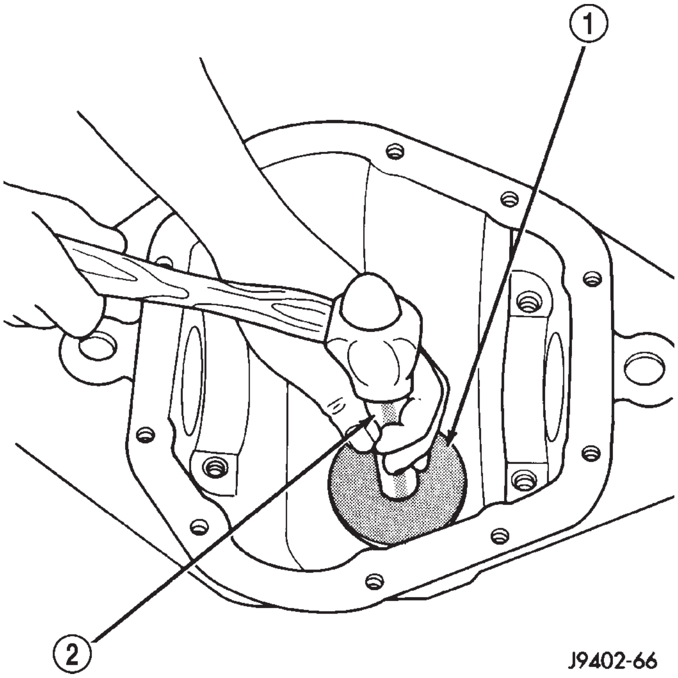


Fig. 80 Rear Pinion Bearing Cup

1 - INSTALLER
2 - HANDLE

(3) Install pinion front bearing cup with Installer D-129 and Handle C-4171 (Fig. 81) and verify cup is seated.

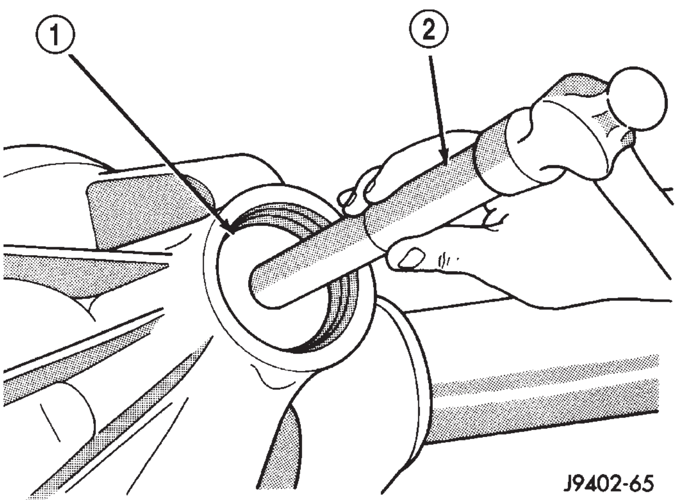


Fig. 81 FRONT PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

(4) Install pinion front bearing and oil slinger, if equipped.

(5) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate (Fig. 82).

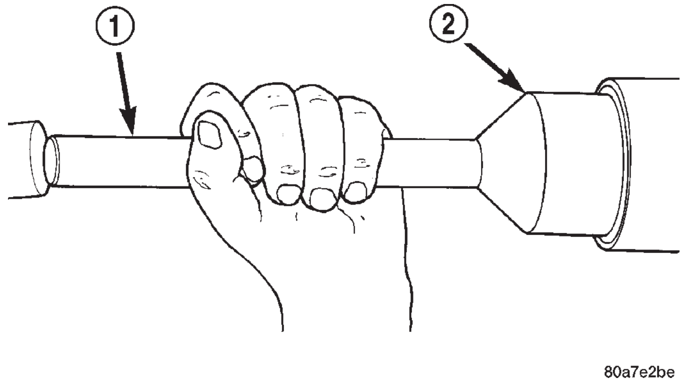


Fig. 82 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(6) Install depth shim on the pinion gear.

(7) Install rear bearing on the pinion gear with Installer 6448 and a press (Fig. 83).

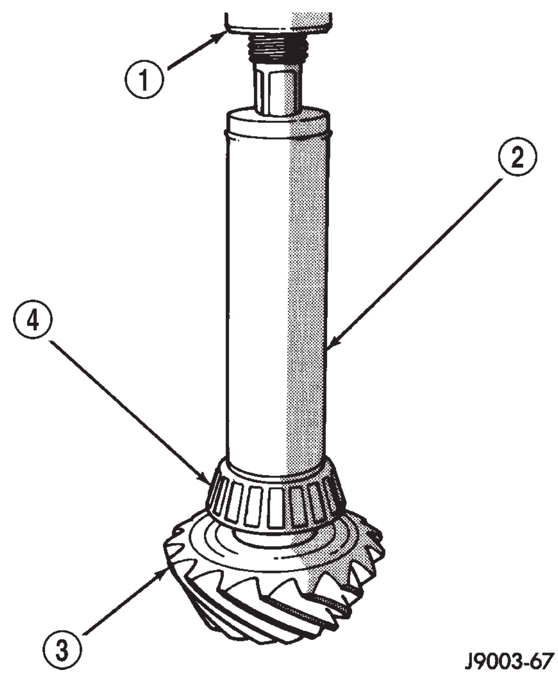


Fig. 83 REAR PINION BEARING

1 - PRESS
2 - INSTALLER
3 - PINION GEAR
4 - PINION BEARING

PINION GEAR/RING GEAR (Continued)

(8) Install a **new** collapsible preload spacer on pinion shaft and install pinion gear in the housing (Fig. 84).

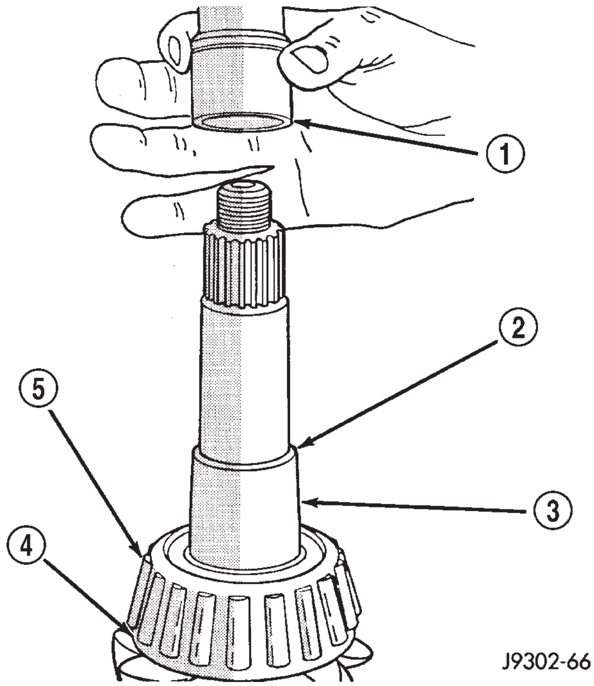


Fig. 84 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - DEPTH SHIM
5 - REAR BEARING

(9) Install yoke with Installer C-3718 and Spanner Wrench 6958 (Fig. 85).

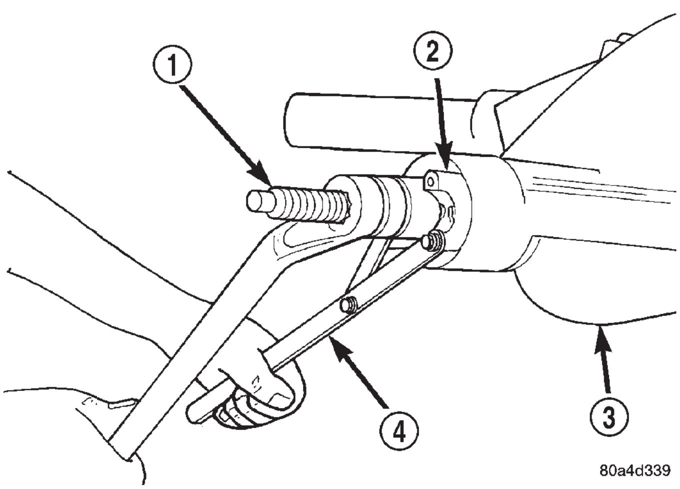


Fig. 85 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - DIFFERENTIAL HOUSING
4 - SPANNER WRENCH

(10) Install the yoke washer and a new nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.

(11) Tighten the nut to 298 N·m (220 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed.

(12) Using Spanner Wrench 6958 and a torque wrench set at 380 N·m (280 ft. lbs.), (Fig. 86) slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 87).

NOTE: If more than 380 N·m (280 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced.

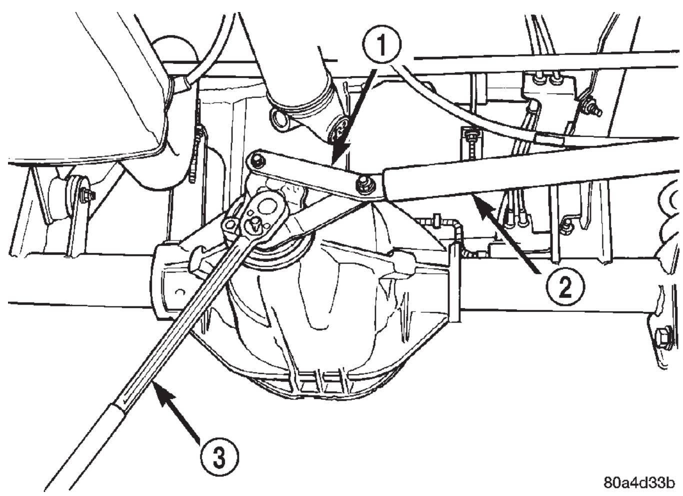


Fig. 86 PINION NUT

1 - SPANNER WRENCH
2 - PIPE
3 - TORQUE WRENCH

PINION GEAR/RING GEAR (Continued)

(13) Check bearing rotating torque with a inch pound torque wrench (Fig. 87). The pinion gear rotating torque should be:

- Original Bearings: 1 to 2.25 N·m (10 to 20 in. lbs.).
- New Bearings: 2.8 to 4 N·m (25 to 35 in. lbs.).

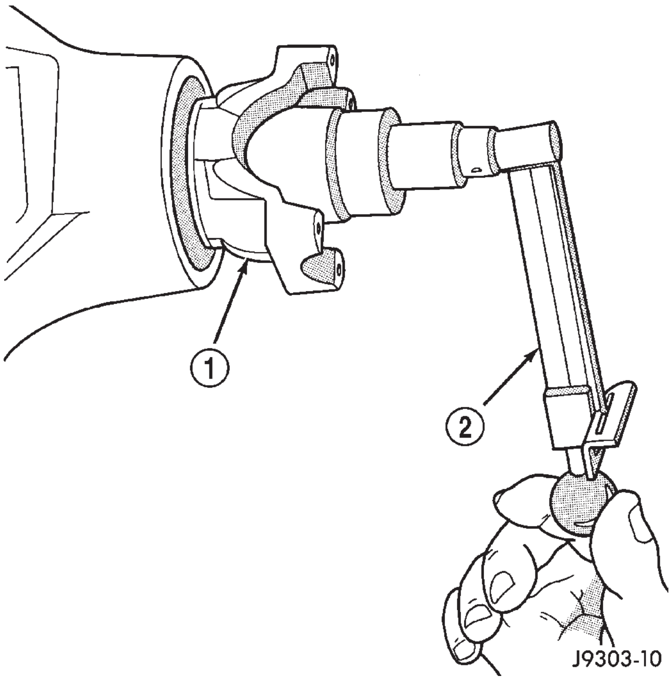


Fig. 87 PINION ROTATING TORQUE

1 - PINION YOKE/COMPANION FLANGE
2 - INCH POUND TORQUE WRENCH

(14) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(15) Invert the differential case in the vise.

(16) Install **new** ring gear bolts and alternately tighten to 129-142 N·m (95-105 ft. lbs.) (Fig. 88).

CAUTION: Never reuse the ring gear bolts. The bolts can fracture causing extensive damage.

NOTE: If equipped with Veri-Lok® differential install oil feed plenum and side bearing.

(17) Install differential in housing.

CAUTION: When installing a Vari-lok® differential (Fig. 89), the oil feed tube must point to the bottom of the housing. If differential is installed with the oil feed tube pointed toward the top, the anti-rotation tabs will be damaged.

(18) Verify differential bearing preload, gear mesh and contact pattern. Refer to Ajustments for procedure.

(19) Install differential cover and fill with gear lubricant.

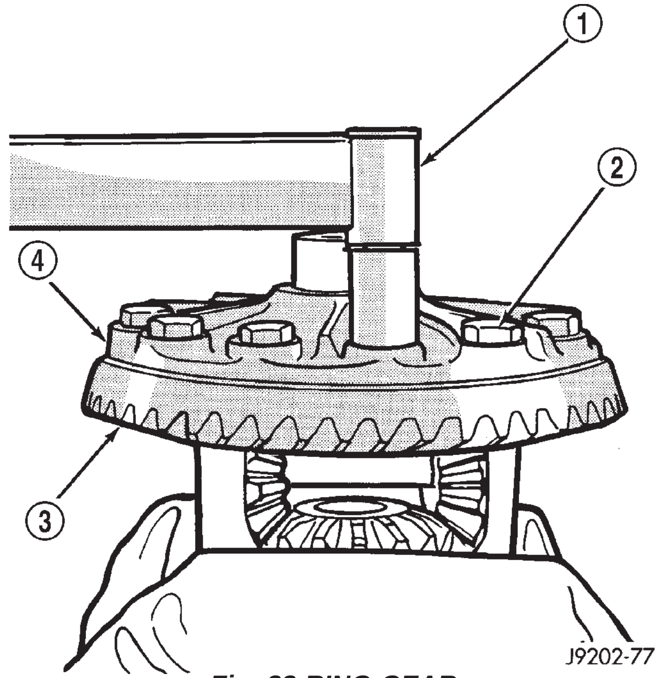


Fig. 88 RING GEAR

1 - TORQUE WRENCH
2 - RING GEAR BOLT
3 - RING GEAR
4 - CASE

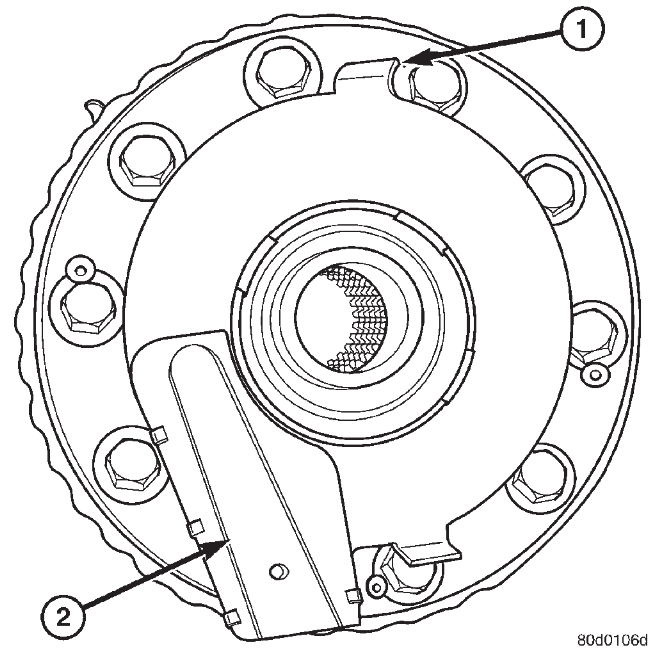


Fig. 89 VARI-LOK

1 - ANTI-ROTATION TAB
2 - OIL FEED TUBE

(20) Install the propeller shaft with the reference marks aligned.

(21) Remove supports and lower vehicle.

BRAKES

TABLE OF CONTENTS

BRAKES - BASE

TABLE OF CONTENTS

BRAKES - BASE

DESCRIPTION

Dual piston disc brake calipers are used on the front. Single piston disc brake calipers are used on the rear. Ventilated disc brake rotors are used on the front and solid rotors are used on the rear.

Power brake assist is supplied by a vacuum operated, dual diaphragm power brake booster. The master cylinder used for all applications has an aluminum body and nylon reservoir with single filler cap. A fluid level indicator is mounted to the side of the reservoir.

The braking force of the rear wheels is controlled by electronic brake distribution (EBD). The EBD functions like a rear proportioning valve. The EBD system uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves located in the HCU.

Factory installed brake linings on all models consists of organic base material combined with metallic particles.

DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, rear park brake drums/rotors, front brake rotors, brake lines, master cylinder, booster, HCU and parking brake shoes.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, electrical or vacuum operated component.

The first diagnosis step is the preliminary check.

PRELIMINARY BRAKE CHECK

(1) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.

BRAKES - BASE (Continued)

(2) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.

(3) Inspect brake fluid level and condition. Note that the brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**

(a) If fluid level is abnormally low, look for evidence of leaks at calipers, brake lines, master cylinder, and HCU.

(b) If fluid appears contaminated, drain out a sample to examine. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals, cups, hoses, master cylinder, and HCU will also have to be replaced after flushing. Use clean brake fluid to flush the system.

(4) Check parking brake operation. Verify free movement and full release of cables and lever. Also note if vehicle was being operated with parking brake partially applied.

(5) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(6) Check booster vacuum check valve and hose.

(7) If components checked appear OK, road test the vehicle.

ROAD TESTING

(1) If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

(2) Check brake pedal response with transmission in neutral and engine running. Pedal should remain firm under constant foot pressure.

(3) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.

(4) Attempt to stop the vehicle with the parking brake only (do not exceed 25 mph) and note grab, drag, noise, etc.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper. If leakage is severe, fluid will be evident at or around the leaking component.

Internal leakage (seal by-pass) in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

An internal leak in the ABS system may also be the problem with no visual fluid leak.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, the most likely causes are worn linings, rotors, or calipers are not sliding on the slide pins. The proper course of action is to inspect and replace all worn component.

SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However substandard brake hoses can cause a spongy pedal. The proper course of action is to bleed the system, and replace substandard quality brake hoses if suspected.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster, check valve, check valve seal/grommet or vacuum leak could also cause a hard pedal or high pedal effort.

PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation. Other causes are loose wheel bearings or calipers and worn, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS activation.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake release. Drag can be minor or severe enough to overheat the linings, rotors and park brake drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and park brake drums from the overheat-cool down process. In most cases, the rotors, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

BRAKES - BASE (Continued)

Common causes of brake drag are:
- Parking brake partially applied.
- Loose/worn wheel bearing.
- Seized caliper.
- Caliper binding.
- Loose caliper mounting.
- Mis-assembled components.
- Damaged brake lines.

If brake drag occurs at the front, rear or all wheels, the problem may be related to a blocked master cylinder return port, faulty power booster (binds-does not release) or the ABS system.

BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

BRAKE PULL

Front brake pull condition could result from:
- Contaminated lining in one caliper
- Seized caliper piston
- Binding caliper
- Loose caliper
- Rusty caliper slide surfaces
- Improper brake shoes
- Damaged rotor
- Wheel alignment.
- Tire pressure.

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE DRAG OR PULL

Rear drag or pull may be caused by improperly adjusted park brake shoes or seized parking brake cables, contaminated lining, bent or binding shoes or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or ABS system could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and or replacement will be necessary.

BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

NOTE: Propshaft angle can also cause vibration/ shudder.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. Tire damage such as a severe bruise, cut, ply separation, low air pressure can cause pull and vibration.

BRAKE NOISES

Some brake noise is common on some disc brakes during the first few stops after a vehicle has been parked overnight or stored. This is primarily due to the formation of trace corrosion (light rust) on metal surfaces. This light corrosion is typically cleared from the metal surfaces after a few brake applications causing the noise to subside.

BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors may become so scored that replacement is necessary.

BRAKES - BASE (Continued)

NOTE: The front outer brake shoes are equipped with a wear indicator. The indicator will produce an audible noise when it contacts the rotor surface.

BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components.

STANDARD PROCEDURE

STANDARD PROCEDURE - MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

(1) Fill the master cylinder reservoir with brake fluid.

(2) If calipers are overhauled, open all caliper bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

(3) Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 1). Be sure end of bleed hose is immersed in fluid.

(4) Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

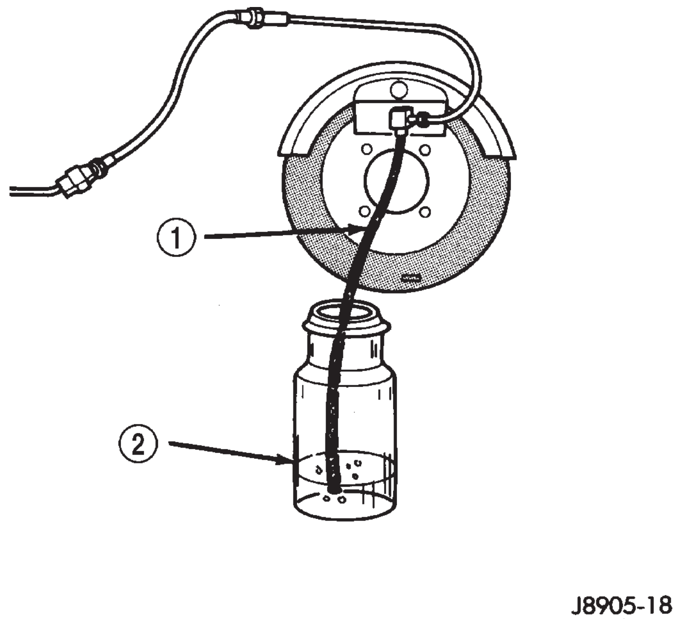


Fig. 1 Bleed Hose Setup

1 - BLEED HOSE
2 - FLUID CONTAINER PARTIALLY FILLED WITH FLUID

STANDARD PROCEDURE - PRESSURE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 51-67 kPa (15-20 psi) is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

BRAKES - BASE (Continued)

SPECIFICATIONS

BRAKE COMPONENTS

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Front Disc Brake Caliper Type	Floating
Front Disc Brake Caliper Piston	48 mm (1.889 in.)
Front Disc Brake Rotor Type	Ventilated
Front Disc Brake Rotor Diameter	305 mm (12 in.)
Front Disc Brake Rotor Max. Runout	0.05 mm (0.002 in.)
Front Disc Brake Rotor Max. Thickness Variation	0.0127 mm (0.0005 in.)
Front Disc Brake Rotor Min. Thickness	24.5 mm (0.9646 in.)
Rear Disc Brake Caliper Type	Floating
Rear Disc Brake Caliper Piston	48 mm (1.889 in.)
Rear Disc Brake Rotor Type Diameter	Solid
Rear Disc Brake Rotor Diameter	305 mm (12 in.)
Rear Disc Brake Rotor Max. Runout	0.76 mm (0.003 in.)
Rear Disc Brake Rotor Max. Thickness Variation	0.0127 mm (0.0005 in.)
Rear Disc Brake Rotor Min. Thickness	8.5 mm (0.335 in.)
Rear Disc Brake Rotor Drum Max. Diameter	196 mm (7.7166 in.)
Brake Booster Type	Dual Diaphragm

TORQUE CHART

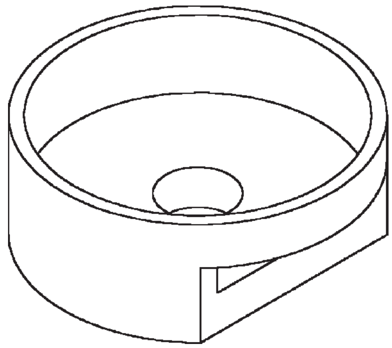
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Pedal Support Bolt	23-24	17-25	—
Brake Pedal Pivot Nut	27-35	20-26	—
Brake Pedal Bracket Adjustable pedals	28	21	250
Brake Pedal Bracket To Dash	12	9	105
Brake Booster Mounting Nuts	39	29	—
Master Cylinder Mounting Nuts	25	18	—
Master Cylinder Primary Brake Line	16	—	144
Master Cylinder Secondary Brake Line	16	—	144
Front Caliper Slide Pins	29-41	21-30	—
Front Caliper Anchor Bolts	90-115	66-85	—
Front Caliper Brake Hose Banjo Bolt	31	23	—
Front Caliper Bleed Screw	16	—	144
Rear Caliper Slide Pins	29-41	21-30	—
Rear Caliper Anchor Bolts	90-115	66-85	—
Rear Caliper Brake Hose Banjo Bolt	31	23	—
Rear Caliper Bleed Screw	16	—	144

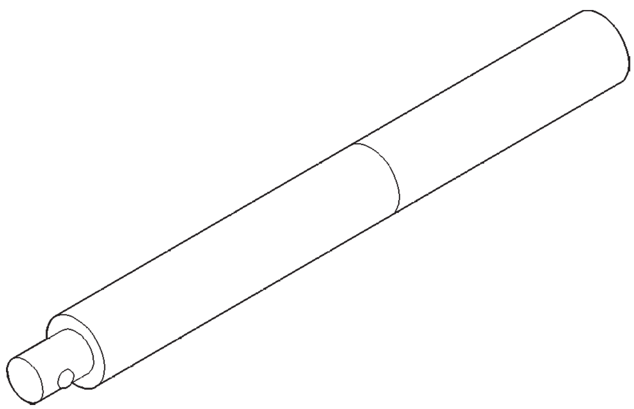
BRAKES - BASE (Continued)

SPECIAL TOOLS

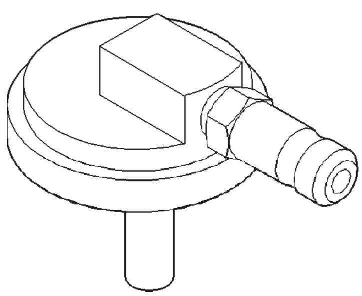
BASE BRAKES



Installer Caliper Dust Boot 8280



Handle C-4171



Adapter Pressure Bleeder 6921

BRAKE FLUID LEVEL SWITCH

REMOVAL

(1) Remove the wire connector from the fluid level sensor.

(2) From the same side of the master cylinder reservoir release the sensor locking taps with a small screw driver.

(3) Pull the sensor out of the reservoir from the connector side of the sensor.

INSTALLATION

(1) Install the sensor with a new o-ring into the reservoir until the locking tabs are engaged.

(2) Install the wire connector to the fluid level sensor.

RED BRAKE WARN INDICATOR SWITCH

DESCRIPTION

A red warning lamp is used for the service brake portion of the hydraulic system. The lamp is located in the instrument cluster.

OPERATION

The lamp is turned on momentarily when the ignition switch is turn to the on position. This is a self test to verify the lamp is operational.

The red warning light alerts the driver if the fluid level is low or the parking brakes are applied. A red warning lamp with an amber warning lamp may indicate a electronic brake distribution fault.

DIAGNOSIS AND TESTING - RED BRAKE WARNING LAMP

The red warning lamp illuminates when the parking brake is applied or when the fluid level in the master cylinder is low. It will also illuminate at start up as part of a bulb check.

If the light comes on, first verify that the parking brakes are fully released. Then check pedal action and fluid level. If a problem is confirmed, inspect the brake hydraulic system for leaks.

A red warning lamp with a amber warning lamp may indicate a electronic brake distribution fault.

ADJUSTABLE PEDAL SWITCH

REMOVAL

(1) Remove the steering column opening cover (Fig. 2)(Refer to 23 - BODY/INSTRUMENT PANEL/ STEERING COLUMN OPENING COVER - REMOVAL).

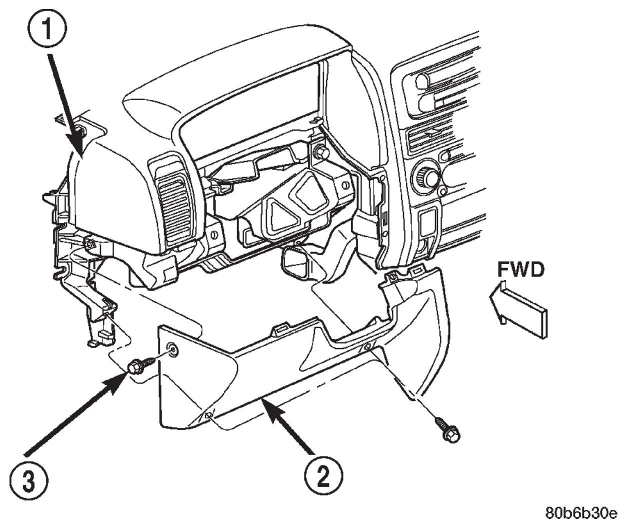


Fig. 2 STEERING COLUMN OPENING COVER REMOVAL/INSTALL

1 - INSTRUMENT PANEL TOP PAD
2 - STEERING COLUMN OPENING COVER
3 - SCREW (3)

(2) Disconnect the electrical connector from the adjustable pedal switch.

(3) Remove the switch from the steering column opening cover by squeezing the retaining clips together and pushing the switch outwards (Fig. 3).

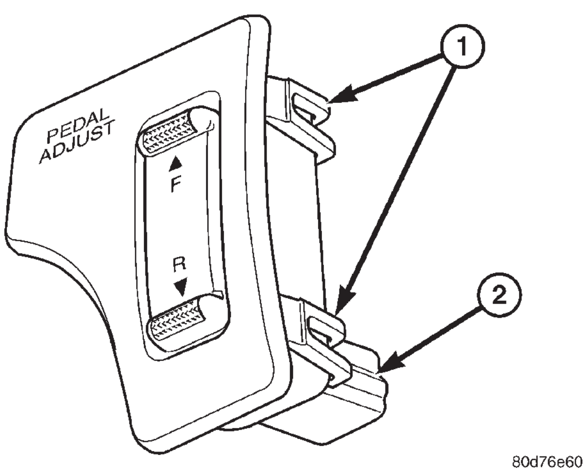


Fig. 3 ADJUSTABLE PEDAL SWITCH

1 - RETAINING CLIPS
2 - ELECTRICAL CONNECTION

INSTALLATION

(1) Install the switch to the steering column opening cover by pushing the switch inwards seating the retaining clips to the steering column opening cover (Fig. 3).

(2) Reconnect the electrical connector to the adjustable pedal switch.

(3) Install the steering column opening cover (Fig. 2)(Refer to 23 - BODY/INSTRUMENT PANEL/ STEERING COLUMN OPENING COVER - INSTALLATION).

BRAKE LINES

DESCRIPTION

Flexible rubber hose is used at both front brakes, rear brakes and at the rear axle junction block. Double walled steel tubing is used. Double inverted style and ISO style flares are used on the brake lines.

DIAGNOSIS AND TESTING - BRAKE HOSES AND LINES

Flexible rubber hose is used at both front and rear brakes and at the rear axle junction block. Inspect the hoses whenever the brake system is serviced, at every engine oil change, or whenever the vehicle is in for service.

Inspect the hoses for surface cracking, scuffing, or worn spots. Replace any brake hose immediately if the fabric casing of the hose is exposed due to cracks or abrasions.

Also check brake hose installation. Faulty installation can result in kinked, twisted hoses, or contact with the wheels and tires or other chassis components. All of these conditions can lead to scuffing, cracking and eventual failure.

The steel brake lines should be inspected periodically for evidence of corrosion, twists, kinks, leaks, or other damage. Heavily corroded lines will eventually rust through causing leaks. In any case, corroded or damaged brake lines should be replaced.

Factory replacement brake lines and hoses are recommended to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that brake line and hose mating surfaces are clean and free from nicks and burrs. Also remember that right and left brake hoses are not interchangeable.

Use new copper gaskets at all caliper connections. Be sure brake line connections are properly made (not cross threaded) and tightened to recommended torque.

BRAKE LINES (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - DOUBLE INVERTED FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

Special bending tools are needed to avoid kinking or twisting of metal brake tubes. Special flaring tools are needed to make a double inverted flare or ISO flare.

(1) Cut off damaged tube with Tubing Cutter.

(2) Ream cut edges of tubing to ensure proper flare.

(3) Install replacement tube nut on the tube.

(4) Insert tube in flaring tool.

(5) Place gauge form over the end of the tube.

(6) Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.

(7) Tighten the tool bar on the tube

(8) Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc (Fig. 4).

(9) Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.

(10) Remove the plug gauge and complete the inverted flare.

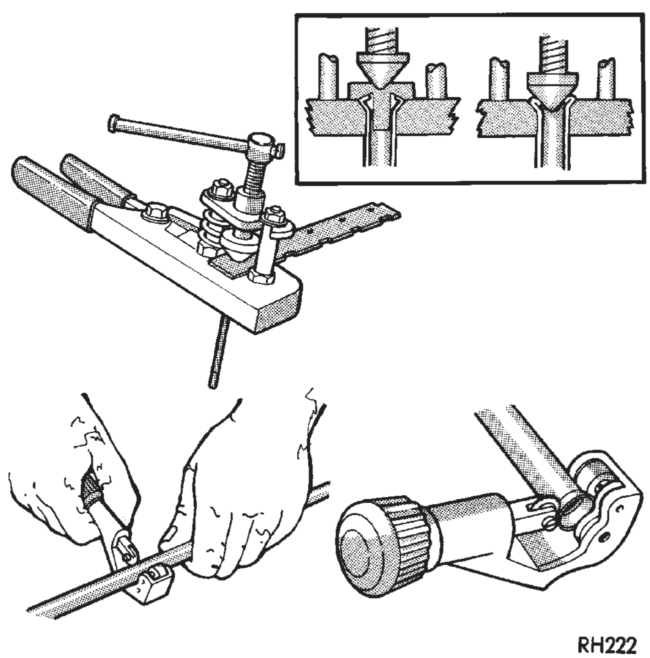


Fig. 4 Inverted

STANDARD PROCEDURE - ISO FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

Special bending tools are needed to avoid kinking or twisting of metal brake tubes. Special flaring tools are needed to make a double inverted flare or ISO flare.

To make a ISO flare use Snap-On® Flaring Tool TFM-428 or equivalent.

(1) Cut off damaged tube with Tubing Cutter.

(2) Remove any burrs from the inside of the tube.

(3) Install tube nut on the tube.

(4) Position the tube in the flaring tool flush with the top of the tool bar (Fig. 5). Then tighten the tool bar on the tube.

(5) Install the correct size adaptor on the flaring tool yoke screw.

(6) Lubricate the adaptor.

(7) Align the adaptor and yoke screw over the tube (Fig. 5).

(8) Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

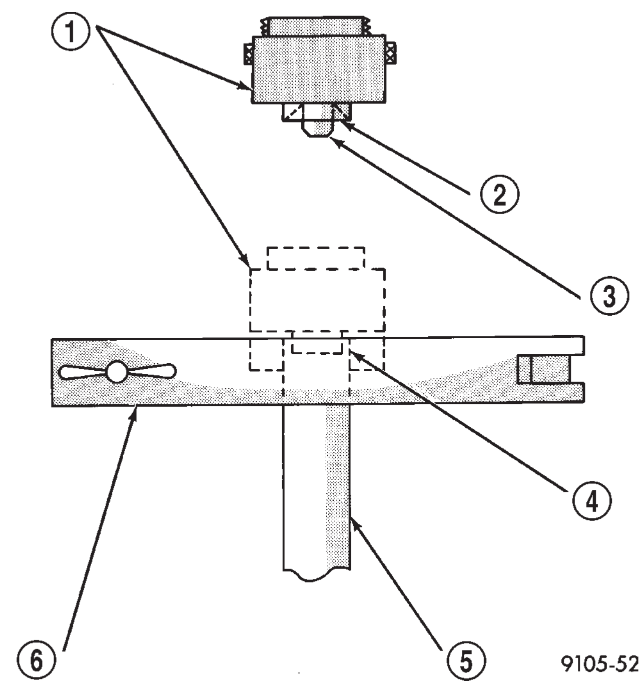


Fig. 5 ISO Flaring

1 - ADAPTER
2 - LUBRICATE HERE
3 - PILOT
4 - FLUSH WITH BAR
5 - TUBING
6 - BAR ASSEMBLY

BRAKE PADS / SHOES

DESCRIPTION

DESCRIPTION - FRONT DISC BRAKE SHOES

The calipers are twin piston type. The calipers are free to slide laterally on the anchor, this allows continuous compensation for lining wear.

DESCRIPTION - REAR DISC BRAKE SHOES

The rear disc brakes consist of single piston floating-type calipers and solid rotors. The rear caliper is mounted on an anchor attached to an adapter attached the rear axle tube flange. The anchors are secured to the adapters with mounting bolts. The disc brake rotor splash shield is part of the adaptor. The disc brake rotor has a built in brake drum used for the parking brakes (Fig. 6). The parking brake shoes are mounted to the adaptor.

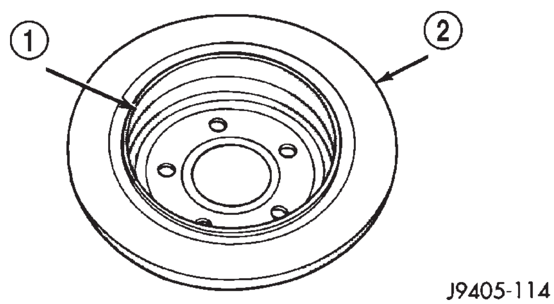


Fig. 6 Rear Disc Brake Rotor

1 - PARKING BRAKE DRUM SURFACE
2 - REAR DISC BRAKE ROTOR

OPERATION

OPERATION - FRONT DISC BRAKE SHOES

When the brakes are applied fluid pressure is exerted against the caliper pistons. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper pistons and within the caliper bores will be equal (Fig. 7).

Fluid pressure applied to the pistons is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bores forces the caliper to slide inward on the slide pins. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

Fluid pressure acting simultaneously on the pistons and caliper to produces a strong clamping action. When sufficient force is applied, friction will stop the rotors from turning and bring the vehicle to a stop.

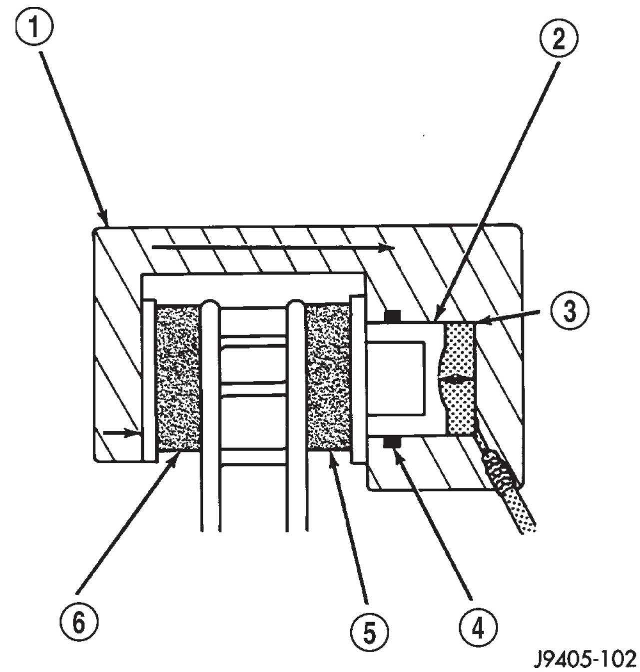


Fig. 7 Brake Caliper Operation

1 - CALIPER
2 - PISTON
3 - PISTON BORE
4 - SEAL
5 - INBOARD SHOE
6 - OUTBOARD SHOE

Application and release of the brake pedal generates only a very slight movement of the caliper and pistons. Upon release of the pedal, the caliper and pistons return to a rest position. The brake shoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seals control the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seals are deflected outward by fluid pressure and piston movement (Fig. 8). When the brakes (and fluid pressure) are released, the seals relax and retract the pistons.

The front outboard brake shoes have wear indicators.

OPERATION - REAR DISC BRAKE SHOES

When the brakes are applied fluid pressure is exerted against the caliper pistons. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper pistons and within the caliper bores will be equal (Fig. 7).

Fluid pressure applied to the pistons is transmitted directly to the inboard brake shoe. This forces the

BRAKE PADS / SHOES (Continued)

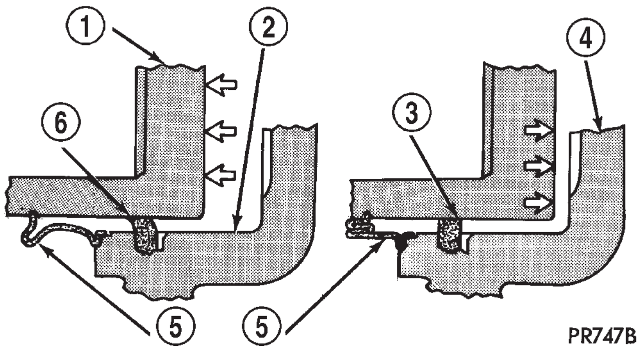


Fig. 8 Lining Wear Compensation By Piston Seal

1 - PISTON
2 - CYLINDER BORE
3 - PISTON SEAL BRAKE PRESSURE OFF
4 - CALIPER HOUSING
5 - DUST BOOT
6 - PISTON SEAL BRAKE PRESSURE ON

shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bores forces the caliper to slide inward on the slide pins. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

Fluid pressure acting simultaneously on the pistons and caliper to produces a strong clamping action. When sufficient force is applied, friction will stop the rotors from turning and bring the vehicle to a stop.

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The caliper piston seals control the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seals are deflected outward by fluid pressure and piston movement (Fig. 8). When the brakes (and fluid pressure) are released, the seals relax and retract the pistons.

The front outboard brake shoes have wear indicators.

REMOVAL

REMOVAL- FRONT DISC BRAKE SHOES

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Drain small amount of fluid from master cylinder brake reservoir with **clean** suction gun.

(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 9).

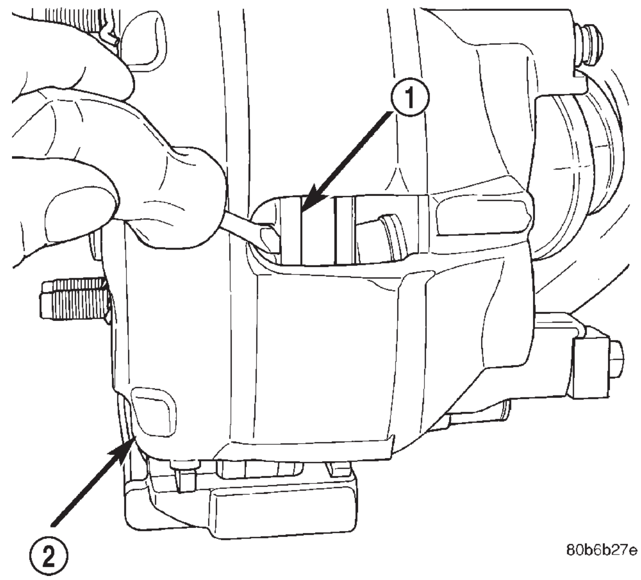


Fig. 9 Bottoming Caliper Piston

1 - ROTOR
2 - CALIPER

(5) Remove the caliper support spring by prying the spring out of the caliper (Fig. 10).

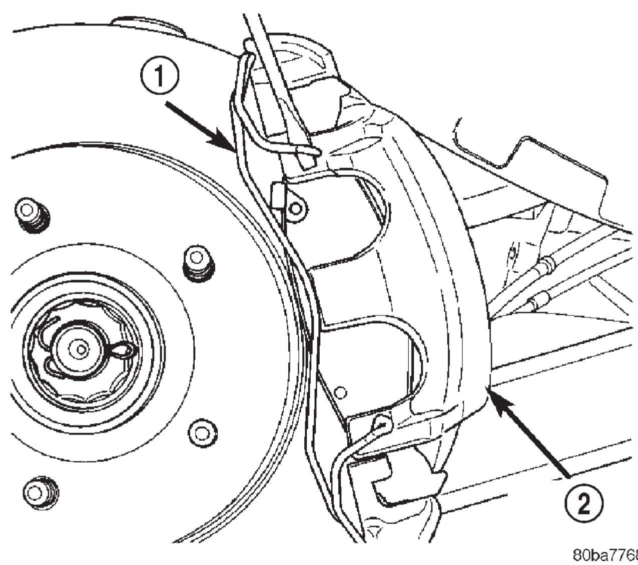


Fig. 10 Caliper Support Spring

1 - SUPPORT SPRING
2 - CALIPER

(6) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 11).

(7) Remove caliper from the anchor.

BRAKE PADS / SHOES (Continued)

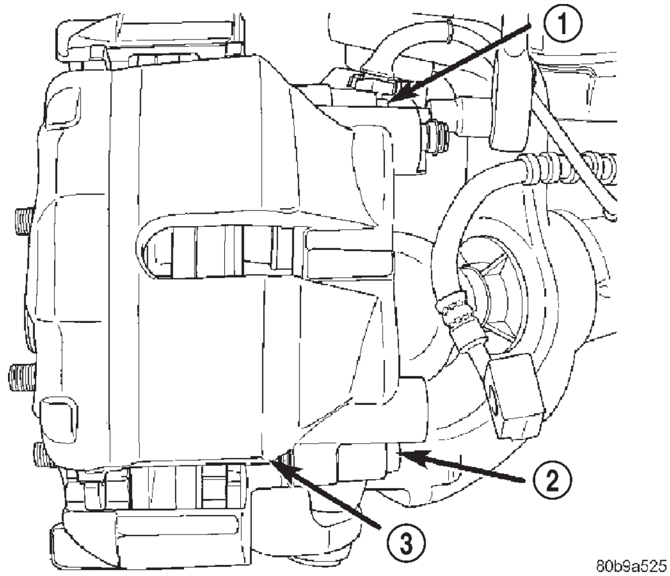


Fig. 11 Caliper Slide

1 - SLIDE PIN
2 - SLIDE PIN
3 - CALIPER

(8) Secure caliper to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**

(9) Remove the inboard brake shoe from the caliper (Fig. 12).

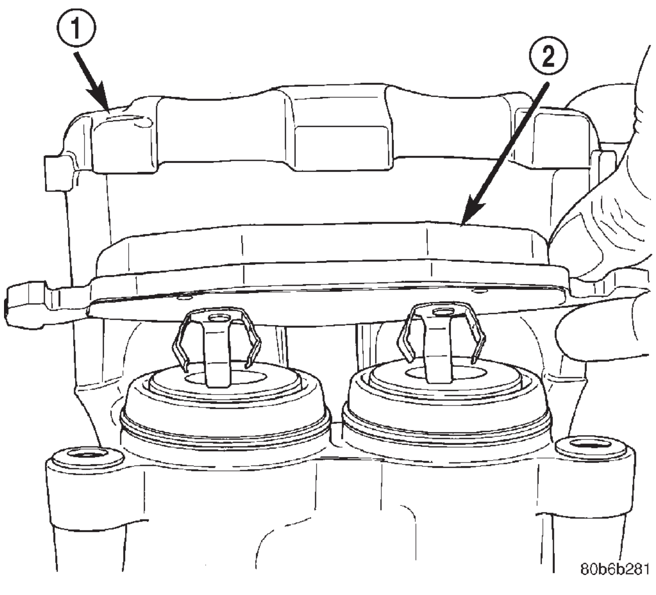


Fig. 12 Inboard Brake Shoe

1 - CALIPER
2 - INBOARD SHOE

(10) Remove the outboard brake shoe (Fig. 13) from the caliper anchor.

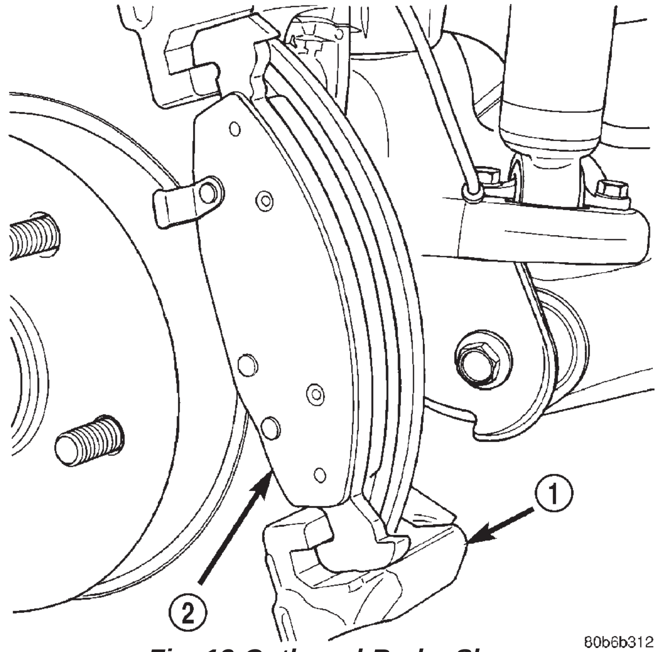


Fig. 13 Outboard Brake Shoe

1 - CALIPER ANCHOR
2 - OUTBOARD BRAKE SHOE

REMOVAL - REAR DISC BRAKE SHOES

(1) Raise and support vehicle.

(2) Remove rear wheel and tire assembly.

(3) Drain small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.

(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 14).

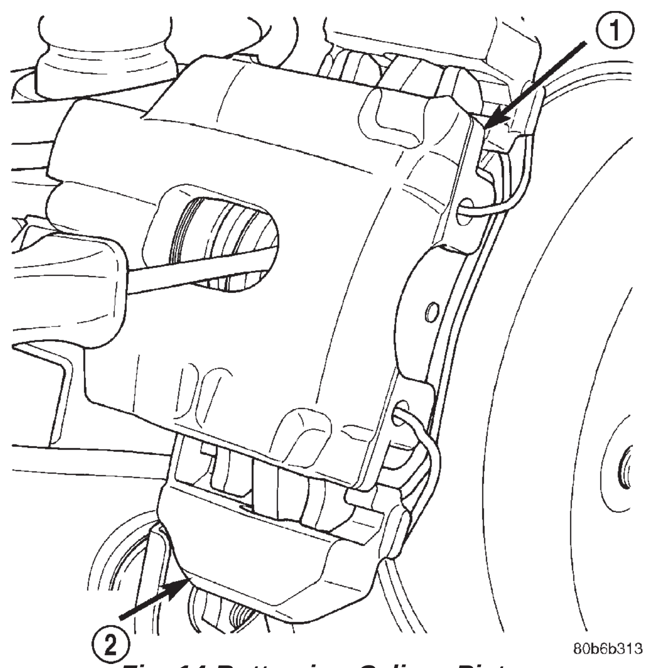


Fig. 14 Bottoming Caliper Piston

1 - CALIPER
2 - CALIPER ANCHOR

BRAKE PADS / SHOES (Continued)

(5) Remove the caliper support spring by prying the spring out of the caliper (Fig. 15).

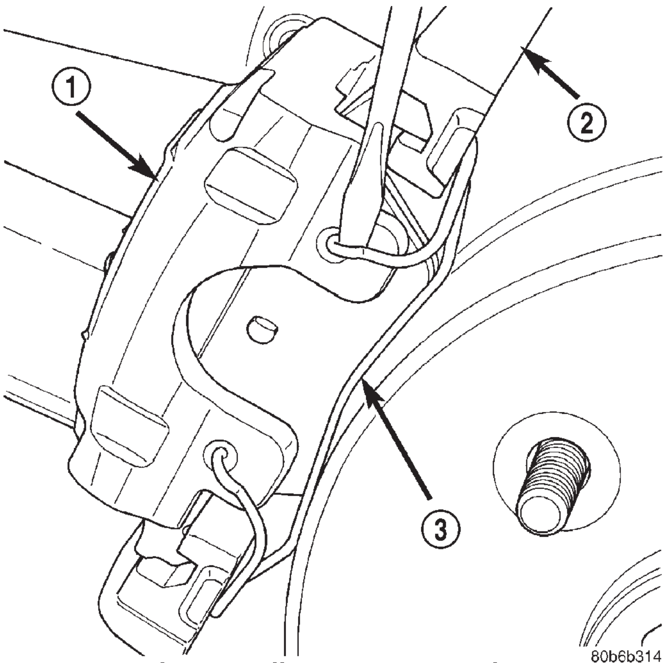


Fig. 15 Caliper Support Spring

1 - CALIPER
2 - ANCHOR
3 - SUPPORT SPRING

(6) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 16).

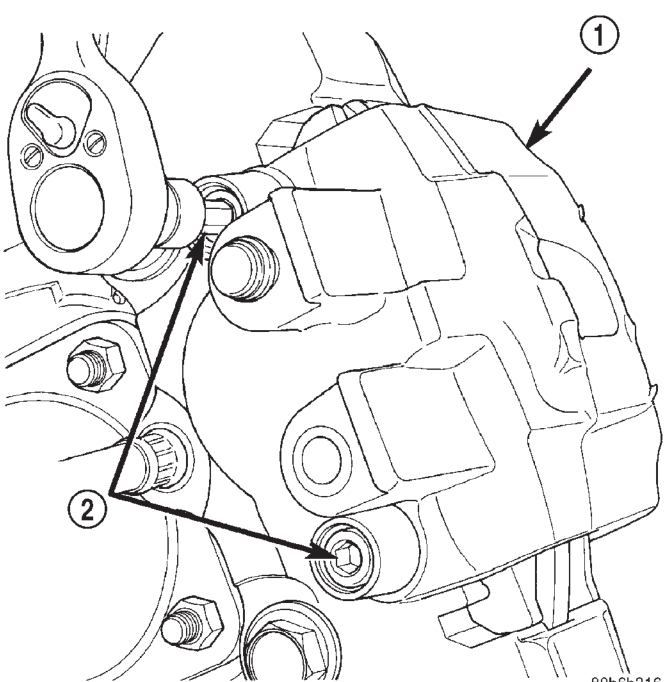


Fig. 16 Caliper Slide Pins

1 - CALIPER
2 - SLIDE PINS

(7) Remove caliper from the anchor.

(8) Secure caliper to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**

(9) Remove the inboard brake shoe from the caliper (Fig. 17).

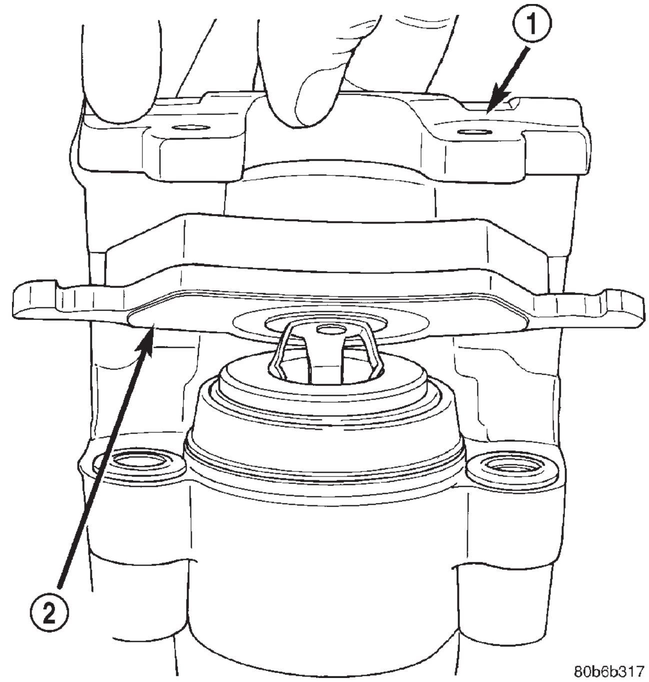


Fig. 17 Inboard Brake Shoe

1 - CALIPER
2 - INBOARD SHOE

(10) Remove outboard brake shoe (Fig. 18) from the caliper anchor.

INSTALLATION

INSTALLATION - FRONT DISC BRAKE SHOES

(1) Install the inboard brake shoe onto the caliper (Fig. 12).

(2) Install the outboard shoe onto the caliper anchor (Fig. 13).

(3) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the brake shoes.

(4) Install caliper on the caliper anchor.

(5) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).

(6) Install the caliper slide pin bushing caps.

(7) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.

BRAKE PADS / SHOES (Continued)

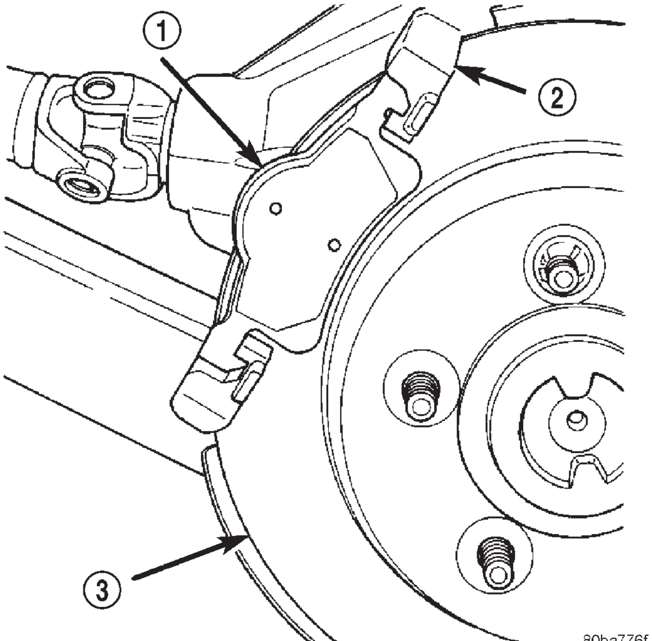


Fig. 18 Outboard Brake Shoe

1 - OUTBOARD BRAKE SHOE
2 - CALIPER ANCHOR
3 - ROTOR

(8) Install wheel and tire assembly.
(9) Remove support and lower vehicle.
(10) Pump brake pedal until caliper pistons and brake shoes are seated and a firm brake pedal is obtained.
(11) Fill brake fluid.

INSTALLATION - REAR DISC BRAKE SHOES

(1) Install the inboard brake shoe onto the caliper (Fig. 17).
(2) Install the outboard brake shoe onto the caliper anchor (Fig. 18).
(3) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the brake shoes.
(4) Install caliper on the anchor.
(5) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).
(6) Install the caliper slide pin bushing caps.
(7) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.
(8) Install wheel and tire assembly.
(9) Remove support and lower vehicle.
(10) Pump brake pedal until caliper piston and brake shoes are seated and a firm brake pedal is obtained.
(11) Fill brake fluid level if necessary.

DISC BRAKE CALIPERS

REMOVAL

REMOVAL - FRONT DISC BRAKE CALIPER

(1) Raise and support vehicle.
(2) Remove front wheel and tire assembly.
(3) Drain small amount of fluid from master cylinder brake reservoir with **clean** suction gun.
(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 19).

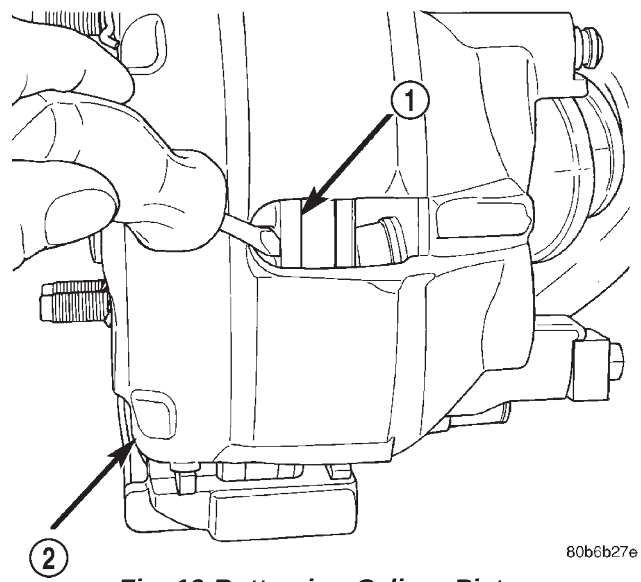


Fig. 19 Bottoming Caliper Piston

1 - ROTOR
2 - CALIPER

DISC BRAKE CALIPERS (Continued)

(5) Remove brake hose banjo bolt and gasket washers. Discard gasket washers.

(6) Remove the caliper support spring by prying the spring out of the caliper (Fig. 20).

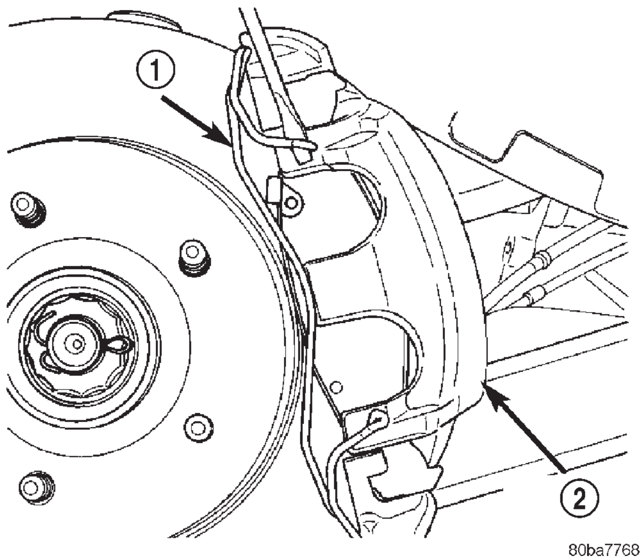


Fig. 20 Caliper Support Spring

1 - SUPPORT SPRING
2 - CALIPER

(7) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 21).

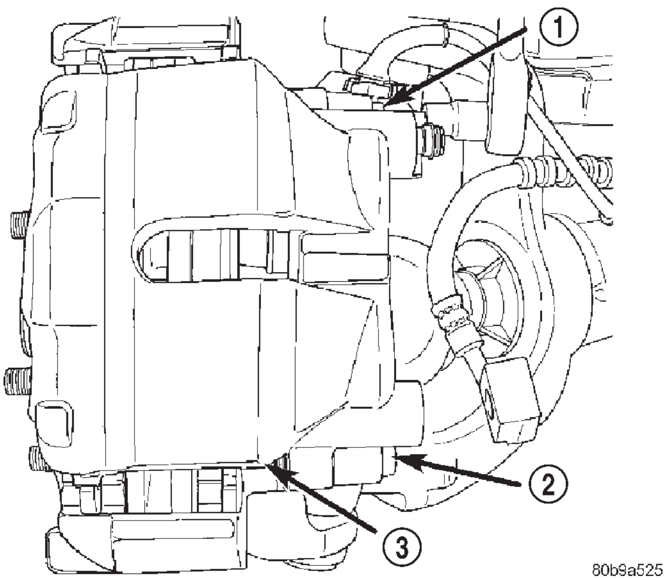


Fig. 21 Slide Pins

1 - SLIDE PIN
2 - SLIDE PIN
3 - CALIPER

(8) Remove caliper from the anchor.

(9) Remove the inboard brake shoe (Fig. 22).

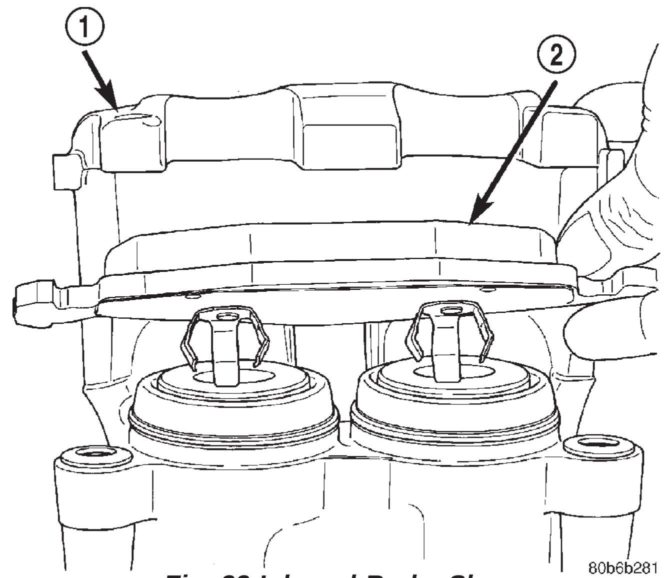


Fig. 22 Inboard Brake Shoe

1 - CALIPER
2 - INBOARD SHOE

REMOVAL - REAR DISC BRAKE CALIPER

(1) Raise and support vehicle.

(2) Remove rear wheel and tire assembly.

(3) Drain small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.

(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 23).

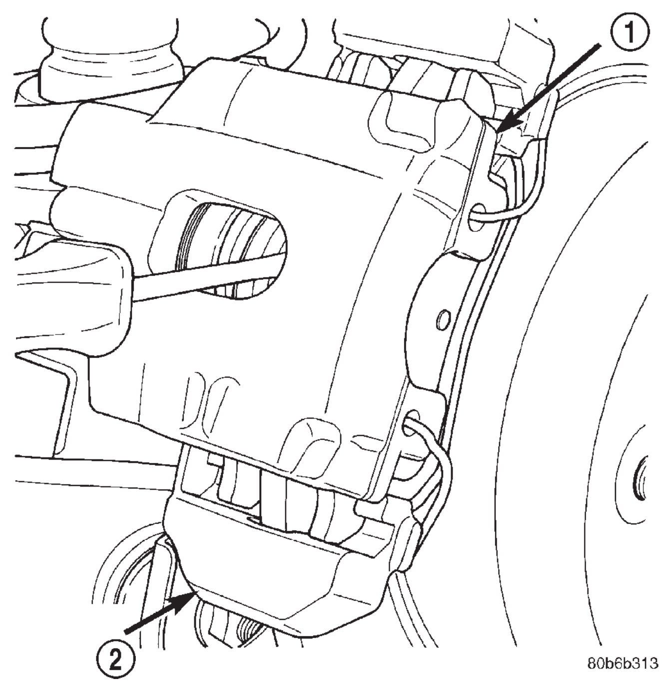


Fig. 23 Bottoming Caliper Piston

1 - CALIPER
2 - CALIPER ANCHOR

DISC BRAKE CALIPERS (Continued)

(5) Remove brake hose banjo bolt and discard gasket washers.

(6) Remove the caliper support spring by prying the spring out of the caliper (Fig. 24).

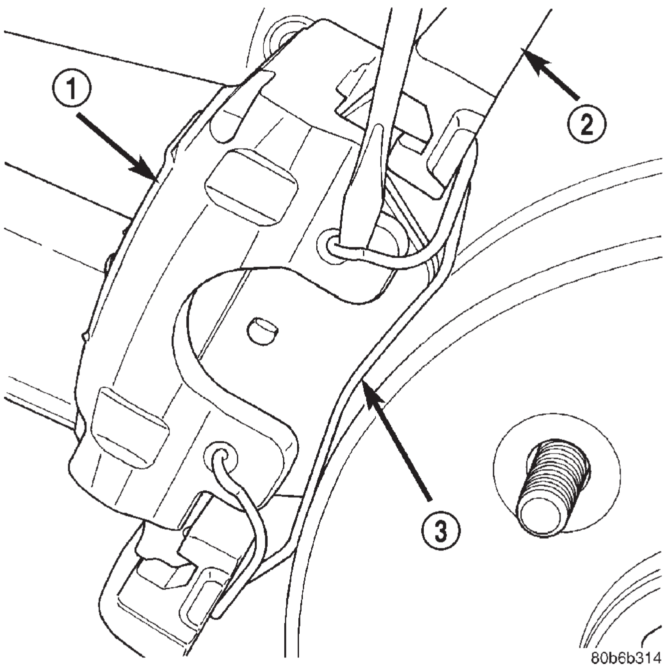


Fig. 24 Caliper Support Spring

1 - CALIPER
2 - ANCHOR
3 - SUPPORT SPRING

(7) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 25).

(8) Remove caliper from the anchor.

(9) Remove the inboard brake shoe (Fig. 26).

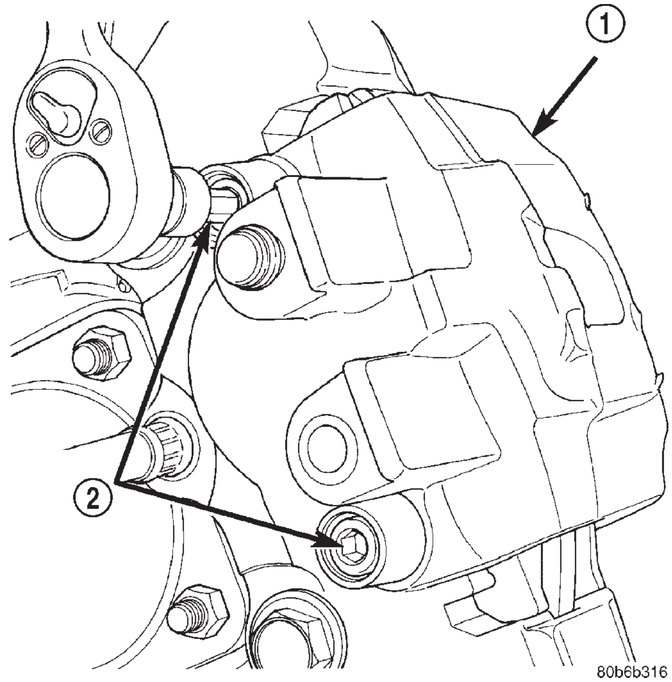


Fig. 25 Caliper Slide Pins

1 - CALIPER
2 - SLIDE PINS

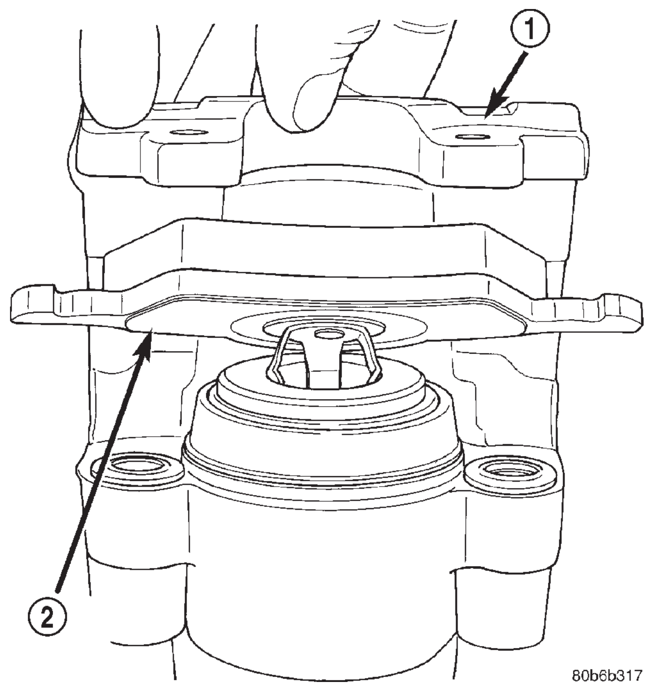


Fig. 26 Inboard Brake Shoe

1 - CALIPER
2 - INBOARD SHOE

DISC BRAKE CALIPERS (Continued)

DISASSEMBLY

DISASSEMBLY - FRONT DISC BRAKE CALIPER

(1) Drain the brake fluid from caliper.

(2) C-clamp a block of wood over one piston (Fig. 27).

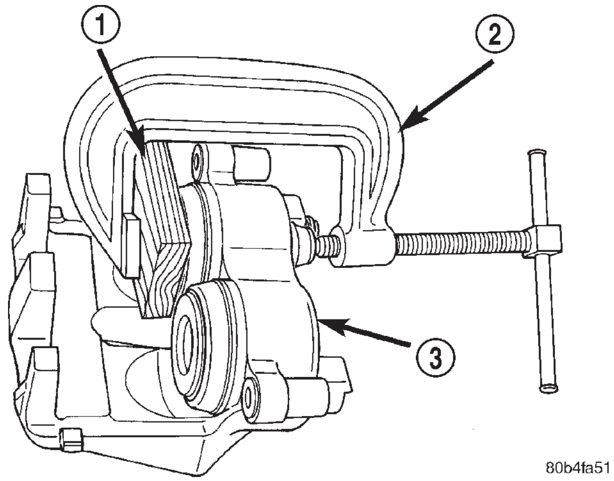


Fig. 27 C-Clamp One Piston

1 - BLOCK OF WOOD
2 - C-CLAMP
3 - CALIPER

(3) Take another piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the other piston. This will cushion and protect caliper piston during removal (Fig. 28).

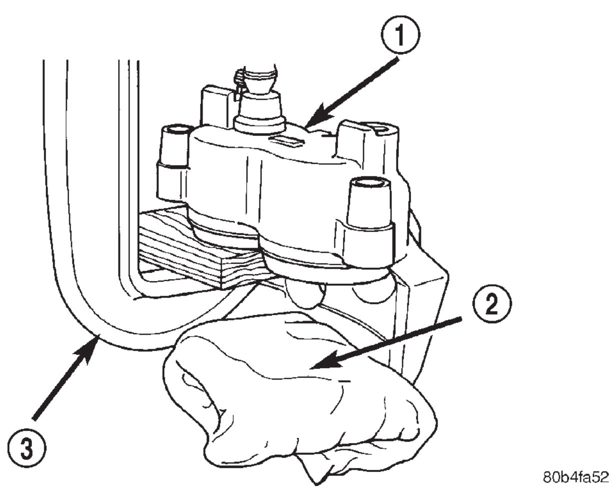


Fig. 28 Protect Caliper Piston

1 - CALIPER
2 - PADDED BLOCK OF WOOD
3 - C-CLAMP

(4) To remove the caliper piston direct **short bursts of low pressure air** with a blow gun through the caliper brake hose port. Use only enough air pressure to ease the piston out.

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS COULD RESULT IN PERSONAL INJURY.

(5) Remove the C-clamp and block of wood from the caliper and clamp it over the dust boot of the first piston removed. This will seal the empty piston bore.

(6) Move the padded piece of wood in front of the other piston.

(7) Remove the second piston using the same procedure with **short bursts of low pressure air**.

(8) Remove piston dust boots with a suitable pry tool (Fig. 29)and discard.

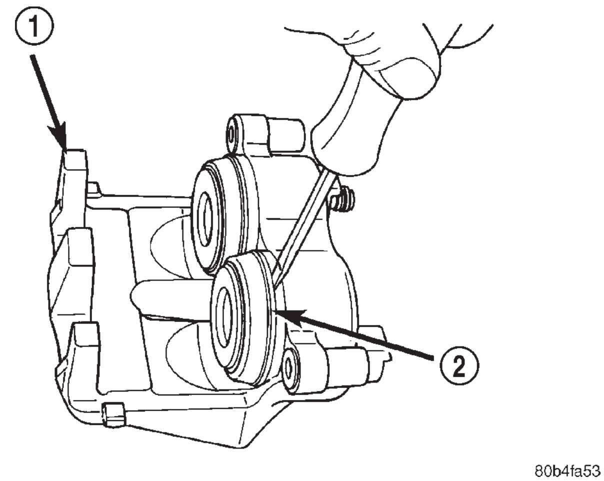


Fig. 29 Piston Dust Boot Removal

1 - CALIPER
2 - PISTON DUST BOOT

DISC BRAKE CALIPERS (Continued)

(9) Remove piston seals from caliper (Fig. 30) and discard.

CAUTION: Do not scratch piston bore while removing the seals.

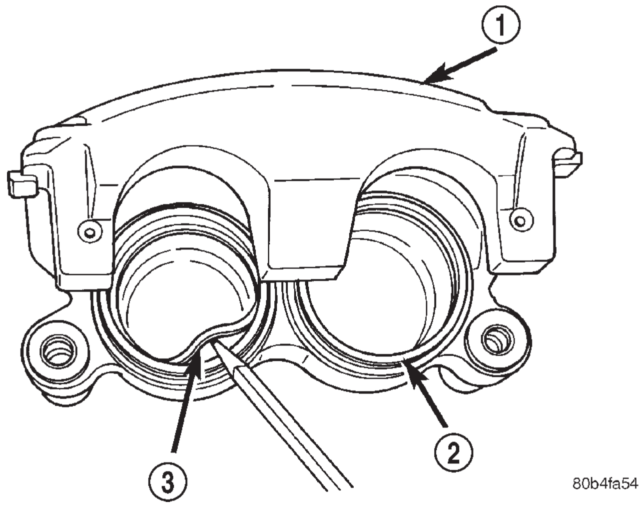


Fig. 30 Piston Seal

1 - CALIPER
2 - PISTON BORE
3 - PISTON SEAL

(10) Remove caliper slide pin bushings (Fig. 31).

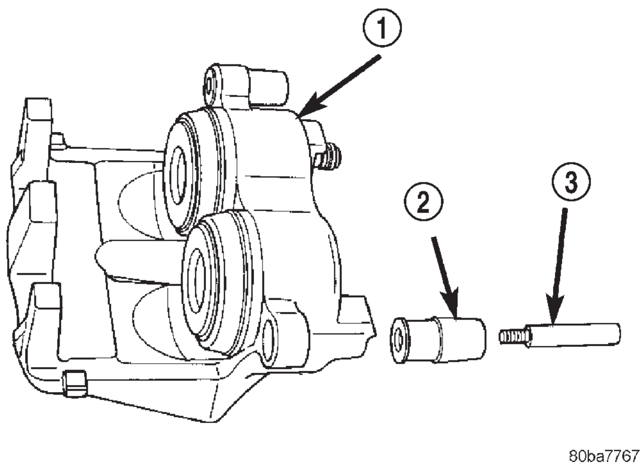


Fig. 31 Caliper Slide Pin Bushings

1 - CALIPER
2 - BUSHING
3 - CALIPER SLIDE PIN

(11) Remove caliper bleed screw.

DISASSEMBLY - REAR DISC BRAKE CALIPER

(1) Drain brake fluid out of caliper.

(2) Take a piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the piston. This will cushion and protect caliper piston during removal (Fig. 32).

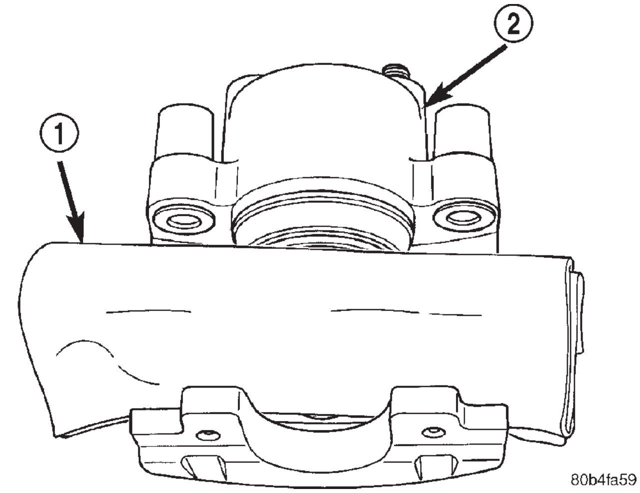


Fig. 32 Padding Caliper Interior

1 - SHOP TOWELS OR CLOTHS
2 - CALIPER

(3) To remove caliper piston direct **short bursts of low pressure air** with a blow gun through the caliper brake hose port (Fig. 33). Use only enough air pressure to ease the piston out.

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS MAY RESULT IN PERSONAL INJURY.

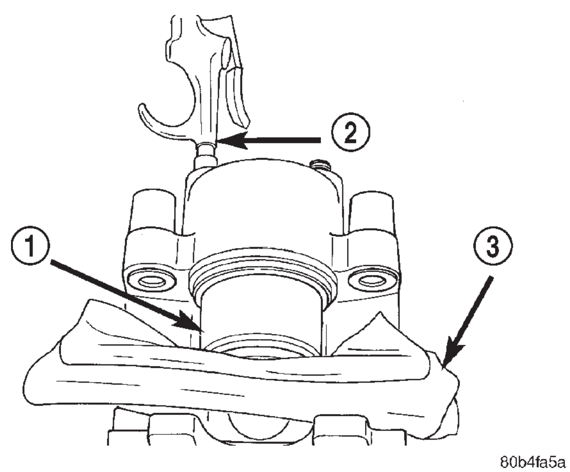


Fig. 33 Caliper Piston Removal

1 - CALIPER PISTON
2 - AIR GUN
3 - PADDING MATERIAL

DISC BRAKE CALIPERS (Continued)

(4) Remove caliper piston dust boot with a suitable pry tool (Fig. 34) and discard.

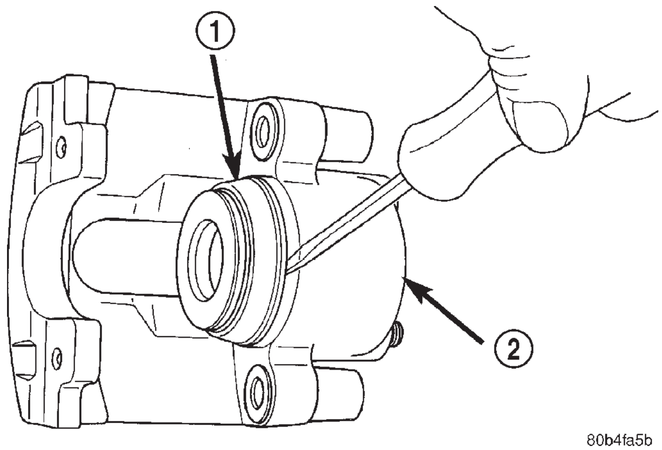


Fig. 34 Caliper Piston Dust

1 - PISTON DUST BOOT
2 - CALIPER

(5) Remove piston seal from the caliper (Fig. 35)and discard.

CAUTION: Do not scratch the piston bore while removing the seal.

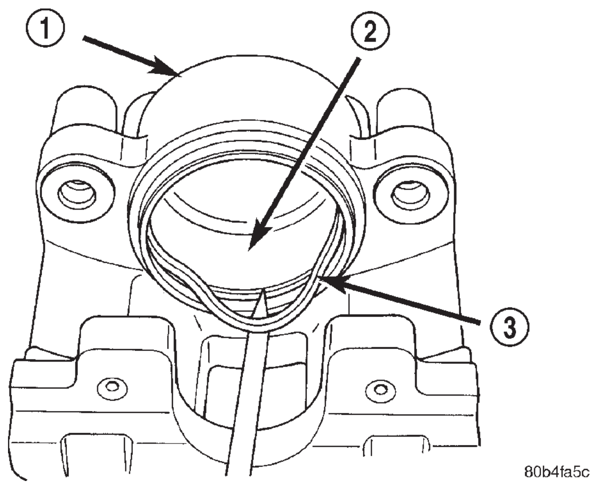


Fig. 35 Piston Seal Removal

1 - CALIPER
2 - PISTON BORE
3 - PISTON SEAL

(6) Remove caliper slide pin bushings (Fig. 36).
(7) Remove caliper bleed screw.

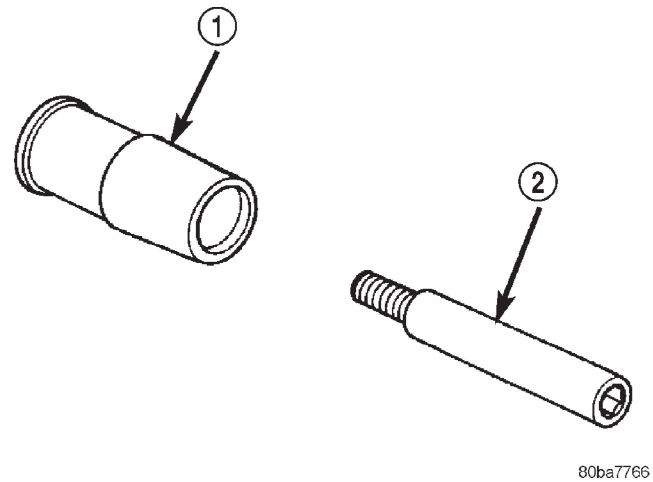


Fig. 36 Slide Pin And Bushing

1 - BUSHING
2 - CALIPER SLIDE PIN

CLEANING - DISC BRAKE CALIPER

Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

CAUTION: Do not use gasoline, kerosene, paint thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.

INSPECTION - DISC BRAKE CALIPER

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections (Fig. 37). The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).

DISC BRAKE CALIPERS (Continued)

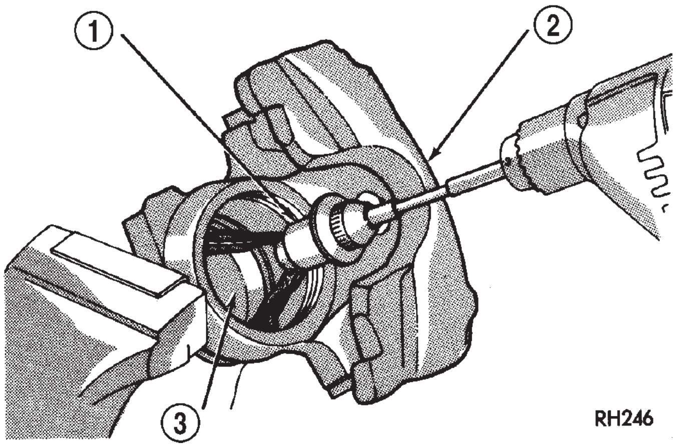


Fig. 37 Polishing Piston Bore

1 - SPECIAL HONE
2 - CALIPER
3 - PISTON BORE

ASSEMBLY

ASSEMBLY - FRONT DISC BRAKE CALIPER

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

(1) Lubricate caliper pistons, piston seals and piston bores with clean brake fluid.

(2) Install new piston seals into seal groove with finger (Fig. 38).

NOTE: Verify seal is fully seated and not twisted.

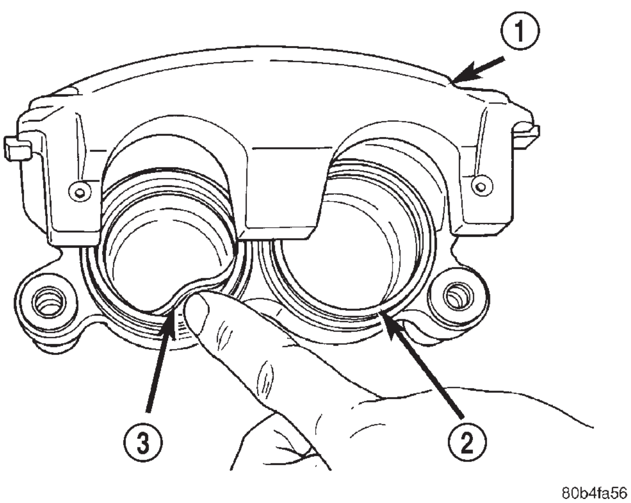


Fig. 38 Piston Seal

1 - CALIPER
2 - PISTON BORE
3 - PISTON SEAL

(3) Install new dust boot on caliper piston and seat boot lip into piston groove (Fig. 39).

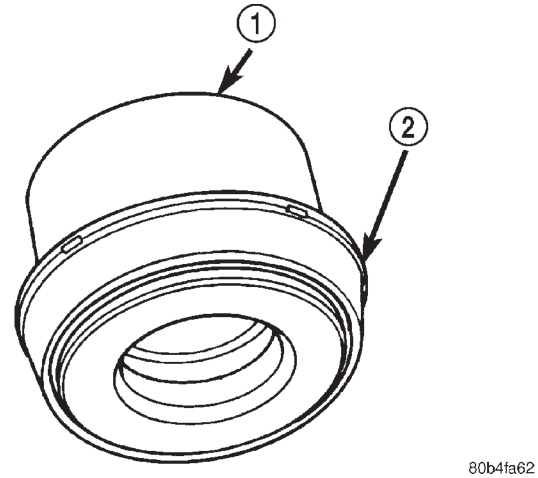


Fig. 39 Dust Boot On Piston

1 - PISTON
2 - DUST BOOT

(4) Stretch boot rearward to straighten boot folds, then move boot forward until folds snap into place.

(5) Install piston into caliper bore and press piston down to the bottom of the caliper bore by hand or with hammer handle (Fig. 40).

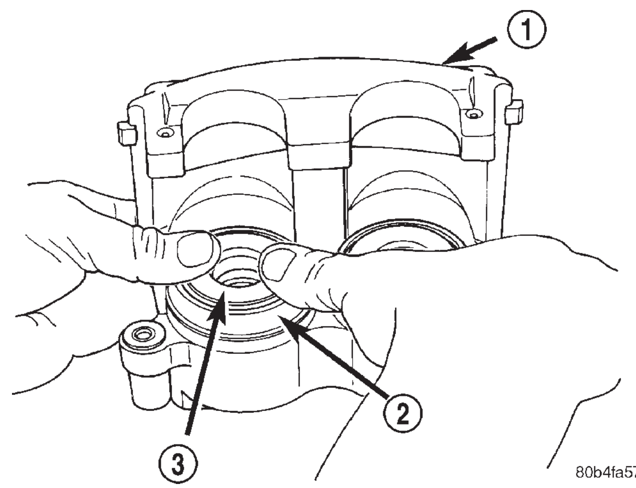


Fig. 40 Caliper Piston Installation

1 - CALIPER
2 - DUST BOOT
3 - PISTON

DISC BRAKE CALIPERS (Continued)

(6) Seat dust boot in caliper (Fig. 41) with Installer 8280 and Handle C-4171.

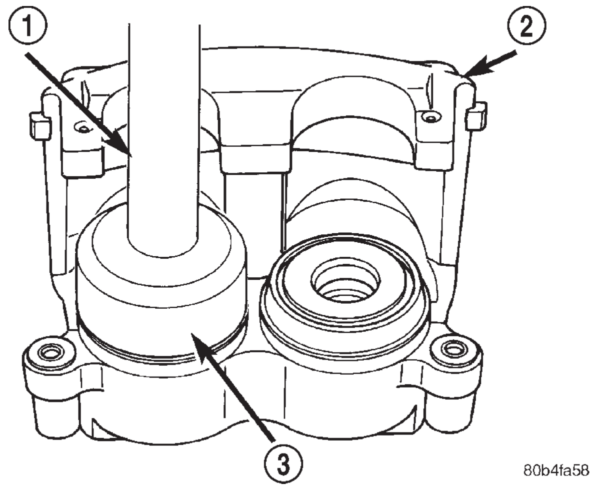


Fig. 41 Seating Dust Boot

1 - HANDLE
2 - CALIPER
3 - DUST BOOT INSTALLER

(7) Install the second piston and dust boot.
(8) Install caliper slide pin bushings into the caliper.
(9) Install caliper bleed screw.

ASSEMBLY - REAR DISC BRAKE CALIPER

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

(1) Lubricate caliper piston, piston seal and piston bore with clean brake fluid.
(2) Install new piston seal into seal groove with finger (Fig. 42).

NOTE: Verify seal is fully seated and not twisted.

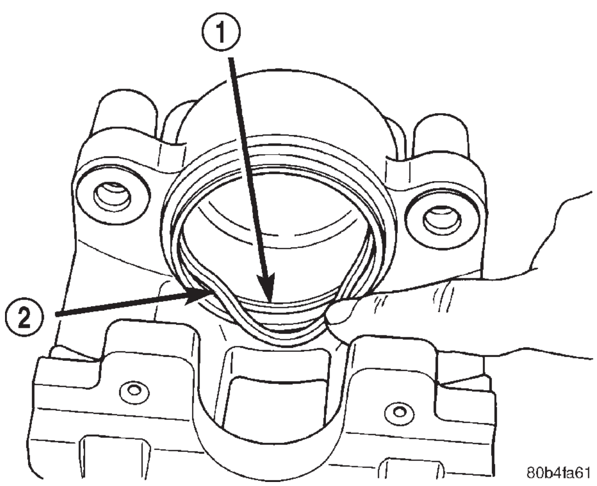


Fig. 42 Piston Seal Installation

1 - SEAL GROOVE
2 - PISTON SEAL

(3) Install new dust boot on caliper piston and seat boot lip into piston groove (Fig. 43).

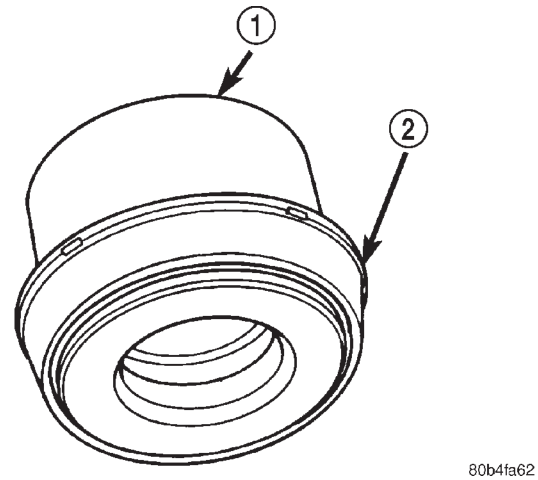


Fig. 43 Dust Boot On Piston

1 - PISTON
2 - DUST BOOT

(4) Stretch boot rearward to straighten boot folds, then move boot forward until folds snap into place.
(5) Install piston into caliper bore and press piston down to the bottom of the caliper bore by hand or with hammer handle (Fig. 44).

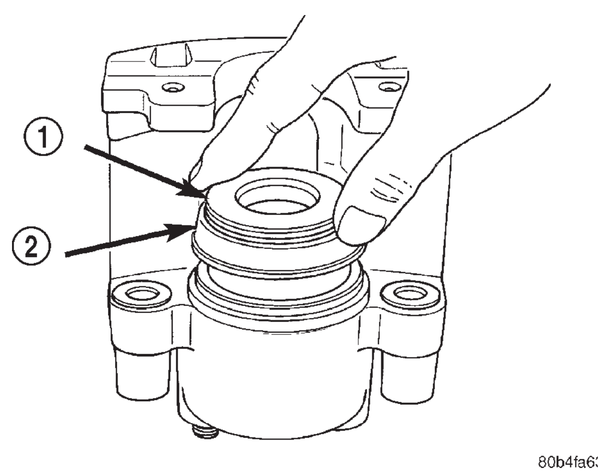


Fig. 44 Caliper Piston Installation

1 - PISTON
2 - BOOT

DISC BRAKE CALIPERS (Continued)

(6) Seat dust boot in caliper with Installer 8280 and Handle C-4171 (Fig. 45).

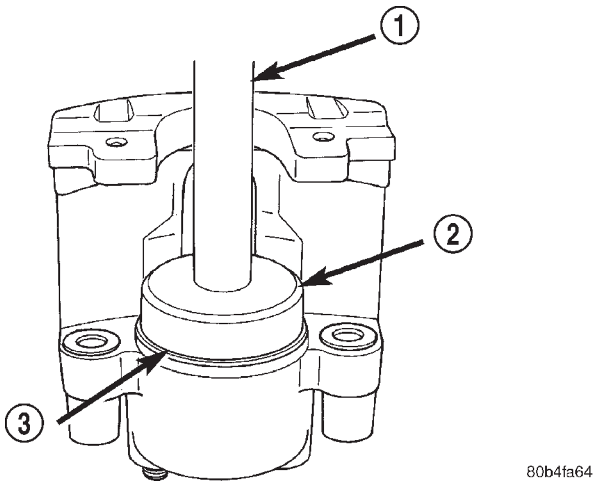


Fig. 45 Piston Dust Boot Installation

1 - HANDLE
2 - INSTALLER
3 - DUST BOOT

(7) Install caliper slide pin bushings into the caliper (Fig. 46).

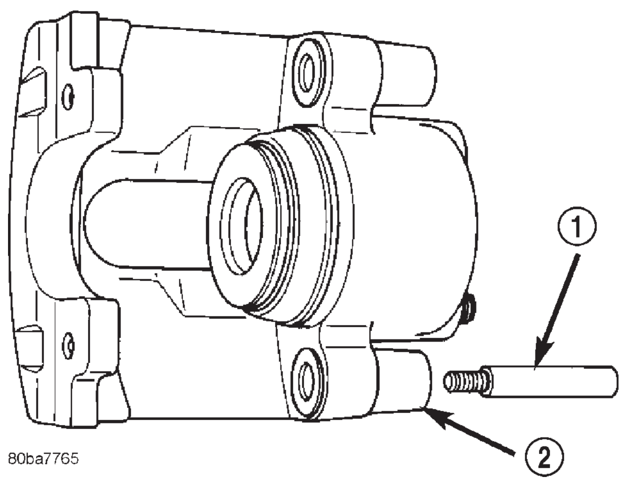


Fig. 46 Slide Pin And Bushing

1 - CALIPER SLIDE PIN
2 - BUSHING

(8) Install caliper bleed screw.

INSTALLATION

INSTALLATION - FRONT DISC BRAKE CALIPER

(1) Install the inboard brake shoe (Fig. 22).
(2) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the caliper.
(3) Install the caliper on the anchor.
(4) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).
(5) Install the caliper slide pin bushing caps.
(6) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.
(7) Install brake hose to caliper with **new gasket washers** and tighten banjo bolt to 31 N·m (23 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening banjo bolt.

(8) Fill and bleed brake system.
(9) Install wheel and tire assemblies.
(10) Remove supports and lower vehicle.
(11) Verify brake fluid level.

INSTALLATION - REAR DISC BRAKE CALIPER

(1) Install the inboard brake shoe (Fig. 26).
(2) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the caliper.
(3) Install the caliper on the anchor.
(4) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).
(5) Install the caliper slide pin caps.
(6) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.

CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.

(7) Install brake hose to caliper with a **new** gasket washers and tighten banjo bolt to 31 N·m (23 ft. lbs.).
(8) Fill and bleed brake system.
(9) Install wheel and tire assemblies.
(10) Remove supports and lower vehicle.

FLUID

DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid sepa-

FLUID (Continued)

rates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder with reservoir, caliper seals, HCU and all hydraulic fluid hoses.

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

FLUID RESERVOIR

REMOVAL

(1) Remove reservoir cap and remove fluid with a **clean**suction gun.

(2) Remove the wire connector from the brake fluid level sensor.

(3) Insert the tool (Fig. 47) provided with the reservoir to release the reservoir retaining tabs.

(4) Pull the reservoir straight up out of the cylinder.

(5) Remove and discard grommets from the cylinder body.

INSTALLATION

(1) Lubricate new grommets with clean brake fluid. Install new grommets into the cylinder body.

CAUTION: Do not use tools to install the grommets. Tools may cut, or tear the grommets. Install the grommets using finger pressure only.

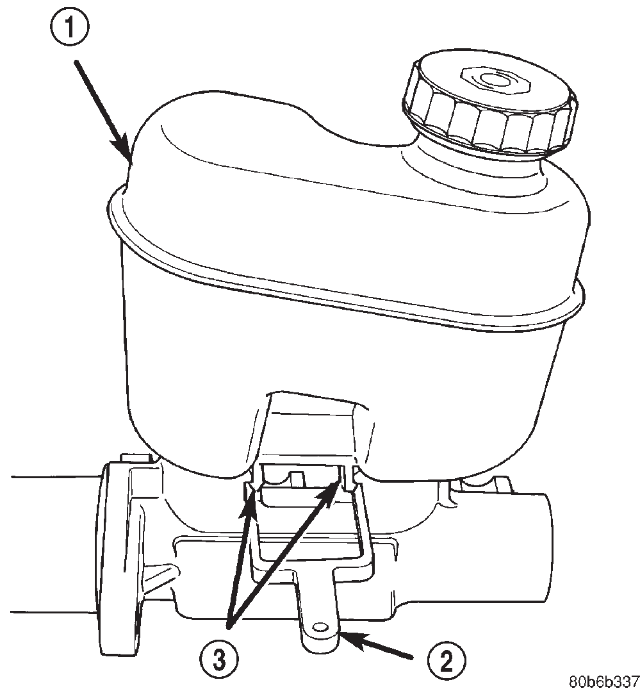


Fig. 47 Release Tool

1 - RESERVOIR
2 - RELEASE TOOL
3 - RETAINING TABS

(2) Start reservoir in grommets then press the reservoir straight down to seat the reservoir into the cylinder grommets.

CAUTION: Do not rock the reservoir during installation.

(3) Verify retaining tabs are seated.

(4) Install the wire connector to the brake fluid level sensor.

(5) Fill master cylinder.

MASTER CYLINDER

DESCRIPTION

The master cylinder body is made of aluminum and contains a primary and secondary piston assembly. The cylinder body including the piston assemblies are not serviceable. If diagnosis indicates an internal problem with the cylinder body, it must be replaced as an assembly. The master cylinder has a removable reservoir and fluid level indicator. The reservoir, reservoir grommets, reservoir cap and fluid level switch are the only replaceable parts on the master cylinder.

MASTER CYLINDER (Continued)

OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes. The master cylinder reservoir stores reserve brake fluid for the hydraulic brake circuits.

DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

NOTE: Inspect and repair any external fluid leaks before performing test.

(1) Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away the master cylinder or HCU may be faulty (internal leakage).

(5) Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.

(6) If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and turn off the engine.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, some component of the booster is faulty.

POWER BOOSTER VACUUM TEST

(1) Connect vacuum gauge to booster check valve with short length of hose and T-fitting (Fig. 48).

(2) Start and run engine at curb idle speed for one minute.

(3) Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.

(4) Clamp hose shut between vacuum source and check valve.

(5) Stop engine and observe vacuum gauge.

(6) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm, check valve or check valve seal/grommet is faulty.

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

(2) Remove check valve and valve seal from booster.

(3) Use a hand operated vacuum pump for test.

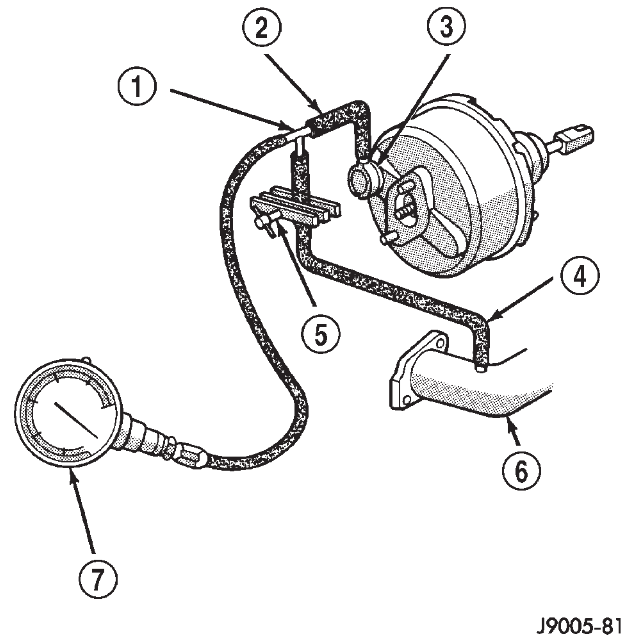


Fig. 48 Typical Booster Vacuum Test Connections

1 - TEE FITTING
2 - SHORT CONNECTING HOSE
3 - CHECK VALVE
4 - CHECK VALVE HOSE
5 - CLAMP TOOL
6 - INTAKE MANIFOLD
7 - VACUUM GAUGE

(4) Apply 51-67 kPa (15-20 in.) vacuum at large end of check valve (Fig. 49).

(5) Vacuum should hold steady. If gauge on pump indicates vacuum loss the check valve and seal should be replaced.

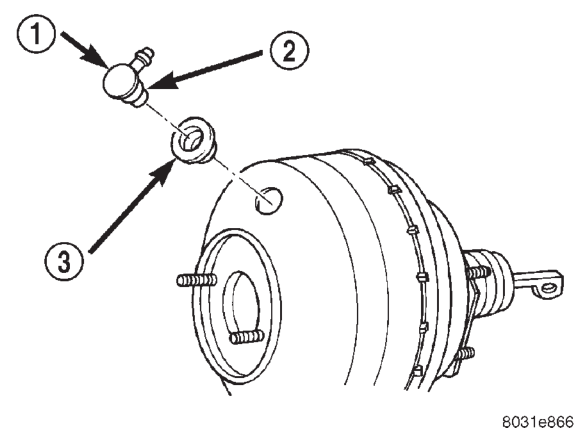


Fig. 49 Vacuum Check Valve And Seal

1 - BOOSTER CHECK VALVE
2 - APPLY TEST VACUUM HERE
3 - VALVE SEAL

MASTER CYLINDER (Continued)

STANDARD PROCEDURE - MASTER CYLINDER BLEEDING PROCEDURE

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

(1) Mount master cylinder in vise with brass jaws.

(2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into the bottom of the reservoir (Fig. 50).

(3) Fill reservoir with fresh brake fluid.

(4) Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.

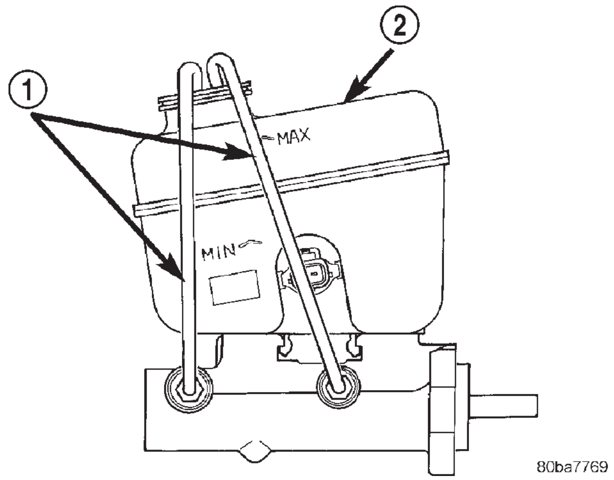


Fig. 50 Master Cylinder Bleeding

1 - BLEEDING TUBES
2 - RESERVOIR

REMOVAL

(1) Remove the wire connector from the brake fluid level sensor.

(2) Remove brake lines from master cylinder.

(3) Remove nuts that attach master cylinder to booster studs (Fig. 51).

(4) Remove master cylinder from booster.

INSTALLATION

NOTE: Bleed new master cylinder on bench before installation, refer to Service Procedures.

(1) Have an assistant depress the brake pedal while guiding the master cylinder on the booster rod and mounting studs.

CAUTION: Do not depress brake pedal too hard and ensure the booster rod is in the master cylinder piston or booster/master cylinder damage will occur.

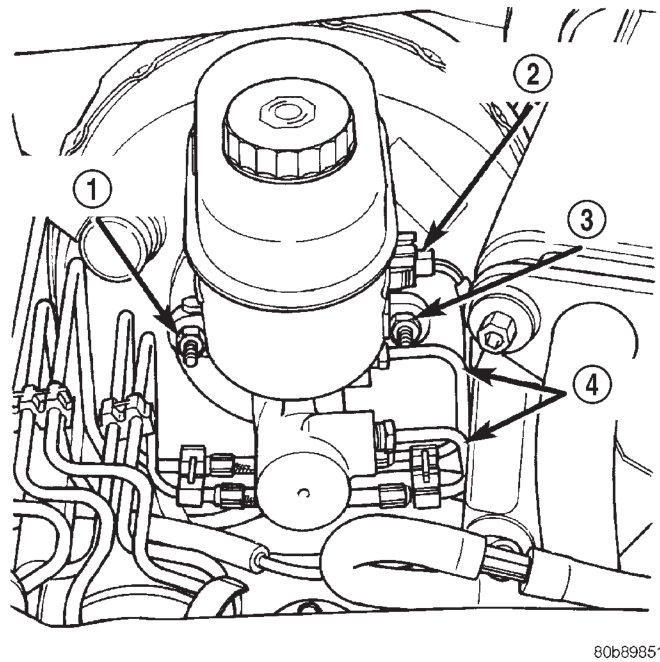


Fig. 51 Master Cylinder Mounting

1 - MOUNTING NUT
2 - SENSOR CONNECTOR
3 - MOUNTING NUT
4 - BRAKE LINES

(2) Install master cylinder mounting nuts and tighten nuts to 25 N·m (18 lb. lbs.).

NOTE: Use original or factory replacement nuts only.

(3) Install brake lines and tighten to 16 N·m (144 in. lbs.).

(4) Install fluid level sensor connector.

(5) Fill and bleed brake system.

PEDAL

DESCRIPTION

DESCRIPTION - STANDARD PEDAL

A suspended-type brake pedal is used, the pedal pivots on a shaft mounted in the pedal support bracket. The bracket is attached to the dash panel.

The brake pedal assembly and pedal pad are the only serviceable component.

DESCRIPTION - ADJUSTABLE PEDALS

The Adjustable Pedals System (APS) is designed to enable the fore and aft repositioning of the brake and accelerator pedals. This results in improved ergonomics in relation to the steering wheel for taller and shorter drivers. Being able to adjust the pedal posi-

PEDAL (Continued)

tions also allows the driver to set steering wheel tilt and seat position to the most comfortable position. The position of the brake and accelerator pedals can be adjusted without compromising safety or comfort in actuating the pedals. Repositioning the pedals does not change the effort required for actuation.

Change of pedal position is accomplished by means of a motor driven screw. Operating the adjustable pedal switch activates the pedal drive motor. The pedal drive motor turns a screw that changes the position of the brake and accelerator pedals. The pedal can be moved rearward (closer to the driver) or forward (away from driver). The brake pedal is moved on its drive screw to a position where the driver feels most comfortable (Fig. 52).

The accelerator pedal is moved at the same time and the same distance as the brake pedal. The accelerator pedal adjustment screw is turned by a flexible shaft slaved off the brake adjustment screw.

Neither the pedal drive motor nor drive mechanism are subject to the mechanical stress of brake or accelerator application.

- SYSTEM FEATURES:
  - Range of Adjustment: The pedals may be adjusted up to 3 in. (75 mm)
  - Pedal Adjustment Speed: 0.5 in./sec (12.5 mm/sec)
  - Pedal Adjustment Inhibitors: Pedal adjustment is inhibited when the vehicle is in reverse or when cruise control is activated.
  - Memory: An optional memory feature is available. This allows storing of one or two preferred pedal positions in the Adjustable Pedal Module (APM). A preferred position can be stored and recalled using the door-mounted switches. A stored pedal position can be recalled (but not stored) using the Remote Keyless Entry (RKE).
  - Adjustable Pedal Feedback Message: The Electronic Vehicle Information Center (EVIC) will display a message when the APS is disabled. ie: ″Adjustable Pedal Disabled - Cruise Control Engaged″ or ″Adjustable Pedal Disabled - Vehicle in Reverse″.
  - Damage Prevention: Foot pressure or debris can stall pedal adjustment. In order to avoid damage to system components during pedal adjustment, the APM will monitor pedal position sensor voltage. If the APM does not detect expected voltage change within 1.5 seconds, it will cut power to the adjustable pedal motor.

OPERATION

The brake pedal is attached to the booster push rod. When the pedal is depressed, the primary booster push rod is depressed which moves the booster secondary rod. The booster secondary rod depresses the master cylinder piston.

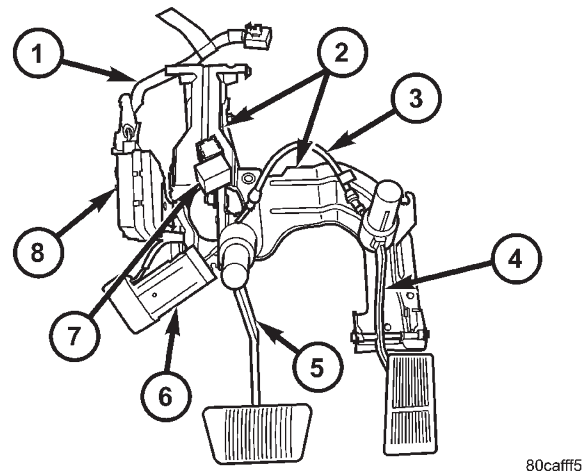


Fig. 52 ADJUSTABLE PEDALS ASSEMBLY

1 - HARNESS
2 - ADJUSTABLE PEDAL BRACKET
3 - CABLE
4 - ACCELERATOR PEDAL
5 - BRAKE PEDAL
6 - ADJUSTABLE PEDAL MOTOR
7 - BRAKE LIGHT SWITCH
8 - ADJUSTABLE PEDALS MODULE

REMOVAL

REMOVAL - NON-ADJUSTABLE PEDAL

(1) Remove retainer clip that holds booster to pedal pin (Fig. 53).

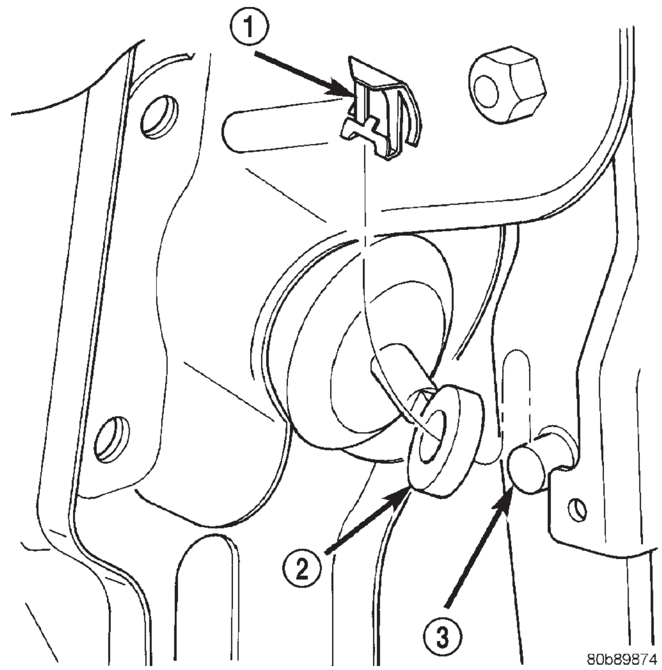


Fig. 53 Push Rod Retainer Clip

1 - RETAINER CLIP
2 - PUSH ROD
3 - PEDAL PIN

PEDAL (Continued)

(2) Remove nut from pedal shaft.

(3) Slide pedal shaft out and remove brake pedal.

(4) Remove pedal bushings (Fig. 54) if they are to be replaced.

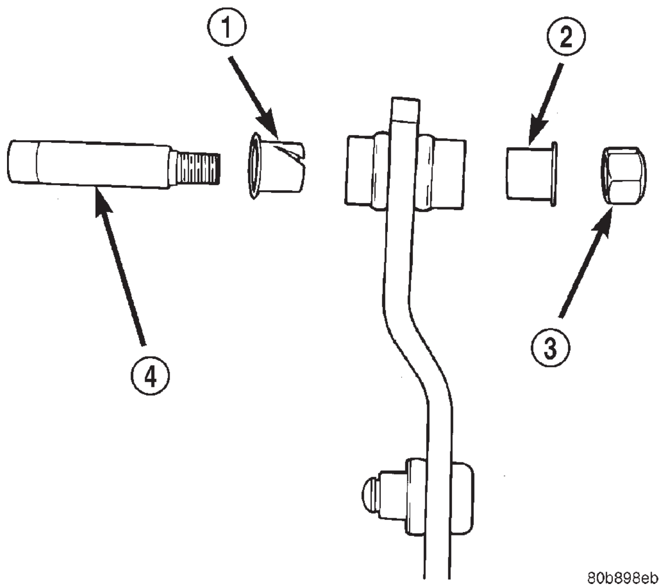


Fig. 54 Pedal Bushings

1 - BUSHING
2 - BUSHING
3 - SHAFT NUT
4 - PEDAL SHAFT

REMOVAL - ADJUSTABLE PEDALS

NOTE: If possible put the pedals in the full forward position.

(1) Disconnect the negative battery cable.

(2) Remove the cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(4) Disconnect the module electrical connector.

(5) Remove the brake light switch.

(6) Disconnect the booster rod clip (Fig. 53).

(7) Disconnect the accelerator cable from the pedal.

(8) Lock the steering wheel into place.

(9) Remove the lower steering shaft pinch bolt (Fig. 56).

(10) Separate the lower shaft coupler and push forward (Fig. 56).

(11) Remove the two pedal bracket upper nuts (Fig. 55).

(12) Remove the brake booster nuts (Fig. 56).

(13) Remove the accelerator pedal nuts (Fig. 57).

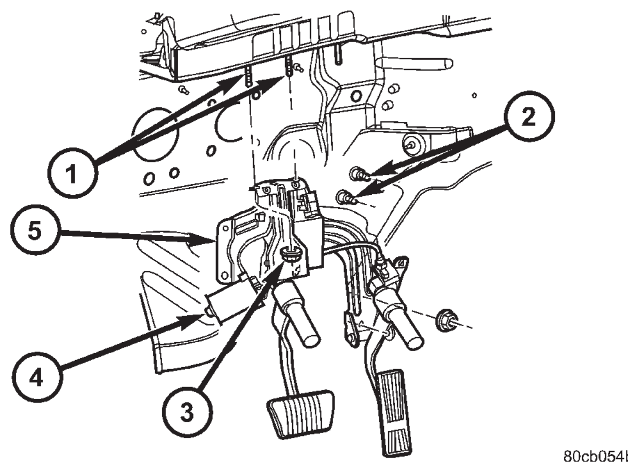


Fig. 55 UPPER MOUNTING NUTS

1 - UPPER MOUNTING STUDS
2 - ACCELERATOR MOUNTING STUDS
3 - UPPER MOUNTING NUT
4 - MOTOR
5 - ADJUSTABLE PEDAL BRACKET

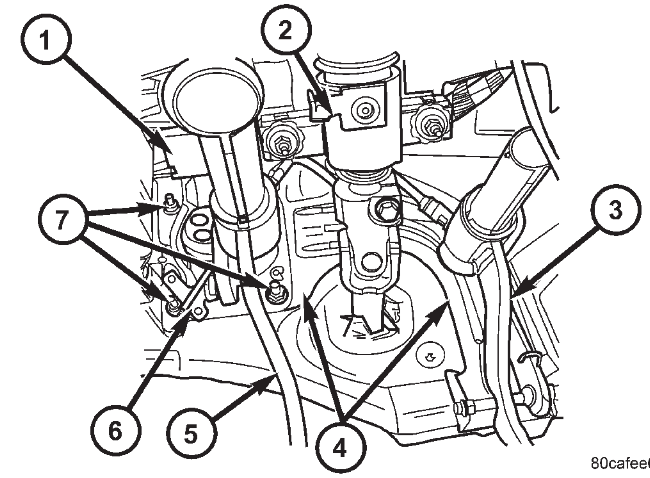


Fig. 56 ADJUSTABLE PEDAL BRACKET

1 - BRAKE LIGHT SWITCH
2 - STEERING COLUMN
3 - ACCELERATOR PEDAL
4 - ADJUSTABLE PEDALS MOUNTING BRACKET
5 - BRAKE PEDAL
6 - MOTOR MOUNTING BRACKET
7 - BRAKE BOOSTER MOUNTING NUTS (4)

(14) Remove the ICU mounting bracket nuts and bolts and move the ICU and booster forward this will allow enough clearance to remove the adjustable pedal bracket from over the booster push rod.

(15) Remove the pedal from the vehicle (Fig. 56).

(16) Transfer the module if needed.

PEDAL (Continued)

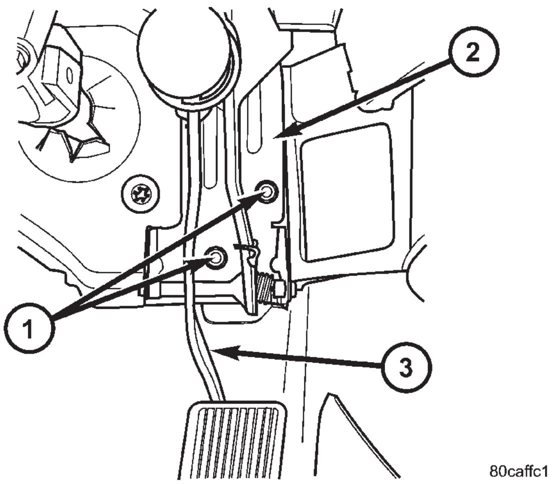


Fig. 57 ACCELERATOR MOUNTING BRACKET

1 - ACCELERATOR MOUNTING NUTS
2 - ADJUSTABLE PEDALS BRACKET
3 - ACCELERATOR PEDAL

INSTALLATION

INSTALLATION - NON-ADJUSTABLE PEDAL

(1) Lubricate bushings, pedal shaft and pedal pin with Mopar multi-mileage grease.

(2) Install bushings into pedal.

(3) Position pedal in bracket and install pedal shaft in support and through pedal.

(4) Install new nut on pedal shaft and tighten to 27 N·m (20 ft. lbs.).

NOTE: Pedal shaft nut should not be reused.

(5) Install booster push rod on pedal pin and install retainer clip on pedal pin.

(6) Check and adjust stop lamp switch if necessary.

INSTALLATION - ADJUSTABLE PEDALS

(1) Install the pedal to the vehicle (Fig. 56).

(2) Reposition the ICU and booster, Install the ICU mounting bracket nuts and bolts.

28 N

(3) Install the brake booster nuts. Tighten to 28 N·m (21 ft. lbs.). (Fig. 56).

(4) Install the pedal bracket upper nuts. Tighten to 12 N·m (9 ft. lbs.). (Fig. 56).

(5) Install the accelerator pedal nuts. Tighten to 28 N·m (21 ft. lbs.). (Fig. 57).

(6) Install the lower steering shaft coupler over the shaft (Fig. 56).

(7) Install the lower steering shaft pinch bolt (Fig. 56).

(8) Unlock the steering wheel.

(9) Reconnect the accelerator cable to the pedal (Fig. 56).

(10) Reconnect the booster rod clip (Fig. 56).

(11) Install the brake light switch.

(12) Reconnect the module electrical connector.

(13) Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(14) Install the cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(15) Reconnect the negative battery cable.

PEDAL MOTOR

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(4) Remove the two mounting screws (Fig. 58).

(5) Disconnect the electrical connector (Fig. 58).

(6) Remove the adjustable pedal motor (Fig. 58).

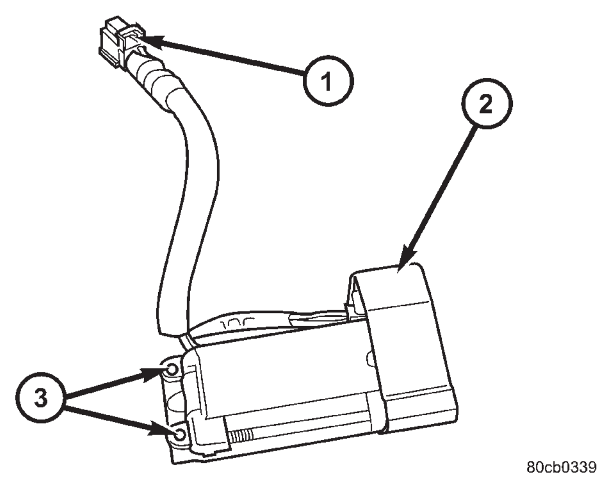


Fig. 58 ADJUSTABLE PEDALS MOTOR

1 - ELECTRICAL CONNECTOR
2 - PEDALS MOTOR
3 - MOUNTING SCREWS HOLES

INSTALLATION

(1) Install the adjustable pedal motor (Fig. 58).

(2) Reconnect the electrical connector (Fig. 58).

(3) Install the two mounting screws (Fig. 58).

(4) Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

PEDAL MOTOR (Continued)

(5) Install the cluster bezel (Refer to 23 - BODY/ INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(6) Reconnect the negative battery cable.

POWER BRAKE BOOSTER

DESCRIPTION

The booster assembly consists of a housing divided into separate chambers by two internal diaphragms. The outer edge of each diaphragm is attached to the booster housing.

Two push rods are used in the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod connects the booster to the master cylinder to stroke the cylinder pistons.

OPERATION

The atmospheric inlet valve is opened and closed by the primary push rod. Booster vacuum supply is through a hose attached to an intake manifold fitting at one end and to the booster check valve at the other. The vacuum check valve in the booster housing is a one-way device that prevents vacuum leak back.

Power assist is generated by utilizing the pressure differential between normal atmospheric pressure and a vacuum. The vacuum needed for booster operation is taken directly from the engine intake manifold. The entry point for atmospheric pressure is through a filter and inlet valve at the rear of the housing (Fig. 59) .

The chamber areas forward of the booster diaphragms are exposed to vacuum from the intake manifold. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Brake pedal application causes the primary push rod to open the atmospheric inlet valve. This exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential provides the extra apply force for power assist.

The booster check valve, check valve grommet and booster seals are serviceable.

POWER BRAKE BOOSTER (Continued)

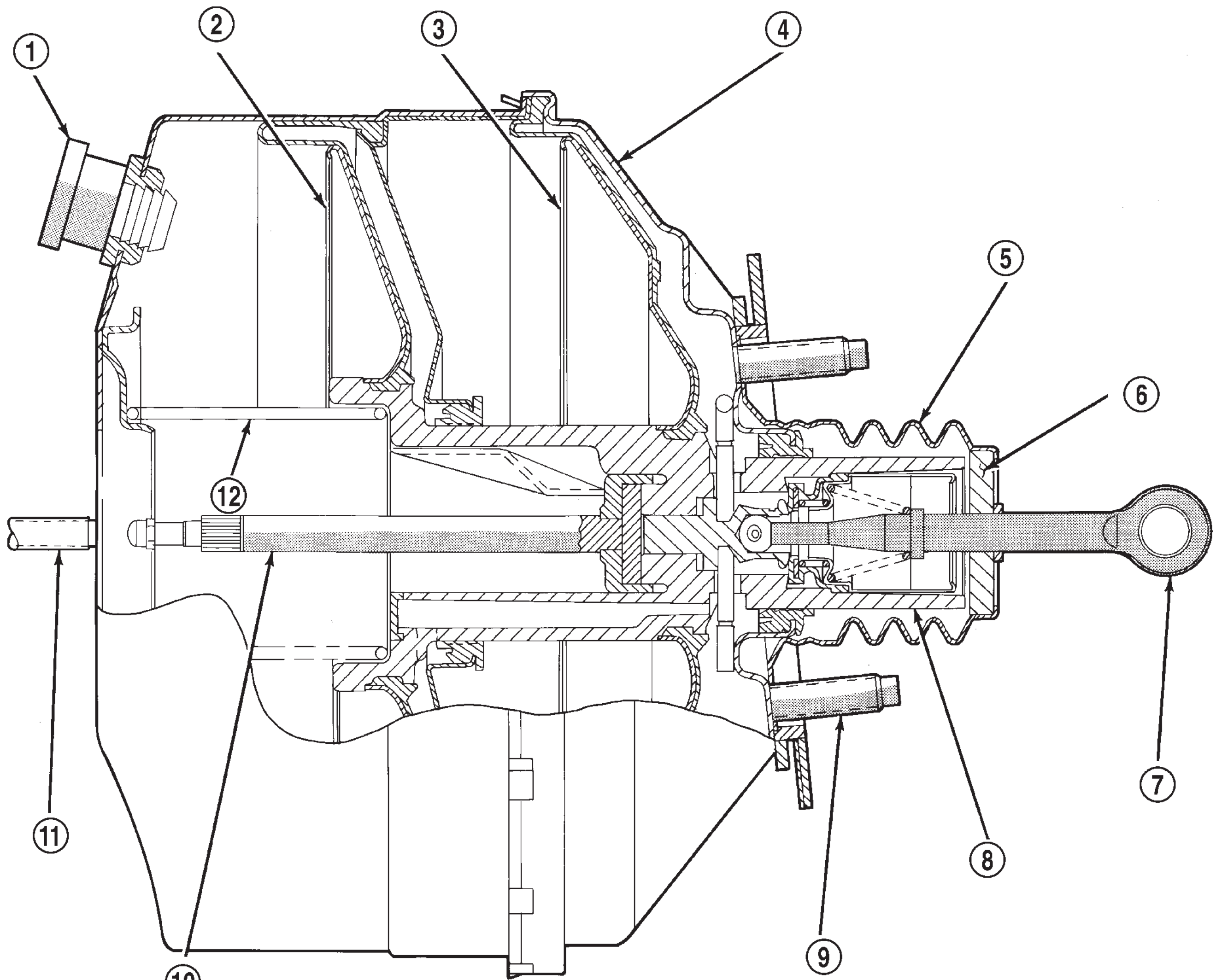


Fig. 59 Power Brake Booster–Typical

1 - VACUUM CHECK VALVE
2 - FRONT DIAPHRAGM
3 - REAR DIAPHRAGM
4 - HOUSING
5 - SEAL
6 - AIR FILTER
7 - PRIMARY PUSH ROD (TO BRAKE PEDAL)
8 - ATMOSPHERIC INLET VALVE ASSEMBLY
9 - BOOSTER MOUNTING STUDS (4)
10 - SECONDARY PUSH ROD (TO MASTER CYLINDER)
11 - MASTER CYLINDER MOUNTING STUD (2)
12 - SPRING

POWER BRAKE BOOSTER (Continued)

REMOVAL

(1) Remove the master cylinder.

(2) Disconnect vacuum hose at booster check valve.

(3) Remove retainer clip (Fig. 60) that holds booster push rod on pedal pin. Then slide push rod off pin.

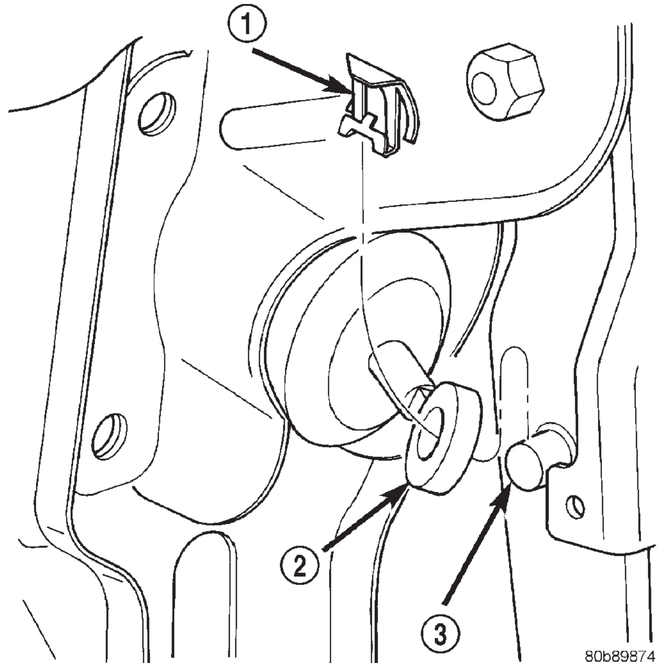


Fig. 60 Retainer Clip

1 - RETAINER CLIP
2 - PUSH ROD
3 - PEDAL PIN

(4) Remove four nuts (Fig. 61) that attach booster to dash panel.

(5) In engine compartment, slide booster forward, tilt it upward slightly, and remove it from engine compartment.

INSTALLATION

(1) Check condition of grommet that secures check valve in booster. Replace grommet if cut, torn, or loose.

(2) Install new booster dash seal.

(3) Align and position booster on engine compartment side of dash panel.

(4) Inside passenger compartment:

(a) Lubricate pedal pin Mopar multi-mileage grease.

(b) Install booster attaching nuts on studs. Tighten attaching nuts to 39 N·m (29 ft. lbs.).

(c) Slide booster push rod on pedal pin. Then secure rod to pin with retainer clip.

(5) In engine compartment, attach vacuum hose to booster check valve.

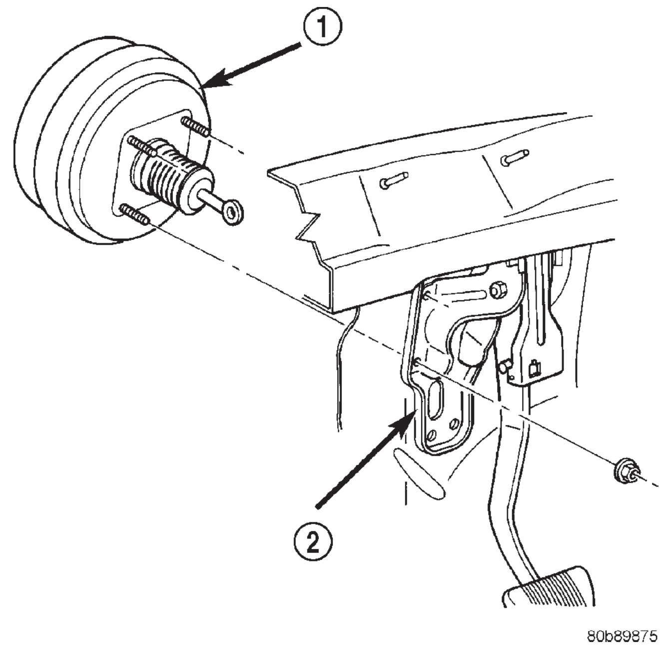


Fig. 61 Power Brake Booster Mounting

1 - BOOSTER
2 - DASH PANEL

(6) Install the master cylinder with new gasket and nuts.

CAUTION: The master cylinder installation procedure must be perform as written or damage to the booster/master cylinder may occur.

(7) Fill and bleed brake system.

ROTORS

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - FRONT DISC BRAKE ROTOR

ROTOR MINIMUM THICKNESS

Rotor minimum usable thickness is 24.5 mm (0.964 in.). Do not resurface a rotor if machining would cause thickness to fall below this limit.

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if refinishing would reduce thickness below the allowable minimum.

FRONT ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

ROTORS (Continued)

Measure rotor thickness a minimum of six points around the rotor face. Position the micrometer approximately 19 mm (3/4 in.) from the rotor outer circumference for each measurement (Fig. 62).

Thickness should not vary by more than 0.0127 mm (0.0005 in.) from point to point on the rotor. Refinish or replace the rotor if necessary.

NOTE: Refinishing the rotor using on-car refinishing equipment is recommended.

Front rotors and hub/bearings are matched mounted for minimum lateral runout. Before removing the rotor, mark the rotor and hub/bearing to maintain original orientation.

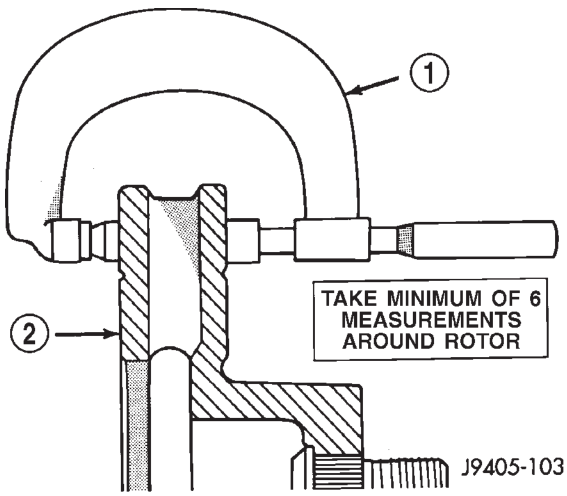


Fig. 62 Measuring Rotor Thickness Variation

1 - MICROMETER
2 - ROTOR

FRONT ROTOR LATERAL RUNOUT

Check rotor lateral runout whenever pedal pulsation, or rapid, uneven brake lining wear has occurred.

The rotor must be securely clamped to the hub to ensure an accurate runout measurement. Secure the rotor with a minimum of 3 lug nuts and large diameter flat washers on each stud.

Use a dial indicator to check lateral runout (Fig. 63).

Maximum allowable rotor lateral runout is 0.76 mm (0.003 in.).

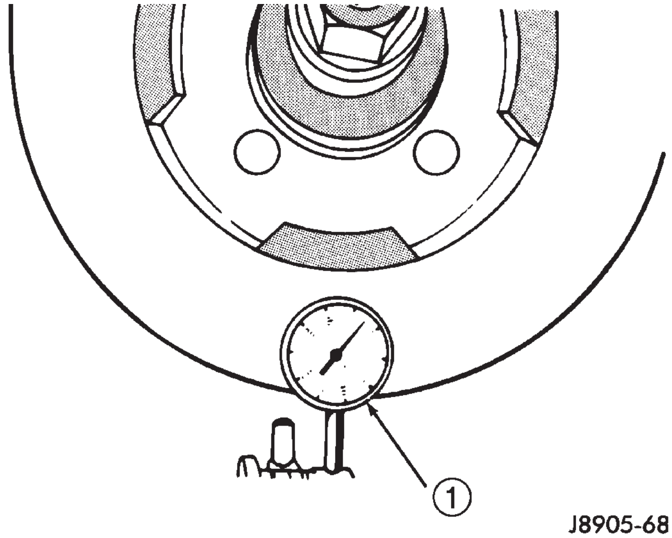


Fig. 63 Checking Rotor Lateral Runout

1 - DIAL INDICATOR

DIAGNOSIS AND TESTING - REAR DISC BRAKE ROTOR

ROTOR MINIMUM THICKNESS

Minimum usable thickness of the rear disc brake rotor is 8.5 mm (0.335 in.). The thickness specification is located on the center section of the rotor.

Never resurface a rotor if machining would cause thickness to fall below this limit.

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if refinishing would reduce thickness below the allowable minimum.

REAR ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at a minimum of six points around the rotor face. Position the micrometer approximately 19 mm (3/4 in.) from the rotor outer circumference for each measurement (Fig. 62).

Thickness should not vary by more than 0.0127 mm (0.0005 in.) from point to point on the rotor. Refinish or replace the rotor if necessary.

REAR ROTOR LATERAL RUNOUT

Check rotor lateral runout whenever diagnosis indicates pedal pulsation and rapid, uneven brake lining wear.

The rotor must be securely clamped to the hub to ensure an accurate runout measurement. Secure the rotor with the wheel nuts and 4 or 5 large diameter flat washers on each stud.

ROTORS (Continued)

Use a dial indicator to check lateral runout (Fig. 63). Maximum allowable lateral runout is 0.76 mm (0.003 in.).

STANDARD PROCEDURE - DISC ROTOR MACHINING

The disc brake rotor can be machined if scored or worn. The lathe must machine both sides of the rotor simultaneously with dual cutter heads. The rotor mounting surface must be clean before placing on the lathe. Equipment capable of machining only one side at a time may produce a tapered rotor.

NOTE: A hub mounted on-vehicle lathe is recommended. This type of lathe trues the rotor to the vehicles hub/bearing.

CAUTION: Brake rotors that do not meet minimum thickness specifications before or after machining must be replaced.

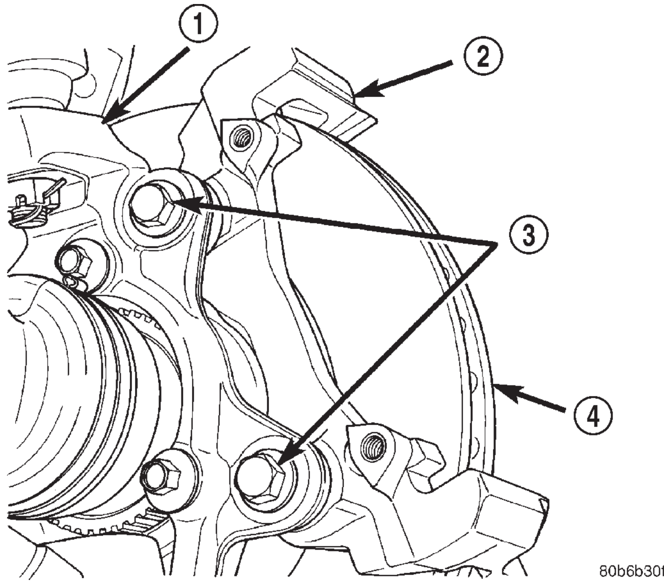


Fig. 64 Caliper Anchor Bolts

1 - KNUCKLE
2 - ANCHOR
3 - ANCHOR BOLTS
4 - ROTOR

REMOVAL

REMOVAL - FRONT DISC BRAKE ROTOR

NOTE: Front rotors and hub/bearings are matched mounted for minimum lateral runout. Before removing the rotor, mark the rotor and hub/bearing to maintain original orientation.

(1) Raise and support the vehicle.
(2) Remove wheel and tire assembly.
(3) Remove the caliper anchor bolts (Fig. 64) and remove the caliper and anchor as an assembly from the steering knuckle.
(4) Secure caliper anchor assembly to nearby suspension part with a wire. **Do not allow brake hose to support caliper weight.**
(5) Mark the rotor and hub/bearing to maintain original orientation. Remove retainers securing rotor to hub studs.
(6) Remove rotor from hub/bearing.

REMOVAL - REAR DISC BRAKE ROTOR

(1) Raise and support the vehicle.
(2) Remove wheel and tire assembly.
(3) Remove the caliper anchor bolts (Fig. 65).
(4) Remove caliper and anchor as an assembly.
(5) Secure caliper anchor assembly to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**
(6) Remove retainers securing rotor to axle studs.
(7) Remove rotor off axle studs.

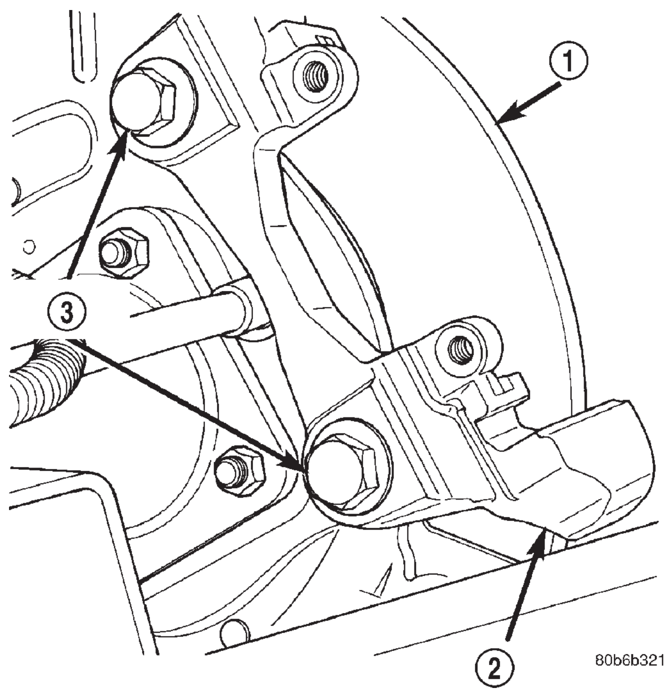


Fig. 65 Caliper Anchor Bolts

1 - ROTOR
2 - ANCHOR
3 - ANCHOR BOLTS

ROTORS (Continued)

INSTALLATION

INSTALLATION - FRONT DISC BRAKE ROTOR

NOTE: If a new rotor is installed it must be match mounted to the hub/bearing.

(1) Install rotor on hub studs in its original location.

(2) Install the caliper anchor assembly on the knuckle. Install anchor bolts and tighten to 90-115 N·m (66-85 ft. lbs.).

(3) Install wheel and tire assembly.

(4) Remove support and lower the vehicle.

(5) Pump brake pedal to seat caliper pistons and brake shoes. Do not move vehicle until firm brake pedal is obtained.

INSTALLATION - REAR DISC BRAKE ROTOR

(1) Install rotor on axle studs.

(2) Install the caliper anchor assembly.

(3) Install anchor bolts and tighten to 90-115 N·m (66-85 ft. lbs.).

(4) Install wheel and tire assembly.

(5) Remove support and lower the vehicle.

(6) Pump brake pedal until caliper pistons and brake shoes are seated.

PARKING BRAKE

OPERATION

The parking brakes operated by a automatic tensioner mechanism built into the hand lever and cable system. The front cable is connected to the hand lever and the equalizer. The rear cables attached to the equalizer and the parking brake shoe actuator.

A set of drum type brake shoes are used for parking brakes. The shoes are mounted to the rear disc brake adaptor. The parking brake drum is integrated into the rear disc brake rotor.

Parking brake cable adjustment is controlled by an automatic tensioner mechanism. The only adjustment if necessary is to the park brake shoes if the linings are worn.

DIAGNOSIS AND TESTING - PARKING BRAKE

NOTE: Parking brake adjustment is controlled by an automatic cable tensioner and does not require adjustment. The only adjustment that may be necessary would be to the park brake shoes if they are worn.

The parking brake switch is in circuit with the red warning lamp in the dash. The switch will cause the lamp to illuminate only when the parking brakes are applied. If the lamp remains on after parking brake release, the switch or wires are faulty.

If the red lamp comes on a fault has occurred in the front or rear brake hydraulic system.

If the red warning lamp and yellow warning lamp come on, the electronic brake distribution may be at fault.

In most cases, the actual cause of an improperly functioning parking brake (too loose/too tight/won't hold), can be traced to a parking brake component.

NOTE: The leading cause of improper parking brake operation, is excessive clearance between the parking brake shoes and the shoe braking surface. Excessive clearance is a result of lining and/or drum wear, drum surface machined oversize.

Excessive parking brake lever travel (sometimes described as a loose lever or too loose condition), is the result of worn brake shoes, improper brake shoe adjustment, or improperly assembled brake parts.

A too loose condition can also be caused by inoperative or improperly assembled parking brake shoe parts.

A condition where the parking brakes do not hold, will most probably be due to a wheel brake component.

Items to look for when diagnosing a parking brake problem, are:

- Brake shoe wear
- Drum surface (in rear rotor) machined oversize
- Front cable not secured to lever
- Rear cable not attached to actuator
- Rear cable seized
- Parking brake lever not seated
- Parking brake lever bind

CABLES

REMOVAL

REMOVAL - FRONT PARKING BRAKE CABLE

(1) Remove center console,(Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(2) Lift up rear seat and carpet covering the parking brake cables.

(3) Place a screw driver through the front cable eyelet (Fig. 66) and pry back on the front cable.

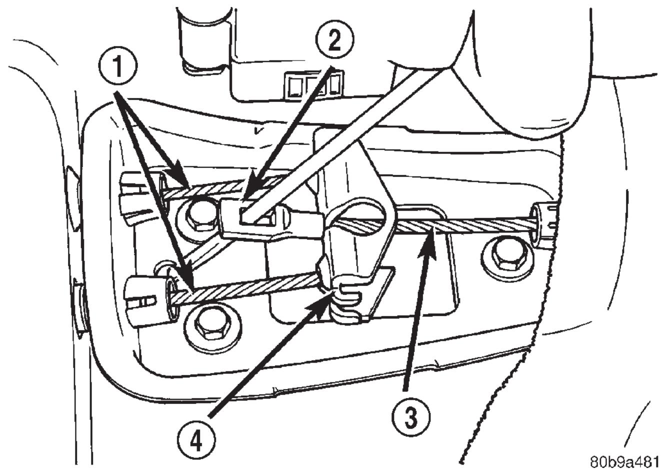


Fig. 66 Front Cable Eyelet

1 - REAR CABLES
2 - FRONT CABLE EYELET
3 - FRONT CABLE
4 - EQUALIZER

(4) Have an assistant pry down the lock out spring through the hole in the side of the park brake lever (Fig. 67) with a small screw driver. Then slowly release the front cable.

NOTE: Their should be slack in the cable if the lock out spring is engaged.

(5) Disengage front cable end from the equalizer (Fig. 68).

(6) Disengage front cable end from the parking brake lever.

(7) Remove the front carpet,(Refer to 23 - BODY/INTERIOR/CARPETS AND FLOOR MATS - REMOVAL).

(8) Remove front cable retainer nuts (Fig. 69) from the floor pan.

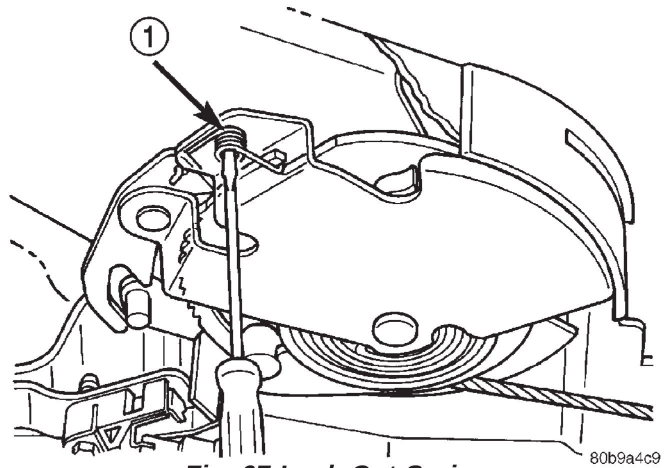


Fig. 67 Lock Out Spring

1 - LOCK OUT SPRING

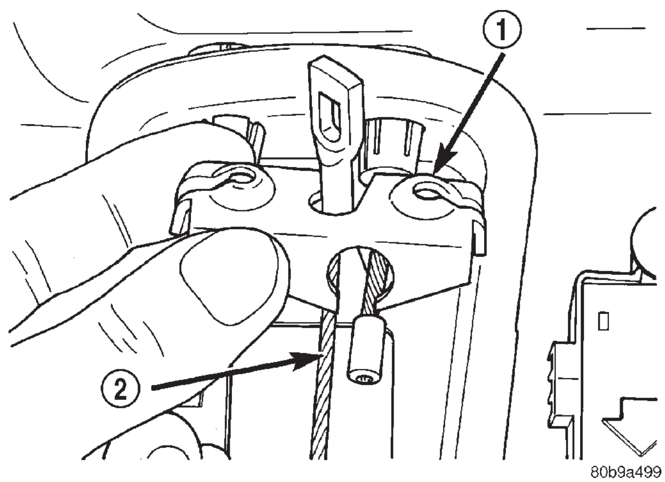


Fig. 68 Cable Equalizer

1 - EQUALIZER
2 - FRONT CABLE

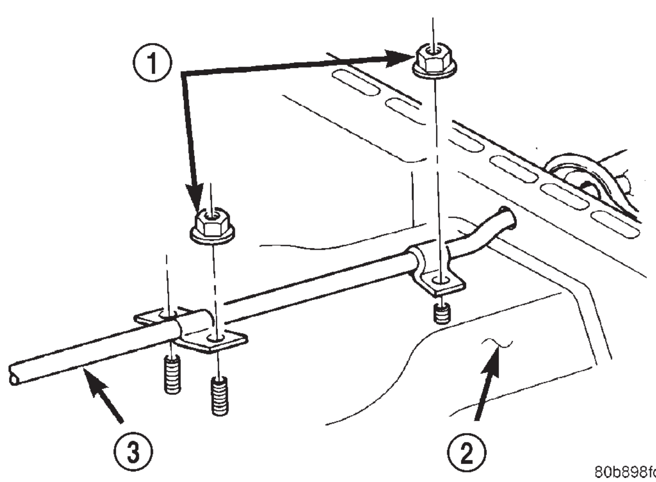


Fig. 69 Front Parking Brake Cable

1 - RETAINER NUT
2 - FLOOR PAN
3 - FRONT CABLE

CABLES (Continued)

(9) Compress the cable retainers with a 13 mm wrench (Fig. 70). Remove the cable from parking brake lever bracket and equalizer bracket.

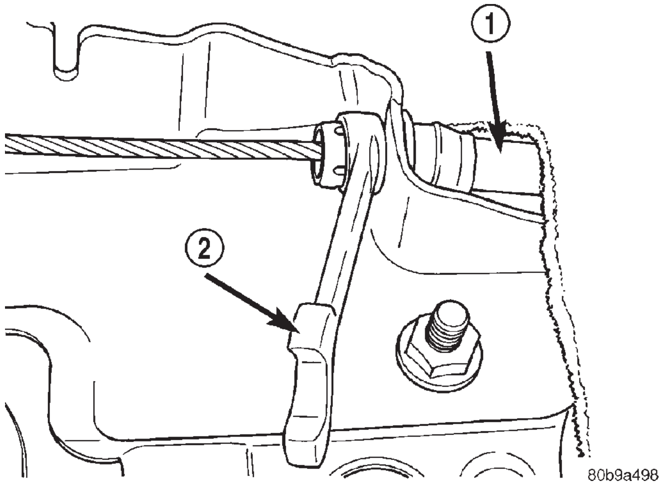


Fig. 70 Brake Lever Bracket

1 - FRONT CABLE
2 - WRENCH

REMOVAL - REAR PARKING BRAKE CABLES

(1) Remove center console, (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(2) Lift up rear seat and carpet covering the parking brake cables.

(3) Place a screw driver through the front cable eyelet (Fig. 71) and pry back on the front cable.

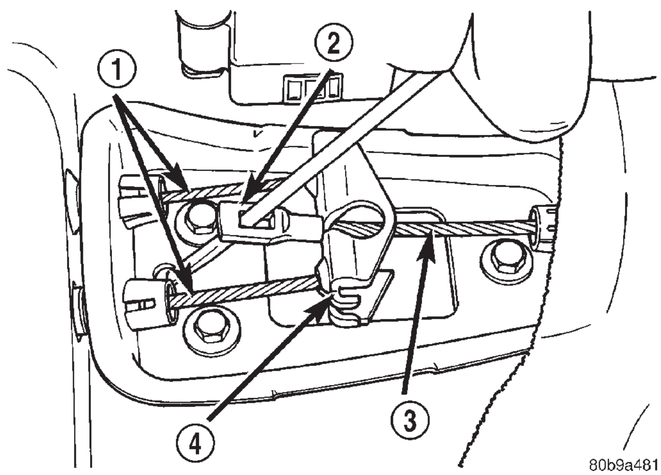


Fig. 71 Front Cable Eyelet

1 - REAR CABLES
2 - FRONT CABLE EYELET
3 - FRONT CABLE
4 - EQUALIZER

(4) Have an assistant pry down the lock out spring through the hole in the side of the park brake lever (Fig. 72) with a small screw driver. Then slowly release the front cable.

NOTE: Their should be slack in the cable if the lock out spring is engaged.

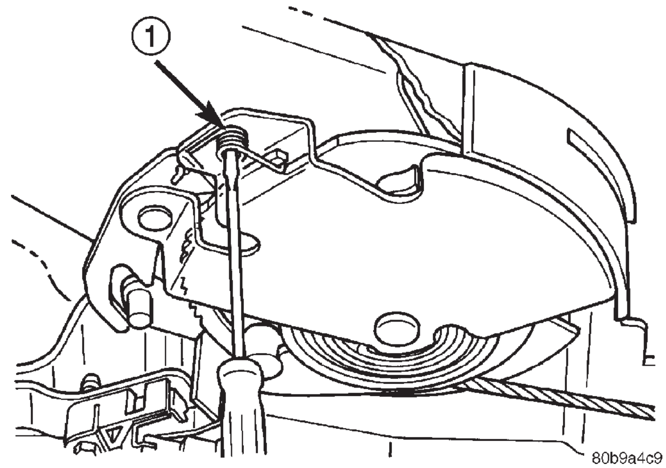


Fig. 72 Lock Out Spring

1 - LOCK OUT SPRING

(5) Disengage rear cables ends from the equalizer.

(6) Compress the cable retainers with a 13 mm wrench (Fig. 73) and remove the cable from equalizer bracket.

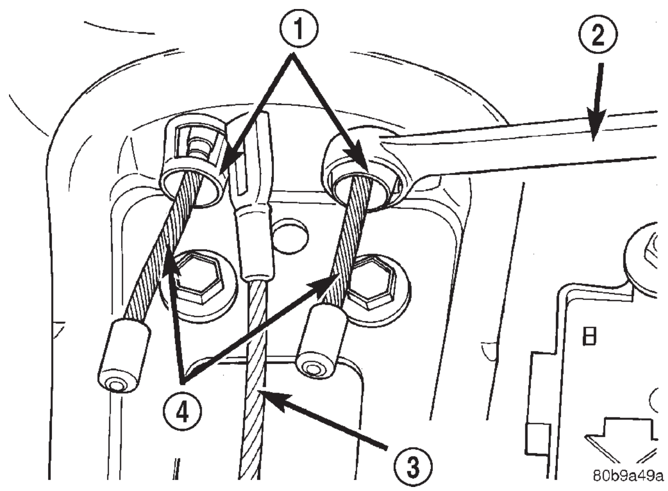


Fig. 73 Cable Retainers

1 - CABLE RETAINER
2 - WRENCH
3 - FRONT CABLE
4 - REAR CABLES

CABLES (Continued)

(7) Raise and support the vehicle.

(8) Remove the wheel and tire assemblies.

(9) Remove the brake calipers, caliper anchors and rotors.

(10) Remove the ABS sensor wiring harness (Fig. 74)from the rear brake cables.

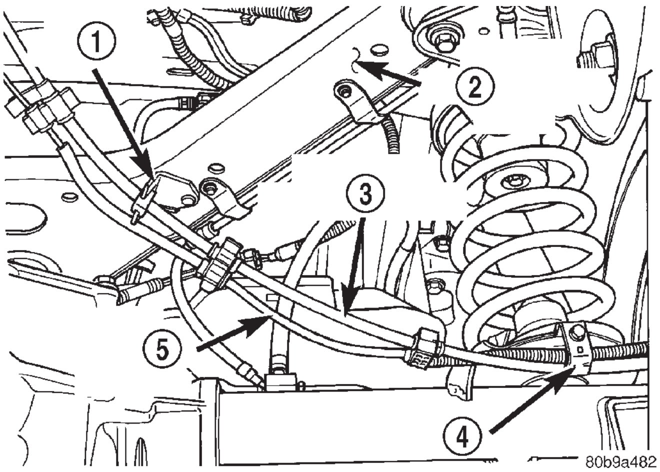


Fig. 74 Left Rear Parking Brake Cable

1 - CABLE BRACKET
2 - UPPER SUSPENSION ARM
3 - PARKING BRAKE CABLE
4 - CABLE RETAINER
5 - ABS SENSOR WIRING

(11) Remove the cable retainer bolts (Fig. 74) from the rear spring pads.

(12) Pull the cables out of the upper suspension arm brackets.

(13) Push the cable in and lift up the end of cable with a small screw driver to disengage the cable from the parking brake actuator (Fig. 75).

(14) Remove the cable from the vehicle.

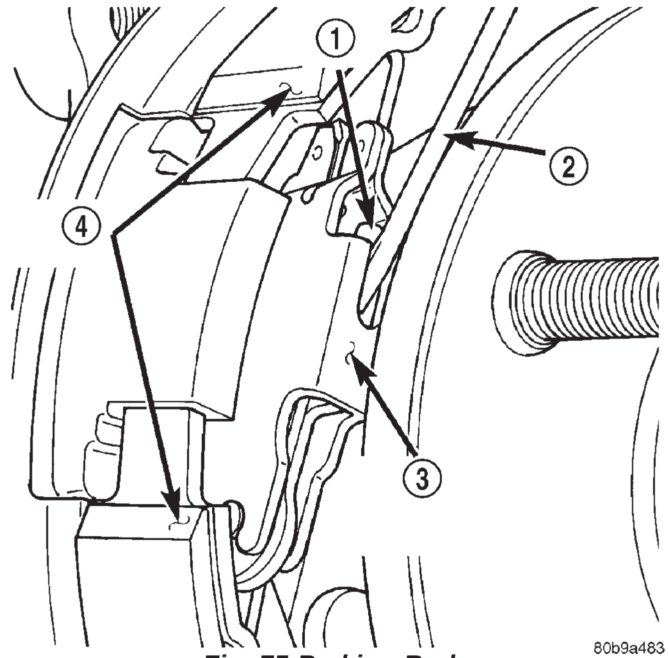


Fig. 75 Parking Brake

1 - CABLE END
2 - SCREW DRIVER
3 - PARKING BRAKE ACTUATOR
4 - BRAKE SHOES

INSTALLATION

INSTALLATION - FRONT PARKING BRAKE CABLE

(1) Install thecable into the parking brake lever bracket and equalizer bracket.

(2) Install the front cable to the floor pan and install retainer nuts.

(3) Engage the front cable ends to the parking brake lever and equalizer.

(4) Install the front carpet, (Refer to 23 - BODY/ INTERIOR/CARPETS AND FLOOR MATS - INSTALLATION).

(5) Pull on the lever to release the lock out spring.

(6) Install the center console, (Refer to 23 - BODY/ INTERIOR/FLOOR CONSOLE - INSTALLATION).

(7) Fold down the rear carpet cover and rear seat.

INSTALLATION - REAR PARKING BRAKE CABLES

(1) Install the cables through the caliper anchor mount. Then push the end of cable strand in to engage the cable end to the parking brake actuator.

(2) Feed the other end of the cables through the body and into the equalizer bracket (Fig. 76).

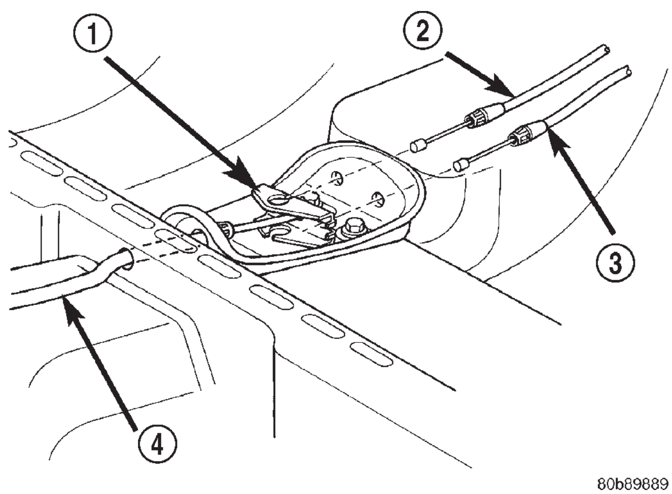


Fig. 76 Equalizer Bracket

1 - EQUALIZER
2 - RIGHT REAR CABLE
3 - LEFT REAR CABLE
4 - FRONT CABLE

CABLES (Continued)

(3) Push the cables into the upper suspension arm brackets.

(4) Install the cable retainer bolts to the rear spring pads.

(5) Install the ABS sensor wiring harness to the rear brake cables.

(6) Install the rotors, caliper anchors and brake calipers.

(7) Install the wheel and tire assemblies.

(8) Remove support and lower the vehicle.

(9) Engage the cable ends into the parking brake equalizer.

(10) Pull on the lever to release the lock out spring.

(11) Install center console, (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(12) Fold down the rear carpet cover and rear seat.

(13) Verify parking brake operation.

LEVER

REMOVAL

(1) Remove center console,(Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(2) Lift up rear seat and carpet covering the parking brake cables.

(3) Place a screw driver through the front cable eyelet (Fig. 77) and pry back on the front cable.

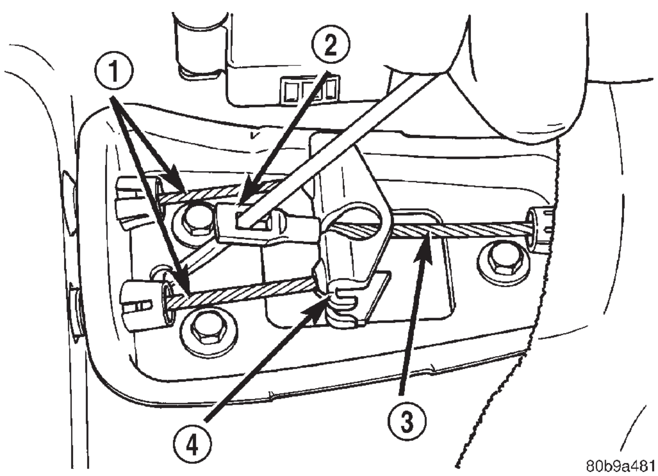


Fig. 77 FRONT CABLE

1 - REAR CABLES
2 - FRONT CABLE EYELET
3 - FRONT CABLE
4 - EQUALIZER

(4) Have an assistant pry down the lock out spring through the hole in the side of the park brake lever (Fig. 78) with a small screw driver. Then slowly release the front cable.

NOTE: Their should be slack in the cable if the lock out spring is engaged.

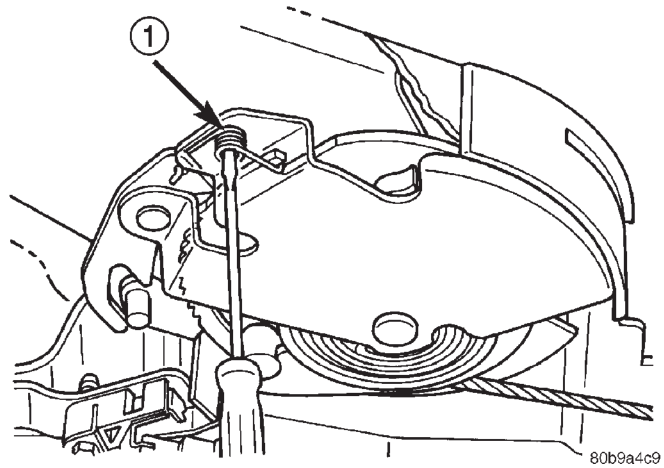


Fig. 78 Lock Out Spring

1 - LOCK OUT SPRING

(5) Disconnect parking brake switch wiring connector.

(6) Disengage front cable end from parking brake lever.

(7) Compress the cable retainer with a 13 mm wrench (Fig. 79) and remove the cable from the parking brake lever bracket.

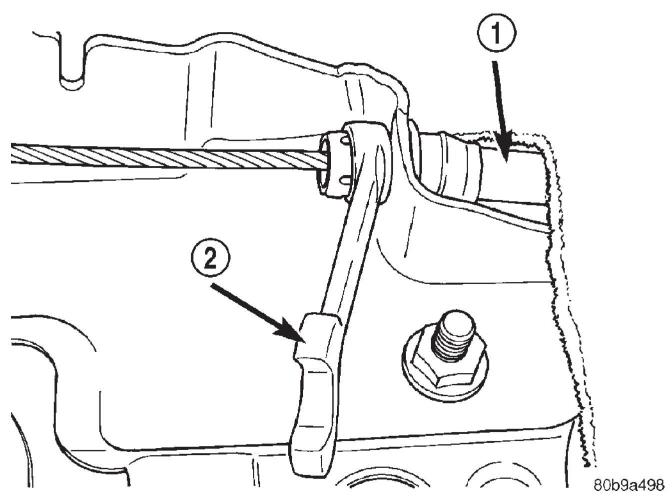


Fig. 79 Parking Brake Lever Bracket

1 - FRONT CABLE
2 - WRENCH

LEVER (Continued)

(8) Remove the park brake lever mounting nuts and console bracket (Fig. 80).

(9) Lift the lever assembly off the mounting studs and pull the front cable out of the lever bracket.

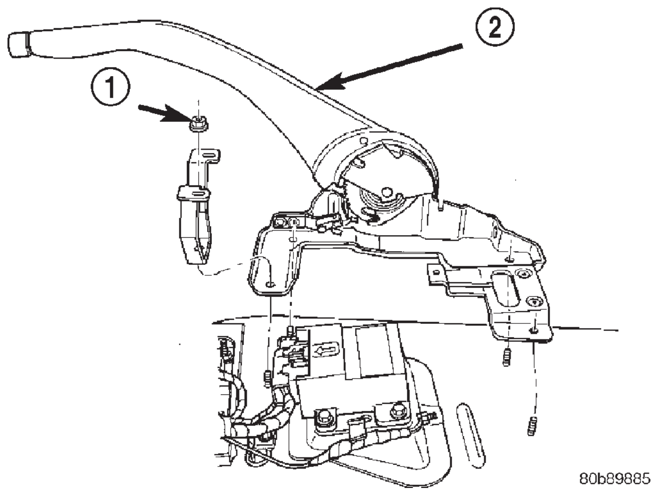


Fig. 80 Parking Brake Lever Mounting

1 - MOUNTING NUT
2 - PARK BRAKE LEVER

INSTALLATION

(1) Install the lever assembly on the mounting studs while feeding the front cable into the lever bracket.

(2) Install the console bracket (Fig. 80) and mounting nuts.

(3) Engage the front cable end to the lever.

(4) Connect parking brake switch wire connector.

(5) Pull on the lever to release the lock out spring.

(6) Install center console,(Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(7) Fold down the rear carpet cover and rear seat.

SHOES

REMOVAL

(1) Lock out park brake lever (Fig. 81).

(2) Raise vehicle.

(3) Remove rear wheel and tire assembly.

(4) Remove caliper and anchor as an assembly.

(5) Remove rubber access plug from back of rear disc brake splash shield.

(6) If necessary retract parking brake shoes with brake adjuster tool (Fig. 82). Position tool at top of star wheel and rotate wheel.

(7) Remove rotor from axle hub flange.

(8) Remove the lower shoe to shoe spring/adjuster spring with needle nose pliers (Fig. 83).

(9) Remove the upper shoe to shoe spring/return spring with brake pliers (Fig. 84).

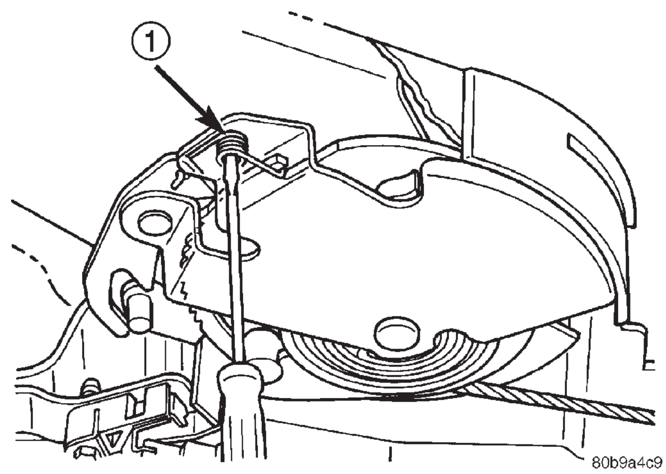


Fig. 81 Lock Out Spring

1 - LOCK OUT SPRING

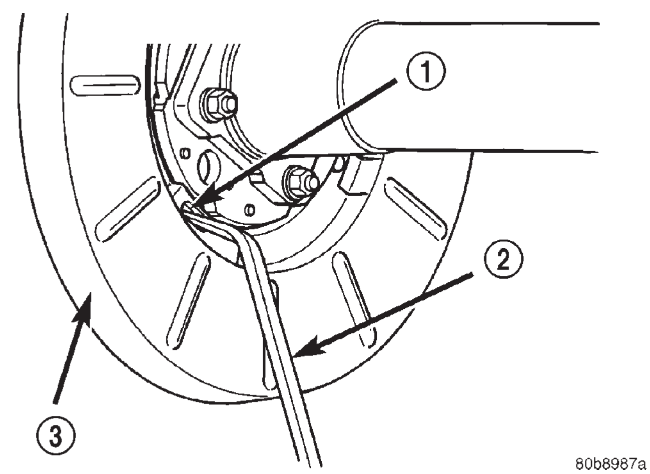


Fig. 82 Retracting Parking Brake Shoes

1 - ACCESS HOLE
2 - BRAKE ADJUSTING TOOL
3 - SPLASH SHIELD

(10) Remove shoe hold-down clips and pins (Fig. 85). Clip is held in place by pin which fits in clip notch. To remove clip, first push clip ends together and slide clip until head of pin clears narrow part of notch. Then remove clip and pin.

(11) Remove shoes and adjuster.

INSTALLATION

(1) Install shoes on splash shield with hold down clips and pins. Be sure shoes are properly engaged in the park brake actuator.

(2) Lubricate and install adjuster screw assembly. Be sure notched ends of screw assembly are properly seated on shoes and that star wheel is aligned with access hole in shield.

SHOES (Continued)

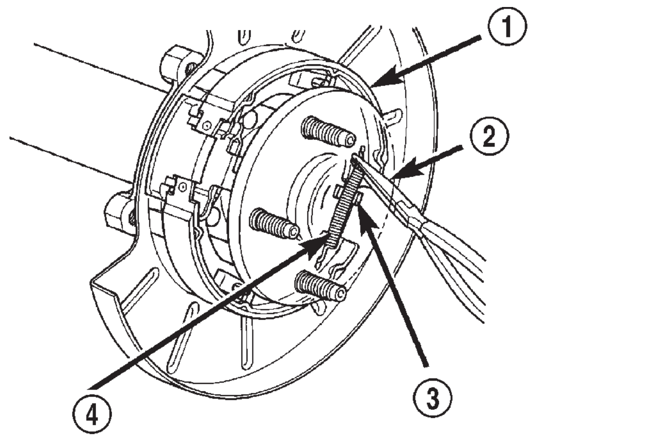


Fig. 83 Lower Spring

1 - REAR SHOE
2 - NEEDLENOSE PLIERS
3 - ADJUSTER SCREW
4 - LOWER SPRING

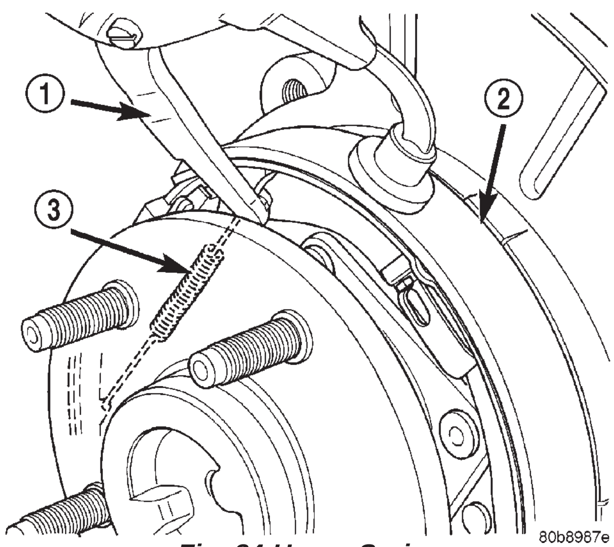


Fig. 84 Upper Spring

1 - BRAKE PLIERS
2 - REAR SHOE
3 - UPPER SPRING

(3) Install lower shoe to shoe spring/adjuster spring. Needle nose pliers can be used to connect spring to each shoe.

(4) Install the upper shoe to shoe spring/return spring with brake pliers (Fig. 83).

(5) Install rotor and caliper anchor assembly.

(6) Install anchor bolts and tighten to 90-115 N·m (66-85 ft. lbs.).

(7) Actuate park brake lever to unlock the park brake system.

(8) Adjust the parking brake shoes (Fig. 82).

(9) Install wheel and tire assembly.

(10) Lower vehicle and verify correct parking brake operation.

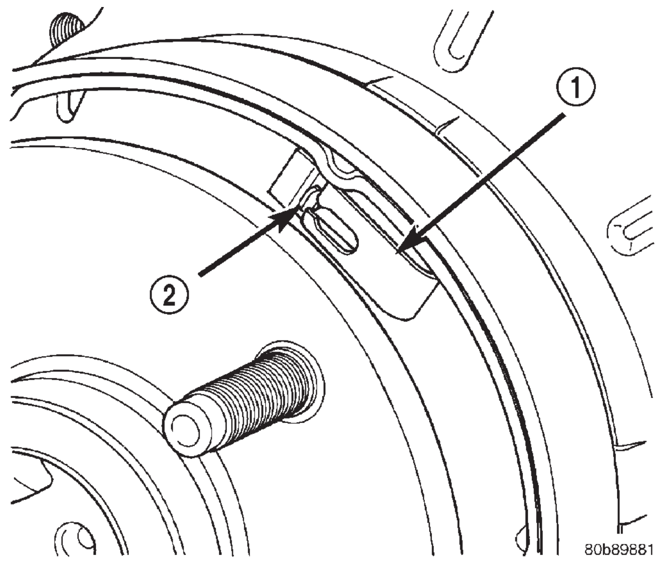


Fig. 85 Hold-Down Clip And Pin

1 - HOLD-DOWN CLIP
2 - HOLD-DOWN PIN

ADJUSTMENTS - PARKING BRAKE SHOE

(1) Remove wheel and tire assemblies.

(2) Secure rotor with two wheel nuts.

(3) Remove rubber access plug from back of splash shield.

(4) Insert brake tool through access hole in splash shield (Fig. 86). Position tool at bottom of star wheel.

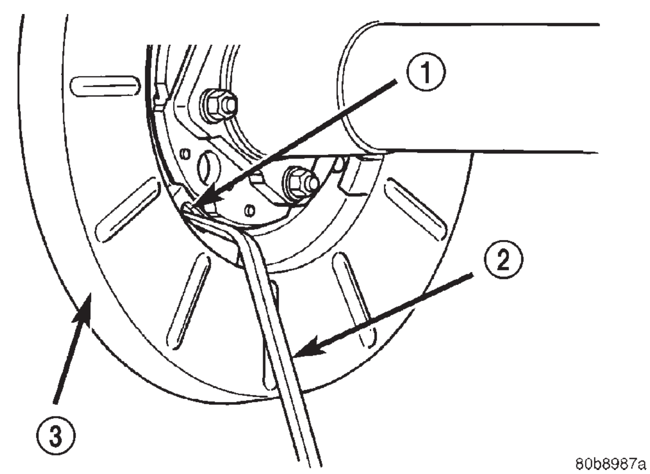


Fig. 86 Park Brake Shoe Adjustment

1 - ACCESS HOLE
2 - BRAKE ADJUSTING TOOL
3 - SPLASH SHIELD

(5) Rotate star wheel upward direction to expand shoes (while facing front of vehicle).

(6) Expand shoes until light drag is experienced. Then back off adjuster screw only enough to eliminate drag.

(7) Install plug in splash shield access hole.

(8) Install wheel and tire assemblies.

BRAKES - ABS

TABLE OF CONTENTS

BRAKES - ABS

DESCRIPTION

The purpose of the antilock system is to prevent wheel lockup during periods of high wheel slip. Preventing lockup helps maintain vehicle braking action and steering control.

The hydraulic system is a three channel design. The front brakes are controlled individually and the rear brakes in tandem.

The ABS electrical system is separate from other vehicle electrical circuits. A separate controller operates the system.

OPERATION

The antilock CAB activates the system whenever sensor signals indicate periods of high wheel slip. High wheel slip can be described as the point where wheel rotation begins approaching 20 to 30 percent of actual vehicle speed during braking. Periods of high wheel slip occur when brake stops involve high pedal pressure and rate of vehicle deceleration.

Battery voltage is supplied to the CAB ignition terminal when the ignition switch is turned to Run position. The CAB performs a system initialization procedure at this point. Initialization consists of a static and dynamic self check of system electrical components.

The static check occurs after the ignition switch is turned to Run position. The dynamic check occurs when vehicle road speed reaches approximately 30 kph (18 mph). During the dynamic check, the CAB briefly cycles the pump and solenoids to verify operation.

If an ABS component exhibits a fault during initialization, the CAB illuminates the amber warning light and registers a fault code in the microprocessor memory.

ANTILOCK BRAKING

The antilock system prevents lockup during high slip conditions by modulating fluid apply pressure to the wheel brake units.

Brake fluid apply pressure is modulated according to wheel speed, degree of slip and rate of deceleration. A sensor at each wheel converts wheel speed into electrical signals. These signals are transmitted to the CAB for processing and determination of wheel slip and deceleration rate.

The ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem. A speed sensor input signal indicating a high slip condition activates the CAB antilock program.

Two solenoid valves are used in each antilock control channel. The valves are all located within the HCU valve body and work in pairs to either increase, hold, or decrease apply pressure as needed in the individual control channels.

The solenoid valves are not static during antilock braking. They are cycled continuously to modulate pressure. Solenoid cycle time in antilock mode can be measured in milliseconds.

BRAKES - ABS (Continued)

DIAGNOSIS AND TESTING - ANTILOCK BRAKES

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the systems input and output circuits to verify the system is operating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.

NOTE: The MDS or DRB III scan tool is used to diagnose the ABS system. For additional information refer to the Electrical section. For test procedures refer to the Chassis Diagnostic Manual.

STANDARD PROCEDURE - BLEEDING ABS BRAKE SYSTEM

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

(1) Perform base brake bleeding. (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).

(2) Connect scan tool to the Data Link Connector.

(3) Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.

(4) Perform base brake bleeding a second time. (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).

(5) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
G-Sensor Bolt	5.6	—	50
Hydraulic Control Unit/Controller Antilock Brakes Mounting Bolts	12	9	125
Hydraulic Control Unit/Controller Antilock Brakes Brake Lines	16	—	144
Hydraulic Control Unit/Controller Antilock Brakes CAB Screws	1.8	—	16
Wheel Speed Sensors Front Sensor Bolt	12-14	106-124	—
Wheel Speed Sensors Rear Sensor Bolt	12-14	106-124	—

ELECTRIC BRAKE

DESCRIPTION

The electronic brake distribution (EBD) functions like a rear proportioning valve. The EBD system uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves located in the HCU.

OPERATION

Upon entry into EBD the inlet valve for the rear brake circuit is switched on so that the fluid supply from the master cylinder is shut off. In order to decrease the rear brake pressure the outlet valve for the rear brake circuit is pulsed. This allows fluid to enter the low pressure accumulator (LPA) in the HCU resulting in a drop in fluid pressure to the rear brakes. In order to increase the rear brake pressure the outlet valve is switched off and the inlet valve is pulsed. This increases the pressure to the rear brakes. This will continue until the required slip difference is obtained. At the end of EBD braking (no brake application) the fluid in the LPA drains back to the master cylinder by switching on the outlet valve and draining through the inlet valve check valve. At the same time the inlet valve is switched on to prevent a hydraulic short circuit in case of another brake application.

The EBD will remain functional during many ABS fault modes. If the red and amber warning lamps are illuminated the EBD may have a fault.

FRONT WHEEL SPEED SENSOR

DESCRIPTION

A wheel speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear sensors are mounted at the outboard end of the axle. Tone wheels are mounted to the outboard ends of the front and rear axle shafts. The gear type tone wheel serves as the trigger mechanism for each sensor.

OPERATION

The sensors convert wheel speed into a small digital signal. The CAB sends 12 volts to the sensors. The sensor has an internal magneto resistance bridge that alters the voltage and amperage of the signal circuit. This voltage and amperage is changed by magnetic induction when the toothed tone wheel passes the wheel speed sensor. This digital signal is sent to the CAB. The CAB measures the voltage and amperage of the digital signal for each wheel.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the front wheel sensor mounting bolt (Fig. 1).

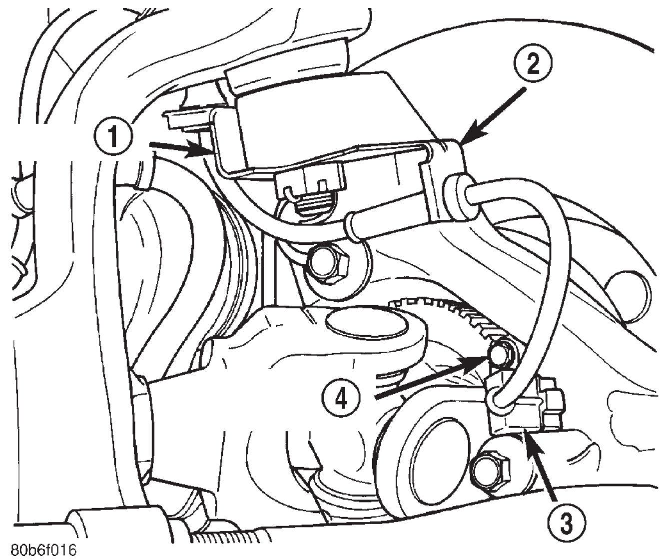


Fig. 1 Sensor Location

1 - BRACKET
2 - BRACKET
3 - WHEEL SPEED SENSOR
4 - MOUNTING BOLT

(3) Remove the sensor from the steering knuckle.

(4) Disengage the sensor wire from the brackets (Fig. 1)on the steering knuckle.

(5) Disconnect the sensor from the sensor harness (Fig. 2)and (Fig. 3).

(6) Remove the sensor and wire.

INSTALLATION

(1) Install the sensor on the steering knuckle.

(2) Apply Mopar Lock N' Seal or Loctite® 242 to the sensor mounting bolt. Use new sensor bolt if original bolt is worn or damaged.

(3) Install the sensor mounting bolt and tighten bolt to 12-14 N·m (106-124 in. lbs.).

(4) Engage the grommets on the sensor wire to the steering knuckle brackets.

(5) Connect the sensor wire to the harness connector.

(6) Check the sensor wire routing. Be sure the wire is clear of all chassis components and is not twisted or kinked at any spot.

(7) Remove the support and lower vehicle.

FRONT WHEEL SPEED SENSOR (Continued)

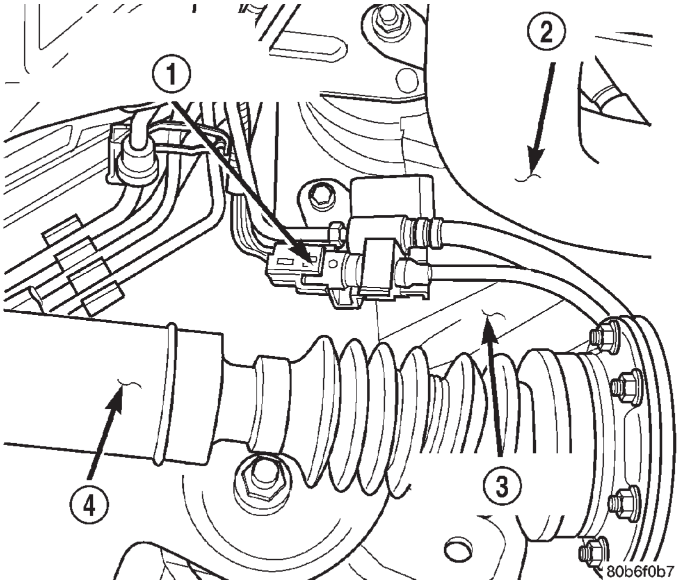


Fig. 2 Left Sensor Connector

1 - LEFT FRONT WHEEL SPEED SENSOR CONNECTOR
2 - ENGINE EXHAUST PIPE
3 - LEFT FRONT FRAME RAIL
4 - FRONT DRIVESHAFT

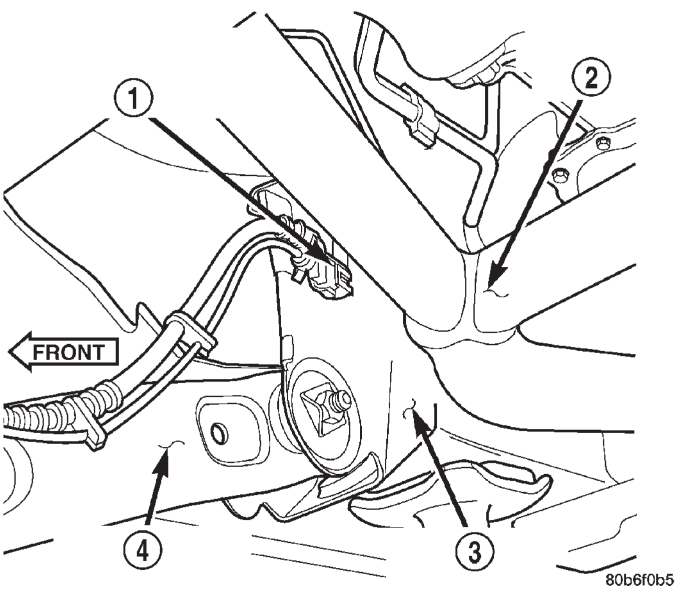


Fig. 3 Right Sensor Connector

1 - RIGHT FRONT WHEEL SPEED SENSOR CONNECTOR
2 - ENGINE EXHAUST Y-PIPE
3 - RIGHT FRONT FRAME RAIL
4 - RIGHT LOWER SUSPENSION ARM

G-SWITCH

DESCRIPTION

The G-switch (Fig. 4) is located under the rear seat. The switch has directional arrow and must be mounted with the arrow pointing towards the front of the vehicle.

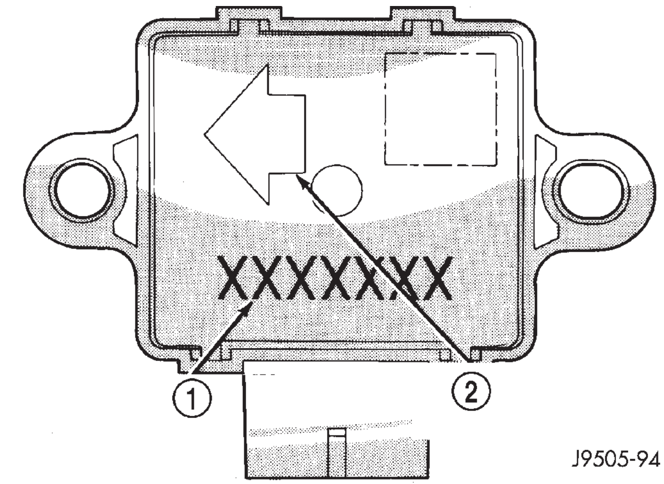


Fig. 4 G-Switch

1 - SWITCH PART NUMBER
2 - ARROW INDICATES FRONT OF SWITCH FOR PROPER MOUNTING

OPERATION

The switch is monitored by the CAB at all times. The switch contains three mercury switches which monitor vehicle deceleration rates (G-force). Sudden changes in deceleration rates trigger the switch, sending a signal to the CAB.

REMOVAL

(1) Fold the rear seat bottom assembly up for access to the switch.

(2) Lift up the carpeting and disconnect the switch harness (Fig. 5).

(3) Remove the switch mounting bolts and remove the switch.

INSTALLATION

CAUTION: The mercury switch (inside the G-Switch), will not function properly if the switch is installed incorrectly. Verify that the switch locating arrow is pointing to the front of the vehicle (Fig. 6).

(1) Note the position of the locating arrow on the switch. Position the switch so the arrow faces forward.

(2) Install the switch and tighten the mounting bolts to 5.6 N·m (50 in. lbs.).

G-SWITCH (Continued)

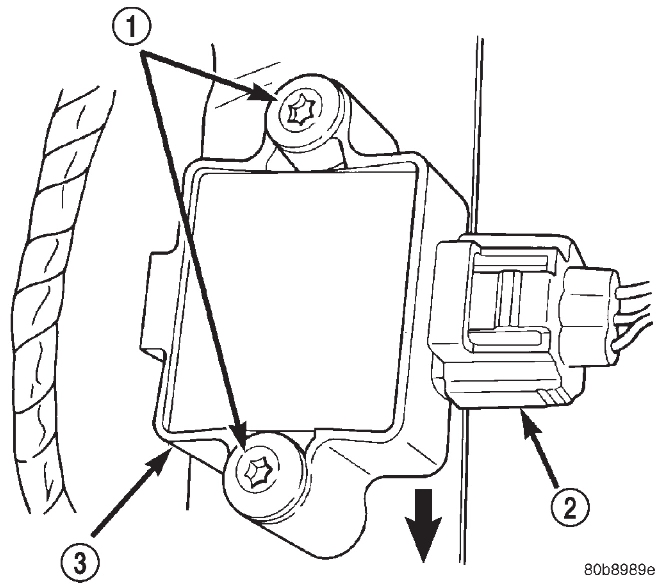


Fig. 5 G-Switch Mounting

1 - MOUNTING BOLTS
2 - CONNECTOR
3 - G-SWITCH

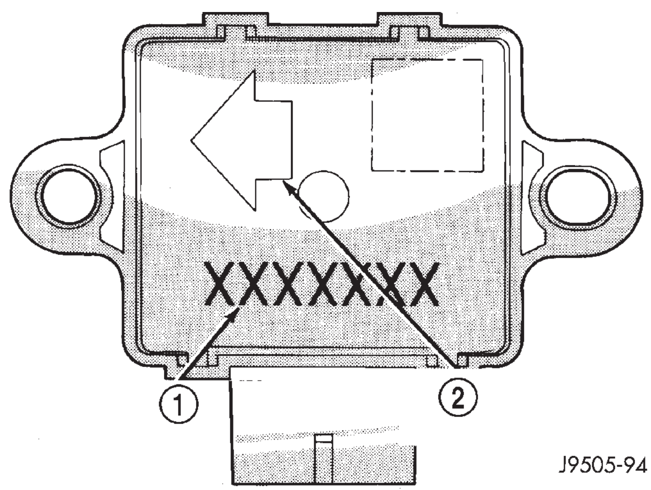


Fig. 6 G-Switch

1 - SWITCH PART NUMBER
2 - ARROW INDICATES FRONT OF SWITCH FOR PROPER MOUNTING

(3) Connect the harness to the switch. Be sure the harness connector is firmly seated.

(4) Place the carpet in position and fold the rear seat back down.

REAR WHEEL SPEED SENSOR

DESCRIPTION

A wheel speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear sensors are mounted at the outboard end of the axle. Tone wheels are mounted to the outboard ends of the front and rear axle shafts. The gear type tone wheel serves as the trigger mechanism for each sensor.

OPERATION

The sensors convert wheel speed into a small digital signal. The CAB sends 12 volts to the sensors. The sensor has an internal magneto resistance bridge that alters the voltage and amperage of the signal circuit. This voltage and amperage is changed by magnetic induction when the toothed tone wheel passes the wheel speed sensor. This digital signal is sent to the CAB. The CAB measures the voltage and amperage of the digital signal for each wheel.

REMOVAL

(1) Raise and fold the rear seat forward. Then move the carpeting aside for access to the rear sensor connectors.

(2) Disconnect the rear sensor wire at the harness connectors (Fig. 7).

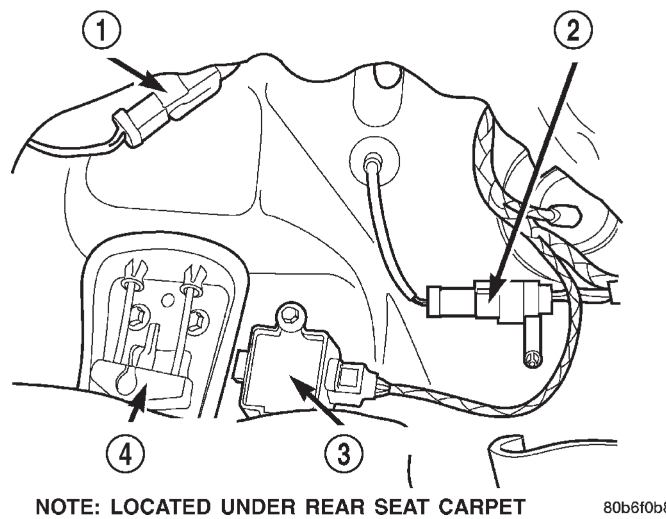


Fig. 7 Rear Sensor Connector

1 - RIGHT REAR WHEEL SPEED SENSOR CONNECTOR
2 - LEFT REAR WHEEL SPEED SENSOR CONNECTOR
3 - G-SWITCH SENSOR
4 - PARKING BRAKE CABLES

(3) Push the sensor wires and grommets through the floorpan holes.

(4) Raise and support the vehicle.

(5) Disengage the sensor wire from the axle and the chassis brackets and from the brake line retainers.

(6) Remove the sensor mounting bolt from the rear brake backing plate. (Fig. 8).

(7) Remove the sensor from the backing plate.

REAR WHEEL SPEED SENSOR (Continued)

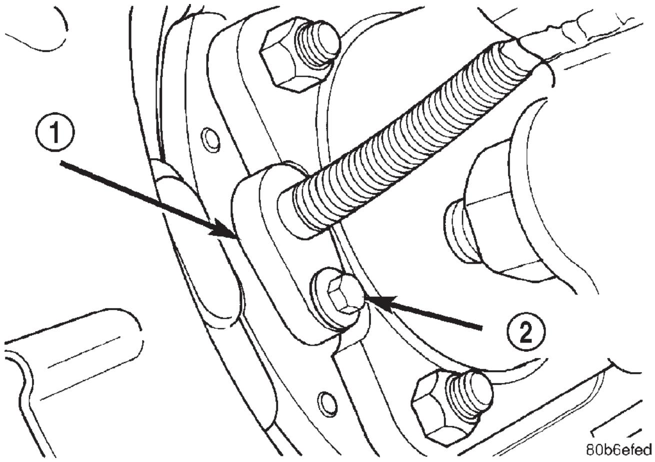


Fig. 8 Sensor Mounting Bolt

1 - WHEEL SPEED SENSOR
2 - MOUNTING BOLT

INSTALLATION

(1) Insert the sensor through the backing plate (Fig. 9).

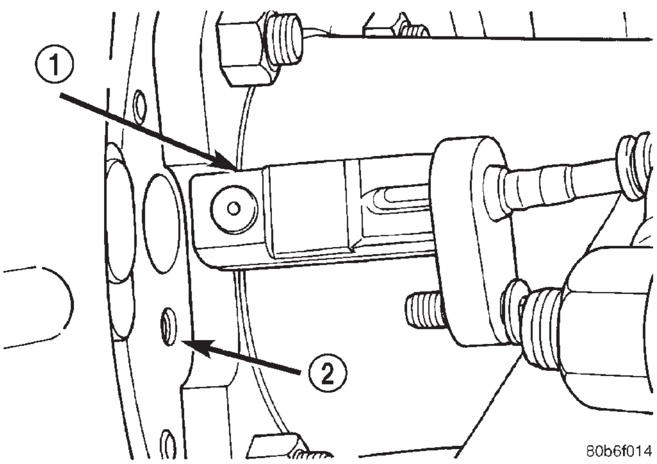


Fig. 9 Wheel Speed Sensor

1 - WHEEL SPEED SENSOR
2 - BACKING PLATE

(2) Apply Mopar Lock N' Seal or Loctite 242® to the original sensor bolt. Use a new bolt if the original is worn or damaged.

(3) Tighten the sensor bolt to 12-14 N·m (106-124 in. lbs.).

(4) Secure the sensor wire in the brackets and the retainers on the rear brake lines. Verify that the sensor wire is secure and clear of the rotating components.

(5) Route the sensor wires to the rear seat area.

(6) Feed the sensor wires the through floorpan access hole and seat the sensor grommets into the floorpan.

(7) Remove the support and lower the vehicle.

(8) Fold the rear seat and carpet forward for access to the sensor wires and connectors.

(9) Connect the sensor wires to the harness connectors.

(10) Reposition the carpet and fold the rear seat down.

HCU (HYDRAULIC CONTROL UNIT)

DESCRIPTION

The HCU consists of a valve body, pump motor, and wire harness.

OPERATION

Accumulators in the valve body store extra fluid released to the system for ABS mode operation. The pump is used to clear the accumulator of brake fluid and is operated by a DC type motor. The motor is controlled by the CAB.

The valves modulate brake pressure during antilock braking and are controlled by the CAB.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

PRESSURE DECREASE

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the CAB closes the inlet then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the CAB closes the outlet valve and begins a pressure increase or hold cycle as needed.

HCU (HYDRAULIC CONTROL UNIT) (Continued)

PRESSURE HOLD

Both solenoid valves are closed in the pressure hold cycle. Fluid apply pressure in the control channel is maintained at a constant rate. The CAB maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

PRESSURE INCREASE

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

REMOVAL

(1) Remove the negative battery cable from the battery.

(2) Remove the air cleaner housing,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(3) Pull the CAB harness connector release up and remove connector (Fig. 10).

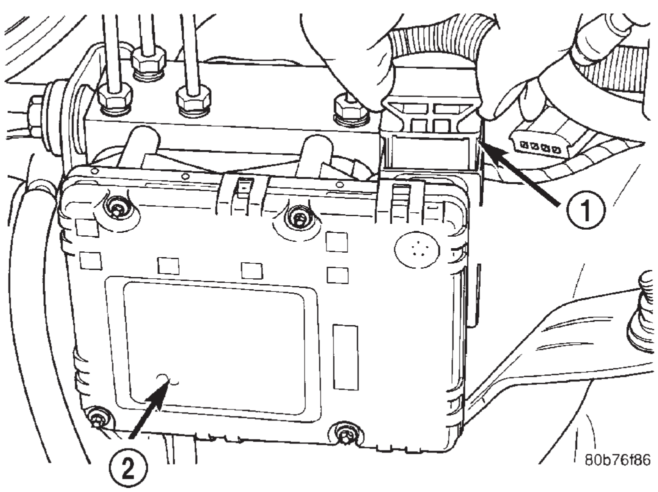


Fig. 10 CAB Connector Release

1 - CONNECTOR RELEASE
2 - CAB

(4) Remove the brake lines from the HCU.

(5) Remove the HCU/CAB side mounting bolt and the two rear mounting bolts. (Fig. 11).

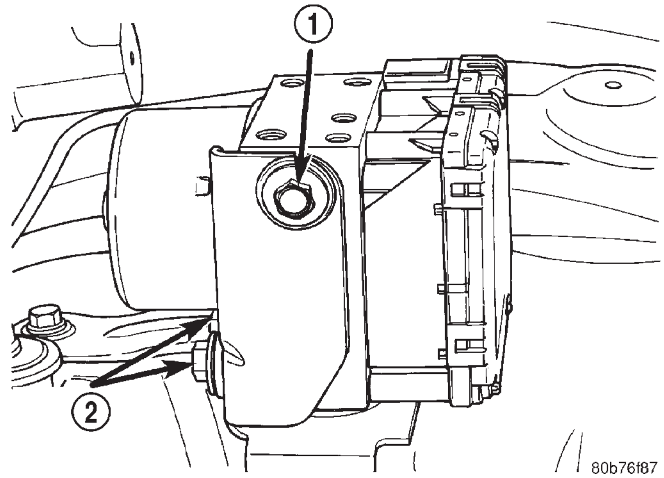


Fig. 11 HCU/CAB Assembly

1 - SIDE MOUNTING BOLT
2 - REAR MOUNTING BOLTS

(6) Remove the HCU/CAB assembly from the vehicle.

INSTALLATION

(1) Install HCU/CAB assembly into the mounting bracket and tighten mounting bolts to 12 N·m (9 ft. lbs.).

(2) Install the brake lines to the HCU and tighten to 16 N·m (12 ft. lbs.).

(3) Install CAB harness connector and push down connector release.

(4) Install air cleaner housing,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(5) Install negative battery cable to the battery.

(6) Bleed base and ABS brake systems,(Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).

COOLING

TABLE OF CONTENTS

COOLING

DESCRIPTION

DESCRIPTION - COOLING SYSTEM 4.7L ENGINE

The cooling system consists of the following items:

- Hydraulic cooling fan and fan drive assembly
- Radiator
- Power steering oil cooler
- Radiator pressure cap
- Thermostat
- Coolant reserve/overflow system
- Transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps

DESCRIPTION - COOLING SYSTEM ROUTING 4.7L ENGINE

For cooling system routing refer to (Fig. 1).

DESCRIPTION—COOLING SYSTEM 4.0L ENGINE

The cooling system consists of:

- A radiator
- Mechanical Cooling Fan
- Thermal viscous fan drive-Low disengaged
- Fan shroud (Fig. 2)
- Radiator pressure cap
- Thermostat
- Coolant reserve/overflow system
- Transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps
- Accessory drive belt

DESCRIPTION—COOLING SYSTEM ROUTING 4.0L ENGINE

For cooling system routing refer to (Fig. 3).

DESCRIPTION—HOSE CLAMPS

The cooling system utilizes both worm drive and spring type hose clamps. If a spring type clamp

COOLING (Continued)

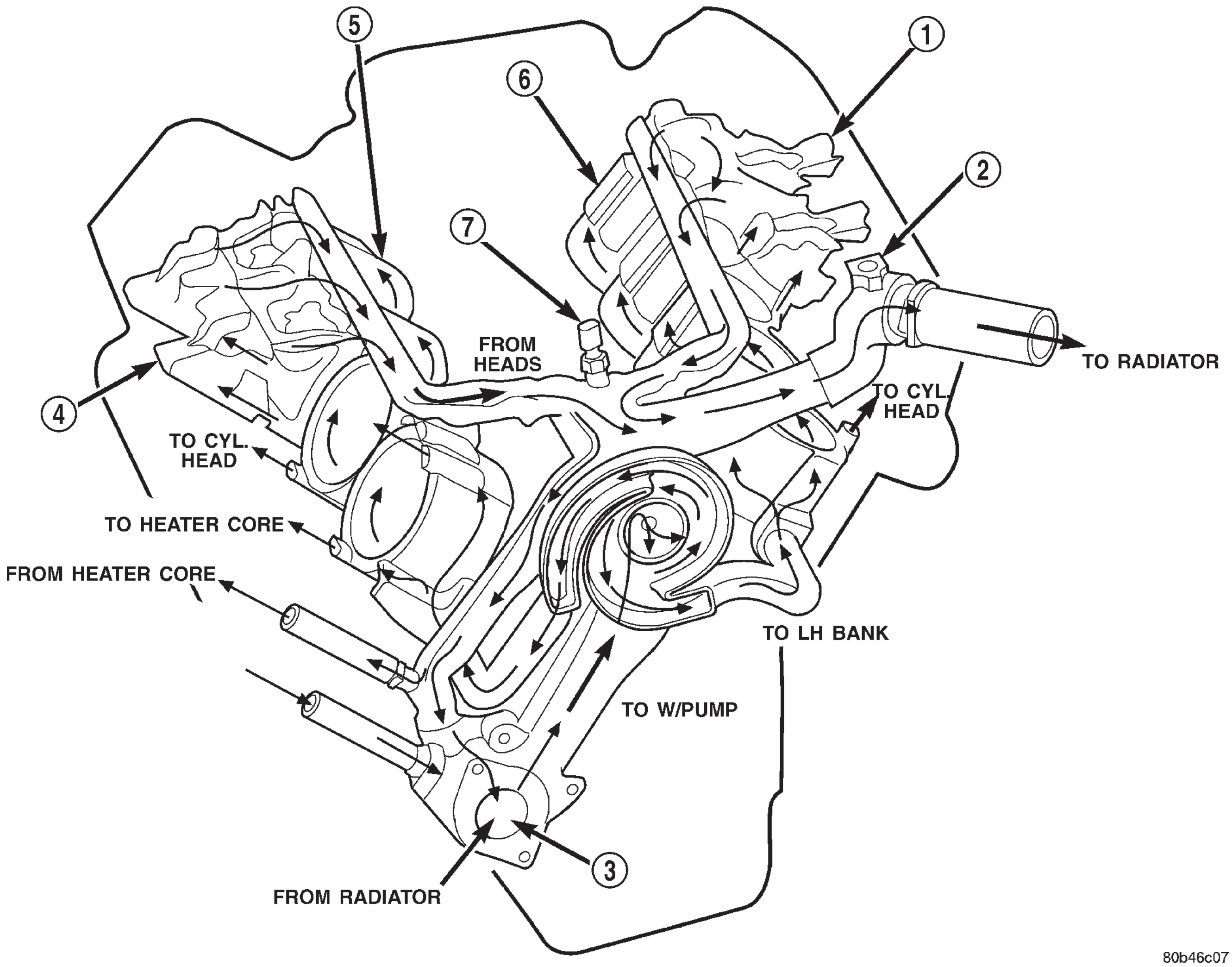


Fig. 1 Engine Cooling System 4.7L Engine

1 - LH CYL. HEAD
2 - AIR BLEED
3 - THERMOSTAT LOCATION
4 - RH CYL. HEAD
5 - RH BANK CYL. BLOCK
6 - LH BANK CYL. BLOCK
7 - COOLANT TEMP. SENSOR

replacement is necessary, replace with the original Mopar® equipment spring type clamp.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 4).

OPERATION

OPERATION—COOLING SYSTEM

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

OPERATION—HOSE CLAMPS

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

COOLING (Continued)

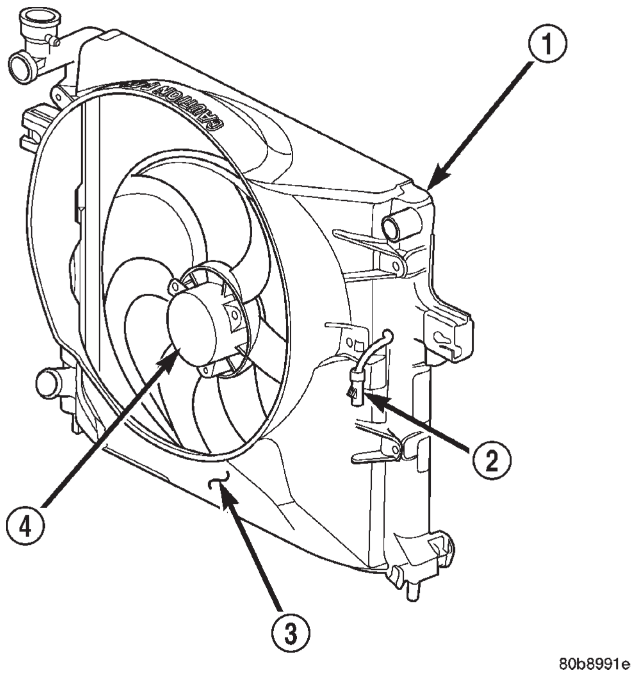


Fig. 2 Cooling Module with Electric Fan

1 - RADIATOR
2 - ELECTRIC COOLING FAN CONNECTOR
3 - FAN SHROUD
4 - ELECTRIC COOLING FAN

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, only use constant tension clamp pliers designed to compress the hose clamp.

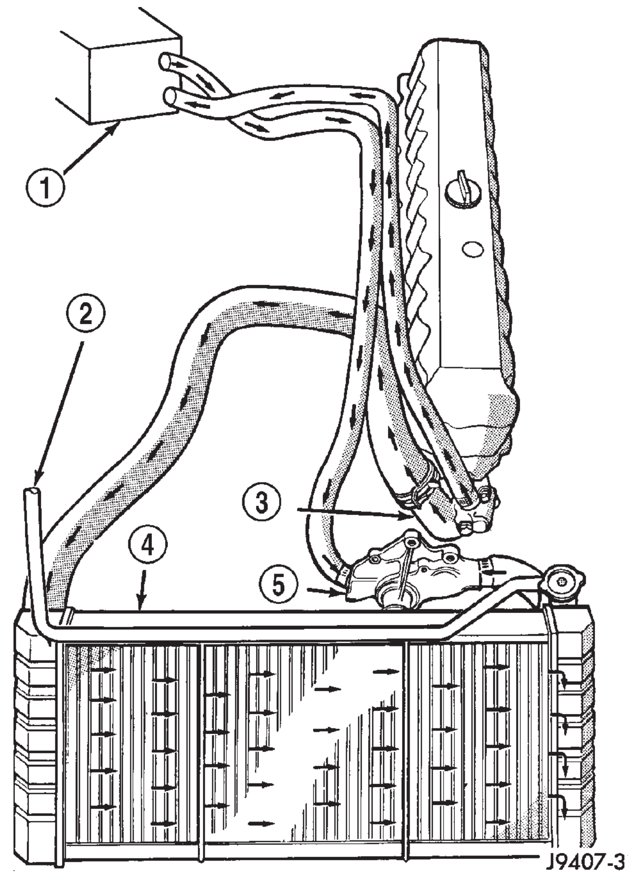


Fig. 3 Engine Cooling System—4.0L Engine—Typical

1 - HEATER CORE
2 - TO COOLANT RESERVE/OVERFLOW TANK
3 - THERMOSTAT HOUSING
4 - RADIATOR
5 - WATER PUMP

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING—ON-BOARD DIAGNOSTICS (OBD)

COOLING SYSTEM RELATED DIAGNOSTICS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

- If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) can be set.
- If an open or shorted condition has developed in the relay circuit controlling the electric radiator fan or fan control solenoid circuit controling the hydraulic fan, a Diagnostic Trouble Code (DTC) can be set.

If the problem is sensed in a monitored circuit often enough to indicated an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

ACCESSING DIAGNOSTIC TROUBLE CODES

To read DTC's and to obtain cooling system data, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service information for operation of the DRB scan tool.

DIAGNOSIS AND TESTING—PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

- PROLONGED IDLE
- VERY HIGH AMBIENT TEMPERATURE

COOLING (Continued)

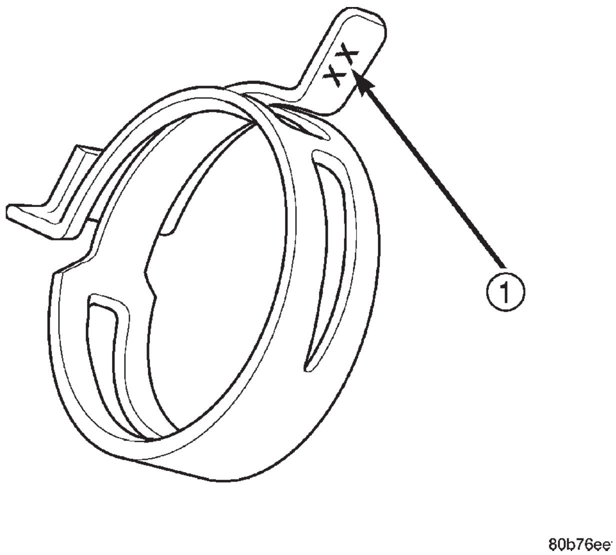


Fig. 4 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

- SLIGHT TAIL WIND AT IDLE
- SLOW TRAFFIC
- TRAFFIC JAMS
- HIGH SPEED
- STEEP GRADES

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- Increase engine speed for more air flow is recommended.

(1) TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

(2) AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

(3) RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump, or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.

These charts are to be used as a quick-reference only. Refer to the group text for information.

COOLING (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM DIAGNOSIS CHART

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat?	1. Refer to (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for On-Board Diagnostics and DTC information. Replace thermostat if necessary.
	2. Is the temperature sending unit connected?	2. Check the temperature sensor connector. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMP SENSOR - DESCRIPTION). Repair connector if necessary.
	3. Is the temperature gauge operating OK?	3. Check gauge operation. Repair as necessary.
	4. Coolant level low in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant reserve/overflow tank and the radiator. Inspect system for leaks. Repair leaks as necessary.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING)
TEMPERATURE GAUGE READS HIGH OR THE COOLANT LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair.
	2. Is the temperature gauge reading correctly?	2. Check gauge. (Refer to Group 8J - INSTRUMENT CLUSTER). Repair as necessary.
	3. Is the temperature warning illuminating unnecessarily?	3. Check warning lamp operation. (Refer to Group 8J - INSTRUMENT CLUSTER).Repair as necessary.
	4. Coolant low in coolant reserve/ overflow tank and radiator?	4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6.	5. Tighten cap

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Poor seals at the radiator cap.	6. (a) Check condition of cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING).
	(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.	
	7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools	7. (a) Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ENGINE/ RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING).
		(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.
		(c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary.
		(d) Check coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.
	8. Incorrect coolant concentration	8. Check coolant. (Refer to 7 - COOLING/ ENGINE/COOLANT - DESCRIPTION) for correct coolant/water mixture ratio.
	9. Coolant not flowing through system	9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine area of obstruction and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. (Refer to 7 - COOLING/ENGINE/RADIATOR - CLEANING).
	11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
	12. Aftermarket A/C installed without proper radiator.	12. Install proper radiator.
	13. Fuel or ignition system problems.	13. Refer to FUEL and /or IGNITION CONTROL for diagnosis.
	14. Dragging brakes.	14. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) for correct procedures.
	15. Bug screen or cardboard is being used, reducing airflow.	15. Remove bug screen or cardboard.
	16. Thermostat partially or completely shut.	16. Check thermostat operation and replaces necessary. (Refer to 7 - COOLING/ENGINE/ ENGINE COOLANT THERMOSTAT - DIAGNOSIS AND TESTING).

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	17. Viscous fan drive not operating properly.	17. Check fan drive operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/ FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING).
	18. Cylinder head gasket leaking.	18. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). For repair, (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
	19. Heater core leaking.	19. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/HEATER CORE - REMOVAL). Repair as necessary.
	20. Hydraulic fan speed too low or inopertive.	20. Check for DTC code. Check fan operation speeds. Refer to fan speed operation table. Low power steering pump output. Refer to power steering pump diagnosis - 4.7L engine.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly.	1. A normal condition. No correction is necessary.
	2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair if necessary. Refer to Group 8J, Instrument cluster.
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running)	3. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven.
	4. Gauge reading high after re-starting a warmed up (hot) engine.	4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.	6. (a) Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). (b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. (Refer to 7 - COOLING/ENGINE/ WATER PUMP - DIAGNOSIS AND TESTING).
	8. Loose accessory drive belt. (water pump slipping)	8. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). Check and correct as necessary.
	9. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/ OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ENGINE/ RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating.	1. Check reason for overheating and repair as necessary.
	2. Freeze point of coolant not correct. Mixture is too rich or too lean.	2. Check coolant concentration. (Refer to 7 - COOLING/ENGINE/COOLANT - DESCRIPTION) and adjust ratio as required.
HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/ overflow system.	1. (a) Radiator cap relief valve stuck. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace if necessary
		(b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary.
		(c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary.
		(d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VISCOUS FAN/DRIVE	1. Fan blades loose - 4.0L.	1. Replace fan blade assembly. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or air conditioning condenser.	3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.
	4. Thermal viscous fan drive has defective bearing - 4.0L	4. Replace fan drive. Bearing is not serviceable. (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - REMOVAL).
INADEQUATE HEATER PERFORMANCE.	1.Thermostat failed in open position	
	2. Has a Diagnostic trouble Code (DTC) been set?	2. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for correct procedures and replace thermostat if necessary
	3. Coolant level low	3. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	4. Obstructions in heater hose/ fittings	4. Remove heater hoses at both ends and check for obstructions
	5. Heater hose kinked	5. Locate kinked area and repair as necessary
	6. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation.	6. (Refer to 7 - COOLING/ENGINE/WATER PUMP - DIAGNOSIS AND TESTING). If a slipping belt is detected, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL). If heater core obstruction is detected, (Refer to 7 - COOLING - STANDARD PROCEDURE) for cooling system reverse flushing.
STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. (Refer to 7 - COOLING/ENGINE/ COOLANT - DESCRIPTION) for coolant concentration information. Adjust coolant mixture as necessary.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.
FAN RUNS ALL THE TIME	1. Fan control sensors inoperative.	1. Check for DTC's. Verify sensor readings.
	2. Fan control solenoid stuck ″on″.	2. Check fan operation speeds. Refer to fan speed operation table.
	3. Fan control solenoid harness damaged.	3. Check for DTC 1499. Repair as required.
	4. Transmission temperature too high.	4. Check for transmission over temp. DTC.
	5. Engine coolant temperature too high.	5. (a) Check coolant level. Correct level as required.
		(b) Thermostat stuck. Replace thermostat.
		(c) Water pump failed. Replace water pump.
		(d) Coolant flow restricted. Clean radiator.
		(e) Air flow over radiator obstructed.Remove obstruction.

DIAGNOSIS AND TESTING - COOLING SYSTEM LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist (Fig. 5).

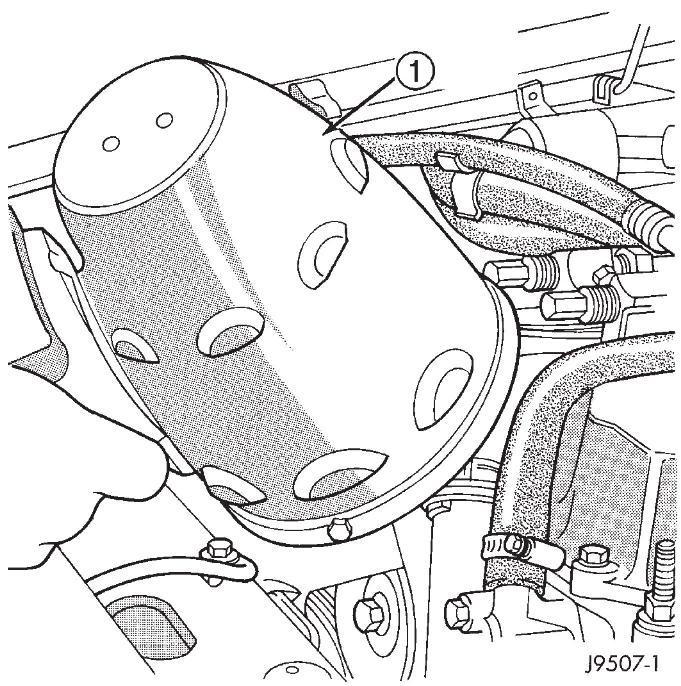


Fig. 5 Leak Detection Using Black Light—Typical

1 - TYPICAL BLACK LIGHT TOOL

PRESSURE TESTER METHOD

The engine should be at normal operating temperature. Recheck the system cold if cause of coolant loss is not located during the warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

COOLING (Continued)

Carefully remove radiator pressure cap from filler neck and check coolant level. Push down on cap to disengage it from stop tabs. Wipe inside of filler neck and examine lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect radiator-to- reserve/overflow tank hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

Inspect cams on outside of filler neck. If cams are damaged, seating of pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to radiator filler neck (Fig. 6).

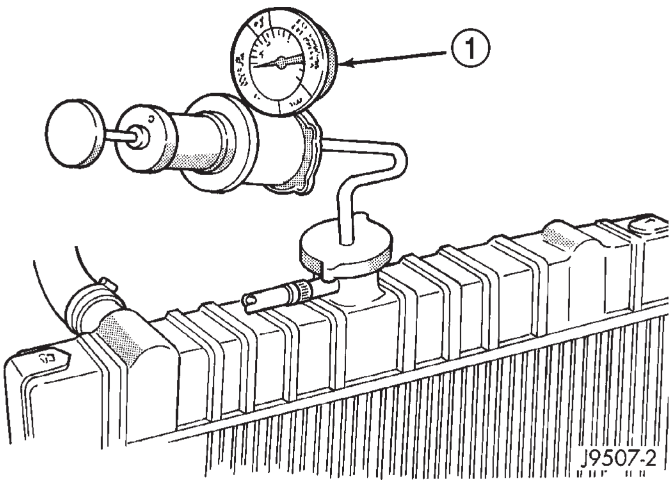


Fig. 6 Pressure Testing Cooling System—Typical

1 - TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate tester pump to apply 103.4 kPa (15 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

Holds Steady: If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 110 KPA (20 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate engine without pressure cap on radiator until thermostat opens. Attach a Pressure Tester to filler neck. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST - WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow thermostat removal. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Remove

COOLING (Continued)

accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

Add coolant to radiator to bring level to within 6.3 mm (1/4 in) of top of thermostat housing.

CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open draincock immediately after test to eliminate boil over.

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

DIAGNOSIS AND TESTING - COOLING SYSTEM DEAERATION

As the engine operates, any air trapped in cooling system gathers under the radiator cap. The next time the engine is operated, thermal expansion of coolant will push any trapped air past radiator cap into the coolant reserve/overflow tank. Here it escapes to the atmosphere into the tank. When the engine cools down the coolant, it will be drawn from the reserve/overflow tank into the radiator to replace any removed air.

STANDARD PROCEDURE

STANDARD PROCEDURE—DRAINING COOLING SYSTEM 4.7L ENGINE

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS (Fig. 7) OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) DO NOT remove radiator cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

NOTE: Radiator draincock is located on the left/lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant reserve/overflow tank. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture. When tank is empty, remove radiator cap and continue draining cooling system.

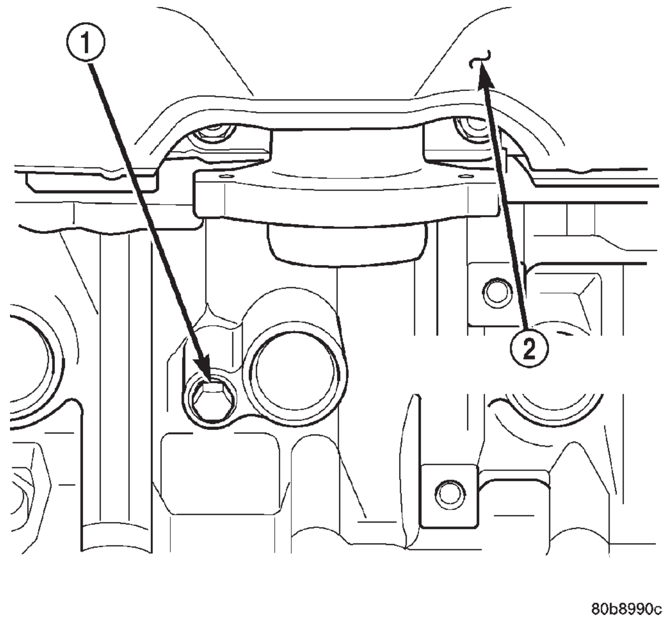


Fig. 7 Drain Plug—4.7L Engine

1 - CYLINDER BLOCK DRAIN PLUG
2 - EXHAUST MANIFOLD AND HEAT SHIELD

STANDARD PROCEDURE - REFILLING COOLING SYSTEM 4.7L ENGINE

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

CAUTION: Failure to purge air from the cooling system can result in an overheating condition and severe engine damage.

(2) Remove the cooling system bleed plug from the radiator upper hose inlet housing. (Fig. 8)Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water, until coolant begains coming out of the cooling system bleed hole. Install the cooling system bleed plug. Fill radiator to top and install radiator cap. Add sufficient coolant to the reserve/overflow tank to raise level to FULL mark.

(3) With heater control unit in the HEAT position, operate engine with radiator cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the reserve/overflow tank.

(5) Add coolant to reserve/overflow tank as necessary. **Only add coolant to the reserve/overflow tank when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** To purge the cooling system of all air, this heat up/cool down cycle (adding coolant to cold engine) must be performed three times. Add necessary coolant to raise tank level to the FULL mark after each cool down period.

COOLING (Continued)

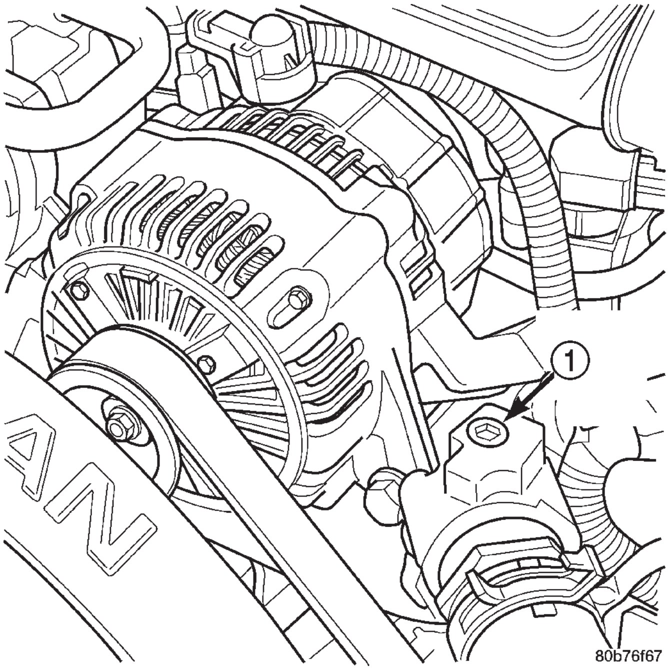


Fig. 8 Cooling System Bleed Plug - 4.7L

1 - COOLING SYSTEM BLEED PLUG

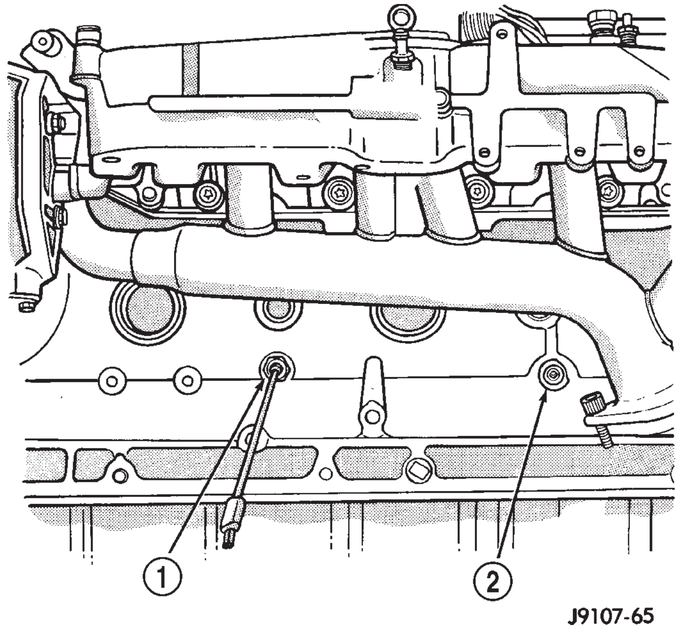


Fig. 9 Drain Plug—4.0L Engine

1 - COOLANT TEMPERATURE SENSOR
2 - BLOCK DRAIN PLUG

STANDARD PROCEDURE - DRAINING COOLING SYSTEM - 4.0L ENGINE

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) DO NOT remove radiator cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

NOTE: Radiator draincock is located on the right/ lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant reserve/overflow tank. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture. When tank is empty, remove radiator cap and continue draining cooling system.

To drain the engine of coolant, remove the cylinder block drain plug located on the side of cylinder block (Fig. 9).

STANDARD PROCEDURE - REFILLING COOLING SYSTEM - 4.0L ENGINE

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

(2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Fill radiator to top and install radiator cap. Add sufficient coolant to the reserve/overflow tank to raise level to FULL mark.

(3) With heater control unit in the HEAT position, operate engine with radiator cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the reserve/overflow tank.

(5) Add coolant to reserve/overflow tank as necessary. **Only add coolant to the reserve/overflow tank when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** To purge the cooling system of all air, this heat up/cool down cycle (adding coolant to cold engine) must be performed three times. Add necessary coolant to raise tank level to the FULL mark after each cool down period.

STANDARD PROCEDURE - ADDING ADDITIONAL COOLANT

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with

COOLING (Continued)

corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

STANDARD PROCEDURE - COOLING SYSTEM - REVERSE FLUSHING

CAUTION: The cooling system normally operates at 97-to-124 kPa (14-to -18 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Reverse flushing of the cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

CHEMICAL CLEANING

If visual inspection indicates the formation of sludge or scaly deposits, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid the flushing operation.

CAUTION: Be sure instructions on the container are followed.

REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

CAUTION: The cooling system normally operates at 97-to-124 kPa (14- to-18 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Allow the radiator to fill with water. When radiator is filled, apply air in short blasts allowing radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. For more information, refer to operating instructions supplied with flushing equipment. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump. Attach a lead away hose to the water pump inlet fitting.

CAUTION: Be sure that the heater control valve is closed (heat off). This is done to prevent coolant flow with scale and other deposits from entering the heater core.

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose. For more information, refer to operating instructions supplied with flushing equipment.

Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Install the thermostat and housing with a replacement gasket (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - INSTALLATION). Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).

SPECIFICATIONS

TORQUE

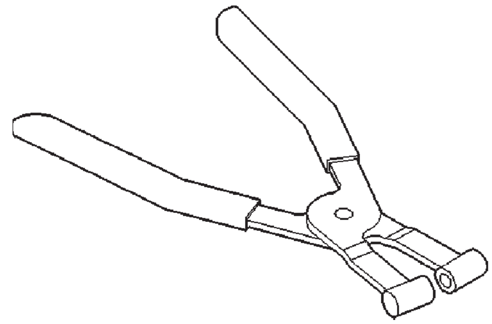
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Automatic Belt Tensioner to Mounting Bracket—Bolt			
4.0L	28	—	250
4.7L	41	30	—
Automatic Belt Tensioner Pulley—Bolt			
(4.7L)	61	45	—
Block Heater—Bolt			

COOLING (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
4.0L 4.7L	4 2	— —	32 17
Fan Blade Assy. to Viscous Drive— Bolts 4.0L	23	—	200
Generator Mounting—Bolts 4.0L	57	42	—
Radiator Upper Isolator to Crossmember—Nuts	3	—	20
Radiator Upper Isolator to Radiator— Nuts	4	—	36
Radiator Brace—Bolts	10	—	90
Thermostat Housing—Bolts 4.0L 4.7L	 22 13	 16 —	 — 115
Upper Radiator Crossmember to Body—Bolts	10	—	90
Water Pump—Bolts 4.0L 4.7L	 23 54	 17 40	 — —
Water Pump Pulley to Water Pump— Bolts 4.0L	28	—	250
High Pressure Inlet Hose to Hydraulic Fan Drive—1/2 inch Fitting	49	36	—
High Pressure Outlet Hose to Steering Gear—3/8 inch Fitting	29	21.5	—
Fan Shroud to Radiator Mounting Bolts	6	—	50

SPECIAL TOOLS

COOLING



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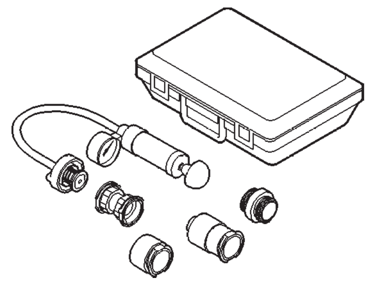


Pressure Tester 7700–A

ACCESSORY DRIVE

TABLE OF CONTENTS

BELT TENSIONERS

REMOVAL

REMOVAL—4.7L ENGINE

(1) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove tensioner assembly from engine front cover (Fig. 1).

WARNING: BECAUSE OF HIGH SPRING TENSION, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY ON TENSIONER).

(3) Remove pulley bolt. Remove pulley from tensioner.

REMOVAL—4.0L ENGINE

(1) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove tensioner assembly from mounting bracket (Fig. 2).

WARNING: BECAUSE OF HIGH SPRING TENSION, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY.

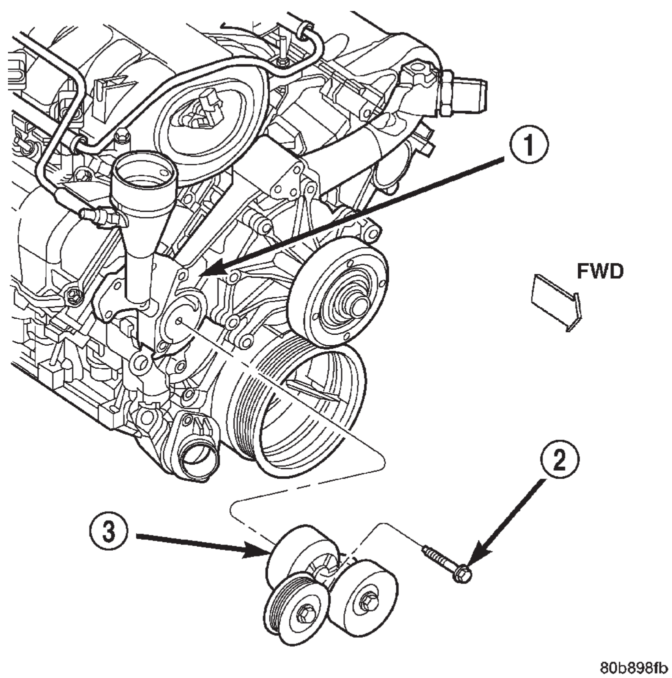


Fig. 1 Automatic Belt Tensioner

1 - TIMING CHAIN COVER
2 - BOLT TORQUE TO 41 N·m (30 FT LBS)
3 - AUTOMATIC BELT TENSIONER

INSTALLATION

INSTALLATION—4.7L ENGINE

(1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque.

(2) An indexing slot is located on back of tensioner. Align this slot to the head of the bolt on the front cover. Install the mounting bolt. Tighten bolt to 41 N·m (30 ft. lbs.).

BELT TENSIONERS (Continued)

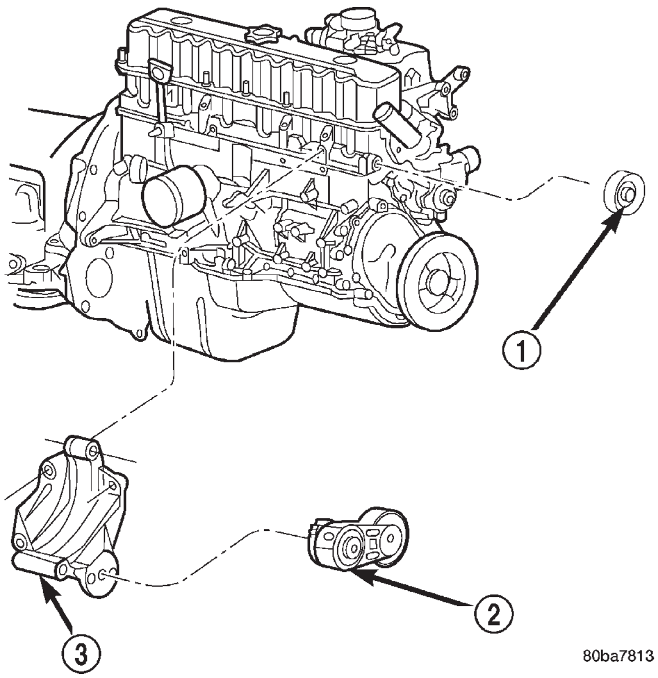


Fig. 2 Automatic Belt Tensioner

1 - IDLER PULLEY TIGHTEN TO 47 N·m (35 FT. LBS.)
2 - AUTOMATIC BELT TENSIONER
3 - GENERATOR MOUNTING BRACKET

(3) Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(4) Check belt indexing marks (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

INSTALLATION—4.0L ENGINE

(1) Install tensioner assembly to mounting bracket, align the two dowels on the tensioner with the mounting bracket and hand start the bolt. Tighten bolt to 28 N·m (250 in. lbs.).

CAUTION: To prevent damage to coil case, coil mounting bolts must be torqued.

(2) Install drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(3) Check belt indexing marks (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

DRIVE BELTS - 4.0L

DIAGNOSIS AND TESTING – SERPENTINE DRIVE BELT

When diagnosing serpentine drive belts, small cracks that run across ribbed surface of belt from rib to rib (Fig. 3), are considered normal. These are not a reason to replace belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 3). Also replace belt if it has excessive wear, frayed cords or severe glazing.

Refer to SERPENTINE DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

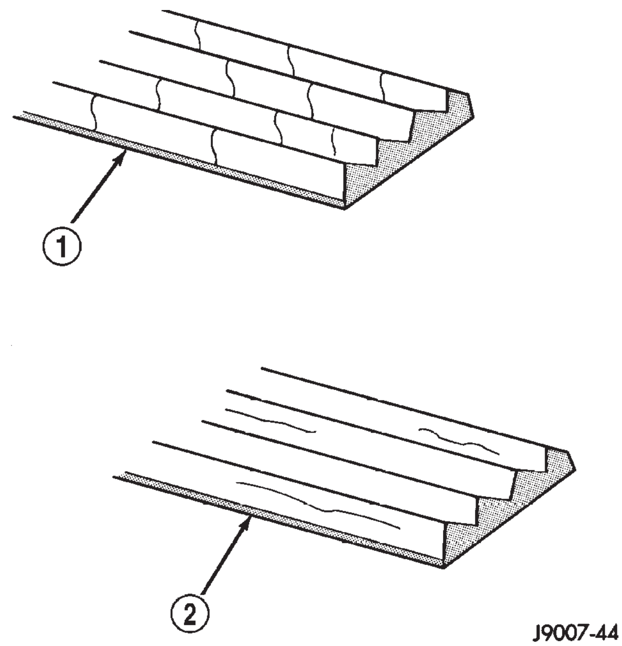


Fig. 3 Serpentine Accessory Drive Belt Wear Patterns

1 - NORMAL CRACKS BELT OK
2 - NOT NORMAL CRACKS REPLACE BELT

DRIVE BELTS - 4.0L (Continued)

SERPENTINE DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage.	2. Replace belt.
RIB OR BELT WEAR	1. Pulley(s) misaligned.	1. Align pulley(s).
	2. Abrasive environment.	2. Clean pulley(s). Replace belt if necessary.
	3. Rusted pulley(s).	3. Clean rust from pulley(s).
	4. Sharp or jagged pulley groove tips.	4. Replace pulley.
	5. Rubber deteriorated.	5. Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	1. Belt has mistracked from pulley groove.	1. Replace belt.
	2. Pulley groove tip has worn away rubber to tensile member.	2. Replace belt.
BELT SLIPS	1. Belt slipping because of insufficient tension.	1. Replace automatic belt tensioner.
	2. Belt routed incorrectly	2. Verify belt routing.
	3. Incorrect belt.	3. Replace belt.
	4. Belt or pulley subjected to substance (belt dressing, oil ethylene glycol) that has reduced friction.	4. Replace belt and clean pulleys.
	5. Driven component bearing failure.	5. Replace faulty component bearing.
	6. Belt glazed and hardened from heat and excessive slippage.	6. Replace belt.
“GROOVE JUMPING” (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY)	1. Belt tension either too high or too low.	1. Replace automatic belt tensioner.
	2. Belt routed incorrectly.	2. Verify belt routing.
	3. Incorrect belt.	3. Replace belt.
	4. Pulley(s) not within design tolerance.	4. Replace pulley(s).
	5. Foreign object(s) in grooves.	5. Remove foreign objects from grooves.
	6. Pulley misalignment.	6. Check and replace.
	7. Belt cord line is broken.	7. Replace belt.

DRIVE BELTS - 4.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED)	1. Excessive tension.	1. Replace belt and automatic belt tensioner.
	2. Incorrect belt.	2. Replace belt.
	3. Tensile member damaged during belt installation.	3. Replace belt.
	4. Severe misalignment.	4. Check and replace.
	5. Bracket, pulley, or bearing failure.	5. Replace defective component and belt.
NOISE (OBJECTIONABLE SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	1. Belt slippage.	1. Replace belt or automatic belt tensioner.
	2. Bearing noise.	2. Locate and repair.
	3. Belt misalignment.	3. Replace belt.
	4. Belt-to-pulley mismatch.	4. Install correct belt.

REMOVAL—4.0L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position. (Fig. 4).

INSTALLATION—4.0L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Check condition of all pulleys.

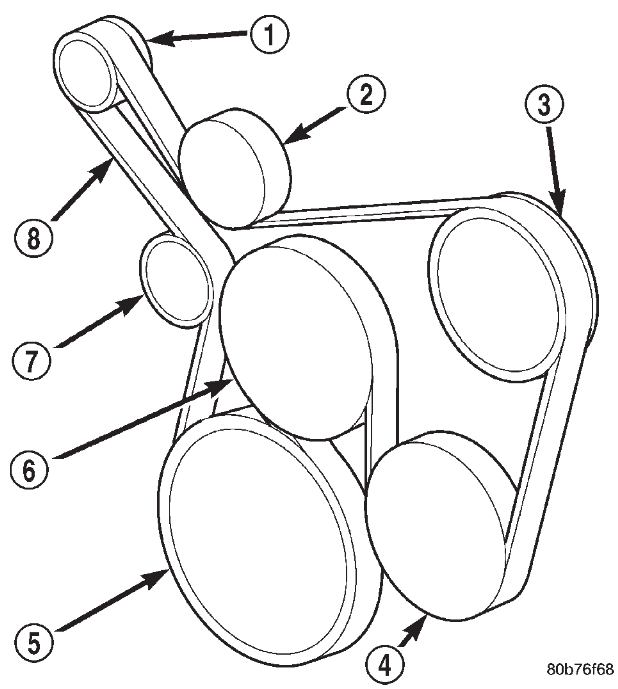


Fig. 4 Belt Routing—4.0L

1 - GENERATOR
2 - IDLER
3 - POWER STEERING
4 - A/C
5 - CRANKSHAFT
6 - WATER PUMP
7 - TENSIONER
8 - ACCESSORY DRIVE BELT

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 4).

DRIVE BELTS - 4.0L (Continued)

(2) Install new belt (Fig. 4). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

(3) With the drive belt installed, inspect the belt wear indicator (Fig. 5). On 4.0L Engines, the indicator mark must be between the minimum and maximum marks. If the measurement exceedes this specification replace the serpentine accessory drive belt.

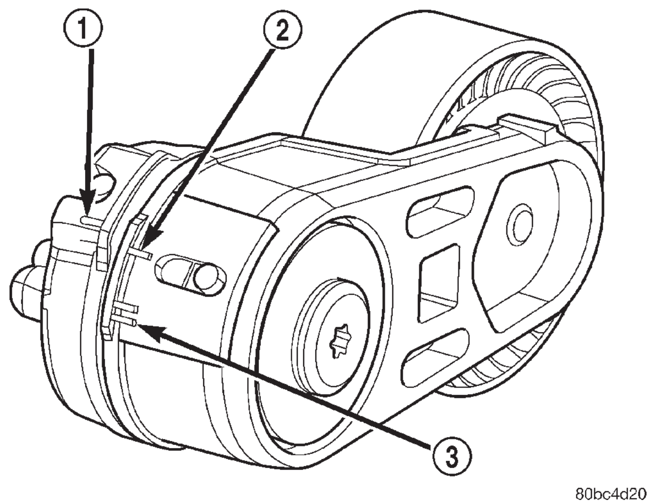


Fig. 5 Accessory Drive Belt Wear Indicator

1 - INDICATOR MARK
2 - MINIMUM TENSION MARK
3 - MAXIMUM TENSION MARK

DRIVE BELTS - 4.7L

DIAGNOSIS AND TESTING – SERPENTINE DRIVE BELT

When diagnosing serpentine drive belts, small cracks that run across ribbed surface of belt from rib to rib (Fig. 6), are considered normal. These are not a reason to replace belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 6). Also replace belt if it has excessive wear, frayed cords or severe glazing.

Refer to SERPENTINE DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

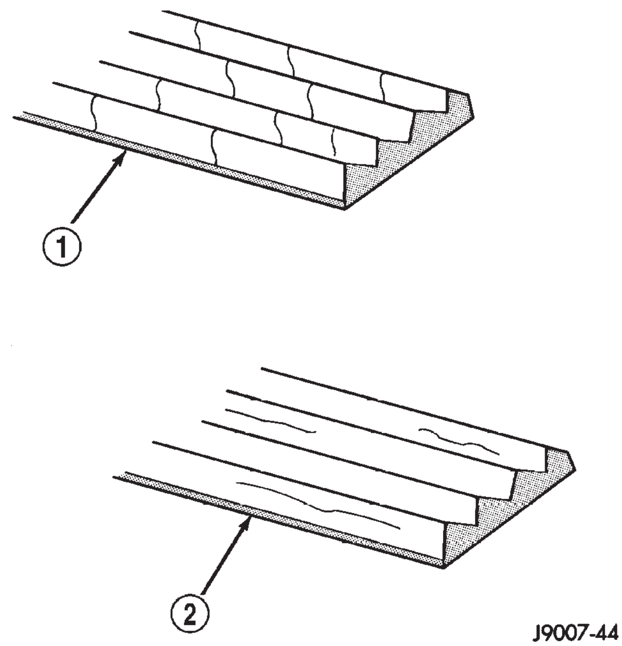


Fig. 6 Serpentine Accessory Drive Belt Wear Patterns

1 - NORMAL CRACKS BELT OK
2 - NOT NORMAL CRACKS REPLACE BELT

DRIVE BELTS - 4.7L (Continued)

SERPENTINE DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY)	1. Foreign objects imbedded in pulley grooves. 2. Installation damage.	1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt.
RIB OR BELT WEAR	1. Pulley(s) misaligned. 2. Abrasive environment. 3. Rusted pulley(s). 4. Sharp or jagged pulley groove tips. 5. Rubber deteriorated.	1. Align pulley(s). 2. Clean pulley(s). Replace belt if necessary. 3. Clean rust from pulley(s). 4. Replace pulley. 5. Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	1. Belt has mistracked from pulley groove. 2. Pulley groove tip has worn away rubber to tensile member.	1. Replace belt. 2. Replace belt.
BELT SLIPS	1. Belt slipping because of insufficient tension. 2. Belt routed incorrectly 3. Incorrect belt. 4. Belt or pulley subjected to substance (belt dressing, oil ethylene glycol) that has reduced friction. 5. Driven component bearing failure. 6. Belt glazed and hardened from heat and excessive slippage.	1. Replace automatic belt tensioner. 2. Verify belt routing. 3. Replace belt. 4. Replace belt and clean pulleys. 5. Replace faulty component bearing. 6. Replace belt.
“GROOVE JUMPING” (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY)	1. Belt tension either too high or too low. 2. Belt routed incorrectly. 3. Incorrect belt. 4. Pulley(s) not within design tolerance. 5. Foreign object(s) in grooves. 6. Pulley misalignment. 7. Belt cord line is broken.	1. Replace automatic belt tensioner. 2. Verify belt routing. 3. Replace belt. 4. Replace pulley(s). 5. Remove foreign objects from grooves. 6. Check and replace. 7. Replace belt.

DRIVE BELTS - 4.7L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED)	1. Excessive tension.	1. Replace belt and automatic belt tensioner.
	2. Incorrect belt.	2. Replace belt.
	3. Tensile member damaged during belt installation.	3. Replace belt.
	4. Severe misalignment.	4. Check and replace.
	5. Bracket, pulley, or bearing failure.	5. Replace defective component and belt.
NOISE (OBJECTIONABLE SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	1. Belt slippage.	1. Replace belt or automatic belt tensioner.
	2. Bearing noise.	2. Locate and repair.
	3. Belt misalignment.	3. Replace belt.
	4. Belt-to-pulley mismatch.	4. Install correct belt.

REMOVAL - 4.7L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position. (Fig. 7).

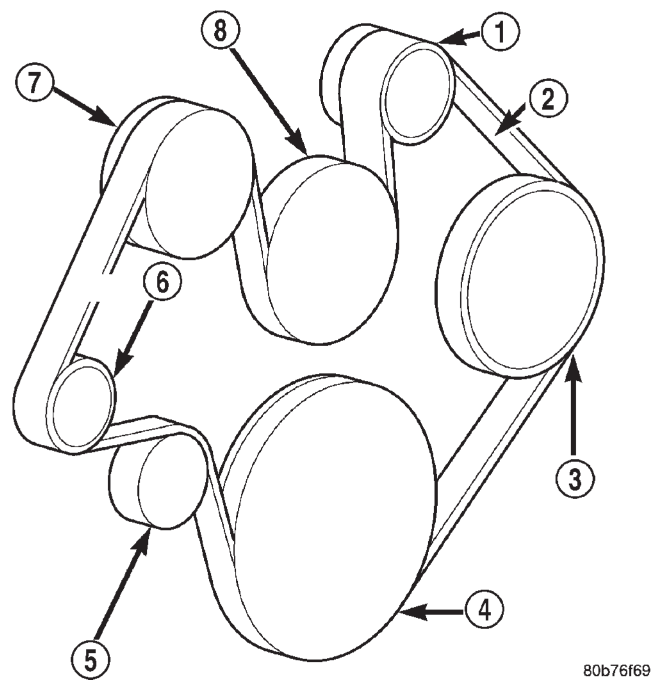


Fig. 7 Belt Routing - 4.7L

1 - GENERATOR PULLEY
2 - ACCESSORY DRIVE BELT
3 - POWER STEERING PUMP PULLEY
4 - CRANKSHAFT PULLEY
5 - IDLER PULLEY
6 - TENSIONER
7 - A/C COMPRESSOR PULLEY
8 - WATER PUMP PULLEY

DRIVE BELTS - 4.7L (Continued)

INSTALLATION - 4.7L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 7).

(2) Install new belt (Fig. 7). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

(3) With the drive belt installed, inspect the belt wear indicator (Fig. 8). On 4.7L Engines the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches).

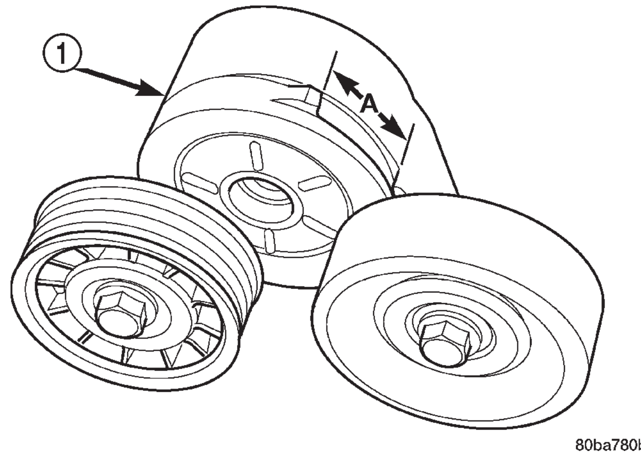


Fig. 8 Accessory Drive Belt Wear Indicator

1 - AUTOMATIC TENSIONER ASSEMBLY

ENGINE

TABLE OF CONTENTS

COOLANT

DESCRIPTION

DESCRIPTION - ENGINE COOLANT

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300) deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

DESCRIPTION - HOAT COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

COOLANT (Continued)

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified (non-HOAT or other HOAT), may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.

COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

Pure Water-Water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

100 percent Ethylene-Glycol-The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22°C (-8°F).

50/50 Ethylene-Glycol and Water-Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

COOLANT SELECTION AND ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

OPERATION

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

COOLANT LEVEL SENSOR

REMOVAL

(1) Open Hood.

(2) Disconnect electrical connector from coolant level sensor.

(3) Pull coolant level sensor out of coolant recovery pressure container.

INSTALLATION

NOTE: Make sure the coolant level sensor fully seats into the rubber grommet. Failure to do so may cause inaccurate coolant level readings and leaks.

COOLANT LEVEL SENSOR (Continued)

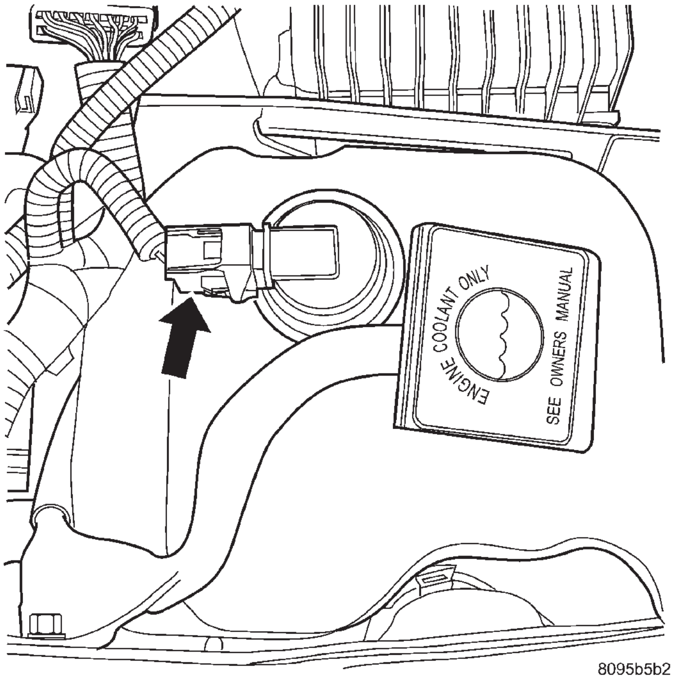


Fig. 1 COOLANT LEVEL SENSOR ELECTRICAL CONNECTOR

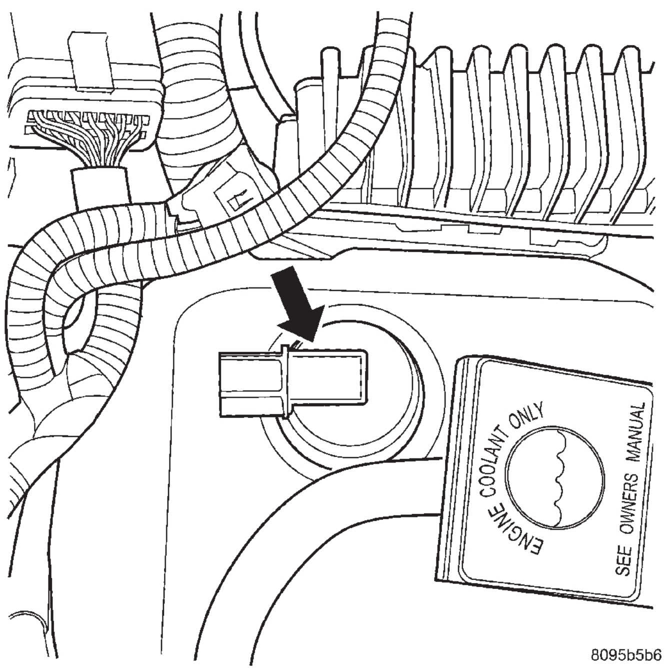


Fig. 2 COOLANT LEVEL SENSOR REMOVAL/ INSTALLATION

(1) Position sensor into the coolant recovery pressure container (Fig. 1).

(2) Connect the coolant level sensor electrical connector (Fig. 2).

(3) Close hood.

COOLANT RECOVERY PRESS CONTAINER

DESCRIPTION

This system works along with the radiator pressure cap. This is done by using thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides:

- A volume for coolant expansion and contraction.
- A convenient and safe method for checking/adjusting coolant level at atmospheric pressure. This is done without removing the radiator pressure cap.
- Some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

The coolant reservoir/overflow system has a radiator mounted pressurized cap, an overflow tube and a plastic coolant reservoir/overflow tank (Fig. 3) mounted to the right inner fender.

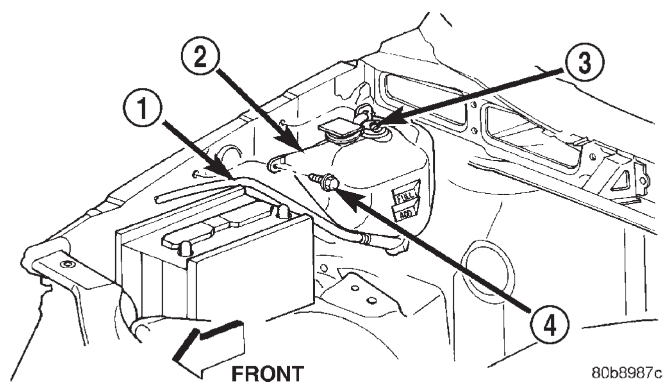


Fig. 3 Coolant Reservoir / Overflow Tank

1 - COOLANT OVERFLOW HOSE
2 - COOLANT RESERVOIR/OVERFLOW TANK
3 - COOLANT LEVEL SENSOR
4 - BOLT

RADIATOR FAN - 4.7L

DESCRIPTION

The hydraulic fan (Fig. 4) used on vehicles equipped the 4.7L engine, replaces both the electric fan and the engine driven mechanical fan. The hydraulic cooling fan is integral to the fan shroud and is located between the radiator and the engine.

The power steering pump supplies the hydraulic fluid and pressure to rotate the cooling fan blade, while the electrical part of the fan is controlled by the JTEC.

The hydraulic fan drive (motor) consists of the three major following components:

- Steering flow control valve

RADIATOR FAN - 4.7L (Continued)

- Fan control valve
- Two stage G-rotor hydraulic drive

The hydraulic fan and drive is not serviceable. Therefore any failure of the fan blade, hydraulic fan drive or fan shroud requires replacement of the fan module because the fan blade and hydraulic fan drive are matched and balanced as a system and servicing either separately would disrupt this balance.

For hydraulic fluid routing information refer to (Fig. 5).

CAUTION: Do not attempt to service the hydraulic cooling fan or fan drive separately replace the cooling module as an assembly. Failure to do so may cause severe damage to the hydraulic cooling fan assembly.

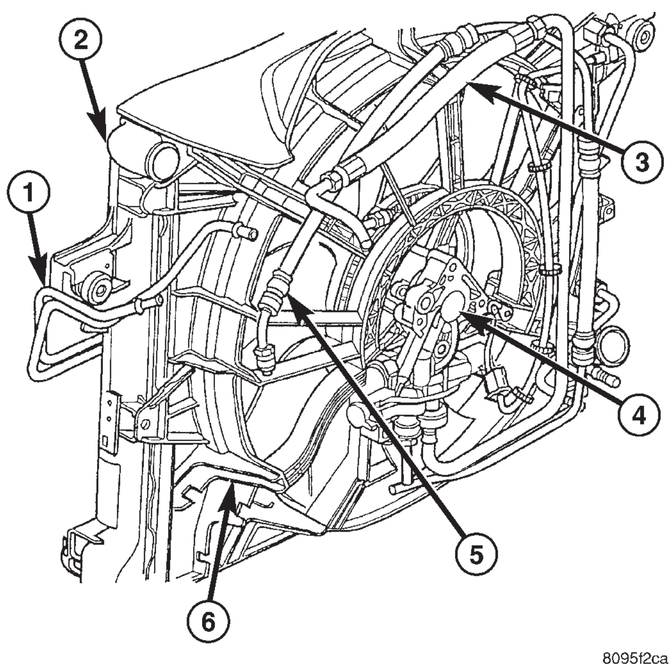


Fig. 4 HYDRAULIC RADIATOR COOLING FAN AND FAN DRIVE

1 - POWER STEERING FLUID COOLER
2 - RADIATOR
3 - HIGH PRESSURE LINE FROM STEERING GEAR PUMP TO HYDRAULIC FAN MOTOR
4 - HYDRAULIC FAN MOTOR
5 - HIGH PRESSURE LINE FROM HYDRAULIC FAN MOTOR TO STEERING GEAR
6 - FAN SHROUD

OPERATION

The hydraulic radiator cooling fan used on the Grand Cherokee with the 4.7L engine replaces both the electric fan and the engine driven mechanical fan. The use of this hydraulic fan provides the 4.7L equipped Grand Cherokee with heavy trailer tow capability while at the same time reducing unnecessary power drain on both the engine and the vehicles electrical system.

HYDRAULIC FAN STRATEGY

The hydraulic radiator cooling fan is controlled by the JTEC. A PWM (Pulse With Modulated) signal from the JTEC controls the fan from 0 to 100% of the available fan speed. There are four inputs to the JTEC that determine what speed percentage of fan is required by the vehicle. These inputs are:

- Engine Coolant Temperature
- Transmission Oil Temperature
- Battery Temperature
- A/C System Pressure

By monitoring these four parameters, the JTEC can determine if cooling airflow is required. If airflow is required, the JTEC will slowly ramp up (speed up) the fan speed until the parameter(s) are under control. Once the temperature or pressure is reduced to within operating parameters the fan will ramp up, ramp down, or hold its speed to maintain the temperature / pressure requirements.

NOTE: Even if the JTEC is not requesting fan on operation the fan blade will usually spin between 100 and 500 RPM when the vehicle is at idle. This is due to a controlled minimum oil flow requirement through the fan drive motor.

ACTIVATING THE HYDRAULIC FAN WITH THE DRB

Under the Engine Systems test heading, there is a subheading. “Hydraulic fan solenoid test”, that has the selections, on /off. Activating the fan with the DRB will run the fan at 100% duty cycle, which will help troubleshoot any system problems, and also help with the deaeration procedure.

NOTE: Engine must be running to activate the fan with the DRB.

RADIATOR COOLING FAN HYDRAULIC FLUID PATH

Hydraulic fluid is pumped through the power steering pump, from the pump the fluid travels though a high pressure delivery line to the fan drive motor. As fluid is diverted through the G-rotors, rotational motion is created as fluid moves from the high-pressure (inlet) side of the motor to the low-pressure (outlet) side. Fluid exiting the drive motor is divided into two paths. Path one continues through a high pressure delivery line to the vehicles steering gear to provide steering assist. and path two sends fluid back to the power steering pump through a low pressure line. Fluid exits the steering gear under low pressure and travels through a low pressure line to the power steering fluid cooler to be cooled before being returned back the the power steering fluid reservoir (Fig. 5).

RADIATOR FAN - 4.7L (Continued)

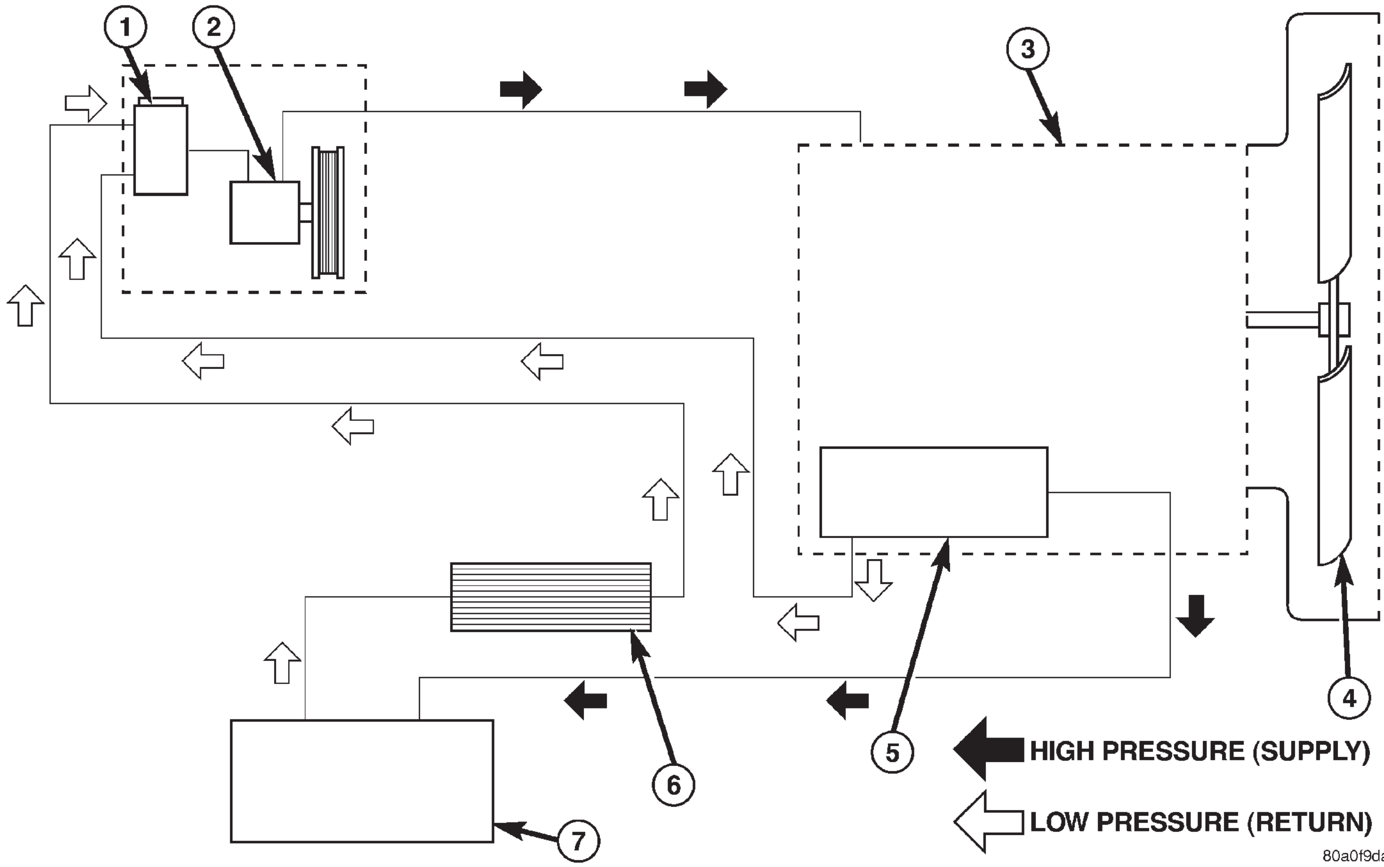


Fig. 5 HYDRAULIC FAN FLUID FLOW CIRCUIT

1 - POWER STEERING RESERVOIR
2 - POWER STEERING PUMP
3 - HYDRAULIC FAN DRIVE ASSEMBLY
4 - FAN BLADE
5 - HYDRAULIC FAN CONTROL SOLENOID
6 - POWER STEERING OIL COOLER
7 - STEERING GEAR

NOTE: There is a steering flow control valve located in the fan drive motor. This valve operates like the flow control valve found in the typical power steering pump. Because of the design of the valve steering assist can not be effected by the radiator cooling fan even during fan drive failure.

REMOVAL

(1) Raise vehicle on hoist.

(2) Drain cooling system.(Refer to 7 - COOLING - STANDARD PROCEDURE)

NOTE: The hydraulic fan drive is driven by the power steering pump. When removing lines or hoses from fan drive assembly use a drain pan to catch any power steering fluid that may exit the fan drive or the lines and hoses.

NOTE: When ever the high pressure line fittings are removed from the hydraulic fan drive the O-rings must be replaced.

(3) Disconnect two high pressure lines at hydraulic fan drive (Fig. 6). Remove and discard o-rings from line fittings.

(4) Disconnect low pressure return hose at hydraulic fan drive (Fig. 6).

NOTE: The lower mounting bolts can only be accessed from under vehicle.

(5) Remove two lower mounting bolts from the shroud (Fig. 8).

(6) Lower vehicle.

(7) Disconnect the electrical connector for the fan control solenoid.

(8) Disconnect the radiator upper hose at the radiator and position out of the way.

(9) Disconnect the power steering gear outlet hose and fluid return hose at the cooler (Fig. 7).

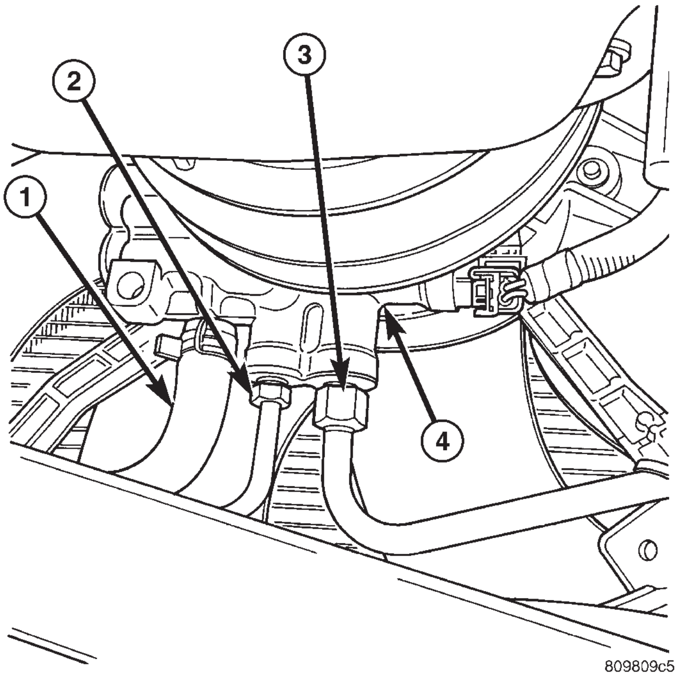


Fig. 6 HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

1 - LOW PRESSURE RETURN HOSE
2 - HIGH PRESSURE LINE (OUTLET)
3 - HIGH PRESSURE LINE (INLET)
4 - HYDRAULIC FAN DRIVE

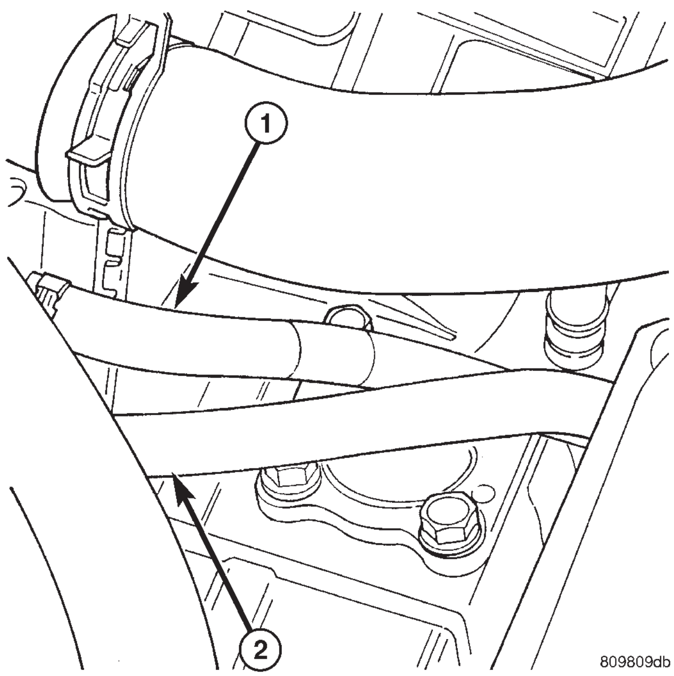


Fig. 7 POWER STEERING GEAR OUTLET AND RETURN HOSES

1 - POWER STEERING COOLER RETURN HOSE
2 - POWER STEERING COOLER SUPPLY HOSE

(10) Remove two upper mounting bolts from the shroud (Fig. 8).

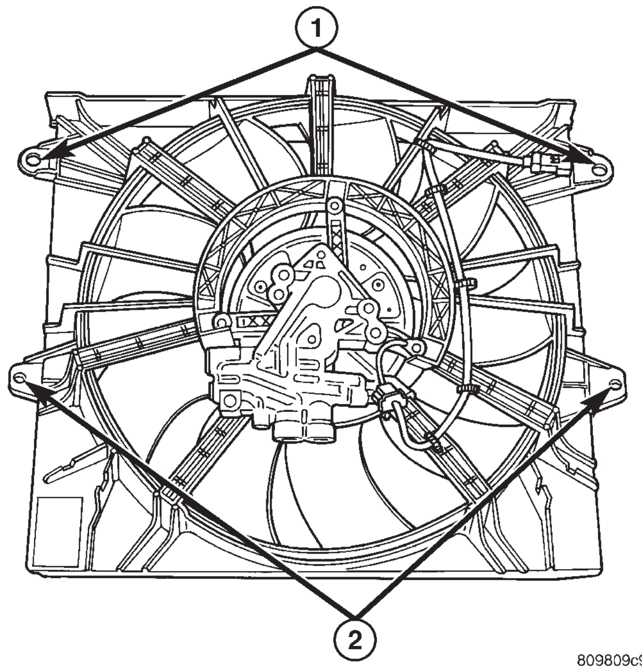


Fig. 8 FAN SHROUD MOUNTING BOLT LOCATIONS

1 - FAN SHROUD UPPER MOUNTING BOLT LOCATIONS
2 - FAN SHROUD LOWER MOUNTING BOLT LOCATIONS

(11) Remove the shroud and fan drive from vehicle.

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSTALLATION

CAUTION: There is an external ground wire connected to the hydraulic fan drive located at the electrical connector on the fan assembly. This ground MUST remain connected at all times. Failure to ensure ground wire is connected when engine is operating can cause severe damage to the JTEC module.

(1) Position fan drive and shroud in vehicle.
(2) Install fan shroud upper mounting bolts. Do not tighten at this time.
(3) Install radiator upper hose onto radiator.
(4) Connect power steering cooler hoses.
(5) Raise vehicle on hoist.
(6) Install fan shroud lower mounting bolts. Tighten to 6 N·m (50 in. lbs.).

RADIATOR FAN - 4.7L (Continued)

NOTE: When ever the high pressure line fittings are removed from the hydraulic fan drive the o-rings located on the fittings must be replaced.

(7) Lubricate the o-rings on the fittings with power steering fluid then connect inlet and outlet high pressure lines to fan drive (Fig. 9). Tighten inlet line to 49 N·m (36 ft. lbs.) tighten outlet line to 29 N·m (21.5 ft. lbs.).

(8) Connect low pressure return hose to fan drive (Fig. 9).

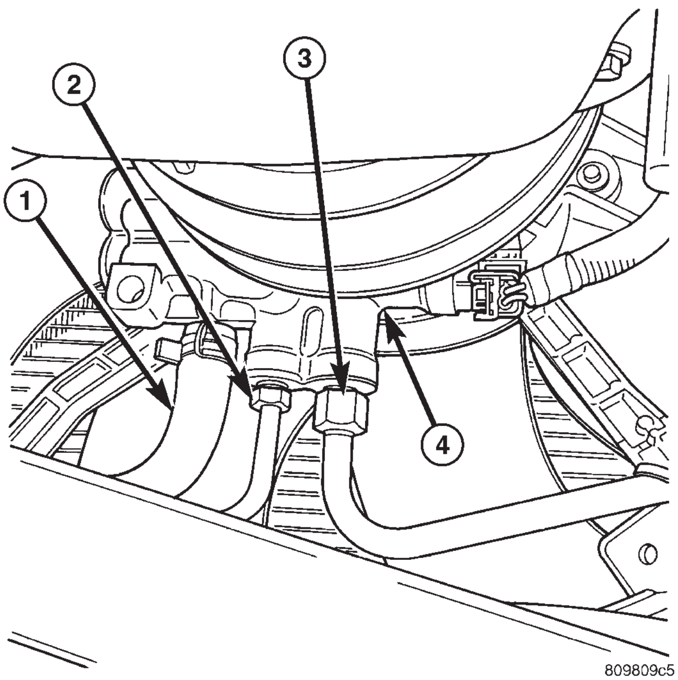


Fig. 9 HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

1 - LOW PRESSURE RETURN HOSE
2 - HIGH PRESSURE LINE (OUTLET)
3 - HIGH PRESSURE LINE (INLET)
4 - HYDRAULIC FAN DRIVE

(9) Lower vehicle.

(10) Install radiator upper hose.

(11) Connect electrical connector for hydraulic fan control solenoid.

(12) Tighten fan shroud upper mounting bolts to 6 N·m (50 in. lbs.).

(13) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

CAUTION: Do not run engine with power steering fluid below the full mark in the reservoir. Sever damage to the hydraulic cooling fan or the engine can occur.

(14) Refill power steering fluid reservoir and bleed air from steering system (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

(15) Run engine and check for leaks.

RADIATOR FAN - 4.0L

DESCRIPTION

The radiator cooling fan used on the 4.0L engine is an hybrid fan design. The hybrid fan system consist of a low speed viscous driven mechanical fan and a electrical fan (Fig. 10).

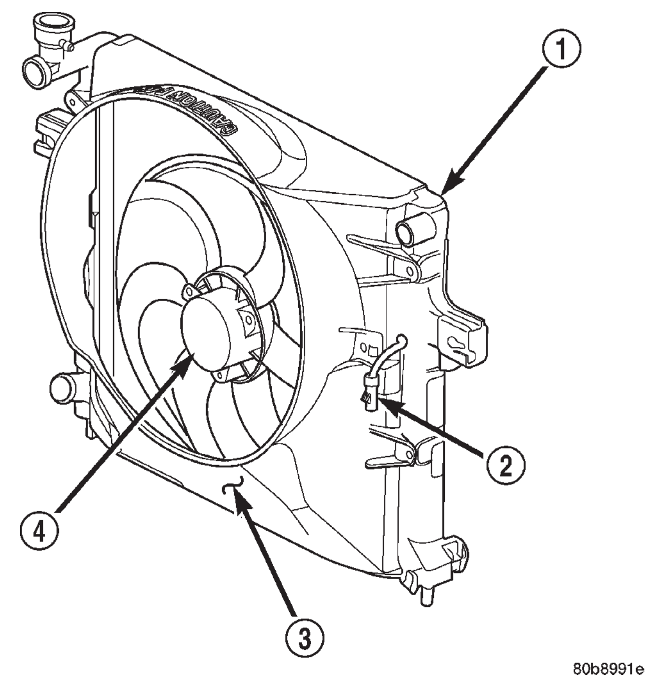


Fig. 10 Radiator Cooling Fan

1 - RADIATOR
2 - ELECTRIC COOLING FAN CONNECTOR
3 - FAN SHROUD
4 - ELECTRIC COOLING FAN

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft. Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front (Fig. 11). Threads on viscous fan drive are **RIGHT HAND.**

(3) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(4) Do not unbolt fan blade assembly from viscous fan drive at this time.

(5) Remove fan shroud-to-upper crossmember nuts.

(6) Remove fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.

RADIATOR FAN - 4.0L (Continued)

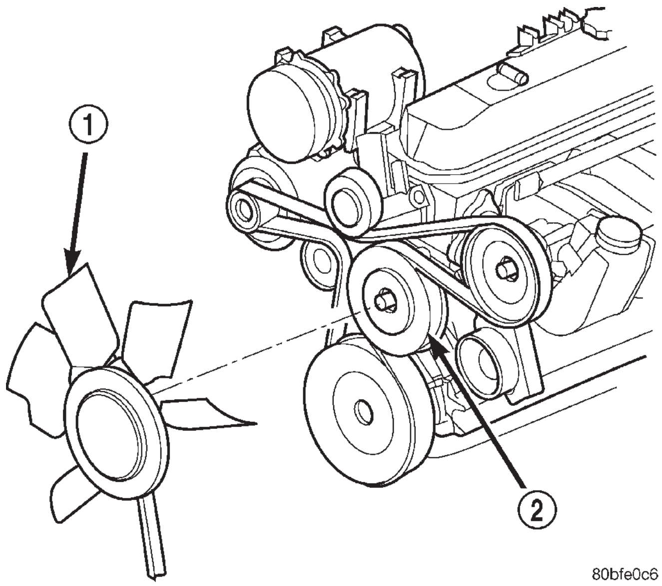


Fig. 11 Fan and Viscous Fan Drive

1 - FAN AND FAN DRIVE
2 - WATER PUMP PULLEY

(7) After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

CAUTION: Do not remove water pump pulley-to-water pump bolts. This pulley is under belt tension.

(8) Remove four bolts securing fan blade assembly to viscous fan drive .

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSPECTION

WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.

CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

(1) Remove fan blade assembly from viscous fan drive unit (four bolts).

(2) Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.

(3) Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

INSTALLATION

(1) Assemble fan blade to viscous fan drive. Tighten mounting bolts to 27 N·m (20 ft. lbs.) torque.

(2) Thread the fan and fan drive onto the water pump pulley.

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) for correct belt routing.

ENGINE BLOCK HEATER

DESCRIPTION

DESCRIPTION—4.7L ENGINE

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.

An optional engine block heater (Fig. 12) is available with all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The heater is mounted in a core hole of the engine cylinder block in place of a freeze plug with the heating element immersed in engine coolant.

DESCRIPTION—4.0L ENGINE

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.

ENGINE BLOCK HEATER (Continued)

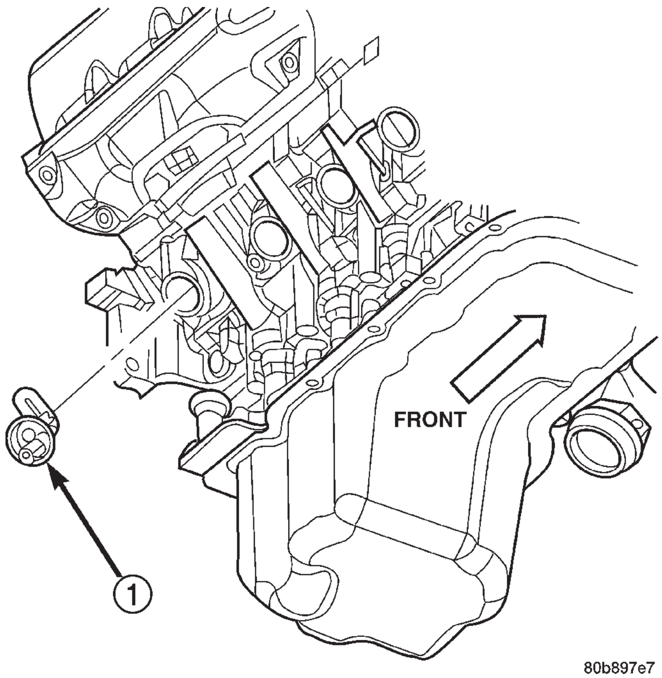


Fig. 12 Engine Block Heater—4.7L

1 - ENGINE BLOCK HEATER

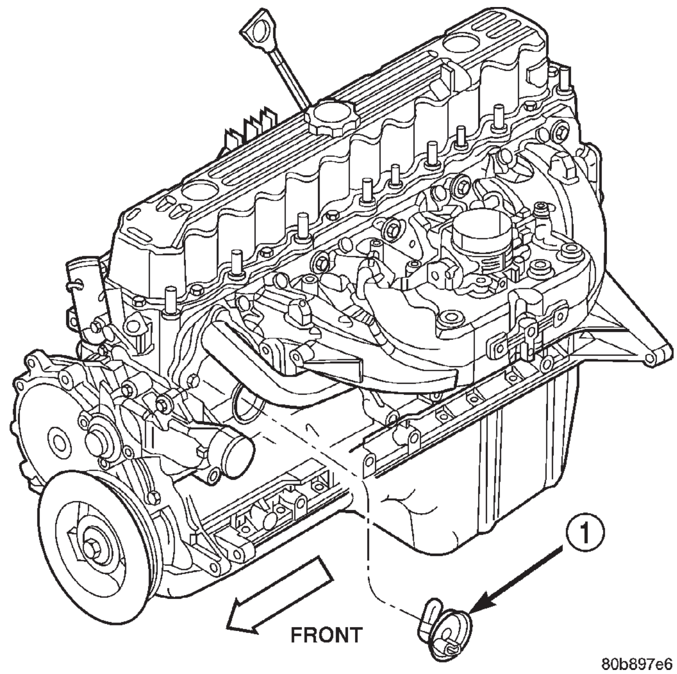


Fig. 13 Block Heater

1 - ENGINE BLOCK HEATER

An optional engine block heater (Fig. 13) is available with all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The heater is mounted in a core hole of the engine cylinder block in place of a freeze plug with the heating element immersed in engine coolant.

OPERATION

Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded, three wire extension cord activates the heating element warming the engine coolant.

DIAGNOSIS AND TESTING—ENGINE BLOCK HEATER

If the unit does not operate (Fig. 14) (Fig. 15), possible causes can be either the power cord or the heater element. Test the power cord for continuity with a 110-volt voltmeter or 110-volt test light. Test heater element continuity with an ohmmeter or a 12-volt test light.

CAUTION: To prevent damage, the power cord must be secured in it's retainer clips and away from any components that may cause abrasion or damage, such as linkages, exhaust components, etc.

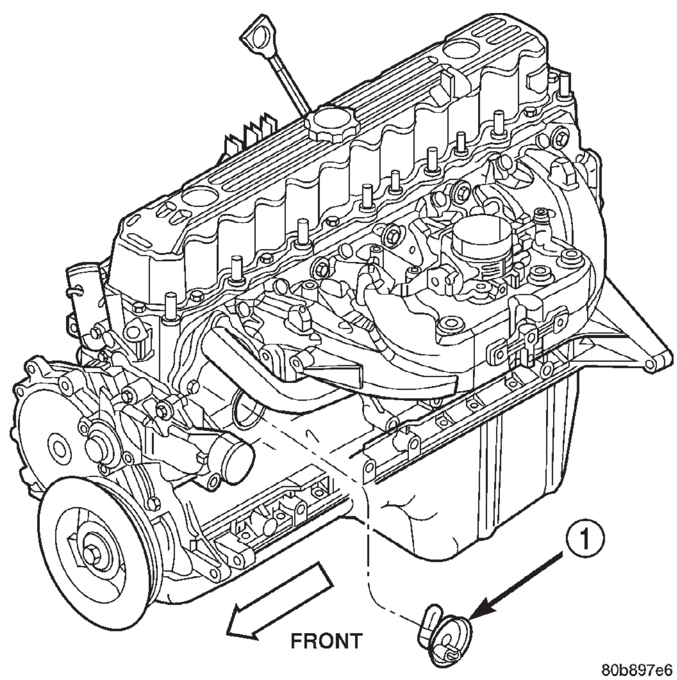


Fig. 14 Engine Block Heater 4.0L Engine

1 - ENGINE BLOCK HEATER

REMOVAL

REMOVAL—4.7L ENGINE

(1) Disconnect negative battery cable from battery.

(2) Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).

ENGINE BLOCK HEATER (Continued)

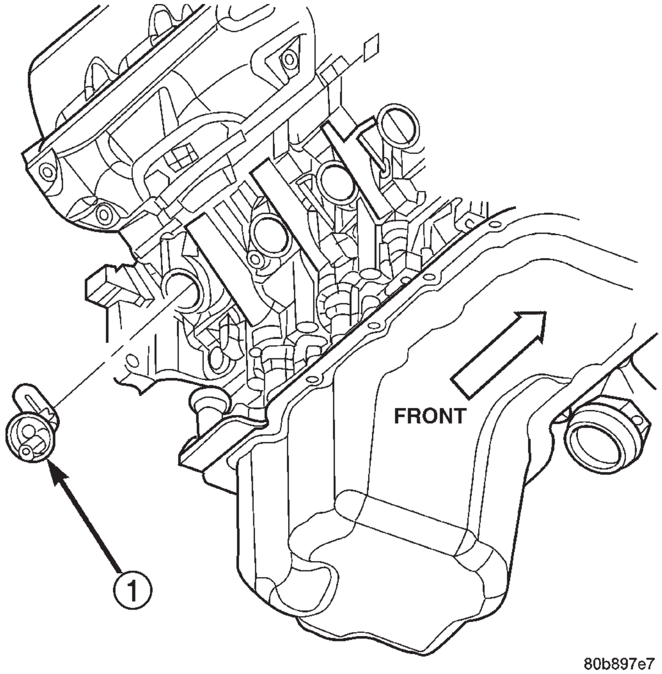


Fig. 15 Engine Block Heater 4.7L Engine

1 - ENGINE BLOCK HEATER

(3) Raise vehicle.

(4) Remove engine cylinder block drain plug(s) located on the sides of cylinder block above the oil pan rail (Fig. 16).

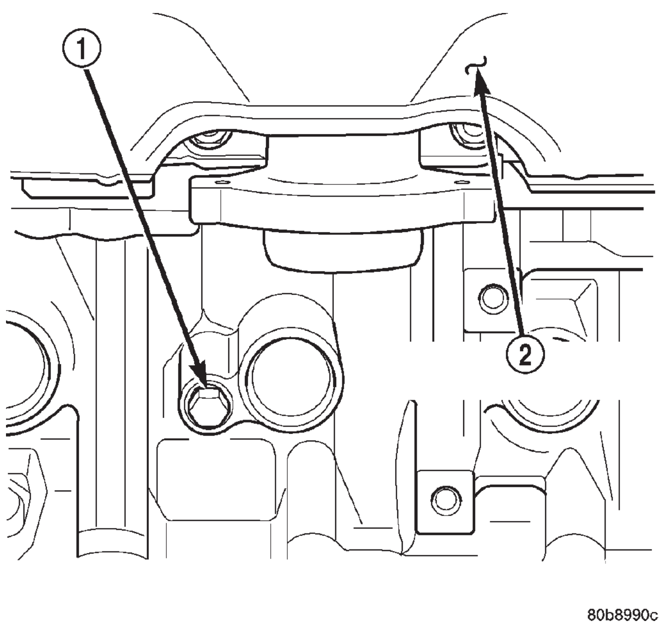


Fig. 16 Drain Plug - 4.7L Engine

1 - CYLINDER BLOCK DRAIN PLUG
2 - EXHAUST MANIFOLD AND HEAT SHIELD

(5) Remove power cord from block heater.

(6) Loosen screw at center of block heater. Remove heater assembly (Fig. 17).

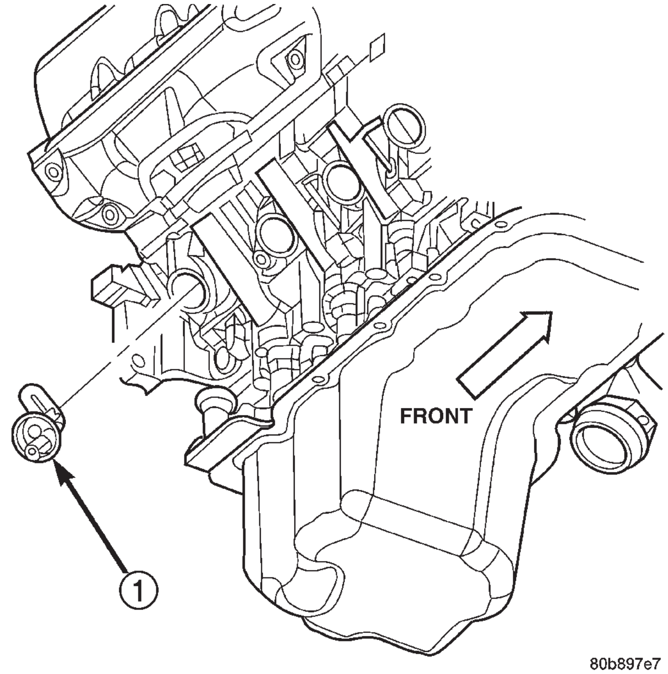


Fig. 17 Engine Block Heater - 4.7L

1 - ENGINE BLOCK HEATER

REMOVAL—4.0L ENGINE

(1) Disconnect negative battery cable from battery.

(2) Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Raise vehicle.

(4) Remove engine cylinder block drain plug(s) located on the sides of cylinder block above the oil pan rail (Fig. 18).

(5) Remove power cord from block heater.

(6) Loosen screw at center of block heater. Remove heater assembly (Fig. 19).

INSTALLATION

INSTALLATION—4.7L ENGINE

(1) Thoroughly clean cylinder block core hole and block heater seat.

(2) Insert block heater assembly with element loop pointing at twelve o'clock (Fig. 17).

(3) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.

(4) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(5) Start and warm the engine. Check for leaks.

INSTALLATION—4.0L ENGINE

(1) Thoroughly clean cylinder block core hole and block heater seat.

ENGINE BLOCK HEATER (Continued)

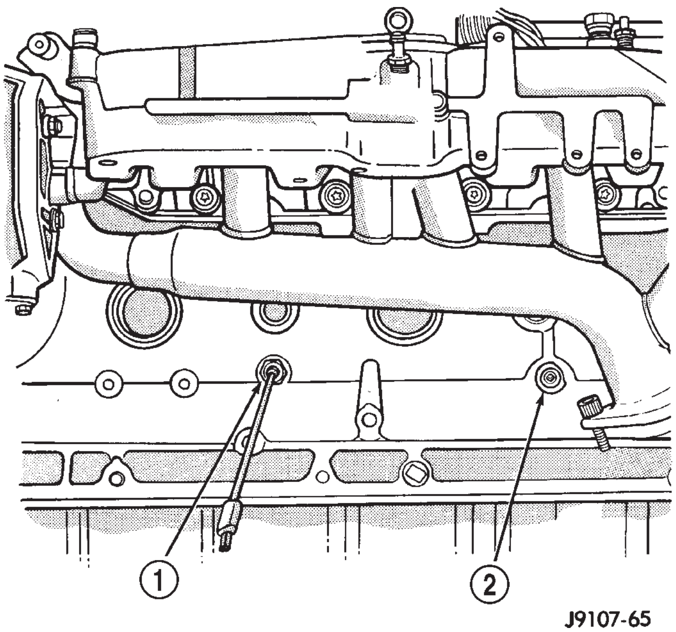


Fig. 18 Drain Plug

1 - COOLANT TEMPERATURE SENSOR
2 - BLOCK DRAIN PLUG

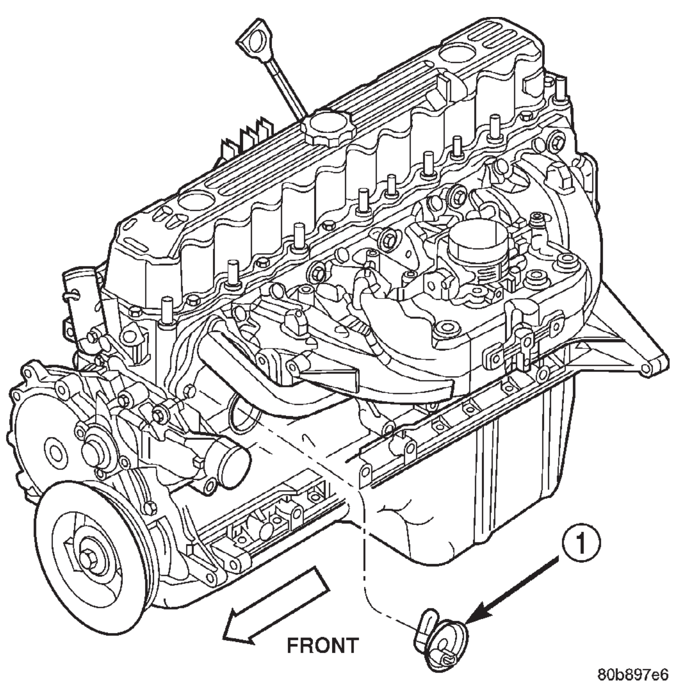


Fig. 19 Engine Block Heater

1 - ENGINE BLOCK HEATER

(2) Insert block heater assembly with element loop pointing at twelve o'clock (Fig. 19).

(3) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.

(4) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(5) Start and warm the engine. Check for leaks.

ENGINE COOLANT TEMP SENSOR

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

- for engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

REMOVAL

REMOVAL—4.0L ENGINE

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR. REFER TO GROUP 7, COOLING.

(1) Partially drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE).

ENGINE COOLANT TEMP SENSOR (Continued)

(2) Disconnect electrical connector from ECT sensor (Fig. 20).
(3) Remove sensor from thermostat housing.

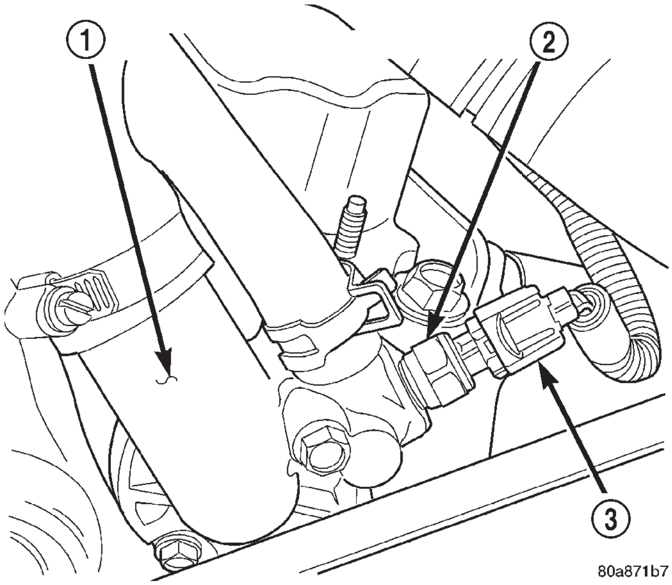


Fig. 20 Engine Coolant Temperature Sensor

1 - THERMOSTAT HOUSING
2 - ENGINE COOLANT TEMPERATURE SENSOR
3 - ELECTRICAL CONNECTOR

REMOVAL—4.7L ENGINE

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR. REFER TO GROUP 7, COOLING.

The ECT sensor is located near the front of the intake manifold (Fig. 21).
(1) Partially drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE).
(2) Disconnect electrical connector from ECT sensor.
(3) Remove sensor from intake manifold.

INSTALLATION

INSTALLATION—4.0L ENGINE

(1) Install sensor.
(2) Tighten to 11 N·m (8 ft. lbs.) torque.
(3) Connect electrical connector to sensor.
(4) Replace any lost engine coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE).

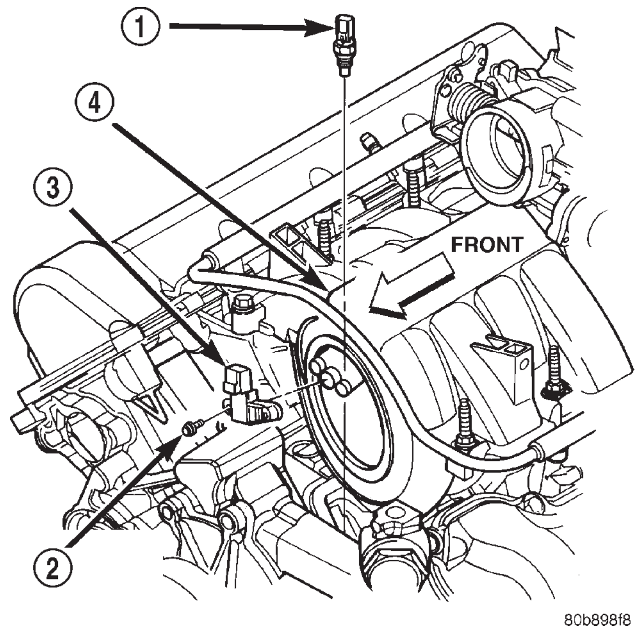


Fig. 21 Engine Coolant Temperature Sensor

1 - ECT SENSOR
2 - MOUNTING BOLTS (2)
3 - MAP SENSOR
4 - INTAKE MANIFOLD

INSTALLATION—4.7L ENGINE

(1) Install sensor.
(2) Tighten to 11 N·m (8 ft. lbs.) torque.
(3) Connect electrical connector to sensor.
(4) Replace any lost engine coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE).

ENGINE COOLANT THERMOSTAT

DESCRIPTION

DESCRIPTION—4.7L ENGINE

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control. On the 4.7L engine the thermostat is designed to block the flow of the coolant bypass journal by 50% instead of completely blocking the flow. This design controls coolant temperature more accurately (Fig. 22).

ENGINE COOLANT THERMOSTAT (Continued)

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

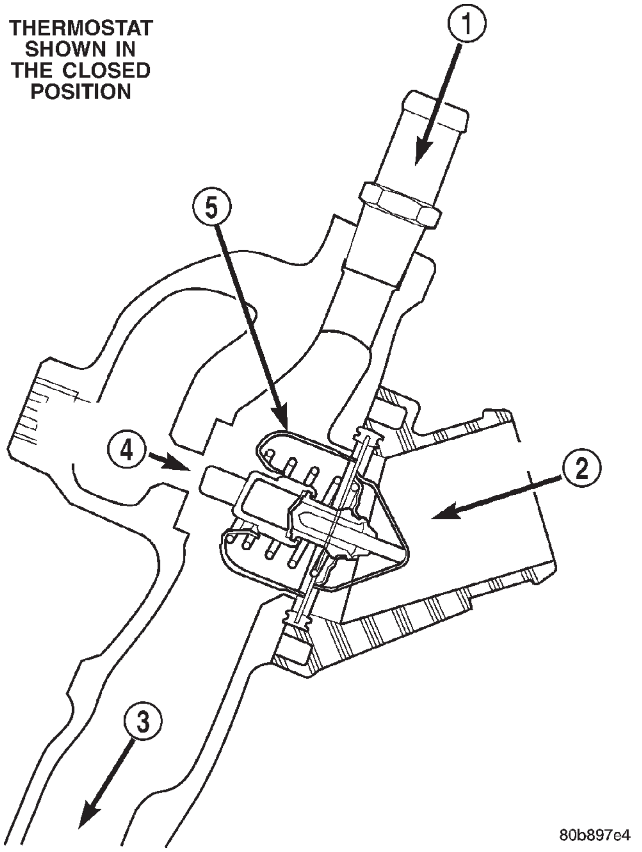


Fig. 22 Thermostat

1 - FROM HEATER
2 - FROM RADIATOR
3 - TO WATER PUMP
4 - ENGINE BYPASS
5 - THERMOSTAT

DESCRIPTION—4.0L ENGINE

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control. (Fig. 23).

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

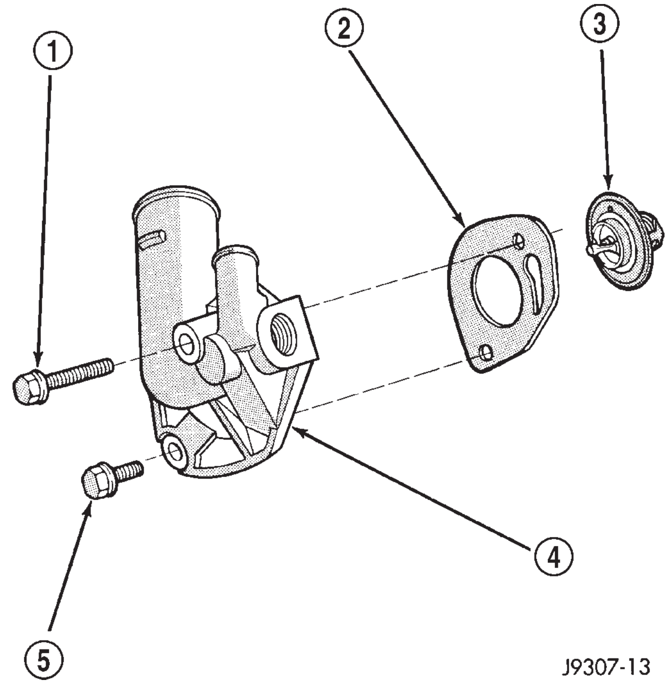


Fig. 23 Thermostat and Housing

1 - LONG BOLT
2 - GASKET
3 - THERMOSTAT
4 - THERMOSTAT HOUSING
5 - SHORT BOLT

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

DIAGNOSIS AND TESTING—THERMOSTAT

ON-BOARD DIAGNOSTICS

All models are equipped with On-Board Diagnostics for certain cooling system components.If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC). For other DTC numbers, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

The DTC can also be accessed through the DRB scan tool.

ENGINE COOLANT THERMOSTAT (Continued)

REMOVAL

REMOVAL—4.0L ENGINE

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(1) Drain the coolant from the radiator until the level is below the thermostat housing (Refer to 7 - COOLING - STANDARD PROCEDURE).

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 52). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Remove radiator upper hose and heater hose at thermostat housing.

(3) Disconnect wiring connector at engine coolant temperature sensor.

(4) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 24). Discard old gasket.

(5) Clean the gasket mating surfaces.

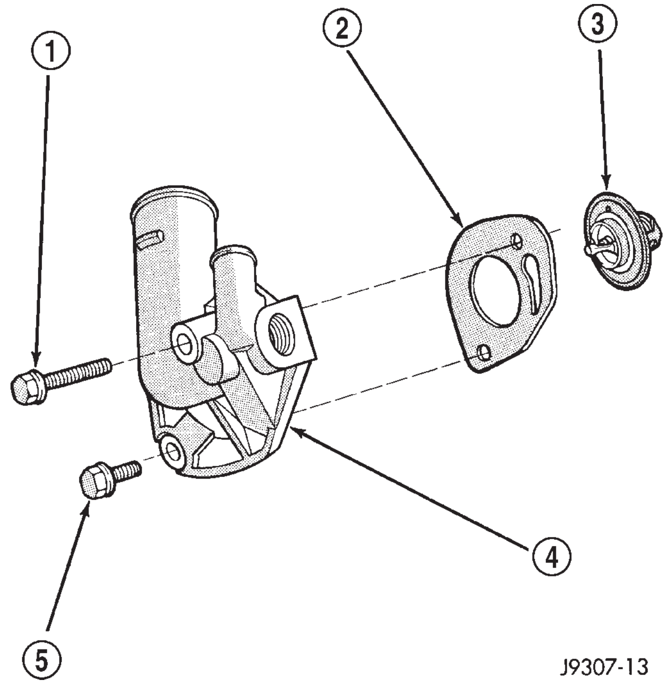


Fig. 24 Thermostat

1 - LONG BOLT
2 - GASKET
3 - THERMOSTAT
4 - THERMOSTAT HOUSING
5 - SHORT BOLT

REMOVAL—4.7L ENGINE

WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

(1) Disconnect negative battery cable at battery.

(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Raise vehicle on hoist.

(4) Remove splash shield.

(5) Remove lower radiator hose clamp and lower radiator hose at thermostat housing.

(6) Remove thermostat housing mounting bolts, thermostat housing and thermostat (Fig. 25).

INSTALLATION

INSTALLATION—4.0L ENGINE

(1) Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

(a) Observe the recess groove in the engine cylinder head (Fig. 26).

(b) Position thermostat in groove with arrow and air bleed hole on outer flange pointing up.

(2) Install replacement gasket and thermostat housing.

CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess, may result in a cracked housing.

(3) Tighten the housing bolts to 22 N·m (16 ft. lbs.) torque.

(4) Install hoses to thermostat housing.

ENGINE COOLANT THERMOSTAT (Continued)

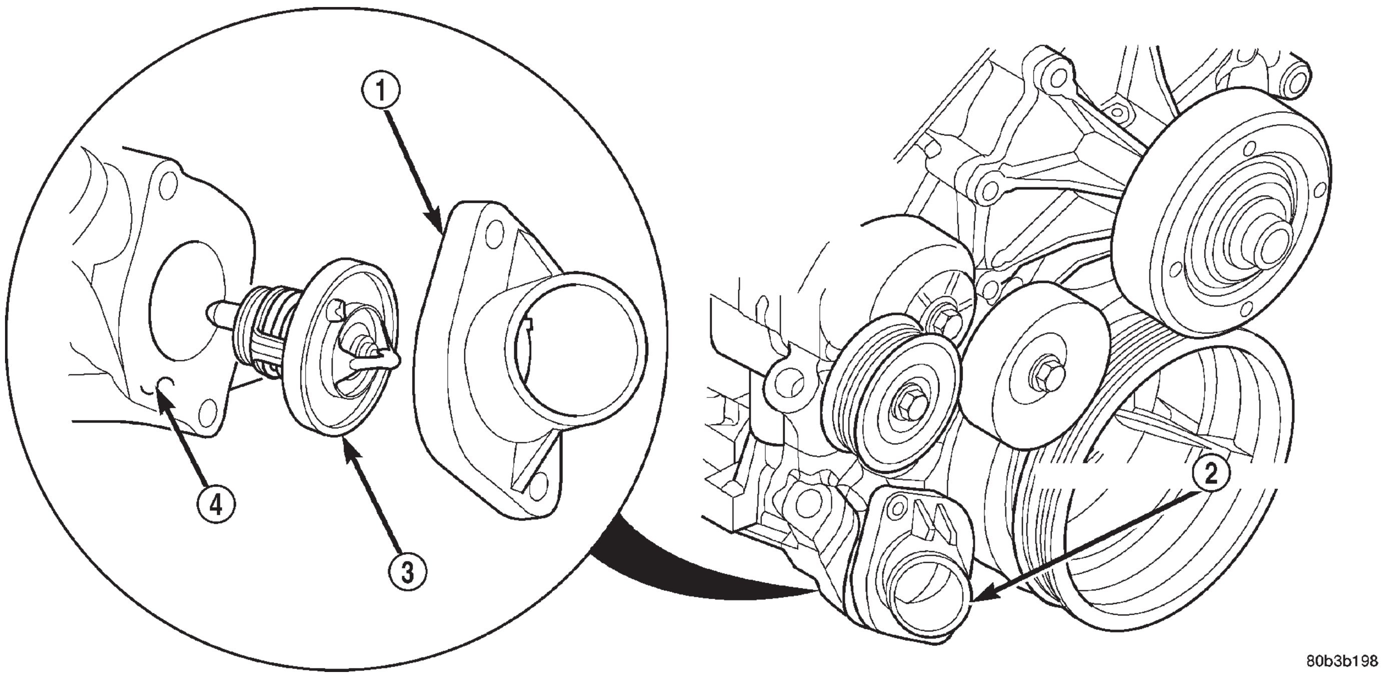


Fig. 25 Thermostat and Thermostat Housing

1 - THERMOSTAT HOUSING
2 - THERMOSTAT LOCATION
3 - THERMOSTAT AND GASKET
4 - TIMING CHAIN COVER

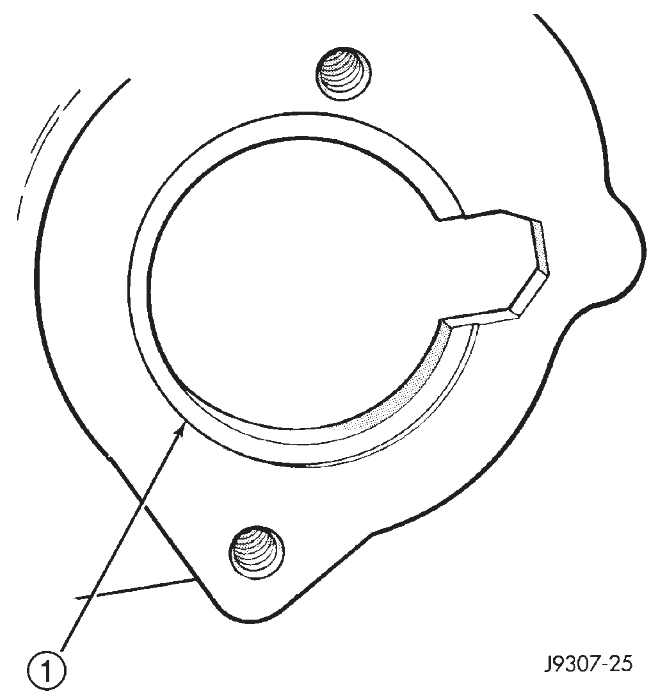


Fig. 26 Thermostat Recess

1 - GROOVE

(5) Install electrical connector to coolant temperature sensor.

(6) Be sure that the radiator draincock is tightly closed. Fill the cooling system to the correct level with the required coolant mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).

(7) Start and warm the engine. Check for leaks.

INSTALLATION—4.7L ENGINE

(1) Clean mating areas of timing chain cover and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on timing chain cover (Fig. 25).

(3) Position thermostat housing on timing chain cover.

(4) Install two housing-to-timing chain cover bolts. Tighten bolts to 13 N·m (115 in. lbs.) torque.

CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in timimg chain cover. If not, it may result in a cracked housing, damaged timing chain cover threads or coolant leaks.

(5) Install lower radiator hose on thermostat housing.

(6) Install splash shield.

(7) Lower vehicle.

(8) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(9) Connect negative battery cable to battery.

(10) Start and warm the engine. Check for leaks.

FAN DRIVE VISCOUS CLUTCH - 4.0L

DESCRIPTION

CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.

The thermal viscous fan drive (Fig. 27) is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

An electrical cooling fan located in the fan shroud aids in low speed cooling, It is designed to augment the viscous fan, However, it does not replace the viscous fan.

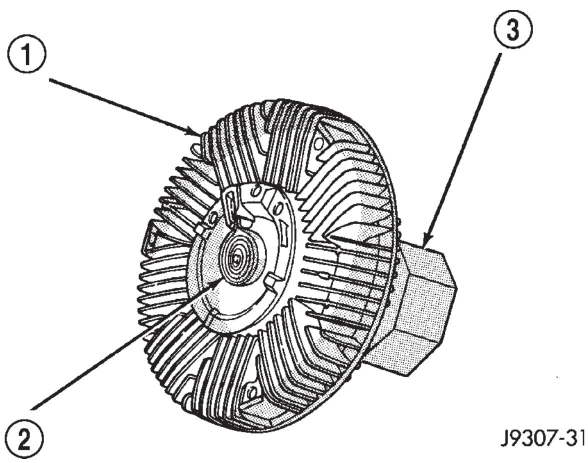


Fig. 27 Viscous Fan Drive

1 - VISCOUS FAN DRIVE
2 - THERMOSTATIC SPRING
3 - MOUNTING NUT TO WATER PUMP HUB

OPERATION

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (Fig. 27). This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, **the fan will remain at a reduced rpm regardless of engine speed. Normally less than three hundred (300) rpm.**

Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

DIAGNOSIS AND TESTING—VISCOUS FAN DRIVE

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

(1) Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud.

(2) Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° to 105°C (0° to 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.

(3) Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).

(4) Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.

(5) Be sure that the air conditioner (if equipped) is turned off.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

FAN DRIVE VISCOUS CLUTCH - 4.0L (Continued)

(6) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 93° C (200° F). Fan drive **engagement** should have started to occur at between 91° to 96° C (195° to 205° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.

(7) When the air temperature reaches 93° C (200° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 62° to 85° C (145° to 185° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

PWM FAN CONTROL MODULE - 4.0L

DESCRIPTION

The pulse width modulated (PWM) radiator cooling fan relay is located behind the front bumper fascia below the right headlamp.

OPERATION

The PWM relay is used to control the speed of the electric radiator cooling fan. It allows for multiple fan speeds. This allows for improved fan noise and A/C performance, better engine cooling, and additional vehicle power.

PWM relay operation is controlled by the Powertrain Control Module (PCM). To operate the PWM relay, the PCM looks at inputs from:

- Engine coolant temperature
- Ambient temperature from the body controller
- Vehicle speed
- Transmission oil temperature
- A/C switch position (A/C request)

REMOVAL

The Pulse Width Modulated (PWM) cooling fan relay is located below the right headlamp behind the bumper fascia (Fig. 28).

(1) Remove front bumper and grill assembly.

(2) Remove 1 support bolt near front of reservoir (Fig. 28).

(3) Remove 2 reservoir mounting bolts.

(4) Remove reservoir from vehicle to gain access to vacuum hose (Fig. 29). Disconnect vacuum hose from reservoir fitting at rear of reservoir.

(5) Disconnect electrical connector at relay (Fig. 30).

(6) Remove 2 relay mounting bolts (Fig. 30) and remove relay.

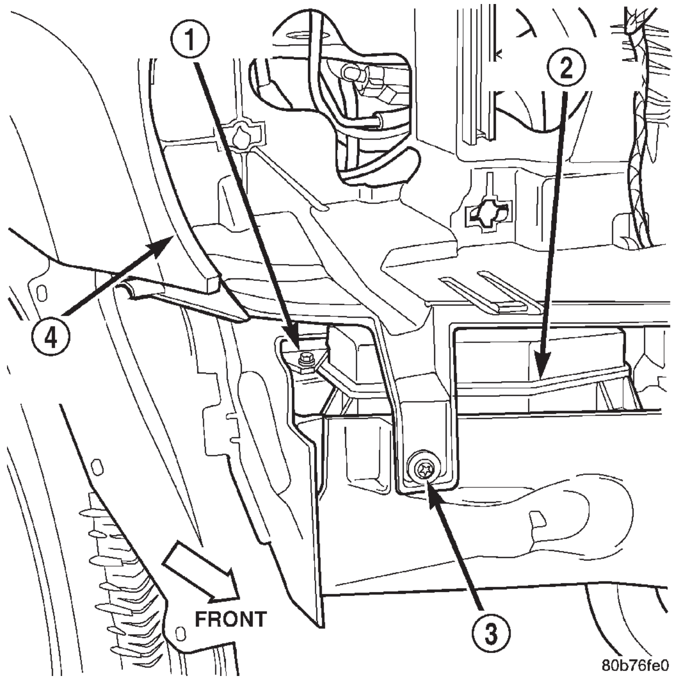


Fig. 28 Radiator Cooling Fan Relay Location

1 - RADIATOR FAN RELAY
2 - VACUUM RESERVOIR
3 - BOLT
4 - RIGHT FRONT FENDER

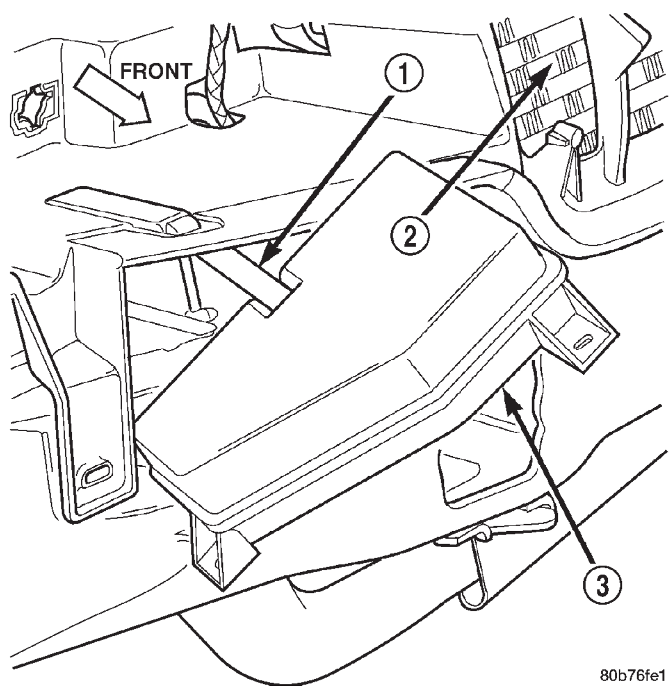


Fig. 29 Vacuum Reservoir Removal/Installation

1 - VACUUM HOSE
2 - RADIATOR
3 - VACUUM RESERVOIR

PWM FAN CONTROL MODULE - 4.0L (Continued)

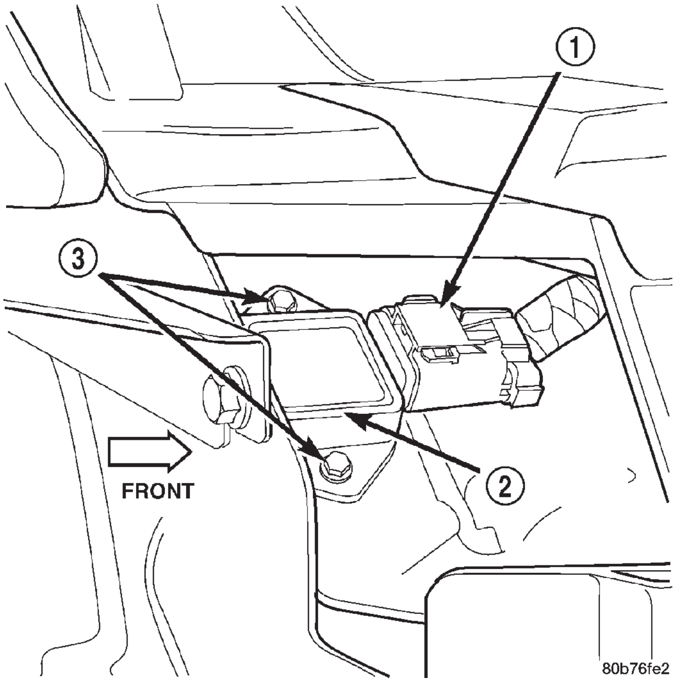


Fig. 30 Radiator Cooling Fan Relay Removal/ Installation

1 - ELECTRICAL CONNECTOR
2 - RADIATOR FAN RELAY
3 - MOUNTING BOLTS (2)

INSTALLATION

(1) Position relay to body and install 2 bolts. Tighten bolts to 3 N·m (25 in. lbs.) torque.

(2) Connect electrical connector to relay.

(3) Connect vacuum hose to reservoir.

(4) Install reservoir and tighten 2 bolts to 3 N·m (25 in. lbs.) torque.

(5) Install front bumper and grill assembly.

RADIATOR - 4.7L

DESCRIPTION

All vehicles are equipped with a cross flow type radiator with plastic side tanks (Fig. 31).

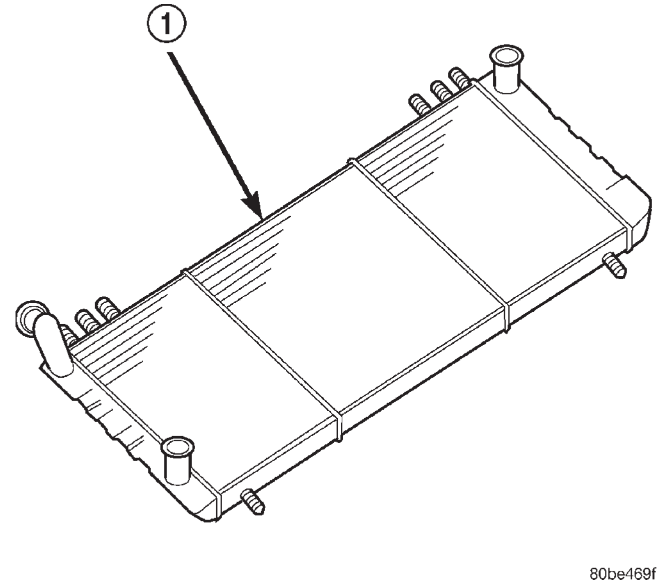


Fig. 31 Cross Flow Radiator - Typical

1 - RADIATOR

Plastic tanks, while stronger than brass, are subject to damage by impact, such as from tools or wrenches. Handle radiator with care.

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR. REFER TO COOLING SYSTEM DRAINING.

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 32). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 33). If replacement is necessary, use only an original equipment clamp with matching number or letter.

CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 34). These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Disconnect the negative battery cable at battery.

(2) Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove the front grill (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

RADIATOR - 4.7L (Continued)

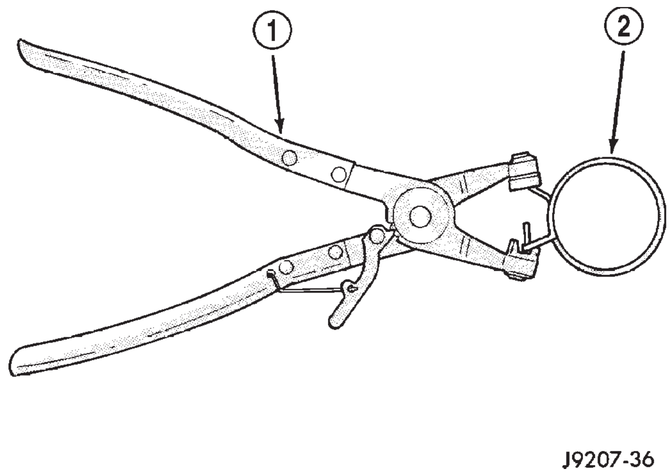


Fig. 32 Hose Clamp Tool - Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

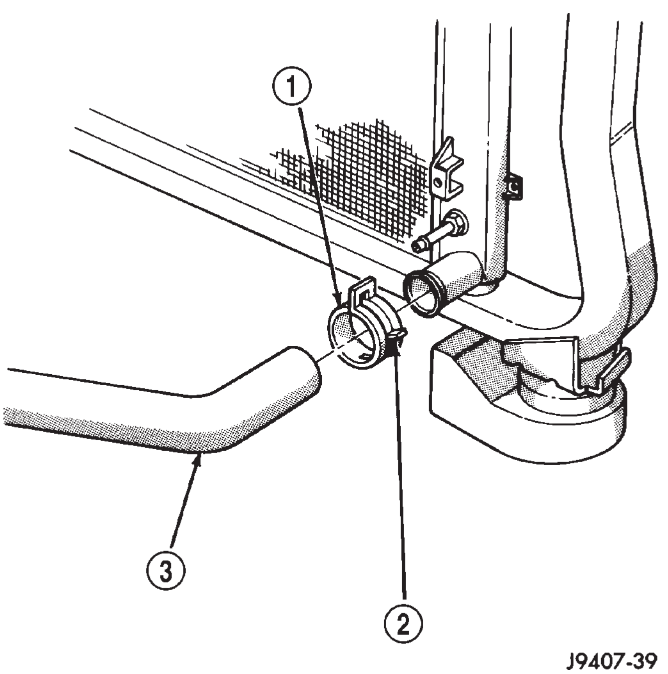


Fig. 33 Clamp Number/Letter Location - Typical

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

(4) Remove two radiator mounting bolts.

(5) Disconnect both transmission cooler lines from radiator.

(6) Disconnect electrical connector for the fan control solenoid.

(7) Disconnect the power steering cooler line from cooler and filter.

(8) Disconnect the radiator upper and lower hoses.

(9) Disconnect the overflow hose from radiator.

(10) Remove the air inlet duct at the grill.

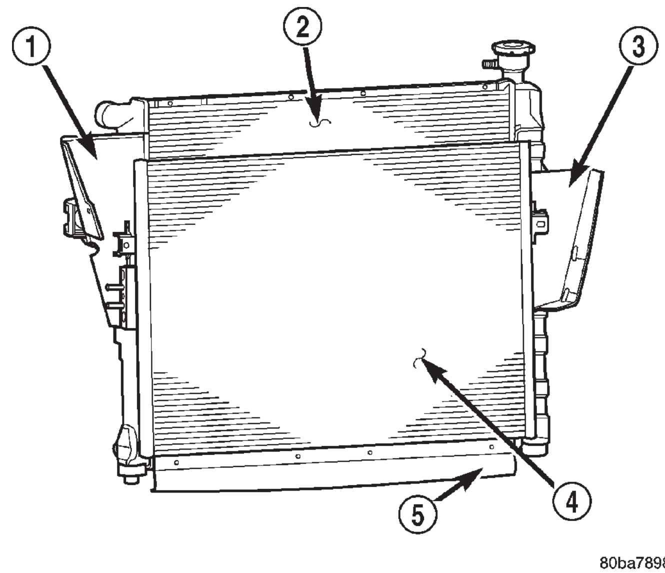


Fig. 34 Air Seals - Typical

1 - AIR DAM
2 - RADIATOR
3 - AIR DAM
4 - A/C CONDENSER
5 - AIR SEAL

(11) The lower part of radiator is equipped with two alignment dowel pins (Fig. 35). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

WARNING: THE AIR CONDITIONING SYSTEM (IF EQUIPPED) IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN, HEATING AND AIR CONDITIONING BEFORE HANDLING ANY AIR CONDITIONING COMPONENT.

NOTE: The radiator and radiator cooling fan can be removed as an assembly. It is not necessary to remove the cooling fan before removing or installing the radiator.

(12) Disconnect the two high pressure fluid lines at the hydraulic fan drive.

(13) Disconnect the low pressure return hose at the hydraulic fan drive.

(14) Gently lift up and remove radiator from vehicle. Be careful not to scrape the radiator fins against any other component. Also be careful not to disturb the air conditioning condenser (if equipped).

CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of

RADIATOR - 4.7L (Continued)

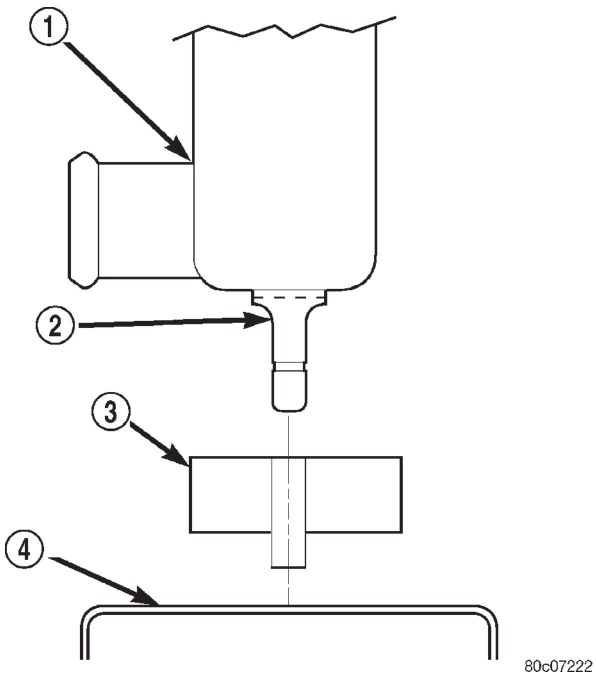


Fig. 35 Radiator Alignment Dowels - Typical

1 - RADIATOR
2 - ALIGNMENT DOWEL
3 - RADIATOR LOWER ISOLATOR
4 - RADIATOR LOWER CROSSMEMBER

the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

INSTALLATION

CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 39) are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Equipped with air conditioning: Gently lower the radiator and fan shroud into the vehicle. Guide the two radiator alignment dowels through the holes in the rubber air seals first and then through the A/C support brackets (Fig. 40). Continue to guide the alignment dowels into the rubber grommets located in lower radiator crossmember. The holes in the L-shaped brackets (located on bottom of A/C condenser) must be positioned between bottom of rubber air seals and top of rubber grommets.

(2) Connect the radiator upper and lower hoses and hose clamps to radiator.

CAUTION: The tangs on the hose clamps must be positioned straight down.

(3) Install coolant reserve/overflow tank hose at radiator.

(4) Connect both transmission cooler lines at the radiator.

(5) Install both radiator mounting bolts.

(6) Install air inlet duct at grill.

(7) Attach electric connector for hydraulic fan control solenoid.

(8) Install the grill (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(9) Connect the two high pressure lines to the hydraulic fan drive. Tighten ½ in. pressure line fitting to 49 N·m (36 ft. lbs.). and the 3/8 in. pressure line fitting to 29 N·m (21.5 ft. lbs.).

(10) Connect the low pressure hose to the hydraulic fan drive. Position the spring clamp.

(11) Connect the power steering filter hoses to the filter. Install new hose clamps.

(12) Rotate the fan blades (by hand) and check for interference at fan shroud.

(13) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(14) Refill the power steering reservoir and bleed air from system (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

(15) Connect battery cable at battery.

(16) Start and warm engine. Check for leaks.

RADIATOR - 4.0L

DESCRIPTION

All vehicles are equipped with a cross flow type radiator with plastic side tanks (Fig. 36).

Plastic tanks, while stronger than brass, are subject to damage by impact, such as from tools or wrenches. Handle radiator with care.

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR. REFER TO COOLING SYSTEM DRAINING.

RADIATOR - 4.0L (Continued)

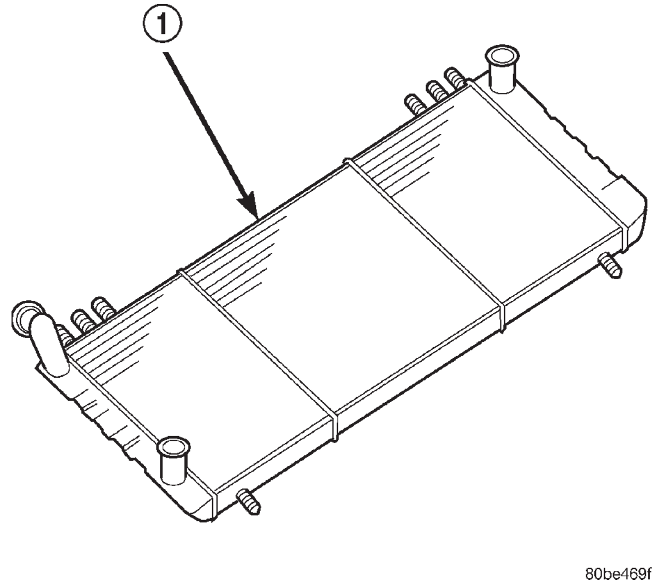


Fig. 36 Cross Flow Radiator - Typical

1 - RADIATOR

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 37). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 38). If replacement is necessary, use only an original equipment clamp with matching number or letter.

CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 39). These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Disconnect the negative battery cable at battery.

(2) Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

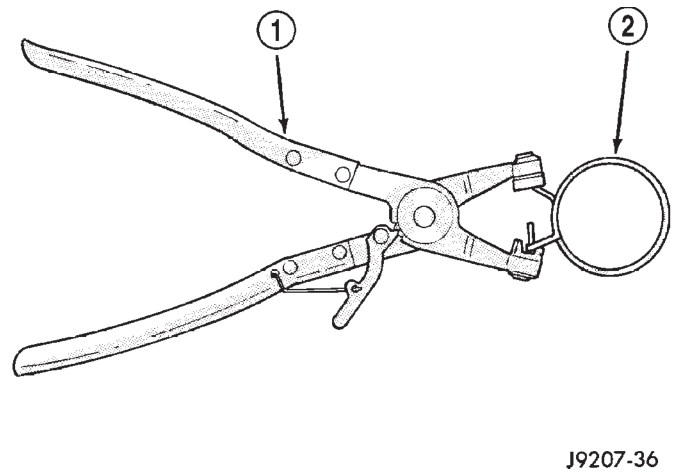


Fig. 37 Hose Clamp Tool - Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

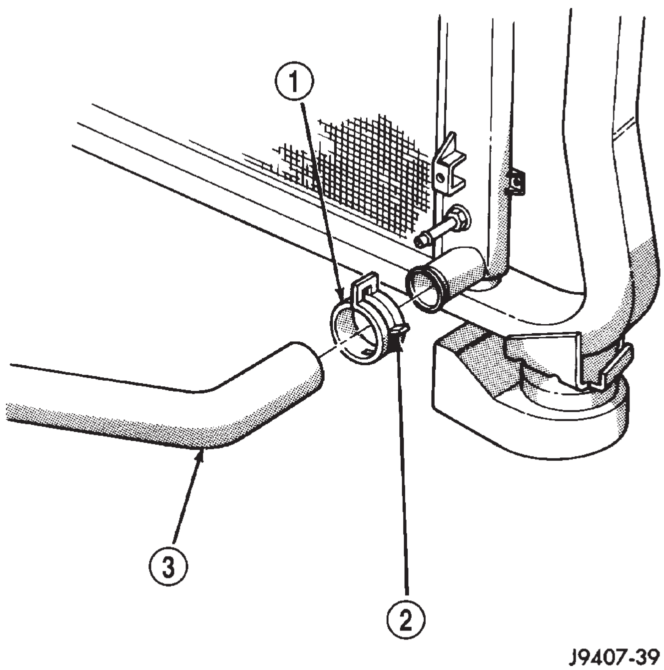


Fig. 38 Clamp Number/Letter Location - Typical

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

(4) Remove the front grill (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(5) Remove two radiator mounting bolts (Fig. 41).

(6) Disconnect both transmission cooler lines from radiator.

(7) Disconnect electric fan connector, then disconnect connector harness from shroud (Fig. 41).

(8) Disconnect the radiator upper and lower hoses (Fig. 41).

RADIATOR - 4.0L (Continued)

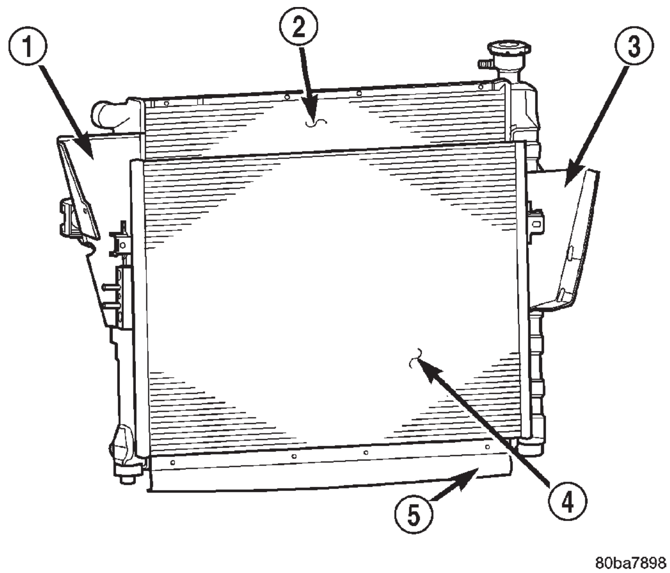


Fig. 39 Air Seals - Typical

1 - AIR DAM
2 - RADIATOR
3 - AIR DAM
4 - A/C CONDENSER
5 - AIR SEAL

(9) Disconnect the overflow hose from radiator (Fig. 41).

(10) Remove the air inlet duct at the grill.

(11) The lower part of radiator is equipped with two alignment dowel pins (Fig. 40). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

WARNING: THE AIR CONDITIONING SYSTEM (IF EQUIPPED) IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING BEFORE HANDLING ANY AIR CONDITIONING COMPONENT.

(12) If equipped with an auxiliary automatic transmission oil cooler, use caution when removing radiator. The oil cooler lines are routed through a rubber air seal on the right side of radiator. Do not cut or tear this seal.

(13) Gently lift up and remove radiator from vehicle. Be careful not to scrape the radiator fins against any other component. Also be careful not to disturb the air conditioning condenser (if equipped).

CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

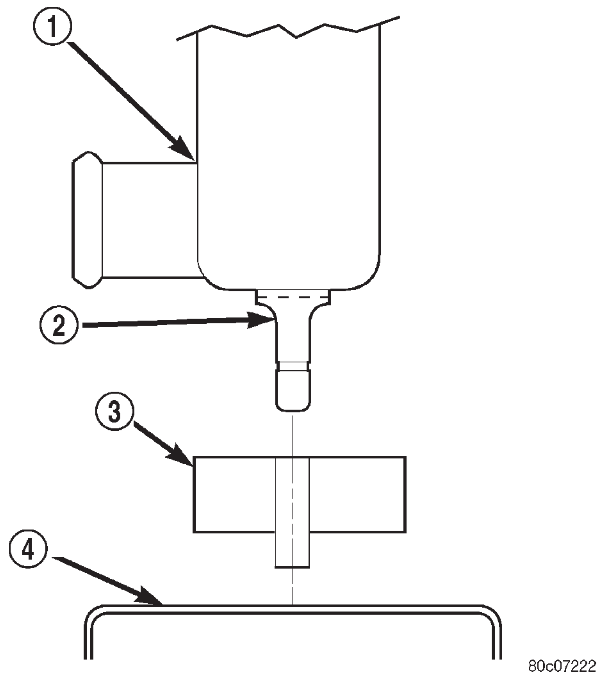


Fig. 40 Radiator Alignment Dowels

1 - RADIATOR
2 - ALIGNMENT DOWEL
3 - RADIATOR LOWER ISOLATOR
4 - RADIATOR LOWER CROSSMEMBER

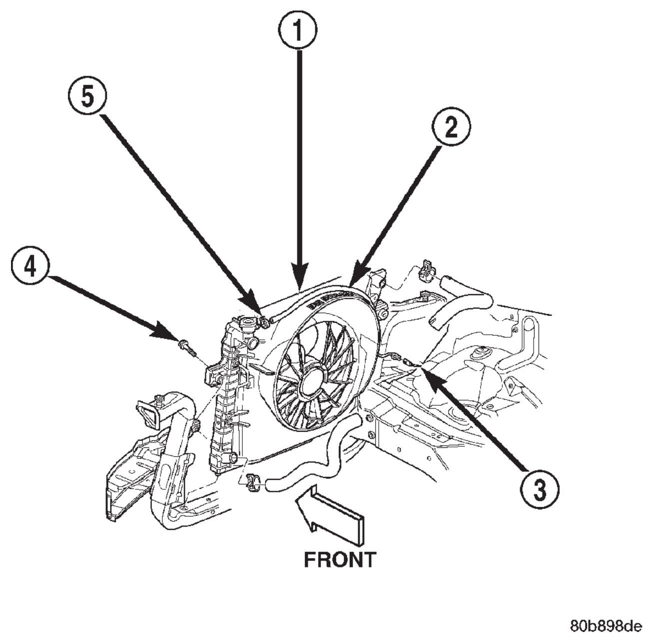


Fig. 41 Radiator, Shroud and Electric Fan

1 - RADIATOR/SHROUD/FAN ASSEMBLY
2 - OVER FLOW HOSE
3 - ELECTRIC FAN CONNECTOR
4 - RADIATOR MOUNTING BOLT(S)
5 - CLAMP

RADIATOR - 4.0L (Continued)

INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

INSTALLATION

CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 39) are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Equipped with air conditioning: Gently lower the radiator into the vehicle. Guide the two radiator alignment dowels through the holes in the rubber air seals first and then through the A/C support brackets (Fig. 40). Continue to guide the alignment dowels into the rubber grommets located in lower radiator crossmember. The holes in the L-shaped brackets (located on bottom of A/C condenser) must be positioned between bottom of rubber air seals and top of rubber grommets.

(2) Connect the radiator upper and lower hoses and hose clamps to radiator (Fig. 41).

CAUTION: The tangs on the hose clamps must be positioned straight down.

(3) Install coolant reserve/overflow tank hose at radiator (Fig. 41).

(4) Connect both transmission cooler lines at the radiator (Fig. 41).

(5) Install both radiator mounting bolts (Fig. 41).

(6) Install air inlet duct at grill.

(7) Attach electric fan harness to shroud, then connect harness to connector (Fig. 41).

(8) Install the grill (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(9) Install the fan/viscous fan drive assembly to the water pump.

(10) Rotate the fan blades (by hand) and check for interference at fan shroud.

(11) Be sure of at least 25 mm (1.0 inch) between tips of fan blades and fan shroud.

(12) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(13) Connect battery cable at battery.

(14) Start and warm engine. Check for leaks.

RADIATOR FAN MOTOR

DIAGNOSIS AND TESTING—ELECTRIC COOLING FAN

The powertrain control module (PCM) will enter a diagnostic trouble code (DTC) in memory if it detects a problem in the auxiliary cooling fan relay or circuit. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

If the electric cooling fan is inoperative, check the 15A fuse in the junction block and the 40A fuse in the Power Distribution Center (PDC) with a 12 volt test lamp or DVOM. Refer to the inside of the PDC cover for the exact location of the fuse. If fuses are okay, refer to ELECTRICAL for cooling fan and relay circuit schematic.

WATER PUMP - 4.7L

DESCRIPTION

DESCRIPTION—WATER PUMP

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

Both heater hoses are connected to fittings on the timing chain front cover. The water pump is also mounted directly to the timing chain cover and is equipped with a non serviceable integral pulley (Fig. 42).

DESCRIPTION—WATER PUMP BYPASS

The 4.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat (Fig. 43) to control flow through the bypass gallery.

OPERATION

OPERATION—WATER PUMP

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold,

WATER PUMP - 4.7L (Continued)

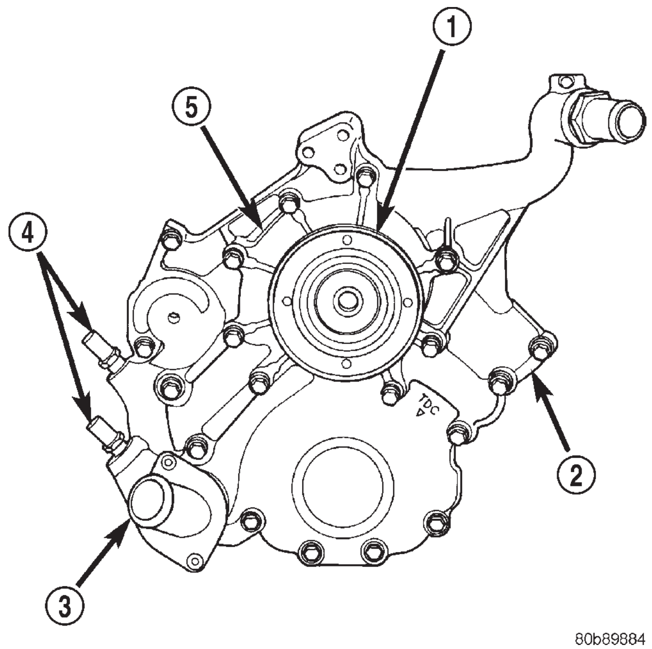


Fig. 42 Water Pump and Timing Chain Cover

1 - INTEGRAL WATER PUMP PULLEY
2 - TIMING CHAIN COVER
3 - THERMOSTAT HOUSING
4 - HEATER HOSE FITTINGS
5 - WATER PUMP

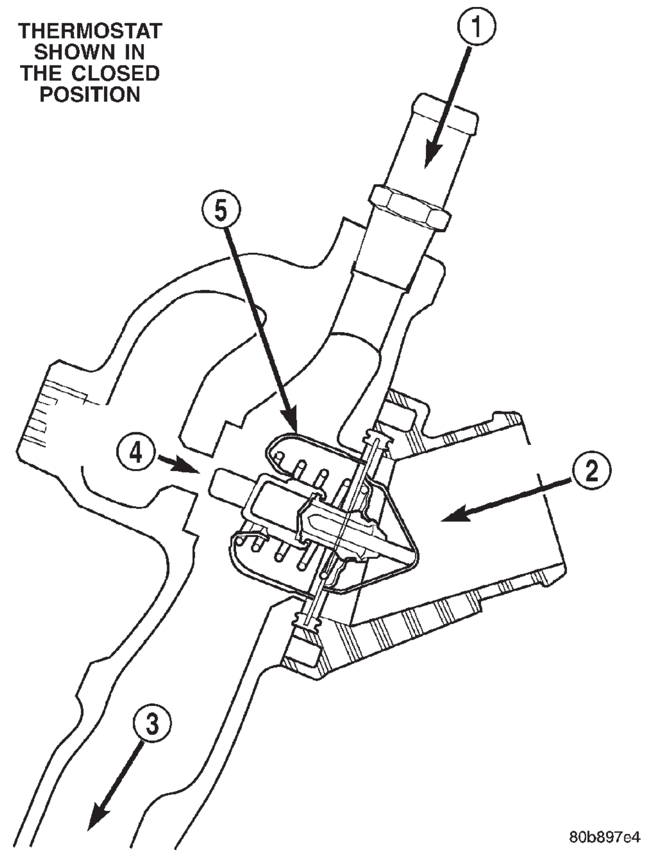


Fig. 43 Water/Coolant Bypass Flow and Thermostat

1 - FROM HEATER
2 - FROM RADIATOR
3 - TO WATER PUMP
4 - ENGINE BYPASS
5 - THERMOSTAT

radiator core, cooling system hoses and heater core, this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

OPERATION—WATER PUMP BYPASS

When the thermostat is in the closed position the bypass gallery is not obstructed allowing 100% flow. When the thermostat is in the open position the stub shaft enters the bypass gallery obstructing bypass coolant flow by 50%. This design allows the coolant to reach operating temperature quickly when cold, while adding extra cooling during normal temperature operation.

DIAGNOSIS AND TESTING—WATER PUMP

LOOSE IMPELLER - 4.0L and 4.7L

NOTE: Due to the design of the 4.0L and 4.7L engine water pumps, testing the pump for a loose impeller must be done by verifying coolant flow in the radiator. To accomplish this refer to the following procedure.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(1) Drain coolant until the first row of cores is visible in the radiator (Refer to 7 - COOLING - STANDARD PROCEDURE) 4.7L Engine or (Refer to 7 - COOLING - STANDARD PROCEDURE) 4.0L Engine.

(2) Leaving the radiator cap off, start the engine. Run engine until thermostat opens.

(3) While looking into the radiator through the radiator fill neck, raise engine rpm to 2000 RPM. Observe the flow of coolant from the first row of cores.

(4) If there is no flow or very little flow visable, replace the water pump.

INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the heater hose inlet.

DO NOT WASTE reusable coolant. If solution is clean, drain the coolant into a clean container for reuse.

WATER PUMP - 4.7L (Continued)

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) Drain sufficient coolant from the radiator to decrease the level below the heater hose inlet. On 4.7L engines this requires complete draining.

(2) Remove the heater hose.

(3) Inspect the inlet for metal casting flash or other restrictions.

NOTE: On 4.0L engines remove the pump from the engine before removing restriction to prevent contamination of the coolant with debris. . On 4.7L engine remove the fitting from the timing chain cover, If the restriction is in the timing chain cover, remove the timing chain cover.

REMOVAL

The water pump on 4.7L engines is bolted directly to the engine timing chain case/cover.

A gasket is used as a seal between the water pump and timing chain case/cover.

The water pump can be removed without discharging the air conditioning system (if equipped).

(1) Disconnect negative battery cable from battery.

(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.

(3) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(4) Remove lower radiator hose clamp and remove lower hose at water pump.

(5) Remove seven water pump mounting bolts and one stud bolt.

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

(6) Remove water pump and gasket. Discard gasket.

CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

INSPECTION

Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, Loose or rough turning bearing or Impeller rubbing either the pump body or timing chain case/cover.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, position water pump and install mounting bolts as shown. (Fig. 44). Tighten water pump mounting bolts to 54 N·m (40 ft. lbs.) torque.

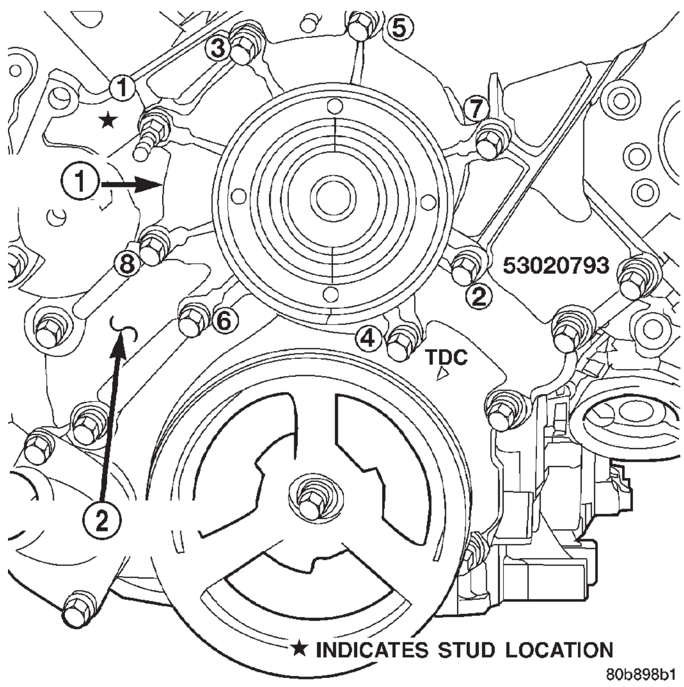


Fig. 44 Water Pump Installation

1 - WATER PUMP
2 - TIMING CHAIN COVER

(3) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(4) Connect radiator lower hose to water pump.

(5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

WATER PUMP - 4.7L (Continued)

CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction.

(6) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(7) Connect negative battery cable.
(8) Start and warm the engine. Check for leaks.

WATER PUMP - 4.0L

DESCRIPTION

CAUTION: All 4.0L 6-cylinder engines are equipped with a reverse (counterclockwise) rotating water pump and thermal viscous fan drive assembly. REVERSE is stamped or imprinted on the cover of the viscous fan drive and inner side of the fan. The letter R is stamped into the back of the water pump impeller. Engines from previous model years, depending upon application, may have been equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump or viscous fan drive will cause engine over heating.

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary (Fig. 45).

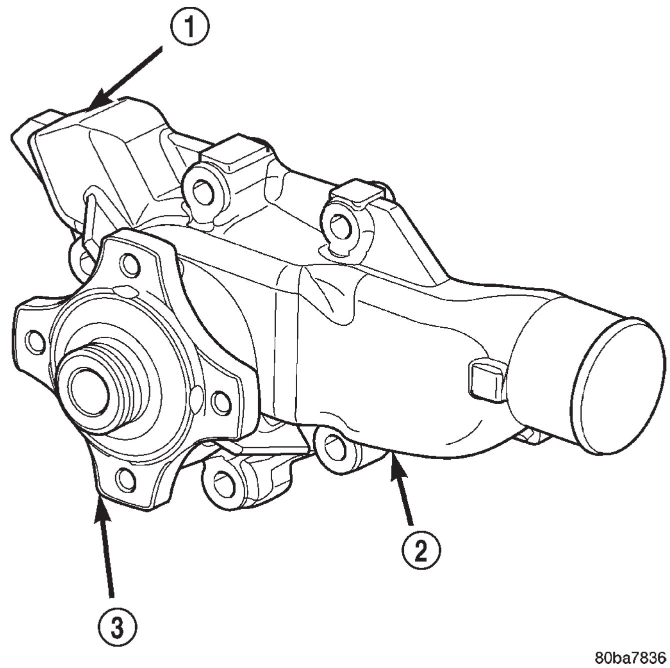


Fig. 45 Water Pump

1 - HEATER HOSE FITTING BORE
2 - WATER PUMP
3 - WATER PUMP HUB

DIAGNOSIS AND TESTING—WATER PUMP

LOOSE IMPELLER - 4.0L and 4.7L

NOTE: Due to the design of the 4.0L and 4.7L engine water pumps, testing the pump for a loose impeller must be done by verifying coolant flow in the radiator. To accomplish this refer to the following procedure.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(1) Drain coolant until the first row of cores is visible in the radiator (Refer to 7 - COOLING - STANDARD PROCEDURE) 4.7L Engine or (Refer to 7 - COOLING - STANDARD PROCEDURE) 4.0L Engine.
(2) Leaving the radiator cap off, start the engine. Run engine until thermostat opens.
(3) While looking into the radiator through the radiator fill neck, raise engine rpm to 2000 RPM. Observe the flow of coolant from the first row of cores.
(4) If there is no flow or very little flow visable, replace the water pump.

INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the heater hose inlet.

DO NOT WASTE reusable coolant. If solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) Drain sufficient coolant from the radiator to decrease the level below the heater hose inlet. On 4.7L engines this requires complete draining.
(2) Remove the heater hose.
(3) Inspect the inlet for metal casting flash or other restrictions.

WATER PUMP - 4.0L (Continued)

NOTE: On 4.0L engines remove the pump from the engine before removing restriction to prevent contamination of the coolant with debris. . On 4.7L engine remove the fitting from the timing chain cover, If the restriction is in the timing chain cover, remove the timing chain cover.

REMOVAL

CAUTION: If the water pump is replaced because of mechanical damage, the fan blades and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

NOTE: The water pump can be replaced without discharging the A/C system.

WARNING: DO NOT REMOVE THE BLOCK DRAIN PLUG(S) OR LOOSEN RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

(1) Disconnect negative battery cable at battery.

(2) Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND** Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(4) If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.

(5) Remove fan shroud-to-radiator nuts (Fig. 46). Do not attempt to remove fan shroud at this time.

(6) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

(7) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

Loosen but do not remove the water pump pulley mounting bolts.

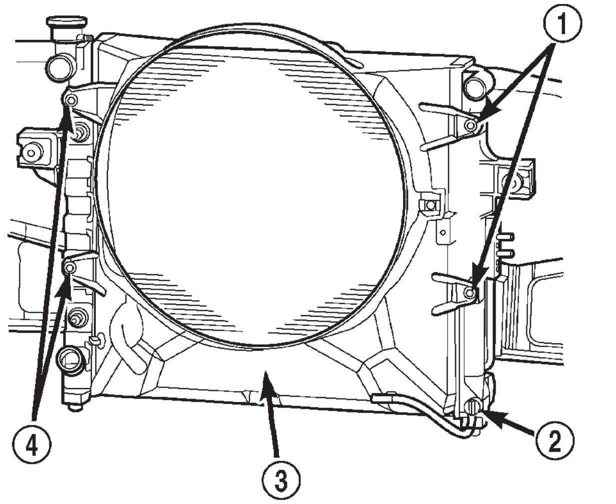


Fig. 46 Fan Shroud Mounting

1 - SHROUD FASTENERS
2 - DRAIN COCK
3 - RADIATOR FAN SHROUD
4 - SHROUD FASTENERS

Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

Remove the water pump pulley.

(8) Remove the idler pulley (located over the water pump).

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 47) SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 48). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(9) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

(10) Remove the five pump mounting bolts (Fig. 49) and remove pump from vehicle. Discard old gasket. Note that one of the five bolts is longer than the other bolts.

(11) If pump is to be replaced, the heater hose fitting must be removed. Note position of fitting before removal.

WATER PUMP - 4.0L (Continued)

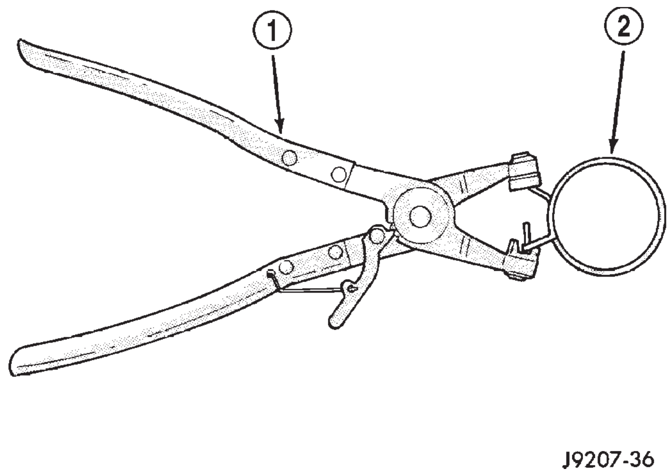


Fig. 47 Hose Clamp Tool - Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

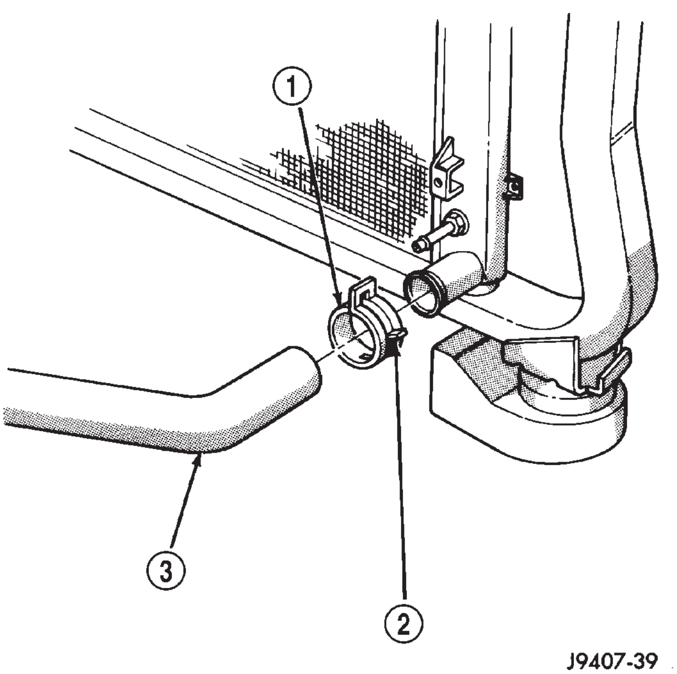


Fig. 48 Clamp - Typical

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

INSPECTION

Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, Loose or rough turning bearing or Impeller rubbing either the pump body or timing chain case/cover.

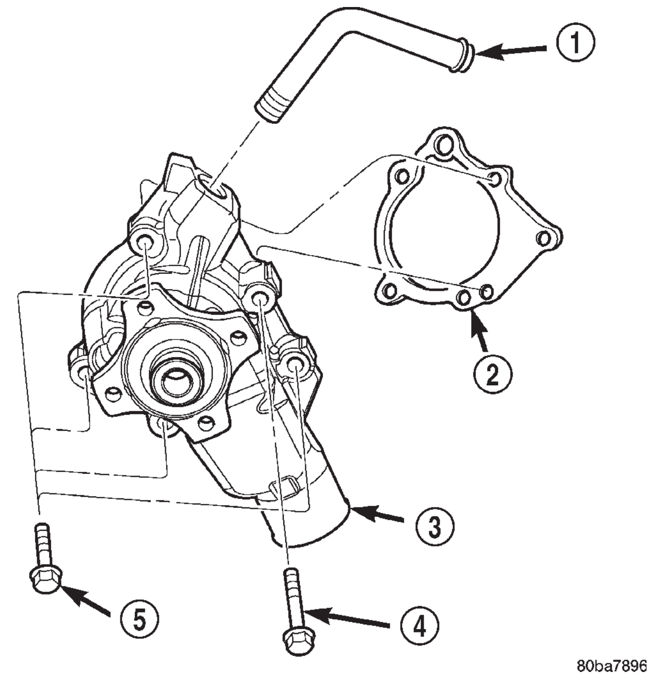


Fig. 49 Water Pump Remove/Install - Typical

1 - HEATER HOSE FITTING
2 - PUMP GASKET
3 - WATER PUMP
4 - LONG BOLT
5 - BOLTS (4) SHORT

INSTALLATION

CAUTION: If the water pump is replaced because of mechanical damage, the fan blades and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

(1) If pump is being replaced, install the heater hose fitting to the pump. Use a sealant on the fitting such as Mopar® Thread Sealant With Teflon. Refer to the directions on the package.

(2) Clean the gasket mating surfaces. If the original pump is used, remove any deposits or other foreign material. Inspect the cylinder block and water pump mating surfaces for erosion or damage from cavitation.

(3) Install the gasket and water pump. The silicone bead on the gasket should be facing the water pump. Also, the gasket is installed dry. Tighten mounting bolts to 30 N·m (22 ft. lbs.) torque. Rotate the shaft by hand to be sure it turns freely.

(4) Connect the radiator and heater hoses to the water pump.

(5) Position water pump pulley to water pump hub. Tighten bolts 28 N·m (250 in. lbs.).

Install the idler pulley. Tighten the bolt 47 N·m (35 ft. lbs.).

WATER PUMP - 4.0L (Continued)

CAUTION: When installing the serpentine engine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. Refer to the Belt Removal and Installtion in this group for appropriate belt routing. You may also refer to the Belt Routing Label in the vehicle engine compartment.

Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Install fan blade and viscous fan drive onto water pump.

(7) Fill cooling system with coolant and check for leaks. (Refer to 7 - COOLING - STANDARD PROCEDURE).

(8) Connect battery cable to battery.

(9) Start and warm the engine. Check for leaks.

RADIATOR PRESSURE CAP

DESCRIPTION

All radiators are equipped with a pressure cap (Fig. 50). This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

DIAGNOSIS AND TESTING—RADIATOR PRESSURE CAP

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install the cap on pressure tester (tool 7700 or an equivalent) (Fig. 51).

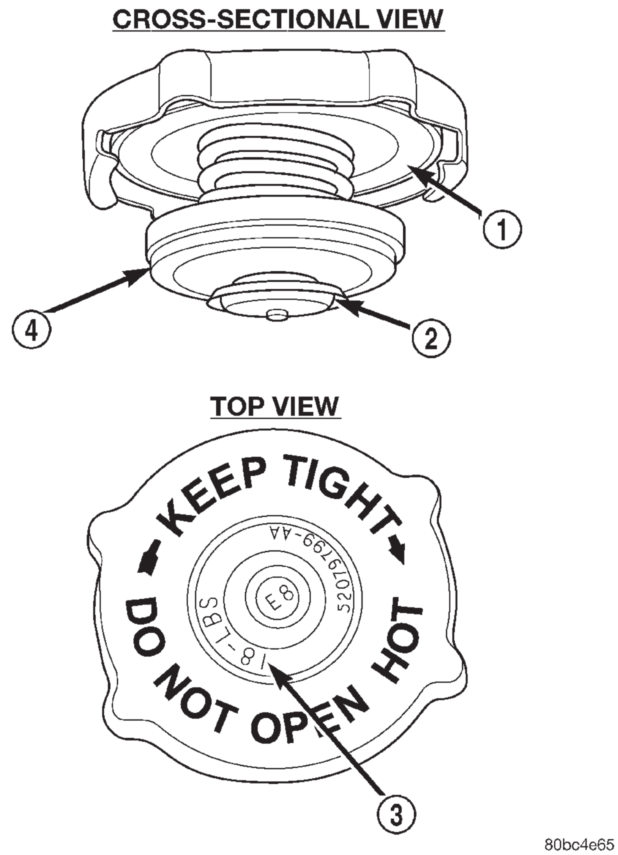


Fig. 50 Radiator Pressure Cap - Typical

1 - FILLER NECK SEAL
2 - VACUUM VENT VALVE
3 - PRESSURE RATING
4 - PRESSURE VALVE

Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 124 to 145 kPa (18 to 21 psi). The cap is satisfactory when the pressure holds steady. It is also good if it holds pressure within the 124 to 145 kPa (18 to 21 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

CLEANING

Clean the radiator pressure cap using a mild soap and water only.

RADIATOR PRESSURE CAP (Continued)

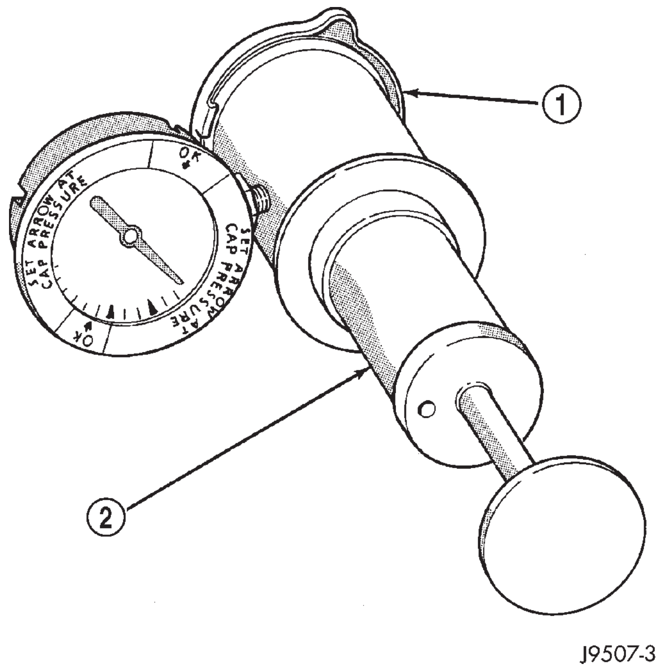


Fig. 51 Pressure Testing Radiator Pressure Cap—Typical

1 - PRESSURE CAP
2 - TYPICAL COOLING SYSTEM PRESSURE TESTER

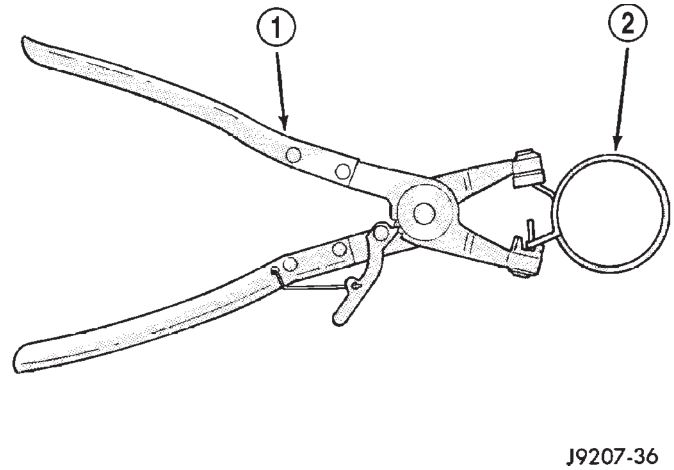


Fig. 52 Hose Clamp Tool—Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

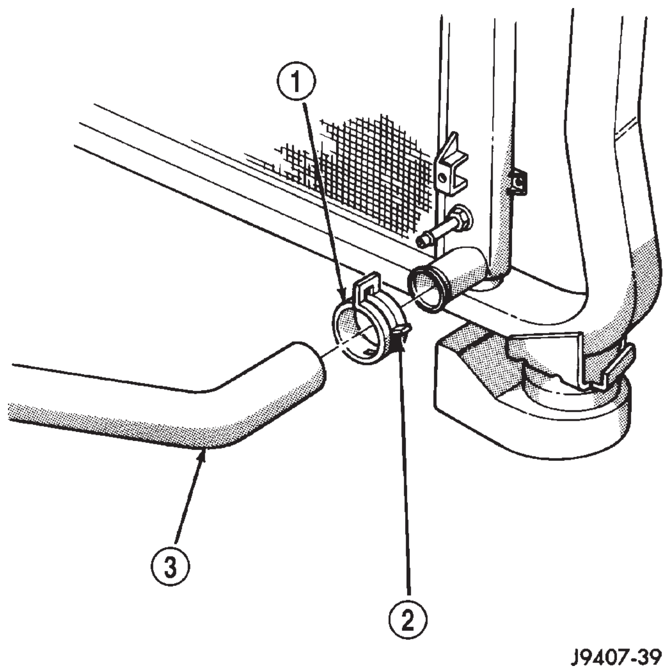


Fig. 53 Clamp Number/Letter Location

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

INSPECTION

Visually inspect the pressure valve gasket on the cap. Replace cap if the gasket is swollen, torn or worn. Inspect the area around radiator filler neck for white deposits that indicate a leaking cap.

WATER PUMP INLET TUBE

REMOVAL

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 52). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 53). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(1) Partially drain cooling system .

(2) Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) Loosen both bypass hose clamps (Fig. 52) and position to center of hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps (Fig. 52) to center of hose.

(2) Install bypass hose to engine.

(3) Secure both hose clamps (Fig. 52).

(4) Refill cooling system .

(5) Start and warm the engine. Check for leaks.

TRANSMISSION

TABLE OF CONTENTS

TRANS COOLER

DESCRIPTION

An internal high capacity/high efficiency cooler is used on all vehicles these coolers are an oil-to-coolant type which consists of plates mounted in the radiator outlet tank (Fig. 36). Because the internal oil cooler is so efficient, no auxiliary oil cooler is offered The cooler is not servicable seperatly from the radiator.

STANDARD PROCEDURE - FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906-B Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.
KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.
KEEP THE AREA WELL VENTILATED.
DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

(1) Remove cover plate filler plug on Tool 6906-B. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906-B.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

AUDIO

TABLE OF CONTENTS

AUDIO

DESCRIPTION

An audio system is standard factory-installed equipment on this model. The standard equipment audio system includes an AM/FM/cassette (RBB sales code) radio receiver, and speakers in six locations. Several combinations of radio receivers and speaker systems are offered as optional equipment on this model. The audio system uses an ignition switched control of battery current so that the system will only operate when the ignition switch is in the On or Accessory positions.

A Compact Disc (CD) changer with a ten disc magazine, remote radio switches with six functions mounted to the backs of the steering wheel spokes, and a memory system that automatically stores and recalls up to twenty radio station presets (ten AM and ten FM) and the last station listened to for two drivers are optional factory-installed equipment on this model. Refer to Electrical, Power Seats for more information on the memory system.

The audio system includes the following components:

- Antenna
- Compact disc changer (available with RBP sales code radio receivers only)
- Power amplifier (with premium speaker system only)
- Radio noise suppression components
- Radio receiver
- Remote radio switches
- Speakers

Certain functions and features of the audio system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect audio system operation are as follows:

- **Body Control Module (BCM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODUL - DESCRIPTION) for more information.
- **Driver Door Module (DDM)** (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - DESCRIPTION) for more information.
- **Passenger Door Module (PDM)** (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - DESCRIPTION) for more information.

The audio system includes the following major components, which are described in further detail elsewhere in this service information:

- **Amplifier** - On models equipped with the optional premium speaker system, an audio power amplifier is located on the rear floor panel underneath the right end of the rear seat cushion in the passenger compartment.
- **Antenna Body and Cable** - The most visible component of the antenna body and cable are the antenna adapter and the antenna cap nut, which are located on the top of the right front fender panel of the vehicle, near the right end of the cowl plenum.
- **Antenna Mast** - The antenna mast is a metal rod that extends upward from the antenna body and cable on the top of the right front fender panel of the vehicle, near the right end of the cowl plenum.
- **Radio** - The radio for this model is located in the instrument panel center stack area, inboard of the instrument cluster and above the heater and air conditioner controls.
- **Radio Noise Suppression Ground Strap** - A radio noise suppression ground strap is installed between the rear of the engine cylinder head(s) and the dash panel sheet metal in the engine compartment.
- **Speaker** - The standard speaker system includes six speakers in six locations, while the premium speaker system includes an amplifier for the six speakers in six locations.

Hard wired circuitry connects the audio system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the audio system components through the use of a combination of soldered splices, splice block connectors and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information in this service manual for complete standard and premium audio system circuit diagrams. The wiring information includes proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices, and grounds.

AUDIO (Continued)

OPERATION

The audio system components are designed to provide audio entertainment and information through the reception, tuning and amplification of locally broadcast radio signals in both the Amplitude Modulating (AM) and Frequency Modulating (FM) commercial frequency ranges. Electromagnetic radio signals that are broadcast from a radio station induce electrical modulations into the audio system antenna mast. The antenna body and cable conduct these weak signals from the antenna mast to the radio. The radio then tunes and amplifies these weak radio frequency signals into stronger electrical audio signals that are required in order to operate the audio system speakers. The speakers convert these electrical signals into air movement, which reproduces the sounds being broadcast by the radio station.

Some audio systems also offer the user the option of selecting from and listening to prerecorded audio cassette tapes, audio compact discs, or both. Regardless of the media type, the audio system components provide the user with the ability to electronically amplify and adjust the audio signals being reproduced by the speakers within the vehicle to suit the preferences of the vehicle occupants.

The audio system components operate on battery current received through a fuse in the Junction Block (JB) on a fused ignition switch output (run-acc) circuit so that the system will only operate when the ignition switch is in the On or Accessory positions.

On vehicles that are equipped with the optional remote radio switches, the BCM receives hard wired resistor multiplexed inputs from the remote radio switches. The programming in the BCM allows it to process those inputs and send the proper messages to the radio receiver over the PCI data bus to control the radio volume up or down, station seek up or down, preset station advance, and mode advance functions.

On vehicles equipped with the optional memory system, when the DDM receives a Driver 1 or Driver 2 memory recall input from the memory switch on the driver side front door trim panel or a memory recall message from the Remote Keyless Entry (RKE) receiver in the PDM, the DDM sends a memory recall message back to the radio receiver over the PCI data bus to recall the radio station presets and last station listened to information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of each of the available audio systems.

DIAGNOSIS AND TESTING - AUDIO

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

AUDIO (Continued)

AUDIO SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO AUDIO	1. Fuse faulty.	1. Check radio fuse in Junction Block (JB) and Ignition-Off Draw (IOD) fuse in Power Distribution Center (PDC). Replace fuses, if required.
	2. Radio connector faulty.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring faulty.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Radio ground faulty.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio faulty.	5. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - DIAGNOSIS AND TESTING).
	6. Speakers faulty.	6. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - DIAGNOSIS AND TESTING).
	7. Amplifier faulty (if equipped).	7. (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - DIAGNOSIS AND TESTING).
NO RADIO DISPLAY	1. Fuse faulty.	1. Check radio fuse in Junction Block (JB) and Ignition-Off Draw (IOD) fuse in Power Distribution Center (PDC). Replace fuses, if required.
	2. Radio connector faulty.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring faulty.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Radio ground faulty.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio faulty.	5. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - DIAGNOSIS AND TESTING).
CLOCK WILL NOT KEEP SET TIME	1. Fuse faulty.	1. Check Ignition-Off Draw (IOD) fuse in the Power Distribution Center (PDC). Replace fuse, if required.
	2. Radio connector faulty.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring faulty.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Radio ground faulty.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio faulty.	5. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - DIAGNOSIS AND TESTING).

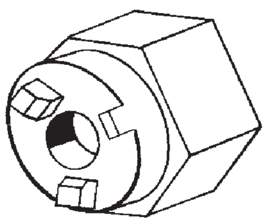
AUDIO (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
POOR RADIO RECEPTION	1. Antenna faulty.	1. (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - DIAGNOSIS AND TESTING).
	2. Radio ground faulty.	2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	3. Radio noise suppression faulty.	3. (Refer to 8 - ELECTRICAL/AUDIO/RADIO NOISE SUPPRESSION - DIAGNOSIS AND TESTING).
	4. Radio faulty.	4. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - DIAGNOSIS AND TESTING).
NO/POOR TAPE OPERATION	1. Faulty tape.	1. Insert known good tape and test operation.
	2. Foreign objects behind tape door.	2. Remove foreign objects and test operation.
	3. Dirty cassette tape head.	3. Clean head with Mopar Cassette Head Cleaner.
	4. Faulty tape deck.	4. Exchange or replace radio, if required.
NO COMPACT DISC OPERATION, OR CD SKIPPING SOUND	1. Faulty CD.	1. Insert known good CD and test operation.
	2. Foreign material on CD.	2. Clean CD and test operation.
	3. Condensation on CD or optics.	3. Allow temperature of vehicle interior to stabilize and test operation.
	4. Faulty CD player.	4. Exchange or replace radio, if required.
NO COMPACT DISC CHANGER OPERATION, OR CD SKIPPING SOUND	1. Faulty CD.	1. Insert known good CD and test operation.
	2. Foreign material on CD.	2. Clean CD and test operation.
	3. Condensation on CD or optics.	3. Allow temperature of vehicle interior to stabilize and test operation.
	4. CD changer connector faulty.	4. Check for loose or corroded CD changer connections. Repair, if required.
	5. Wiring faulty.	5. Refer to Compact Disc Changer in the Diagnosis and Testing section of this group.
	6. PCI data bus faulty.	6. Use DRB scan tool and the Diagnostic Procedures manual to test PCI data bus. Repair, if required.
	7. CD changer faulty.	7. Refer to Compact Disc Changer in the Diagnosis and Testing section of this group.

AUDIO (Continued)

SPECIAL TOOLS

AUDIO SYSTEMS



Antenna Nut Wrench C-4816

AMPLIFIER

DESCRIPTION

Models equipped with the Infinity premium speaker package have a separate power amplifier unit. This power amplifier is rated at 180 watts output. The power amplifier unit is mounted to the rear floor panel under the passenger side rear seat cushion. The power amplifier unit can be accessed for service by unlatching and tilting the passenger side rear seat cushion forward.

The power amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - DIAGNOSIS AND TESTING). The power amplifier cannot be repaired or adjusted and, if faulty or damaged, the unit must be replaced.

OPERATION

The power amplifier is energized by a fused 12 volt output from the radio receiver whenever the radio is turned on. The power amplifier receives the sound signal inputs for four speaker channels from the radio receiver, then sends the amplified speaker outputs for each of those channels to the six Infinity speakers. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

DIAGNOSIS AND TESTING - AMPLIFIER

The power amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - DIAGNOSIS AND TESTING). For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unlatch and lift the right rear seat cushion to the upright position.

(3) Disconnect the two right body wire harness connectors from the amplifier (Fig. 1).

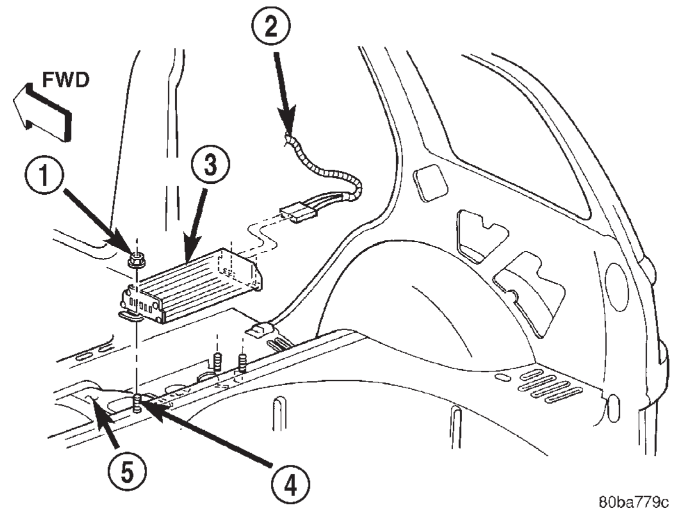


Fig. 1 Power Amplifier Remove/Install

1 - NUT (3)
2 - RIGHT BODY WIRE HARNESS
3 - AMPLIFIER
4 - STUD (3)
5 - RIGHT REAR FLOOR PANEL

(4) Remove the three mounting nuts.

(5) Remove the power amplifier.

INSTALLATION

(1) Position the power amplifier onto the three floor panel studs.

(2) Install the mounting nuts. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(3) Reconnect the two right body wire harness connectors.

(4) Lower the right rear seat cushion to the floor panel.

(5) Reconnect the battery negative cable.

ANTENNA BODY & CABLE

DESCRIPTION

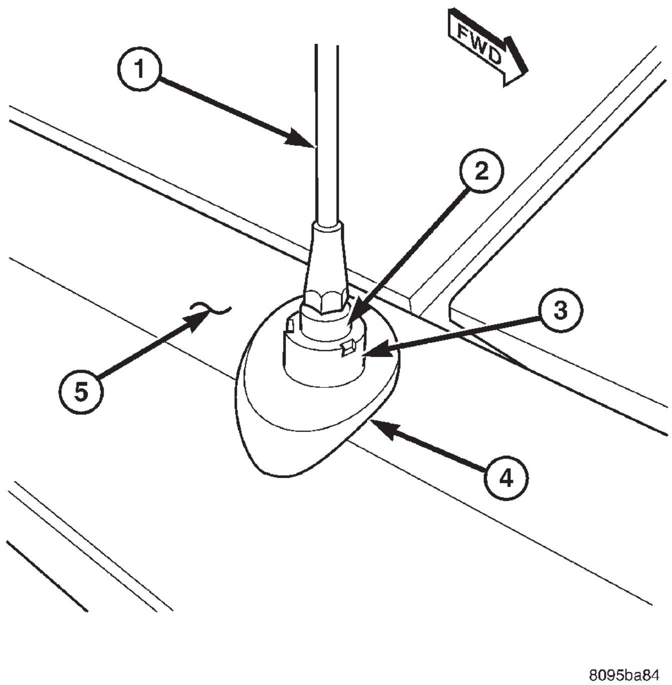


Fig. 2 Antenna Body and Cable

1 - MAST
2 - BODY & CABLE
3 - CAP NUT
4 - ADAPTER
5 - RIGHT FRONT FENDER

The antenna body and cable is secured below the fender panel by the antenna cap nut through a mounting hole in the of the right front fender (Fig. 2). The primary coaxial antenna cable is then routed beneath the fender sheet metal and through a entry hole in the right cowl side panel into the interior of the vehicle. Inside the vehicle, the primary coaxial cable is connected to a secondary instrument panel antenna coaxial cable with an in-line connector that is located behind the right kick panel. The secondary coaxial cable is then routed behind the instrument panel to the back of the radio.

OPERATION

The antenna body and cable connects the antenna mast to the radio. The radio antenna is an electromagnetic circuit component used to capture radio frequency signals that are broadcast by local commercial radio stations in both the Amplitude Modulating (AM) and Frequency Modulating (FM) frequency ranges. These electromagnetic radio frequency signals induce small electrical modulations into the antenna as they move past the mast. The antenna body transfers the weak electromagnetic radio waves induced into the rigid antenna mast into the center conductor of the flexible primary antenna coaxial cable. The braided outer shield of the antenna coaxial cable is grounded through both the antenna body and the radio chassis, effectively shielding the radio waves as they are conducted to the radio. The radio then tunes and amplifies the weak radio signals into stronger electrical signals in order to operate the audio system speakers.

DIAGNOSIS AND TESTING - ANTENNA BODY AND CABLE

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1** - Mast to ground test
- **Test 2** - Tip-of-mast to tip-of-conductor test
- **Test 3** - Body ground to battery ground test
- **Test 4** - Body ground to antenna coaxial cable shield test.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The ohmmeter test lead connections for each test are shown in the illustration (Fig. 3).

ANTENNA BODY & CABLE (Continued)

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate an antenna cable problem. First, test the primary antenna cable (integral to the antenna body and cable) from the coaxial cable connector under the right end of the instrument panel near the right cowl side inner panel to the antenna body. Then, test the secondary antenna cable (instrument panel antenna cable) from the coaxial cable connector under the right end of the instrument panel near the right cowl side inner panel to the coaxial cable connector at the radio.

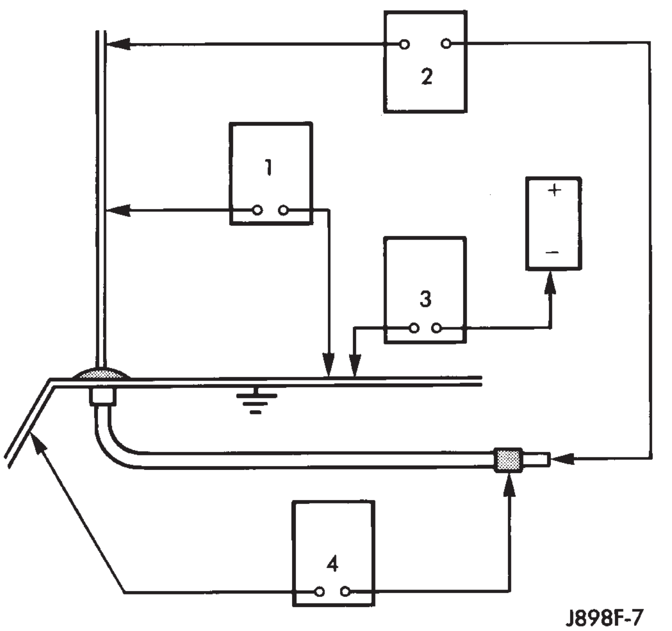


Fig. 3 Antenna Tests - Typical

NOTE: Use extreme caution when checking continuity of center conductor to avoid damage.

TEST 1

Test 1 determines if the antenna mast is insulated from ground. Proceed as follows:

(1) Disconnect and isolate the antenna coaxial cable connector under the right end of the instrument panel near the right cowl side inner panel.

(2) Touch one ohmmeter test lead to the tip of the antenna mast. Touch the other test lead to the antenna cap nut. Check the ohmmeter reading for continuity.

(3) There should be no continuity. If OK, go to Test 2. If not OK, replace the faulty antenna body and cable.

TEST 2

Test 2 checks the antenna conductor components for an open circuit. This test should be performed first on the entire antenna circuit, from the antenna mast to the center conductor of the coaxial cable connector at the radio. If an open circuit is detected, each of the three antenna conductor components (antenna mast, antenna body and primary cable unit, instrument panel antenna secondary cable) should be isolated and tested individually to locate the exact component that is the source of the open circuit. To begin this test, proceed as follows:

(1) Disconnect the instrument panel (secondary) antenna cable coaxial connector from the back of the radio.

(2) Touch one ohmmeter test lead to the tip of the antenna mast. Touch the other test lead to the center conductor pin of the instrument panel antenna cable coaxial connector for the radio. Check the ohmmeter reading for continuity.

(3) There should be continuity. The ohmmeter should register only a fraction of an ohm resistance. High or infinite resistance indicates a damaged or open antenna conductor. If OK, go to Test 3. If not OK, isolate and test each of the individual antenna conductor components. Replace only the faulty antenna conductor component.

TEST 3

Test 3 checks the condition of the vehicle body ground connection. To begin this test, proceed as follows:

(1) This test must be performed with the battery positive cable disconnected from the battery. Disconnect and isolate both battery cables, negative cable first.

(2) Reconnect the battery negative cable.

(3) Touch one ohmmeter test lead to a good clean ground point on the vehicle fender. Touch the other test lead to the battery negative terminal post. Check the ohmmeter reading for continuity.

(4) There should be continuity. The ohmmeter should register less than one ohm resistance. High or infinite resistance indicates a loose, corroded, or damaged connection between the battery negative terminal and the vehicle body. If OK, go to Test 4. If not OK, check the battery negative cable connection to the vehicle body and the radio noise suppression ground strap connections to the engine and the vehicle body for being loose or corroded. Clean or tighten these connections as required.

TEST 4

Test 4 checks the condition of the connection between the antenna coaxial cable shield and the vehicle body ground as follows:

(1) Disconnect and isolate the antenna coaxial cable connector under the right end of the instrument panel near the right cowl side inner panel.

ANTENNA BODY & CABLE (Continued)

(2) Touch one ohmmeter test lead to a good clean ground point on the vehicle fender. Touch the other test lead to the outer crimp on the antenna coaxial cable connector under the right end of the instrument panel near the right cowl side inner panel. Check the ohmmeter reading for continuity.

(3) There should be continuity. The ohmmeter should register less than one ohm resistance. High or infinite resistance indicates a loose, corroded, or damaged connection between the antenna body and the vehicle body or between the antenna body and the antenna coaxial cable shield. If not OK, clean the antenna body to fender mating surfaces and tighten the antenna cap nut to specifications.

(4) Check the resistance again with an ohmmeter. If the resistance is still more then one ohm, replace the faulty antenna body and cable.

REMOVAL

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the scuff plate from the right front door sill. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - REMOVAL) for the procedures.

(3) Remove the trim panel from the right inner cowl side.(Refer to 23 - BODY/INTERIOR/COWL TRIM - REMOVAL) for the procedures.

(4) Reach under the passenger side of the instrument panel near the right cowl side inner panel to disconnect the antenna coaxial cable connector by pulling it apart while twisting the metal connector halves (Fig. 4). Do not pull on the cable.

(5) Remove the lower rear half of the inner liner from the right front fender wheel house. (Refer to 23 - BODY/EXTERIOR/FRONT FENDER - REMOVAL) for the procedures.

(6) Reach through the rear of the right front fender wheel house opening to access and unseat the antenna lead grommet from the hole in the right cowl side outer panel.

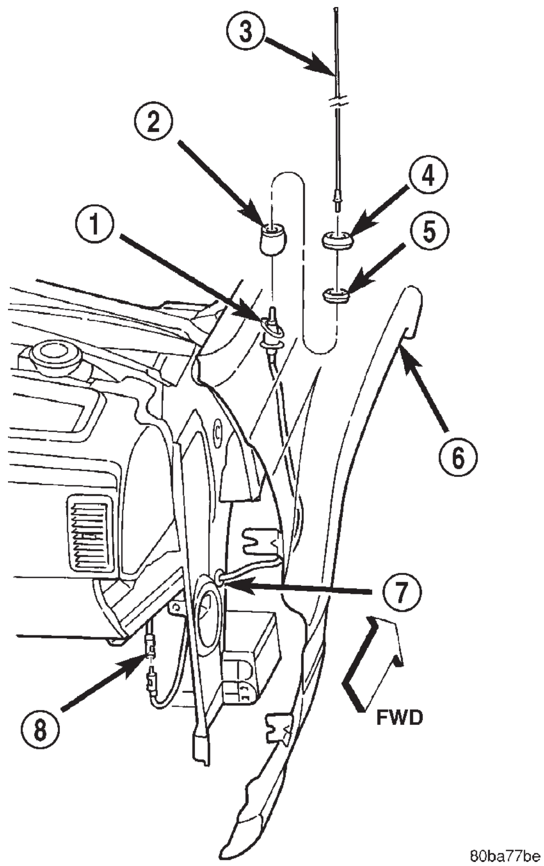


Fig. 4 Antenna Base and Lead Remove/Install

1 - BASE AND LEAD
2 - ESCUTCHEON
3 - MAST
4 - SHROUD
5 - CAP NUT
6 - RIGHT FRONT FENDER
7 - GROMMET
8 - CONNECTOR

(7) Pull the antenna lead coaxial cable and connector out of the passenger compartment and into the right front fender wheel house through the hole in the right cowl side outer panel.

(8) Unscrew the antenna mast from the antenna base (Fig. 5).

(9) Remove the plastic shroud from the antenna base cap nut.

(10) Remove the antenna base cap nut using an antenna nut wrench (Special Tool C-4816) (Fig. 6).

(11) Remove the antenna escutcheon from the antenna base on the top of the right front fender.

(12) Lower the antenna base from the mounting hole in the top of the right front fender.

(13) Remove the antenna base and lead from the rear of the right front fender wheel house opening.

ANTENNA BODY & CABLE (Continued)

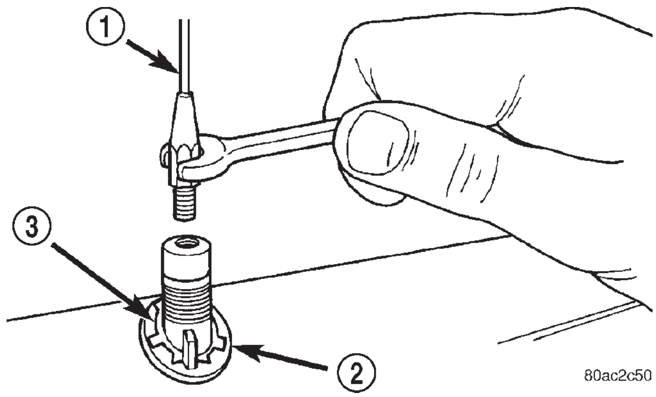


Fig. 5 Antenna Mast Remove/Install - Typical

1 - ANTENNA MAST
2 - ADAPTER
3 - CAP NUT

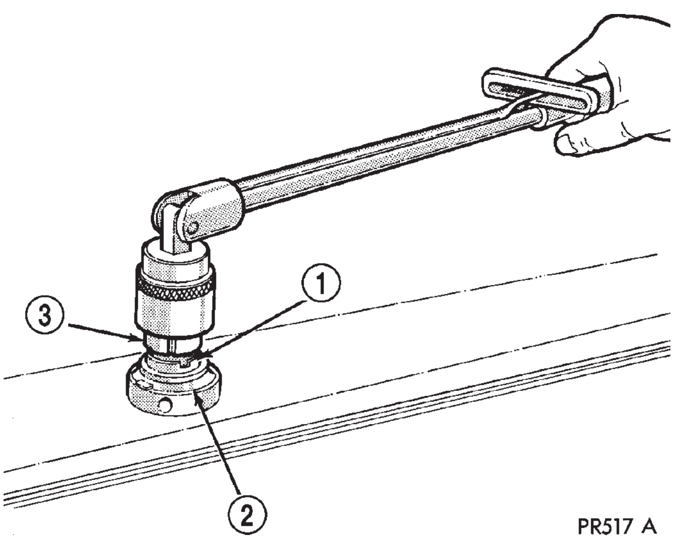


Fig. 6 Antenna Base Cap Nut Remove/Install - Typical

1 - CAP NUT
2 - ANTENNA ADAPTER
3 - TOOL

INSTALLATION

(1) Position the antenna base and lead into the rear of the right front fender wheel house opening.

(2) Insert the antenna base into the mounting hole in the top of the right front fender.

(3) Install the antenna escutcheon onto the antenna base on the top of the right front fender.

(4) Install and tighten the antenna base cap nut using an antenna nut wrench (Special Tool C-4816). Tighten the cap nut to 6.8 N·m (60 in. lbs.).

(5) Install the plastic shroud onto the antenna base cap nut.

(6) Install and tighten the antenna mast onto the antenna base. Tighten the antenna mast to 3.3 N·m (30 in. lbs.).

(7) Reach through the rear of the right front fender wheel house opening to access and insert the antenna lead coaxial cable and connector into the passenger compartment through the hole in the right cowl side outer panel.

(8) From the right front fender wheel house, seat the antenna lead grommet into the hole in the right cowl side outer panel.

(9) Install the lower rear half of the inner liner into the right front fender wheel house.

(10) Reach under the passenger side of the instrument panel near the right cowl side inner panel to reconnect the antenna coaxial cable connector halves.

(11) Install the trim panel onto the right inner cowl side.

(12) Install the scuff plate onto the right front door sill.

(13) Reconnect the battery negative cable.

ANTENNA MODULE - EXPORT

DESCRIPTION

The antenna module (Fig. 7) is an electromagnetic circuit component designed to capture and enhance RF (Radio Frequency) signals in both the AM and FM broadcast bands. The antenna module is mounted to the right rear roof rail under the headliner. The modules mounting brackets also double as the ground circuit. The module has a two wire electrical connector that connects to the electric backlite integral radio antenna, located on the right rear quarter glass, a connector for the radio coax cable and a connector for battery voltage.

ANTENNA MODULE - EXPORT (Continued)

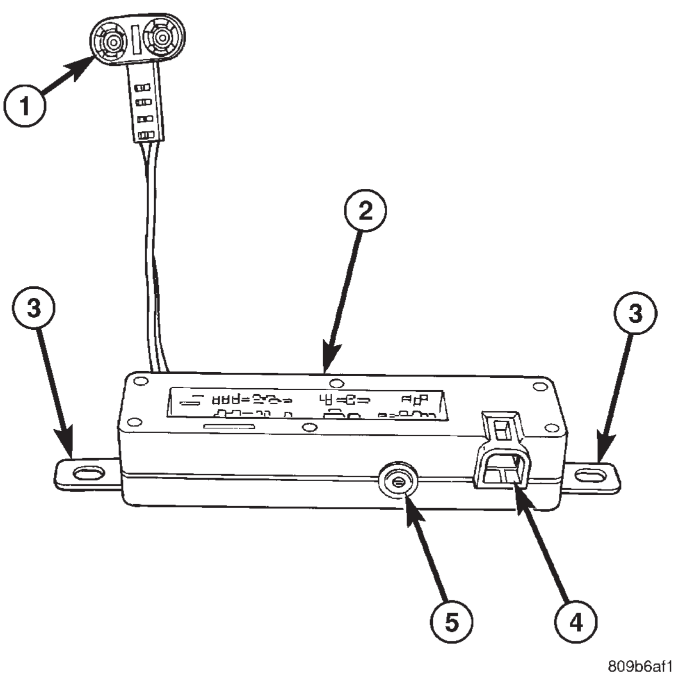


Fig. 7 ANTENNA MODULE

1 - ANTENNA LEAD CONNECTOR
2 - ANTENNA MODULE
3 - ANTENNA MODULE MOUNT/GROUND BRACKETS
4 - BATTERY SUPPLY CONNECTION POINT
5 - COAX CONNECTION POINT

OPERATION

The antenna module receives both AM and FM radio signals supplied by the side window integral radio antenna system and selectively amplifies them while at the same time avoiding unusable or unwanted signals. The amplified signal is then sent through the body length coax cable to the radio input.

DIAGNOSIS AND TESTING - ANTENNA MODULE - EXPORT

ANTENNA MODULE DIAGNOSIS TABLE

CONDITION	POSSIBLE CAUSES	CORRECTION
NO AM RECEPTION, WEAK FM RECEPTION	1. Antenna module to antenna connector open or disconnected.	1. Repair open, reconnect antenna module connector to glass mounted antenna.
	2. Coax open or disconnected.	2. Repair open, reconnect coax.
	3. No battery power at antenna module.	3. Check fuse. if okay, repair open in battery voltage circuit.
NO AM OR FM RECEPTION	1. Coax disconnected at radio.	1. Reconnect coax.
	2. Coax shorted to ground.	2. Repair or Replace coax
WEAK OR NO AM/FM RECEPTION	1. Antenna Module faulty.	1. Substitute known good module. If reception improves, Antenna Module was faulty.

ANTENNA MODULE - EXPORT (Continued)

REMOVAL

(1) Remove the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)

(2) Disconnect the battery power lead connector from the antenna module.

(3) Disconnect the antenna module connector from the integral antenna (Fig. 8).

(4) Remove the mounting screws and the antenna module.

(5) Disconnect the coax lead from the antenna module.

INSTALLATION

(1) Plug coax into antenna module.

(2) Position antenna module onto right side upper roof rail and install screws. Tighten the screws to 8 N·m (71 in. lbs.).

(3) Connect antenna module lead to the integral antenna.

(4) Connect battery power supply lead to antenna module.

(5) Install headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)

CD CHANGER

DESCRIPTION

A factory-installed Compact Disc (CD) changer featuring a ten-CD magazine is an available option on this model when it is also equipped with the premium speaker package and a radio receiver including the CD controls feature. The CD changer is mounted in the cargo area of the passenger compartment on the right rear quarter panel.

The CD changer is connected to a take out from the right body wire harness and receives both ground and radio-switched battery current through the radio receiver. The controls on the radio receiver operate the CD changer through messages sent over the Programmable Communications Interface (PCI) data bus network. The two-channel audio outputs of the CD changer are hard wired back to the radio receiver, which then outputs the signal through four channels to the power amplifier. For diagnosis of the messaging functions of the radio receiver and the CD changer, or of the PCI data bus, a DRB scan tool and the proper Diagnostic Procedures manual are required.

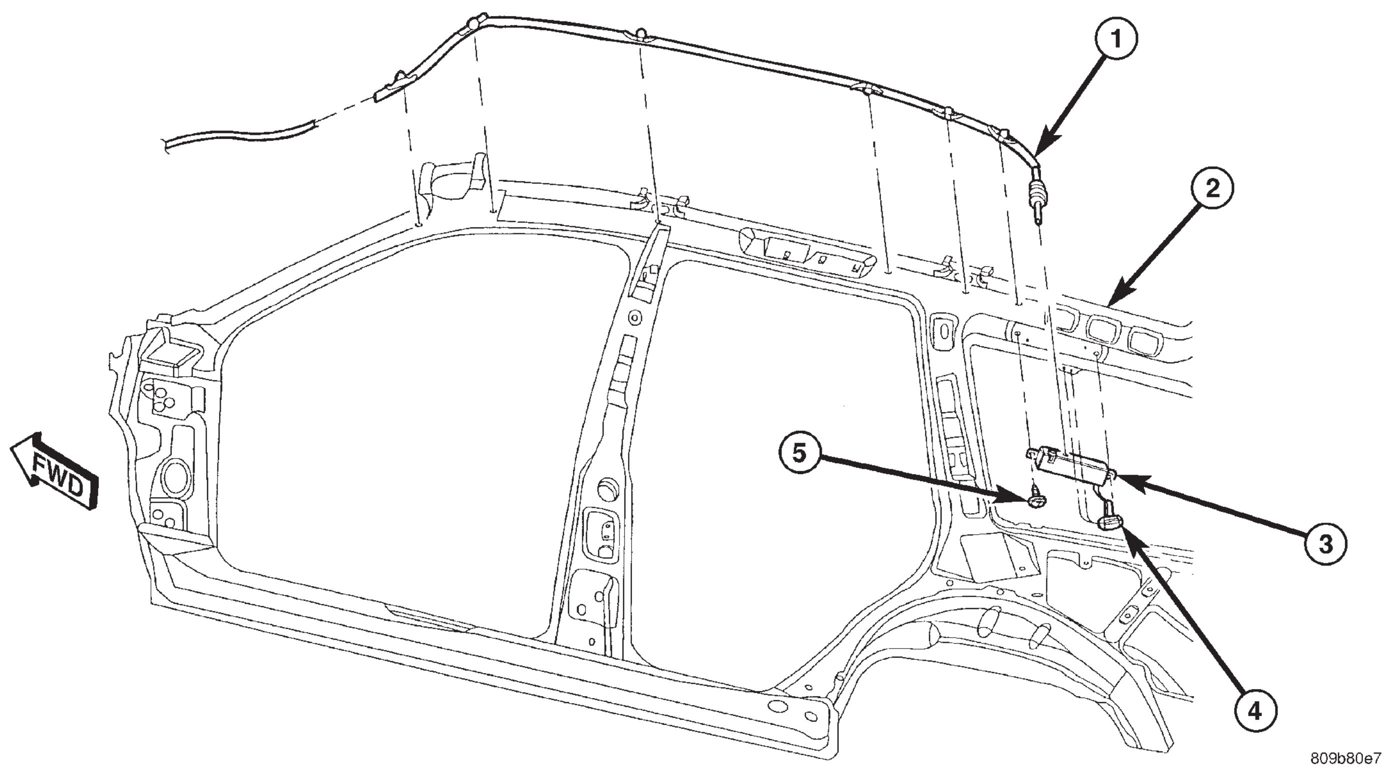


Fig. 8 ANTENNA MODULE

1 - COAX
2 - RIGHT SIDE ROOF RAIL
3 - ANTENNA MODULE
4 - ANTENNA MODULE TO ANTENNA CONNECTOR
5 - SCREW (2)

CD CHANGER (Continued)

The CD changer can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

OPERATION

The CD changer will only operate when the ignition switch is in the On or Accessory positions, and the radio is turned on. For more information on the features, loading procedures and radio control functions for the operation of the CD changer, see the owner's manual in the vehicle glove box.

DIAGNOSIS AND TESTING - CD CHANGER

Following are tests that will help to diagnose the hard wired components and circuits of the Compact Disc (CD) changer unit. However, these tests may not prove conclusive in the diagnosis of this unit. In order to obtain conclusive testing of the CD changer unit, the Programmable Communications Interface (PCI) data bus network, the CD changer unit, the radio receiver unit and any other electronic modules that provide inputs to, or receive outputs from the audio system must be checked.

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

COMPACT DISC CHANGER INOPERATIVE

(1) Turn the ignition switch to the On position. Turn the radio receiver on and check its operation. If OK, go to Step 2. If not OK, (Refer to 8 - ELECTRICAL/AUDIO/RADIO - OPERATION).

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the right body wire harness connector from the CD changer connector receptacle. Check for continuity between the power ground (Z17) circuit of the right body wire harness connector for the CD changer and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open power ground circuit to the radio receiver as required.

(3) Reconnect the battery negative cable. Check for battery voltage at the B(+) circuit cavity of the right body wire harness connector for the CD changer. If OK, go to Step 4. If not OK, go to Step 5.

(4) Turn the ignition switch to the On position. Check for battery voltage at the ignition switch output circuit cavity of the right body wire harness connector for the CD changer. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual for further diagnosis. If not OK, go to Step 6.

(5) Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. Disconnect the 10 pin cable connector from the radio receiver, but do not disconnect the other wire harness connectors. Reconnect the battery negative cable. Check for battery voltage at the B(+) circuit cavity of the 10 pin connector receptacle on the radio receiver. If OK, repair the open B(+) circuit to the CD changer as required. If not OK, check for a shorted B(+) circuit to the CD changer and repair as required, then replace the faulty radio receiver.

(6) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. Disconnect the 10 pin cable connector from the radio receiver, but do not disconnect the other wire harness connectors. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the ignition switch output circuit cavity of the 10 pin connector receptacle on the radio receiver. If OK, repair the open ignition switch output circuit to the CD changer as required. If not OK, check for a shorted ignition switch output circuit to the CD changer and repair as required, then replace the faulty radio receiver.

NO SOUND OR ONLY ONE CHANNEL SOUND FROM CD CHANGER

(1) Turn the ignition switch to the On position. Turn the radio receiver on and check its audio output operation. If OK, go to Step 2. If not OK, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - OPERATION).

(2) Disconnect and isolate the battery negative cable. Disconnect the right body wire harness connector from the CD changer connector receptacle. Remove the radio receiver from the instrument

CD CHANGER (Continued)

panel. Disconnect the 10 pin cable connector from the radio receiver. Check for continuity between the audio ground (Z4) circuit cavity of the right body wire harness connector for the CD changer and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted audio ground (Z4) circuit as required.

(3) Check for continuity between the audio ground (Z4) circuit cavity of the right body wire harness connector for the CD changer and the audio ground (Z4) circuit pin of the 10 pin cable connector for the radio receiver. There should be continuity. If OK, go to Step 4. If not OK, repair the open audio ground (Z4) circuit as required.

(4) Check for continuity between the audio out right circuit cavity of the right body wire harness connector for the CD changer and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted audio out right circuit as required.

(5) Check for continuity between the audio out right circuit cavity of the right body wire harness connector for the CD changer and the audio out right circuit pin of the 10 pin cable connector for the radio receiver. There should be continuity. If OK, go to Step 6. If not OK, repair the open audio out right circuit as required.

(6) Check for continuity between the audio out left circuit cavity of the right body wire harness connector for the CD changer and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted audio out left circuit as required.

(7) Check for continuity between the audio out left circuit cavity of the right body wire harness connector for the CD changer and the audio out left circuit pin of the 10 pin cable connector for the radio receiver. There should be continuity. If OK, replace the faulty CD changer. If not OK, repair the open audio out left circuit as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Release the latch and open the lid of the compact disc changer storage bin on the right side quarter trim panel (Fig. 9).

(3) Remove the two mounting screws.

(4) Grasp the bottom of the compact disc changer storage bin firmly with both hands and lift it upwards.

(5) Remove the compact disc changer storage bin from the right side quarter trim panel.

(6) Disconnect the right body wire harness connector from compact disc changer (Fig. 10).

(7) Remove the four mounting nuts.

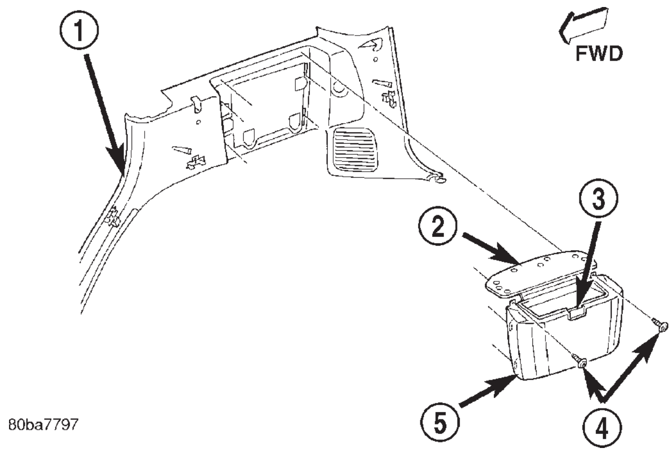


Fig. 9 Compact Disc Changer Storage Bin Remove/Install

1 - RIGHT SIDE QUARTER TRIM PANEL
2 - LID
3 - LATCH
4 - SCREW (2)
5 - CD CHANGER STORAGE BIN

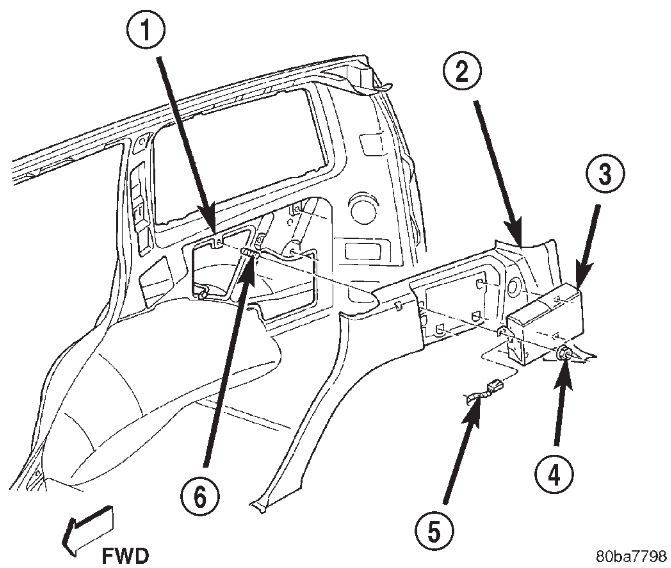


Fig. 10 Compact Disc Changer Remove/Install

1 - RIGHT SIDE QUARTER INNER PANEL
2 - RIGHT SIDE QUARTER TRIM PANEL
3 - COMPACT DISC CHANGER
4 - NUT (4)
5 - RIGHT BODY WIRE HARNESS
6 - STUD (4)

(8) Remove the compact disc changer from the right side quarter inner panel.

INSTALLATION

(1) Position the compact disc changer onto the four studs.

CD CHANGER (Continued)

(2) Install the four mounting nuts. Tighten the nuts to 12 N·m (105 in. lbs.).

(3) Reconnect the right body wire harness connector.

(4) Position the compact disc changer storage bin onto the right side quarter trim panel.

(5) Using both hands push the compact disc changer storage bin firmly and evenly toward the right side quarter trim panel far enough to engage the hooks on the bin with the slots in the panel.

(6) Using both hands push the compact disc changer storage bin firmly and evenly downward far enough to align the screw holes in the bin with the mounting holes in the right side quarter trim panel.

(7) Install the two screws that secure the top of the compact disc changer storage bin. Tighten the screws to 1.7 N·m (15 in. lbs.).

(8) Reconnect the battery negative cable.

INSTRUMENT PANEL ANTENNA CABLE

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the scuff plate from the right front door sill. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - REMOVAL) for the procedures.

(3) Remove the trim panel from the right inner cowl side. (Refer to 23 - BODY/INTERIOR/COWL TRIM - REMOVAL) for the procedures.

(4) Reach under the passenger side of the instrument panel near the right cowl side inner panel to disconnect the antenna coaxial cable connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.

(5) Disengage the antenna cable retainer from the mounting hole in the wire harness mounting tab under the passenger side end of the instrument panel.

(6) Remove the radio receiver from the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL) for the procedures.

(7) Remove the passenger side airbag module from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL) for the procedures.

(8) Disengage the antenna cable retainer from the mounting hole in the top of the radio mount on the instrument panel structural duct (Fig. 11).

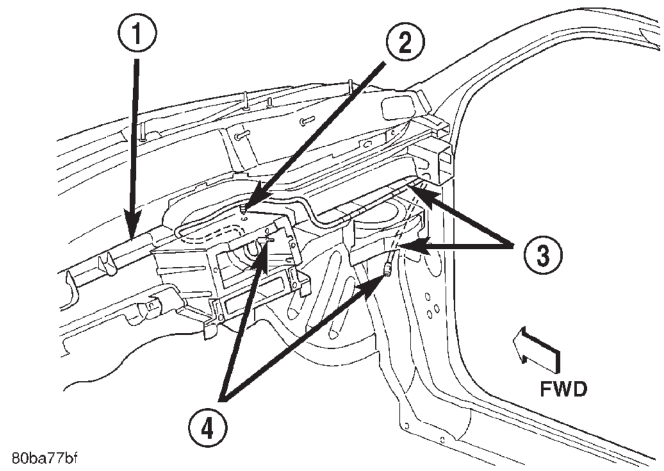


Fig. 11 Instrument Panel Antenna Cable Routing

1 - INSTRUMENT PANEL STRUCTURAL DUCT
2 - RETAINER
3 - COAXIAL CABLE
4 - COAXIAL CABLE CONNECTORS

(9) Disengage the antenna cable from the locator tabs on the top of the instrument panel structural duct above the glove box opening.

(10) Remove the antenna cable from the instrument panel.

INSTALLATION

(1) Position the antenna cable onto the instrument panel.

(2) Engage the antenna cable with the locator tabs on the top of the instrument panel structural duct above the glove box opening.

(3) Engage the antenna cable retainer into the mounting hole in the top of the radio mount on the instrument panel structural duct.

(4) Install the passenger side airbag module onto the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION) for the procedures.

(5) Install the radio receiver onto the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION) for the procedures.

(6) Engage the antenna cable retainer into the mounting hole in the wire harness mounting tab under the passenger side end of the instrument panel.

INSTRUMENT PANEL ANTENNA CABLE (Continued)

(7) Reach under the passenger side of the instrument panel near the right cowl side inner panel to reconnect the antenna coaxial cable connector halves.

(8) Install the trim panel onto the right inner cowl side. (Refer to 23 - BODY/INTERIOR/COWL TRIM - INSTALLATION) for the procedures.

(9) Install the scuff plate onto the right front door sill. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - INSTALLATION) for the procedures.

(10) Reconnect the battery negative cable.

QUARTER GLASS INTEGRAL ANTENNA - EXPORT

DESCRIPTION

The integral radio antenna element is bonded to the right rear quarter glass and is replaced with the glass assembly only.

OPERATION

The integral antenna receives RF (Radio Frequencies) and sends them to the antenna module for amplification.

DIAGNOSIS AND TESTING - QUARTER GLASS INTEGRAL ANTENNA - EXPORT

For complete circuit diagrams, refer to the Appropriate Wiring Information. To detect breaks in the integral antenna elements, the following procedure is required:

(1) Disconnect the antenna module connector from the antenna.

(2) Using a Ohmmeter, place both leads onto the connector pins on the integral antenna. If continuity is present antenna grid is Okay. If continuity is not present move one lead through the grid in progression until continuity is detected. A break in the antenna grid can be repaired using a Mopar Rear Window Defogger Repair Kit (Part Number 4267922) or equivalent. (Refer to 8 - ELECTRICAL/WINDOW DEFOGGER/REAR WINDOW DEFOGGER GRID - STANDARD PROCEDURE)

RADIO

DESCRIPTION

Available factory-installed radio receivers for this model include an AM/FM/cassette with CD changer control feature (RBB sales code), an AM/FM/CD/2-band graphic equalizer with CD changer control feature (RBK sales code), or an AM/FM/CD/cassette/2-band graphic equalizer (RBP sales code). All factory-installed radio receivers can communicate on the Programmable Communications Interface (PCI) data bus network through a separate wire harness connector. All factory-installed receivers are stereo Electronically Tuned Radios (ETR) and include an electronic digital clock function.

These radio receivers can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is removed when the vehicle is shipped from the factory. This fuse feeds various accessories that require battery current when the ignition switch is in the Off position, including the clock. The IOD fuse is removed to prevent battery discharge during vehicle storage.

When removing or installing the IOD fuse, it is important that the ignition switch be in the Off position. Failure to place the ignition switch in the Off position can cause the radio display to become scrambled when the IOD fuse is removed and replaced. Removing and replacing the IOD fuse again, with the ignition switch in the Off position, will correct the scrambled display condition.

The IOD fuse should be checked if the radio or clock displays are inoperative. The IOD fuse is located in the Power Distribution Center (PDC). Refer to the fuse layout label on the underside of the PDC cover for IOD fuse identification and location.

OPERATION

The radio receiver operates on ignition switched battery current that is available only when the ignition switch is in the On or Accessory positions. The electronic digital clock function of the radio operates on fused battery current supplied through the IOD fuse, regardless of the ignition switch position.

For more information on the features, setting procedures, and control functions for each of the available factory-installed radio receivers, refer to the owner's manual. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

DIAGNOSIS AND TESTING - RADIO

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

If the vehicle is equipped with the optional remote radio switches located on the steering wheel and the

RADIO (Continued)

problem being diagnosed is related to one of the symptoms listed below, be certain to check the remote radio switches and circuits. (Refer to 8 - ELECTRICAL/AUDIO/REMOTE SWITCHES - OPERATION).

- Stations changing with no remote radio switch input
- Radio memory presets not working properly
- Volume changes with no remote radio switch input
- Remote radio switch buttons taking on other functions
- CD player skipping tracks
- Mode (AM, FM, CD, CD changer) changes with no remote radio switch input
- Remote radio switch inoperative.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

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CAUTION: The speaker output of the radio receiver is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio receiver may result.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(3) Check the fused ignition switch output (acc/run) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel, but do not disconnect the wire harness connectors. Check for continuity between the radio receiver chassis and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Test the radio receiver antenna. (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - DIAGNOSIS AND TESTING). If OK, go to Step 7. If not OK, replace the faulty antenna or coaxial cable as required.

(7) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity of the 22 pin radio wire harness connector. If OK, go to Step 8. If not OK, repair the open fused ignition switch output (acc/run) circuit to the junction block fuse as required.

(8) Turn the ignition switch to the Off position. Check for battery voltage at the fused B(+) circuit cavity of the 22 pin radio wire harness connector. If OK, replace the faulty radio receiver. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

REMOVAL

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center upper bezel from the instrument panel.(Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(3) Remove the four screws that secure the radio receiver to the instrument panel (Fig. 12).

RADIO (Continued)

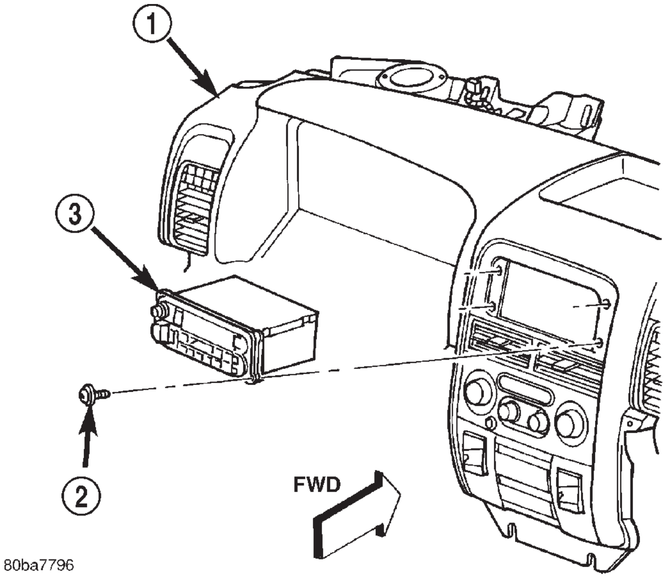


Fig. 12 Radio Remove/Install

1 - INSTRUMENT PANEL
2 - SCREW (4)
3 - RADIO RECEIVER

(4) Disconnect the instrument panel wire harness connectors and the antenna coaxial cable connector from the receptacles on the rear of the radio receiver.

(5) Remove the radio receiver from the instrument panel.

INSTALLATION

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the radio receiver to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors and the antenna coaxial cable connector to the receptacles on the rear of the radio receiver.

(3) Install the four mounting screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install the center upper bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION) for the procedures.

(5) Reconnect the battery negative cable.

RADIO NOISE SUPPRESSION GROUND STRAP

DESCRIPTION

Radio Frequency Interference (RFI) and Electro-Magnetic Interference (EMI) noise suppression is accomplished primarily through circuitry internal to the radio receivers. These internal suppression devices are only serviced as part of the radio receiver.

External suppression devices that are used on this vehicle to control RFI or EMI noise include the following:

- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Engine-to-body ground strap(s)
- Exhaust system-to-body and transmission ground strap (4.7L engines only)
- Resistor-type spark plugs
- Radio suppression-type secondary ignition wiring.

For more information on the spark plugs and secondary ignition components, refer to Ignition System in Ignition System.

REMOVAL

REMOVAL - ENGINE-TO-BODY GROUND STRAP

(1) Remove the screw that secures the engine-to-body ground strap eyelet to the lower plenum panel (Fig. 13) or (Fig. 14).

(2) On models with a 4.0L engine, remove the nut that secures the engine-to-body ground strap eyelet to the stud on the right rear side of the engine cylinder head.

(3) On models with a 4.7L engine, remove the two nuts that secure the engine-to-body ground strap eyelets to the studs on the right and left rear sides of the engine intake manifold.

(4) Remove the engine-to-body ground strap eyelet(s) from the stud(s) on the engine.

(5) Remove the engine-to-body ground strap from the engine compartment.

RADIO NOISE SUPPRESSION GROUND STRAP (Continued)

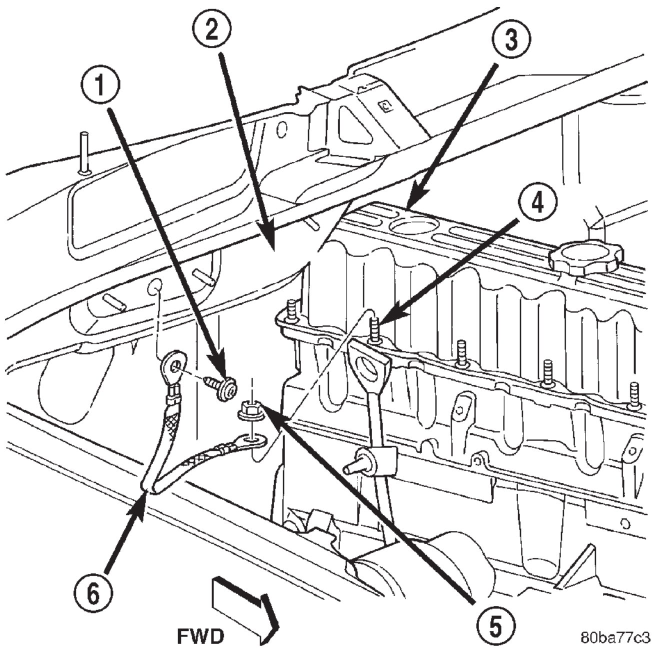


Fig. 13 Engine-To-Body Ground Strap Remove/ Install - 4.0L Engine

1 - SCREW
2 - LOWER PLENUM PANEL
3 - ENGINE
4 - STUD
5 - NUT
6 - GROUND STRAP

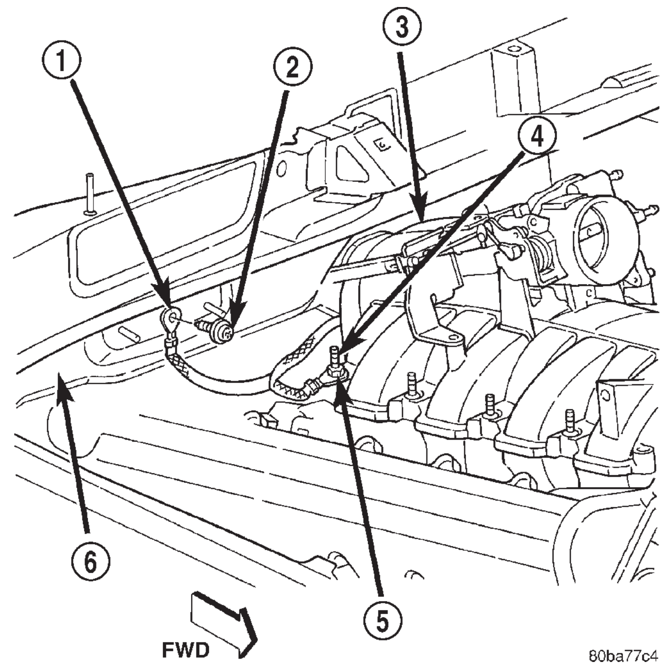


Fig. 14 Engine-To-Body Ground Strap Remove/ Install - 4.7L Engine

1 - GROUND STRAP
2 - SCREW
3 - ENGINE
4 - STUD (2)
5 - NUT (2)
6 - LOWER PLENUM PANEL

REMOVAL - EXHAUST-TO-BODY GROUND STRAP

(1) Raise and support vehicle.

(2) Remove fasteners from exhaust, crossmember and transmission/transfer case.

(3) Remove the ground strap.

INSTALLATION

INSTALLATION - ENGINE TO BODY GROUND STRAP

(1) Position the engine-to-body ground strap into the engine compartment.

(2) Install the engine-to-body ground strap eyelet(s) onto the stud(s) on the engine.

(3) On models with a 4.0L engine, install and tighten the nut that secures the engine-to-body ground strap eyelet to the stud on the right rear side of the engine cylinder head. Tighten the nut to 5.6 N·m (50 in. lbs.).

(4) On models with a 4.7L engine, install and tighten the two nuts that secure the engine-to-body ground strap eyelets to the studs on the right and left rear sides of the engine intake manifold. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(5) Install and tighten the screw that secures the engine-to-body ground strap eyelet to the lower plenum panel. Tighten the screw to 4.5 N·m (40 in. lbs.).

INSTALLATION - EXHAUST-TO-BODY GROUND STRAP

(1) Install the ground strap to the exhaust, crossmember and transmission/transfer case.

(2) Install the fasteners.

(3) Lower the vehicle.

REMOTE SWITCHES

DESCRIPTION

Remote radio control switches are included on models equipped with the optional leather-wrapped steering wheel. The two rocker-type switch units (Fig. 15) are mounted in the upper spoke covers of the rear (instrument panel side) steering wheel trim cover. The switch unit on the left side is the seek switch and has seek up, seek down, and preset station advance switch functions. The switch unit on the right side is the volume control switch and has volume up, volume down, and mode advance switch functions.

REMOTE SWITCHES (Continued)

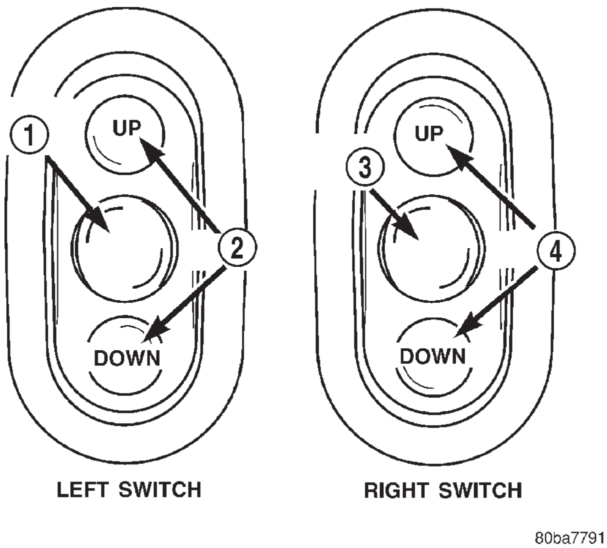


Fig. 15 Remote Radio Switches

1 - PRESET ADVANCE
2 - SEEK
3 - MODE ADVANCE
4 - VOLUME

The two remote radio switch units share a common steering wheel wire harness with the vehicle speed control switches. The steering wheel wire harness is connected to the instrument panel wire harness through the clockspring. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - DESCRIPTION) for more information on this component.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

OPERATION

The six switches in the two remote radio switch units are normally open, resistor multiplexed momentary switches that are hard wired to the Body Control Module (BCM) through the clockspring. The BCM sends a five volt reference signal to both switch units on one circuit, and senses the status of all of the switches by reading the voltage drop on a second circuit.

When the BCM senses an input (voltage drop) from any one of the remote radio switches, it sends the proper switch status messages on the Programmable Communication Interface (PCI) data bus network to the radio receiver. The electronic circuitry within the radio receiver is programmed to respond to these remote radio switch status messages by adjusting the radio settings as requested. For diagnosis of the BCM or the PCI data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

For more information on the features and control functions for each of the remote radio switches, see the owner's manual in the vehicle glove box.

DIAGNOSIS AND TESTING - REMOTE SWITCHES

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the remote radio switch(es) (Fig. 16) from the steering wheel.

(2) Use an ohmmeter to check the switch resistances as shown in the Remote Radio Switch Test chart. If the remote radio switch resistances check OK, go to Step 3. If not OK, replace the faulty switch.

REMOTE SWITCHES (Continued)

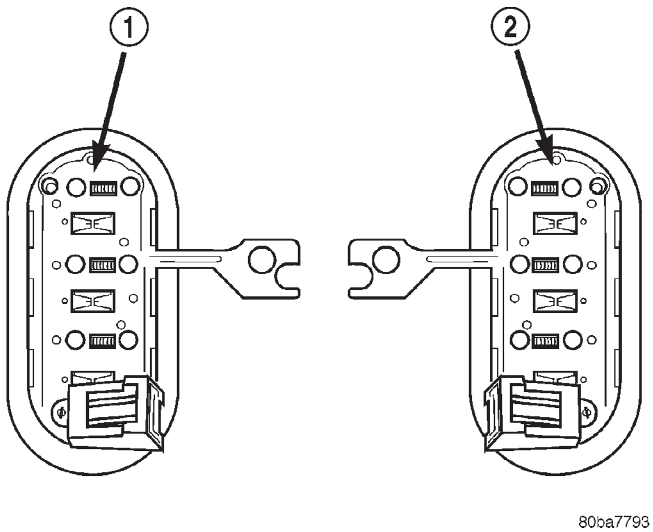


Fig. 16 Remote Radio Switches

1 - BLACK (LEFT) SWITCH
2 - WHITE (RIGHT) SWITCH

Remote Radio Switch Test		
Switch	Switch Position	Resistance
Right (White)	Volume Up	1.210 Kilohms
Right (White)	Volume Down	3.010 Kilohms
Right (White)	Mode Advance	0.0511 Kilohms
Left (Black)	Seek Up	0.261 Kilohms
Left (Black)	Seek Down	0.681 Kilohms
Left (Black)	Pre-Set Station Advance	0.162 Kilohms

(3) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for 5 volts at the radio control mux circuit cavities of the steering wheel wire harness connectors for both remote radio switches. If OK, go to Step 4. If not OK, repair the open or shorted radio control mux circuit to the Body Control Module (BCM) as required.

(4) Disconnect and isolate the battery negative cable. Disconnect the 22-way instrument panel wire harness connector from the BCM. Check for continuity between the remote radio switch ground circuit cavities of the steering wheel wire harness connectors for both remote radio switches and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted remote radio switch ground circuit to the BCM as required.

(5) Check for continuity between the remote radio switch ground circuit cavities of the steering wheel wire harness connectors for both remote radio switches and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, refer to the proper Diagnostic Procedures manual to test the BCM and the PCI data bus. If not OK, repair the open remote radio switch ground circuit as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL) for the procedures.

(3) Remove the speed control switch located on the same side of the steering wheel as the remote radio switch that is being serviced. Refer to Electrical, Speed Control for the procedures.

(4) Disconnect the steering wheel wire harness connector from the connector receptacle of the remote radio switch (Fig. 17).

(5) From the inside of the steering wheel rear trim cover, press firmly and evenly outward on the back of the switch.

(6) From the outside of the steering wheel rear trim cover, remove the remote radio switch from the trim cover mounting hole.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the remote radio switch to the mounting hole on the outside of the steering wheel rear trim cover. Be certain that the connector receptacle is oriented toward the bottom of the switch and pointed toward the center of the steering wheel.

REMOTE SWITCHES (Continued)

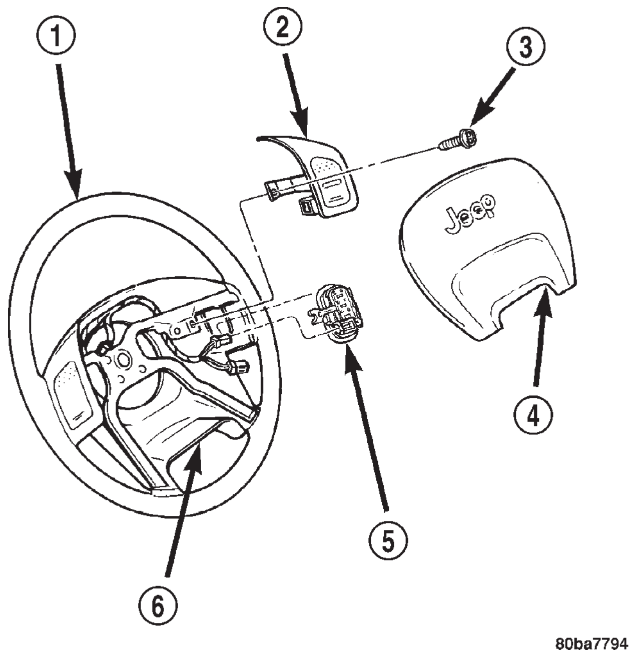


Fig. 17 Remote Radio Switches Remove/Install

1 - STEERING WHEEL
2 - SPEED CONTROL SWITCH
3 - SCREW
4 - DRIVER SIDE AIRBAG MODULE
5 - REMOTE RADIO SWITCH
6 - REAR TRIM COVER

(2) Press firmly and evenly on the remote radio switch until each of the switch snap features is fully engaged in the mounting hole of the steering wheel rear trim cover.

(3) Reconnect the steering wheel wire harness connector to the connector receptacle of the remote radio switch.

(4) Install the speed control switch onto the steering wheel. Refer to Electrical, Speed Control for the procedures.

(5) Install the driver side airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION) for the procedures.

(6) Reconnect the battery negative cable.

SPEAKER

DESCRIPTION

STANDARD

The standard equipment speaker system includes speakers in six locations. One 6.4 centimeter (2.50 inch) diameter tweeter is installed on each end of the instrument panel top pad. One 15.2 by 22.9 centimeter (6 by 9 inch) full-range speaker is located in each front door. There is also one full-range 16.5 centimeter (6.5 inch) diameter full-range speaker located in each rear door.

PREMIUM

The optional premium speaker system features six Infinity model speakers in six locations. Each of the standard speakers is replaced with Infinity model speakers. One 6.4 centimeter (2.50 inch) diameter Infinity tweeter is installed on each end of the instrument panel top pad. One 15.2 by 22.9 centimeter (6 by 9 inch) Infinity woofer is located in each front door. There is also one full-range 16.5 centimeter (6.5 inch) diameter Infinity full-range speaker located in each rear door. The premium speaker system also includes an additional Infinity power amplifier. The total available power of the premium speaker system is about 180 watts.

OPERATION

STANDARD

Each of the two tweeters and four full-range speakers used in the standard speaker system is driven by the amplifier that is integral to the factory-installed radio receiver. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

PREMIUM

The six Infinity speakers used in the premium speaker system are all driven by the radio receiver through an Infinity power amplifier. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

SPEAKER (Continued)

DIAGNOSIS AND TESTING - SPEAKER

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

(1) Turn the ignition switch to the On position. Turn the radio receiver on. Adjust the balance and fader controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 2.

(2) Turn the radio receiver off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. If the vehicle is equipped with the Infinity speaker package, also disconnect the wire harness connectors at the power amplifier. Check both the speaker feed (+) circuit and return (–) circuit cavities for the inoperative speaker location(s) at the radio receiver wire harness connectors for continuity to ground. In each case, there should be no continuity. If OK, go to Step 3. If not OK, repair the shorted speaker feed (+) and/or return (–) circuit(s) to the speaker as required.

(3) If the vehicle is equipped with the Infinity speaker package, go to Step 6. If the vehicle is equipped with the standard speaker system, check the resistance between the speaker feed (+) circuit and return (–) circuit cavities of the radio receiver wire harness connectors for the inoperative speaker location(s). The meter should read between 2 and 3 ohms (speaker resistance). If OK, go to Step 4. If not OK, go to Step 5.

(4) Install a known good radio receiver. Connect the battery negative cable. Turn the ignition switch to the On position. Turn on the radio receiver and test the speaker operation. If OK, replace the faulty radio receiver. If not OK, turn the radio receiver off, turn the ignition switch to the Off position, disconnect and isolate the battery negative cable, remove the test radio receiver, and go to Step 5.

(5) Disconnect the wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (–) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open speaker feed (+) and/or return (–) circuit(s) as required.

(6) For each inoperative speaker location, check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connectors and the power amplifier wire harness connectors. Repeat the check for each inoperative speaker location between the speaker return (–) circuit cavities of the radio receiver wire harness connectors and the power amplifier wire harness connectors. In each case, there should be continuity. If OK, go to Step 7. If not OK, repair the open speaker feed (+) and/or return (–) circuit(s) as required.

(7) Check for continuity between the two ground circuit cavities of the power amplifier wire harness connector and a good ground. There should be continuity. If OK, go to Step 8. If not OK, repair the open ground circuit(s) to ground as required.

(8) Check the fused B(+) fuse for the power amplifier in the junction block. If OK, go to Step 9. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(9) Install the radio receiver. Connect the battery negative cable. Check for battery voltage at the fused B(+) fuse for the power amplifier in the junction block. If OK, go to Step 10. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(10) Check for battery voltage at the two fused B(+) circuit cavities of the power amplifier wire harness connector. If OK, go to Step 11. If not OK, repair the open fused B(+) circuit(s) to the power amplifier fuse in the junction block as required.

(11) Turn the ignition switch to the On position. Turn the radio receiver on. Check for battery voltage

SPEAKER (Continued)

at the enable signal to amplifier circuit cavity of the power amplifier wire harness connector. If OK, go to Step 12. If not OK, repair the open enable signal to amplifier circuit to the radio receiver as required.

(12) Turn the radio receiver off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. For each inoperative speaker location, check both the amplified feed (+) circuit and the amplified return (–) circuit cavities of the power amplifier wire harness connectors for continuity to ground. In each case there should be no continuity. If OK, go to Step 13. If not OK, repair the shorted amplified feed (+) and/or amplified return (–) circuit(s) to the speaker as required.

(13) For each inoperative speaker location, check the resistance between the amplified feed (+) circuit and the amplified return (–) circuit cavities of the power amplifier wire harness connectors. The meter should read between 2 and 3 ohms (speaker resistance). If OK, replace the faulty power amplifier. If not OK, go to Step 14.

(14) Disconnect the speaker wire harness connector at the inoperative speaker. Check for continuity between the amplified feed (+) circuit cavities of the speaker wire harness connector and the power amplifier wire harness connector. Repeat the check between the amplified return (–) circuit cavities of the speaker wire harness connector and the power amplifier wire harness connector. In each case there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open amplified feed (+) and/or amplified return (–) circuit(s) as required.

REMOVAL

REAR DOOR SPEAKER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear door. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL) for the procedures.

(3) Remove the three screws that secure the speaker to the rear door inner panel (Fig. 18).

(4) Disconnect the rear door wire harness connector from the speaker connector receptacle.

(5) Remove the speaker from the rear door inner panel.

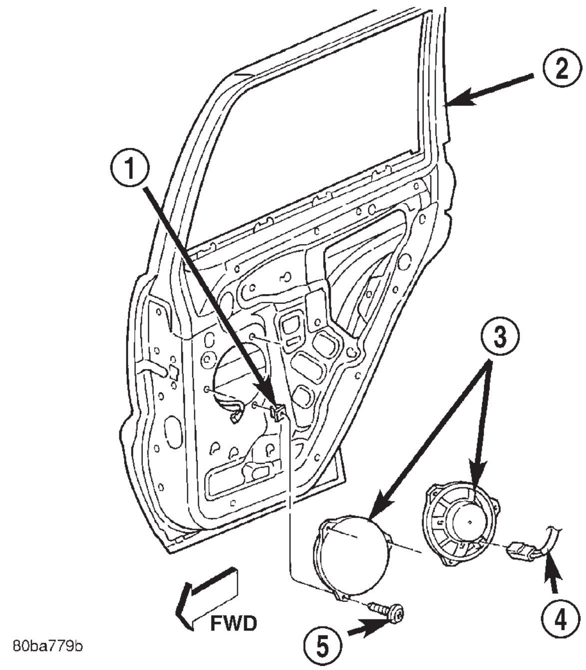


Fig. 18 Rear Door Speaker Remove/Install

1 - PLASTIC NUT (3)
2 - REAR DOOR
3 - REAR DOOR SPEAKER
4 - REAR DOOR WIRE HARNESS
5 - SCREW (3)

INSTRUMENT PANEL SPEAKER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).

(3) Disconnect the instrument panel wire harness connector from the speaker wire harness connector (Fig. 19).

(4) Remove the two screws that secure the speaker to the top of the instrument panel.

(5) Remove the speaker from the top of instrument panel.

FRONT DOOR SPEAKER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL) for the procedures.

(3) Remove the four screws that secure the speaker to the front door inner panel (Fig. 20).

(4) Disconnect the front door wire harness connector from the speaker connector receptacle.

(5) Remove the speaker from the front door inner panel.

SPEAKER (Continued)

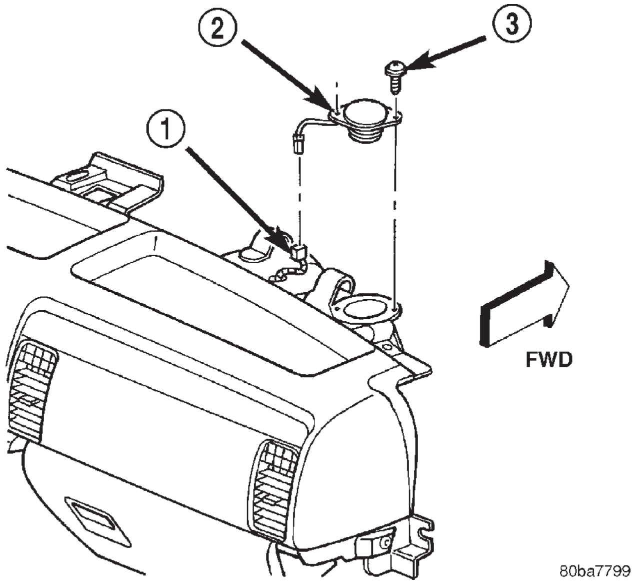


Fig. 19 Instrument Panel Speaker Remove/Install

1 - INSTRUMENT PANEL WIRE HARNESS
2 - INSTRUMENT PANEL SPEAKER
3 - SCREW (2)

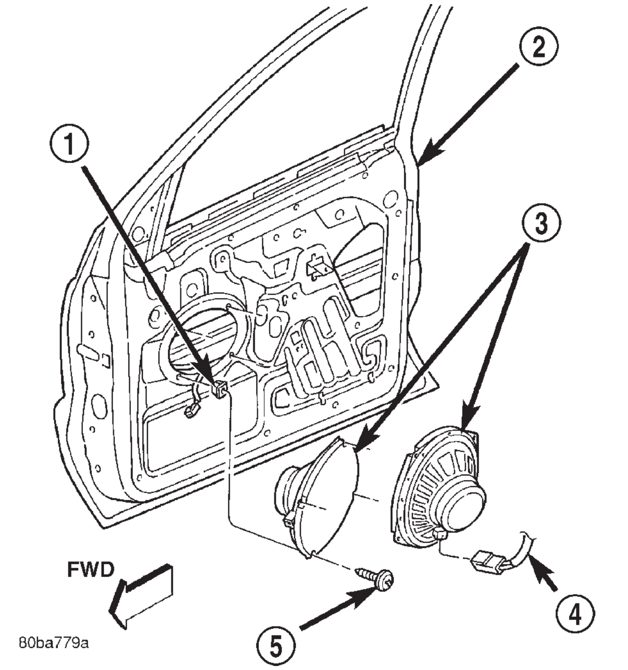


Fig. 20 Front Door Speaker Remove/Install

1 - PLASTIC NUT (4)
2 - FRONT DOOR
3 - FRONT DOOR SPEAKER
4 - FRONT DOOR WIRE HARNESS
5 - SCREW (4)

INSTALLATION

INSTALLATION - REAR DOOR SPEAKER

(1) Position the speaker to the rear door inner panel.

(2) Reconnect the rear door wire harness connector to the speaker connector receptacle.

(3) Position the speaker onto the rear door inner panel.

(4) Install and tighten the three screws that secure the speaker to the rear door inner panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the trim panel onto the rear door. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION) for the procedures.

(6) Reconnect the battery negative cable.

INSTALLATION - INSTRUMENT PANEL SPEAKER

(1) Position the speaker onto the top of the instrument panel.

(2) Install and tighten the two screws that secure the speaker to the top of the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the speaker wire harness connector.

(4) Install the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATIONl for the procedures.

(5) Reconnect the battery negative cable.

INSTALLATION - FRONT DOOR SPEAKER

(1) Position the speaker to the front door inner panel.

(2) Reconnect the front door wire harness connector to the speaker connector receptacle.

(3) Position the speaker onto the front door inner door panel.

(4) Install and tighten the four screws that secure the speaker to the front door inner panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the trim panel onto the front door. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION) for the procedures.

(6) Reconnect the battery negative cable.

CHIME/BUZZER

TABLE OF CONTENTS

CHIME WARNING SYSTEM

DESCRIPTION

The chime warning system uses a single chime tone generator that is integral to the Body Control Module (BCM) to provide an audible indication of vehicle conditions that may require the attention of the vehicle operator (Fig. 1). The chime warning system includes the following major components:

- Body Control Module
- Door Ajar Switch
- Headlamp Switch
- Ignition Switch
- Seat Belt Switch

Hard wired circuitry connects many of the chime warning system components to each other through the electrical system of the vehicle.

If the BCM or the chime tone generator are damaged or faulty, the BCM unit must be replaced.

OPERATION

The chime warning system components operate on battery voltage received through the Ignition-Off Draw (IOD) fuse in the Power Distribution Center (PDC) on a non-switched B(+) circuit so that the system may operate regardless of the ignition switch position.

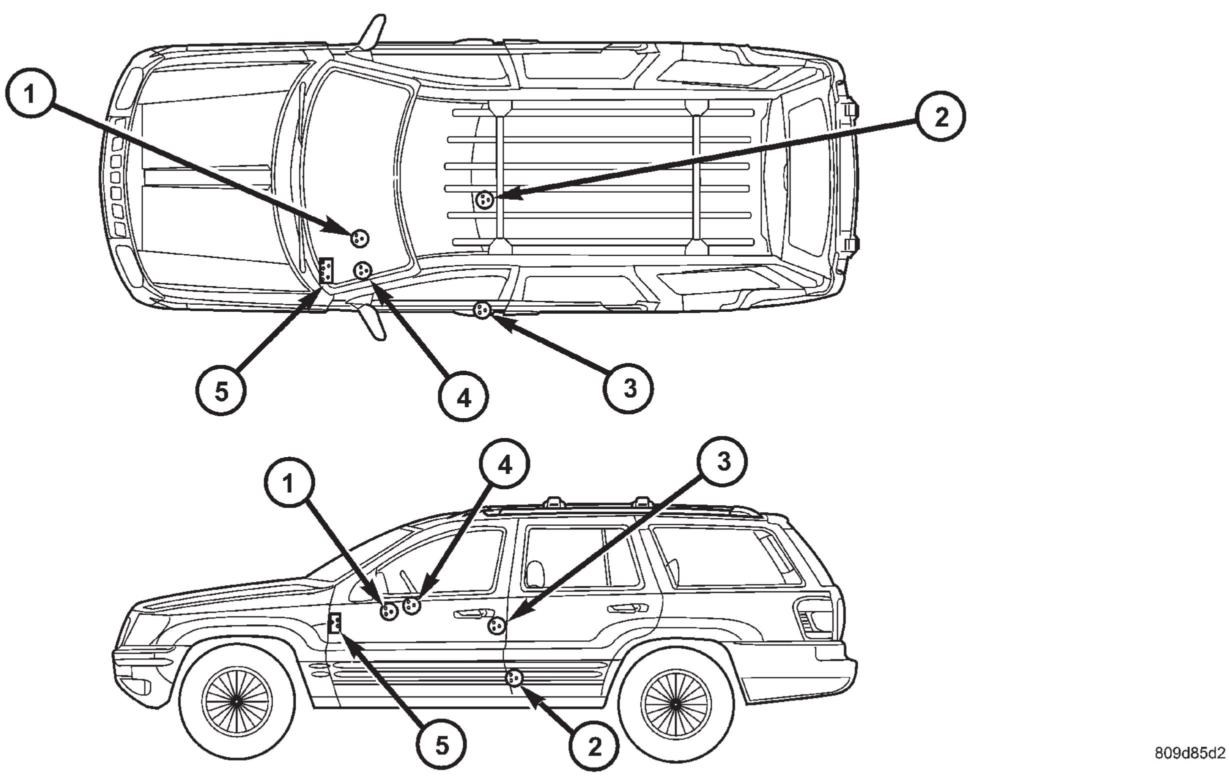


Fig. 1 Chime Warning System

1 - IGNITION SWITCH
2 - SEAT BELT SWITCH
3 - DOOR AJAR SWITCH
4 - HEADLAMP SWITCH
5 - BODY CONTROL MODULE

CHIME WARNING SYSTEM (Continued)

The chime warning system provides an audible indication to the vehicle operator under the following conditions:

• **Fasten Seat Belt Warning** - The Body Control Module (BCM) chime tone generator will generate repetitive chimes to announce that an input from the seat belt switch indicates the driver side front seat belt is not fastened. Unless the driver side front seat belt is fastened, the chimes will continue to sound for a duration of about six seconds each time the ignition switch is turned to the On position or until the driver side front seat belt is fastened.

• **Head/Park Lights-On Warning** - The BCM chime tone generator will generate repetitive chimes at a fast rate to announce that a Programmable Communications Interface (PCI) data bus driver door ajar message, along with hard wired inputs from the headlamp switch indicate that the exterior lamps are turned On with the driver side front door opened. The chime will continue to sound until the exterior lamps are turned Off, the driver side front door is closed, or the ignition switch is turned to the On position.

• **Key-In-Ignition Warning** - The BCM chime tone generator will generate repetitive chimes at a fast rate to announce that a PCI data bus driver door ajar message received from the Driver Door Module (DDM), along with hard wired inputs from the key-in-ignition warning switch indicate that the key is in the ignition cylinder with the driver side front door opened and the ignition switch in the Off position. The chime will continue to sound until the key is removed from the ignition lock cylinder, the driver side front door is closed, or the ignition switch is turned to the On position.

• **Overspeed Warning** - The BCM chime tone generator will generate repetitive chimes at a slow rate to announce that a PCI data bus vehicle speed message received from the Powertrain Control Module (PCM) indicates that the vehicle speed is above 120 kilometers-per-hour (75 miles-per-hour). The chimes will continue to sound until the vehicle speed is below 120 kilometers-per-hour (75 miles-per-hour). This feature is only enabled on a BCM that has been programmed with a Middle East Gulf Coast Country (GCC) country code.

• **Tactile Beep Support** - The BCM chime tone generator will generate a single beep each time a PCI data bus tactile beep request message is received from the Electronic Vehicle Information Center (EVIC) or the Sentry Key Immobilizer Module (SKIM). This beep provides an audible confirmation that an EVIC button was completely depressed, or that the optional Sentry Key Immobilizer System (SKIS) is in the "Customer Learn" mode.

• **Warning Beep Support** - The BCM chime tone generator will generate a short series of beeps each time a PCI data bus warning beep request message is received from the EVIC or the Electro-Mechanical Instrument Cluster (EMIC). These beeps provide an audible alert to the vehicle operator, of certain visual warning indications displayed by the EVIC and/or the EMIC.

The BCM provides chime service for all available features in the chime warning system. The BCM relies upon message inputs received from other modules over the PCI data bus network to provide chime service for all of the remaining chime warning system features.

The internal programming of the BCM determines the priority of each chime tone request input that is received, as well as the rate and duration of each chime tone that is to be generated.

CHIME WARNING SYSTEM (Continued)

DIAGNOSIS AND TESTING - CHIME WARNING SYSTEM

Refer to the appropriate wiring information. Conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster or the Programmable Communications Interface (PCI) data bus network. The most reliable, efficient and accurate means to diagnose the BCM and the PCI data bus network inputs for the chime warning system requires the use of a DRBIII® scan tool and the appropriate diagnostic information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CHIME WARNING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO SEAT BELT WARNING CHIME WITH SEAT BELT UNBUCKLED, BUT OTHER CHIME FEATURES OK	1. Seat belt switch ground circuit open.	1. Check for continuity between the ground circuit of the wire harness connector for the seat belt switch and a good ground. Repair the ground circuit, if required.
	2. Seat belt switch sense circuit open.	2. Check for continuity between the seat belt switch sense circuit of the wire harness connector for the seat belt switch and the body wire harness junction block connector. Repair the seat belt switch sense circuit, if required.
	3. Faulty seat belt switch.	3. Check for continuity between the ground circuit and the seat belt switch sense circuit of the seat belt switch pigtail wire connector. There should be continuity with the seat belt unbuckled. Replace the faulty seat belt, if required.
SEAT BELT WARNING CHIME WITH SEAT BELT BUCKLED	1. Seat belt switch sense circuit shorted.	1. With the wire harness connector for the seat belt switch and the body wire harness junction block connector disconnected, there should be no continuity between the seat belt switch sense circuit and a good ground. Repair the seat belt switch sense circuit, if required.
	2. Faulty seat belt switch.	2. Check for continuity between the ground circuit and the seat belt switch sense circuit of the seat belt switch pigtail wire connector. There should be no continuity with the seat belt buckled. Replace the faulty seat belt, if required.

CHIME WARNING SYSTEM (Continued)

CHIME WARNING SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
NO KEY-IN IGNITION OR HEADLAMPS-ON WARNING CHIME WITH DRIVER SIDE FRONT DOOR OPEN	1. Faulty door ajar switch or circuits.	1. Check that interior lights illuminate with driver door open. If not OK, repair the interior lighting system as required.
	2. Faulty headlamp switch (left multi-function switch) or circuits.	2. Check for proper exterior lighting operation. If not OK, repair the exterior lighting system as required.
	3. Key-in ignition switch sense circuit open.	2. Check for continuity between the key-in ignition switch sense circuit of the instrument panel wire harness connector for the ignition switch and the body wire harness connector for the junction block. Repair the key-in ignition switch sense circuit, if required.
	4. Faulty ignition switch.	3. Check for continuity between the two terminals in the ignition switch connector. There should be continuity with a key in the ignition lock cylinder. Replace the faulty ignition switch, if required.
CHIME SOUNDS WITH DRIVER SIDE FRONT DOOR OPEN	1. Key-in ignition switch sense circuit shorted.	1. Disconnect the instrument panel wire harness connector for the ignition switch and the body wire harness connector for the junction block. There should be no continuity between the key-in ignition switch sense circuit of the instrument panel wire harness connector for the ignition switch and a good ground. Repair the key-in ignition switch sense circuit, if required.
	2. Faulty ignition switch.	2. Check for continuity between the two terminals in the ignition switch connector. There should be no continuity with the key removed from the ignition lock cylinder. Replace the faulty ignition switch, if required.
NO CHIMES AT ALL TIMES	1. Faulty Body Control Module (BCM).	1. Use a DRBIII® scan tool and refer to the appropriate diagnostic information. Replace the faulty BCM, if required

ELECTRONIC CONTROL MODULES

TABLE OF CONTENTS

ELECTRONIC CONTROL MODULES

STANDARD PROCEDURE - PCM/SKIM PROGRAMMING

NOTE: Before replacing the PCM, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM failures are caused by internal component failures (i.e. relays and solenoids) and shorted circuits (i.e. pull-ups, drivers, and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has been set.

When a PCM (JTEC) and the SKIM are replaced at the same time, perform the following steps in order:

(1) Program the new PCM (JTEC).
(2) Program the new SKIM.
(3) Replace all ignition keys and program them to the new SKIM.

PROGRAMMING THE PCM (JTEC)

The SKIS Secret Key is an ID code that is unique to each SKIM. This code is programmed and stored in the SKIM, the PCM, and the ignition key transponder chip(s). When replacing the PCM, it is necessary to program the secret key into the new PCM using the DRBIII® scan tool. Perform the following steps to program the secret key into the PCM.

ELECTRONIC CONTROL MODULES (Continued)

(1) Turn the ignition switch to the On position (transmission in Park/Neutral).

(2) Use the DRBIII® and select THEFT ALARM, SKIM, then MISCELLANEOUS.

(3) Select PCM REPLACED (GAS ENGINE).

(4) Enter secured access mode by entering the vehicle four-digit PIN.

(5) Select ENTER to update PCM VIN.

NOTE: If three attempts are made to enter secure access mode using an incorrect PIN, secured access mode will be locked out for one hour. To exit this lockout mode, turn the ignition switch to the ON position for one hour, then enter the correct PIN. (Ensure all accessories are turned off. Also monitor the battery state and connect a battery charger if necessary).

(6) Press ENTER to transfer the secret key (the SKIM will send the secret key to the PCM).

(7) Press Page Back to get to the Select System menu and select ENGINE, MISCELLANEOUS, and SRI MEMORY CHECK.

(8) The DRBIII® will ask, "Is odometer reading between XX and XX?" Select the YES or NO button on the DRBIII®. If NO is selected, the DRBIII® will read, "Enter Odometer Reading (From I.P. odometer)". Enter the odometer reading from the instrument cluster and press ENTER.

PROGRAMMING THE SKIM

(1) Turn the ignition switch to the On position (transmission in Park/Neutral).

(2) Use the DRBIII® and select THEFT ALARM, SKIM, then MISCELLANEOUS.

(3) Select PCM REPLACED (GAS ENGINE).

(4) Program the vehicle four-digit PIN into SKIM.

(5) Select COUNTRY CODE and enter the correct country.

NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, it cannot be changed and the SKIM must be replaced.

(6) Select YES to update VIN (the SKIM will learn the VIN from the PCM).

(7) Press ENTER to transfer the secret key (the PCM will send the secret key to the SKIM).

(8) Program ignition keys to the SKIM.

NOTE: If the PCM and the SKIM are replaced at the same time, all vehicle ignition keys will need to be replaced and programmed to the new SKIM.

PROGRAMMING IGNITION KEYS TO THE SKIM

(1) Turn the ignition switch to the On position (transmission in Park/Neutral).

(2) Use the DRBIII® and select THEFT ALARM, SKIM, then MISCELLANEOUS.

(3) Select PROGRAM IGNITION KEY'S.

(4) Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM it (the key) cannot be transferred to another vehicle.

(5) Obtain ignition keys to be programmed from the customer (8 keys maximum).

(6) Using the DRBIII®, erase all ignition keys by selecting MISCELLANEOUS, and ERASE ALL CURRENT IGN. KEYS.

(7) Program all of the ignition keys.

If ignition key programming is unsuccessful, the DRBIII® will display one of the following messages:

- **Programming Not Attempted** - The DRBIII® attempts to read the programmed key status and there are no keys programmed into SKIM memory.
- **Programming Key Failed (Possible Used Key From Wrong Vehicle)** - SKIM is unable to program an ignition key transponder due to one of the following:
- The ignition key transponder is faulty.
- The ignition key transponder is or has been already programmed to another vehicle.
- **8 Keys Already Learned, Programming Not Done** - The SKIM transponder ID memory is full.
- **Learned Key In Ignition** - The ID for the ignition key transponder currently in the ignition lock cylinder is already programmed in SKIM memory.

ADJUSTABLE PEDALS MODULE

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(4) Remove the adjustable pedal motor for accessibility. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/PEDAL - REMOVAL).

(5) Remove the two mounting clips from the module (Fig. 1).

(6) Disconnect the electrical connector.

(7) Remove the adjustable pedal module.

ADJUSTABLE PEDALS MODULE (Continued)

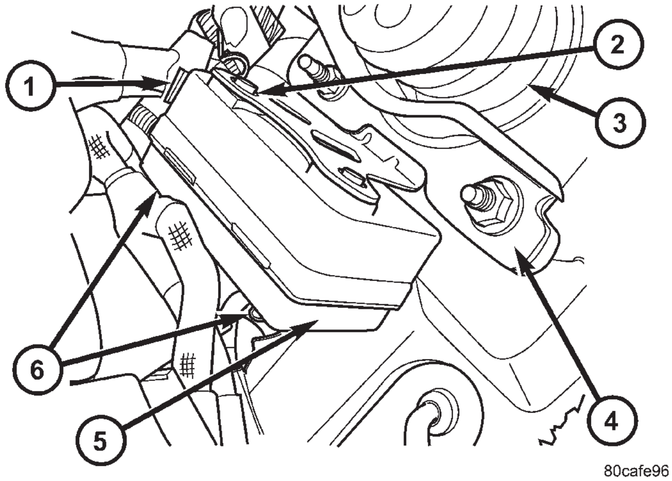


Fig. 1 ADJUSTABLE PEDALS MODULE

1 - ELECTRICAL CONNECTOR
2 - MODULE MOUNTING BRACKET
3 - BRAKE BOOSTER
4 - ADJUSTABLE PEDALS MOUNTING BRACKET
5 - ADJUSTABLE PEDALS CONTROL MODULE
6 - HOLD DOWN CLIPS

INSTALLATION

(1) Install the module on the mounting pins in the vehicle.

(2) Reconnect the electrical connector.

(3) Install the two mounting clips for the module (Fig. 1).

(4) Install the adjustable pedal motor. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/PEDAL - INSTALLATION).

(5) Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(6) Install the cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(7) Reconnect the negative battery cable.

BODY CONTROL MODULE

DESCRIPTION

A Body Control Module (BCM) is concealed below the driver side end of the instrument panel (Fig. 2).

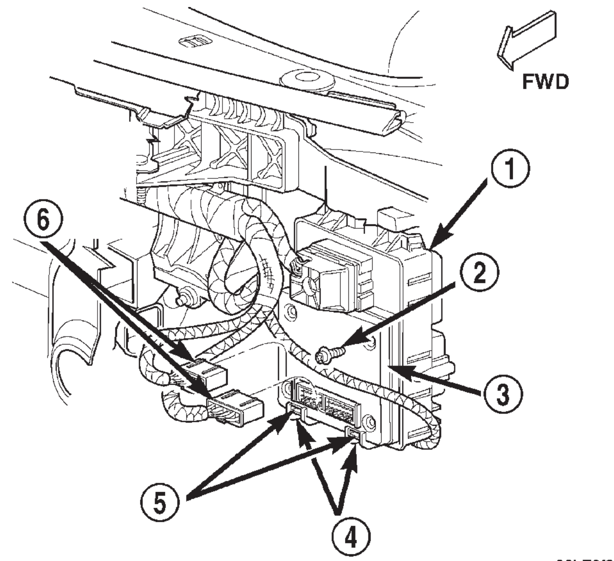


Fig. 2 Body Control Module

1 - JUNCTION BLOCK
2 - SCREWS (4)
3 - BODY CONTROL MODULE
4 - FUSE COVER LOCATOR CHANNELS
5 - FUSE COVER MOUNTING SLOTS
6 - INSTRUMENT PANEL WIRE HARNESS CONNECTORS

The BCM utilizes integrated circuitry and information carried on the Programmable Communications Interface (PCI) data bus network along with many hard wired inputs to monitor many sensor and switch inputs throughout the vehicle. In response to those inputs, the internal circuitry and programming of the BCM allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the PCI data bus. The electronic functions and features that the BCM supports or controls include the following:

The BCM for this model is serviced only as a complete unit. Many of the electronic features in the vehicle controlled or supported by the BCM are programmable using either the Electronic Vehicle Information Center (EVIC) user interface, or the DRBIII® scan tool. In addition, the BCM software is Flash compatible, which means it can be reprogrammed using Flash reprogramming procedures. A BCM can only be repaired by or replaced through an authorized electronic warranty repair station. Refer to the latest version of the Warranty Policies and Procedures manual for a current listing of authorized electronic repair stations.

OPERATION

The Body Control Module (BCM) is designed to control and integrate many of the electronic features and functions of the vehicle. The microprocessor-based BCM hardware and software monitors many hard wired switch and sensor inputs as well as those resources it shares with other electronic modules in the vehicle through its communication over the PCI data bus network. The internal programming of the BCM microprocessor allows the BCM to determine the tasks it needs to perform and their priorities. The

BODY CONTROL MODULE (Continued)

BCM programming then performs those tasks and provides features through both PCI data bus communication with other electronic modules and hard wired outputs to a number of relays. These relays provide the BCM with the ability to control numerous high current accessory systems in the vehicle.

The BCM circuitry operates on battery current received through fuses in the Junction Block (JB) on a non-switched fused B(+) circuit, a fused ignition switch output (start-run) circuit, and a fused ignition switch output (run-accessory) circuit. This arrangement allows the BCM to provide some features regardless of the ignition switch position. The BCM circuitry is grounded through the chassis beneath the center console.

The BCM monitors its own internal circuitry as well as many of its input and output circuits, and will store a Diagnostic Trouble Code (DTC) in electronic memory for any failure it detects. These DTCs can be retrieved and diagnosed using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

HARD WIRED INPUTS

The hard wired inputs to the BCM include the following:

- A/C switch signal
- Ambient temperature sensor signal
- Body control module flash enable
- Coolant level switch sense
- Door ajar switch sense (two circuits - one left rear, and one right rear)
- Driver seat heater switch mux
- Fog lamp switch sense
- Fused B(+)
- Fused ignition switch output (run-acc)
- Fused ignition switch output (st-run)
- Ground (five circuits - two Z1, and three Z2)
- Hazard switch sense
- Headlamp switch mux
- High beam switch sense
- Hood ajar switch sense (export)
- Key-in ignition switch sense
- Liftgate ajar switch sense
- Liftgate courtesy disable
- Liftgate flip-up ajar switch sense
- Panel lamps dimmer signal
- Park lamp relay output
- Passenger seat heater switch mux
- PCI bus
- Radio control mux
- Rear window defogger switch sense
- Seat belt switch sense
- Ultralight sensor signal
- Washer fluid switch sense
- Washer pump switch sense
- Windshield wiper switch mux
- Wiper park switch sense

MESSAGING

The BCM uses the following messages received from other electronic modules over the PCI data bus:

- Accessory Delay Control (DDM/PDM)
- Battery Temperature (PCM)
- Chime Request (EMIC, EVIC, SKIM)
- Cylinder Lock Switch Status (DDM)
- Door Ajar Status/Front Doors (DDM/PDM)
- Door Lock Status (DDM/PDM)
- Engine Model (PCM)
- Engine RPM (PCM)
- Engine Temperature (PCM)
- English/Metric Default (EMIC)
- Fuel Tank Level (PCM)
- Fuel Used/Injector Pulses (PCM)
- Panic Control (PDM)
- Programmable Features Preferences/Audible & Optical Chirps/Headlamp Delay (EVIC)
- RKE Status (PDM)
- Vehicle Identification Number (PCM)
- Vehicle Speed (PCM)

The BCM provides the following messages to other electronic modules over the PCI data bus:

- A/C Switch Status (PCM)
- Ambient Temperature Data (AZC/EVIC/PCM)
- Average/Instantaneous Fuel Economy (EVIC)
- Country Code (EMIC)
- Courtesy Lamp Status (DDM/PDM)
- Distance To Empty (EVIC)
- Elapsed Ignition On Timer (EVIC)
- English/Metric Status (EMIC)
- Front & Rear Door Ajar Status (EVIC)
- Front & Rear Fog Lamp Status (EMIC)
- Heated Seat Switch Status (HSM/MHSM)
- High Beam Status (EMIC)
- Ignition Off Timer (EVIC)
- Ignition Switch Position (DDM/PDM)
- Key-In Ignition Status (DDM/PDM)
- Low Beam Status (EMIC)
- Panel Lamp Status (AZC/EMIC/Radio)
- Rear Window Defogger Relay Status (DDM/PDM)
- Remote Radio Switch Status (Radio)
- Seatbelt Status (EMIC/MHSM/MSM)

DIAGNOSIS AND TESTING - BODY CONTROL MODULE

The hard wired inputs to and outputs from the Body Control Module (BCM) may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

Conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM. In order to obtain conclusive testing of the BCM, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide

BODY CONTROL MODULE (Continued)

inputs to or receive outputs from the BCM must also be checked. The most reliable, efficient, and accurate means to diagnose the BCM, the PCI data bus network, and the electronic modules that provide inputs to or receive outputs from the BCM requires the use of a DRBIII® scan tool and the appropriate diagnostic information. The DRBIII® scan tool can provide confirmation that the PCI data bus network is functional, that all of the modules are sending and receiving the proper messages over the PCI data bus, and that the BCM is receiving the proper hard wired inputs and responding with the proper hard wired outputs needed to perform its many functions.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel fuse cover.(Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - REMOVAL).

(3) Access and disconnect the instrument panel wire harness connectors from the BCM (Fig. 3).

(4) Remove the mounting screws (Torx T-20) that secure the BCM to the JB.

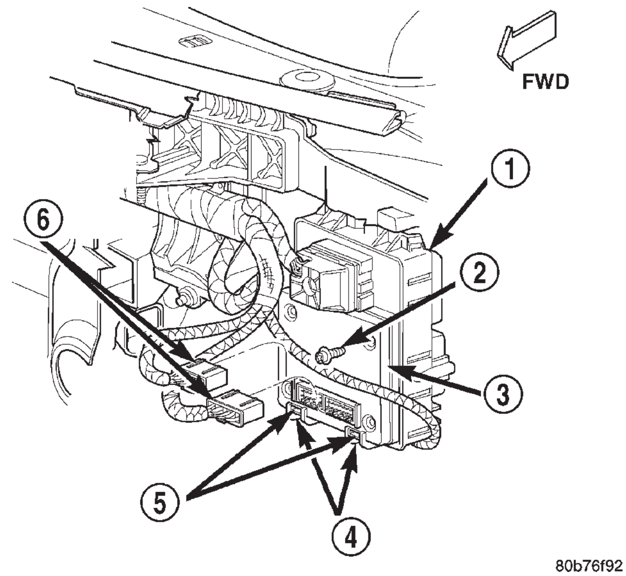


Fig. 3 Body Control Module Remove/Install

1 - JUNCTION BLOCK
2 - SCREWS (4)
3 - BODY CONTROL MODULE
4 - FUSE COVER LOCATOR CHANNELS
5 - FUSE COVER MOUNTING SLOTS
6 - INSTRUMENT PANEL WIRE HARNESS CONNECTORS

(5) Pull the BCM straight out towards the dash panel far enough to disconnect the integral BCM to JB connector.

(6) Remove the BCM.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the Body Control Module (BCM) to its mounting location (Fig. 3).

(2) Align the terminal pins of the BCM connector with the connector on the JB.

(3) Engage the BCM integral connector into the JB.

(4) Install the four screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

BODY CONTROL MODULE (Continued)

(5) Connect the two instrument panel wire harness connectors to the BCM.

(6) Reinstall the instrument panel fuse cover to the bottom of the BCM and JB unit. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - INSTALLATION).

(7) Connect the battery negative cable.

COMMUNICATION

DESCRIPTION

The Programmable Communication Interface (PCI) data bus system is a single wire multiplex system used for vehicle communications. Multiplexing is a system that enables the transmission of several messages over a single channel or circuit.

Many of the control modules in a vehicle require information from the same sensing device. Multiplexing reduces wire harness complexity, sensor current loads and controller hardware because each sensing device is connected to only one controller, which reads and distributes the sensor information to the other controllers over the data bus. Also, because each controller on the data bus can access the controller sensor inputs to every other controller on the data bus, more function and feature capabilities are possible.

A multiplex system allows the information flowing between controllers to be monitored using a diagnostic scan tool. This system allows a control module to broadcast message data out onto the bus where all other control modules can read the messages that are being sent. When a module reads a message on the data bus that it requires, it relays that message to its microprocessor. Each module ignores the messages on the data bus that it dosen't recognize.

OPERATION

Data exchange between modules is achieved by serial transmission of encoded data over a single wire broadcast network. The PCI data bus messages are carried over the bus in the form of Variable Pulse Width Modulated (VPWM) signals. The PCI data bus speed is an average 10.4 Kilo-bits per second (Kbps).

The voltage network used to transmit messages requires biasing and termination. Each module on the PCI data bus system provides its own biasing and termination. Each module (also referred to as a node) terminates the bus through a terminating resistor and a terminating capacitor. The Powertrain Control Module (PCM) is the only dominant node for the PCI data bus system.

The PCI bus uses low and high voltage levels to generate signals. The voltage on the buss varies between zero and seven and one-half volts. The low and high voltage levels are generated by means of variable-pulse width modulation to form signals of varying length.

When a module is transmitting on the bus, it is reading the bus at the same time to ensure message integrity.

Each module is capable of transmitting and receiving data simultaneously.

The PCI data bus can be monitored using the DRBIII® scan tool. It is possible for the bus to pass all DRBIII® tests and still be faulty if the voltage parameters are all within the specified range and false messages are being sent.

CONTROLLER ANTILOCK BRAKE

DESCRIPTION

The Controler Antilock Brake (CAB) is mounted to the Hydraulic Control Unit (HCU) and operates the ABS system (Fig. 4).

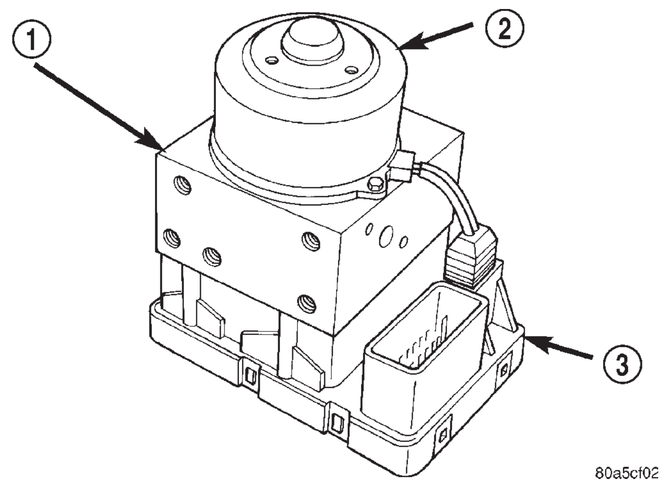


Fig. 4 Controller Antilock Brakes

1 - HCU
2 - MOTOR
3 - CAB

OPERATION

The CAB voltage is supplied by the ignition switch in the RUN position. The CAB contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously. The CAB contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the DRBIII® scan tool. ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored

CONTROLLER ANTILOCK BRAKE (Continued)

faults are **not** erased if the battery is disconnected. (Fig. 4)

REMOVAL

(1) Remove negative battery cable from the battery.

(2) Remove air cleaner housing,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL) OR (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(3) Release CAB harness connector and remove connector (Fig. 5).

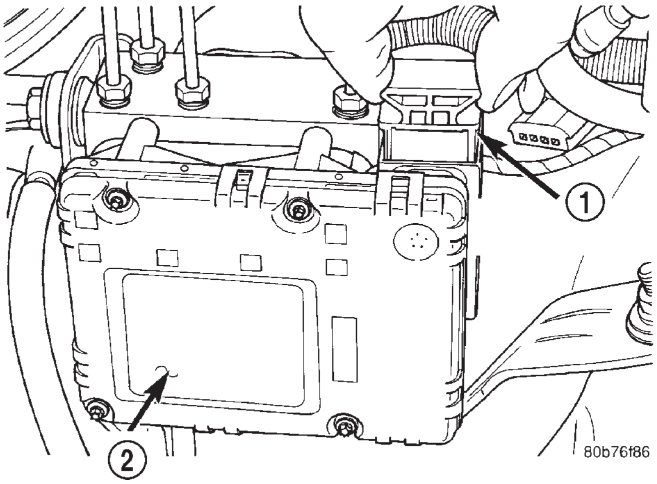


Fig. 5 CAB Connector Release

1 - CONNECTOR RELEASE
2 - CAB

(4) Remove pump motor connector.

(5) Remove CAB mounting bolts (Fig. 6) and remove the CAB from the HCU.

INSTALLATION

(1) Install the CAB onto the HCU and tighten mounting bolts to 1.8 N·m (16 in. lbs.).

(2) Install pump motor connector.

(3) Install CAB harness connector and push down connector release.

(4) Install air cleaner housing,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION) OR (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(5) Install negative battery cable to the battery.

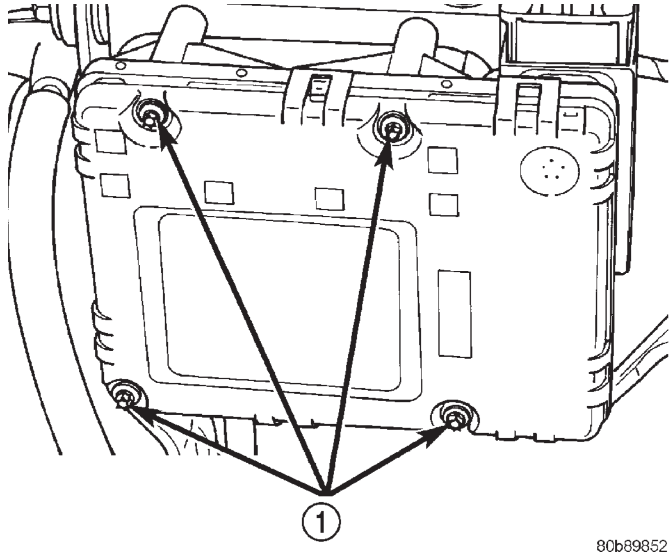


Fig. 6 CAB Mounting Bolts

1 - MOUNTING BOLTS

DATA LINK CONNECTOR

DESCRIPTION - DATA LINK CONNECTOR

The data link connector (DLC) is located at the lower edge of the instrument panel near the steering column.

OPERATION - DATA LINK CONNECTOR

The 16–way DLC links the DRBIII® scan tool or the Mopar Diagnostic System (MDS) with the Powertrain Control Module (PCM).

DOOR MODULE

DESCRIPTION

A door module is concealed behind the trim panel of each front door (Fig. 7).The module on the driver side is referred to as the Driver Door Module (DDM), while the module on the passenger side is the Passenger Door Module (PDM). Each door module houses both the front power lock and power window switches. In addition to the power window and power lock switches for its own door, the DDM also houses individual switches for each passenger door power window, a power window lockout switch, the power mirror switch, and the power foldaway mirror switch for export vehicles.

The DDM and PDM each utilize integrated circuitry and information carried on the Programmable Communications Interface (PCI) data bus network along with many hard wired inputs to monitor many sensor and switch inputs throughout the vehicle. The PDM also receives inputs through an integral Radio

DOOR MODULE (Continued)

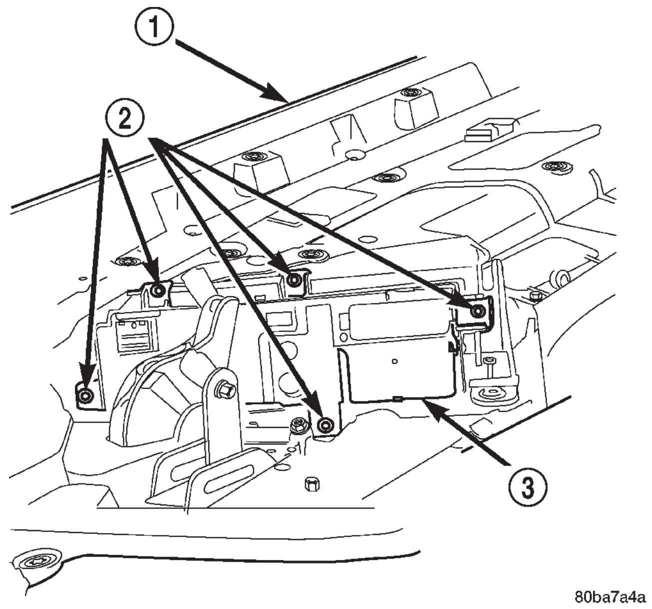


Fig. 7 Door Module

1 - FRONT DOOR TRIM PANEL
2 - SCREW (5)
3 - DOOR MODULE

Frequency (RF) Remote Keyless Entry (RKE) receiver. The DDM and PDM control and integrate many functions and features of the vehicle through both hard wired outputs and messages over the PCI data bus. The functions and features that the door modules support or control include the following:

- **Automatic Door Lock -** The two door modules provide an automatic door lock feature which locks the doors when the vehicle is moving. This is a programmable feature.
- **Automatic Door Unlock On Exit -** The two door modules provide an automatic door unlock on exit feature. This feature will unlock all the doors if they were locked via the automatic door lock feature after the vehicle has stopped moving and the driver door is opened. This is a programmable feature via the EVIC.
- **Customer Programmable Features -** Each door module provides support for certain customer programmable features that are monitored on the PCI bus.
- **Cylinder Lock Switch Status -** The DDM monitors and transmits the status of the cylinder lock switch on the driver side front door lock cylinder.
- **Door Courtesy Lamp Control -** Each door module provides control of its own optional front door-mounted courtesy lamp.
- **Door Lock Inhibit -** Each door module provides a door lock inhibit feature which prevents the doors from being locked with a power lock switch if the key was left in the ignition and a front door is open.
- **Express-Down Window -** The DDM provides an express-down feature for the driver side front door window only.
- **Extended Window Operation -** Both door modules provide an extended power window operation feature that allows operation of the power windows for 45 seconds following ignition Off or until a front door is opened.
- **Front Door Ajar Switch Status -** Each door module monitors and transmits the status of its own front door ajar switch.
- **Heated Mirrors -** Each door module provides control for its own optional heated outside rear view mirror.
- **Illuminated Entry -** Each door module supports an illuminated entry feature through its own optional front door-mounted courtesy lamp.
- **Memory Mirrors -** Each door module provides control for its own optional memory outside rear view mirror.
- **Memory Switch -** The DDM monitors the status of the optional memory switch and controls the illumination of the memory switch “set” Light Emitting Diode (LED) indicator and illumination lamps.
- **Memory System -** The DDM transmits memory set and recall messages based upon inputs from the memory switch. If the optional RKE linked to memory feature is enabled, the DDM will also transmit memory recall messages based upon memory requests received from the Remote Keyless Entry (RKE) system in the PDM. Certain memory system features are programmable.
- **Power Foldaway Mirrors - Export Only -** Each door module provides support for the optional power foldaway outside mirrors. The DDM also houses the control switch for this system.
- **Power Lock Control -** The DDM provides control for the driver side front door power lock motor, while the PDM provides control for the power lock motors of the three remaining doors and the liftgate.
- **Power Lock Switch Status -** Each door module monitors and transmits the status of its own integral power lock switch.
- **Power Window Control -** Each door module provides control for both the front and rear door power window motors and the rear door power window switches on the same side of the vehicle.
- **Power Window Switch Status -** The DDM monitors and transmits the status of its integral passenger side front and rear power window switches.
- **Remote Keyless Entry -** The PDM monitors and transmits the status of the Remote Keyless Entry (RKE) system and provides support for the RKE Lock (with the optional horn chirp and park

DOOR MODULE (Continued)

lamp flash features), Unlock with the optional RKE unlock, and Panic Mode functions. The optional RKE features are programmable.

- **Switch Illumination** - Each door module provides control of the power window and power lock switch illumination for the front and rear doors on the same side of the vehicle. The DDM provides control of the power mirror switch illumination.
- **Window Lockout** - The DDM monitors and transmits the status of its integral window lockout switch to provide the power window lockout feature and coordinate power window switch knob illumination.

The door modules are serviced only as complete units. Many of the features in the vehicle controlled or supported by the door modules are programmable using either the Electronic Vehicle Information Center (EVIC) user interface, or the DRBIII® scan tool. If a door module is damaged or faulty, the entire door module unit must be replaced.

OPERATION

The microprocessor-based DDM and PDM hardware and software monitors integral and hard wired external switch inputs as well as those resources it shares with other electronic modules in the vehicle through its communication over the PCI data bus network. The internal programming and all of these inputs allow the DDM or PDM microprocessor to determine the tasks it needs to perform and their priorities, as well as both the standard and optional features that it should provide.

The DDM and PDM are powered by a fused battery circuit so that they can operate regardless of the ignition switch position. The DDM and PDM circuitry is grounded to the chassis beneath the front seat.

The DDM and PDM can be diagnosed using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

HARD WIRED INPUTS

The hard wired inputs to the door modules include the following:

- Door ajar switch sense
- Driver door key cylinder switch sense (DDM)
- Fused B(+)
- Ground
- Memory switch mux (DDM)
- Mirror horizontal position signal
- Mirror vertical position signal
- PCI bus

HARD WIRED OUTPUTS

The hard wired outputs of the door modules include the following:

- Courtesy lamp driver
- Courtesy lamp ground
- Diagnostic out (DDM)
- Door/liftgate lock driver
- Door/liftgate unlock driver
- Door switch illumination (rear power window)
- Front window driver (down)
- Front window driver (up)
- Memory set indicator driver (DDM)
- Memory switch return (DDM)
- Mirror common driver
- Mirror heater ground
- Mirror heater 12V supply
- Rear window driver (down)
- Rear window driver (up)
- Mirror horizontal driver
- Mirror sensor ground
- Mirror vertical driver
- PCI bus
- Switch illumination driver (memory - DDM)

MESSAGING

The door modules use the following messages received from other electronic modules over the PCI data bus:

- Accessory Delay Control (PDM)
- Courtesy Lamp Status (BCM)
- Door Ajar Status/Rear Doors (BCM)
- Door Lock Status (DDM/PDM)
- Ignition Switch Position (BCM)
- Key-In Ignition Status (BCM)
- Programmable Features Preferences/Auto Lock/Auto Unlock/RKE Unlock Sequence/RKE Link to Memory (EVIC)
- Memory Recall (DDM)
- Rear Window Defogger Relay Status (BCM)
- Vehicle Speed (PCM)

The door modules provide the following messages to other electronic modules over the PCI data bus:

- Cylinder Lock Switch Status (BCM)
- Door Ajar Status/Front Doors (BCM/DDM/PDM)
- Door Lock Status (DDM/PDM)
- Memory Recall (PDM/MHSM/MSM/Radio)
- Memory Set Switch Status (PDM/MHSM/MSM/Radio)
- Panic Control (BCM)
- Power Window Switch Status (PDM)
- RKE Status (BCM/DDM)
- Window Lockout Switch Status (PDM)

DOOR MODULE (Continued)

DIAGNOSIS AND TESTING - DOOR MODULE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The hard wired inputs to and outputs from the Driver Door Module (DDM) or the Passenger Door Module (PDM) may be diagnosed and tested using conventional diagnostic tools and procedures. It is suggested that the proper operation of the inoperative power window motor, power door lock motor, power liftgate lock motor, power mirror motors, or heated mirror grid be confirmed using jumper wires to bypass the door module. If the inoperative component operates when the door module is bypassed, check the circuits between the component and the door module, as well as the fused B(+) and ground circuits of the door module for shorts or opens.

These conventional diagnostic methods may not prove conclusive in the diagnosis of the DDM or the PDM. In order to obtain conclusive testing of these modules, the Programmable Communications Interface (PCI) data bus network and all of the modules that provide inputs to or receive outputs from the door modules must also be checked. The most reliable, efficient, and accurate means to diagnose the DDM, the PDM, the PCI data bus network, and the modules that provide inputs to or receive outputs from the door modules requires the use of a DRBIII® scan tool and the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).

(3) Remove the door module from the back of the front door trim panel (Fig. 8).

(4) Remove the door module from the front door trim panel.

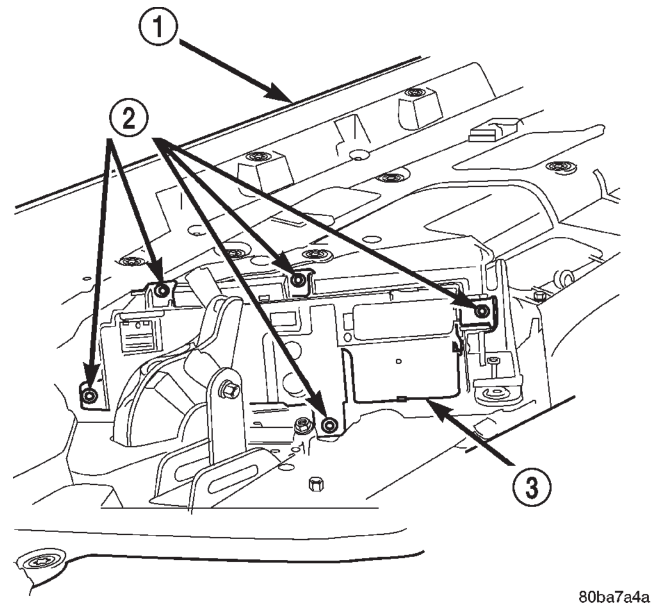


Fig. 8 Door Module Remove/Install

1 - FRONT DOOR TRIM PANEL
2 - SCREW (5)
3 - DOOR MODULE

INSTALLATION

(1) Position the door module onto the front door trim panel.

(2) Install the door module to the back of the front door trim panel (Fig. 8). Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reinstall the trim panel onto the front door. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).

(4) Reconnect the battery negative cable.

MEMORY HEATED SEAT/ MIRROR MODULE

DESCRIPTION

There are two different modules that can be used in the optional heated seat system. The Heated Seat Module (HSM) is used on vehicles that are not equipped with the optional Memory System. The Memory Heated Seat Module (MHSM) is used on vehicles that are equipped with the optional Memory System and the optional heated seat system.Refer to **Memory System** in Power Seat Systems for more information on the memory system option.

The module is mounted on a bracket that is located between the power seat track and the seat cushion frame (Fig. 9). The HSM or MHSM is used to control the heated seat system functions for both front seats. The HSM or MHSM contains a central processing unit that communicates with other modules on the

MEMORY HEATED SEAT/MIRROR MODULE (Continued)

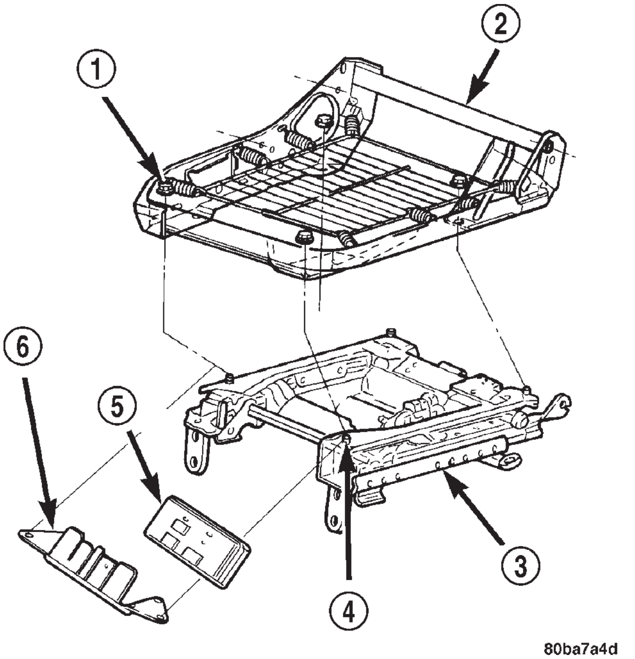


Fig. 9 Heated Seat Module Remove/Install

1 - NUT (4)
2 - SEAT CUSHION FRAME
3 - POWER SEAT TRACK
4 - STUD (4)
5 - MODULE
6 - BRACKET

Programmable Communications Interface (PCI) data bus network.

For diagnosis of the HSM, MHSM or the PCI data bus, a DRBIII® scan tool and the proper Diagnostic Procedures manual are recommended. The HSM or MHSM cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The MSM receives hard wired inputs from the power seat switch and the potentiometers on each of the driver side power seat motors. The MSM receives messages over the PCI data bus from the Driver Door Module (DDM) (memory switch status), the Powertrain Control Module (PCM) (vehicle speed status), and the Body Control Module (seat belt switch status).The MSM will prevent the seat memory recall function from being initiated if the driver side seat belt is buckled, if the transmission gear selector lever is not in the Park or Neutral positions, or if the vehicle is moving.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - HEATED SEAT MODULE

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. If any of the above conditions are present, repair as necessary. If not, use a DRBIII® scan tool and the proper Diagnostic Procedures Manual to test the HSM or MHSM. For complete circuit diagrams, refer to **Power Seat Premium I/III** in Wiring Diagrams.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side front bucket seat from the power seat track unit. Refer to **Bucket Seat Track Adjuster** in Body for the procedure.

(3) Lift the heated seat module off of the power seat track and disconnect the power seat wire harness connectors (Fig. 10).

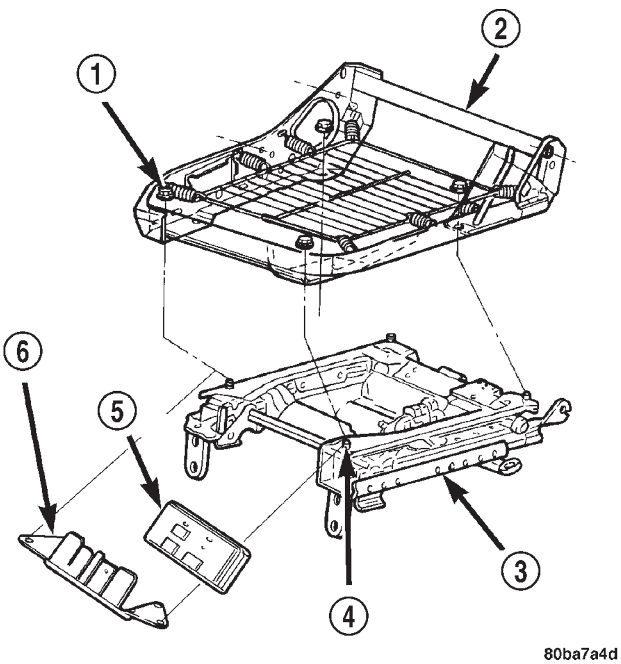


Fig. 10 Heated Seat Module Remove/Install

1 - NUT (4)
2 - SEAT CUSHION FRAME
3 - POWER SEAT TRACK
4 - STUD (4)
5 - MODULE
6 - BRACKET

(4) Remove the module from the bracket.

INSTALLATION

(1) Install the MHSM,HSM into the bracket.

(2) Position the heated seat module and mounting bracket onto the power seat track.

(3) Reconnect the power seat wiring harness connectors to the heated seat module.

(4) Install the driver side front bucket seat onto the power seat track unit (Refer to 23 - BODY/SEATS/SEAT TRACK ADJUSTER - INSTALLATION).

(5) Reconnect the battery negative cable.

NOTE: If the vehicle is equipped with the optional Memory System, following installation, it will be necessary to initialize the Memory Heated Seat Module (MHSM). In order to function properly, the MHSM must "learn" the sensor values of each of the power seat motor position transducers in each of the adjuster hard stop positions. This is done by performing the "Reset Guard Band" procedure using a DRBIII® scan tool and the proper Diagnostic Procedures manual.

WARNING: THE "RESET GUARD BAND" PROCEDURE WILL CAUSE THE DRIVER SIDE FRONT SEAT TO AUTOMATICALLY ADJUST TO EACH OF ITS TRAVEL LIMITS. BE CERTAIN THAT NO ONE IS SEATED IN THE VEHICLE AND THAT THERE IS NOTHING IN THE VEHICLE THAT WILL OBSTRUCT SEAT MOVEMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN PERSONAL INJURIES AND/OR VEHICLE DAMAGE.

POWERTRAIN CONTROL MODULE

DESCRIPTION

DESCRIPTION - PCM

The Powertrain Control Module (PCM) is located in the engine compartment (Fig. 11). The PCM is referred to as JTEC.

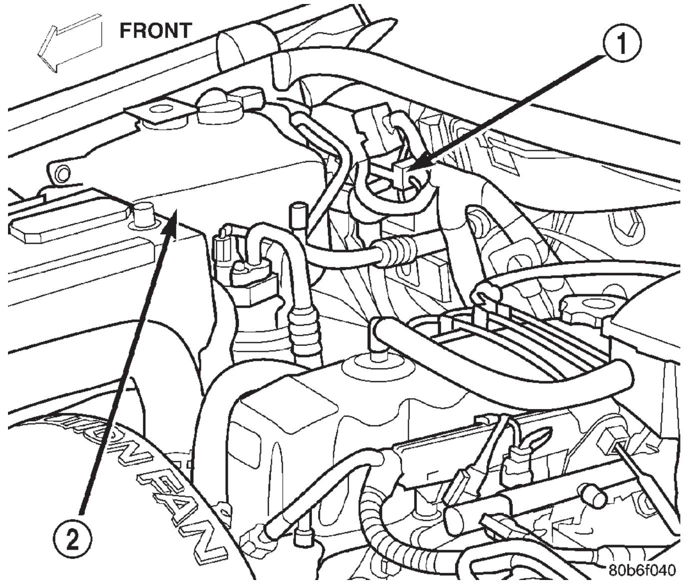


Fig. 11 PCM Location

1 - PCM
2 - COOLANT TANK

MODES OF OPERATION

As input signals to the Powertrain Control Module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate different injector pulse width and ignition timing for idle than it does for wide open throttle (WOT).

The PCM will operate in two different modes: **Open Loop and Closed Loop**.

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

POWERTRAIN CONTROL MODULE (Continued)

- The PCM pre-positions the idle air control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored.
- Throttle position sensor (TPS) is monitored.
- The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized via the O2S relays. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The PCM receives inputs from:

- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Starter motor relay
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within approximately 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the PCM receives inputs from:

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.
- The PCM operates the A/C compressor clutch through the clutch relay. This is done if A/C has been selected by the vehicle operator and requested by the A/C thermostat.
- When engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.

POWERTRAIN CONTROL MODULE (Continued)

• The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the PCM receives inputs from:

• Air conditioning select signal (if equipped)
• Air conditioning request signal (if equipped)
• Battery voltage
• Engine coolant temperature sensor
• Crankshaft position sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal
• Park/neutral switch (gear indicator signal—auto. trans. only)
• Oxygen (O2S) sensors

Based on these inputs, the following occurs:

• Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
• The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.
• The PCM adjusts ignition timing by turning the ground path to the coil on and off.
• The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

ACCELERATION MODE

This is an Open Loop mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the PCM receives the following inputs.

• Air conditioning select signal (if equipped)
• Air conditioning request signal (if equipped)
• Battery voltage
• Engine coolant temperature sensor
• Crankshaft position sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal
• Park/neutral switch (gear indicator signal—auto. trans. only)
• Vehicle speed

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply a ground to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the PCM receives the following inputs.

• Battery voltage
• Crankshaft position sensor
• Engine coolant temperature sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal

During wide open throttle conditions, the following occurs:

• Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
• The PCM adjusts ignition timing by turning the ground path to the coil on and off.

IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

DESCRIPTION - 5 VOLT SUPPLIES

Two different Powertrain Control Module (PCM) five volt supply circuits are used; primary and secondary.

DESCRIPTION - IGNITION CIRCUIT SENSE

This circuit ties the ignition switch to the Powertrain Control Module (PCM).

POWERTRAIN CONTROL MODULE (Continued)

DESCRIPTION - POWER GROUNDS

The Powertrain Control Module (PCM) has 2 main grounds. Both of these grounds are referred to as power grounds. All of the high-current, noisy, electrical devices are connected to these grounds as well as all of the sensor returns. The sensor return comes into the sensor return circuit, passes through noise suppression, and is then connected to the power ground.

The power ground is used to control ground circuits for the following PCM loads:
- Generator field winding
- Fuel injectors
- Ignition coil(s)
- Certain relays/solenoids
- Certain sensors

DESCRIPTION - SENSOR RETURN

The Sensor Return circuits are internal to the Powertrain Control Module (PCM).

Sensor Return provides a low–noise ground reference for all engine control system sensors. Refer to Power Grounds for more information.

OPERATION

OPERATION - PCM

(1) Also refer to Modes of Operation.

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: PCM Inputs:

- A/C request
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- J1850 bus circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connections for DRB scan tool
- Engine coolant temperature sensor
- Five volts (primary)
- Five volts (secondary)
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Overdrive/override switch
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transmission governor pressure sensor
- Transmission temperature sensor
- Vehicle speed (from ABS module)

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- J1850 (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for DRBIII® scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Generator lamp (if equipped)
- Idle air control (IAC) motor
- Ignition coil
- Leak detection pump

POWERTRAIN CONTROL MODULE (Continued)

- Malfunction indicator lamp (Check engine lamp). Driven through J1850 circuits.
- Overdrive indicator lamp (if equipped). Driven through J1850 circuits.
- Oxygen sensor heater relays (if equipped).
- Radiator cooling fan relay (pulse width modulated)
- Speed control source
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through J1850 circuits.
- Transmission convertor clutch circuit
- Transmission 3–4 shift solenoid
- Transmission relay
- Transmission temperature lamp (if equipped)
- Transmission variable force solenoid

OPERATION - 5 VOLT SUPPLIES

Primary 5–volt supply:

- supplies the required 5 volt power source to the Crankshaft Position (CKP) sensor.
- supplies the required 5 volt power source to the Camshaft Position (CMP) sensor.
- supplies a reference voltage for the Manifold Absolute Pressure (MAP) sensor.
- supplies a reference voltage for the Throttle Position Sensor (TPS) sensor.

Secondary 5–volt supply:

- supplies the required 5 volt power source to the oil pressure sensor.
- supplies the required 5 volt power source for the Vehicle Speed Sensor (VSS) (if equipped).
- supplies the 5 volt power source to the transmission pressure sensor (if equipped with an RE automatic transmission).

OPERATION - IGNITION CIRCUIT SENSE

The ignition circuit sense input tells the PCM the ignition switch has energized the ignition circuit.

Battery voltage is also supplied to the PCM through the ignition switch when the ignition is in the RUN or START position. This is referred to as the ″ignition sense″ circuit and is used to ″wake up″ the PCM.

REMOVAL

USE THE DRBIII® SCAN TOOL TO REPROGRAM THE NEW POWERTRAIN CONTROL MODULE (PCM) WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

The PCM is located on the cowl panel in right/rear side of engine compartment (Fig. 12).

The PCM is located on the cowl panel in right/rear side of engine compartment (Fig. 12).

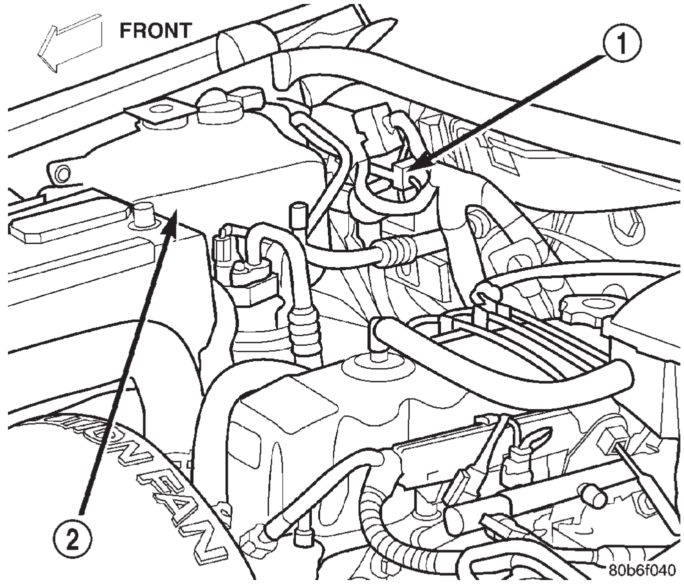


Fig. 12 Powertrain Control Module (PCM) Location

1 - PCM
2 - COOLANT TANK

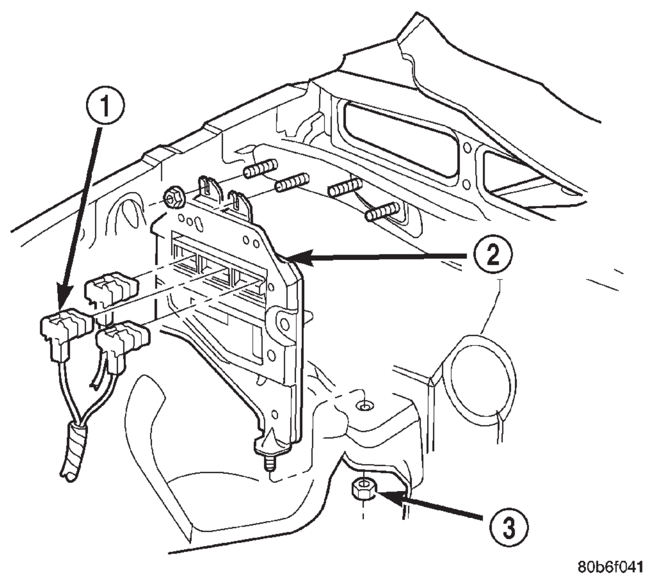


Fig. 13 Powertrain Control Module (PCM) 32–Way Connectors

1 - 3 32–WAY CONNECTORS
2 - PCM/BRACKET ASSEMBLY
3 - BRACKET NUTS (3)

To avoid possible voltage spike damage to PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

(1) Disconnect negative battery cable at battery.

POWERTRAIN CONTROL MODULE (Continued)

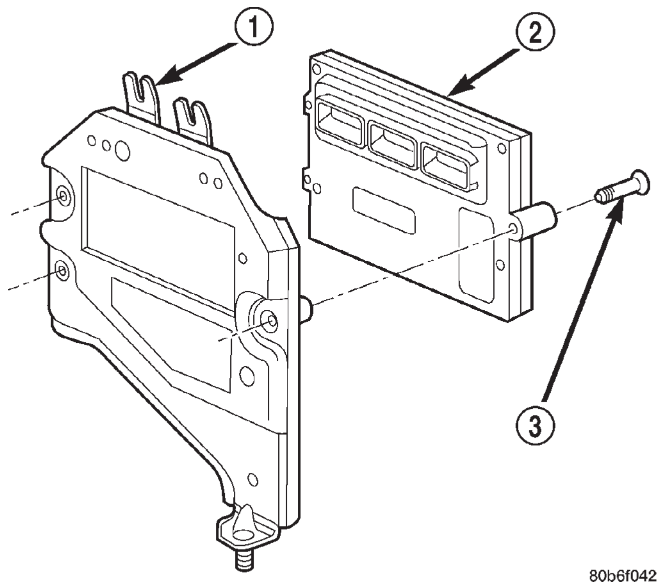


Fig. 14 Powertrain Control Module (PCM) Mounting Bracket

1 - PCM BRACKET
2 - PCM
3 - PCM-TO-BRACKET SCREWS (3)

(2) If equipped, remove Transmission Control Module (TCM).

(3) Remove coolant reserve/overflow tank.

(4) Remove cover over electrical connectors. Cover snaps onto PCM.

(5) Carefully unplug three 32–way connectors at PCM.

(6) Remove three PCM bracket-to-body mounting nuts (Fig. 13).

(7) Remove PCM/PCM bracket assembly from vehicle.

(8) Remove 3 PCM-to-PCM bracket bolts (screws) (Fig. 14).

INSTALLATION

USE THE DRBIII® SCAN TOOL TO REPROGRAM THE NEW POWERTRAIN CONTROL MODULE (PCM) WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

The PCM is located on the cowl panel in right/rear side of engine compartment (Fig. 12).

(1) Check pins in three 32–way electrical connectors for damage. Repair as necessary.

(2) Install PCM to its mounting bracket. Tighten three mounting bolts to 3 N·m (25 in. lbs.) torque.

(3) Install PCM/PCM bracket to body. Install 3 nuts and tighten 9 N·m (80 in. lbs.) torque.

(4) Install three 32–way connectors.

(5) Install cover over electrical connectors. Cover snaps onto PCM.

(6) Install coolant reserve/overflow tank.

(7) If equipped, install Transmission Control Module (TCM).

(8) Connect negative cable to battery.

(9) Use the DRBIII® scan tool to reprogram new PCM with vehicles original Identification Number (VIN) and original vehicle mileage.

SENTRY KEY IMMOBILIZER MODULE

DESCRIPTION

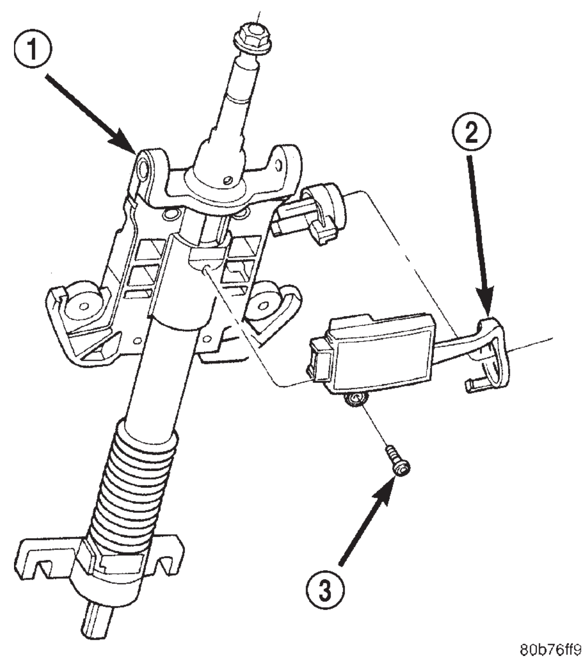


Fig. 15 Sentry Key Immobilizer Module

1 - STEERING COLUMN
2 - SKIM
3 - MOUNTING SCREW

The Sentry Key Immobilizer Module (SKIM) is the primary component of the Sentry Key Immobilizer System (SKIS) (Fig. 15). The SKIM is located in the steering column, below the ignition lock cylinder housing. The SKIM has an integral halo-like antenna ring that extends from one side.

The SKIM cannot be adjusted or repaired. If faulty or damaged, the entire SKIM unit must be replaced.

OPERATION

The Sentry Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a microprocessor. The SKIM transmits RF signals to, and receives RF signals from the Sentry Key tran-

SENTRY KEY IMMOBILIZER MODULE (Continued)

sponder through a tuned antenna ring integral to the SKIM housing. If this antenna ring is not mounted properly around the ignition lock cylinder housing, communication problems between the SKIM and the transponder may arise. These communication problems will result in Sentry Key transponder-related faults. The SKIM also communicates over the Programmable Communications Interface (PCI) data bus with the Powertrain Control Module (PCM), the ElectroMechanical Instrument Cluster (EMIC), the Body Control Module (BCM), and/or the DRBIII® scan tool.

The SKIM retains in memory the ID numbers of any Sentry Key transponder that is programmed into it. A maximum of eight transponders can be programmed into the SKIM. For added system security, each SKIM is programmed with a unique Secret Key code. This code is stored in memory, sent over the PCI data bus to the PCM, and is encoded to the transponder of every Sentry Key that is programmed into the SKIM. Another security code, called a PIN, is used to gain access to the SKIM Secured Access Mode. The Secured Access Mode is required during service to perform the SKIS initialization and Sentry Key transponder programming procedures. The SKIM also stores the Vehicle Identification Number (VIN) in its memory, which it learns through a PCI data bus message from the PCM during SKIS initialization.

In the event that a SKIM replacement is required, the Secret Key code can be transferred to the new SKIM from the PCM using the DRBIII® scan tool and the SKIS replacement procedure. Proper completion of the SKIS initialization will allow the existing Sentry Keys to be programmed into the new SKIM so that new keys will not be required. In the event that the original Secret Key code cannot be recovered, SKIM replacement will also require new Sentry Keys. The DRBIII® scan tool will alert the technician during the SKIS replacement procedure if new Sentry Keys are required.

When the ignition switch is turned to the On position, the SKIM transmits an RF signal to the transponder in the ignition key. The SKIM then waits for an RF signal response from the transponder. If the response received identifies the key as valid, the SKIM sends a valid key message to the PCM over the PCI data bus. If the response received identifies the key as invalid, or if no response is received from the key transponder, the SKIM sends an invalid key message to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages. It is important to note that the default condition in the PCM is an invalid key; therefore, if no message is received from the SKIM by the PCM, the engine will be disabled and the vehicle immobilized after two seconds of running.

The SKIM also sends indicator light status messages to the EMIC over the PCI data bus to tell the EMIC how to operate the SKIS indicator. This indicator light status message tells the EMIC to turn the indicator on for about three seconds each time the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends indicator light status messages to the EMIC to turn the indicator off, turn the indicator on, or to flash the indicator on and off. If the SKIS indicator lamp flashes or stays on solid after the bulb test, it signifies a SKIS fault. If the SKIM detects a system malfunction and/or the SKIS has become inoperative, the SKIS indicator will stay on solid. If the SKIM detects an invalid key or if a key transponder-related fault exists, the SKIS indicator will flash. If the vehicle is equipped with the Customer Learn transponder programming feature, the SKIM will also send messages to the EMIC to flash the SKIS indicator lamp, and to the BCM to generate a single audible chime tone whenever the Customer Learn programming mode is being utilized. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store fault information in the form of Diagnostic Trouble Codes (DTC's) in SKIM memory if a system malfunction is detected. The SKIM can be diagnosed, and any stored DTC's can be retrieved using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

SENTRY KEY IMMOBILIZER MODULE (Continued)

(3) Disconnect the instrument panel wire harness connector from the SKIM connector.

(4) Remove the screw that secures the SKIM to the bottom of the steering column housing (Fig. 16).

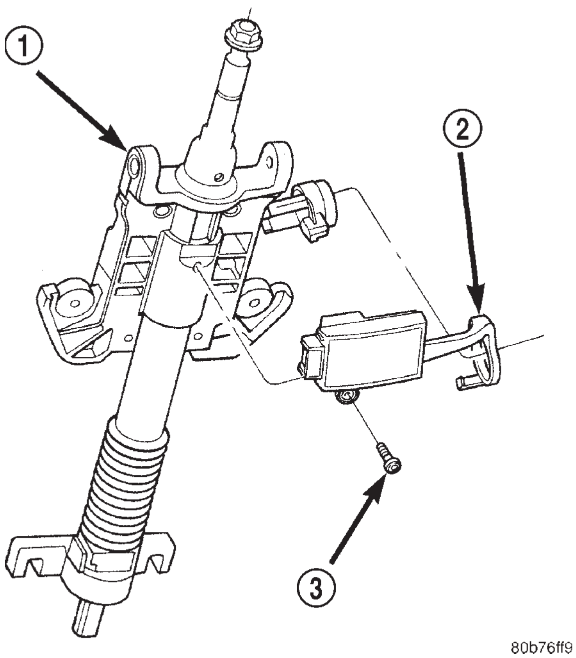


Fig. 16

(5) Disengage the antenna ring of the SKIM from around the ignition lock cylinder housing.

(6) Remove the SKIM from the steering column.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the SKIM to the underside of the steering column (Fig. 16).

(2) Engage the antenna ring of the SKIM around the ignition lock cylinder housing.

(3) Install and tighten the screw that secures the SKIM to the bottom of the steering column housing.Tighten the screw to 3.4 N·m (30 in lbs.).

(4) Reconnect the instrument panel wire harness connector to the SKIM connector.

(5) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(6) Reconnect the battery negative cable.

(7) Perform the SKIS Replacement procedure using the DRBIII®.

(8) Perform the SKIS Initialization Procedure using the DRBIII®.

TRANSMISSION CONTROL MODULE

DESCRIPTION

The Transmission Control Module (TCM) is located in the engine compartment on the right (passenger) side and is mounted to the inner fender (Fig. 17).

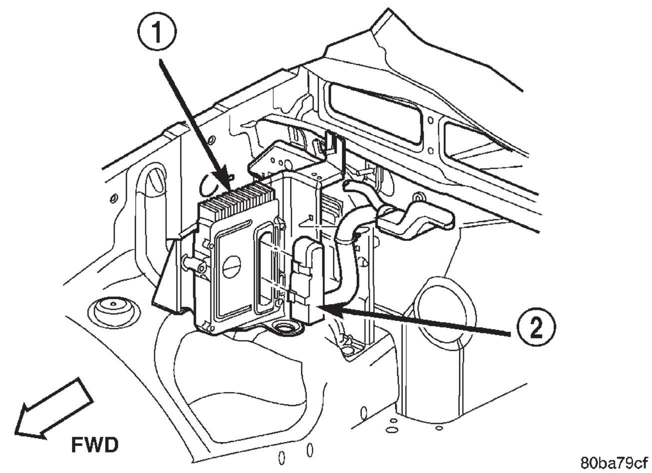


Fig. 17 Transmission Control Module Location

1 - TRANSMISSION CONTROL MODULE (TCM)
2 - 60–WAY CONNECTOR

OPERATION

The Transmission Control Module (TCM) controls all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hardwired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the vehicle communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor
- Transmission Range Sensor

TRANSMISSION CONTROL MODULE (Continued)

- Pressure Switches
- Transmission Temperature Sensor
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- Line Pressure Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Engine Coolant Temperature
- Ambient/Battery Temperature
- DRB® Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids
- Torque Reduction Request

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with DRB® scan tool)

NOTE: If the TCM has been replaced, the "Quick Learn Procedure" must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

BATTERY FEED

A fused, direct battery feed to the TCM is used for continuous power. This battery voltage is necessary to retain adaptive learn values in the TCM's RAM (Random Access Memory). When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

CLUTCH VOLUME INDEXES (CVI)

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur (Fig. 18).

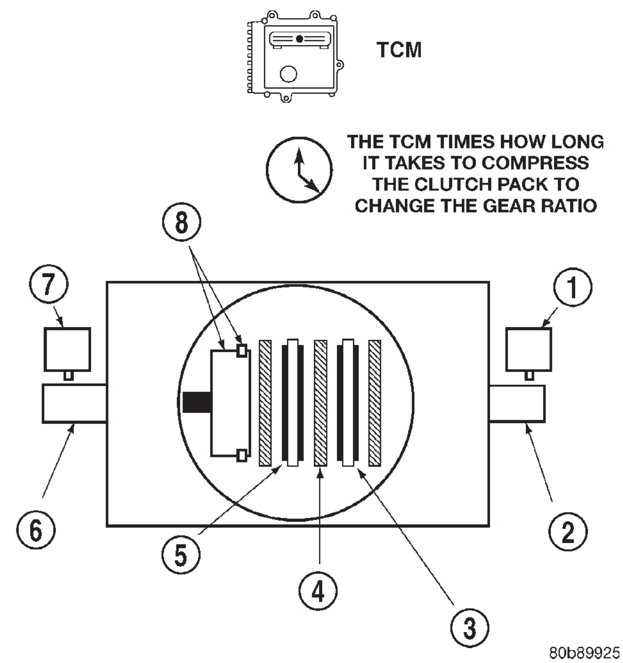


Fig. 18 Example of CVI Calculation

1 - OUTPUT SPEED SENSOR
2 - OUTPUT SHAFT
3 - CLUTCH PACK
4 - SEPARATOR PLATE
5 - FRICTION DISCS
6 - INPUT SHAFT
7 - INPUT SPEED SENSOR
8 - PISTON AND SEAL

Gear ratios can be determined by using the DRBIII® Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

TRANSMISSION CONTROL MODULE (Continued)

Certain mechanical failures within the input clutch assembly can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

CLUTCH VOLUMES		
Clutch	When Updated	Proper Clutch Volume
L/R	2-1 or 3-1 downshift	45 to 134
2C	3-2 kickdown shift	25 to 85
OD	2-3 upshift	30 to 100
4C	3-4 upshift	30 to 85
UD	4-3 kickdown shift	30 to 100

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature below -16° F	-Park, Reverse, Neutral and 1st and 3rd gear only in D position, 2nd gear only in Manual 2 or L -No EMCC
Super Cold	Oil temperature between -12° F and 10° F	- Delayed 2-3 upshift - Delayed 3-4 upshift - Early 4-3 coastdown shift - High speed 4-2, 3-2, 2-1 kickdown shifts are prevented -Shifts at high throttle openings willl be early. - No EMCC
Cold	Oil temperature between 10° F and 36° F	-Shift schedule is the same as Super Cold except that the 2-3 upshifts are not delayed.
Warm	Oil temperature between 40° F and 80° F	- Normal operation (upshift, kickdowns, and coastdowns) - No EMCC
Hot	Oil temperature between 80° F and 240° F	- Normal operation (upshift, kickdowns, and coastdowns) - Normal EMCC operation
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	- Delayed 2-3 upshift - Delayed 3-4 upshift - 3rd gear FEMCC from 30-48 mph - 3rd gear PEMCC above 35 mph - Above 25 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

STANDARD PROCEDURE

STANDARD PROCEDURE - TCM QUICK LEARN

The quick learn procedure requires the use of the DRBIII® scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRB® indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

ENGINE SYSTEMS

TABLE OF CONTENTS

BATTERY SYSTEM

TABLE OF CONTENTS

BATTERY SYSTEM

DESCRIPTION

A single 12-volt battery system is standard factory-installed equipment on this model. All of the components of the battery system are located within the engine compartment of the vehicle. The service information for the battery system in this vehicle covers the following related components, which are covered in further detail elsewhere in this service manual:

- **Battery -** The storage battery provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Battery Cables -** The battery cables connect the battery terminal posts to the vehicle electrical system.
- **Battery Holddown -** The battery holddown hardware secures the battery in the battery tray in the engine compartment.
- **Battery Tray -** The battery tray provides a secure mounting location in the vehicle for the battery and an anchor point for the battery holddown hardware.

For battery system maintenance schedules and jump starting procedures, see the owner's manual in the vehicle glove box. Optionally, refer to Lubrication and Maintenance for the recommended battery maintenance schedules and for the proper battery jump starting procedures. While battery charging can be considered a maintenance procedure, the battery charging procedures and related information are located in the standard procedures section of this service manual. This was done because the battery must be fully-charged before any battery system diagnosis or testing procedures can be performed. Refer to Standard procedures for the proper battery charging procedures.

OPERATION

The battery system is designed to provide a safe, efficient, reliable and mobile means of delivering and storing electrical energy. This electrical energy is required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components or circuits in the vehicle.

DIAGNOSIS AND TESTING - BATTERY SYSTEM

The battery, starting, and charging systems in the vehicle operate with one another and must be tested as a complete system. In order for the engine to start and the battery to maintain its charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to Charging System for the proper charging system on-board diagnostic test procedures.

MICRO 420 ELECTRICAL SYSTEM TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 electrical system tester.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE.	1. The electrical system ignition-off draw is excessive.	1. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the excessive ignition-off draw, as required.
	2. The charging system is faulty.	2. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	3. The battery is discharged.	3. Determine the battery state-of-charge using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Charge the faulty battery, as required.
	4. The battery terminal connections are loose or corroded.	4. Refer to Battery Cables for the proper battery cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	5. The battery has an incorrect size or rating for this vehicle.	5. Refer to Battery System Specifications for the proper size and rating. Replace an incorrect battery, as required.
	6. The battery is faulty.	6. Determine the battery cranking capacity using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Replace the faulty battery, as required.
	7. The starting system is faulty.	7. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	8. The battery is physically damaged.	8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED.	1. The battery has an incorrect size or rating for this vehicle.	1. Refer to Battery System Specifications for the proper specifications. Replace an incorrect battery, as required.
	2. The battery terminal connections are loose or corroded.	2. Refer to Battery Cable for the proper cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	3. The electrical system ignition-off draw is excessive.	3. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the faulty electrical system, as required.
	4. The battery is faulty.	4. Test the battery using the Micro 420 battery tester. Refer to Standard Procedures for additional test procedures. Replace the faulty battery, as required.
	5. The starting system is faulty.	5. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	6. The charging system is faulty.	6. Determine if the charging system is performing to specifications using the Micro 420 battery. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	7. Electrical loads exceed the output of the charging system.	7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.
	8. Slow driving or prolonged idling with high-amperage draw systems in use.	8. Advise the vehicle operator, as required.
THE BATTERY WILL NOT ACCEPT A CHARGE.	1. The battery is faulty.	1. Test the battery using the Micro 420 battery tester. Charge or replace the faulty battery, as required.

ABNORMAL BATTERY DISCHARGING

Any of the following conditions can result in abnormal battery discharging:

1. A faulty or incorrect charging system component. Refer to Charging System for additional charging system diagnosis and testing procedures.
2. A faulty or incorrect battery. Use Micro 420 battery tester and refer to Battery System for additional battery diagnosis and testing procedures.
3. A faulty circuit or component causing excessive ignition-off draw.
4. Electrical loads that exceed the output of the charging system. This can be due to equipment installed after manufacture, or repeated short trip use.
5. A faulty or incorrect starting system component. Refer to Starting System for the proper starting system diagnosis and testing procedures.
6. Corroded or loose battery posts and/or terminal clamps.
7. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw systems in use.

BATTERY SYSTEM (Continued)

CLEANING

The following information details the recommended cleaning procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Clean the battery cable terminal clamps of all corrosion. Remove any corrosion using a wire brush or a post and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 1).

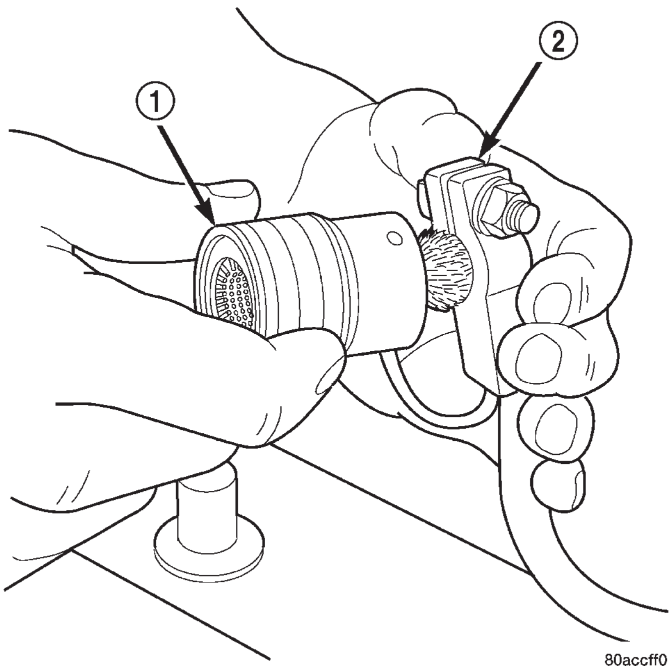


Fig. 1 Clean Battery Cable Terminal Clamp - Typical

1 - TERMINAL BRUSH
2 - BATTERY CABLE

(2) Clean the battery tray and battery holddown hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.

(3) If the removed battery is to be reinstalled, clean the outside of the battery case and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film (Fig. 2). Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, refer to Battery System Specifications for the factory-installed battery specifications. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.

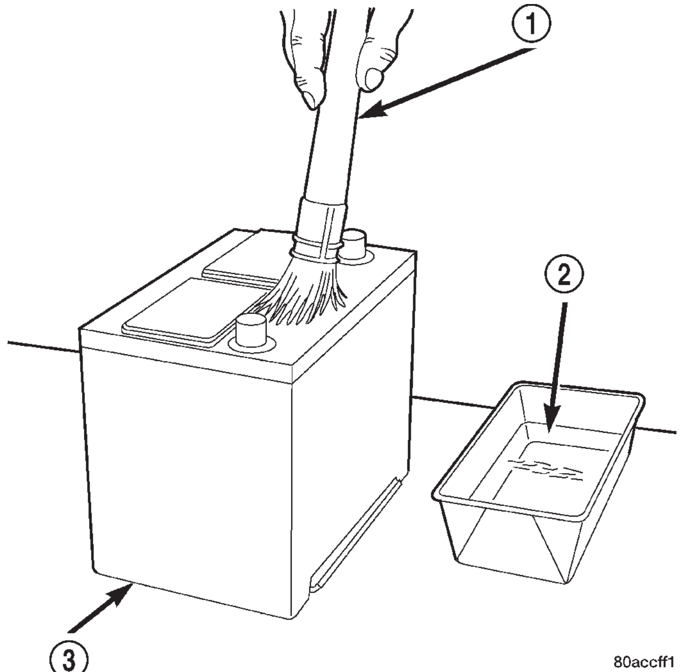


Fig. 2 Clean Battery - Typical

1 - CLEANING BRUSH
2 - WARM WATER AND BAKING SODA SOLUTION
3 - BATTERY

(4) Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 3).

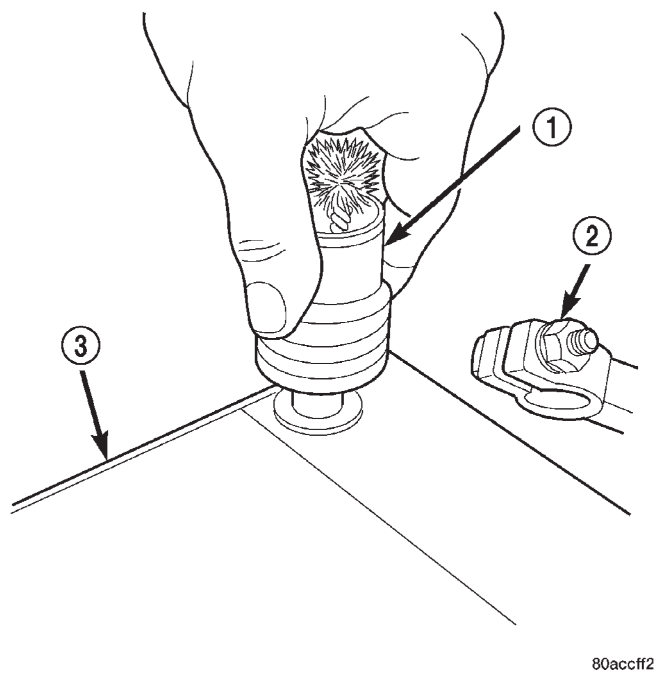


Fig. 3 Clean Battery Terminal Post - Typical

1 - TERMINAL BRUSH
2 - BATTERY CABLE
3 - BATTERY

BATTERY SYSTEM (Continued)

INSPECTION

The following information details the recommended inspection procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.

(2) Inspect the battery tray and battery holddown hardware for damage. Replace any damaged parts.

(3) Slide the thermal guard off of the battery case. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.

(4) Inspect the battery built-in test indicator sight glass for an indication of the battery condition. If the battery is discharged, charge as required. Refer to Standard Procedures for the proper battery built-in indicator test procedures. Also refer to Standard Procedures for the proper battery charging procedures.

SPECIFICATIONS

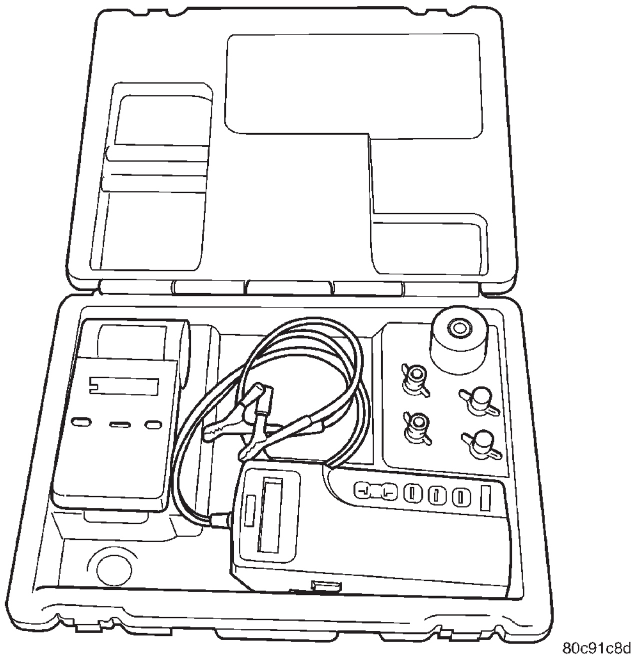
The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Battery sizes and ratings are discussed in more detail below.

- **Group Size** - The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.
- **Cold Cranking Amperage** - The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.
- **Reserve Capacity** - The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.
- **Ampere-Hours** - The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.

BATTERY CLASSIFICATIONS & RATINGS					
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere - Hours	Load Test Amperage
56041113	65	625	120 Minutes	69	300

BATTERY SYSTEM (Continued)

SPECIAL TOOLS



MICRO 420 BATTERY AND CHARGING SYSTEM TESTER

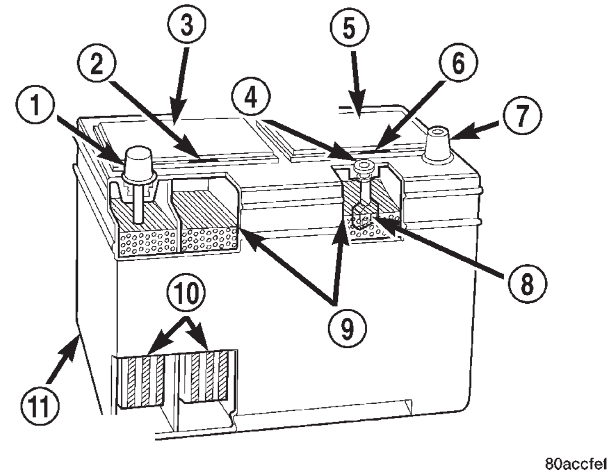


Fig. 4 Low-Maintenance Battery - Typical

1 - POSITIVE POST
2 - VENT
3 - CELL CAP
4 - TEST INDICATOR
5 - CELL CAP
6 - VENT
7 - NEGATIVE POST
8 - GREEN BALL
9 - ELECTROLYTE LEVEL
10 - PLATE GROUPS
11 - LOW-MAINTENANCE BATTERY

BATTERY

DESCRIPTION

A large capacity, low-maintenance storage battery (Fig. 4) is standard factory-installed equipment on this model. Male post type terminals made of a soft lead material protrude from the top of the molded plastic battery case to provide the means for connecting the battery to the vehicle electrical system. The battery positive terminal post is visibly larger in diameter than the negative terminal post, for easy identification. The letters **POS** and **NEG** are also molded into the top of the battery case adjacent to their respective positive and negative terminal posts for additional identification confirmation. Refer to **Battery Cables** in the index of this service manual for the location of more information on the battery cables that connect the battery to the vehicle electrical system.

This battery is designed to provide a safe, efficient and reliable means of storing electrical energy in a chemical form. This means of energy storage allows the battery to produce the electrical energy required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups that are connected with lead straps to the positive terminal post, and negatively charged plate groups that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with lead dioxide (positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called an electrolyte.

Some factory-installed batteries have a built-in test indicator (hydrometer). The color visible in the sight glass of the indicator will reveal the battery condition. For more information on the use of the built-in test indicator, refer to **Standard Procedures The factory-installed low-maintenance battery has removable battery cell caps.** Distilled water can be added to this battery. The battery is not sealed and has vent holes in the cell caps. The chemical composition of the metal coated plates within the low-maintenance battery reduces battery gassing and water loss, at normal charge and discharge rates. Therefore, the battery should not require additional water in normal service. If the electrolyte level in this battery does become low, distilled water must be added. However, rapid loss of electrolyte can be caused by an overcharging condition. Be certain to

BATTERY (Continued)

diagnose the charging system after replenishing the water in the battery for a low electrolyte condition and before returning the vehicle to service. Refer to **Charging System** for additional information.

For battery maintenance schedules and jump starting procedures, see the owner's manual in the vehicle glove box. Optionally, refer to **Maintenance Schedules** and **Jump Starting, Towing and Hoisting** in the index of this service manual for the location of the recommended battery maintenance schedules and the proper battery jump starting procedures. While battery charging can be considered a maintenance procedure, the battery charging procedures and information are located in the service procedures section of this service manual. This was done because the battery must be fully-charged before any battery diagnosis or testing procedures can be performed. Refer to **Standard Procedures** in the index of this service manual for the location of the proper battery charging procedures.

OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite. If the electrolyte level is low, the battery may arc internally and explode. If the battery is equipped with removable cell caps, add distilled water whenever the electrolyte level is below the top of the plates. If the battery cell caps cannot be removed, the battery must be replaced if the electrolyte level becomes low.

DIAGNOSIS AND TESTING - BATTERY

The battery must be completely charged and the terminals should be properly cleaned and inspected before diagnostic procedures are performed. Refer to Battery System Cleaning for the proper cleaning procedures, and Battery System Inspection for the proper battery inspection procedures. Refer to Standard Procedures for the proper battery charging procedures.

MICRO 420 ELECTRICAL SYSTEM TESTER

The Micro420 automotive battery tester is designed to help the dealership technicians diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro420 electrical system tester.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING OR LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be load tested

BATTERY (Continued)

to determine its cranking capacity. A battery that is fully-charged, but does not pass the load test, is faulty and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Standard Procedures for the proper battery charging procedures.

STANDARD PROCEDURE

STANDARD PROCEDURE - BATTERY CHARGING

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- Micro 420 electrical system tester indicates battery is OK.
- All of the battery cells are gassing freely during battery charging.
- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity of the battery electrolyte.
- Open-circuit voltage of the battery is 12.4 volts or above.

WARNING: NEVER EXCEED TWENTY AMPERES WHEN CHARGING A COLD (-1° C [30° F] OR LOWER) BATTERY. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

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WARNING: IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.

CAUTION: Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.

CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine the battery cranking capacity. Refer to Standard Procedures for the proper battery load test procedures. If the battery will endure a load test, return the battery to service. If the battery will not endure a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. Refer to Battery System Cleaning for the proper battery system cleaning procedures, and Battery System Inspection for the proper battery system inspection procedures.

CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt (Fig. 5). If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.

BATTERY (Continued)

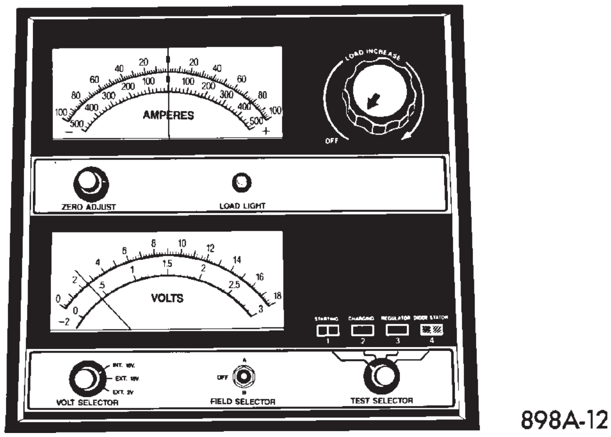

Fig. 5 Voltmeter - Typical

(2) Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

(3) Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

CHARGE RATE TABLE	
Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

BATTERY CHARGING TIME TABLE			
Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging @ 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
Below 10.00	18 hours	9 hours	4.5 hours

STANDARD PROCEDURE - USING MICRO 420 ELECTRICAL TESTER

Always use the Micro 420 Instruction Manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:

WARNING: ALWAYS WEAR APPROPRIATE EYE PROTECTION AND USE EXTREME CAUTION WHEN WORKING WITH BATTERIES.

BATTERY TESTING

(1) If testing the battery OUT-OF-VEHICLE, clean the battery terminals with a wire brush before testing. If the battery is equipped with side post terminals, install and tighten the supplied lead terminal stud adapters. Do not use steel bolts. Failure to properly install the stud adapters, or using stud adapters that are dirty or worn-out may result in false test readings.

BATTERY (Continued)

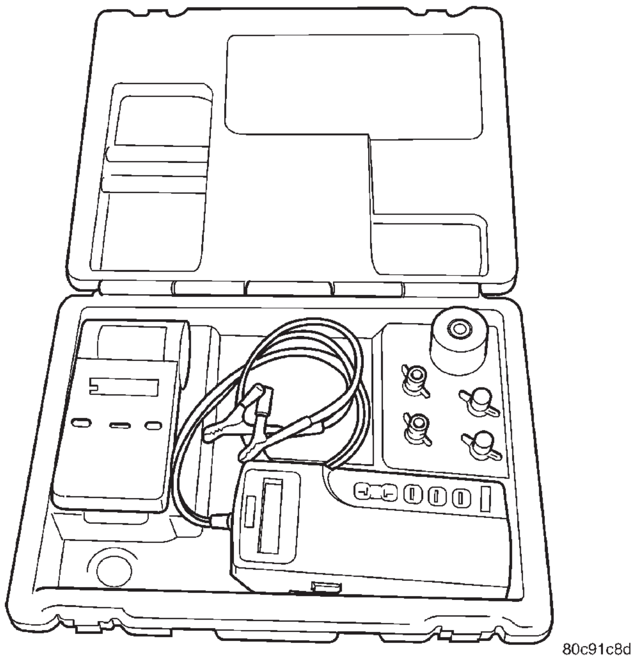

Fig. 6 MICRO 420 BATTERY AND CHARGING SYSTEM TESTER

(2) If testing the battery IN-THE-VEHICLE, make certain all of the vehicle accessory loads are OFF, including the ignition. **The preferred test position is at the battery terminal**. If the battery is not accessible, you may test using both the positive and negative jumper posts. Select TESTING AT JUMPER POST when connecting to that location.

(3) Connect the tester (Fig. 6) to the battery or jumper posts, the red clamp to positive (+) and the black clamp to negative (–).

NOTE: Multiple batteries connected in parallel must have the ground cable disconnected to perform a battery test. Failure to disconnect may result in false battery test readings.

(4) Using the ARROW key select **in** or **out** of vehicle testing and press ENTER to make a selection.

(5) If not selected, choose the Cold Cranking Amp (CCA) battery rating. Or select the appropriate battery rating for your area (see menu). The tester will then run its self programmed test of the battery and display the results. Refer to the test result table noted below.

CAUTION: If REPLACE BATTERY is the result of the test, this may mean a poor connection between the vehicle's cables and battery exists. After disconnecting the vehicle's battery cables from the battery, retest the battery using the OUT-OF-VEHICLE test before replacing.

(6) While viewing the battery test result, press the CODE button and the tester will prompt you for the last 4 digits of the VIN. Use the UP/DOWN arrow buttons to scroll to the correct character; then press ENTER to select and move to the next digit. Then press the ENTER button to view the SERVICE CODE. Pressing the CODE button a second time will return you to the test results.

BATTERY TEST RESULTS	
GOOD BATTERY	Return to service
GOOD - RECHARGE	Fully charge battery and return to service
CHARGE & RETEST	Fully charge battery and retest battery
REPLACE BATTERY	Replace the battery and retest complete system
BAD-CELL REPLACE	Replace the battery and retest complete system

NOTE: The SERVICE CODE is required on every warranty claim submitted for battery replacement.

STANDARD PROCEDURE - BUILT-IN INDICATOR TEST

An indicator (hydrometer) built into the top of the battery case provides visual information for battery testing (Fig. 7). Like a hydrometer, the built-in indicator measures the specific gravity of the battery electrolyte. The specific gravity of the electrolyte reveals the battery state-of-charge; however, it will not reveal the cranking capacity of the battery. A load test must be performed to determine the battery cranking capacity. Refer to Standard Procedures for the proper battery load test procedures.

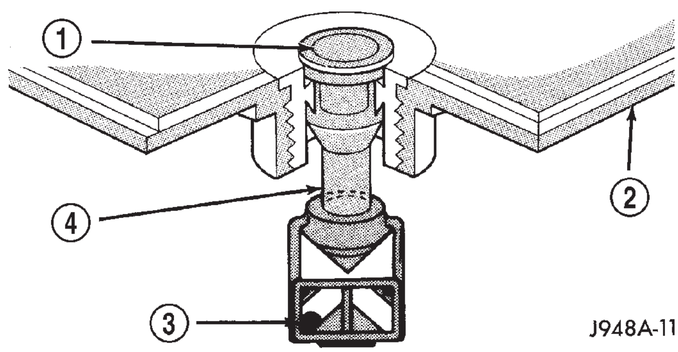

Fig. 7 Built-In Indicator

1 - SIGHT GLASS
2 - BATTERY TOP
3 - GREEN BALL
4 - PLASTIC ROD

BATTERY (Continued)

Before testing, visually inspect the battery for any damage (a cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. In order to obtain correct indications from the built-in indicator, it is important that the battery be level and have a clean sight glass. Additional light may be required to view the indicator. **Do not use open flame as a source of additional light.**

To read the built-in indicator, look into the sight glass and note the color of the indication (Fig. 8). The battery condition that each color indicates is described in the following list:

- **Green** - Indicates 75% to 100% battery state-of-charge. The battery is adequately charged for further testing or return to service. If the starter will not crank for a minimum of fifteen seconds with a fully-charged battery, the battery must be load tested. Refer to Standard Procedures for the proper battery load test procedures.
- **Black or Dark** - Indicates 0% to 75% battery state-of-charge. The battery is inadequately charged and must be charged until a green indication is visible in the sight glass (12.4 volts or more), before the battery is tested further or returned to service. Refer to Standard Procedures for the proper battery charging procedures. Also refer to Diagnosis and Testing for more information on the possible causes of the discharged battery condition.
- **Clear or Bright** - Indicates a low battery electrolyte level. The electrolyte level in the battery is below the built-in indicator. A maintenance-free battery with non-removable cell caps must be replaced if the electrolyte level is low. Water must be added to a low-maintenance battery with removable cell caps before it is charged. Refer to Standard Procedures for the proper battery filling procedures. A low electrolyte level may be caused by an overcharging condition. Refer to Charging System for the proper charging system diagnosis and testing procedures.

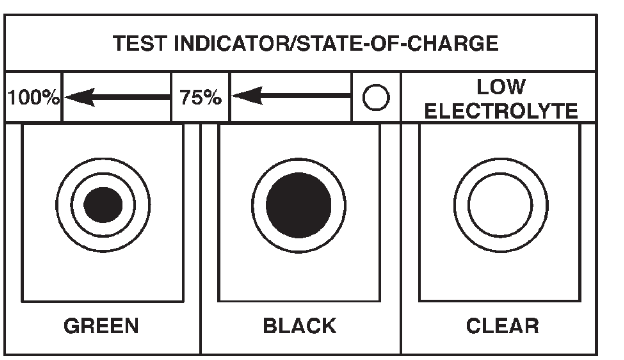

Fig. 8 Built-In Indicator Sight Glass Chart

STANDARD PROCEDURE - OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the approximate state-of-charge of a battery. This test can be used in place of the hydrometer test when a hydrometer is not available, or for maintenance-free batteries with non-removable cell caps.

Before proceeding with this test, completely charge the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

(1) Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.

(2) Disconnect and isolate both battery cables, negative cable first.

(3) Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage (Fig. 9).

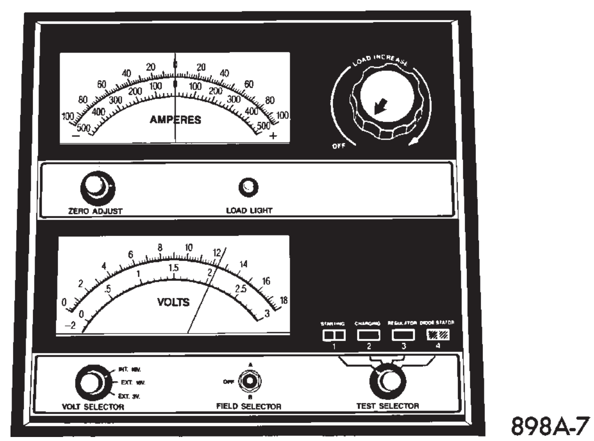

Fig. 9 Testing Open-Circuit Voltage - Typical

See the Open-Circuit Voltage Table. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

OPEN CIRCUIT VOLTAGE TABLE	
Open Circuit Voltage	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

BATTERY (Continued)

STANDARD PROCEDURE - IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to thirty-five milliamperes (0.005 to 0.035 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to thirty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the Power Distribution Center (PDC). This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on.
- Faulty or improperly adjusted switches.
- Faulty or shorted electronic modules and components.
- An internally shorted generator.
- Intermittent shorts in the wiring.

If the IOD is over thirty-five milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

(1) Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes. See the Electronic Module Ignition-Off Draw Table for more information.

ELECTRONIC MODULE IGNITION-OFF DRAW (IOD) TABLE			
Module	Time Out? (If Yes, Interval And Wake-Up Input)	IOD	IOD After Time Out
Radio	No	1 to 3 milliamperes	N/A
Audio Power Amplifier	No	up to 1 milliampere	N/A
Body Control Module (BCM)	No	5.90 milliamperes (max.)	N/A
Powertrain Control Module (PCM)	No	0.95 milliampere	N/A
Transmission Control Module (TCM) 4.7L w/45RFE	YES (20 minutes, ignition on)	130 milliamperes	0.64 milliampere
ElectroMechanical Instrument Cluster (EMIC)	No	0.44 milliampere	N/A
Combination Flasher	No	0.08 milliampere	N/A

(2) Determine that the underhood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.

(3) Disconnect the battery negative cable.

(4) Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.

BATTERY (Continued)

(5) After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Power Distribution Center (PDC) and then in the Junction Block (JB), one at a time until the amperage reading becomes very low, or nonexistent. Refer to the appropriate wiring information in this service manual for complete PDC and JB fuse, circuit breaker, and circuit identification. This will isolate each circuit and identify the circuit that is the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, refer to Charging System for the proper charging system diagnosis and testing procedures. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.

(6) Observe the multi-meter reading. The low-amperage IOD should not exceed thirty-five milliamperes (0.035 ampere). If the current draw exceeds thirty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 5. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

STANDARD PROCEDURE - CHECKING BATTERY ELECTROLYTE LEVEL

The following procedure can be used to check the battery electrolyte level.

(1) Remove the battery cell caps (Fig. 10).

(2) Look through the battery cap holes to determine the level of the electrolyte in the battery (Fig. 11). The electrolyte should be approximately 1 centimeter above the battery plates or until the hook inside the battery cap holes is covered.

(3) Add only distilled water until the electrolyte level is approx. one centimeter above the plates.

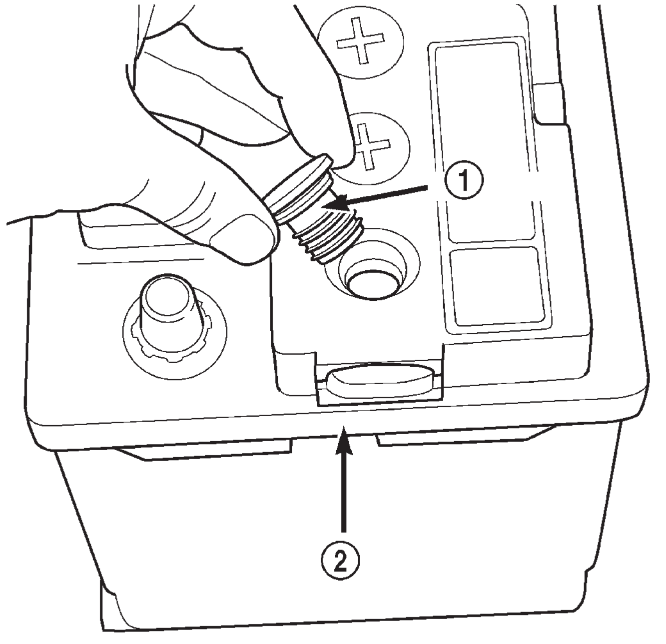

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Fig. 10 Battery Caps - Export Battery

1 - BATTERY CAP
2 - BATTERY

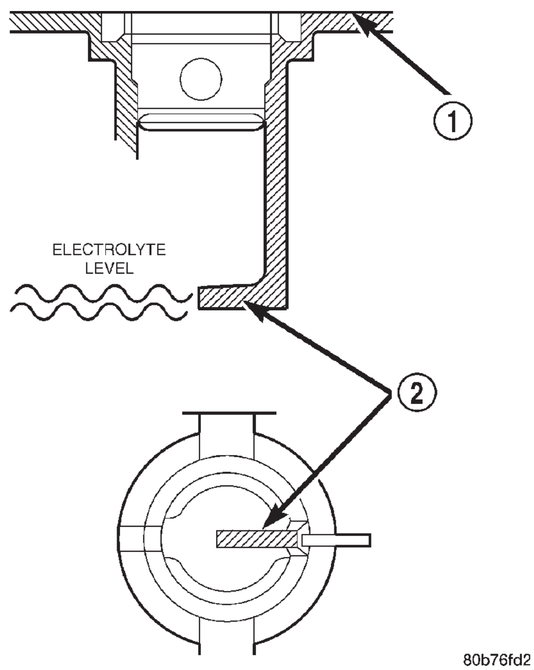

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Fig. 11 Hook Inside Battery Cap Holes - Export Battery

1 - BATTERY SURFACE COVER
2 - HOOK

BATTERY (Continued)

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post (Fig. 12).

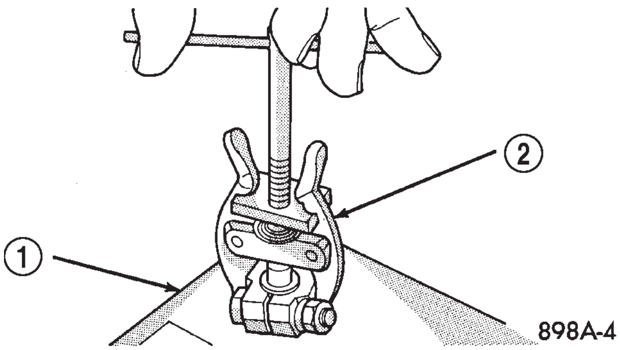


Fig. 12 Remove Battery Cable Terminal Clamp - Typical

1 - BATTERY
2 - BATTERY TERMINAL PULLER

(4) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(6) Remove the battery hold down from the battery. Refer to **Battery Hold Down** in this section of the service manual for the procedure.

WARNING: WEAR A SUITABLE PAIR OF RUBBER GLOVES (NOT THE HOUSEHOLD TYPE) WHEN REMOVING A BATTERY BY HAND. SAFETY GLASSES SHOULD ALSO BE WORN. IF THE BATTERY IS CRACKED OR LEAKING, THE ELECTROLYTE CAN BURN THE SKIN AND EYES.

(7) Remove the battery from the battery tray.

INSTALLATION

(1) Clean and inspect the battery. Refer to the procedures in this section.

(2) Position the battery onto the battery tray as a unit. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables (Fig. 13) or (Fig. 14).

(3) Reinstall the battery hold downs onto the battery. Refer to **Battery Hold Downs**

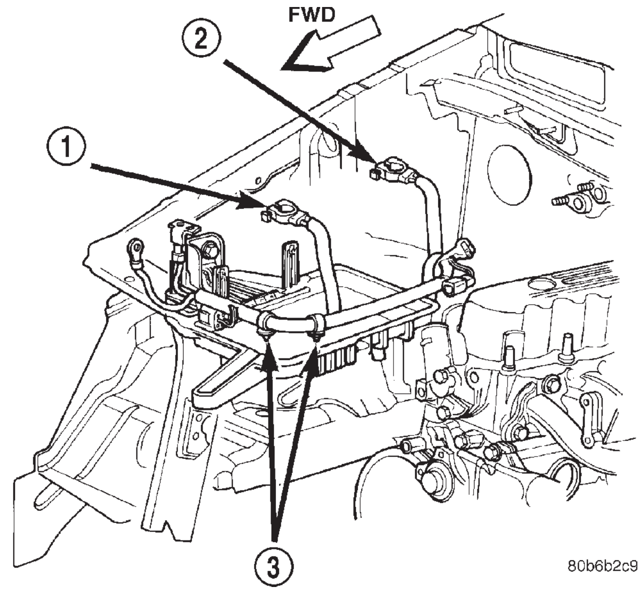


Fig. 13 Battery Cables - 4.0L Engine

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - CLIPS

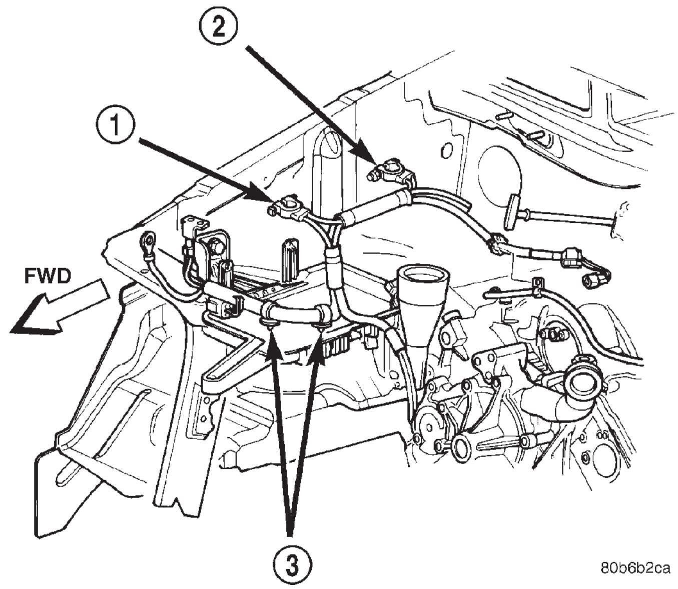


Fig. 14 Battery Cables - 4.7L Engine

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - CLIPS

CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reverse battery polarity may damage electrical components of the vehicle.

(4) Clean the battery cable terminal clamps and the battery terminal posts.

BATTERY (Continued)

(5) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 6.8 N·m (60 in. lbs.).

(6) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 6.8 N·m (60 in. lbs.).

(7) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

BATTERY HOLDDOWN

DESCRIPTION

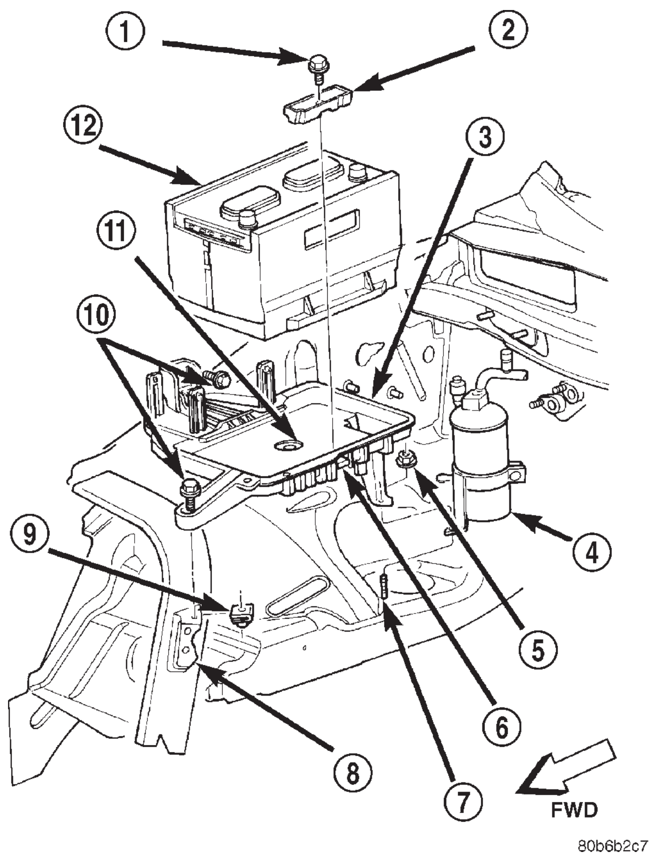


Fig. 15 Battery Hold Downs

1 - SCREW
2 - HOLD DOWN BRACKET
3 - BATTERY SUPPORT
4 - ACCUMULATOR
5 - NUT
6 - U-NUT
7 - STUD
8 - RADIATOR SUPPORT BRACKET
9 - U-NUT
10 - SCREW
11 - BATTERY TEMPERATURE SENSOR
12 - BATTERY

The battery hold down hardware consists of (Fig. 15) a molded plastic lip that is integral to the outboard edge of the battery tray and support unit, a molded plastic hold down bracket, a single hex screw with a coned washer and a U-nut.

When installing a battery into the battery tray, be certain that the hold down hardware is properly installed and that the fasteners are tightened to the proper specifications. Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the vehicle or both.

OPERATION

The battery holddown secures the battery in the battery tray. This holddown is designed to prevent battery movement during the most extreme vehicle operation conditions. Periodic removal and lubrication of the battery holddown hardware is recommended to prevent hardware seizure at a later date.

CAUTION: Never operate a vehicle without a battery holddown device properly installed. Damage to the vehicle, components and battery could result.

REMOVAL

All of the battery hold down hardware can be serviced without removal of the battery or the battery tray and support unit.

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(4) Remove the screw with washer that secures the battery hold down bracket to the U-nut on the inboard side of the battery tray and support unit (Fig. 16).

(5) Remove the battery hold down bracket from the battery tray and support unit.

INSTALLATION

All of the battery hold down hardware can be serviced without removal of the battery or the battery tray and support unit.

(1) Clean and inspect the battery hold down hardware. Refer to the procedures in this section of the service manual.

(2) Be certain that the battery is properly positioned in the battery tray and support unit. The ledge on the outboard side of the battery case must be engaged under the lip on the outboard side of the battery tray and support unit.

BATTERY HOLDDOWN (Continued)

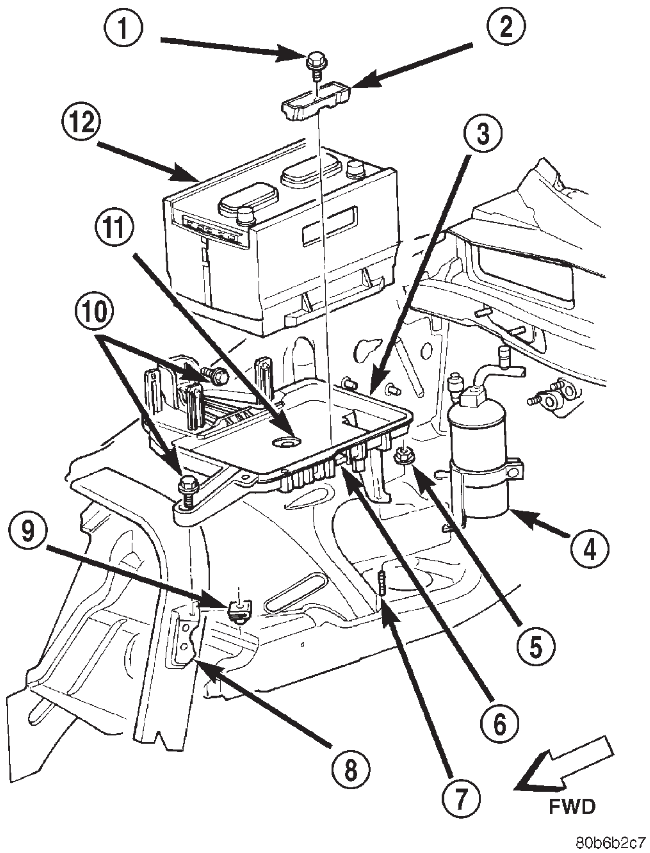


Fig. 16 Battery Hold Downs Remove/Install

1 - SCREW
2 - HOLD DOWN BRACKET
3 - BATTERY SUPPORT
4 - ACCUMULATOR
5 - NUT
6 - U-NUT
7 - STUD
8 - RADIATOR SUPPORT BRACKET
9 - U-NUT
10 - SCREW
11 - BATTERY TEMPERATURE SENSOR
12 - BATTERY

(3) Position the battery hold down bracket over the ledge on the inboard side of the battery case in the battery tray and support unit. Be certain that the ledge on the bottom of the hold down bracket is oriented towards the inboard side of the battery case. Proper hold down bracket orientation may also be determined by noting the direction of the arrow-like formations of the molded reinforcing ribs on the top of the hold down bracket. These arrows should be pointed towards the battery.

(4) Install and tighten the screw that secures the battery hold down bracket to the U-nut on the inboard side of the battery tray and support unit. Tighten thew screw to 3.4 N·m (30 in. lbs.).

(5) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

BATTERY CABLE

DESCRIPTION

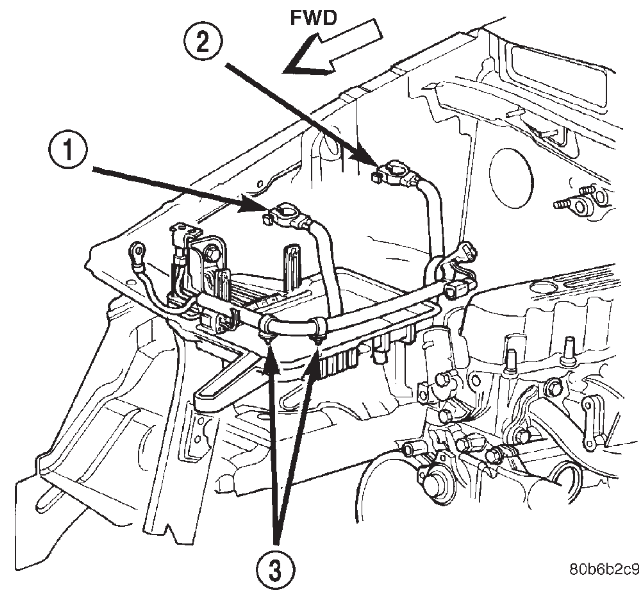


Fig. 17 Battery Cables - 4.0L Engine

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - CLIPS

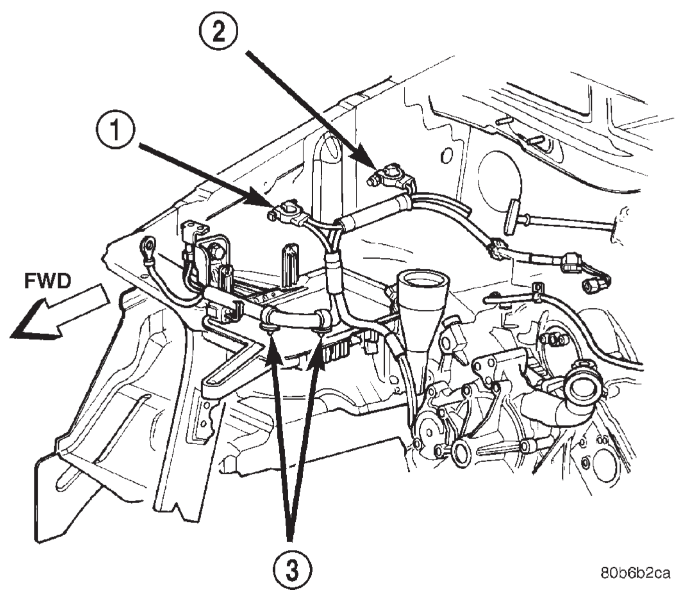


Fig. 18 Battery Cables - 4.7L Engine

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - CLIPS

BATTERY CABLE (Continued)

The battery cables (Fig. 17) or (Fig. 18) are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity. Refer to **Wiring Diagrams** for battery cable wire gauge information.

A clamping type female battery terminal made of soft lead is die cast onto one end of the battery cable wire. A square headed pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a black insulating jacket and a smaller female battery terminal clamp.

The battery cables cannot be repaired and, if damaged or faulty they must be replaced. Both the battery positive and negative cables are available for service replacement only as a unit with the battery wire harness, which may include portions of the wiring circuits for the generator and other components on some models. Refer to **Wiring Diagrams** for more information on the various wiring circuits included in the battery wire harness for the vehicle being serviced.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a path back to the battery for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the opposite ends of the battery cable wires from the female battery terminal clamps provide secure and reliable connection of the battery cables to the vehicle electrical system.

The battery positive cable terminal clamp is die cast onto the ends of two wires. One wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the Power Distribution Center (PDC), and the other wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the engine starter motor solenoid. The battery negative cable terminal clamp is also die cast onto the ends of two wires. One wire has an eyelet terminal that connects the battery negative cable to the vehicle powertrain through a stud on the right side of the engine cylinder block. The other wire has an eyelet terminal that connects the battery negative cable to the vehicle body through a ground screw on the right front fender inner shield, near the battery.

DIAGNOSIS AND TESTING - BATTERY CABLES

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cable. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

VOLTAGE DROP TEST

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and load tested. Refer to Standard Procedures for the proper battery charging and load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic Shut Down (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

BATTERY CABLE (Continued)

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable terminal clamp (Fig. 19). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.

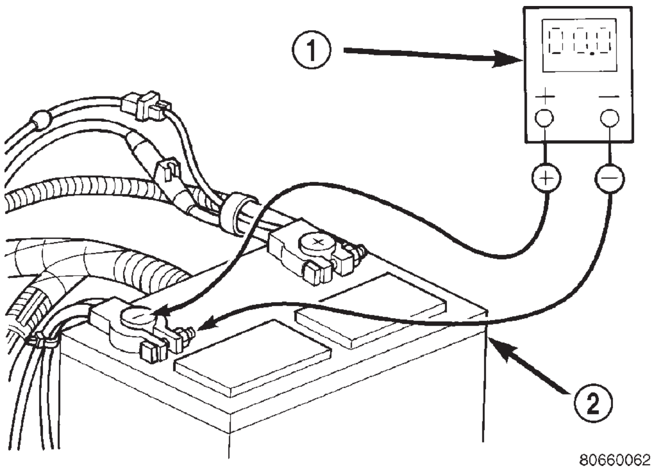


Fig. 19 TEST BATTERY NEGATIVE CONNECTION RESISTANCE - TYPICAL

1 - VOLTMETER
2 - BATTERY

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable terminal clamp (Fig. 20). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.

(3) Connect the voltmeter to measure between the battery positive cable terminal clamp and the starter solenoid B(+) terminal stud (Fig. 21). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

(4) Connect the voltmeter to measure between the battery negative cable terminal clamp and a good clean ground on the engine block (Fig. 22). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

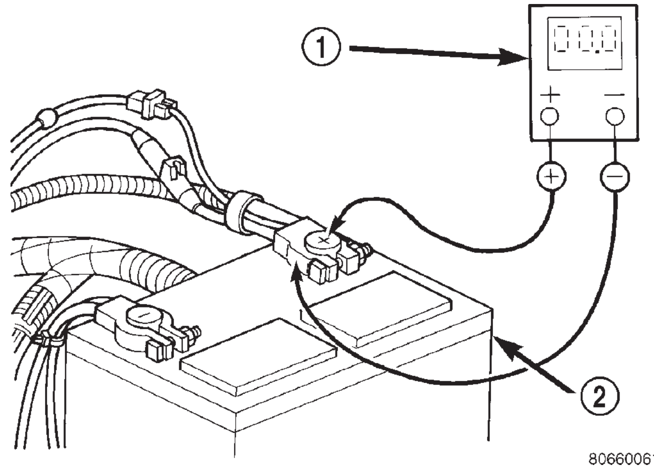


Fig. 20 TEST BATTERY POSITIVE CONNECTION RESISTANCE - TYPICAL

1 - VOLTMETER
2 - BATTERY

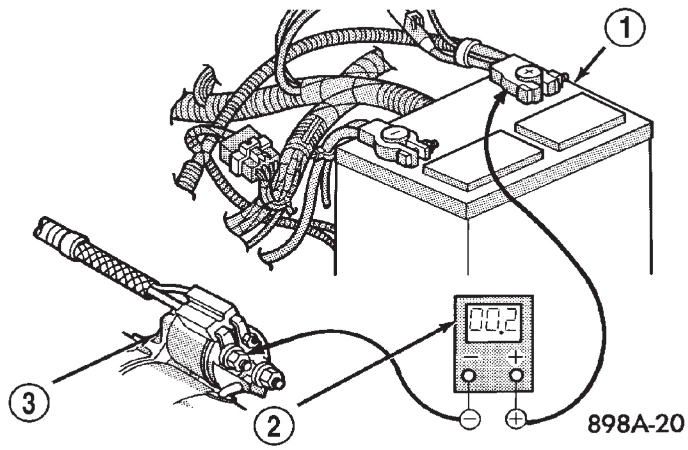


Fig. 21 TEST BATTERY POSITIVE CABLE RESISTANCE - TYPICAL

1 - BATTERY
2 - VOLTMETER
3 - STARTER MOTOR

REMOVAL

Both the battery negative cable and the battery positive cable are serviced in the battery wire harness. If either battery cable is damaged or faulty, the battery wire harness unit must be replaced.

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

BATTERY CABLE (Continued)

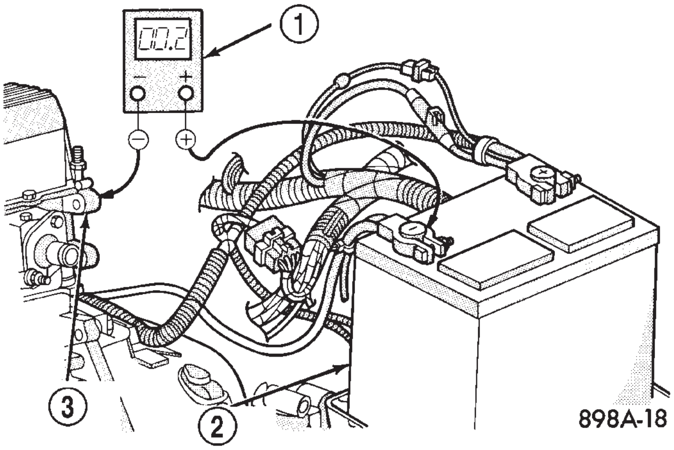


Fig. 22 TEST GROUND CIRCUIT RESISTANCE - TYPICAL

1 - VOLTMETER
2 - BATTERY
3 - ENGINE GROUND

(4) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(6) Unlatch and open the cover on the Power Distribution Center (PDC).

(7) Remove the two nuts that secure the battery positive cable and generator output cable eyelet terminal to the B(+) terminal studs in the PDC.

(8) Remove the battery positive cable and generator output cable eyelet terminal from the B(+) terminal studs in the PDC.

(9) Disconnect the battery wire harness connector from the right headlamp and dash wire harness connector located near the front of the battery.

(10) Remove the screw that secures the battery negative cable eyelet terminal to the inner fender shield near the front of the battery.

(11) On models with the 4.7L engine, remove the nut that secures the battery harness clip to the stud on the right side of the intake manifold and remove the clip from the stud.

(12) Unlatch and remove the cover from the generator output terminal stud housing on the back of the generator.

(13) Remove the nut that secures the generator output cable eyelet terminal to the generator output terminal stud.

(14) Remove the generator output cable eyelet terminal from the generator output terminal stud.

(15) Disconnect the battery wire harness connector from the generator field terminal connector receptacle on the back of the generator.

(16) Remove the screw that secures the battery negative cable ground eyelet terminal to the right side of the engine block.

(17) Remove the nut that secures the battery positive cable eyelet terminal to the B(+) terminal stud on the starter solenoid.

(18) Remove the battery positive cable eyelet terminal from the B(+) terminal stud on the starter solenoid.

(19) Disconnect the battery wire harness connector from the connector receptacle on the starter solenoid.

(20) Remove the battery wire harness from the engine compartment.

INSTALLATION

Both the battery negative cable and the battery positive cable are serviced in the battery wire harness. If either battery cable is damaged or faulty, the battery wire harness unit must be replaced.

(1) Clean and inspect the battery cable terminal clamps and the battery terminal posts.

(2) Position the battery wire harness into the engine compartment (Fig. 23) or (Fig. 24).

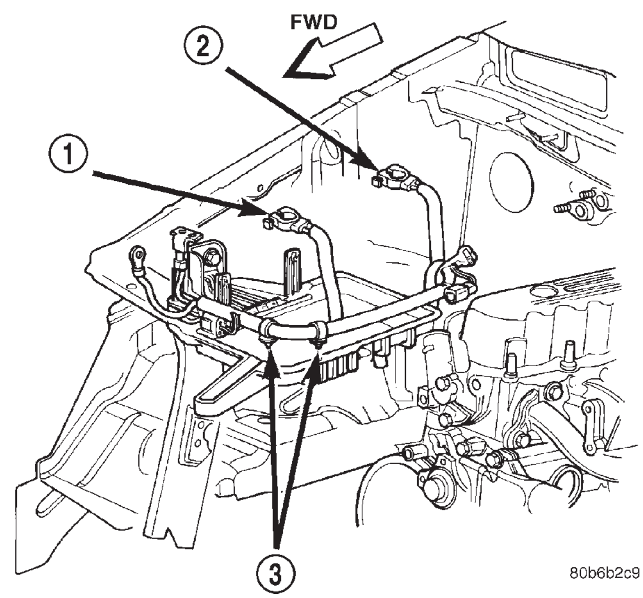


Fig. 23 Battery Cables - 4.0L Engine

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - CLIPS

(3) Reconnect the battery wire harness connector to the connector receptacle on the starter solenoid.

(4) Install the battery positive cable eyelet terminal onto the B(+) terminal stud on the starter solenoid.

BATTERY CABLE (Continued)

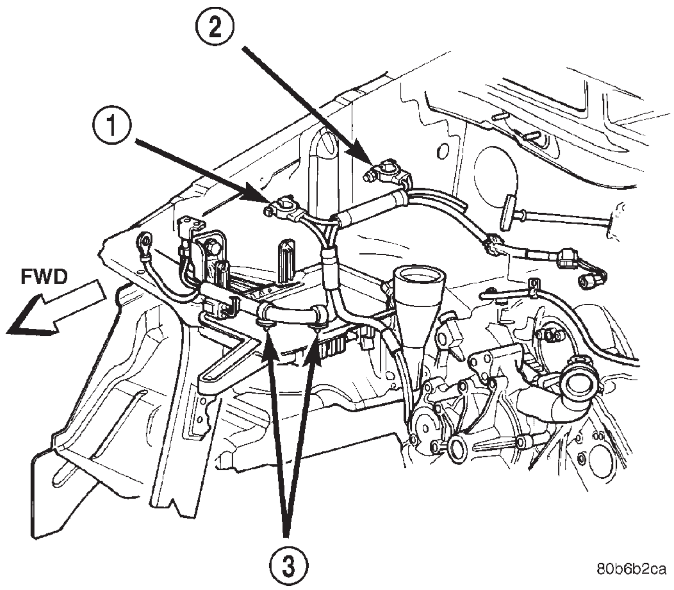


Fig. 24 Battery Cables - 4.7L Engine

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - CLIPS

(5) Install and tighten the nut that secures the battery positive cable eyelet terminal to the B(+) terminal stud on the starter solenoid. Tighten the nut to 11.3 N·m (100 in. lbs.).

(6) Install and tighten the screw that secures the battery negative cable ground eyelet terminal to the right side of the engine block. Tighten the screw to 10.2 N·m (90 in. lbs.) for 4.0L engines, or 13.0 N·m (115 in. lbs.) for 4.7L engines.

(7) Reconnect the battery wire harness connector to the generator field terminal connector receptacle on the back of the generator.

(8) Install the generator output cable eyelet terminal onto the generator output terminal stud.

(9) Install and tighten the nut that secures the generator output cable eyelet terminal to the generator output terminal stud. Tighten the nut to 10.7 N·m (95 in. lbs.).

(10) Position the cover for the generator output terminal stud housing onto the back of the generator and snap it into place.

(11) On models with the 4.7L engine, install the battery harness clip onto the stud on the right side of the intake manifold, then install and tighten the nut that secures the clip to the stud. Tighten the nut to 11.3 N·m (100 in. lbs.).

(12) Install and tighten the screw that secures the battery negative cable eyelet terminal to the inner fender shield near the front of the battery. Tighten the screw to 28.2 N·m (250 in. lbs.).

(13) Reconnect the battery wire harness connector to the right headlamp and dash wire harness connector located near the front of the battery.

(14) Install the battery positive cable and generator output cable eyelet terminal onto the PDC B(+) terminal studs.

(15) Install and tighten the two nuts that secure the battery positive cable and generator output cable eyelet terminal to the PDC B(+) terminal studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(16) Close and latch the PDC cover.

(17) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 6.8 N·m (60 in. lbs.).

(18) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 6.8 N·m (60 in. lbs.).

(19) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

BATTERY TRAY

DESCRIPTION

The battery is mounted in a molded plastic battery tray and support unit (Fig. 25) located in the right front corner of the engine compartment. The battery tray and support unit is secured at the rear with a nut to a stud on the front wheelhouse inner panel, at the outboard side with a screw to the side cowl reinforcement panel, and at the front with a screw through a U-nut on a bracket of the radiator support.

The battery tray and support unit also includes three upright stanchions that are molded into the outboard side of the unit. These stanchions support the Power Distribution Center (PDC). Refer to **Power Distribution Center** in the Power Distribution section of this service manual for more information on the PDC.

A hole in the bottom of the battery tray is fitted with a battery temperature sensor. Refer to **Battery Temperature Sensor** in the Charging section of this service manual for more information on the battery temperature sensor. Refer to **Battery Hold Down** in this section of the service manual for more information on the battery hold down hardware.

BATTERY TRAY (Continued)

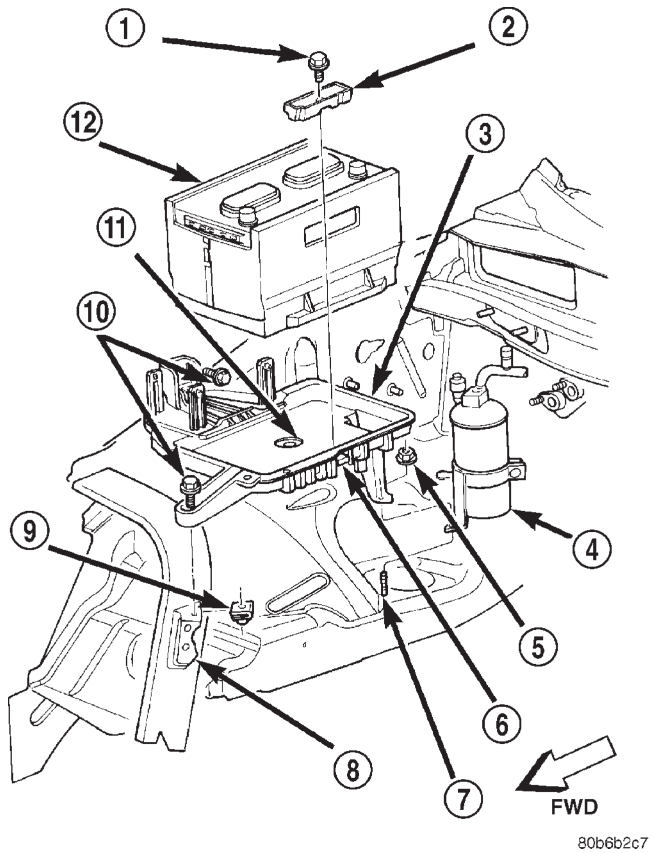


Fig. 25 Battery Tray and Support

1 - SCREW
2 - HOLD DOWN BRACKET
3 - BATTERY SUPPORT
4 - ACCUMULATOR
5 - NUT
6 - U-NUT
7 - STUD
8 - RADIATOR SUPPORT BRACKET
9 - U-NUT
10 - SCREW
11 - BATTERY TEMPERATURE SENSOR
12 - BATTERY

OPERATION

The battery tray provides a secure mounting location and supports the battery. On some vehicles, the battery tray also provides the anchor point/s for the battery holddown hardware. The battery tray and the battery holddown hardware combine to secure and stabilize the battery in the engine compartment, which prevents battery movement during vehicle operation. Unrestrained battery movement during vehicle operation could result in damage to the vehicle, the battery, or both.

REMOVAL

(1) Remove the battery from the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

(2) Remove the Power Distribution Center (PDC) from the stanchions on the outboard side of the battery tray and support unit. Refer to **Power Distribution Center** in the Power Distribution section of this service manual for PDC removal procedure.

(3) Remove the one screw that secures the front of the battery tray and support unit to the bracket on the right side of the radiator support (Fig. 26).

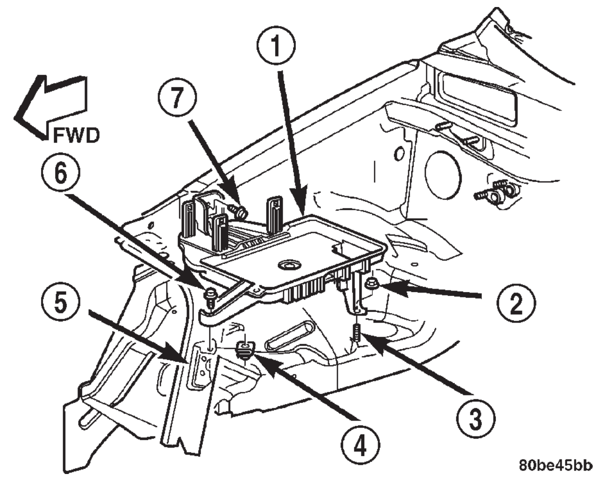


Fig. 26 Battery Tray and Support Remove/Install

1 - BATTERY TRAY AND SUPPORT
2 - NUT (1)
3 - STUD
4 - U-NUT (1)
5 - RADIATOR SUPPORT BRACKET
6 - SCREW (1)
7 - SCREW (1)

(4) Remove the one screw that secures the outboard side of the battery tray and support unit to the right fender side cowl reinforcement.

(5) Remove the one nut that secures the rear of the battery tray and support unit to the stud on the right fender front wheelhouse inner panel.

(6) Remove the battery temperature sensor from the battery tray. Refer to **Battery Temperature Sensor** in the Charging section of this service manual for battery temperature sensor removal procedure.

(7) Remove the battery tray and support unit from the right front corner of the engine compartment.

BATTERY TRAY (Continued)

INSTALLATION

(1) Clean and inspect the battery tray and support unit. Refer to the procedures in this section of the service manual.

(2) Install the battery temperature sensor onto the battery tray. Refer to **Battery Temperature Sensor** in the Charging section of this service manual for battery temperature sensor installation procedure.

(3) Position the battery tray and support unit into the right front corner of the engine compartment. Be certain that no hoses or wire harnesses are trapped or pinched by the installation of the tray.

(4) Install and tighten the one nut that secures the rear of the battery tray and support unit to the stud on the right fender front wheelhouse inner panel. Tighten the nut to 7.3 N·m (65 in. lbs.).

(5) Install and tighten the one screw that secures the outboard side of the battery tray and support unit to the right fender side cowl reinforcement. Tighten the screw to 8.1 N·m (72 in. lbs.).

(6) Install and tighten the one screw that secures the front of the battery tray and support unit to the bracket on the right side of the radiator support. Tighten the screw to 8.1 N·m (72 in. lbs.).

(7) Install the Power Distribution Center (PDC) onto the stanchions on the outboard side of the battery tray and support unit. Refer to **Power Distribution Center** in the Power Distribution section of this service manual for PDC installation procedure.

(8) Install the battery onto the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

CHARGING

TABLE OF CONTENTS

CHARGING

DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch
- Battery (refer to 8, Battery for information)
- Battery temperature sensor
- Generator Lamp (if equipped)
- Check Gauges Lamp (if equipped)
- Voltmeter (refer to 8, Instrument Cluster for information)
- Wiring harness and connections (refer to 8, Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects. Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as reminder to check the three gauges. The signal to activate the lamp is sent via the CCD bus circuits. The lamp is located on the instrument panel. Refer to 8, Instrument Cluster for additional information.

DIAGNOSIS AND TESTING - CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the check gauges lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running

CHARGING (Continued)

• a faulty or improperly adjusted switch that allows a lamp to stay on. Refer to Ignition-Off Draw Test in 8, Battery for more information.

INSPECTION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some charging system circuits are checked continuously, and some are checked only under certain conditions.

Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information. This will include a complete list of DTC's including DTC's for the charging system.

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures service manual and the DRB® scan tool. Perform the following inspections before attaching the scan tool.

(1) Inspect the battery condition. Refer to 8, Battery for procedures.

(2) Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.

(3) Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in 7, Cooling System.

(6) Inspect automatic belt tensioner (if equipped). Refer to 7, Cooling System for information.

(7) Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

SPECIFICATIONS

GENERATOR RATINGS - GAS POWERED

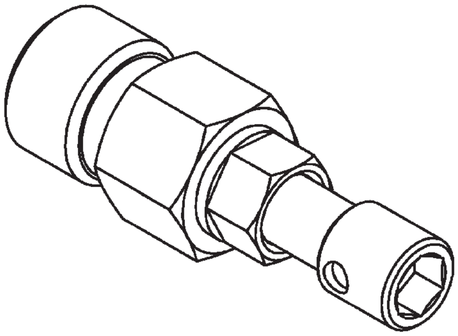
TYPE	PART NUMBER	RATED SAE AMPS	ENGINES	MINIMUM TEST AMPS
BOSCH	56041322	136	4.0L 6-Cylinder	100
DENSO	56041324	136	4.7L V-8	100

TORQUE - GAS POWERED

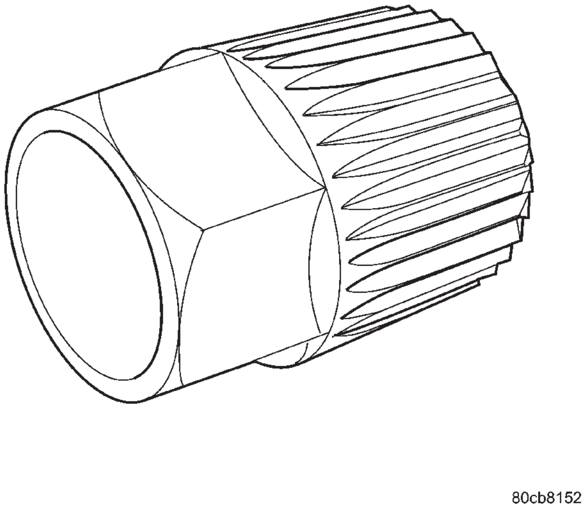
DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Generator Mounting Bolts-4.0L	55	41	
Generator Vertical Mounting Bolt-4.7L	40	29	
Generator (long) Horizontal Mounting Bolt-4.7L	55	41	
Generator (short) Horizontal Mounting Bolt-4.7L	55	41	
Generator B+ Terminal Nut	11		95

CHARGING (Continued)

SPECIAL TOOLS



GENERATOR DECOUPLER TOOL #8433



GENERATOR DECOUPLER TOOL #8823

BATTERY TEMPERATURE SENSOR

DESCRIPTION

The Battery Temperature Sensor (BTS) is attached to the battery tray located under the battery.

OPERATION

The BTS is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The PCM sends 5 volts to the sensor and is grounded through the sensor return line. As temperature increases, resistance in the sensor decreases and the detection voltage at the PCM increases.

The BTS is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled, depending upon BTS input (for example, disable purge and enable Leak Detection Pump (LDP) and O2 sensor heater tests). Most OBD II monitors are disabled below 20 degrees F.

REMOVAL

The battery temperature sensor is located under the vehicle battery (Fig. 1) and is attached to a mounting hole on the battery tray.

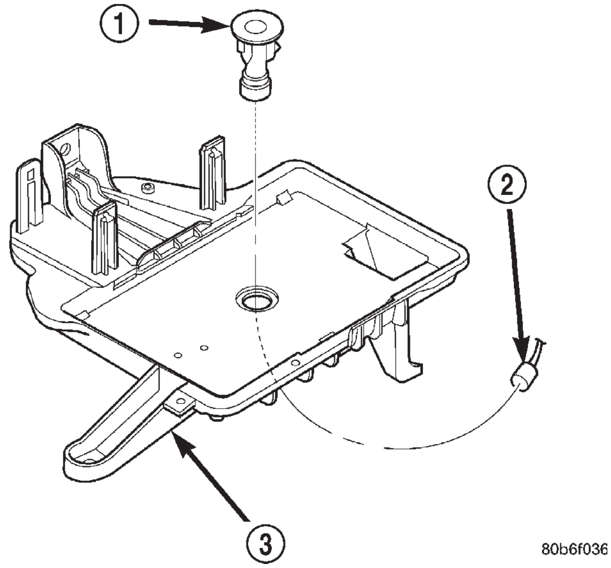


Fig. 1 Battery Temperature Sensor Location

1 - BATTERY TEMPERATURE SENSOR
2 - ENGINE WIRE HARNESS
3 - BATTERY TRAY

The battery temperature sensor is located under the vehicle battery (Fig. 1) and is attached to a mounting hole on the battery tray.

(1) Remove battery. Refer to Group 8A, Battery for procedures.

(2) Remove battery tray.

(3) Pull sensor up from battery tray and disconnect engine wire harness.

(4) Remove sensor from battery tray.

INSTALLATION

The battery temperature sensor is located under the vehicle battery (Fig. 1) and is attached to a mounting hole on the battery tray.

(1) Position sensor into mounting hole and attach wiring harness.

(2) Press sensor into top of battery tray.

(3) Install battery. Refer to Group 8A, Battery for procedures.

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings in the Specifications section at the back of this group for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

REMOVAL

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE (B+ WIRE) FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY OR DAMAGE TO ELECTRICAL SYSTEM.

(1) Disconnect negative battery cable at battery.

(2) Remove generator drive belt. Refer to Cooling System for procedure.

(3) Unsnap cable protector cover from B+ mounting stud (Fig. 2) .

(4) Disconnect (unsnap) 2–wire field connector at rear of generator (Fig. 2) .

(5) Remove generator mounting bolts (Fig. 3) or (Fig. 4).

(6) Remove generator from vehicle.

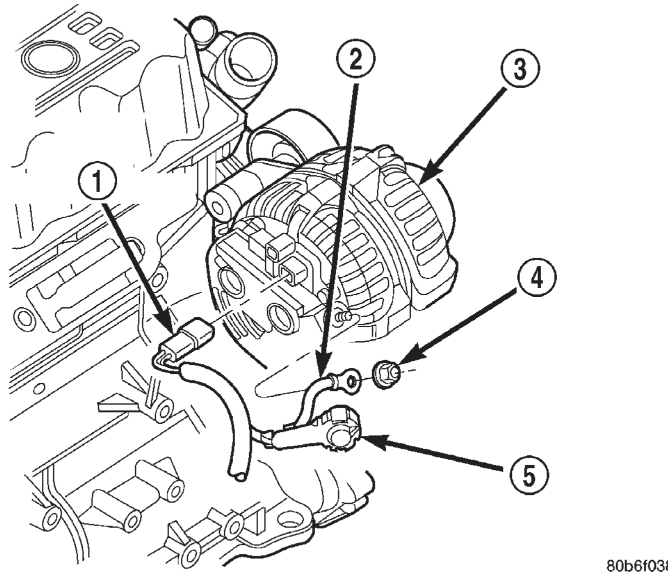


Fig. 2 Generator B+ Cable and Field Wire Connections (Typical—4.0L Engine Shown)

1 - FIELD WIRE CONNECTOR
2 - B+ CABLE
3 - GENERATOR
4 - B+ CABLE MOUNTING NUT
5 - CABLE PROTECTOR

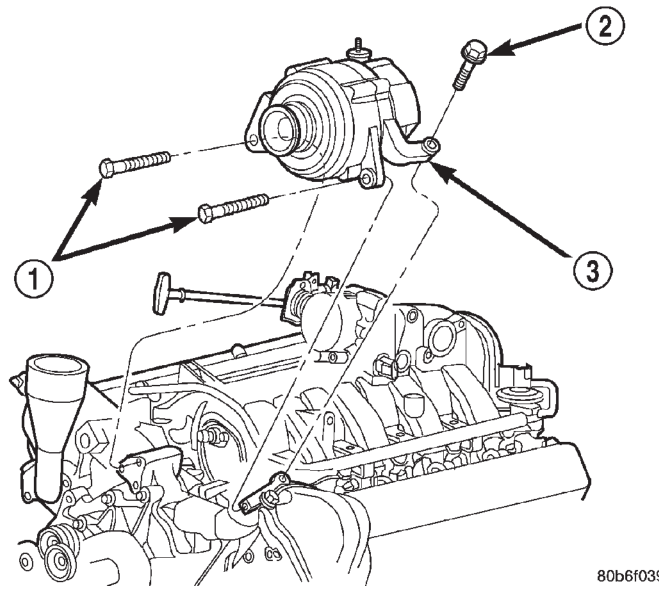


Fig. 3 Remove/Install Generator—4.7L V-8 Engine

1 - LOWER BOLTS
2 - REAR BOLT
3 - GENERATOR

GENERATOR (Continued)

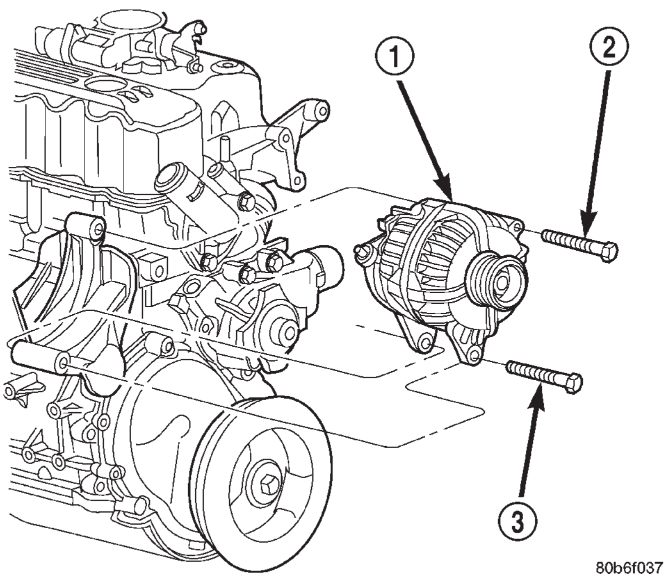


Fig. 4 Remove/Install Generator—4.0L 6–Cylinder Engine

1 - GENERATOR
2 - UPPER BOLT
3 - LOWER BOLT

INSTALLATION

(1) Position generator to engine and install mounting bolts.

(2) Tighten generator mounting bolts as follows:

- Vertical mounting bolt 4.7L engine—40 N·m (29 ft. lbs.)
- Long horizontal mounting bolt 4.7L engine—55 N·m (41 ft. lbs.)
- Short horizontal mounting bolt 4.7L engine—55 N·m (41 ft. lbs.)
- Generator mounting bolts 4.0L engine—55 N·m (41 ft. lbs.)
- B+ terminal nut—11 N·m (95 in. lbs.)

(3) Snap 2–wire field connector into rear of generator.

(4) Snap cable protector cover to B+ mounting stud.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in 7, Cooling System.

(5) Install generator drive belt. Refer to 7, Cooling System for procedure.

(6) Install negative battery cable to battery.

VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging System Operation for additional information.

STARTING

TABLE OF CONTENTS

STARTING

DESCRIPTION

An electrically operated engine starting system is standard factory-installed equipment on this model. The starting system is designed to provide the vehicle operator with a convenient, efficient and reliable means of cranking and starting the internal combustion engine used to power the vehicle and all of its accessory systems from within the safe and secure confines of the passenger compartment. See the owner's manual in the vehicle glove box for more information and instructions on the recommended use and operation of the factory-installed starting system.

The starting system consists of the following components:

- Battery
- Starter relay
- Starter motor (including an integral starter solenoid)
- Ignition switch
- Park/neutral position switch
- Wire harnesses and connections (including the battery cables).

This group provides complete service information for the starter motor and the starter relay. Complete service information for the other starting system components can be located as follows:

- Refer to **Battery** in the proper section of Group 8A - Battery for complete service information for the battery.
- Refer to **Ignition Switch and Key Lock Cylinder** in the proper section of Group 8D - Ignition System for complete service information for the ignition switch.
- Refer to **Park/Neutral Position Switch** in the proper section of Group 21 - Transmission for complete service information for the park/neutral position switch.
- Refer to the proper section of **Group 8W - Wiring Diagrams** for complete service information and circuit diagrams for the starting system wiring components.

Group 8A covers the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The battery, starting, and charging systems in the vehicle operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components that are used in these systems must perform within specifications.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

STARTING (Continued)

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes, and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the park/ neutral position switch, the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

Battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the momentary Start position. The park/neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear on the automatic transmission torque converter drive plate.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter motor from damage by allowing the starter pinion gear to spin faster than the pinion shaft. When the driver releases the ignition switch to the On position, the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid plunger hold-in coil is de-energized.

When the solenoid plunger hold-in coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the starter ring gear.

DIAGNOSIS AND TESTING - STARTING SYSTEM

The battery, starting, and charging systems operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components involved in these systems must perform within specifications.

Group 8A covers the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

STARTING (Continued)

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO OPERATE.	1. Battery discharged or faulty.	1. Refer to Battery in the Diagnosis and Testing section of Group 8A - Battery. Charge or replace the battery, if required.
	2. Starting circuit wiring faulty.	2. Refer to Starting System in Group 8W - Wiring Diagrams. Test and repair the starter feed and/or control circuits, if required.
	3. Starter relay faulty.	3. Refer to Starter Relay in the Diagnosis and Testing section of this group. Replace the starter relay, if required.
	4. Ignition switch faulty.	4. Refer to Ignition Switch and Key Lock Cylinder in the Diagnosis and Testing section of Group 8D - Ignition System. Replace the ignition switch, if required.
	5. Park/Neutral position switch faulty or misadjusted.	5. Refer to Park/Neutral Position Switch in the Diagnosis and Testing section of Group 21 - Transmission. Replace the park/neutral position switch, if required.
	6. Starter solenoid faulty.	6. Refer to Starter Motor in the Diagnosis and Testing section of this group. Replace the starter motor assembly, if required.
	7. Starter motor faulty.	7. If all other starting system components and circuits test OK, replace the starter motor assembly.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty.	1. Refer to Battery in the Diagnosis and Testing section of Group 8A - Battery. Charge or replace the battery, if required.
	2. Starting circuit wiring faulty.	2. Refer to Starting System in Group 8W - Wiring Diagrams. Test and repair the starter feed and/or control circuits, if required.
	3. Starter motor faulty.	3. If all other starting system components and circuits test OK, replace the starter motor assembly.
	4. Engine seized.	4. Refer to Engine Diagnosis in the Diagnosis and Testing section of Group 9 - Engine.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Starter ring gear faulty.	1. Refer to Starter Motor in the Removal and Installation section of this group. Remove the starter motor to inspect the starter ring gear. Replace the starter ring gear, if required.
	2. Starter motor faulty.	2. If all other starting system components and circuits test OK, replace the starter motor assembly.
STARTER DOES NOT DISENGAGE.	1. Starter motor improperly installed.	1. Refer to Starter Motor in the Removal and Installation section of this group. Tighten the starter mounting hardware to the correct tightness specifications.
	2. Starter relay faulty.	2. Refer to Starter Relay in the Diagnosis and Testing section of this group. Replace the starter relay, if required.
	3. Ignition switch faulty.	3. Refer to Ignition Switch and Key Lock Cylinder in the Diagnosis and Testing section of Group 8D - Ignition System. Replace the ignition switch, if required.
	4. Starter motor faulty.	4. If all other starting system components and circuits test OK, replace the starter motor assembly.

STARTING (Continued)

INSPECTION

For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams. Before removing any unit from the starting system for repair or diagnosis, perform the following inspections:

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **Battery** - Visually inspect the battery for indications of physical damage and loose or corroded cable connections. Determine the state-of-charge and cranking capacity of the battery. Charge or replace the battery, if required. Refer to **Battery** in the proper section of Group 8A - Battery for complete service information for the battery.
- **Ignition Switch** - Visually inspect the ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder** in the proper section of Group 8D - Ignition System for complete service information for the ignition switch.
- **Park/Neutral Position Switch** - Visually inspect the park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in the proper section of Group 21 - Transmission for complete service information for the park/neutral position switch.
- **Starter Relay** - Visually inspect the starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter Motor** - Visually inspect the starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect the starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect the wire harnesses for damage. Repair or replace any faulty wiring, as required. Refer to the proper section of **Group 8W - Wiring Diagrams** for complete service information and circuit diagrams for the starting system wiring components.

TESTING

COLD CRANKING TEST

For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to **Battery** in the Diagnosis and Testing section of Group 8A - Battery for the procedures.

(1) Connect a suitable volt-ampere tester to the battery terminals (Fig. 1). See the instructions provided by the manufacturer of the volt-ampere tester being used.

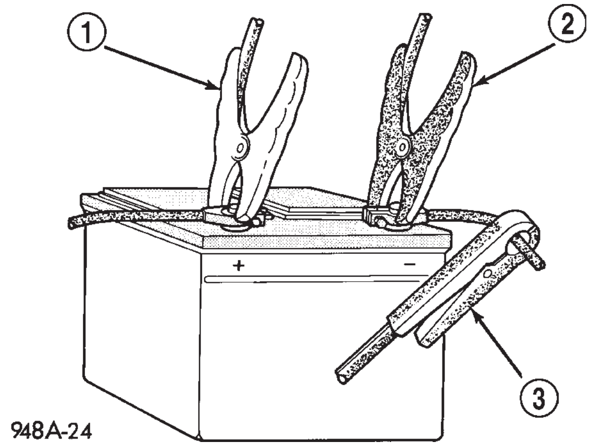


Fig. 1 Volts-Amps Tester Connections - Typical

1 - POSITIVE CLAMP
2 - NEGATIVE CLAMP
3 - INDUCTION AMMETER CLAMP

(2) Fully engage the parking brake.

(3) Place the automatic transmission gearshift selector lever in the Park position.

(4) Verify that all lamps and accessories are turned off.

(5) To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(6) Rotate and hold the ignition switch in the Start position. Note the cranking voltage and current (amperage) draw readings shown on the volt-ampere tester.

(a) If the voltage reads below 9.6 volts, refer to **Starter Motor** in the Diagnosis and Testing section of this group. If the starter motor is OK, refer to **Engine Diagnosis** in the Diagnosis and Testing section of Group 9 - Engine for further testing of the engine. If the starter motor is not OK, replace the faulty starter motor.

STARTING (Continued)

(b) If the voltage reads above 9.6 volts and the current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.

(c) If the voltage reads 12.5 volts or greater and the starter motor does not turn, refer to **Control Circuit Testing** in this section.

(d) If the voltage reads 12.5 volts or greater and the starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

NOTE: A cold engine will increase the starter current (amperage) draw reading, and reduce the battery voltage reading.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in the high-amperage feed circuit. For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams.

When performing these tests, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached.

Example: When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable clamp and the cable connector at the starter solenoid. If you probe the battery positive terminal post and the cable connector at the starter solenoid, you are reading the combined voltage drop in the battery positive cable clamp-to-terminal post connection and the battery positive cable.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing the tests, be certain that the following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in the Diagnosis and Testing section of Group 8A - Battery for the procedures.
- Fully engage the parking brake.
- Place the automatic transmission gearshift selector lever in the Park position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable clamp (Fig. 2). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

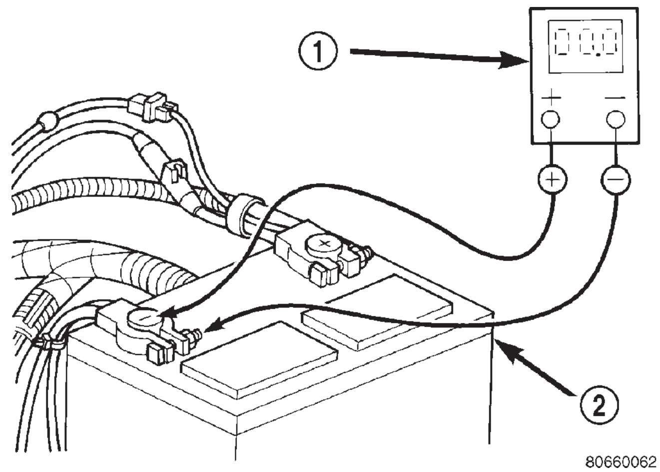


Fig. 2 Test Battery Negative Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable clamp (Fig. 3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

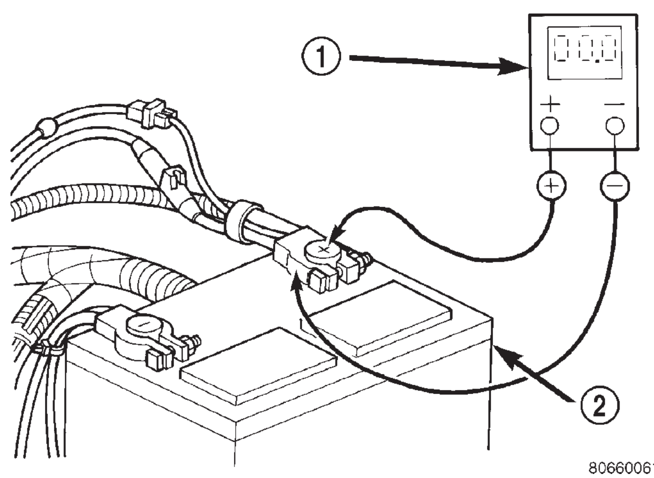


Fig. 3 Test Battery Positive Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

(3) Connect the voltmeter to measure between the battery positive terminal post and the starter solenoid battery terminal stud (Fig. 4). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery cable connection at the solenoid.

STARTING (Continued)

Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

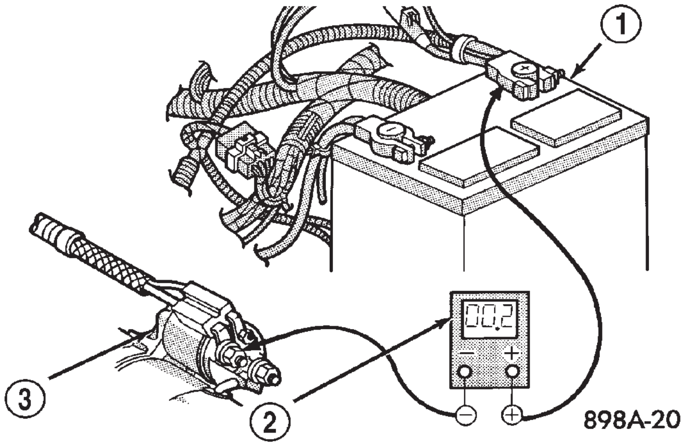


Fig. 4 Test Battery Positive Cable Resistance - Typical

1 - BATTERY
2 - VOLTMETER
3 - STARTER MOTOR

(4) Connect the voltmeter to measure between the battery negative terminal post and a good clean ground on the engine block (Fig. 5). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable attachment on the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

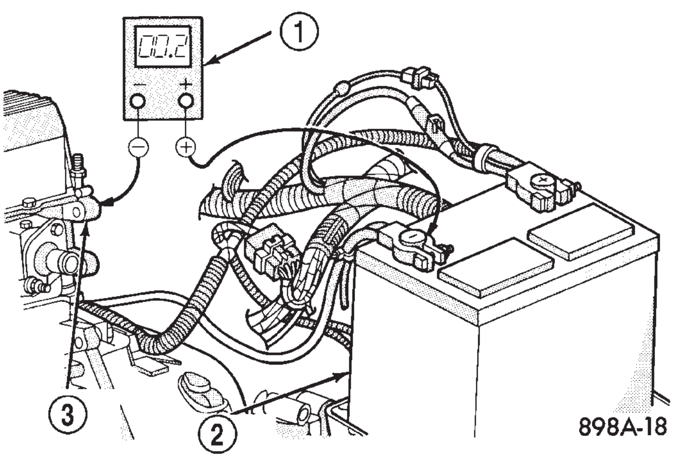


Fig. 5 Test Ground Circuit

1 - VOLTMETER
2 - BATTERY
3 - ENGINE GROUND

(5) Connect the positive lead of the voltmeter to the starter housing. Connect the negative lead of the voltmeter to the battery negative terminal post (Fig. 6). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, correct the poor starter to engine block ground contact.

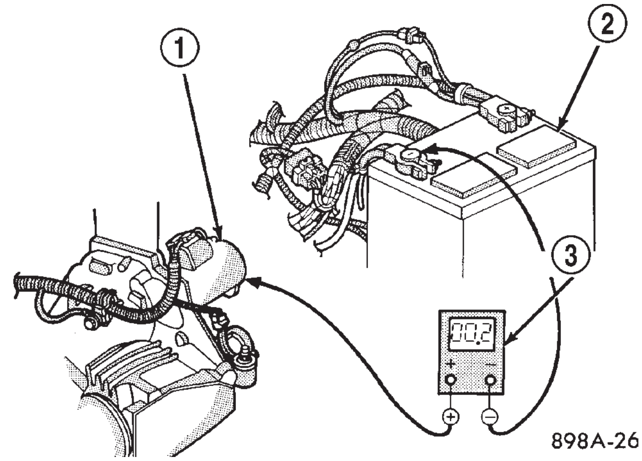


Fig. 6 Test Starter Ground - Typical

1 - STARTER MOTOR
2 - BATTERY
3 - VOLTMETER

If the resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing section of this group.

CONTROL CIRCUIT TESTING

The starter control circuit components should be tested in the order in which they are listed, as follows:

- **Starter Relay** - Refer to **Starter Relay** in the Diagnosis and Testing section of this group for the procedures.
- **Starter Solenoid** - Refer to **Starter Motor** in the Diagnosis and Testing section of this group for the procedures.
- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder** in the Diagnosis and Testing section of Group 8D - Ignition System for the procedures.
- **Park/Neutral Position Switch** - Refer to **Park/Neutral Position Switch** in the Diagnosis and Testing section of Group 21 - Transmission for the procedures.
- **Wire harnesses and connections** - Refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

STARTING (Continued)

SPECIFICATIONS

TORQUE - STARTER

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Stater Motor (B+) Terminal (Diesel)	27	20	
Stater Motor (B+) Terminal (Except Diesel)	11.3		100
Starter Motor Retaining Bolts (Diesel)	27	20	
Starter Motor Retaining Bolt (Forward Facing 4.0L)	41	30	
Starter Motor Retaining Bolt (Forward Facing 4.7L)	54	40	
Starter Motor Retaining Bolt (Rearward Facing 4.7L)	54	40	

STARTER MOTOR - GAS POWERED

Starter Motor and Solenoid	
Manufacturer	Mitsubishi
Engine Application	4.0L/4.7L
Power Rating	1.4 Kilowatt (1.9 Horsepower)
Voltage	12 Volts
Number of Fields	4
Number of Poles	4
Number of Brushes	4
Drive Type	Planetary Gear Reduction
Free Running Test Voltage	11.2 Volts
Free Running Test Maximum Amperage Draw	90 Amperes
Free Running Test Minimum Speed	2400 rpm
Solenoid Closing Maximum Voltage Required	7.8 Volts
*Cranking Amperage Draw Test	160 Amperes
*Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.	

STARTER MOTOR

DESCRIPTION

The starter motors used for both the 4.0L and the 4.7L engines available in this model are very similar, but are not interchangeable. Both starter motors are mounted with two screws to the automatic transmission torque converter housing and are located on the right side of the engine.

Each of these starter motors incorporates several of the same features to create a reliable, efficient, compact, lightweight and powerful unit. The electric motors of both starters feature four electromagnetic field coils wound around four pole shoes, and four brushes contact the motor commutator. Both starter motors are rated at 1.4 kilowatts (about 1.9 horsepower) output at 12 volts.

Both of these starter motors are serviced only as a unit with their starter solenoids, and cannot be repaired. If either component is faulty or damaged, the entire starter motor and starter solenoid unit must be replaced.

STARTER MOTOR (Continued)

OPERATION

These starter motors are equipped with a planetary gear reduction (intermediate transmission) system. The planetary gear reduction system consists of a gear that is integral to the output end of the electric motor armature shaft that is in continual engagement with a larger gear that is splined to the input end of the starter pinion gear shaft. This feature makes it possible to reduce the dimensions of the starter. At the same time, it allows higher armature rotational speed and delivers increased torque through the starter pinion gear to the starter ring gear.

The starter motors for both engines are activated by an integral heavy duty starter solenoid switch mounted to the overrunning clutch housing. This electromechanical switch connects and disconnects the feed of battery voltage to the starter motor and actuates a shift fork that engages and disengages the starter pinion gear with the starter ring gear.

Both starter motors use an overrunning clutch and starter pinion gear unit to engage and drive a starter ring gear that is integral to the torque converter drive plate mounted on the rear crankshaft flange.

DIAGNOSIS AND TESTING - STARTER MOTOR

Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with the starter motor removed from the vehicle. Refer to **Starting System** in the Specifications section of this group for the starter motor specifications.

(1) Remove the starter motor from the vehicle. Refer to **Starter Motor** in the Removal and Installation section of this group for the procedures.

(2) Mount the starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of the starter motor. Never clamp on the starter motor by the field frame.

(3) Connect a suitable volt-ampere tester and a 12-volt battery to the starter motor in series, and set the ammeter to the 100 ampere scale. See the instructions provided by the manufacturer of the volt-ampere tester being used.

(4) Install a jumper wire from the solenoid terminal to the solenoid battery terminal. The starter motor should operate. If the starter motor fails to operate, replace the faulty starter motor assembly.

(5) Adjust the carbon pile load of the tester to obtain the free running test voltage. Refer to **Starting System** in the Specifications section of this group for the starter motor free running test voltage specifications.

(6) Note the reading on the ammeter and compare this reading to the free running test maximum amperage draw. Refer to **Starting System** in the Specifications section of this group for the starter motor free running test maximum amperage draw specifications.

(7) If the ammeter reading exceeds the maximum amperage draw specification, replace the faulty starter motor assembly.

STARTER SOLENOID

This test can only be performed with the starter motor removed from the vehicle.

(1) Remove the starter motor from the vehicle. Refer to **Starter Motor** in the Removal and Installation section of this group for the procedures.

(2) Disconnect the wire from the solenoid field coil terminal.

(3) Check for continuity between the solenoid terminal and the solenoid field coil terminal with a continuity tester (Fig. 7). There should be continuity. If OK, go to Step 4. If not OK, replace the faulty starter motor assembly.

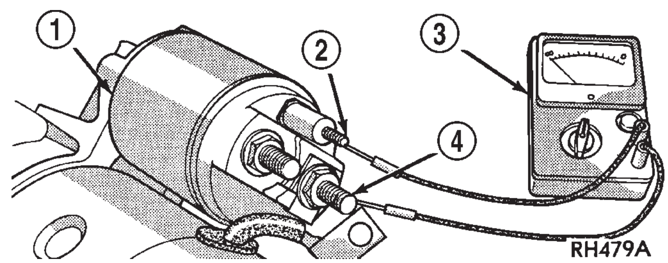


Fig. 7 Continuity Test Between Solenoid Terminal and Field Coil Terminal - Typical

1 - SOLENOID
2 - SOLENOID TERMINAL
3 - OHMMETER
4 - FIELD COIL TERMINAL

(4) Check for continuity between the solenoid terminal and the solenoid case (Fig. 8). There should be continuity. If not OK, replace the faulty starter motor assembly.

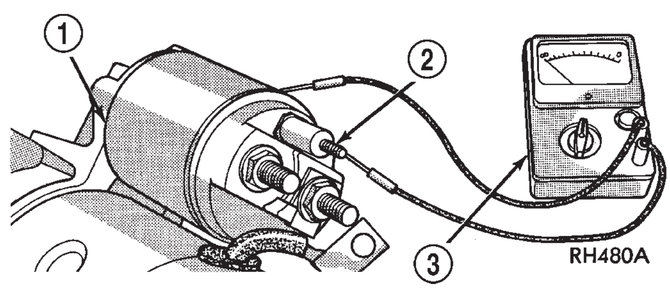


Fig. 8 Continuity Test Between Solenoid Terminal

1 - SOLENOID
2 - SOLENOID TERMINAL
3 - OHMMETER

STARTER MOTOR (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the lower (forward facing) mounting screw securing the starter motor to the automatic transmission torque converter housing (Fig. 9) or (Fig. 10) .

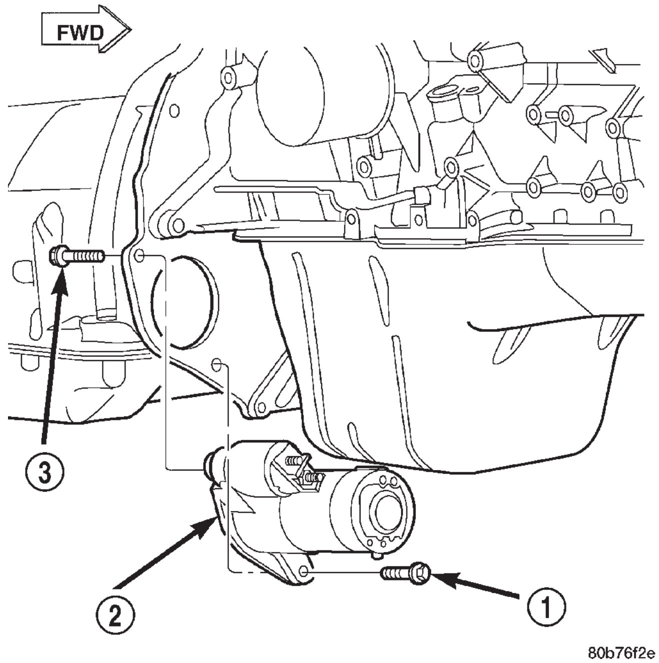


Fig. 9 Starter Motor Remove/Install - 4.0L Engine

1 - SCREW
2 - STARTER MOTOR
3 - SCREW

(4) While supporting the starter motor with one hand, use the other hand to remove the upper (rear facing) mounting screw securing the starter motor to the automatic transmission torque converter housing.

(5) Lower the starter motor from the front of the automatic transmission torque converter housing far enough to access and remove the nut that secures the battery cable eyelet to the solenoid battery terminal (Fig. 11) or (Fig. 12) . Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(6) Remove the battery cable eyelet from the solenoid battery terminal. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(7) Disconnect the solenoid terminal wire harness connector from the connector receptacle on the starter solenoid. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

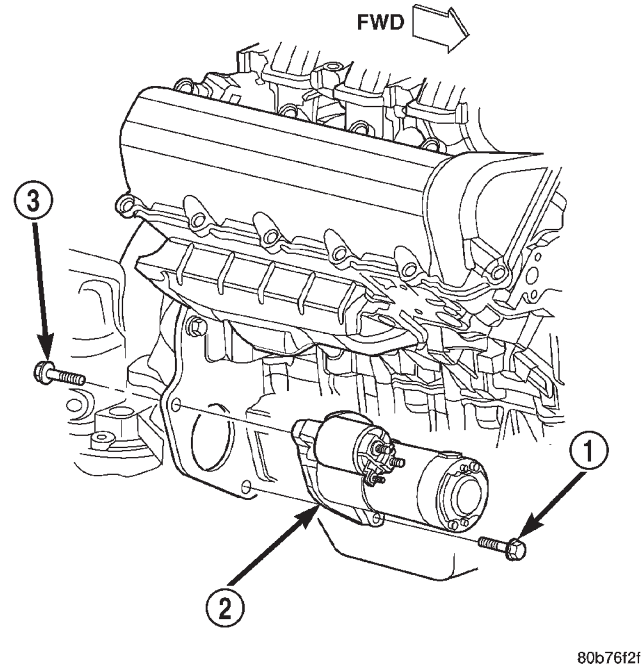


Fig. 10 Starter Motor Remove/Install - 4.7L Engine

1 - SCREW
2 - STARTER MOTOR
3 - SCREW

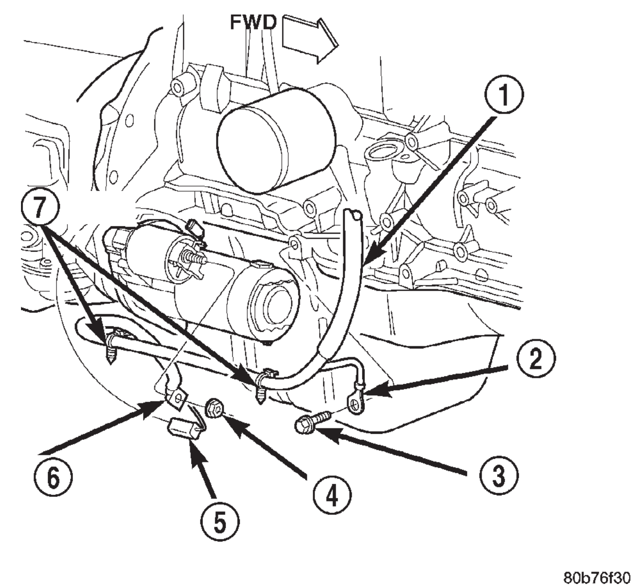


Fig. 11 Starter Wire Harness Remove/Install - 4.0L Engine

1 - BATTERY, STARTER AND GENERATOR WIRE HARNESS
2 - GROUND EYELET
3 - SCREW
4 - NUT
5 - SOLENOID TERMINAL CONNECTOR
6 - SOLENOID BATTERY TERMINAL EYELET
7 - RETAINERS

STARTER MOTOR (Continued)

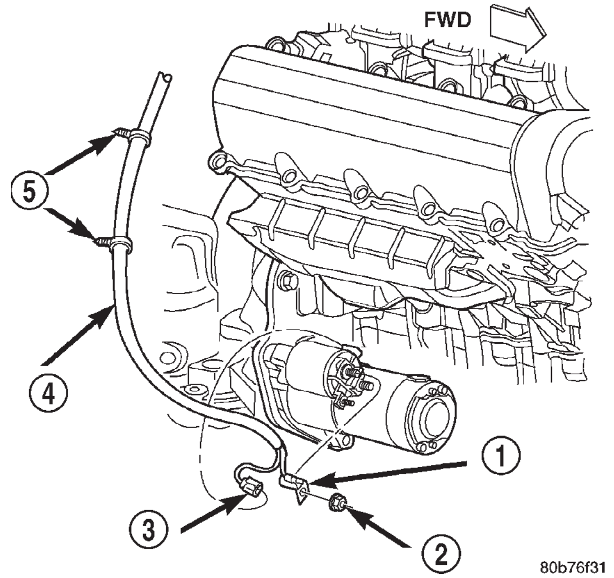


Fig. 12 Starter Wire Harness Remove/Install - 4.7L Engine

1 - SOLENOID BATTERY TERMINAL EYELET
2 - NUT
3 - SOLENOID TERMINAL CONNECTOR
4 - BATTERY STARTER AND GENERATOR WIRE HARNESS
5 - RETAINERS

(8) Remove the starter motor from the engine compartment.

INSTALLATION

(1) Position the starter motor in the engine compartment.

(2) Reconnect the solenoid terminal wire harness connector to the connector receptacle on the starter solenoid. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(3) Install the battery cable eyelet onto the solenoid battery terminal. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(4) Install and tighten the nut that secures the battery cable eyelet to the solenoid battery terminal. Tighten the nut to 11.3 N·m (100 in. lbs.). Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(5) Position the starter motor to the front of the automatic transmission torque converter housing and loosely install both the upper and lower mounting screws.

(6) Tighten the lower (forward facing) starter motor mounting screw. On 4.0L engines, tighten the screw to 41 N·m (30 ft. lbs.). On 4.7L engines, tighten the screw to 54 N·m (40 ft. lbs.).

(7) Tighten the upper (rearward facing) starter mounting screw. Tighten the screw to 54 N·m (40 ft. lbs.).

(8) Lower the vehicle.

(9) Reconnect the battery negative cable.

STARTER MOTOR RELAY

DESCRIPTION

The starter relay is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when the ignition switch is turned to the Start position. The starter relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for starter relay identification and location.

The starter relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The starter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING - STARTER RELAY

The starter relay (Fig. 13) is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for starter relay identification and location. For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams.

STARTER MOTOR RELAY (Continued)

(1) Remove the starter relay from the PDC. Refer to **Starter Relay** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

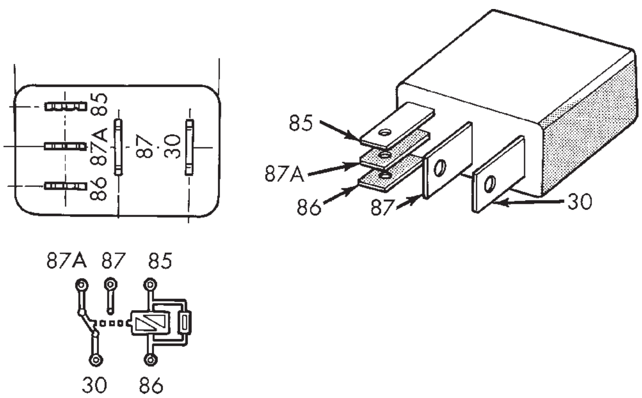


Fig. 13 Starter Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coils. There should be continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open circuit to the starter solenoid as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If not OK, check for an open or short circuit to the ignition switch and repair, if required. If the circuit to the ignition switch is OK, refer to **Ignition Switch and Key Lock Cylinder** in the Diagnosis and Testing section of Group 8D - Ignition System for testing of the ignition switch.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. Check for continuity to ground at the cavity for relay terminal 85. If not OK, check for an open or short circuit to the park/neutral position switch and repair, if required. If the circuit to the park/neutral position switch is OK, refer to **Park/ Neutral Position Switch** in the Diagnosis and Testing section of Group 21 - Transmission for testing of the park/neutral position switch.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 14) .

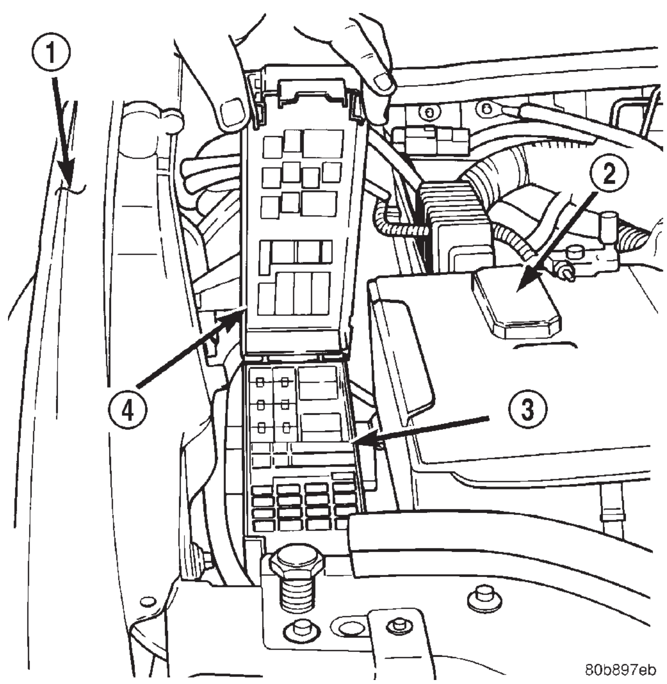


Fig. 14 Power Distribution Center

1 - RIGHT FENDER
2 - BATTERY
3 - POWER DISTRIBUTION CENTER
4 - COVER

STARTER MOTOR RELAY (Continued)

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for starter relay identification and location.

(4) Remove the starter relay from the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper starter relay location.

(2) Position the starter relay in the proper receptacle in the PDC.

(3) Align the starter relay terminals with the terminal cavities in the PDC receptacle.

(4) Push down firmly on the starter relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Install the cover onto the PDC.

(6) Reconnect the battery negative cable.

HEATED SYSTEMS

TABLE OF CONTENTS

HEATED GLASS

TABLE OF CONTENTS

HEATED GLASS

DESCRIPTION - REAR WINDOW DEFOGGER

An electrically heated rear window defogger is standard factory-installed equipment on this model. Electrically heated outside rear view mirrors are available factory-installed optional equipment. When the rear window defogger system is turned on, electric heater grids on the liftgate flip-up glass and behind both outside rear view mirror glasses are energized. These electric heater grids produce heat to help clear the rear window glass and the outside rear view mirrors of ice, snow, or fog. The rear window defogger system control circuit uses ignition switched battery current, so the system will only operate when the ignition switch is in the On position.

This group covers the following components of the rear window defogger system:

- Rear glass heating grid
- Rear window defogger relay
- Rear window defogger switch.

Certain functions and features of the rear window defogger system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, use a DRBIII® scan tool and (Refer to Appropriate Diagnostic Information).

The other electronic modules that may affect proper system operation are:

- **Body Control Module (BCM)** - Refer to Electronic Control Modules for more information.
- **Driver Door Module (DDM)** - Refer to Electronic Control Modules for more information.

HEATED GLASS (Continued)

• **Passenger Door Module (PDM)** - Refer to Electronic Control Modules for more information.

OPERATION - REAR WINDOW DEFOGGER

The rear window defogger system is controlled by a momentary switch that is integral to the a/c heater control located in the center stack area of the instrument panel. A Light-Emitting Diode (LED) in the switch button will light to indicate when the rear window defogger system is turned on. The BCM, which contains the rear window defogger system timer and control logic, monitors the status of the defogger switch through a hard-wired input. The BCM then sends control outputs through a hard wired circuit to energize or de-energize the defogger relay.

The electrically heated outside rear view mirror heating grids are also controlled by the rear window defogger switch. When the BCM receives an input from the switch, it sends a defogger switch status message to the DDM and the PDM over the PCI data bus. The DDM and PDM respond to the defogger switch status messages by energizing or de-energizing the battery current feed to their respective outside rear view mirror heating grids.

The rear window defogger system will be automatically turned off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the defogger switch is turned on again during the same ignition cycle, the defogger system will automatically turn off after about five minutes. The defogger system will automatically shut off if the ignition switch is turned to the Off position, or it can be turned off manually by depressing the rear window defogger switch again.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the rear window defogger system.

DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For complete circuit diagrams, (Refer to Appropriate Wiring Information). The operation of the electrically heated rear window defogger system can be confirmed in one of the following manners:

1. Turn the ignition switch to the On position. While monitoring the instrument panel voltmeter, depress the rear window defogger switch to the On position. When the rear window defogger switch is turned On, a distinct voltmeter needle deflection should be noted.
2. Turn the ignition switch to the On position. Depress the rear window defogger switch to the On position. The rear window defogger operation can be checked by feeling the rear window or outside rear view mirror glass. A distinct difference in temperature between the grid lines and the adjacent clear glass or the mirror glass can be detected within three to four minutes of operation.
3. Using a 12-volt DC voltmeter, contact the rear glass heating grid terminal A (right side) with the negative lead, and terminal B (left side) with the positive lead (Fig. 1). The voltmeter should read battery voltage.

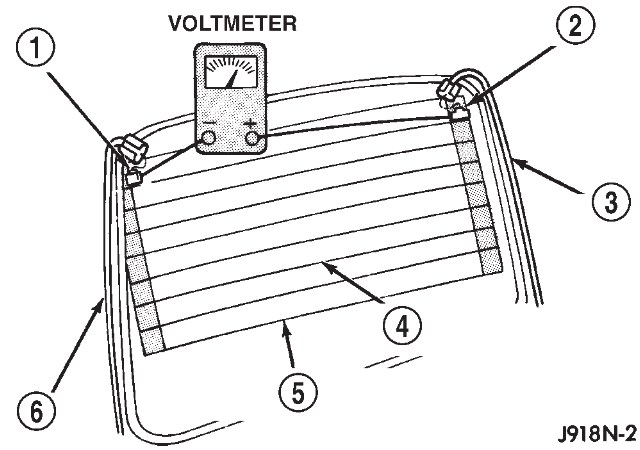


Fig. 1 REAR WINDOW GLASS GRID TEST

1 - TERMINAL "A"
2 - TERMINAL "B"
3 - FEED WIRE
4 - MID-POINT "C" (TYPICAL)
5 - HEATED REAR WINDOW DEFOGGER GRID
6 - GROUND WIRE

The above checks will confirm rear window defogger system operation. Illumination of the rear window defogger switch LED indicator means that there is battery current available at the output of the rear window defogger relay, but does not confirm that battery current is reaching the rear glass heating grid lines.

If the rear window defogger system does not operate, the problem should be isolated in the following manner:

HEATED GLASS (Continued)

(1) Confirm that the ignition switch is in the On position.

(2) Ensure that the rear glass heating grid feed and ground terminals are connected to the glass. Confirm that the ground wire has continuity to ground.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). The fuse must be tight in its receptacles and all electrical connections must be secure.

When the above steps have been completed and the rear glass heating grid is still inoperative, one or more of the following is faulty:

- Rear window defogger switch
- Rear window defogger relay
- Body Control Module (BCM)
- Rear window grid lines (all grid lines would have to be broken or one of the feed wires disconnected for the entire system to be inoperative).

When the above steps have been completed and the heated mirror glass heating grid is still inoperative, one or more of the following is faulty:

- Body Control Module (BCM)
- Programmable Communications Interface (PCI) data bus
- Driver Door Module (DDM) or Passenger Door Module (PDM)
- Outside rear view mirror heating grids.

If turning the rear window defogger system on produces a severe voltmeter deflection, check for a short circuit between the rear window defogger relay output and the rear glass heating grid.

REAR WINDOW DEFOGGER GRID

DESCRIPTION

The electrically heated rear window glass is standard equipment on this model. The liftgate flip-up glass has two electrically conductive vertical bus bars and a series of horizontal grid lines made of a silver-ceramic material, which is baked on and bonded to the inside surface of the glass. These grid lines and the bus bars comprise a parallel electrical circuit. A spade type terminal near the top of each bus bar accept the connectors from the two coiled liftgate wire harness take outs.

The grid lines and bus bars are highly resistant to abrasion. However, it is possible for an open circuit to occur in an individual grid line, resulting in no current flow through the line. The grid lines can be damaged or scraped off with sharp instruments. Care should be taken when cleaning the glass or removing foreign materials, decals, or stickers from the glass. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

A repair kit is available to repair the grid lines and bus bars, or to reinstall the heated glass terminals. (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER GRID - STANDARD PROCEDURE)

OPERATION

The rear glass heating grid is energized and de-energized by the rear window defogger relay. The Body Control Module (BCM) monitors the rear window defogger switch. When the BCM receives an input from the switch, it energizes or de-energizes the rear window defogger relay through a hard wired control output. The rear defogger relay switches fused battery current to the rear window grid lines through the bus bars. The grid lines heat the rear window glass to clear the surface of ice, snow or fog. Protection for the rear glass heating grid circuit is provided by a fuse in the Power Distribution Center (PDC).

DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER GRID

For complete circuit diagrams, (Refer to Appropriate Wiring Information). To detect breaks in the rear glass heating grid lines, the following procedure is required:

(1) Turn the ignition switch to the On position. Turn the rear window defogger system on. The rear window defogger switch LED indicator should light. If OK, go to Step 2. If not OK, (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER RELAY - DIAGNOSIS AND TESTING).

(2) Using a 12-volt DC voltmeter, contact the rear glass heating grid vertical bus bar on the right side of the vehicle with the negative lead. With the positive lead, contact the rear glass heating grid vertical bus bar on the left side of the vehicle. The voltmeter should read battery voltage. If OK, go to Step 3. If not OK, repair the open rear window defogger relay output circuit to the rear window defogger relay as required.

(3) With the positive voltmeter lead still contacting the rear glass heating grid vertical bus bar on the left side of the vehicle, move the negative lead of the voltmeter to a good body ground point. The voltage reading should not change. If OK, go to Step 4. If not OK, repair the ground circuit to ground as required.

(4) Connect the negative lead of the voltmeter to the right side bus bar and touch each grid line at midpoint C with the positive lead (Fig. 2). A reading of approximately six volts indicates a line is good. A reading of zero volts indicates a break in the grid line between midpoint C and the left side rear glass heating grid bus bar. A reading of ten to fourteen

REAR WINDOW DEFOGGER GRID (Continued)

volts indicates a break between midpoint C and the right side rear heating grid bus bar. Move the positive lead on the grid line towards the break and the voltage reading will change as soon as the break is crossed.

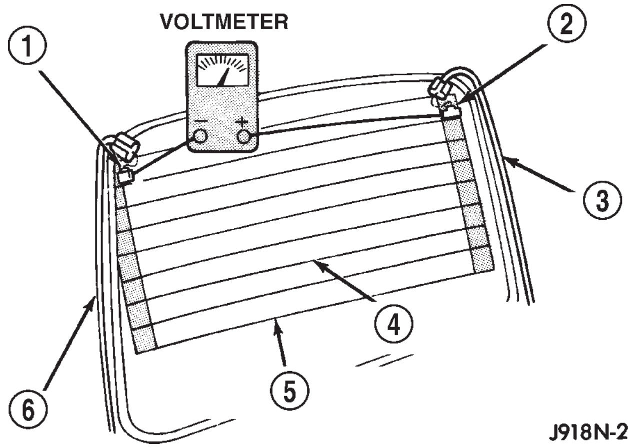


Fig. 2 REAR WINDOW GLASS GRID TEST

1 - TERMINAL “A”
2 - TERMINAL “B”
3 - FEED WIRE
4 - MID-POINT “C” (TYPICAL)
5 - HEATED REAR WINDOW DEFOGGER GRID
6 - GROUND WIRE

STANDARD PROCEDURE - REAR GLASS HEATING GRID REPAIR

Repair of the rear glass heating grid lines, bus bars, and terminals can be accomplished using a Mopar Rear Window Defogger Repair Kit (Part Number 4267922) or equivalent.

WARNING: MATERIALS CONTAINED IN THE REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION. THE KIT CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, WHICH ARE HARMFUL IF SWALLOWED. AVOID CONTACT WITH THE SKIN AND EYES. FOR SKIN CONTACT, WASH THE AFFECTED AREAS WITH SOAP AND WATER. FOR CONTACT WITH THE EYES, FLUSH WITH PLENTY OF WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING AND CALL A PHYSICIAN IMMEDIATELY. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTAINS FLAMMABLE SOLVENTS. KEEP OUT OF THE REACH OF CHILDREN.

(1) Mask the repair area on the inside of the rear glass so that the conductive epoxy can be applied neatly. Extend the epoxy application onto the rear glass heating grid bus bar or grid line on each side of the break (Fig. 3).

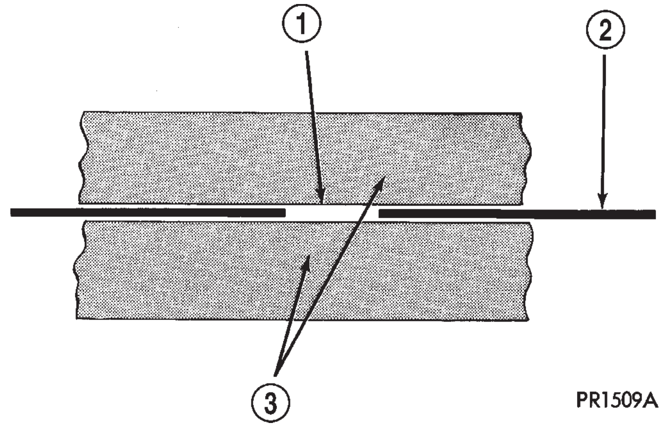


Fig. 3 GRID LINE REPAIR

1 - BREAK
2 - GRID LINE
3 - MASKING TAPE

(2) Follow the instructions in the repair kit for preparing the damaged area.

(3) Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.

(4) For rear glass heating grid line repairs, mask the area to be repaired with masking tape or a template.

(5) Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).

(6) For a rear glass heating grid terminal replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as onto the bus bar. Apply a thin layer of epoxy to the area where the terminal was previously fastened and onto the adjacent grid line.

(7) Apply a thin layer of conductive epoxy to the terminal and place it in the proper location on the rear glass heating grid bus bar. To prevent the terminal from moving while the epoxy is curing, it must be wedged or clamped.

(8) Carefully remove the masking tape or template.

CAUTION: Do not allow the glass surface to exceed 204° C (400° F) or the glass may fracture.

(9) Allow the epoxy to cure for 24 hours at room temperature, or use a heat gun with a 260° to 371° C (500° to 700° F) range for fifteen minutes. Hold the heat gun approximately 25.4 centimeters (10 inches) from the repair.

(10) After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal. Do

REAR WINDOW DEFOGGER GRID (Continued)

not attach the wire harness connectors until the curing process is complete.

(11) Check the operation of the rear glass heating grid.

REAR WINDOW DEFOGGER RELAY

DESCRIPTION

The rear window defogger relay is an electromechanical device that switches fused battery current to the rear glass heating grid and the Light-Emitting Diode (LED) indicator of the rear window defogger switch, when the Body Control Module (BCM) rear window defogger timer and logic circuitry grounds the relay coil. The rear window defogger relay is located in the junction block, under the left end of the instrument panel in the passenger compartment.

The rear window defogger relay is a International Standards Organization (ISO) relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

The rear window defogger relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

RELAY TEST

The rear window defogger relay (Fig. 4) is located in the junction block, under the left end of the instrument panel in the passenger compartment. Remove the rear window defogger relay from the junction block to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 10 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to the **Relay Circuit Test**. If not OK, replace the faulty relay.

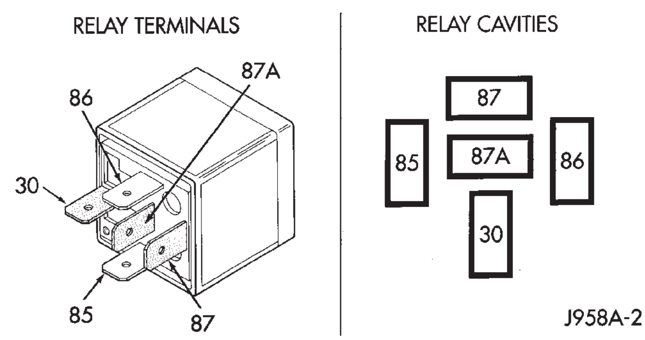


Fig. 4 REAR WINDOW DEFOGGER RELAY

TERMINAL LEGEND

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

REAR WINDOW DEFOGGER RELAY (Continued)

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the rear glass heating grid and to the fuse in the junction block that feeds the rear window defogger switch LED indicator. There should be continuity between the cavity for relay terminal 87 and the rear glass heating grid and the rear window defogger switch LED indicator at all times. If OK, go to Step 4. If not OK, repair the open rear window defogger relay output circuit as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is connected to battery voltage and should be hot at all times. Check for battery voltage at the cavity for relay terminal 86. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the PDC fuse as required.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. This terminal is provided with ground by the Body Control Module (BCM) rear window defogger timer and logic circuitry to energize the defogger relay. There should be continuity to the rear window defogger relay control circuit cavity of the 22-way instrument panel wire harness connector for the BCM. If OK, use a DRB scan tool and refer to the Appropriate Diagnostic Information to test the BCM. If not OK, repair the open rear window defogger relay control circuit as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to Instrument Panel System for the procedures.

(3) The rear window defogger relay is located on the right side of the combination flasher in the junction block (Fig. 5).

(4) Remove the rear window defogger relay from the junction block.

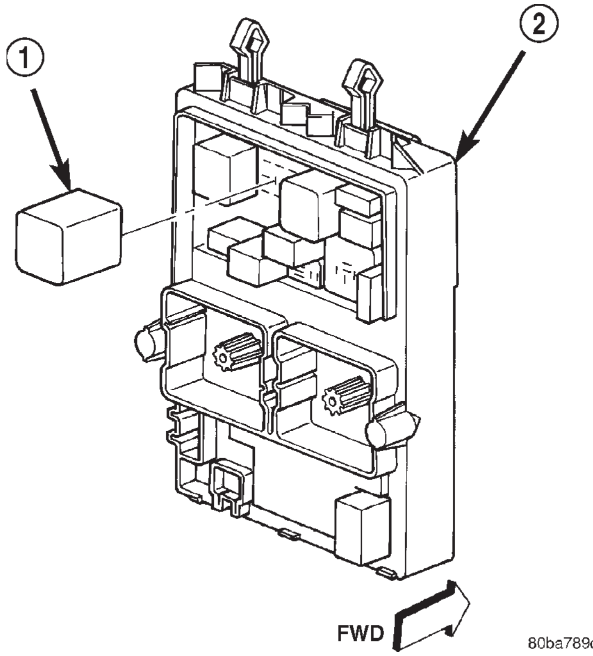


Fig. 5 JUNCTION BLOCK

1 - COMBINATION FLASHER
2 - JUNCTION BLOCK

INSTALLATION

(1) Position the rear window defogger relay in the proper receptacle in the junction block.

(2) Align the rear window defogger relay terminals with the terminal cavities in the junction block receptacle.

(3) Push in firmly on the rear window defogger relay until the terminals are fully seated in the terminal cavities in the junction block receptacle.

(4) Install the steering column opening cover onto the instrument panel. Refer to Instrument Panel System for the procedures.

(5) Reconnect the battery negative cable.

REAR WINDOW DEFOGGER SWITCH

DESCRIPTION

The rear window defogger switch is integral to the a/c heater control, which is located in the instrument panel center stack below the radio receiver. This momentary switch provides a hard wired ground signal to the Body Control Module (BCM) each time it is depressed. A Light Emitting Diode (LED) in the push button for the rear window defogger switch illuminates to indicate when the rear window defogger system is turned on.

The rear window defogger switch and the rear window defogger switch LED indicator cannot be

REAR WINDOW DEFOGGER SWITCH (Continued)

repaired and, if faulty or damaged, the entire a/c heater control must be replaced. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL)

OPERATION

When the rear window defogger switch push button is depressed, it momentarily closes the rear window defogger switch sense circuit for the BCM to ground. The BCM monitors the rear window defogger switch sense circuit. Each time the BCM rear window defogger timer and logic circuitry sees another input from the switch, it toggles a control output to the rear window defogger relay. Energizing the rear window defogger relay provides electrical current to the rear window defogger grid and to the LED indicator in the switch, which lights to indicate when the defogger system is turned on. A dedicated fuse in the junction block protects the rear window defogger relay output circuit to the LED indicator.

DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER SWITCH

For complete circuit diagrams, refer to the Appropriate Wiring Information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the a/c heater control from the instrument panel and disconnect the 11-way (manual temperature control) or 16-way (automatic zone control) instrument panel wire harness connector from the a/c heater control receptacle.

(2) Check for continuity between the ground circuit cavity of the 11-way or 16-way instrument panel wire harness connector for the a/c heater control and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Connect two jumper wires to the a/c heater control 11-way or 16-way connector receptacle. Connect one jumper from the ground circuit terminal in the 11-way or 16-way a/c heater control connector receptacle to a good ground. Connect the other jumper from the fused rear window defogger relay output circuit terminal of the 11-way or 16-way connector receptacle to a 12-volt battery feed. The rear window defogger switch LED indicator should light. If OK, go to Step 4. If not OK, replace the faulty a/c heater control.

(4) Check for continuity between the ground circuit and rear window defogger switch sense circuit terminals of the 11-way or 16-way a/c heater control connector receptacle. There should be momentary continuity as the rear window defogger switch push button is depressed, and then no continuity. If OK, go to Step 5. If not OK, replace the faulty a/c heater control.

(5) Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the rear window defogger switch sense circuit cavity of the 11-way or 16-way instrument panel wire harness connector for the a/c heater control and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted rear window defogger switch sense circuit as required.

(6) Check for continuity between the rear window defogger switch sense circuit cavities of the 11-way or 16-way instrument panel wire harness connector for the a/c heater control and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, refer to (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER RELAY - DIAGNOSIS AND TESTING).

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL)

HEATED MIRRORS

TABLE OF CONTENTS

HEATED MIRRORS

DESCRIPTION

Electrically heated outside rear view mirrors are optional equipment on this model. These mirrors feature an electric heating grid located behind the mirror glass of each power operated outside rear view mirror. These heating grids consist of a single resistor wire routed in a grid-like pattern and captured between two thin sheets of plastic. When electrical current is passed through the resistor wire, it produces enough heat energy to clear the outside mirror glass of ice, snow or fog. Battery current is directed to the outside mirror heating grid only when the rear window defogger switch is in the On position.

If the outside mirror heating grids and the rear window heating grid are all inoperative, (Refer to 8 - ELECTRICAL/HEATED GLASS - DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER SYSTEM). If the outside mirror heating grids are inoperative, but the rear window heating grid is operating as designed, (Refer to 8 - ELECTRICAL/HEATED MIRRORS - DIAGNOSIS AND TESTING)

The heating grid behind each outside mirror glass cannot be repaired and, if faulty or damaged, the entire power mirror unit must be replaced. Refer to Power Mirrors for the procedures.

OPERATION

The outside mirror heating grids are energized and de-energized by the Driver Door Module (DDM) and the Passenger Door Module (PDM) based upon the rear window defogger switch status. The Body Control Module (BCM) monitors the rear window defogger switch. When the BCM receives an input from the switch, it sends a defogger switch status message to the DDM and the PDM over the Programmable Communications Interface data bus. The DDM and PDM respond to the defogger switch status messages by energizing or de-energizing the battery current feed to their respective outside rear view mirror heating grids.

DIAGNOSIS AND TESTING - HEATED MIRRORS

For circuit descriptions and diagrams, (Refer to Appropriate Wiring Information).

(1) If both mirror heaters are inoperative, check for proper operation of the Rear Window Defogger System. (Refer to 8 - ELECTRICAL/HEATED GLASS - DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER SYSTEM). If Rear Window Defogger System operates correctly, or if only one mirror heater is inoperative, go to Step 2.

(2) Disconnect and isolate the battery negative cable. Remove the front door trim panel on the side of the inoperative mirror heater. Go to Step 3.

(3) Disconnect the door wire harness connector from the door module connector receptacle. Check for continuity between the mirror heater 12 volt supply, and the mirror heater ground. There should be continuity. If OK, go to Step 4. If not OK, check for continuity of the individual circuits between the power mirror and the door module, and of the mirror heater grid right at the power mirror.

(4) Use a DRB III® and (Refer to Appropriate Diagnostic Information) to test the door module and the PCI data bus.

HEATED SEAT SYSTEM

TABLE OF CONTENTS

HEATED SEAT SYSTEM

DESCRIPTION

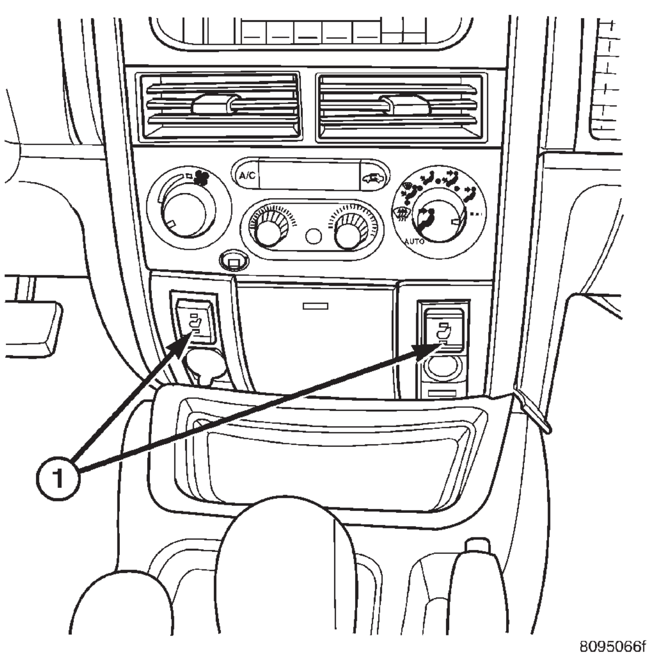


Fig. 1 HEATED SEAT SWITCHES

1 - HEATED SEAT SWITCHES

Individually controlled driver and passenger side electrically heated front seats are available factory-installed optional equipment on this model, when it is also equipped with the power seat option. The heated seat system allows both the driver and the front seat passenger the option to select one of two seat heating ranges, Low or High, or to turn the individual seat heaters Off using the heated seat switches located in the center lower bezel near the bottom of the instrument panel center stack (Fig. 1). The heated seat switch circuit operates on ignition switched battery current supplied through a fuse in the junction block, only when the ignition switch is in the On position.

The heated seat system consists of the following components :

- Heated seat elements
- Heated seat sensors
- Heated seat module (or memory heated seat module)
- Heated seat switches.

The heated seat system also relies upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of

HEATED SEAT SYSTEM (Continued)

these electronic modules or of the PCI data bus network, the use of a DRB® scan tool and the proper Diagnostic Procedures manual are recommended.

The electronic modules that may affect heated seat system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in Electronic Control Modules for more information.
- **Heated Seat Module (HSM)** - Refer to **Heated Seat Module** in Electronic Control Modules for more information.
- **Memory Heated Seat Module (MHSM)** - If the vehicle is equipped with the Memory System, refer to **Memory Seat Module** in Electronic Control Modules for more information.

Refer to **Power Seats Premium I/III** in the Contents of Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the heated seat system.

OPERATION

The heated seat system will only operate when the ignition switch is in the On position, and the surface temperature at the front seat heating element sensors is below the designed temperature set points of the system. The heated seat system will not operate in ambient temperatures greater than about 41° C (105° F). The front seat heating elements and sensors are hard wired to the Heated Seat Module (HSM) or the Memory Heated Seat Module (MHSM).

The heated seat switches are hard wired to the Body Control Module (BCM). The BCM monitors the heated seat switch inputs, then sends heated seat switch status messages to the HSM or MHSM over the Programmable Communications Interface (PCI) data bus. The HSM or MHSM contains the control logic for the heated seat system. The HSM or MHSM responds to the heated seat switch status messages, ignition switch status messages, and the front seat heating element sensor inputs by controlling the output to the front seat heating elements through integral solid-state relays.

When a seat heater is turned on, the sensor located on the seat cushion electric heater element provides the HSM or MHSM with an input indicating the surface temperature of the seat cushion. If the surface temperature input is below the temperature set point for the selected Low or High heated seat switch position, the HSM or MHSM energizes the integral solid-state relay, which supplies battery current to the heating elements in the seat cushion and back. When the sensor input indicates the correct temperature set point has been achieved, the HSM or MHSM de-energizes the solid-state relay. The HSM or MHSM will continue to cycle the solid-state relay as needed to maintain the temperature set point.

The HSM or MHSM and the seat heater elements operate on non-switched battery current supplied through the power seat circuit breaker in the junction block. However, the HSM or MHSM will automatically turn off the heating elements if it detects an open or short in the sensor circuit, a short or open in the heating element circuit causing an excessive current draw, or when the ignition switch is turned to the Off position.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the heated seat system.

DIAGNOSIS AND TESTING - HEATED SEAT SYSTEM

Following are tests that will help to diagnose the components and circuits that are hard wired inputs or outputs of the heated seat system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the heated seat system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the heated seat system components must be checked.

The most reliable, efficient, and accurate means to diagnose the heated seat system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB® scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM) is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its heated seat system functions.

For complete circuit diagrams, refer to **Wiring Diagrams**.

NOTE: DO NOT ATTEMPT TO SWAP MEMORY OR NON-MEMORY HEATED SEAT MODULES FROM ONE VEHICLE TO ANOTHER. MOST OF THESE MODULES ARE VEHICLE FEATURE SPECIFIC AND THEREFORE NOT INTERCHANGEABLE. ALWAYS USE THE CORRECT PART NUMBERED MODULE WHEN DIAGNOSING OR REPLACING A MODULE.

WARNING: REFER TO THE RESTRAINTS SECTION OF THIS MANUAL BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

HEATED SEAT SYSTEM (Continued)

PRELIMINARY TEST

Before testing the individual components in the heated seat system, check the following:

• If the heated seat switch LED indicators do not light with the ignition switch in the On position and the heated seat switch in the Low or High position, check the fused ignition switch output (run) fuse in the junction block. If OK, refer to **Heated Seat Switch Diagnosis and Testing** in this section. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

• If the heated seat switch LED indicators light, but the heating elements do not heat, check the power seat circuit breaker in the junction block. If OK, refer to **Heated Seat Element Diagnosis and Testing** in this section of the manual. If not OK, replace the faulty power seat circuit breaker.

DRIVER HEATED SEAT SWITCH

DESCRIPTION

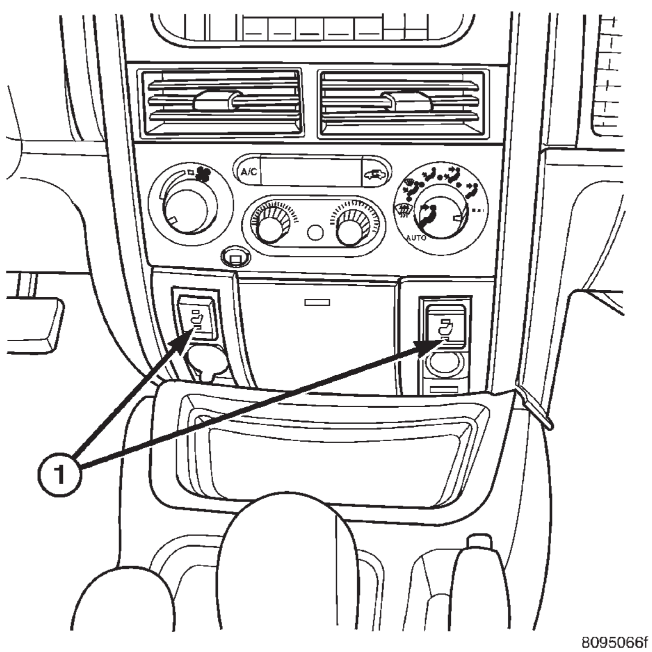


Fig. 2 HEATED SEAT SWITCHES

1 - HEATED SEAT SWITCHES

The heated seat switches are mounted in the instrument panel center lower bezel (Fig. 2), which is located near the bottom of the instrument panel center stack. The two three-position rocker-type switches, one switch for each front seat, provide a resistor multiplexed signal to the Body Control Module (BCM) through separate hard wired circuits. Each switch has an Off, Low, and High position so that both the driver and the front seat passenger can select a preferred seat heating mode. Each switch has two Light-Emitting Diodes (LED), one each for the Low position and the High position, which light to indicate that the heater for the seat that the switch controls is turned on. Each switch is also back lit by a replaceable incandescent bulb.

The heated seat switches and their LEDs cannot be repaired. If either switch or LED is faulty or damaged, the entire switch unit must be replaced. The incandescent switch illumination bulb and bulb holder units are available for service replacement.

OPERATION

There are three positions that can be selected with each of the heated seat switches: Off, Low, or High. When the top of the switch rocker is fully depressed, the High position is selected and the high position LED indicator illuminates. When the bottom of the switch rocker is fully depressed, the Low position is selected and the low position LED indicator illuminates. When the switch rocker is moved to its neutral position, Off is selected and both LED indicators are extinguished.

Both switches provide separate resistor multiplexed hard wire inputs to the BCM to indicate the selected switch position. The BCM monitors the switch inputs and sends heated seat switch status messages to the Heated Seat Module (HSM) or the Memory Heated Seat Module (MHSM) over the Programmable Communications Interface (PCI) data bus. The HSM or MHSM responds to the heated seat switch status messages by controlling the output to the seat heater elements of the selected seat. The Low heat position set point is about 36° C (97° F), and the High heat position set point is about 41° C (105° F).

DIAGNOSIS AND TESTING - DRIVER HEATED SEAT SWITCH

For complete circuit diagrams, refer to **Wiring Diagrams**.

WARNING: REFER TO THE RESTRAINTS SECTION OF THIS MANUAL BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 2. If not

DRIVER HEATED SEAT SWITCH (Continued)

OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run) circuit to the ignition switch as required.

(3) Disconnect and isolate the battery negative cable. Remove the lower center bezel from the instrument panel and disconnect the instrument panel wire harness connectors from both heated seat switch connector receptacles. Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es) and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es). If OK, turn the ignition switch to the Off position, disconnect and isolate the battery negative cable, and go to Step 5. If not OK, repair the open fused ignition switch output (run) circuit to the junction block fuse as required.

(5) Test the heated seat switch(es) (Fig. 3) as shown in the Heated Seat Switch Test chart. If OK, go to Step 6. If not OK, replace the faulty heated seat switch(es).

HEATED SEAT SWITCH TEST		
SWITCH POSITION	RESISTANCE BETWEEN	RESISTANCE (OHMS)
Off	Pin 1 & 6	55
Low	Pin 1 & 6	1430
High	Pin 1 & 6	365
All resistance values are ±5%.		

(6) Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the seat heater switch sensor ground circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es) and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted seat heater switch sensor ground circuit as required.

(7) Check for continuity between the seat heater switch sensor ground circuit cavities of the instrument panel wire harness connector for the in operative heated seat switch(es) and the 22-way instrument panel wire harness connector for the

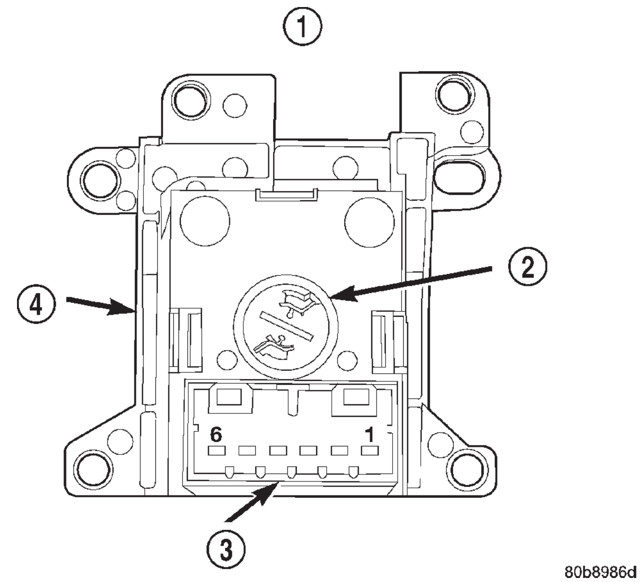


Fig. 3 Rear of Heated Seat Switch

1 - LEFT SHOWN (RIGHT TYPICAL)
2 - ILLUMINATION LAMP
3 - CONNECTOR RECEPTACLE
4 - HEATED SEAT SWITCH

BCM. There should be continuity. If OK, go to Step 8. If not OK, repair the open seat heater switch sensor ground circuit as required.

(8) Check for continuity between the seat heater switch mux circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch and a good ground. There should be no continuity. If OK, go to Step 9. If not OK, repair the shorted seat heater switch mux circuit as required.

(9) Check for continuity between the seat heater switch mux circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRB® scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open seat heater switch mux circuit as required.

REMOVAL

WARNING: REFER TO THE RESTRAINTS SECTION OF THIS MANUAL BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

DRIVER HEATED SEAT SWITCH (Continued)

(2) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Body section of this manual for the procedure.

(3) Remove the four screws that secure the heated seat switch to the back of the instrument panel center lower bezel (Fig. 4).

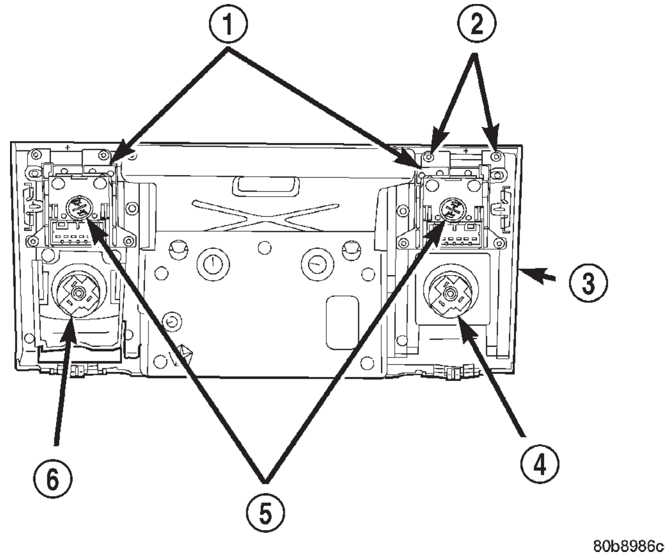


Fig. 4 Heated Seat Switch Remove/Install

1 - HEATED SEAT SWITCHES
2 - SCREWS (4)
3 - CENTER LOWER BEZEL
4 - CIGAR LIGHTER
5 - ILLUMINATION LAMPS
6 - POWER OUTLET

(4) Remove the heated seat switch from the back of the instrument panel center lower bezel.

INSTALLATION

(1) Position the heated seat switch onto the back of the instrument panel center lower bezel.

(2) Install and tighten the four screws that secure the heated seat switch to the back of the instrument panel center lower bezel. Tighten the screws to 1.5 N·m (13 in. lbs.).

(3) Install the center lower bezel onto the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Body section of this manual for the procedure.

(4) Reconnect the battery negative cable.

HEATED SEAT ELEMENT

DESCRIPTION

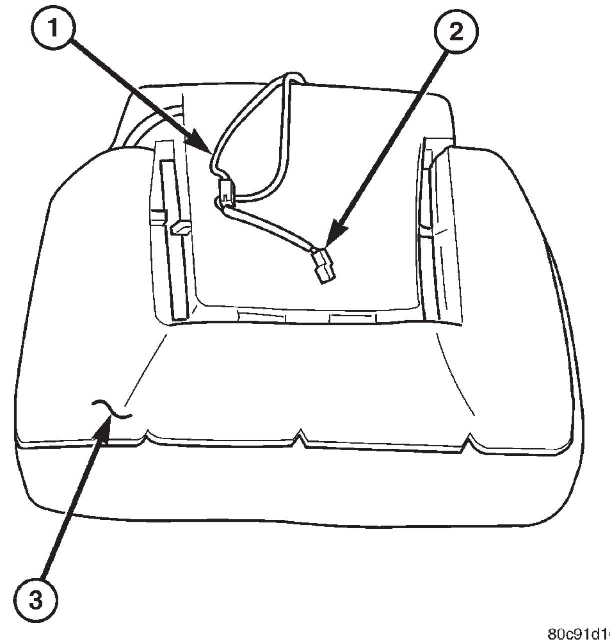


Fig. 5 HEATING ELEMENT INSTALLED

1 - SEAT BACK WIRE HARNESS
2 - HEATED SEAT WIRE HARNESS CONNECTOR
3 - HEATED SEAT CUSHION ELEMENT

The heated seat system includes two seat heating elements in each front seat, one for the seat cushion (Fig. 5)and the other for the seat back. One type of heated seat element is offered. All models use two resistor wire heating elements for each seat that are connected in series with the Heated Seat Module (HSM).

The seat heating elements are glued to the seat and seat back cushions. The heated seat elements can be replaced if faulty or damaged, service replacement seat or seat back elements are available. Refer to the procedure in this section for detailed instructions.

OPERATION

The heated seat elements resist the flow of electrical current. When battery current is passed through the elements, the energy lost by the resistance of the elements to the current flow is released in the form of heat. The temperature sensor is a NTC thermistor. When the temperature of the seat cushion cover rises, the resistance of the sensor decreases. The HSM or MHSM supplies a five-volt current to one side of each sensor, and monitors the voltage drop through the sensor on a return circuit. The MSM or MHSM uses this temperature sensor input to monitor the temperature of the seat, and regulates the current flow to the seat heating elements accordingly.

HEATED SEAT ELEMENT (Continued)

DIAGNOSIS AND TESTING - HEATED SEAT ELEMENT

RESISTOR WIRE ELEMENT

(1) Disconnect and isolate the battery negative cable. The power seat wire harness connectors for the seat cushion and seat back heating elements are secured to a bracket located under the rear edge of the seat cushion frame. Refer to **Wiring** for complete circuit schematics and connector locations.

(2) Disconnect the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM) C2 connector. Check for continuity between the SEAT HEATER B(+) DRIVER circuit cavity of the C2 connector and the seat cushion frame. There should be NO continuity. If OK, go to Step 3. If not OK, repair the shorted seat heater B(+) driver circuit as required.

NOTE: WHEN CHECKING HEATED SEAT ELEMENTS FOR CONTINUITY, BE CERTAIN TO MOVE THE HEATING ELEMENT BEING CHECKED. MOVING THE ELEMENT, SUCH AS SITTING IN THE SEAT WILL ELIMINATE THE POSSIBILITY OF AN INTERMITTENT OPEN IN THE ELEMENT WHICH WOULD ONLY BE EVIDENT IF THE ELEMENT WAS MOVED IN A CERTAIN DIRECTION. FAILURE TO CHECK THE ELEMENT IN VARIOUS POSITIONS COULD RESULT IN AN INCOMPLETE TEST.

(3) Check for continuity between the SEAT HEATER B(+) DRIVER circuit cavity of the C2 connector and the ground circuit cavity. There should be continuity at all times (even upon moving or sitting in the seat). If OK, proceed with testing the other components in the heated seat system. If not OK, replace the open heating element. Refer to the procedure in this section of the manual.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the appropriate seat cushion or seat back trim cover. Refer to the Body section of the service manual for the procedures.

(3) Disconnect the inoperative heated seat cushion or seat back element electrical connectors.

(4) Gently peel-off defective heater element from foam cushion.

INSTALLATION

(1) Peel off the adhesive backing on the back of the replacement heating element and install on cushion pad in the same location as the original (Fig. 6).

CAUTION: During the installation of the replacement heating element, be very careful not to fold or crease the element assembly. Folds or creases will cause premature failure.

(2) Connect the new heating element electrical connectors (Fig. 6).

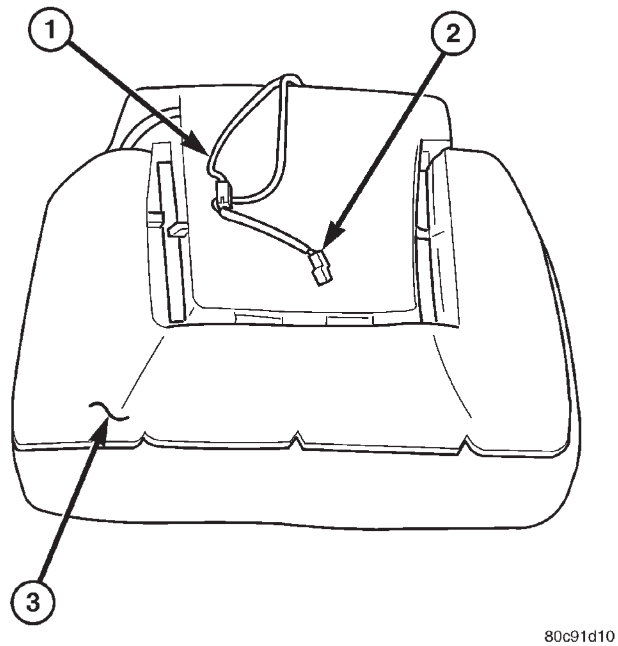


Fig. 6 HEATING ELEMENT INSTALLED

1 - SEAT BACK WIRE HARNESS
2 - HEATED SEAT WIRE HARNESS CONNECTOR
3 - HEATED SEAT CUSHION ELEMENT

(3) Connect the negative battery cable.

(4) Verify heated seat system operation.

(5) Install the appropriate seat cushion or seat back trim cover. Make certain the seat wire harness is correctly routed through the seat and seat back. The excess wire between the cushion and back elements should be securely tucked between the rear of the cushion foam and the rear carpet flap of the trim cover.

HEATED SEAT SENSOR

DESCRIPTION

The heated seat temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. One temperature sensor is used for each seat. This temperature sensor is located in the seat cushion heating element on all models.

The heated seat temperature sensor cannot be repaired or adjusted and must be replaced if defective. The heated seat cushion element must be replaced if the temperature sensor is defective. Refer to the procedure in this section of the service manual.

DIAGNOSIS AND TESTING - HEATED SEAT SENSOR

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Disconnect the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM) C1 connector. Check for continuity between the SEAT SENSOR 5V SUPPLY circuit cavity and the seat cushion frame. There should be **NO** continuity. If OK, go to Step 2. If not OK, repair the shorted seat sensor 5V supply circuit as required.

(2) Check for continuity between the SEAT SENSOR 5V SUPPLY circuit cavity of the 4-way power seat wire harness connector and the C1 connector for the HSM or MHSM. There should be continuity. If OK, go to Step 3. If not OK, repair the open seat sensor 5V supply circuit as required.

(3) Connect the module electrical connector. Turn system ON, using a voltmeter, backprobe the HSM or MHSM C1 connector on the SEAT TEMPERATURE SENSOR INPUT circuit cavity. Voltage should be present (2-4 volts). If OK, proceed with testing the other components in the heated seat system. If not OK, refer to Heated Seat Module Diagnosis and Testing in the electronic control modules section of this manual.

REMOVAL

(1) For heated seat sensor replacement procedure (Refer to 8 - ELECTRICAL/HEATED SEATS/ HEATED SEAT ELEMENT - REMOVAL).

PASSENGER HEATED SEAT SWITCH

DESCRIPTION

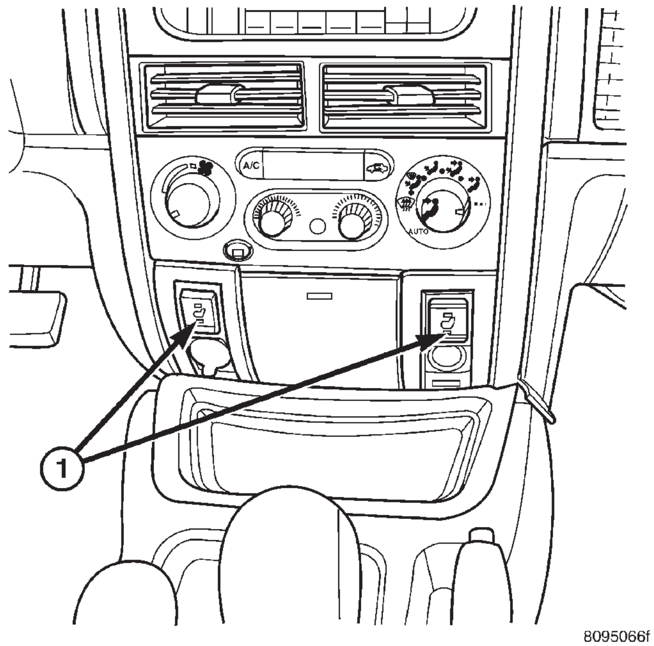


Fig. 7 HEATED SEAT SWITCHES

1 - HEATED SEAT SWITCHES

The heated seat switches are mounted in the instrument panel center lower bezel (Fig. 7), which is located near the bottom of the instrument panel center stack. The two three-position rocker-type switches, one switch for each front seat, provide a resistor multiplexed signal to the Body Control Module (BCM) through separate hard wired circuits. Each switch has an Off, Low, and High position so that both the driver and the front seat passenger can select a preferred seat heating mode. Each switch has two Light-Emitting Diodes (LED), one each for the Low position and the High position, which light to indicate that the heater for the seat that the switch controls is turned on. Each switch is also back lit by a replaceable incandescent bulb.

The heated seat switches and their LEDs cannot be repaired. If either switch or LED is faulty or damaged, the entire switch unit must be replaced. The incandescent switch illumination bulb and bulb holder units are available for service replacement.

PASSENGER HEATED SEAT SWITCH (Continued)

OPERATION

There are three positions that can be selected with each of the heated seat switches: Off, Low, or High. When the top of the switch rocker is fully depressed, the High position is selected and the high position LED indicator illuminates. When the bottom of the switch rocker is fully depressed, the Low position is selected and the low position LED indicator illuminates. When the switch rocker is moved to its neutral position, Off is selected and both LED indicators are extinguished.

Both switches provide separate resistor multiplexed hard wire inputs to the BCM to indicate the selected switch position. The BCM monitors the switch inputs and sends heated seat switch status messages to the Heated Seat Module (HSM) or the Memory Heated Seat Module (MHSM) over the Programmable Communications Interface (PCI) data bus. The HSM or MHSM responds to the heated seat switch status messages by controlling the output to the seat heater elements of the selected seat. The Low heat position set point is about 36° C (97° F), and the High heat position set point is about 41° C (105° F).

DIAGNOSIS AND TESTING - PASSENGER HEATED SEAT SWITCH

For complete circuit diagrams, refer to **Wiring Diagrams**.

WARNING: REFER TO THE RESTRAINTS SECTION OF THIS MANUAL BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run) circuit to the ignition switch as required.

(3) Disconnect and isolate the battery negative cable. Remove the lower center bezel from the instrument panel and disconnect the instrument panel wire harness connectors from both heated seat switch connector receptacles. Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es) and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es). If OK, turn the ignition switch to the Off position, disconnect and isolate the battery negative cable, and go to Step 5. If not OK, repair the open fused ignition switch output (run) circuit to the junction block fuse as required.

(5) Test the heated seat switch(es) (Fig. 8) as shown in the Heated Seat Switch Test chart. If OK, go to Step 6. If not OK, replace the faulty heated seat switch(es).

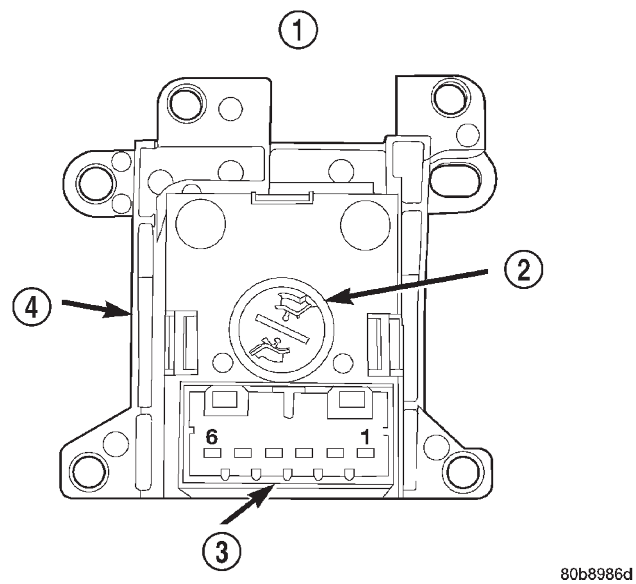


Fig. 8 Rear of Heated Seat Switch

1 - LEFT SHOWN (RIGHT TYPICAL)
2 - ILLUMINATION LAMP
3 - CONNECTOR RECEPTACLE
4 - HEATED SEAT SWITCH

HEATED SEAT SWITCH TEST		
SWITCH POSITION	RESISTANCE BETWEEN	RESISTANCE (OHMS)
Off	Pin 1 & 6	55
Low	Pin 1 & 6	1430
High	Pin 1 & 6	365
All resistance values are ±5%.		

PASSENGER HEATED SEAT SWITCH (Continued)

(6) Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the seat heater switch sensor ground circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es) and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted seat heater switch sensor ground circuit as required.

(7) Check for continuity between the seat heater switch sensor ground circuit cavities of the instrument panel wire harness connector for the in operative heated seat switch(es) and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, go to Step 8. If not OK, repair the open seat heater switch sensor ground circuit as required.

(8) Check for continuity between the seat heater switch mux circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch and a good ground. There should be no continuity. If OK, go to Step 9. If not OK, repair the shorted seat heater switch mux circuit as required.

(9) Check for continuity between the seat heater switch mux circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRB® scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open seat heater switch mux circuit as required.

REMOVAL

WARNING: REFER TO THE RESTRAINTS SECTION OF THIS MANUAL BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Body section of this manual for the procedure.

(3) Remove the four screws that secure the heated seat switch to the back of the instrument panel center lower bezel (Fig. 9).

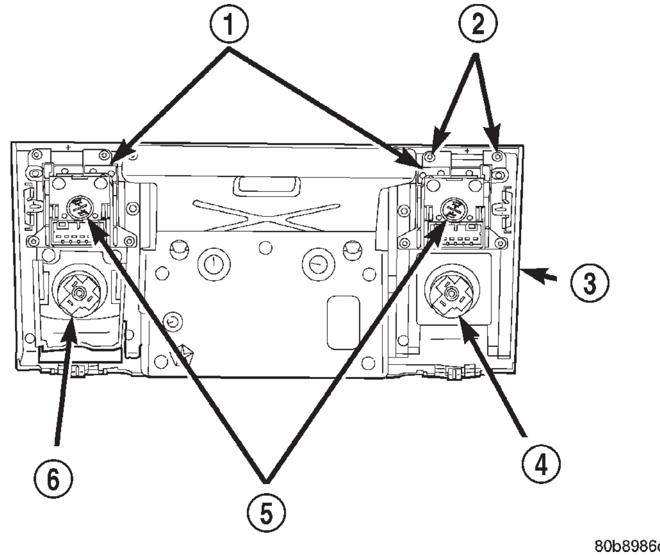


Fig. 9 Heated Seat Switch Remove/Install

1 - HEATED SEAT SWITCHES
2 - SCREWS (4)
3 - CENTER LOWER BEZEL
4 - CIGAR LIGHTER
5 - ILLUMINATION LAMPS
6 - POWER OUTLET

(4) Remove the heated seat switch from the back of the instrument panel center lower bezel.

INSTALLATION

(1) Position the heated seat switch onto the back of the instrument panel center lower bezel.

(2) Install and tighten the four screws that secure the heated seat switch to the back of the instrument panel center lower bezel. Tighten the screws to 1.5 N·m (13 in. lbs.).

(3) Install the center lower bezel onto the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Body section of this manual for the procedure.

(4) Reconnect the battery negative cable.

HORN

TABLE OF CONTENTS

HORN SYSTEM

DESCRIPTION

A dual-note electric horn system is standard factory-installed equipment on this model. The standard equipment horn system features one low-note horn unit and one high-note horn unit. The horn system allows the vehicle operator to provide an audible warning of the presence or approach of the vehicle to pedestrians and the drivers of other vehicles in near proximity. The horn system uses a non-switched source of battery current so that the system will remain functional, regardless of the ignition switch position.

The horn system can also be activated by the Body Control Module (BCM). The BCM is programmed to activate the horns in order to provide the following features:

• Remote Keyless Entry (RKE) system lock request audible verification (except export)

• RKE system panic mode audible alert

• Vehicle Theft Security System (VTSS) audible alarm.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to Overhead Console for more information on the customer programmable feature options. Customer programmable feature options affecting the horn system include:

• **Sound Horn on Lock** - Allows the option of having the horn sound a short chirp as an audible verification that the RKE system received a valid Lock request from the RKE transmitter, or having no audible verification.

The horn system includes the following components:

• Clockspring
• Horns
• Horn relay
• Horn switch

Certain functions and features of the horn system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect horn system operation are as follows:

• **Body Control Module (BCM)** (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODUL - DESCRIPTION) for more information.

• **Electronic Vehicle Information Center (EVIC)** (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION) for more information.

(Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - DESCRIPTION) for more information on this component. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds. Following are general descriptions of the remaining major components in the horn system.

OPERATION

The horn system is activated by a horn switch concealed beneath the driver side airbag module trim cover in the center of the steering wheel. Depressing the center of the driver side airbag module trim cover closes the horn switch. Closing the horn switch activates the horn relay. The activated horn relay then switches the battery current needed to energize the horns.

The BCM can also activate the horn system by energizing the horn relay through a single hard wired output circuit. The BCM energizes and de-energizes the horn relay in response to internal programming as well as message inputs received over the Programmable Communications Interface (PCI) data bus network. The BCM can energize the horn relay for a single chirp (RKE lock request), or for extended operation (RKE panic mode and VTSS alarm mode).

Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the horn system.

DIAGNOSIS AND TESTING - HORN SYSTEM

In most cases, any problem involving continually sounding horns can be quickly alleviated by removing the horn relay from the Power Distribution Center (PDC). Refer to Horn Relay for the proper removal procedure. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

HORN SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
BOTH HORNS INOPERATIVE	1. Faulty fuse.	1. Check the fuses in the Power Distribution Center (PDC) and the Junction Block (JB). Replace the fuse and repair the shorted circuit or component, if required.
	2. Faulty horn relay.	2. Refer to Horn Relay for the proper horn relay diagnosis and testing procedures. Replace the horn relay or repair the open horn relay circuit, if required.
	3. Faulty horn switch.	3. Refer to Horn Switch for the proper horn switch diagnosis and testing procedures. Replace the horn switch or repair the open horn switch circuit, if required.
	4. Faulty horns.	4. Refer to Horn for the proper horn diagnosis and testing procedures. Replace the horns or repair the open horn circuit, if required.
ONE HORN INOPERATIVE	1. Faulty horn.	1. Refer to Horn for the proper horn diagnosis and testing procedures. Replace the horn or repair the open horn circuit, if required.

HORN SYSTEM (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HORN SOUNDS CONTINUOUSLY	1. Faulty horn relay.	1. Refer to Horn Relay for the proper horn relay diagnosis and testing procedures. Replace the horn relay or repair the shorted horn relay control circuit, if required.
	2. Faulty horn switch.	2. Refer to Horn Switch for the proper horn switch diagnosis and testing procedures. Replace the horn switch or repair the shorted horn switch circuit, if required.

HORN

DESCRIPTION

The dual electromagnetic diaphragm-type horns are standard equipment on this model. Both horns are secured to a mounting bracket. The mounting bracket is secured with a screw to the back side of the right extension of the radiator closure assembly, just ahead of the right front wheel house and below the front wheel house extension. The two horns are connected in parallel. Each horn is grounded through its wire harness connector and circuit to an eyelet secured to the right inner fender shield near the battery, and receives battery feed through the closed contacts of the horn relay.

The horns cannot be repaired or adjusted and, if faulty or damaged, they must be individually replaced.

OPERATION

Within the two halves of the molded plastic horn housing are a flexible diaphragm, a plunger, an electromagnetic coil and a set of contact points. The diaphragm is secured in suspension around its perimeter by the mating surfaces of the horn housing. The plunger is secured to the center of the diaphragm and extends into the center of the electromagnet. The contact points control the current flow through the electromagnet.

When the horn is energized, electrical current flows through the closed contact points to the electromagnet. The resulting electromagnetic field draws the plunger and diaphragm toward it until that movement mechanically opens the contact points. When the contact points open, the electromagnetic field collapses allowing the plunger and diaphragm to return to their relaxed positions and closing the contact points again. This cycle continues repeating at a very rapid rate producing the vibration and movement of air that creates the sound that is directed through the horn outlet.

DIAGNOSIS AND TESTING - HORN

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect the wire harness connector(s) from the horn connector receptacle(s). Measure the resistance between the ground circuit cavity of the horn(s) wire harness connector(s) and a good ground. There should be no measurable resistance. If OK, go to Step 2. If not OK, repair the open ground circuit to ground as required.

(2) Check for battery voltage at the horn relay output circuit cavity of the horn(s) wire harness connector(s). There should be zero volts. If OK, go to Step 3. If not OK, repair the shorted horn relay output circuit or replace the faulty horn relay as required.

(3) Depress the horn switch. There should now be battery voltage at the horn relay output circuit cavity of the horn(s) wire harness connector(s). If OK, replace the faulty horns. If not OK, repair the open horn relay output circuit to the horn relay as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the lower front half of the inner liner from the right front fender wheel house. (Refer to 23 - BODY/EXTERIOR/FRONT FENDER - REMOVAL).

(4) Reach through the front of the right front fender wheel house opening to access and disconnect the two right headlamp and dash wire harness connectors from the horn connector receptacles (Fig. 1). Be certain to disengage the connector lock tabs before disconnecting them from the horn connector receptacles.

(5) Remove the screw that secures the horn mounting bracket to the right extension of the radiator closure assembly.

HORN (Continued)

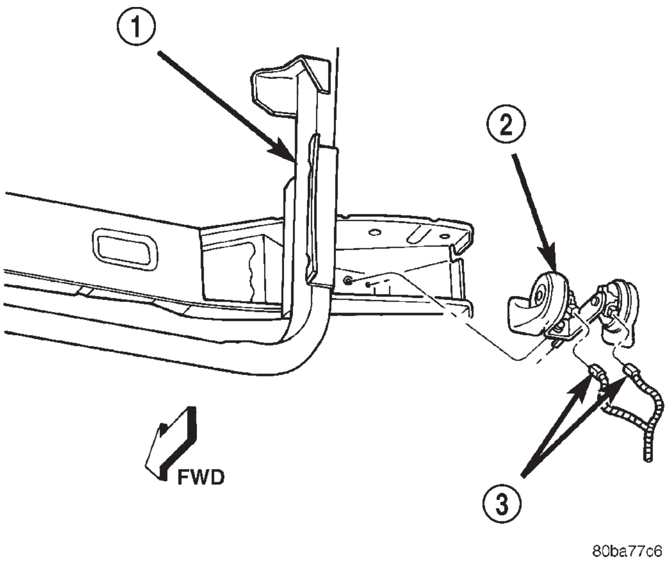


Fig. 1 Horns Remove/Install

1 - RADIATOR CLOSURE ASSEMBLY
2 - HORNS AND MOUNTING BRACKET
3 - RIGHT HEADLAMP AND DASH WIRE HARNESS CONNECTORS

(6) Remove both horns and the mounting bracket from the right extension of the radiator closure assembly as a unit.

INSTALLATION

(1) Position both horns and the mounting bracket onto the right extension of the radiator closure assembly as a unit.

(2) Install and tighten the screw that secures the horn mounting bracket to the right extension of the radiator closure assembly. Tighten the screw to 11.3 N·m (100 in. lbs.).

(3) Reconnect the two right headlamp and dash wire harness connectors to the horn connector receptacles. Be certain to engage the connector lock tabs after reconnecting them to the horn connector receptacles.

(4) Install the lower front half of the inner liner to the right front fender wheel house. (Refer to 23 - BODY/EXTERIOR/FRONT FENDER - INSTALLATION) for the procedure.

(5) Lower the vehicle.

(6) Reconnect the battery negative cable.

HORN RELAY

DESCRIPTION

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch grounds the relay coil. The horn relay is located in the Power Distribution Center (PDC) in the engine compartment. If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the PDC until further diagnosis is completed. See the fuse and relay layout label affixed to the inside surface of the PDC cover for horn relay identification and location.

The horn relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The horn relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING - HORN RELAY

The horn relay (Fig. 2) is located in the Power Distribution Center (PDC) between the battery and the right inner fender shield on the passenger side of the engine compartment. If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the PDC until further diagnosis is completed. See the fuse and relay layout label affixed to the inside surface of the PDC cover for horn relay identification and location. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

HORN RELAY (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the horn relay from the PDC. (Refer to 8 - ELECTRICAL/HORN/HORN RELAY - REMOVAL) for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

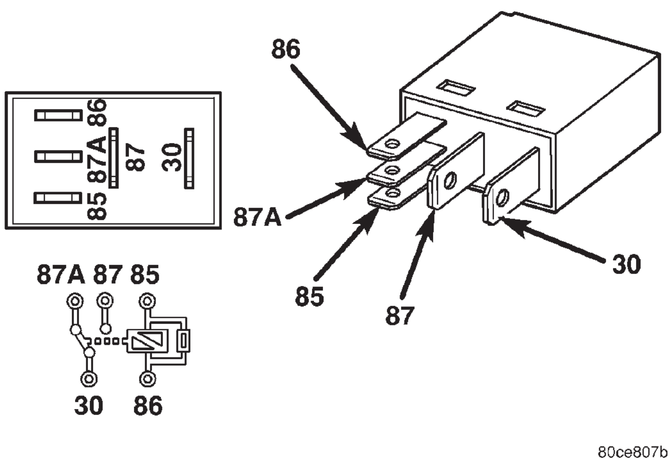


Fig. 2 Horn Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the horn(s). There should be continuity between the cavity for relay terminal 87 and the horn relay output circuit cavity of each horn wire harness connector at all times. If OK, go to Step 4. If not OK, repair the open circuit to the horn(s) as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is connected to battery voltage and should be hot at all times. Check for battery voltage at the cavity for relay terminal 86. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the PDC as required.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded through the horn switch when the horn switch is depressed. The horn relay coil ground terminal can also be grounded by the Body Control Module (BCM) in response to certain inputs related to the RKE system or the Vehicle Theft Security System. Check for continuity to ground at the cavity for relay terminal 85. There should be continuity with the horn switch depressed, and no continuity with the horn switch released. If not OK, (Refer to 8 - ELECTRICAL/HORN/HORN SWITCH - DIAGNOSIS AND TESTING).

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 3) .

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for horn relay identification and location.

(4) Remove the horn relay from the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper horn relay location.

(2) Position the horn relay in the proper receptacle in the PDC.

(3) Align the horn relay terminals with the terminal cavities in the PDC receptacle.

(4) Push down firmly on the horn relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Install the cover onto the PDC.

(6) Reconnect the battery negative cable.

HORN RELAY (Continued)

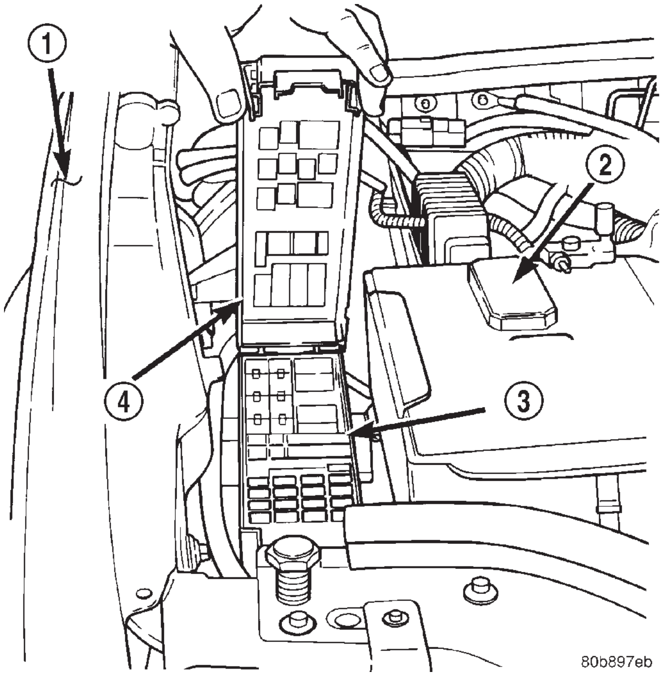


Fig. 3 Power Distribution Center

1 - RIGHT FENDER
2 - BATTERY
3 - POWER DISTRIBUTION CENTER
4 - COVER

HORN SWITCH

DESCRIPTION

A center-blow, normally open, resistive membrane-type horn switch is secured in a plastic tray that is inserted in a pocket sewn on the front of the driver side airbag retainer strap. The horn switch is concealed behind the driver side airbag module trim cover in the center of the steering wheel. The switch consists of two plastic membranes, one that is flat and one that is slightly convex. These two membranes are secured to each other around the perimeter. Inside the switch, the centers of the facing surfaces of these membranes each has a grid made with an electrically conductive material applied to it. One of the grids is connected to a circuit that provides it with continuity to ground at all times. The grid of the other membrane is connected to the horn relay control circuit.

The steering wheel and steering column must be properly grounded in order for the horn switch to function properly. The horn switch and plastic tray are serviced as a unit. If the horn switch is damaged or faulty, or if the driver side airbag is deployed, the horn switch and tray must be replaced as a unit.

OPERATION

When the center area of the driver side airbag trim cover is depressed, the electrically conductive grids on the facing surfaces of the horn switch membranes contact each other, closing the switch circuit. The completed horn switch circuit provides a ground for the control coil side of the horn relay, which activates the relay. When the horn switch is released, the resistive tension of the convex membrane separates the two electrically conductive grids and opens the switch circuit.

DIAGNOSIS AND TESTING - HORN SWITCH

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

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(1) Disconnect and isolate the battery negative cable. Remove the steering column opening cover from the instrument panel.

(2) Check for continuity between the metal steering column jacket and a good ground. There should be continuity. If OK, go to Step 3. If not OK, refer to Steering, Column for proper installation of the steering column.

(3) Remove the driver side airbag module from the steering wheel. Disconnect the horn switch wire harness connectors from the driver side airbag module.

(4) Remove the horn relay from the Power Distribution Center (PDC). Check for continuity between the steering column half of the horn switch feed wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted horn relay control circuit to the horn relay in the PDC as required.

(5) Check for continuity between the steering column half of the horn switch feed wire harness connector and the horn relay control circuit cavity for the horn relay in the PDC. There should be continuity. If OK, go to Step 6. If not OK, repair the open horn relay control circuit to the horn relay in the PDC as required.

HORN SWITCH (Continued)

(6) Check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should be no continuity. If OK, go to Step 7. If not OK, replace the faulty horn switch.

(7) Depress the center of the driver side airbag module trim cover and check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should now be continuity. If not OK, replace the faulty horn switch.

REMOVAL

WARNING:

• ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

• THE HORN SWITCH IS INTEGRAL TO THE DRIVER SIDE AIRBAG MODULE. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim cover from the driver side airbag module. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL) for the procedure.

(3) Remove the horn switch and tray as a unit from the pouch on the retaining strap of the driver side airbag module (Fig. 4).

INSTALLATION

WARNING:

• ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

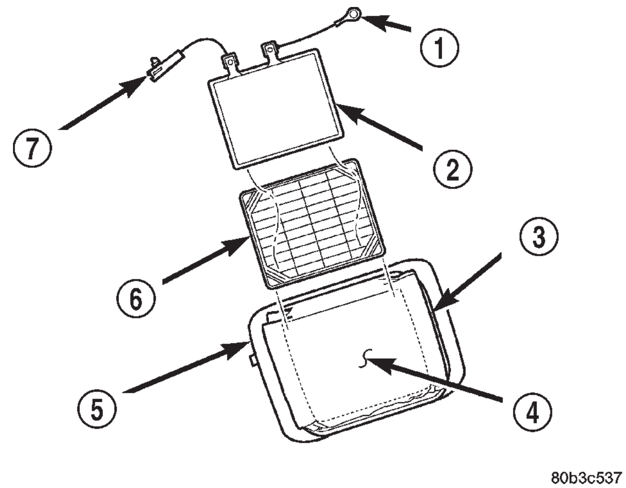


Fig. 4 Horn Switch Remove/Install

1 - HORN SWITCH GROUND WIRE EYELET
2 - HORN SWITCH
3 - AIRBAG RETAINING STRAP
4 - POUCH
5 - DRIVER SIDE AIRBAG MODULE (TRIM COVER REMOVED)
6 - TRAY
7 - HORN SWITCH FEED WIRE CONNECTOR

• THE HORN SWITCH IS INTEGRAL TO THE DRIVER SIDE AIRBAG MODULE. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Install the horn switch and tray as a unit into the pouch on the retaining strap of the driver side airbag module. Be certain that the tray is facing the airbag module, that the horn switch is facing the trim cover, that the horn switch feed wire is on the left, and that the horn switch ground wire is on the right.

(2) Install the trim cover onto the driver side airbag module. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION) for the procedure.

(3) Reconnect the battery negative cable.

IGNITION CONTROL

TABLE OF CONTENTS

IGNITION CONTROL

DESCRIPTION

Two different ignition systems are used. One type of system is for the 4.0L 6–cylinder engine. The other is for the 4.7L V-8 engine.

OPERATION

The 4.0L 6–cylinder engine uses a one-piece coil rail containing three independent coils. Although cylinder firing order is the same as 4.0L engines of previous years, spark plug firing is not. The 3 coils dual-fire the spark plugs on cylinders 1–6, 2–5 and/or 3–4. When one cylinder is being fired (on compression stroke), the spark to the opposite cylinder is being wasted (on exhaust stroke). The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 6 spark plugs. One electrical connector (located at the rear end of the coil rail) is used for all three coils.

The 4.7L V-8 engine uses 8 dedicated and individually fired coil for each spark plug. Each coil is mounted directly to the top of each spark plug. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used on either engine. A **distributor is not used** with either the 4.0L or 4.7L engines.

IGNITION CONTROL (Continued)

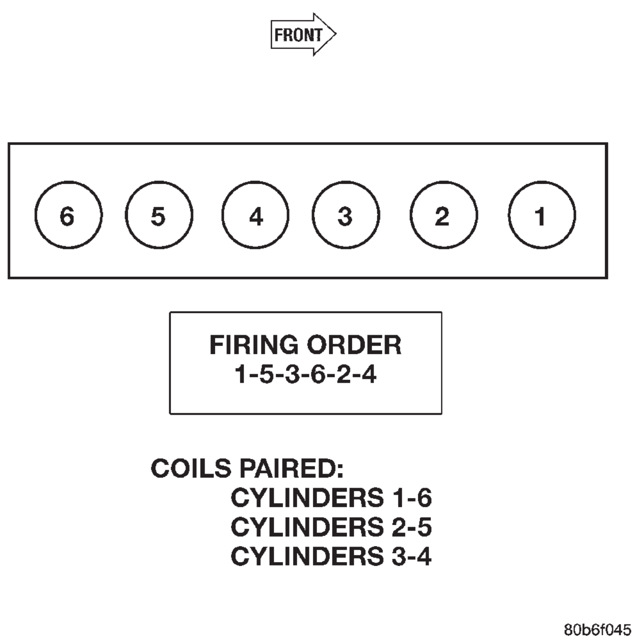
The ignition system is controlled by the powertrain control module (PCM) on all engines.

The ignition system consists of:

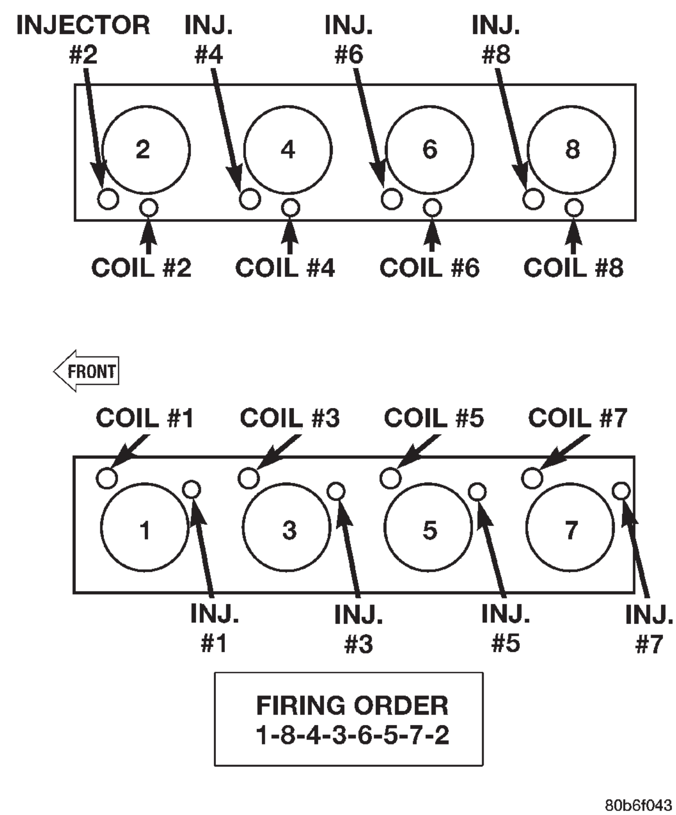
- Spark Plugs
- Ignition Coil(s)
- Powertrain Control Module (PCM)
- Crankshaft Position Sensor
- Camshaft Position Sensor
- The MAP, TPS, IAC and ECT also have an effect on the control of the ignition system.

SPECIFICATIONS

ENGINE FIRING ORDER - 4.0L 6-CYLINDER ENGINE



ENGINE FIRING ORDER—4.7L V-8 ENGINE



IGNITION COIL RESISTANCE - 4.0L ENGINE

PRIMARY RESISTANCE 21-27°C (70-80°F)
0.71 - 0.88 Ohms

IGNITION COIL RESISTANCE—4.7L V-8 ENGINE

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

IGNITION TIMING

All ignition timing functions are controlled by the Powertrain Control Module (PCM). Mechanical adjustments are not needed and can't be made.

On the 4.0L 6–cylinder engine, do not attempt to rotate the oil pump drive to adjust timing. This adjustment is used for fuel synchronization after camshaft position sensor replacement.

IGNITION CONTROL (Continued)

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
4.0L 6-CYL.	RC12ECC	0.89 mm (.035 in.)
4.7L V-8 (Exc. HO)	RC12MCC4	1.01 mm (.040 in.)
4.7L V-8 High Output (HO)	RC7PYCB4	1.01 mm (.040 in.)

TORQUE - IGNITION SYSTEM

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Crankshaft Position Sensor Bolts - 4.0L Engine	7	-	60
Crankshaft Position Sensor Bolt - 4.7L V-8 Engine	28	21	-
Camshaft Position Sensor–to–base bolts - 4.0L Engine	2	-	15
Camshaft Position Sensor Bolt - 4.7L V-8 Engine	12	-	106
Oil Pump Drive Hold-down Bolt - 4.0L Engine	23	17	-
Ignition Coil Rail Mounting Bolts - 4.0L Engine	29	-	250
Ignition Coil Mounting Nut - 4.7L V-8 Engine	8	-	70
* Knock Sensor Bolt - 4.7L HO V-8 Engine	*20	*15	-
Spark Plugs - 4.0L Engine	35-41	26-30	-
Spark Plugs - 4.7L V-8 Engine	24 - 30	18 - 22	-
* Do not apply any sealant, thread-locker or adhesive to bolts. Poor sensor performance may result. Refer to Removal / Installation for additional information.			

AUTO SHUT DOWN RELAY

DESCRIPTION - PCM OUTPUT

The 5–pin, 12–volt, Automatic Shutdown (ASD) relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION

OPERATION - PCM OUTPUT

The ASD relay supplies battery voltage (12+ volts) to the fuel injectors and ignition coil(s). With certain emissions packages it also supplies 12–volts to the oxygen sensor heating elements.

The ground circuit for the coil within the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM operates the ASD relay by switching its ground circuit on and off.

AUTO SHUT DOWN RELAY (Continued)

The ASD relay will be shut–down, meaning the 12–volt power supply to the ASD relay will be de-activated by the PCM if:

• the ignition key is left in the ON position. This is if the engine has not been running for approximately 1.8 seconds.

• there is a crankshaft position sensor signal to the PCM that is lower than pre-determined values.

OPERATION - ASD SENSE - PCM INPUT

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater element, ignition coil and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the Powertrain Control Module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

REMOVAL

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 1). Refer to label on PDC cover for relay location.

(1) Remove PDC cover.

(2) Remove relay from PDC.

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

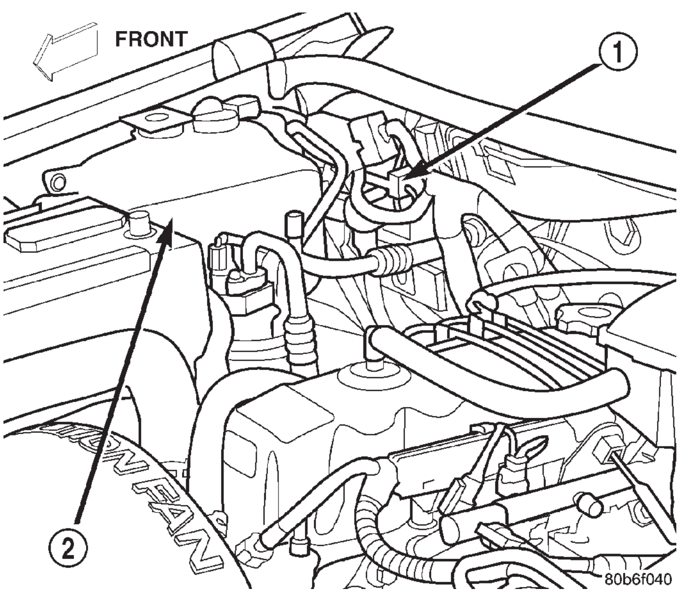


Fig. 1 Power Distribution Center (PDC) Location

1 - PCM
2 - COOLANT TANK

INSTALLATION

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 1). Refer to label on PDC cover for relay location.

(1) Install relay to PDC.

(2) Install cover to PDC.

CAMSHAFT POSITION SENSOR

DESCRIPTION

DESCRIPTION - 4.0L

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 2). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 3).

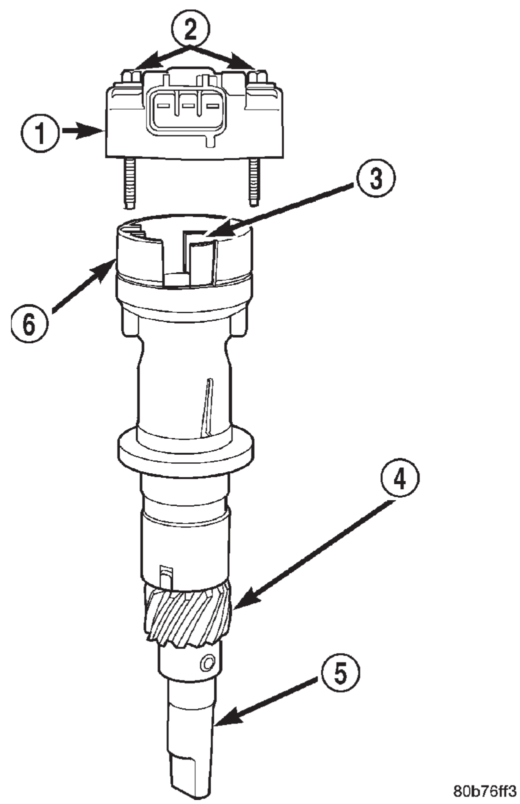


Fig. 2 CMP and Oil Pump Drive Shaft—4.0L Engine

1 - CAMSHAFT POSITION SENSOR
2 - MOUNTING BOLTS (2)
3 - PULSE RING
4 - DRIVE GEAR (TO CAMSHAFT)
5 - OIL PUMP DRIVESHAFT
6 - SENSOR BASE (OIL PUMP DRIVESHAFT ASSEMBLY)

CAMSHAFT POSITION SENSOR (Continued)

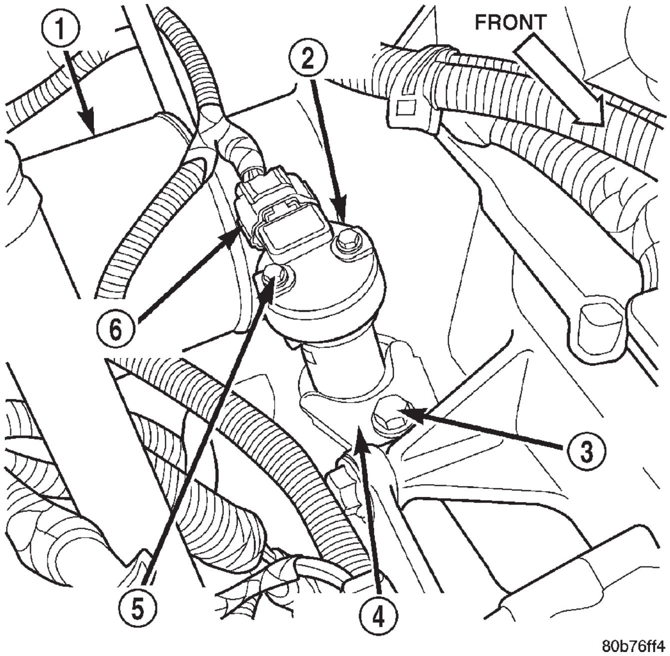


Fig. 3 CMP Location—4.0L Engine

1 - OIL FILTER
2 - CAMSHAFT POSITION SENSOR
3 - CLAMP BOLT
4 - HOLD-DOWN CLAMP
5 - MOUNTING BOLTS (2)
6 - ELEC. CONNECTOR

DESCRIPTION - 4.7L

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 4).

OPERATION

OPERATION - 4.0L

The CMP sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects a rotating pulse ring (shutter) on the oil pump drive shaft (Fig. 2). The pulse ring rotates 180 degrees through the sync signal generator. Its signal is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the pulse ring (shutter) enters the sync signal generator, the following occurs: The interruption of magnetic field causes the voltage to switch high resulting in a sync signal of approximately 5 volts.

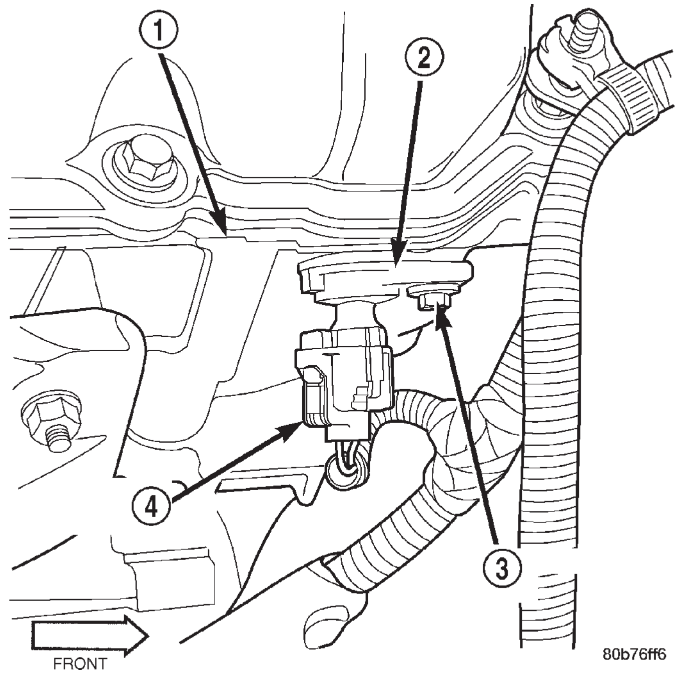


Fig. 4 CMP Location—4.7L Engine

1 - RIGHT CYLINDER HEAD
2 - CAMSHAFT POSITION SENSOR
3 - MOUNTING BOLT
4 - ELEC. CONNECTOR

When the trailing edge of the pulse ring (shutter) leaves the sync signal generator, the following occurs: The change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

OPERATION - 4.7L

The CMP sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects notches located on a tonewheel. The tonewheel is located at the front of the camshaft for the right cylinder head (Fig. 5). As the tonewheel rotates, the notches pass through the sync signal generator. The pattern of the notches (viewed counter-clockwise from front of engine) is: 1 notch, 2 notches, 3 notches, 3 notches, 2 notches 1 notch, 3 notches and 1 notch. The signal from the CMP sensor is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

CAMSHAFT POSITION SENSOR (Continued)

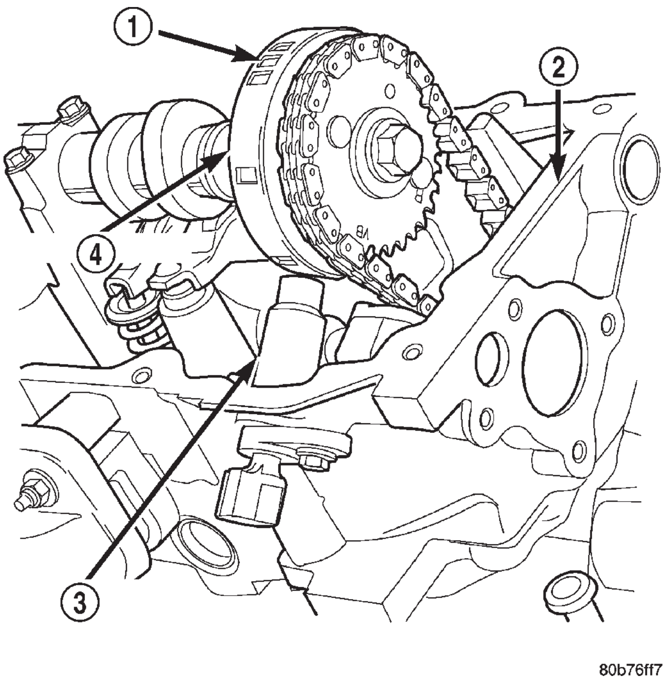


Fig. 5 CMP Sensor and Tonewheel—4.7L Engine

1 - NOTCHES
2 - RIGHT CYLINDER HEAD
3 - CAMSHAFT POSITION SENSOR
4 - TONEWHEEL

REMOVAL

REMOVAL - 4.0L

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 6). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 7).

The rotational position of oil pump drive determines fuel synchronization only. It does not determine ignition timing.

NOTE: Do not attempt to rotate the oil pump drive to modify ignition timing.

Two different procedures are used for removal and installation. The first procedure will detail removal and installation of the sensor only. The second procedure will detail removal and installation of the sensor and oil pump drive shaft assembly. The second procedure is to be used if the engine has been disassembled.

An internal oil seal is used in the drive shaft housing that prevents engine oil at the bottom of the sensor. The seal is not serviceable.

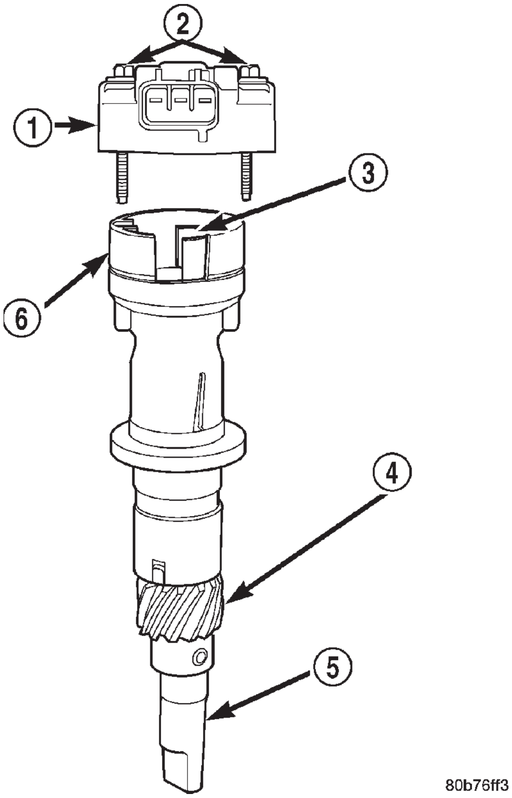


Fig. 6 CMP and Oil Pump Drive Shaft - 4.0L Engine

1 - CAMSHAFT POSITION SENSOR
2 - MOUNTING BOLTS (2)
3 - PULSE RING
4 - DRIVE GEAR (TO CAMSHAFT)
5 - OIL PUMP DRIVESHAFT
6 - SENSOR BASE (OIL PUMP DRIVESHAFT ASSEMBLY)

SENSOR ONLY - 4.0L

(1) Disconnect electrical connector at CMP sensor (Fig. 7).

(2) Remove 2 sensor mounting bolts (Fig. 6) or (Fig. 7).

(3) Remove sensor from oil pump drive.

OIL PUMP DRIVE AND SENSOR - 4.0L

If the CMP and oil pump drive are to be removed and installed, do not allow engine crankshaft or camshaft to rotate. CMP sensor relationship will be lost.

(1) Disconnect electrical connector at CMP sensor (Fig. 7).

(2) Remove 2 sensor mounting bolts (Fig. 6) or (Fig. 7).

(3) Remove sensor from oil pump drive.

(4) Before proceeding to next step, mark and note rotational position of oil pump drive in relationship to engine block. After installation, the CMP sensor should face rear of engine 0°.

(5) Remove hold-down bolt and clamp (Fig. 7).

CAMSHAFT POSITION SENSOR (Continued)

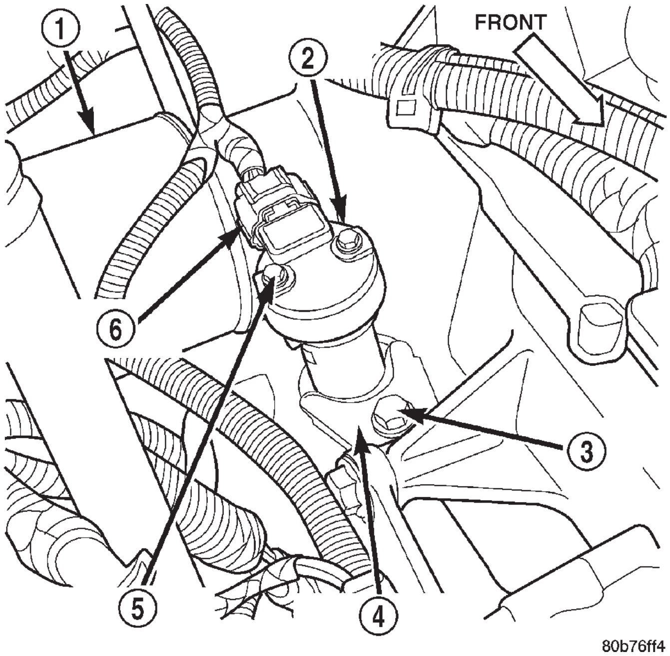


Fig. 7 CMP Location - 4.0L Engine

1 - OIL FILTER
2 - CAMSHAFT POSITION SENSOR
3 - CLAMP BOLT
4 - HOLD-DOWN CLAMP
5 - MOUNTING BOLTS (2)
6 - ELEC. CONNECTOR

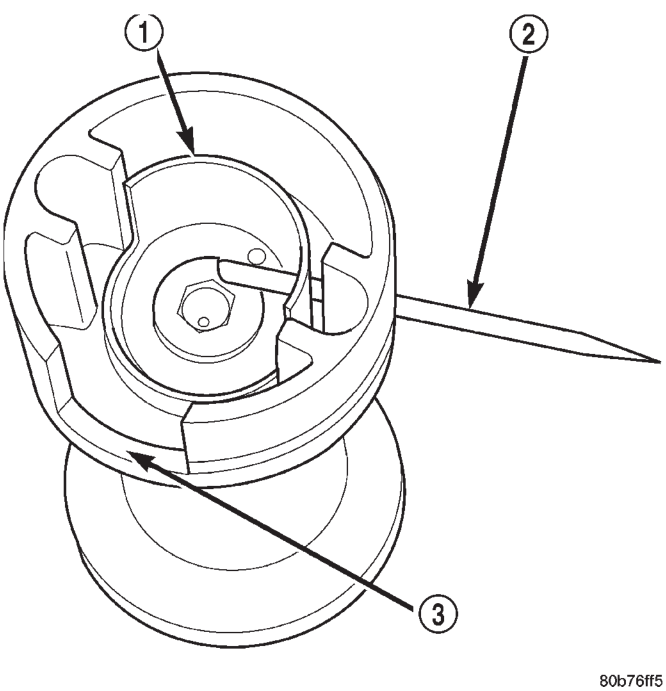


Fig. 8 CMP Pulse Ring Alignment - 4.0L Engine

1 - PULSE RING (SHUTTER)
2 - TOOTHPICK
3 - SENSOR BASE (OIL PUMP DRIVESHAFT ASSEMBLY)

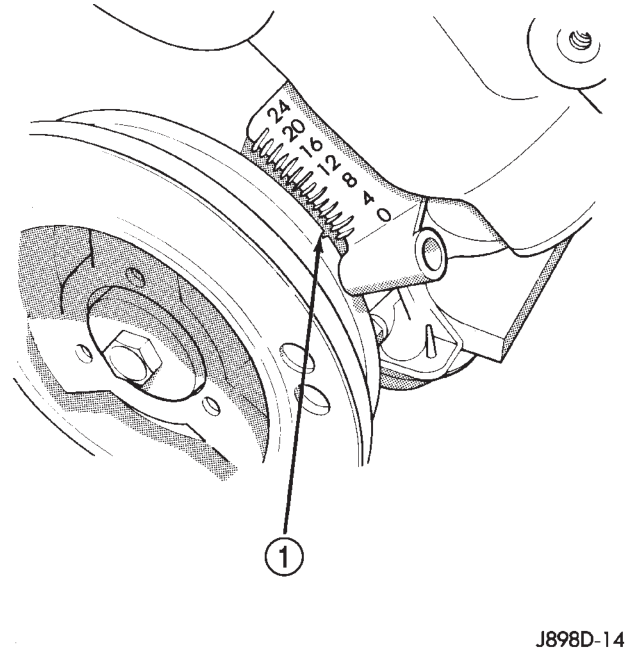


Fig. 9 Align Timing Marks - 4.0L Engine

1 - CRANKSHAFT VIBRATION DAMPER TIMING MARK

(6) While pulling assembly from engine, note direction and position of pulse ring (Fig. 6). After removal, look down into top of oil pump and note direction and position of slot at top of oil pump gear.

(7) Remove and discard old oil pump drive-to-engine block gasket.

REMOVAL - 4.7L

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 10).

It is easier to remove/install sensor from under vehicle.

(1) Raise and support vehicle.

(2) Disconnect electrical connector at CMP sensor (Fig. 10).

(3) Remove sensor mounting bolt (Fig. 10).

(4) Carefully pry sensor from cylinder head in a rocking action with two small screwdrivers. **Some 4.7L engines are equipped with a sensor spacer shim. If equipped, this shim will be located at sensor bolt hole between cylinder head and sensor mounting tang (TSB W08–18–00). Save this shim for sensor installation.**

(5) Check condition of sensor o-ring.

CAMSHAFT POSITION SENSOR (Continued)

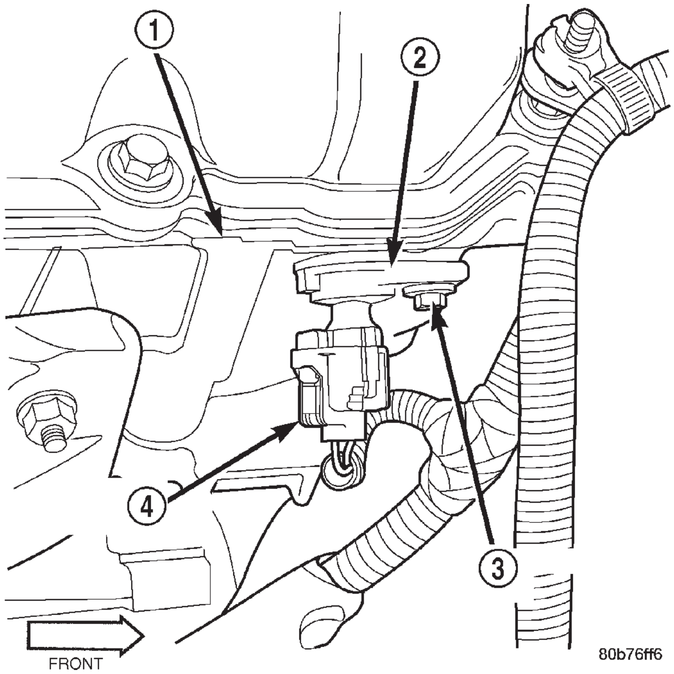


Fig. 10 CMP Location—4.7L Engine

1 - RIGHT CYLINDER HEAD
2 - CAMSHAFT POSITION SENSOR
3 - MOUNTING BOLT
4 - ELEC. CONNECTOR

INSTALLATION

INSTALLATION - 4.0L

SENSOR ONLY - 4.0L

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 6). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 7).

(1) Install sensor to oil pump drive.

(2) Install 2 sensor mounting bolts and tighten to 2 N·m (15 in. lbs.) torque.

(3) Connect electrical connector to CMP sensor.

OIL PUMP DRIVE AND SENSOR - 4.0L

(1) Clean oil pump drive mounting hole area of engine block.

(2) Install new oil pump drive-to-engine block gasket.

(3) Temporarily install a toothpick or similar tool through access hole at side of oil pump drive housing. Align toothpick into mating hole on pulse ring (Fig. 8).

(4) Install oil pump drive into engine while aligning into slot on oil pump. Rotate oil pump drive back to its original position and install hold-down clamp and bolt. Finger tighten bolt. Do not do a final tightening of bolt at this time.

(5) If engine crankshaft or camshaft has been rotated, such as during engine tear-down, CMP sensor relationship must be reestablished.

(a) Remove ignition coil rail assembly. Refer to Ignition Coil Removal/Installation.

(b) Remove cylinder number 1 spark plug.

(c) Hold a finger over the open spark plug hole. Rotate engine at vibration dampener bolt until compression (pressure) is felt.

(d) Slowly continue to rotate engine. Do this until timing index mark on vibration damper pulley aligns with top dead center (TDC) mark (0 degree) on timing degree scale (Fig. 9). Always rotate engine in direction of normal rotation. Do not rotate engine backward to align timing marks.

(e) Install oil pump drive into engine while aligning into slot on oil pump. If pump drive will not drop down flush to engine block, the oil pump slot is not aligned. Remove oil pump drive and align slot in oil pump to shaft at bottom of drive. Install into engine. Rotate oil pump drive back to its original position and install hold-down clamp and bolt. Finger tighten bolt. Do not do a final tightening of bolt at this time.

(f) Remove toothpick from housing.

(6) Install sensor to oil pump drive. After installation, the CMP sensor should face rear of engine 0°.

(7) Install 2 sensor mounting bolts and tighten to 2 N·m (15 in. lbs.) torque.

(8) Connect electrical connector to CMP sensor.

(9) If removed, install spark plug and ignition coil rail.

To verify correct rotational position of oil pump drive, the DRB scan tool must be used.

WARNING: WHEN PERFORMING THE FOLLOWING TEST, THE ENGINE WILL BE RUNNING. BE CAREFUL NOT TO STAND IN LINE WITH THE FAN BLADES OR FAN BELT. DO NOT WEAR LOOSE CLOTHING.

(10) Connect DRB scan tool to data link connector. The data link connector is located in passenger compartment, below and to left of steering column.

(11) Gain access to SET SYNC screen on DRB.

(12) Follow directions on DRB screen and start engine. Bring to operating temperature (engine must be in “closed loop” mode).

(13) With engine running at **idle speed**, the words IN RANGE should appear on screen along with 0°. This indicates correct position of oil pump drive.

CAMSHAFT POSITION SENSOR (Continued)

(14) If a plus (+) or a minus (-) is displayed next to degree number, and/or the degree displayed is not zero, loosen but do not remove hold-down clamp bolt. Rotate oil pump drive until IN RANGE appears on screen. Continue to rotate oil pump drive until achieving as close to 0° as possible.

The degree scale on SET SYNC screen of DRB is referring to fuel synchronization only. **It is not referring to ignition timing.** Because of this, do not attempt to adjust ignition timing using this method. Rotating oil pump drive will have no effect on ignition timing. All ignition timing values are controlled by powertrain control module (PCM).

(15) Tighten hold-down clamp bolt to 23 N·m (17 ft. lbs.) torque.

INSTALLATION - 4.7L

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 10).

(1) Clean out machined hole in cylinder head.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into cylinder head with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 12 N·m (106 in. lbs.) torque.

(5) Connect electrical connector to sensor.

(6) Lower vehicle.

COIL RAIL

DESCRIPTION

A one-piece coil rail assembly containing three individual coils is used on the 4.0L 6–cylinder engine (Fig. 11). The coil rail must be replaced as one assembly. The bottom of the coil is equipped with 6 individual rubber boots (Fig. 11) to seal the 6 spark plugs to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately.

(1) The coil is bolted directly to the cylinder head (Fig. 12). One electrical connector (located at rear of coil) is used for all three coils.

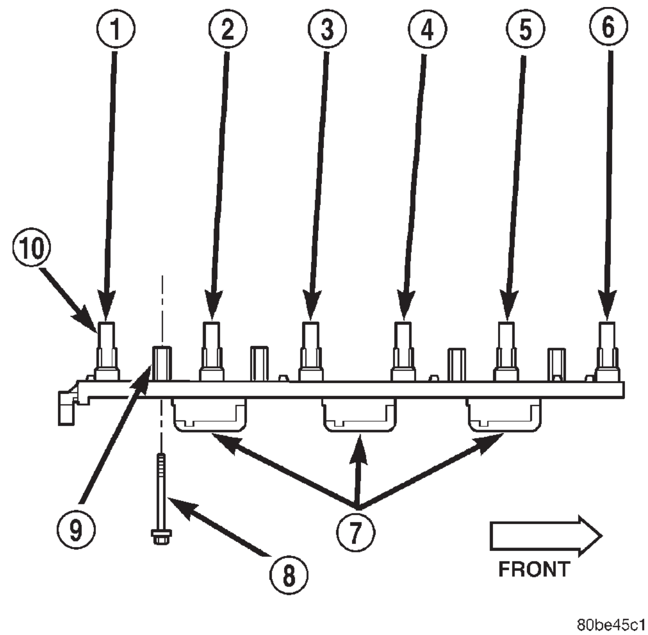


Fig. 11 Ignition Coil Assembly—4.0L 6–Cylinder Engine

1 - CYL. #6
2 - CYL. #5
3 - CYL. #4
4 - CYL. #3
5 - CYL. #2
6 - CYL. #1
7 - COILS (3)
8 - MOUNTING BOLTS (4)
9 - BOLT BASES (4)
10 - RUBBER BOOTS (6)

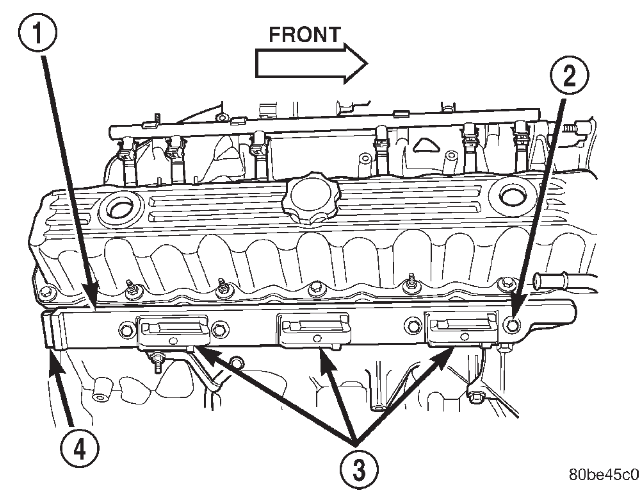


Fig. 12 Coil Location—4.0L Engine

1 - COIL RAIL
2 - COIL MOUNTING BOLTS (4)
3 - COIL
4 - COIL ELECTRICAL CONNECTION

COIL RAIL (Continued)

OPERATION

Although cylinder firing order is the same as 4.0L Jeep engines of previous years, spark plug firing is not. The 3 coils dual-fire the spark plugs on cylinders 1-6, 2-5 and/or 3-4. When one cylinder is being fired (on compression stroke), the spark to the opposite cylinder is being wasted (on exhaust stroke).

Battery voltage is supplied to the three ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes the ignition coil ground circuit for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used. The cables are integral within the coil rail.

REMOVAL

A one-piece coil rail assembly containing three individual coils is used on the 4.0L engine (Fig. 13). The coil rail must be replaced as one assembly. The bottom of the coil is equipped with 6 individual rubber boots (Fig. 13) to seal the 6 spark plugs to the coil. Inside each rubber boot is a spring. The spring is used for an electrical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately.

(1) Disconnect negative battery cable at battery.

(2) The coil is bolted directly to the cylinder head. Remove 4 coil mounting bolts (Fig. 14).

(3) Carefully pry up coil assembly from spark plugs. Do this by prying alternately at each end of coil until rubber boots have disengaged from all spark plugs. If boots will not release from spark plugs, use a commercially available spark plug boot removal tool. Twist and loosen a few boots from a few spark plugs to help remove coil.

(4) After coil has cleared spark plugs, position coil for access to primary electrical connector. Disconnect connector from coil by pushing slide tab outwards to right side of vehicle (Fig. 15). After slide tab has been positioned outwards, push in on secondary release lock (Fig. 15) on side of connector and pull connector from coil.

(5) Remove coil from vehicle.

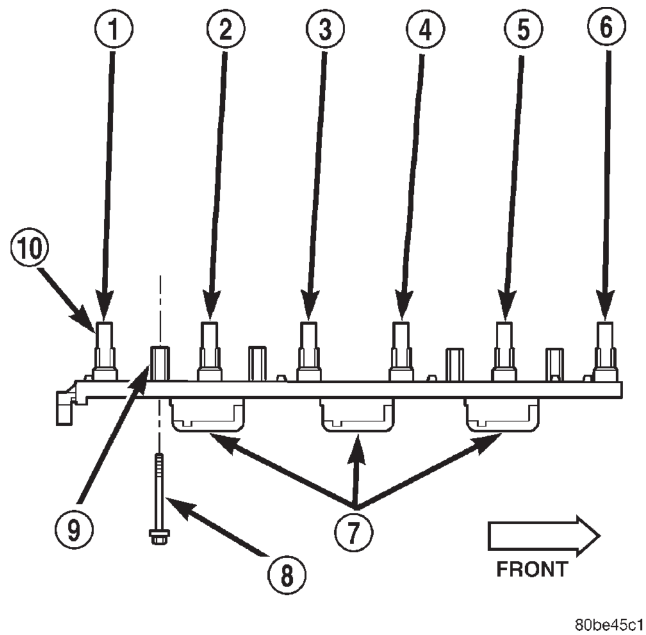


Fig. 13 Ignition Coil Assembly—4.0L 6–Cylinder Engine

1 - CYL. #6
2 - CYL. #5
3 - CYL. #4
4 - CYL. #3
5 - CYL. #2
6 - CYL. #1
7 - COILS (3)
8 - MOUNTING BOLTS (4)
9 - BOLT BASES (4)
10 - RUBBER BOOTS (6)

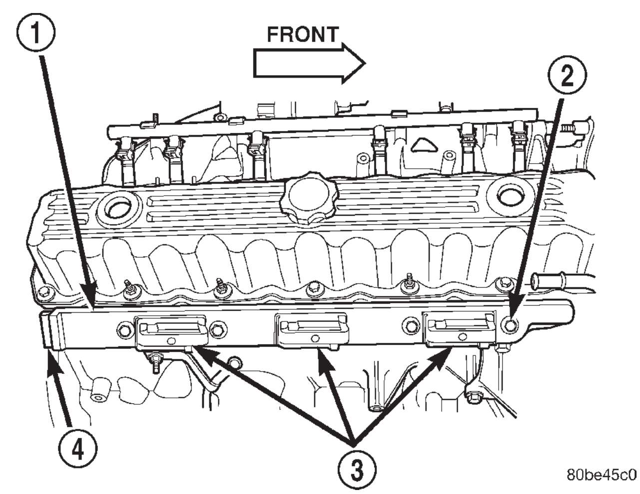


Fig. 14 Ignition Coil Rail Location—4.0L 6–Cylinder Engine

1 - COIL RAIL
2 - COIL MOUNTING BOLTS (4)
3 - COIL
4 - COIL ELECTRICAL CONNECTION

COIL RAIL (Continued)

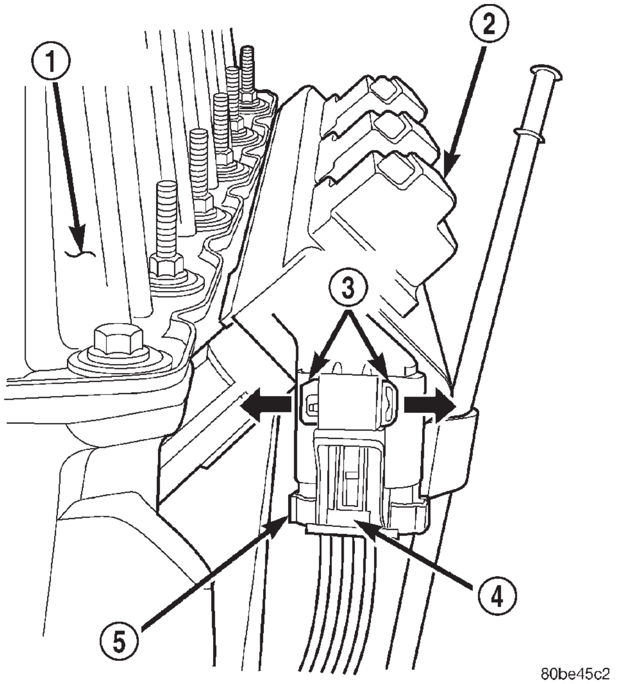


Fig. 15 Ignition Coil Electrical Connector—4.0L 6–Cylinder Engine

1 - REAR OF VALVE COVER
2 - COIL RAIL
3 - SLIDE TAB
4 - RELEASE LOCK
5 - COIL CONNECTOR

INSTALLATION

(1) Connect engine harness connector to coil by snapping into position. Move slide tab towards engine (Fig. 15) for a positive lock.

(2) Position ignition coil rubber boots to all spark plugs. Push down on coil assembly until bolt bases have contacted cylinder head

(3) Install 4 coil mounting bolts. Loosely tighten 4 bolts just enough to allow bolt bases to contact cylinder head. Do a final tightening of each bolt in steps down to 29 N·m (250 in. lbs.) torque. Do not apply full torque to any bolt first.

(4) Connect negative battery cable to battery.

IGNITION COIL

DESCRIPTION

The 4.7L V–8 engine uses 8 dedicated, and individually fired coil (Fig. 16) for each spark plug. Each coil is mounted directly to the top of each spark plug (Fig. 17).

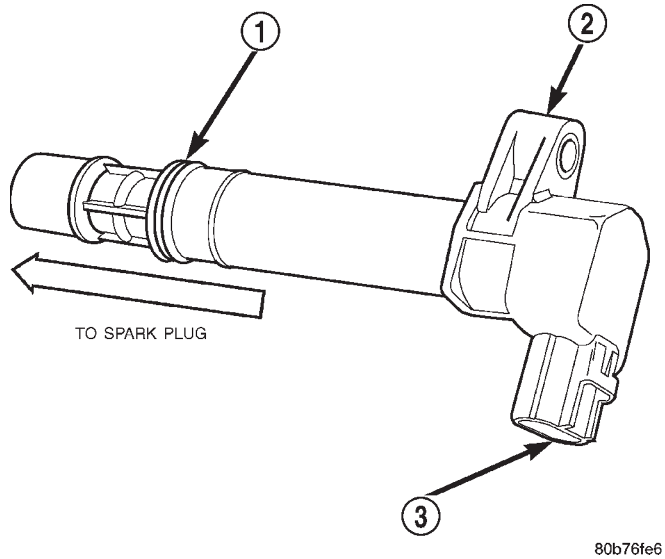


Fig. 16 Ignition Coil—4.7L Engine

1 - O-RING
2 - IGNITION COIL
3 - ELECTRICAL CONNECTOR

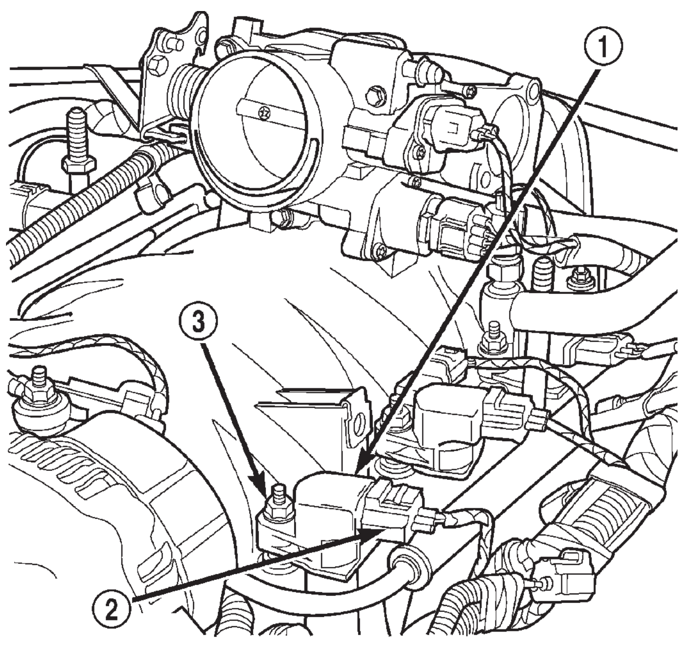


Fig. 17 Ignition Coil Location—4.7L Engine

1 - IGNITION COIL
2 - COIL ELECTRICAL CONNECTOR
3 - COIL MOUNTING STUD/NUT

IGNITION COIL (Continued)

OPERATION

Battery voltage is supplied to the 8 ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used.

REMOVAL

An individual ignition coil is used for each spark plug (Fig. 18). The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold (Fig. 19). The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (Fig. 18) is used to seal the coil at the opening into the cylinder head.

(1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.

(2) Disconnect electrical connector (Fig. 19) from coil by pushing downward on release lock on top of connector and pull connector from coil.

(3) Clean area at base of coil with compressed air before removal.

(4) Remove coil mounting nut from mounting stud (Fig. 19).

(5) Carefully pull up coil from cylinder head opening with a slight twisting action.

(6) Remove coil from vehicle.

INSTALLATION

(1) Using compressed air, blow out any dirt or contaminants from around top of spark plug.

(2) Check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.

(3) Position ignition coil into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.

(4) Install mounting stud nut and tighten to 8 N·m (70 in. lbs.) torque.

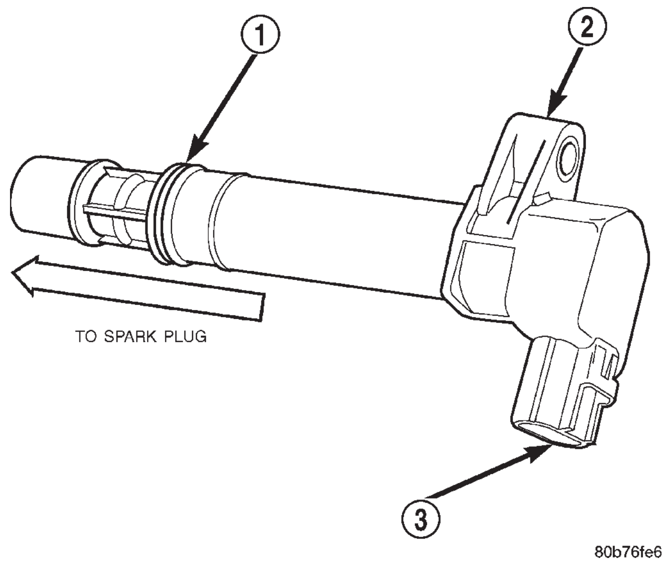


Fig. 18 Ignition Coil—4.7L V–8

1 - O-RING
2 - IGNITION COIL
3 - ELECTRICAL CONNECTOR

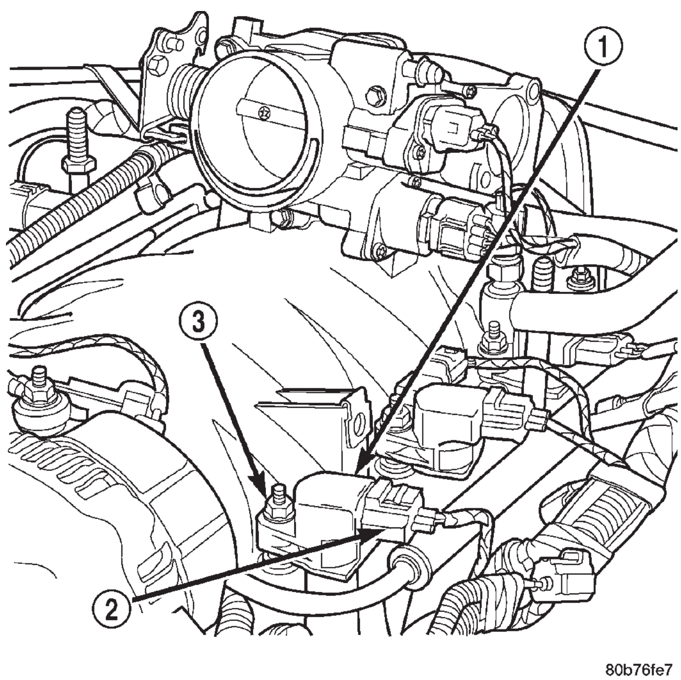


Fig. 19 Ignition Coil

1 - IGNITION COIL
2 - COIL ELECTRICAL CONNECTOR
3 - COIL MOUNTING STUD/NUT

(5) Connect electrical connector to coil by snapping into position.

(6) If necessary, install throttle body air tube or box.

IGNITION COIL CAPACITOR

DESCRIPTION

Two coil capacitors are used. One of them is located near the center of, and on the left side of the intake manifold (Fig. 20). The other capacitor is located near the center of, and on the right side of the intake manifold.

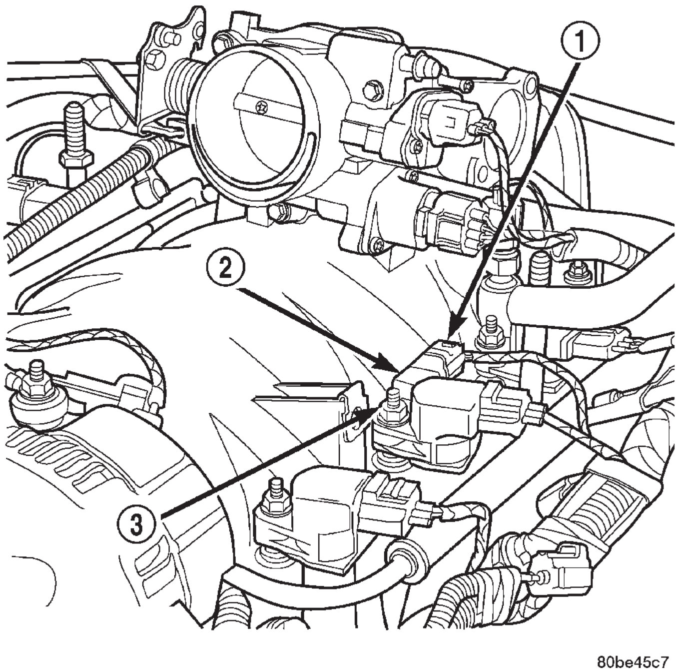


Fig. 20 Coil Capacitor (Left Side Shown)

1 - ELECTRICAL CONNECTOR
2 - COIL CAPACITOR
3 - MOUNTING NUT

OPERATION

The 2 coil capacitors are used to prevent high-voltage spikes from interfering with the operation of certain powertrain sensors. They are also used to help prevent radio interference.

REMOVAL

Two coil capacitors are used. One of them is located near the center of, and on the left side of the intake manifold (Fig. 21). The other capacitor is located near the center of, and on the right side of the intake manifold.

(1) Disconnect electrical connector at coil capacitor (Fig. 21).

(2) Remove mounting nut.

(3) Remove capacitor from mounting stud.

INSTALLATION

(1) Position capacitor to manifold mounting stud.

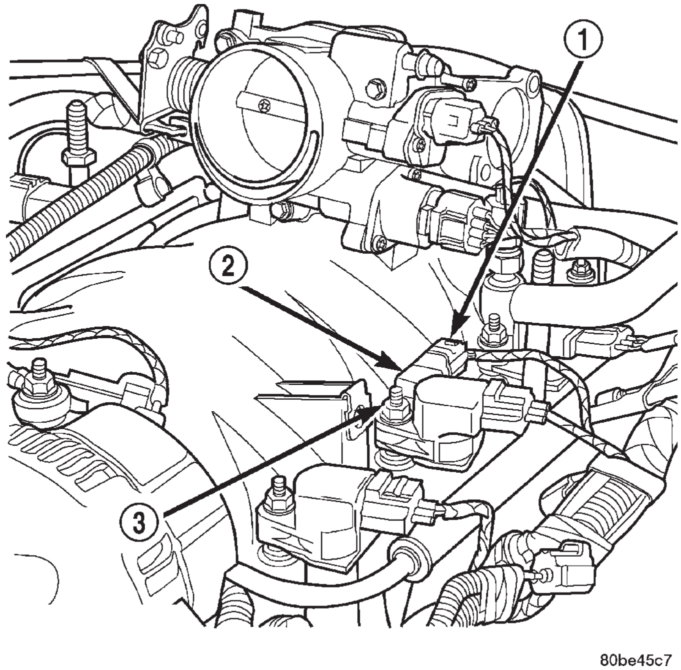


Fig. 21 Coil Capacitor (Left Side Shown)

1 - ELECTRICAL CONNECTOR
2 - COIL CAPACITOR
3 - MOUNTING NUT

(2) Install nut and tighten to 8 N·m (70 in. lbs.) torque.

(3) Connect electrical connector to capacitor (Fig. 21).

KNOCK SENSOR

DESCRIPTION

4.7L High-Output Engine

The 2 knock sensors are bolted into the cylinder block under the intake manifold.

OPERATION

4.7L High-Output Engine

Two knock sensors are used on the 4.7L V-8 engine if equipped with the high-output package; one for each cylinder bank. When the knock sensor detects a knock in one of the cylinders on the corresponding bank, it sends an input signal to the Powertrain Control Module (PCM). In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increases, the knock sensor output voltage also increases.

KNOCK SENSOR (Continued)

The voltage signal produced by the knock sensor increases with the amplitude of vibration. The PCM receives the knock sensor voltage signal as an input. If the signal rises above a predetermined level, the PCM will store that value in memory and retard ignition timing to reduce engine knock. If the knock sensor voltage exceeds a preset value, the PCM retards ignition timing for all cylinders. It is not a selective cylinder retard.

The PCM ignores knock sensor input during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Knock retard uses its own short term and long term memory program.

Long term memory stores previous detonation information in its battery-backed RAM. The maximum authority that long term memory has over timing retard can be calibrated.

Short term memory is allowed to retard timing up to a preset amount under all operating conditions (as long as rpm is above the minimum rpm) except at Wide Open Throttle (WOT). The PCM, using short term memory, can respond quickly to retard timing when engine knock is detected. Short term memory is lost any time the ignition key is turned off.

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors.

REMOVAL

4.7L High-Output Engine Only

The 2 knock sensors are bolted into the cylinder block under the intake manifold (Fig. 22).

NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

(1) Disconnect knock sensor dual pigtail harness connector from engine wiring harness connector. This connection is made near the right/rear of intake manifold (Fig. 23).

(2) Remove intake manifold. Refer to Engine section.

(3) Remove sensor mounting bolts (Fig. 22). Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

(4) Remove sensors from engine.

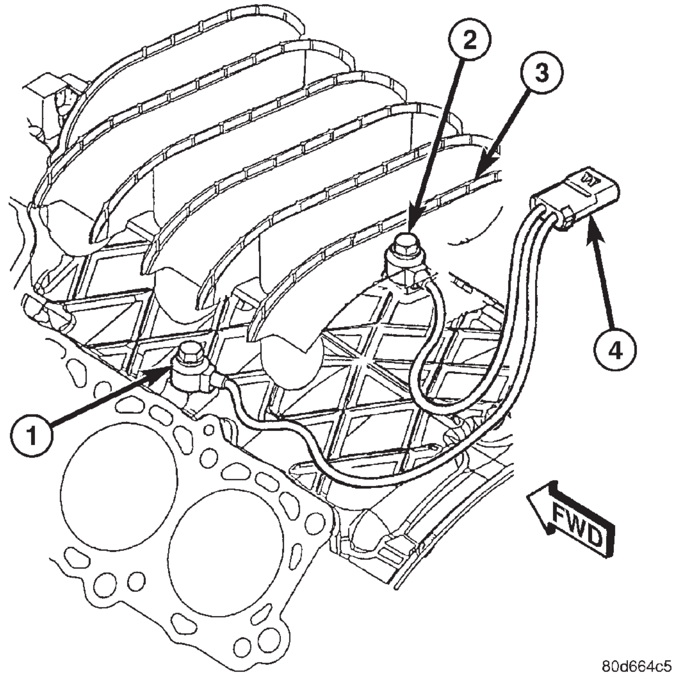


Fig. 22 KNOCK SENSOR LOCATION - 4.7L H.O.

1 - KNOCK SENSORS (2)
2 - MOUNTING BOLTS
3 - INTAKE MANIFOLD (CUTAWAY)
4 - PIGTAIL CONNECTOR

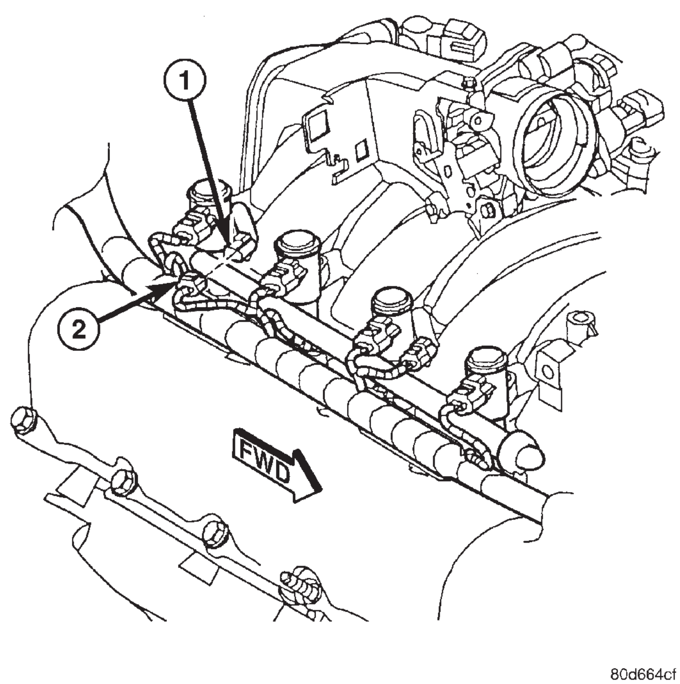


Fig. 23 KNOCK SENSOR ELEC. CONNECTOR - 4.7L H.O.

1 - KNOCK SENSOR PIGTAIL HARNESS CONNECTOR
2 - ENGINE WIRING HARNESS

KNOCK SENSOR (Continued)

INSTALLATION

4.7L High-Output Engine Only

NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.

(1) Thoroughly clean knock sensor mounting holes.
(2) Install sensors (Fig. 22) into cylinder block.

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors. The torque for the knock senor bolt is relatively light for an 8mm bolt.

NOTE: Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

(3) Install and tighten mounting bolts. **Bolt torque is critical.** Refer to torque specification.
(4) Install intake manifold. Refer to Engine section.
(5) Connect knock sensor pigtail wiring harness to engine wiring harness near right / rear of intake manifold (Fig. 23).

SPARK PLUG

DESCRIPTION

Both the 4.0L 6-cylinder and the 4.7L V-8 engine use resistor type spark plugs. Standard 4.7L V-8 engines are equipped with “fired in suppressor seal” type spark plugs using a copper core ground electrode. High-Output (H.O.) 4.7L V-8 engines are equipped with unique plugs using a platinum rivet located on the tip of the center electrode.

Because of the use of an aluminum cylinder head on the 4.7L engine, spark plug torque is very critical.

To prevent possible pre-ignition and/or mechanical engine damage, the correct type/heat range/number spark plug must be used. **Do not substitute any other spark plug on the 4.7L H.O. engine. Serious engine damage may occur.**

Plugs on both engines have resistance values ranging from 6,000 to 20,000 ohms (when checked with at least a 1000 volt spark plug tester). **Do not use an ohmmeter to check the resistance values of the spark plugs. Inaccurate readings will result.** Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. A single plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in Group O, Lubrication and Maintenance.

EXCEPT 4.7L H.O. ENGINE : Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled. Also refer to Spark Plug Conditions. **4.7L H.O. ENGINE :** Never clean spark plugs on the 4.7L H.O. engine. Damage to the platinum rivet will result.

CAUTION: EXCEPT 4.7L H.O. ENGINE : Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

H.O. Gap Adjustment: If equipped with the 4.7L H.O. engine, do not use a wire-type gapping tool as damage to the platinum rivet on the center electrode may occur. Use a tapered-type gauge (Fig. 24).

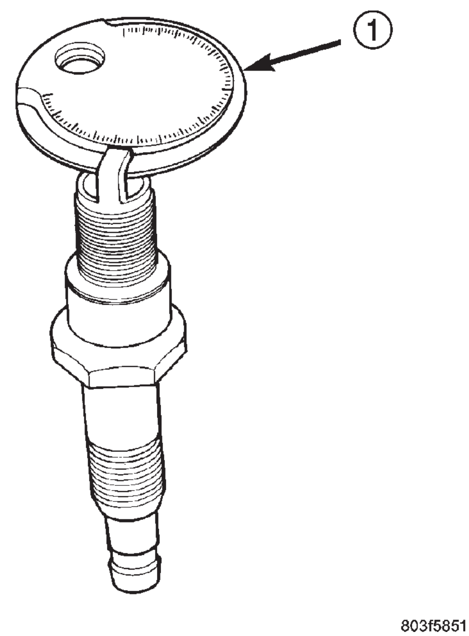


Fig. 24 PLUG GAP - 4.7L H.O.

1 - TAPER GAUGE

DIAGNOSIS AND TESTING - SPARK PLUG CONDITIONS

NORMAL OPERATING

The few deposits present on the spark plug will probably be light tan or slightly gray in color. This is evident with most grades of commercial gasoline

SPARK PLUG (Continued)

(Fig. 25). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 3200 km (2000 miles) of operation.

Spark plugs **except platinum tipped** that have normal wear can usually be cleaned, have the electrodes filed, have the gap set and then be installed.

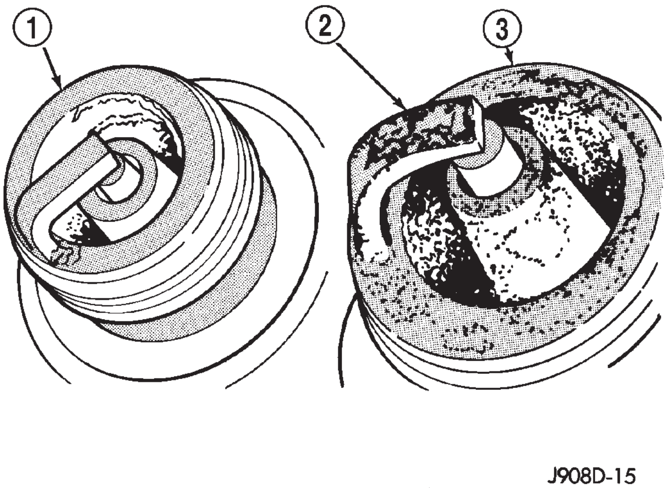


Fig. 25 NORMAL OPERATION AND COLD (CARBON) FOULING

1 - NORMAL
2 - DRY BLACK DEPOSITS
3 - COLD (CARBON) FOULING

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT causes the entire tip of the spark plug to be coated with a rust colored deposit. This rust color can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance may be affected by MMT deposits.

COLD FOULING/CARBON FOULING

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 25). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set of spark plugs may be caused by a clogged air cleaner element or repeated short operating times (short trips).

WET FOULING OR GAS FOULING

A spark plug coated with excessive wet fuel or oil is wet fouled. In older engines, worn piston rings, leaking valve guide seals or excessive cylinder wear can cause wet fouling. In new or recently overhauled engines, wet fouling may occur before break-in (normal oil control) is achieved. This condition can usually be resolved by cleaning and reinstalling the fouled plugs.

OIL OR ASH ENCRUSTED

If one or more spark plugs are oil or oil ash encrusted (Fig. 26), evaluate engine condition for the cause of oil entry into that particular combustion chamber.

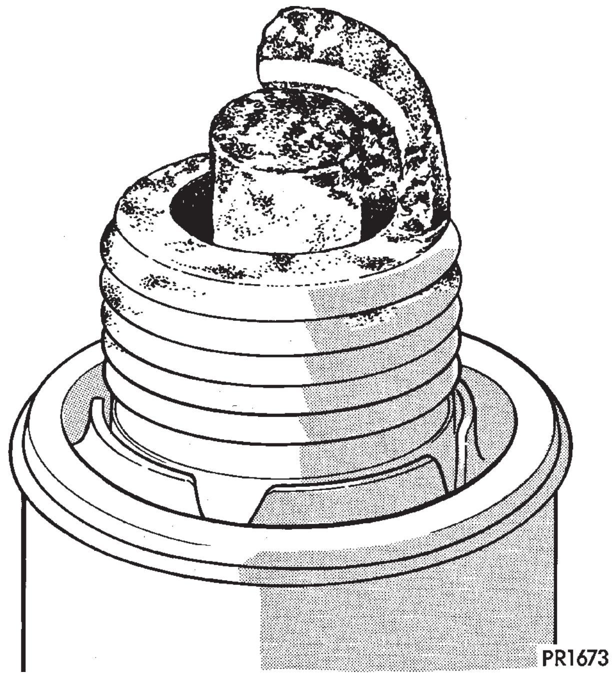


Fig. 26 OIL OR ASH ENCRUSTED

ELECTRODE GAP BRIDGING

Electrode gap bridging may be traced to loose deposits in the combustion chamber. These deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, deposits partially liquefy and bridge the gap between electrodes (Fig. 27). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 28). They may appear to be harmful, but this is a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy, but the deposits are easily removed. Spark plugs with scavenger deposits can be considered normal in condition and can be cleaned using standard procedures.

SPARK PLUG (Continued)

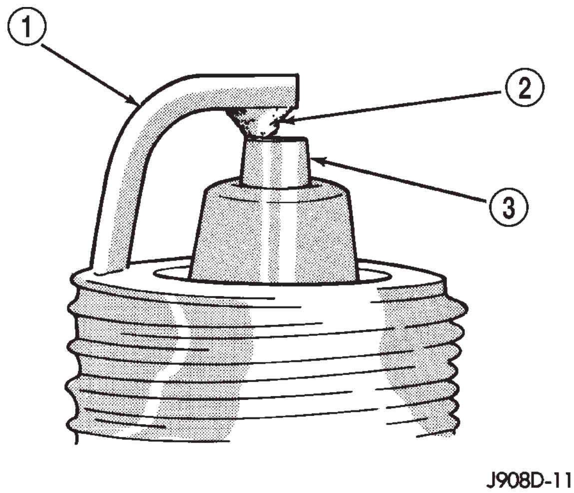


Fig. 27 ELECTRODE GAP BRIDGING

1 - GROUND ELECTRODE
2 - DEPOSITS
3 - CENTER ELECTRODE

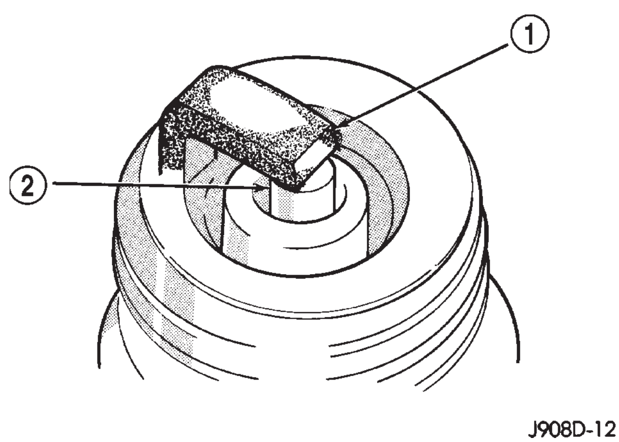


Fig. 28 SCAVENGER DEPOSITS

1 - GROUND ELECTRODE COVERED WITH WHITE OR YELLOW DEPOSITS
2 - CENTER ELECTRODE

CHIPPED ELECTRODE INSULATOR

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap. Under certain conditions, severe detonation can also separate the insulator from the center electrode (Fig. 29). Spark plugs with this condition must be replaced.

PRE-IGNITION DAMAGE

Pre-ignition damage is usually caused by excessive combustion chamber temperature. The center electrode dissolves first and the ground electrode dissolves somewhat latter (Fig. 30). Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating for the engine.

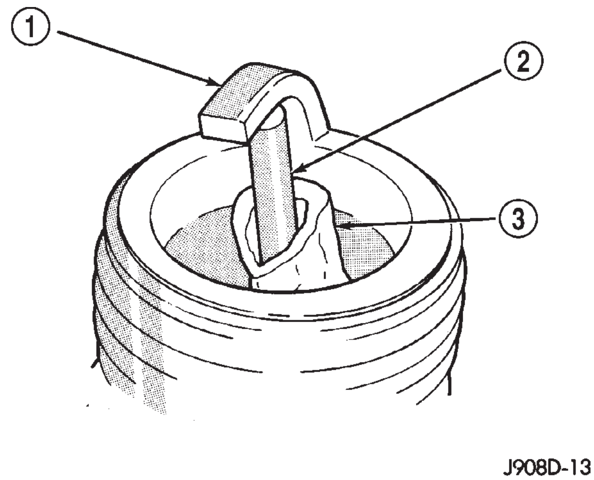


Fig. 29 CHIPPED ELECTRODE INSULATOR

1 - GROUND ELECTRODE
2 - CENTER ELECTRODE
3 - CHIPPED INSULATOR

Determine if ignition timing is over advanced or if other operating conditions are causing engine overheating. (The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges. This depends upon the thickness and length of the center electrodes porcelain insulator.)

CAUTION: If the engine is equipped with copper core ground electrode, or platinum tipped spark plugs, they must be replaced with the same type/ number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

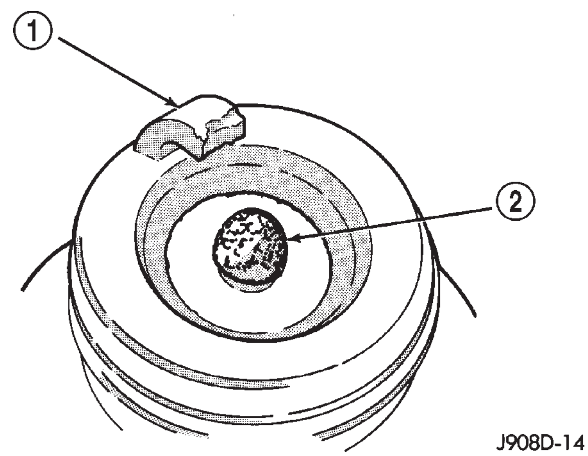


Fig. 30 PRE-IGNITION DAMAGE

1 - GROUND ELECTRODE STARTING TO DISSOLVE
2 - CENTER ELECTRODE DISSOLVED

SPARK PLUG (Continued)

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 31). The increase in electrode gap will be considerably in excess of 0.001 inch per 2000 miles of operation. This suggests that a plug with a cooler heat range rating should be used. Over advanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

CAUTION: If the engine is equipped with copper core ground electrode, or platinum tipped spark plugs, they must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

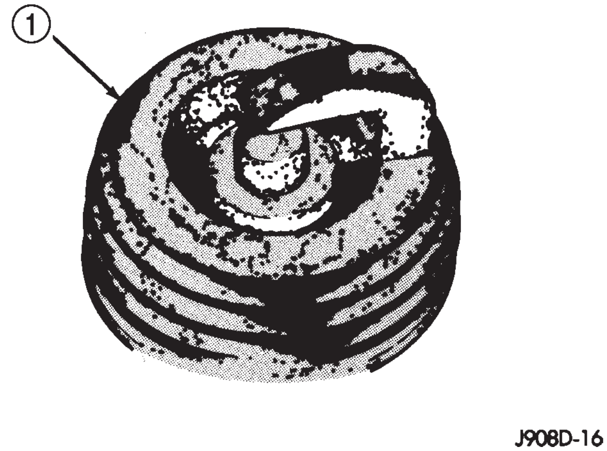


Fig. 31 SPARK PLUG OVERHEATING

1 - BLISTERED WHITE OR GRAY COLORED INSULATOR

REMOVAL

CAUTION: If equipped with a 4.7L H.O. (High-Output) engine, never substitute the original platinum tipped spark plug with a different part number. Serious engine damage may result.

On the 4.0L 6–cylinder engine, the spark plugs are located below the coil rail assembly. On the 4.7L V–8 engine, each individual spark plug is located under each ignition coil.

(1) 4.0L 6–Cylinder Engine: Prior to removing spark plug, spray compressed air around spark plug hole and area around spark plug. This will help prevent foreign material from entering combustion chamber.

(2) 4.7L V–8 Engine: Prior to removing spark plug, spray compressed air around base of ignition coil at cylinder head. This will help prevent foreign material from entering combustion chamber.

(3) On the 4.0L engine the coil rail assembly must be removed to gain access to any/all spark plug. Refer to Ignition Coil Removal/Installation. On the 4.7L V-8 engine each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

(4) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. If equipped with a 4.7L V-8 engine, also check condition of coil o-ring and replace as necessary.

(5) Inspect spark plug condition. Refer to Spark Plug Conditions.

CLEANING

Except 4.7L H.O. Engine: The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file center electrode flat with a small point file or jewelers file before adjusting gap.

CAUTION: Never use a motorized wire wheel brush to clean spark plugs. Metallic deposits will remain on spark plug insulator and will cause plug misfire.

4.7L H.O. Engine: Never clean spark plugs on the 4.7L H.O. engine. Damage to the platinum rivet on the center electrode will result.

INSTALLATION

CAUTION: The standard 4.7L V-8 engine is equipped with copper core ground electrode spark plugs. They must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

CAUTION: If equipped with a 4.7L H.O. (High-Output) engine, never substitute the original platinum tipped spark plug with a different type/part number. Serious engine damage may result.

Special care should be taken when installing spark plugs into cylinder head spark plug wells. Be sure plugs do not drop into plug wells as ground straps may be bent resulting in a change in plug gap, or electrodes can be damaged.

Always tighten spark plugs to specified torque. Over tightening can cause distortion resulting in a change in spark plug gap or a cracked porcelain insulator.

(1) Start spark plug into cylinder head by hand to avoid cross threading.

(2) 4.0L 6–Cylinder Engine: Tighten spark plugs to 35-41 N·m (26-30 ft. lbs.) torque.

(3) 4.7L V–8 Engine: Tighten spark plugs to 27 N·m (20 ft. lbs.) torque.

(4) 4.7L V–8 Engine: Before installing coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.

(5) Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

INSTRUMENT CLUSTER

TABLE OF CONTENTS

INSTRUMENT CLUSTER

DESCRIPTION

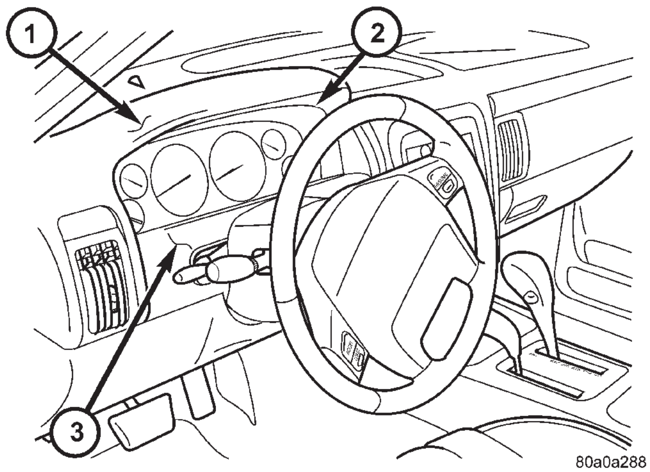


Fig. 1 Instrument Cluster

1 - INSTRUMENT PANEL TOP PAD HOOD FORMATION
2 - INSTRUMENT CLUSTER
3 - CLUSTER BEZEL

The instrument cluster for this model is an ElectroMechanical Instrument Cluster (EMIC) module that is located in the instrument panel above the steering column opening, directly in front of the driver (Fig. 1). The remainder of the EMIC, including the mounts and the electrical connections, are concealed behind the cluster bezel. The EMIC gauges and indicators are protected by an integral clear plastic cluster lens, and are visible through a dedicated hooded opening in the instrument panel top pad. Just behind and integral to the cluster lens are the cluster hood and cluster mask, which are constructed of molded black plastic. Two cluster masks are used: A base version features a black matte face and no trim ring around the perimeter of each gauge opening, while a premium version features a black matte face and a raised trim ring around the perimeter of each gauge opening. The cluster hood serves as a visor and shields the face of the cluster from ambient light and reflections to reduce glare, while the cluster mask serves to separate and define the individual gauges of the EMIC. On the lower edge of the cluster lens just right of the speedometer, the black plastic odometer/trip odometer switch button protrudes through dedicated holes in the cluster mask and the cluster lens. The molded plastic EMIC lens, hood and mask unit has four integral mounting tabs, two tabs extend down vertically from the lower edge of the unit and two tabs extend horizontally rearward from the upper surface of the hood. The two lower mounting tabs are used to secure the EMIC to the molded plastic instrument panel cluster carrier with two screws, while the two upper tabs are secured to the underside of the hood formation of the instrument panel top pad with two screws. A single molded connector receptacle located on the EMIC electronic circuit board is accessed from the back of the cluster housing and is connected to the vehicle electrical system through a single dedicated take out and connector of the instrument panel wire harness.

The cluster mask features two large round openings near its center through which the two major gauges are visible, and two smaller round openings stacked at the outboard side of each of the large openings through which the four minor gauges are visible. The cluster mask and the dial faces of the gauges are laminated plastic units. The dark, visible surface of the mask and the gauge dial faces are the outer layer or overlay, which is translucent. The darkness of this outer layer prevents the cluster from appearing too cluttered or busy by concealing the cluster indicators that are not illuminated, while the translucence of this layer allows those indicators and icons that are illuminated to be readily visible. The underlying layer of the cluster mask overlay is opaque and allows light from the various indicators behind it to be visible through the outer layer of the mask and gauge dial faces only through predetermined cutouts. On the base instrument clusters the graphics, increments, and numerals on the gauge faces are also translucent and illuminated from behind, while the orange gauge pointers are illuminated internally. On the premium instrument clusters the graphics, increments, numerals and gauge needles are opaque while the remainder of the gauge faces are translucent and illuminated from behind by an electro-luminescent lamp. The EMIC electronic circuitry is protected by a molded plastic rear cover that features several round access holes for service of the incandescent cluster indicator and illumination lighting lamps and a large rectangular access hole for the EMIC connector receptacle. The EMIC rear cover is secured to the cluster housing with screws, while the cluster lens, hood, and mask unit is secured to the cluster housing with several integral plastic latch features.

Twelve versions of the EMIC module are offered on this model, two base and ten premium. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle will be offered. This module utilizes integrated circuitry and information carried on the Programmable Communications Interface (PCI) data bus network for control of all gauges and many of the indicators. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - PCI BUS). The

INSTRUMENT CLUSTER (Continued)

EMIC also uses several hard wired inputs in order to perform its many functions. The EMIC module incorporates a blue-green digital Vacuum Fluorescent Display (VFD) for displaying odometer and trip odometer information.

The EMIC houses six analog gauges and has provisions for up to twenty indicators (Fig. 2). The EMIC includes the following analog gauges:

- **Coolant Temperature Gauge**
- **Fuel Gauge**
- **Oil Pressure Gauge**
- **Speedometer**
- **Tachometer**
- **Voltage Gauge**

Some of the EMIC indicators are automatically configured when the EMIC is connected to the vehicle electrical system for compatibility with certain optional equipment or equipment required for regulatory purposes in certain markets. While each EMIC may have provisions for indicators to support every available option, the configurable indicators will not be functional in a vehicle that does not have the equipment that an indicator supports. The EMIC includes provisions for the following indicators (Fig. 2):

- **Airbag Indicator (with Airbags only)**
- **Antilock Brake System (ABS) Indicator**
- **Brake Indicator**
- **Check Gauges Indicator**
- **Coolant Low Indicator (with Diesel Engine only)**
- **Cruise Indicator**
- **Four-Wheel Drive Part Time Indicator (with Selec-Trac NVG-242 Transfer Case only)**
- **Front Fog Lamp Indicator (with Front Fog Lamps only)**
- **High Beam Indicator**
- **Low Fuel Indicator**
- **Malfunction Indicator Lamp (MIL)**
- **Overdrive-Off Indicator (except Diesel Engine)**
- **Rear Fog Lamp Indicator (with Rear Fog Lamps only)**
- **Seatbelt Indicator**
- **Sentry Key Immobilizer System (SKIS) Indicator**
- **Transmission Overtemp Indicator (except Diesel Engine)**
- **Turn Signal (Right and Left) Indicators**
- **Wait-To-Start Indicator (with Diesel Engine only)**
- **Water-In-Fuel Indicator (with Diesel Engine only)**

Many indicators in the EMIC are illuminated by a dedicated Light Emitting Diode (LED) that is soldered onto the EMIC electronic circuit board. The LEDs are not available for service replacement and, if damaged or faulty, the entire EMIC must be replaced. Base cluster illumination is accomplished by dimmable incandescent back lighting, which illuminates the gauges for visibility when the exterior lighting is turned on. Premium cluster illumination is accomplished by a dimmable electro-luminescent lamp that is serviced only as a unit with the EMIC. Each of the incandescent bulbs is secured by an integral bulb holder to the electronic circuit board from the back of the cluster housing. The incandescent bulb/bulb holder units are available for service replacement.

Hard wired circuitry connects the EMIC to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC modules for this model are serviced only as complete units. The EMIC module cannot be adjusted or repaired. If a gauge, an LED indicator, the VFD, the electronic circuit board, the circuit board hardware, the cluster overlay, the electro-luminescent lamp (premium model only) or the EMIC housing are damaged or faulty, the entire EMIC module must be replaced. The cluster lens, hood and mask unit and the individual incandescent lamp bulbs with holders are available for service replacement.

INSTRUMENT CLUSTER (Continued)

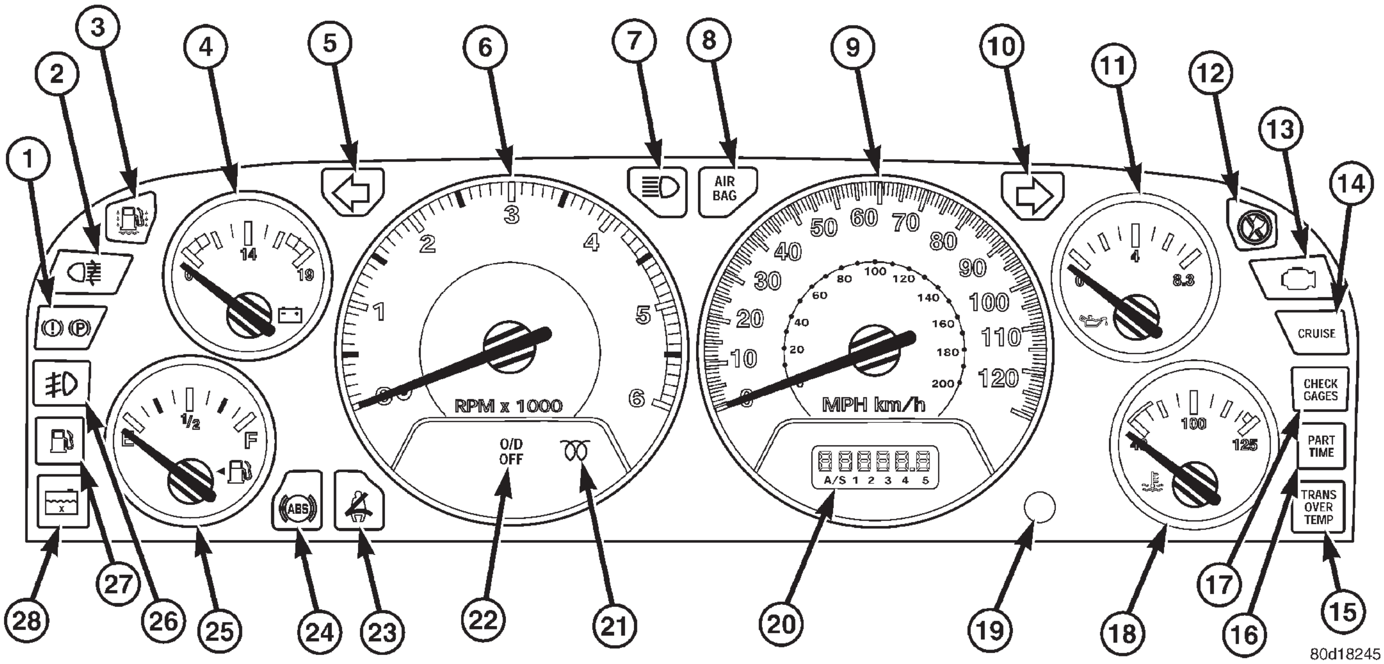


Fig. 2 EMIC Gauges & Indicators

1 - BRAKE INDICATOR
2 - REAR FOG LAMP INDICATOR
3 - WATER-IN-FUEL INDICATOR
4 - VOLTAGE GAUGE
5 - LEFT TURN INDICATOR
6 - TACHOMETER
7 - HIGH BEAM INDICATOR
8 - AIRBAG INDICATOR
9 - SPEEDOMETER
10 - RIGHT TURN INDICATOR
11 - OIL PRESSURE GAUGE
12 - SKIS INDICATOR
13 - MALFUNCTION INDICATOR LAMP (MIL)
14 - CRUISE INDICATOR
15 - TRANSMISSION OVERTEMP INDICATOR
16 - PART TIME 4WD INDICATOR
17 - CHECK GAUGES INDICATOR
18 - ENGINE TEMPERATURE GAUGE
19 - ODOMETER/TRIP ODOMETER SWITCH BUTTON
20 - ODOMETER/TRIP ODOMETER DISPLAY
21 - WAIT-TO-START INDICATOR
22 - OVERDRIVE-OFF INDICATOR
23 - SEATBELT INDICATOR
24 - ABS INDICATOR
25 - FUEL GAUGE
26 - FRONT FOG LAMP INDICATOR
27 - LOW FUEL INDICATOR
28 - COOLANT LOW INDICATOR

OPERATION

The ElectroMechanical Instrument Cluster (EMIC) is designed to allow the vehicle operator to monitor the conditions of many of the vehicle components and operating systems. The gauges and indicators in the EMIC provide valuable information about the various standard and optional powertrains, fuel and emissions systems, cooling systems, lighting systems, safety systems and many other convenience items. The EMIC is installed in the instrument panel so that all of these monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access for service. The microprocessor-based EMIC hardware and software uses various inputs to control the gauges and indicators visible on the face of the cluster. Some of these inputs are hard wired, but most are in the form of electronic messages that are transmitted by other electronic modules over the Programmable Communications Interface (PCI) data bus network. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

The EMIC microprocessor smooths the input data using algorithms to provide gauge readings that are accurate, stable and responsive to operating conditions. These algorithms are designed to provide gauge readings during normal operation that are consistent with customer expectations. However, when abnormal conditions exist, such as low or high battery voltage, low oil pressure or high coolant temperature, the algorithm can drive the gauge pointer to an extreme position and the microprocessor turns on the Check Gauges indicator to provide a distinct visual indication of a problem to the vehicle operator. The instrument cluster circuitry also sends electronic chime tone request messages over the PCI data bus to the Body Control Module (BCM) when it monitors

INSTRUMENT CLUSTER (Continued)

certain conditions or inputs to provide the vehicle operator with an audible alert to supplement a visual indication.

The EMIC circuitry operates on battery current received through fused B(+) fuses in the Power Distribution Center (PDC) and the Junction Block (JB) on a non-switched fused B(+) circuit, and on battery current received through a fused ignition switch output (run-start) fuse in the JB on a fused ignition switch output (run-start) circuit. This arrangement allows the EMIC to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the On or Start positions. The EMIC circuitry is grounded through two separate ground circuits of the instrument panel wire harness. These ground circuits receive ground through take outs of the instrument panel wire harness with eyelet terminal connectors that are secured by a nut to a ground stud located on the floor panel transmission tunnel beneath the center floor console, just forward of the Airbag Control Module (ACM).

The EMIC also has a self-diagnostic actuator test capability, which will test each of the PCI bus message-controlled functions of the cluster by lighting the appropriate indicators (except the airbag indicator), sweeping the gauge needles across the gauge faces from their minimum to their maximum readings, and stepping the odometer display sequentially from all zeros through all nines. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). The self-diagnostic actuator test can be initialized manually or using a DRBIII® scan tool. Refer to the appropriate diagnostic information. See the owner's manual in the vehicle glove box for more information on the features, use and operation of the EMIC.

GAUGES

All gauges receive battery current through the EMIC circuitry when the ignition switch is in the On or Start positions. With the ignition switch in the Off position battery current is not supplied to any gauges, and the EMIC circuitry is programmed to move all of the gauge needles back to the low end of their respective scales. Therefore, the gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On or Start positions. All of the EMIC gauges, except the odometer, are air core magnetic units. Two fixed electromagnetic coils are located within each gauge. These coils are wrapped at right angles to each other around a movable permanent magnet. The movable magnet is suspended within the coils on one end of a pivot shaft, while the gauge needle is attached to the other end of the shaft. One of the coils has a fixed current flowing through it to maintain a constant magnetic field strength. Current flow through the second coil changes, which causes changes in its magnetic field strength. The current flowing through the second coil is changed by the EMIC circuitry in response to messages received over the PCI data bus. The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets.

The gauges are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus, and the data bus message inputs to the EMIC that control each gauge requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific operation details for each gauge may be found elsewhere in this service information.

VACUUM-FLUORESCENT DISPLAY

The Vacuum-Fluorescent Display (VFD) module is soldered to the EMIC circuit board. The display is active with the ignition switch in the On or Start positions, and inactive when the ignition switch is in any other position. The illumination intensity of the VFD is controlled by the EMIC circuitry based upon electronic dimming level messages received from the BCM over the PCI data bus, and is synchronized with the illumination intensity of other VFDs in the vehicle. The BCM provides dimming level messages based upon internal programming and inputs it receives from the control knob and control ring on the control stalk of the left (lighting) multi-function switch on the steering column.

The VFD has several display capabilities including odometer and trip odometer information. An odometer/trip odometer switch on the EMIC circuit board is used to control the display modes. This switch is actuated manually by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just right of the speedometer. Actuating this switch momentarily with the ignition switch in the On position will toggle the VFD between the odometer and trip odometer modes. The EMIC microprocessor remembers which display mode is active when the ignition switch is turned to the Off position, and returns the display to that mode when the ignition switch is turned On again. Depressing the switch button for about two seconds while the VFD is in the trip odometer mode will reset the trip odometer value to zero. Holding this switch depressed while turning the ignition switch from the Off position to the On position will initiate the EMIC self-diagnostic actuator test. Refer to the appropriate diagnostic information for additional details on this VFD function.

INSTRUMENT CLUSTER (Continued)

The VFD is diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the data bus message inputs to the EMIC that control the VFD functions requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific operation details for the odometer and trip odometer functions of the VFD may be found elsewhere in this service information.

INDICATORS

Indicators are located in various positions within the EMIC and are all connected to the EMIC circuit board. The turn signal indicators are hard wired. The brake indicator is controlled by PCI data bus messages from the Controller Antilock Brake (CAB) as well as by hard wired park brake switch and brake fluid level switch inputs to the EMIC. The Malfunction Indicator Lamp (MIL) is normally controlled by PCI data bus messages from the Powertrain Control Module (PCM); however, if the EMIC loses PCI data bus communication, the EMIC circuitry will automatically turn the MIL on until PCI data bus communication is restored. The EMIC uses PCI data bus messages from the Airbag Control Module (ACM), the BCM, the PCM, the CAB, the Sentry Key Immobilizer Module (SKIM), and the Transmission Control Module (TCM) to control all of the remaining indicators.

The various indicators are controlled by different strategies; some receive fused ignition switch output from the EMIC circuitry and have a switched ground, others are grounded through the EMIC circuitry and have a switched battery feed, while still others are completely controlled by the EMIC microprocessor based upon various hard wired and electronic message inputs. Some indicators are illuminated at a fixed intensity, while the illumination intensity of others is synchronized with that of the EMIC general illumination lamps.

The hard wired indicators are diagnosed using conventional diagnostic methods. The EMIC and PCI bus message controlled indicators are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic data bus message inputs to the EMIC that control each indicator require the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific details of the operation for each indicator may be found elsewhere in this service information.

CLUSTER ILLUMINATION

Two types of general cluster illumination are available in this model. Base versions of the EMIC have several incandescent illumination lamps, while premium versions of the EMIC have a single electro-luminescent lamp. Both types of lamps provide cluster back lighting whenever the exterior lighting is turned On with the control knob on the left (lighting) multi-function switch control stalk. The illumination intensity of these lamps is adjusted by the EMIC microprocessor based upon electronic dimming level messages received from the Body Control Module (BCM) over the PCI data bus. The BCM provides electronic dimming level messages to the EMIC based upon internal programming and inputs it receives when the control ring on the left (lighting) multi-function switch control stalk is rotated (down to dim, up to brighten) to one of six available minor detent positions.

The incandescent illumination lamps receive battery current at all times, while the ground for these lamps is controlled by a 12-volt Pulse Width Modulated (PWM) output of the EMIC electronic circuitry. The illumination intensity of these bulbs and of the vacuum-fluorescent electronic display are controlled by the instrument cluster microprocessor based upon dimming level messages received from the Body Control Module (BCM) over the PCI data bus. The BCM uses inputs from the headlamp and panel dimmer switches within the left (lighting) multi-function switch control stalk and internal programming to decide what dimming level message is required. The BCM then sends the proper dimming level messages to the EMIC over the PCI data bus.

The electro-luminescent lamp unit consists of layers of phosphor, carbon, idium tin oxide, and dielectric applied by a silk-screen process between two polyester membranes and includes a short pigtail wire and connector. The lamp pigtail wire is connected to a small connector receptacle on the EMIC circuit board through a small clearance hole in the cluster housing rear cover. The EMIC electronic circuitry also uses a PWM strategy to control the illumination intensity of this lamp; however, the EMIC powers this lamp with an Alternating Current (AC) rated at 80 volts rms (root mean squared) and 415 Hertz, which excites the phosphor particles causing them to luminesce.

The BCM also has several hard wired panel lamp driver outputs and sends the proper panel lamps dimming level messages over the PCI data bus to coordinate the illumination intensity of all of the instrument panel lighting and the VFDs of other electronic modules on the PCI data bus. Vehicles equipped with the Auto Headlamps option have an automatic parade mode. In this mode, the BCM uses

INSTRUMENT CLUSTER (Continued)

an input from the auto headlamp light sensor to determine the ambient light levels. If the BCM decides that the exterior lighting is turned on in the daylight, it overrides the selected panel dimmer switch signal by sending a message over the PCI data bus to illuminate all vacuum fluorescent displays at full brightness for improved visibility in daytime light levels. The automatic parade mode has no effect on the incandescent bulb illumination intensity.

The hard wired cluster illumination circuits between the left (lighting) multi-function switch and the BCM may be diagnosed using conventional diagnostic tools and methods. The electro-luminescent lamp is diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). However, proper testing of the EMIC and the electronic dimming level messages sent by the BCM over the PCI data bus requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

CHIME SERVICE

The EMIC is programmed to request chime service from the Body Control Module (BCM) when certain indicators are illuminated. The EMIC chime request for illumination of the low fuel indicator is a customer programmable feature. When the programmed conditions are met, the EMIC generates an electronic chime request message and sends it over the PCI data bus to the BCM. Upon receiving the proper chime request, the BCM activates an integral chime tone generator to provide the audible chime tone to the vehicle operator. (Refer to 8 - ELECTRICAL/CHIME WARNING SYSTEM - OPERATION). Proper testing of the PCI data bus and the electronic chime request message outputs from the EMIC requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - INSTRUMENT CLUSTER

If all of the instrument cluster gauges and/or indicators are inoperative, refer to PRELIMINARY DIAGNOSIS . If an individual gauge or Programmable Communications Interface (PCI) data bus message-controlled indicator is inoperative, refer to ACTUATOR TEST . If an individual hard wired indicator is inoperative, refer to the diagnosis and testing information for that specific indicator. If the base instrument cluster incandescent illumination lighting is inoperative, refer to CLUSTER ILLUMINATION DIAGNOSIS . If the premium instrument cluster electro-luminescent illumination lighting is inoperative, refer to ACTUATOR TEST . Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

NOTE: Occasionally, a condition may be encountered where the gauge pointer for the speedometer or the tachometer becomes caught on the wrong side of the pointer stop. To correct this condition, the technician should use a DRBIII® scan tool and the appropriate diagnostic information to perform the instrument cluster self-diagnostic actuator test procedure. When performed, the actuator test procedure will automatically return the pointer to the correct side of the pointer stop.

PRELIMINARY DIAGNOSIS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: ON VEHICLES EQUIPPED WITH THE PREMIUM INSTRUMENT CLUSTER, THE CLUSTER CIRCUITRY PROVIDES AN ALTERNATING CURRENT TO SUPPLY POWER TO THE ELECTRO-LUMINESCENT ILLUMINATION LAMP THROUGH A PIGTAIL WIRE AND CONNECTOR THAT IS ACCESSIBLE AT THE BACK OF THE CLUSTER HOUSING. USE PROPER PRECAUTIONS WHEN HANDLING THIS UNIT DURING DIAGNOSIS OR SERVICE TO AVOID ELECTRICAL SHOCK AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse (Fuse 17 - 10 ampere) in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse (Fuse 17 - 10 ampere) in the JB. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit between

INSTRUMENT CLUSTER (Continued)

the JB and the Power Distribution Center (PDC) as required.

(3) Check the fused ignition switch output (run-start) fuse (Fuse 22 - 10 ampere) in the JB. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-start) fuse (Fuse 22 - 10 ampere) in the JB. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run-start) circuit between the JB and the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument cluster. Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the instrument cluster. If OK, go to Step 6. If not OK, repair the open fused B(+) circuit between the instrument cluster and the JB as required.

(6) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-start) circuit cavity of the instrument panel wire harness connector for the instrument cluster. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (run-start) circuit between the instrument cluster and the JB as required.

(7) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between each of the ground circuit cavities of the instrument panel wire harness connector for the instrument cluster and a good ground. There should be continuity. If OK, refer to the ACTUATOR TEST . If not OK, repair the open ground circuit(s) between the instrument cluster and ground (G200) as required.

ACTUATOR TEST

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: ON VEHICLES EQUIPPED WITH THE PREMIUM INSTRUMENT CLUSTER, THE CLUSTER CIRCUITRY PROVIDES AN ALTERNATING CURRENT TO SUPPLY POWER TO THE ELECTRO-LUMINESCENT ILLUMINATION LAMP THROUGH A PIGTAIL WIRE AND CONNECTOR THAT IS ACCESSIBLE AT THE BACK OF THE CLUSTER HOUSING. USE PROPER PRECAUTIONS WHEN HANDLING THIS UNIT DURING DIAGNOSIS OR SERVICE TO AVOID ELECTRICAL SHOCK AND POSSIBLE PERSONAL INJURY.

The instrument cluster actuator test will put the instrument cluster into its self-diagnostic mode. In this mode the instrument cluster can perform a self-diagnostic test that will confirm that the instrument cluster circuitry, the gauges, the PCI data bus message controlled indicators, and the electro-luminescent illumination lamp (if equipped) are capable of operating as designed. During the actuator test the instrument cluster circuitry will sweep each of the gauge needles across the gauge faces, illuminate each of the segments in the Vacuum-Fluorescent Display (VFD), turn all of the PCI data bus message-controlled indicators on and off again, and turn the electro-luminescent illumination lamp (if equipped) on and off again.

Successful completion of the actuator test will confirm that the instrument cluster is operational. However, there may still be a problem with the PCI data bus, the Powertrain Control Module, the Airbag Control Module (ACM), the Body Control Module (BCM), the Controller Anti-lock Brake (CAB), the Sentry Key Immobilizer Module (SKIM), or the inputs to one of these electronic control modules. Use a DRBIII® scan tool to diagnose these components. Refer to the appropriate diagnostic information.

If an individual indicator lamp or the electro-luminescent illumination lamp do not illuminate during the actuator test, the instrument cluster should be removed. However, check that the incandescent lamp bulb is not faulty, that the bulb holder is properly installed on the instrument cluster electronic circuit board, or that the electro-luminescent lamp pigtail wire connector is properly connected to the instrument cluster electronic circuit board before considering instrument cluster replacement. If the bulb and bulb holder, or the electro-luminescent lamp connection check OK, replace the faulty instrument cluster unit.

(1) Begin the test with the ignition switch in the Off position.

(2) Depress the odometer/trip odometer switch button.

INSTRUMENT CLUSTER (Continued)

(3) While still holding the odometer/trip odometer switch button depressed, turn the ignition switch to the On position, but do not start the engine.

(4) Release the odometer/trip odometer switch button.

(5) The instrument cluster will automatically begin the actuator test sequence, as follows:

(a) The cluster will turn on, then off again each of the PCI data bus message controlled indicators (except Airbag) to confirm the functionality of the indicator and the cluster control circuitry:

(b) The cluster will sweep the needles for each of the gauges from minimum to maximum and back to minimum to confirm the functionality of the gauge and the cluster control circuitry:

(c) Only on models with a premium version of the cluster, the cluster will illuminate the electro-luminescent lamp and turn it off again to confirm the functionality of the lamp and the cluster control circuitry.

(d) The cluster will sequentially step the odometer/trip odometer VFD display from all zeros (000000) through all nines (999999) to confirm the functionality of all VFD segments and their control circuitry, then display the software version number, followed by "DONE".

(6) The actuator test is now completed. The instrument cluster will automatically exit the self-diagnostic mode and return to normal operation at the completion of the test, if the ignition switch is turned to the Off position during the test, or if a vehicle speed message indicating that the vehicle is moving is received from the PCM over the PCI data bus during the test.

(7) Go back to Step 1 to repeat the test, if required.

CLUSTER ILLUMINATION DIAGNOSIS

On models equipped with a base version of the instrument cluster, the EMIC has several incandescent illumination lamps that are illuminated whenever the exterior lighting is turned On. If the problem being diagnosed is a single inoperative illumination lamp, be certain that the bulb and bulb holder unit are properly installed in the instrument cluster electronic circuit board. If no installation problems are found replace the faulty bulb and bulb holder unit. If all of the cluster illumination lamps are inoperative, the most reliable, efficient, and accurate means to diagnose the cluster illumination function of the instrument cluster requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: ON VEHICLES EQUIPPED WITH THE PREMIUM INSTRUMENT CLUSTER, THE CLUSTER CIRCUITRY PROVIDES AN ALTERNATING CURRENT TO SUPPLY POWER TO THE ELECTRO-LUMINESCENT ILLUMINATION LAMP THROUGH A PIGTAIL WIRE AND CONNECTOR THAT IS ACCESSIBLE AT THE BACK OF THE CLUSTER HOUSING. USE PROPER PRECAUTIONS WHEN HANDLING THIS UNIT DURING DIAGNOSIS OR SERVICE TO AVOID ELECTRICAL SHOCK AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) Remove the two screws that secure the upper mounting tabs of the instrument cluster to the underside of the instrument cluster hood formation of the instrument panel top pad.

(4) Remove the two screws that secure the lower mounting tabs of the instrument cluster to the instrument panel structural duct.

INSTRUMENT CLUSTER (Continued)

(5) Pull the upper mounting tabs of the instrument cluster downward, then pull the instrument cluster rearward far enough to access the instrument panel wire harness connector for the instrument cluster (Fig. 3).

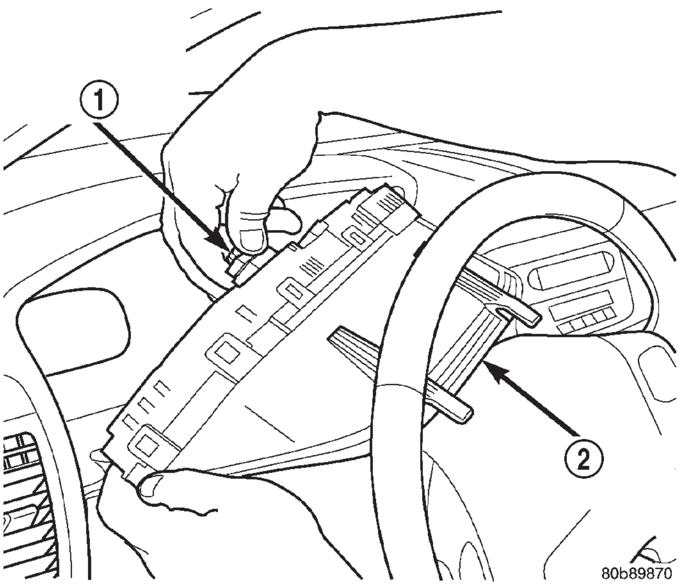


Fig. 3 Instrument Cluster Remove/Install

1 - INSTRUMENT PANEL WIRE HARNESS CONNECTOR
2 - INSTRUMENT CLUSTER

(6) Disconnect the instrument panel wire harness connector for the instrument cluster from the connector receptacle on the back of the instrument cluster housing.

(7) Remove the instrument cluster from the instrument panel.

DISASSEMBLY

Some of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include: the incandescent instrument cluster indicator and illumination lamp bulbs (including the integral bulb holders), the cluster lens, hood and mask unit, and the cluster housing rear cover. Following are the procedures for disassembling these components from the instrument cluster unit.

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CLUSTER BULB

This procedure applies to each of the incandescent cluster illumination lamp or indicator bulb and bulb holder units. However, the illumination lamps and the indicators use different bulb and bulb holder unit sizes. They must never be interchanged. Be certain that any bulb holder removed from the electronic circuit board is reinstalled in the correct position.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Turn the bulb holder counterclockwise about sixty degrees on the cluster electronic circuit board (Fig. 4).

(4) Pull the bulb and bulb holder straight back to remove it from the bulb mounting hole in the cluster electronic circuit board.

CLUSTER LENS, HOOD AND MASK

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Work around the perimeter of the cluster housing to disengage each of the eight latches that secure the cluster lens, hood and mask unit to the cluster housing (Fig. 5).

(4) Gently pull the cluster lens, hood and mask unit away from the cluster housing.

CLUSTER HOUSING REAR COVER

(1) Disconnect and isolate the battery negative cable.

INSTRUMENT CLUSTER (Continued)

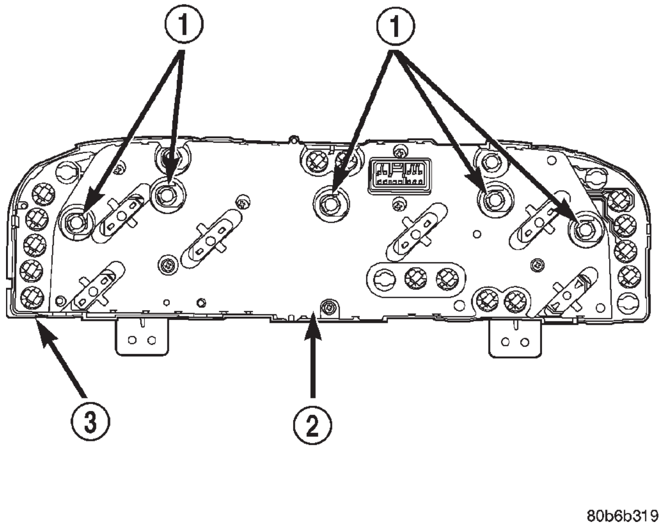

Fig. 4 Cluster Bulb Locations - Typical

1 - ILLUMINATION LAMP BULBS AND HOLDERS (5)
2 - CLUSTER HOUSING REAR COVER
3 - CLUSTER HOUSING

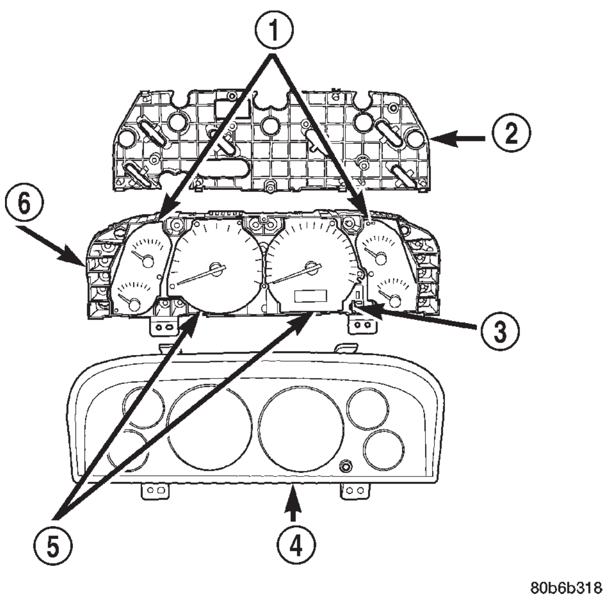

Fig. 5 Instrument Cluster Components

1 - MINOR GAUGE SETS
2 - HOUSING REAR COVER
3 - TRIP ODOMETER RESET KNOB
4 - LENS, HOOD AND MASK
5 - MAJOR GAUGES
6 - CLUSTER HOUSING

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) On models with a premium cluster only, disconnect the electro-luminescent illumination lamp pigtail wire connector from the receptacle on the cluster electronic circuit board and disengage the pigtail wire from the integral routing clip on the rear cover (Fig. 6).

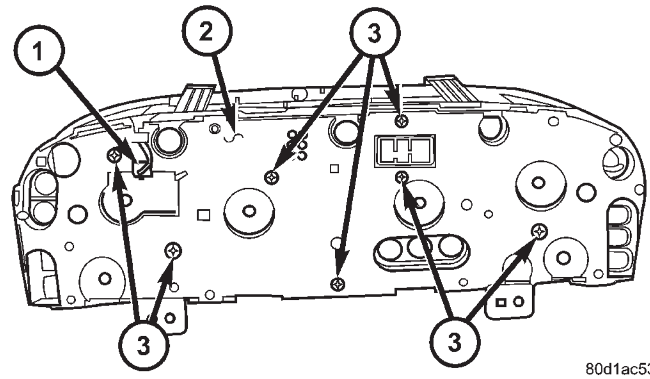

Fig. 6 Cluster Housing Rear Cover Screws

1 - ELECTRO-LUMINESCENT LAMP PIGTAIL WIRE CONNECTOR
2 - REAR COVER
3 - SCREW (7)

(4) Remove the seven screws that secure the rear cover to the back of the cluster housing.

(5) Disengage the eight latch features (four on top, four on the bottom) that secure the upper and lower edges of the rear cover to the top and bottom of the cluster housing.

(6) Remove the rear cover from the back of the cluster housing.

ASSEMBLY

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INSTRUMENT CLUSTER (Continued)

WARNING: ON VEHICLES EQUIPPED WITH THE PREMIUM INSTRUMENT CLUSTER, THE CLUSTER CIRCUITRY PROVIDES AN ALTERNATING CURRENT TO SUPPLY POWER TO THE ELECTRO-LUMINESCENT ILLUMINATION LAMP THROUGH A PIGTAIL WIRE AND CONNECTOR THAT IS ACCESSIBLE AT THE BACK OF THE CLUSTER HOUSING. USE PROPER PRECAUTIONS WHEN HANDLING THIS UNIT DURING DIAGNOSIS OR SERVICE TO AVOID ELECTRICAL SHOCK AND POSSIBLE PERSONAL INJURY.

CLUSTER BULB

This procedure applies to each of the incandescent cluster illumination lamp or indicator bulb and bulb holder units. However, the illumination lamps and the indicators use different bulb and bulb holder unit sizes. They must never be interchanged.

CAUTION: Be certain that any bulb and bulb holder unit removed from the cluster electronic circuit board is reinstalled in the correct position. Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.

(1) Insert the bulb and bulb holder straight into the correct bulb mounting hole in the cluster electronic circuit board (Fig. 4).

(2) With the bulb holder fully seated against the cluster electronic circuit board, turn the bulb holder clockwise about sixty degrees to lock it into place.

(3) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(4) Reconnect the battery negative cable.

CLUSTER LENS, HOOD AND MASK

(1) Position the cluster lens, hood and mask unit over the face of the instrument cluster (Fig. 5). Be certain that the odometer/trip odometer switch button is inserted through the proper clearance holes in the mask and the lens.

(2) Press firmly and evenly on the cluster lens, hood and mask unit to install it onto the cluster housing.

(3) Work around the perimeter of the cluster housing to be certain that each of the eight latches that secure the cluster lens, hood and mask unit to the cluster housing is fully engaged.

(4) Reinstall the instrument cluster into the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(5) Reconnect the battery negative cable.

CLUSTER HOUSING REAR COVER

(1) Position the rear cover onto the back of the cluster housing (Fig. 6).

(2) Press firmly and evenly on the rear cover until each of the eight latches (four on top, four on the bottom) that secure the upper and lower edges of the rear cover to the top and bottom of the cluster housing are fully engaged.

(3) Install and tighten the seven screws that secure the rear cover to the back of the cluster housing. Tighten the screws to 2 N·m (20 in. lbs.).

(4) On models with a premium cluster only, reconnect the electro-luminescent illumination lamp pigtail wire connector to the receptacle on the cluster electronic circuit board and engage the pigtail wire under the integral routing clip on the rear cover.

(5) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(6) Reconnect the battery negative cable.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

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(1) Position the instrument cluster to the instrument panel.

INSTRUMENT CLUSTER (Continued)

(2) Reconnect the instrument panel wire harness connector for the instrument cluster to the connector receptacle on the back of the instrument cluster housing (Fig. 7).

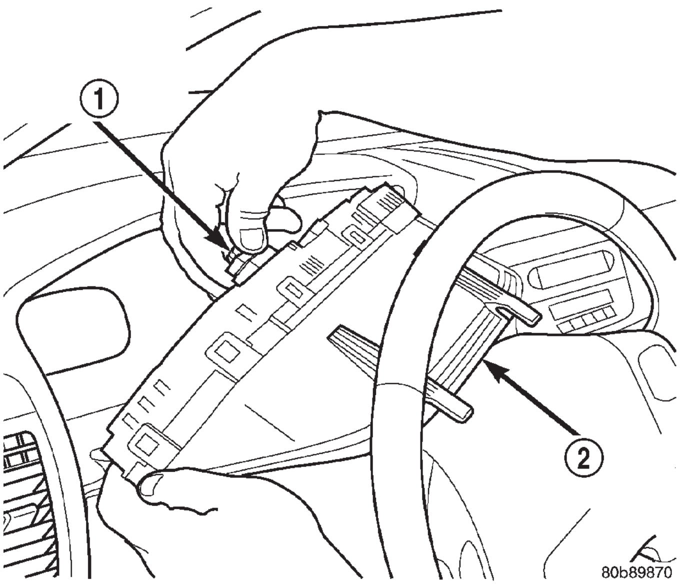

Fig. 7 Instrument Cluster Remove/Install

1 - INSTRUMENT PANEL WIRE HARNESS CONNECTOR
2 - INSTRUMENT CLUSTER

(3) Position the lower mounting tabs of the instrument cluster to the mounting holes on the instrument panel structural duct, then tilt the top of the instrument cluster forward until the upper mounting tabs are positioned to the mounting holes on the underside of the instrument cluster hood formation of the instrument panel top pad.

(4) Install and tighten the two screws that secure the upper mounting tabs of the instrument cluster to the underside of the instrument cluster hood formation of the instrument panel top pad. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install and tighten the two screws that secure the lower mounting tabs of the instrument cluster to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(7) Reconnect the battery negative cable.

ABS INDICATOR

DESCRIPTION

An Anti-lock Brake System (ABS) indicator is standard equipment on all instrument clusters. The ABS indicator is located on the lower left edge of the instrument cluster, to the left of the tachometer. The ABS indicator consists of a International Control and Display Symbol icon for “Failure of Anti-lock Braking System” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The ABS indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The ABS indicator gives an indication to the vehicle operator when the ABS system is faulty or inoperative. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Anti-lock Brake (CAB) over the Programmable Communications Interface (PCI) data bus. The ABS indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the ABS indicator for the following reasons:

- **Bulb Test -** Each time the ignition switch is turned to the On position the CAB sends an electronic ABS lamp-on message to the cluster which will illuminate the ABS indicator for about four seconds as a bulb test. The entire four second bulb test is a function of the CAB.
- **ABS Indicator Lamp-On Message -** Each time the cluster receives an ABS indicator lamp-on message from the CAB, the ABS indicator will be illuminated. The indicator remains illuminated until the cluster receives an ABS indicator lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error -** If the cluster receives no ABS indicator lamp-on or lamp-off messages from the CAB for six consecutive seconds, the ABS indicator is illuminated. The indicator remains illuminated until the cluster receives a valid lamp-on or lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test -** Each time the instrument cluster is put through the actuator test, the ABS indica-

ABS INDICATOR (Continued)

tor will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

- **ABS Diagnostic Test** - The ABS indicator is blinked on and off based upon lamp-on and lamp-off messages from the CAB during the performance of the ABS diagnostic tests.

The CAB continually monitors the ABS circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper ABS indicator lamp-on or lamp-off messages to the instrument cluster. If the ABS indicator fails to light during the bulb test, replace the bulb with a known good unit. If the CAB sends an ABS indicator lamp-on message after the bulb test, it indicates that the CAB has detected a system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ABS indicator fails to illuminate due to an open or short in the cluster ABS indicator circuit or bulb, the cluster sends a message notifying the CAB of the condition, then the instrument cluster and the CAB will each store a DTC. For proper diagnosis of the anti-lock brake system, the CAB, the PCI data bus, or the electronic message inputs to the instrument cluster that control the ABS indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

AIRBAG INDICATOR

DESCRIPTION

An airbag indicator is standard equipment on all instrument clusters. However, the instrument cluster is programmed to automatically enable this indicator only on vehicles equipped with the airbag system, which is not available in some markets. The airbag indicator is located on the upper edge of the instrument cluster, between the speedometer and the tachometer. The airbag indicator consists of the words “AIR BAG” imprinted on a red lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The “AIR BAG” text appears silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a Light Emitting Diode (LED), which is soldered onto the instrument cluster electronic circuit board. The airbag indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The airbag indicator gives an indication to the vehicle operator when the airbag system is faulty or inoperative. The airbag indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus. The airbag indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is switched to ground by the instrument cluster transistor. The instrument cluster will turn on the airbag indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the ACM sends an electronic airbag indicator lamp-on message to the cluster which will illuminate the airbag indicator for about six seconds as a bulb test. The entire six second bulb test is a function of the ACM.
- **Airbag Indicator Lamp-On Message** - Each time the cluster receives an airbag indicator lamp-on message from the ACM, the airbag indicator will be illuminated. The indicator remains illuminated for about twelve seconds or until the cluster receives an airbag indicator lamp-off message from the ACM, whichever is longer.
- **Communication Error** - If the cluster receives no airbag indicator lamp-on or lamp-off messages for six consecutive seconds, the airbag indicator is illuminated. The indicator remains illuminated until the cluster receives a single valid airbag indicator lamp-off message from the ACM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the airbag indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the airbag indicator is also a function of the ACM.

The ACM continually monitors the airbag system circuits and sensors to decide whether the system is in good operating condition. The ACM then sends the proper airbag indicator lamp-on or lamp-off messages to the instrument cluster. If the ACM sends an airbag indicator lamp-on message after the bulb test, it indicates that the ACM has detected a system malfunction. Such a malfunction could mean that the airbags may not deploy when required, or may deploy when not required. The ACM will store a

AIRBAG INDICATOR (Continued)

Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the airbag indicator fails to illuminate due to an open or short in the cluster airbag indicator circuit, the cluster sends a message notifying the ACM of the condition, then the instrument cluster and the ACM will each store a DTC. For proper diagnosis of the airbag system, the ACM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the airbag indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

BRAKE/PARK BRAKE INDICATOR

DESCRIPTION

A brake indicator is standard equipment on all instrument clusters. The brake indicator is located near the left edge of the instrument cluster, to the left of the tachometer. There are two versions of the brake indicator. The version used depends upon the market for which the vehicle is manufactured. The version of the brake indicator used for vehicles manufactured for the United States consists of the word “BRAKE” imprinted on a red lens. The Rest-Of-World (ROW) market version of this indicator has two International Control and Display Symbol icons imprinted on the red lens; one is the icon for “Brake Failure”, and the other is the icon for “Parking Brake”. In either case, the lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The “BRAKE” text or the two icons appear silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a Light Emitting Diode (LED), which is soldered onto the instrument cluster electronic circuit board. The brake indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The brake indicator gives an indication to the vehicle operator when the parking brake is applied, when the fluid level of the brake hydraulic system is low, or if there are certain malfunctions of the Anti-lock Brake System (ABS). This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming, electronic messages received by the cluster from the Controller Anti-lock Brake (CAB) over the Programmable Communications Interface (PCI) data bus, and a hard wired input to the cluster from the park brake switch. The brake indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the brake indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake indicator is illuminated by the instrument cluster for about three seconds as a bulb test.
- **Brake Indicator Lamp-On Message** - Each time the cluster receives a brake indicator lamp-on message from the CAB, the brake indicator will be illuminated. The indicator remains illuminated until the cluster receives a brake indicator lamp-off message from the CAB.
- **Park Brake Switch Input** - Each time the cluster logic circuit detects ground on the park brake switch sense circuit (park brake switch closed = park brake applied or not fully released) the brake indicator is illuminated. The indicator remains illuminated until the park brake switch sense input to the cluster is an open circuit (park brake switch open = park brake fully released), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster receives no brake indicator lamp-on or lamp-off messages from the CAB for six consecutive seconds, the brake indicator is illuminated. The indicator remains illuminated until the cluster receives a single valid brake indicator lamp-off message from the CAB.
- **Actuator Test** - Each time the cluster is put through the actuator test, the brake indicator will be turned on for the duration of the test to confirm the functionality of the LED and the cluster control circuitry.

The park brake switch on the park brake pedal mechanism provides a hard wired ground input to the instrument cluster circuitry through the red brake warning indicator driver circuit whenever the park brake is applied or not fully released. The CAB continually monitors the input from the brake fluid level switch and the circuits of the anti-lock brake system, then sends the proper brake indicator lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a brake indicator lamp-on message after the bulb test, it indicates that the CAB has detected a brake hydraulic system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects.

BRAKE/PARK BRAKE INDICATOR (Continued)

For further diagnosis of the brake indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). The park brake switch input to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the brake fluid level switch input to the CAB, the anti-lock brake system, the CAB, the PCI data bus, or the electronic message inputs to the instrument cluster that control the brake indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - BRAKE INDICATOR

The diagnosis found here addresses an inoperative park brake indicator condition. If there are problems with several indicators in the instrument cluster, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the brake indicator stays on with the ignition switch in the On position and the park brake released, or comes on while driving, (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If no brake system problem is found, the following procedures will help to locate a shorted or open circuit, or a faulty park brake switch input. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

INDICATOR ILLUMINATES DURING BULB TEST, BUT DOES NOT WHEN PARK BRAKE APPLIED

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the park brake switch from the switch terminal. Apply the parking brake. Check for continuity between the park brake switch terminal and a good ground. There should be continuity. If OK, go to Step 2. If not OK, replace the faulty park brake switch.

(2) Disconnect the instrument panel wire harness connector for the instrument cluster from the cluster connector receptacle. Check for continuity between the red brake warning indicator driver circuit cavities of the instrument panel wire harness connector for the park brake switch and the instrument panel wire harness connector for the instrument cluster. There should be continuity. If not OK, repair the open red brake warning indicator driver circuit between the park brake switch and the instrument cluster as required.

INDICATOR REMAINS ILLUMINATED - BRAKE SYSTEM CHECKS OK

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the park brake switch from the park brake switch terminal. Check for continuity between the terminal of the park brake switch and a good ground. There should be no continuity with the park brake released, and continuity with the park brake applied. If OK, go to Step 2. If not OK, replace the faulty park brake switch.

(2) Disconnect the instrument panel wire harness connector for the instrument cluster from the cluster connector receptacle. Check for continuity between the red brake warning indicator driver circuit cavity of the instrument panel wire harness connector for the park brake switch and a good ground. There should be no continuity. If not OK, repair the shorted red brake warning indicator driver circuit between the park brake switch and the instrument cluster as required.

CHECK GAUGES INDICATOR

DESCRIPTION

A check gauges indicator is standard equipment on all instrument clusters. The check gauges indicator is located on the right edge of the instrument cluster, to the right of the speedometer. The check gauges indicator consists of the words “CHECK GAGES” imprinted on a red lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The “CHECK GAGES” text appears silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a Light Emitting Diode (LED), which is soldered onto the instrument cluster electronic circuit board. The check gauges indicator

CHECK GAUGES INDICATOR (Continued)

lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The check gauges indicator gives an indication to the vehicle operator when certain instrument cluster gauge readings reflect a condition requiring immediate attention. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The check gauges indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the check gauges indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the check gauges indicator is illuminated for about three seconds as a bulb test.
- **Engine Temperature High/Critical Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is high or critical [above about 127° C (261° F) for gasoline engines except Gulf Coast Country (GCC), 129° C (264° F) for GCC gasoline engines, and 118° C (244° F) for diesel engines], the check gauges indicator is illuminated. The indicator remains illuminated until the cluster receives a message indicating the engine coolant temperature is not high or critical [about 125° C (255° F) or below for all gasoline engines, or 115° C (239° F) for all diesel engines].
- **Engine Oil Pressure Low Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure is about 0.28 kg/cm or lower (about 4 psi or lower), the check gauges indicator is illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine oil pressure is about 0.56 kg/cm or higher (about 8 psi or higher). The cluster will only turn the indicator on in response to an engine oil pressure low message if the ignition switch is in the On position and the engine speed is 300 rpm or greater.
- **System Voltage Low Message** - Each time the cluster receives a message from the PCM indicating a low system voltage condition (system voltage is about eleven volts or lower), the check gauges indicator is illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating there is no low system voltage condition (system voltage is above about eleven volts, but lower than about sixteen volts).
- **System Voltage High Message** - Each time the cluster receives a message from the PCM indicating a high system voltage condition (system voltage is about sixteen volts or higher), the check gauges indicator is illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating there is no high system voltage condition (system voltage is below about sixteen volts, but higher than about eleven volts).
- **Actuator Test** - Each time the cluster is put through the actuator test, the check gauges indicator will be turned on for the duration of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the engine temperature, oil pressure, and electrical system voltage, then sends the proper messages to the instrument cluster. For further diagnosis of the check gauges indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the check gauges indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

COOLANT LOW INDICATOR

DESCRIPTION

A coolant low indicator is only found in the instrument clusters of vehicles equipped with an optional diesel engine. The coolant low indicator should not be confused with the coolant level low indication provided by the Electronic Vehicle Information Center (EVIC) of vehicles equipped with a gasoline engine, although they do perform the same function. The coolant low indicator is located in the lower left corner of the instrument cluster, to the left of the tachometer. The coolant low indicator consists of an International Control and Display Symbol icon for “Low Coolant” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the

COOLANT LOW INDICATOR (Continued)

exterior lighting is turned On, the illumination intensity of the coolant low indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The coolant low indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The coolant low indicator gives an indication to the vehicle operator when the diesel engine coolant level is low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. The coolant low indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the coolant low indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the coolant low indicator is illuminated for about three seconds as a bulb test.
- **Coolant Low Indicator Lamp-On Message** - Each time the cluster receives a coolant low indicator lamp-on message from the BCM indicating the engine coolant is below the minimum level in the coolant reservoir, the coolant low indicator will be illuminated. The indicator remains illuminated until the cluster receives a coolant low indicator lamp-off message from the BCM indicating that the engine coolant level is above the minimum level.
- **Actuator Test** - Each time the cluster is put through the actuator test, the coolant low indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The BCM continually monitors the input from the coolant level switch, then sends the proper coolant low indicator lamp-on and lamp-off messages to the instrument cluster. If the coolant low indicator fails to light during the bulb test, replace the bulb with a known good unit. For further diagnosis of the coolant low indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the coolant level switch, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the coolant low indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

CRUISE INDICATOR

DESCRIPTION

A cruise indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional speed control system. The cruise indicator is located on the right edge of the instrument cluster, to the right of the speedometer. The cruise indicator consists of the word “CRUISE” imprinted on a blue/green lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The “CRUISE” text appears silhouetted against a blue/green field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the exterior lighting is turned On, the illumination intensity of the cruise indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The cruise indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The cruise indicator gives an indication to the vehicle operator when the speed control system is turned On, regardless of whether the speed control is engaged. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The cruise indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the cruise indicator for the following reasons:

- **Cruise Indicator Lamp-On Message** - Each time the cluster receives a cruise indicator lamp-on message from the PCM indicating the speed control

CRUISE INDICATOR (Continued)

system has been turned On, the cruise indicator is illuminated. The indicator remains illuminated until the cluster receives a cruise indicator lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.

- **Actuator Test** - Each time the cluster is put through the actuator test, the cruise indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM continually monitors the speed control switches to determine the proper outputs to the speed control servo. The PCM then sends the proper cruise indicator lamp-on and lamp-off messages to the instrument cluster. If the cruise indicator fails to light during the actuator test, replace the bulb with a known good unit. For further diagnosis of the cruise indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the speed control switches, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the cruise indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

ENGINE TEMPERATURE GAUGE

DESCRIPTION

An engine coolant temperature gauge is standard equipment on all instrument clusters. The engine coolant temperature gauge is located in the lower right corner of the instrument cluster, to the right of the speedometer. The engine coolant temperature gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the gauge dial face that reads left-to-right from 40° C to 125° C, or from 100° F to 260° F, depending upon the market for which the vehicle is manufactured. An International Control and Display Symbol icon for “Engine Coolant Temperature” is located on the gauge dial face.

The engine coolant temperature gauge graphics are either white, gray and orange against a black gauge dial face (base cluster) or black, gray and red against a taupe gauge dial face (premium cluster), making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the base cluster white gauge graphics appear blue-green and the orange graphics still appear orange, while the premium cluster taupe gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background and the red graphics still appear red. The gray gauge graphics for both versions of the cluster are not illuminated. The orange gauge needle in the base cluster gauge is internally illuminated, while the black gauge needle in the premium cluster gauge is not.

Base cluster gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. Premium cluster gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The engine coolant temperature gauge is serviced as a unit with the instrument cluster.

OPERATION

The engine coolant temperature gauge gives an indication to the vehicle operator of the engine coolant temperature. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The engine coolant temperature gauge is an air core magnetic unit that is completely controlled by the instrument cluster electronic circuit board. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Temperature Normal Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is within the normal operating range [up to about 124° C (255° F) for gasoline engines, and 115° C (239° F) for diesel engines], the gauge needle is moved to the relative temperature position of the gauge scale.
- **Engine Temperature High Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is high [above about 127° C (260° F) for gasoline engines except Gulf Coast Country (GCC), 129° C (264° F) for GCC gasoline engines, and 118° C (244° F) for diesel engines], the gauge needle is moved to the center of the red warning zone on the gauge scale.
- **Engine Temperature Critical Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is critical [about 132° C (270° F) or higher for all gasoline engines, and 126° C (259° F) for all diesel engines], the gauge needle is moved to the high end of the red warning zone on the gauge scale.
- **Communication Error** - If the cluster fails to receive an engine temperature message, it will hold

ENGINE TEMPERATURE GAUGE (Continued)

the gauge needle at the last indication for about twelve seconds or until a new engine temperature message is received, whichever occurs first. After twelve seconds, the cluster will return the gauge needle to the low end of the gauge scale.

- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept across the entire gauge scale and back in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper engine coolant temperature messages to the instrument cluster. For further diagnosis of the engine coolant temperature gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster moves the engine coolant temperature gauge needle to indicate a high or critical engine temperature, it may indicate that the engine or the engine cooling system requires service. For proper diagnosis of the engine coolant temperature sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the engine coolant temperature gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

FRONT FOG LAMP INDICATOR

DESCRIPTION

A front fog lamp indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional front fog lamps. The front fog lamp indicator is located on the left edge of the instrument cluster, to the left of the tachometer. The front fog lamp indicator consists of an International Control and Display Symbol icon for “Front Fog Light” imprinted on a green lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The icon appears silhouetted against a green field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the exterior lighting is turned On, the illumination intensity of the front fog lamp indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The front fog lamp indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The front fog lamp indicator gives an indication to the vehicle operator whenever the front fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. The front fog lamp indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the indicator can be illuminated regardless of the ignition switch position. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the front fog lamp indicator for the following reasons:

- **Front Fog Lamp Indicator Lamp-On Message** - Each time the cluster receives a front fog lamp indicator lamp-on message from the BCM indicating that the front fog lamps are turned On, the front fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a front fog lamp indicator lamp-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the front fog lamp indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The BCM continually monitors the exterior lighting (left multi-function) switch to determine the proper outputs to the front fog lamp relay. The BCM then sends the proper front fog lamp indicator lamp-on and lamp-off messages to the instrument cluster. If the front fog lamp indicator fails to light during the actuator test, replace the bulb with a known good unit. For further diagnosis of the front fog lamp indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the front fog lamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the front fog lamp indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

FUEL GAUGE

DESCRIPTION

A fuel gauge is standard equipment on all instrument clusters. The fuel gauge is located in the lower left corner of the instrument cluster, to the left of the tachometer. The fuel gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the gauge dial face that reads left-to-right from E (or Empty) to F (or Full). An International Control and Display Symbol icon for “Fuel” is located on the gauge dial face. An arrowhead pointed to the left side of the vehicle is imprinted next to the “Fuel” icon on the fuel gauge dial face to provide the driver with a reminder as to the location of the fuel filler access.

The fuel gauge graphics are either white, gray and orange against a black gauge dial face (base cluster) or black and gray against a taupe gauge dial face (premium cluster), making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the base cluster white gauge graphics appear blue-green and the orange graphics still appear orange, while the premium cluster taupe gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background. The gray gauge graphics for both versions of the cluster are not illuminated. The orange gauge needle in the base cluster gauge is internally illuminated, while the black gauge needle in the premium cluster gauge is not.

Base cluster gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. Premium cluster gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The fuel gauge is serviced as a unit with the instrument cluster.

OPERATION

The fuel gauge gives an indication to the vehicle operator of the level of fuel in the fuel tank. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The fuel gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full, the cluster moves the gauge needle to the relative fuel level position on the gauge scale. The PCM applies an algorithm to the input from the fuel tank sender to dampen gauge needle movement against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs to the PCM.
- **Less Than 12.5 Percent Tank Full Message** - Each time the cluster receives messages from the PCM indicating the percent tank full is less than 12.5 (one-eighth), the gauge needle is moved to the proper position on the gauge scale and the low fuel indicator is illuminated. The low fuel indicator remains illuminated until the cluster receives messages from the PCM indicating that the percent tank full is greater than 12.5 (one-eighth), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Less Than Empty Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full is less than empty, the gauge needle is moved to the far left (low) end of the gauge scale and the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is a short circuit.
- **More Than Full Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full is more than full, the gauge needle is moved to the far left (low) end of the gauge scale and the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is an open circuit.
- **Communication Error** - If the cluster fails to receive a percent tank full message, it will hold the gauge needle at the last indication for about twelve seconds, until a new message is received, or until the ignition switch is turned to the Off position, whichever occurs first. After twelve seconds, the cluster will return the gauge needle to the low end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept across the entire gauge scale and back in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the fuel tank sender to determine the fuel level. The PCM then applies an algorithm to the input and sends the

FUEL GAUGE (Continued)

proper percent tank full messages to the instrument cluster. For further diagnosis of the fuel gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the fuel tank sender, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the fuel gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

HIGH BEAM INDICATOR

DESCRIPTION

A high beam indicator is standard equipment on all instrument clusters. The high beam indicator is located near the upper edge of the instrument cluster, between the tachometer and the speedometer. The high beam indicator consists of an International Control and Display Symbol icon for “High Beam” imprinted on a blue lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The icon appears silhouetted against a blue field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the exterior lighting is turned On, the illumination intensity of the high beam indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The high beam indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The high beam indicator gives an indication to the vehicle operator whenever the headlamp high beams are illuminated. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. The high beam indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the indicator can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the high beam indicator for the following reasons:

- **High Beam Indicator Lamp-On Message** - Each time the cluster receives a high beam indicator lamp-on message from the BCM indicating that the headlamp high beams are turned On, the high beam indicator will be illuminated. The indicator remains illuminated until the cluster receives a high beam indicator lamp-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the high beam indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The BCM continually monitors the exterior lighting (left multi-function) switch to determine the proper outputs to the headlamp low beam and high beam relays. The BCM then sends the proper high beam indicator lamp-on and lamp-off messages to the instrument cluster. If the high beam indicator fails to light during the actuator test, replace the bulb with a known good unit. For further diagnosis of the high beam indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the headlamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the high beam indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

LOW FUEL INDICATOR

DESCRIPTION

A low fuel indicator is standard equipment on all instrument clusters. The low fuel indicator is located near the left edge of the instrument cluster, to the left of the tachometer. The low fuel indicator consists of an International Control and Display Symbol icon for “Fuel” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the icon from being clearly visible when the indicator is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the exterior lighting is turned On, the illumination intensity of the low fuel indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The low fuel indica-

LOW FUEL INDICATOR (Continued)

tor lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The low fuel indicator gives an indication to the vehicle operator when the level of fuel in the fuel tank becomes low. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The low fuel indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is switched to ground by the instrument cluster transistor. The instrument cluster will turn on the low fuel indicator for the following reasons:

- **Bulb Test -** Each time the ignition switch is turned to the On position the low fuel indicator is illuminated for about three seconds as a bulb test.
- **Less Than 12.5 Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating that the percent tank full is less than about 12.5 (one-eighth), the low fuel indicator is illuminated. The indicator remains illuminated until the cluster receives messages from the PCM indicating that the percent tank full has increased to greater than about 12.5 (one-eighth). The PCM applies an algorithm to the input from the fuel tank sender to dampen the illumination of the low fuel indicator against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs to the PCM.
- **Less Than Empty Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full is less than empty, the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is a short circuit.
- **More Than Full Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full is more than full, the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is an open circuit.
- **Communication Error -** If the cluster fails to receive a percent tank full message for more than about twelve seconds, the cluster control circuitry will illuminate the low fuel indicator until a new percent tank full message is received.
- **Actuator Test -** Each time the cluster is put through the actuator test, the low fuel indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM continually monitors the fuel tank sender input to determine the fuel level. The PCM then applies an algorithm to the input and sends the proper percent tank full messages to the instrument cluster. If the low fuel indicator fails to light during the bulb test, replace the bulb with a known good unit. For further diagnosis of the low fuel indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the fuel tank sender, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the low fuel indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

A Malfunction Indicator Lamp (MIL) is standard equipment on all instrument clusters. The MIL is located near the right edge of the instrument cluster, to the right of the speedometer. The MIL consists of an International Control and Display Symbol icon for “Engine” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the icon from being clearly visible when the indicator is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The MIL lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The Malfunction Indicator Lamp (MIL) gives an indication to the vehicle operator when the Powertrain Control Module (PCM) has recorded a Diagnostic Trouble Code (DTC) for an On-Board Diagnostics II (OBDII) emissions-related circuit or component malfunction. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the PCM over the Programmable Communications Interface (PCI) data bus. The MIL bulb is completely controlled by the

MALFUNCTION INDICATOR LAMP (MIL) (Continued)

instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the MIL for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the MIL is illuminated for about three seconds as a bulb test.
- **MIL Lamp-On Message** - Each time the cluster receives a MIL lamp-on message from the PCM, the indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the PCM message. For some DTC's, if a problem does not recur, the PCM will send a MIL lamp-off message automatically. Other DTC's may require that a fault be repaired and the PCM be reset before a MIL lamp-off message will be sent. For more information on the PCM and the DTC set and reset parameters, (Refer to 25 - EMISSIONS CONTROL - OPERATION).
- **Communication Error** - If the cluster receives no MIL lamp-on or lamp-off messages from the PCM for twenty consecutive seconds, the MIL is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid MIL lamp-on or lamp-off message is received from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the MIL will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM continually monitors each of the many fuel and emissions system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper MIL lamp-on or lamp-off messages to the instrument cluster. If the MIL fails to light during the bulb test, replace the bulb with a known good unit. For further diagnosis of the MIL or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the MIL after the bulb test, it may indicate that a malfunction has occurred and that the fuel and emissions system may require service. For proper diagnosis of the fuel and emissions systems, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the MIL, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

ODOMETER

DESCRIPTION

An odometer and trip odometer are standard equipment in all instrument clusters. The odometer and trip odometer information are displayed in a common electronic, blue-green Vacuum-Fluorescent Display (VFD), which is located in the lower edge of the speedometer dial face in the instrument cluster and, when illuminated, is visible through a small window cutout in the gauge overlay. However, the odometer and trip odometer information are not displayed simultaneously. The trip odometer reset switch on the instrument cluster electronic circuit board toggles the display between odometer and trip odometer modes by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens to the right of the speedometer.

All odometer and trip odometer distance information is stored in the instrument cluster memory. This distance information can be increased when the proper inputs are provided to the instrument cluster, but the distance information cannot be decreased. The odometer can display values up to 999,999 kilometers (999,999 miles). The odometer will not roll over, but will latch at the maximum value. The trip odometer can display values up to 999.9 kilometers (999.9 miles) before it rolls over to zero. The odometer display does not have a decimal point and will not show values less than a full unit (kilometer or mile), the trip odometer display does have a decimal point and will show tenths of a unit (kilometer or mile).

The unit of measure for the odometer and trip odometer display is not shown in the VFD. The unit of measure for the odometer/trip odometer is selected at the time that the instrument cluster is manufactured, and cannot be changed. If the instrument cluster has a kilometers-per-hour primary speedometer scale, the odometer/trip odometer registers kilometers; and, if the cluster features a miles-per-hour primary speedometer scale, the odometer/trip odometer registers miles.

During daylight hours (exterior lamps Off) the VFD is illuminated at full brightness for clear visibility. At night (exterior lamps are On) the instrument cluster converts an electronic dimming level message received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus to a digital dimming level signal for controlling the lighting level of the VFD. However, a "Parade" mode position of the panel lamps dimmer control ring on the control stalk of the left (lighting) multi-function switch allows the VFD to be illumi-

ODOMETER (Continued)

nated at full brightness if the exterior lamps are turned On during daylight hours.

The VFD, the trip odometer switch, and the trip odometer switch button are serviced as a unit with the instrument cluster.

OPERATION

The odometer and trip odometer give an indication to the vehicle operator of the distance the vehicle has traveled. This gauge is controlled by the instrument cluster electronic circuitry based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The odometer and trip odometer information is displayed by the instrument cluster Vacuum Fluorescent Display (VFD). The VFD will only display odometer or trip odometer information after the ignition switch is turned to the On or Start positions, and will display the information in the odometer or trip odometer mode based upon the selection that was active when the ignition switch was last turned to the Off position. The instrument cluster circuitry controls the VFD and provides the following features:

- **Odometer/Trip Odometer Display Toggling** - Actuating the trip odometer reset switch button momentarily with the ignition switch in the On position will toggle the display between the odometer and trip odometer information. Each time the ignition switch is turned to the On or Start positions, the display will automatically return to the last mode selected (odometer or trip odometer) before the ignition switch was turned to the Off position.
- **Trip Odometer Reset** - When the trip odometer reset switch button is depressed and held for longer than about two seconds with the ignitions switch in the On or Start positions, the trip odometer will be reset to 000.0 kilometers (miles). The VFD must be displaying the current trip odometer information in order for the trip odometer information to be reset.
- **Communication Error** - If the cluster fails to receive a distance message during normal operation, it will hold and display the last data received until the ignition switch is turned to the Off position. If the cluster does not receive a distance message within one second after the ignition switch is turned to the On position, it will display the last distance message stored in the cluster memory. If it is determined that the distance information stored in the cluster memory is corrupt, it will display "------" in the VFD. If the cluster is unable to display distance information due to an error internal to the cluster, the VFD display will be blank.
- **Actuator Test** - Each time the cluster is put through the actuator test, the VFD will step sequentially through a display of "000000" through "999999", then display the cluster software version number to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors the vehicle speed pulse information received from the vehicle speed sensor, then sends the proper distance messages to the instrument cluster. For further diagnosis of the odometer/trip odometer or the instrument cluster circuitry that controls these functions, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the vehicle speed sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the odometer/trip odometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

OIL PRESSURE GAUGE

DESCRIPTION

An oil pressure gauge is standard equipment on all instrument clusters. The oil pressure gauge is located in the upper right corner of the instrument cluster, to the right of the speedometer. The oil pressure gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the gauge dial face that reads left-to-right from 0 kg/cm to 5.4 kg/cm (metric cluster for gasoline engines), from 0 kg/cm to 8.3 kg/cm (metric cluster for diesel engines), or from 0 psi to 80 psi (U.S. cluster), depending upon the market for which the vehicle is manufactured. An International Control and Display Symbol icon for "Engine Oil" is located on the gauge dial face.

The oil pressure gauge graphics are either white, gray and orange against a black gauge dial face (base cluster) or black and gray against a taupe gauge dial face (premium cluster), making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the base cluster white gauge graphics appear blue-green and the orange graphics still appear orange, while the premium cluster taupe gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background. The gray gauge graphics for both versions of the cluster are not illuminated. The orange gauge needle in the base cluster gauge is internally illuminated, while the black gauge needle in the premium cluster gauge is not.

OIL PRESSURE GAUGE (Continued)

Base cluster gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. Premium cluster gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The oil pressure gauge is serviced as a unit with the instrument cluster.

OPERATION

The oil pressure gauge gives an indication to the vehicle operator of the engine oil pressure. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The oil pressure gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Oil Pressure Normal Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure is within the normal operating range [above 0.28 kg/cm (above 4 psi), the gauge needle is moved to the relative pressure position of the gauge scale.
- **Engine Oil Pressure Low Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure is about 0.28 kg/cm or lower (about 4 psi or lower), the gauge needle is moved to the far left (low) end of the gauge scale. The gauge needle remains at the low end of the scale until the cluster receives a message from the PCM indicating that the engine oil pressure is about 0.56 kg/cm or higher (about 8 psi or higher).
- **Communication Error** - If the cluster fails to receive an engine oil pressure message, it will hold the gauge needle at the last indication for about twelve seconds or until a new engine oil pressure message is received, whichever occurs first. After twelve seconds, the cluster will return the gauge needle to the low end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept across the entire gauge scale and back in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine oil pressure sensor to determine the engine oil pressure. The PCM then sends the proper engine oil pressure messages to the instrument cluster. For further diagnosis of the oil pressure gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the check gauges indicator due to a low oil pressure gauge reading, it may indicate that the engine or the engine oiling system requires service. For proper diagnosis of the engine oil pressure sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the oil pressure gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

OVERDRIVE OFF INDICATOR

DESCRIPTION

An overdrive off indicator is standard equipment on all gasoline engine instrument clusters. The overdrive off indicator is located in the lower edge of the tachometer gauge dial face in the instrument cluster. The overdrive off indicator consists of the words “O/D OFF” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the tachometer gauge dial face overlay. The dark outer layer of the gauge dial face overlay prevents the indicator from being clearly visible when it is not illuminated. The words “O/D OFF” appear silhouetted against an amber field through the translucent outer layer of the gauge dial face overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the exterior lighting is turned On, the illumination intensity of the overdrive off indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The overdrive off indicator lens is serviced as a unit with the instrument cluster.

OPERATION

The overdrive off indicator gives an indication to the vehicle operator when the Off position of the overdrive off switch has been selected, disabling the electronically controlled overdrive feature of the automatic transmission. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster over the Programmable Communications Interface (PCI) data bus. These messages are sent by the Powertrain Control Module (PCM) or by the Transmission Control Module (TCM), depending on the model of the automatic transmission. The overdrive off indicator bulb is com-

OVERDRIVE OFF INDICATOR (Continued)

pletely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the overdrive off indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the overdrive off indicator is illuminated for about three seconds as a bulb test.
- **Overdrive Off Indicator Lamp-On Message** - Each time the cluster receives an overdrive off indicator lamp-on message from the PCM or TCM indicating that the Off position of the overdrive off switch has been selected, the overdrive off indicator will be illuminated. The indicator remains illuminated until the cluster receives an overdrive off indicator lamp-off message from the PCM or TCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the overdrive off indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM or TCM continually monitors the overdrive off switch to determine the proper outputs to the automatic transmission. The PCM or TCM then sends the proper overdrive off indicator lamp-on or lamp-off messages to the instrument cluster. If the overdrive off indicator fails to light during the bulb test, replace the bulb with a known good unit. For further diagnosis of the overdrive off indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the overdrive control system, the PCM, the TCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the overdrive off indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

REAR FOG LAMP INDICATOR

DESCRIPTION

A rear fog lamp indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with optional rear fog lamps, which are available only in certain international markets where they are required. The rear fog lamp indicator is located on the left edge of the instrument cluster, to the left of the tachometer. The rear fog lamp indicator consists of an International Control and Display Symbol icon for “Rear Fog Light” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. When the exterior lighting is turned On, the illumination intensity of the rear fog lamp indicator is dimmable, which is adjusted using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. The rear fog lamp indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The rear fog lamp indicator gives an indication to the vehicle operator whenever the rear fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. The rear fog lamp indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the indicator can be illuminated regardless of the ignition switch position. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the rear fog lamp indicator for the following reasons:

- **Rear Fog Lamp Indicator Lamp-On Message** - Each time the cluster receives a rear fog lamp indicator lamp-on message from the BCM indicating that the rear fog lamps are turned On, the rear fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a rear fog lamp indicator lamp-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the rear fog lamp indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The BCM continually monitors the exterior lighting (left multi-function) switch to determine the proper outputs to the rear fog lamp relay. The BCM

REAR FOG LAMP INDICATOR (Continued)

then sends the proper rear fog lamp indicator lamp-on and lamp-off messages to the instrument cluster. If the rear fog lamp indicator fails to light during the actuator test, replace the bulb with a known good unit. For further diagnosis of the rear fog lamp indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the rear fog lamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the rear fog lamp indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SEATBELT INDICATOR

DESCRIPTION

A seatbelt indicator is standard equipment on all instrument clusters. The seatbelt indicator is located near the lower edge of the instrument cluster, to the left of the tachometer. The seatbelt indicator consists of an International Control and Display Symbol icon for "Seat Belt" imprinted on a red lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the icon from being clearly visible when the indicator is not illuminated. The icon appears silhouetted against a red field through the translucent outer layer of the overlay when it is illuminated from behind by a Light Emitting Diode (LED), which is soldered onto the instrument cluster electronic circuit board. The seatbelt indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The seatbelt indicator gives an indication to the vehicle operator of the status of the driver side front seatbelt. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming. On models equipped with airbags the indicator is also controlled by electronic messages received by the cluster from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus. The seatbelt indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the seatbelt indicator for the following reasons:

- **Seatbelt Reminder Function** - Each time the cluster receives a battery current input on the fused ignition switch output (run-start) circuit, the indicator will be illuminated as a seatbelt reminder for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. This reminder function will occur regardless of the status of the electronic seat belt lamp-on or lamp-off messages received by the cluster from the ACM.
- **Seat Belt Indicator Lamp-On Message** - On models equipped with airbags, following the seatbelt reminder function, each time the cluster receives a seat belt indicator lamp-on message from the ACM indicating the driver side front seat belt is not fastened with the ignition switch in the Start or On positions, the seatbelt indicator will be illuminated. The indicator remains illuminated until the cluster receives a seat belt indicator lamp-off message from the ACM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the seatbelt indicator will be turned on for the duration of the test to confirm the functionality of the LED and the cluster control circuitry.

The instrument cluster continually monitors the status of the ignition switch through the hard wired fused ignition switch output (run-start) circuit to determine when to provide the seatbelt reminder function. On models equipped with airbags, the ACM continually monitors the status of both front seat belt switches to determine the proper airbag system response to a frontal impact of the vehicle. The ACM then sends the proper seatbelt indicator lamp-on and lamp-off messages to the instrument cluster based upon the status of the driver side front seat belt switch input. For further diagnosis of the seatbelt indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the seatbelt switches, the ACM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the seatbelt indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SHIFT INDICATOR (TRANSFER CASE)

DESCRIPTION

A part time indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the standard equipment Selec-Trac four-wheel drive system. The part time indicator is located near the right edge of the instrument cluster, to the right of the speedometer. The part time indicator consists of the words “PART TIME” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The words “PART TIME” appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The part time indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The part time indicator gives an indication to the vehicle operator that a four-wheel drive part time operating mode of the transfer case is selected. On vehicles with the standard equipment Selec-Trac four-wheel drive system, the part time indicator illuminates when the NV-242 transfer case is engaged in either the 4 X 4 Part Time or 4 Lo positions. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The part time indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the part time indicator for the following reasons:

- **Part Time Indicator Lamp-On Message** - Each time the cluster receives a part time indicator lamp-on message from the PCM indicating that a four-wheel drive part time position of the transfer case has been selected, the part time indicator will be illuminated. The indicator remains illuminated until the cluster receives a part time indicator lamp-off message from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the part time indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM continually monitors the transfer case switch to determine the driveline operating mode. The PCM then sends the proper part time indicator lamp-on and lamp-off messages to the instrument cluster. If the part time indicator fails to light during the actuator test, replace the bulb with a known good unit. For further diagnosis of the part time indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the transfer case switch, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the part time indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SKIS INDICATOR

DESCRIPTION

A Sentry Key Immobilizer System (SKIS) indicator is standard equipment on all instrument clusters, but is only operational on vehicles equipped with the optional SKIS. The SKIS indicator is located in the upper right corner of the instrument cluster, to the right of the speedometer. The SKIS indicator consists of a graphical representation or icon of a circled and crossed-out key imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the overlay when it is illuminated from behind by an incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The SKIS indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The Sentry Key Immobilizer System (SKIS) indicator gives an indication to the vehicle operator of the status of the SKIS. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Sentry Key Immobilizer Module (SKIM) over the

SKIS INDICATOR (Continued)

Programmable Communications Interface (PCI) data bus. The SKIS indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is switched to ground by the instrument cluster transistor. The instrument cluster will turn on the SKIS indicator for the following reasons:

• **Bulb Test** - Each time the ignition switch is turned to the On position, the SKIM tells the cluster to illuminate the SKIS indicator for about three seconds as a bulb test.

• **SKIS Indicator Lamp-On Message** - Each time the cluster receives a SKIS indicator lamp-on message from the SKIM, the SKIS indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the SKIM message. For more information on the SKIS and the SKIS indicator control parameters, (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - OPERATION). The indicator remains illuminated until the cluster receives a SKIS indicator lamp-off message from the SKIM, or until the ignition switch is turned to the Off position, whichever occurs first.

• **Communication Error** - If the cluster receives no SKIS indicator lamp-on or lamp-off messages from the SKIM for twenty consecutive seconds, the SKIS indicator is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid SKIS indicator lamp-on or lamp-off message is received from the SKIM.

• **Actuator Test** - Each time the cluster is put through the actuator test, the SKIS indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The SKIM performs a self-test each time the ignition switch is turned to the On position to decide whether the system is in good operating condition and whether a valid key is present in the ignition lock cylinder. The SKIM then sends the proper SKIS indicator lamp-on or lamp-off messages to the instrument cluster. If the SKIS indicator fails to light during the bulb test, replace the bulb with a known good unit. For further diagnosis of the SKIS indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster flashes the SKIS indicator upon ignition On, or turns on the SKIS indicator solid after the bulb test, it indicates that a SKIS malfunction has occurred or that the SKIS is inoperative. For proper diagnosis of the SKIS, the PCI data bus, or the electronic message inputs to the instrument cluster that control the SKIS indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SPEEDOMETER

DESCRIPTION

A speedometer is standard equipment on all instrument clusters. The speedometer is located to the right of the tachometer in the instrument cluster. The speedometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry, and a fixed 255 degree primary scale on the gauge dial face that reads left-to-right either from 0 to 120 mph, from 0 to 200 km/h, or from 0 to 220 km/h, depending upon the market for which the vehicle is manufactured. Most models also have a smaller secondary inner scale on the gauge dial face that provides the equivalent opposite measurement units from the primary scale. Text appearing in the center of the gauge dial face just beneath the hub of the speedometer needle abbreviates the unit of measure for the primary scale in all upper case letters (i.e.: MPH or KM/H). On models with a secondary scale, the abbreviation for that scale follows the abbreviation for the primary scale in all lower case letters (i.e.: mph or km/h).

The speedometer graphics are either white, gray and orange against a black gauge dial face (base cluster) or black and gray against a taupe gauge dial face (premium cluster), making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the base cluster white gauge graphics appear blue-green and the orange graphics still appear orange, while the premium cluster taupe gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background. The gray gauge graphics for both versions of the cluster are not illuminated. The orange gauge needle in the base cluster gauge is internally illuminated, while the black gauge needle in the premium cluster gauge is not.

Base cluster gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. Premium cluster gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The speedometer is serviced as a unit with the instrument cluster.

SPEEDOMETER (Continued)

OPERATION

The speedometer gives an indication to the vehicle operator of the vehicle road speed. This gauge is controlled by the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The speedometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Vehicle Speed Message** - Each time the cluster receives a vehicle speed message from the PCM it will calculate the correct vehicle speed reading and position the gauge needle at that speed position on the gauge scale. The cluster will receive a new vehicle speed message and reposition the gauge pointer accordingly about every 86 milliseconds. The gauge needle will continue to be positioned at the actual vehicle speed position on the gauge scale until the ignition switch is turned to the Off position.
- **Communication Error** - If the cluster fails to receive a speedometer message, it will hold the gauge needle at the last indication for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. If a new speed message is not received after about six seconds, the gauge needle will return to the far left (low) end of the scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept across the entire gauge scale and back in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the vehicle speed information received from the Controller Anti-lock Brake (CAB) to determine the vehicle road speed, then sends the proper vehicle speed messages to the instrument cluster. For further diagnosis of the speedometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the CAB, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the speedometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TACHOMETER

DESCRIPTION

A tachometer is standard equipment on all instrument clusters. The tachometer is located to the left of the speedometer in the instrument cluster. The tachometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry, and a fixed 255 degree scale on the gauge dial face that reads left-to-right from 0 to 7 for gasoline engines, or from 0 to 6 for diesel engines. The text "X 1000" (base cluster) or "RPM X 1000" (premium cluster) imprinted on the cluster overlay directly below the hub of the tachometer needle identifies that each number on the tachometer scale is to be multiplied by 1000 rpm. The gasoline engine tachometer has a red zone beginning at 5800 RPM, while the red zone for the diesel engine tachometer begins at 4200 RPM. The tachometer in the premium version cluster for certain engine and market applications also includes red text located in the center of the gauge dial face just above the hub of the tachometer needle that specifies a special fuel requirement.

The tachometer graphics are either white, gray and orange against a black gauge dial face (base cluster) or black, gray and red against a taupe gauge dial face (premium cluster), making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the base cluster white gauge graphics appear blue-green and the orange graphics still appear orange, while the premium cluster taupe gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background and the red graphics still appear red. The gray gauge graphics for both versions of the cluster are not illuminated. The orange gauge needle in the base cluster gauge is internally illuminated, while the black gauge needle in the premium cluster gauge is not.

Base cluster gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. Premium cluster gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The tachometer is serviced as a unit with the instrument cluster.

OPERATION

The tachometer gives an indication to the vehicle operator of the engine speed. This gauge is controlled by the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain

TACHOMETER (Continued)

Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The tachometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Speed Message** - Each time the cluster receives an engine speed message from the PCM it will calculate the correct engine speed reading and position the gauge needle at that speed position on the gauge scale. The cluster will receive a new engine speed message and reposition the gauge pointer accordingly about every 86 milliseconds. The gauge needle will continue to be positioned at the actual engine speed position on the gauge scale until the ignition switch is turned to the Off position.
- **Communication Error** - If the cluster fails to receive an engine speed message, it will hold the gauge needle at the last indication for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. If a new engine speed message is not received after about six seconds, the gauge needle will return to the far left (low) end of the scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept across the entire gauge scale and back in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the crankshaft position sensor to determine the engine speed, then sends the proper engine speed messages to the instrument cluster. For further diagnosis of the tachometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the crankshaft position sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the tachometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TRANS TEMP INDICATOR

DESCRIPTION

A transmission over-temperature indicator is standard equipment on all gasoline engine instrument clusters. The transmission over-temperature indicator is located near the lower right corner of the instrument cluster, to the right of the speedometer. The transmission over-temperature indicator consists of the words “TRANS OVER TEMP” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. The words “TRANS OVER TEMP” appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The transmission over-temperature indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The transmission over-temperature indicator gives an indication to the vehicle operator when the transmission fluid temperature is excessive, which may lead to accelerated transmission component wear or failure. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster over the Programmable Communications Interface (PCI) data bus. These messages are sent by the Powertrain Control Module (PCM) or by the Transmission Control Module (TCM), depending on the model of the automatic transmission. The transmission over-temperature indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the transmission over-temperature indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the transmission over-temperature indicator is illuminated for about three seconds as a bulb test.
- **Trans Over-Temp Indicator Lamp-On Message** - Each time the cluster receives a trans over-temp indicator lamp-on message from the PCM or TCM indicating that the transmission fluid temperature is 135° C (275° F) or higher, the transmission over-temperature indicator will be illuminated. The indicator remains illuminated until the cluster receives a trans over-temp indicator lamp-off message from the PCM or TCM, or until the ignition

TRANS TEMP INDICATOR (Continued)

switch is turned to the Off position, whichever occurs first.

- **Actuator Test** - Each time the cluster is put through the actuator test, the transmission over-temperature indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM or TCM continually monitors the transmission temperature sensor to determine the transmission operating condition. The PCM or TCM then sends the proper trans over-temp indicator lamp-on or lamp-off messages to the instrument cluster. If the transmission over-temperature indicator fails to light during the bulb test, replace the bulb with a known good unit. If the instrument cluster turns on the transmission over-temperature indicator due to a high transmission oil temperature condition, it may indicate that the transmission or the transmission cooling system are being overloaded or that they require service. For further diagnosis of the transmission over-temperature indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the transmission temperature sensor, the PCM, the TCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the transmission over-temperature indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TURN SIGNAL INDICATOR

DESCRIPTION

Two turn signal indicators, one right and one left, are standard equipment on all instrument clusters. The turn signal indicators are located near the upper edge of the instrument cluster, the left one is left of the tachometer, and the right one is right of the speedometer. Each turn signal indicator consists of an International Control and Display Symbol icon for “Turn Warning” imprinted on a green lens. Each lens is located behind a dedicated cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents these icons from being clearly visible when they are not illuminated. The icons appear silhouetted against a green field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The turn signal indicator lenses are serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The turn signal indicators give an indication to the vehicle operator that the turn signal (left or right indicator flashing) or hazard warning (both left and right indicators flashing) have been selected and are operating. These indicators are controlled by two individual hard wired inputs from the combination flasher circuitry to the instrument cluster electronic circuit board. Each turn signal indicator bulb is grounded on the instrument cluster electronic circuit board at all times; therefore, these indicators remain functional regardless of the ignition switch position. Each indicator bulb will only illuminate when it is provided with battery current by the combination flasher in the Junction Block (JB).

The turn signal indicators are connected in parallel with the other turn signal circuits. This arrangement allows the turn signal indicators to remain functional, regardless of the condition of the other circuits in the turn signal and hazard warning systems. The combination flasher outputs to the instrument cluster turn signal indicator inputs can be diagnosed using conventional diagnostic tools and methods. For more information on the turn signal and hazard warning system, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - OPERATION - TURN SIGNAL & HAZARD WARNING SYSTEM).

DIAGNOSIS AND TESTING - TURN SIGNAL INDICATOR

The diagnosis found here addresses an inoperative turn signal indicator condition. If the problem being diagnosed is related to inoperative turn signal or hazard warning lamps, be certain to repair the turn signal and hazard warning system before attempting to diagnose or repair the turn signal indicators. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING - TURN SIGNAL & HAZARD WARNING SYSTEM). If no turn signal and hazard warning system problem is found, the following procedure will help locate an open in the turn signal indicator circuit. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

TURN SIGNAL INDICATOR (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel and disconnect the instrument panel wire harness for the instrument cluster from the cluster connector receptacle.

(2) Reconnect the battery negative cable. Activate the hazard warning system by moving the hazard warning switch button to the On position. Check for battery voltage at the inoperative (right or left) turn signal circuit cavity of the instrument panel wire harness connector for the instrument cluster. There should be a switching (on and off) battery voltage signal present. If OK, replace the faulty (right or left) turn signal indicator bulb. If not OK, repair the open (right or left) turn signal circuit between the instrument cluster and the combination flasher in the Junction Block (JB) as required.

VOLTAGE GAUGE

DESCRIPTION

A voltage gauge is standard equipment on all instrument clusters. The voltage gauge is located in the upper left corner of the instrument cluster, to the left of the tachometer. The voltage gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the gauge dial face that reads left-to-right from 9 volts to 19 volts. An International Control and Display Symbol icon for “Battery Charging Condition” is located on the gauge dial face.

The voltage gauge graphics are either white, gray and orange against a black gauge dial face (base cluster) or black, gray and red against a taupe gauge dial face (premium cluster), making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the base cluster white gauge graphics appear blue-green and the orange graphics still appear orange, while the premium cluster taupe gauge dial face appears blue-green with the black graphics silhouetted against the illuminated background and the red graphics still appear red. The gray gauge graphics for both versions of the cluster are not illuminated. The orange gauge needle in the base cluster gauge is internally illuminated, while the black gauge needle in the premium cluster gauge is not.

Base cluster gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. Premium cluster gauge illumination is provided by an integral electro-luminescent lamp that is serviced as a unit with the instrument cluster. The voltage gauge is serviced as a unit with the instrument cluster.

OPERATION

The voltage gauge gives an indication to the vehicle operator of the electrical system voltage. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The voltage gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **System Voltage Message** - Each time the cluster receives a message from the PCM indicating the system voltage, the cluster moves the gauge needle to the relative voltage level position on the gauge scale.
- **System Voltage Low Message** - Each time the cluster receives a message from the PCM indicating the system voltage is low (system voltage is about eleven volts or lower), the gauge needle is moved to the relative voltage position in the red zone of the gauge scale and the check gauges indicator is illuminated. The gauge needle remains in the red zone and the check gauges indicator remains illuminated until the cluster receives a message from the PCM indicating there is no low system voltage condition (system voltage is above about eleven volts, but lower than about sixteen volts).
- **System Voltage High Message** - Each time the cluster receives a message from the PCM indicat-

VOLTAGE GAUGE (Continued)

ing the system voltage is high (system voltage is about sixteen volts or higher), the gauge needle is moved to the relative voltage position in the red zone of the gauge scale and the check gauges indicator is illuminated. The gauge needle remains in the red zone and the check gauges indicator remains illuminated until the cluster receives a message from the PCM indicating there is no high system voltage condition (system voltage is below about sixteen volts, but higher than about eleven volts).

- **Communication Error** - If the cluster fails to receive a system voltage message, it will hold the gauge needle at the last indication for about twelve seconds, until a new message is received, or until the ignition switch is turned to the Off position, whichever occurs first. After twelve seconds, the cluster will return the gauge needle to the low end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept across the entire gauge scale and back to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the system voltage to control the generator output. The PCM then sends the proper system voltage messages to the instrument cluster. For further diagnosis of the voltage gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the check gauges indicator due to a system voltage low or high condition, it may indicate that the charging system requires service. For proper diagnosis of the charging system, the PCI data bus, or the electronic message inputs to the instrument cluster that control the voltage gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

WAIT-TO-START INDICATOR

DESCRIPTION

A wait-to-start indicator is only found in the instrument clusters of vehicles equipped with an optional diesel engine. The wait-to-start indicator is located near the lower edge of the tachometer gauge dial face, to the right of center. The wait-to-start indicator consists of an International Control and Display Symbol icon for “Diesel Preheat” imprinted on an amber lens. The lens is located behind a cutout in the opaque layer of the tachometer gauge dial face overlay. The dark outer layer of the gauge dial face overlay prevents the icon from being clearly visible when the indicator is not illuminated. The icon appears silhouetted against an amber field through the translucent outer layer of the gauge dial face overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit located on the instrument cluster electronic circuit board. The wait-to-start indicator lens is serviced as a unit with the instrument cluster.

OPERATION

The wait-to-start indicator gives an indication to the vehicle operator when the diesel engine glow plugs are energized in their preheat operating mode. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The wait-to-start indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The bulb only illuminates when it is switched to ground by the instrument cluster transistor. The instrument cluster will turn on the wait-to-start indicator for the following reasons:

- **Wait-To-Start Indicator Lamp-On Message** - Each time the cluster receives a wait-to-start indicator lamp-on message from the PCM indicating the glow plugs are heating and the driver must wait to start the engine, the wait-to-start indicator will be illuminated. The indicator remains illuminated until the cluster receives a wait-to-start indicator lamp-off message, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the wait-to-start indicator will be turned on for the duration of the test to confirm the functionality of the bulb and the cluster control circuitry.

The PCM continually monitors the ambient temperature and the glow plug pre-heater circuits to determine how long the glow plugs must be heated in the pre-heat operating mode. The PCM then sends the proper wait-to-start indicator lamp-on and lamp-off messages to the instrument cluster. If the wait-to-start indicator fails to light during the actuator test, replace the bulb with a known good unit. For further diagnosis of the wait-to-start indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the glow plug pre-heater control circuits, the PCM, the PCI data bus, or the electronic message

WAIT-TO-START INDICATOR (Continued)

inputs to the instrument cluster that control the wait-to-start indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

WATER-IN-FUEL INDICATOR

DESCRIPTION

A water-in-fuel indicator is only found in the instrument clusters of vehicles equipped with an optional diesel engine. The water-in-fuel indicator is located near the left edge of the instrument cluster, to the left of the tachometer. The water-in-fuel indicator consists of an International Control and Display Symbol icon for “Water in Fuel” imprinted on a red lens. The lens is located behind a cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the icon from being clearly visible when the indicator is not illuminated. The icon appears silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by a Light Emitting Diode (LED), which is soldered onto the instrument cluster electronic circuit board. The water-in-fuel indicator lens is serviced as a unit with the instrument cluster lens, hood and mask unit.

OPERATION

The water-in-fuel indicator gives an indication to the vehicle operator when there is excessive water in the fuel system. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The water-in-fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the water-in-fuel indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the water-in-fuel indicator is illuminated for about three seconds as a bulb test.
- **Water-In-Fuel Indicator Lamp-On Message** - Each time the cluster receives a water-in-fuel indicator lamp-on message from the PCM indicating there is excessive water in the diesel fuel system, the water-in-fuel indicator will be illuminated. The indicator remains illuminated until the cluster receives a water-in-fuel indicator lamp-off message, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the water-in-fuel indicator will be turned on for the duration of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the water-in-fuel sensor to determine whether there is excessive water in the diesel fuel. The PCM then sends the proper water-in-fuel indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the water-in-fuel indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the water-in-fuel sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the water-in-fuel indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

LAMPS

TABLE OF CONTENTS

LAMPS/LIGHTING - EXTERIOR

TABLE OF CONTENTS

LAMPS/LIGHTING - EXTERIOR

DESCRIPTION - TURN SIGNAL & HAZARD WARNING SYSTEM

The turn signal and hazard warning system includes the following major components, which are described in further detail elsewhere in this service information:

- Combination Flasher
- Front Side Marker Lamps
- Hazard Warning Switch
- Turn Signal Cancel Cam
- Turn Signal Indicators
- Turn Signal Lamps
- Turn Signal Switch

The turn signal and hazard warning systems also provide the following features:

- **Flash Lights with Lock** - This customer programmable feature flashes the hazard warning lamps to provide optical verification that the Remote Keyless Entry (RKE) System has received a valid Lock or Unlock request from an RKE transmitter. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION - REMOTE KEYLESS ENTRY SYSTEM).
- **Panic Mode Optical Alert** - This feature flashes the hazard warning lamps to provide an optical alert when the Remote Keyless Entry (RKE) System panic mode is activated by depressing the Panic button on an RKE transmitter. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION - REMOTE KEYLESS ENTRY SYSTEM).
- **Turn Signal On Warning** - This feature provides the vehicle operator with both visual and audible reminders when a turn signal has been left turned on for an extended period. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION).
- **Vehicle Theft Security System (VTSS) Optical Alarm** - This feature flashes the hazard warning lamps to provide an optical alarm when the VTSS is armed and activated by an unauthorized entry into the vehicle. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - DESCRIPTION - VEHICLE THEFT SECURITY SYSTEM).

OPERATION - TURN SIGNAL & HAZARD WARNING SYSTEM

The turn signal system operates on battery current received on a fused ignition switch output (run) circuit so that the turn signals will only operate with the ignition switch in the On position. The hazard warning system operates on non-switched battery current received on a fused B(+) circuit so that the hazard warning remains operational regardless of the ignition switch position. When the turn signal system is activated, the circuitry of the turn signal switch and the combination flasher will cause the selected (right or left) turn signal indicator, front park/turn signal lamp, front side marker lamp and rear tail/stop/turn signal lamp to flash on and off. When the hazard warning system is activated, the circuitry of the hazard warning switch and the combination flasher will cause both the right side and the left side turn signal indicators, front park/turn signal lamps, front side marker lamps and rear tail/stop/turn signal lamps to flash on and off.

The Body Control Module (BCM) can also activate the hazard warning system lamps by energizing the combination flasher through a single hard wired connection to the hazard warning switch sense circuit. The BCM grounds the circuit to energize and de-en-

LAMPS/LIGHTING - EXTERIOR (Continued)

ergize the combination flasher in response to message inputs received over the Programmable Communications Interface (PCI) data bus network. The BCM can energize the combination flasher when the VTSS is requested.

Vehicles equipped with the optional Electronic Vehicle Information Center (EVIC) use turn signal status messages received from the Electro-Mechanical Instrument Cluster (EMIC) and distance messages received from the Powertrain Control Module (PCM) over the PCI data bus to determine when the Turn Signal On warning should be activated. The EMIC receives hard wired inputs from the combination flasher to operate the turn signal indicators, then sends the proper turn signal status message to the EVIC. If a turn signal is left on for more than about 1.6 kilometers (1 mile) of driving distance, the EVIC will display a visual “Turn Signal On” message and will send a request to the BCM over the PCI data bus to notify the vehicle operator.

During both the turn signal and the hazard warning operation, if the exterior lamps are turned Off, the front park/turn signal lamps and the front side marker lamps will flash in unison. If the exterior lamps are turned On, the front park/turn signal lamps and the front side marker lamps will flash alternately. Refer to the owner’s manual.

DIAGNOSIS AND TESTING - TURN SIGNAL & HAZARD WARNING SYSTEMS

When diagnosing the turn signal and hazard warning circuits, remember that high generator output can burn out bulbs rapidly and repeatedly. If this is a concern on the vehicle being diagnosed, test the charging system as required.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Actuate the turn signal switch or the hazard warning switch. Observe the turn signal indicator lamp(s) in the instrument cluster. If the flash rate is very high, check for a turn signal bulb that is not lit or is very dimly lit. Repair the circuits to that lamp or replace the faulty bulb, as required. If the turn signal indicator(s) fail to light, go to Step 2.

(2) Turn the ignition switch to the Off position. Check the ignition run fuse and the flasher fuse in the Junction Block (JB). If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(3) Check for battery voltage at the flasher fuse in the JB. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit between the JB and the Power Distribution Center (PDC).

(4) Turn the ignition switch to the On position. Check for battery voltage at the ignition run fuse in the JB. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run) circuit between the JB and the ignition switch.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the combination flasher from the JB and replace it with a known good unit. Reconnect the battery negative cable. Test the operation of the turn signal and hazard warning systems. If OK, discard the faulty combination flasher. If not OK, remove the test flasher and go to Step 6.

(6) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity in the JB for the combination flasher. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (run) circuit between the combination flasher and the ignition run fuse in the JB.

(7) Turn the ignition switch to the Off position. Check for battery voltage at the B(+) circuit of the JB for the combination flasher. If OK, go to Step 8. If not OK, repair the open B(+) circuit between the combination flasher and the flasher fuse in the JB.

(8) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the turn signal and hazard warning switches from the multi-function switch connector. Check for continuity between the ground circuit of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be continuity. If OK, go to Step 9. If not OK, repair the open ground circuit.

(9) Check for continuity between the hazard switch sense circuit of the instrument panel wire harness connector for the multi-function switch and a good ground. There should be no continuity. If OK, go to Step 10. If not OK, repair the shorted hazard switch sense circuit between the multi-function switch and the combination flasher.

(10) Check for continuity between the hazard switch sense circuit of the JB for the combination flasher and the instrument panel wire harness con-

LAMPS/LIGHTING - EXTERIOR (Continued)

nector for the multi-function switch. There should be continuity. If OK, go to Step 11. If not OK, repair the open hazard switch sense circuit between the multi-function switch and the combination flasher.

(11) Check for continuity between the turn switch sense circuit of the instrument panel wire harness connector for the multi-function switch and a good ground. There should be no continuity. If OK, go to Step 12. If not OK, repair the shorted left turn switch sense circuit between the multi-function switch and the combination flasher.

(12) Check for continuity between the left turn switch sense circuit of the JB for the combination flasher and the instrument panel wire harness connector for the multi-function switch. There should be continuity. If OK, go to Step 13. If not OK, repair the open left turn switch sense circuit between the multi-function switch and the combination flasher.

(13) Check for continuity between the right turn switch sense circuit of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be no continuity. If OK, go to Step 14. If not OK, repair the shorted right turn switch sense circuit between the left multi-function switch and the combination flasher.

(14) Check for continuity between the right turn switch sense circuit of the JB for the combination flasher and the instrument panel wire harness connector for the multi-function switch. There should be continuity. If OK, test the left multi-function switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). If not OK, repair the open right turn switch sense circuit between the multi-function switch and the combination flasher as required.

SPECIFICATIONS

EXTERIOR LAMPS

CAUTION: Do not use bulbs other than the bulbs listed in the Bulb Application Table. Damage to lamp can result. Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

LAMP	BULB TYPE
BACK-UP	3157
CENTER HIGH MOUNTED STOP LAMP	921
FOG LAMP	9005
FRONT SIDE MARKER	194/194NA
FRONT TURN SIGNAL	3157/3157NA
HIGH BEAM	9005XS
LOW BEAM	9006XS
LICENSE PLATE	168
TAIL/BRAKE	3157
REAR TURN SIGNAL	3157
UNDERHOOD LAMP	561

AUTO HEADLAMP SENSOR

DIAGNOSIS AND TESTING - AUTO HEADLAMP SENSOR (AHL)

The auto headlamp sensor needs real sunlight to properly register the light level. When auto headlamps are enabled indoors, the headlamps may be turned on. The sensor is located in the center of the defroster grille at the base of the windshield. There are no faults set in the Body Control Module (BCM) for a inoperative or missing AHL Sensor. Symptom of a missing sensor or unconnected sensor would be that the Headlamps and Parklamps turn on when the vehicle is started and there is a high level of ambient light present (ie. daytime). Auto headlamps should not function in the presence of daylight.

REMOVAL

(1) Remove the instrument panel top cover. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL) for service procedures.

(2) Remove the screw attaching auto headlamp sensor to instrument panel (Fig. 1).

(3) Disengage the harness connector from auto headlamp sensor.

(4) Separate the auto headlamp sensor from instrument panel.

INSTALLATION

(1) Position the auto headlamp sensor on instrument panel.

(2) Engage the harness connector to auto headlamp sensor.

(3) Install the screw attaching auto headlamp sensor to instrument panel.

(4) Install the instrument panel top cover. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION) for service procedures.

AUTO HEADLAMP SENSOR (Continued)

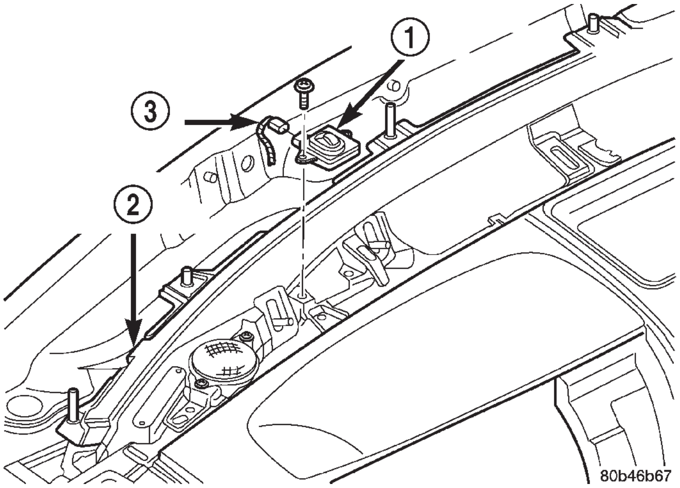

Fig. 1 Auto Headlamp Sensor

1 - AUTO HEADLAMP SENSOR
2 - I/P ASSEMBLY
3 - CONNECTOR

BRAKE LAMP SWITCH

DESCRIPTION

The brake lamp switch is mounted on a bracket attached to the brake pedal support. The switch is adjustable.

OPERATION

The brake lamp switch is used for the brake lamp, speed control and brake sensor circuits.

DIAGNOSIS AND TESTING — BRAKE LAMP SWITCH

Brake lamp switch operation can be tested with an ohmmeter. The ohmmeter is used to check continuity between the pin terminals at different plunger positions (Fig. 2).

SWITCH CIRCUIT IDENTIFICATION

- Terminals 1 and 2: brake sensor circuit
- Terminals 3 and 4: speed control circuit
- Terminals 5 and 6: brake lamp circuit

SWITCH CONTINUITY TEST

NOTE: Disconnect switch harness before testing continuity.

With the switch plunger retracted, attach the test leads to terminal pins 1 and 2. Replace switch if meter indicates no continuity.

With the switch plunger retracted, attach the test leads to terminal pins 3 and 4. Replace switch if meter indicates no continuity.

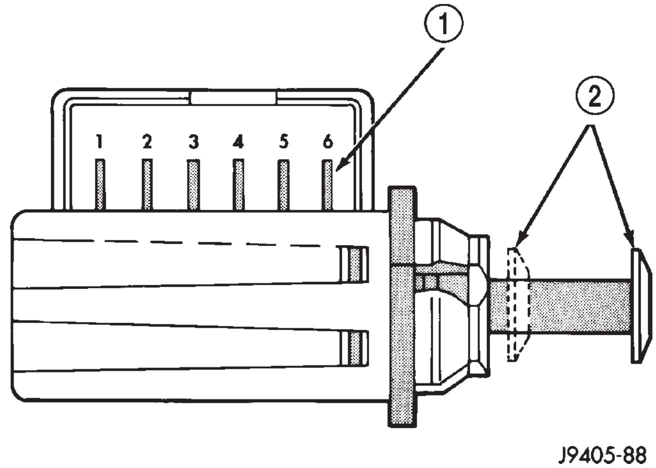

Fig. 2 Brake Lamp Switch Terminal Identification

1 - TERMINAL PINS
2 - PLUNGER TEST POSITIONS

With the switch plunger extended, attach the test leads to terminal pins 5 and 6. Replace switch if meter indicates no continuity.

REMOVAL

(1) Remove the steering column cover and lower trim panel.

(2) Press the brake pedal downward to fully applied position.

(3) Rotate the switch approximately 30° in counterclockwise direction to unlock the switch retainer. Pull switch rearward and out of bracket.

(4) Disconnect switch harness and remove switch from vehicle (Fig. 3).

INSTALLATION

(1) Pull the switch plunger all the way out to fully extended position.

(2) Connect the harness wires to switch.

(3) Press and hold brake pedal in applied position.

(4) Install the switch as follows: Align the tab on the switch with the notch in the switch bracket. Insert the switch in the bracket and turn it clockwise about 30° to lock it in place.

(5) Release the brake pedal. Then pull the pedal lightly rearward. The pedal will set the plunger to the correct position as the pedal pushes the plunger into switch body. The switch will make ratcheting sound as it self adjusts.

CAUTION: Booster damage may occur if the pedal pull exceeds 20 lbs.

BRAKE LAMP SWITCH (Continued)

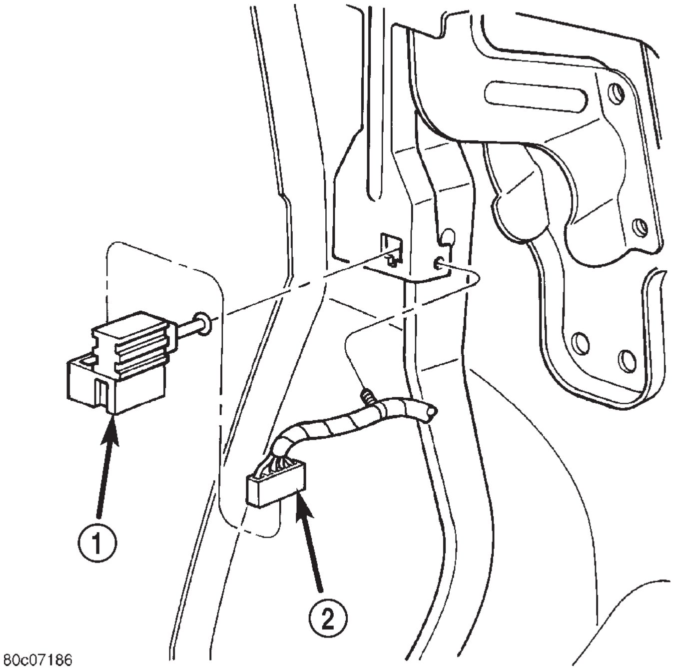

Fig. 3 Brake Lamp

1 - SWITCH
2 - HARNESS CONNECTOR

ADJUSTMENTS

ADJUSTMENT

(1) Press and hold brake pedal in applied position.

(2) Pull switch plunger all the way out to fully extended position.

(3) Release brake pedal. Then pull pedal lightly rearward. Pedal will set plunger to correct position as pedal pushes plunger into switch body. Switch will make ratcheting sound as it self adjusts.

CAUTION: Booster damage may occur if the pedal pull exceeds 20 lbs.

CENTER HIGH MOUNTED STOP LAMP

REMOVAL

REMOVAL - BULB

(1) Remove the screws attaching the lamp housing to the liftgate.

(2) Rotate the bulb socket 1/4 turn and remove it from the housing (Fig. 4).

(3) Remove the bulb from the socket.

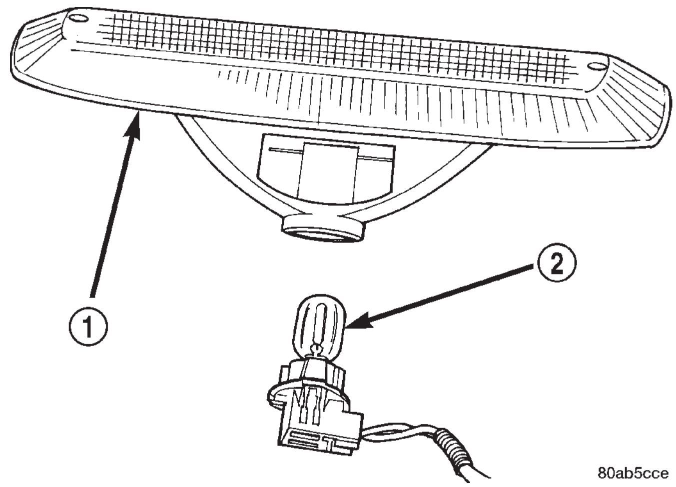

Fig. 4 CHMSL Bulb

1 - CHMSL
2 - CHMSL BULB

REMOVAL - CHMSL

(1) Remove the screws attaching CHMSL to the liftgate (Fig. 5).

(2) Disconnect the wire harness connector.

(3) Separate the CHMSL from the vehicle.

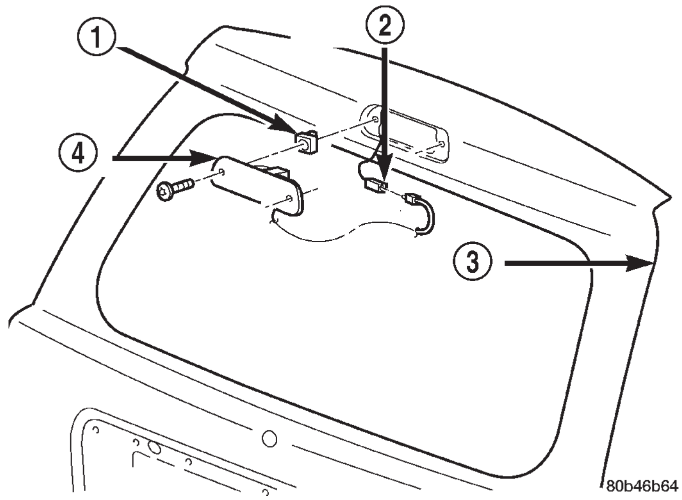

Fig. 5 Center High Mounted Stop lamp

1 - PUSH-IN NUT
2 - CONNECTOR
3 - LIFTGATE
4 - CHSML

INSTALLATION

INSTALLATION - BULB

(1) Push the bulb into the socket.

(2) Position the socket in lamp and rotate 1/4 turn.

(3) Install the screws attaching the lamp housing to liftgate.

CENTER HIGH MOUNTED STOP LAMP (Continued)

INSTALLATION - CHMSL

(1) Connect the wire harness connector.

(2) Position the CHMSL on liftgate.

(3) Install the screws attaching the CHMSL to the liftgate.

COMBINATION FLASHER

DESCRIPTION

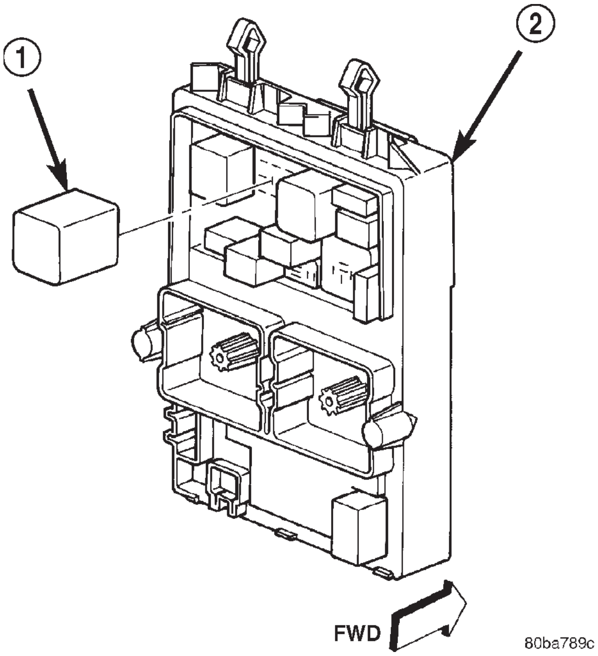

Fig. 6 Combination Flasher

1 - COMBINATION FLASHER
2 - JUNCTION BLOCK

The combination flasher is located in the Junction Block (JB) (Fig. 6). The JB is located underneath the driver side of the instrument panel outboard of the steering column. The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher is designed to handle the current flow requirements of the factory-installed lighting. If supplemental lighting is added to the turn signal lamp circuits, such as when towing a trailer with lights, the combination flasher will automatically try to compensate to keep the flash rate the same.

The combination flasher has nine blade-type terminals that connect it to the vehicle electrical system. Refer to the appropriate wiring information.

Because of the active electronic elements within the combination flasher, it cannot be tested with conventional automotive electrical test equipment. If the combination flasher is believed to be faulty, test the turn signal system and hazard warning system circuits.(Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING - TURN SIGNAL & HAZARD WARNING SYSTEM). The combination flasher cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The combination flasher controls the following inputs and outputs: B(+), fused ignition switch output, left turn switch sense, right turn switch sense, hazard switch sense, left front turn signal circuit, right front turn signal circuit, left rear turn signal circuit and right rear turn signal circuit. Constant battery voltage is supplied to the flasher so that it can perform the hazard warning function, and ignition switched battery voltage is supplied for the turn signal function. However, when the flasher is idle no current is drawn through the module. The unit does not become active until it is provided a signal ground from the turn signal switch, hazard warning switch or the Body Control Module (BCM).

The IC within the combination flasher (Fig. 7) contains the logic that controls the flasher operation and the flash rate. When a bulb is burnt out, or when a circuit for a lamp is open, the turn signal flash rate will increase. However, an open lamp circuit or burnt out bulb does not change the hazard warning flash rate.

COMBINATION FLASHER (Continued)

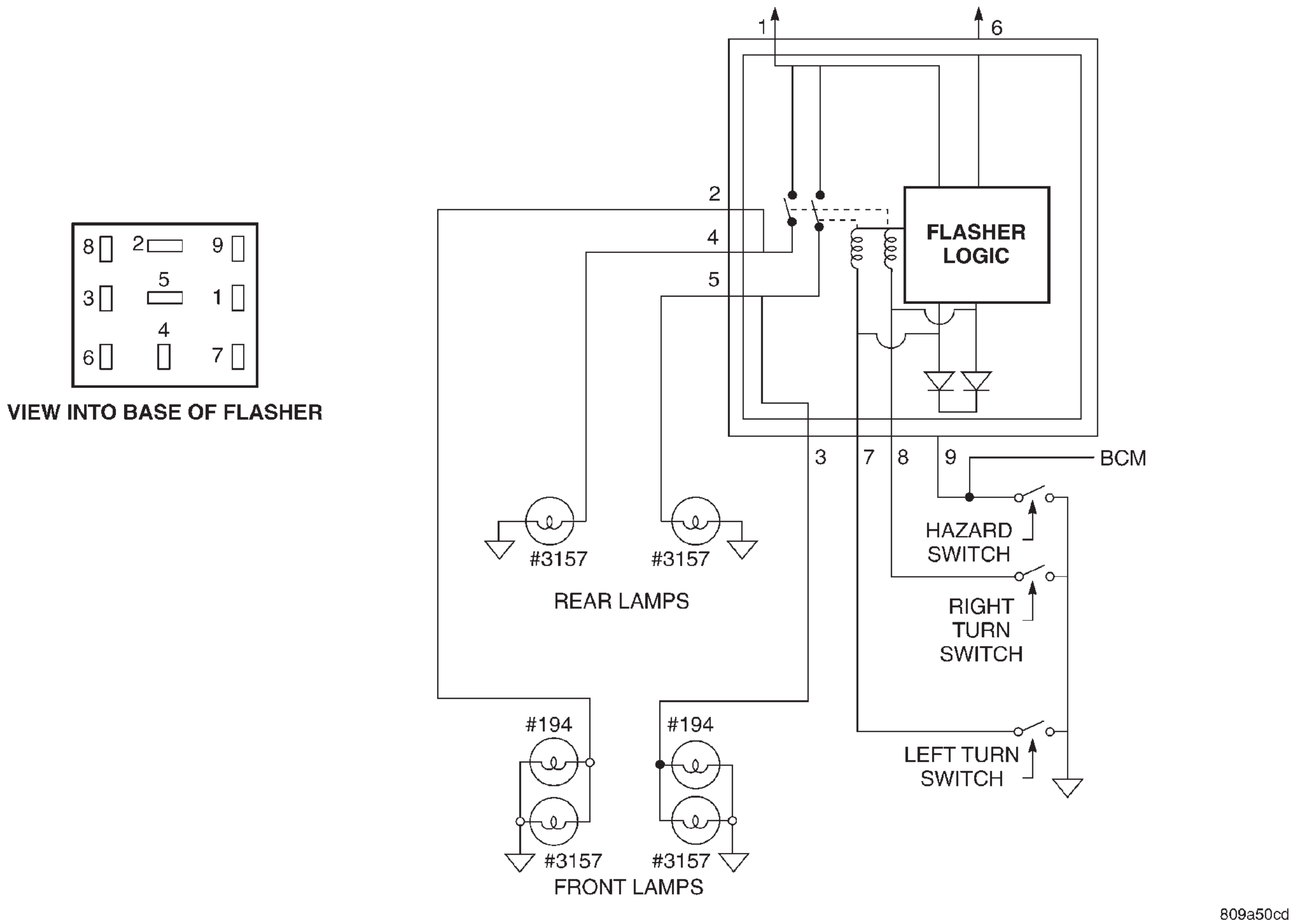

Fig. 7 Combination Flasher

COMBINATION FLASHER CIRCUITS		
CAVITY	**CIRCUIT**	**FUNCTION**
1	L25	Fused B(+)
2	L61	Left Front Turn Signal
3	L60	Right Front Turn Signal
4	L63	Left Rear Turn Signal
5	L62	Right Rear Turn Signal
6	F22	Fused Ignition Switch Output
7	L305	Left Turn Switch Sense
8	L302	Right Turn Switch Sense
9	L91	Hazard Switch Sense

COMBINATION FLASHER (Continued)

Turn signal inputs that actuate the combination flasher are low current grounds, each drawing a maximum of 300 milliamperes.The hazard warning signal input is a low current ground drawing a maximum of 600 milliamperes.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.
(2) Remove the steering column cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
(3) Remove the combination flasher from the Junction Block (JB) (Fig. 8).

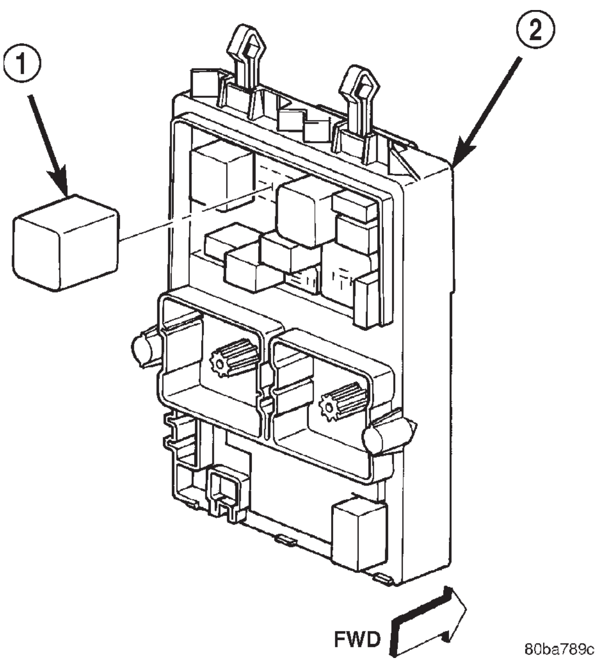

Fig. 8 Combination Flasher

1 - COMBINATION FLASHER
2 - JUNCTION BLOCK

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Align the terminals of the combination flasher with the terminal cavities in the JB. (Fig. 8)
(2) Push in firmly and evenly on the combination flasher until the terminals are fully seated.
(3) Reinstall the steering column opening cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
(4) Reconnect the battery negative cable.

DAYTIME RUNNING LAMP MODULE

DESCRIPTION

The Daytime Running Lights (Headlamps) System is installed on vehicles manufactured for sale in Canada only. A separate module, mounted in the junction block under the dash, controls the DRL.

OPERATION

The headlamps are illuminated at a reduced intensity when the engine is running, headlamp switch off, and the parking brake released.

REMOVAL

(1) Lower the junction block. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - REMOVAL) for service procedures.
(2) Remove the module from the junction block.

INSTALLATION

(1) Position the module in the junction block and press to secure.
(2) Install the junction block. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - INSTALLATION) for service procedures.

FOG LAMP

REMOVAL

(1) Disconnect the fog lamp harness connector.
(2) Rotate the bulb socket 1/4 turn counter clockwise.
(3) Remove the bulb socket from lamp (Fig. 9).

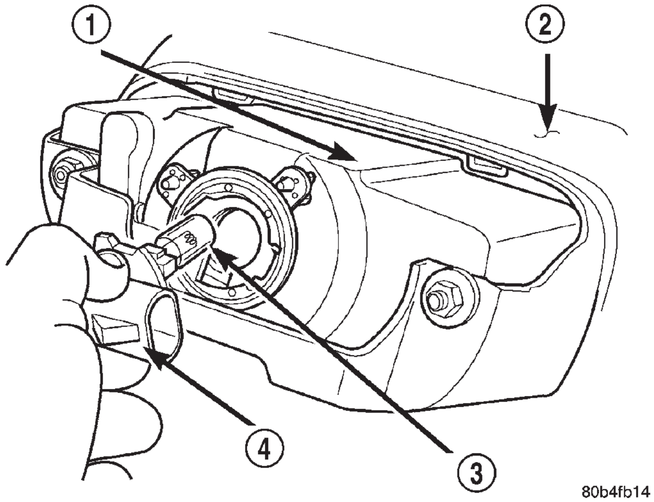

Fig. 9 Fog Lamp Bulb

1 - FOG LAMP
2 - FASCIA
3 - BULB
4 - BULB SOCKET

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Position the bulb socket in fog lamp.
(2) Rotate the bulb socket 1/4 turn clockwise.
(3) Connect the fog lamp harness connector.

FOG LAMP UNIT

REMOVAL

(1) Disengage the fog lamp electrical connector.
(2) Remove the nuts attaching fog lamp to fascia (Fig. 10).
(3) Separate the fog lamp from vehicle.

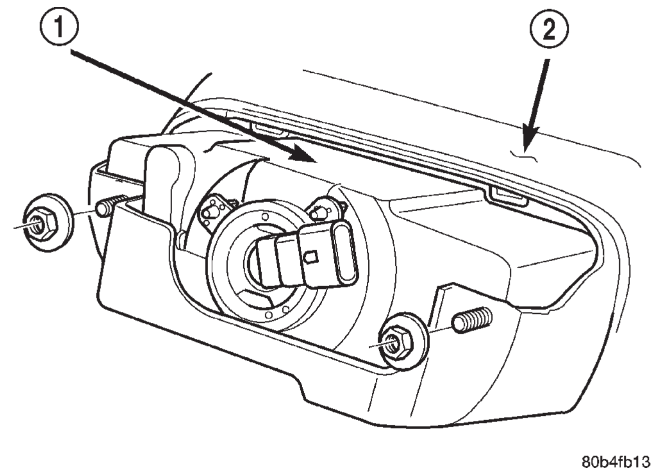

Fig. 10 Fog Lamp

1 - FOG LAMP
2 - FASCIA

INSTALLATION

(1) Position the fog lamp in fascia.
(2) Install the nuts attaching fog lamp to fascia.
(3) Engage the fog lamp electrical connector.
(4) Align the fog lamp, if necessary.

ADJUSTMENTS

FOG LAMP ADJUSTMENT

Prepare an alignment screen. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp centerline and straight ahead (Fig. 11).

Rotate the adjustment screw to adjust beam height (Fig. 12).

FOG LAMP UNIT (Continued)

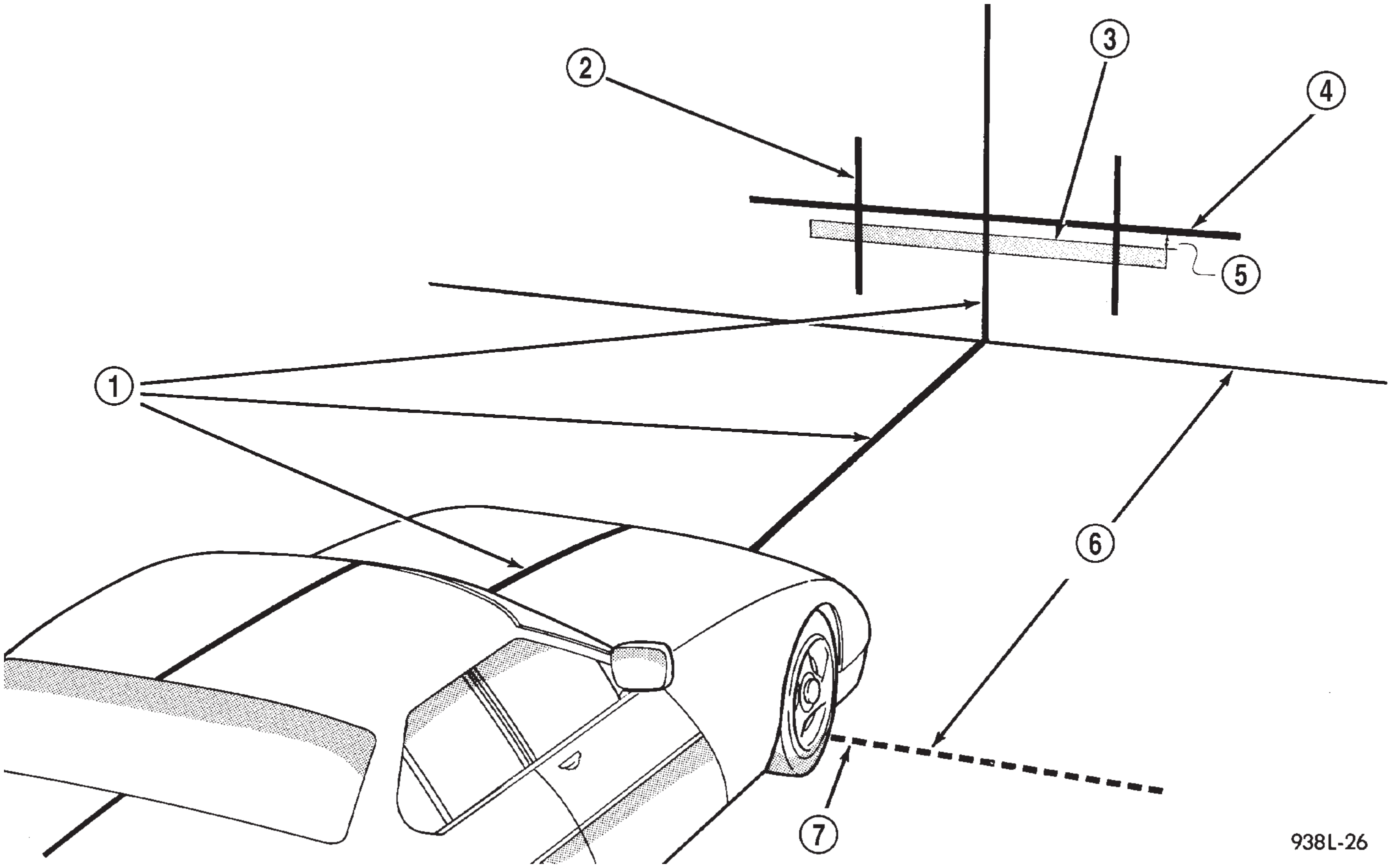

Fig. 11 Fog Lamp Alignment—Typical

1 - VEHICLE CENTERLINE
2 - CENTER OF VEHICLE TO CENTER OF FOG LAMP LENS
3 - HIGH-INTENSITY AREA
4 - FLOOR TO CENTER OF FOG LAMP LENS
5 - 100 mm (4 in.)
6 - 7.62 METERS (25 FEET)
7 - FRONT OF FOG LAMP

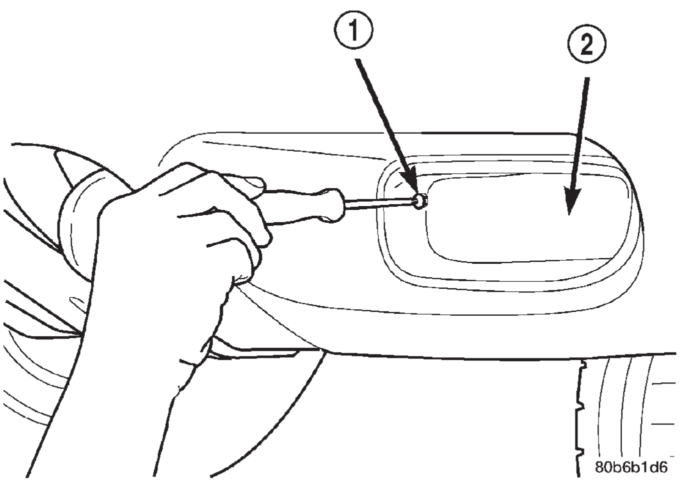

Fig. 12 Fog Lamp Adjustment

1 - ADJUSTMENT SCREW
2 - FOG LAMP

HEADLAMP

DESCRIPTION

The headlamps are modular in design.The headlamp module contains five bulbs; a dual filament headlamp low beam bulb, a single filament high beam bulb, two turnsignal/park bulbs, and a side marker bulb.

OPERATION

All headlamp, turnsignal, park lamp, and high beam operations are controlled by the left multifunction switch. Exterior lamps and bulbs are serviceable separately.

HEADLAMP (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING — HEADLAMP SYSTEM

HEADLAMPS

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
OR IGNITION TURNED OFF	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system, refer to Electrical, Charging
	4. Battery has insufficient charge.	4. Test battery state-of -charge, refer to Electrical, Battery System.
	5. Battery is sulfated or shorted.	5. Load test battery, refer to Electrical,Battery System.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations, refer to Electrical, Wiring Digram Information.
	7. Both headlamp bulbs defective.	7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT	1. Charging system output too high.	1. Test and repair charging system, refer to Electrical, Charging.
FREQUENTLY	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices, refer to Electrical, Wiring Information.
HEADLAMPS ARE DIM WITH ENGINE RUNNING	1. Charging system output too low.	1. Test and repair charging system, refer to Electrical, Wiring Information.
ABOVE IDLE*	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations, refer to Electrical, Wiring Information.
	3. High resistance in headlamp circuit.	3. Test amperage draw of headlamp circuit.
	4. Both headlamp bulbs defective.	4. Replace both headlamp bulbs.
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations, refer to Electrical, Wiring Information.
	2. High resistance in headlamp circuit.	2. Test amperage draw of headlamp circuit. Should not exceed 30 amps.
	3. Loose or corroded terminals or splices in circuit.	3. Inspect and repair all connectors and splices, refer to Electrical, Wiring Information.
HEADLAMPS DO NOT ILLUMINATE	1. No voltage to headlamps.	1. Repair open headlamp circuit, refer to Electrical, Wiring Information.
	2. No Z1-ground at headlamps.	2. Repair circuit ground, refer to Electrical, Wiring Information.

HEADLAMP (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	3. Faulty headlamp switch.	3. Refer to BCM diagnostics.
	4. Blown fuse for headlamps.	4. Replace fuse refer to Electrical, Wiring Information.
	5. Broken connector terminal or wire splice in headlamp circuit.	5. Repair connector terminal or wire splice.
	6. Both headlamp bulbs defective.	6. Replace both headlamp bulbs.
*Canada vehicles must have lamps ON.		

FOG LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system. Refer to Electrical, Charging,
	4. Battery has insufficient charge.	4. Test battery state-of -charge. Refer to Electrical, Battery System.
	5. Battery is sulfated or shorted.	5. Load test battery. Refer to Electrical, Battery System.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations. Refer to Electrical, Wiring Information.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system. Refer to Electrical, Charging.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices. Refer to Electrical, Wiring Information.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system. Refer to Electrical, Charging.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations. Refer to Electrical, Wiring Information.
	3. High resistance in fog lamp circuit.	3. Test amperage draw of fog lamp circuit.
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations. Refer to Electrical, Wiring Information.
	2. High resistance in fog lamp circuit.	2. Test amperage draw of fog lamp circuit.
	3. Faulty multifunction switch.	3. Refer to Electrical, Electronic Control Modules.
	4. Loose or corroded terminals or splices in circuit.	4. Inspect and repair all connectors and splices. Refer to Electrical, Wiring Information.

HEADLAMP (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamp.	1. Replace fuse. Refer to Electrical, Wiring Information.
	2. No Z1-ground at fog lamps.	2. Repair circuit ground. Refer to Electrical, Wiring Information.
	3. Faulty multifunction switch.	3. Refer to Electrical, Wiring Information.
	4. Broken connector terminal or wire splice in fog lamp circuit.	4. Repair connector terminal or wire splice.
	5. Defective or burned out bulb.	5. Replace bulb.

DAYTIME RUNNING LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
DAYTIME RUNNING LAMPS DO NOT WORK	1. Poor connection at DRL module.	1. Secure connector on DRL module.
	2. Parking brake engaged.	2. Disengage parking brake.
	3. Parking brake circuit shorted to ground.	3. Check cluster telltale, refer to Group 8W.
	4. Headlamp circuit shorted to ground.	4. Refer to Group 8W.
	5. Defective DRL relay.	5. Replace DRL relay.
	6. Body controller not programed with Canadian country code.	6. Check country code.
	7. DRL relay is missing.	7. Install DRL relay.
	8. Blown fuse for DRL.	8. Replace fuse refer to Electrical, Wiring Information.
Clicking or chattering when DRL is on.	1. Mechanical relay is installed in the junction block.	1. Ensure that the DRL relay is installed in the proper socket in junction block, and that no mechanical relay exists in the low beam socket.

DIAGNOSIS AND TESTING — HEADLAMP

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result. Do not use bulbs other than those indicated in the Bulb Application table. Damage to lamp and/or Daytime Running Lamp Module can result. Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

Each vehicle is equipped with various lamp assemblies. A good power feed and ground are necessary for proper lighting operation. Grounding is provided by the lamp socket when it comes in contact with the metal body, or through a separate ground wire.

When changing lamp bulbs check the socket for corrosion. If corrosion is present, clean it with a wire brush and coat the inside of the socket lightly with Mopar Multi-Purpose Grease or equivalent.

REMOVAL - BULB

(1) Remove the headlamp.

(2) Turn the bulb socket one quarter turn counter clockwise.

(3) Remove the socket from lamp (Fig. 13).

(4) Remove the bulb from socket.

HEADLAMP (Continued)

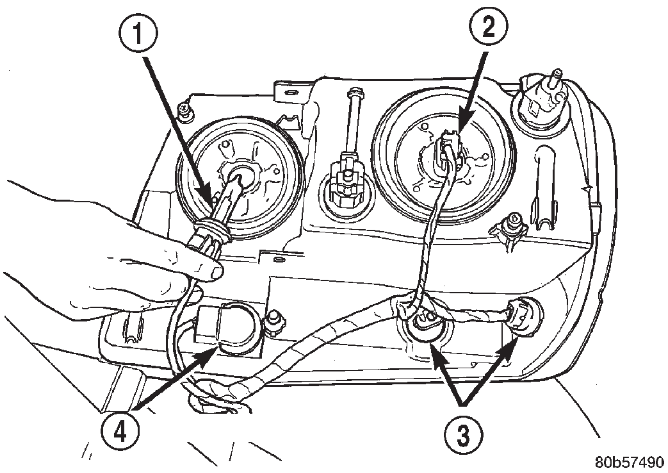

Fig. 13 Headlamp Bulb

1 - HIGH BEAM BULB
2 - LOW BEAM BULB
3 - MARKER BULB
4 - PARK/TURN SIGNAL BULB

INSTALLATION - BULB

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Position the bulb into socket and push into place.

(2) Position the bulb socket in headlamp and turn the bulb socket one quarter turn clockwise.

(3) Install the headlamp.

HEADLAMP SWITCH

DESCRIPTION

The headlamp switch is part of the left multi-function switch. A knob on the end of the multi-function switch control stalk controls all of the exterior lighting switch functions. The exterior lighting switch is hard wired to the Body Control Module (BCM).

The exterior lighting switch cannot be adjusted or repaired and, if faulty or damaged, the entire left multi-function switch unit must be replaced. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/TURN SIGNAL/HAZARD SWITCH - REMOVAL) for the service procedures. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODUL - DESCRIPTION) for more information on this component.

OPERATION

The exterior lighting switch uses a hard wired five volt reference circuit from the BCM, resistor multiplexing and a hard wired switch output circuit to provide the BCM with a zero to five volt signal that indicates the status of all of the exterior lighting switch settings. The BCM then uses control outputs to energize the headlamp and park lamp relays that activate the exterior lighting circuits.

The BCM monitors the exterior lighting switch status, then sends the proper switch status messages to other modules over the Programmable Communications Interface (PCI) data bus network. The exterior lighting switch status is also used by the BCM as an input for chime warning system operation.

DIAGNOSIS AND TESTING — HEADLAMP SWITCH

Before testing the headlamp switch, turn on the exterior lighting and open the driver side front door. If the exterior lamps of the vehicle operate, but there is no chime warning issued with the driver side front door open, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOOR AJAR SWITCH - DIAGNOSIS AND TESTING). If the exterior lamps of the vehicle are inoperative, but the chime warning is issued, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING).

If the exterior lamps and the chime warning are both inoperative, test the left multi-function switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING). If the multi-function switch tests OK, proceed as follows. The following tests will help to locate a short or open in the hard wired circuits between the multi-function switch and the Body Control Module (BCM). For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the left multi-function switch connector. Disconnect the instrument panel wire harness connector from the Body Control Module (BCM). Check for continuity between the headlamp switch mux circuit of the instrument panel wire harness connector for the multi-function switch and a good ground. There should be no continuity. If OK, go to Step 2. If not OK, repair the shorted headlamp switch mux circuit.

(2) Check for continuity between the headlamp switch mux circuit of the instrument panel wire har-

HEADLAMP SWITCH (Continued)

ness connector for the multi-function switch and the instrument panel wire harness connector for the BCM. There should be continuity. If OK, go to Step 3. If not OK, repair the open headlamp switch mux circuit.

(3) Check for continuity between the headlamp switch return circuit of the instrument panel wire harness connector for the multi-function switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted headlamp switch return circuit.

(4) Check for continuity between the headlamp switch return circuit of the instrument panel wire harness connector for the multi-function switch and the instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRBIII® scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open headlamp switch return circuit.

HEADLAMP UNIT

REMOVAL

(1) Remove the jack screw attaching the top of headlamp to the headlamp mounting module (Fig. 14).

(2) Grasp upper inboard and lower outboard corners of headlamp (Fig. 15) and pull headlamp outward.

(3) Remove all of the bulb sockets from headlamp module.

(4) Separate the headlamp from vehicle.

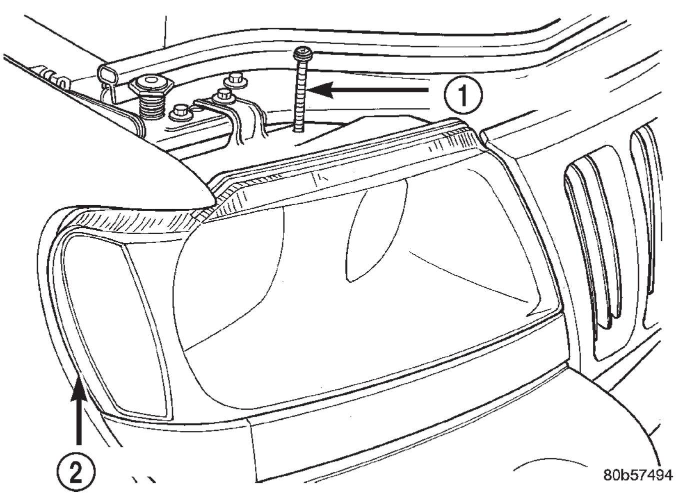

Fig. 14 Headlamp Jackscrew

1 - JACKSCREW
2 - HEADLAMP

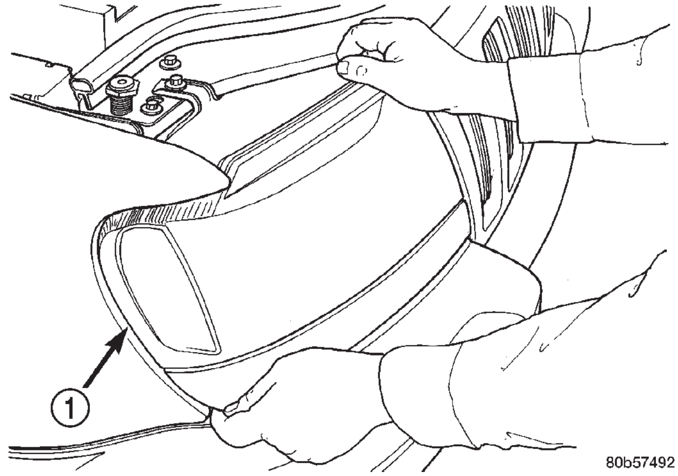

Fig. 15 Headlamp Removal

1 - HEADLAMP

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Install all of the bulb sockets in headlamp module.

(2) Position the headlamp on the vehicle and align the ball studs with the sockets.

(3) Push the headlamp inward to secure the ball studs with the sockets.

(4) Install the jack screw attaching the top of headlamp to the headlamp mounting module.

ADJUSTMENTS

VEHICLE PREPARATION FOR LAMP ALIGNMENT

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Correct defective components that could hinder proper lamp alignment.

(3) Verify proper tire inflation.

(4) Clean lamp lenses.

(5) Verify that luggage area is not heavily loaded.

(6) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

LAMP ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft) away from front of headlamp lens (Fig. 16).

(2) If necessary, tape a line on the floor 7.62 meters (25 ft) away from and parallel to the wall.

(3) Measure from the floor up 1.27 meters (5 ft) and tape a line on the wall at the centerline of the vehicle. Sight along the centerline of the vehicle

HEADLAMP UNIT (Continued)

(from rear of vehicle forward) to verify accuracy of the line placement.

(4) Rock vehicle side-to-side three times to allow suspension to stabilize.

(5) Jounce front suspension three times by pushing downward on front bumper and releasing.

(6) Measure the distance from the center of headlamp lens to the floor. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(7) Measure distance from the centerline of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each side of vehicle centerline. Use these lines for left/right adjustment reference.

HEADLAMP ADJUSTMENT

A properly aimed low beam will project the top edge of the beam intensity pattern on the screen from 25 mm (1 in.) above to 75 mm (3 in.) below headlamp centerline. The side-to-side left edge of the beam intensity pattern should be from 50 mm (2 in.) left to 50 mm (2 in.) right of headlamp centerline (Fig. 17).

(1) Clean front of the headlamps.

(2) Place headlamps on LOW beam.

(3) Cover front of the headlamp that is not being adjusted.

(4) Turn adjustment screw (Fig. 18) and (Fig. 19) until the top edge of the beam intensity pattern is positioned within 25 mm (1 in.) above or 75 mm (3 in.) below the headlamp horizontal centerline.

(5) Cover front of the headlamp and adjust the other headlamp beam as instructed below.

(6) Rotate the adjustment screw until the top edge of the beam intensity pattern is positioned within 25 mm (1 in.) above or 75 mm (3 in.) below the headlamp horizontal centerline.

LICENSE PLATE LAMP

REMOVAL

REMOVAL - BULB

(1) Remove lamp assembly from liftgate lamp module.

(2) Rotate bulb socket counterclockwise to disconnect bulb socket from lamp.

(3) Remove bulb from socket.

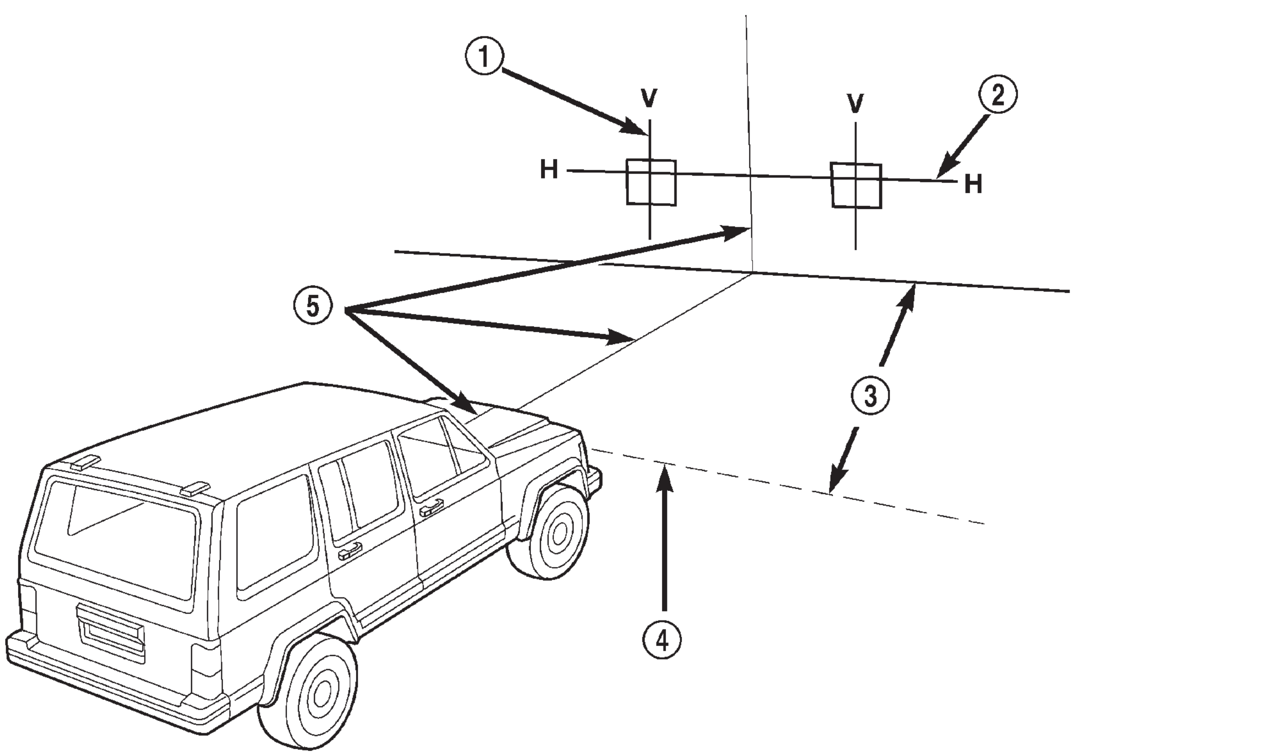

Fig. 16 Headlamp Alignment Screen—Typical

1 - CENTER OF VEHICLE TO CENTER OF HEADLAMP LENS
2 - FLOOR TO CENTER OF HEADLAMP LENS
3 - 7.62 METERS (25 FEET)
4 - FRONT OF HEADLAMP
5 - VEHICLE CENTERLINE

LICENSE PLATE LAMP (Continued)

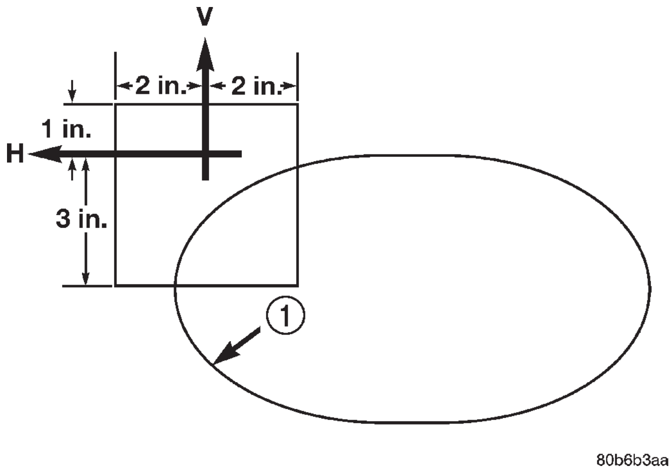

Fig. 17 Low Beam Pattern

1 - LOW BEAM INTENSITY PATTERN (ISO-CANDELA CURVE)

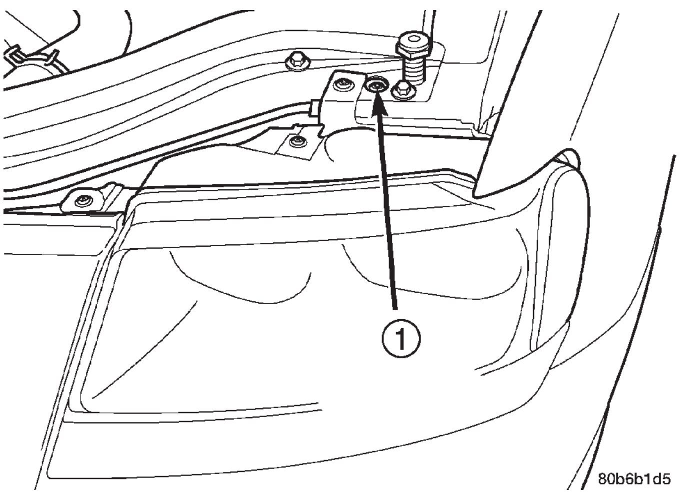

Fig. 18 Headlamp Beam Adjustment Screw

1 - ADJUSTMENT SCREW LOCATION

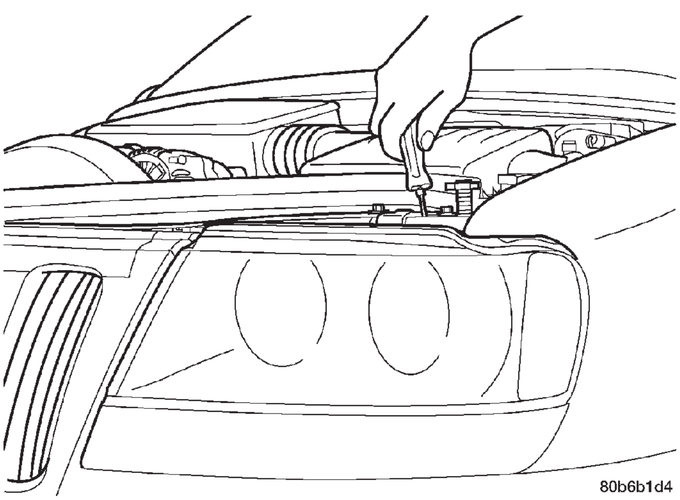

Fig. 19 Headlamp Beam Adjustment

REMOVAL - LAMP

(1) Remove the screws attaching lamp assembly to liftgate. (Fig. 20).

(2) Pull the lamp assembly away from the sheet-metal at extreme outboard edges to disengage the push pins.

(3) Separate lamp assembly harness wiring connector.

(4) Remove lamp.

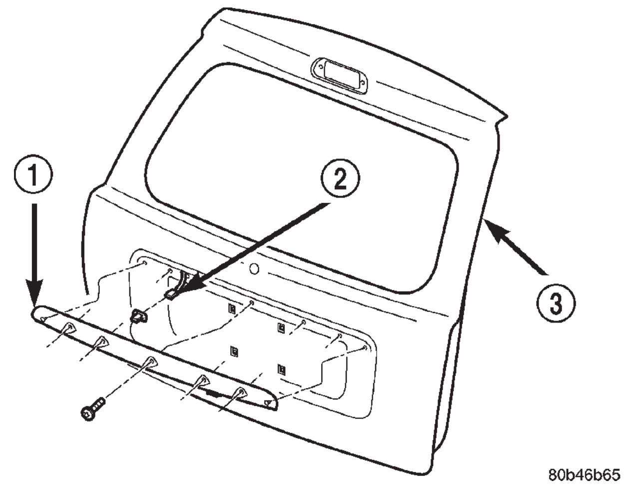

Fig. 20 License Plate Lamp Housing

1 - LICENSE PLATE LAMP
2 - CONNECTOR
3 - LIFTGATE

INSTALLATION

INSTALLATION - BULB

(1) Install bulb in socket.

(2) Install socket and bulb assembly in lamp housing.

(3) Install lamp assembly in liftgate lamp module.

INSTALLATION - LAMP

(1) Connect bulb harness to lamp assembly.

(2) Position lamp assembly on liftgate and press outboard fasteners in place.

(3) Install screws in lamp assembly.

LICENSE PLATE LAMP UNIT

REMOVAL

(1) Remove the screws retaining the lamp housing/trim panel to the liftgate (Fig. 21).

(2) Disconnect the wire harness for the license plate lamps and the flip up glass switch, if equipped.

(3) Remove the license plate lamps and the flip up glass switch, if equipped.

(4) Remove the license plate lamp housing.

LICENSE PLATE LAMP UNIT (Continued)

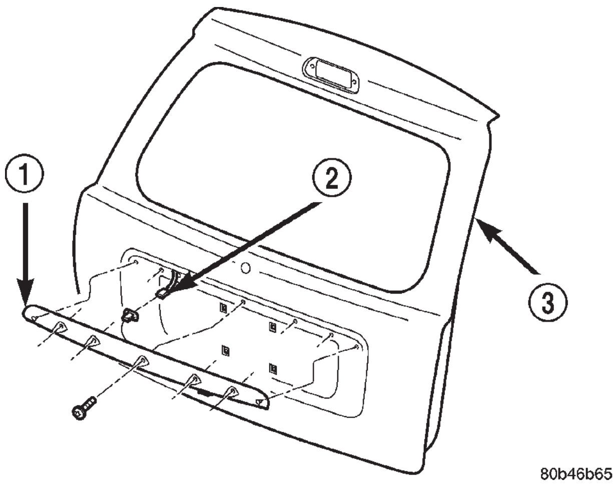

Fig. 21 License Plate Lamp Housing

1 - LICENSE PLATE LAMP
2 - CONNECTOR
3 - LIFTGATE

INSTALLATION

(1) Install the license plate lamps, and the flip up glass switch, if equipped.

(2) Connect the wire harnesses for the license plate lamps and the flip up glass switch.

(3) Install the lamp housing/trim panel on the liftgate.

LEFT MULTI-FUNCTION SWITCH

DESCRIPTION

The left multi-function switch, its mounting provisions, and its electrical connections are all concealed beneath the steering column shrouds, just below the steering wheel (Fig. 22).

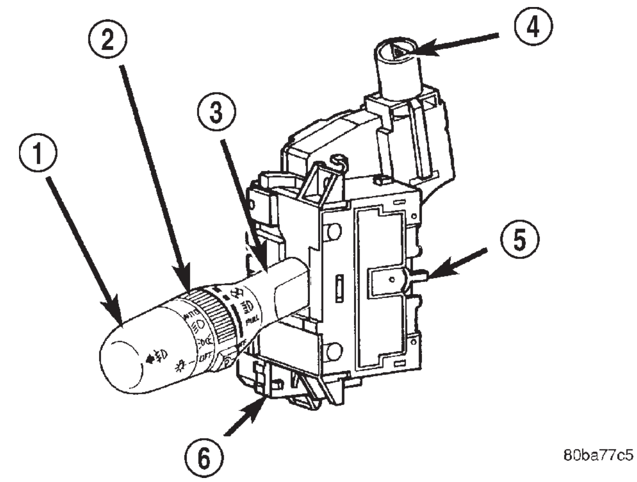

Fig. 22 Left (Lighting) Multi-Function Switch

1 - EXTERIOR LIGHTING CONTROL
2 - INTERIOR LIGHTING CONTROL
3 - CONTROL STALK
4 - HAZARD WARNING BUTTON
5 - CANCEL ACTUATOR
6 - LEFT (LIGHTING) MULTI-FUNCTION SWITCH

A single connector with eleven terminal pins is located on the back of the switch housing and connects the switch to the vehicle electrical system. The left multi-function switch supports the following exterior lighting functions:

- Auto Headlamps
- Front Fog Lamps
- Hazard Warning Control
- Headlamps
- Headlamp Beam Selection
- Headlamp Optical Horn
- Park Lamps
- Rear Fog Lamps
- Turn Signal Control

The left multi-function switch also supports the following interior lighting functions:

- Panel Lamps Dimming
- Interior Lamps Defeat
- Interior Lamps On
- Parade Mode

The left multi-function switch cannot be adjusted or repaired. If any function of the switch is faulty, or if the switch is damaged, the entire switch unit must be replaced.

OPERATION

The left multi-function switch uses a combination of resistor multiplexed and conventionally switched outputs to control the many functions and features it provides using a minimal number of hard wired circuits. The switch is grounded to the chassis beneath the center floor console, just forward of the Airbag Control Module (ACM). Following are descriptions of the how the left multi-function switch operates to control the many exterior lighting functions and features it provides:

- **Auto Headlamps** - The automatic headlamps feature is provided by the Body Control Module (BCM), which monitors an input from a photodiode sensor located on the top of the instrument panel to detect ambient light levels whenever the ignition switch is in the On position. Based upon the multiplexed input from the left multi-function switch and the input of the photodiode sensor, the BCM controls outputs to the park lamp and headlamp relays to illuminate or extinguish all exterior lighting.
- **Front Fog Lamps** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that switched ground input, controls an output to the front fog lamp relay to illuminate or extinguish the front fog lamps.

LEFT MULTI-FUNCTION SWITCH (Continued)

- **Hazard Warning Control** - The hazard warning push button is pressed down to activate the hazard warning system, and pressed down again to turn the system off. The left multi-function switch provides a ground to the hazard warning sense input of the combination flasher to control activation of the hazard warning lamps.
- **Headlamps** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, controls an output to the headlamp low or high beam relays to illuminate or extinguish the headlamps.
- **Headlamp Beam Selection** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that switched ground input, controls an output to the headlamp low or high beam relays to activate the selected headlamp beam.
- **Headlamp Optical Horn** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that switched ground input, controls an output to the headlamp high beam relay to activate the headlamp high beams.
- **Park Lamps** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, controls an output to the park lamp relay to illuminate or extinguish the parking lamps.
- **Rear Fog Lamps** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, controls an output to the rear fog lamp relay to illuminate or extinguish the rear fog lamps.
- **Turn Signal Control** - The left multi-function switch control stalk actuates the turn signal switch. The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, provides a variable voltage output to control the lighting of the turn signals.

Following are descriptions of the how the left multi-function switch operates to control the many interior lighting functions and features it provides:

- **Panel Lamps Dimming** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, provides a variable voltage output through several panel lamps driver circuits to control the lighting of many incandescent panel lamps. The BCM also sends panel lamps dimming messages over the Programmable Communications Interface (PCI) data bus to other modules to control Display lighting levels in those modules.
- **Interior Lamps Defeat** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, internally disables the function the BCM normally provides to control the illumination of the interior lamps.
- **Interior Lamps On** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, provides a control output to activate all of the interior lamp circuits.
- **Parade Mode** - The Body Control Module (BCM) monitors the left multi-function switch then, based upon that multiplexed input, provides a voltage output through several panel lamps driver circuits to control the lighting of many incandescent panel lamps. The BCM also sends panel lamps dimming messages over the Programmable Communications Interface (PCI) data bus to other modules on the bus to control lighting levels in those modules.

DIAGNOSIS AND TESTING - LEFT MULTI - FUNCTION SWITCH

Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the multi-function switch connector.

(2) Using an ohmmeter, perform the continuity and resistance tests at the terminals in the multi-function switch connector as shown in the Left Multi-Function Switch Test chart (Fig. 23).

LEFT MULTI-FUNCTION SWITCH (Continued)

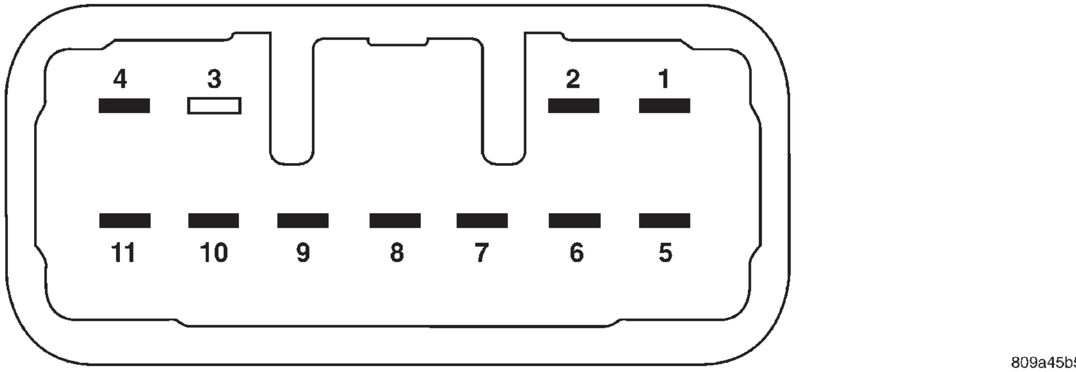

Fig. 23 Left Multi -Function Switch Test

LEFT (LIGHTING) MULTI-FUNCTION SWITCH			
TURN SIGNAL AND HAZARD WARNING SWITCH TESTS			
SWITCH POSITION		CONTINUITY BETWEEN	
TURN	HAZARD		
Neutral	Off	No Related Continuity	
Left	Off	Pins 2 & 8	
Right	Off	Pins 2 & 7	
Neutral	On	Pins 2 & 9	
EXTERIOR LIGHTING SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	-	Pins 4 & 11	3743 - 3824
Park Lamps On	-	Pins 4 & 11	901 - 926
Head Lamps On	-	Pins 4 & 11	345 - 358
Auto Headlamps On	-	Pins 4 & 11	74 - 81
Fog Lamps	Pins 1 & 2	-	-
Optical Horn	Pins 2 & 5	-	-
High Beam	Pins 2 & 6	-	-
INTERIOR LIGHTING SWITCH TESTS			
Dome Lamp Disable On	-	Pins 4 & 9	63 - 70
Panel Lamps Dimming Position 1	-	Pins 4 & 9	198 - 208
Dimming Position 2	-	Pins 4 & 9	551 - 569
Dimming Position 3	-	Pins 4 & 9	905 - 929
Dimming Position 4	-	Pins 4 & 9	1258 - 1290
Dimming Position 5	-	Pins 4 & 9	1611 - 1651
Dimming Position 6	-	Pins 4 & 9	1965 - 2011
Parade Mode On	-	Pins 4 & 9	3534 - 3611
Dome Lamp Enable On	-	Pins 4 & 9	7811 - 7974

LEFT MULTI-FUNCTION SWITCH (Continued)

(3) If the multi-function switch fails any of the continuity or resistance tests, replace the switch.

REMOVAL

REMOVAL - LEFT MULTI-FUNCTION SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.
(2) Remove the lower tilting steering column shroud (Fig. 24).
(3) Unsnap the two halves of the steering column shroud, and remove.
(4) Disconnect the instrument panel wire harness connector from the switch connector.
(5) Remove the screws that secure the left multi-function switch to the housing (Fig. 25).
(6) Remove the left multi-function switch.

REMOVAL - MULTI-FUNCTION SWITCH MOUNTING HOUSING

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

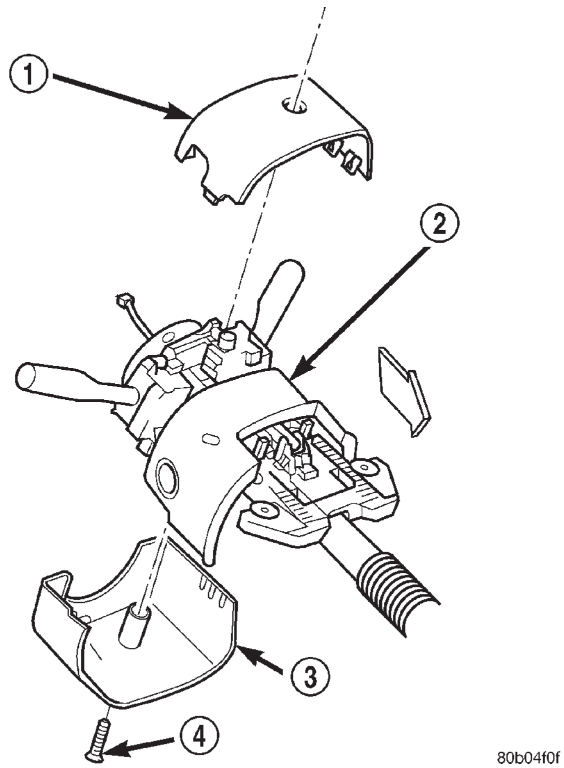

Fig. 24 Steering Column Shrouds Remove/Install

1 - UPPER TILTING COLUMN SHROUD
2 - FIXED COLUMN SHROUD
3 - LOWER TILTING COLUMN SHROUD
4 - SCREW

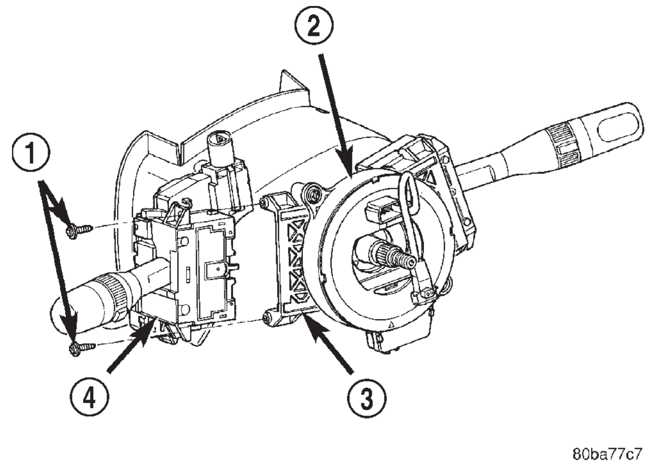

Fig. 25 Left Multi-Function Switch Remove/Install

1 - SCREW (2)
2 - STEERING COLUMN
3 - MULTI-FUNCTION SWITCH MOUNTING HOUSING
4 - LEFT MULTI-FUNCTION SWITCH

(1) Disconnect and isolate the battery negative cable.

LEFT MULTI-FUNCTION SWITCH (Continued)

(2) Remove the clockspring from the multi-function switch mounting housing. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

(3) Remove the left multi-function switch from the multi-function switch mounting housing. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - REMOVAL - LEFT MULTI-FUNCTION SWITCH).

(4) Remove the right multi-function switch from the multi-function switch mounting housing. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - REMOVAL).

(5) Remove the screw that secures the multi-function switch mounting housing to the steering column housing (Fig. 26).

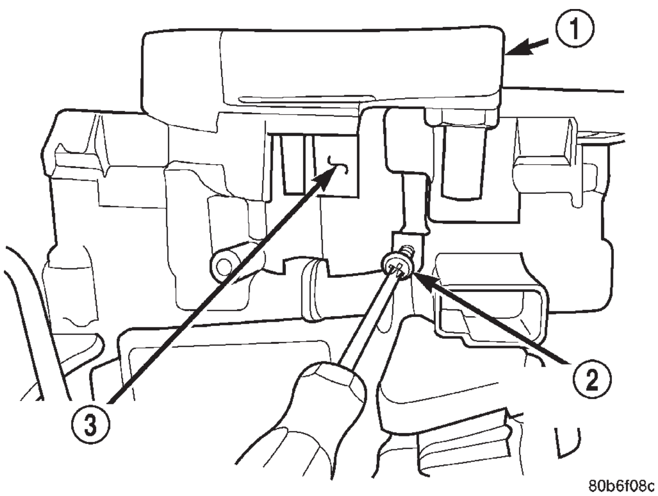

Fig. 26 Multi-Function Switch Mounting Housing Screw Remove/Install

1 - CLOCK SPRING
2 - SCREW
3 - MULTI-FUNCTION SWITCH MOUNTING HOUSING

(6) Remove the multi-function switch mounting housing (Fig. 27).

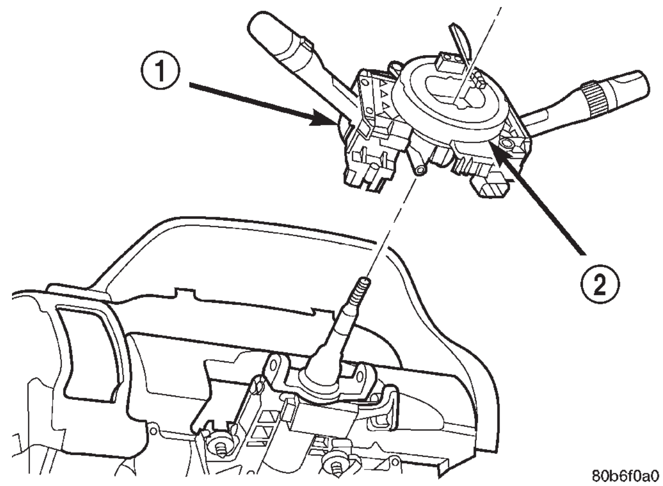

Fig. 27 Multi-Function Switch Mounting Housing Remove/install

1 - MULTI-FUNCTION SWITCH ASSEMBLY
2 - CLOCKSPRING

INSTALLATION

INSTALLATION - LEFT MULTI-FUNCTION SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the left multi-function switch onto the housing (Fig. 28).

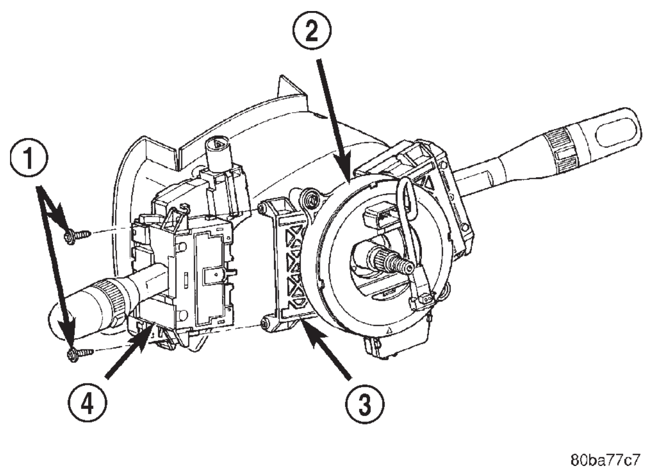

Fig. 28 Left Multi-Function Switch Remove/Install

1 - SCREW (2)
2 - STEERING COLUMN
3 - MULTI-FUNCTION SWITCH MOUNTING HOUSING
4 - LEFT MULTI-FUNCTION SWITCH

(2) Install and tighten the screws that secure the left multi-function switch housing. Tighten the screws to 2.5 N·m (22 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the switch connector.

LEFT MULTI-FUNCTION SWITCH (Continued)

(4) Position the lower tilting steering column shroud to the underside of the steering column (Fig. 29).

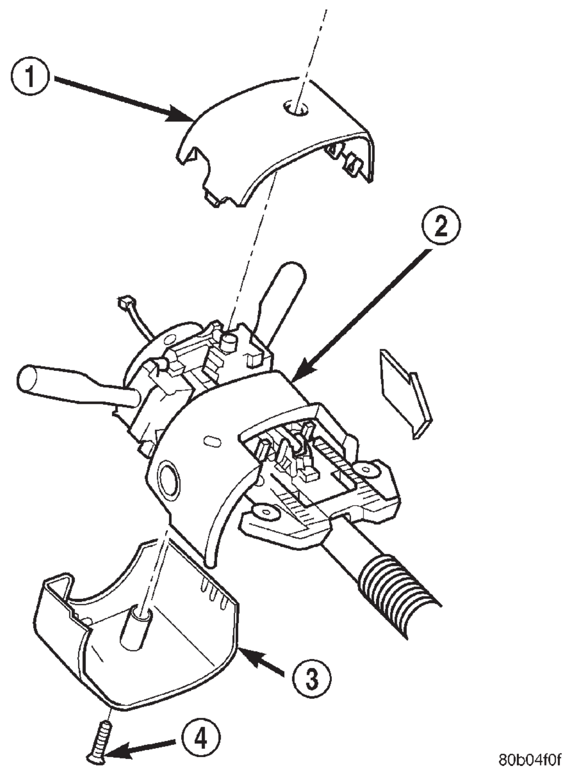

Fig. 29 Steering Column Shrouds Remove/Install

1 - UPPER TILTING COLUMN SHROUD
2 - FIXED COLUMN SHROUD
3 - LOWER TILTING COLUMN SHROUD
4 - SCREW

(5) Install and tighten the screw that secures the lower steering column shroud housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(6) Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(7) Reconnect the battery negative cable.

INSTALLATION - MULTI-FUNCTION SWITCH MOUNTING HOUSING

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) Rotate the turn signal cancel cam in the multi-function switch housing until the alignment hole in the one cam lobe is aligned with the alignment hole in the back of the housing. The oblong hole in the hub of the cam should now be at the top, and the locating tab in the hub of the cam should be at the bottom (Fig. 30).

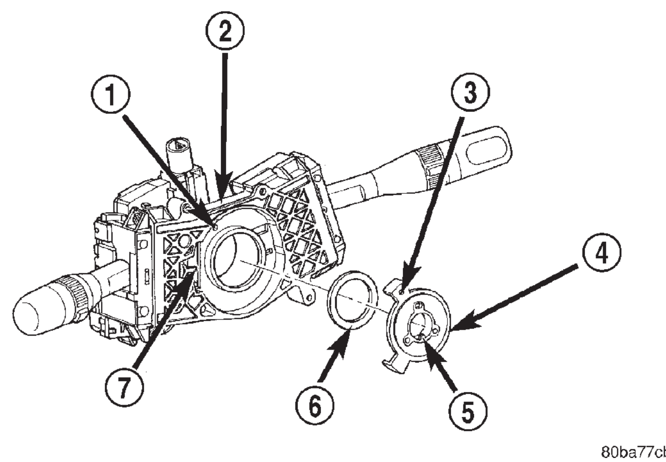

Fig. 30 Turn Signal Cancel Cam Alignment

1 - ALIGNMENT HOLE
2 - MULTI-FUNCTION SWITCH MOUNTING HOUSING
3 - ALIGNMENT HOLE
4 - TURN SIGNAL CANCEL CAM
5 - LOCATING TAB
6 - WASHER
7 - TURN SIGNAL SWITCH CANCEL ACTUATOR

(2) Position the multi-function switch housing onto the top of the steering column. The locating tab in the hub of the turn signal cancel cam must be engaged with the alignment groove in the bottom of the upper steering column shaft.

(3) Install and tighten the screw that secures the multi-function switch housing to the top of the column housing (Fig. 31). Tighten the screw to 1.9 N·m (17 in. lbs.).

(4) Reinstall the right multi-function switch onto the multi-function switch housing. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - INSTALLATION).

(5) Reinstall the left multi-function switch onto the multi-function switch housing. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT

LEFT MULTI-FUNCTION SWITCH (Continued)

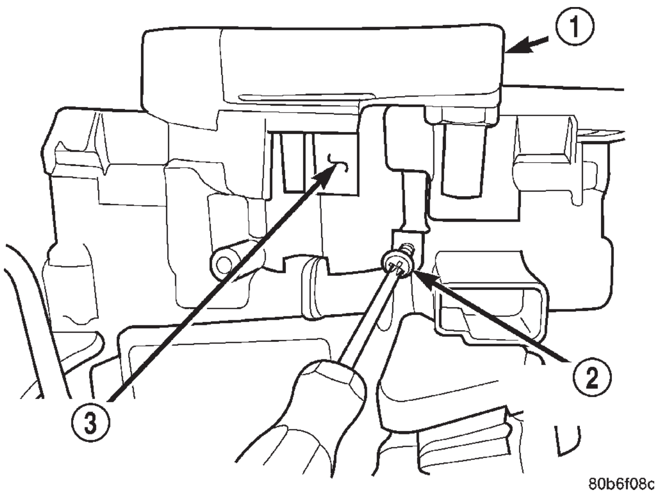

Fig. 31 Multi-Function Switch Mounting Housing Screw Remove/Install

1 - CLOCK SPRING
2 - SCREW
3 - MULTI-FUNCTION SWITCH MOUNTING HOUSING

MULTI-FUNCTION SWITCH - INSTALLATION - LEFT MULTI-FUNCTION SWITCH).

(6) Reinstall the clockspring onto the multi-function switch housing. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

(7) Reconnect the battery negative cable.

PARK/TURN SIGNAL LAMP

REMOVAL - BULBS

(1) Remove the headlamp module.
(2) Rotate the turn signal bulb socket 1/4 turn counter clockwise.
(3) Remove the bulb socket from module.
(4) Remove the bulb from socket.

INSTALLATION - BULBS

(1) Press the bulb into socket.
(2) Position the bulb socket in module.
(3) Rotate the turn signal bulb socket 1/4 turn clockwise.
(4) Install the headlamp module.

TAIL LAMP

DESCRIPTION

The taillamp module contains a housing, lens, and three bulbs. A dual filament bulb is used for tail and stop functions. A single filament bulb is used for turn signal operations. A separate bulb is used for back-up illumination.

OPERATION

All exterior lighting function are controlled by the multifunction switch. Stop lamp functions are controlled by the stoplamp switch. The back-up lamps are controlled by the back-up lamp switch.

REMOVAL

REMOVAL - BULBS

The brake, turn signal, back-up, and side marker lamp bulbs are incorporated into the tail lamp.

(1) Remove the tail lamp.
(2) Rotate the bulb socket counterclockwise.
(3) Separate the socket from the lamp
(4) Remove the bulb from the socket (Fig. 32).

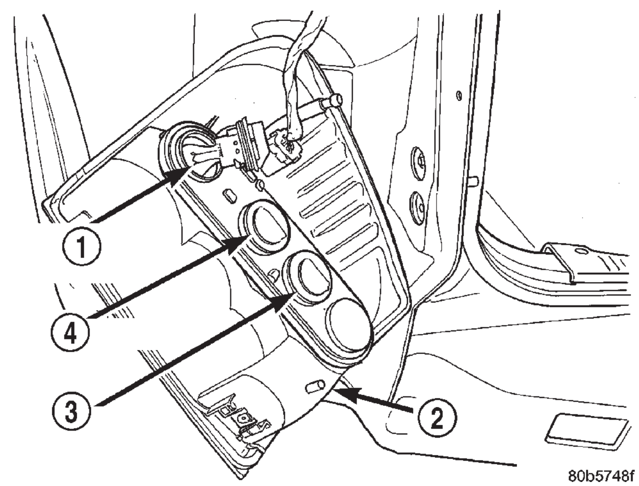

Fig. 32 Tail Lamp Bulbs

1 - TAIL/STOP BULB
2 - TAIL LAMP
3 - BACK-UP BULB
4 - TURN SIGNAL BULB

REMOVAL - LAMP

The brake, turn signal, back-up, and side marker lamps are incorporated in the tail lamp.

(1) Remove the screws attaching the lamp to body (Fig. 33).
(2) Disengage the lamp from the alignment pin.
(3) Disconnect lamp wire harness connector.
(4) Separate lamp from vehicle.

TAIL LAMP (Continued)

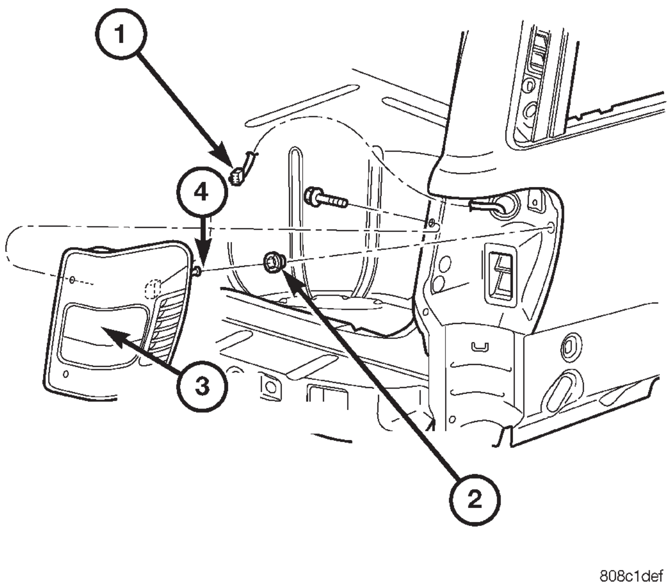

Fig. 33 Tail Lamp

1 - CONNECTOR
2 - RETAINER
3 - TAILLAMP (STOP, TURN, BACK-UP, SIDE MARKER)
4 - PIN

INSTALLATION

INSTALLATION - BULBS

(1) Position the bulb in socket and push into place.

(2) Position the bulb socket in the lamp and rotate clockwise.

(3) Install the lamp.

INSTALLATION - LAMP

The brake, turn signal, back-up, and side marker lamps are incorporated in the tail lamp.

(1) Position the lamp.

(2) Connect the lamp wire harness connector.

(3) Align the pin with the retainer and press the lamp inward to engage.

(4) Install the screws attaching the lamp to body.

TURN SIGNAL CANCEL CAM

DESCRIPTION

The turn signal cancel cam is concealed within the multi-function switch housing below the steering wheel and the clockspring mechanism. The turn signal cancel cam consists of a disc unit with two integral lobes. The upper lobe of the cam has an alignment hole that is used to align it with another hole in the back of the multi-function switch mounting housing. The upper surface of the turn signal cancel cam features three holes, two round and one oblong. These holes engage and key the cancel cam to three matching pins in the hub of the clockspring mechanism. The hub of the clockspring and the turn signal cancel cam rotate with the steering wheel. The centered clockspring housing is then secured to the multi-function switch mounting housing over the top of the turn signal cancel cam.

The turn signal cancel cam is serviced as a assembly with the multi-function switch housing. The turn signal cancel cam cannot be repaired and, if faulty or damaged, the multi-function switch mounting housing unit must be replaced. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - REMOVAL - MULTI-FUNCTION SWITCH MOUNTING HOUSING).

OPERATION

The turn signal cancel cam has two lobes. When the turn signals are activated by moving the left multi-function switch control stalk to a detent position, a turn signal cancel actuator is extended from the inside surface of the multi-function switch housing toward the center of the steering column and the turn signal cancel cam. When the steering wheel is rotated during a turning maneuver, one of the two turn signal cancel cam lobes will contact the turn signal cancel actuator. The cancel actuator latches against the cancel cam rotation in the direction opposite that which is signaled.

UNDERHOOD LAMP

REMOVAL

REMOVAL - BULB

(1) Insert a small flat blade in access slot between the lamp base and lamp lens.

(2) Lift the lamp lens upward and remove the lamp lens (Fig. 34).

(3) Depress bulb terminal inward (Fig. 35) to release bulb.

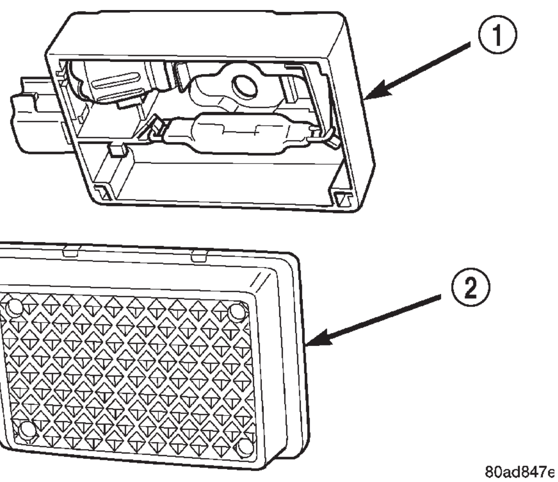

Fig. 34 Underhood Lamp Lens

1 - LAMP
2 - LAMP LENS

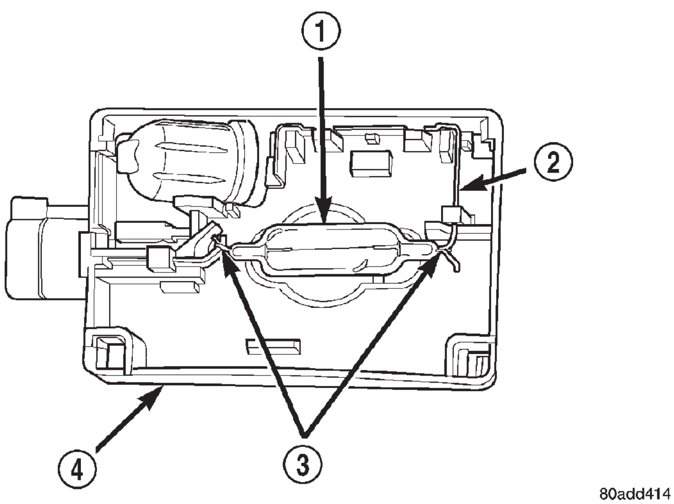

Fig. 35 Underhood Lamp Bulb

1 - BULB
2 - DEPRESS TERMINAL INWARD
3 - BULB WIRE LOOP
4 - LAMP BASE

REMOVAL - LAMP

(1) Disconnect the wire harness connector from lamp.

(2) Remove the screw attaching underhood lamp to inner hood panel (Fig. 36).

(3) Remove the underhood lamp from the vehicle.

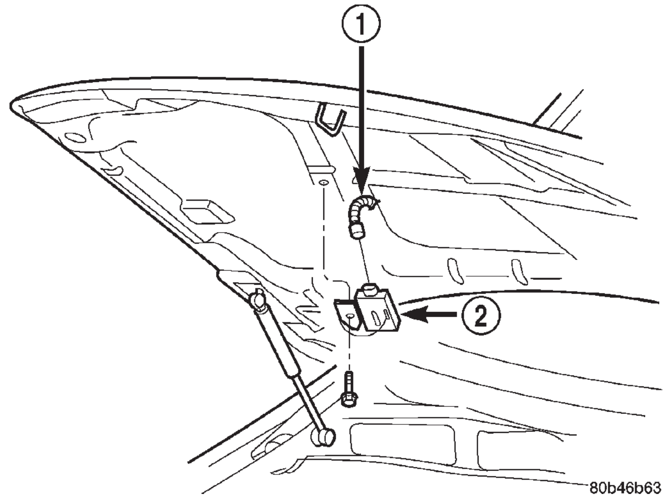

Fig. 36 Underhood Lamp

1 - CONNECTOR
2 - UNDERHOOD LAMP

INSTALLATION

INSTALLATION - BULB

(1) Engage the replacement bulb wire loop to terminal closest to lamp base wire connector.

(2) Depress the opposite terminal inward and engage the remaining bulb wire loop.

(3) Position the lamp lens on the lamp base and press into place.

INSTALLATION - LAMP

(1) Position the underhood lamp on the hood inner panel.

(2) Install the screw attaching the lamp base to the inner hood panel.

(3) Install the lamp housing and press into place.

(4) Connect the wire harness connector.

LAMPS/LIGHTING - INTERIOR

TABLE OF CONTENTS

LAMPS/LIGHTING - INTERIOR

SPECIFICATIONS

CAUTION: Do not use bulbs other than the bulbs listed in the Bulb Application Table. Damage to lamp can result.

Service procedures for most of the lamps in the instrument panel, are located in Electrical, Instrument Panel. Some components have lamps that can only be serviced by an Authorized Service Center (ASC) after the component is removed from the vehicle.

LAMP	BULB TYPE
A/C HEATER	NOT SERVICED
ASH RECEIVER	161
CLIMATE CONTROL	74
PASSENGER ASSIST HANDLE	214–2
FRONT READING	192
GLOVE COMPARTMENT	194
TELLTALE/HAZARD LAMP	74
HEATER	NOT SERVICED
OVERHEAD CONSOLE	192
RADIO	ASC
REAR CARGO	214–2
UNDER PANEL COURTESY	906
CLUSTER ILLUMINATION	103
SUNVISOR VANITY	CHRYSLER P/N 6501966

COURTESY LAMP

REMOVAL

REMOVAL - BULB

(1) Remove the door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL) for the service procedures.
(2) Remove the bulb socket from the lamp.
(3) Remove the bulb from the socket.

REMOVAL - LAMP

(1) Remove door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL) for the procedures.
(2) Disengage the electrical connectors.
(3) Depress the locking tabs and remove the lamp module.
(4) Remove the bulb socket.

INSTALLATION

INSTALLATION - BULB

(1) Install the bulb in the socket.
(2) Install the bulb socket in the lamp.
(3) Install the door trim panel.

INSTALLATION - LAMP

(1) Install the bulb socket into the lamp module.
(2) Align the lamp module with the door trim panel.
(3) Snap the lamp module into place.
(4) Install the door panel.

DOME LAMP

REMOVAL

REMOVAL - BULB

(1) Rotate the the grab handle down.
(2) Remove the screws retaining the grab handle/ dome lens.
(3) Remove the grab handle/lens from the module.
(4) Remove the bulb from the lamp terminals.

REMOVAL - LAMP

It will be necessary to partially remove the headliner to remove the bulb socket.
(1) Remove the screws holding the grab handle/ lens assembly to the headliner and roof panel.
(2) Lower the headliner as needed. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL) for the service procedure.
(3) Separate the lamp socket from the headliner and roof panel.
(4) Disconnect the wire connector.

INSTALLATION

INSTALLATION - BULB

(1) Insert the bulb into the lamp terminals.
(2) Position the grab handle/lens on the lamp module.
(3) Install the screws retaining the grab handle/ lens to the lamp module.

INSTALLATION - LAMP

(1) Position the lamp socket on the headliner and roof panel.
(2) Connect the wire harness.
(3) Install the headliner.
(4) Position the grab handle/lens on the lamp module.
(5) Install the screws retaining the grab handle/ lens into the lamp socket.

DOOR AJAR SWITCH

DESCRIPTION

DESCRIPTION - DOOR AJAR SWITCH

The door ajar switches are integral to the door latch mechnicism. The front door ajar switches are actuated by the front door latch mechanisms, and are hard wired between a body ground and the Driver Door Module (DDM) or the Passenger Door Module (PDM). The rear door ajar switches are actuated by the rear door latch mechanisms, and are hard wired between a body ground and the Body Control Module (BCM) through the rear door and body wire harnesses.

The door ajar switches cannot be adjusted or repaired and, if faulty or damaged, the door latch unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/LATCH - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/LATCH - REMOVAL) for the service procedures. For complete circuit diagrams, refer to the appropriate wiring information.

DESCRIPTION - FLIP UP GLASS AJAR SWITCH

The liftgate flip-up glass ajar switch is integral to the liftgate flip-up glass latch mechnicism. The liftgate flip-up glass ajar switch is actuated by the liftgate flip-up glass latch mechanism, and is hard

DOOR AJAR SWITCH (Continued)

wired between a body ground, the Body Control Module (BCM) and the rear wiper motor module through the liftgate and body wire harnesses.

The liftgate flip-up glass ajar switch cannot be adjusted or repaired and, if faulty or damaged, the liftgate flip-up glass latch unit must be replaced. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/FLIP-UP GLASS LATCH - REMOVAL) for the service procedures. For complete circuit diagrams, refer to the appropriate wiring information.

DESCRIPTION - LIFTGATE AJAR SWITCH

The two liftgate ajar switches are integral to the two liftgate latch mechanisms. The two liftgate ajar switches are actuated by the liftgate latch mechanisms, and are hard wired with each other between a body ground and the Body Control Module (BCM) through the liftgate and body wire harnesses.

The liftgate ajar switches cannot be adjusted or repaired and, if faulty or damaged, the liftgate latch unit must be replaced. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/LATCH - REMOVAL) for the service procedures. For complete circuit diagrams, refer to the appropriate wiring information.

OPERATION

OPERATION - DOOR AJAR SWITCH

The front door ajar switches close a path to ground for the DDM or the PDM when a front door is opened, and opens the ground path when a front door is closed. The rear door ajar switches close a path to ground for the BCM when a rear door is opened, and opens the ground path when a rear door is closed. The DDM, PDM, or BCM read the switch status then send the proper switch status messages to other modules over the Programmable Communications Interface (PCI) data bus network. The door ajar switch status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

OPERATION - FLIP UP GLASS AJAR SWITCH

The liftgate flip-up glass ajar switch can close a path to ground for the BCM and the rear wiper motor module when the liftgate flip-up glass is opened, and opens the ground path when the liftgate flip-up glass is closed. The rear wiper motor module uses the liftgate flip-up glass ajar switch input to control the rear wiper operation, and will park the rear wiper blade if this input indicates that the liftgate flip-up glass is ajar. The BCM reads the switch status then sends the proper switch status message to other modules over the Programmable Communications Interface (PCI) data bus network. The liftgate flip-up glass ajar switch status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

OPERATION - LIFTGATE AJAR SWITCH

Each of the liftgate ajar switches can close a path to ground for the BCM when the liftgate is opened, and opens the ground path when the liftgate is closed. The BCM reads the switch status then sends the proper switch status message to other modules over the Programmable Communications Interface (PCI) data bus network. The liftgate ajar switch status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

DIAGNOSIS AND TESTING - DOOR AJAR SWITCH

The following diagnosis and testing is only for the chime functions. For interior lamp diagnosis, refer to the appropriate wiring information. The driver door ajar switch is hard wired to the Driver Door Module (DDM). The DDM communicates the switch status to the other modules in the vehicle on the Programmable Communications Interface (PCI) data bus network. The following test will diagnose a faulty driver door ajar switch and circuits. For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check that the interior lighting switch on the control stalk of the left multi-function switch is not in the dome lamp disable position. Open the driver side front door and note whether the interior lamps light. They should light. If OK, refer to Key-In Ignition Switch in the Diagnosis and Testing section of this group for further diagnosis of the chime warning system. If not OK, go to Step 2.

(2) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver front door and disconnect the 4-way door wire harness connector from the front door latch connector. Check for continuity between the ground circuit of the 4-way door wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the ground circuit.

DOOR AJAR SWITCH (Continued)

(3) Disconnect the door wire harness connector from the Driver Door Module (DDM) connector. Check for continuity between the driver door ajar switch sense circuit of the door wire harness connector for the DDM and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted driver door ajar switch sense circuit.

(4) Check for continuity between the driver door ajar switch sense circuit of the door wire harness connector for the DDM and the 4-way door wire harness connector for the front door latch. There should be continuity. If OK, go to Step 5. If not OK, repair the open driver door ajar switch sense circuit.

(5) Check for continuity between the ground circuit terminal and the driver door ajar switch sense circuit terminal of the front door latch connector. There should be continuity with the driver side front door open, and no continuity with the door closed. If OK, use a DRBIII® scan tool and the proper Diagnostic Procedures manual to test the operation of the PCI data bus and the DDM. If not OK, replace the faulty driver side front door latch unit.

GLOVE BOX LAMP/SWITCH

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Roll down the glove box from the instrument panel.(Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL) for the procedures.

(3) Remove the lower right center bezel from the instrument panel.(Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL) for the procedures.

(4) Reach through the glove box opening and depress the retaining latches on the top and bottom of the glove box lamp and switch housing.

(5) While holding the retaining latches depressed, push the glove box lamp and switch out through the mounting hole (Fig. 1).

(6) Disconnect the instrument panel wire harness connector from the glove box lamp and switch connector.

(7) Remove the glove box lamp and switch.

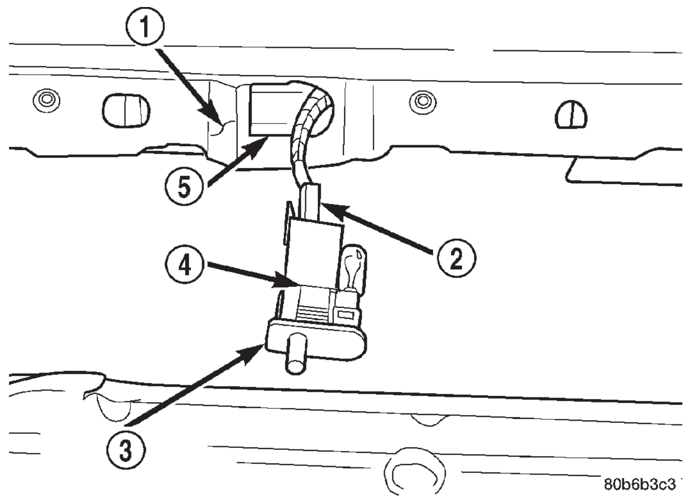

Fig. 1 Glove Box Lamp and Switch Remove/Install

1 - GLOVE BOX OPENING UPPER REINFORCEMENT
2 - WIRE HARNESS CONNECTOR
3 - GLOVE BOX LAMP & SWITCH
4 - LATCH
5 - MOUNTING HOLE

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the glove box lamp and switch to the instrument panel.

(2) Reconnect the instrument panel wire harness connector to the glove box lamp and switch connector.

(3) Align the glove box lamp and switch housing with the mounting hole in the instrument panel glove box opening upper reinforcement.

(4) Push the glove box lamp and switch into the mounting hole until the retaining latches are fully engaged.

(5) Install the lower right center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION) for the procedures.

(6) Roll the glove box back up into the instrument panel.(Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION) for the procedures.

(7) Reconnect the battery negative cable.

READING LAMP

DESCRIPTION

The overhead console in this vehicle is equipped with two individual reading and courtesy lamps.Each lamp has its own switch, bulb, reflector and lens; but both lamps share a common lamp housing within the overhead console.

The overhead console reading and courtesy lamps operate on battery current that is provided at all times, regardless of the ignition switch position. The ground feed for the lamps is switched through the integral reading and courtesy lamp switches or through the door jamb switches.

The reading and courtesy lamp lenses and the lamp housing and reflector unit are serviced only as a unit with the overhead console housing.The reading and courtesy lamp switches, bulb holders and wiring are only available as part of the overhead console wire harness.

For service of the reading and courtesy lamp bulbs, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/READING LAMP - REMOVAL). For diagnosis of the reading and courtesy lamps, refer to the appropriate wiring information.

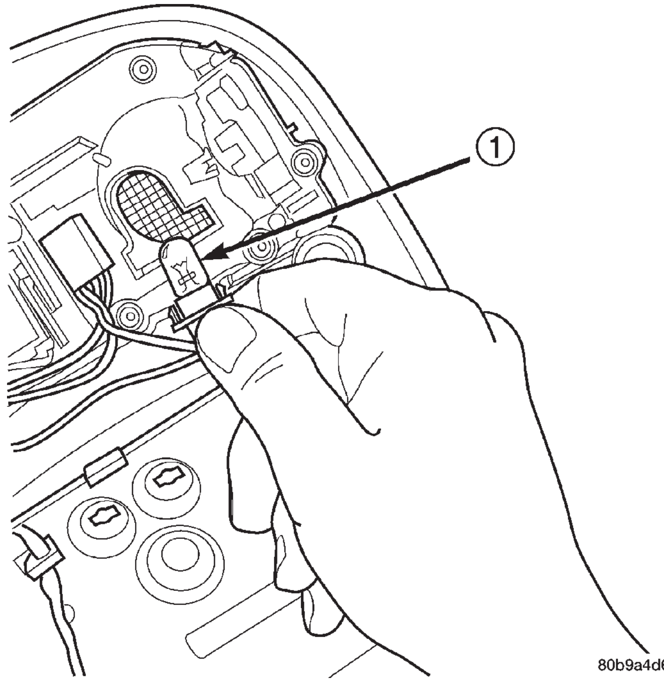

Fig. 2 Overhead Console Reading Lamp Bulb

1 - BULB

OPERATION

All reading and courtesy lamps located in the overhead console are activated by the door jamb switches. When all of the doors are closed, these lamps can be individually activated by depressing the corresponding lens. When any door is open, depressing the lamp lenses to activate the lamp switches will not turn the lamps off.

REMOVAL

(1) Remove the overhead console.

(2) Rotate the console until the bulb is visible (Fig. 2).

(3) Grasp the bulb and remove from the socket.

INSTALLATION

(1) Push the bulb into the bulb socket.

(2) Install the console on the headliner and roof panel.

(3) Align the screw hole and install the screw.

TRANS RANGE INDICATOR ILLUMINATION

DESCRIPTION

The Transmission Range Indicator Lamp, mounted on the floor console, uses electroluminescent technology as the light source. This lamp requires a 120 volt AC signal that is provided by a power converter included as part of the assembly. The module is not serviceable separately. Because of a potential shock hazard, diagnostic testing of the lamp assembly should be avoided. Refer to TRANSMISSION, Range Selector Assembly Removal and Installation.

VANITY LAMP

REMOVAL

(1) Fold down the visor.

(2) Using a small flat blade, and staring at the base of the lamp assembly, carefully pry the base of the lamp from the visor.

(3) Disconnect the vanity lamp visor and remove the lamp from the vehicle.

INSTALLATION

(1) Position the lamp at the visor and connect the wire connector.

(2) Press the lamp in place.

MESSAGE SYSTEMS

TABLE OF CONTENTS

OVERHEAD CONSOLE

DESCRIPTION

An overhead console is standard factory-installed equipment on this model. The overhead console includes the Electronic Vehicle Information Center (EVIC) and two reading and courtesy lamps (Fig. 1). On vehicles equipped with a power sunroof option, the overhead console also houses the power sunroof switch between the two reading and courtesy lamps. The overhead console is mounted with one screw and two snap-clips to a molded plastic retainer bracket located above the headliner. The retainer bracket is secured with adhesive to the inside surface of the roof panel.

Following are general descriptions of the major components used in the overhead console. Refer to **Overhead Console** in Wiring Diagrams for complete circuit diagrams.

OPERATION

See the owner's manual in the vehicle glove box for more information on the use and operation of the various overhead console features.

STANDARD PROCEDURE

STANDARD PROCEDURE - MODULE LAMP REPLACEMENT

(1) Remove the overhead console (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
(2) Using a flat blade screwdriver twist out socket/lamp (Fig. 2).
(3) Replace lamp(s) as necessary.

STANDARD PROCEDURE - COURTESY LAMP REPLACEMENT

(1) Open hood, disconnect and isolate the negative battery cable.

OVERHEAD CONSOLE (Continued)

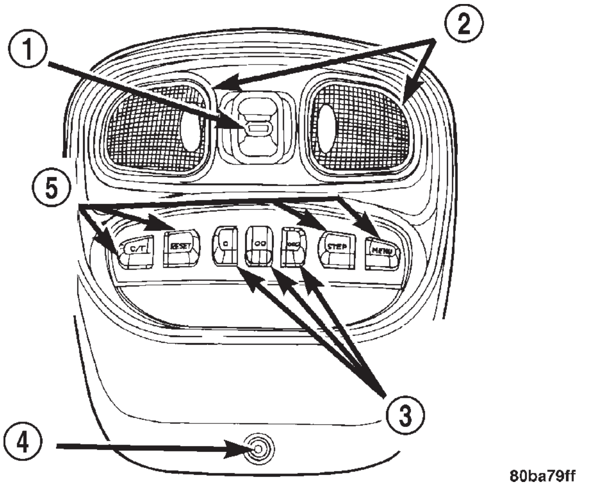

Fig. 1 Overhead Console

1 - POWER SUNROOF SWITCH (IF EQUIPPED)
2 - READING AND COURTESY LAMPS
3 - UNIVERSAL GARAGE DOOR OPENER PUSH BUTTONS (IF EQUIPPED)
4 - SCREW
5 - ELECTRONIC VEHICLE INFORMATION CENTER PUSH BUTTONS

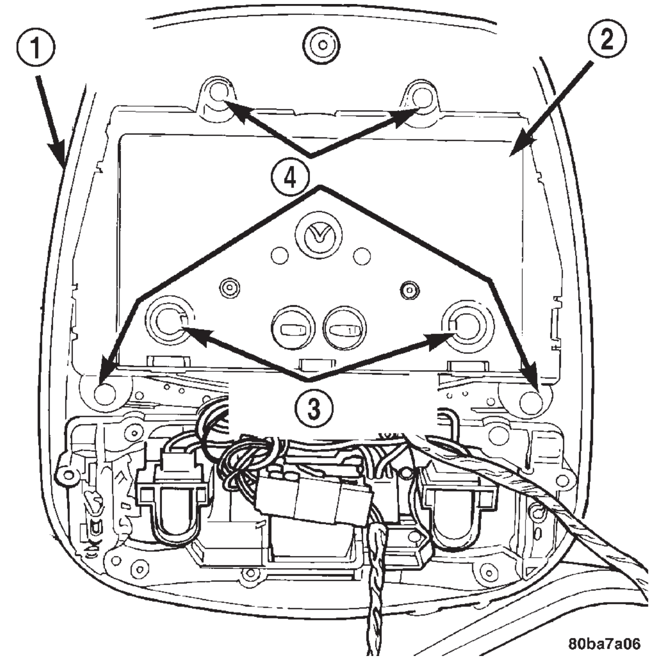

Fig. 2 Top of Overhead Console

1 - OVERHEAD CONSOLE HOUSING
2 - EVIC MODULE
3 - ILLUMINATION LAMPS
4 - SCREWS (4)

(2) Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).

(3) Remove the lamp and socket assembly from the overhead console.

(4) Remove the lamp bulb by pulling it straight out of its socket.

STANDARD PROCEDURE - MODULE LENS REPLACEMENT

(1) Remove the overhead console (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).

(2) Remove the electronics module from the overhead console. Refer to the procedure in this section.

(3) Unsnap the lens from the module and replace lens as necessary.

STANDARD PROCEDURE - ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING

EVIC PROGRAMMING MODE

The Electronic Vehicle Information Center (EVIC) provides the vehicle operator with a user interface, which allows the selection of several optional customer programmable electronic features to suit individual preferences. The EVIC must be placed into its programming mode in order to view or change the programmable features. To enter the EVIC programming mode and to view or change the selected programmable features options, proceed as follows:

(1) Turn the ignition switch to the On position.

(2) Depress and release the Menu push button. The first item in the programmable features menu list will appear in the EVIC display.

(3) Momentarily depress and release the Menu push button to step through the programmable features list. Each programmable feature and its currently selected option will appear on the EVIC display in the sequence shown in the Programmable Features list that follows.

(4) Momentarily depress and release the Step push button to step through the available options for the programmable feature being displayed.

(5) The option that last appears in the display with a programmable feature before exiting the programming mode, becomes the newly selected programmable feature option.

(6) The EVIC exits the programming mode and returns to its normal operating mode when the C/T push button is depressed or when the end of the programmable features menu list is reached, whichever occurs first.

OVERHEAD CONSOLE (Continued)

PROGRAMMABLE FEATURES

• **LANGUAGE? -** The options include English, Francaise, Deutsch, Italiana, or Espanol. The default is English. All EVIC display nomenclature, including the trip computer functions, warning messages and the programmable features appear in the selected language.

• **DISPLAY U.S. OR METRIC? -** The options include U.S. and M. The default is U.S. This feature toggles the trip computer temperature, fuel economy and odometer display readings between U.S. and metric units of measure. It also changes the odometer display in the instrument cluster.

• **AUTO DOOR LOCKS? -** The options include Yes and No. The default is Yes. When Yes is selected, all doors and the liftgate lock automatically when vehicle speed reaches 25 kilometers-per-hour (15 miles-per-hour). If YES is selected, a second programmable feature appears, **AUTO UNLOCK ON EXIT? -** The options again include Yes and No. The default is No. When Yes is selected, following each Auto Door Lock event all doors and the liftgate will automatically unlock when the driver door is opened, if the vehicle is stopped and the transmission gear selector is in Park or Neutral. The Auto Door Unlock event will only occur once following each Auto Door Lock event.

• **REMOTE UNLOCK -** The options include Driver Door 1st and All Doors. The default is Driver Door 1st. When Diver Door 1st is selected, only the driver door unlocks when the Unlock button of the Remote Keyless Entry (RKE) transmitter is depressed once. The Unlock button of the RKE transmitter must be depressed twice to unlock all doors and the liftgate. When All Doors is selected, all doors and the liftgate unlock when the Unlock button of the RKE transmitter is depressed once.

• **REMOTE LINKED TO MEMORY? -** This programmable feature only applies to vehicles equipped with the optional memory system. The options include Yes and No. The default is No. When Yes is selected, the memory system will recall the Driver 1 or Driver 2 memory settings assigned to the RKE transmitter being used to unlock the vehicle. When No is selected, the memory system will only recall memory settings when the Driver 1 or Driver 2 push buttons of the memory switch on the driver side front door trim panel are depressed.

• **SOUND HORN ON LOCK? -** The options include Yes and No. The default is No. When Yes is selected, a short horn chirp will provide an audible confirmation when the RKE receiver recognizes a valid Lock signal from an RKE transmitter. When No is selected, no horn chirp will occur with the RKE Lock event. This feature may be selected independent of the **FLASH LIGHTS WITH LOCKS?** programmable feature.

• **FLASH LIGHTS WITH LOCKS? -** The options include Yes and No. The default is Yes. When Yes is selected, a single flash of the hazard warning lamps will provide an optical confirmation when the RKE receiver recognizes a valid Lock signal from an RKE transmitter, and two flashes of the same lamps will occur when the RKE receiver recognizes a valid Unlock signal from an RKE transmitter. When No is selected, no lamp flash will occur with the RKE Lock or Unlock event. This feature may be selected independent of the **SOUND HORN ON LOCK?** programmable feature.

• **HEADLAMP DELAY = -** The options include Off, 30 Sec, 60 Sec, and 90 Sec. The default is 90 Sec. When a time interval is selected, the headlamps will remain on for that length of time when the headlamps are turned off after the ignition is turned off, or if the Auto mode is selected on vehicles with the Auto Headlamps option. When Off is selected, the headlamp delay feature is disabled.

• **HEADLAMPS ON WITH WIPERS? -** This programmable feature only applies to vehicles equipped with the optional Auto Headlamps. The options include Yes and No. The default is No. When Yes is selected, the headlamps will turn on automatically when the windshield wipers are turned on. The headlamps will turn off when the wipers are turned off, as long as the headlamp switch is in the Auto or Off positions. When No is selected, the headlamps will only turn on if manually selected or if the Auto mode is selected and the outside ambient light levels dictate that they should be on.

• **SERVICE INTV. = -** The options include from 1000 to 12000 kilometers in 1000 kilometer increments (2000 to 7500 miles in 500 mile increments). The default is 12000 kilometers (7500 miles). The selected distance becomes the interval at which the Perform Service warning message will be displayed by the EVIC. If a new distance is selected, a second programmable feature appears, **RESET SERVICE DISTANCE? -** The options include No and Yes. The default is Yes. When Yes is selected, the accumulated distance since the last previous Perform Service warning message will be reset to zero because the service interval has been changed. When No is selected, the distance until the next Perform Service warning message is reduced by the accumulated distance since the last previous message.

• **LOW FUEL CHIME? -** The options include Yes and No. The default is Yes. When Yes is selected, a single chime will sound as an audible alert whenever the instrument cluster low fuel warning lamp lights. The chime will sound only once per ignition cycle. When No is selected, only the low fuel warning lamp in the instrument cluster will light and no chime will sound.

OVERHEAD CONSOLE (Continued)

- **RETRAIN TIRE SENSORS?** - This programmable feature only applies to vehicles equipped with the optional tire pressure monitoring system. The options include Yes and No. The default is No. When Yes is selected and the menu button is depressed, the EVIC will enter the training mode starting with the left front tire.
- **EASY EXIT SEAT?** - This programmable feature only applies to vehicles equipped with the optional memory system. The options include Yes and No. The default is No. When Yes is selected, the driver seat moves rearward about 55 millimeters (two inches) or to the farthest rearward position, whichever comes first, when the key is removed from the ignition switch lock cylinder. This provides additional ease for exiting from the vehicle. The seat will automatically return to the memory system setting position when the Driver 1 or Driver 2 button of the memory switch on the door panel is depressed or, if the **REMOTE LINKED TO MEMORY** programmable feature is enabled, when the RKE Unlock button is depressed. While not automatic, an easy entry feature can be obtained by enabling the **EASY EXIT SEAT** feature and disabling the **REMOTE LINKED TO MEMORY** feature. Then the **EASY EXIT SEAT** feature will move the seat back, but the RKE unlock event will not reposition the seat. Thus, the seat remains positioned for easy entry, and the memory switch on the door panel can be depressed after entering the vehicle to return the seat to the desired memory position.

STANDARD PROCEDURE - COMPASS DEMAGNETIZING

A degaussing tool (Special Tool 6029) is used to demagnetize, or degauss, the overhead console forward mounting screw and the roof panel above the overhead console. Equivalent units must be rated as continuous duty for 110/115 volts and 60 Hz. They must also have a field strength of over 350 gauss at 7 millimeters (0.25 inch) beyond the tip of the probe.

To demagnetize the roof panel and the overhead console forward mounting screw, proceed as follows:

(1) Be certain that the ignition switch is in the Off position, before you begin the demagnetizing procedure.

(2) Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.

(3) Slowly approach the head of the overhead console forward mounting screw with the degaussing tool connected.

(4) Contact the head of the screw with the plastic coated tip of the degaussing tool for about two seconds.

(5) With the degaussing tool still energized, slowly back it away from the screw. When the tip of the tool is at least 61 centimeters (2 feet) from the screw head, disconnect the tool.

(6) Place a piece of paper approximately 22 by 28 centimeters (8.5 by 11 inches), oriented on the vehicle lengthwise from front to rear, on the center line of the roof at the windshield header (Fig. 3). The purpose of the paper is to protect the roof panel from scratches, and to define the area to be demagnetized.

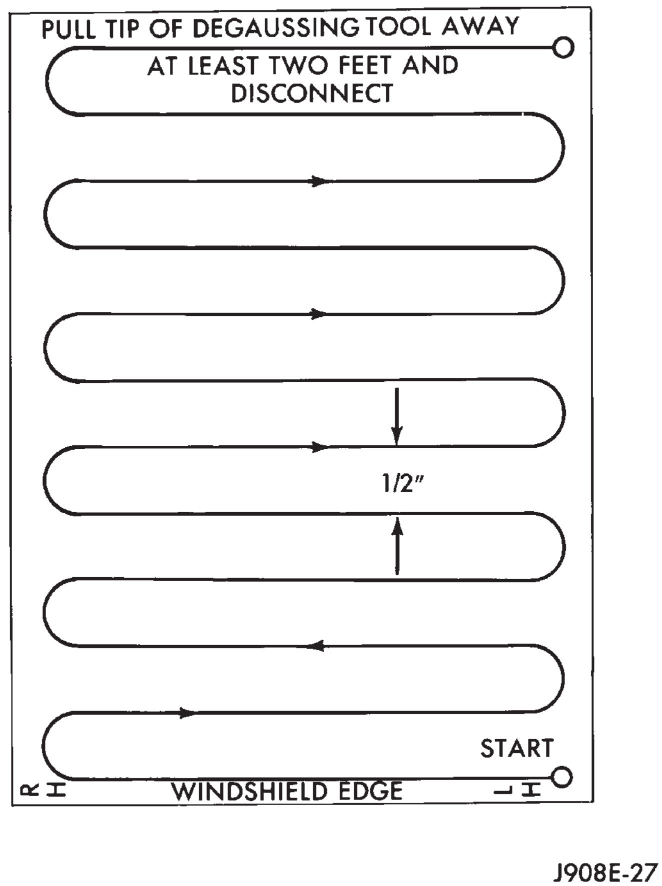

Fig. 3 Roof Demagnetizing Pattern

(7) Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.

(8) Slowly approach the center line of the roof panel at the windshield header, with the degaussing tool connected.

(9) Contact the roof panel with the plastic coated tip of the degaussing tool. Be sure that the template is in place to avoid scratching the roof panel. Using a slow, back-and-forth sweeping motion, and allowing 13 millimeters (0.50 inch) between passes, move the tool at least 11 centimeters (4 inches) to each side of the roof center line, and 28 centimeters (11 inches) back from the windshield header.

(10) With the degaussing tool still energized, slowly back it away from the roof panel. When the

OVERHEAD CONSOLE (Continued)

tip of the tool is at least 61 centimeters (2 feet) from the roof panel, disconnect the tool.

(11) Calibrate the compass and adjust the compass variance (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - STANDARD PROCEDURE).

STANDARD PROCEDURE - COMPASS CALIBRATION

CAUTION: Do not place any external magnets, such as magnetic roof mount antennas, in the vicinity of the compass. Do not use magnetic tools when servicing the overhead console.

The electronic compass unit features a self-calibrating design, which simplifies the calibration procedure. This feature automatically updates the compass calibration while the vehicle is being driven. This allows the compass unit to compensate for small changes in the residual magnetism that the vehicle may acquire during normal use. If the compass readings appear to be erratic or out of calibration, perform the following calibration procedure. Also, new service replacement Electronic Vehicle Information Center (EVIC) modules must have their compass calibrated using this procedure. Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines.

NOTE: Whenever an EVIC module is replaced, the variance number must also be reset. Refer to Compass Variation Adjustment in this group.

Calibrate the compass manually as follows:

(1) Turn the ignition switch to the On position. If the compass/temperature data is not currently being displayed, momentarily depress and release the C/T push button to reach the compass/temperature display.

(2) Depress the Reset push button and hold the button down until “CAL” appears in the display. This takes about ten seconds, and appears about five seconds after “VARIANCE = XX” is displayed.

(3) Release the Reset push button.

(4) Drive the vehicle on a level surface, away from large metal objects and power lines, through one complete circle at between five and eight kilometers-per-hour (three and five miles-per-hour) in not less than 20 seconds. The “CAL” message will disappear from the display to indicate that the compass is now calibrated.

NOTE: If the “CAL” message remains in the display, either there is excessive magnetism near the compass, or the unit is faulty. Repeat the calibration procedure one more time.

NOTE: If the wrong direction is still indicated in the compass display, the area selected for calibration may be too close to a strong magnetic field. Repeat the calibration procedure in another location.

STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT

Compass variance, also known as magnetic declination, is the difference in angle between magnetic north and true geographic north. In some geographic locations, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this problem occurs, the compass variance setting may need to be changed.

To set the compass variance:

(1) Using the Variance Settings map, find your geographic location and note the zone number (Fig. 4).

(2) Turn the ignition switch to the On position. If the compass/temperature data is not currently being displayed, momentarily depress and release the C/T push button to reach the compass/temperature display.

(3) Depress the Reset push button and hold the button down until “VARIANCE = XX” appears in the display. This takes about five seconds.

(4) Release the Reset push button. “VARIANCE =XX ” will remain in the display. “XX” equals the current variance zone setting.

(5) Momentarily depress and release the Step push button to step through the zone numbers, until the zone number for your geographic location appears in the display.

(6) Momentarily depress and release the Reset push button to enter the displayed zone number into the EVIC module memory.

(7) Confirm that the correct directions are now indicated by the compass.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screw that secures the front of the overhead console to the front of the overhead console retainer bracket.

(3) Insert the fingertips of both hands between the headliner and the sides of the overhead console housing in the area near the reading and courtesy lamps.

(4) Pull downward on the sides of the overhead console housing firmly and evenly to disengage the two snap clips that secure the rear of the unit from their receptacles in the overhead console retainer bracket.

(5) Lower the overhead console from the headliner far enough to access the wire harness connectors.

OVERHEAD CONSOLE (Continued)

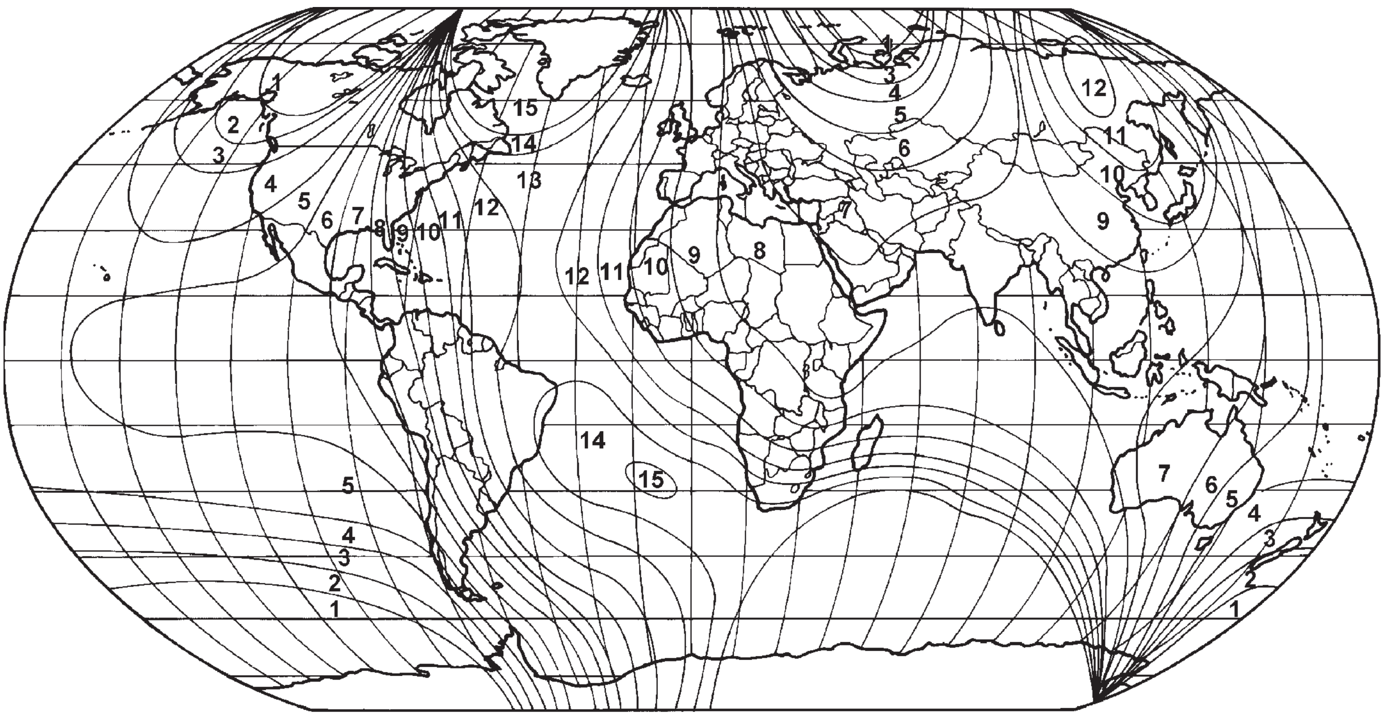

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Fig. 4 Variance Settings

(6) Disconnect the roof wire harness connectors from the Electronic Vehicle Information Center connector receptacle, the reading and courtesy lamp wire harness connector and, if the vehicle is so equipped, from the back of the power sunroof switch.

(7) Remove the overhead console from the headliner.

INSTALLATION

(1) Position the overhead console near the mounting location on the headliner.

(2) Reconnect the roof wire harness connectors to the Electronic Vehicle Information Center connector receptacle, the reading and courtesy lamp wire harness connector and, if the vehicle is so equipped, to the back of the power sunroof switch.

(3) Align the two snap clips on the rear of the overhead console housing with their receptacles in the overhead console retainer bracket.

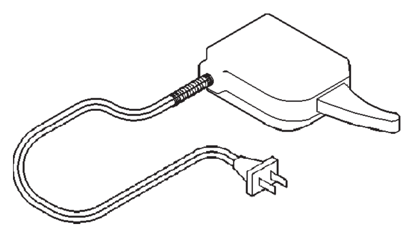
(4) Push upward firmly and evenly on the sides of the overhead console housing over both of the snap clip locations until each of the two snap clips is fully engaged with its receptacle in the overhead console retainer bracket.

(5) Install and tighten the screw that secures the front of the overhead console housing to the overhead console retainer bracket. Tighten the screw to 1.2 N·m (10 in. lbs.).

(6) Reconnect the battery negative cable.

SPECIAL TOOLS

OVERHEAD CONSOLE SYSTEMS



Degaussing Tool 6029

ELECTRONIC VEHICLE INFO CENTER

DESCRIPTION

The Electronic Vehicle Information Center (EVIC) is located in the overhead console on models equipped with this option. Three versions of the EVIC module are available on the Grand Cherokee. These three versions are identical except that some models include an integral three-push button Universal Transmitter transceiver and/or Tire Pressure Monitoring System (TPM). All three EVIC modules feature a large Vacuum Fluorescent Display (VFD) screen for displaying information, and back-lit push buttons function switches labeled C/T (compass/temperature), RESET, STEP, and MENU. The VFD screen can also display a vehicle graphic that is used

ELECTRONIC VEHICLE INFO CENTER (Continued)

for door and liftgate open indications and to show if a turn signal has been left on. The EVIC messages and displays are coordinated with warning indicators in the instrument cluster to avoid duplication.

The EVIC module contains a central processing unit and interfaces with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

The EVIC module includes the following display options:

- **Compass and Temperature** - provides the outside temperature and one of eight compass readings to indicate the direction the vehicle is facing.
- **Average fuel economy** - shows the average fuel economy since the last trip computer reset.
- **Distance to empty** - shows the estimated distance that can be travelled with the fuel remaining in the fuel tank. This estimated distance is computed using the average miles-per-gallon from the last 30 gallons of fuel used.
- **Instant fuel economy** - shows the present fuel economy based upon the current vehicle distance and fuel used information.
- **Trip distance** - shows the distance travelled since the last trip computer reset.
- **Elapsed time** - shows the accumulated ignition-on time since the last trip computer reset.
- **Distance to service** - shows the distance remaining until the next scheduled service interval.
- **Tire Pressure** - shows the tire pressure in each tire.
- **Blank screen** - the EVIC compass/temperature/trip computer VFD is turned off.

The EVIC is capable of displaying the following alert messages, which are accompanied by an audible announcement consisting of a series of beeps:

- **TURN SIGNALS ON (with vehicle graphic)** - Indicates that a turn signal has remained on for about 1.6 kilometers (one mile).
- **PERFORM SERVICE** - Indicates that a customer programmable service interval distance has been reached.
- **DOOR OPEN (one or more, with vehicle graphic)** - Indicates that a door is open or not fully closed.
- **LIFTGATE OPEN (with vehicle graphic)** - Indicates that the liftgate is open or not fully closed.
- **LIFTGLASS OPEN (with vehicle graphic)** - Indicates that the liftglass is open or not fully closed.
- **COOLANT LEVEL LOW (with vehicle graphic)** - Indicates that the coolant level in the engine coolant reservoir is low.
- **XX LOW PRESSURE (with vehicle graphic)** - Indicates that the air pressure in the selected tire is low.
- **WASHER FLUID LOW (with vehicle graphic)** - Indicates that the fluid level in the washer fluid reservoir is low.

The EVIC “Menu” push button provides the vehicle operator with a user interface, which allows the selection of several optional customer programmable electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of this group for more information on the customer programmable feature options.

If the vehicle is equipped with the optional memory system, the EVIC will display the following memory system messages:

- **MEMORY #X POSITION SET (X = Driver 1 or Driver 2)** - This message appears in the EVIC display each time the memory system is successfully programmed. It is accompanied by an audible announcement chime tone.
- **MEMORY SYSTEM DISABLED** - The memory system is automatically disabled while the driver side seat belt is fastened and/or while the automatic transmission gear selector is in any position except Park or Neutral. This message appears in the EVIC display as a reminder when a memory switch push button is depressed while the memory system is disabled. If the REMOTE LINKED TO MEMORY customer programmable feature has been selected, this message will also appear when the Unlock button of the Remote Keyless Entry (RKE) transmitter is depressed while the memory system is disabled.

If the vehicle is equipped with the optional Universal Transmitter transceiver, the EVIC will also display messages and an icon indicating when the Universal Transmitter is being trained, which of the three transmitter buttons is transmitting, and when the transceiver is cleared.

If the vehicle is equipped with the optional **Tire Pressure Monitoring System**, the EVIC will also display messages and an icon indicating when the tire air pressure falls below a given set-point, and which of the five tires is transmitting the low pressure warning, and when the condition is cleared. Refer to the Tires/Wheels section of this manual for complete Tire Pressure Monitoring System description. Refer to this section of the service manual for EVIC modules function description for the Tire Pressure Monitoring.

Data input for all EVIC functions, including VFD dimming level, is received through PCI data bus messages. The EVIC module uses its internal programming and all of its data inputs to calculate and display the requested data. If the data displayed is incorrect, perform the self-diagnostic tests as described in this group. If these tests prove inconclusive, the use of a DRBIII® scan tool and the proper Diagnostic Procedures manual are recommended for further testing of the EVIC module and the PCI data bus.

The EVIC module cannot be repaired, and is available for service only as a unit. This unit includes the push button switches and the plastic housed module. If any of these components are faulty or damaged, the complete EVIC module must be replaced. The incandescent bulbs used for EVIC push button backlighting and the display lens are available for service replacement.

ELECTRONIC VEHICLE INFORMATION CENTER CHIME

The Electronic Vehicle Information Center (EVIC) uses the chime warning system for two different kinds of support. In addition to requesting chime tones from the Body Control Module (BCM) as tactile beep support, the EVIC is programmed to send chime request messages over the Programmable Communications Interface (PCI) data bus when it detects the following conditions:

- **Door Open Warning** - A door is open above a critical speed [about 16 kilometers-per-hour (10 miles-per-hour) for the driver side front door, or about 5 kilometers-per-hour (3 miles-per-hour) for any other door].
- **Liftgate Open Warning** - The liftgate is open above a critical speed [about 5 kilometers-per-hour (3 miles-per-hour)].
- **Liftglass Open Warning** - The liftgate flip-up glass is open above a critical speed [about 5 kilometers-per-hour (3 miles-per-hour)].
- **Low Coolant Level Warning** - The coolant level in the engine coolant reservoir is low.
- **Perform Service Alert** - An audible alert that a “Perform Service” reminder message is being displayed by the EVIC.
- **Turn Signal On Warning** - A turn signal remains on for about 1.6 kilometers (one mile).
- **Washer Fluid Low Warning** - The fluid level in the washer reservoir is low.

See the owner’s manual in the vehicle glove box for more information on the features, use and operation of the EVIC. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION) for more information on the EVIC.

COMPASS

While in the compass/temperature mode, the compass will display the direction in which the vehicle is pointed using the eight major compass headings (Examples: north is N, northeast is NE). The self-calibrating compass unit requires no adjusting in normal use. The only calibration that may prove necessary is to drive the vehicle in one circle at 5 to 8 kilometers-per-hour (3 to 5 miles-per-hour), on level ground, in not less than 20 seconds. This will reorient the compass unit to its vehicle.

The compass unit also will compensate for magnetism the body of the vehicle may acquire during normal use. However, avoid placing anything magnetic directly on the roof of the vehicle. Magnetic mounts for an antenna, a repair order hat, or a funeral procession flag can exceed the compensating ability of the compass unit if placed on the roof panel. Magnetic bit drivers used on the fasteners that hold the overhead console assembly to the roof header can also affect compass operation. If the vehicle roof should become magnetized, the demagnetizing and calibration procedures found in this group may be required to restore proper compass operation.

TEMPERATURE

The outside ambient temperature is displayed in whole degrees. The temperature display can be toggled from Fahrenheit to Celsius by selecting the desired U.S./Metric option from the customer programmable features as described in **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Standard Procedures section of this group. The displayed temperature is not an instant reading of conditions, but an average temperature. It may take the temperature display several minutes to respond to a major temperature change, such as driving out of a heated garage into winter temperatures.

When the ignition switch is turned to the Off position, the last displayed temperature reading stays in the Body Control Module (BCM) unit memory. When the ignition switch is turned to the On position again, the EVIC will display the memory temperature for one minute; then update the display to the current average temperature reading within five minutes.

The temperature function is supported by an ambient temperature sensor. The sensor is mounted outside the passenger compartment near the front and center of the vehicle, and is hard wired to the Body Control Module (BCM). The BCM sends temperature status messages to the EVIC module over the PCI data bus network. The ambient temperature sensor is available as a separate service item.

OPERATION

The EVIC has access to both non-switched and ignition switched sources of battery current so that some of its features remain operational at any time, while others may only operate with the ignition switch in the On position. When the ignition switch is turned to the On position, the EVIC module VFD will return to the last function being displayed before the ignition was turned to the Off position.

The compass/temperature display is the normal EVIC display. With the ignition switch in the On position, momentarily depressing and releasing the C/T (compass/temperature) push button switch will cause the EVIC to return to the compass/temperature/trip computer display mode from any other mode. While in the compass/temperature/trip computer display mode, momentarily depressing and releasing the Step push button will step through the available trip computer display options.

The EVIC trip computer features several functions that can be reset. The functions that can be reset are: average fuel economy, trip odometer and elapsed time. With the ignition switch in the On position and with one of the functions of the trip computer that can be reset currently displayed, depressing the Reset push button twice within three seconds will perform a global reset, and all of the trip computer information that can be reset will be reset to zero. With the ignition switch in the On position and the function that is to be reset currently displayed, momentarily depressing and releasing the Reset push button once will perform a local reset, and only the value of the displayed function will be reset to zero. A global or local reset will only occur if the function currently displayed is a function that can be reset. The distance to service function can also be reset using the local reset method, but it will reset back to the Service Interval distance that is set in the EVIC programmable features mode. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of this group for more information on setting the Service Interval.

For more information on the features, control functions and setting procedures for the EVIC module, see the owner's manual in the vehicle glove box.

DIAGNOSIS AND TESTING - ELECTRONIC VEHICLE INFORMATION CENTER

If the problem with the Electronic Vehicle Information Center (EVIC) is a temperature reading of 130° F or -40°F shown in the compass/temperature display, refer to **Ambient Temperature Sensor Diagnosis and Testing** in this group. If the problem with the EVIC is an inaccurate or scrambled display, refer to **Self-Diagnostic Test** in this group. If the problem with the EVIC is incorrect Vacuum Fluorescent Display (VFD) dimming levels, use a DRB® scan tool and the proper Diagnostic Procedures manual to test for the correct dimming message inputs being received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. If the problem is a no-display condition, use the following procedures. For complete circuit diagrams, refer to **Overhead Console** in Wiring Diagrams.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fused B(+) fuse in the PDC as required.

(3) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the overhead console. Check for continuity between the ground circuit cavity of the roof wire harness connector for the EVIC module and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the roof wire harness connector for the EVIC module. If OK, go to Step 7. If not OK, repair the open fused B(+) circuit to the fused B(+) fuse in the junction block as required.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the roof wire harness connector for the EVIC module. If OK, refer to **Self-Diagnostic Test** below for further diagnosis of the EVIC module and the PCI data bus. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.

SELF-DIAGNOSTIC TEST

A self-diagnostic test is used to determine that the EVIC module is operating properly, and that all PCI

ELECTRONIC VEHICLE INFO CENTER (Continued)

data bus messages are being received for initial operation. Initiate the self-diagnostic test as follows:

(1) With the ignition switch in the Off position, simultaneously depress and hold the C/T button and the Reset button.

(2) Turn the ignition switch to the On position.

(3) Continue to hold both buttons depressed until the EVIC software version information is displayed, then release both buttons.

(4) Following completion of these tests, the EVIC module will display one of the following messages:

a. **Pass Self Test -** Momentarily depress and release the Reset button to return to the compass/temperature/trip computer display mode. The EVIC module is working properly.

b. **Failed Self Test -** The EVIC module has an internal failure. The EVIC module is faulty and must be replaced.

c. **Not Receiving J1850 Message -** The EVIC module is not receiving proper message input through the PCI data bus. This can result from one or more faulty electronic modules in the vehicle, or from a faulty PCI data bus. The use of a DRB scan tool and the proper Diagnostic Procedures manual are required for further diagnosis.

NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth's magnetic field strength, based on geographic location. Refer to Compass Variation Adjustment in the Standard Procedures section of this group.

NOTE: If the compass reading displays a blank, and only "CAL" appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. Refer to Compass Demagnetizing in the Standard Procedures section of this group.

STANDARD PROCEDURE - TIRE PRESSURE SYSTEM TEST

The following test can be used to verify two functions. One, that the tire pressure sensors are transmitting properly and two, the EVIC module is receiving these transmissions accordingly.

(1) Retrain the tire sensors (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING/SENSOR - STANDARD PROCEDURE). The tire sensors must be retrained in order to set the proper transmitting time cycle (twice a minute), failure to retrain the sensors will cause a much slower transmitting time cycle (once a hour).

(2) Using the STEP button on the overhead console, scroll to the blank display, then press the RESET button for five seconds, a beep will sound indicating the start of this test. The vehicle icon and transmission counters will now be displayed, (same display as individual tire pressure except counters replace tire pressure values).

(3) Upon entering the test mode, the EVIC will clear the sensor counter and each time a sensor signal for a road tire is received, the EVIC will update the counter value (vehicle must be driven at 25 mph to transmit). The counter values should all read the same value. If any of the road tires indicate a different value than another tire sensor, this is a sign of a problem. Replace the appropriate tire sensor and retest the system. This test will continue until any of the overhead console buttons are pressed or the ignition is turned off.

NOTE: Pressing the RESET button during the test will sound a beep and reset all the counter values back to zero.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).

(3) Remove the four screws that secure the Electronic Vehicle Information Center (EVIC) module to the overhead console housing (Fig. 5).

(4) Remove the EVIC module from the overhead console housing.

INSTALLATION

(1) Position the EVIC module onto the overhead console housing.

(2) Install and tighten the four screws that secure the EVIC module to the overhead console housing. Tighten the screws to 0.9 N·m (8 in. lbs.).

(3) Install the overhead console onto the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).

(4) Reconnect the battery negative cable.

NOTE: If a new EVIC module has been installed, the compass will have to be calibrated and the variance set. Refer to Compass Variation Adjustment and Compass Calibration in the Service Procedures section of this group for the procedures.

ELECTRONIC VEHICLE INFO CENTER (Continued)

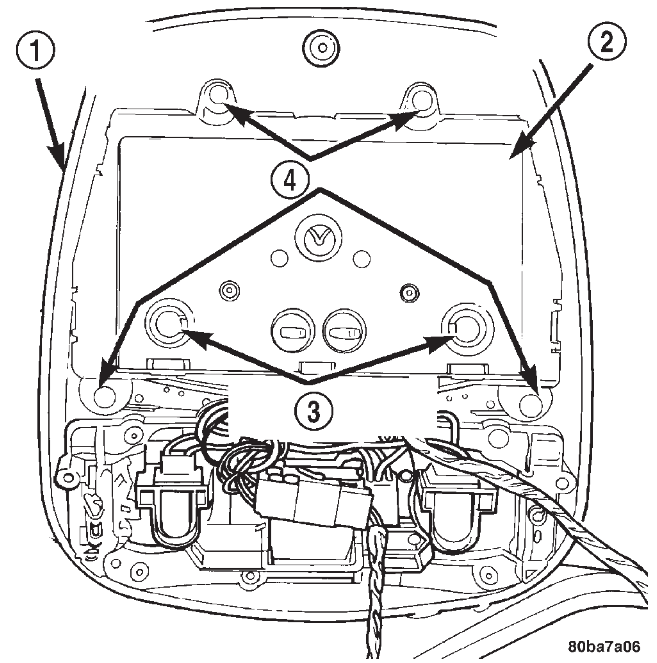


Fig. 5 Top of Overhead Console

1 - OVERHEAD CONSOLE HOUSING
2 - EVIC MODULE
3 - ILLUMINATION LAMPS
4 - SCREWS (4)

NOTE: If the vehicle is equipped with the Tire Pressure Monitoring (TPM) System, and the overhead console electronics module is removed or replaced, the TPM system will need to be retrained. Refer to the Tires/Wheels section of this manual for the procedure.

UNIVERSAL TRANSMITTER

DESCRIPTION

The Grand Cherokee Limited model has a Universal Garage Door Opener (UGDO) transceiver as standard factory-installed equipment. The UGDO is optional on Laredo models. The UGDO transceiver is integral to the Electronic Vehicle Information Center (EVIC), which is located in the overhead console. The only visible component of the UGDO are the three transmitter push buttons centered between the four EVIC push buttons located just rearward of the EVIC display screen in the overhead console. The three UGDO transmitter push buttons are identified with one, two or three dots so that they be easily identified by sight.

Each of the three UGDO transmitter push buttons controls an independent radio transmitter channel. Each of these three channels can be trained to transmit a different radio frequency signal for the remote operation of garage door openers, motorized gate openers, home or office lighting, security systems or just about any other device that can be equipped with a radio receiver in the 288 to 410 MegaHertz (MHz) frequency range for remote operation. The UGDO is capable of operating systems using either rolling code or non-rolling code technology.

The EVIC module displays messages and a small house-shaped icon with one, two or three dots corresponding to the three transmitter buttons to indicate the status of the UGDO. The EVIC messages are:

- **Cleared Channels -** Indicates that all of the transmitter codes stored in the UGDO have been successfully cleared.
- **Training -** Indicates that the UGDO is in its transmitter learning mode.
- **Trained -** Indicates that the UGDO has successfully acquired a new transmitter code.
- **Transmit -** Indicates that a trained UGDO transmitter button has been depressed and that the UGDO is transmitting.

The UGDO cannot be repaired, and is available for service only as a unit with the EVIC module. This unit includes the push button switches and the plastic module. If any of these components are faulty or damaged, the complete EVIC module must be replaced.

OPERATION

The universal transmitter operates on a non-switched source of battery current so the unit will remain functional, regardless of the ignition switch position. For more information on the features, programming procedures and operation of the universal transmitter, see the owner's manual in the vehicle glove box.

DIAGNOSIS AND TESTING - UNIVERSAL TRANSMITTER

If the Universal Transmitter is inoperative, but the Electronic Vehicle Information Center (EVIC) is operating normally, see the owner's manual in the vehicle glove box for instructions on training the Transmitter. Retrain the Transmitter with a known good transmitter as instructed in the owner's manual and test the Transmitter operation again. If the unit is still inoperative, replace the faulty Transmitter and EVIC module as a unit. If both the Transmitter and the EVIC module are inoperative, refer to **Electronic Vehicle Information Center Diagnosis and Testing** in this group for further diagnosis. For complete circuit diagrams, refer to **Wiring Diagrams**.

AMBIENT TEMP SENSOR

DESCRIPTION

Ambient air temperature is monitored by the Electronic Vehicle Information Center (EVIC) through ambient temperature messages received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus network. The BCM receives a hard wired input from the ambient temperature sensor. The ambient temperature sensor is a variable resistor mounted to a bracket that is secured with a screw to the right side of the headlamp mounting module grille opening, behind the radiator grille and in front of the engine compartment.

Refer to **Body Control Module** in Electronic Control Modules. For complete circuit diagrams, refer to the appropriate wiring information. The ambient temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The ambient temperature sensor is a variable resistor that operates on a five-volt reference signal sent to it by the BCM. The resistance in the sensor changes as temperature changes, changing the temperature sensor signal circuit voltage to the BCM. Based upon the resistance in the sensor, the BCM senses a specific voltage on the temperature sensor signal circuit, which it is programmed to correspond to a specific temperature. The BCM then sends the proper ambient temperature messages to the EVIC over the PCI data bus.

The temperature function is supported by the ambient temperature sensor, a wiring circuit, the Body Control Module (BCM), the Programmable Communications Interface (PCI) data bus, and a portion of the Electronic Vehicle Information Center (EVIC) module. If any portion of the ambient temperature sensor circuit fails, the BCM will self-diagnose the circuit. A temperature reading of 130° F will appear in the EVIC display in place of the temperature when the sensor circuit is shorted. A temperature reading of –40° F will appear in the EVIC display in place of the temperature when the sensor circuit is open.

The ambient temperature sensor circuit can also be diagnosed by referring to **Diagnosis and Testing - Ambient Temperature Sensor, and Diagnosis and Testing - Ambient Temperature Sensor Circuit**. If the temperature sensor and circuit are confirmed to be OK, but the temperature display is inoperative or incorrect, refer to **Diagnosis and Testing - Electronic Vehicle Information Center** in this group. For complete circuit diagrams, refer to the appropriate wiring information.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AMBIENT TEMPERATURE SENSOR

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector.

(2) Measure the resistance of the ambient temperature sensor. At –40° C (–40° F), the sensor resistance is 336.6 kilohms. At 60° C (140° F), the sensor resistance is 2.49 kilohms. The sensor resistance should read between these two values. If OK, refer to **Diagnosis and Testing - Ambient Temperature Sensor Circuit** in this group. If not OK, replace the faulty ambient temperature sensor.

DIAGNOSIS AND TESTING - AMBIENT TEMPERATURE SENSOR CIRCUIT

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the 2-way ambient temperature sensor wire harness connector and the 22-way Body Control Module (BCM) wire harness connector.

(2) Connect a jumper wire between the two terminals in the body half of the 2-way ambient temperature sensor wire harness connector.

(3) Check for continuity between the sensor return circuit and the ambient temperature sensor signal circuit cavities of the 22-way BCM wire harness connector. There should be continuity. If OK, go to Step 4. If not OK, repair the open sensor return circuit or ambient temperature sensor signal circuit to the ambient temperature sensor as required.

(4) Remove the jumper wire from the body half of the 2-way ambient temperature sensor wire harness connector. Check for continuity between the sensor return circuit cavity of the 22-way BCM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted sensor return circuit as required.

(5) Check for continuity between the ambient temperature sensor signal circuit cavity of the 22-way BCM wire harness connector and a good ground. There should be no continuity. If OK, refer to **Diagnosis and Testing - Electronic Vehicle Information Center** in this group. If not OK, repair the shorted ambient temperature sensor signal circuit as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

AMBIENT TEMP SENSOR (Continued)

(2) Locate the ambient temperature sensor, on the right side of the radiator opening in the headlamp mounting module, behind the grille (Fig. 6).

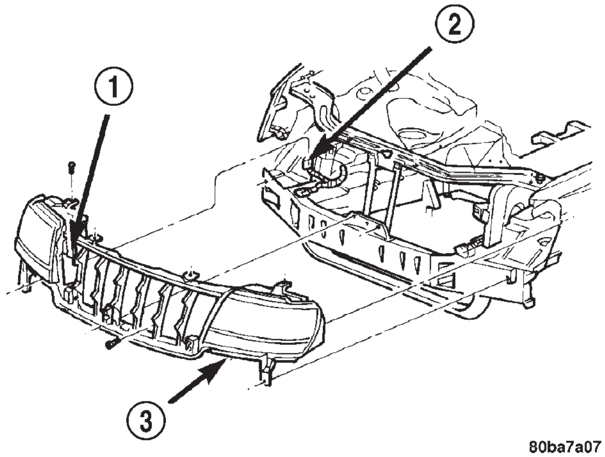


Fig. 6 AMBIENT TEMPERATURE SENSOR

1 - AMBIENT TEMPERATURE SENSOR
2 - WIRE HARNESS CONNECTOR
3 - HEADLAMP MOUNTING MODULE

(3) Remove the radiator grille fascia and insert from the headlamp mounting module. Refer to Body for the procedures.

(4) Disconnect the wire harness connector from the ambient temperature sensor connector receptacle.

(5) Remove the one screw that secures the ambient temperature sensor bracket to the headlamp mounting module.

(6) Remove the ambient temperature sensor from the headlamp mounting module.

INSTALLATION

(1) Position the ambient temperature sensor onto the headlamp mounting module.

(2) Install and tighten the one screw that secures the ambient temperature sensor bracket to the headlamp mounting module. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Reconnect the wire harness connector to the ambient temperature sensor connector receptacle.

(4) Install the radiator grille fascia and insert onto the headlamp mounting module. Refer to the Body section of this manual for the procedures.

(5) Reconnect the battery negative cable.

POWER SYSTEMS

TABLE OF CONTENTS

POWER LOCKS

TABLE OF CONTENTS

POWER LOCKS

DESCRIPTION

DESCRIPTION - POWER LOCK SYSTEM

A power operated door and liftgate lock system is standard factory-installed equipment on this model. The power lock system allows all of the doors and the liftgate to be locked or unlocked electrically by operating a switch on either front door trim panel. The power lock system receives non-switched battery feed through a fuse in the Power Distribution Center (PDC), so that the power locks remain operational, regardless of the ignition switch position.

The power lock system for this vehicle also has a door lock inhibit feature, which prevents the power lock system from being energized with a power door lock switch if a front door is open with the key in the ignition. However, the locks can still be operated manually, with a key, energized with the RKE transmitter or by sliding the door lock lever to the appropriate position.

POWER LOCKS (Continued)

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION). Customer programmable feature options affecting the power door lock system include:

- **Auto Door Locks** - Automatically locks all of the vehicle doors and the liftgate when the vehicle reaches a speed of about 24 kilometers-per-hour (15 miles-per-hour) with 10% throttle tip-in.
- **Auto Unlock on Exit** - Automatically unlocks all of the vehicle doors and the liftgate when the driver side front door is opened, if the vehicle is stopped and the transmission gear selector is in the Park or Neutral positions. This feature is linked to the Auto Door Locks feature, and will only occur one time following each Auto Door Lock event.

The power lock system for this vehicle can also be operated remotely using the standard equipment Remote Keyless Entry (RKE) system radio frequency transmitters. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION - REMOTE KEYLESS ENTRY SYSTEM).

The components of the power lock system include:

- **Driver Door Module (DDM)**
- **Passenger Door Module (PDM)**
- **PCI Bus Messages**
- **Power Lock Motors**

Certain functions and features of the power lock system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For proper diagnosis of these electronic modules or of the PCI data bus network, the use of a DRBIII® scan tool and the appropriate diagnostic information are required.

The other electronic modules that may affect power lock system operation are as follows:

- **Body Control Module (BCM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODULE - DESCRIPTION).
- **Electronic Vehicle Information Center (EVIC)** - (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION).
- **Powertrain Control Module (PCM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DESCRIPTION).

Hard wired circuitry connects the power lock system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the power lock system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

DESCRIPTION - REMOTE KEYLESS ENTRY SYSTEM

A Radio Frequency (RF) type Remote Keyless Entry (RKE) system is standard factory-installed equipment on this model. The RKE system allows the use of a remote battery-powered radio transmitter to control the power lock system. The RKE receiver operates on non-switched battery current through a fuse in the Power Distribution Center (PDC), so that the system remains operational, regardless of the ignition switch position.

In addition to Lock and Unlock buttons, the RKE transmitters are also equipped with a Panic button. If the Panic button on the RKE transmitter is depressed, the horn will sound and the exterior lights will flash on the vehicle for about three minutes, or until the Panic button is depressed a second time, if ignition is in the Off position. A vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) will also cancel the panic event.

The RKE system can also perform other functions on this vehicle. If the vehicle is equipped with the optional Vehicle Theft Security System (VTSS), the RKE transmitter will arm the VTSS when the Lock button is depressed, and disarm the VTSS when the Unlock button is depressed. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - DESCRIPTION - VEHICLE THEFT SECURITY SYSTEM). If the vehicle is equipped with the optional Memory System, each of the two numbered and color-coded RKE transmitters can be used to recall the stored driver side front seat position, both outside power rear view mirror positions, and the radio station presets for the two assigned drivers. (Refer to 8 - ELECTRICAL/POWER SEATS - DESCRIPTION - MEMORY SYSTEM).

POWER LOCKS (Continued)

The RKE system includes two transmitters when the vehicle is shipped from the factory, but the system can retain the vehicle access codes of up to four transmitters. The transmitter codes are retained in the RKE receiver memory, even if the battery is disconnected. If an RKE transmitter is faulty or lost, new transmitter vehicle access codes can be programmed into the system using a DRBIII® scan tool and the appropriate diagnostic information.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION). Customer programmable feature options affecting the RKE system include:

- **Remote Unlock** - Allows the option of having only the driver side front door unlock when the RKE transmitter Unlock button is depressed the first time and the remaining doors and the liftgate unlock when the button is depressed a second time, or having all doors and the liftgate unlock upon the first depression of the RKE transmitter Unlock button.
- **Remote Linked to Memory** - If the vehicle is equipped with the Memory System, this feature allows the option of having the RKE transmitter Unlock button activate the recall of the stored settings, or having the recall function assigned solely to the memory switch on the driver side front door trim panel.
- **Sound Horn on Lock** - Allows the option of having the horn sound a short chirp as an audible verification that the doors have locked, or having no audible verification.
- **Flash Lights with Lock** - Allows the option of having the lights flash as an optical verification that the doors have locked, or having no optical verification.

This group covers the following components of the RKE system:

- **RKE Receiver**
- **RKE Transmitter**

Certain functions and features of the RKE system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRBIII® scan tool and the appropriate diagnostic information are required.

The other electronic modules that may affect RKE system operation are as follows:

- **Body Control Module (BCM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODULE - DESCRIPTION).
- **Driver Door Module (DDM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DESCRIPTION).
- **Electronic Vehicle Information Center (EVIC)** - (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DESCRIPTION).
- **Passenger Door Module (PDM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DESCRIPTION).
- **Powertrain Control Module (PCM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DESCRIPTION).

Hard wired circuitry connects the RKE system components via the PDM to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the RKE system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

COMBINATION FLASHER

The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher can be energized by the BCM to flash all of the park/turn signal/front side marker lamps as an optical alert for the RKE panic function and, if the Flash Lights with Lock programmable feature is enabled, as an optical verification for the RKE lock event. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/COMBINATION FLASHER - DESCRIPTION).

HORN RELAY

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch grounds the relay coil. The horn relay is located in the Power Distribution Center (PDC) in

POWER LOCKS (Continued)

the engine compartment. This relay can be energized by the BCM to sound the horns as an audible alert for the RKE panic function and, if the Sound Horn on Lock programmable feature is enabled, as an audible verification for the RKE lock event. (Refer to 8 - ELECTRICAL/HORN/HORN RELAY - DESCRIPTION).

LOW BEAM HEADLAMP RELAY

The low beam headlamp relay is a electromechanical device that switches battery current to the headlamp low beams when the BCM grounds the relay coil. The low beam headlamp relay is located in the junction block in the passenger compartment. This relay can be energized by the BCM to flash the headlamp low beams as an optical alert for the RKE panic function. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP - DESCRIPTION).

DESCRIPTION - LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM

A power operated liftgate flip-up glass release system is standard factory installed equipment on this model. The liftgate flip-up glass power release system allows the flip-up glass latch to be released electrically by depressing a switch located on the bottom of the liftgate license plate lamp housing unit, above the license plate on the outside of the liftgate.

The liftgate flip-up glass release system operates on non-switched battery current supplied through a fuse in the junction block so that the system remains functional, regardless of the ignition switch position. However, a limit switch that is integral to the liftgate latch actuator unit opens to prevent the flip-up glass latch from being actuated when the liftgate latch is locked.

The liftgate flip-up glass power release system includes the following components:

- **Liftgate Flip-Up Glass Limit Switch** - The liftgate flip-up glass limit switch is integral to the liftgate latch unit. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/LATCH - REMOVAL) and (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/LATCH - INSTALLATION).
- **Liftgate Flip-Up Glass Release Motor** - The liftgate flip-up glass release motor is integral to the liftgate flip-up glass latch unit. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/FLIP-UP GLASS LATCH - REMOVAL) and (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/FLIP-UP GLASS LATCH - INSTALLATION).
- **Liftgate Flip-Up Glass Release Switch** - The liftgate flip-up glass release switch is integral to the liftgate license plate lamp housing. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/FLIP-UP GLASS SWITCH - REMOVAL) and (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/FLIP-UP GLASS SWITCH - INSTALLATION).

Hard wired circuitry connects the liftgate flip-up glass power release system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the liftgate flip-up glass power release system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

OPERATION - POWER LOCK SYSTEM

The Passenger Door Module (PDM) contains the power door lock control logic and a power lock switch. The Driver Door Module (DDM) contains a power lock switch and controls the output to the driver side front door power lock motor, while the PDM controls the output to the power lock motors for the remaining doors and the liftgate.

When the power lock switch on the DDM is used to lock or unlock the doors, the DDM sends a control output to the driver side front door power lock motor and sends lock or unlock request messages to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to the power lock motors of the remaining doors and the liftgate. When the power lock switch on the PDM is used to lock or unlock the doors, the PDM sends control outputs to the power lock motors in the passenger side front door, both rear doors and the liftgate, then sends lock or unlock request messages to the DDM over the Programmable Communications Interface (PCI) data bus. The DDM responds to these messages by sending control outputs to the power lock motor of the driver side front door.

In order to support the auto door locks and unlock on exit features, if enabled, the power lock system logic in the PDM needs to know the door ajar switch status, vehicle speed, and transmission gear selector lever position. The passenger side front door ajar switch is the only hard wired input to the PDM. The PDM obtains the remaining information from messages it receives from other electronic modules over the PCI data bus network.

POWER LOCKS (Continued)

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power lock system.

OPERATION - REMOTE KEYLESS ENTRY SYSTEM

The Passenger Door Module (PDM) contains the RKE system control logic and the RKE receiver. When the RKE receiver recognizes a Lock, Unlock or Panic message from a valid RKE transmitter, the RKE receiver provides that input to the PDM. The PDM circuitry and programming responds by sending the proper messages to the other electronic modules over the Programmable Communications Interface (PCI) data bus.

When an RKE lock message is received, the doors and the liftgate lock, the interior lighting fades to off, the horn chirps (if this feature is enabled), the exterior lamps flash (if this feature is enabled) and, if the vehicle is so equipped, the Vehicle Theft Security System (VTSS) is armed. When an RKE unlock message is received, the driver side front door (or all doors and the liftgate if this feature is enabled) unlock, the interior lighting is turned on and, if the vehicle is so equipped, the VTSS is disarmed. If the vehicle is equipped with the Memory System and the RKE Linked to Memory feature is enabled, the RKE unlock message also recalls the driver seat, outside mirror and radio settings assigned to the RKE transmitter that sent the unlock signal.

When an RKE panic message is received, it causes the exterior lamps (including the headlights) to flash, and the horn to pulse for about three minutes, or until a second panic message is received. A vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) will also cancel the panic event.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the RKE system.

OPERATION - LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM

When the liftgate mounted flip-up glass release switch is depressed, battery current is directed to the electric release motor that is integral to the flip-up glass latch located inside the liftgate. When the release motor is energized the latch releases and the flip-up glass can be opened. A liftgate flip-up glass limit switch is integral to the liftgate latch actuator mechanism. The limit switch automatically enables or disables the liftgate flip-up glass power release circuitry, depending upon the position of the liftgate latch lock mechanism. When the liftgate latch is unlocked, the limit switch closes and battery current is available at the release switch. When the liftgate latch is locked , the limit switch opens, and the release switch is disabled.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the liftgate flip-up glass power release system.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - POWER LOCK SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power lock system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power lock system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power lock system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a DRBIII® scan tool and the proper Diagnostic Procedures manual. The DRBIII® scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the power lock motors are being sent the proper hard wired outputs by the door modules for them to perform their power lock system functions.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

PRELIMINARY DIAGNOSIS

As a preliminary diagnosis for the power lock system, note the system operation while you actuate both the Lock and Unlock functions with the power lock switches and with the Remote Keyless Entry (RKE) transmitter. Then, proceed as follows:

- If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fused B(+) fuse in the Power Distribution Center. If the fuse is OK, proceed to diagnosis of the door modules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DIAGNOSIS AND TESTING).
- If the power lock system functions with both power lock switches, but not with the RKE transmitter, proceed to diagnosis of the Remote Keyless Entry (RKE) system. (Refer to 8 - ELECTRICAL/POWER LOCKS - DIAGNOSIS AND TESTING - REMOTE KEYLESS ENTRY SYSTEM).

POWER LOCKS (Continued)

• If the power lock system functions with the RKE transmitter, but not with one or both power lock switches, proceed to diagnosis of the door modules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DIAGNOSIS AND TESTING).

• If the driver side power lock switch operates only the driver side front door power lock motor, but all other power lock motors operate with the passenger side power lock switch or the RKE transmitter, use a DRBIII® scan tool and the appropriate diagnostic information to diagnose the Programmable Communications Interface (PCI) data bus.

• If only one power lock motor fails to operate with both power lock switches and the RKE transmitter, proceed to diagnosis of the power lock motor. (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK MOTOR - DIAGNOSIS AND TESTING).

DIAGNOSIS AND TESTING - REMOTE KEYLESS ENTRY SYSTEM

Following are tests that will help to diagnose the Remote Keyless Entry (RKE) system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the RKE system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the RKE system components must be checked.

The most reliable, efficient, and accurate means to diagnose the RKE system requires the use of a DRBIII® scan tool and the appropriate diagnostic information. The DRBIII® scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the RKE receiver is being sent the proper radio frequency signals by the RKE transmitters to perform its RKE system functions.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

PRELIMINARY DIAGNOSIS

As a preliminary diagnosis for the RKE system, note the system operation while you perform both the Lock and Unlock functions with the power lock switches and with the Remote Keyless Entry (RKE) transmitter. Then, proceed as follows:

• If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fused B(+) fuse in the Power Distribution Center. If the fuse is OK, proceed to the diagnosis for the door modules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DIAGNOSIS AND TESTING).

• If the power lock system functions with both power lock switches, but not with the RKE transmitter, proceed to the diagnosis for the RKE transmitter. (Refer to 8 - ELECTRICAL/POWER LOCKS/REMOTE KEYLESS ENTRY TRANSMITTER - DIAGNOSIS AND TESTING).

• If the driver side power lock switch operates only the driver side front door power lock motor, but all other power lock motors operate with the passenger side power lock switch or the RKE transmitter, use a DRBIII® scan tool and the appropriate diagnostic information to diagnose the Programmable Communications Interface (PCI) data bus.

If the problem being diagnosed involves only the Sound Horn on Lock or the Flash Lights with Locks features, be certain that these programmable features are enabled. If the features are enabled and the service horn and turn signals still operate, the Body Control Module (BCM) and the PCI data bus must be tested. For diagnosis of the BCM or the PCI data bus, the use of a DRBIII scan tool and the appropriate diagnostic information are required.

DIAGNOSIS AND TESTING - LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Check the fused B(+) fuse in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the JB. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) as required.

(3) Disconnect the liftgate wire harness connector for the liftgate lock motor and flip-up glass limit switch from the motor and switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the liftgate wire harness connector for the liftgate lock motor and flip-up glass limit switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit between the liftgate lock motor and flip-up glass limit switch and the JB as required.

(4) Check for continuity between the two liftgate flip-up glass limit switch terminals. There should be continuity with the liftgate latch unlocked, and no continuity with the latch locked. If OK, go to Step 5.

POWER LOCKS (Continued)

If not OK, replace the faulty liftgate latch actuator (brainplate) unit.

(5) Disconnect the liftgate wire harness connector for the liftgate flip-up glass release switch from the switch connector receptacle. With the liftgate latch unlocked, check for battery voltage at the liftgate flip-up glass limit switch output circuit cavity of the liftgate wire harness connector for the release switch. If OK, go to Step 6. If not OK, repair the open liftgate flip-up glass limit switch output circuit between the release switch and the limit switch as required.

(6) Check for continuity between the two terminals of the liftgate flip-up glass release switch. There should be no continuity. Depress the switch, there should now be continuity. If OK, go to Step 7. If not OK, replace the faulty liftgate flip-up glass release switch.

(7) Disconnect the liftgate wire harness connector for the liftgate flip-up glass latch motor from the motor connector receptacle. Check for continuity between the ground circuit cavity of the liftgate wire harness connector for the latch motor and a good ground. There should be continuity. If OK, go to Step 8. If not OK, repair the open ground circuit to ground as required.

(8) With the liftgate latch unlocked and the flip-up glass release switch depressed, check for battery voltage at the liftgate flip-up glass release switch output circuit cavity of the liftgate wire harness connector for the latch motor. If OK, replace the faulty liftgate flip-up glass latch unit. If not OK, repair the open liftgate flip-up glass release switch output circuit between the latch motor and the release switch as required.

DOOR CYLINDER LOCK SWITCH

DESCRIPTION

The driver cylinder lock switch is integral to the key lock cylinder inside the driver side front door. The driver cylinder lock switch is a resistive multiplexed switch that is hard wired between a body ground and the Driver Door Module (DDM) through the front door wire harness. It maintains a path to ground, and changes voltages through an internal resistor when the lock cylinder is rotated to the lock or unlock position.

The driver cylinder lock switch cannot be adjusted or repaired and, if faulty or damaged, the driver side front door lock cylinder unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/LOCK CYLINDER - REMOVAL) and (Refer to 23 - BODY/DOOR - FRONT/LOCK CYLINDER - INSTALLATION). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The driver cylinder lock switch is actuated by the key lock cylinder when the key is inserted in the lock cylinder and turned to the unlock position. The driver cylinder lock switch maintains a path to ground and changes voltages through an internal resistor for the DDM when the driver door key lock cylinder is in the lock or unlock position. The DDM reads the switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The driver cylinder lock switch unlock status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation and interior lighting.

POWER LOCK MOTOR

DESCRIPTION

Power operated front door, rear door, and liftgate locking mechanisms are standard equipment on this model. The lock mechanisms are actuated by a reversible electric motor mounted within each door and the liftgate. The power lock motors for the doors are integral to the door latch units. The liftgate power lock motor is a separate unit secured to the latch brainplate near the center of the liftgate and operates the liftgate latch lock mechanism through a connecting linkage rod.

The power lock motors for the four doors cannot be adjusted or repaired and, if faulty or damaged, the entire door latch unit must be replaced. The liftgate power lock motor cannot be adjusted or repaired and, if faulty or damaged, the entire liftgate latch actuator (brainplate) unit must be replaced.

OPERATION

The driver side front door power lock motor is controlled by the Driver Door Module (DDM). The remaining power door lock motors and the liftgate power lock motor are controlled by the Passenger Door Module (PDM). A positive and negative battery connection to the two motor terminals will cause the power lock motor plunger to move in one direction. Reversing the current through these same two connections will cause the power lock motor plunger to move in the opposite direction.

POWER LOCK MOTOR (Continued)

DIAGNOSIS AND TESTING - POWER LOCK MOTOR

Remember, the Driver Door Module (DDM) circuitry controls the output to the driver side front door power lock motor. The Passenger Door Module (PDM) circuitry controls the output to the power lock motors for the remaining doors and the liftgate. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Check each power lock motor for correct operation while moving the power lock switch to both the Lock and Unlock positions. If all of the power lock motors are inoperative, go to Step 2. If one power lock motor is inoperative, go to Step 3.

(2) If all of the power lock motors except the driver side front door are inoperative, the problem may be caused by one shorted motor. Disconnecting a shorted power lock motor from the power lock circuit will allow the good power lock motors to operate. Disconnect the wire harness connector from each PDM-controlled power lock motor, one at a time, and recheck both the lock and unlock functions by operating the power lock switch. If all of the PDM-controlled power lock motors are still inoperative after the above test, check for a short or open circuit between the power lock motors and the PDM. If disconnecting one power lock motor causes the other motors to become functional, go to Step 3 to test the power lock motor that was last disconnected.

(3) Once it is determined which power lock motor is inoperative, that motor can be tested as follows. Disconnect the door or liftgate wire harness connector from the inoperative power lock motor. Apply 12 volts to the lock and unlock driver circuit cavities of the power lock motor connector to check its operation in one direction. Reverse the polarity to check the motor operation in the opposite direction. If OK, repair the shorted or open circuits between the lock motor and the DDM or PDM as required. If not OK, replace the faulty power lock motor.

POWER LOCK SWITCH

DESCRIPTION

The power lock motors are controlled by a two-way momentary switch mounted on the trim panel of each front door. Each power lock switch is illuminated by a Light-Emitting Diode (LED) that is integral to the switch paddle.

The driver side front door power lock switch is integral to the Driver Door Module (DDM), and the passenger side front door power lock switch is integral to the Passenger Door Module (PDM). The power lock switches and their lamps cannot be adjusted or repaired and, if faulty or damaged, the entire DDM or PDM unit must be replaced. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DESCRIPTION).

OPERATION

The front door power lock switches provide a lock and unlock signal to the door module circuitry. The Driver Door Module (DDM) circuitry controls the output to the driver side front door power lock motor, while the Passenger Door Module (PDM) circuitry controls the output to the passenger side front door, both rear door and the liftgate power lock motors.

When the DDM-integrated power lock switch is actuated, the DDM circuitry sends control outputs to the driver side front door power lock motor and sends a message to the PDM over the Programmable Communications Interface (PCI) data bus to control the output to the passenger side front door, both rear door and the liftgate power lock motors. When the PDM-integrated power lock switch is actuated, the PDM circuitry sends control outputs to the passenger side front door, both rear door and the liftgate power lock motors and sends a message to the DDM over the Programmable Communications Interface (PCI) data bus to control the output to the driver side front door power lock motor.

Each power lock switch is illuminated by a Light-Emitting Diode (LED) when the ignition switch is turned to the On position. See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power lock switches.

REMOTE KEYLESS ENTRY MODULE

DESCRIPTION

The Remote Keyless Entry (RKE) receiver is a radio frequency unit contained within the Passenger Door Module (PDM). The PDM also contains the program logic circuitry for the RKE system. The PDM is secured with screws to the back of the trim panel inside the passenger side front door. The RKE receiver has a memory function to retain the vehicle access codes of up to four RKE transmitters. The receiver is designed to retain the transmitter codes in memory, even if the battery is disconnected.

For diagnosis of the RKE receiver, the PDM, or the Programmable Communications Interface (PCI) data bus a DRBIII® scan tool and the appropriate diagnostic information are required. The RKE receiver is only serviced as a unit with the PDM and, if faulty or damaged, the entire PDM unit must be replaced. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DESCRIPTION).

OPERATION

The RKE receiver is energized by one of three messages from the RKE transmitter: Unlock, Lock, or Panic. The PDM circuitry responds to these messages to lock or unlock the power lock motors that it controls. The PDM circuitry also sends Lock, Unlock, and Panic messages to other electronic modules over the Programmable Communications Interface (PCI) data bus. These messages will result in the Driver Door Module (DDM) locking or unlocking the driver side front door, and the other electronic modules in the vehicle responding as their programming dictates.

REMOTE KEYLESS ENTRY TRANSMITTER

DESCRIPTION

The Remote Keyless Entry (RKE) system Radio Frequency (RF) transmitter is equipped with three buttons, labeled Lock, Unlock, and Panic. It is also equipped with a key ring and is designed to serve as a key fob. The operating range of the transmitter radio signal is up to 10 meters (30 feet) from the RKE receiver.

Each RKE transmitter has a different vehicle access code, which must be programmed into the memory of the RKE receiver in the vehicle in order to operate the RKE system. Two transmitters are provided with the vehicle, but the RKE receiver can retain the access codes of up to four transmitters in its memory. (Refer to 8 - ELECTRICAL/POWER LOCKS/REMOTE KEYLESS ENTRY TRANSMITTER - STANDARD PROCEDURE - RKE TRANSMITTER PROGRAMMING).

In addition, the RKE transmitters for vehicles equipped with the optional Memory System are color-coded and have a number “1” or “2” molded into the transmitter case to coincide with the “Driver 1 (Black)” and “Driver 2 (Gray)” buttons of the memory switch on the driver side front door trim panel. These transmitters must also have their access codes programmed into the RKE receiver so that they coincide with the “Driver 1” and “Driver 2” buttons of the memory switch. (Refer to 8 - ELECTRICAL/POWER SEATS - DESCRIPTION - MEMORY SYSTEM).

The RKE transmitter operates on two Panasonic CR2016 (or equivalent) batteries. Typical battery life is from one to two years. The RKE transmitter cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

See the owner’s manual in the vehicle glove box for more information on the features, use and operation of the Remote Keyless Entry (RKE) transmitters.

DIAGNOSIS AND TESTING - REMOTE KEYLESS ENTRY TRANSMITTER

(1) Replace the Remote Keyless Entry (RKE) transmitter batteries. (Refer to 8 - ELECTRICAL/POWER LOCKS/REMOTE KEYLESS ENTRY TRANSMITTER - STANDARD PROCEDURE - RKE TRANSMITTER BATTERIES). Test each of the RKE transmitter functions. If OK, discard the faulty batteries. If not OK, go to Step 2.

(2) Program the suspect RKE transmitter and another known good transmitter into the RKE receiver. Use a DRBIII® scan tool, as described in the appropriate diagnostic information. (Refer to 8 - ELECTRICAL/POWER LOCKS/REMOTE KEYLESS ENTRY TRANSMITTER - STANDARD PROCEDURE - RKE TRANSMITTER PROGRAMMING).

(3) Test the RKE system operation with both transmitters. If both transmitters fail to operate the power lock system, use a DRBIII® scan tool and the appropriate diagnostic information for further diagnosis of the RKE system. If the known good RKE transmitter operates the power locks and the suspect transmitter does not, replace the faulty RKE transmitter.

NOTE: Be certain to perform the RKE Transmitter Programming procedure again following this test. This procedure will erase the access code of the test transmitter from the RKE receiver.

REMOTE KEYLESS ENTRY TRANSMITTER (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - RKE TRANSMITTER PROGRAMMING

To program the Remote Keyless Entry (RKE) transmitter access codes into the RKE receiver in the Passenger Door Module (PDM) requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

STANDARD PROCEDURE - RKE TRANSMITTER BATTERIES

The Remote Keyless Entry (RKE) transmitter case snaps open and shut for battery access. To replace the RKE transmitter batteries:

(1) Using a trim stick or a thin coin, gently pry at the notch in the center seam of the RKE transmitter case halves near the key ring until the two halves unsnap.

(2) Lift the back half of the transmitter case off of the RKE transmitter.

(3) Remove the two batteries from the RKE transmitter.

(4) Replace the two batteries with new Panasonic CR2016, or their equivalent. Be certain that the batteries are installed with their polarity correctly oriented.

(5) Align the two RKE transmitter case halves with each other, and squeeze them firmly and evenly together until they snap back into place.

NOTE: The RKE system for this model uses a rolling code security strategy. This strategy requires that synchronization be maintained between the RKE transmitter and the RKE receiver. RKE transmitter battery removal or replacement can cause a loss of synchronization. If the RKE receiver fails to respond to the RKE transmitter following battery removal or replacement, depress and release the RKE transmitter Unlock button repeatedly while listening carefully for the power door locks in the vehicle to cycle. After between five and eight presses of the Unlock button, the power door locks should cycle, indicating that re-synchronization has occurred.

POWER MIRRORS

TABLE OF CONTENTS

POWER MIRRORS

DESCRIPTION

Driver and passenger side power operated outside rear view mirrors are standard factory-installed equipment on this model. The power mirror system allows the driver to adjust both outside mirrors electrically from the driver seat position by operating a switch on the driver side front door trim panel. The power mirror system receives non-switched battery current through a fuse in the Power Distribution Center (PDC) so that the power mirrors remain operational, regardless of the ignition switch position.

The standard equipment power operated outside rear view mirrors are also equipped with the heated mirror system, which will only operate when the ignition switch is in the On position and the rear window defogger switch is turned on. When the rear window defogger switch is in the On position, electric heater grids on the rear window glass and behind both outside rear view mirror glasses are energized. These electric heater grids produce heat to help clear the rear window glass and outside rear view mirrors of ice, snow, or fog. (Refer to 8 - ELECTRICAL/HEATED MIRRORS - DESCRIPTION) for more information on this feature.

A driver side automatic dimming outside mirror that dims the mirror to reduce the glare of bright lights approaching the vehicle from behind, and a memory system that automatically positions the power mirrors for two different drivers are optional factory-installed equipment on this model. (Refer to 8 - ELECTRICAL/POWER MIRRORS/AUTOMATIC DAY / NIGHT MIRROR - DESCRIPTION) for more information. (Refer to 8 - ELECTRICAL/POWER SEATS - DESCRIPTION) for more information.

This group covers the following components of the power mirror system:

- Power mirrors
- Power mirror switch.

Certain functions and features of the power mirror system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect power mirror system operation are as follows:

- **Body Control Module (BCM)** (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODUL - DESCRIPTION) for more information.
- **Driver Door Module (DDM)** (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MOD-

POWER MIRRORS (Continued)

ULES/DRIVER DOOR MODULE - DESCRIPTION) for more information.

• **Passenger Door Module (PDM)**(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - DESCRIPTION) for more information.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

OPERATION

The Driver Door Module (DDM) and the Passenger Door Module (PDM) each contain the power mirror control logic for the mirror on its respective door. The DDM also houses the power mirror switch. Each door module controls the positioning of its respective outside mirror through hard wired outputs to that mirror. When the power mirror switch on the DDM is used to position the passenger side outside mirror, the DDM sends mirror positioning messages to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to move the passenger side mirror accordingly.

Both the PDM and DDM respond to the defogger switch status messages sent by the Body Control Module (BCM) over the PCI data bus to control the electric heater grids of their respective mirrors. (Refer to 8 - ELECTRICAL/HEATED MIRRORS - DESCRIPTION) for more information on this feature.

On models equipped with the optional memory system, each door module also receives a hard wired input from the two power mirror motor position potentiometers that are integral to each power mirror. Each door module then stores the Driver 1 and Driver 2 mirror position information for its respective mirror. When the DDM receives a Driver 1 or Driver 2 memory recall message from the memory switch on the driver side front door trim panel or from the Remote Keyless Entry (RKE) receiver in the PDM, the DDM positions the driver side mirror and sends a memory recall message back to the PDM over the PCI data bus to position the passenger side mirror.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power mirror system.

DIAGNOSIS AND TESTING - POWER MIRRORS

Following are tests that will help to diagnose the hard wired components and circuits of the power mirror system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power mirror system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power mirror system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power mirror system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, that the power mirror motors are being sent the proper hard wired outputs, and that the mirror position potentiometers are returning the proper outputs to the door modules for them to perform their power mirror system functions.

AUTOMATIC DAY/NIGHT MIRROR

DESCRIPTION

DESCRIPTION - REAR VIEW MIRROR

An automatic day/night mirror system is an available factory-installed option on this model. The automatic dimming inside day/night rear view mirror system is a completely self-contained unit that replaces the standard equipment inside rear view mirror. This system will automatically change the reflectance of the inside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The automatic day/night inside mirror receives ignition switched battery current through a fuse in the junction block, and will only operate when the ignition switch is in the On position.

Vehicles equipped with the automatic day/night mirror system are also available with an optional factory-installed automatic dimming outside rear view mirror for the driver side of the vehicle. (Refer to 8 - ELECTRICAL/POWER MIRRORS/SIDEVIEW MIRROR - DESCRIPTION) for more information on this option.

The automatic day/night mirror sensitivity cannot be repaired or adjusted. If any component of this unit is faulty or damaged, the entire automatic day/night inside rear view mirror unit must be replaced. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

AUTOMATIC DAY/NIGHT MIRROR (Continued)

DESCRIPTION - OUTSIDE REAR VIEW MIRROR

An automatic dimming outside rear view mirror is an available factory-installed option for the driver side of the vehicle, if the vehicle is also equipped with the automatic day/night inside rear view mirror. The automatic dimming outside mirror is completely controlled by the circuitry of the automatic day/night inside rear view mirror. The automatic dimming outside mirror will automatically change the reflectance of the driver side outside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The automatic dimming outside mirror will only operate when the ignition switch is in the On position.

The automatic dimming outside mirror sensitivity cannot be repaired or adjusted. If any component of this unit is faulty or damaged, the entire automatic dimming outside mirror unit must be replaced. (Refer to 8 - ELECTRICAL/POWER MIRRORS/SIDEVIEW MIRROR - DIAGNOSIS AND TESTING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

OPERATION

OPERATION - REAR VIEW MIRROR

The automatic day/night mirror switch allows the driver a manual control of whether the automatic dimming feature is operational. This switch is a momentary rocker-type switch located on the lower rear-facing surface of the mirror housing. When Auto is selected, a Light-Emitting Diode (LED) on the mirror housing just to the right of the switch illuminates to indicate that automatic day/night mirror is turned on. When Off is selected, the LED is turned off. The mirror also senses the backup lamp circuit, and will automatically disable its self-dimming feature whenever the transmission gear selector is in the Reverse position.

A thin layer of electrochromatic material between two pieces of conductive glass make up the face of the mirror. Two photocell sensors are used to monitor light levels and adjust the reflectance of the mirror. The ambient photocell sensor faces forward, to detect the outside light levels. The headlamp sensor is located on the mirror housing just to the left of the switch and facing rearward, to detect the light level received at the rear window side of the mirror. When the difference between the two light levels becomes too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), the mirror begins to darken.

On models with an optional driver side automatic dimming outside mirror, the signal to control the dimming of that mirror is generated by the automatic day/night inside rear view mirror circuitry. That signal is then delivered to the driver side outside rear view mirror on a hard wired circuit.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the automatic day/night mirror system.

OPERATION - OUTSIDE REAR VIEW MIRROR

The automatic dimming outside mirror is operated by the same controls and circuitry as the automatic day/night mirror. When the automatic day/night mirror is turned on or off, the automatic dimming outside mirror is likewise turned on or off. Like in the automatic day/night mirror, a thin layer of electrochromatic material between two pieces of conductive glass make up the face of the automatic dimming outside mirror. However, the signal to control the dimming of the outside mirror is generated by the automatic day/night inside rear view mirror circuitry.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the automatic dimming outside mirror.

DIAGNOSIS AND TESTING - AUTOMATIC DAY / NIGHT MIRROR

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Disconnect the overhead wire harness connector from the automatic day/night mirror connector receptacle. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the overhead wire harness connector for the automatic day/night mirror. If OK, go to Step 4. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.

AUTOMATIC DAY/NIGHT MIRROR (Continued)

(4) Turn the ignition switch to the Off position. Check for continuity between the ground circuit cavity of the overhead wire harness connector for the automatic day/night mirror and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Turn the ignition switch to the On position. Set the parking brake. Place the transmission gear selector lever in the Reverse position. Check for battery voltage at the backup lamp switch output circuit cavity of the overhead wire harness connector for the automatic day/night mirror. If OK, reconnect the overhead wire harness connector to the automatic day/night mirror connector receptacle and go to Step 6. If not OK, repair the open backup lamp switch output circuit as required.

(6) Place the transmission gear selector lever in the Neutral position. Place the automatic day/night mirror switch in the Auto (LED next to the switch is lighted) position (Fig. 1). Cover the forward facing ambient photocell sensor to keep out any ambient light.

NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.

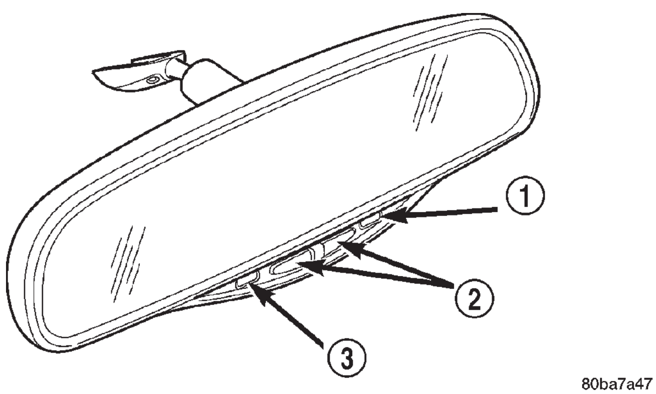


Fig. 1 Automatic Day/Night Mirror

1 - LED INDICATOR
2 - SWITCH
3 - HEADLAMP SENSOR

(7) Shine a light into the rearward facing headlamp photocell sensor. The automatic day/night mirror should darken. If OK, go to Step 8. If not OK, replace the faulty automatic day/night mirror unit.

(8) With the mirror darkened, place the transmission gear selector lever in the Reverse position. The automatic day/night mirror should return to its normal reflectance. If not OK, replace the faulty automatic day/night mirror unit.

POWER FOLD-AWAY MIRROR - EXPORT

DESCRIPTION

Some vehicles are equipped with Power Fold-Away Side View Mirrors. This feature allows both the driver and passenger side view mirrors to fold inward (retract) on demand. This feature is controlled by an additional switch located on the power mirror switch.

The fold-away side view mirror is attached to the vehicle's door in the same manner as mirrors without the fold-away option. The fold-away mirrors unique option is the internal motor which allows the mirrors to fold inward on demand. the fold-away mirror motor is not serviceable separately, and if a motor is found to be faulty the entire side view mirror must be replaced.

OPERATION

When the mirror retract switch is depressed, both of the side view mirrors will fold inward, thus making the overall width of the vehicle the smallest possible. This can be very helpful where parking space is an absolute minimum.

DIAGNOSIS AND TESTING - POWER FOLD-AWAY MIRROR - EXPORT

The most reliable, efficient and accurate means to diagnose the power mirror system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, that the power mirror motors are being sent the proper hard wired outputs, and that the mirror position potentiometers are returning the proper outputs to the door modules for them to perform their power mirror system functions.

REMOVAL

The fold-away mirror motor is not serviceable separately, and if a motor is found to be faulty the entire side view mirror must be replaced. (Refer to 8 - ELECTRICAL/POWER MIRRORS/SIDEVIEW MIRROR - REMOVAL).

POWER MIRROR SWITCH

DESCRIPTION

Both the right and left power outside mirrors are controlled by a single multi-function switch unit located on the driver side front door trim panel. The power mirror switch unit includes a three-position rocker selector switch and four momentary directional push button switches.

The power mirror switch unit is integral to the Driver Door Module (DDM). The power mirror switch cannot be repaired or adjusted and, if faulty or damaged, the entire DDM unit must be replaced. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - REMOVAL) for the DDM service procedures.

OPERATION

The power mirror selector switch is moved right (right mirror control), left (left mirror control), or center to turn the power outside mirror system off. When the selector switch is in the right mirror control or left mirror control position, one of the four directional control buttons is depressed to control movement of the selected mirror up, down, right, or left. When the selector switch is in the Off position, depressing any of the directional switches will not change either mirror position.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power mirror switches.

SIDEVIEW MIRROR

DESCRIPTION

Mechanically folding, power operated outside rear view mirrors are standard equipment on this model. Each power mirror housing contains two electric motors, two drive mechanisms, an electric heating grid, the mirror glass case and the mirror glass. One motor and drive controls mirror up-and-down (vertical) movement, and the other controls right-and-left (horizontal) movement. If the vehicle is equipped with the optional memory system, each mirror head also contains two position potentiometers. One position potentiometer monitors the vertical mirror motor, and the other monitors the horizontal mirror motor.

An optional driver side automatic dimming mirror is able to automatically change its reflectance level. This mirror is controlled by the circuitry of the automatic day/night inside rear view mirror. A thin layer of electrochromic material between two pieces of conductive glass make up the face of the mirror. (Refer to 8 - ELECTRICAL/POWER MIRRORS/AUTOMATIC DAY / NIGHT MIRROR - DESCRIPTION) for more information on this feature.

The power mirror unit cannot be repaired. Only the mirror glass and glass case are serviced separately. The replacement mirror glass is supplied with an instruction sheet that details the recommended replacement procedure. If any other component of the power mirror unit is faulty or damaged, the entire power mirror unit must be replaced.

OPERATION

Each of the two outside power mirrors includes two reversible electric motors that are secured within the power mirror housing. Each motor moves the mirror case and glass through an integral drive unit. When a power mirror motor is supplied with battery current and ground, it moves the mirror case and glass through its drive unit in one direction. When the battery current and ground feeds to the motor are reversed, it moves the mirror case and glass in the opposite direction.

The power mirrors are equipped with a standard equipment electric heating grid that is applied to the back of each outside rear view mirror glass. When an electrical current is passed through the resistor wire of the heating grid, it warms the mirror glass. (Refer to 8 - ELECTRICAL/HEATED MIRRORS - DESCRIPTION) for more information on the operation of the heated mirrors and the rear window defogger system.

If the driver side mirror is equipped with the automatic dimming outside mirror option, two photocell sensors on the inside rear view mirror are used to monitor light levels and adjust the reflectance of both the inside and driver side outside mirrors. This change in reflectance helps to reduce the glare of headlamps approaching the vehicle from the rear. (Refer to 8 - ELECTRICAL/POWER MIRRORS/AUTOMATIC DAY / NIGHT MIRROR - OPERATION) for more information on this feature.

If the vehicle is equipped with the optional memory system, the Driver Door Module (DDM) and the Passenger Door Module (PDM) store the mirror position information as monitored through the mirror motor position potentiometers. When the memory system requests a recall of the stored mirror position, the DDM and the PDM are able to duplicate the stored mirror positions by moving the mirror motors until the potentiometer readings match the stored values.

SIDEVIEW MIRROR (Continued)

DIAGNOSIS AND TESTING - SIDEVIEW MIRROR

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

BOTH MIRRORS INOPERATIVE

(1) Check the operation of the power lock switch on the driver side front door. If all of the doors lock and unlock, replace the faulty Driver Door Module (DDM). If not OK, go to Step 2.

(2) Check the operation of the power lock switch on the passenger side front door. If all of the doors lock and unlock, replace the faulty DDM. If not OK, go to Step 3.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the battery as required.

(5) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver side front door. Disconnect the 15-way door wire harness connector from the DDM connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the DDM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the DDM. If OK, replace the faulty DDM. If not OK, repair the open fused B(+) circuit to the fuse in the PDC as required.

ONE MIRROR INOPERATIVE

(1) If the one inoperative mirror is on the passenger side, go to Step 2. If the one inoperative mirror is on the driver side, go to Step 3.

(2) Check if the passenger front door will lock and unlock using the power lock switch on the driver side front door. If OK, go to Step 3. If not OK, go to Step 6.

(3) Disconnect and isolate the battery negative cable. Remove the trim panel from the front door. Disconnect the 12-way mirror wire harness connector from the door wire harness connector.

(4) Using two jumper wires, test the mirror as shown in the Mirror Test chart (Fig. 2). If the mirror tests OK, go to Step 5. If the mirror does not test OK, replace the faulty mirror.

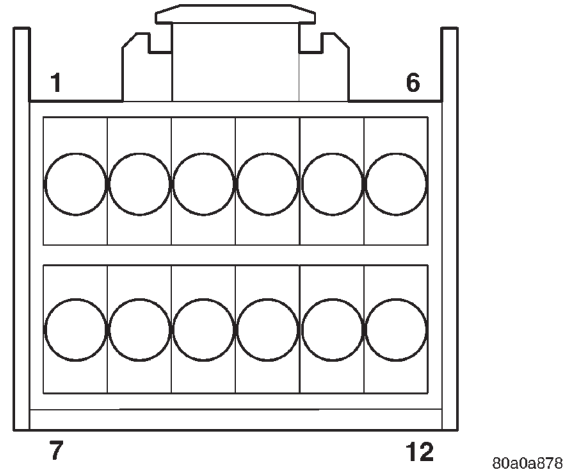


Fig. 2 Mirror Test

POWER MIRROR TEST TABLE

APPLY 12 VOLTS TO:	APPLY GROUND TO:	MIRROR REACTION
	DRIVER SIDE	
1	7	LEFT
7	1	RIGHT
8	7	UP
7	8	DOWN
	PASSENGER SIDE	
1	7	LEFT
7	1	RIGHT
8	7	UP
7	8	DOWN

(5) Disconnect the 12-way door wire harness connector from the door module connector receptacle. Check all of the circuits of the door wire harness between the connector for the mirror and the connector for the door module for opens or shorts. If all of the circuits are OK, replace the faulty door module. If any of the circuits are not OK, repair the open or shorted circuit(s) as required.

(6) Use a DRB scan tool and the proper Diagnostic Procedures manual to test and repair the faulty Programmable Communications Interface (PCI) data bus communication between the two door modules.

NO MIRROR HEAT

If one or both mirror heaters are inoperative, (Refer to 8 - ELECTRICAL/HEATED MIRRORS - DESCRIPTION).

(1) Disconnect and isolate the battery negative cable. Remove the front door trim panel on the side of the inoperative mirror heater.

(2) Disconnect the 12-way door wire harness connector from the door module connector receptacle. Check for continuity between the heater switched ground circuit cavity and the heater 12V supply circuit cavity of the 12-way door wire harness connector

for the door module. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the door module and the PCI data bus. If not OK, replace the faulty power mirror unit.

NO MIRROR DIMMING (Driver Side Only)

(1) Test the operation of the automatic day/night mirror. (Refer to 8 - ELECTRICAL/POWER MIRRORS/AUTOMATIC DAY / NIGHT MIRROR - OPERATION). If OK, go to Step 2. If not OK, repair the automatic day/night mirror unit as required.

(2) Disconnect and isolate the battery negative cable. Remove the driver side front door trim panel.

(3) Disconnect the door wire harness connector from the power mirror wire harness connector. Connect a voltmeter between the electrochromatic (+) and electrochromatic (–) circuit cavities of the door wire harness connector for the power mirror. Turn on the automatic day/night mirror system while observing the voltmeter. A voltmeter reading of 1.45 ± 0.05 volts indicates a proper dimming signal is being received at the door wire harness connector for the power mirror. If OK, replace the faulty power mirror. If not OK, repair the shorted or open electrochromatic (+) or electrochromatic (–) circuit(s) to the automatic day/night mirror as required.

NO MIRROR MEMORY

For diagnosis of the memory system, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended. (Refer to 8 - ELECTRICAL/POWER SEATS - DESCRIPTION).

POWER SEAT SYSTEM

TABLE OF CONTENTS

POWER SEAT SYSTEM

DESCRIPTION

DESCRIPTION

Driver and passenger power front seats are an available factory-installed option for this vehicle. The power seat system option allows the driver and front seat passenger to electrically adjust their seating positions for optimum control and comfort using the power seat switches located on the outboard seat cushion side shield of each front seat. The power seat system receives battery current through a fuse in the Power Distribution Center (PDC) and a circuit breaker in the junction block so that the power seats remain operational, regardless of the ignition switch position.

Four power seat options are offered on this vehicle, depending upon the model. They are as follows:

- **Six-way power drivers seat with manual passenger seat -** This power seat package is an option on Laredo models equipped with cloth-trimmed seats and includes a six-way adjustable driver seat track with manual seat back recliners.
- **Six-way power driver and passenger seat -** This power seat package is an option on Laredo models equipped with cloth or leather-trimmed seats and includes six-way adjustable seat tracks with manual seat back recliners. Heated Seats are available on leather-trimmed seats.
- **Ten-way power drivers seat with Memory and Six-way power passenger seat -** This power seat package is standard on Limited models. This option includes a six-way adjustable seat track with power seat back recliners and power lumbar supports for the driver and six-way only for the passenger.

POWER SEAT SYSTEM (Continued)

• **Ten-way power drivers and passenger seats with Memory** - This power seat option is standard on Overland models and optional on Limited models. This option includes a six-way adjustable seat cushion track with power seat back recliners and power lumbar supports. Heated Seats are standard with this option.

Refer to **Heated Seat System** for more information on the heated seat option. Refer to **Memory System** in the Memory System section of this group for more information on the memory system.

The power seat system includes the following components:

• Power lumbar adjuster (ten-way power seat only)
• Power lumbar switch (ten-way power seat only)
• Power seat recliner (ten-way power seat only)
• Power seat switch
• Power seat track.

Refer to **Power Seat** in Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power seat/ memory seat system.

DESCRIPTION - MEMORY SYSTEM

An electronic memory system is standard equipment on the Limited model. The memory system is able to store and recall the driver side power seat positions (including the power recliner position), and both outside power mirror positions for two drivers. For vehicles with a radio connected to the Programmable Communications Interface (PCI) data bus network, the memory system is also able to store and recall up to twenty - ten AM and ten FM - radio station presets for two drivers. The memory system also will store and recall the last station listened to for each driver, even if it is not one of the twenty preset stations.

The memory system will automatically return to all of these settings when the corresponding numbered and color-coded button (Driver 1 - Black, or Driver 2 - Gray) of the memory switch on the driver side front door trim panel is depressed, or when the doors are unlocked using the corresponding numbered and color-coded (Driver 1 - Black, or Driver 2 - Gray) Remote Keyless Entry (RKE) transmitter. A customer programmable feature of the memory system allows the RKE recall of memory features to be disabled in cases where there are more than two drivers of the vehicle.

The memory system also has a customer programmable easy exit feature that will move the driver seat rearward 55 millimeters (two inches) or to the end of its travel, whichever occurs first, when the key is removed from the ignition switch lock cylinder.

A Memory Seat Module (MSM) or Memory Heated Seat Module (MHSM) are used on this model to control and integrate the many electronic functions and features included in the memory system. On vehicles equipped with the heated seat system option, the MHSM also controls the functions and features of that system.

The memory system includes the following components:

• Memory seat module (or memory heated seat module)
• Memory switch
• Position potentiometers on both outside power mirrors
• Position potentiometers on the driver side power seat track and power seat recliner motors.
• Radio receiver (if PCI data bus capable).

Certain functions and features of the memory system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB® scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect memory system operation are as follows:

• **Body Control Module (BCM)** - Refer to **Body Control Module** in Electronic Control Modules for more information.

• **Driver Door Module (DDM)** - Refer to **Door Module** in Electronic Control Modules for more information.

• **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in Overhead Console Systems for more information.

• **Passenger Door Module (PDM)** - Refer to **Door Module** in Electronic Control Modules for more information.

• **Powertrain Control Module (PCM)** - Refer to **Powertrain Control Module** in Electronic Control Modules for more information.

• **Radio Receiver** - Refer to **Radio Receiver** in Audio Systems for more information.

Refer to **Heated Seat System** for more information on this system. Refer to **Remote Keyless Entry System** in Power Lock Systems for more information on the RKE system. Refer to **Power Mirror** in Power Mirror Systems for more information on the

POWER SEAT SYSTEM (Continued)

mirror position potentiometers. Refer to **Power Seat Track** and **Power Seat Recliner** in the Power Seat System section of this group for more information on the driver side power seat position potentiometers.

Refer to **Power Seat** in Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the factory-installed memory system.

OPERATION

OPERATION - POWER SEAT SYSTEM

The power seat system allows the driver and/or front passenger seating positions to be adjusted electrically and independently using the separate power seat switches found on the outboard seat cushion side shield of each front seat. See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power seat system.

OPERATION - MEMORY SYSTEM

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the memory system. For diagnosis of the MSM, the PCI data bus, or the other electronic modules on the PCI data bus that provide inputs and outputs for the memory system, the use of a DRB® scan tool and the proper Diagnostic Procedures manual are recommended.

DRIVER AND PASSENGER DOOR MODULES

The Driver Door Module (DDM) monitors the memory switch through a hard wired circuit. It also monitors the unlock messages from the Remote Keyless Entry (RKE) receiver in the Passenger Door Module (PDM) sent over the Programmable Communications Interface (PCI) data bus. The DDM is programmed to send memory recall messages and memory system status messages over the PCI data bus to the other electronic modules when it detects a memory recall request.

Refer to **Door Module** in Electronic Control Modules for more information on the DDM and PDM.

ELECTRONIC VEHICLE INFORMATION CENTER

The Electronic Vehicle Information Center (EVIC) serves as the user interface for the memory system. It displays memory system status messages and provides the user with the means for enabling and disabling the many customer programmable features available on the vehicle, including those for the memory system.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the EVIC. Refer to **Electronic Vehicle Information Center** in Overhead Console Systems for more information on the EVIC.

DIAGNOSIS AND TESTING

DIAGNOSIS & TESTING - POWER SEAT SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power seat system. However, if the vehicle is also equipped with the optional memory system, these tests may not prove conclusive in the diagnosis of the driver side power seat. In order to obtain conclusive testing of the driver side power seat with the memory system option, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the driver side power seat with the memory system option requires the use of a DRB® scan tool and the proper Diagnostic Procedures manual. The DRB® scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its driver side power seat functions.

Before any testing of the power seat system is attempted, the battery should be fully-charged and all of the power seat system wire harness connections and pins cleaned and tightened to ensure proper circuit continuity and ground paths. For complete circuit diagrams, refer to **Power Seat** in Wiring Diagrams.

With the dome lamp on, apply the power seat switch in the direction of the failure. If the dome lamp dims, the seat may be jamming. Check under and behind the seat for binding or obstructions. If the dome lamp does not dim, proceed with testing of the individual components and circuits.

DIAGNOSIS & TESTING - MEMORY SYSTEM

Following are tests that will help to diagnose the components and circuits that provide hard wired inputs to the memory system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the memory system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the memory system requires the use of a DRB® scan tool and the proper Diagnostic Procedures manual. The DRB® scan tool can provide confirmation that the PCI data bus is functional, that all

POWER SEAT SYSTEM (Continued)

of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its functions.

DRIVER SEAT SWITCH

DESCRIPTION

Two different power seat switches are used on this vehicle, depending upon the optional power seat system installed in the vehicle. The six-way power seats are each equipped with a switch featuring three switch control knobs ganged together on the outboard seat cushion side shield (Fig. 1). The ten-way power seats are each equipped with a switch featuring two knobs ganged together on the outboard seat cushion side shield (Fig. 2).

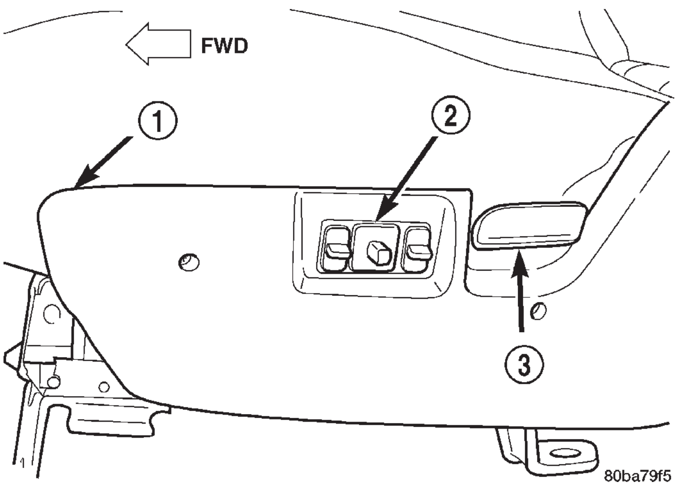


Fig. 1 Six-Way Power Seat Switches - Typical

1 - OUTBOARD SEAT CUSHION SIDE SHIELD
2 - POWER SEAT TRACK SWITCHES
3 - MECHANICAL SEAT BACK RECLINER LEVER

The switch units for both power seat types are secured to the back of the seat cushion side shield with two screws. However, the control knobs for the six-way power seat switch unit remain installed during switch unit removal and installation, while both knobs for the ten-way power seat switch unit must be removed.

The individual switches in both power seat switch units cannot be repaired. If one switch is damaged or faulty, the entire power seat switch unit must be replaced.

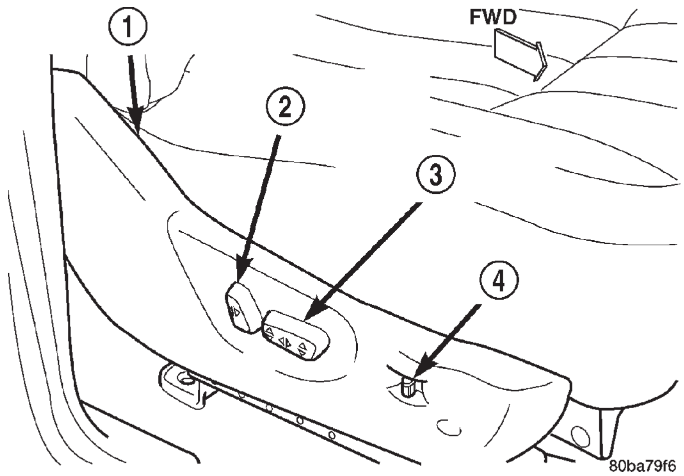


Fig. 2 Ten-Way Power Seat Switches - Typical

1 - OUTBOARD CUSHION SIDE SHIELD
2 - POWER SEAT RECLINER SWITCH
3 - POWER SEAT TRACK SWITCH
4 - POWER LUMBAR SWITCH

OPERATION

The power seat tracks of both the six-way and the ten-way power seat systems can be adjusted in six different ways using the power seat switches. The ten-way system has the additional power seat recliner switch integral to the power seat switch and also has a separate, stand-alone switch to control the power lumbar adjuster. See the owner's manual in the vehicle glove box for more information on the power seat switch functions and the seat adjusting procedures.

When a power switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the power seat track or recliner adjuster motor. The selected adjuster motor operates to move the seat track or recliner through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

No power seat switch should be held applied in any direction after the adjuster has reached its travel limit. The power seat adjuster motors each contain a self-resetting circuit breaker to protect them from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

DRIVER SEAT SWITCH (Continued)

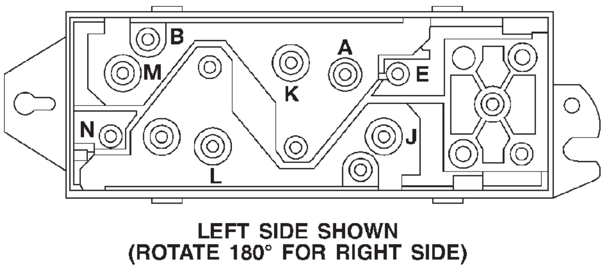
DIAGNOSIS AND TESTING - DRIVER SEAT SWITCH

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power seat switch from the outboard seat cushion side shield. Refer to the procedure in this section of the manual.

(3) Use an ohmmeter to test the continuity of the power seat switch in each switch position. See the Power Seat Switch Continuity chart (Fig. 3) or (Fig. 4). If OK, refer to **Diagnosis and Testing Power Seat Track** or **Diagnosis and Testing Power Seat Recliner** in this section. If not OK, replace the faulty power seat switch.



SIX-WAY POWER SEAT SWITCH TEST		
LEFT SWITCH POSITION	RIGHT SWITCH POSITION	CONTINUITY BETWEEN
OFF	OFF	B-N, B-J, B-M, B-E, B-L, B-K
VERTICAL UP	VERTICAL DOWN	A-J, A-N, B-M, B-E
VERTICAL DOWN	VERTICAL UP	A-E, A-M, B-N, B-J
HORIZONTAL FORWARD	HORIZONTAL REARWARD	A-K, B-L
FRONT TILT UP	FRONT TILT DOWN	A-J, B-E
FRONT TILT DOWN	FRONT TILT UP	A-E, B-J
REAR TILT UP	REAR TILT DOWN	A-N, B-M
REAR TILT DOWN	REAR TILT UP	A-M, B-N

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Fig. 3 Rear Of Six-Way Power Seat Switch

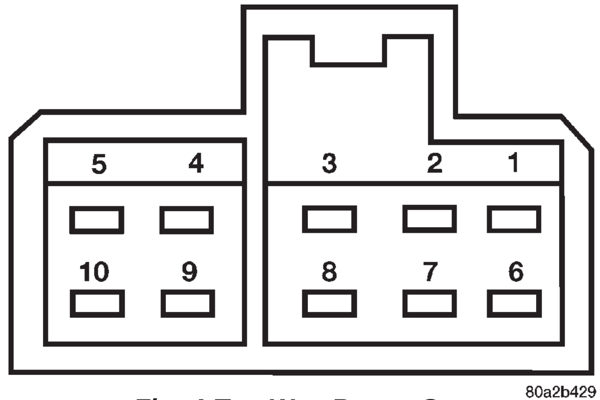


Fig. 4 Ten-Way Power Seat Switch Connector Receptacle

SWITCH POSITION	CONTINUITY BETWEEN PINS	
	LEFT SEAT	RIGHT SEAT
OFF	PIN 1 to 2	PIN 1 to 2
	PIN 1 to 3	PIN 1 to 3
	PIN 1 to 4	PIN 1 to 4
	PIN 1 to 6	PIN 1 to 6
	PIN 1 to 7	PIN 1 to 7
	PIN 1 to 8	PIN 1 to 8
	PIN 1 to 9	PIN 1 to 9
	PIN 1 to 10	PIN 1 to 10
FRONT RISER UP	PIN 1 to 10	PIN 1 to 7
	PIN 5 to 7	PIN 5 to 10
FRONT RISER DOWN	PIN 1 to 7	PIN 1 to 10
	PIN 5 to 10	PIN 5 to 7
CENTER SWITCH FORWARD	PIN 1 to 3	PIN 1 to 3
	PIN 5 to 6	PIN 5 to 6
CENTER SWITCH REARWARD	PIN 1 to 6	PIN 1 to 6
	PIN 3 to 5	PIN 3 to 5
REAR RISER UP	PIN 1 to 9	PIN 1 to 8
	PIN 5 to 8	PIN 5 to 9
REAR RISER DOWN	PIN 1 to 8	PIN 1 to 9
	PIN 5 to 9	PIN 5 to 8
RECLINER UP	PIN 1 to 4	PIN 1 to 4
	PIN 2 to 5	PIN 2 to 5
RECLINER DOWN	PIN 1 to 2	PIN 1 to 2
	PIN 4 to 5	PIN 4 to 5

DRIVER SEAT SWITCH (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) On models with the ten-way power seat system only, using a push pin remover or another suitable wide flat-bladed tool, gently pry the power seat and power recliner switch knobs off of the switch stems (Fig. 5).

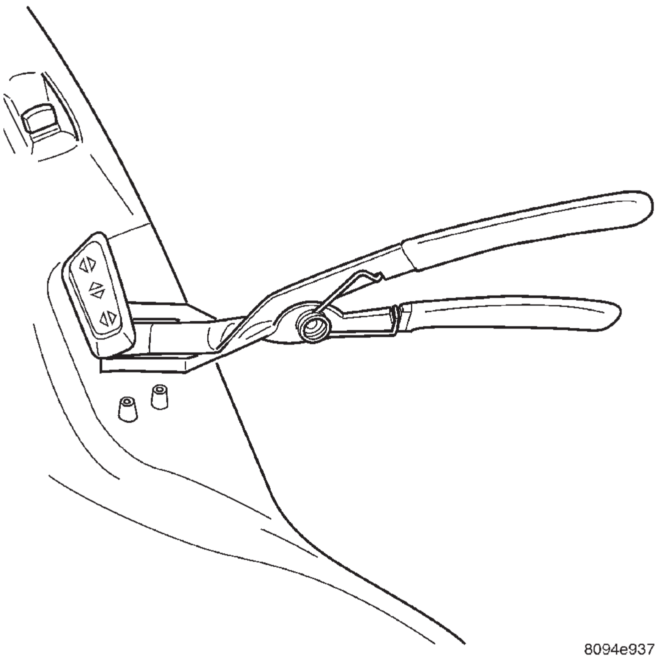


Fig. 5 Removing Switch Control Knobs - Typical

(3) Remove the three screws that secure the outboard seat cushion side shield to the seat cushion frame.

(4) Pull the outboard seat cushion side shield away from the seat cushion frame far enough to access the power seat switch wire harness connector.

(5) Disconnect the power seat wire harness connector from the power seat switch connector receptacle.

(6) Remove the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield (Fig. 6) or (Fig. 7).

(7) Remove the power seat switch from the outboard seat cushion side shield.

INSTALLATION

(1) Position the power seat switch onto the outboard seat cushion side shield.

(2) Install and tighten the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield. Tighten the screws to 1.5 N·m (14 in. lbs.).

(3) Reconnect the power seat wire harness connector to the power seat switch connector receptacle.

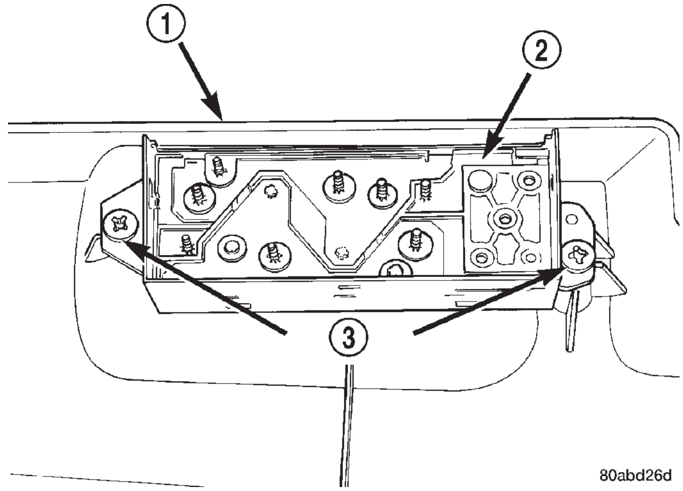


Fig. 6 Six-Way Power Seat Switches Remove/Install

1 - SEAT SIDE SHIELD
2 - POWER SEAT SWITCH
3 - SCREWS

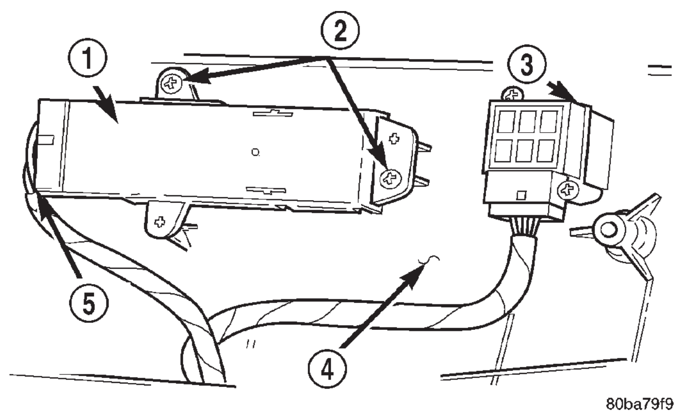


Fig. 7 Ten-Way Power Seat Switches Remove/Install

1 - POWER SEAT SWITCH
2 - SCREWS (2)
3 - POWER LUMBAR SWITCH
4 - SEAT CUSHION SIDE SHIELD
5 - WIRE HARNESS CONNECTOR

(4) Position the outboard seat cushion side shield onto the seat cushion frame

(5) Install and tighten the three screws that secure the outboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1.5 N·m (14 in. lbs.).

(6) On models with the ten-way power seat system only, position the power seat and power recliner switch knobs onto the switch stems and push on them firmly and evenly until they snap into place.

(7) Reconnect the battery negative cable.

LUMBAR CONTROL SWITCH

DESCRIPTION

The ten-way power seat option includes an electrically operated lumbar support mechanism. A single two-way momentary power lumbar switch is located on the outboard seat cushion side shield of each front seat, just forward of the other power seat switches (Fig. 8). The power lumbar switch is secured to the back of the seat cushion side shield with two screws, and the switch paddle protrudes through a hole to the outside of the shield. The switch paddle is located in a shallow depression molded into the outer surface of the seat cushion side shield that helps to shroud it from unintentional actuation when entering or leaving the vehicle.

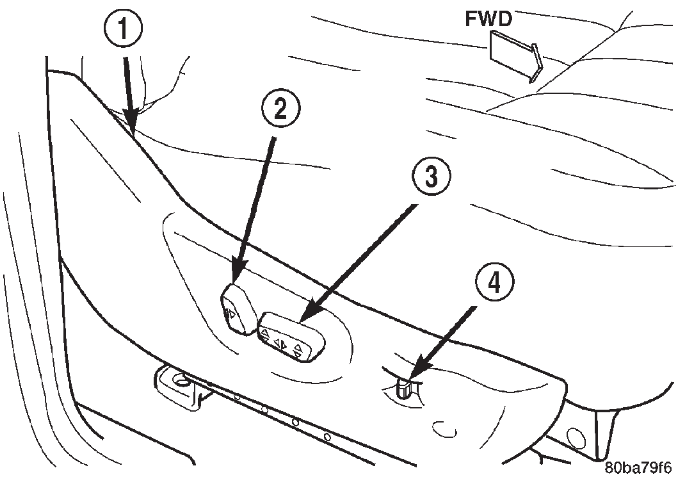


Fig. 8 Ten-Way Power Seat Switches

1 - OUTBOARD CUSHION SIDE SHIELD
2 - POWER SEAT RECLINER SWITCH
3 - POWER SEAT TRACK SWITCH
4 - POWER LUMBAR SWITCH

The power lumbar switches cannot be adjusted or repaired and, if faulty or damaged, they must be replaced.

OPERATION

When the power lumbar switch paddle is actuated, a battery feed and a ground path are applied through the switch contacts to the power lumbar adjuster motor. The motor operates to move the lumbar adjuster through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the motor to run in the opposite direction.

The power lumbar switch should not be held applied in either direction after the adjuster has reached its travel limit. The power lumbar adjuster motor contains a self-resetting circuit breaker to protect it from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

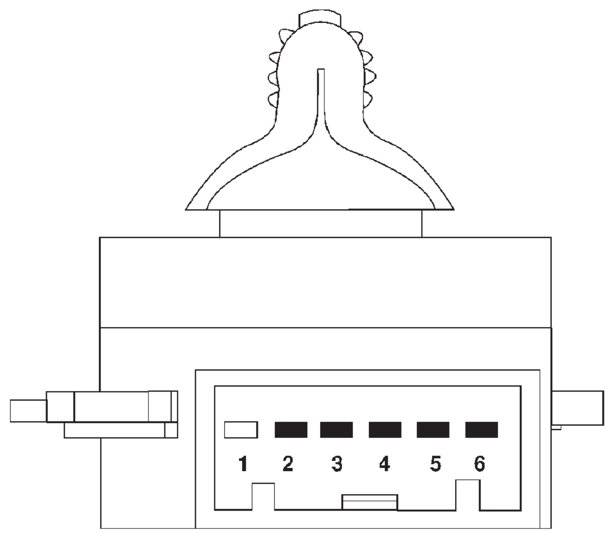
DIAGNOSIS AND TESTING - POWER LUMBAR SWITCH

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power lumbar switch from the outboard seat cushion side shield. Refer to the procedure in this section of the manual.

(3) Use an ohmmeter to test the continuity of the power lumbar switch in each switch position. See the Power Lumbar Switch Continuity chart (Fig. 9). If OK, refer to **Power Lumbar Adjuster Diagnosis and Testing** in this group. If not OK, replace the faulty power lumbar switch.



POWER LUMBAR SWITCH		
LEFT SWITCH POSITION	RIGHT SWITCH POSITION	CONTINUITY BETWEEN
Off	Off	2-4, 3-5
Forward	Rearward	3-5, 4-6
Rearward	Forward	2-4, 3-6

80ba79fb

Fig. 9 Power Lumbar Switch

REMOVAL

(1) Disconnect and isolate the battery negative cable.

LUMBAR CONTROL SWITCH (Continued)

(2) Remove the three screws that secure the outboard seat cushion side shield to the seat cushion frame.

(3) Pull the outboard seat cushion side shield away from the seat cushion frame far enough to access the power lumbar switch wire harness connector.

(4) Disconnect the power seat wire harness connector from the power lumbar switch connector receptacle (Fig. 10).

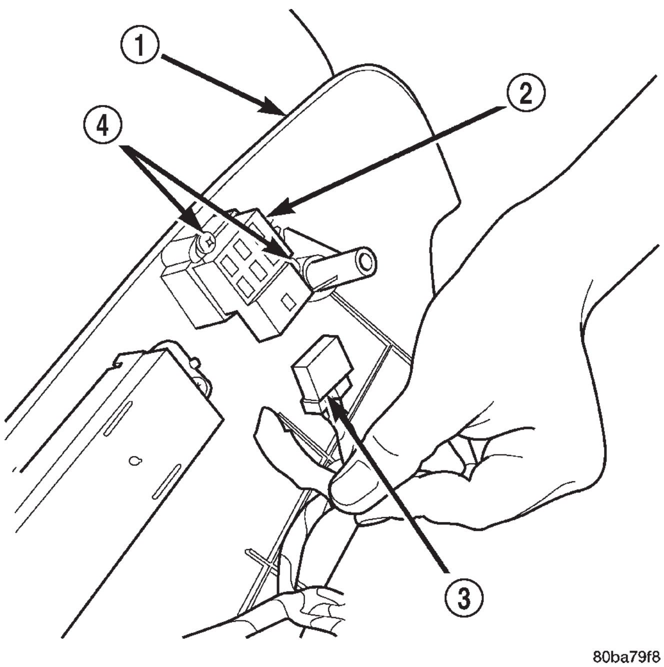


Fig. 10 Power Lumbar Switch Remove/Install

1 - OUTBOARD SEAT CUSHION SIDE SHIELD
2 - POWER LUMBAR SWITCH
3 - WIRE HARNESS CONNECTOR
4 - SCREWS (2)

(5) Remove the two screws that secure the power lumbar switch to the inside of the outboard seat cushion side shield.

(6) Remove the power lumbar switch from the outboard seat cushion side shield.

INSTALLATION

(1) Position the power lumbar switch onto the outboard seat cushion side shield.

(2) Install and tighten the two screws that secure the power lumbar switch to the inside of the outboard seat cushion side shield. Tighten the screws to 1.5 N·m (14 in. lbs.).

(3) Reconnect the power seat wire harness connector to the power lumbar switch connector receptacle.

(4) Position the outboard seat cushion side shield onto the seat cushion frame

(5) Install and tighten the three screws that secure the outboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1.5 N·m (14 in. lbs.).

(6) Reconnect the battery negative cable.

LUMBAR MOTOR

DESCRIPTION

The ten-way power seat option includes an electrically operated lumbar support mechanism. The only visible evidence of this option is the separate power lumbar switch control paddle that is located on the outboard seat cushion side shield, just forward of the other power seat switch control knobs. The power lumbar adjuster and motor are concealed beneath the seat back trim cover and padding, where they are secured to a molded plastic back panel and to the seat back frame (Fig. 11).

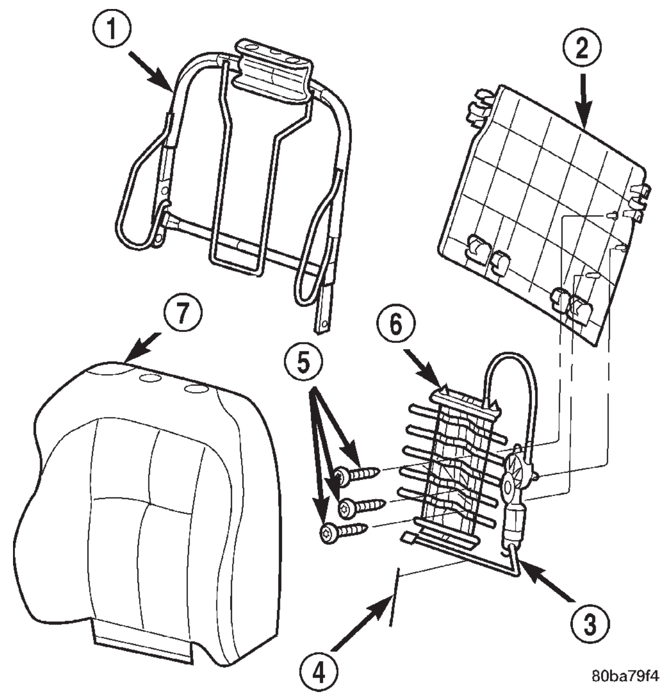


Fig. 11 Power Lumbar Adjuster

1 - SEAT BACK FRAME
2 - SEAT BACK PANEL
3 - LUMBAR MOTOR PIGTAIL TO SEAT WIRE HARNESS
4 - TIE WRAP
5 - SCREW (3)
6 - POWER LUMBAR ADJUSTER
7 - SEAT BACK TRIM COVER AND PADDING

The power lumbar adjuster cannot be repaired, and is serviced only as a unit with the seat back frame. If the power lumbar adjuster or the seat back frame are damaged or faulty, the entire seat back frame unit must be replaced.

LUMBAR MOTOR (Continued)

OPERATION

The power lumbar adjuster mechanism includes a reversible electric motor that is secured to the inboard side of the seat back panel and is connected to a worm-drive gearbox. The motor and gearbox operate the lumbar adjuster mechanism in the center of the seat back by extending and retracting a cable that actuates a lever. The action of this lever compresses or relaxes a grid of flexible slats. The more this grid is compressed, the more the slats bow outward against the center of the seat back padding, providing additional lumbar support.

DIAGNOSIS AND TESTING - POWER LUMBAR ADJUSTER

Actuate the power lumbar switch to move the power lumbar adjuster in each direction. The power lumbar adjuster should move in both directions. It should be noted that the power lumber adjuster normally operates very quietly and exhibits little visible movement. If the power lumbar adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power lumbar adjuster still fails to operate in only one direction, refer to **Diagnosis and Testing Power Lumbar Switch** in this group. If the power lumbar adjuster fails to operate in either direction, perform the following tests. For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Check the power seat circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty power seat circuit breaker.

(2) Check for battery voltage at the power seat circuit breaker in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center as required.

(3) Remove the outboard seat cushion side shield from the seat. Disconnect the seat wire harness connector from the power lumbar switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the power seat wire harness connector for the power lumbar switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

(4) Check for continuity between the ground circuit cavity of the power seat wire harness connector for the power lumbar switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Test the power lumbar switch. Refer to **Diagnosis and Testing Power Lumbar Switch** in this group. If the switch tests OK, test the circuits of the power seat wire harness between the power lumbar adjuster motor and the power lumbar switch for shorts or opens. If the circuits check OK, replace the faulty seat back frame assembly. If the circuits are not OK, repair the power seat wire harness as required.

MEMORY SET SWITCH

DESCRIPTION

Vehicles equipped with the memory system have a memory switch mounted to the driver side front door trim panel (Fig. 12). This switch is used to set and recall all of the memory system settings for up to two drivers. The memory switch is a resistor multiplexed unit that is hard wired to the Driver Door Module (DDM), which is also located on the driver side front door trim panel. The DDM sends out the memory system set and recall requests to the other electronic modules over the Programmable Communications Interface (PCI) data bus.

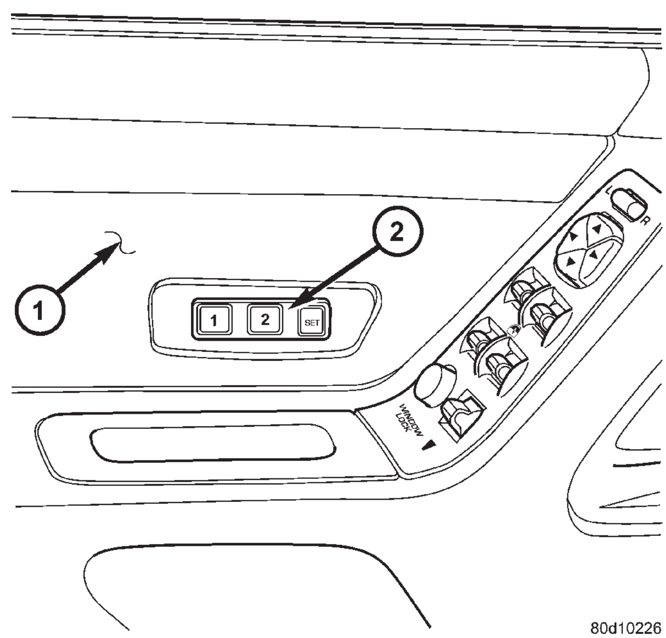


Fig. 12 WJ/WG MEMORY SELECT/SET SWITCH

1 - DRIVER TRIM PANEL
2 - MEMORY SWITCH

The memory switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced. For complete circuit diagrams, refer to **Wiring Diagrams**.

OPERATION

The memory switch has three momentary switch buttons labeled Set, 1 and 2. The Driver 1 and Driver 2 buttons are back-lit with Light-Emitting Diodes

MEMORY SET SWITCH (Continued)

(LED) for visibility, and are also color-coded to coincide with the color-coded Driver 1 and Driver 2 Remote Keyless Entry (RKE) transmitters. The Driver 1 memory switch button and RKE transmitter are black, and the Driver 2 memory switch button and RKE transmitter are gray. The memory switch Set button also has an LED that will illuminate and flash to indicate that the memory system is in the set mode. This LED will automatically be extinguished when a set request has been successfully completed.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the memory switch. For diagnosis of the memory switch, the DDM or the PCI data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

DIAGNOSIS AND TESTING - MEMORY SWITCH

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side front door trim panel. Refer to the Body section for the procedure.

(3) Disconnect the memory switch wire harness connector from the driver door module connector receptacle.

(4) Use an ohmmeter to test the resistances of the memory switch in each switch position. See the Memory Switch Test chart MEMORY SWITCH TEST . If OK, refer to **Memory System Diagnosis and Testing** in this group. If not OK, replace the faulty memory switch.

MEMORY SWITCH TEST

MEMORY SWITCH POSITION	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
NEUTRAL	A&D	14000 ± 1%
MEMORY 1	A&B	4600 ± 1%
MEMORY 2	A&B	1700 ± 1%
SET	A&B	300 ± 1%

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the driver side front door. Refer to **Front Door Trim Panel** in Body for the procedure.

(3) Disconnect the memory switch wire harness connector from the driver door module connector receptacle.

(4) Remove the two screws that secure the memory switch to the back of the driver side front door trim panel.

(5) Remove the memory switch from the back of the driver side front door trim panel.

INSTALLATION

(1) Position the memory switch onto the back of the driver side front door trim panel.

(2) Install and tighten the two screws that secure the memory switch to the back of the driver side front door trim panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reconnect the memory switch wire harness connector to the driver door module connector receptacle.

(4) Install the trim panel onto the driver side front door. Refer to **Front Door Trim Panel** in Body for the procedure.

(5) Reconnect the battery negative cable.

PASSENGER SEAT SWITCH

DESCRIPTION

Two different power seat switches are used on this vehicle, depending upon the optional power seat system installed in the vehicle. The six-way power seats are each equipped with a switch featuring three switch control knobs ganged together on the outboard seat cushion side shield (Fig. 13). The ten-way power seats are each equipped with a switch featuring two knobs ganged together on the outboard seat cushion side shield (Fig. 14).

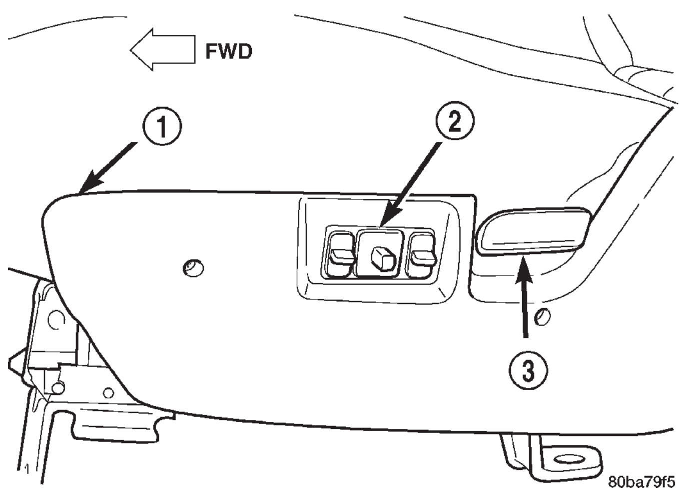


Fig. 13 Six-Way Power Seat Switches - Typical

1 - OUTBOARD SEAT CUSHION SIDE SHIELD
2 - POWER SEAT TRACK SWITCHES
3 - MECHANICAL SEAT BACK RECLINER LEVER

The switch units for both power seat types are secured to the back of the seat cushion side shield with two screws. However, the control knobs for the six-way power seat switch unit remain installed dur-

PASSENGER SEAT SWITCH (Continued)

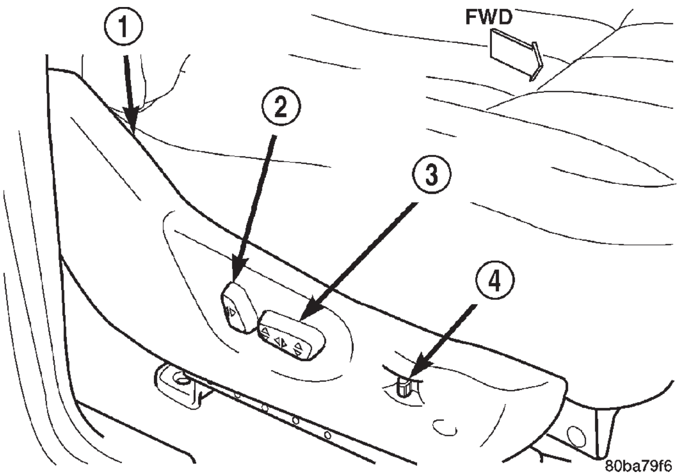


Fig. 14 Ten-Way Power Seat Switches - Typical

1 - OUTBOARD CUSHION SIDE SHIELD
2 - POWER SEAT RECLINER SWITCH
3 - POWER SEAT TRACK SWITCH
4 - POWER LUMBAR SWITCH

ing switch unit removal and installation, while both knobs for the ten-way power seat switch unit must be removed.

The individual switches in both power seat switch units cannot be repaired. If one switch is damaged or faulty, the entire power seat switch unit must be replaced.

OPERATION

The power seat tracks of both the six-way and the ten-way power seat systems can be adjusted in six different ways using the power seat switches. The ten-way system has the additional power seat recliner switch integral to the power seat switch and also has a separate, stand-alone switch to control the power lumbar adjuster. See the owner's manual in the vehicle glove box for more information on the power seat switch functions and the seat adjusting procedures.

When a power switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the power seat track or recliner adjuster motor. The selected adjuster motor operates to move the seat track or recliner through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

No power seat switch should be held applied in any direction after the adjuster has reached its travel limit. The power seat adjuster motors each contain a self-resetting circuit breaker to protect them from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

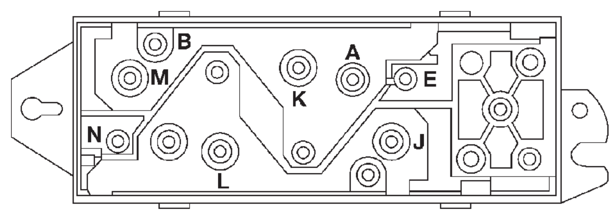
DIAGNOSIS AND TESTING - PASSENGER SEAT SWITCH

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power seat switch from the outboard seat cushion side shield. Refer to the procedure in this section of the manual.

(3) Use an ohmmeter to test the continuity of the power seat switch in each switch position. See the Power Seat Switch Continuity chart (Fig. 15) or (Fig. 16). If OK, refer to **Diagnosis and Testing Power Seat Track** or **Diagnosis and Testing Power Seat Recliner** in this section. If not OK, replace the faulty power seat switch.



LEFT SIDE SHOWN
(ROTATE 180° FOR RIGHT SIDE)

SIX-WAY POWER SEAT SWITCH TEST		
LEFT SWITCH POSITION	RIGHT SWITCH POSITION	CONTINUITY BETWEEN
OFF	OFF	B-N, B-J, B-M, B-E, B-L, B-K
VERTICAL UP	VERTICAL DOWN	A-J, A-N, B-M, B-E
VERTICAL DOWN	VERTICAL UP	A-E, A-M, B-N, B-J
HORIZONTAL FORWARD	HORIZONTAL REARWARD	A-K, B-L
FRONT TILT UP	FRONT TILT DOWN	A-J, B-E
FRONT TILT DOWN	FRONT TILT UP	A-E, B-J
REAR TILT UP	REAR TILT DOWN	A-N, B-M
REAR TILT DOWN	REAR TILT UP	A-M, B-N

80ba79fc

Fig. 15 Rear Of Six-Way Power Seat Switch

PASSENGER SEAT SWITCH (Continued)

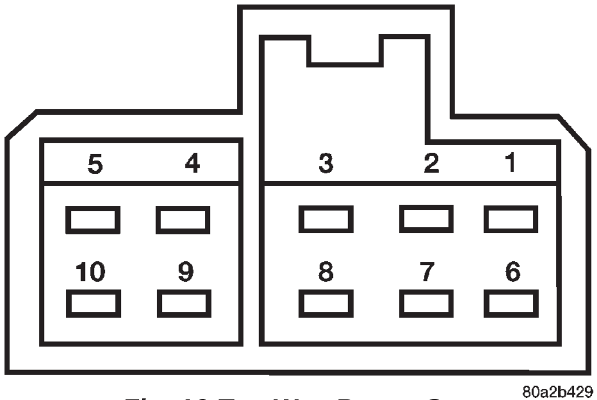


Fig. 16 Ten-Way Power Seat Switch Connector Receptacle

SWITCH POSITION	CONTINUITY BETWEEN PINS	
	LEFT SEAT	RIGHT SEAT
OFF	PIN 1 to 2 PIN 1 to 3 PIN 1 to 4 PIN 1 to 6 PIN 1 to 7 PIN 1 to 8 PIN 1 to 9 PIN 1 to 10	PIN 1 to 2 PIN 1 to 3 PIN 1 to 4 PIN 1 to 6 PIN 1 to 7 PIN 1 to 8 PIN 1 to 9 PIN 1 to 10
FRONT RISER UP	PIN 1 to 10 PIN 5 to 7	PIN 1 to 7 PIN 5 to 10
FRONT RISER DOWN	PIN 1 to 7 PIN 5 to 10	PIN 1 to 10 PIN 5 to 7
CENTER SWITCH FORWARD	PIN 1 to 3 PIN 5 to 6	PIN 1 to 3 PIN 5 to 6
CENTER SWITCH REARWARD	PIN 1 to 6 PIN 3 to 5	PIN 1 to 6 PIN 3 to 5
REAR RISER UP	PIN 1 to 9 PIN 5 to 8	PIN 1 to 8 PIN 5 to 9
REAR RISER DOWN	PIN 1 to 8 PIN 5 to 9	PIN 1 to 9 PIN 5 to 8
RECLINER UP	PIN 1 to 4 PIN 2 to 5	PIN 1 to 4 PIN 2 to 5
RECLINER DOWN	PIN 1 to 2 PIN 4 to 5	PIN 1 to 2 PIN 4 to 5

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) On models with the ten-way power seat system only, using a push pin remover or another suitable wide flat-bladed tool, gently pry the power seat and power recliner switch knobs off of the switch stems (Fig. 17).

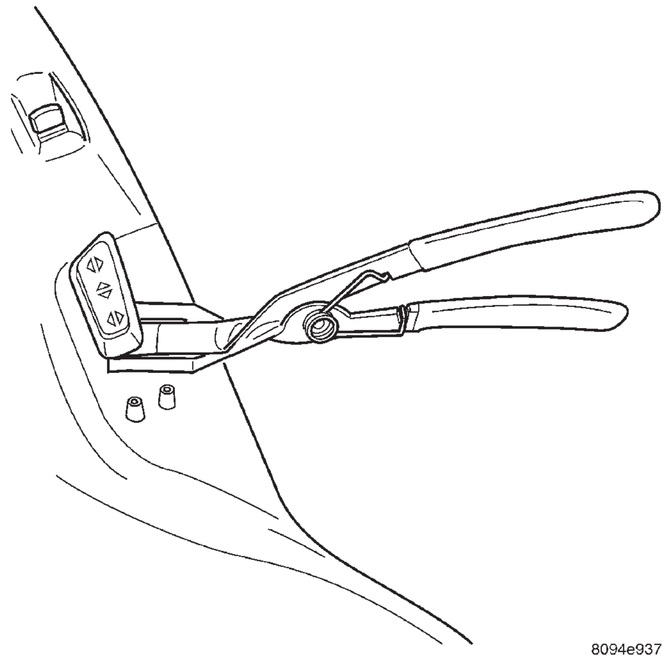


Fig. 17 Removing Switch Control Knobs - Typical

(3) Remove the three screws that secure the outboard seat cushion side shield to the seat cushion frame.

(4) Pull the outboard seat cushion side shield away from the seat cushion frame far enough to access the power seat switch wire harness connector.

(5) Disconnect the power seat wire harness connector from the power seat switch connector receptacle.

(6) Remove the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield (Fig. 18) or (Fig. 19).

(7) Remove the power seat switch from the outboard seat cushion side shield.

INSTALLATION

(1) Position the power seat switch onto the outboard seat cushion side shield.

(2) Install and tighten the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield. Tighten the screws to 1.5 N·m (14 in. lbs.).

(3) Reconnect the power seat wire harness connector to the power seat switch connector receptacle.

PASSENGER SEAT SWITCH (Continued)

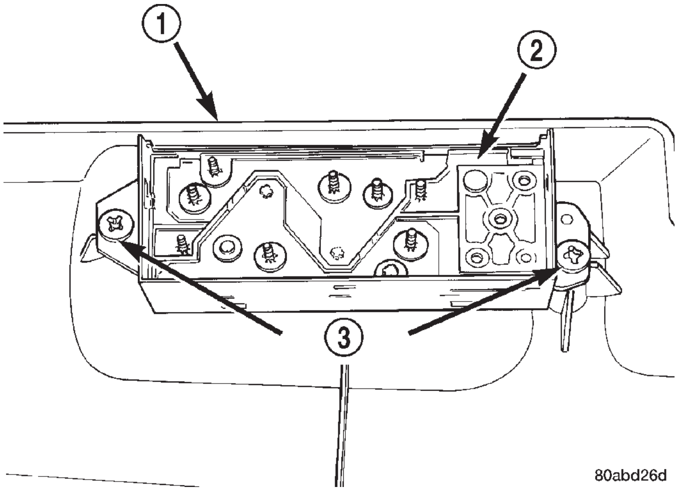


Fig. 18 Six-Way Power Seat Switches Remove/ Install

1 - SEAT SIDE SHIELD
2 - POWER SEAT SWITCH
3 - SCREWS

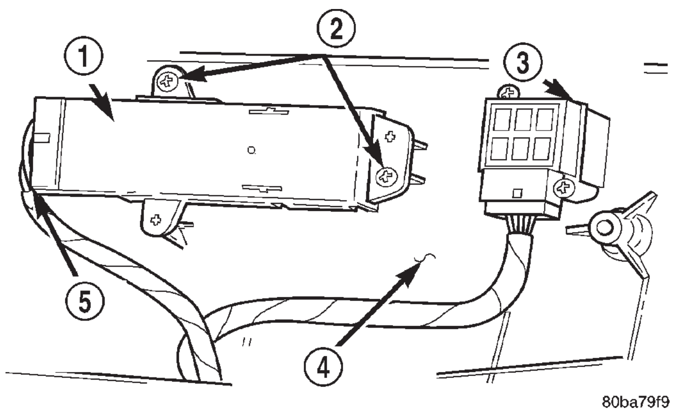


Fig. 19 Ten-Way Power Seat Switches Remove/ Install

1 - POWER SEAT SWITCH
2 - SCREWS (2)
3 - POWER LUMBAR SWITCH
4 - SEAT CUSHION SIDE SHIELD
5 - WIRE HARNESS CONNECTOR

(4) Position the outboard seat cushion side shield onto the seat cushion frame

(5) Install and tighten the three screws that secure the outboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1.5 N·m (14 in. lbs.).

(6) On models with the ten-way power seat system only, position the power seat and power recliner switch knobs onto the switch stems and push on them firmly and evenly until they snap into place.

(7) Reconnect the battery negative cable.

RECLINER MOTOR

DESCRIPTION

The ten-way power seat option includes an electrically operated seat back recliner mechanism. The only visible evidence of this option is the separate power seat recliner switch control knob that is located on the outboard seat cushion side shield, just behind the other power seat switch control knob. The power seat recliner switch is integral to the ten-way power seat switch unit, but is actuated with a separate switch knob.

The power seat recliner unit is mounted in the place of a seat hinge on the outboard side of the seat (Fig. 20). The upper hinge plate of the power seat recliner mechanism is secured with two screws to the seat back frame and is concealed beneath the seat back trim cover and padding. The lower hinge plate and the motor and drive unit of the power seat recliner mechanism is secured with two screws to the seat cushion frame, and is concealed by the outboard seat cushion side shield.

The power seat recliner cannot be repaired. If the unit is faulty or damaged, it must be replaced. Refer to **Bucket Seat Recliner** in Body for the service procedure.

OPERATION

The power seat recliner includes a reversible electric motor that is secured to the lower hinge plate of the recliner unit. The motor is connected to a gearbox that moves the upper hinge plate of the power seat recliner through a screw-type drive unit. The driver side power seat recliner motor used on models equipped with the optional memory system also has a position potentiometer integral to the motor assembly, which electronically monitors the motor position.

DIAGNOSIS AND TESTING - RECLINER MOTOR

Actuate the power seat recliner switch to move the power seat recliner adjuster in each direction. The power seat recliner adjuster should move in both directions. If the power seat recliner adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power seat recliner adjuster still fails to operate in only one direction, refer to **Power Seat Switch Diagnosis and Testing** in this group. If the power recliner adjuster fails to operate in either direction, perform the following tests. For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Check the power seat circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty power seat circuit breaker.

RECLINER MOTOR (Continued)

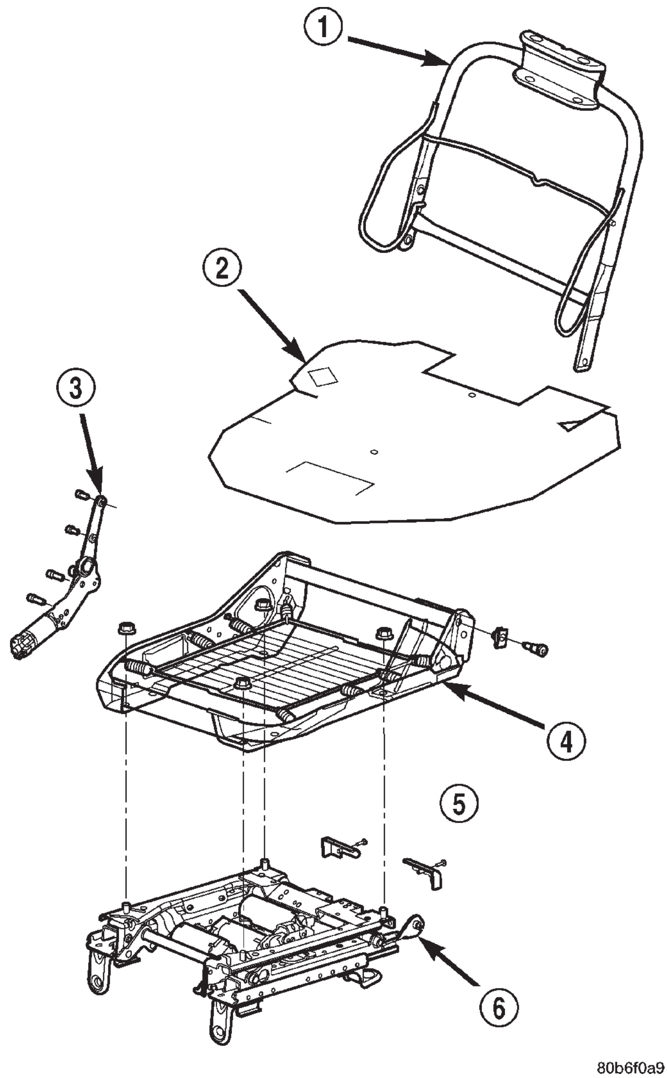


Fig. 20 Power Seat Recliner and Track - Typical

1 - SEAT BACK FRAME
2 - SEAT CUSHION PAD
3 - POWER RECLINER
4 - SEAT CUSHION FRAME
5 - SHIELD
6 - POWER SEAT TRACK ADJUSTER

(2) Check for battery voltage at the power seat circuit breaker in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center as required.

(3) Remove the outboard seat cushion side shield from the seat. Disconnect the seat wire harness connector from the power seat switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the power seat wire harness connector for the power seat switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

(4) Check for continuity between the ground circuit cavity of the power seat wire harness connector for the power seat switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Test the power seat switch. Refer to **Power Seat Switch Diagnosis and Testing** in this group. If the switch tests OK, test the circuits of the power seat wire harness between the power seat recliner adjuster motor and the power seat switch for shorts or opens. If the circuits check OK, replace the faulty power seat recliner unit. If the circuits are not OK, repair the power seat wire harness as required.

POWER SEAT TRACK

DESCRIPTION

Both the six-way and the ten-way power seat options include a single electrically operated power seat track unit located under each front bucket seat (Fig. 21). The power seat track unit replaces the standard equipment manual seat tracks. The lower half of the power seat track is secured at the front with two screws to the floor panel seat cross member, and at the rear with two screws to the floor panel. Four nuts secure the bottom of the seat cushion frame to four studs on the upper half of the power seat track unit.

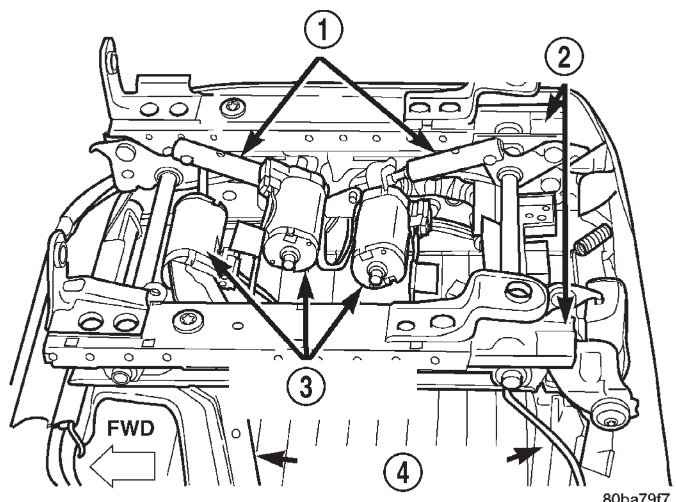


Fig. 21 Power Seat Track - Typical

1 - DRIVE UNITS
2 - LOWER SEAT TRACKS
3 - POWER SEAT MOTORS
4 - SEAT CUSHION FRAME

The power seat track unit cannot be repaired, and is serviced only as a complete unit. If any component in this unit is faulty or damaged, the entire power seat track unit must be replaced. Refer to **Bucket Seat Track Adjuster** in Body for the service procedure.

POWER SEAT TRACK (Continued)

OPERATION

The power seat track unit includes three reversible electric motors that are secured to the upper half of the track unit. Each motor moves the seat adjuster through a combination of worm-drive gearboxes and screw-type drive units. Each of the three driver side power seat track motors used on models equipped with the optional memory system also has a position potentiometer integral to the motor assembly, which electronically monitors the motor position.

The front and rear of the seat are operated by two separate vertical adjustment motors. These motors can be operated independently of each other, tilting the entire seat assembly forward or rearward; or, they can be operated in unison by selecting the proper power seat switch functions, which will raise or lower the entire seat assembly. The third motor is the horizontal adjustment motor, which moves the seat track in the forward and rearward directions.

DIAGNOSIS AND TESTING - POWER SEAT TRACK

Following are tests that will help to diagnose the hard wired components and circuits of the power seat system. However, if the vehicle is also equipped with the optional memory system, these tests may not prove conclusive in the diagnosis of the driver side power seat. In order to obtain conclusive testing of the driver side power seat with the memory system option, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the driver side power seat with the memory system option requires the use of a DRB® scan tool and the proper Diagnostic Procedures manual. The DRB® scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its driver side power seat functions.

Actuate the power seat switch to move all three power seat track adjusters in each direction. The power seat track adjusters should move in each of the selected directions. If a power seat track adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power seat track adjuster still fails to operate in only one direction, refer to **Power Seat Switch Diagnosis and Testing** in this group. If the power seat track adjuster fails to operate in more than one direction, perform the following tests. For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Check the power seat circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty power seat circuit breaker.

(2) Check for battery voltage at the power seat circuit breaker in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center as required.

(3) Remove the outboard seat cushion side shield from the seat. Disconnect the seat wire harness connector from the power seat switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the power seat wire harness connector for the power seat switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

(4) Check for continuity between the ground circuit cavity of the power seat wire harness connector for the power seat switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Test the power seat switch. Refer to **Power Seat Switch Diagnosis and Testing** in this group. If the switch tests OK, test the circuits of the power seat wire harness between the inoperative power seat track adjuster motor and the power seat switch for shorts or opens. If the circuits check OK, replace the faulty power seat track unit. If the circuits are not OK, repair the power seat wire harness as required.

POWER WINDOWS

TABLE OF CONTENTS

POWER WINDOWS

DESCRIPTION

Power operated driver side and passenger side front and rear door windows are standard factory-installed equipment on this model. The power window system allows each of the door windows to be raised or lowered electrically by operating a switch on the trim panel for that door. Additionally, the master switches on the driver side front door trim panel allow all of the windows to be operated from the driver seat position. A power window lockout switch on the driver side front door trim panel will allow the driver to disable all of the passenger door window switches.

The power window system functionally operates when the ignition switch is in the On position. However, a unique feature of this system will allow the power windows to be operated for up to forty-five seconds after the ignition switch is turned to the Off position, or until a front door is opened, whichever occurs first.

An auto-down feature allows the driver side front door window to be lowered all the way, even if the window switch is released. The driver side front door window switch must be depressed in the down direction to a second detent to begin an auto-down event. Depressing the switch again in any direction cancel the auto-down event and begin movement in the direction specified.

This group covers the following components of the power window system:

- Power window switches
- Power window motors.

Certain functions and features of the power window system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect power window system operation are as follows:

- **Body Control Module (BCM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL/CENTRAL TIMER MODUL - DESCRIPTION) for more information.
- **Driver Door Module (DDM)** -(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - DESCRIPTION) for more information.
- **Passenger Door Module (PDM)** - (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - DESCRIPTION) for more information.

This group covers diagnosis and service of only the electrical components in the power window system. For service of mechanical components, such as the regulator, lift plate, window tracks, or glass refer to Body. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pinout information and location views for the various wire harness connectors, splices and grounds. Following are general descriptions of the major components in the power window system.

POWER WINDOWS (Continued)

OPERATION

The power window system includes the Driver Door Module (DDM) and Passenger Door Module (PDM), which are mounted in their respective front door, the rear door power window switches mounted on the rear doors, and the power window motors mounted to the window regulator in each door. The DDM houses four master power window switches, the power window lockout switch and the control logic for the driver side front and rear door power windows. The PDM houses the passenger side front door power window switch and the control logic for the passenger side front and rear door power windows.

When a master power window switch on the DDM is used to operate a passenger side power window, the DDM sends the window switch actuation message to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to move the passenger side power window motors. In addition, when the power window lockout switch in the DDM is actuated to disable power window operation, a lockout message is sent to the PDM over the PCI data bus.

The Body Control Module (BCM) also supports and controls certain features of the power window system. The BCM receives a hard wired input from the ignition switch. The programming in the BCM allows it to process the information from this input and send ignition switch status messages to the DDM and the PDM over the PCI data bus. The DDM and PDM use this information and hard wired inputs from the front door ajar switches to control the lighting of the power window switch lamps, and to control the operation of the power window after ignition-off feature.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window system.

DIAGNOSIS AND TESTING - POWER WINDOWS

Following are tests that will help to diagnose the hard wired components and circuits of the power window system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power window system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power window system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power window system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the power window motors are being sent the proper hard wired outputs by the door modules for them to perform their power window system functions.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

ALL WINDOWS INOPERATIVE

(1) Check the operation of the power lock switch on the driver side front door. If all of the doors lock and unlock, but none of the power windows operate, use a DRB scan tool and the proper Diagnostic Procedures manual to check the Body Control Module (BCM), the Driver Door Module (DDM) and the PCI data bus for proper operation. If not OK, go to Step 2.

(2) Check the operation of the power lock switch on the passenger side front door. If the passenger doors lock and unlock, but the driver side front door does not, go to Step 5. If all of the power locks and power windows are inoperative from both front doors, go to Step 3.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the battery as required.

(5) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver side front door. Disconnect the 15-way door wire harness connector from the DDM connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the DDM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the DDM. If OK, replace the faulty DDM. If not OK, repair the open fused B(+) circuit to the fuse in the PDC as required.

POWER WINDOWS (Continued)

PASSENGER SIDE FRONT AND REAR WINDOWS INOPERATIVE

If the driver side front and rear power windows operate, but the passenger side front and rear do not, use a DRB scan tool and the proper Diagnostic Procedures manual to check the PCI data bus for proper operation.

ONE WINDOW INOPERATIVE

The window glass and regulator mechanism must be free to slide up and down for the power window motor to function properly. If the window glass and regulator is not free to move up and down, the motor will overload and trip the integral circuit breaker. To determine if the window glass and regulator are free, disconnect the regulator plate from the glass. Then slide the window up and down by hand.

There is an alternate method to check if the window glass and regulator mechanism is free. Position the glass between the up and down stops. Then, shake the glass in the door. Check that the glass can be moved slightly from side to side, front to rear, and up and down. Then check that the glass is not bound tight in the tracks.

If the window glass and regulator mechanism is free, refer to **Door Module** in Electrical, Power Windows. If the glass is not free, inspect the window glass mounting and operating hardware for damage or improperly installed components. Refer to **Body** to check for proper installation or damage of the window glass mounting and operating hardware.

DOOR MODULE

NOTE: The following tests may not prove conclusive in the diagnosis of this component. The most reliable, efficient, and accurate means to diagnose this component requires the use of a DRB scan tool and the proper Diagnostic Procedures manual.

If the problem being diagnosed is a rear door window that does not operate from the rear door switch, but does operate from the master switch on the driver side front door, (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - DIAGNOSIS AND TESTING). If the problem is a passenger side front or rear window that operates from the switch on that door, but does not operate from the master switch on the driver side front door, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the circuitry of both door modules and the PCI data bus. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect and isolate the battery negative cable. Remove the trim panel from the front door, but do not disconnect the door wire harness connectors from the door module. Go to Step 2.

(2) Check the 15-way door wire harness connector for the door module to see that it is fully seated in the door module connector receptacle. If OK, go to Step 3. If not OK, properly connect the 15-way door wire harness connector for the door module to the door module connector receptacle.

(3) Disconnect the 15-way door wire harness connector from the door module connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the door module and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the door module. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center (PDC) as required.

(5) If the inoperative window is on a front door, go to Step 6. If the inoperative window is on a rear door go to Step 9.

(6) Disconnect and isolate the battery negative cable. Disconnect the door wire harness connector from the inoperative power window motor wire harness connector. Check for continuity between the front window driver up circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the front window driver down circuit. In each case there should be no continuity. If OK, go to Step 7. If not OK, repair the shorted front window driver up or down circuit as required.

(7) Check for continuity between the front window driver up circuit cavities of the 15-way door wire harness connector for the door module and the door wire harness connector for the power window motor. Repeat the check for the front window driver down circuit. In each case there should be continuity. If OK, go to Step 8. If not OK, repair the open front window driver up or down circuit as required.

(8) Reconnect the 15-way door wire harness connector back into the door module connector receptacle. Connect the battery negative cable. Connect the probes of a reversible DC digital voltmeter to the door wire harness connector for the power window motor. Observe the voltmeter while actuating the switch for that window in the up and down directions. There should be battery voltage for as long as the switch is held in both the up and down positions,

POWER WINDOWS (Continued)

and no voltage in the neutral position. If OK,(Refer to 8 - ELECTRICAL/POWER WINDOWS/WINDOW MOTOR - DIAGNOSIS AND TESTING). If not OK, replace the faulty door module.

(9) Check the rear door power window switch continuity. (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - DIAGNOSIS AND TESTING). If OK, go to Step 10. If not OK, replace the faulty rear door power window switch.

(10) Disconnect and isolate the battery negative cable. Reconnect the door wire harness connector to the rear door power window switch. Disconnect the door wire harness connector from the inoperative power window motor wire harness connector. Check for continuity between the rear window driver up circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the rear window driver down circuit. In each case there should be no continuity. If OK, go to Step 11. If not OK, repair the shorted rear window driver up or down circuit as required.

(11) Check for continuity between the rear window driver up circuit cavities of the 15-way door wire harness connector for the door module and the power window motor wire harness connector. Repeat the check for the rear window driver down circuit. In each case there should be continuity. If OK, go to Step 12. If not OK, repair the open rear window driver up or down circuit as required.

NOTE: The door module feeds battery current to both terminals of the rear door power window motors when the power window lockout switch is in the Unlock position, until the master window switch on the driver side front door is actuated. The door module feeds ground to both terminals of the rear door power window motor when the power window lockout switch is in the Lock position, until the master window switch on the driver side front door is actuated.

(12) Reconnect the 15-way door wire harness connector for the door module to the door module connector receptacle. Connect the battery negative cable. Check for battery voltage at each cavity in the door wire harness connector for the power window motor. Each cavity should have battery voltage when the power window switch is in the neutral position. Each cavity should also have battery voltage in one other switch position, either up or down, and zero volts with the switch in the opposite position. If OK, (Refer to 8 - ELECTRICAL/POWER WINDOWS/WINDOW MOTOR - DIAGNOSIS AND TESTING). If not OK, replace the faulty door module.

POWER WINDOW SWITCH

DESCRIPTION

The power window motors are controlled by a two-way momentary switch mounted on the trim panel of each passenger door, and four two-way momentary switches on the driver side front door trim panel. The driver side front door trim panel also has a two-position power window lockout switch. Each power window switch, except the lockout switch, is illuminated by a Light-Emitting Diode (LED) that is integral to the switch paddle.

The front door power window switches and the power window lockout switch are integral to the Driver Door Module (DDM) and Passenger Door Module (PDM). The front door power window switches and their lamps cannot be adjusted or repaired and, if faulty or damaged, the entire DDM or PDM unit must be replaced. The rear door power window switches and their lamps cannot be adjusted or repaired but, if faulty or damaged, only the affected rear door power window switch must be replaced. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - REMOVAL).

OPERATION

The front door power window switches provide an up or down (or lock and unlock signal in the case of the lockout switch) to the door module circuitry. The Driver Door Module (DDM) circuitry controls the output to the driver side front and rear door power window motors, and supplies electrical current as required for the stand-alone operation of the driver side rear door power window switch. The Passenger Door Module (PDM) circuitry controls the output to the passenger side front and rear door power window motors, and supplies electrical current as required for the stand-alone operation of the passenger side rear door power window switch.

When a DDM-integrated master power window switch for a passenger side window is actuated, or when the power window lockout switch is actuated to disable the passenger door power windows, the DDM circuitry sends a message to the PDM over the Programmable Communications Interface (PCI) data bus to control the output to that power window motor(s).

The power window switch for the driver side front door power window has two detent positions in the Down direction. The first detent provides normal power window down operation. If this switch is depressed to the second detent, the Auto Down circuitry of the DDM is activated. The Auto-Down circuitry will automatically move the driver side front door window to its fully lowered position, even if the power window switch is released. The Auto-Down

POWER WINDOW SWITCH (Continued)

event will be automatically cancelled and the window movement will be stopped if the DDM circuitry detects a second input from the driver side front door power window switch, in either direction.

Each power window switch, except the lockout switch, is illuminated by a Light-Emitting Diode (LED) when the ignition switch is turned to the On position. However, when the lockout switch is placed in the Lock position, the LED for the locked-out front and rear passenger door power window switches is turned off.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window switches.

DIAGNOSIS AND TESTING - POWER WINDOW SWITCH

The diagnosis found here applies only to the rear door power window switches. If the problem being diagnosed is an inoperative power window switch illumination lamp, but the power window switch operates as designed, replace the faulty rear door power window switch **(verify the power lockout switch is not actuated)**. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power window switch from the rear door trim panel. (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - REMOVAL).

(3) Check the rear door power window switch continuity as shown in the Rear Door Power Window Switch Continuity chart (Fig. 1). If OK, (Refer to 8 - ELECTRICAL/POWER WINDOWS/WINDOW MOTOR - DIAGNOSIS AND TESTING). If not OK, replace the faulty rear door power window switch.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear door. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL) for the procedures.

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the sides of the switch receptacle on the back of the rear door trim panel away from the perimeter of the power window switch to release the switch from the receptacle (Fig. 2).

(4) Remove the power window switch from the rear door trim panel switch receptacle.

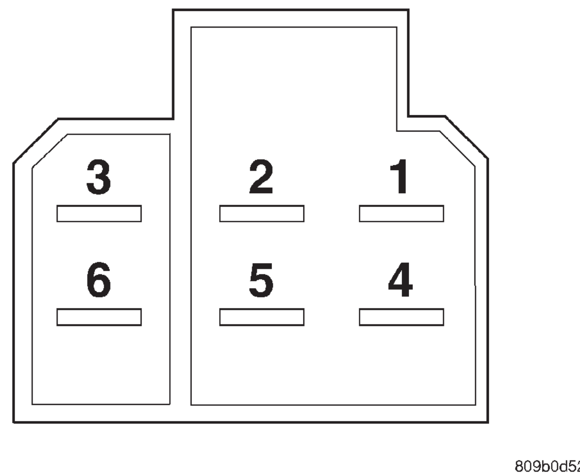


Fig. 1 Rear Door Power Window Switch Continuity

SWITCH POSITION	CONTINUITY BETWEEN
LED	3 AND 6
OFF	1 AND 2
OFF	4 AND 5
FORWARD	1 AND 2
FORWARD	5 AND 6
REARWARD	2 AND 6
REARWARD	4 AND 5

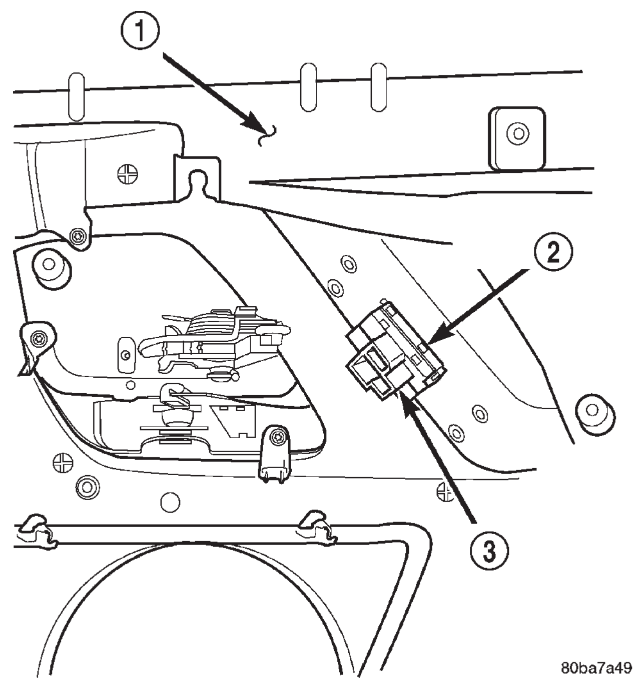


Fig. 2 Rear Door Power Window Switch Remove/ Install

1 - REAR DOOR TRIM PANEL
2 - TRIM PANEL RECEPTACLE
3 - POWER WINDOW SWITCH

POWER WINDOW SWITCH (Continued)

INSTALLATION

(1) Position the power window switch to the rear door trim panel switch receptacle.

(2) Press firmly and evenly on the back of the power window switch until it snaps into rear door trim panel switch receptacle.

(3) Install the trim panel onto the rear door. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION) for the procedures.

(4) Reconnect the battery negative cable.

WINDOW MOTOR

DESCRIPTION

Power operated front and rear door windows are standard equipment on this model. Each door has a permanent magnet reversible electric motor with an integral right angle gearbox mechanism that operates the window regulator. In addition, each power window motor is equipped with an integral self-resetting circuit breaker to protect the motor from overloads.

The power window motor gearbox housing is secured to the window regulator drum housing with screws. The window regulators used in all four doors are single vertical post cable-and-drum type. A molded plastic slider guided by the post is driven by the regulator cables. The slider raises and lowers the window glass through a steel lift plate attachment. Front and rear glass channels within each door guide and stabilize each end of the glass.

The power window motor and gearbox assembly cannot be repaired and, if faulty or damaged, the entire power window motor and gearbox unit must be replaced. The window regulators are available for service. (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - REMOVAL) for the regulator service procedures.

OPERATION

A positive and negative battery connection to the two motor terminals will cause the power window motor to rotate in one direction. Reversing the current through these same two connections will cause the motor to rotate in the opposite direction.

When the power window motor operates, it rotates the regulator cable drum through its gearbox. The window regulator cable drum is connected through two cables to the plastic slider on the vertical post. As the cable drum rotates, it lets cable out on one side of the drum, and takes cable in on the other side of the drum. The changes in cable length move the slider up or down the vertical post, raising or lowering the window glass.

If the window regulator or window glass bind, encounter obstructions, or reach their travel limits it overloads the power window motor. The overloading condition causes the power window motor self-resetting circuit breaker to open, which stops the motor from running.

DIAGNOSIS AND TESTING - WINDOW MOTOR

Before you proceed with this diagnosis, confirm proper switch operation. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DRIVER DOOR MODULE - OPERATION) or (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - OPERATION). For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Remove the trim panel from the door with the inoperative power window. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL) for the procedures.

(2) Disconnect the door wire harness connector from the power window motor wire harness connector. Apply battery current to one cavity of the power window motor wire harness connector, and apply ground to the other cavity of the connector. The power window motor should operate in one direction. Remember, if the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, go to Step 3. If not OK, replace the faulty power window motor.

(3) Reverse the battery and ground connections to the two cavities of the power window motor wire harness connector. The power window motor should now operate in the other direction. Remember, if the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, go to Step 4. If not OK, replace the faulty power window motor.

(4) If the power window motor operates in both directions, check the operation of the window glass and regulator mechanism through its complete up and down travel. There should be no binding or sticking of the window glass or regulator mechanism through the entire travel range. If not OK, (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - REMOVAL) to check for proper installation or damage of the window glass mounting and operating hardware.

WINDOW MOTOR (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the window regulator from the door. (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - REMOVAL) for the procedures.

(3) Place the window regulator on a suitable work surface and remove the screws that secure the power window motor to the window regulator.

(4) Remove the power window motor from the window regulator.

INSTALLATION

(1) Position the power window motor onto the window regulator.

(2) Install and tighten the screws that secure the power window motor to the window regulator. Tighten the screws to 9 N·m (80 in. lbs.).

(3) Install the window regulator onto the door. (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - INSTALLATION) or(Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - INSTALLATION) for the procedures.

(4) Reconnect the battery negative cable.

RESTRAINTS

TABLE OF CONTENTS

RESTRAINTS

DESCRIPTION

An occupant restraint system is standard factory-installed safety equipment on this model. Available occupant restraints for this model include both active and passive types. Active restraints are those which require the vehicle occupants to take some action to employ, such as fastening a seat belt; while passive restraints require no action by the vehicle occupants to be employed (Fig. 1).

RESTRAINTS (Continued)

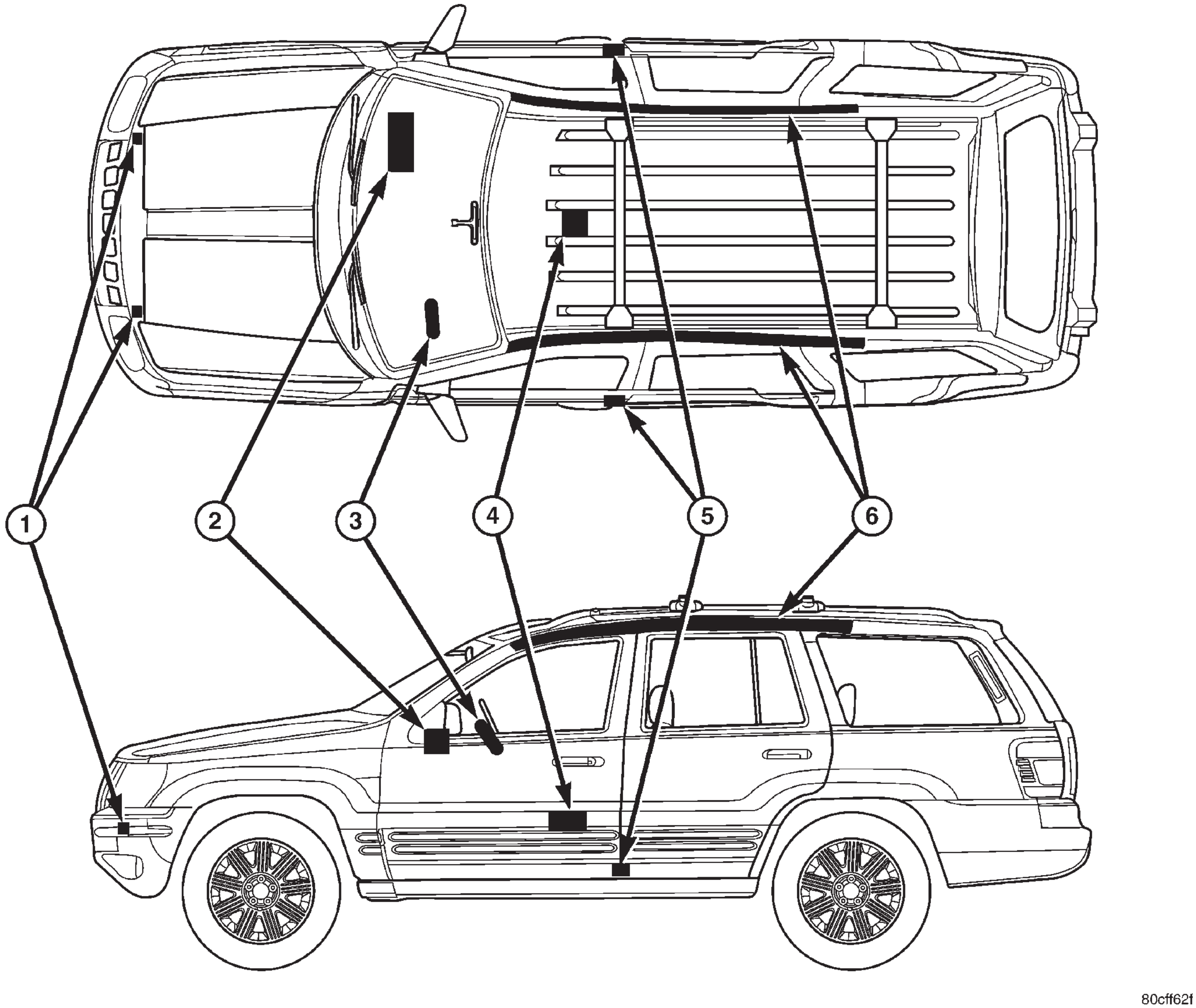


Fig. 1 Supplemental Restraints

1 - FRONT IMPACT SENSOR (2)
2 - PASSENGER AIRBAG
3 - DRIVER AIRBAG
4 - AIRBAG CONTROL MODULE
5 - SIDE IMPACT SENSOR (2)
6 - SIDE CURTAIN AIRBAG (2)

RESTRAINTS (Continued)

ACTIVE RESTRAINTS

The active restraints for this model include:

• **Front Seat Belts** - Both front seating positions are equipped with three-point seat belt systems employing a lower B-pillar mounted inertia latch-type retractor, height-adjustable upper B-pillar mounted turning loops, a fixed lower seat belt anchor secured to the lower B-pillar, and a fixed end-release seat belt buckle secured to the side of the floor panel transmission tunnel. Both front seat belt buckles include an integral Hall-effect seat belt switch that detects whether its respective seat belt has been fastened.

• **Rear Seat Belts** - Both outboard rear seating positions are equipped with three-point seat belt systems. The outboard seating position belts employ a lower C-pillar mounted inertia latch-type retractor, height-adjustable upper C-pillar mounted turning loops, and a fixed lower seat belt anchor secured to the floor panel. The center rear seating position of vehicles manufactured for sale in North America has a lap belt that is anchored to the rear floor panel with the right outboard seat belt buckle. Vehicles manufactured for sale outside of North America are equipped with a three-point seat belt in the rear seat center seating position. This seat belt has an inertia latch-type retractor that is integral to the rear seat back panel, and the lower belt anchor is secured to the rear floor panel with the right outboard seat belt buckle. A cable from the seat back latch locks the center belt retractor spool unless the seat back is fully latched. All three rear seat belts have fixed end-release seat belt buckles secured to the rear floor panel, a single buckle unit on the right side and a double buckle unit on the left side.

• **Child Seat Tether Anchors** - All vehicles are equipped with three, fixed-position, child seat upper tether anchors and two lower anchors. Two upper anchors are integral to the back of the right rear seat back panel, and one is integral to the left rear seat back panel. The two lower anchors are integral to the outboard rear seat back brackets.

PASSIVE RESTRAINTS

The passive restraints available for this model include the following:

• **Dual Front Airbags** - Multistage driver and front passenger airbags are available for this model. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by the "SRS - AIRBAG" logo molded into the driver airbag trim cover in the center of the steering wheel and also into the passenger airbag door area of the instrument panel top pad above the glove box (Fig. 2). Vehicles with the airbag system can also be identified by the airbag indicator, which will illuminate in the instrument cluster for about seven seconds as a bulb test each time the ignition switch is turned to the On position.

• **Side Curtain Airbags** - Optional side curtain airbags are available for this model when it is also equipped with dual front airbags. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by a molded identification trim button with the "SRS - AIRBAG" logo located on the headliner above each B-pillar (Fig. 2).

Fig. 2 SRS Logo

The supplemental restraint system includes the following major components, which are described in further detail elsewhere in this service information:

• **Airbag Control Module** - The Airbag Control Module (ACM) is also sometimes referred to as the Occupant Restraint Controller (ORC). The ACM is located on a mount on the floor panel transmission tunnel near the park brake release mechanism, under the center floor console.

• **Airbag Indicator** - The airbag indicator is integral to the ElectroMechanical Instrument Cluster (EMIC), which is located on the instrument panel in front of the driver.

• **Clockspring** - The clockspring is located near the top of the steering column, directly beneath the steering wheel.

• **Driver Airbag** - The driver airbag is located in the center of the steering wheel, beneath the driver airbag trim cover.

• **Driver Knee Blocker** - The driver knee blocker is a structural unit secured to the back side of and integral to the instrument panel steering column opening cover.

• **Front Impact Sensor** - Two front impact sensors are used on vehicles equipped with dual front airbags, one left side and one right side. One sensor is located on a bracket on the lower inboard side of each vertical member of the radiator support.

RESTRAINTS (Continued)

- **Passenger Airbag** - The passenger airbag is located on the instrument panel, beneath the instrument panel top pad and above the glove box on the passenger side of the vehicle.
- **Passenger Knee Blocker** - The passenger knee blocker is a structural reinforcement that is integral to and concealed within the glove box door.
- **Side Impact Sensor** - Two side impact sensors are used on vehicles with the optional side curtain airbags, one left side and one right side. One sensor is located behind the B-pillar trim near the base of each B-pillar.
- **Side Curtain Airbag** - In vehicles equipped with this option, a side curtain airbag is located on each inside roof side rail above the headliner, and extends from the A-pillar to just beyond the C-pillar.

The ACM and the EMIC each contain a central processing unit and programming that allow them to communicate with each other using the Programmable Communication Interface (PCI) data bus network. This method of communication is used by the ACM for control of the airbag indicator on all models equipped with dual front airbags. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ COMMUNICATION - DESCRIPTION).

Hard wired circuitry connects the supplemental restraint system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system, and to the supplemental restraint system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

ACTIVE RESTRAINTS

The primary passenger restraints in this or any other vehicle are the standard equipment factory-installed seat belts. Seat belts are referred to as an active restraint because the vehicle occupants are required to physically fasten and properly adjust these restraints in order to benefit from them. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed active restraints.

PASSIVE RESTRAINTS

The passive restraints system is referred to as a supplemental restraint system because they were designed and are intended to enhance the protection for the vehicle occupants of the vehicle **only** when used in conjunction with the seat belts. They are referred to as passive systems because the vehicle occupants are not required to do anything to make them operate; however, the vehicle occupants must be wearing their seat belts in order to obtain the maximum safety benefit from the factory-installed supplemental restraint systems.

The supplemental restraint system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Airbag Control Module (ACM). An airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the airbag indicator is turned on or off by the ACM to indicate the status of the supplemental restraint system. If the airbag indicator comes on at any time other than during the bulb test, it indicates that there is a problem in the supplemental restraint system electrical circuits. Such a problem may cause airbags not to deploy when required, or to deploy when not required.

Deployment of the supplemental restraints depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the impact sensors. When an impact is severe enough, the microprocessor in the ACM signals the inflator unit of the airbag module to deploy the airbag. During a frontal vehicle impact, the knee blockers work in concert with properly fastened and adjusted seat belts to restrain both the driver and the front seat passenger in the proper position for an airbag deployment. The knee blockers also absorb and distribute the crash energy from the driver and the front seat passenger to the structure of the instrument panel.

Typically, the vehicle occupants recall more about the events preceding and following a collision than they have of an airbag deployment itself. This is because the airbag deployment and deflation occur so rapidly. In a typical 48 kilometer-per-hour (30 mile-per-hour) barrier impact, from the moment of impact until the airbags are fully inflated takes about 40 milliseconds. Within one to two seconds from the moment of impact, the airbags are almost entirely deflated. The times cited for these events are approximations, which apply only to a barrier impact at the given speed. Actual times will vary somewhat,

RESTRAINTS (Continued)

depending upon the vehicle speed, impact angle, severity of the impact, and the type of collision.

When the ACM monitors a problem in any of the airbag system circuits or components, it stores a fault code or Diagnostic Trouble Code (DTC) in its memory circuit and sends an electronic message to the EMIC to turn on the airbag indicator. Proper testing of the airbag system components, the Programmable Communication Interface (PCI) data bus, the data bus message inputs to and outputs from the EMIC or the ACM, as well as the retrieval or erasure of a DTC from the ACM or EMIC requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed passive restraints.

WARNING - RESTRAINT SYSTEM

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: AN AIRBAG INFLATOR UNIT MAY CONTAIN SODIUM AZIDE AND POTASSIUM NITRATE. THESE MATERIALS ARE POISONOUS AND EXTREMELY FLAMMABLE. CONTACT WITH ACID, WATER, OR HEAVY METALS MAY PRODUCE HARMFUL AND IRRITATING GASES (SODIUM HYDROXIDE IS FORMED IN THE PRESENCE OF MOISTURE) OR COMBUSTIBLE COMPOUNDS. AN AIRBAG INFLATOR UNIT MAY ALSO CONTAIN A GAS CANISTER PRESSURIZED TO OVER 2500 PSI. DO NOT ATTEMPT TO DISMANTLE AN AIRBAG UNIT OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURES EXCEEDING 93° C (200° F).

WARNING: REPLACE ALL RESTRAINT SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WARNING: THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE RESTRAINT SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE RESTRAINT SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

WARNING: WHEN A STEERING COLUMN HAS AN AIRBAG UNIT ATTACHED, NEVER PLACE THE COLUMN ON THE FLOOR OR ANY OTHER SURFACE WITH THE STEERING WHEEL OR AIRBAG UNIT FACE DOWN.

DIAGNOSIS AND TESTING - SUPPLEMENTAL RESTRAINT SYSTEM

Proper diagnosis and testing of the supplemental restraint system components, the PCI data bus, the data bus message inputs to and outputs from the ElectroMechanical Instrument Cluster (EMIC) or the Airbag Control Module (ACM), as well as the retrieval or erasure of a Diagnostic Trouble Code (DTC) from the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

RESTRAINTS (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

STANDARD PROCEDURE

STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS

At no time should any source of electricity be permitted near the inflator on the back of a non-deployed airbag. When carrying a non-deployed airbag, the trim cover or airbag cushion side of the unit should be pointed away from the body to minimize injury in the event of an accidental deployment. If the airbag unit is placed on a bench or any other surface, the trim cover or airbag cushion side of the unit should be face up to minimize movement in the event of an accidental deployment. In addition, the supplemental restraint system should be disarmed whenever any steering wheel, steering column, driver airbag, passenger airbag, front impact sensor, side impact sensor, side curtain airbag, or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury.

All damaged, faulty or non-deployed airbags which are replaced on vehicles are to be handled and disposed of properly. If an airbag unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Dispose of all non-deployed and deployed airbags in a manner consistent with state, provincial, local and federal regulations.

SUPPLEMENTAL RESTRAINT STORAGE

Airbags must be stored in their original, special container until they are used for service. Also, they must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store any airbag on a surface with its trim cover or airbag cushion side facing up, to minimize movement in case of an accidental deployment.

STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT

Any vehicle which is to be returned to use following a supplemental restraint deployment, must have the deployed restraints replaced. In addition, if the driver airbag has been deployed, the clockspring must be replaced. If the passenger airbag is deployed, the instrument panel top pad must be replaced. If a side curtain airbag has been deployed, the complete airbag unit, the headliner, as well as the upper A, B, C and D-pillar trim must be replaced. These components are not intended for reuse and will be damaged or weakened as a result of a supplemental restraint deployment, which may or may not be obvious during a visual inspection.

The passenger airbag mounting points on the instrument panel structural duct must be closely inspected for damage, and the instrument panel assembly replaced if structural duct damage is evident. On vehicles with an optional sunroof, the sunroof drain tubes and hoses must be closely inspected following a side curtain airbag deployment. It is also critical that the mounting surfaces and/or mounting brackets for the front and side impact sensors be closely inspected and restored to their original conditions following any vehicle impact damage. Because the ACM and each impact sensor are used by the supplemental restraint system to monitor or confirm the direction and severity of a vehicle impact, improper orientation or insecure fastening of these components may cause airbags not to deploy when required, or to deploy when not required.

All other vehicle components should be closely inspected following any supplemental restraint deployment, but are to be replaced only as required by the extent of the visible damage incurred.

AIRBAG SQUIB STATUS

Multistage airbags with multiple initiators (squibs) must be checked to determine that all squibs were used during the deployment event. The driver and passenger airbags in this model are deployed by electrical signals generated by the Airbag Control Module (ACM) through the driver or passenger squib 1 and squib 2 circuits to the two initiators in the airbag inflators. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used due to an airbag system fault; therefore, it is always necessary to confirm that both initiators have been used in order to avoid the improper handling or disposal of potentially live pyrotechnic or hazardous materials. The

RESTRAINTS (Continued)

following procedure should be performed using a DRBIII® scan tool to verify the status of both airbag squibs before either deployed airbag is removed from the vehicle for disposal.

CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are sure of complete deployment. Refer to the Hazardous Substance Control System for proper disposal procedures. Dispose of all non-deployed and deployed airbags in a manner consistent with state, provincial, local, and federal regulations.

(1) Be certain that the DRBIII® scan tool contains the latest version of the proper DRBIII® software. Connect the DRBIII® to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, outboard of the steering column.

(2) Turn the ignition switch to the On position.

(3) Using the DRBIII®, read and record the active (current) Diagnostic Trouble Code (DTC) data.

Using the active DTC information, refer to the **Airbag Squib Status** table to determine the status of both driver and/or passenger airbag squibs.

AIRBAG SQUIB STATUS

IF the Active DTC is:	Conditions	Squib Status
Driver or Passenger Squib 1 open	**AND** the stored DTC minutes for both Driver or Passenger squibs are within 15 minutes of each other	Both Squib 1 and 2 were used.
Driver or Passenger Squib 2 open		
Driver or Passenger Squib 1 open	**AND** the stored DTC minutes for Driver or Passenger Squib 2 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 1 by 15 minutes or more	Squib 1 was used; Squib 2 is live.
Driver or Passenger Squib 2 open		
Driver or Passenger Squib 1 open	**AND** the stored DTC minutes for Driver or Passenger Squib 1 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 2 by 15 minutes or more	Squib 1 is live; Squib 2 was used.
Driver or Passenger Squib 2 open		
Driver or Passenger Squib 1 open	**AND** Driver or Passenger Squib 2 open is NOT an active code	Squib 1 was used; Squib 2 is live.
Driver or Passenger Squib 2 open	**AND** Driver or Passenger Squib 1 open is NOT an active code	Squib 1 is live; Squib 2 was used.

If none of the Driver or Passenger Squib 1 or 2 open are active codes, the status of the airbag squibs is unknown. In this case the airbag should be handled and disposed of as if the squibs were both live.

CLEANUP PROCEDURE

Following a supplemental restraint deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge that initiates the propellant used to deploy a supplemental restraint. However, this residue may also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the inert gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be sure to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup (Fig. 3).

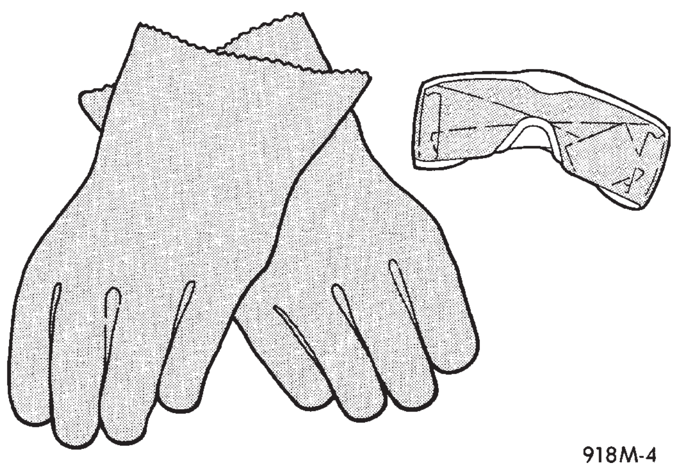


Fig. 3 Wear Safety Glasses and Rubber Gloves - Typical

RESTRAINTS (Continued)

WARNING: IF YOU EXPERIENCE SKIN IRRITATION DURING CLEANUP, RUN COOL WATER OVER THE AFFECTED AREA. ALSO, IF YOU EXPERIENCE IRRITATION OF THE NOSE OR THROAT, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

(1) Begin the cleanup by using a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on a non-cleaned area.

(2) Be certain to vacuum the heater and air conditioning outlets as well (Fig. 4). Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets.

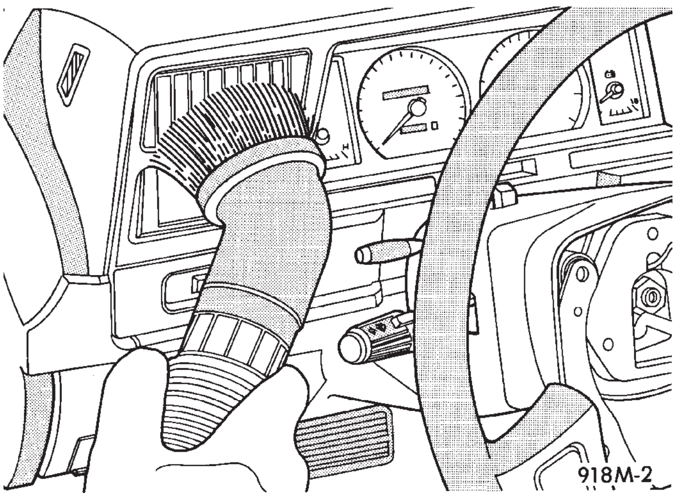


Fig. 4 Vacuum Heater and A/C Outlets - Typical

CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are sure of complete deployment. Refer to AIRBAG SQUIB STATUS . Refer to the Hazardous Substance Control System for proper disposal procedures. Dispose of all non-deployed and deployed airbags in a manner consistent with state, provincial, local, and federal regulations.

(3) Next, remove the deployed supplemental restraints from the vehicle. Refer to the appropriate service removal procedures.

(4) You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

STANDARD PROCEDURE - VERIFICATION TEST

The following procedure should be performed using a DRBIII® scan tool to verify proper supplemental restraint system operation following the service or replacement of any supplemental restraint system component.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) During the following test, the battery negative cable remains disconnected and isolated, as it was during the airbag component removal and installation procedures.

(2) Be certain that the DRBIII® scan tool contains the latest version of the proper DRBIII® software. Connect the DRBIII® to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, outboard of the steering column (Fig. 5).

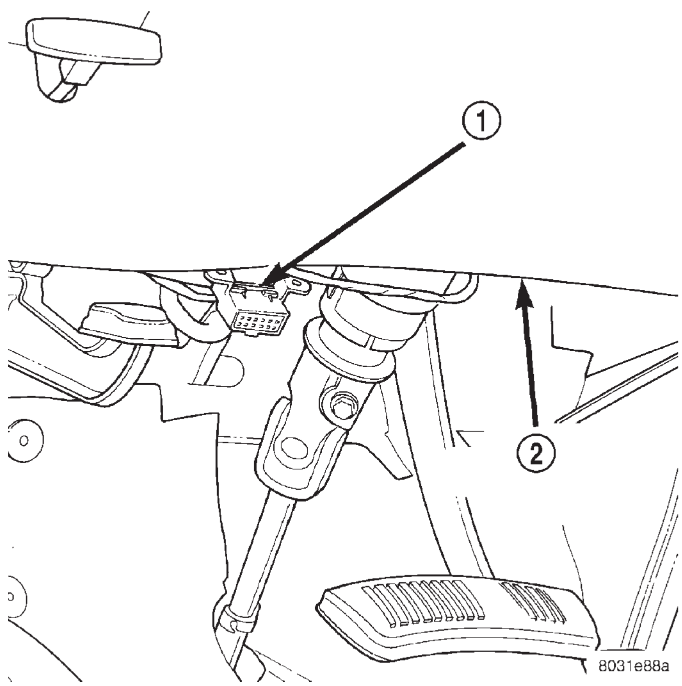


Fig. 5 16-Way Data Link Connector - Typical

1 - 16–WAY DATA LINK CONNECTOR
2 - BOTTOM OF INSTRUMENT PANEL

(3) Turn the ignition switch to the On position and exit the vehicle with the DRBIII® scan tool.

RESTRAINTS (Continued)

(4) Check to be certain that nobody is in the vehicle, then reconnect the battery negative cable.

(5) Using the DRBIII®, read and record the active (current) Diagnostic Trouble Code (DTC) data.

(6) Next, use the DRBIII® to read and record any stored (historical) DTC data.

(7) If any DTC is found in Step 5 or Step 6, refer to the appropriate diagnostic information.

(8) Use the DRBIII® to erase the stored DTC data. If any problems remain, the stored DTC data will not erase. Refer to the appropriate diagnostic information to diagnose any stored DTC that will not erase. If the stored DTC information is successfully erased, go to Step 9.

(9) Turn the ignition switch to the Off position for about fifteen seconds, and then back to the On position. Observe the airbag indicator in the instrument cluster. It should light for six to eight seconds, and then go out. This indicates that the supplemental restraint system is functioning normally and that the repairs are complete. If the airbag indicator fails to light, or lights and stays on, there is still an active supplemental restraint system fault or malfunction. Refer to the appropriate diagnostic information to diagnose the problem.

AIRBAG CONTROL MODULE

DESCRIPTION

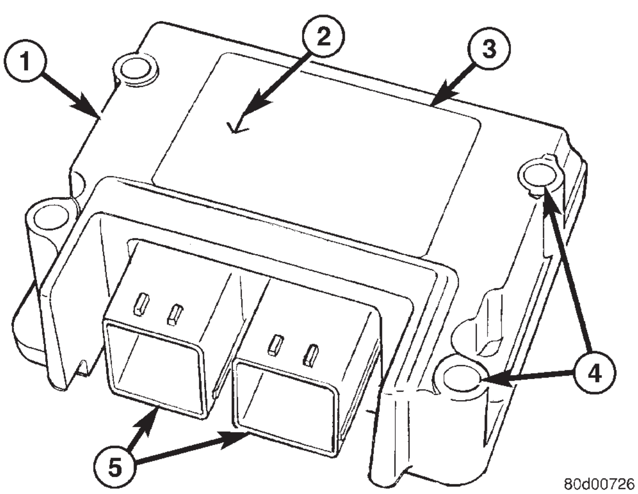


Fig. 6 Airbag Control Module

1 - AIRBAG CONTROL MODULE
2 - ORIENTATION ARROW
3 - LABEL
4 - MOUNTING HOLES (4)
5 - CONNECTOR RECEPTACLE (2)

The Airbag Control Module (ACM) is also sometimes referred to as the Occupant Restraint Controller (ORC) (Fig. 6). The ACM is concealed underneath the center floor console, where it is secured by four screws to a stamped steel mounting bracket welded onto the top of the floor panel transmission tunnel just forward of the park brake mechanism in the passenger compartment of the vehicle.

Concealed within a hollow in the center of the die cast aluminum ACM housing is the electronic circuitry of the ACM which includes a microprocessor, an electronic impact sensor, an electronic safing sensor, and an energy storage capacitor. A stamped metal cover plate is secured to the bottom of the ACM housing with four screws to enclose and protect the internal electronic circuitry and components. A printed label on the top of the ACM housing provides a visual verification of the proper orientation of the unit, and should always be pointed toward the front of the vehicle.

Two molded plastic electrical connector receptacles exit the forward side of the ACM housing. These two receptacles connect the ACM to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness, and a dedicated take out and connector of the airbag overlay wire harness. For vehicles equipped with the optional side curtain airbags, both ACM connector receptacles are black in color and the ACM contains a second bi-directional safing sensor for the side airbags. For vehicles not equipped with the optional side curtain airbags, the ACM connector receptacles are both gray.

The impact sensor and safing sensor internal to the ACM are calibrated for the specific vehicle, and are only serviced as a unit with the ACM. The ACM cannot be repaired or adjusted and, if damaged or faulty, it must be replaced.

OPERATION

The microprocessor in the Airbag Control Module (ACM) contains the supplemental restraint system logic circuits and controls all of the supplemental restraint system components. The ACM uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the DRBIII® scan tool using the Programmable Communications Interface (PCI) data bus network. This method of communication is used for control of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and for supplemental restraint system diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

AIRBAG CONTROL MODULE (Continued)

The ACM microprocessor continuously monitors all of the supplemental restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends electronic messages to the EMIC over the PCI data bus to turn on the airbag indicator. An active fault only remains for the duration of the fault or in some cases the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ACM. For some DTCs, if a fault does not recur for a number of ignition cycles, the ACM will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

The ACM receives battery current through two circuits, on a fused ignition switch output (run) circuit through a fuse in the Junction Block (JB), and on a fused ignition switch output (start-run) circuit through a second fuse in the JB. The ACM is grounded through a ground circuit and take out of the instrument panel floor wire harness. This take out has a single eyelet terminal connector secured by a nut to a ground stud located behind the ACM mount on the floor panel transmission tunnel. These connections allow the ACM to be operational whenever the ignition switch is in the Start or On positions. The ACM also contains an energy-storage capacitor. When the ignition switch is in the Start or On positions, this capacitor is continually being charged with enough electrical energy to deploy the airbags for up to one second following a battery disconnect or failure. The purpose of the capacitor is to provide backup supplemental restraint system protection in case there is a loss of battery current supply to the ACM during an impact.

Two sensors are contained within the ACM, an electronic impact sensor and a safing sensor. The ACM also monitors inputs from two remote front impact sensors located on brackets on the inboard sides of the right and left vertical members of the radiator support near the front of the vehicle. The electronic impact sensors are accelerometers that sense the rate of vehicle deceleration, which provide verification of the direction and severity of an impact. On models equipped with optional side curtain airbags, the ACM also monitors inputs from two remote side impact sensors located near the base of both the left and right inner B-pillars to control the deployment of the side curtain airbag units.

The safing sensor is an electronic accelerometer sensor within the ACM that provides an additional logic input to the ACM microprocessor. The safing sensor is used to verify the need for an airbag deployment by detecting impact energy of a lesser magnitude than that of the primary electronic impact sensors, and must exceed a safing threshold in order for the airbags to deploy. The ACM also monitors a Hall effect-type seat belt switch located in the buckle of each front seat belt to determine whether the seatbelts are buckled, and provides an input to the EMIC over the PCI data bus to control the seatbelt indicator operation based upon the status of the driver side front seat belt switch. Vehicles with the optional side curtain airbags feature a second safing sensor within the ACM to provide confirmation to the ACM of side impact forces. This second safing sensor is a bi-directional unit that detects impact forces from either side of the vehicle.

Pre-programmed decision algorithms in the ACM microprocessor determine when the deceleration rate as signaled by the impact sensors and the safing sensors indicate an impact that is severe enough to require supplemental restraint system protection. The ACM also determines the level of front airbag deployment force required for each front seating position based upon the status of the two seat belt switch inputs and the severity of the monitored impact. When the programmed conditions are met, the ACM sends the proper electrical signals to deploy the multistage dual front airbags at the programmed force levels, and to deploy either side curtain airbag.

The hard wired inputs and outputs for the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM, the PCI data bus network, or the electronic message inputs to and outputs from the ACM. The most reliable, efficient, and accurate means to diagnose the ACM, the PCI data bus network, and the electronic message inputs to and outputs from the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

Two different Airbag Control Modules (ACM) are available for this vehicle. For vehicles equipped with the optional side curtain airbags, both ACM connector receptacles are black in color and the ACM contains a second bi-directional safing sensor for the side airbags. For vehicles not equipped with the optional side curtain airbags, the ACM connector receptacles are gray.

AIRBAG CONTROL MODULE (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP THE AIRBAG CONTROL MODULE, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN AIRBAG CONTROL MODULE IS ACCIDENTALLY DROPPED DURING SERVICE, THE MODULE MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the center console from the top of the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(3) Remove the two nuts that secure the center console bracket to the studs on the floor panel transmission tunnel just forward of the Airbag Control Module (ACM) (Fig. 7).

(4) Remove the center console bracket from the two studs on the floor panel transmission tunnel.

(5) Disconnect the airbag overlay wire harness connector for the ACM from the ACM connector receptacle (Fig. 8). To disconnect the airbag overlay wire harness connector from the ACM:

(a) Slide the red Connector Position Assurance (CPA) lock on the top of the connector toward the front of the vehicle.

(b) Depress the forward edge of the CPA lock to release the connector latch tab and pull the connector straight away from the ACM connector receptacle.

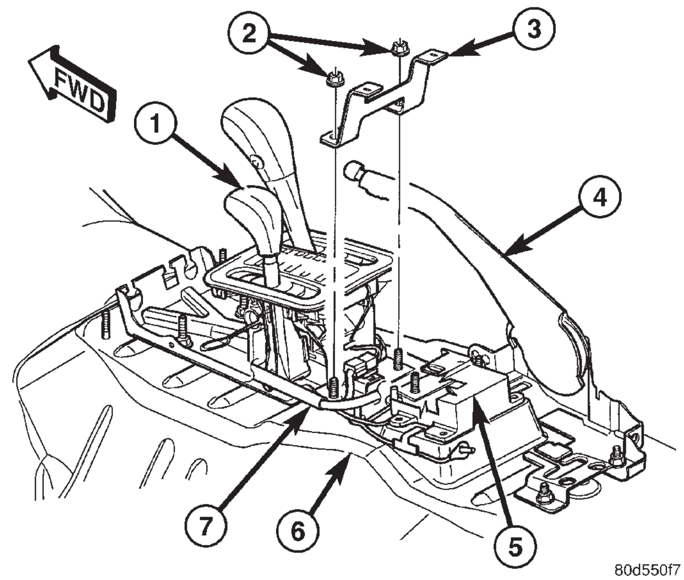


Fig. 7 Center Console Bracket Remove/Install

1 - SHIFTER
2 - NUT (2)
3 - BRACKET
4 - PARK BRAKE LEVER
5 - AIRBAG CONTROL MODULE
6 - FLOOR PANEL TRANSMISSION TUNNEL
7 - INSTRUMENT PANEL WIRE HARNESS

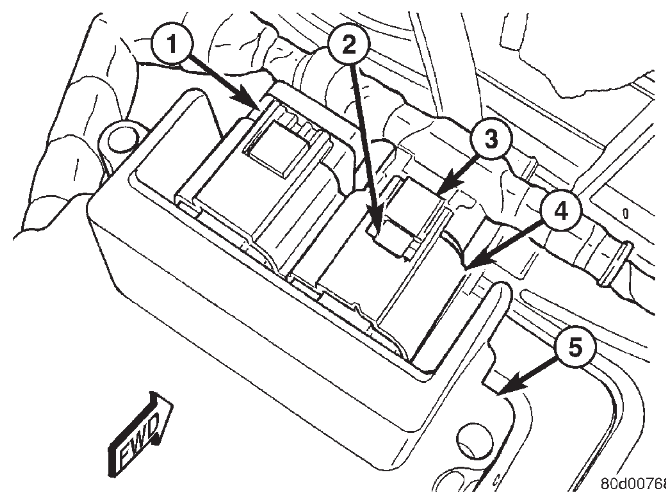


Fig. 8 Airbag Control Module Connector

1 - INSTRUMENT PANEL WIRE HARNESS CONNECTOR
2 - LATCH TAB
3 - CPA LOCK
4 - AIRBAG OVERLAY WIRE HARNESS CONNECTOR
5 - AIRBAG CONTROL MODULE

(6) Disconnect the instrument panel wire harness connector for the ACM from the ACM connector receptacle.

AIRBAG CONTROL MODULE (Continued)

(7) Remove the four screws that secure the ACM to the mount that is welded onto the top of the floor panel transmission tunnel (Fig. 9).

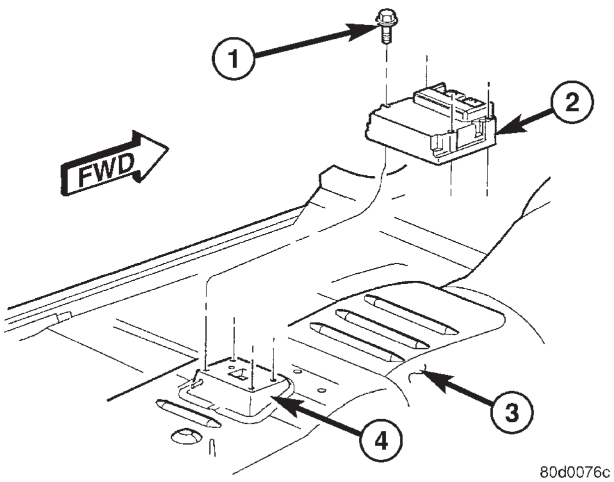


Fig. 9 Airbag Control Module Remove/Install

1 - SCREW (4)
2 - AIRBAG CONTROL MODULE
3 - FLOOR PANEL TRANSMISSION TUNNEL
4 - MOUNT

(8) Remove the ACM from the ACM mount on the top of the floor panel transmission tunnel.

INSTALLATION

Two different Airbag Control Modules (ACM) are available for this vehicle. For vehicles equipped with the optional side curtain airbags, both ACM connector receptacles are black in color and the ACM contains a second bi-directional safing sensor for the side airbags. For vehicles not equipped with the optional side curtain airbags, the ACM connector receptacles are gray.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

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(1) Carefully position the Airbag Control Module (ACM) to the mount that is welded onto the top of the floor panel transmission tunnel (Fig. 9). The bottom of the ACM housing is keyed. When the ACM is correctly positioned, the bottom of the housing will fit flush with the mount and the orientation arrow on the label on top of the housing will be pointed forward in the vehicle.

(2) Install and tighten the four screws that secure the ACM to the mount that is welded onto the top of the floor panel transmission tunnel. Tighten the screws to 11 N·m (95 in. lbs.).

(3) Reconnect the instrument panel wire harness connector for the ACM to the ACM connector receptacle. Be certain that the connector latch and the red CPA lock are fully engaged (Fig. 8).

(4) Reconnect the airbag overlay wire harness connector for the ACM to the ACM connector receptacle. Be certain that the connector latch and the red CPA lock are fully engaged.

(5) Reinstall the center console bracket onto the two studs on the floor panel transmission tunnel just forward of the ACM (Fig. 7).

(6) Install and tighten the two nuts that secure the center console bracket to the studs on the floor panel transmission tunnel. Tighten the nuts to 28 N·m (21 ft. lbs.).

(7) Reinstall the center console onto the top of the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(8) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

CHILD TETHER ANCHOR

DESCRIPTION

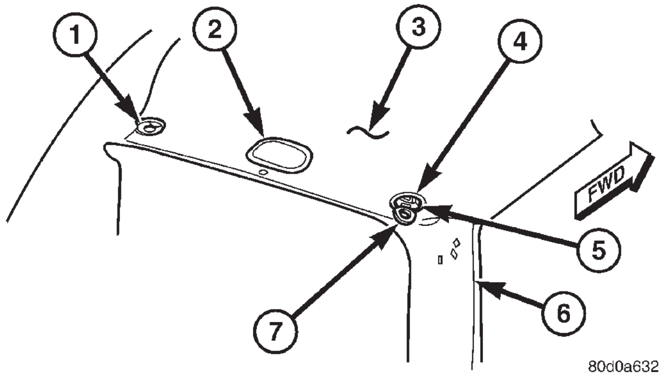

Fig. 10 Child Tether Anchors - North America

1 - CHILD TETHER ANCHOR (RIGHT)
2 - CARGO LAMP
3 - HEADLINER
4 - BEZEL
5 - CHILD TETHER ANCHOR BRACKET
6 - D-PILLAR
7 - CAP

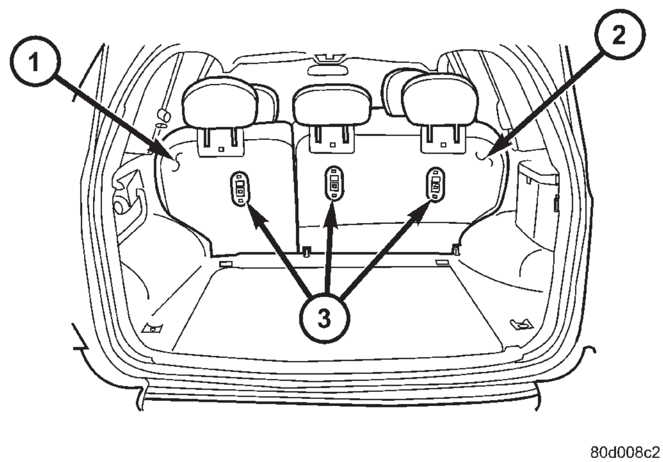

Fig. 11 Child Tether Anchors - Rest-Of-World

1 - REAR SEAT BACK (LEFT)
2 - REAR SEAT BACK (RIGHT)
3 - CHILD TETHER ANCHOR (3)

All vehicles are equipped with fixed-position, child seat tether anchors. Vehicles manufactured for sale in North America have two stamped steel child tether anchor brackets, one secured with a screw to each outboard end of the inner liftgate opening header at the rear of the passenger compartment (Fig. 10). These child tether anchors are concealed behind a removable molded plastic cap that snaps into a bezel located in the headliner over each anchor bracket position. Vehicles manufactured for sale in Rest-Of-World (ROW) markets have two anchors that are integral to the back of the right rear seat back panel, and one that is integral to the left rear seat back panel (Fig. 11). The North American child seat tether anchor brackets are available for separate service replacement. The ROW child seat tether anchors cannot be adjusted or repaired and, if faulty or damaged, they must be replaced as a unit with the rear seat back panel.

OPERATION

See the owner's manual in the vehicle glove box for more information on the proper use of the factory-installed child seat tether anchors.

REMOVAL

The following service procedure applies to vehicles manufactured for sale in North America, which have removable child seat tether anchor brackets that are located on the inner liftgate opening header. Vehicles manufactured for sale in Rest-Of-World (ROW) markets have child tether anchors that are integral to, and are only serviced with the rear seat back panels.

(1) Remove the cover from the child tether anchor bezel in the headliner near the liftgate opening header.

(2) Remove the screw that secures the child tether anchor bracket to the inner liftgate opening header (Fig. 12).

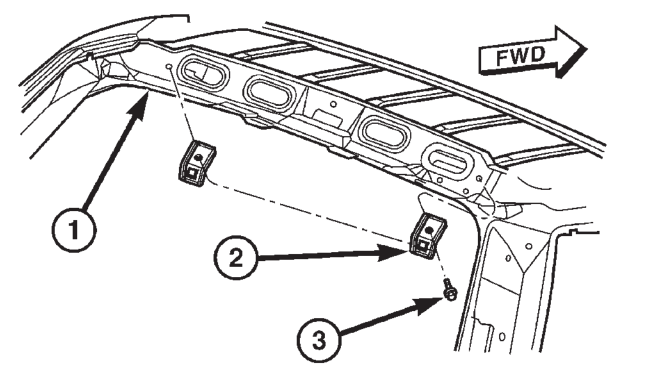

Fig. 12 Child Tether Anchor Remove/Install

1 - INNER LIFTGATE OPENING HEADER
2 - CHILD TETHER ANCHOR BRACKET
3 - SCREW

(3) Remove the child tether anchor bracket from the inner liftgate opening header.

CHILD TETHER ANCHOR (Continued)

INSTALLATION

The following service procedure applies to vehicles manufactured for sale in North America, which have removable child seat tether anchor brackets that are located on the inner liftgate opening header. Vehicles manufactured for sale in Rest-Of-World (ROW) markets have child tether anchors that are integral to, and are only serviced with the rear seat back panels.

(1) Position the child tether anchor bracket onto the inner liftgate opening header (Fig. 12).

(2) Install and tighten the screw that secures the child tether anchor bracket to the inner liftgate opening header. Tighten the screw to 11.8 N·m (105 in. lbs.).

(3) Reinstall the cover into the child tether anchor bezel in the headliner near the liftgate opening header.

CLOCKSPRING

DESCRIPTION

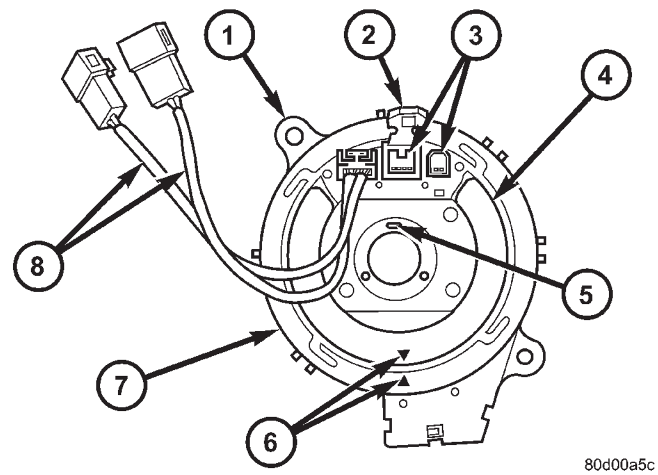

Fig. 13 Clockspring (Upper View)

1 - MOUNTING EAR (2)
2 - LOCKING PIN
3 - UPPER CONNECTOR RECEPTACLE (2)
4 - LABEL
5 - OBLONG PIN
6 - ALIGNMENT ARROWS
7 - CASE
8 - PIGTAIL WIRE (2)

The clockspring assembly is secured with two screws to the multi-function switch mounting housing near the top of the steering column behind the steering wheel (Fig. 13). The clockspring consists of a flat, round molded plastic case with a stubby tail that hangs below the steering column and contains two connector receptacles that face toward the instrument panel (Fig. 14). Within the plastic housing is a spool-like molded plastic rotor with a large exposed hub. The upper surface of the rotor hub has a large center hole, two large flats, an index hole, two short pigtail wires with connectors, and two connector receptacles that face toward the steering wheel.

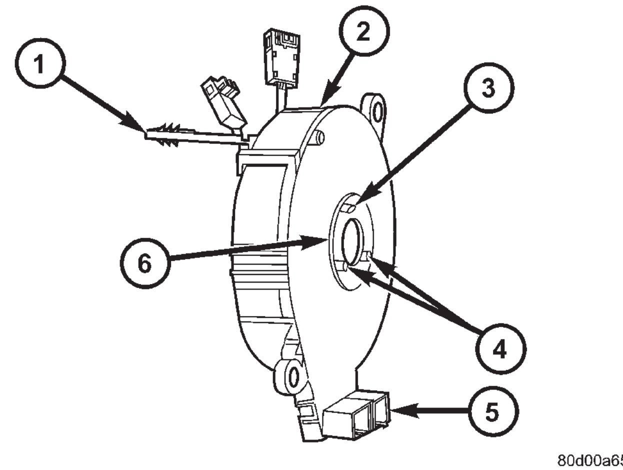

Fig. 14 Clockspring (Lower View)

1 - LOCKING PIN
2 - CASE
3 - OBLONG PIN
4 - ROUND PIN (2)
5 - LOWER CONNECTOR RECEPTACLE (2)
6 - ROTOR

The lower surface of the rotor hub has three pins, two round and one oblong. These pins index the clockspring to the turn signal cancel cam unit in the multi-function switch mounting housing. Within the plastic case and wound around the rotor spool is a long ribbon-like tape that consists of several thin copper wire leads sandwiched between two thin plastic membranes. The outer end of the tape terminates at the connector receptacles that face the instrument panel, while the inner end of the tape terminates at the pigtail wires and connector receptacles on the hub of the clockspring rotor that face the steering wheel.

Service replacement clocksprings are shipped precentered and with a molded plastic locking pin installed. The locking pin secures the centered clockspring rotor to the clockspring case during shipment and handling, but must be removed from the clockspring after it and the multi-function switch mounting housing are installed on the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver airbag has been deployed, the clockspring must be replaced.

CLOCKSPRING (Continued)

OPERATION

The clockspring is a mechanical electrical circuit component that is used to provide continuous electrical continuity between the fixed instrument panel wire harness and the electrical components mounted on or in the rotating steering wheel. On this model the rotating electrical components include the driver airbag, the horn switch, the speed control switches, and the remote radio switches, if the vehicle is so equipped. The clockspring case is positioned and secured to the multi-function switch mounting housing on the upper steering column housing by two screws. The two connector receptacles on the tail of the fixed clockspring case connect the clockspring to the vehicle electrical system through two take outs with connectors from the instrument panel wire harness. The clockspring rotor is movable and is keyed to the hub of the steering wheel by two large flats that are molded into the rotor hub. The three pins (two round and one oblong) on the lower surface of the clockspring rotor hub engage and index the clockspring rotor to the turn signal cancel cam. The turn signal cancel cam is integral to the multi-function switch mounting housing and is keyed to the upper steering column shaft. Two short, yellow-sleeved pigtail wires on the upper surface of the clockspring rotor connect the clockspring to the driver airbag, while a steering wheel wire harness connects the two connector receptacles on the upper surface of the clockspring rotor to the horn switch, the two speed control switches, and the remote radio switches on vehicles that are so equipped.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly during full stop-to-stop steering wheel rotation. To prevent this from occurring, the clockspring must be centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to the movable steering components so that the tape can operate within its designed travel limits. However, if the clockspring is removed from the steering column or if the steering shaft is disconnected from the steering gear, the clockspring spool can change position relative to the movable steering components and must be re-centered following completion of the service or the tape may be damaged. Service replacement clocksprings are shipped pre-centered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

STANDARD PROCEDURE - CLOCKSPRING CENTERING

The clockspring is designed to wind and unwind when the steering wheel is rotated, but is only designed to rotate the same number of turns (about five complete rotations) as the steering wheel can be turned from stop to stop. Centering the clockspring indexes the clockspring tape to other steering components so that it can operate within its designed travel limits. The rotor of a centered clockspring can be rotated two and one-half turns in either direction from the centered position, without damaging the clockspring tape.

However, if the clockspring is removed for service or if the steering column is disconnected from the steering gear, the clockspring tape can change position relative to the other steering components. The clockspring must then be re-centered following completion of such service or the clockspring tape may be damaged. Service replacement clocksprings are shipped pre-centered and with a molded plastic locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the clockspring from the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

CLOCKSPRING (Continued)

(3) Hold the clockspring case in one hand so that it is oriented as it would be when it is installed on the steering column (Fig. 15).

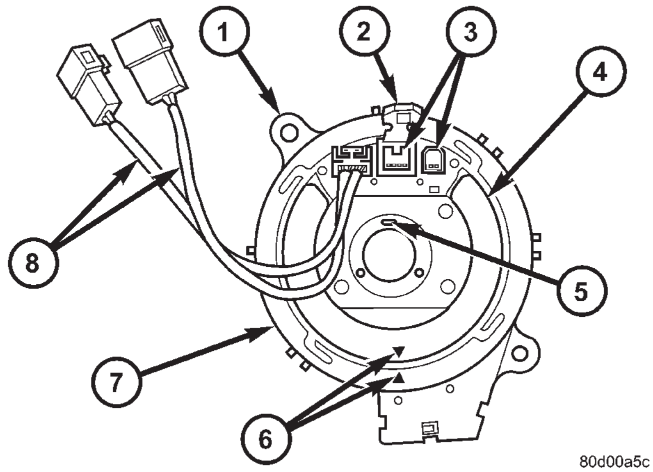

Fig. 15 Clockspring

1 - MOUNTING EAR (2)
2 - LOCKING PIN
3 - UPPER CONNECTOR RECEPTACLE (2)
4 - LABEL
5 - OBLONG PIN
6 - ALIGNMENT ARROWS
7 - CASE
8 - PIGTAIL WIRE (2)

(4) Use your other hand to rotate the clockspring rotor clockwise to the end of its travel. **Do not apply excessive torque.**

(5) From the end of the clockwise travel, rotate the rotor about two and one-half turns counterclockwise, until the arrows on the clockspring rotor label and the clockspring case are aligned. The uppermost pin on the lower surface of the clockspring rotor should now be the oblong pin.

(6) The clockspring is now centered. Secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column.

(7) The front wheels should still be in the straight-ahead position. Reinstall the clockspring onto the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

REMOVAL

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(3) Disconnect the steering wheel wire harness connectors from the upper clockspring connector receptacles.

(4) Remove the steering wheel from the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).

(5) From below the steering column, remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 16).

(6) Using hand pressure, push gently inward on both sides of the upper shroud near the parting line between the upper and lower shrouds to release the snap features that secure the two halves to each other.

(7) Remove both the upper and lower shrouds from the steering column.

(8) Disconnect the two instrument panel wire harness connectors for the clockspring from the two connector receptacles below the steering column on the back of the clockspring case.

(9) Remove the two screws that secure the clockspring case to the multi-function switch mounting housing (Fig. 17).

(10) Remove the clockspring from the multi-function switch mounting housing. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

(11) If the removed clockspring is to be reused, be certain to secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column. If clockspring centering is not maintained, the clockspring must be centered again before it is reinstalled. (Refer to 8 -

CLOCKSPRING (Continued)

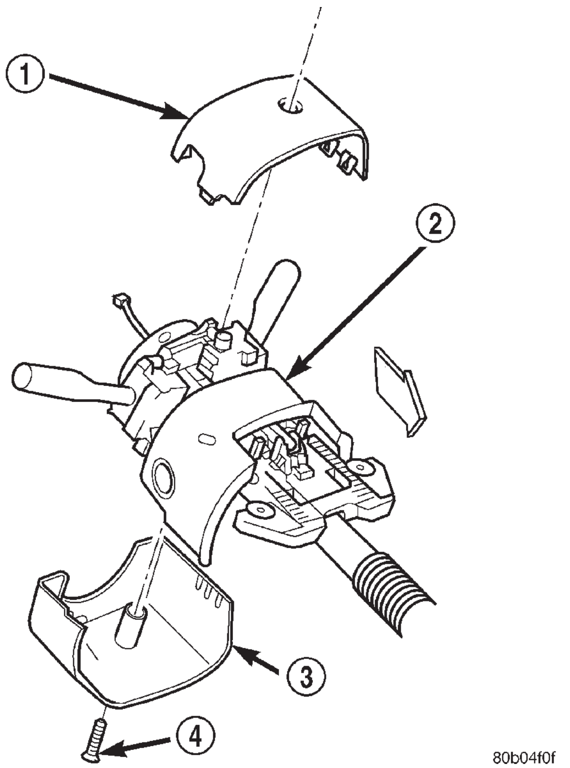

Fig. 16 Steering Column Shrouds Remove/Install

1 - UPPER TILTING COLUMN SHROUD
2 - FIXED COLUMN SHROUD
3 - LOWER TILTING COLUMN SHROUD
4 - SCREW

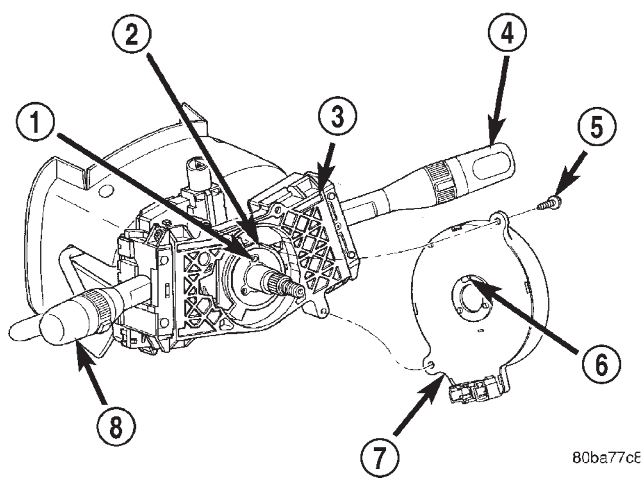

Fig. 17 Clockspring Remove/Install

1 - OBLONG HOLE
2 - TURN SIGNAL CANCEL CAM
3 - MULTI-FUNCTION SWITCH MOUNTING HOUSING
4 - RIGHT MULTI-FUNCTION SWITCH
5 - SCREW (2)
6 - OBLONG PIN
7 - CLOCKSPRING
8 - LEFT MULTI-FUNCTION SWITCH

ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

INSTALLATION

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING). Service replacement clocksprings are shipped pre-centered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) While holding the centered clockspring rotor and case stationary in relation to each other, carefully slide the clockspring down over the steering column upper shaft.

(2) Align and seat the three pins on the lower surface of the clockspring rotor hub with the three holes in the hub of the turn signal cancel cam (Fig. 17). It should be noted that when the clockspring is properly centered the uppermost pin on the clockspring rotor hub is the oblong pin, and it will only fit in the oblong hole in the hub of the turn signal cancel cam.

CLOCKSPRING (Continued)

(3) Align and seat the one pin and the two mounting ears on the clockspring case to their respective holes in the multi-function switch mounting housing.

(4) Install and tighten the two clockspring mounting screws. Tighten the screws to 2.5 N·m (22 in. lbs.).

(5) Reconnect the two instrument panel wire harness connectors for the clockspring to the two connector receptacles below the steering column on the back of the clockspring case.

(6) Position the lower tilting steering column shroud onto the steering column (Fig. 16).

(7) Install and tighten the screw that secures the lower tilting steering column shroud to the multi-function switch mounting housing. Tighten the screw to 2 N·m (17 in. lbs.).

(8) Position the upper tilting column shroud onto the steering column with the hazard warning switch button inserted through the hole in the upper surface of the shroud. Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(9) Align the snap features on the upper and lower shrouds and apply hand pressure to snap them together.

(10) Reinstall the steering wheel onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

(11) Reconnect the steering wheel wire harness connectors to the upper clockspring connector receptacles.

(12) Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

DRIVER AIRBAG

DESCRIPTION

The injection molded, thermoplastic driver airbag protective trim cover is the most visible part of the driver airbag (Fig. 18). The driver airbag is located in the center of the steering wheel, where it is secured with two screws to the two horizontal spokes of the four-spoke steering wheel armature. A stamped, satin polished emblem with the Jeep® logo is applied to the center of the trim cover. Concealed beneath the driver airbag trim cover are the horn switch, the folded airbag cushion, the airbag retainer or housing, the airbag inflator, and the retainers that secure the inflator to the airbag housing.

The airbag cushion, housing, and inflator are secured within an integral receptacle molded into the back of the trim cover. The driver airbag trim cover has locking blocks molded into the back side of it that engage a lip formed around the perimeter of the airbag housing. Two stamped metal retainers then fit

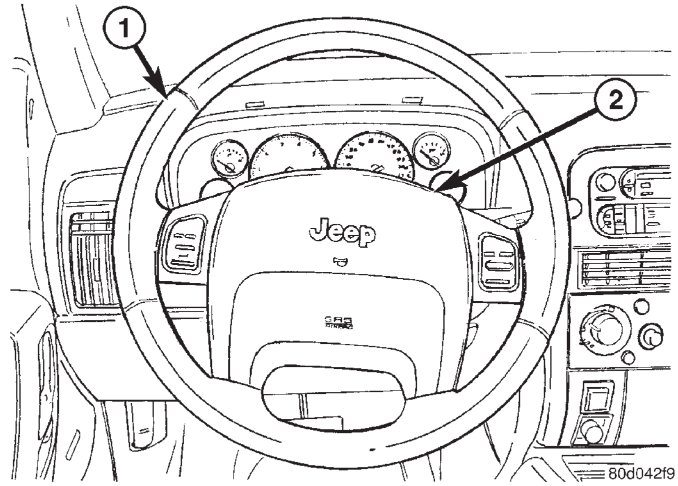

Fig. 18 Driver Airbag Trim Cover

1 - STEERING WHEEL
2 - TRIM COVER

over the inflator mounting studs on the back of the airbag housing and are engaged in slots within the upper and lower trim cover locking blocks, securely locking the cover into place.

The resistive membrane-type horn switch is secured within a plastic tray that is inserted in a pocket or pouch sewn onto the airbag cushion retainer strap, between the trim cover and the folded airbag cushion. The horn switch ground pigtail wire has an eyelet terminal connector that is captured on the upper right inflator mounting stud between the inflator and the upper trim cover retainer. The horn switch feed pigtail wire has a white, molded plastic insulator that is secured by an integral retainer to a mounting hole located in the upper trim cover retainer near the upper left corner on the back of the airbag housing, and is connected to the vehicle electrical system through a take out and connector of the steering wheel wire harness.

The airbag used in this model is a multistage, Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. A radial deploying fabric airbag cushion with tethers is used. The airbag inflator is a dual-initiator, non-azide, pyrotechnic-type unit with four mounting studs and is secured to the stamped metal airbag housing using four hex nuts with washers. Two keyed and color-coded connector receptacles on the driver airbag inflator connect the two inflator initiators to the vehicle electrical system through two yellow-jacketed, two-wire pigtail harnesses of the clockspring. The driver airbag cannot be repaired, and must be replaced if deployed or in any way damaged. The driver airbag trim cover and the horn switch are available individually, and may be disassembled from the driver airbag for service replacement.

DRIVER AIRBAG (Continued)

OPERATION

The multistage driver airbag is deployed by electrical signals generated by the Airbag Control Module (ACM) through the driver airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ACM to suit the monitored impact conditions by providing one of four delay intervals between the electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy. When the ACM sends the proper electrical signals to each initiator, the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of nitrogen gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the nitrogen gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the driver airbag trim cover will split at predetermined breakout lines, then fold back out of the way along with the horn switch and tray unit. Following an airbag deployment, the airbag cushion quickly deflates by venting the nitrogen gas towards the instrument panel through vent holes within the fabric used to construct the back (steering wheel side) panel of the airbag cushion.

Some of the chemicals used to create the nitrogen gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic or hazardous materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT). The nitrogen gas that is produced when the chemicals are burned is harmless. However, a small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noted, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician.

REMOVAL

The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG CUSHION AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) From the underside of the steering wheel, remove the two screws that secure the driver airbag to the steering wheel armature (Fig. 19).

(3) Pull the driver airbag away from the steering wheel far enough to access the three electrical connections on the back of the airbag housing.

(4) Disconnect the steering wheel wire harness connector for the horn switch from the horn switch feed pigtail wire connector, which is located on the back of the driver airbag housing.

DRIVER AIRBAG (Continued)

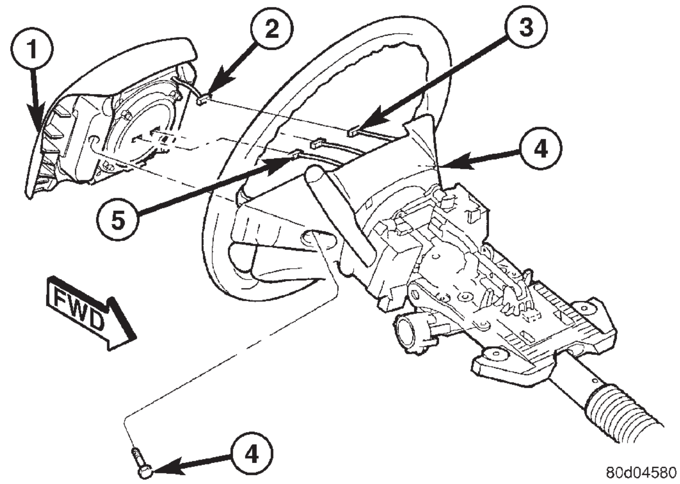

Fig. 19 Driver Airbag Remove/Install

1 - DRIVER AIRBAG
2 - HORN SWITCH FEED WIRE CONNECTOR
3 - STEERING WHEEL WIRE HARNESS CONNECTOR
4 - SCREW (2)
5 - CLOCKSPRING PIGTAIL WIRE CONNECTOR (2)

CAUTION: Do not pull on the clockspring pigtail wires or pry on the connector insulator to disengage the connector from the driver airbag inflator connector receptacle. Improper removal of these pigtail wires and their connector insulators can result in damage to the airbag circuits or connector insulators.

(5) The clockspring driver airbag pigtail wire connectors are secured by an integral lock to the airbag inflator connector receptacles, which are located at the back of the driver airbag housing. Firmly grasp and pull the lock straight out from the connector insulator, then pull the insulators straight out from the airbag inflator to disconnect them from the connector receptacles.

(6) Remove the driver airbag from the steering wheel.

(7) If the driver airbag has been deployed, the clockspring must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

DISASSEMBLY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE HORN SWITCH IS INTEGRAL TO THE DRIVER AIRBAG UNIT. SERVICE OF THIS UNIT SHOULD BE PERFORMED ONLY BY DAIMLERCHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(3) Remove the four nuts that secure the upper and lower trim cover retainers to the studs on the back of the driver airbag housing (Fig. 20).

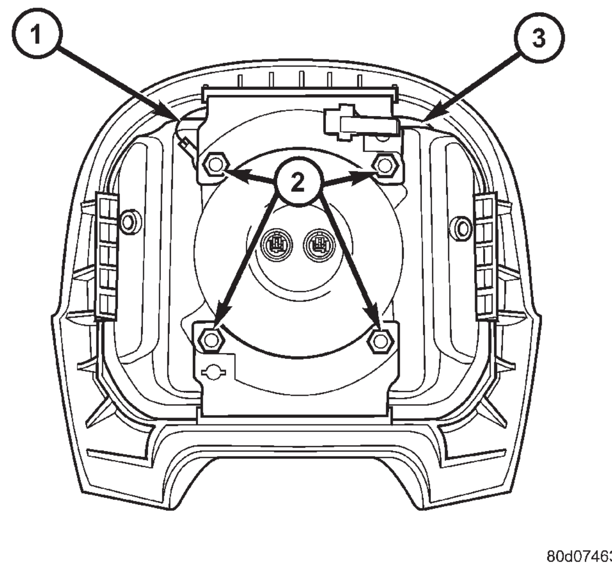

Fig. 20 Driver Airbag Trim Cover Retainer Nuts Remove/Install

1 - HORN SWITCH GROUND PIGTAIL WIRE
2 - NUTS
3 - HORN SWITCH FEED PIGTAIL WIRE

(4) Remove the upper and lower trim cover retainers from the airbag housing studs (Fig. 21).

DRIVER AIRBAG (Continued)

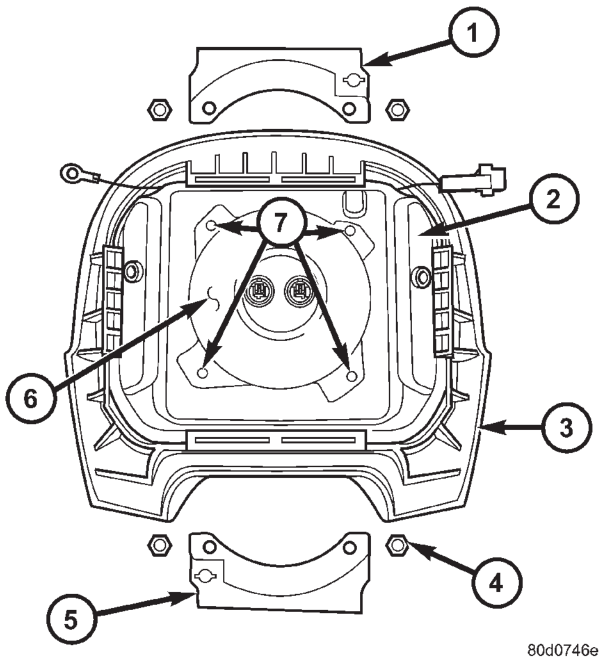

Fig. 21 Driver Airbag Trim Cover Retainers

1 - UPPER RETAINER
2 - AIRBAG HOUSING
3 - TRIM COVER
4 - NUT (4)
5 - LOWER RETAINER
6 - INFLATOR
7 - STUDS

(5) Disengage the horn switch feed pigtail wire connector retainer from the mounting hole in the upper trim cover retainer.

(6) Remove the horn switch ground pigtail wire eyelet terminal from the upper right airbag housing stud.

(7) Disengage the four trim cover locking blocks from the lip around the outside edge of the driver airbag housing and remove the housing from the cover (Fig. 22).

ASSEMBLY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

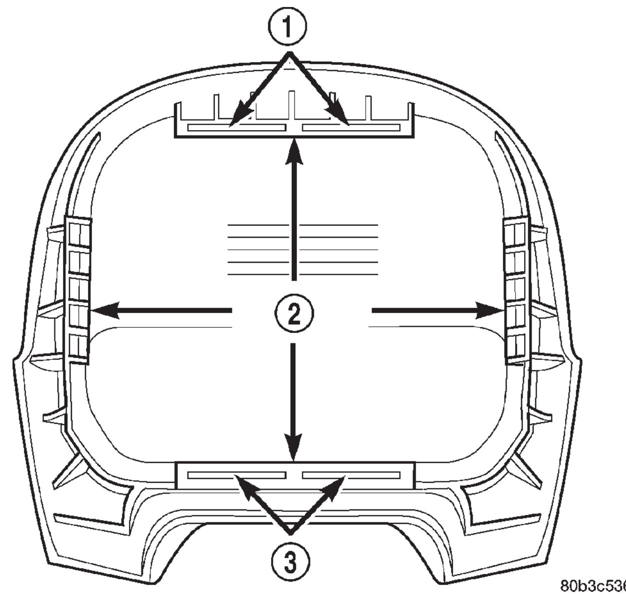

Fig. 22 Driver Airbag Trim Cover Remove/Install

1 - RETAINER SLOTS
2 - LOCKING BLOCKS
3 - RETAINER SLOTS

WARNING: THE HORN SWITCH IS INTEGRAL TO THE DRIVER AIRBAG UNIT. SERVICE OF THIS UNIT SHOULD BE PERFORMED ONLY BY DAIMLERCHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE DRIVER AIRBAG CUSHION AND THE DRIVER AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

DRIVER AIRBAG (Continued)

WARNING: THE DRIVER AIRBAG TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

NOTE: If the horn switch and tray have been removed from the sewn pouch in the airbag cushion retaining strap, be certain that they are properly reinstalled with the horn switch feed and ground pigtail wires properly oriented before assembling the trim cover onto the airbag housing. (Refer to 8 - ELECTRICAL/HORN/HORN SWITCH - INSTALLATION).

(1) Carefully position the driver airbag in the trim cover. Be certain that the horn switch feed and ground pigtail wires are not pinched between the airbag housing and the trim cover locking blocks.

(2) Engage the upper and lower trim cover locking blocks with the lip of the driver airbag housing, then engage the locking blocks on each side of the trim cover with the lip of the housing. Be certain that each of the locking blocks is fully engaged on the lip of the airbag housing (Fig. 23).

(3) Reinstall the horn switch ground pigtail wire eyelet terminal over the right upper airbag housing stud.

(4) Reinstall the upper and lower airbag trim cover retainers over the airbag housing studs. Be certain that the tabs on each retainer are engaged in the retainer slots of the upper and lower trim cover locking blocks (Fig. 22).

(5) Install and tighten the nuts that secure the trim cover retainers to the airbag housing studs. Tighten the nuts to 6.8 N·m (60 in. lbs.).

(6) Engage the horn switch feed pigtail wire connector retainer in the mounting hole in the upper trim cover retainer.

(7) Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/ DRIVER AIRBAG - INSTALLATION).

INSTALLATION

The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for

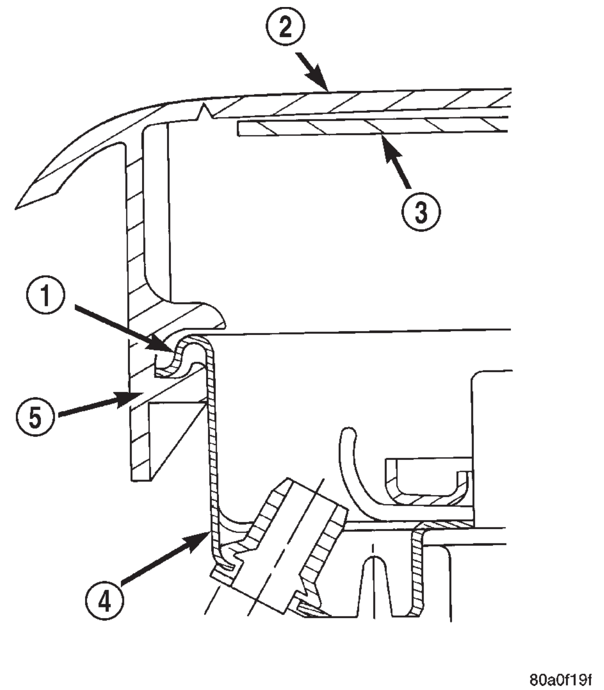

Fig. 23 Driver Airbag Trim Cover Locking Blocks Engaged

1 - LIP
2 - TRIM COVER
3 - HORN SWITCH
4 - AIRBAG HOUSING
5 - LOCKING BLOCK

service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

DRIVER AIRBAG (Continued)

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE DRIVER AIRBAG CUSHION AND THE DRIVER AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: THE DRIVER AIRBAG TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT AIRBAGS AND TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Assemble the driver airbag trim cover onto the airbag housing. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - ASSEMBLY).

(2) Position the driver airbag close enough to the steering wheel to reconnect all three electrical connections on the back of the airbag housing.

(3) When installing the driver airbag, reconnect the two clockspring driver airbag pigtail wire connectors to the airbag inflator connector receptacles by pressing straight in on the connectors (Fig. 19), then pushing the locks straight into the connectors. You can be certain that the connector is fully engaged by listening carefully for a distinct, audible click as the connector latches snap into place.

(4) Reconnect the steering wheel wire harness connector for the horn switch to the horn switch feed pigtail wire connector, which is located at the back of the driver airbag housing.

(5) Carefully position the driver airbag in the steering wheel. Be certain that the clockspring pigtail wires and steering wheel wire harness in the steering wheel hub area are not pinched between the driver airbag and the steering wheel armature.

(6) From the underside of the steering wheel, install and tighten the two screws that secure the driver airbag to the steering wheel armature. Tighten the screws to 10 N·m (90 in. lbs.).

(7) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

FRONT IMPACT SENSOR

DESCRIPTION

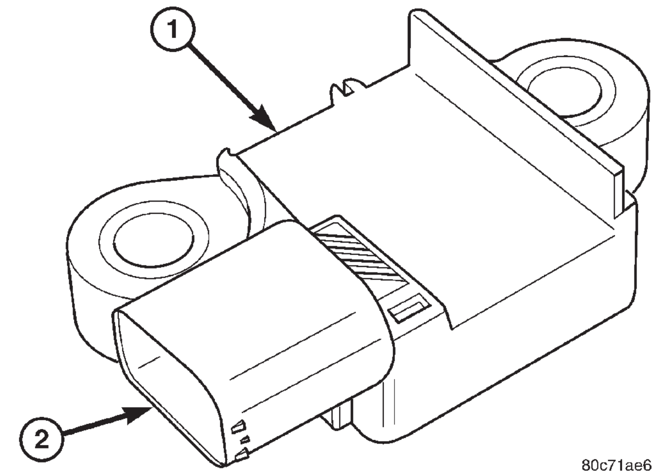

Fig. 24 Front Impact Sensor

1 - SENSOR
2 - CONNECTOR RECEPTACLE

Two front impact sensors are used on this model, one each for the left and right sides of the vehicle (Fig. 24). These sensors are mounted remotely from the impact sensor that is internal to the Airbag Control Module (ACM). The right and left front and side impact sensors are identical in construction and calibration with the exception of the right-hand and left-hand die cast aluminum mounting brackets to which each front impact sensor is secured with two screws. The front impact sensor brackets are secured with three screws to the front and inboard sides of the right and left vertical members of the radiator support within the engine compartment.

The impact sensor housing has an integral connector receptacle and two integral mounting ears, each with a metal sleeve to provide crush protection. A cavity in the center of the molded black plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. Potting material fills the cavity to seal and protect the internal electronic circuitry and components. The front impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the right or left headlamp and dash wire harnesses.

The front impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced. If a front impact sensor is faulty, only the sensor needs to be replaced. If the sensor or the sensor mounting bracket is damaged or faulty, or if proper tightening torque of the screws that secure the sensor to the bracket cannot be achieved, the sensor and bracket unit must be replaced.

FRONT IMPACT SENSOR (Continued)

OPERATION

The front impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Airbag Control Module (ACM). The ACM microprocessor continuously monitors all of the passive restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly.

The impact sensors each receive battery current and ground through dedicated left and right sensor plus and minus circuits from the ACM. The impact sensors and the ACM communicate by modulating the voltage in the sensor plus circuit. The hard wired circuits between the front impact sensors and the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM or the impact sensors. The most reliable, efficient, and accurate means to diagnose the impact sensors, the ACM, and the electronic message communication between the sensors and the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

The front and side impact sensors are interchangeable except that the front impact sensors are serviced with a right or left mounting bracket, while the side impact sensors use no mounting bracket. If a front impact sensor is faulty, but not damaged, the sensor may be removed from the sensor mounting bracket and replaced with a side impact sensor. If the front impact sensor or the sensor mounting bracket are damaged in any way, or if proper tightening torque of the screws that secure the sensor to the bracket cannot be achieved, the front impact sensor and bracket must be replaced as a unit.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE FRONT IMPACT SENSOR ENABLES THE SYSTEM TO DEPLOY THE FRONT SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP THE FRONT IMPACT SENSOR, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN IMPACT SENSOR IS ACCIDENTALLY DROPPED DURING SERVICE, THE SENSOR MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER FRONT SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) From the engine compartment, disconnect the right or left headlamp and dash wire harness connector for the front impact sensor from the sensor connector receptacle (Fig. 25).

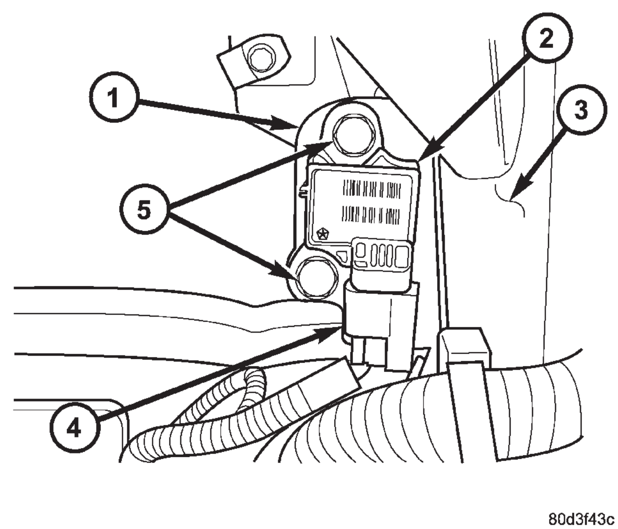

Fig. 25 Front Impact Sensor Remove/Install (Right Side Shown, Left Side Similar)

1 - BRACKET
2 - IMPACT SENSOR
3 - RADIATOR SUPPORT
4 - WIRE HARNESS CONNECTOR
5 - SCREW (2)

FRONT IMPACT SENSOR (Continued)

(3) From the engine compartment, remove the two screws that secure the right or left front impact sensor to the sensor mounting bracket on the right or left radiator support vertical member.

(4) Remove the front impact sensor from the sensor mounting bracket.

INSTALLATION

The front and side impact sensors are interchangeable except that the front impact sensors are serviced with a right or left mounting bracket, while the side impact sensors use no mounting bracket. If a front impact sensor is faulty, but not damaged, the sensor may be removed from the sensor mounting bracket and replaced with a side impact sensor. If the front impact sensor or the sensor mounting bracket are damaged in any way, or if proper tightening torque of the screws that secure the sensor to the bracket cannot be achieved, the front impact sensor and bracket must be replaced as a unit.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE FRONT IMPACT SENSOR ENABLES THE SYSTEM TO DEPLOY THE FRONT SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP THE FRONT IMPACT SENSOR, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN IMPACT SENSOR IS ACCIDENTALLY DROPPED DURING SERVICE, THE SENSOR MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER FRONT SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Position the right or left front impact sensor to the sensor mounting bracket on the right or left radiator support vertical member in the engine compartment (Fig. 25).

(2) Install and tighten the two screws that secure the right or left front impact sensor to the sensor mounting bracket. Tighten the screws to 10 N·m (85 in. lbs.).

(3) Reconnect the right or left headlamp and dash wire harness connector for the front impact sensor to the sensor connector receptacle.

(4) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

FRONT IMPACT SENSOR & BRACKET

REMOVAL

The front and side impact sensors are interchangeable except that the front impact sensors are serviced with a right or left mounting bracket, while the side impact sensors use no mounting bracket. If a front impact sensor is faulty, but not damaged, the sensor may be removed from the sensor mounting bracket and replaced with a side impact sensor. If the front impact sensor or the sensor mounting bracket are damaged in any way, or if proper tightening torque of the screws that secure the sensor to the bracket cannot be achieved, the front impact sensor and bracket must be replaced as a unit.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FRONT IMPACT SENSOR & BRACKET (Continued)

WARNING: THE FRONT IMPACT SENSOR ENABLES THE SYSTEM TO DEPLOY THE FRONT SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP THE FRONT IMPACT SENSOR, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN IMPACT SENSOR IS ACCIDENTALLY DROPPED DURING SERVICE, THE SENSOR MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER FRONT SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the headlamp mounting module from the front of the vehicle. (Refer to 23 - BODY/EXTERIOR/HEADLAMP MOUNTING MODULE - REMOVAL).

(3) Disconnect the right or left headlamp and dash wire harness connector for the front impact sensor from the sensor connector receptacle.

(4) Remove the three screws that secure the right or left front impact sensor and bracket unit to the right or left radiator support vertical member (Fig. 26).

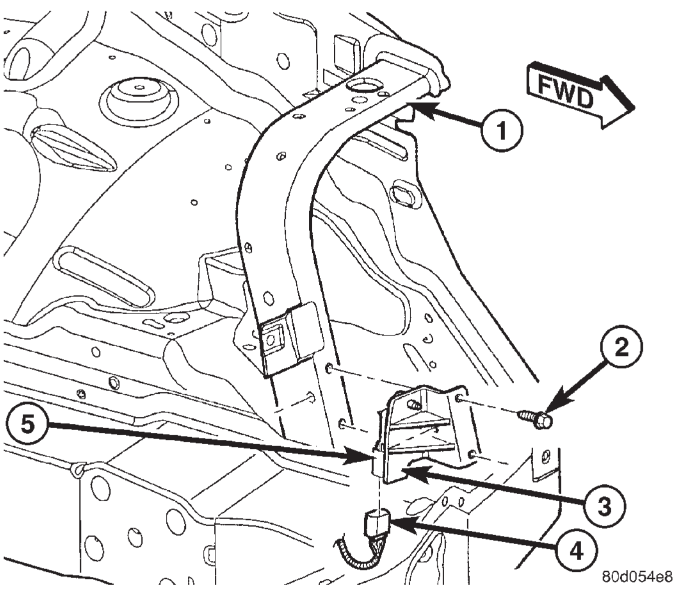

Fig. 26 Front Impact Sensor & B Remove/Install

1 - RADIATOR SUPPORT
2 - SCREW (3)
3 - BRACKET
4 - WIRE HARNESS CONNECTOR
5 - IMPACT SENSOR

(5) Remove the right or left front impact sensor and bracket unit from the front of the vehicle.

INSTALLATION

The front and side impact sensors are interchangeable except that the front impact sensors are serviced with a right or left mounting bracket, while the side impact sensors use no mounting bracket. If a front impact sensor is faulty, but not damaged, the sensor may be removed from the sensor mounting bracket and replaced with a side impact sensor. If the front impact sensor or the sensor mounting bracket are damaged in any way, or if proper tightening torque of the screws that secure the sensor to the bracket cannot be achieved, the front impact sensor and bracket must be replaced as a unit.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE FRONT IMPACT SENSOR ENABLES THE SYSTEM TO DEPLOY THE FRONT SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP THE FRONT IMPACT SENSOR, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN IMPACT SENSOR IS ACCIDENTALLY DROPPED DURING SERVICE, THE SENSOR MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER FRONT SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Position the right or left front impact sensor and bracket unit to the front of the vehicle (Fig. 26).

(2) Position the right or left front impact sensor and bracket unit to the right or left radiator support vertical member.

(3) Loosely install the three screws that secure the right or left front impact sensor and bracket unit right or left radiator support vertical member.

FRONT IMPACT SENSOR & BRACKET (Continued)

(4) For the right impact sensor and bracket unit, the tightening sequence for the three screws that secure it to the right radiator support vertical member is from top to bottom. For the left impact sensor and bracket unit, the tightening sequence for the three screws that secure it to the left radiator support vertical member is from bottom to top. Tighten the screws to 12 N·m (105 in. lbs.).

(5) Reconnect the right or left headlamp and dash wire harness connector for the front impact sensor to the sensor connector receptacle.

(6) Reinstall the headlamp mounting module to the front of the vehicle. (Refer to 23 - BODY/EXTERIOR/HEADLAMP MOUNTING MODULE - INSTALLATION).

(7) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

FRONT SEAT BELT & RETRACTOR

REMOVAL

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Adjust the front seat to its most forward position for easiest access to the front seat belt lower anchor and the B-pillar trim.

(2) Disconnect and isolate the battery negative cable.

(3) Lift the front seat belt lower anchor cover far enough to access the screw that secures it to the lower B-pillar (Fig. 27).

(4) Remove the screw that secures the lower anchor to the B-pillar.

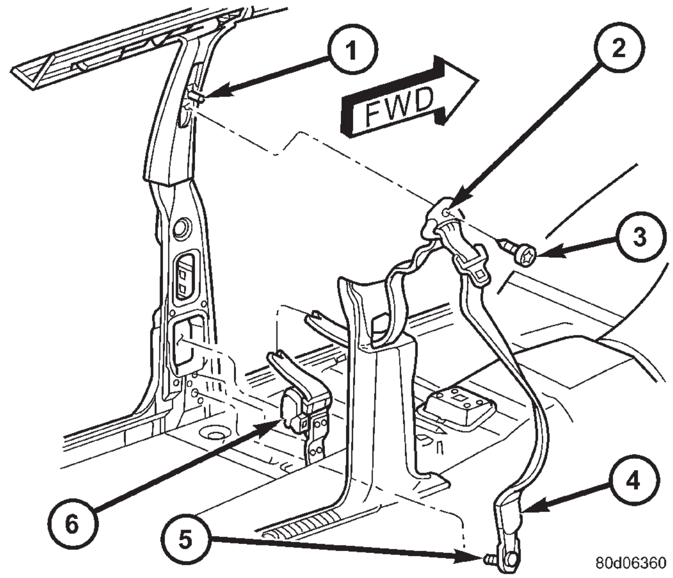

Fig. 27 Front Seat Belt & Retractor Remove/Install

1 - ADJUSTER
2 - TURNING LOOP
3 - SCREW
4 - LOWER ANCHOR
5 - SCREW
6 - RETRACTOR

(5) Using a trim stick or another suitable wide flat-bladed tool, gently pry the top of the turning loop trim cover to unsnap it from the height adjuster and access the screw that secures the front seat belt turning loop to the adjuster on the upper B-pillar (Fig. 28).

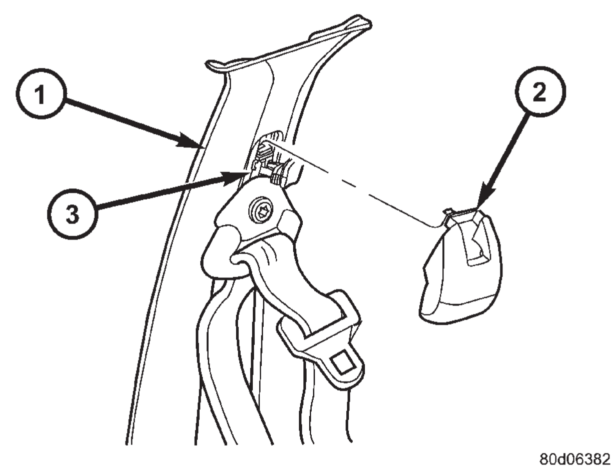

Fig. 28 Turning Loop Cover Remove/Install

1 - PILLAR
2 - TRIM COVER
3 - ADJUSTER

FRONT SEAT BELT & RETRACTOR (Continued)

(6) Remove the screw that secures the seat belt turning loop to the height adjuster on the upper B-pillar.

(7) Remove the seat belt turning loop from the height adjuster.

(8) Remove the trim from the lower B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).

(9) Pull the front seat belt turning loop and lower anchor through the access hole in the lower B-pillar trim.

(10) Remove the plastic push-in fastener that secures the retractor to the lower B-pillar (Fig. 29).

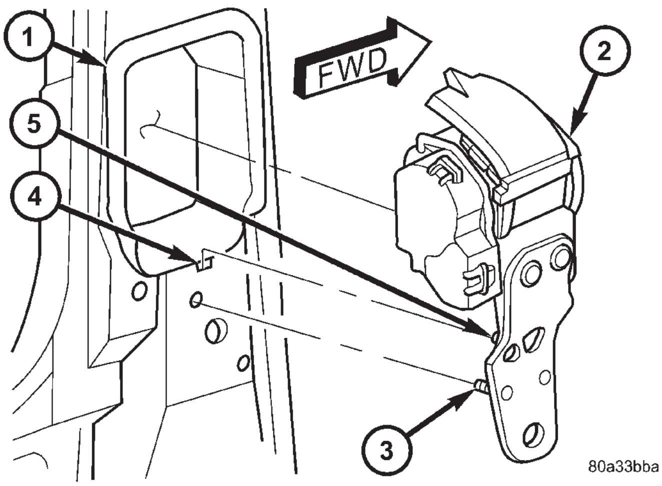

Fig. 29 Front Retractor

1 - SHIELD
2 - RETRACTOR
3 - PLASTIC FASTENER
4 - SLOT
5 - LOCATOR TAB

(11) Disengage the retractor locator tab from the slot in the B-pillar.

(12) Remove the front seat belt and retractor from the B-pillar as a unit.

INSTALLATION

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Be certain that the retractor shield is properly installed in the lower B-pillar and in good condition before reinstalling the retractor (Fig. 29).

(2) Position the front seat belt and retractor to the B-pillar as a unit. Be certain to engage the retractor locator tab in the slot in the lower B-pillar.

(3) Using hand pressure, install the plastic push-in fastener that secures the retractor to the lower B-pillar.

(4) Push the seat belt lower anchor and turning loop through the access hole in the lower B-pillar trim (Fig. 27).

(5) Reinstall the trim onto the lower B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).

(6) Position the seat belt turning loop onto the height adjuster on the upper B-pillar.

(7) Install and tighten the screw that secures the seat belt turning loop to the height adjuster. Tighten the screw to 37 N·m (27 ft. lbs.).

(8) Using hand pressure, press the top of the turning loop trim cover to snap it onto the height adjuster and cover the screw that secures the front seat belt turning loop to the adjuster on the upper B-pillar (Fig. 28).

(9) Position the front seat belt lower anchor to the lower B-pillar.

(10) Install and tighten the screw that secures the seat belt lower anchor to the B-pillar. Tighten the screw to 37 N·m (27 ft. lbs.).

(11) Pull down the cover over the front seat belt lower anchor far enough to conceal the screw.

(12) Reconnect the battery negative cable.

FRONT SEAT BELT BUCKLE

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FRONT SEAT BELT BUCKLE (Continued)

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Move the front seat to its most forward position for easiest access to the front seat belt buckle lower anchor screw.

(2) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(3) Disconnect the seat belt switch pigtail wire connector from the body wire harness connector for the seat belt switch with manual seats, or from the power seat wire harness connector for the seat belt switch with power seats (Fig. 30).

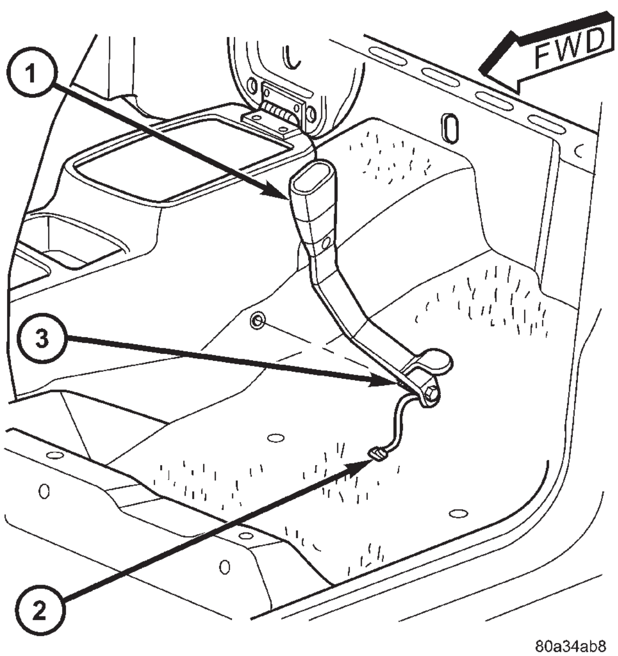

Fig. 30 Front Seat Belt Buckle

1 - SEAT BELT BUCKLE
2 - SEAT BELT SWITCH PIGTAIL WIRE
3 - SCREW

(4) Remove the screw that secures the front seat belt buckle lower anchor to the side of the floor panel transmission tunnel.

(5) Remove the front seat belt buckle from the floor panel transmission tunnel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Position the front seat belt buckle to the side of the floor panel transmission tunnel (Fig. 30).

(2) Install and tighten the screw that secures the front seat belt buckle lower anchor to the side of the floor panel transmission tunnel. Tighten the screw to 43 N·m (32 ft. lbs.).

(3) Reconnect the seat belt switch pigtail wire connector to the body wire harness connector for the seat belt switch with manual seats, or to the power seat wire harness connector for the seat belt switch with power seats.

(4) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

PASSENGER AIRBAG

DESCRIPTION

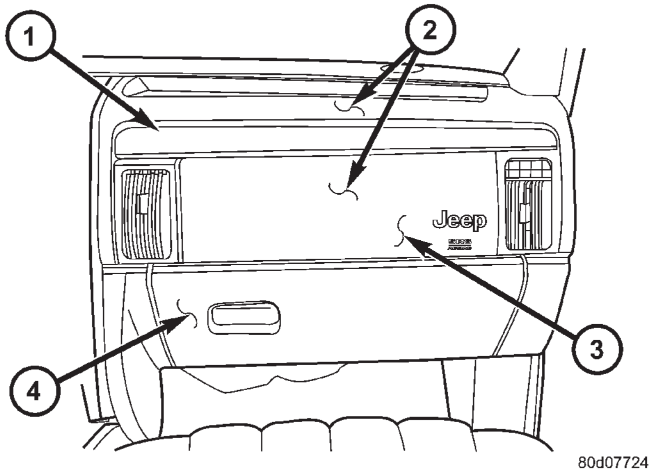

Fig. 31 Passenger Airbag Door

1 - BEZEL
2 - TOP PAD
3 - PASSENGER AIRBAG DOOR
4 - GLOVE BOX DOOR

The rearward facing surface of the instrument panel top pad above the glove box is the most visible part of the passenger airbag (Fig. 31). The passenger airbag is located above the glove box opening in front of the front seat passenger seating position within the instrument panel. The stamped steel passenger airbag door is secured on the back of the instrument panel top pad armature between the two passenger side panel outlets. A stamped metal reinforcement is secured to the instrument panel top pad armature near the upper edge of the passenger airbag door opening, and helps to define a predetermined hinge line beneath the decorative cover of the top pad. The instrument panel passenger side bezel is secured to the airbag door from behind with four screws.

Located behind the passenger airbag door within the instrument panel is the passenger airbag unit. The passenger airbag unit used in this model is a multistage, Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. The passenger airbag unit consists of an extruded aluminum housing, a molded plastic inner airbag cushion dust cover, the airbag cushion, and the airbag inflator. The airbag housing contains the airbag inflator, while the inner dust cover contains the folded airbag cushion. The dust cover completely encloses the airbag cushion and is permanently retained to the housing. The passenger airbag unit is secured with four screws to the instrument panel structural duct. Concealed beneath the instrument panel top pad are the passenger airbag door, the folded airbag cushion, the airbag retainer or housing, and the airbag inflator. The airbag cushion is constructed of a coated nylon fabric. The airbag inflator is a dual-initiator, hybrid-type unit that is secured to and sealed within the airbag housing. A short four-wire pigtail harness with a keyed, yellow connector insulator connects the two inflator initiators to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The passenger airbag cannot be repaired, and must be replaced if deployed, faulty, or in any way damaged. The passenger airbag cannot be repaired, and must be replaced if faulty or in any way damaged. The passenger airbag door is serviced only as a unit with the instrument panel top pad. Following a passenger airbag deployment, the passenger airbag and the instrument panel top pad must be replaced. If inspection reveals that the passenger airbag mounting points on the instrument panel structural duct have been cracked or damaged, the instrument panel structural duct assembly must also be replaced.

OPERATION

The multistage passenger airbag is deployed by electrical signals generated by the Airbag Control Module (ACM) through the passenger airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ACM to suit the monitored impact conditions by providing one of four delay intervals between the electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

The hybrid-type inflator assembly includes a small canister of highly compressed gas. When the ACM sends the proper electrical signal to the airbag inflator, the initiator generates enough heat to ignite chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce the pressure necessary to rupture a containment disk in the pressurized gas canister. The inflator and gas canister are sealed to the airbag cushion so that all of the released inert gas is directed into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the passenger airbag door will bend back the instrument panel top pad at the predetermined hinge line, then fold back over the top of the instrument panel and out of the way. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas through vent holes within the fabric used to construct the sides of the airbag cushion.

PASSENGER AIRBAG (Continued)

Typically, both initiators are used during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

REMOVAL

The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the top pad from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP PAD - REMOVAL).

(3) Disconnect the passenger airbag pigtail wire connector from the instrument panel wire harness connector for the airbag. This connector is secured to the outside of the outboard airbag unit end bracket. To disconnect the connector:

(a) Slide the red Connector Position Assurance (CPA) lock on the top of the connector toward the side of the connector.

(b) Depress the connector latch tab and pull the two halves of the connector straight away from each other.

(4) Remove the two screws that secure the two airbag end bracket front mounting tabs to the top of the instrument panel structural duct (Fig. 32).

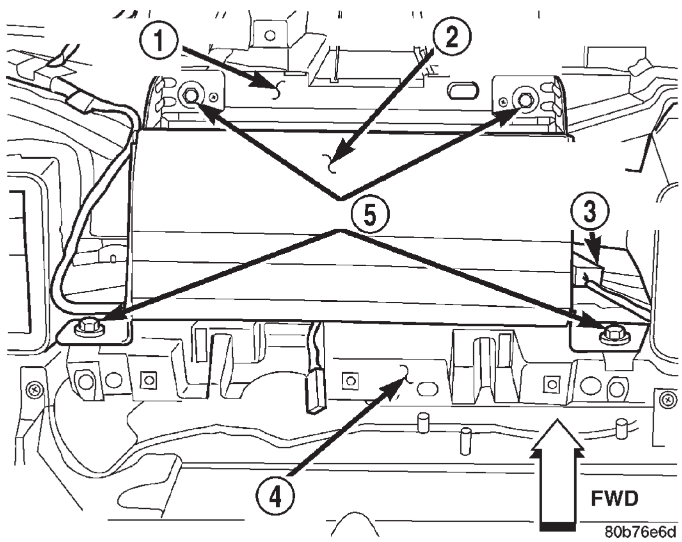

Fig. 32 Passenger Side Airbag Module Remove/Install

1 - STRUCTURAL DUCT
2 - PASSENGER AIRBAG
3 - WIRE HARNESS CONNECTOR
4 - STRUCTURAL DUCT
5 - SCREWS

(5) Remove the two screws that secure the two airbag end bracket rear mounting tabs to the rear of the structural duct, just above the instrument panel upper glove box opening reinforcement.

(6) Remove the passenger airbag from the instrument panel structural duct as a unit.

PASSENGER AIRBAG (Continued)

INSTALLATION

The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

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WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE INSTRUMENT PANEL TOP PAD. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: THE INSTRUMENT PANEL TOP PAD MUST NEVER BE PAINTED. REPLACEMENT TOP PADS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TOP PAD RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Carefully position the passenger airbag onto the instrument panel structural duct (Fig. 32).

(2) Install and tighten the four screws that secure the passenger airbag to the instrument panel structural duct. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Reconnect the instrument panel wire harness connector for the passenger airbag to the passenger airbag pigtail wire connector. This connector is secured to the outside of the outboard airbag unit end bracket. Be certain that the latch on the connector and the red Connector Position Assurance (CPA) lock are each fully engaged.

(4) Reinstall the top pad onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP PAD - INSTALLATION).

(5) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

REAR CENTER SEAT BELT & RETRACTOR

REMOVAL

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REAR CENTER SEAT BELT & RETRACTOR (Continued)

(1) Unlatch and fold the right rear seat cushion forward.

(2) Remove the screw that secures the rear center seat belt lower anchor to the right rear seat belt buckle unit bracket on the rear floor panel (Fig. 33).

(3) Unlatch and fold the right rear seat back forward and separate the cargo area carpet from the base of the seat back panel.

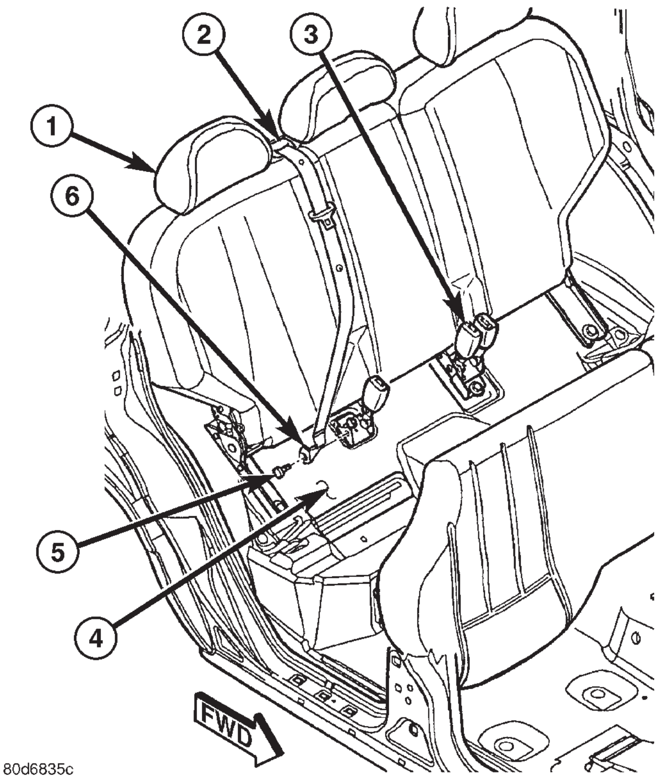

Fig. 33 Rear Center Seat Belt Lower Anchor Remove/Install

1 - REAR SEAT BACK
2 - REAR CENTER SEAT BELT & RETRACTOR
3 - RIGHT REAR SEAT BELT BUCKLE UNIT
4 - REAR FLOOR PANEL
5 - SCREW (1)
6 - LOWER ANCHOR

(4) Remove the right rear seat back panel from the vehicle. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - REMOVAL).

(5) Remove the two screws that secure the belt web guide to the top of the right rear seat back panel.

(6) Remove the trim from the right rear seat back. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - REMOVAL).

(7) Route the rear seat belt lower anchor and belt web guide through the top of the seat back panel.

(8) Disengage the seat back latch cable fitting from the cable support on the retractor, which is a light snap fit (Fig. 34).

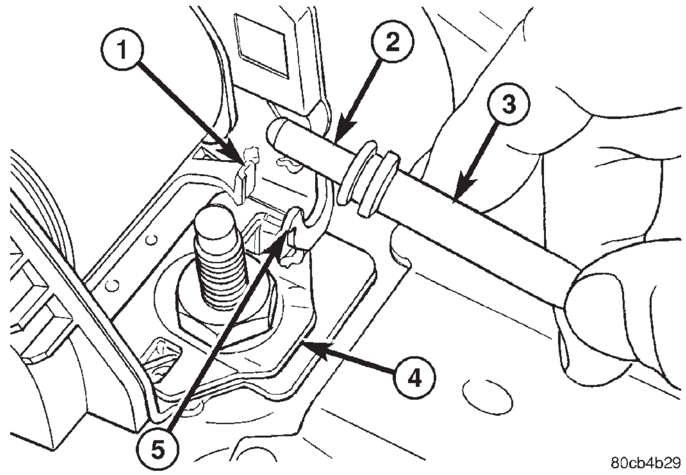

Fig. 34 Seat Back Latch Cable Disengage/Engage

1 - LEVER
2 - PLUNGER
3 - LATCH CABLE FITTING
4 - REAR CENTER RETRACTOR
5 - SUPPORT

(9) Remove the screw that secures the retractor to the rear seat back panel (Fig. 35).

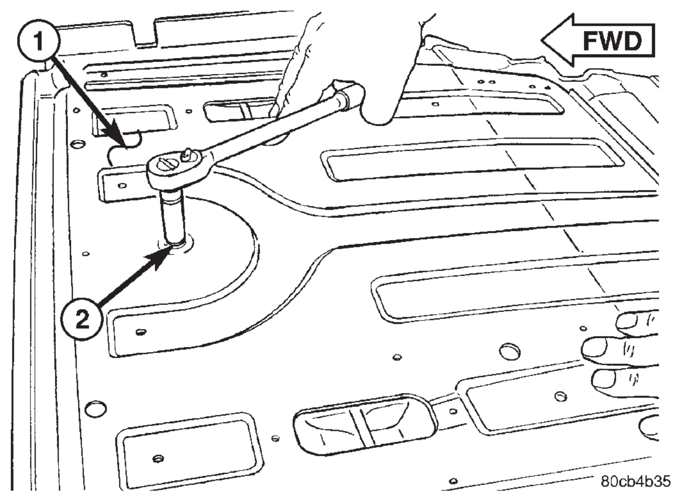

Fig. 35 Rear Center Retractor Remove/Install

1 - REAR SEAT BACK PANEL
2 - SCREW (1)

(10) Remove the rear center seat belt and retractor unit from the seat back panel.

INSTALLATION

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(1) Position the rear center seat belt and retractor unit onto the seat back panel.

(2) Install and tighten the screw that secures the retractor to the rear seat back panel (Fig. 35). Tighten the screw to 43 N·m (32 ft. lbs.).

(3) Position the seat back latch cable plunger against the retractor latch lever, then engage the cable fitting into the cable support on the retractor, which is a light snap fit (Fig. 34).

(4) Route the rear seat belt lower anchor and belt web guide through the top of the seat back panel.

(5) Reinstall the trim onto the right rear seat back. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - INSTALLATION).

(6) Install and tighten the two screws that secure the belt web guide to the top of the right rear seat back panel. Tighten the screws to 2 N·m (20 in. lbs.).

(7) Reinstall the right rear seat back panel into the vehicle. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - INSTALLATION).

(8) Restore the cargo area carpet to the base of the seat back panel and unfold the right rear seat back to its upright position.

(9) Position the rear center seat belt lower anchor to the right rear seat belt buckle unit bracket on the rear floor panel (Fig. 33).

(10) Install and tighten the screw that secures the rear center seat belt lower anchor to the right rear seat belt buckle unit bracket on the rear floor panel. Tighten the screw to 43 N·m (32 ft. lbs.).

(11) Fold and latch the right rear seat cushion in its normal seating position.

REAR OUTBOARD SEAT BELT & RETRACTOR

REMOVAL

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(1) Disengage the rear seat cushion latch by pulling upward on the release strap.

(2) Fold the rear seat cushion forward against the back of the front bucket seat.

(3) Remove the screw that secures the rear outboard seat belt lower anchor to the rear floor panel (Fig. 36).

(4) Remove the lower anchor from the rear floor panel.

(5) Using a trim stick or another suitable wide flat-bladed tool, gently pry the top of the turning loop trim cover to unsnap it from the height adjuster and access the screw that secures the rear outboard seat belt turning loop to the adjuster on the upper C-pillar (Fig. 37).

(6) Remove the screw that secures the seat belt turning loop to the height adjuster on the upper C-pillar.

(7) Remove the seat belt turning loop from the height adjuster.

(8) Remove the trim from the quarter inner panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).

(9) Remove the screw that secures the retractor to the mounting tab on the inner and outer rear wheelhouse flange.

(10) Disengage the retractor locator tab from the slot in the lower C-pillar (Fig. 38).

(11) Remove the rear outboard seat belt and retractor from the C-pillar as a unit.

REAR OUTBOARD SEAT BELT & RETRACTOR (Continued)

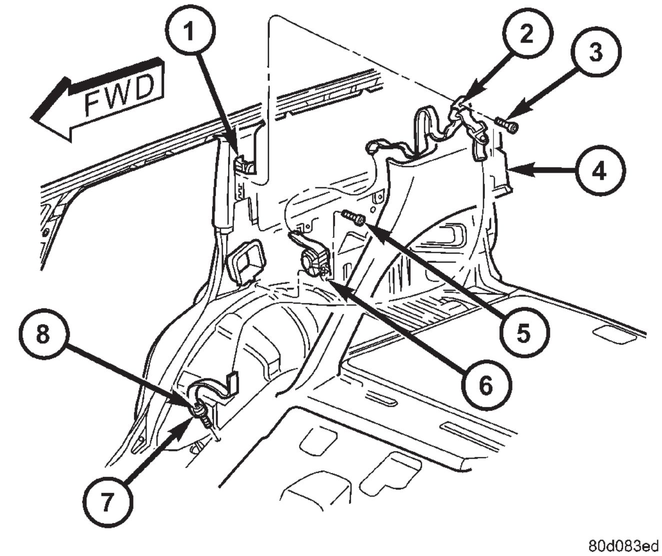

Fig. 36 Rear Outboard Seat Belt & Retractor Remove/Install

1 - ADJUSTER
2 - TURNING LOOP
3 - SCREW
4 - QUARTER TRIM PANEL
5 - SCREW
6 - RETRACTOR
7 - LOWER ANCHOR
8 - SCREW

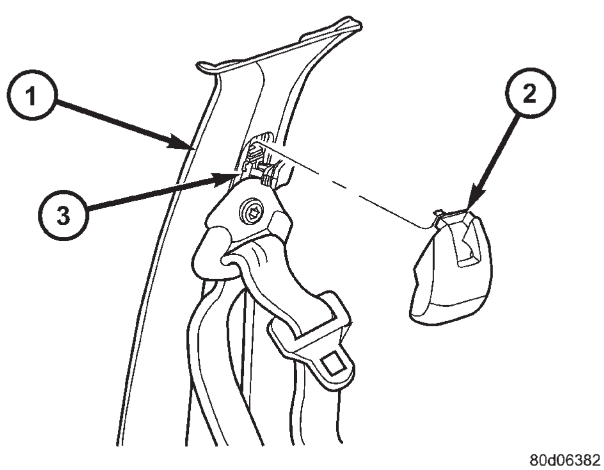

Fig. 37 Turning Loop Cover Remove/Install

1 - PILLAR
2 - TRIM COVER
3 - ADJUSTER

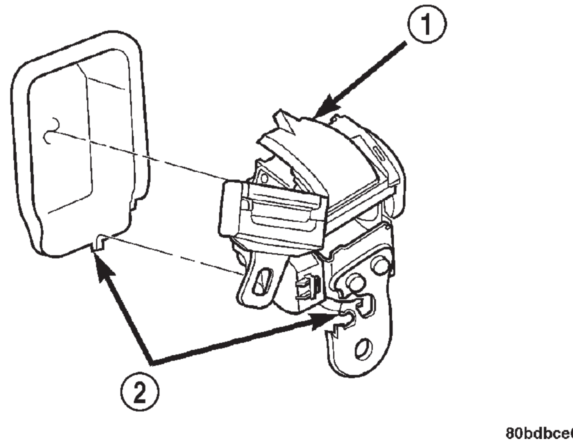

Fig. 38 Rear Outboard Retractor

1 - RETRACTOR
2 - SLOT/LOCATOR TAB

INSTALLATION

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(1) Be certain that the retractor shield is properly installed in the C-pillar and in good condition before installing the retractor.

(2) Position the retractor in the retractor shield and be certain that the retractor locator tab is engaged in the slot in the lower C-pillar below the retractor shield (Fig. 38).

(3) Install and tighten the screw that secures the retractor bracket to the mounting tab on the inner and outer rear wheelhouse flange (Fig. 36). Tighten the screw to 43 N·m (32 ft. lbs.).

(4) Reinstall the trim onto the quarter inner panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).

(5) Position the seat belt turning loop to the height adjuster on the upper C-pillar.

REAR OUTBOARD SEAT BELT & RETRACTOR (Continued)

(6) Install and tighten the screw that secures the seat belt turning loop to the height adjuster. Tighten the screw to 37 N·m (27 ft. lbs.).

(7) Using hand pressure, press the top of the turning loop trim cover to snap it onto the height adjuster and cover the screw that secures the rear outboard seat belt turning loop to the adjuster on the upper C-pillar (Fig. 37).

(8) Position the rear outboard seat belt lower anchor to the rear floor panel.

(9) Install and tighten the screw that secures the seat belt lower anchor to the rear floor panel. Tighten the screw to 43 N·m (32 ft. lbs.).

(10) Fold the rear seat cushion back into the seating position.

REAR SEAT BELT BUCKLE

REMOVAL

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(1) Disengage the rear seat cushion latch by pulling upward on the release strap.

(2) Fold the rear seat cushion forward against the back of the front bucket seat.

(3) Remove the screw that secures the anchor plate of the rear seat lap belt/buckle unit (right side) or buckle/buckle unit (left side) to the rear floor panel (Fig. 39).

NOTE: Vehicles equipped with a three-point center seat belt have the center seat belt lower anchor secured to the right buckle anchor plate with a screw instead of the center lap belt. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR CENTER SEAT BELT & RETRACTOR - REMOVAL).

(4) Remove the rear seat lap belt/buckle unit (right side) or buckle/buckle unit (left side) from the rear floor panel.

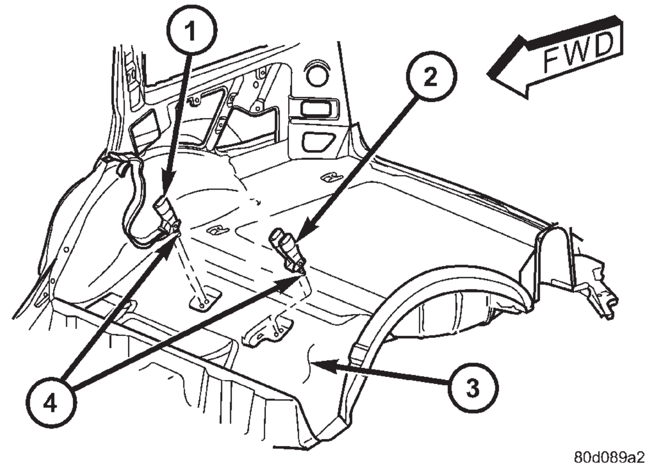


Fig. 39 Rear Seat Lap Belt/Buckle

1 - REAR SEAT LAP BELT/BUCKLE UNIT
2 - REAR SEAT BUCKLE/BUCKLE UNIT
3 - REAR FLOOR PANEL
4 - SCREW

INSTALLATION

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Position the rear seat lap belt/buckle unit (right side) or buckle/buckle unit (left side) onto the rear floor panel (Fig. 39). Be certain the locator tab on the anchor plate is installed in the locator hole near the mounting hole in the rear floor panel.

(2) Install and tighten the screw that secures the anchor plate of the rear seat lap belt/buckle unit (right side) or buckle/buckle unit (left side) to the rear floor panel. Tighten the screw to 43 N·m (32 ft. lbs.).

REAR SEAT BELT BUCKLE (Continued)

NOTE: Vehicles equipped with a three-point center seat belt have the center seat belt lower anchor secured to the right buckle anchor plate with a screw instead of the center lap belt. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR CENTER SEAT BELT & RETRACTOR - INSTALLATION).

(3) Fold the rear seat cushion back into the seating position.

SEAT BELT SWITCH

DESCRIPTION

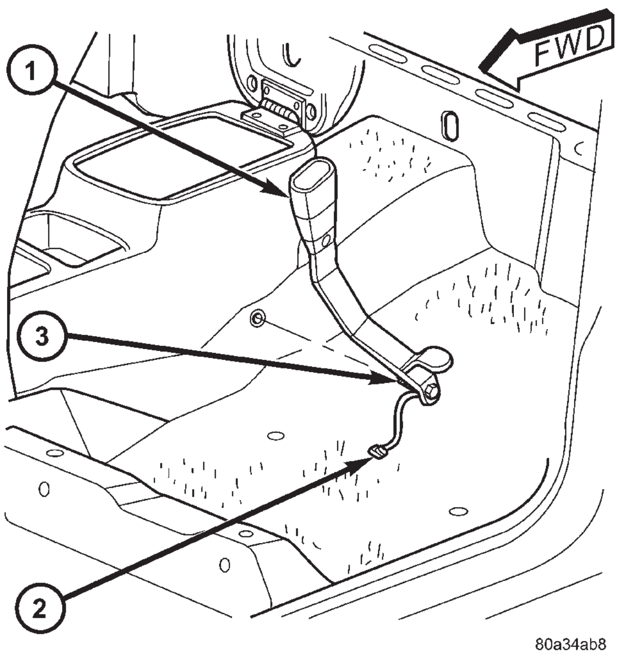


Fig. 40 Front Seat Belt Buckle

1 - SEAT BELT BUCKLE
2 - SEAT BELT SWITCH PIGTAIL WIRE
3 - SCREW

The seat belt switch for this model is actually a Hall Effect-type sensor. This sensor consists of a fixed-position, Hall Effect Integrated Circuit (IC) chip and a small permanent magnet that are integral to each front seat belt buckle. The front seat belt buckles are each located on a stamped steel stanchion within a molded plastic scabbard and secured with a screw to the floor panel transmission tunnel on the inboard side of each front seat cushion (Fig. 40). The seat belt switches are connected to the vehicle electrical system through a two-lead pigtail wire and connector on the seat belt buckle-half, which is connected to a wire harness connector and take out of the body wire harness on vehicles with manual seat adjusters, or to a connector and take out of the power seat wire harness on vehicles with power seat adjusters. A radio noise suppression capacitor is connected in parallel with the IC where the two pigtail wire leads connect to the IC pins.

The seat belt switch cannot be adjusted or repaired and, if faulty or damaged, the entire seat belt buckle-half unit must be replaced.

OPERATION

The seat belt switches are designed to provide a status signal to the seat belt switch sense inputs of the Airbag Control Module (ACM) indicating whether the front seat belts are fastened. The ACM uses the seat belt switch inputs as a factor in determining what level of force with which it should deploy the multistage driver and passenger airbags. In addition, the ACM sends electronic messages to the ElectroMechanical Instrument Cluster (EMIC) to control the seat belt indicator based upon the status of the driver side front seat belt switch. A spring-loaded slide with a small window-like opening is integral to the buckle latch mechanism. When a seat belt tip-half is inserted and latched into the seat belt buckle, the slide is pushed downward and the window of the slide exposes the Hall Effect Integrated Circuit (IC) chip within the buckle to the field of the permanent magnet, which induces a current within the chip. The chip provides this induced current as an output to the ACM, which monitors the current to determine the status of the front seat belts. When the seat belt is unbuckled, the spring-loaded slide moves upward and shields the IC from the field of the permanent magnet, causing the output current from the seat belt switch to be reduced.

The seat belt switch receives a supply current from the ACM, and the ACM senses the status of the front seat belts through its pigtail wire connection to the airbag overlay wire harness. The ACM monitors the condition of the seat belt switch circuits and will illuminate the airbag indicator in the EMIC then store a Diagnostic Trouble Code (DTC) for any fault that is detected in either seat belt switch circuit. For proper diagnosis of the seat belt switches, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SEAT BELT TURNING LOOP ADJUSTER

REMOVAL

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Remove the turning loop from the front or rear seat belt turning loop adjuster. (Refer to 8 - ELECTRICAL/RESTRAINTS/FRONT SEAT BELT & RETRACTOR - REMOVAL) or (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR OUTBOARD SEAT BELT & RETRACTOR - REMOVAL).

(2) Remove the trim from the upper B-pillar (front seat belt adjuster) or upper C-pillar (rear seat belt adjuster). (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL) or (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL).

(3) Remove the screw that secures the upper end of the front or rear turning loop adjuster to the pillar (Fig. 41).

(4) Pull the upper end of the turning loop adjuster away from the pillar far enough to disengage the hooks on the lower end of the adjuster from the slots in the pillar.

(5) Remove the turning loop adjuster from the B-pillar (front seat belt) or C-pillar (rear seat belt).

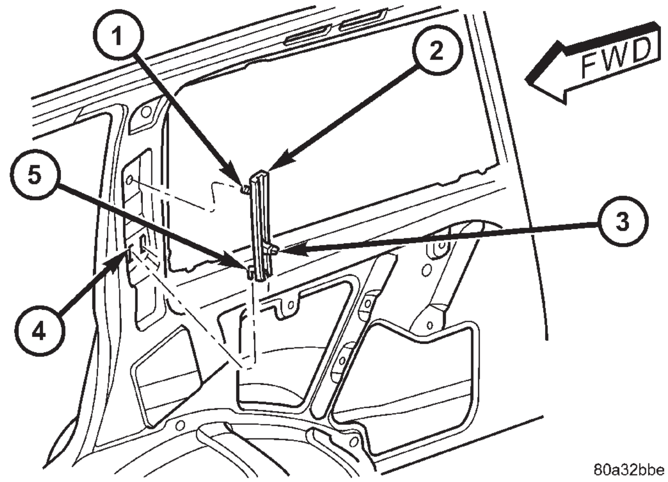


Fig. 41 Seat Belt Turning Loop Adjuster - Typical

1 - SCREW (1)
2 - ADJUSTER
3 - LEVER
4 - SLOTS (2)
5 - HOOKS (2)

INSTALLATION

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, AND RETRACTORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE MOPAR PARTS CATALOG.

(1) Position the turning loop adjuster to the B-pillar (front seat belt) or C-pillar (rear seat belt).

(2) Engage the hooks on the lower end of the adjuster into the slots in the pillar (Fig. 41).

(3) Tilt the upper end of the turning loop adjuster into position against the pillar.

(4) Install and tighten the screw that secures the upper end of the front or rear height adjuster to the pillar. Tighten the screw to 43 N·m (32 ft. lbs.).

(5) Reinstall the trim onto the upper B-pillar (front seat belt adjuster) or upper C-pillar (rear seat belt adjuster). (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION) or (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION).

(6) Reinstall the front or rear seat belt turning loop to the adjuster. (Refer to 8 - ELECTRICAL/RESTRAINTS/FRONT SEAT BELT & RETRACTOR - INSTALLATION) or (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR OUTBOARD SEAT BELT & RETRACTOR - INSTALLATION).

SIDE CURTAIN AIRBAG

DESCRIPTION

8098029e

Fig. 42 SRS Logo

Optional side curtain airbags are available for this model when it is also equipped with dual front airbags. These airbags are passive, inflatable, Supplemental Restraint System (SRS) components, and vehicles with this equipment can be readily identified by a molded identification trim button with the “SRS - AIRBAG” logo located on the headliner above each B-pillar (Fig. 42). This system is designed to reduce injuries to the vehicle occupants in the event of a side impact collision.

Vehicles equipped with side curtain airbags have two individually controlled curtain airbag units. These airbag units are concealed and mounted above the headliner where they are each secured to one of the roof side rails (Fig. 43). Each folded airbag cushion is contained within a long extruded plastic channel that extends along the roof rail from the A-pillar at the front of the vehicle to just behind the C-pillar at the rear of the vehicle. One tether extends down the A-pillar from the front of the airbag cushion, and a second tether extends to the roof rail above the D-pillar. The ends of these tethers are secured to slots in the sheet metal with metal hooks retained by plastic anchor clips.

The hybrid-type inflator for each airbag is secured to the roof rail at the rear of the airbag unit between the C-pillar and the D-pillar, and is connected to the airbag cushion by a long tubular manifold. The inflator bracket and the extruded airbag cushion channel are secured with both plastic push-in fasteners and screws to the roof rail. A dedicated two-wire take out and connector of the body wire harness is routed forward from the D-pillar to the airbag inflator.

The side curtain airbag unit cannot be adjusted or repaired and must be replaced if deployed, faulty, or in any way damaged. Once a side curtain airbag has been deployed, the complete airbag unit, the headliner, the upper A, B, and C-pillar trim, and all other visibly damaged components must be replaced.

OPERATION

Each side curtain airbag is deployed individually by an electrical signal generated by the Airbag Control Module (ACM) to which it is connected through left or right curtain airbag line 1 and line 2 (or squib) circuits. The hybrid-type inflator assembly for each airbag contains a small canister of highly compressed gas. When the ACM sends the proper electrical signal to the airbag inflator, the electrical energy creates enough heat to ignite chemical pellets within the inflator. Once ignited, these chemicals burn rapidly and produce the pressure necessary to rupture a containment disk in the pressurized gas canister. The inflator and gas canister are sealed and connected to a tubular manifold so that all of the released inert gas is directed into the folded side curtain airbag cushion, causing the cushion to inflate.

As the airbag cushion inflates it will drop down from the roof rail between the edge of the headliner and the side glass/body pillars to form a curtain-like cushion to protect the vehicle occupants during a side impact collision. The front and rear tethers keep the side curtain bag taut, thus ensuring that the bag will deploy in the proper position. Following the airbag deployment, the airbag cushion quickly deflates by venting the inert gas through the loose weave of the cushion fabric, and the deflated cushion hangs down loosely from the roof rail.

REMOVAL

The following procedure is for replacement of a faulty or damaged side curtain airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the side curtain airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

SIDE CURTAIN AIRBAG (Continued)

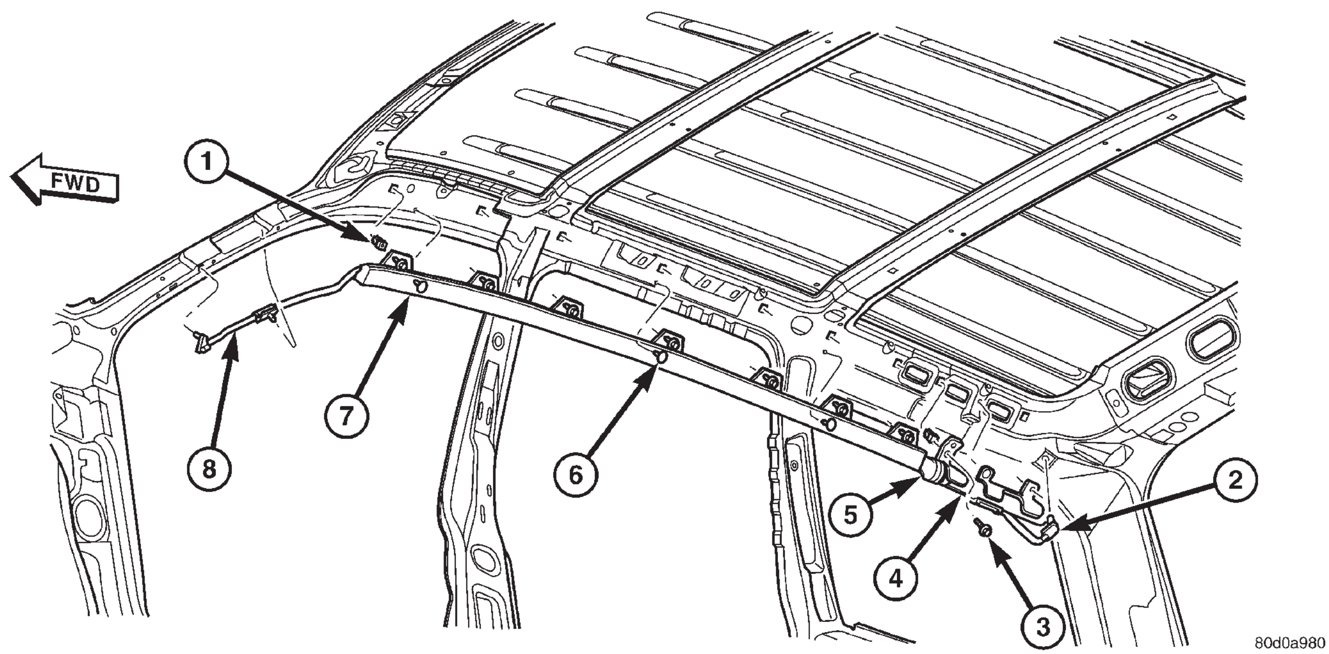


Fig. 43 Side Curtain Airbag

1 - NUT (9)
2 - REAR TETHER
3 - SCREW (9)
4 - INFLATOR
5 - MANIFOLD
6 - PUSH-IN FASTENER (4)
7 - CHANNEL
8 - FRONT TETHER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE SIDE CURTAIN AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE SIDE CURTAIN AIRBAG CUSHION AND THE HEADLINER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the headliner from the vehicle. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).

(3) Disconnect the body wire harness connector for the side curtain airbag inflator from the inflator connector receptacle (Fig. 44).

(4) Disengage the side curtain airbag rear tether hook and plastic retainer clip from the slot in the roof rail near the D-pillar.

(5) Disengage the side curtain airbag front tether hook and plastic retainer clip from the slot in the lower A-pillar (Fig. 45).

(6) Disengage the side curtain airbag front tether plastic retainer from the hole in the upper A-pillar.

SIDE CURTAIN AIRBAG (Continued)

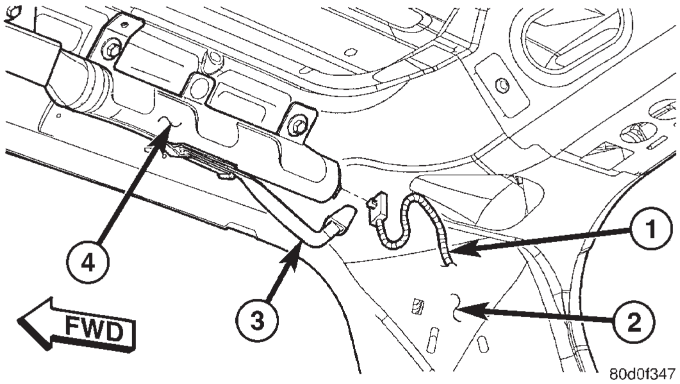


Fig. 44 Side Curtain Airbag Inflator

1 - BODY WIRE HARNESS
2 - D-PILLAR
3 - REAR TETHER
4 - INFLATOR

(7) Remove the nine screws that secure the side curtain airbag channel and inflator mounting bracket to the spring nuts in the roof side rail.

(8) Grasp the extruded plastic channel of the side curtain airbag firmly and pull it straight away from the body far enough to disengage all three plastic push-in fasteners that secure it to the locating holes in the roof side rail.

(9) Grasp the inflator of the side curtain airbag firmly and pull it straight away from the body far enough to disengage the push-in fastener that secures it to the locating hole in the roof side rail.

(10) Remove the side curtain airbag from the vehicle as a unit.

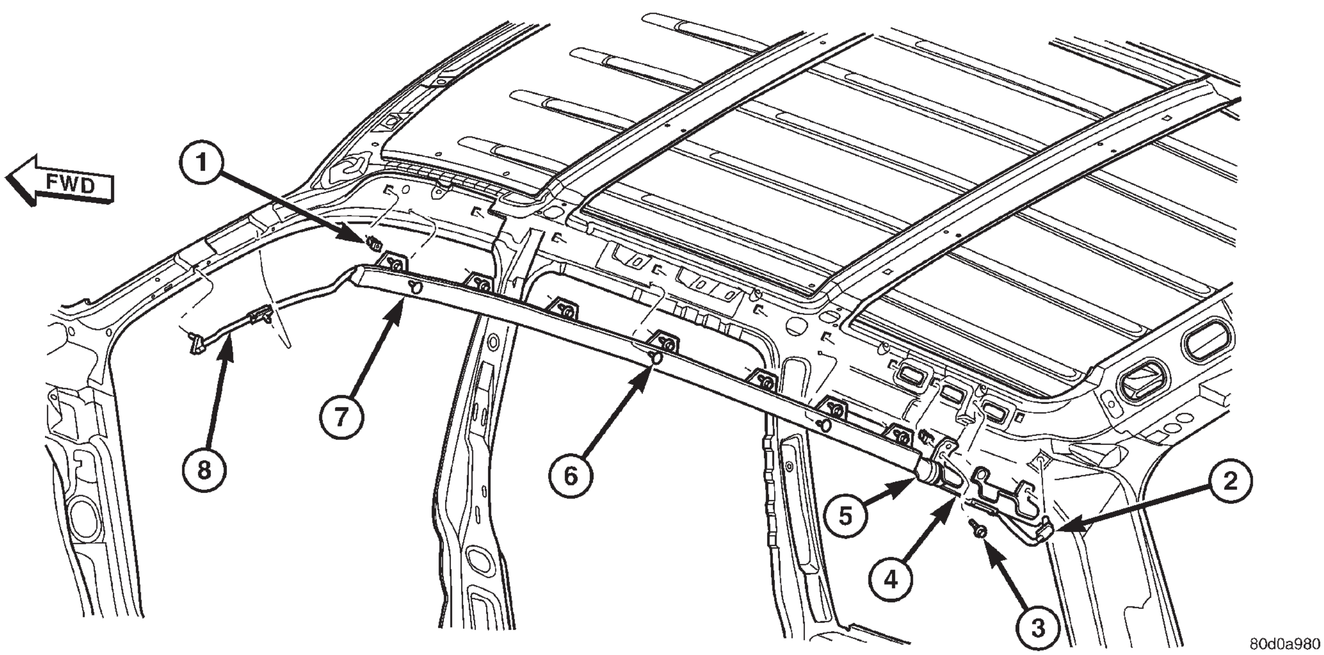


Fig. 45 Side Curtain Airbag Remove/Install

1 - NUT (9)
2 - REAR TETHER
3 - SCREW (9)
4 - INFLATOR
5 - MANIFOLD
6 - PUSH-IN FASTENER (4)
7 - CHANNEL
8 - FRONT TETHER

SIDE CURTAIN AIRBAG (Continued)

INSTALLATION

The following procedure is for replacement of a faulty or damaged side curtain airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the side curtain airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE SIDE CURTAIN AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE SIDE CURTAIN AIRBAG CUSHION AND THE HEADLINER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Position the side curtain airbag into the vehicle as a unit.

(2) Align the push-in fastener that secures the inflator of the side curtain airbag to the locating hole in the roof side rail and, using hand pressure, push firmly on the retainer until it is fully seated (Fig. 45).

(3) Align the three push-in fasteners that secure the extruded plastic channel of the side curtain airbag to the locating holes in the roof side rail and, using hand pressure, push firmly on each retainer until it is fully seated.

(4) Install and tighten the nine screws that secure the side curtain airbag channel and inflator mounting bracket to the spring nuts in the roof side rail. Tighten the screws to 6 N·m (50 in. lbs.).

(5) Align the side curtain airbag front tether plastic retainer with the hole in the upper A-pillar and, using hand pressure, push firmly on the retainer until it is fully seated.

(6) Engage the side curtain airbag front tether hook and plastic retainer clip into the slot in the lower A-pillar.

(7) Engage the side curtain airbag rear tether hook and plastic retainer clip into the slot in the roof rail near the D-pillar (Fig. 44).

(8) Reconnect the body wire harness connector for the side curtain airbag inflator to the inflator connector receptacle.

(9) Reinstall the headliner into the vehicle. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).

(10) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

SIDE IMPACT SENSOR

DESCRIPTION

Two side impact sensors are used on this model when it is equipped with the optional side curtain airbags, one each for the left and right sides of the vehicle (Fig. 46). These sensors are mounted remotely from the bi-directional safing sensor that is internal to the Airbag Control Module (ACM). The side and front impact sensors are identical in construction and calibration with the exception of the right-hand and left-hand die cast aluminum mounting brackets to which each front impact sensor is secured with two screws. The side impact sensors are secured with two screws to the base of the right and left B-pillars just below the front seat belt retractors and behind the lower B-pillar trim within the passenger compartment.

SIDE IMPACT SENSOR (Continued)

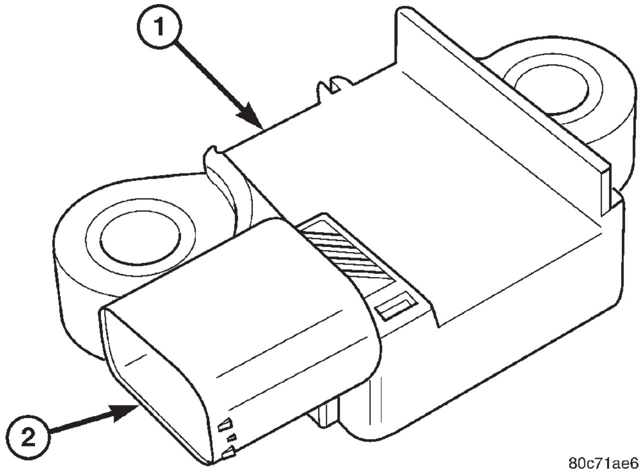


Fig. 46 Side Impact Sensor

1 - SENSOR
2 - CONNECTOR RECEPTACLE

The impact sensor housing has an integral connector receptacle and two integral mounting ears, each with a metal sleeve to provide crush protection. A cavity in the center of the molded black plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. Potting material fills the cavity to seal and protect the internal electronic circuitry and components. The side impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the airbag overlay wire harness.

The side impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced.

OPERATION

The side impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Airbag Control Module (ACM). The ACM microprocessor continuously monitors all of the passive restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly.

The impact sensors each receive battery current and ground through dedicated left and right sensor plus and minus circuits from the ACM. The impact sensors and the ACM communicate by modulating the voltage in the sensor plus circuit. The hard wired circuits between the side impact sensors and the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM or the impact sensors. The most reliable, efficient, and accurate means to diagnose the impact sensors, the ACM, and the electronic message communication between the sensors and the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE SIDE IMPACT SENSOR ENABLES THE SYSTEM TO DEPLOY THE SIDE CURTAIN AIRBAG. NEVER STRIKE OR DROP THE SIDE IMPACT SENSOR, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN IMPACT SENSOR IS ACCIDENTALLY DROPPED DURING SERVICE, THE SENSOR MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER SIDE CURTAIN AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the trim from the lower right or left B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).

(3) Disconnect the airbag overlay wire harness connector for the right or left side impact sensor from the sensor connector receptacle (Fig. 47).

(4) Remove the two screws that secure the right or left side impact sensor to the B-pillar.

(5) Remove the side impact sensor from the B-pillar.

SIDE IMPACT SENSOR (Continued)

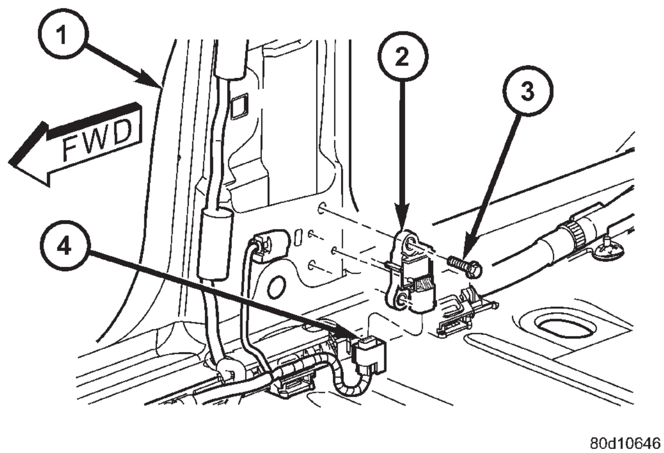


Fig. 47 Side Impact Sensor Remove/Install

1 - B-PILLAR
2 - SIDE IMPACT SENSOR
3 - SCREW (2)
4 - WIRE HARNESS CONNECTOR

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE SIDE IMPACT SENSOR ENABLES THE SYSTEM TO DEPLOY THE SIDE CURTAIN AIRBAG. NEVER STRIKE OR DROP THE SIDE IMPACT SENSOR, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN IMPACT SENSOR IS ACCIDENTALLY DROPPED DURING SERVICE, THE SENSOR MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER SIDE CURTAIN AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Position the right or left side impact sensor onto the B-pillar (Fig. 47).

(2) Install and tighten the two screws that secure the right or left side impact sensor to the B-pillar. Tighten the screws to 12 N·m (105 in. lbs.).

(3) Reconnect the airbag overlay wire harness connector for the right or left side impact sensor to the sensor connector receptacle.

(4) Reinstall the trim onto the lower right or left B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).

(5) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

SPEED CONTROL

TABLE OF CONTENTS

SPEED CONTROL

DESCRIPTION

The speed control system is electronically controlled and vacuum operated. Electronic control of the speed control system is integrated into the Powertrain Control Module (PCM). The controls consist of two steering wheel mounted switches. The switches are labeled: ON/OFF, RES/ACCEL, SET, COAST, and CANCEL.

The system is designed to operate at speeds above 30 mph (50 km/h).

WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

OPERATION

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in PCM RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal (if equipped).

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)

SPEED CONTROL (Continued)

- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RES/ACCEL switch (when speed is greater than 30 mph) restores the vehicle to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the RES/ACCEL switch. The new target speed is stored in the PCM when the RES/ACCEL is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

A “tap down” feature is used to decelerate without disengaging the speed control system. To decelerate from an existing recorded target speed, momentarily depress the COAST switch. For each switch activation, speed will be lowered approximately 1 mph.

OVERSHOOT/UNDERSHOOT

If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as a “lift foot set”), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h). It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.

The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. When the speed control is set with the vehicle operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly. If the “lift foot sets” are continually used, a speed control overshoot/undershoot condition will develop.

To “unlearn” the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating), and then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. This procedure must be performed approximately 10–15 times to completely unlearn the overshoot/undershoot condition.

DIAGNOSIS AND TESTING - ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Group 8J, Instrument Cluster for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose, damaged or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment of both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Failed speed control servo. Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

SPEED CONTROL (Continued)

SPECIFICATIONS

TORQUE - SPEED CONTROL

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Servo Mounting Bracket-to-Servo Nuts	8.5		75
Servo Mounting Bracket-to-Body Nuts	28 ± 6		250 ± 50
Switch Module Mounting Screws	.6-1		6-9
Vacuum Reservoir Mounting Bolts	3		25

CABLE

DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

OPERATION

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

REMOVAL

REMOVAL - 4.0L

(1) Disconnect negative battery cable at battery.

(2) Remove air box housing from throttle body.

(3) Using finger pressure only, remove speed control cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards drivers side of vehicle (Fig. 1). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(4) Remove cable from cable guide at top of valve cover.

(5) Squeeze 2 release tabs (Fig. 1) on sides of cable at bracket and push cable out of bracket.

(6) Remove servo cable from servo. Refer to Speed Control Servo Removal/Installation.

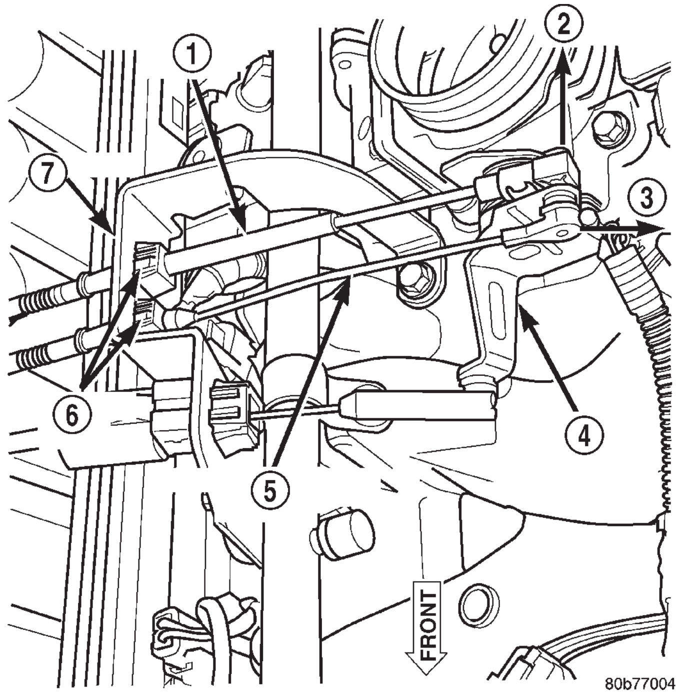


Fig. 1 Speed Control Cable at Bell Crank—4.0L Engine

1 - ACCELERATOR CABLE
2 - OFF
3 - OFF
4 - THROTTLE BODY BELLCRANK
5 - SPEED CONTROL CABLE
6 - RELEASE TABS
7 - BRACKET

REMOVAL - 4.7L

(1) Disconnect negative battery cable at battery.

(2) Remove air box housing from throttle body.

The accelerator cable must be partially removed to gain access to speed control cable.

(3) Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 2). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

CABLE (Continued)

(4) Lift accelerator cable from top of cable cam (Fig. 2).

(5) Press tab (Fig. 3) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (Fig. 3) towards passenger side of vehicle to remove cable from bracket.

(6) Using finger pressure only, disconnect speed control cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 2). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(7) Slide speed control cable plastic mount towards passenger side of vehicle to remove cable from bracket (Fig. 4).

(8) Remove servo cable from servo. Refer to Speed Control Servo Removal/Installation.

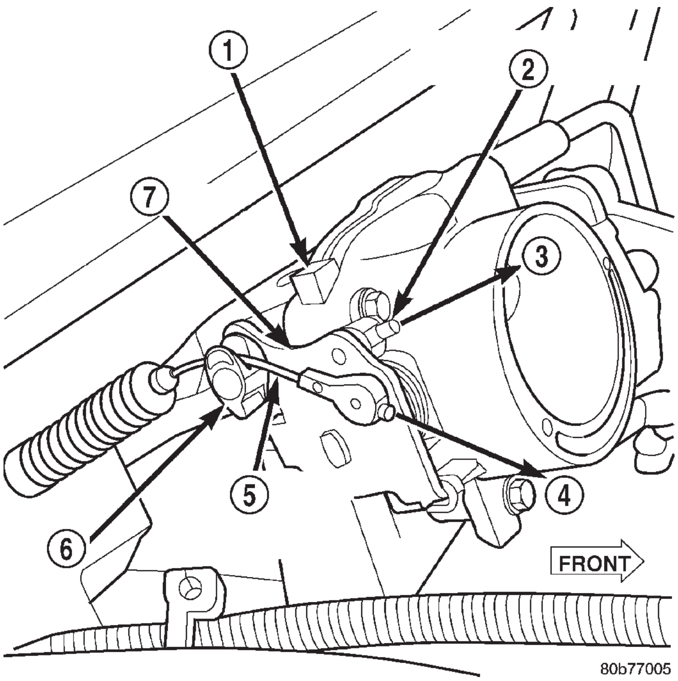


Fig. 2 Cable Connectors at Bell Crank—4.7L V-8 Engine

1 - THROTTLE BODY
2 - SPEED CONTROL CABLE CONNECTOR
3 - OFF
4 - OFF
5 - ACCELERATOR CABLE CONNECTOR
6 - CABLE CAM
7 - BELLCRANK

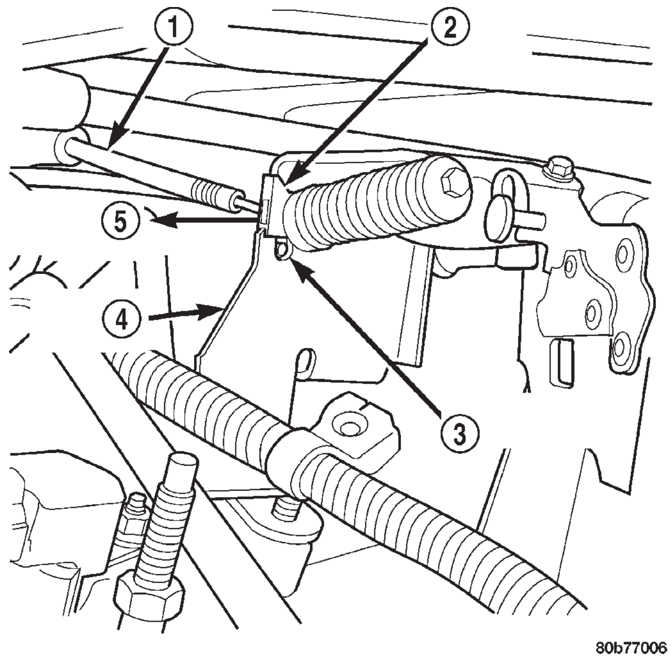


Fig. 3 Accelerator Cable Release Tab—4.7L V-8 Engine

1 - ACCELERATOR CABLE
2 - PLASTIC CABLE MOUNT
3 - PRESS TAB FOR REMOVAL
4 - CABLE BRACKET
5 - SLIDE FOR REMOVAL

INSTALLATION

INSTALLATION - 4.0L

(1) Install end of cable to speed control servo. Refer to Speed Control Servo Removal/Installation.

(2) Install cable into mounting bracket (snaps in).

(3) Install speed control cable connector at throttle body bellcrank pin (snaps on).

(4) Connect negative battery cable at battery.

(5) Before starting engine, operate accelerator pedal to check for any binding.

INSTALLATION - 4.7L

(1) Install end of cable to speed control servo. Refer to Speed Control Servo Removal/Installation.

(2) Slide speed control cable plastic mount into bracket.

(3) Install speed control cable connector onto throttle body bellcrank pin (snaps on).

(4) Slide accelerator cable plastic mount into bracket. Continue sliding until tab (Fig. 3) is aligned to hole in mounting bracket.

(5) Route accelerator cable over top of cable cam (Fig. 2).

(6) Install accelerator cable connector onto throttle body bellcrank pin (snaps on).

(7) Install air box housing to throttle body.

CABLE (Continued)

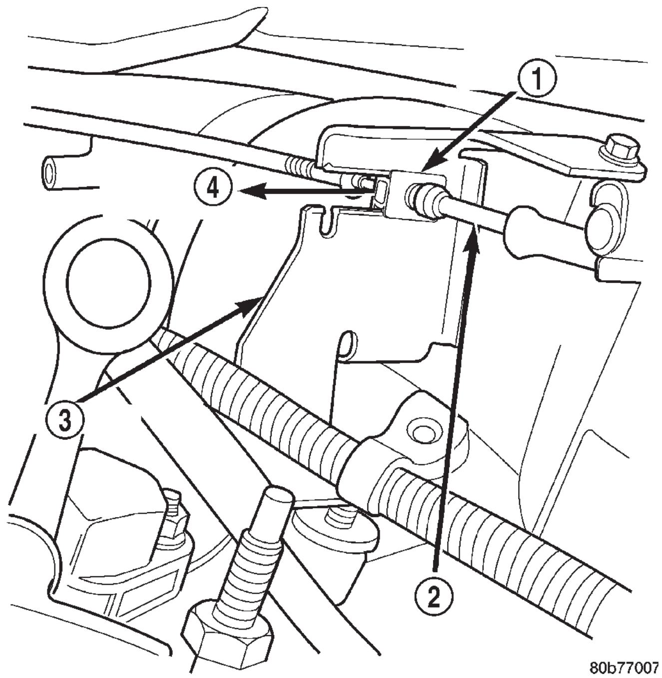


Fig. 4 Speed Control Cable at Bracket—4.7L V-8 Engine

1 - PLASTIC CABLE MOUNT
2 - SPEED CONTROL CABLE
3 - BRACKET
4 - SLIDE FOR REMOVAL

(8) Connect negative battery cable at battery.

(9) Before starting engine, operate accelerator pedal to check for any binding.

SERVO

DESCRIPTION

The servo unit consists of a solenoid valve body, and a vacuum chamber. The solenoid valve body contains three solenoids:

- Vacuum
- Vent
- Dump

The vacuum chamber contains a diaphragm with a cable attached to control the throttle linkage.

OPERATION

The Powertrain Control Module (PCM) controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

Power is supplied to the servo's by the PCM through the brake switch. The PCM controls the ground path for the vacuum and vent solenoids.

The dump solenoid is energized anytime it receives power. If power to the dump solenoid is interrupted, the solenoid dumps vacuum in the servo. This provides a safety backup to the vent and vacuum solenoids.

The vacuum and vent solenoids must be grounded at the PCM to operate. When the PCM grounds the vacuum servo solenoid, the solenoid allows vacuum to enter the servo and pull open the throttle plate using the cable. When the PCM breaks the ground, the solenoid closes and no more vacuum is allowed to enter the servo. The PCM also operates the vent solenoid via ground. The vent solenoid opens and closes a passage to bleed or hold vacuum in the servo as required.

The PCM duty cycles the vacuum and vent solenoids to maintain the set speed, or to accelerate and decelerate the vehicle. To increase throttle opening, the PCM grounds the vacuum and vent solenoids. To decrease throttle opening, the PCM removes the grounds from the vacuum and vent solenoids. When the brake is released, if vehicle speed exceeds 30 mph to resume, 35 mph to set, and the RES/ACCEL switch has been depressed, ground for the vent and vacuum circuits is restored.

REMOVAL

The speed control servo is attached to a bracket. The bracket and servo assembly are located below the battery tray.

(1) Disconnect negative battery cable at battery.

(2) Disconnect positive battery cable at battery.

(3) Remove air cleaner housing at top of throttle body and disconnect servo cable at throttle body. Refer to Servo Cable Removal/Installation.

(4) Remove battery from battery tray.

(5) Disconnect wiring at battery tray.

(6) Disconnect positive battery cable at Power Distribution Center (PDC).

(7) Loosen PDC at battery tray.

(8) Remove 4 battery tray bolts. One of these bolts attaches to speed control bracket flange that supports battery tray. While removing battery tray, disconnect battery temperature sensor electrical connector at sensor.

(9) Disconnect vacuum line at servo vacuum hose fitting (Fig. 5) .

(10) Disconnect electrical connector at servo (Fig. 5) .

If servo and mounting bracket are being removed as one assembly, remove two mounting nuts (Fig. 5) . These are located above right-front tire. Remove inner fender clips and pry inner fender back slightly to gain access to mounting nuts.

SERVO (Continued)

(11) If servo is being removed from its mounting bracket, remove 2 mounting nuts holding servo cable sleeve to bracket (Fig. 6) .

(12) Pull speed control cable sleeve and servo away from servo mounting bracket to expose cable retaining clip (Fig. 6) and remove clip. Note: The servo mounting bracket displayed in (Fig. 6) is a typical bracket and may/may not be applicable to this model vehicle.

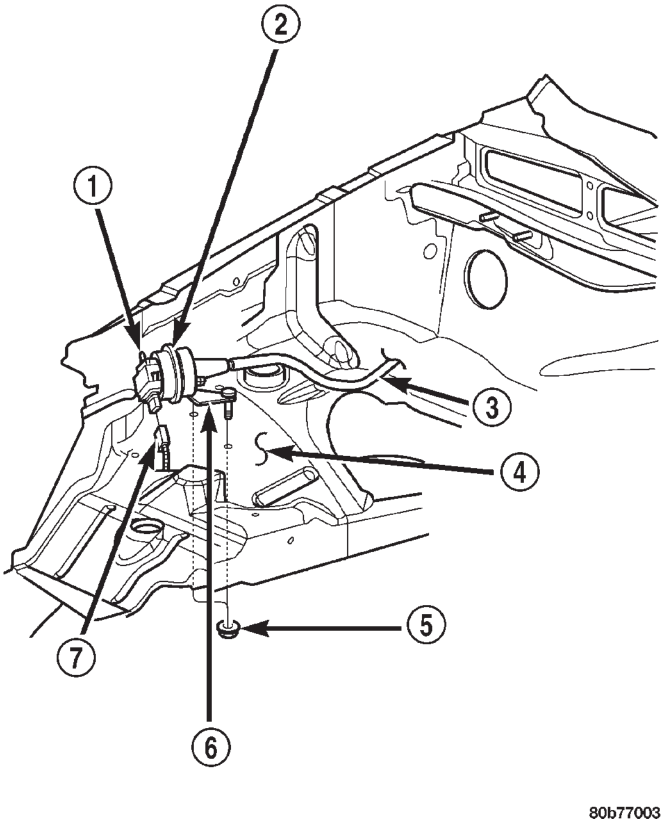


Fig. 5 Speed Control

1 - VACUUM HOSE FITTING
2 - SPEED CONTROL SERVO
3 - SERVO CABLE
4 - RIGHT INNER FENDER
5 - SERVO MOUNTING NUTS (2)
6 - SERVO MOUNTING BRACKET
7 - ELEC. CONNECTOR

(13) Remove servo from mounting bracket or, remove servo and mounting bracket as one assembly.

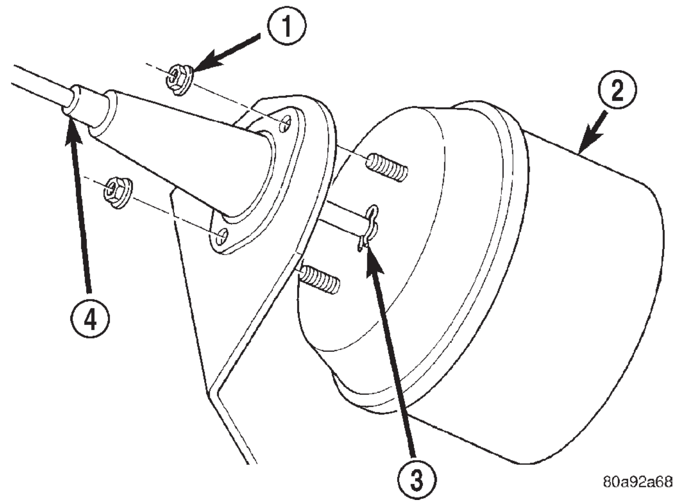


Fig. 6 Servo Cable Clip Remove/Install—Typical

1 - SERVO MOUNTING NUTS (2)
2 - SERVO
3 - CABLE RETAINING CLIP
4 - SERVO CABLE AND SLEEVE

INSTALLATION

(1) Position servo to mounting bracket.

(2) Align hole in cable connector with hole in servo pin. Install cable-to-servo retaining clip.

(3) Insert servo mounting studs through holes in servo mounting bracket.

(4) Install servo cable mounting nuts (Fig. 6) and tighten to 8.5 N·m (75 in. lbs.) torque. If servo and bracket is being installed as one assembly, install 2 mounting nuts (Fig. 5) and tighten to 28 N·m ±6 N·m (250 in. lbs. ±50 in. lbs.) torque.

(5) Connect vacuum line at servo.

(6) Connect electrical connector at servo.

(7) Connect servo cable to throttle body. Refer to Servo Cable Removal/Installation.

(8) Install battery tray and battery temperature sensor.

(9) Connect wiring to battery tray.

(10) Install battery to battery tray.

(11) Connect positive battery cable to Power Distribution Center (PDC).

(12) Connect positive battery cable to battery.

(13) Connect negative battery cable to battery.

(14) Before starting engine, operate accelerator pedal to check for any binding.

SWITCH

DESCRIPTION

There are two separate switch pods that operate the speed control system. The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

OPERATION

When speed control is selected by depressing the ON, OFF switch, the PCM allows a set speed to be stored in its RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between approximately 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral
- The VSS signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- Depressing the clutch pedal.
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)
- If the actual speed is not within 20 mph of the set speed

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the ACCEL switch restores the vehicle to the target speed that was stored in the PCM's RAM.

NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.

If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the ACCEL switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the PCM's RAM when the ACCEL switch is released. The PCM also has a "tap-up" feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACCEL switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST switch until the desired speed is reached. Then release the switch. The ON, OFF switch operates two components: the PCM's ON, OFF input, and the battery voltage to the brake switch, which powers the speed control servo.

Multiplexing

The PCM sends out 5 volts through a fixed resistor and monitors the voltage change between the fixed resistor and the switches. If none of the switches are depressed, the PCM will measure 5 volts at the sensor point (open circuit). If a switch with no resistor is closed, the PCM will measure 0 volts (grounded circuit). Now, if a resistor is added to a switch, then the PCM will measure some voltage proportional to the size of the resistor. By adding a different resistor to each switch, the PCM will see a different voltage depending on which switch is pushed.

Another resistor has been added to the 'at rest circuit' causing the PCM to never see 5 volts. This was done for diagnostic purposes. If the switch circuit should open (bad connection), then the PCM will see the 5 volts and know the circuit is bad. The PCM will then set an open circuit fault.

REMOVAL

WARNING: BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION, REMOVE AND ISOLATE THE NEGATIVE (-) CABLE FROM THE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. THEN WAIT TWO MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE INJURY.

(1) Disconnect and isolate negative battery cable.
(2) Remove airbag module. Refer to Group 8M, Passive Restraint Systems.
(3) Remove electrical connector at switch.
(4) Remove switch-to-steering wheel mounting screw (Fig. 7) .
(5) Remove switch.

INSTALLATION

(1) Install switch and mounting screw.
(2) Tighten screw to 1.5 N·m (15 in. lbs.) torque.
(3) Install electrical connector to switch.

SWITCH (Continued)

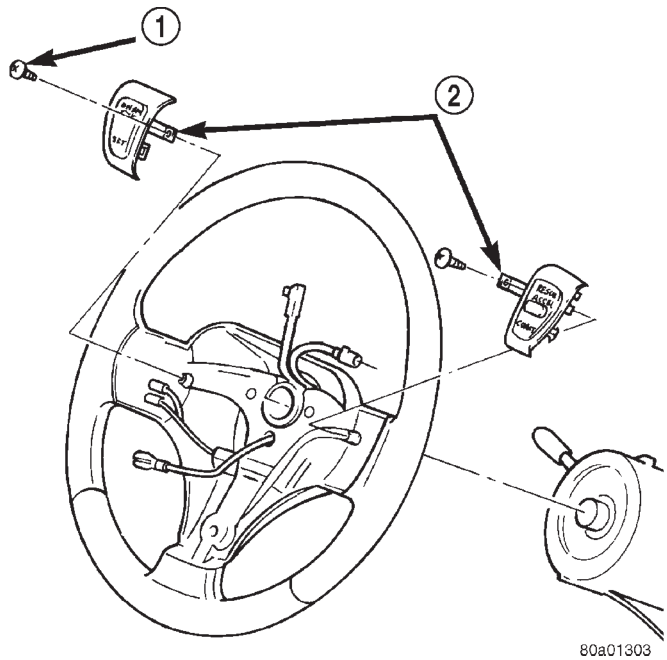


Fig. 7 Speed Control Switches

1 - MOUNTING SCREW
2 - SPEED CONTROL SWITCHES

(4) Install airbag module. Refer to Group 8M, Passive Restraint Systems.

(5) Connect negative battery cable.

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is a plastic storage tank connected to an engine vacuum source by vacuum lines.

OPERATION

The vacuum reservoir is used to supply the vacuum needed to maintain proper speed control operation when engine vacuum drops, such as in climbing a grade while driving. A one-way check valve is used in the vacuum line between the reservoir and the vacuum source. This check valve is used to trap engine vacuum in the reservoir. On certain vehicle applications, this reservoir is shared with the heating/air-conditioning system. The vacuum reservoir cannot be repaired and must be replaced if faulty.

DIAGNOSIS AND TESTING - VACUUM RESERVOIR

(1) Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.

(3) If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum line to engine for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.

(4) If vacuum line to engine is not leaking, check for leak at vacuum reservoir. To locate and gain access to reservoir, refer to Vacuum Reservoir Removal/Installation in this group. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.

(5) Verify operation of one-way check valve and check it for leaks.

(a) Locate one-way check valve. The valve is located in vacuum line between vacuum reservoir and engine vacuum source. Disconnect vacuum hoses (lines) at each end of valve.

(b) Connect a hand-operated vacuum pump to reservoir end of check valve. Apply vacuum. Vacuum should not bleed off. If vacuum is being lost, replace one-way check valve.

(c) Connect a hand-operated vacuum pump to vacuum source end of check valve. Apply vacuum. Vacuum should flow through valve. If vacuum is not flowing, replace one-way check valve. Seal the fitting at opposite end of valve with a finger and apply vacuum. If vacuum will not hold, diaphragm within check valve has ruptured. Replace valve.

REMOVAL

The vacuum reservoir is located in the right/front corner of the vehicle behind the front bumper fascia (Fig. 8).

(1) Remove front bumper and grill assembly.

(2) Remove 1 support bolt near front of reservoir (Fig. 8).

(3) Remove 2 reservoir mounting bolts.

(4) Remove reservoir from vehicle to gain access to vacuum hose (Fig. 9). Disconnect vacuum hose from reservoir fitting at rear of reservoir.

VACUUM RESERVOIR (Continued)

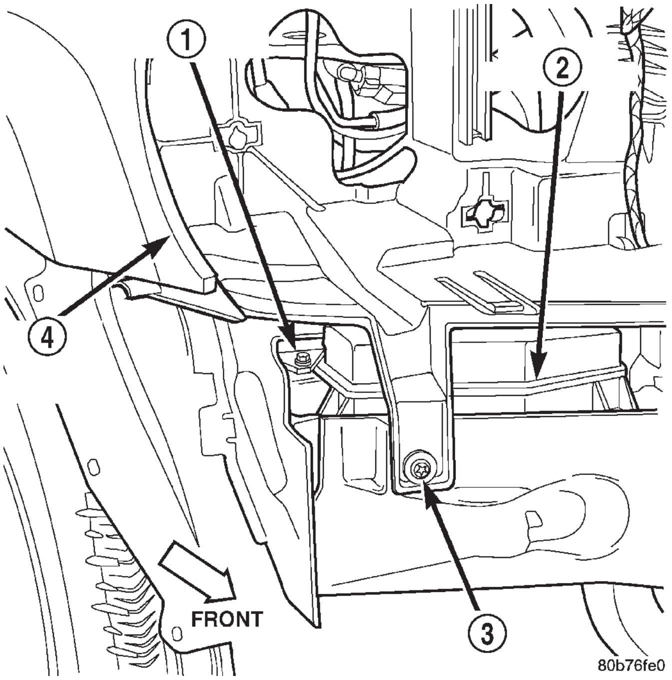


Fig. 8 Vacuum Reservoir Location

1 - RADIATOR FAN RELAY
2 - VACUUM RESERVOIR
3 - BOLT
4 - RIGHT FRONT FENDER

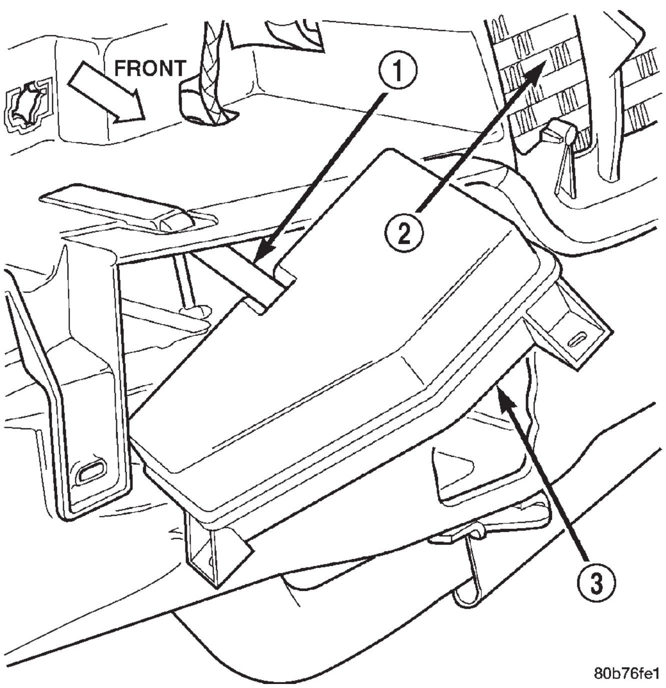


Fig. 9 Vacuum Reservoir Removal/Installation

1 - VACUUM HOSE
2 - RADIATOR
3 - VACUUM RESERVOIR

INSTALLATION

The vacuum reservoir is located in the right/front corner of the vehicle behind the front bumper fascia (Fig. 8).

(1) Connect vacuum hose to reservoir.

(2) Install reservoir and tighten 2 bolts to 3 N·m (25 in. lbs.) torque.

(3) Install front bumper and grill assembly.

VEHICLE THEFT SECURITY

TABLE OF CONTENTS

VEHICLE THEFT SECURITY

DESCRIPTION

DESCRIPTION - VEHICLE THEFT SECURITY SYSTEM

The Vehicle Theft Security System (VTSS) is designed to provide perimeter protection against unauthorized vehicle use or tampering by monitoring the vehicle doors, the liftgate, the liftgate flip-up glass, the ignition system and, only on vehicles built for sale in certain international markets where it is required equipment, the hood. If unauthorized vehicle use or tampering is detected, the system responds by pulsing the horn and flashing the exterior lamps. In many markets the VTSS also includes the Sentry Key Immobilizer System (SKIS), which provides passive vehicle protection by preventing the engine from operating unless a valid electronically encoded key is detected in the ignition lock cylinder. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - DESCRIPTION - SENTRY KEY IMMOBILIZER SYSTEM).

The VTSS includes the following major components, which are described in further detail elsewhere in this service manual:

• Body Control Module (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY

VEHICLE THEFT SECURITY (Continued)

CONTROL/CENTRAL TIMER MODULE - DESCRIPTION).

- Combination Flasher (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/COMBINATION FLASHER - DESCRIPTION).
- Door Ajar Switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOOR AJAR SWITCH - DESCRIPTION - DOOR AJAR SWITCH).
- Driver Cylinder Lock Switch (Refer to 8 - ELECTRICAL/POWER LOCKS/DOOR CYLINDER LOCK/UNLOCK SWITCH - DESCRIPTION).
- Hood Ajar Switch(Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - DESCRIPTION).
- Horn Relay (Refer to 8 - ELECTRICAL/HORN/HORN RELAY - DESCRIPTION).
- Liftgate Ajar Switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOOR AJAR SWITCH - DESCRIPTION - LIFTGATE AJAR SWITCH).
- Liftgate Flip-Up Glass Ajar Switch(Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOOR AJAR SWITCH - DESCRIPTION - LIFTGATE FLIP-UP GLASS AJAR SWITCH).
- Low Beam Headlamp Relay
- VTSS Indicator (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/VTSS INDICATOR - DESCRIPTION).

Certain functions and features of the VTSS rely upon resources shared with or controlled by other modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The other modules that may affect VTSS operation are:

- Driver Door Module (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DESCRIPTION).
- Passenger Door Module (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/DOOR MODULE - DESCRIPTION).

DESCRIPTION - SENTRY KEY IMMOBILIZER SYSTEM

Vehicles equipped with the Sentry Key Immobilizer System (SKIS) can be identified by the presence of an amber SKIS indicator in the instrument cluster that will illuminate for about three seconds each time the ignition switch is turned to the On position, or by a gray molded rubber cap on the head of the ignition key. Models not equipped with SKIS still have a SKIS indicator in the cluster, but it will not illuminate. Also, models not equipped with the SKIS have a black molded rubber cap on the head of the ignition key.

The SKIS includes the following major components, which are described in further detail elsewhere in this service manual:

- Powertrain Control Module
- Sentry Key Immobilizer Module
- Sentry Key Transponder
- SKIS Indicator

Except for the Sentry Key transponders, which rely upon Radio Frequency (RF) communication, hard wired circuitry connects the SKIS components to the electrical system of the vehicle.Refer to the appropriate wiring information.

OPERATION

OPERATION - VEHICLE THEFT SECURITY SYSTEM

The Vehicle Theft Security System (VTSS) is divided into two basic subsystems: Vehicle Theft Alarm (VTA) and Sentry Key Immobilizer System (SKIS). The following are paragraphs that briefly describe the operation of each of those two subsystems.

A Body Control Module (BCM) is used to control and integrate many of the functions and features included in the Vehicle Theft Security System (VTSS). In the VTSS, the BCM receives inputs indicating the status of the door ajar switches, the driver cylinder lock switch, the ignition switch, the liftgate ajar switches, the liftgate flip-up glass ajar switch, the power lock switches and, in vehicles so equipped, the hood ajar switch. The programming in the BCM allows it to process the information from all of these inputs and send control outputs to energize or de-energize the combination flasher, the horn relay (except vehicles with the premium version of the VTA), and the VTSS indicator. In addition, in vehicles built for certain markets where premium versions of the VTA is required, the BCM also exchanges messages with the Intrusion Transceiver Module (ITM) over the Programmable Communications Interface (PCI) data buss network to provide the features found in this version of the VTA. The control of these inputs and outputs are what constitute all of the features of the VTSS. Following is information on the operation of each of the VTSS features.

ENABLING

The BCM must have the VTSS function enabled in order for the VTSS to perform as designed. The logic in the BCM keeps its VTSS function dormant until it is enabled using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

PRE-ARMING

The VTA has a pre-arming sequence. Pre-arming occurs when a door, the tailgate, or the flip-up glass is open when the vehicle is locked using a power lock

VEHICLE THEFT SECURITY (Continued)

switch, or when the “Lock” button on the Remote Keyless Entry (RKE) transmitter is depressed. The powerlock switch will not initiate the pre-arming sequence if the key is in the ignition switch. When the VTA is pre-armed, the arming sequence is delayed until all of the doors, the tailgate and the flip-up glass are closed.

ARMING

Passive arming of the VTSS occurs when the vehicle is exited with the key removed from the ignition switch, the headlamps are turned off, and the doors are locked while they are open using the power lock switch. The power lock switch will not function if the key is in the ignition switch or the headlamps are turned on with the driver side front door open. The VTSS will not arm if the driver side front door is locked using the key in the lock cylinder or using the mechanical lock button. Active arming of the VTSS occurs when the “Lock” button on the Remote Keyless Entry (RKE) transmitter is depressed to lock the vehicle, even if the doors and/or the liftgate are open when the RKE transmitter Lock button is depressed. However, the VTSS arming will not be complete until all of the doors, the liftgate and the liftgate flip-up glass are closed. On vehicles equipped with the hood ajar switch, VTSS arming will complete if the hood is open, but the underhood area will not be protected unless the hood is closed when the VTSS is armed.

Following successful passive or active VTSS arming, the VTSS indicator on the top of the instrument panel will flash rapidly for about sixteen seconds after the illuminated entry system times out. This indicates that VTSS arming is in progress. Once the sixteen second arming function is successfully completed, the indicator will flash at a slower rate, indicating that the VTSS is armed.

DISARMING

Passive disarming of the VTSS occurs when the vehicle is unlocked using the key to unlock the driver side front door. Active disarming of the VTSS occurs when the vehicle is unlocked by depressing the “Unlock” button of the Remote Keyless Entry (RKE) transmitter. Once the alarm has been activated, either disarming method will also deactivate the alarm. Depressing the “Panic” button on the RKE transmitter will also disarm the VTSS, but the horn will continue to pulse and the exterior lamps will continue to flash for about three minutes as part of the Panic feature function. The Panic feature is overridden if the “Panic” button is depressed a second time, or if a vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) is attained.

POWER-UP MODE

When the armed VTSS senses that the battery has been disconnected and reconnected, it enters its power-up mode. In the power-up mode the alarm system remains armed following a battery failure or disconnect. If the VTSS was armed prior to a battery disconnect or failure, the technician or vehicle operator will have to actively or passively disarm the alarm system after the battery is reconnected. The power-up mode will also apply if the battery goes dead while the system is armed, and battery jump-starting is then attempted. The VTSS will be armed until it is actively or passively disarmed. If the VTSS is in the disarmed mode prior to a battery disconnect or failure, it will remain disarmed after the battery is reconnected or replaced, or if jump-starting is attempted.

ALARM

The VTA alarm output varies by the version of the VTA with which the vehicle is equipped. In all cases, the alarm provides both visual and audible outputs; however, the time intervals of these outputs vary by the requirements of the market for which the vehicle is manufactured. In all cases, the visual output will be a flashing of the exterior lamps. For vehicles equipped with North American or the base version of the VTA, the audible output will be the pulsing of the horn. For vehicles with the premium version of the VTA, the audible output will be the cycling of the siren. The inputs that will trigger the alarm include the door ajar switch, the flip-up glass ajar switch, and in vehicles built for certain markets where they are required, the hood ajar switch and the Intrusion Transceiver Module (ITM).

TAMPER ALERT

The VTSS tamper alert feature will sound the horn (or the alarm siren for the premium version) three times upon VTA disarming, if the alarm was triggered and has since timed-out (about eighteen minutes). This feature alerts the vehicle operator that the VTA alarm was activated while the vehicle was unattended.

INTRUSION ALARM

The Intrusion Alarm is an exclusive feature of the premium version of the VTA, which is only available in certain markets, where it is required. When the VTA is armed, a motion sensor in the Intrusion Transceiver Module (ITM) monitors the interior of the vehicle for movement. If motion is detected, the ITM sends a message to the BCM over the PCI bus to invoke the visual alarm feature, and sends a message to the alarm siren over a dedicated serial bus to invoke the audible alarm feature. The motion detec-

VEHICLE THEFT SECURITY (Continued)

tion feature of the ITM can be disabled by depressing the “Lock” button on the RKE transmitter three times or cycling the key in the driver door cylinder from the center to lock position within fifteen seconds during VTA arming, while the security indicator is still flashing rapidly. The VTA provides a single short siren “chirp” as an audible conformation that the motion detect disable request has been received. The ITM must be electronically enabled in order for the intrusion alarm to perform as designed. The intrusion alarm function of the ITM is enabled on vehicles equipped with this option at the factory, but a service replacement ITM must be configured and enabled by the dealer using the DRBIII® scan tool. Refer to the appropriate diagnostic information.

OPERATION - SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by disabling the engine after about two seconds of running, whenever any method other than a valid Sentry Key is used to start the vehicle. The SKIS is considered a passive protection system because it is always active when the ignition system is energized and does not require any customer intervention. The SKIS uses Radio Frequency (RF) communication to obtain confirmation that the key in the ignition switch is a valid key for operating the vehicle. The microprocessor-based SKIS hardware and software also uses messages to communicate with other modules in the vehicle over the Programmable Communications Interface (PCI) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

Pre-programmed Sentry Key transponders are provided with the vehicle from the factory. Each Sentry Key Immobilizer Module (SKIM) will recognize a maximum of eight Sentry Keys. If the customer would like additional keys other than those provided with the vehicle, they may be purchased from any authorized dealer. These additional keys must be programmed to the SKIM in the vehicle in order for the system to recognize them as valid keys. This can be done by the dealer using a DRBIII® scan tool or, if Customer Learn programming is an available SKIS feature in the market where the vehicle was purchased, the customer can program the additional keys, as long as at least two valid Sentry Keys are already available. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store fault information in the form of Diagnostic Trouble Codes (DTC’s) if a system malfunction is detected. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - VEHICLE THEFT SECURITY SYSTEM

The VTSS-related hard wired inputs to and outputs from the Body Control Module (BCM), the Driver Door Module (DDM), or the Passenger Door Module (PDM) may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM, the DDM, the PDM, or the Programmable Communications Interface (PCI) data bus network. In order to obtain conclusive testing of the VTSS, the BCM, the DDM, the PDM, and the PCI data bus network must also be checked. The most reliable, efficient, and accurate means to diagnose the VTSS requires the use of a DRBIII® scan tool and the appropriate diagnostic information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

VEHICLE THEFT SECURITY (Continued)

DIAGNOSIS AND TESTING - SENTRY KEY IMMOBILIZER SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

SENTRY KEY IMMOBILIZER SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
SKIS INDICATOR FAILS TO LIGHT DURING BULB TEST	1. Bulb faulty.	1. Perform the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING - ACTUATOR TEST). Replace the faulty bulb, if required.
	2. Fuse faulty.	2. Check the SKIM fused B(+) fuse and the fused ignition switch output (st-run) fuse in the JB. Replace fuses, if required.
	3. Ground path faulty.	3. Check for continuity to ground at the connector for the SKIM. Repair wiring, if required.
	4. Battery feed faulty.	4. Check for battery current at the connector for the SKIM. Repair wiring, if required.
	5. Ignition feed faulty.	5. Check for battery current at the connector for the SKIM with the ignition switch in the On position. Repair wiring, if required.
SKIS INDICATOR FLASHES FOLLOWING BULB TEST	1. Invalid key in ignition switch lock cylinder.	1. Replace the key with a known valid key.
	2. Key-related fault.	2. Use a DRBIII® scan tool and the appropriate diagnostic information for further diagnosis.
SKIS INDICATOR LIGHTS SOLID FOLLOWING BULB TEST	1. SKIS system malfunction/ fault detected.	1. Use a DRBIII® scan tool and the appropriate diagnostic information for further diagnosis.
	2. SKIS system inoperative.	2. Use a DRBIII® scan tool and the appropriate diagnostic information for further diagnosis.

SKIS INDICATOR FAILS TO LIGHT DURING BULB TEST

If the Sentry Key Immobilizer System (SKIS) indicator in the instrument cluster fails to illuminate for about three seconds after the ignition switch is turned to the On position (bulb test), perform the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING - ACTUATOR TEST). If the bulb fails to operate during the actuator test, replace the bulb. If the SKIS indicator still fails to light during the bulb test, a wiring problem resulting in the loss of battery current or ground to the Sentry Key Immobilizer Module (SKIM) should be suspected, and the following procedure should be used for diagnosis. Refer to the appropriate wiring information.

NOTE: The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Sentry Key Immobilizer System requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

(1) Check the fused B(+) fuse in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component and replace the faulty fuse.

VEHICLE THEFT SECURITY (Continued)

(2) Check for battery voltage at the fused B(+) fuse in the JB. If OK, go to Step 3. If not OK, repair the open B(+) circuit between the JB fuse and the Power Distribution Center (PDC).

(3) Check the fused ignition switch output (st-run) fuse in the JB. If OK, go to Step 4. If not OK, repair the shorted circuit or component and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (st-run) fuse in the JB. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (st-run) circuit between the JB fuse and the ignition switch as required.

(5) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the Sentry Key Immobilizer Module (SKIM) from the SKIM connector. Check for continuity between the ground circuit of the instrument panel wire harness connector for the SKIM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit.

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the SKIM. If OK, go to Step 7. If not OK, repair the open fused B(+) circuit between the SKIM and the JB fuse.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (st-run) circuit of the instrument panel wire harness connector for the SKIM. If OK, refer to the appropriate diagnostic information and use a DRBIII® scan tool to complete the diagnosis of the SKIS. If not OK, repair the open fused ignition switch output (st-run) circuit between the SKIM and the JB fuse.

SKIS INDICATOR FLASHES OR LIGHTS SOLID FOLLOWING BULB TEST

A SKIS indicator that flashes following a successful bulb test indicates that an invalid key has been detected, or that a key-related fault has been set. A SKIS indicator that lights solid following a successful bulb test indicates that the SKIM has detected a system malfunction or that the SKIS is inoperative. In either case, fault information will be stored in the SKIM memory. For retrieval of this fault information and further diagnosis of the SKIS, the PCI data bus, the SKIM message outputs to the instrument cluster, the SKIM message outputs to the Body Control Module (BCM), or the message inputs and outputs between the SKIM and the Powertrain Control Module (PCM), a DRBIII® scan tool and the appropriate diagnostic information are required. Following are preliminary troubleshooting guidelines to be followed during diagnosis using a DRBIII® scan tool:

(1) Using the DRBIII® scan tool, read and record the faults as they exist in the SKIM when you first begin your diagnosis of the vehicle. It is important to document these faults because the SKIM does not differentiate between historical and active faults. If this problem turns out to be an intermittent condition, this information may become invaluable to your diagnosis.

(2) Using the DRBIII® scan tool, erase all of the faults from the SKIM.

(3) Cycle the ignition switch to the Off position, then back to the On position.

(4) Using the DRBIII® scan tool, read any faults that are now present in the SKIM. These are the active faults.

(5) Using this active fault information, refer to the proper procedure in the appropriate diagnostic information for the additional specific diagnostic steps.

STANDARD PROCEDURE

STANDARD PROCEDURE - SKIS INITIALIZATION

The Sentry Key Immobilizer System (SKIS) must be initialized following a Sentry Key Immobilizer Module (SKIM) replacement. SKIS initialization requires the use of a DRBIII® scan tool. Initialization will also require that you have access to the unique four-digit PIN code that was assigned to the original SKIM. The PIN code **must** be used to enter the Secured Access Mode in the SKIM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - PCM/SKIM PROGRAMMING).

NOTE: If a Powertrain Control Module (PCM) is replaced on a vehicle equipped with the Sentry Key Immobilizer System (SKIS), the unique Secret Key data must be transferred from the Sentry Key Immobilizer Module (SKIM) to the new PCM using the PCM replacement procedure. This procedure also requires the use of a DRBIII® scan tool and the unique four-digit PIN code to enter the Secured Access Mode in the SKIM. Refer to the appropriate diagnostic information for the proper PCM replacement procedures.

STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING

All Sentry Keys included with the vehicle are preprogrammed to work with the Sentry Key Immobilizer System (SKIS) when it is shipped from the

VEHICLE THEFT SECURITY (Continued)

factory. The Sentry Key Immobilizer Module (SKIM) can be programmed to recognize up to a total of eight Sentry Keys. When programming a blank Sentry Key transponder, the key must first be cut to match the ignition switch lock cylinde for which it will be used. Once the additional key has been cut, the SKIM must be programmed to recognize it as a valid key. There are two possible methods to program the SKIM to recognize a new or additional valid key, the Secured Access Method and the Customer Learn Method. Following are the details of these two programming methods.

SECURED ACCESS METHOD

The Secured Access method applies to all vehicles. This method requires the use of a DRBIII® scan tool. This method will also require that you have access to the unique four-digit PIN code that was assigned to the original SKIM. The PIN code **must** be used to enter the Secured Access Mode in the SKIM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. Refer to the appropriate diagnostic information for the proper Secured Access method programming procedures.

CUSTOMER LEARN METHOD

The Customer Learn feature is only available on domestic vehicles, or those vehicles which have a U.S. country code designator. This programming method also requires access to at least two valid Sentry Keys. If two valid Sentry Keys are not available, or if the vehicle does not have a U.S. country code designator, the Secured Access Method **must** be used to program new or additional valid keys to the SKIM. The Customer Learn programming method procedures are as follows:

(1) Obtain the blank Sentry Key(s) that are to be programmed as valid keys for the vehicle. Cut the blank key(s) to match the ignition switch lock cylinder mechanical key codes.

(2) Insert one of the two valid Sentry Keys into the ignition switch and turn the ignition switch to the On position.

(3) After the ignition switch has been in the On position for longer than three seconds, but no more than fifteen seconds, cycle the ignition switch back to the Off position. Replace the first valid Sentry Key in the ignition switch lock cylinder with the second valid Sentry Key and turn the ignition switch back to the On position. The second valid Sentry Key must be inserted in the lock cylinder within fifteen seconds of removing the first valid key.

(4) About ten seconds after the completion of Step 3, the SKIS indicator in the instrument cluster will start to flash and a single audible chime tone will sound to indicate that the system has entered the Customer Learn programming mode.

(5) Within sixty seconds of entering the Customer Learn programming mode, turn the ignition switch to the Off position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the On position.

(6) About ten seconds after the completion of Step 5, a single audible chime tone will sound and the SKIS indicator will stop flashing, stay on solid for three seconds, then turn off to indicate that the blank Sentry Key has been successfully programmed. The SKIS will immediately exit the Customer Learn programming mode and the vehicle may now be started using the newly programmed valid Sentry Key.

Each of these steps must be repeated and completed in their entirety for each additional Sentry Key that is to be programmed. If the above steps are not completed in the given sequence, or within the allotted time, the SKIS will exit the Customer Learn programming mode and the programming will be unsuccessful. The SKIS will also automatically exit the Customer Learn programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight (8) valid Sentry Keys, or if the ignition switch is turned to the Off position for more than about fifty seconds.

NOTE: If an attempt is made to start the vehicle while in the Customer Learn mode (SKIS indicator flashing), the SKIS will respond as though the vehicle were being started with an invalid key. In other words, the engine will stall after about two seconds of operation. No faults will be set.

NOTE: Once a Sentry Key has been programmed as a valid key to a vehicle, it cannot be programmed as a valid key for use on any other vehicle.

DOOR CYLINDER LOCK SWITCH

DESCRIPTION

Vehicles manufactured for North American markets that are equipped with the optional Vehicle Theft Security System (VTSS) have a door cylinder lock switch secured to the back of the key lock cylinder inside the drivers front door (Fig. 1). The door cylinder lock switch is a resistor multiplexed momentary switch that is hard wired in series between the door lock switch ground and right or left cylinder lock switch mux circuits of the Drivers Door Module (DDM) through the front door wire harness. The door

DOOR CYLINDER LOCK SWITCH (Continued)

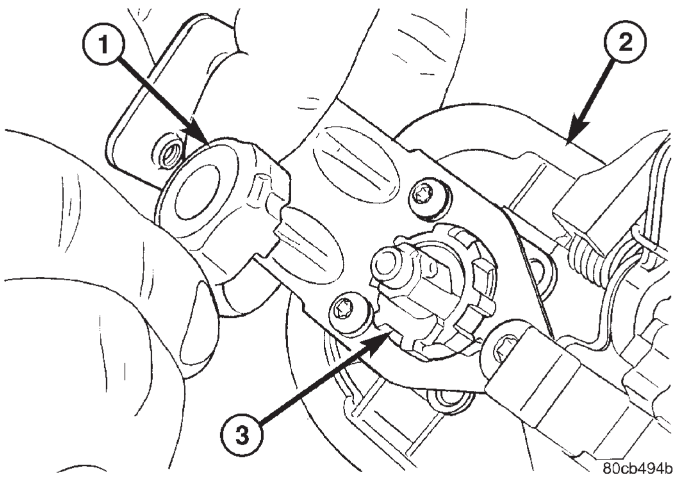


Fig. 1 DOOR CYLINDER LOCK SWITCH

1 - SWITCH
2 - OUTSIDE DOOR HANDLE
3 - DOOR LOCK CYLINDER

cylinder lock switches are driven by the key lock cylinders and contain two internal resistors. One resistor value is used for the Lock position, and one for the Unlock position.

The door cylinder lock switches cannot be adjusted or repaired and, if faulty or damaged, they must be replaced.

OPERATION

The door cylinder lock switches are actuated by the key lock cylinder when the key is inserted in the lock cylinder and turned to the lock or unlock positions. The door cylinder lock switch close a circuit between the door lock switch ground circuit and the left or right cylinder lock switch mux circuits through one of two internal resistors for the Driver Door Module (DDM) when either front door key lock cylinder is in the Lock, or Unlock positions. The DDM reads the switch status through an internal pull-up, then uses this information as an input for the Vehicle Theft Security System (VTSS) operation.

The door cylinder lock switches and circuits can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - DOOR CYLINDER LOCK SWITCH

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect the door cylinder lock switch pigtail wire connector from the door wire harness connector.

(2) Using a ohmmeter, check the switch resistance checks between the two terminals in the door cylinder lock switch pigtail wire connector. Actuate the switch by rotating the key in the door lock cylinder to test for the proper resistance values in each of the two switch positions, as shown in the Door Cylinder Lock Switch Test table.

DOOR CYLINDER LOCK SWITCH TEST		
Switch Position		Resistance (±10%)
Left Side	Right Side	
Lock (Clockwise)	Unlock (Counterclockwise)	473 Ohms
Unlock (Counterclockwise)	Lock (Clockwise)	1.994 Kilohms

(3) If a door cylinder lock switch fails either of the resistance tests, replace the faulty switch.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the outside door handle unit from the outer door panel. (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - REMOVAL).

(3) Remove the retainer clip from the pin on the back of the door lock cylinder (Fig. 2).

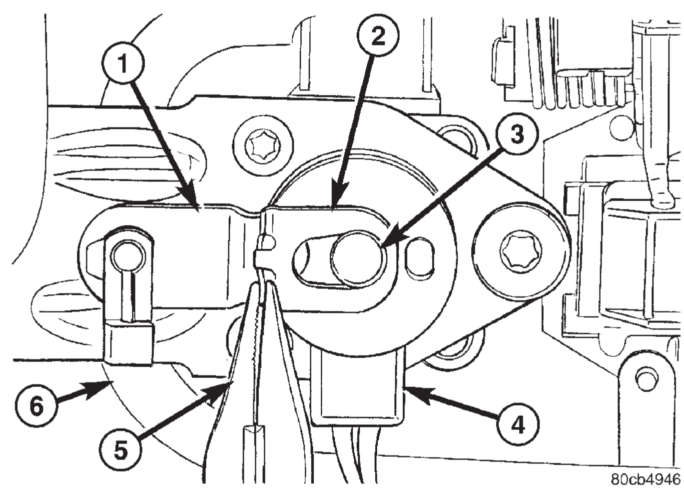


Fig. 2 LOCK CYLINDER LEVER RETAINER RE

1 - LEVER
2 - RETAINER
3 - LOCK CYLINDER
4 - SWITCH
5 - PLIERS
6 - OUTSIDE DOOR HANDLE

(4) Remove the lock lever from the pin on the back of the door lock cylinder.

DOOR CYLINDER LOCK SWITCH (Continued)

(5) Remove the door cylinder lock switch from the back of the lock cylinder.

INSTALLATION

(1) Position the door cylinder lock switch onto the back of the lock cylinder with its pigtail wire harness oriented toward the bottom (Fig. 2).

(2) Position the lock lever onto the pin on the back of the door lock cylinder with the lever oriented toward the rear.

(3) Install the retainer clip onto the pin on the back of the door lock cylinder. Be certain that the center tab of the retainer is engaged in the retention hole on the lock lever.

(4) Reinstall the outside door handle unit onto the outer door panel. (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - INSTALLATION).

(5) Reconnect the battery negative cable.

HOOD AJAR SWITCH

DESCRIPTION

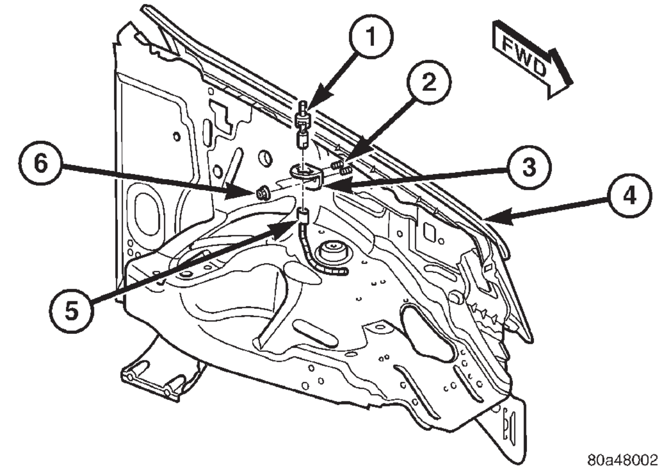


Fig. 3 Hood Ajar Switch

1 - SWITCH
2 - STUD (2)
3 - BRACKET
4 - FENDER
5 - CONNECTOR
6 - NUT (2)

The hood ajar switch is a self-adjusting, normally closed, single pole, double throw momentary switch that is used only on vehicles built for sale in certain international markets where it is required equipment (Fig. 3). The mounting bracket is fastened to the left inner fender. A molded plastic striker with three integral retainers is secured to the underside of the hood panel inner reinforcement to actuate the switch plunger as the hood panel is closed.The switch receives a path to ground through the left inner fender shield in the engine compartment.

The hood ajar switch adjusts itself as the striker pushes the switch body down through the switch when the hood panel is closed after the initial installation. This self-adjustment feature is only functional the first time the hood is closed following installation. If the switch requires adjustment following the initial installation, the switch must be replaced.

OPERATION

The normally closed hood ajar switch is normally held open when the hood panel is closed and latched. When the hood is opened, the switch plunger extends from the switch body and the switch contacts are closed. The hood ajar switch is connected in series between ground and the hood ajar switch sense input of the Body Control Module (BCM). The BCM uses an internal resistor pull up to monitor the state of the hood ajar switch contacts. The hood ajar switch can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - HOOD AJAR SWITCH

The diagnosis found here addresses an inoperative hood ajar switch. If the problem being diagnosed is related to hood ajar switch accuracy, be certain to confirm that the problem is not an improperly adjusted hood ajar switch. If no hood ajar switch adjustment problem is found, the following procedure will help to locate a short or open in the hood ajar switch circuit. Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the hood ajar switch. Check for continuity between the harness ground circuit a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open ground circuit to ground.

HOOD AJAR SWITCH (Continued)

(2) Check for continuity between the two terminals of the hood ajar switch. There should be continuity with the switch plunger extended, and no continuity with the switch plunger depressed. If OK, go to Step 3. If not OK, replace the faulty hood ajar switch.

(3) Disconnect the instrument panel wire harness connector from the Body Control Module (BCM). Check for continuity between the hood ajar switch sense circuit of the hood ajar switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted hood ajar switch sense circuit between the hood ajar switch and the BCM.

(4) Check for continuity between the hood ajar switch sense circuit and the instrument panel wire harness connector for the BCM. There should be continuity. If OK, proceed to diagnosis of the Vehicle Theft Security System (VTSS). (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - DIAGNOSIS AND TESTING). If not OK, repair the open hood ajar switch sense circuit between the hood ajar switch and the BCM.

REMOVAL

REMOVAL - HOOD AJAR SWITCH

(1) Open the hood.

(2) Disconnect and isolate the battery negative cable.

(3) Squeeze the two switch latch tabs together and pull the switch upward (Fig. 3)

(4) Disconnect the wiring harness connector.

(5) Remove the hood ajar switch from the mounting bracket.

REMOVAL - HOOD AJAR SWITCH BRACKET

(1) Remove the hood ajar switch from the mounting bracket. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - REMOVAL).

(2) Remove the two nuts that secure the hood ajar switch bracket to the left inner fender (Fig. 3)

(3) Remove the hood ajar switch bracket from the studs on the left inner fender.

REMOVAL - HOOD AJAR SWITCH STRIKER

(1) Open the hood.

(2) Using a trim stick or another suitable wide flat-blade tool, gently raise the hood ajar switch striker away from the inner hood panel reinforcement, and remove. (Fig. 4).

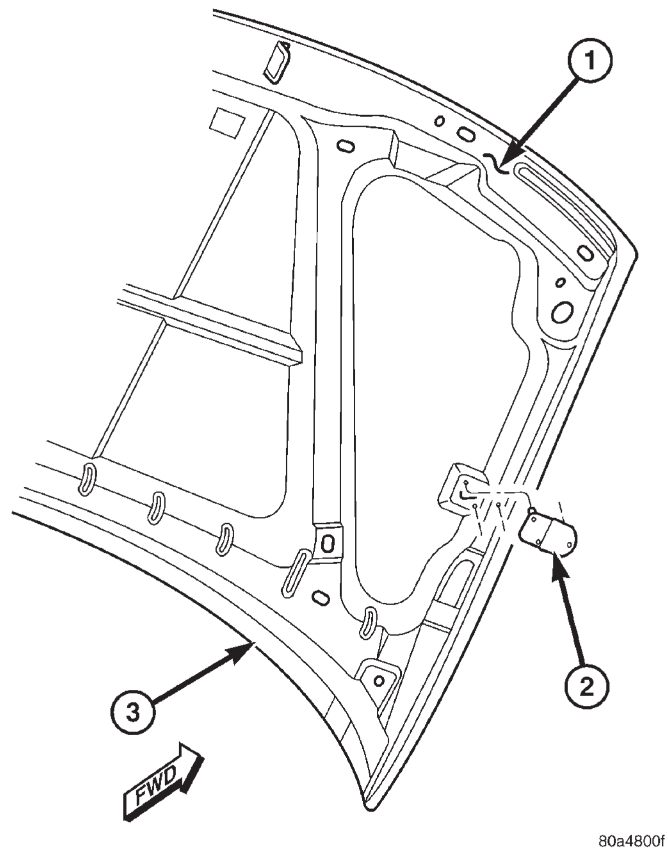


Fig. 4 Hood Ajar Switch Striker

1 - REINFORCEMENT
2 - STRIKER
3 - HOOD

INSTALLATION

INSTALLATION - HOOD AJAR SWITCH

(1) Position the hood ajar switch into the hole in the mounting bracket (Fig. 3)

(2) Reconnect the wiring harness connector.

(3) Press the switch downward into the mounting bracket until the latch tabs lock it into place.

(4) Reconnect the battery negative cable.

(5) Close and latch the hood.

INSTALLATION - HOOD AJAR SWITCH BRACKET

(1) Position the hood ajar switch bracket onto the studs on the left inner fender (Fig. 3)

(2) Install and tighten the two nuts. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(3) Reinstall the hood ajar switch into the mounting bracket. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - INSTALLATION).

HOOD AJAR SWITCH (Continued)

INSTALLATION - HOOD AJAR SWITCH STRIKER

(1) Align the three integral retainers of the hood ajar switch striker with their mounting holes in the inner hood panel reinforcement (Fig. 4).

(2) Using hand pressure, firmly press the hood ajar switch striker against the inner hood panel reinforcement until all of the striker retainers are fully engaged in their mounting holes.

(3) Close and latch the hood.

INTRUSION TRANSCEIVER MODULE

DESCRIPTION

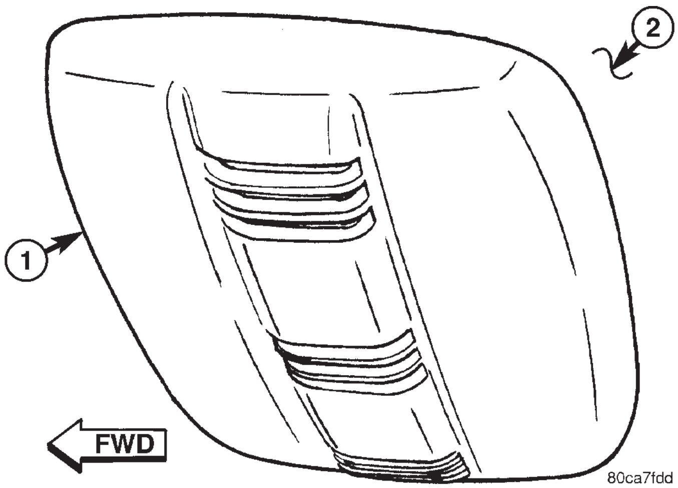


Fig. 5 INTRUSION TRANSCEIVER MODULE

1 - ITM
2 - HEADLINER

An Intrusion Transceiver Module (ITM) is part of the premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS) (Fig. 5). The premium version of the VTA is only available in vehicles built for certain markets, where the additional features offered by this system are required. The ITM is located in the passenger compartment. This unit is designed to provide interior motion detection, and serve as an interface between the Body Control Module (BCM) and the alarm siren module.

The ITM is concealed beneath a dedicated molded plastic trim cover that approximates the size and shape of a typical dome lamp housing. However, rather than a lens, the ITM features three sets of louvered openings. One set of louvered openings is located at each outboard end of the center rib, while the third set is centered. Each of the louvered openings is covered on the inside by a sight shield that extends the length of the center rib. The module is secured to a mounting bracket above the headliner (Fig. 6).

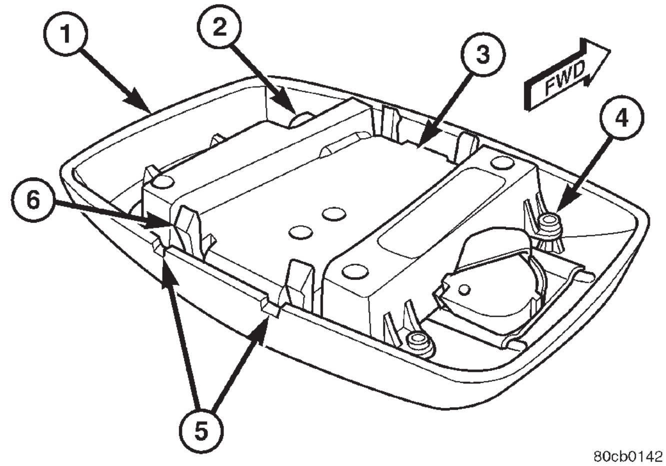


Fig. 6 INTRUSION TRANSCEIVER MODULE

1 - TRIM COVER
2 - CONNECTOR RECEPTACLE
3 - HOUSING
4 - SCREW (4)
5 - SERVICE HOLE (2)
6 - LATCH FEATURE (4)

Concealed within the housing is the circuitry of the ITM which includes a microprocessor, and an ultrasonic receive transducer. Both the transmit transducer on the right side of the module and the receive transducer on the ITM circuit board are aimed through two small round holes in the sight shield of the trim cover. The ITM is connected to the vehicle electrical system by a take out and connector of the overhead wire harness that is integral to the headliner.

The ITM unit cannot be adjusted or repaired and, if faulty or damaged, it must be replaced. The ITM is serviced as a unit with the trim cover.

OPERATION

The microprocessor in the Intrusion Transceiver Module (ITM) contains the motion sensor logic circuits and controls all of the features of the premium version of the Vehicle Theft Alarm (VTA). The ITM uses On-Board Diagnostics (OBD) and can communicate with other modules in the vehicle as well as with the DRBIII® scan tool using the Programmable Communications Interface (PCI) data bus network. This method of communication is used by the ITM to communicate with the Body Control Module (BCM) and for diagnosis and testing. The ITM also communicates with the alarm siren over a dedicated serial bus circuit.

INTRUSION TRANSCEIVER MODULE (Continued)

The ITM microprocessor continuously monitors inputs from its on-board motion sensor as well as inputs from the BCM and the alarm siren module. The ITM motion sensor transmits ultrasonic signals into the vehicle cabin through a transmit transducer, then listens to the returning signals as the bounce off of objects in the vehicle interior. If an object is moving in the interior, a detection circuit in the ITM senses this movement through the modulation of the returning ultrasonic signals that occurs due to the Doppler effect. The motion detect function of the ITM can be disabled by depressing the “Lock” button on the Remote Keyless Entry (RKE) transmitter three times within fifteen seconds, while the security indicator is still flashing rapidly or by cycling the key in the driver door cylinder from the center to the lock position. The ITM will signal the alarm siren module to provide a single siren “chirp” as an audible confirmation that the motion sensor function has been disabled.

If movement is detected, the ITM sends an message to the BCM over the PCI data bus to flash the exterior lighting and send a message to the alarm siren module over a dedicated serial bus line to sound the siren. When the BCM detects a breach in the perimeter protection through a door, tailgate, flip-up glass, or hood ajar switch input, it sends an message to the ITM and the ITM sends an message to the BCM over the PCI data bus to flash the exterior lighting and send a message to the alarm siren module over a dedicated serial bus line to sound the siren. The ITM also monitors inputs from the alarm siren module for siren battery or siren input/output circuit tamper alerts, and siren battery condition alerts, then sets active and stored Diagnostic Trouble Codes (DTC) for any monitored system faults it detects. An active fault only remains for the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ITM. If a fault does not reoccur for fifty ignition cycles, the ITM will automatically erase the stored DTC.

The ITM is connected to the vehicle electrical system through the overhead wire harness. The ITM receives battery voltage on a B(+) circuit through a fuse in the Junction Block (JB), and is grounded to the chassis at G303. These connections allow the ITM to remain operational, regardless of the ignition switch position. The hard wired inputs and outputs for the ITM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ITM, the PCI data bus network, or the electronic message inputs to and outputs from the ITM. The most reliable, efficient, and accurate means to diagnose the ITM, the PCI data bus network, and the message inputs to and outputs from the ITM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) While pulling downward lightly on the rear corner of the Intrusion Transceiver Module (ITM) trim cover, insert a small thin-bladed screwdriver through each of the service holes on the rear edge of the trim cover to release the two integral rear latch features of the module from the mounting bracket above the headliner (Fig. 7).

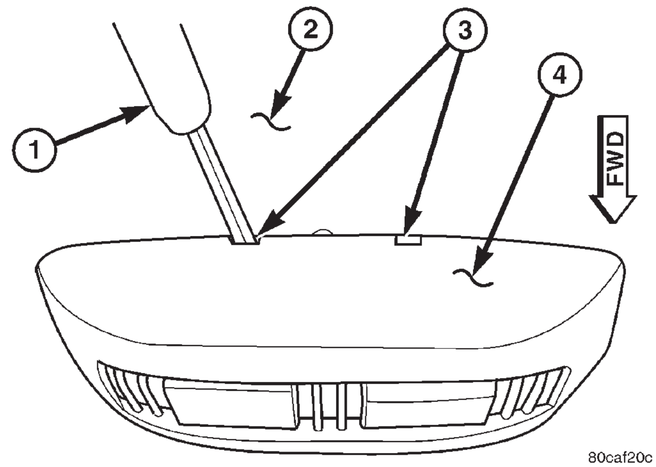


Fig. 7 INTRUSION TRANSCEIVER MODULE REMOVE

1 - SMALL SCREWDRIVER
2 - HEADLINER
3 - SERVICE HOLES
4 - ITM

(3) Pull the ITM trim cover rearward far enough to disengage the two front latch features of the module from the mounting bracket above the headliner.

(4) Pull the ITM and trim cover down from the headliner far enough to access and disconnect the overhead wire harness connector for the ITM from the module connector.

(5) Remove the ITM from the headliner.

INSTALLATION

(1) Position the Intrusion Transceiver Module (ITM) to the headliner.

(2) Reconnect the overhead wire harness connector for the ITM to the module connector.

(3) Align the two front latch features of the ITM with the two front latch receptacles of the mounting bracket above the headliner (Fig. 8).

(4) Push the ITM trim cover forward far enough to insert the two rear latch features of the module into

INTRUSION TRANSCEIVER MODULE (Continued)

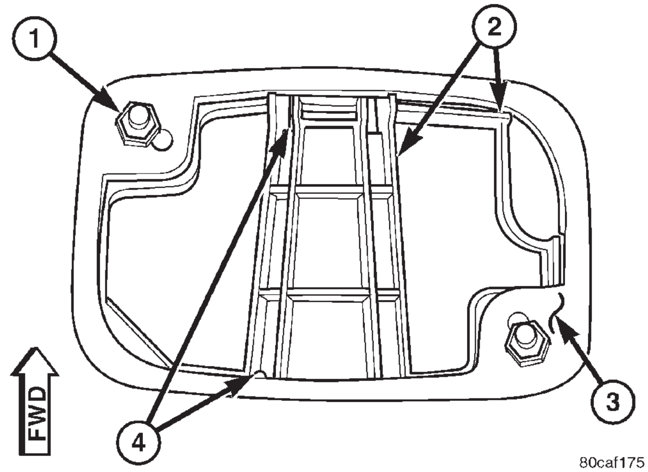


Fig. 8 INTRUSION TRANSCEIVER MODULE RETAINER RING

1 - STAMPED NUT (2)
2 - MOUNTING BRACKET
3 - HEADLINER
4 - LATCH RECEPTACLES (4)

the two rear latch receptacles of the mounting bracket above the headliner.

(5) Push upward firmly and evenly on the rear edge of the ITM trim cover until the two rear latch features of the module are engaged and latched in the mounting bracket above the headliner.

(6) Reconnect the battery negative cable.

NOTE: If the Intrusion Transceiver Module (ITM) has been replaced with a new unit, the new ITM MUST be initialized before the Vehicle Theft Security System can operate as designed. The use of a DRBIII® scan tool is required to initialize the ITM. Refer to the appropriate diagnostic information.

SIREN

DESCRIPTION

An alarm siren module is part of the premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS) (Fig. 9). The premium version of the VTA is only available in vehicles built for certain markets, where the additional features offered by this system are required. The alarm siren module is located in the right front frame rail. This unit is designed to provide the audible alert requirements for the premium VTA.

The alarm siren module consists of microprocessor, the siren, and a nickel metal hydride backup battery. All of the alarm module components are protected and sealed within the housing.

The alarm siren module cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The microprocessor within the alarm siren module provides the siren unit features and functions based upon internal programming and arm and disarm messages received from the Intrusion Transceiver Module (ITM) over a dedicated serial bus communication circuit. The alarm siren module will self-detect problems with its internal and external power supply and communication circuits, then send messages indicating the problem to the ITM upon receiving a request from the ITM. The ITM will store a Diagnostic Trouble Code (DTC) for a detected alarm siren module fault that can be retrieved with the DRBIII® scan tool over the Programmable Communications Interface (PCI) data bus.

When the premium version of the Vehicle Theft Alarm (VTA) is armed, the alarm siren module continuously monitors inputs from the ITM for messages to sound its siren and enters its auto-detect mode. While in the auto-detect mode, if the alarm siren module detects that its power supply or communication circuits are being tampered with or have been sabotaged, it will sound an alarm and continue to operate through its on-board backup battery. If the arm siren module is in its disarmed mode when its power supply or communication circuits are interrupted, the siren will not sound. The alarm module will also notify the ITM when the backup battery requires charging, and the ITM will send a message that will allow the backup battery to be charged through the battery voltage and ground circuits to the alarm module only when the ignition switch is in the On position and the engine is running. This will prevent the charging of the alarm backup battery from depleting the charge in the main vehicle battery while the vehicle is not being operated.

The alarm siren module receives battery voltage through a fuse in the Power Distribution Center (PDC), and is grounded to the chassis. These connections allow the alarm siren module to remain operational, regardless of the ignition switch position. The hard wired inputs and outputs for the alarm siren module may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the internal circuitry or the backup battery of the alarm siren module, the ITM, the serial bus communication line, or the message inputs to and outputs from the alarm siren module. The most reliable, efficient, and accurate means to diagnose the alarm siren module, the ITM, the serial bus communication line, and the electronic

SIREN (Continued)

message inputs to and outputs from the alarm siren module requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the alarm siren module wiring harness connector. (Fig. 9).

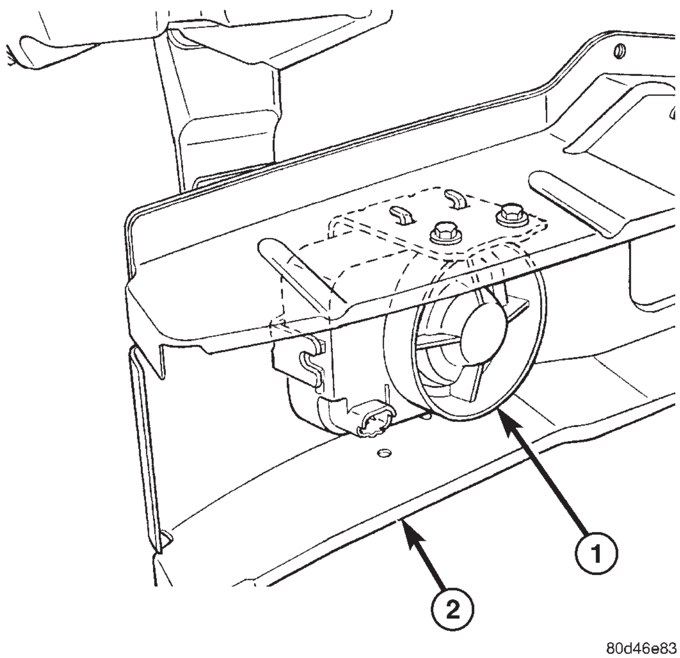


Fig. 9 Siren Remove/Install

1 - SIREN
2 - FRAME

(3) Remove the screws that secure the alarm siren module to the left frame rail.

(4) Remove the alarm siren module.

INSTALLATION

(1) Position the alarm siren module on to the left frame rail. (Fig. 9).

(2) Install and tighten the screws that secure the alarm siren moduleto the frame rail. Tighten the screws to 6 N·m (50 in. lbs.).

(3) Reconnect the alarm siren module wiring harness connector.

(4) Reconnect the battery negative cable.

NOTE: If the alarm siren module has been replaced with a new unit, the new unit MUST be configured in the Intrusion Transceiver Module (ITM) before the Vehicle Theft Security System can operate as designed. The use of a DRBIII® scan tool is required to configure the alarm siren module settings in the ITM. Refer to the appropriate diagnostic information.

SKIS INDICATOR LAMP

DESCRIPTION

A Sentry Key Immobilizer System (SKIS) indicator lamp is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional SKIS. The amber SKIS indicator lamp is located to the right of the oil pressure gauge.

OPERATION

The Sentry Key Immobilizer System (SKIS) indicator lamp gives an indication to the vehicle operator of the status of the SKIS. This lamp is controlled by a transistor on the instrument cluster circuit board based upon messages received by the cluster from the Sentry Key Immobilizer Module (SKIM) over the Programmable Communications Interface (PCI) data bus. The SKIS indicator lamp bulb receives battery current on the instrument cluster circuit board through the fused ignition switch output (st-run) circuit whenever the ignition switch is in the On or Start positions. The lamp bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the SKIS indicator lamp for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position, the SKIM tells the cluster to illuminate the lamp for about three seconds.
- **SKIS Lamp-On Message** - Each time the cluster receives a SKIS lamp-on message from the SKIM, the lamp will be illuminated. The lamp can be flashed on and off, or illuminated solid, as dictated by the message from the SKIM. For more information on the SKIS and the SKIS lamp control parameters, (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - OPERATION - SENTRY KEY IMMOBILIZER SYSTEM). The lamp remains illuminated until the cluster receives a lamp-off message from the SKIM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the lamp will be turned on for the duration of the test to confirm the functionality of the lamp and the cluster.

The SKIM performs a self-test each time the ignition switch is turned to the On position to decide whether the system is in good operating condition. The SKIM then sends a message to the instrument cluster. If the SKIS indicator lamp fails to light during the bulb test, replace the bulb. For further diagnosis of the SKIS indicator lamp or the instrument

SKIS INDICATOR LAMP (Continued)

cluster circuitry that controls the lamp, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the SKIS indicator lamp after the bulb test, either solid or flashing, it indicates that a SKIS malfunction has occurred or that the SKIS is inoperative. For proper diagnosis of the SKIS, the PCI data bus, or the message inputs to the instrument cluster that control the SKIS indicator lamp, a DRBIII® scan tool and the appropriate diagnostic information are required.

TRANSPONDER KEY

DESCRIPTION

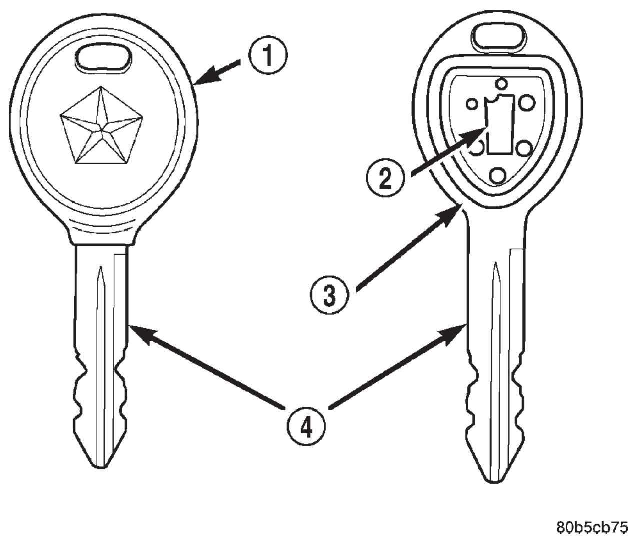


Fig. 10 Sentry Key Immobilizer Transponder

1 - MOLDED CAP
2 - TRANSPONDER CHIP
3 - MOLDED CAP REMOVED
4 - TRANSPONDER KEY

Each ignition key used in the Sentry Key Immobilizer System (SKIS) has an integral transponder chip (Fig. 10). Ignition keys with this feature can be readily identified by a gray rubber cap molded onto the head of the key, while conventional ignition keys have a black molded rubber cap. The transponder chip is concealed beneath the molded rubber cap, where it is molded into the head of the metal key. Each new Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. The Sentry Key transponder if faulty or damaged, must be replaced.

OPERATION

When the ignition switch is turned to the On position, the Sentry Key Immobilizer Module (SKIM) communicates through its antenna with the Sentry Key transponder using a Radio Frequency (RF) signal. The SKIM then waits for a RF response from the transponder through the same antenna. The Sentry Key transponder chip is within the range of the SKIM transceiver antenna ring when it is inserted into the ignition lock cylinder. The SKIM determines whether a valid key is present in the ignition lock cylinder based upon the response from the transponder. If a valid key is detected, that fact is communicated by the SKIM to the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus, and the PCM allows the engine to continue running. If the PCM receives an invalid key message, or receives no message from the SKIM over the PCI data bus, the engine will be disabled after about two seconds of operation. The ElectroMechanical Instrument Cluster (EMIC) will also respond to the invalid key message on the PCI data bus by flashing the SKIS indicator on and off.

Each Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. Likewise, the SKIM has a unique Secret Key code programmed into it by the manufacturer. When a Sentry Key is programmed into the memory of the SKIM, the SKIM stores the transponder identification code from the Sentry Key, and the Sentry Key learns the Secret Key code from the SKIM. Once the Sentry Key learns the Secret Key code of the SKIM, it is permanently stored in the memory of the transponder. Therefore, once a Sentry Key has been programmed to a particular vehicle, it cannot be used on any other vehicle. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

VTSS INDICATOR

DESCRIPTION

The Vehicle Theft Security System (VTSS) indicator consists of a red Light-Emitting Diode that is mounted and integral to the automatic headlamp light sensor photo diode unit, which is located on the top of the instrument panel. The remainder of the housing including the mount and the electrical connection are concealed beneath the instrument panel top cover.

The VTSS indicator cannot be adjusted or repaired the entire automatic headlamp light sensor/VTSS indicator must be replaced. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/AUTO HEADLAMP SENSOR - REMOVAL).

VTSS INDICATOR (Continued)

OPERATION

The Vehicle Theft Security System (VTSS) indicator gives a visible indication of the VTSS arming status. One side of Light-Emittiong Diode (LED) in the VTSS indicator is connected to unswitched battery current through a fused B(+) circuit and a fuse in the Junction Block (JB). The other side of the LED is hard wired to the Body Control Module (BCM), which controls the operation of the VTSS indicator by pulling this side of the LED circuit to ground. When the VTSS arming is in progress, the BCM will flash the LED rapidly on and off for about fifteen seconds. When the VTSS has been successfully armed, the BCM will flash the LED on and off continually at a much slower rate until the VTSS has been disarmed. The VTSS indicator can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - VTSS INDICATOR

The diagnosis found here addresses an inoperative Vehicle Theft Security System (VTSS) indicator condition. If the problem being diagnosed is related to indicator accuracy, be certain to confirm that the problem is with the indicator and not with an inoperative VTSS. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - DIAGNOSIS AND TESTING - VEHICLE THEFT SECURITY SYSTEM). If no VTSS problem is found, the following procedure will help to locate a short or open in the VTSS indicator control circuit. Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the JB. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit between the JB and the Power Distribution Center (PDC).

(3) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the automatic headlamp light sensor/VTSS indicator from the automatic headlamp light sensor/VTSS indicator pigtail wire connector. Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the automatic headlamp light sensor/VTSS indicator. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit between the VTSS indicator and the JB.

(4) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the JB from the JB connector receptacle. Check for continuity between the VTSS indicator driver circuit cavity of the instrument panel wire harness connector for the automatic headlamp light sensor/VTSS indicator and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted VTSS indicator driver circuit between the VTSS indicator and the JB.

(5) Check for continuity between the VTSS indicator driver circuit of the instrument panel wire harness connector for the automatic headlamp light sensor/VTSS indicator and the instrument panel wire harness connector for the JB. There should be continuity. If OK, replace the faulty VTSS indicator. If not OK, repair the open VTSS indicator driver circuit between the VTSS indicator and the JB.

WIPERS/WASHERS

TABLE OF CONTENTS

FRONT WIPERS/WASHERS

TABLE OF CONTENTS

FRONT WIPERS/WASHERS

DESCRIPTION

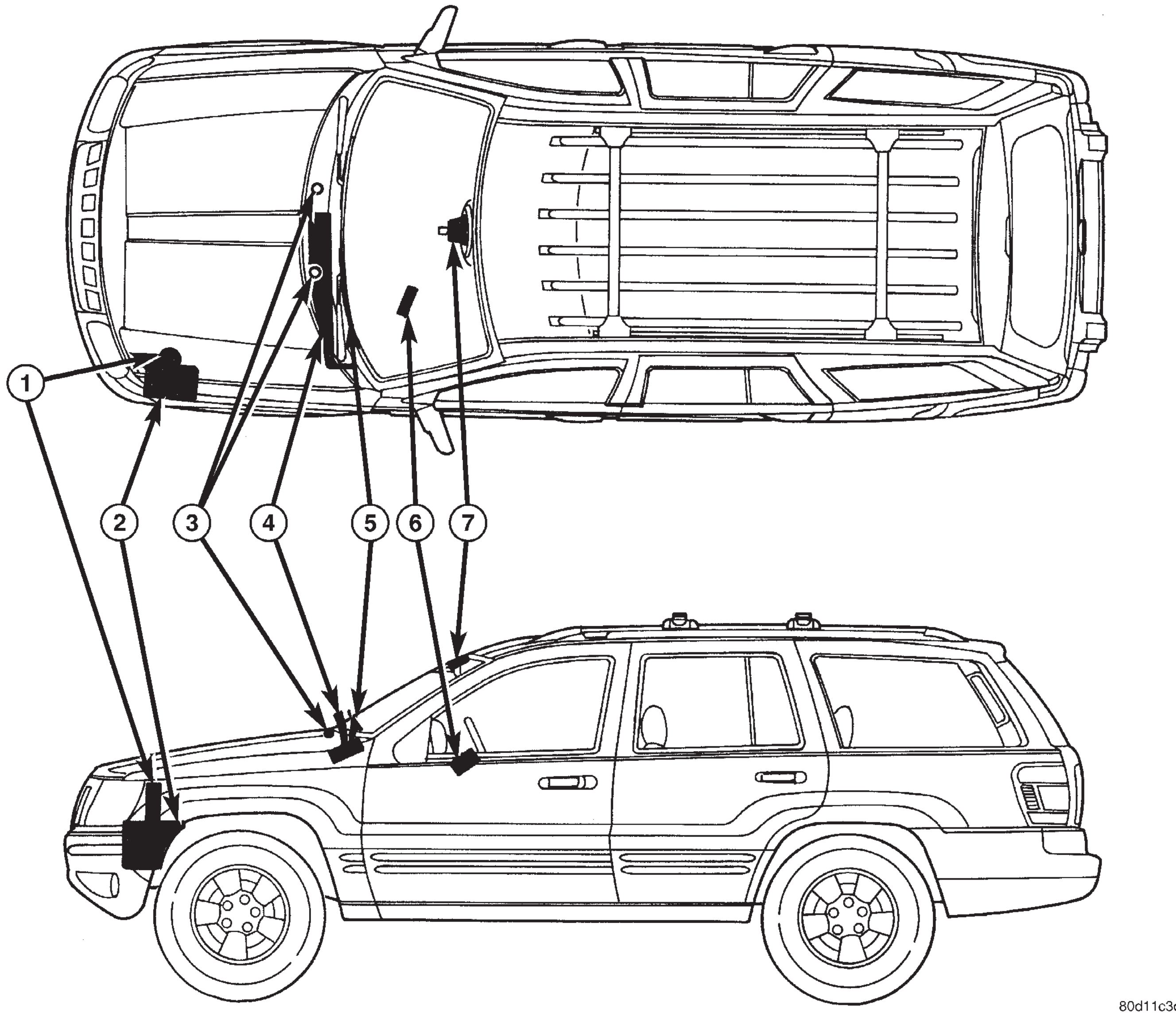


Fig. 1 Front Wiper & Washer System

1 - WASHER RESEVOIR FILLER TUBE
2 - WASHER RESERVOIR, PUMP/MOTOR, FLUID LEVEL SWITCH
3 - WASHER NOZZLE (2)
4 - WIPER MODULE
5 - WIPER ARM & BLADE (2)
6 - RIGHT (WIPER) MULTI-FUNCTION SWITCH RIGHT
7 - RAIN SENSOR MODULE

An electrically operated intermittent front wiper and washer system is standard factory-installed safety equipment on this model (Fig. 1). The front wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

• **Body Control Module** - The Body Control Module (BCM) is located on the Junction Block (JB) under the driver side outboard end of the instrument panel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL MODULE - DESCRIPTION).

FRONT WIPERS/WASHERS (Continued)

• **Front Check Valve** - The front washer system check valve is integral to the wye fitting located in the washer plumbing between the cowl plenum washer hose and the front washer nozzles, and is concealed beneath the cowl plenum cover/grille panel at the base of the windshield.

• **Front Washer Nozzle** - Two fluidic front washer nozzles are secured with integral snap features to dedicated openings in the cowl plenum cover/grille panel located near the base of the windshield.

• **Front Washer Plumbing** - The plumbing for the front washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the left side of the engine compartment from the washer reservoir, and through the dash panel into the cowl plenum to the front washer nozzle fittings beneath the cowl plenum cover/grille panel.

• **Front Washer Pump/Motor** - The front washer pump/motor unit is located in a dedicated hole on the lower outboard side of the washer reservoir, behind the inner fender liner ahead of the left front wheel. The front washer pump is located ahead of and below the rear washer pump.

• **Front Wiper Arm** - The two front wiper arms are secured with nuts to the threaded studs on the ends of the two wiper pivot shafts, which extend through the cowl plenum cover/grille panel located near the base of the windshield.

• **Front Wiper Blade** - The two front wiper blades are secured to the two front wiper arms with an integral latch, and are parked on the glass near the bottom of the windshield when the front wiper system is not in operation.

• **Front Wiper Module** - The front wiper pivot shafts are the only visible components of the front wiper module. The remainder of the module is concealed within the cowl plenum beneath the cowl plenum cover/grille panel. The front wiper module includes the module bracket, four rubber-isolated wiper module mounts, the front wiper motor, the wiper motor crank arm, the two wiper drive links, and the two front wiper pivots.

• **Rain Sensor Module** - Models equipped with the optional automatic wiper feature have a Rain Sensor Module (RSM) located behind a trim cover on a bracket bonded to the inside surface of the windshield glass, just above the inside rear view mirror mounting button.

• **Right Multi-Function Switch** - The right (wiper) multi-function switch is secured to the right side of the multi-function switch mounting housing near the top of the steering column, just below the steering wheel. Only the control stalk for the right multi-function switch is visible, while the remainder of the switch is concealed beneath the steering column shrouds. The right multi-function switch contains all of the switches and control circuitry for both the front and rear wiper and washer systems.

• **Washer Fluid Level Switch** - The washer fluid level switch is located in a dedicated hole near the center of the forward surface of the washer reservoir, behind the left front wheel house splash shield.

• **Washer Reservoir** - The washer reservoir is concealed between the left inner fender shield and the left outer fender panel, behind the inner fender liner and ahead of the left front wheel. The washer reservoir filler neck is the only visible portion of the reservoir, and it is accessed from the left front corner of the engine compartment.

• **Wiper High-Low Relay** - The wiper high-low relay is an International Standards Organization (ISO) micro relay located in the Power Distribution Center (PDC) in the engine compartment near the battery.

• **Wiper On-Off Relay** - The wiper on-off relay is an International Standards Organization (ISO) micro relay located in the Power Distribution Center (PDC) in the engine compartment near the battery.

Hard wired circuitry connects the front wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the front wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATING MODES

The components of the front wiper and washer system are designed to work in concert to provide the following operating modes:

• **Automatic Wiper** - In models equipped with the optional automatic wiper feature, the internal circuitry of both the right (wiper) multi-function switch, the rain sensor module, and the BCM work in concert to provide an automatic wiper mode with five sensitivity selections. The BCM tells the Rain Sensor Module (RSM) when the automatic wiper mode is selected and the manually selected sensitivity level, then the rain sensor module tells the BCM each time enough water droplets have accumulated within the wipe pattern on the windshield to require front wiper operation. The BCM then automatically

FRONT WIPERS/WASHERS (Continued)

operates the front wipers at the programmed speed and intervals requested by the RSM to maintain visibility through the windshield.

- **Continuous Wipe Mode** - The control knob on the control stalk of the right (wiper) multi-function switch has two continuous wipe positions, Low and High. When selected, these switch positions will cause the two-speed front wiper motor to operate in a continuous low or high speed cycle.
- **Headlamps On With Wipers** - The BCM provides an automatic headlamps on with wipers feature for models equipped with the optional automatic headlamps. This is a customer programmable feature. If this feature is enabled, the headlamps will turn on automatically when the windshield wipers are turned on; and, if the headlamps were turned on automatically when the wipers were turned on, they will turn off automatically when the wipers are turned off. In models equipped with the optional automatic wiper feature, when the automatic wiper mode is selected the headlamps will turn on automatically only after the wipers complete three automatic wipe cycles within about thirty seconds, and they will turn off automatically after three minutes elapse without any automatic wipe cycles. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - STANDARD PROCEDURE - ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING).
- **Mist Wipe Mode** - The control stalk of the right (wiper) multi-function switch has a momentary Mist position. When selected, this switch position will operate the front wipers in a low speed continuous cycle for as long as the switch is held closed, then will complete the current wipe cycle and park the front wiper blades near the base of the windshield when the switch is released.
- **Speed Sensitive Intermittent Wipe Mode** - Except on models equipped with the optional automatic wiper system, the internal circuitry of both the right (wiper) multi-function switch and the BCM work in concert to provide an intermittent wipe mode with five delay interval selections. The BCM automatically adjusts each manually selected delay interval to compensate for vehicle speed.
- **Washer Mode** - When the momentary front wash position of the control stalk for the right (wiper) multi-function switch is selected with the front wiper system operating in a continuous wipe mode, washer fluid will be dispensed onto the windshield glass through the washer nozzles for as long as the washer switch is held closed. When the front washer switch is actuated with the front wiper system operating in an intermittent wipe mode, washer fluid is still dispensed until the switch is released; however, the front wipers will operate in a low speed continuous cycle from the time the washer switch is closed until several wipe cycles after the switch is released, before returning to the selected intermittent wipe mode.
- **Wipe-After-Wash Mode** - When the momentary front wash position of the control stalk for the right (wiper) multi-function switch is selected with the front wiper system turned Off, the internal circuitry of the BCM provides a wipe-after-wash feature. When selected, this feature will operate the front washer pump/motor and the front wipers for as long as the front washer switch is held closed, then provide several additional wipe cycles after the switch is released before parking the front wiper blades near the base of the windshield.

OPERATION

The front wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris that might be encountered while driving the vehicle under numerous types of inclement operating conditions from the outside windshield glass surface.

The vehicle operator initiates all front wiper and washer system functions with the control stalk of the right (wiper) multi-function switch that extends from the right side of the steering column, just below the steering wheel. Rotating the control knob on the end of the right (wiper) multi-function switch control stalk selects the Off, Delay (on models not equipped with the optional automatic wiper system), Auto (on models equipped with the optional automatic wiper system), Low, or High front wiper system operating modes. In the Delay mode, the control knob also allows the vehicle operator to select from one of five intermittent wipe Delay intervals. In the Auto mode, the control knob also allows the vehicle operator to select from one of five automatic wiper sensitivity levels. Pulling the right control stalk downwards actuates the momentary front wiper system Mist mode switch, while pulling the right control stalk towards the steering wheel actuates the front washer system switch. The multi-function switch provides hard wired resistor multiplexed inputs to the Body Control Module (BCM) for all of the front wiper sys-

FRONT WIPERS/WASHERS (Continued)

tem functions, as well as separate hard wired sense inputs to the BCM for the high speed continuous wipe and front washer system functions.

The front wiper and washer system will only operate when the ignition switch is in the Accessory or On positions. Battery current is directed from a B(+) fuse in the Power Distribution Center (PDC) to the wiper and washer system circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit. The automatic resetting circuit breaker then provides battery current through a fused ignition switch output (run-acc) circuit to the wiper on/off relay, and the park switch in the front wiper motor. A separate fuse in the JB provides battery current through another fused ignition switch output (run-acc) circuit to the right multi-function switch. The right multi-function switch circuitry uses this battery feed to directly control the operation of the front washer pump/motor unit. The BCM uses low side drivers to control front wiper system operation by energizing or de-energizing the wiper high/low and wiper on/off relays.

The hard wired circuits and components of the front wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), or the inputs to or outputs from the BCM that control the front wiper and washer system operating modes. The most reliable, efficient, and accurate means to diagnose the BCM, or the BCM inputs and outputs related to the various front wiper and washer system operating modes requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

Following are paragraphs that briefly describe the operation of each of the front wiper and washer system operating modes.

CONTINUOUS WIPE MODE

When the Low position of the control knob on the control stalk of the right (wiper) multi-function switch is selected, the Body Control Module (BCM) energizes the wiper on/off relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally closed contacts of the de-energized wiper high/low relay to the low speed brush of the front wiper motor, causing the front wipers to cycle at low speed. When the High position of the control knob is selected, the BCM energizes both the wiper on/off relay and the wiper high/low relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally open contacts of the energized wiper high/low relay to the high speed brush of the front wiper motor, causing the front wipers to cycle at high speed.

When the Off position of the control knob is selected, the BCM de-energizes both the wiper on/off and wiper high/low relays, then one of two events will occur. The event that will occur depends upon the position of the wiper blades on the windshield at the moment that the control knob Off position is selected. If the wiper blades are in the down position on the windshield when the Off position is selected, the park switch that is integral to the front wiper motor is closed to ground and the wiper motor ceases to operate. If the wiper blades are not in the down position on the windshield at the moment the Off position is selected, the park switch is closed to battery current from the fused ignition switch output (run-acc) circuit of the front wiper motor. The park switch directs this battery current to the low speed brush of the wiper motor through the wiper park switch sense circuit and the normally closed contacts of the wiper on/off and wiper high/low relays. This causes the wiper motor to continue running at low speed until the wiper blades are in the down position on the windshield and the park switch is again closed to ground.

INTERMITTENT WIPE MODE

On models not equipped with the optional automatic wiper system, when the control knob on the control stalk of the right (wiper) multi-function switch is moved to one of the five Delay interval positions, the BCM electronic intermittent wipe logic circuit responds by calculating the correct length of time between wiper sweeps based upon the selected delay interval input. The BCM monitors the changing state of the wiper motor park switch through a hard wired front wiper park switch sense circuit input. This input allows the BCM to determine the proper intervals at which to energize and de-energize the wiper on/off relay to operate the front wiper motor intermittently for one low speed cycle at a time. The BCM logic is also programmed to provide an immediate wipe cycle and begin a new delay interval timing cycle each time a shorter delay interval is selected, and to add the remaining delay timing interval to the new delay interval timing before the next wipe cycle occurs each time a longer delay interval is selected.

The intermittent wipe mode delay times are speed sensitive. The BCM monitors vehicle speed messages received from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus network in order to provide the speed sensitive delay intervals. Above about sixteen kilometers-per-hour (ten miles-per-hour) the delay is driver adjustable from about one-half second to about eighteen seconds. Below about sixteen kilometers-per-hour (ten miles-per-hour) the delay times are doubled, from about one second to about thirty-six seconds.

AUTOMATIC WIPE MODE

On models equipped with the optional automatic wiper system, when the control knob on the control stalk of the right (wiper) multi-function switch is moved to one of the five Auto sensitivity positions, the BCM sends an electronic message to the Rain Sensor Module (RSM) over the Programmable Communications Interface (PCI) data bus network indicating the selected position. The RSM monitors an area within the wipe pattern of the windshield glass for the accumulation of moisture. Based upon internal programming and the selected sensitivity level, when sufficient moisture has accumulated the RSM sends the appropriate electronic wipe command messages to the BCM over the PCI data bus and the BCM operates the front wiper system accordingly. As the sensitivity level is set higher, the RSM is more sensitive to moisture accumulation and will send wipe commands more frequently. The BCM logic is also programmed to provide an immediate wipe cycle each time the control knob on the control stalk of the right multi-function switch is moved from a non-automatic wipe position to one of the five Auto sensitivity positions, and another immediate wipe cycle each time the control knob is moved from a lower Auto sensitivity position to a higher Auto sensitivity position.

MIST WIPE MODE

When the control stalk of the right (wiper) multi-function switch is moved to the momentary Mist position, the BCM energizes the wiper on/off relay for as long as the Mist switch is held closed, then de-energizes the relay when the state of the Mist switch input changes to open. The BCM can operate the front wiper motor in this mode for only one low speed cycle at a time, or for an indefinite number of sequential low speed cycles, depending upon how long the Mist switch is held closed.

WASH MODE

When the control stalk of the right (wiper) multi-function switch is moved to the momentary front Wash position while the control knob is in the Low or High positions, the circuitry within the switch directs battery current to the front washer pump/motor unit. This will cause the front washer pump/motor unit to be energized for as long as the front Wash switch is held closed, and to de-energize when the front Wash switch is released. When the control stalk of the right (wiper) multi-function switch is moved to the momentary front Wash position while the control knob is in one of the Delay interval or Auto sensitivity positions, the front washer pump/motor operation is the same. However, the BCM energizes the wiper on/off relay to override the selected delay interval or auto sensitivity level and operate the front wiper motor in a continuous low speed mode for as long as the front Wash switch is held closed, then de-energizes the relay and reverts to the selected delay mode interval or auto sensitivity level several wipe cycles after the front Wash switch is released. The BCM detects the front Wash switch state through a hard wired washer pump motor switch output circuit input from the right multi-function switch.

WIPE-AFTER-WASH MODE

When the control stalk of the right (wiper) multi-function switch is moved to the momentary front Wash position while the control knob is in the Off position, the BCM detects that switch state through a hard wired washer pump motor switch output circuit input from the right multi-function switch. The BCM responds to this input by energizing the wiper on/off relay for as long as the Wash switch is held closed, then de-energizes the relay several wipe cycles after the front Wash switch is released. The BCM monitors the changing state of the wiper motor park switch through a hard wired front wiper park switch sense circuit input. This input allows the BCM to count the number of wipe cycles that occur after the front Wash switch state changes to open, and to determine the proper interval at which to de-energize the wiper on/off relay to complete the wipe-after-wash mode cycle.

DIAGNOSIS AND TESTING - FRONT WIPER & WASHER SYSTEM

FRONT WIPER SYSTEM

If the front wiper motor operates, but the wipers do not move on the windshield, replace the faulty front wiper module. If the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the wiper system components as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - INSPECTION) and (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

The hard wired circuits and components of the front wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic meth-

FRONT WIPERS/WASHERS (Continued)

ods may not prove conclusive in the diagnosis of the Body Control Module (BCM), the Rain Sensor Module (RSM), the Powertrain Control Module (PCM) or the inputs to or outputs from these modules that control the various front wiper and washer system operating modes. The most reliable, efficient, and accurate means to diagnose the BCM, the RSM, the PCM or the BCM inputs and outputs related to the various front wiper and washer system operating modes requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FRONT WASHER SYSTEM

The diagnosis found here addresses an electrically inoperative washer system. If the washer pump/motor operates, but no washer fluid is emitted from the front washer nozzles, be certain to check the fluid level in the reservoir. Also inspect the front washer system components as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - INSPECTION). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pinout information and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Turn the control knob on the control stalk of the right (wiper) multi-function switch to the Low or High wiper position. Check whether the front wiper system is operating. If OK, go to Step 2. If not OK, test and repair the front wiper system before continuing with these tests. Refer to FRONT WIPER SYSTEM

(2) Turn the control knob on the control stalk of the right (wiper) multi-function switch to the Off position. Pull the control stalk of the right (wiper) multi-function switch toward the steering wheel to close the front washer switch. The front washer pump should operate and the front wipers should operate for about three sweep cycles after the switch is released before they park. If the front wipers are OK, but the front washers are not, go to Step 3. If the front washers are OK, but the front wipers are not, go to Step 5.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the left headlamp and dash wire harness connector for the front washer pump/motor from the pump/motor connector receptacle. Check for continuity between the ground circuit cavity of the left headlamp and dash wire harness connector for the front washer pump/motor and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground (G106) as required.

(4) Reconnect the battery negative cable. Turn the ignition switch to the On position. While pulling the control stalk of the right (wiper) multi-function switch toward the steering wheel to close the front washer switch, check for battery voltage at the washer pump switch sense circuit cavity of the left headlamp and dash wire harness connector for the front washer pump/motor unit. If OK, replace the faulty front washer pump/motor. If not OK, repair the open washer pump switch sense circuit between the right (wiper) multi-function switch and the front washer pump/motor unit as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector (Connector C2) for the Body Control Module (BCM) from the BCM connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. While pulling the control stalk of the right (wiper) multi-function switch toward the steering wheel to close the front washer

FRONT WIPERS/WASHERS (Continued)

switch, check for battery voltage at the washer pump switch sense circuit cavity of the instrument panel wire harness connector (Connector C2) for the BCM. If OK, use a DRBIII® scan tool to diagnose the BCM. Refer to the appropriate diagnostic information. If not OK, repair the open washer pump switch sense circuit between the right (wiper) multi-function switch and the BCM as required.

CLEANING - FRONT WIPER & WASHER SYSTEM

WIPER SYSTEM

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the front washer pump/motor from the reservoir. Clean foreign material from the inside of the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hoses from the washer nozzles, then running the washer pump/motor to run clean washer fluid or water through the system. Plugged or restricted washer nozzles should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

INSPECTION - FRONT WIPER & WASHER SYSTEM

WIPER SYSTEM

The front wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

(1) Inspect the wiper arms for any indications of damage, or contamination. If the wiper arms are contaminated with any foreign material, clean them as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING). If a wiper arm is damaged or corrosion is evident, replace the wiper arm with a new unit. Do not attempt to repair a wiper arm that is damaged or corroded.

(2) Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(3) Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if it has comparatively lower spring tension, as evidenced by a lower scale reading.

(4) Inspect the wiper blades and squeegees for any indications of damage, contamination, or rubber deterioration (Fig. 2). If the wiper blades or squeegees are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING). After cleaning the wiper blade and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade. Also, if a wiper blade is damaged or the squeegee rubber is damaged or deteriorated, replace the wiper blade with a new unit. Do not attempt to repair a wiper blade that is damaged.

FRONT WIPERS/WASHERS (Continued)

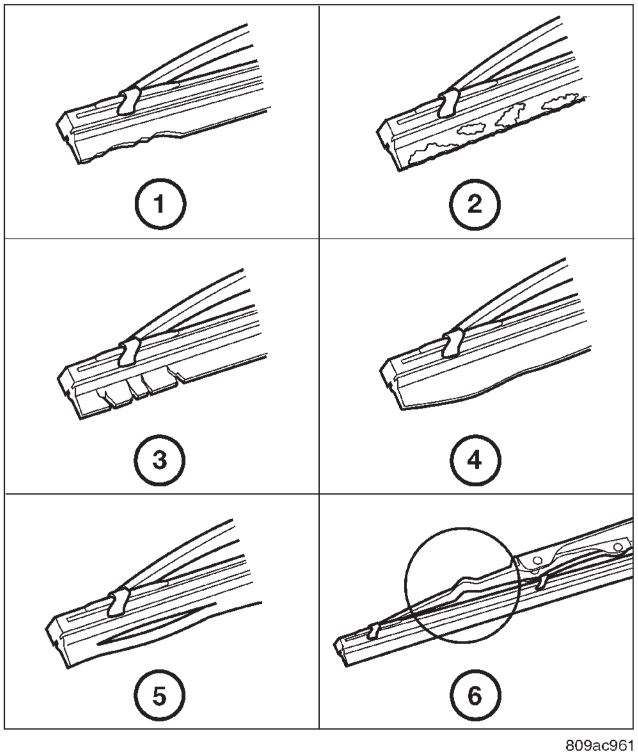


Fig. 2 Wiper Blade Inspection

1 - WORN OR UNEVEN EDGES
2 - ROAD FILM OR FOREIGN MATERIAL DEPOSITS
3 - HARD, BRITTLE, OR CRACKED
4 - DEFORMED OR FATIGUED
5 - SPLIT
6 - DAMAGED SUPPORT COMPONENTS

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

(1) Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/ FRONT WIPERS/WASHERS - CLEANING).

(2) Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

FRONT CHECK VALVE

DESCRIPTION

A front washer system check valve is standard equipment on this model. The front check valve is integral to the front washer nozzle plumbing wye fitting located in the cowl plenum beneath the cowl plenum cover/grille panel near the base of the windshield. The check valve consists of a molded plastic body with a round center section. Three barbed hose nipples are formed in a wye configuration on the outside circumference of the center section of the valve body. Within the check valve body, a small check valve operated by a small coiled spring restricts flow through the unit until the valve is unseated by a predetermined inlet fluid pressure. The front check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The front check valve provides more than one function in this application. It serves as a wye connector fitting between the cowl grille panel and washer nozzle sections of the front washer supply hose. It also prevents washer fluid from draining out of the front washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the front washer switch is actuated until washer fluid was dispensed through the front washer nozzles, because the front washer pump would have to refill the front washer plumbing from the reservoir to the nozzles. Finally, the front check valve prevents washer fluid from siphoning through the front washer nozzles after the front washer system is turned Off. When the front washer pump pressurizes and pumps washer fluid from the reservoir through the front washer plumbing, the fluid pressure overrides the spring pressure applied to the check valve and unseats the valve, allowing washer fluid to flow toward the front washer nozzles. When the front washer pump stops operating, spring pressure seats the check valve and fluid flow in either direction within the front washer plumbing is prevented.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARMS - REMOVAL).

(3) Open the hood and pull the hood to plenum seal off of the forward flanges of the cowl grille cover and the plenum panel.

FRONT CHECK VALVE (Continued)

(4) Remove the six plastic nuts (2 short and 4 long) that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield (Fig. 3).

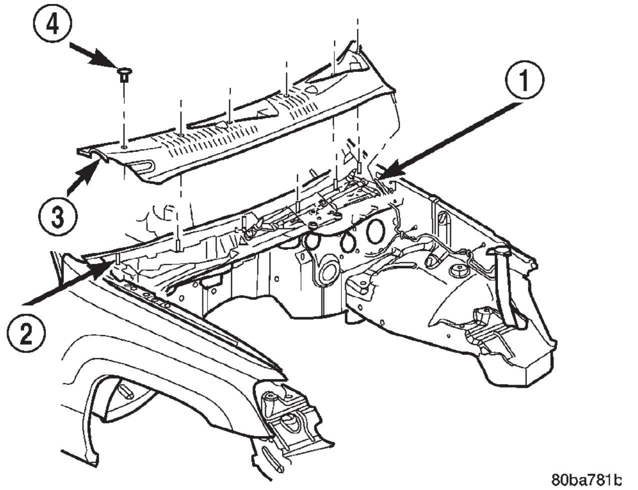


Fig. 3 Cowl Grille Cover Remove/Install

1 - WASHER HOSE CONNECTION
2 - STUDS (6)
3 - COWL GRILLE COVER
4 - PLASTIC NUT (6)

(5) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the front washer plumbing.

(6) Disconnect the engine compartment washer hose from the cowl grille cover washer hose at the plastic elbow connector.

(7) Remove the cowl grille cover from the cowl plenum and cowl top panels through the opening between the hood and the base of the windshield.

(8) From the underside of the cowl grille cover, disconnect the washer hoses from the three barbed nipples of the wye fitting/check valve unit.

(9) Remove the wye fitting/check valve unit from the underside of the cowl grille cover.

INSTALLATION

(1) Position the wye fitting/check valve unit to the underside of the cowl grille cover.

(2) From the underside of the cowl grille cover, reconnect the three washer hoses to the barbed nipples of the wye fitting/check valve unit.

(3) Reinstall the washer hoses for the front washer nozzles into their routing clips on the underside of the cowl grille cover.

(4) Position the cowl grille cover onto the cowl plenum and cowl top panels through the opening between the hood and the base of the windshield (Fig. 3).

(5) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the front washer plumbing.

(6) Reconnect the cowl grille cover washer hose to the engine compartment washer hose at the elbow connector.

(7) Install the six plastic nuts that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield. These nuts are to be installed by pushing them onto the studs in the following sequence:

(a) First, install the short nuts to the third stud from the right, then the second stud from the left.

(b) Next, install the long nuts to the right outboard stud, then the left outboard stud.

(c) Finally, install the two remaining long nuts to the third stud from the left, then the second stud from the right.

(8) Starting at the ends and working toward the center, push the hood to plenum seal onto the forward flanges of the cowl grille cover and the plenum panel.

(9) Reinstall the wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARMS - INSTALLATION).

(10) Reconnect the battery negative cable.

FRONT WASHER HOSES/ TUBES

DESCRIPTION

The front washer plumbing consists of a small diameter rubber hose that is routed from the barbed outlet nipple of the front washer pump/motor on the washer reservoir along the filler neck into the engine compartment. In the engine compartment, a molded plastic in-line fitting with barbed nipples joins the washer hose to another section of hose that is routed near the left headlamp and dash wire harness to the cowl plenum area. The engine compartment washer hose passes from the engine compartment into the cowl plenum area through a dedicated hole with a rubber grommet near the left end of the cowl plenum panel. A molded plastic elbow fitting with barbed nipples joins the engine compartment hose to the cowl grille cover hose. The cowl grille cover washer hose is routed through routing clips on the underside of the cowl grille cover to a molded plastic wye fitting with barbed nipples and an integral check valve. The cowl grille cover hose is connected to one nipple on the wye fitting and the two washer nozzle hoses are connected to the other two wye fitting nipples. The washer nozzle hoses are routed along the underside of the cowl grille cover to the two washer nozzles.

FRONT WASHER HOSES/TUBES (Continued)

Washer hose is available for service only as roll stock, which must then be cut to length. The molded plastic washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the front washer pump/motor through the front washer system plumbing and fittings to the two front washer nozzles. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

FRONT WASHER NOZZLE

DESCRIPTION

The two front washer nozzles have integral snap features that secure them in dedicated holes in the cowl plenum cover/grille panel located near the base of the windshield. The domed upper surface of the washer nozzle is visible on the top of the plenum cover/grille panel, and the nozzle orifice is oriented towards the windshield glass. The washer plumbing fittings for the washer nozzles are concealed beneath the cowl plenum cover/grille panel. These fluidic washer nozzles are constructed of molded plastic. The cowl plenum cover/grille panel must be removed from the vehicle to access the nozzles for service. The washer nozzles cannot be adjusted or repaired. If faulty or damaged, they must be replaced.

OPERATION

The two front washer nozzles are designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to each nozzle from the washer reservoir by the front washer pump/motor through a single hose, which is attached to a barbed nipple on each front washer nozzle below the cowl plenum cover/grille panel. The washer nozzles incorporate a fluidic design, which causes the nozzle to emit the pressurized washer fluid as an oscillating stream to more effectively cover a larger area of the glass area to be cleaned.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARMS - REMOVAL).

(3) Unlatch and open the hood.

(4) Pull the hood to plenum seal off of the forward flanges of the cowl grille cover and the plenum panel.

(5) Remove the six plastic nuts (2 short and 4 long) that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield (Fig. 4).

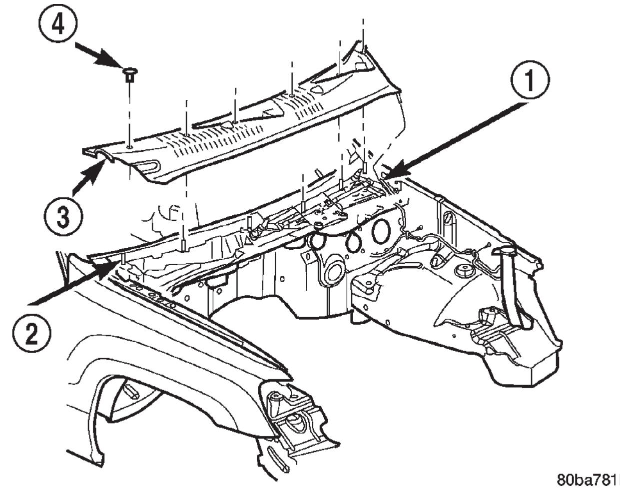


Fig. 4 Cowl Grille Cover Remove/Install

1 - WASHER HOSE CONNECTION
2 - STUDS (6)
3 - COWL GRILLE COVER
4 - PLASTIC NUT (6)

(6) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the front washer plumbing.

(7) Disconnect the engine compartment washer hose from the cowl grille cover washer hose at the plastic elbow connector.

(8) Remove the cowl grille cover from the cowl plenum and cowl top panels through the opening between the hood and the base of the windshield.

(9) From the underside of the cowl grille cover, disconnect the washer hose(s) from the barbed nipple(s) of the front washer nozzle(s).

(10) From the underside of the cowl grille cover, release the integral snap features of the front washer nozzle(s) and push the nozzle(s) out through the mounting hole toward the top side of the cowl grille cover.

INSTALLATION

(1) From the top side of the cowl grille cover, insert the nipple end of the front washer nozzle(s) through the mounting hole in the cowl grille cover.

(2) Push firmly and evenly on the top of the front washer nozzle until the integral snap features lock into place on the underside of the cowl grille cover.

(3) From the underside of the cowl grille cover, reconnect the washer hose(s) to the barbed nipple(s) of the front washer nozzle(s).

FRONT WASHER NOZZLE (Continued)

(4) Reinstall the washer hoses for the front washer nozzle(s) into their routing clips on the underside of the cowl grille cover.

(5) Position the cowl grille cover onto the cowl plenum and cowl top panels through the opening between the hood and the base of the windshield (Fig. 4).

(6) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the front washer plumbing.

(7) Reconnect the cowl grille cover washer hose to the engine compartment washer hose at the elbow connector.

(8) Install the six plastic nuts that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield. These nuts are to be installed by pushing them onto the studs in the following sequence:

(a) First, install the short nuts to the third stud from the right, then the second stud from the left.

(b) Next, install the long nuts to the right outboard stud, then the left outboard stud.

(c) Finally, install the two remaining long nuts to the third stud from the left, then the second stud from the right.

(9) Starting at the ends and working toward the center, push the hood to plenum seal onto the forward flanges of the cowl grille cover and the plenum panel.

(10) Close and latch the hood.

(11) Reinstall the wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARMS - INSTALLATION).

(12) Reconnect the battery negative cable.

FRONT WASHER PUMP/ MOTOR

DESCRIPTION

The front washer pump/motor unit is located on the outboard side and near the front of the washer reservoir, between the left front inner and outer fender panels (Fig. 5). A small permanently lubricated and sealed electric motor is coupled to the rotor-type washer pump. A seal flange with a large barbed inlet nipple on the pump housing passes through a rubber grommet seal installed in one of two dedicated mounting holes near the bottom of the washer reservoir. The front washer pump/motor unit is always mounted in the lower pump mounting hole of the reservoir. A smaller barbed outlet nipple on the pump housing connects the unit to the front washer hose. The washer pump/motor unit is retained on the reservoir by the interference fit between the barbed pump inlet nipple and the grommet seal, which is a light press fit. An integral electrical connector receptacle is located on the top of the motor housing. The front washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

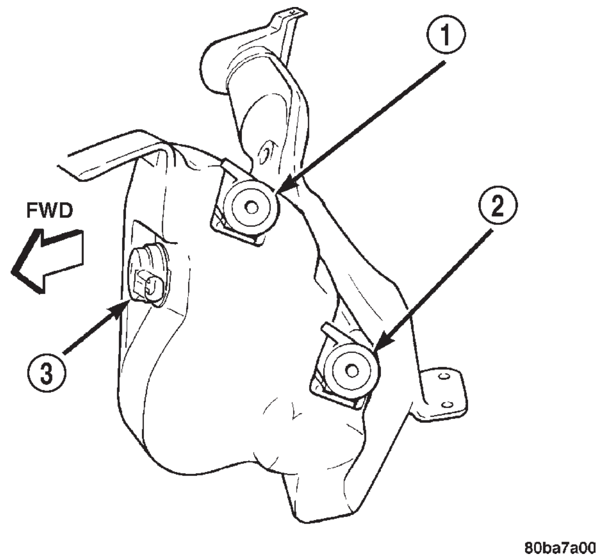


Fig. 5 Washer Pumps (Viewed from Bottom of Reservoir)

1 - REAR WASHER PUMP/MOTOR
2 - FRONT WASHER PUMP/MOTOR
3 - WASHER FLUID LEVEL SWITCH

OPERATION

The front washer pump/motor unit is connected to the vehicle electrical system through a single take out and two-cavity connector of the left headlamp and dash wire harness. The washer pump/motor is grounded at all times through a take out of the left headlamp and dash wire harness with a single eyelet terminal connector that is secured under a ground screw to the top of the left inner fender shield in the engine compartment. The front washer pump/motor receives battery current on a fused ignition switch output (run-acc) circuit through the closed contacts of the momentary front washer switch within the right multi-function switch only when the switch control stalk is pulled towards the steering wheel. Washer fluid is gravity-fed from the washer reservoir to the inlet side of the washer pump. When the pump motor is energized, the rotor-type pump pressurizes the washer fluid and forces it through the pump outlet nipple, the front washer plumbing, and the front washer nozzles onto the windshield glass.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

FRONT WASHER PUMP/MOTOR (Continued)

(2) Raise and support the vehicle.

(3) Remove the liner from the left front fender wheel house.

(4) Disconnect the left headlamp and dash wire harness connector for the front washer pump/motor from the motor connector receptacle (Fig. 6).

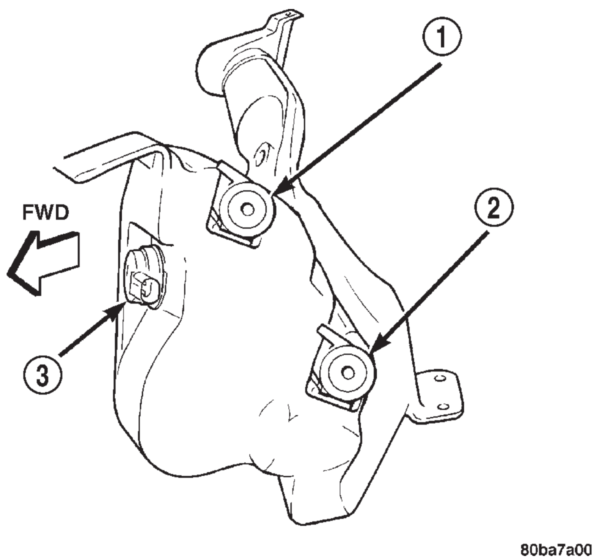


Fig. 6 Washer Pumps (Viewed from Bottom of Reservoir)

1 - REAR WASHER PUMP/MOTOR
2 - FRONT WASHER PUMP/MOTOR
3 - WASHER FLUID LEVEL SWITCH

(5) Disconnect the washer hose from the barbed outlet nipple of the front washer pump/motor and allow the washer fluid to drain into a clean container for reuse.

(6) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed inlet nipple of the washer pump out of the rubber grommet seal in the reservoir. Care must be taken not to damage the reservoir.

(7) Remove the rubber grommet seal from the washer pump mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the washer pump mounting hole in the washer reservoir. Always use a new rubber grommet seal on the reservoir.

(2) Position the barbed inlet nipple of the washer pump to the rubber grommet seal in the reservoir (Fig. 6).

(3) Press firmly and evenly on the washer pump until the barbed inlet nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

(4) Reconnect the washer hose to the barbed outlet nipple of the washer pump.

(5) Reconnect the left headlamp and dash wire harness connector for the front washer pump/motor unit to the motor connector receptacle.

(6) Reinstall the liner into the left front fender wheel house.

(7) Lower the vehicle.

(8) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(9) Reconnect the battery negative cable.

FRONT WIPER ARM

DESCRIPTION

The front wiper arms are the rigid members located between the wiper pivots that protrude from the cowl plenum cover/grille panel near the base of the windshield and the wiper blades on the windshield glass. These wiper arms feature an over-center hinge that allows easy access to the windshield glass for cleaning. The wiper arm has a die cast metal pivot end with a large mounting hole with internal serrations at one end. A molded black plastic cap fits over the wiper arm retaining nut to conceal the nut and this mounting hole following wiper arm installation. The wide end of a tapered, stamped steel channel hinges on and is secured with a hinge pin to the blade end of the wiper arm pivot end. One end of a long, rigid, stamped steel strap, with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook. Concealed within the stamped steel channel, one end of a long spring is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced.

OPERATION

The front wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The mounting hole formation with internal serrations in the wiper arm pivot end interlocks with the serrations on the outer circumference of the wiper pivot driver, allowing positive engagement and finite adjustment of this

FRONT WIPER ARM (Continued)

connection. The mounting nut locks the wiper arm to the threaded stud on the wiper pivot. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

(1) Lift the front wiper arm to its over-center position to hold the wiper blade off of the glass and relieve the spring tension on the wiper arm to wiper pivot connection.

(2) Carefully pry the plastic nut cap off of the pivot end of the wiper arm (Fig. 7).

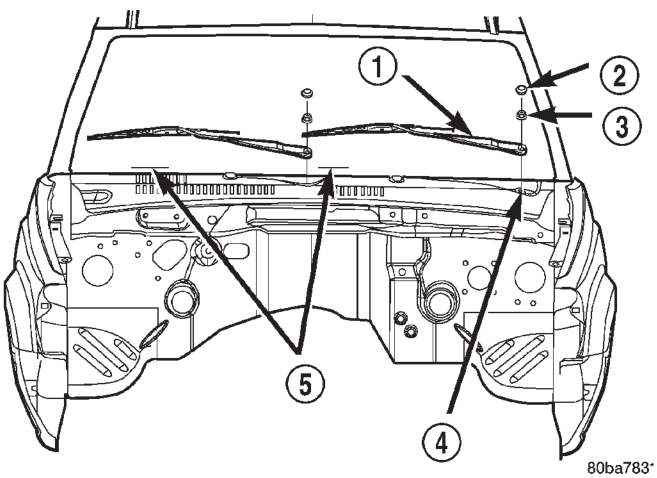


Fig. 7 Wiper Arm Remove/Install

1 - ARM AND BLADE
2 - CAP
3 - NUT
4 - PIVOT SHAFT
5 - ALIGNMENT LINE

(3) Remove the nut that secures the wiper arm to the wiper pivot shaft.

(4) Use a suitable battery terminal puller to disengage the wiper arm from the wiper pivot shaft splines (Fig. 8).

(5) Remove the front wiper arm pivot end from the wiper pivot.

INSTALLATION

NOTE: Be certain that the wiper motor is in the park position before attempting to install the wiper arms. Turn the ignition switch to the On position and move the right multi-function switch control knob to its Off position. If the wiper pivots move, wait until they stop moving, then turn the ignition switch back to the Off position. The wiper motor is now in its park position.

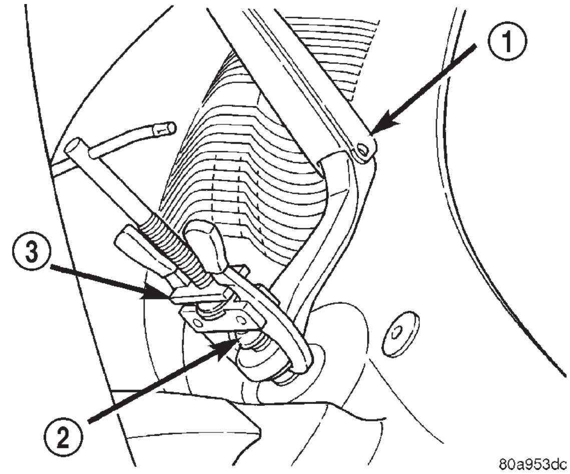


Fig. 8 Wiper Arm Puller - Typical

1 - WIPER ARM
2 - WIPER PIVOT
3 - BATTERY TERMINAL PULLER

(1) The front wiper arms must be indexed to the wiper pivots with the wiper motor in the park position to be properly installed. Position the front wiper arm pivot ends onto the wiper pivots so that the lower edge of the blade is aligned with the wiper alignment lines located in the lower edge of the windshield glass (Fig. 7).

(2) Once the wiper blade is aligned, lift the wiper arm away from the windshield slightly to relieve the spring tension on the pivot end and push the pivot hole on the end of the wiper arm down over the wiper pivot shaft.

(3) Install and tighten the nut that secures the wiper arm to the wiper pivot shaft. Tighten the nut to 23.7 N·m (210 in. lbs.).

(4) Wet the windshield glass, then operate the front wipers. Turn the wiper switch to the Off position, then check for the correct wiper arm position and readjust as required.

(5) Reinstall the plastic nut cap onto the wiper arm pivot nut.

FRONT WIPER BLADE

DESCRIPTION

Each front wiper blade is secured by an integral latching pivot block to the hook formation on the tip of the front wiper arms, and rests on the glass near the base of the windshield when the wipers are not in operation (Fig. 9). The wiper blade consists of the following components:

• **Superstructure -** The superstructure includes several stamped steel bridges and links with claw

FRONT WIPER BLADE (Continued)

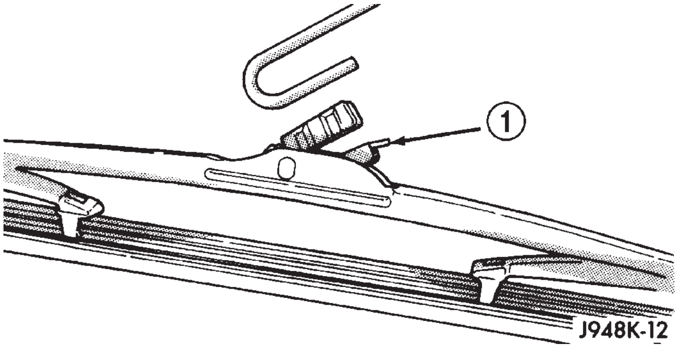


Fig. 9 Wiper Blade - Typical

1 - RELEASE TAB

formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.

- **Element -** The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor -** The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All Grand Cherokee models have two 52.50 centimeter (20.67 inch) long windshield wiper blades with non-replaceable rubber elements (squeegees). The wiper blades cannot be adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature found across the glass surface. The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, but resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

REMOVAL

NOTE: The notched retainer end of the wiper element should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(1) Lift the front wiper arm to raise the wiper blade and element off of the glass, until the wiper arm hinge is in its over-center position.

(2) To remove the wiper blade from the wiper arm, push the pivot block latch release tab under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook (Fig. 10).

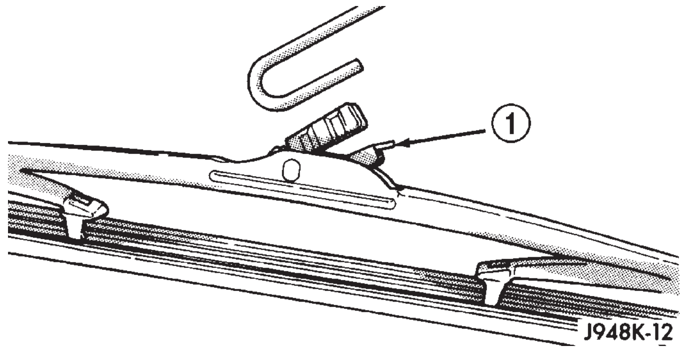


Fig. 10 Wiper Blade Remove/Install - Typical

1 - RELEASE TAB

(3) Extract the hook formation on the tip of the wiper arm from the opening in the wiper blade superstructure ahead of the wiper blade pivot block/ latch unit.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(4) Gently lower the wiper arm tip onto the glass.

INSTALLATION

NOTE: The notched retainer end of the wiper element should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(1) Lift the front wiper arm off of the windshield glass, until the wiper arm hinge is in its over-center position.

(2) Position the front wiper blade near the hook formation on the tip of the arm with the notched retainer for the wiper element oriented towards the end of the wiper arm that is nearest to the wiper pivot.

FRONT WIPER BLADE (Continued)

(3) Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit far enough to engage the pivot block with the hook (Fig. 10).

(4) Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab snaps into its locked position. Latch engagement will be accompanied by an audible click.

(5) Gently lower the wiper blade onto the glass.

FRONT WIPER MODULE

DESCRIPTION

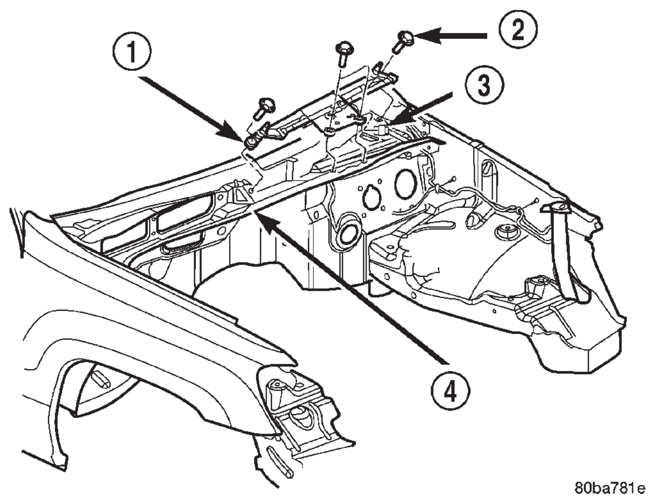


Fig. 11 Front Wiper Module

1 - FRONT WIPER MODULE
2 - SCREW (4)
3 - WIRE HARNESS CONNECTOR
4 - LOWER COWL PLENUM PANEL

The front wiper module is secured with four screws through rubber isolators to the cowl plenum panel beneath the cowl plenum cover/grille panel (Fig. 11). The ends of the wiper pivot shafts that protrude through dedicated openings in the cowl plenum cover/grille panel to drive the wiper arms and blades are the only visible components of the front wiper module. The front wiper module consists of the following major components:

- **Bracket** - The front wiper module bracket consists of a long tubular steel main member that has a stamped pivot bracket formation near each end where the two wiper pivots are secured. A stamped steel mounting plate for the wiper motor is secured with welds near the center of the main member.
- **Crank Arm** - The front wiper motor crank arm is a stamped steel unit with a slotted hole on the driven end that is secured to the wiper motor output shaft with a nut, and a ball stud secured to the drive end.
- **Linkage** - Two stamped steel drive links connect the wiper motor crank arm to the pivot lever arms. The passenger side drive link has a plastic socket-type bushing on each end. The driver side drive link has a plastic socket-type bushing on one end, and a plastic sleeve-type bushing on the other end. The socket-type bushing on one end of each drive link is snap-fit over the ball stud on the lever arm of its respective pivot. The driver side drive link sleeve-type bushing end is then fit over the motor crank arm ball stud, and the other socket-type bushing of the passenger side drive link is snap-fit over the exposed end of the wiper motor crank arm ball stud.
- **Motor** - The front wiper motor is secured with three screws to the motor mounting plate near the center of the wiper module bracket. The wiper motor output shaft passes through a hole in the module bracket, where a nut secures the wiper motor crank arm to the motor output shaft. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal automatic resetting circuit breaker.
- **Pivots** - The two front wiper pivots are secured to the ends of the wiper module bracket. The crank arms that extend from the bottom of the pivot shafts each have a ball stud on their end. The upper end of each pivot shaft where the wiper arms will be fastened each has an externally serrated drum with a threaded stud secured to it.

The front wiper module cannot be adjusted or repaired. If any component of the module is faulty or damaged, the entire front wiper module unit must be replaced. The reinforcement bracket and stud plate are available for service replacement.

OPERATION

The front wiper module operation is controlled by the battery current inputs received by the wiper motor from the wiper on/off and wiper high/low relays. The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately closes the wiper park switch sense circuit to ground or to battery current, depending upon the position of the wipers on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned Off, and to park the wiper blades in the lowest portion of the wipe pattern. The automatic resetting circuit breaker protects the motor from overloads. The wiper motor

FRONT WIPER MODULE (Continued)

crank arm, the two wiper linkage members, and the two wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the front wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARMS - REMOVAL).

(3) Unlatch and open the hood.

(4) Remove the hood to plenum seal from the forward flanges of the cowl grille cover and the plenum panel.

(5) Remove the six plastic nuts (2 short and 4 long) that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield (Fig. 12).

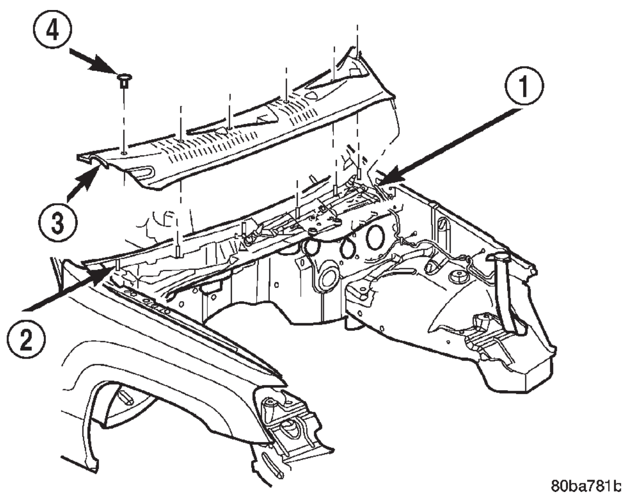


Fig. 12 Cowl Grille Cover Remove/Install

1 - WASHER HOSE CONNECTION
2 - STUDS (6)
3 - COWL GRILLE COVER
4 - PLASTIC NUT (6)

(6) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the front washer plumbing.

(7) Disconnect the front washer engine compartment hose from the cowl grille cover hose at the elbow connector.

(8) Remove the cowl grille cover from the cowl plenum and cowl top panels through the opening between the hood and the base of the windshield.

(9) Remove the four screws that secure the front wiper module to the cowl plenum panel (Fig. 13).

(10) Lift the left end of the front wiper module far enough to access the front wiper motor wire harness connector.

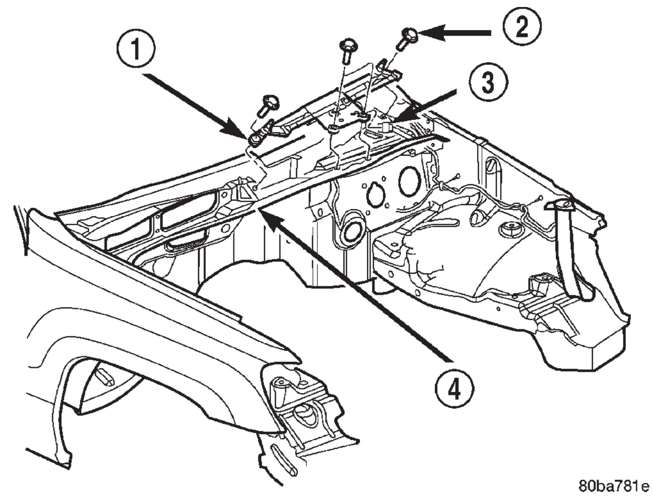


Fig. 13 Front Wiper Module Remove/Install

1 - FRONT WIPER MODULE
2 - SCREW (4)
3 - WIRE HARNESS CONNECTOR
4 - LOWER COWL PLENUM PANEL

(11) Disconnect the left headlamp and dash wire harness connector for the front wiper motor from the front wiper motor pigtail wire connector.

(12) Remove the front wiper module from the cowl plenum as a unit.

INSTALLATION

(1) Position the front wiper module into the cowl plenum as a unit (Fig. 13).

(2) Lift the left end of the front wiper module far enough to access the front wiper motor wire harness connector.

(3) Reconnect the left headlamp and dash wire harness connector for the front wiper motor to the front wiper motor pigtail wire connector.

(4) Loosely install one of the front wiper module mounting screws to the mounting hole near the pivot on the right end of the module to locate the module in the plenum.

(5) Working from left to right, install and tighten the four screws that secure the front wiper module to the cowl plenum panel. Tighten the screws to 8 N·m (72 in. lbs.).

(6) Position the cowl grille cover onto the cowl plenum and cowl top panels through the opening between the hood and the base of the windshield (Fig. 12).

(7) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the front washer plumbing.

(8) Reconnect the front washer system engine compartment hose to the cowl grille cover hose at the elbow connector.

FRONT WIPER MODULE (Continued)

(9) Install the six plastic nuts that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield. These nuts are to be installed by pushing them onto the studs in the following sequence:

(a) First, install the short nuts to the third stud from the right, then the second stud from the left.

(b) Next, install long nuts to the right outboard stud, then the left outboard stud.

(c) Finally, install the two remaining long nuts to the third stud from the left, then the second stud from the right.

(10) Starting at the ends and working toward the center, push the hood to plenum seal onto the forward flanges of the cowl grille cover and the plenum panel.

(11) Close and latch the hood.

(12) Reinstall the wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARMS - INSTALLATION).

(13) Reconnect the battery negative cable.

RAIN SENSOR MODULE

DESCRIPTION

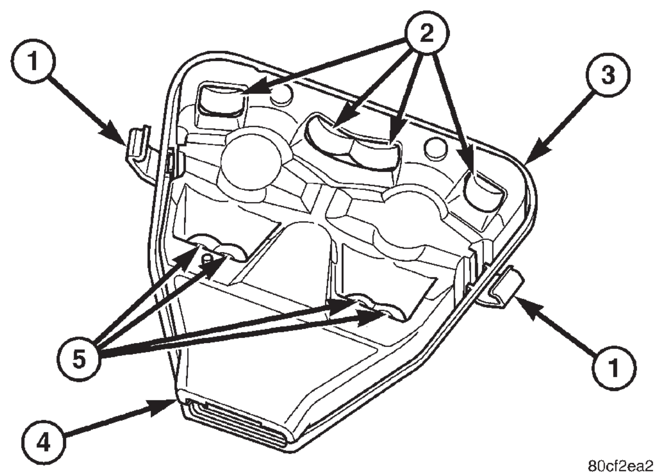


Fig. 14 Rain Sensor Module

1 - SPRING CLIP (2)
2 - INFRARED LENS (4)
3 - HOUSING
4 - CONNECTOR RECEPTACLE
5 - PHOTOCELL LENS (4)

The Rain Sensor Module (RSM) is the primary component of the automatic wiper system (Fig. 14). The RSM is located on the inside of the windshield, between the rear view mirror mounting button and the windshield header and is concealed behind a molded plastic trim cover that snaps over the module housing. The triangular-shaped molded black plastic housing of the RSM has a rectangular opening located on the upper end of the housing for the module connector receptacle, which contains four terminal pins. These terminal pins connect the rain sensor to the vehicle electrical system through a dedicated take out and connector of the overhead wire harness that extends from above the headliner. Five openings on the windshield side of the RSM housing are fitted with eight convex clear plastic lenses. A metal spring clip on each side of the housing near the bottom secures the RSM to a plastic mounting bracket that is bonded to the windshield glass. Concealed within the RSM housing is the electronic circuitry of the module, which includes four InfraRed (IR) diodes, two photocells, and a microprocessor.

The RSM software is Flash compatible, which means it can be reprogrammed using Flash reprogramming procedures. However, if any of the hardware of the RSM is damaged or faulty, the entire module must be replaced. The RSM bracket is serviced as a unit with the windshield glass. If the bracket is faulty, damaged, or separated from the windshield glass, the windshield unit must be replaced.

OPERATION

The microprocessor-based Rain Sensor Module (RSM) senses moisture in the wipe pattern on the outside of the windshield glass and sends wipe commands to the Body Control Module (BCM). Four InfraRed (IR) diodes within the RSM generate IR light beams that are aimed by four of the convex optical lenses near the base of the module through the windshield glass. Four additional convex optical lenses near the top of the RSM are focused on the IR light beams on the outside of the windshield glass and allow the two photocells within the module to sense changes in the intensity of these IR light beams. When sufficient moisture accumulates within the wipe pattern of the windshield glass, the RSM detects a change in the monitored IR light beam intensity.

The internal programming of the RSM then sends the appropriate electronic wipe command messages to the BCM over the Programmable Communications Interface (PCI) data bus. The BCM responds by activating or deactivating the front wiper system. The BCM also sends electronic sensitivity level messages to the RSM over the PCI data bus based upon the driver-selected sensitivity setting of the control knob on the control stalk of the right (wiper) multi-function switch. The higher the selected sensitivity setting the more sensitive the RSM is to the accumulated moisture on the windshield glass, and

RAIN SENSOR MODULE (Continued)

the more frequently the RSM will send wipe commands to the BCM to operate the front wiper system.

The RSM operates on battery current received through a fuse in the Junction Block (JB) on a fused B(+) circuit. This circuit is switched by the power accessory (sunroof) delay relay in the JB so that the RSM will operate whenever the relay is energized by the BCM. The RSM receives ground at all times through a take out of the left body wire harness with an eyelet terminal that is secured by a ground screw to the front seat crossmember on the floor panel under the left front seat. It is important to note that the default condition for the wiper system is automatic wipers Off; therefore, if no message is received from the RSM by the BCM for more than about five seconds, the automatic wipers will be disabled and the BCM will default the front wiper system operation to the low speed continuous wipe mode.

The RSM ground and battery current inputs can be diagnosed using conventional diagnostic tools and methods. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the RSM internal circuitry, the BCM, the PCI data bus network, or the electronic messages received and transmitted by the RSM over the PCI data bus. The most reliable, efficient, and accurate means to diagnose the RSM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Adjust the inside rear view mirror on the windshield downward far enough to access the lower edge of the Rain Sensor Module (RSM) trim cover (Fig. 15).

(3) Using a small thin-bladed screwdriver inserted into the notch at the bottom of trim cover, gently pry the trim cover away from the windshield glass until it unsnaps from the RSM.

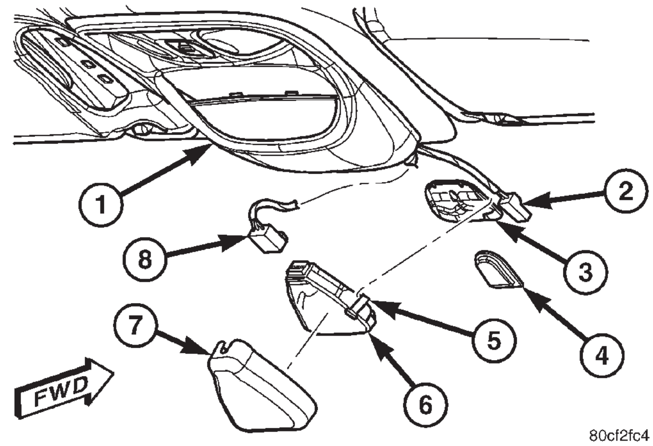


Fig. 15 Rain Sensor Module Remove/Install

1 - OVERHEAD CONSOLE
2 - REAR VIEW MIRROR CONNECTOR
3 - BRACKET
4 - REAR VIEW MIRROR BUTTON
5 - SPRING CLIP (2)
6 - RAIN SENSOR MODULE
7 - TRIM COVER
8 - WIRE HARNESS CONNECTOR

(4) Using a small thin-bladed screwdriver, gently pry the spring clips on each side of the RSM away from the bracket on the windshield.

(5) Pull the RSM away from the bracket on the windshield far enough to access and disconnect the overhead wire harness connector for the module from the module connector receptacle.

(6) Remove the RSM from above the inside rear view mirror.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

RAIN SENSOR MODULE (Continued)

(1) Position the Rain Sensor Module (RSM) above the inside rear view mirror (Fig. 15).

(2) Reconnect the overhead wire harness connector for the RSM to the module connector receptacle.

(3) Position the RSM to the bracket on the windshield above the inside rear view mirror.

(4) Using hand pressure, press the spring clips on each side of the RSM until they snap over the bracket on the windshield.

NOTE: The spring clips on the RSM will become deformed after numerous (about ten) removal and installation cycles. If the spring clips become deformed, the RSM must be replaced with a new unit.

(5) Align and engage the top of the trim cover over the top of the RSM.

(6) Using hand pressure, press the bottom of the trim cover toward the windshield glass until it snaps over the bottom of the RSM.

(7) Reconnect the battery negative cable.

RIGHT MULTI-FUNCTION SWITCH

DESCRIPTION

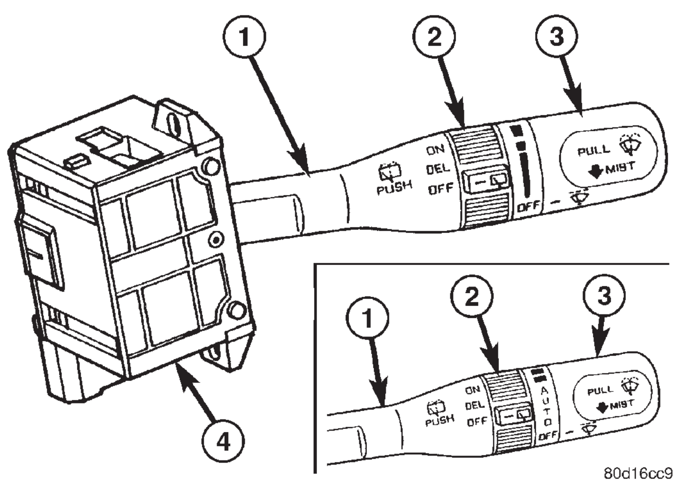


Fig. 16 Right (Wiper) Multi-Function Switch

1 - CONTROL STALK
2 - REAR WIPER CONTROL SLEEVE
3 - FRONT WIPER CONTROL KNOB
4 - RIGHT (WIPER) MULTI-FUNCTION SWITCH

The right (wiper) multi-function switch is secured to the right side of the multi-function switch mounting housing at the top of the steering column, just below the steering wheel (Fig. 16). The only visible component of the right multi-function switch is the control stalk that extends through a dedicated opening in the right side of the steering column shrouds. The remainder of the right multi-function switch is concealed beneath the steering column shrouds. The switch housing and its control stalk are constructed of molded black plastic. A single connector receptacle containing up to ten terminal pins is located on the back of the switch housing and connects the switch to the vehicle electrical system through a take out and connector of the instrument panel wire harness. The switch is secured to the multi-function switch mounting housing near the top of the steering column by two screws.

There are two versions of the right multi-function switch: one to support the standard equipment speed sensitive intermittent front wiper system, and a second to support the optional front automatic wiper system. Each version of the right multi-function switch control stalk has both white nomenclature and International Control and Display Symbol icons applied to it, which clearly identify its many functions. The control stalk has a control knob on its end with a flattened face to allow it to be easily rotated. Just below the control knob is a knurled control sleeve. The right multi-function switch is the primary control for the front and rear wiper and washer systems, and contains switches and circuitry to provide signals to the Body Control Module (BCM) and the rear wiper module.

The right (wiper) multi-function switch cannot be adjusted or repaired. If any function of the switch is faulty, or if the switch is damaged, the entire switch unit must be replaced.

The right (wiper) multi-function switch supports the following functions and features:

• **Automatic Front Wipe Mode** - On models equipped with the optional automatic wiper system, the internal circuitry and hardware of the right (wiper) multi-function switch control knob provide an automatic front wipe mode with five sensitivity positions.

• **Continuous Front Wipe Modes** - The internal circuitry and hardware of the right (wiper) multi-function switch control knob provide two continuous front wipe switch positions, low speed or high speed.

RIGHT MULTI-FUNCTION SWITCH (Continued)

- **Continuous Rear Wipe Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control sleeve provides one continuous rear wipe switch position.
- **Front Washer Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control stalk provide front washer system operation.
- **Front Wipe-After-Wash Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control stalk provide a wipe-after-wash mode.
- **Front Wiper Mist Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control stalk provide a front wiper system mist mode.
- **Intermittent Front Wipe Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control knob provide an intermittent front wipe mode with five delay interval positions, except on models equipped with the optional automatic wiper system.
- **Intermittent Rear Wipe Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control ring provide one fixed interval intermittent rear wipe mode switch position.
- **Rear Washer Mode** - The internal circuitry and hardware of the right (wiper) multi-function switch control stalk provide rear washer system operation.

OPERATION

The right (wiper) multi-function switch uses a combination of resistor multiplexed and conventionally switched outputs to control the many functions and features it provides. The switch receives battery current on a fused ignition switch output (run-acc) circuit from a fuse in the Junction Block (JB) whenever the ignition switch is in the On or Accessory positions, and receives ground from the Body Control Module (BCM) on a windshield wiper switch return circuit. The right (wiper) multi-function switch may be diagnosed using conventional diagnostic tools and methods.

Following are descriptions of how the right (wiper) multi-function switch control stalk operates to control the functions and features it provides:

- **Automatic Wipe Mode** - On models equipped with the optional automatic wiper system, the control knob on the end of the right (wiper) multi-function switch control stalk is rotated to one of five minor intermediate detents to select the desired automatic wipe sensitivity level. The control knob is rotated rearward (counterclockwise) to reduce the sensitivity (increase the interval between wipes), or forward (clockwise) to increase the sensitivity (decrease the interval between wipes). The right (wiper) multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a windshield wiper switch mux circuit. The BCM responds by sending an electronic message to the Rain Sensor Module (RSM) over the Programmable Communications Interface (PCI) data bus indicating the selected sensitivity level, and by operating the front wiper system based upon electronic wipe commands received from the RSM over the PCI data bus.
- **Continuous Front Wipe Modes** - The control knob on the end of the right (wiper) multi-function switch control stalk is rotated to an intermediate detent that is one detent rearward (counterclockwise) from the full forward (clockwise) detent to select the low speed continuous front wiper mode, or to its full forward (clockwise) detent to select the high speed continuous front wiper mode. For the low speed mode, the multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a windshield wiper switch mux circuit, and the BCM responds by energizing the wiper on/off relay in the Power Distribution Center (PDC) for the front low speed continuous wipe mode. For the high speed mode, the multi-function switch provides the same resistor multiplexed output to the BCM on the windshield wiper switch mux circuit as the low speed mode, but also provides a ground output to the BCM on a wiper high control circuit. The BCM responds to these inputs by energizing the wiper on/off relay and the wiper high/low relay in the PDC for the front high speed continuous wipe mode.
- **Continuous Rear Wipe Mode** - The control ring on the right (wiper) multi-function switch control stalk is rotated to the most forward (clockwise) detent to select the continuous rear wiper mode. The multi-function switch provides a battery current output to the rear wiper motor on a rear wiper motor control circuit to signal the rear wiper module to operate the rear wiper motor in the continuous wipe mode.
- **Front Washer Mode** - The control stalk of the right (wiper) multi-function switch is pulled toward the steering wheel to momentarily activate the front washer pump/motor in the front washer mode. The front washer pump will continue to operate in the front washer mode until the control stalk is released. The right (wiper) multi-function switch provides a battery current output on a washer pump motor switch output circuit to energize the front washer pump in the front washer mode.
- **Front Wiper Mist Mode** - The control stalk of the right (wiper) multi-function switch is pushed towards the floor to momentarily activate the front wiper motor in the mist mode. The front wiper motor will continue to operate in the mist mode until the control stalk is released. The right (wiper) multi-

RIGHT MULTI-FUNCTION SWITCH (Continued)

function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a windshield wiper switch mux circuit, and the BCM responds by energizing the wiper on/off relay in the Power Distribution Center (PDC) to operate the front wiper motor momentarily at low speed to provide the front wiper mist mode.

- **Intermittent Front Wipe Mode** - On models not equipped with the optional automatic wiper system, the control knob on the end of the right (wiper) multi-function switch control stalk is rotated to one of five minor intermediate detents to select the desired intermittent front wipe delay interval. The control knob is rotated rearward (counterclockwise) to increase the delay, or forward (clockwise) to decrease the delay. The right (wiper) multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a windshield wiper switch mux circuit. The BCM responds by monitoring electronic vehicle speed messages received from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus, then energizing the wiper on/off relay in the Power Distribution Center (PDC) to operate the front wiper motor at the proper delay intervals.
- **Intermittent Rear Wipe Mode** - The control ring on the right (wiper) multi-function switch control stalk is rotated to the center detent to select the intermittent rear wiper mode. The right (wiper) multi-function switch provides a battery current output to the rear wiper motor on a rear wiper motor delay control circuit to signal the rear wiper module to operate the rear wiper in the intermittent wipe mode.
- **Rear Washer Mode** - The right (wiper) multi-function switch control stalk is pushed forward toward the instrument panel to a momentary positions to activate the rear washer pump/motor in the rear washer mode. The rear washer pump will continue to operate in the rear washer mode until the control stalk is released. The right (wiper) multi-function switch provides battery current on a rear washer pump motor control circuit to energize the rear washer pump in the rear washer mode.

DIAGNOSIS AND TESTING - RIGHT MULTI-FUNCTION SWITCH

Be certain to perform the diagnosis for the front wiper system, front washer system, rear wiper system, and/or rear washer system before testing the right multi-function switch. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - DIAGNOSIS AND TESTING) or (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - DIAGNOSIS AND TESTING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE PASSIVE RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG. SIDE CURTAIN AIRBAG, FRONT IMPACT SENSOR, SIDE IMPACT SENSOR, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE PASSIVE RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the right multi-function switch from the steering column and disconnect the instrument panel wire harness connector for the switch from the switch connector receptacle.

(3) Using an ohmmeter, check the right multi-function switch continuity and resistances at the switch terminals as shown in the Right Multi-Function Switch test chart (Fig. 17).

RIGHT MULTI-FUNCTION SWITCH (Continued)

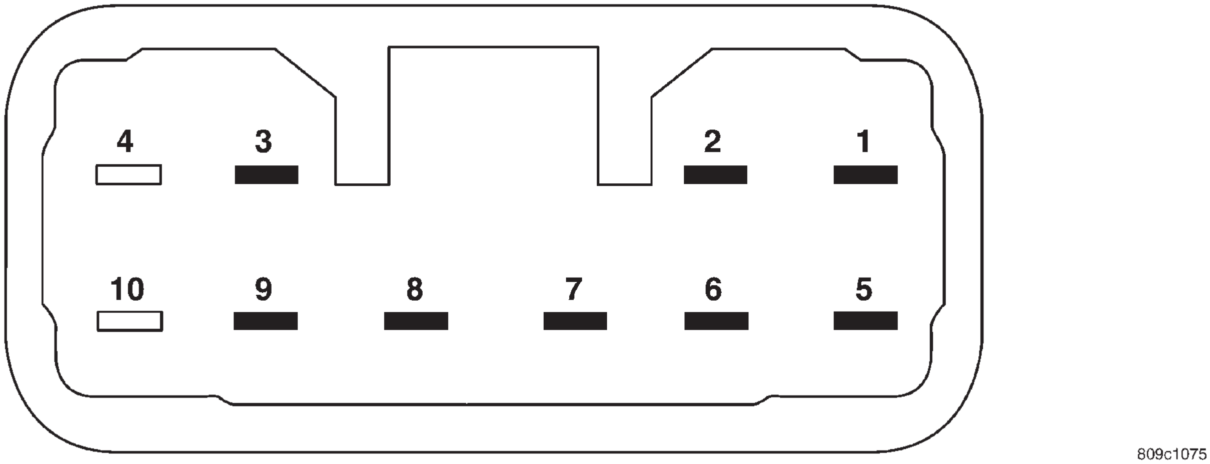


Fig. 17 Right Multi-Function Switch Tests

RIGHT (WIPER) MULTI-FUNCTION SWITCH			
FRONT WIPER/WASHER SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	-	Pins 7 & 8	4286-4379
Intermittent Wipe or Sensitivity Position 1	-	Pins 7 & 8	1445-1480
Intermittent Wipe or Sensitivity Position 2	-	Pins 7 & 8	847-870
Intermittent Wipe or Sensitivity Position 3	-	Pins 7 & 8	556-573
Intermittent Wipe or Sensitivity Position 4	-	Pins 7 & 8	367-380
Intermittent Wipe or Sensitivity Position 5	-	Pins 7 & 8	218-229
Low Speed	-	Pins 7 & 8	99-106
High Speed	Pins 7 & 9	Pins 7 & 8	99-106
Mist	-	Pins 7 & 8	49-56
Wash	Pins 1 & 3	-	-
REAR WIPER/WASHER SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE BETWEEN
Off	-	-	-
Delay	Pins 1 & 6	-	-
On	Pins 1 & 5	-	-
Wash	Pins 1 & 5 & 6 & 2	-	-

RIGHT MULTI-FUNCTION SWITCH (Continued)

(4) If the right multi-function switch fails any of the continuity or resistance tests, replace the faulty right multi-function switch as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 18).

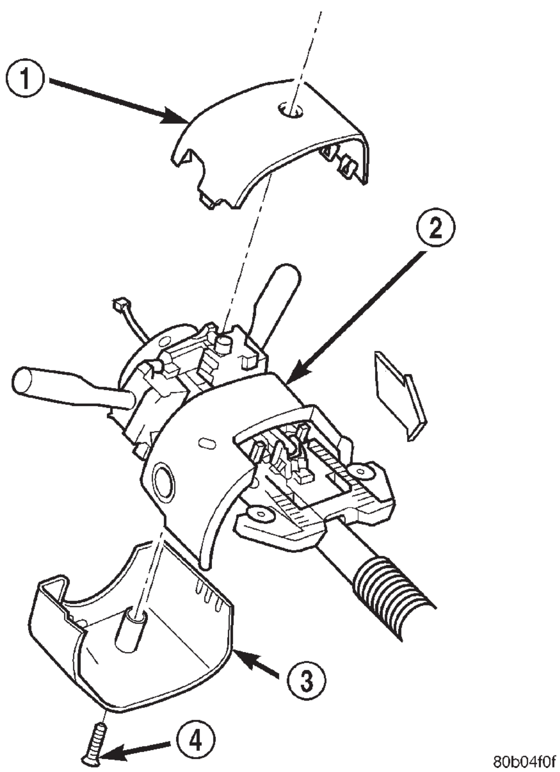


Fig. 18 Steering Column Shrouds Remove/Install

1 - UPPER TILTING COLUMN SHROUD
2 - FIXED COLUMN SHROUD
3 - LOWER TILTING COLUMN SHROUD
4 - SCREW

(3) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(4) Disconnect the instrument panel wire harness connector for the right multi-function switch from the switch connector receptacle.

(5) Remove the two screws that secure the right multi-function switch to the multi-function switch mounting housing (Fig. 19).

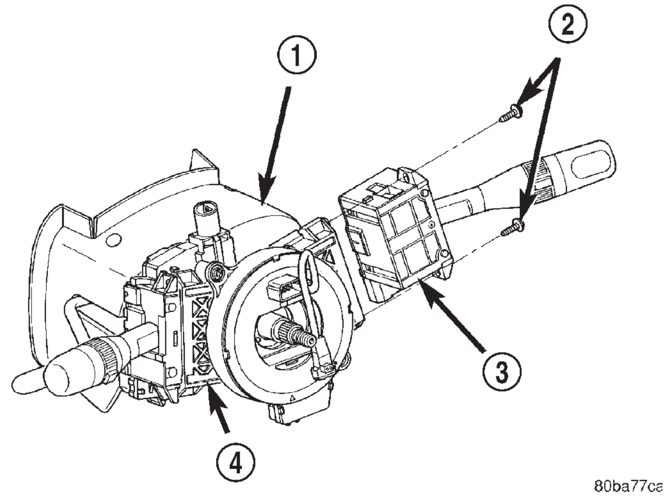


Fig. 19 Right Multi-Function Switch Remove/Install

1 - STEERING COLUMN
2 - SCREWS (2)
3 - RIGHT MULTI-FUNCTION SWITCH
4 - MULTI-FUNCTION SWITCH MOUNTING HOUSING

(6) Remove the right multi-function switch from the multi-function switch mounting housing.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the right multi-function switch onto the multi-function switch mounting housing (Fig. 19).

(2) Install and tighten the two screws that secure the right multi-function switch to the multi-function

RIGHT MULTI-FUNCTION SWITCH (Continued)

switch mounting housing. Tighten the screws to 2.5 N·m (22 in. lbs.).

(3) Reconnect the instrument panel wire harness connector for the right multi-function switch to the switch connector receptacle.

(4) Position the lower tilting steering column shroud to the underside of the steering column (Fig. 18).

(5) Install and tighten the screw that secures the lower tilting steering column shroud to the multi-function switch mounting housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(6) Position the upper tilting column shroud over the steering column with the hazard warning switch button inserted through the hole in the upper surface of the shroud. Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(7) Reconnect the battery negative cable.

WASHER FLUID LEVEL SWITCH

DESCRIPTION

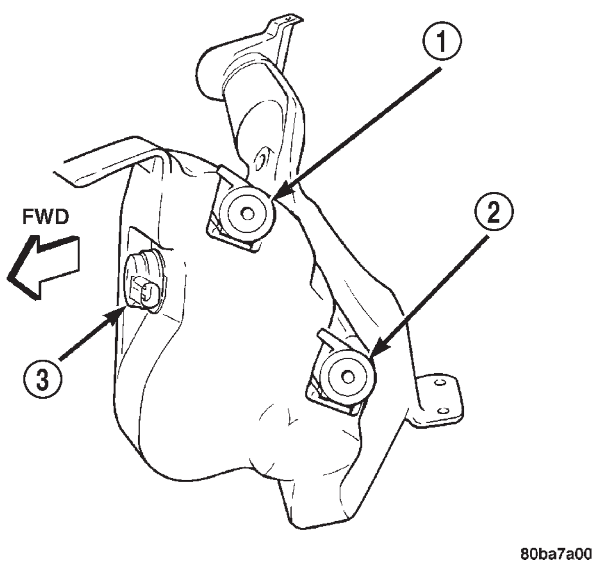


Fig. 20 Washer Fluid Level Switch (Viewed from Bottom of Reservoir)

1 - REAR WASHER PUMP/MOTOR
2 - FRONT WASHER PUMP/MOTOR
3 - WASHER FLUID LEVEL SWITCH

The washer fluid level switch is a single pole, single throw reed-type switch mounted near the front of the washer reservoir, forward of the two washer pump/motors (Fig. 20). Only the molded plastic switch mounting flange and connector receptacle are visible when the switch is installed in the reservoir. A short nipple formation extends from the inner surface of the switch mounting flange, and a barb on the nipple near the switch mounting flange is press-fit into a rubber grommet seal installed in the mounting hole of the reservoir. A small plastic float pivots on the end of a bracket that extends from the switch nipple formation. Within the float is a small magnet, which actuates the reed switch. The washer fluid level switch cannot be adjusted or repaired. If faulty or damaged, the switch must be replaced.

OPERATION

The washer fluid level switch uses a pivoting, oblong float to monitor the level of the washer fluid in the washer reservoir. The float contains a small magnet. When the float pivots, the changing proximity of its magnetic field will cause the contacts of the small, stationary reed switch to open or close. When the fluid level in the washer reservoir is at or above the float level, the float moves to a vertical position and the switch contacts open. When the fluid level in the washer reservoir falls below the pivoting float, the float moves to a horizontal position and the switch contacts close. The switch is connected to the vehicle electrical system through a dedicated take out and connector of the left headlamp and dash wire harness. The switch receives a five volt reference signal from the Body Control Module (BCM) through the washer fluid switch output circuit. The switch is grounded at all times through another take out of the left headlamp and dash wire harness with a single eyelet terminal connector that is secured under a ground screw near the top of the left front fender inner shield in the engine compartment.

When the switch closes, the BCM senses the voltage change on the circuit. The BCM is programmed to send low washer fluid messages to the Electronic Vehicle Information Center (EVIC) over the Programmable Communications Interface (PCI) data bus. The EVIC is programmed to respond to this message by displaying the Washer Fluid Low warning and sending a chime request message back to the BCM over the PCI data bus. Then the BCM generates an audible chime tone warning. A resistor within the washer fluid level switch allows the BCM to monitor and diagnose this circuit. The BCM will store a Diagnostic Trouble Code (DTC) for any fault that it detects. For retrieval of this fault information and further diagnosis of the washer fluid level switch, the BCM, the EVIC, the PCI data bus, the BCM message outputs to the EVIC that control the Low Washer Fluid indicator, or the EVIC message outputs to the BCM that control chime service, a DRBIII® scan tool and the appropriate diagnostic information are required.

WASHER FLUID LEVEL SWITCH (Continued)

REMOVAL

The washer fluid level switch can be removed from the washer reservoir without removing the reservoir from the vehicle.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the one screw that secures the washer reservoir filler neck to the left inner fender shield.

(3) Raise and support the vehicle.

(4) Remove the liner from the left front fender wheel house.

(5) Disconnect the washer hose from the barbed outlet nipple of the rearmost (front) washer pump/motor unit and allow the washer fluid to drain into a clean container for reuse.

(6) Remove the two screws that secure the inboard mounting flange of the washer reservoir to the left inner wheel house.

(7) Pull the bottom of the washer reservoir rearward far enough to access the left headlamp and dash wire harness connector for the washer fluid level switch on the front of the reservoir.

(8) Disconnect the left headlamp and dash wire harness connector for the washer fluid level switch from the switch connector receptacle.

(9) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed nipple of the washer fluid level switch out of the rubber grommet seal on the front of the reservoir (Fig. 21). Care must be taken not to damage the reservoir.

(10) Remove the washer fluid level switch and float from the washer reservoir.

(11) Remove the rubber grommet seal from the washer fluid level switch mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the washer fluid level switch mounting hole in the front of the washer reservoir. Always use a new rubber grommet seal on the reservoir.

(2) Position the float of the washer fluid level switch through the rubber grommet seal in the washer reservoir (Fig. 21). The connector receptacle of the washer fluid level switch should be pointed downward.

(3) Press firmly and evenly on the washer fluid level switch using hand pressure until the barbed nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

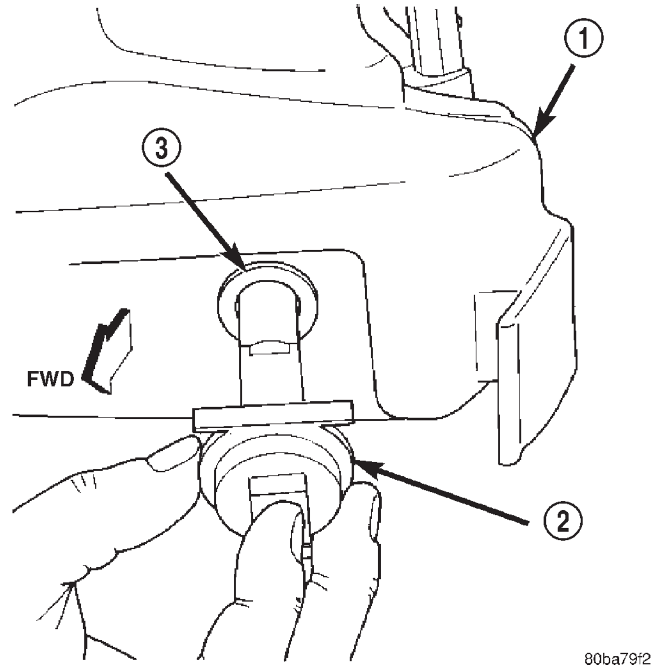


Fig. 21 Washer Fluid Level Switch Remove/Install

1 - WASHER RESERVOIR
2 - WASHER FLUID LEVEL SWITCH
3 - GROMMET SEAL

(4) Reconnect the left headlamp and dash wire harness connector for the washer fluid level switch to the switch connector receptacle.

(5) Reconnect the washer hose to the barbed outlet nipple of the front washer pump/motor unit.

(6) Install and tighten the two screws that secure the inboard mounting flange of the washer reservoir to the left inner wheel house. Tighten the screws to 7.4 N·m (66 in. lbs.).

(7) Reinstall the liner into the left front fender wheel house.

(8) Lower the vehicle.

(9) Install and tighten the one screw that secures the washer reservoir filler neck to the left inner fender shield. Tighten the screw to 7.4 N·m (66 in. lbs.).

(10) Fill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(11) Reconnect the battery negative cable.

WASHER RESERVOIR

DESCRIPTION

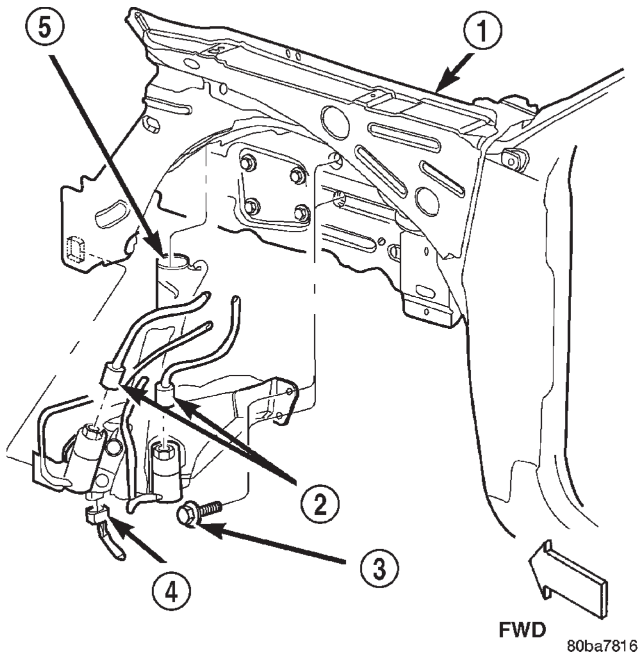


Fig. 22 Washer Reservoir

1 - LEFT FENDER INNER SHIELD
2 - SCREW (2)
3 - WASHER PUMP WIRE HARNESS CONNECTORS
4 - WASHER FLUID LEVEL SWITCH WIRE HARNESS CONNECTOR
5 - WASHER RESERVOIR

A single washer fluid reservoir is used for both the front and rear washer systems (Fig. 22). The molded plastic washer fluid reservoir is concealed between the left front inner and outer fender panels, behind the inner fender liner in front of the left front wheel. The only visible component of the washer reservoir is the filler neck and cap unit, which extends through a hole in the left front wheel house extension panel into the engine compartment. A bright yellow plastic filler cap with a rubber seal and an International Control and Display Symbol icon for “Windshield Washer” and the text “Washer Fluid Only” molded into it snaps over the open end of the filler neck. The cap hinges on and is secured to a molded-in hook formation on the rear of the reservoir filler neck.

There are separate, dedicated holes on the outboard side of the reservoir provided for the mounting of the front and rear washer/pump motor units, and another dedicated hole on the front of the reservoir for the washer fluid level switch. The inboard side of the washer reservoir has an integral flange that is secured to the inside of the left front fender wheel house by two screws, while an integral molded tab engages a slot in the left front fender inner shield to support the outboard side of the reservoir. Another screw secures the reservoir filler neck to the left front fender inner shield near the front of the engine compartment. The left front fender wheel house inner liner must be removed to access the washer reservoir for service.

The washer reservoir cannot be repaired and, if faulty or damaged, it must be replaced. The washer reservoir, the grommet seals for the washer pump/motor units and the washer fluid level switch, and the filler cap are each available for service replacement.

OPERATION

The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the front and rear washer systems. The washer reservoir filler neck provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir. The front and rear washer/pump motor units are located in a sump area near the front of the reservoir to be certain that washer fluid will be available to the pumps as the fluid level in the reservoir becomes depleted. The front washer pump/motor unit is mounted in the lowest position in the sump so that the front washers will operate even after the rear washer system will no longer operate. The washer fluid level switch is mounted just above the sump area of the reservoir so that there will be adequate warning to the vehicle operator that the washer fluid level is low, before the washer system will no longer operate.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the air cleaner housing from the top of the left front fender wheel house. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

WASHER RESERVOIR (Continued)

(3) Disconnect the two washer reservoir washer hoses from the two engine compartment washer hoses at the inline connectors located on the top of the left front fender wheel house (Fig. 23).

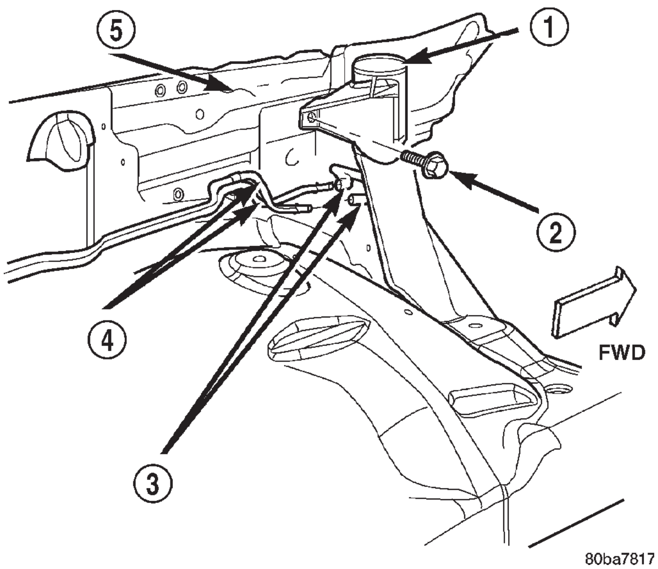


Fig. 23 Washer Reservoir Filler Neck Mounting

1 - WASHER RESERVOIR
2 - SCREW
3 - WASHER HOSES FROM PUMPS
4 - WASHER HOSES TO NOZZLES
5 - LEFT FENDER INNER SHIELD

(4) Open the washer reservoir filler cap and unsnap the filler cap hinge from the hook on the filler neck.

(5) Remove the one screw that secures the washer reservoir filler neck to the left inner fender shield.

(6) Raise and support the vehicle.

(7) Remove the liner from the left front fender wheel house.

(8) Disconnect the left headlamp and dash wire harness connectors for the two washer pump/motor units from the pump/motor connector receptacles (Fig. 24).

(9) Remove the two screws that secure the inboard mounting flange of the washer reservoir to the left front inner wheel house.

(10) Pull the bottom of the washer reservoir rearward far enough to access the left headlamp and dash wire harness connector for the washer fluid level switch on the front of the reservoir.

(11) Disconnect the left headlamp and dash wire harness connector for the washer fluid level switch from the switch connector receptacle.

(12) Pull the bottom of the washer reservoir rearward far enough to disengage the outboard mounting tab from the mounting slot on the left front inner fender shield.

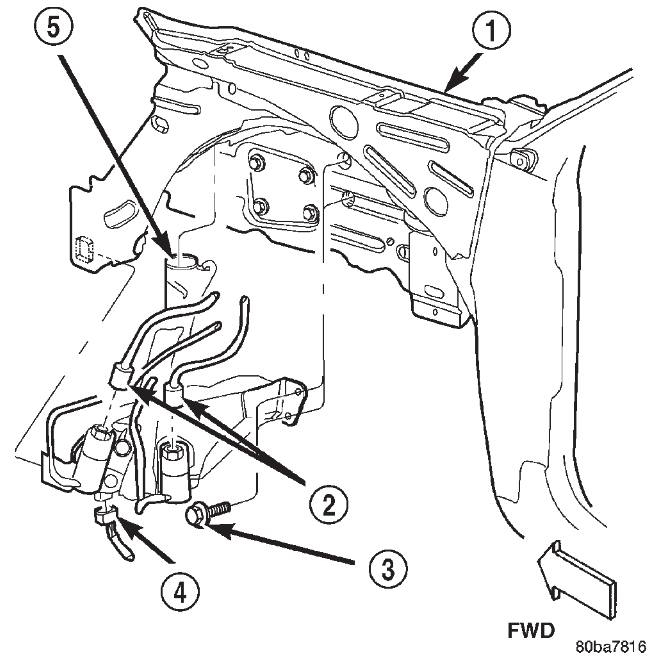


Fig. 24 Washer Reservoir

1 - LEFT FENDER INNER SHIELD
2 - SCREW (2)
3 - WASHER PUMP WIRE HARNESS CONNECTORS
4 - WASHER FLUID LEVEL SWITCH WIRE HARNESS CONNECTOR
5 - WASHER RESERVOIR

(13) Rotate the washer reservoir far enough so that the inboard mounting flange clears the front suspension components, then lower the reservoir far enough to disengage the filler neck from the hole in the left front wheel house extension.

(14) Remove the washer reservoir from the left front fender wheel house.

INSTALLATION

(1) Position the washer reservoir into the left front fender wheel house.

(2) Raise the washer reservoir filler neck through the hole in the left front fender wheelhouse extension into the engine compartment and rotate the reservoir as needed to orient the inboard mounting flange over the top of the front suspension components.

(3) Pull the bottom of the washer reservoir rearward far enough to engage the outboard mounting tab with the mounting slot in the left front inner fender shield (Fig. 24).

(4) Pull the bottom of the washer reservoir rearward far enough to access the washer fluid level switch connector receptacle on the front of the reservoir.

(5) Reconnect the left headlamp and dash wire harness connector for the washer fluid level switch to the switch connector receptacle.

WASHER RESERVOIR (Continued)

(6) Install and tighten the two screws that secure the inboard mounting flange of the washer reservoir to the left inner wheel house. Tighten the screws to 7.4 N·m (66 in. lbs.).

(7) Reconnect the left headlamp and dash wire harness connectors for the two washer pump/motor units to the pump/motor unit connector receptacles.

(8) Reinstall the liner into the left front fender wheel house.

(9) Lower the vehicle.

(10) Install and tighten the one screw that secures the washer reservoir filler neck to the left inner fender shield (Fig. 23). Tighten the screw to 7.4 N·m (66 in. lbs.).

(11) Reinstall the washer reservoir filler cap hinge onto the hook on the filler neck and close the cap.

(12) Reconnect the two washer reservoir washer hoses to the two engine compartment washer hoses at the inline connectors located on the top of the left front fender wheel house.

(13) Reinstall the air cleaner housing onto the top of the left front fender wheel house. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(14) Reconnect the battery negative cable.

WIPER HIGH/LOW RELAY

DESCRIPTION

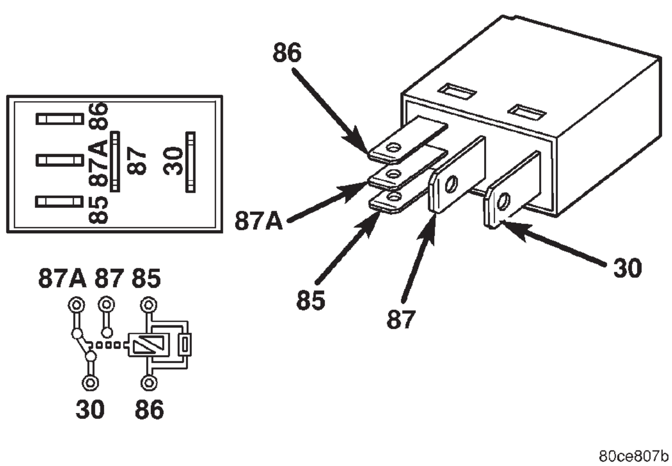


Fig. 25 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

The wiper high/low relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. The wiper high/low relay is a conventional International Standards Organization (ISO) micro relay (Fig. 25). Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

The wiper high/low relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

The wiper high/low relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the front wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper high/low relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC). The inputs and outputs of the wiper high/low relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the output of the wiper on/off relay at all times through the wiper on/off relay output circuit.
- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Body Control Module (BCM) through a front wiper high/low relay control circuit. The BCM controls front wiper motor operation by controlling a ground path through this circuit.
- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current at all times from a circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit.

WIPER HIGH/LOW RELAY (Continued)

- **Normally Open Terminal** - The normally open terminal (87) is connected to the high speed brush of the front wiper motor through a front wiper high/low relay high speed output circuit, and is connected to the high speed brush whenever the relay is energized.
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to the low speed brush of the front wiper motor through a front wiper high/low relay low speed output circuit, and is connected to the low speed brush whenever the relay is de-energized.

The wiper high/low relay can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - WIPER HIGH/LOW RELAY

The wiper high/low relay (Fig. 26) is located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

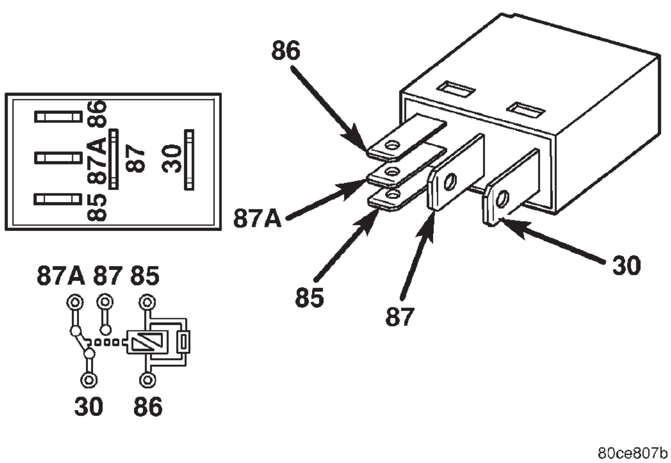


Fig. 26 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

(1) Remove the wiper high/low relay from the PDC. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER HIGH/LOW RELAY - REMOVAL).

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 8 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, reinstall the relay and use a DRBIII® scan tool to perform further testing. Refer to the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 27).

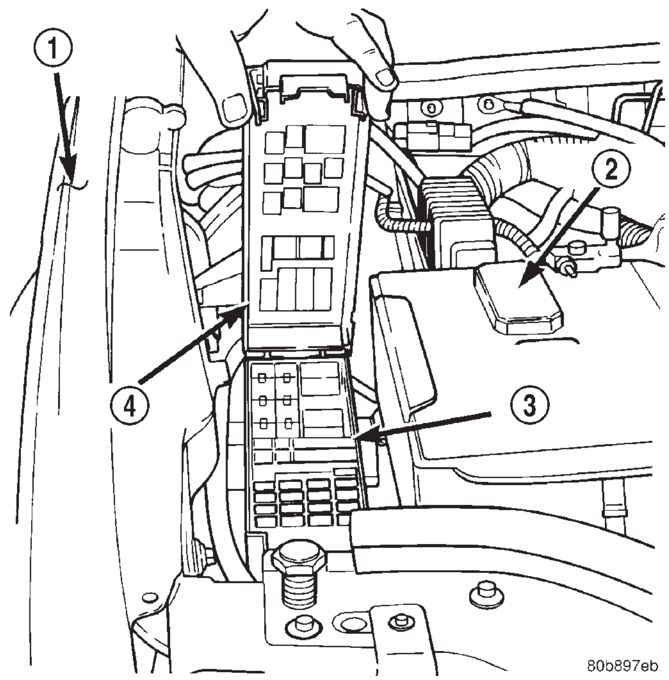


Fig. 27 Power Distribution Center

1 - RIGHT FENDER
2 - BATTERY
3 - POWER DISTRIBUTION CENTER
4 - COVER

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for wiper high/low relay identification and location.

(4) Remove the wiper high/low relay by grasping it firmly and pulling it straight out from the receptacle in the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper wiper high/low relay location (Fig. 27).

WIPER HIGH/LOW RELAY (Continued)

(2) Position the wiper high/low relay in the proper receptacle in the PDC.

(3) Align the wiper high/low relay terminals with the terminal cavities in the PDC receptacle.

(4) Push firmly and evenly on the top of the wiper high/low relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Reinstall the cover onto the PDC.

(6) Reconnect the battery negative cable.

WIPER ON/OFF RELAY

DESCRIPTION

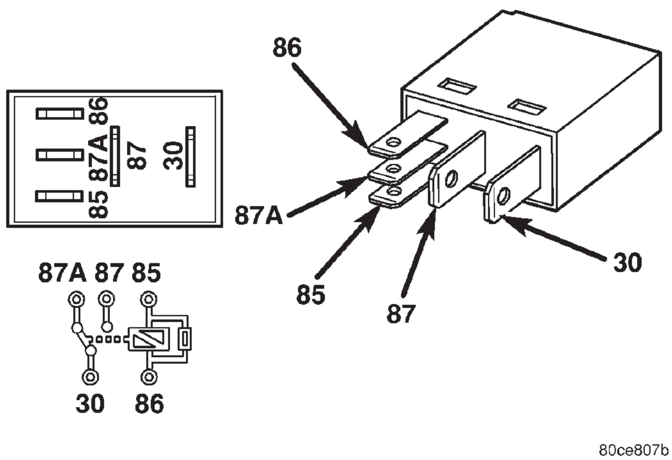


Fig. 28 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

The wiper on/off relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. The wiper on/off relay is a conventional International Standards Organization (ISO) micro relay (Fig. 28). Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

The wiper on/off relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

The wiper on/off relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the front wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper on/off relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC). The inputs and outputs of the wiper on/off relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the common feed terminal of the wiper high/low relay at all times through the wiper on/off relay output circuit.
- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Body Control Module (BCM) through a front wiper on/off relay control circuit. The BCM controls front wiper motor operation by controlling a ground path through this circuit.
- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current at all times from a circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit.
- **Normally Open Terminal** - The normally open terminal (87) receives battery current at all times from a circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit, and provides battery current to the front wiper on/off relay output circuit whenever the relay is energized.
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to the wiper park switch in the front wiper motor through the front wiper park switch sense circuit, and is connected to the wiper park switch whenever the relay is de-energized.

The wiper on/off relay can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - WIPER ON/OFF RELAY

The wiper on/off relay (Fig. 29) is located in the Power Distribution Center (PDC) in the engine compartment near the battery. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

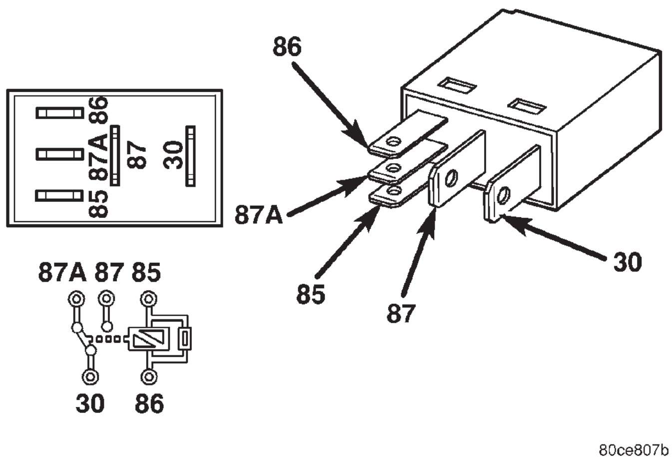


Fig. 29 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

(1) Remove the wiper on/off relay from the PDC. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ON/OFF RELAY - REMOVAL).

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 8 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, reinstall the relay and use a DRBIII® scan tool to perform further testing. Refer to the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 30).

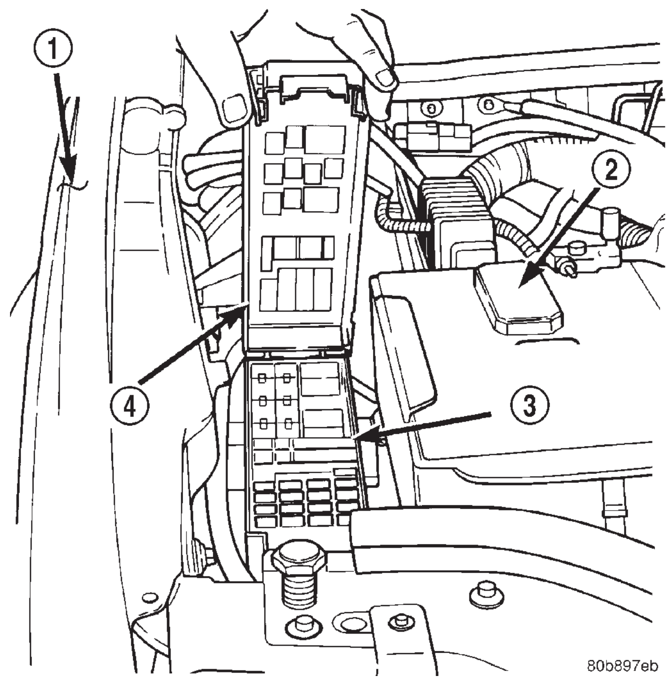


Fig. 30 Power Distribution Center

1 - RIGHT FENDER
2 - BATTERY
3 - POWER DISTRIBUTION CENTER
4 - COVER

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for wiper on/off relay identification and location.

(4) Remove the wiper on/off relay by grasping it firmly and pulling it straight out from the receptacle in the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper wiper on/off relay location (Fig. 30).

(2) Position the wiper on/off relay in the proper receptacle in the PDC.

(3) Align the wiper on/off relay terminals with the terminal cavities in the PDC receptacle.

(4) Push firmly and evenly on the top of the wiper on/off relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Reinstall the cover onto the PDC.

(6) Reconnect the battery negative cable.

REAR WIPERS/WASHERS

TABLE OF CONTENTS

REAR WIPERS/WASHERS

DESCRIPTION

An electrically operated fixed interval intermittent rear wiper and washer system is standard factory-installed equipment on this model. The rear wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **Rear Washer Nozzle** - The rear washer nozzle is secured by a snap fit onto the top of the liftgate outer panel above the liftgate glass. The rear washer nozzle includes an integral check valve. The rear washer system plumbing is concealed within and routed through the interior of the vehicle.
- **Rear Washer Pump/Motor** - The rear washer pump/motor unit is located in a dedicated hole on the lower outboard side of the washer reservoir, ahead of the left front wheel housing. The rear washer pump mounting hole is located higher on the reservoir than the front washer pump mounting hole.
- **Rear Wiper Arm** - The single rear wiper arm is secured by a nut directly to the rear wiper module output shaft, which extends through the liftgate outer panel near the base of the liftgate glass.
- **Rear Wiper Arm Park Ramp** - The molded rubber rear wiper arm park ramp is secured with a screw to the liftgate outer panel, just below the right side of the liftgate glass. When the rear wiper system is not in operation, the rear wiper arm is parked on this ramp so that it will not interfere with or be damaged by liftgate flip-up glass operation.
- **Rear Wiper Blade** - The single rear wiper blade is secured to the rear wiper arm, and is moved off of the liftgate glass when the rear wiper system is not in operation.
- **Rear Wiper Module** - The rear wiper module output shaft is the only visible component of the rear wiper module. The remainder of the module is concealed within the liftgate beneath the liftgate glass opening. The rear wiper module includes the module bracket, the rear wiper motor, and the rear wiper module electronic control circuitry.
- **Right Multi-Function Switch** - The right (wiper) multi-function switch is secured to the right side of the multi-function switch mounting housing near the top of the steering column. Only the control stalk for the right multi-function switch is visible, the remainder of the switch is concealed beneath the steering column shrouds. The right multi-function switch contains all of the switches and control circuitry for both the front and rear wiper and washer systems.

REAR WIPERS/WASHERS (Continued)

• **Washer Reservoir** - The rear washer system shares a single reservoir with the front washer system, but has its own dedicated washer pump/motor and plumbing. The washer reservoir is concealed between the left inner fender shield and the left outer fender panel, behind the inner fender liner and ahead of the left front wheel. The washer reservoir filler neck is the only visible portion of the reservoir, and it is accessed from the left front corner of the engine compartment.

Features of the rear wiper and washer system include the following:

• **Continuous Wipe Mode** - When the right multi-function switch control sleeve is moved to the On position, the rear wiper will be operated at a fixed speed, continual wipe cycle until the switch sleeve is moved to the Delay or Off positions, until the ignition switch is turned to the Off position, or until the liftgate flip-up glass is ajar.

• **Intermittent Wipe Mode** - When the right multi-function switch control sleeve is moved to the Delay position, the rear wiper will be operated in a fixed interval, intermittent wipe cycle until the switch sleeve is moved to the On or Off positions, until the ignition switch is turned to the Off position, until the liftgate flip-up glass is ajar, or until the right multi-function switch control stalk is pushed forward to activate the rear washer system. The intermittent wipe mode delay time has a fixed delay interval of about five to eight seconds between sweeps.

• **Washer Mode** - When the right multi-function switch control stalk is pushed forward to activate the rear washer system, washer fluid will be dispensed from the washer reservoir onto the liftgate glass through the rear washer nozzle and the rear wiper will operate in a fixed cycle (not intermittent) for as long as the rear washer pump/motor unit remains energized. When the control stalk is released from the momentary Wash position, the wipe-after-wash feature will continue to operate the rear wiper at a fixed cycle for about three additional wiper sweeps before returning to the previously selected mode.

Hard wired circuitry connects the rear wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the rear wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The rear wiper and washer system is intended to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the liftgate glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blade to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outside liftgate glass surface that might be encountered while driving the vehicle under numerous types of inclement operating conditions. The vehicle operator initiates all rear wiper and washer system functions with the right multi-function switch located on the right side of the steering column, just below the steering wheel. Moving the switch control sleeve to a detent position selects the rear wiper system operating mode. Moving the switch control stalk forward to a momentary position activates the rear washer pump/motor, which dispenses washer fluid onto the liftgate glass through the rear washer nozzle and operates the rear wiper system in the fixed cycle mode for as long as the washer switch is closed plus about three wiper sweeps.

When the ignition switch is in the Accessory or On positions, battery current from a fuse in the Junction Block (JB) is provided to the right multi-function switch through a fused ignition switch output (run-acc) circuit. A separate fuse in the JB provides battery current to the electronic control circuitry of the rear wiper module through a fused B(+) circuit. When the right multi-function switch control sleeve On position is selected, the On position circuitry within the switch directs a battery current rear wiper motor control signal input to the rear wiper module electronic circuitry, which causes the rear wiper motor to run at a fixed continuous wipe cycle. When the right multi-function switch control sleeve Delay position is selected, the Delay position circuitry within the switch directs a battery current rear washer switch output signal input to the rear wiper module electronic circuitry, which causes the rear wiper motor to run at a fixed intermittent wipe cycle. When the right multi-function switch control

REAR WIPERS/WASHERS (Continued)

stalk is moved to the rear Wash position, the Wash position circuitry within the switch directs battery current to the rear washer pump/motor unit, and to both the rear wiper motor control and rear washer switch output signal inputs of the rear wiper module electronic circuitry, which causes the wiper motor to run at a fixed cycle for as long as the Wash mode is selected plus about three additional fixed wipe cycles.

The rear wiper module electronic circuitry controls the switching of battery current to the rear wiper motor brush, which controls wiper motor operation. The intermittent wipe and wipe-after-wash features of the rear wiper and washer system are both provided by the rear wiper module electronic circuitry. The rear wiper module electronic circuitry also monitors the liftgate flip-up glass ajar switch and will park the rear wiper blade off of the glass any time it senses that the liftgate flip-up glass is ajar, the ignition switch is turned to the Off position, or the right multi-function switch control sleeve is moved to the Off position. This feature ensures that the rear wiper blade will not interfere with or be damaged by the operation of the liftgate flip-up glass. However, if the ignition switch is turned to the Off position or the liftgate flip-up glass is opened while the rear wiper is operating, the right multi-function switch control sleeve must be cycled to the Off position and back to the On or Delay position after the ignition switch is turned back On or the liftgate flip-up glass is closed before the rear wiper will operate again.

Refer to the owner's manual in the vehicle glove box for more information on the features and operation of the rear wiper and washer system.

DIAGNOSIS AND TESTING - REAR WIPER & WASHER SYSTEM

WIPER SYSTEM

The diagnosis found here addresses an electrically inoperative rear wiper system. If the rear wiper motor operates, but the wiper does not move on the liftgate glass, replace the faulty rear wiper module. If the wiper operates, but chatters, lifts, or does not clear the glass, clean and inspect the wiper system components as required. (Refer to 8 - ELECTRICAL/ REAR WIPERS/WASHERS - INSPECTION) and (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check that the interior lighting switch on the control stalk of the left multi-function switch is not in the dome lamp disable position. With all four doors and the liftgate closed, open the liftgate flip-up glass. The interior lamps should light. If not, depress the cargo lamp lens to actuate the cargo lamp defeat switch and the interior lamps should light. Close all four doors, the liftgate and the liftgate flip-up glass. Note whether the interior lamps remain lighted. They should turn off after about thirty seconds. If OK, go to Step 2. If not OK, go to Step 9.

(2) Check the fused B(+) fuse (Fuse 8 - 15 ampere) in the Junction Block (JB). If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(3) Check for battery voltage at the fused B(+) fuse (Fuse 8 - 15 ampere) in the JB. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit between the JB and the Power Distribution Center (PDC) as required.

(4) Check the fused ignition switch output (run-acc) fuse (Fuse 29 - 10 ampere) in the JB. If OK, go to Step 5. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(5) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-acc) fuse (Fuse 29 - 10 ampere) in the JB. If OK, turn the ignition switch to the Off position and go to Step 6. If not OK, repair the open fused ignition switch output (run-acc) circuit between the JB and the ignition switch as required.

(6) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the right multi-function switch from the switch connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-acc) circuit cavity of the instrument panel wire harness connector for the right multi-function switch. If OK, go to Step 7. If not OK, repair the open fused ignition switch output

REAR WIPERS/WASHERS (Continued)

(run-acc) circuit between the right multi-function switch and the JB as required.

(7) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Test the right multi-function switch. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). If the right multi-function switch tests OK, reconnect the instrument panel wire harness connector for the right multi-function switch to the switch connector receptacle and go to Step 8. If the right multi-function switch does not test OK, replace the faulty switch.

(8) Remove the liftgate inner trim panel. Disconnect the liftgate wire harness connector for the rear wiper module from the module connector receptacle. Check for continuity between the ground circuit cavity of the liftgate wire harness connector for the rear wiper module and a good ground. There should be continuity. If OK, go to Step 9. If not OK, repair the open ground circuit to ground (G301) as required.

(9) Check for continuity between the liftgate flip-up glass ajar switch sense circuit cavity of the liftgate wire harness connector for the rear wiper module and a good ground. There should be continuity with the liftgate flip-up glass open, and no continuity with the liftgate flip-up glass closed. If OK, go to Step 10. If not OK, repair the liftgate flip-up glass ajar circuit as required.

(10) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the liftgate wire harness connector for the rear wiper module. If OK, go to Step 11. If not OK, repair the open fused B(+) circuit between the rear wiper module and the JB as required.

(11) Turn the ignition switch to the On position. Turn the right multi-function switch control sleeve to the Delay position. Check for battery voltage at the rear washer switch output circuit cavity of the liftgate wire harness connector for the rear wiper module. If OK, go to Step 12. If not OK, repair the open rear washer switch output circuit between the rear wiper module and the right multi-function switch as required.

(12) Turn the right multi-function switch control sleeve to the On position. Check for battery voltage at the rear wiper motor control circuit cavity of the liftgate wire harness connector for the rear wiper module. If OK, replace the faulty rear wiper module. If not OK, repair the open rear wiper motor control circuit between the rear wiper module and the right multi-function switch as required.

WASHER SYSTEM

The diagnosis found here addresses an electrically inoperative rear washer system. If the rear washer pump/motor operates, but no washer fluid is emitted from the rear washer nozzle, be certain to check the fluid level in the reservoir. Also inspect the washer system components as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - INSPECTION). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Turn the right multi-function switch control sleeve to the On position. Check whether the rear wiper system is operating. If OK, go to Step 2. If not OK, test and repair the rear wiper system before continuing with these tests. Refer to WIPER SYSTEM .

REAR WIPERS/WASHERS (Continued)

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the left headlamp and dash wire harness connector for the rear washer pump/motor unit from the pump/motor unit connector receptacle. Check for continuity between the ground circuit cavity of the left headlamp and dash wire harness connector for the rear washer pump/motor unit and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground (G106) as required.

(3) Reconnect the battery negative cable. Turn the ignition switch to the On position. Push the right multi-function switch control stalk toward the instrument panel to actuate the rear washer switch. With the rear washer switch actuated, check for battery voltage at the rear washer switch output circuit cavity of the left headlamp and dash wire harness connector for the rear washer pump/motor unit. If OK, replace the faulty rear washer pump/motor unit. If not OK, repair the open rear washer switch output circuit between the rear washer pump/motor unit and the right multi-function switch as required.

CLEANING - REAR WIPER & WASHER SYSTEM

WIPER SYSTEM

The squeegee of a wiper blade exposed to the elements for a long time tends to lose its wiping effectiveness. Periodic cleaning of the squeegee is suggested to remove any deposits of salt or road film. The wiper blade, arm, and liftgate glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blade continues to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegee of the wiper blade from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegee.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the front washer pump/motor from the reservoir. Clean foreign material from the inside of the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hose from the washer nozzle, then running the washer pump/motor to run clean washer fluid or water through the system. A plugged or restricted washer nozzle should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegee of the wiper blade.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

INSPECTION - REAR WIPER & WASHER SYSTEM

WIPER SYSTEM

The rear wiper blade and wiper arm should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

(1) Inspect the wiper arm for any indications of damage, or contamination. If the wiper arm is contaminated with any foreign material, clean as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING). If a wiper arm is damaged or corrosion is evident, replace the wiper arm with a new unit. Do not attempt to repair a wiper arm that is damaged or corroded.

(2) Carefully lift the wiper arm off of the ramp. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(3) Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. The spring tension of the wiper arm should be sufficient to cause the rubber squeegee to conform to the curvature of the glass. Replace a wiper arm if it has low or no spring tension.

(4) Inspect the wiper blade and squeegee for any indications of damage, contamination, or rubber deterioration (Fig. 1). If the wiper blade or squeegee is contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRI-

REAR WIPERS/WASHERS (Continued)

CAL/REAR WIPERS/WASHERS - CLEANING). If after cleaning the wiper blade and the glass, the wiper blade fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade. Also, if a wiper blade is damaged or if the squeegee rubber is damaged or deteriorated, replace the wiper blade with a new unit. Do not attempt to repair a wiper blade that is damaged.

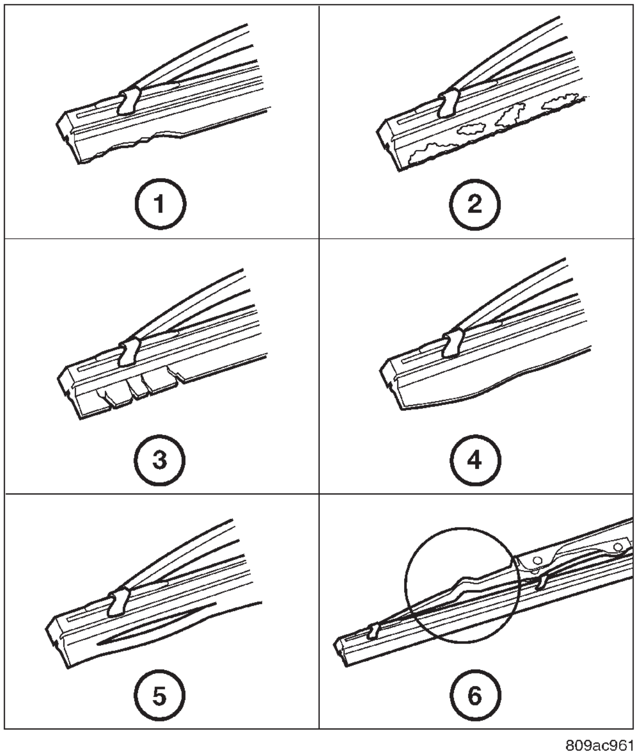


Fig. 1 Wiper Blade Inspection

1 - WORN OR UNEVEN EDGES
2 - ROAD FILM OR FOREIGN MATERIAL DEPOSITS
3 - HARD, BRITTLE, OR CRACKED
4 - DEFORMED OR FATIGUED
5 - SPLIT
6 - DAMAGED SUPPORT COMPONENTS

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

(1) Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/ REAR WIPERS/WASHERS - CLEANING).

(2) Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

REAR WASHER HOSES/TUBES

DESCRIPTION

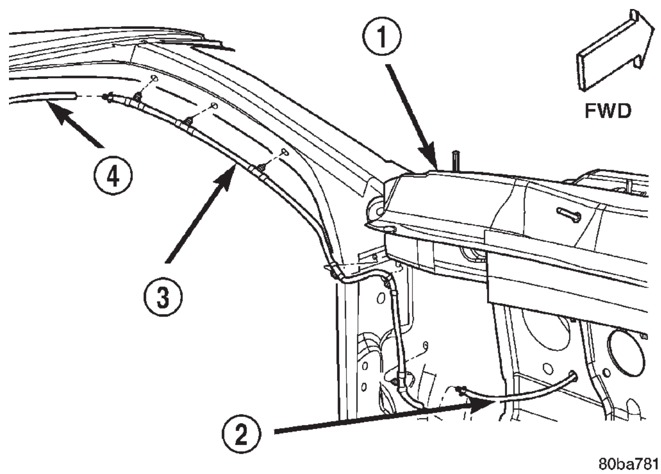


Fig. 2 Rear Washer Plumbing

1 - UPPER COWL PLENUM PANEL
2 - WASHER HOSE FROM ENGINE COMPARTMENT
3 - A-PILLAR WASHER HOSE
4 - HEADLINER WASHER HOSE

The rear washer plumbing consists of small diameter rubber hoses and molded plastic inline connector fittings (Fig. 2). The washer reservoir hose is connected to the barbed outlet nipple of the rear washer pump/motor unit below the left front wheel house extension and routed up the washer reservoir filler neck to the engine compartment. Just rearward of the washer reservoir filler neck in the engine compartment, an inline connector with barbed nipples joins the reservoir hose to the engine compartment hose. The engine compartment hose is routed along the top of the left front fender wheel house to the dash panel. The engine compartment hose passes through a hole with a rubber grommet in the dash panel into the passenger compartment. Below the instrument panel in the passenger compartment near the left cowl side inner panel, another inline connector joins the engine compartment hose to the A-pillar hose. The A-pillar hose is routed up the left A-pillar to the headliner. At the headliner, an inline connector joins the A-pillar hose to the headliner hose. The headliner hose is routed above the headliner and

REAR WASHER HOSES/TUBES (Continued)

along the left roof side rail to the rear of the vehicle. At the rear of the vehicle, the headliner hose is routed above the headliner and along the upper liftgate opening panel toward the right side of the vehicle. The headliner hose then passes through a hole with a rubber grommet in the upper liftgate opening panel and through another hole with a rubber grommet into the upper inner liftgate panel to the rear washer nozzle.

Washer hose is available for service only as roll stock, which must then be cut to length. The headliner washer hose is integral to the headliner unit and, if faulty or damaged, the headliner unit must be replaced. The molded plastic washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the rear washer pump/motor through the rear washer system plumbing and fittings to the rear washer nozzle on the liftgate outer panel above the liftgate glass. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

REAR WASHER NOZZLE

DESCRIPTION

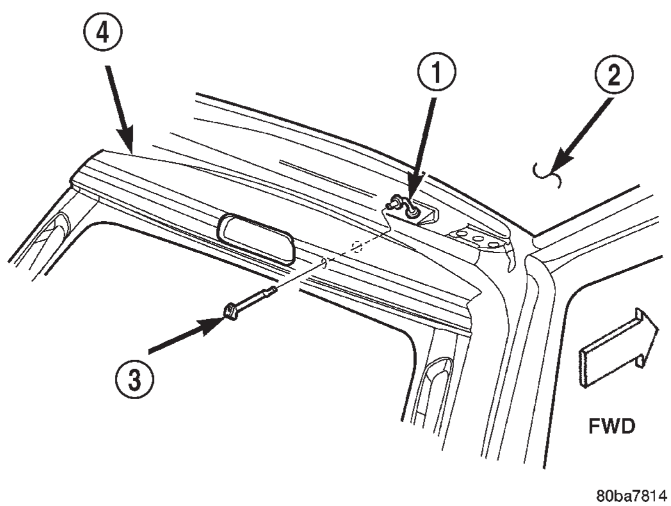


Fig. 3 Rear Washer Nozzle

1 - HEADLINER WASHER HOSE
2 - ROOF PANEL
3 - REAR WASHER NOZZLE
4 - LIFTGATE

The rear washer nozzle is a fluidic type unit that includes an integral check valve (Fig. 3). The nozzle is constructed of molded plastic and has a rubber seal and integral snap features on the back of it. The nozzle is secured by a snap fit in a dedicated mounting hole in the liftgate outer panel above the liftgate flip-up glass. Within the rear nozzle body, a small check ball is held against an integral valve seat at the inlet end of the nozzle by a small coiled spring. The rear washer nozzle and check valve unit cannot be adjusted or repaired. If faulty or damaged, the entire nozzle and check valve unit must be replaced.

OPERATION

The rear washer nozzle is designed to dispense washer fluid into the wiper pattern area on the outside of the liftgate glass. Pressurized washer fluid is fed to the nozzle from the washer reservoir by the rear washer pump/motor through a single hose, which is attached to a barbed nipple on the back of the rear washer nozzle. The rear washer nozzle incorporates a fluidic design, which causes the nozzle to emit the pressurized washer fluid as an oscillating stream to more effectively cover a larger area of the glass area to be cleaned. The integral rear nozzle check valve prevents washer fluid from draining out of the rear washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the rear washer switch is actuated until washer fluid was dispensed through the rear washer nozzle, because the rear washer pump would have to refill the rear washer plumbing from the reservoir to the nozzle. The check valve also prevents washer fluid from siphoning through the rear washer nozzle after the rear washer system is turned Off. When the rear washer pump pressurizes and pumps washer fluid from the reservoir through the rear washer plumbing, the fluid pressure overrides the spring pressure applied to the check ball within the valve and unseats the check ball, allowing washer fluid to flow to the rear washer nozzle. When the rear washer pump stops operating, spring pressure seats the check ball in the valve and fluid flow in either direction within the rear washer plumbing is prevented.

REMOVAL

The check valve for the rear washer nozzle is integral to the nozzle.

(1) Using a trim stick or another suitable wide flat-bladed tool, gently pry at the sides of the rear washer nozzle to release the snap features that secure it in the mounting hole of the liftgate outer panel.

REAR WASHER NOZZLE (Continued)

(2) Pull the rear washer nozzle out from the lift-gate outer panel far enough to access the washer supply hose (Fig. 4).

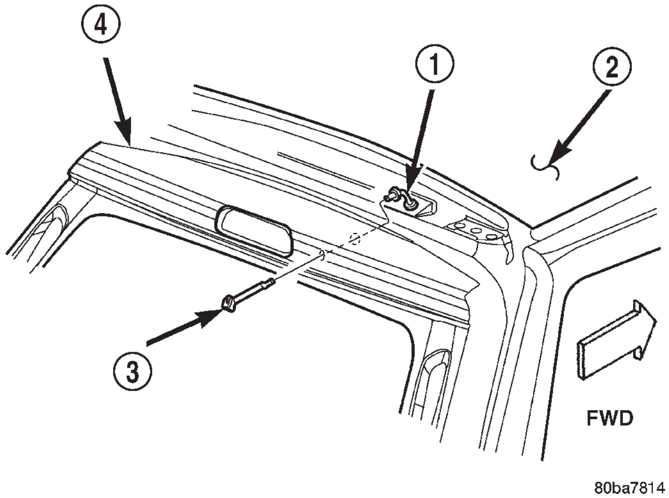


Fig. 4 Rear Washer Nozzle Remove/Install

1 - HEADLINER WASHER HOSE
2 - ROOF PANEL
3 - REAR WASHER NOZZLE
4 - LIFTGATE

(3) Disconnect the washer supply hose from the barbed nipple of the rear washer nozzle.

(4) Remove the rear washer nozzle from the lift-gate.

INSTALLATION

(1) Position the rear washer nozzle to the liftgate (Fig. 4).

(2) Reconnect the washer supply hose to the barbed nipple of the rear washer nozzle.

(3) Insert the rear washer nozzle supply hose and nipple into the mounting hole in the liftgate outer panel.

(4) Using hand pressure, push firmly and evenly on the rear washer nozzle until the snap features lock into place on the inside of the liftgate outer panel mounting hole.

REAR WASHER PUMP/MOTOR

DESCRIPTION

The rear washer pump/motor unit is located on the outboard side and near the rear of the washer reservoir, between the left front inner and outer fender panels (Fig. 5). A small permanently lubricated and sealed electric motor is coupled to the rotor-type washer pump. A seal flange with a large barbed inlet nipple on the pump housing passes through a rubber grommet seal installed in one of two dedicated mounting holes near the bottom of the washer reservoir. The rear washer pump/motor unit is always mounted in the higher pump mounting hole of the reservoir. A smaller barbed outlet nipple on the pump housing connects the unit to the rear washer hose. The washer pump/motor unit is retained on the reservoir by the interference fit between the barbed pump inlet nipple and the grommet seal, which is a light press fit. An integral electrical connector receptacle is located on the top of the motor housing. The rear washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

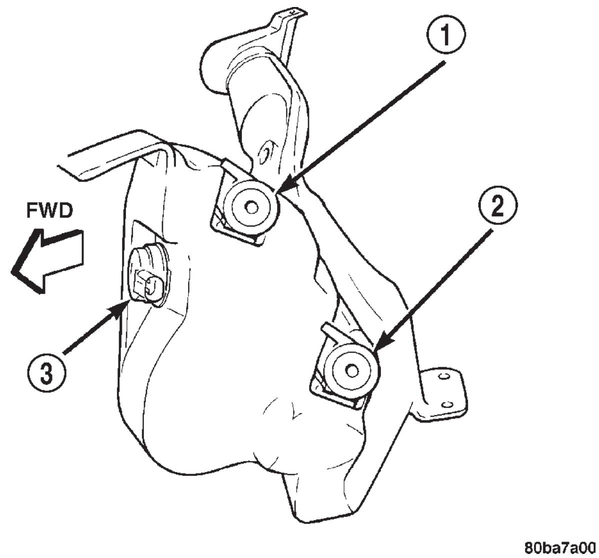


Fig. 5 Washer Pumps (Viewed from Bottom of Reservoir)

1 - REAR WASHER PUMP/MOTOR
2 - FRONT WASHER PUMP/MOTOR
3 - WASHER FLUID LEVEL SWITCH

OPERATION

The rear washer pump/motor unit is connected to the vehicle electrical system through a single take out and two-cavity connector of the left headlamp and dash wire harness. The washer pump/motor is grounded at all times through a take out of the left headlamp and dash wire harness with a single eyelet terminal connector that is secured under a ground screw to the top of the left inner fender shield in the engine compartment. The rear washer pump/motor receives battery current on a fused ignition switch output (run-acc) circuit through the closed contacts of the momentary rear washer switch within the right multi-function switch only when the switch control stalk is pushed towards the instrument panel. Washer fluid is gravity-fed from the washer reservoir to the inlet side of the washer pump. When the pump motor is energized, the rotor-type pump pressurizes

REAR WASHER PUMP/MOTOR (Continued)

the washer fluid and forces it through the pump outlet nipple, the rear washer plumbing, and the rear washer nozzle onto the liftgate glass.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the liner from the left front fender wheel house.

(4) Disconnect the left headlamp and dash wire harness connector for the rear washer pump/motor from the motor connector receptacle (Fig. 6).

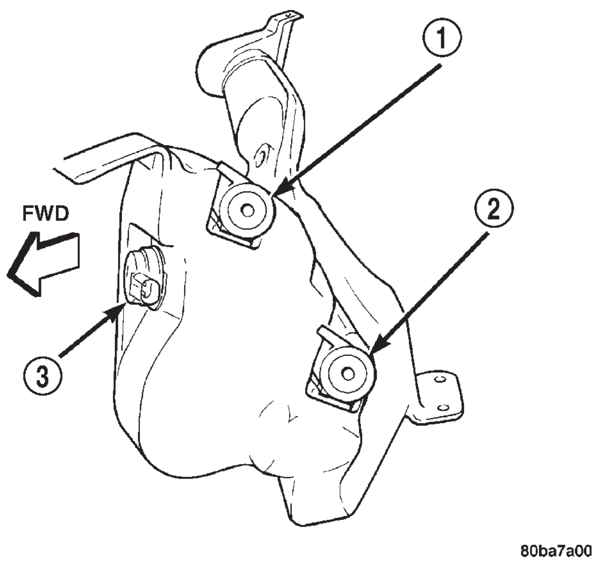


Fig. 6 Washer Pumps (Viewed from Bottom of Reservoir)

1 - REAR WASHER PUMP/MOTOR
2 - FRONT WASHER PUMP/MOTOR
3 - WASHER FLUID LEVEL SWITCH

(5) Disconnect the washer hose from the barbed outlet nipple of the rear washer pump/motor and allow the washer fluid to drain into a clean container for reuse.

(6) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed inlet nipple of the washer pump out of the rubber grommet seal in the reservoir. Care must be taken not to damage the reservoir.

(7) Remove the rubber grommet seal from the washer pump mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the washer pump mounting hole in the washer reservoir. Always use a new rubber grommet seal on the reservoir.

(2) Position the barbed inlet nipple of the washer pump to the rubber grommet seal in the reservoir (Fig. 6).

(3) Press firmly and evenly on the washer pump until the barbed inlet nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

(4) Reconnect the washer hose to the barbed outlet nipple of the washer pump.

(5) Reconnect the left headlamp and dash wire harness connector for the rear washer pump/motor unit to the motor connector receptacle.

(6) Reinstall the liner into the left front fender wheel house.

(7) Lower the vehicle.

(8) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(9) Reconnect the battery negative cable.

REAR WIPER ARM

DESCRIPTION

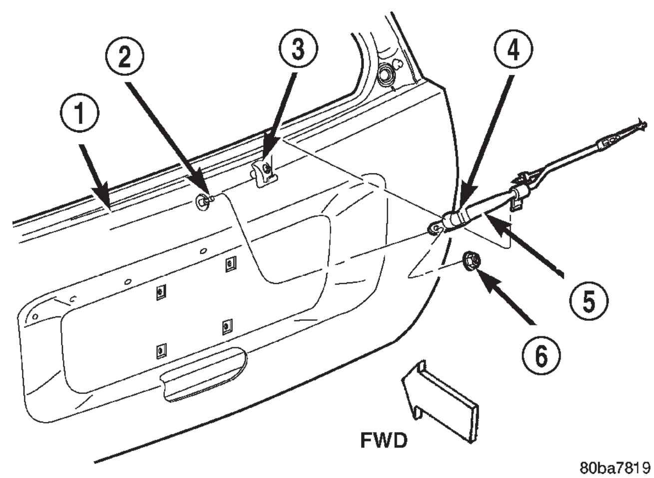


Fig. 7 Rear Wiper Arm

1 - LIFTGATE
2 - REAR WIPER MOTOR OUTPUT SHAFT
3 - PARK RAMP
4 - PIVOT COVER
5 - REAR WIPER ARM
6 - NUT

The rear wiper arm is the rigid member located between the rear wiper motor output shaft that protrudes from the outer liftgate panel near the base of the liftgate glass opening and the rear wiper blade (Fig. 7). This wiper arm features an over-center hinge that allows easy access to the liftgate and liftgate glass for cleaning. The wiper arm has a die cast metal pivot end. This pivot end has a hole in it with internal serrations and a plastic pivot cover is

REAR WIPER ARM (Continued)

secured loosely to and pivots on the wiper arm hinge pin to conceal the wiper arm retaining nut. The wide end of a tapered, stamped steel channel is secured with a hinge pin to the pivot end of the wiper arm. One end of a long, rigid, stamped steel strap, with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook. Concealed within the stamped steel channel, one end of a long spring is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. A molded plastic wiper arm support is snapped onto the wiper arm strap where it exits the channel. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced.

OPERATION

The rear wiper arm is designed to mechanically transmit the motion from the rear wiper motor output shaft to the rear wiper blade. The wiper arm must be properly indexed to the motor output shaft in order to maintain the proper wiper blade travel on the glass. The wiper arm support is designed to lift and support the rear wiper arm and blade off of the glass when the rear wiper blade is parked. This support and the park ramp on the liftgate outer panel below the glass also provide an alignment reference to ensure accurate rear wiper arm and blade installation. The hole with internal serrations in the wiper arm pivot end interlocks with the serrations on the outer circumference of the motor output shaft, allowing positive engagement and finite adjustment of this connection. A hex nut secures the wiper arm pivot end to the threads on the motor output shaft and the pivot cover hinges and snaps over this connection for a neat appearance. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

(1) Lift the rear wiper arm pivot cover by lifting it at the rear wiper motor output shaft end of the arm (Fig. 8).

(2) Remove the nut that secures the rear wiper arm to the rear wiper motor output shaft.

(3) Lift the rear wiper arm far enough to engage the over-center arm hinge in its upright position to hold the wiper blade off of the liftgate.

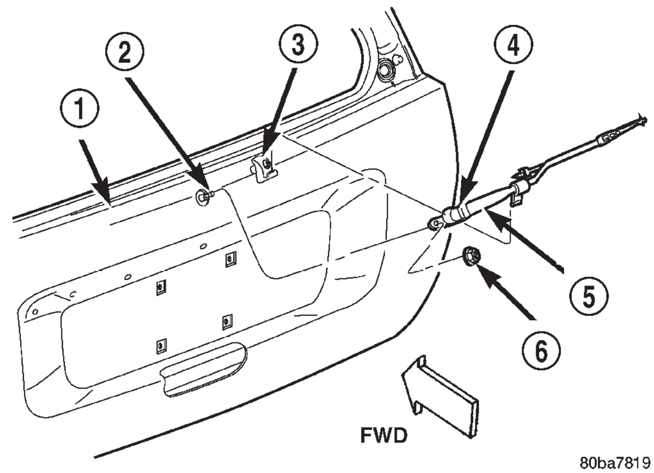


Fig. 8 Rear Wiper Arm Remove/Install

1 - LIFTGATE
2 - REAR WIPER MOTOR OUTPUT SHAFT
3 - PARK RAMP
4 - PIVOT COVER
5 - REAR WIPER ARM
6 - NUT

(4) Use a battery terminal puller to disengage the wiper arm from the rear wiper motor output shaft splines (Fig. 9).

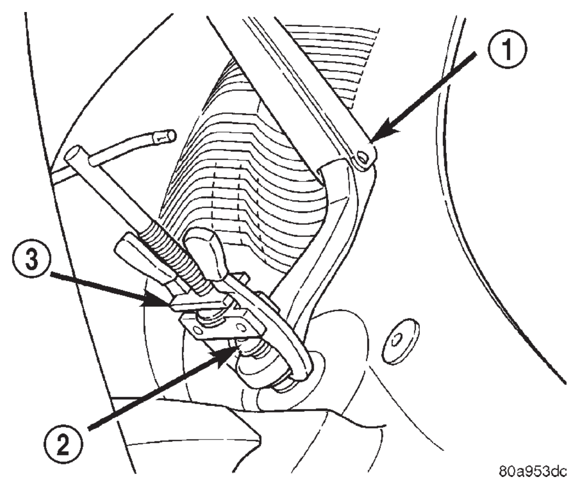


Fig. 9 Wiper Arm Puller - Typical

1 - WIPER ARM
2 - WIPER PIVOT
3 - BATTERY TERMINAL PULLER

(5) Remove the rear wiper arm pivot end from the motor output shaft.

INSTALLATION

NOTE: Always install the wiper arm and blade with the wiper motor in the Park position.

REAR WIPER ARM (Continued)

(1) The rear wiper arm must be indexed to the motor output shaft with the rear wiper motor in the park position to be properly installed. Place the wiper arm onto the liftgate with the wiper arm support positioned on the park ramp and the pivot hole on the end of the arm positioned over the rear wiper motor output shaft.

(2) Position the ridge of the wiper arm support on the liftgate park ramp in the Installation Position (Fig. 10).

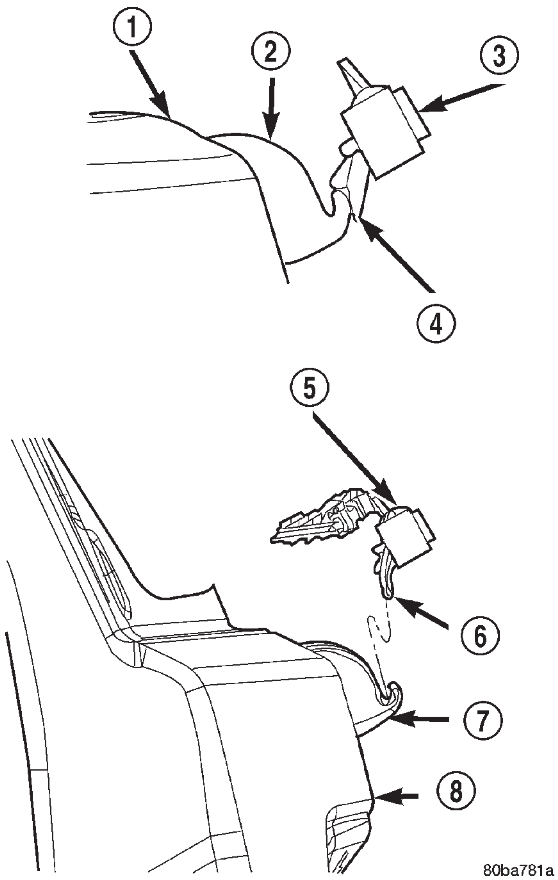


Fig. 10 Rear Wiper Arm Installation

1 - LIFTGATE
2 - PARK RAMP
3 - REAR WIPER ARM
4 - INSTALLATION POSITION
5 - REAR WIPER ARM AND BLADE
6 - PARK POSITION
7 - PARK RAMP
8 - LIFTGATE

(3) With the wiper arm in the Installation Position, push the pivot hole on the end of the wiper arm down over the rear wiper motor output shaft.

(4) Install and tighten the nut that secures the rear wiper arm to the rear wiper motor output shaft. Tighten the nut to 18 N·m (160 in. lbs.).

(5) Close the rear wiper arm pivot cover.

(6) Lift the rear wiper arm support away from the park ramp, then place the wiper arm support in the park ramp in the Park Position (Fig. 10).

REAR WIPER BLADE

DESCRIPTION

The rear wiper blade is secured by an integral latching pivot block to the hook formation on the tip of the rear wiper arm, and rests off the glass near the base of the liftgate glass opening when the wiper is not in operation. The wiper blade consists of the following components:

- **Superstructure** - The superstructure includes a stamped steel bridge and plastic links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.
- **Element** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All Grand Cherokee models have a single 31.00 centimeter (12.20 inch) rear wiper blade with a non-replaceable rubber element (squeegee). The wiper blade cannot be adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

The wiper blade is moved back and forth across the glass by the wiper arm when the wiper system is in operation. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature found across the glass surface. The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, but resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

REAR WIPER BLADE (Continued)

REMOVAL

NOTE: The notched retainer end of the wiper element should always be oriented towards the end of the wiper blade that is nearest to the wiper motor output shaft.

(1) Disengage the rear wiper arm support from the rubber rear wiper arm park ramp on the right side of the liftgate just below the liftgate glass.

(2) Lift the rear wiper arm to engage the arm hinge in its over-center position with the wiper blade and element off of the liftgate and the glass.

(3) To remove the wiper blade from the wiper arm, push the pivot block latch release tab under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook (Fig. 11).

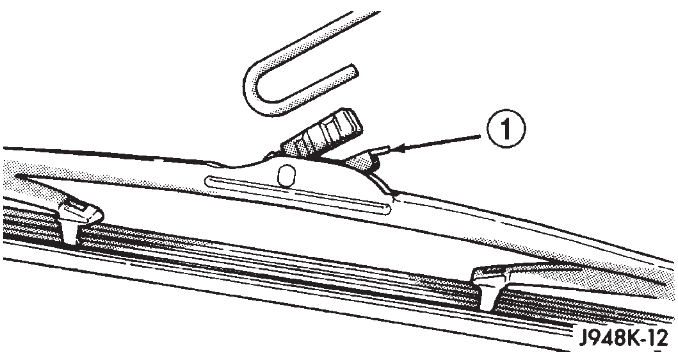


Fig. 11 Wiper Blade Remove/Install - Typical

1 - PIVOT BLOCK LATCH RELEASE TAB

(4) Extract the hook formation on the tip of the wiper arm from the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit.

CAUTION: Do not allow the wiper arm to spring back against the liftgate or the glass without the wiper blade in place or they may be damaged.

(5) Gently lower the wiper arm and place the arm support in the park ramp.

INSTALLATION

NOTE: The notched retainer end of the wiper element should always be oriented towards the end of the wiper blade that is nearest to the wiper motor output shaft.

(1) Lift the rear wiper arm off of the liftgate park ramp.

(2) Position the rear wiper blade near the hook formation on the tip of the arm with the notched retainer for the wiper element oriented towards the end of the wiper arm that is nearest to the wiper motor output shaft.

(3) Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit far enough to engage the pivot block with the hook (Fig. 11).

(4) Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab snaps into its locked position.

(5) Gently lower the wiper arm and place the arm support in the park ramp.

REAR WIPER MODULE

DESCRIPTION

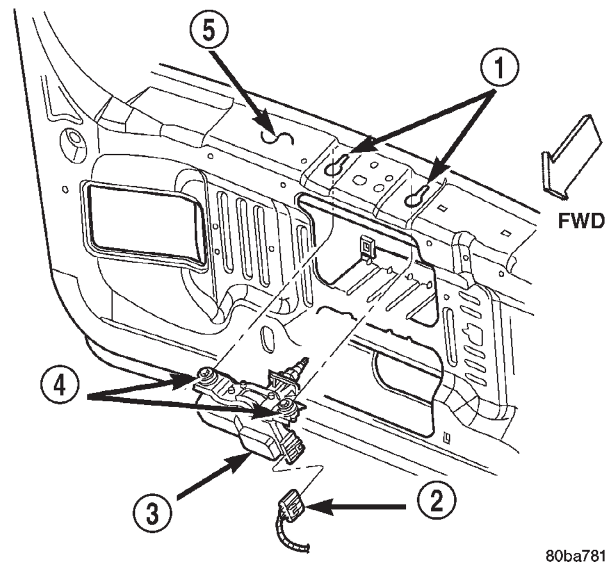


Fig. 12 Rear Wiper Module

1 - KEYED SLOTS
2 - LIFTGATE WIRE HARNESS CONNECTOR
3 - REAR WIPER MODULE
4 - NUT (2)
5 - LIFTGATE INNER PANEL

The rear wiper module is concealed within the liftgate, below the liftgate glass and behind the liftgate trim panel (Fig. 12). The end of the motor output shaft that protrudes through the liftgate outer panel to drive the rear wiper arm and blade is the only visible component of the rear wiper module. A rubber gasket, a bezel, and a nut seal and secure the motor output shaft to the liftgate outer panel. A molded plastic nut cover snaps onto the bezel to conceal the nut and improve appearance. The rear wiper module consists of the following major components:

- **Bracket -** The rear wiper module bracket consists of a stamped steel mounting plate for the wiper

REAR WIPER MODULE (Continued)

motor that is secured with screws to the wiper motor and to the liftgate inner panel.

• **Electronic Controls** - The rear wiper module electronic controls include the rear wiper system electronic logic and rear wiper motor electronic controls. The electronic controls for the motor include an electronic speed control that speeds the wiper blade near the center of the glass, but slows the wiper blade during directional reversals at each end of the wipe pattern and during wiper blade off-the-glass parking for quieter operation.

• **Motor** - The permanent magnet rear wiper motor is secured with screws to the rear wiper module bracket. The wiper motor includes an integral transmission, and the motor output shaft.

The rear wiper module cannot be adjusted or repaired. If any component of the module is faulty or damaged, the entire rear wiper module unit must be replaced. The motor output shaft gasket, bezel, nut, and nut cover are available for service replacement.

OPERATION

The rear wiper module receives non-switched battery current through a fuse in the Junction Block (JB) and is grounded at all times. The rear wiper module operation is controlled by the vehicle operator through battery current signal inputs received by the rear wiper module electronic controls from the right multi-function switch on the steering column. The module also receives an external control input from the liftgate flip-up glass ajar switch circuit. The rear wiper module electronic control logic uses these inputs, its internal inputs, and its programming to provide continuous wipe, delay wipe, wipe-after-wash and off-the-glass wiper blade parking. The wiper blade cycling is controlled by the rear wiper module electronic controls, which control current flow to the wiper motor brushes. The wiper motor transmission converts the rotary output of the wiper motor to the back and forth wiping motion of the rear wiper arm and blade on the liftgate glass.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the rear wiper arm from the rear wiper motor output shaft. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER ARM - REMOVAL).

(3) Use a door trim panel removal tool to gently pry at the base of the nut cover where it meets the wiper motor output shaft bezel and gasket on the outer liftgate panel until it unsnaps from the bezel (Fig. 13). Be certain to use proper caution to protect the outer liftgate panel and its paint finish from damage during this procedure.

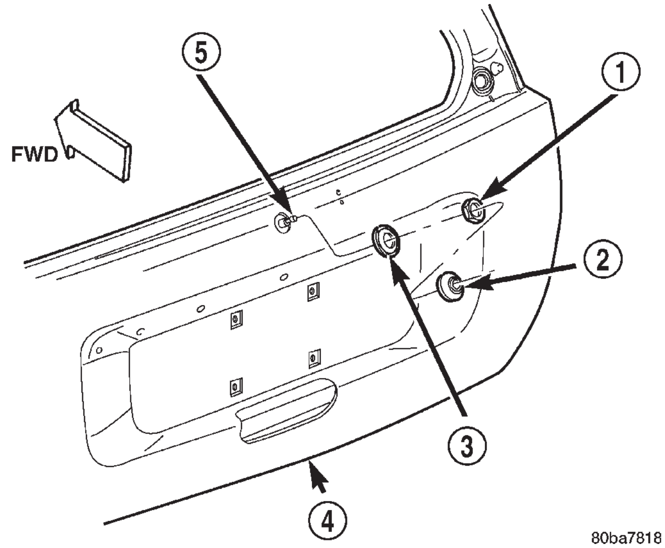


Fig. 13 Rear Wiper Motor Output Shaft Remove/ Install

1 - NUT
2 - NUT COVER
3 - BEZEL AND GASKET
4 - LIFTGATE OUTER PANEL
5 - REAR WIPER MOTOR OUTPUT SHAFT

(4) Remove the nut that secures the rear wiper motor output shaft to the outer liftgate panel.

(5) Remove the bezel and gasket from the rear wiper motor output shaft.

(6) Remove the trim panel from the inside of the liftgate. (Refer to 23 - BODY/DECKLID/HATCH/ LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).

(7) Disconnect the liftgate wire harness connector for the rear wiper module from the module connector receptacle (Fig. 14).

(8) Loosen the two nuts that secure the rear wiper module mounting bracket to the liftgate inner panel.

(9) Slide the rear wiper module and mounting bracket forward far enough to disengage the mounting nuts from the keyed holes in the liftgate inner panel.

(10) Remove the rear wiper module and mounting bracket from the liftgate as a unit.

INSTALLATION

(1) Position the rear wiper module and bracket to the liftgate as a unit (Fig. 14).

(2) Insert the rear wiper motor output shaft through the hole in the liftgate outer panel and engage the mounting nuts in the keyed holes in the liftgate inner panel.

(3) From the outside of the liftgate, center the rear wiper motor output shaft in the liftgate outer panel mounting hole and install the gasket and bezel over the centered shaft (Fig. 13).

REAR WIPER MODULE (Continued)

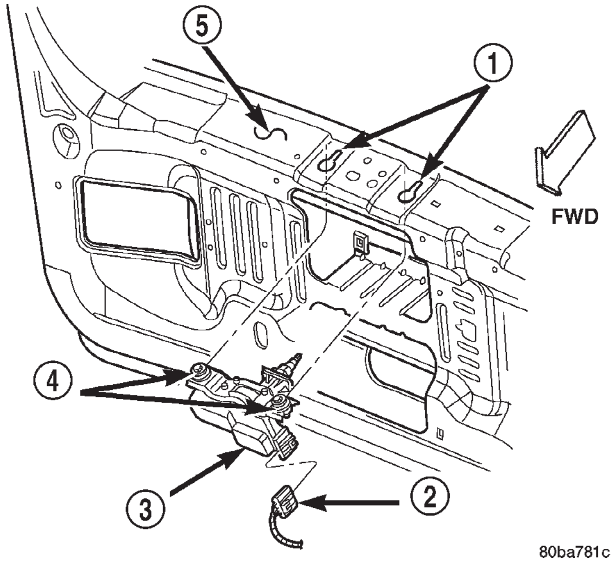


Fig. 14 Rear Wiper Module Remove/Install

1 - KEYED SLOTS
2 - LIFTGATE WIRE HARNESS CONNECTOR
3 - REAR WIPER MODULE
4 - NUT (2)
5 - LIFTGATE INNER PANEL

(4) Install and tighten the nut that secures the rear wiper motor output shaft to the outer liftgate panel. Tighten the nut to 4.8 N·m (43 in. lbs.).

(5) From the inside of the liftgate, install and tighten the two nuts that secure the rear wiper module mounting bracket to the liftgate inner panel. Tighten the nuts to 5.3 N·m (47 in. lbs.).

(6) Reconnect the liftgate wire harness connector for the rear wiper module to the module connector receptacle.

(7) Reinstall the trim panel onto the inside of the liftgate. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - INSTALLATION).

(8) From the outside of the liftgate, press the nut cover firmly and evenly over the rear wiper motor output shaft bezel using thumb pressure until it snaps into place.

(9) Reinstall the rear wiper arm onto the rear wiper motor output shaft. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER ARM - INSTALLATION).

(10) Reconnect the battery negative cable.

WIPER ARM PARK RAMP

REMOVAL

(1) Disengage the rear wiper arm support from the wiper arm park ramp on the right side of the liftgate just below the liftgate glass.

(2) Lift the wiper arm and blade away from the liftgate until the wiper arm hinge is in its over-center position.

(3) Remove the screw that secures the wiper arm park ramp to the liftgate outer panel (Fig. 15).

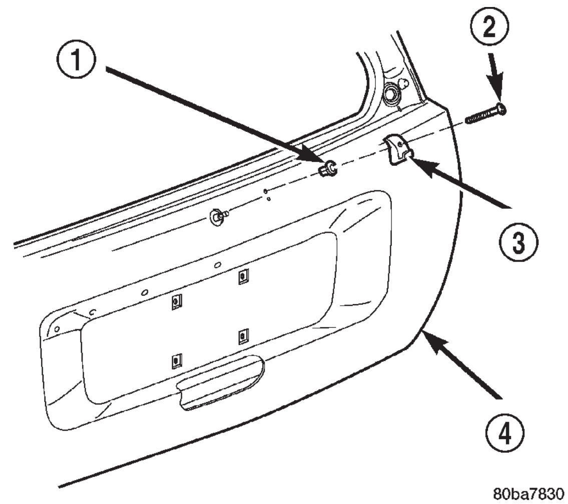


Fig. 15 Wiper Arm Park Ramp Remove/Install

1 - RIVET NUT
2 - SCREW
3 - PARK RAMP
4 - LIFTGATE

(4) Remove the wiper arm park ramp from the liftgate outer panel.

INSTALLATION

(1) Position the wiper arm park ramp onto the liftgate outer panel (Fig. 15).

(2) Install and tighten the screw that secures the wiper arm park ramp to the liftgate outer panel. Tighten the screw to 6.8 N·m (60 in. lbs.).

(3) Lower the rear wiper arm and blade and gently place the wiper arm support onto the wiper arm park ramp.

WIRING

TABLE OF CONTENTS

8W-01 WIRING DIAGRAM INFORMATION

TABLE OF CONTENTS

WIRING DIAGRAM INFORMATION

DESCRIPTION

DESCRIPTION - HOW TO USE WIRING DIAGRAMS

DaimlerChrysler Corporation wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use the wiring diagrams to diagnose and repair DaimlerChrysler Corporation vehicles, it is important to understand all of their features and characteristics.

Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page (Fig. 1).

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition (Fig. 2).

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around the component indicates that the component is being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world (Fig. 3).

WIRING DIAGRAM INFORMATION (Continued)

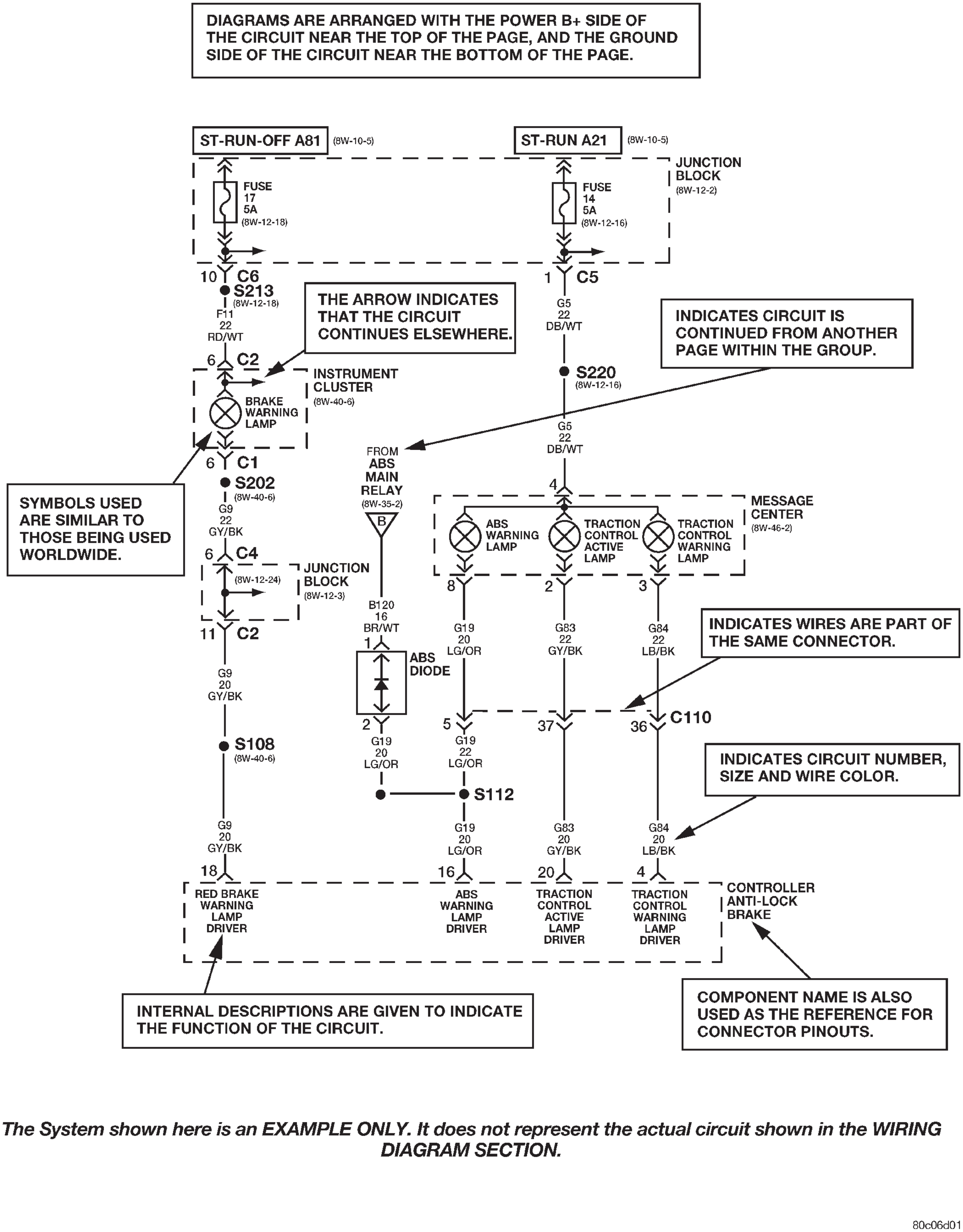


Fig. 1 WIRING DIAGRAM EXAMPLE 1

WIRING DIAGRAM INFORMATION (Continued)

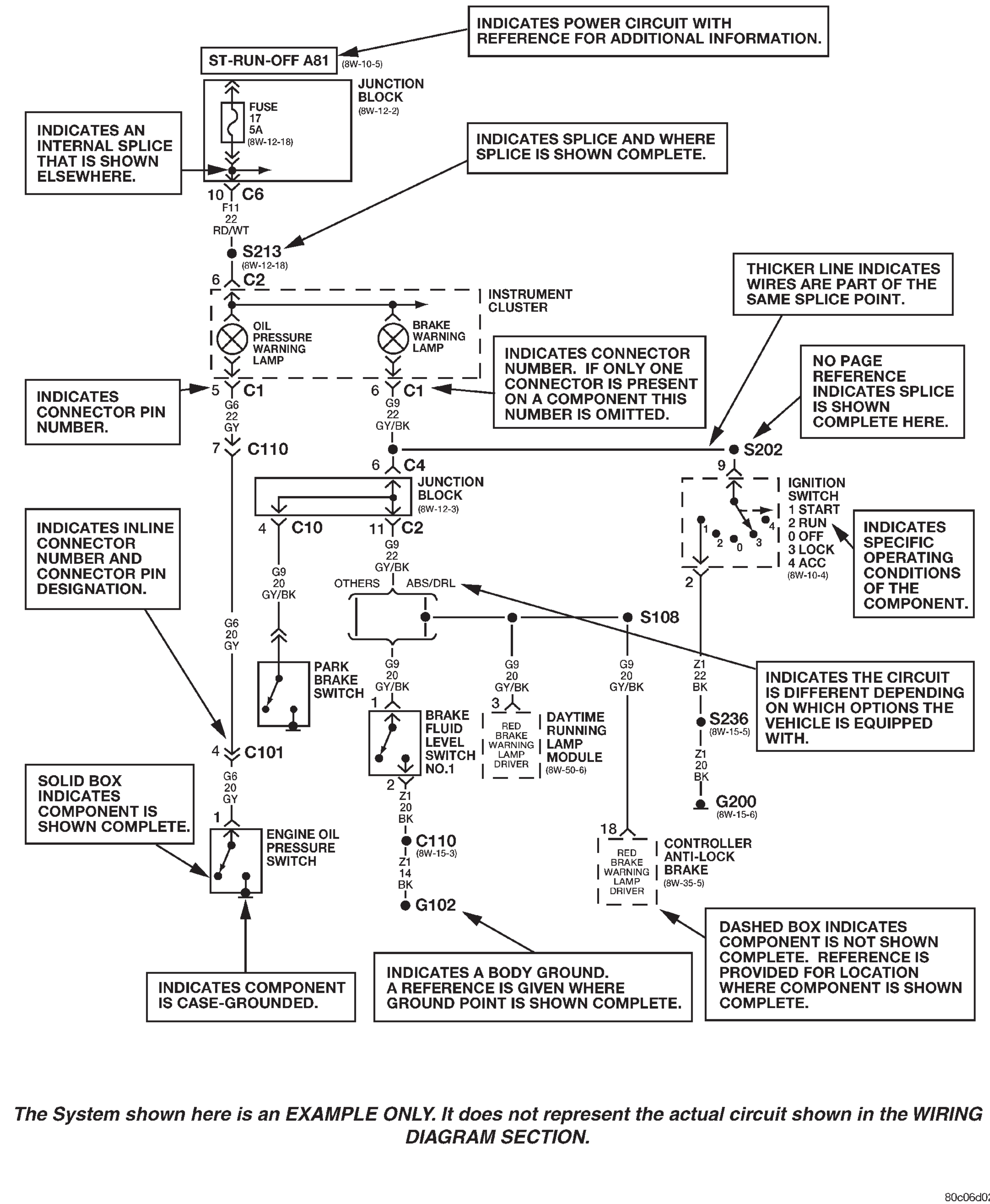


Fig. 2 WIRING DIAGRAM EXAMPLE 2

WIRING DIAGRAM INFORMATION (Continued)

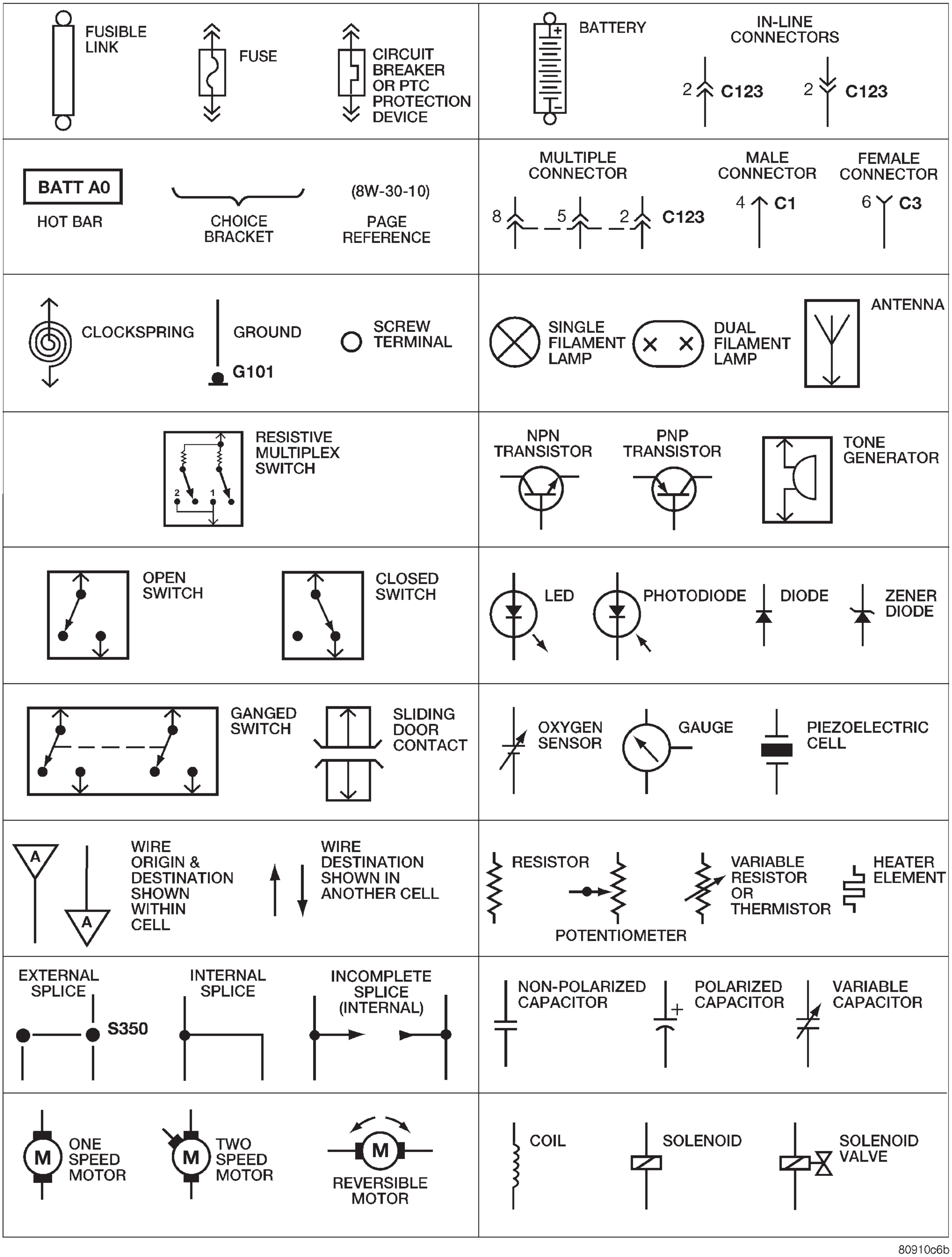


Fig. 3 WIRING DIAGRAM SYMBOLS

WIRING DIAGRAM INFORMATION (Continued)

TERMINOLOGY

This is a list of terms and definitions used in the wiring diagrams.

LHD . . . . Left Hand Drive Vehicles
RHD . . . . Right Hand Drive Vehicles
ATX . . Automatic Transmissions-Front Wheel Drive
MTX . . . . Manual Transmissions-Front Wheel Drive
AT . . . . Automatic Transmissions-Rear Wheel Drive
MT . . . . . Manual Transmissions-Rear Wheel Drive
SOHC . . . . Single Over Head Cam Engine
DOHC . . . . Double Over Head Cam Engine
Built-Up-Export . . . . Vehicles Built For Sale In Markets Other Than North America
Except Built-Up-Export . . Vehicles Built For Sale In North America

DESCRIPTION - CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, part of the main circuit, gage of wire, and color (Fig. 4).

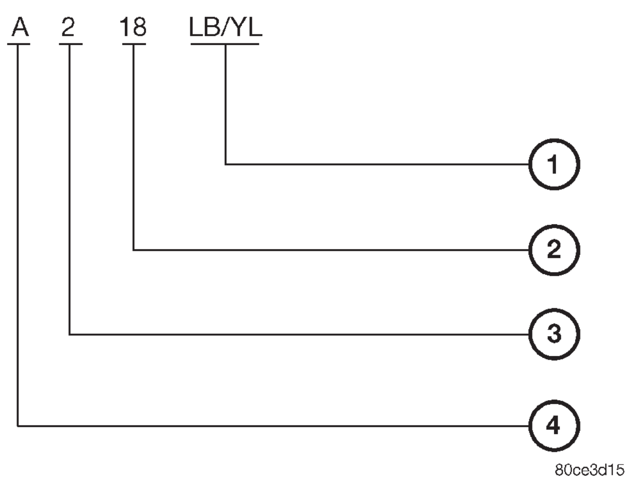


Fig. 4 WIRE CODE IDENTIFICATION

1 - COLOR OF WIRE (LIGHT BLUE WITH YELLOW TRACER
2 - GAGE OF WIRE (18 GAGE)
3 - PART OF MAIN CIRCUIT (VARIES DEPENDING ON EQUIPMENT)
4 - MAIN CIRCUIT IDENTIFICATION

WIRE COLOR CODE CHART

COLOR CODE	COLOR
BL	BLUE
BK	BLACK
BR	BROWN
DB	DARK BLUE
DG	DARK GREEN
GY	GRAY
LB	LIGHT BLUE
LG	LIGHT GREEN
OR	ORANGE
PK	PINK
RD	RED
TN	TAN
VT	VIOLET
WT	WHITE
YL	YELLOW
*	WITH TRACER

WIRING DIAGRAM INFORMATION (Continued)

DESCRIPTION - CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and it's function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	OPEN
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	NOT USED
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/ WASHER
W	OPEN
X	AUDIO SYSTEMS
Y	OPEN
Z	GROUNDS

DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION

The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

Splice diagrams in Section 8W-70 show the entire splice and provide references to other sections the splices serves. Section 8W-70 only contains splice diagrams that are not shown in their entirety somewhere else in the wiring diagrams.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the diagram pages.

WIRING SECTION CHART

GROUP	TOPIC
8W-01 thru 8W-09	General information and Diagram Overview
8W-10 thru 8W-19	Main Sources of Power and Vehicle Grounding
8W-20 thru 8W-29	Starting and Charging
8W-30 thru 8W-39	Powertrain/Drivetrain Systems
8W-40 thru 8W-49	Body Electrical items and A/C
8W-50 thru 8W-59	Exterior Lighting, Wipers and Trailer Tow
8W-60 thru 8W-69	Power Accessories
8W-70	Splice Information
8W-80	Connector Pin Outs
8W-91	Connector, Ground and Splice Locations

WIRING DIAGRAM INFORMATION (Continued)

DESCRIPTION - CONNECTOR, GROUND AND SPLICE INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located in the engine compartment are C100 series numbers
- In-line connectors located in the Instrument Panel area are C200 series numbers.
- In-line connectors located in the body are C300 series numbers.
- Jumper harness connectors are C400 series numbers.
- Grounds and ground connectors are identified with a “G” and follow the same series numbering as the in-line connectors.
- Splices are identified with an “S” and follow the same series numbering as the in-line connectors.
- Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

LOCATIONS

Section 8W-91 contains connector/ground/splice location illustrations. The illustrations contain the connector name (or number)/ground number/splice number and component identification. Connector/ground/splice location charts in section 8W-91 reference the figure numbers of the illustrations.

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component. The abbreviation N/S means Not Shown in the illustrations

WARNING

WARNINGS - GENERAL

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER AND MUFFLER.

WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY AND AVOID LOOSE CLOTHING.

DIAGNOSIS AND TESTING - WIRING HARNESS

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

- Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.

- Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today’s vehicles are Solid State. When checking voltages in these circuits, use a meter with a 10 - megohm or greater impedance rating.

WIRING DIAGRAM INFORMATION (Continued)

• Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking resistance in these circuits use a meter with a 10 - megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle's electrical system can cause damage to the equipment and provide false readings.

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 5). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.

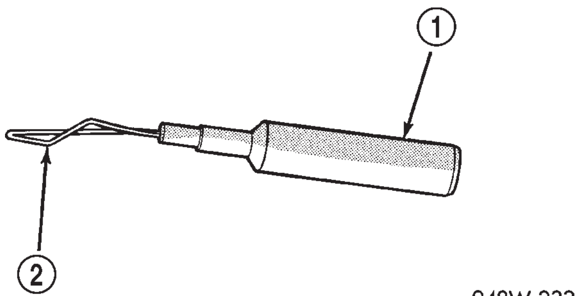


Fig. 5 PROBING TOOL

1 - SPECIAL TOOL 6801
2 - PROBING END

INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly, check the following items.

• Connectors are fully seated
• Spread terminals, or terminal push out
• Terminals in the wiring assembly are fully seated into the connector/component and locked into position
• Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
• Damaged connector/component casing exposing the item to dirt or moisture
• Wire insulation that has rubbed through causing a short to ground
• Some or all of the wiring strands broken inside of the insulation
• Wiring broken inside of the insulation

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.

(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.

(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.

(4) Isolate the problem area.

(5) Repair the problem area.

(6) Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

STANDARD PROCEDURE

STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 6) is used to indicate this. When handling any component with this symbol, comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.

(3) When using a voltmeter, be sure to connect the ground lead first.

(4) Do not remove the part form it's protective packing until it is time to install the part.

(5) Before removing the part from it's pakage, ground the pakage to a known good ground on the vehicle.

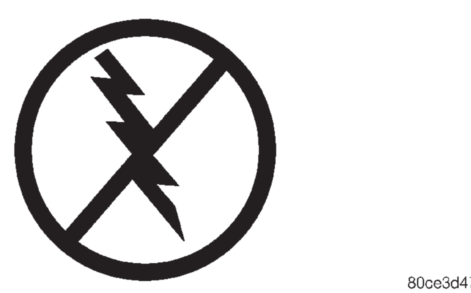


Fig. 6 ELECTROSTATIC DISCHARGE SYMBOL

WIRING DIAGRAM INFORMATION (Continued)

STANDARD PROCEDURE - TESTING OF VOLTAGE POTENTIAL

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 7).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

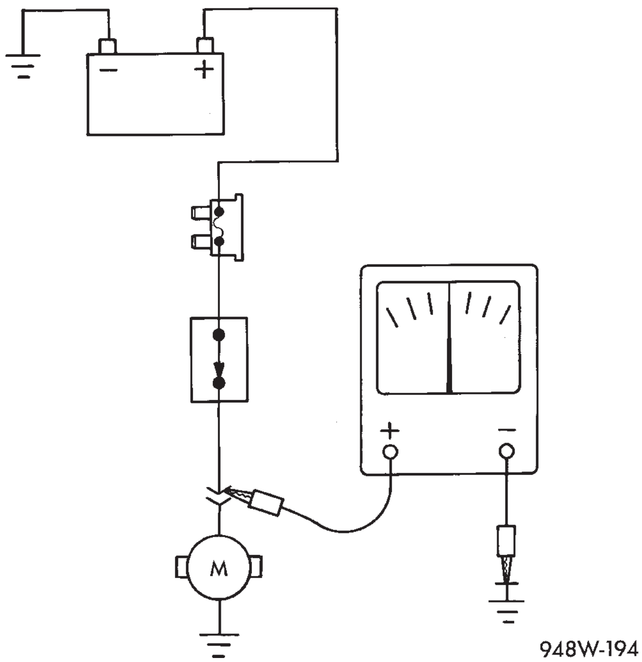


Fig. 7 TESTING FOR VOLTAGE POTENTIAL

STANDARD PROCEDURE - TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 8).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

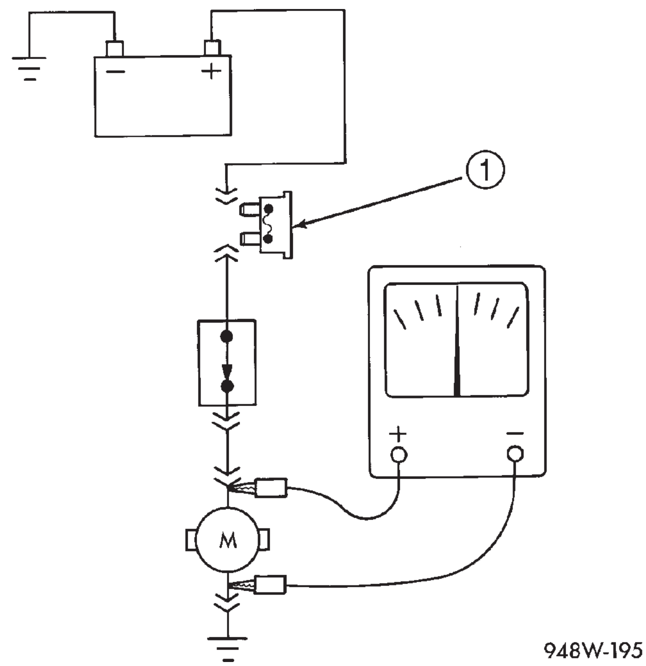


Fig. 8 TESTING FOR CONTINUITY

1 - FUSE REMOVED FROM CIRCUIT

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

WIRING DIAGRAM INFORMATION (Continued)

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

(1) Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting or energizing the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

STANDARD PROCEDURE - TESTING FOR A VOLTAGE DROP

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 9).

(2) Connect the other lead of the voltmeter to the other side of the switch, component or circuit.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

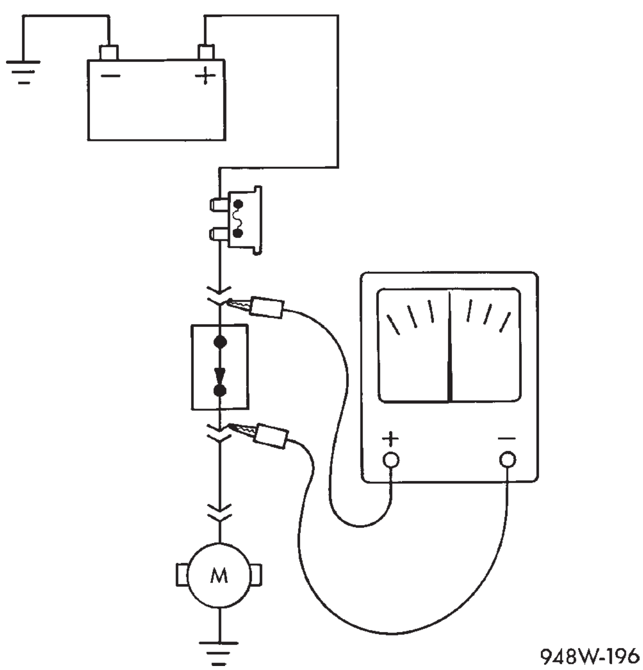
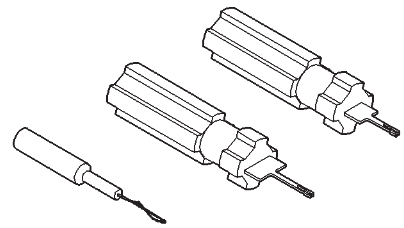


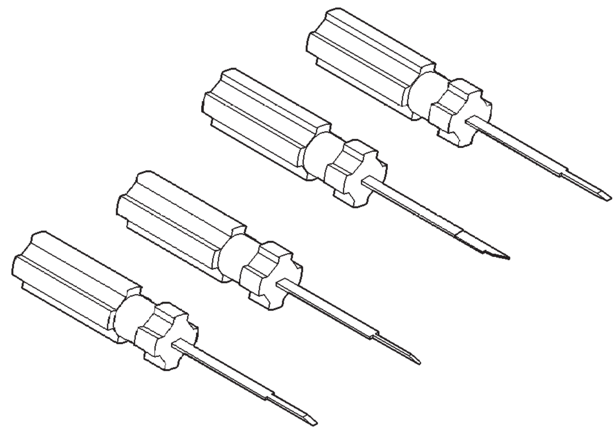
Fig. 9 TESTING FOR VOLTAGE DROP

SPECIAL TOOLS

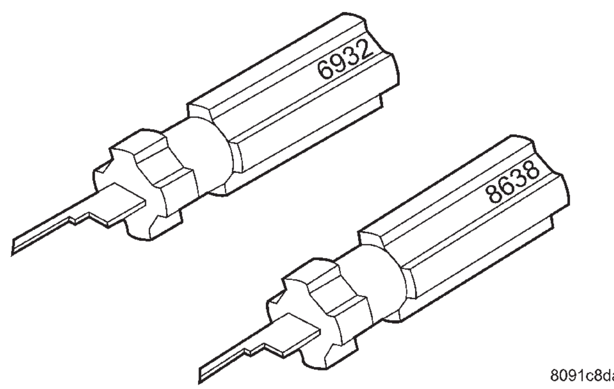
WIRING/TERMINAL



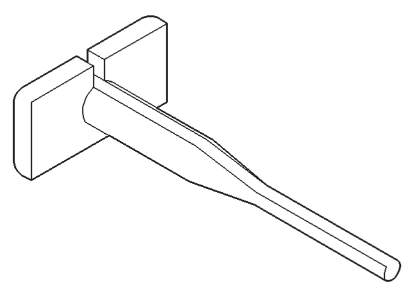
PROBING TOOL PACKAGE 6807



TERMINAL PICK TOOL SET 6680



TERMINAL REMOVING TOOLS 6932 AND 8638



TERMINAL REMOVING TOOL 6934

CONNECTOR

REMOVAL

(1) Disconnect battery.

(2) Release Connector Lock (Fig. 10).

(3) Disconnect the connector being repaired from its mating half/component.

(4) Remove the dress cover (if applicable) (Fig. 10).

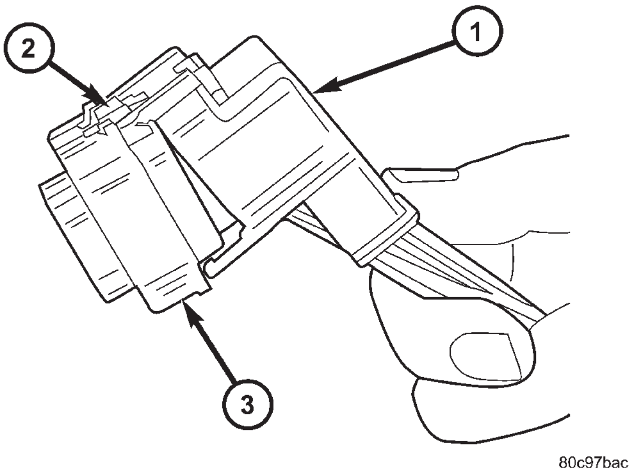


Fig. 10 REMOVAL OF DRESS COVER

1 - DRESS COVER
2 - CONNECTOR LOCK
3 - CONNECTOR

(5) Release the Secondary Terminal Lock, if required (Fig. 11).

(6) Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector (Fig. 12).

INSTALLATION

(1) Insert the removed terminal in the same cavity on the repair connector.

(2) Repeat steps for each terminal in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.

(3) When the connector is re-assembled, the secondary terminal lock must be placed in the locked position to prevent terminal push out.

(4) Replace dress cover (if applicable).

(5) Connect connector to its mating half/component.

(6) Connect battery and test all affected systems.

CONNECTOR (Continued)

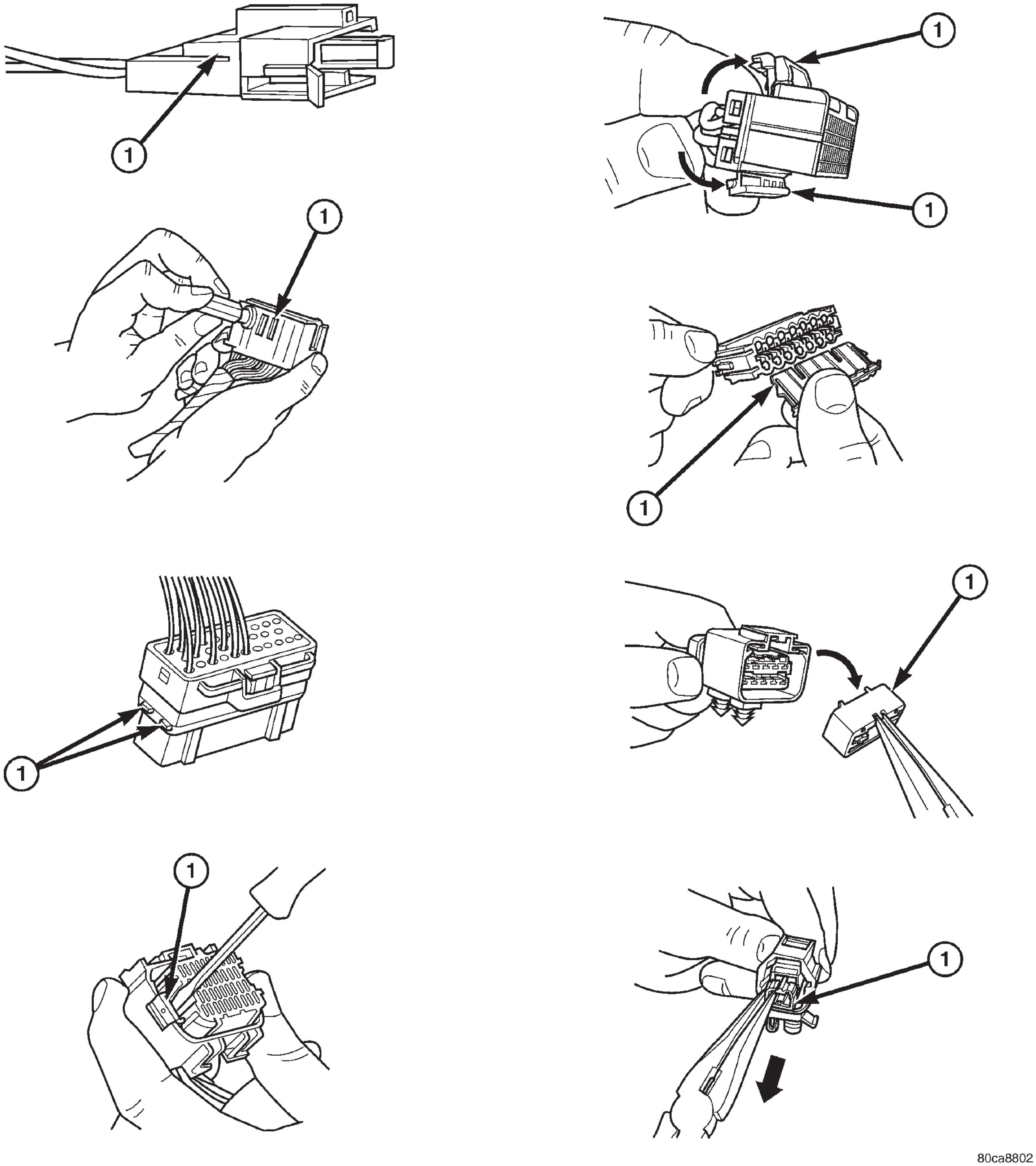


Fig. 11 EXAMPLES OF CONNECTOR SECONDARY TERMINAL LOCKS

1 - Secondary Terminal Lock

CONNECTOR (Continued)

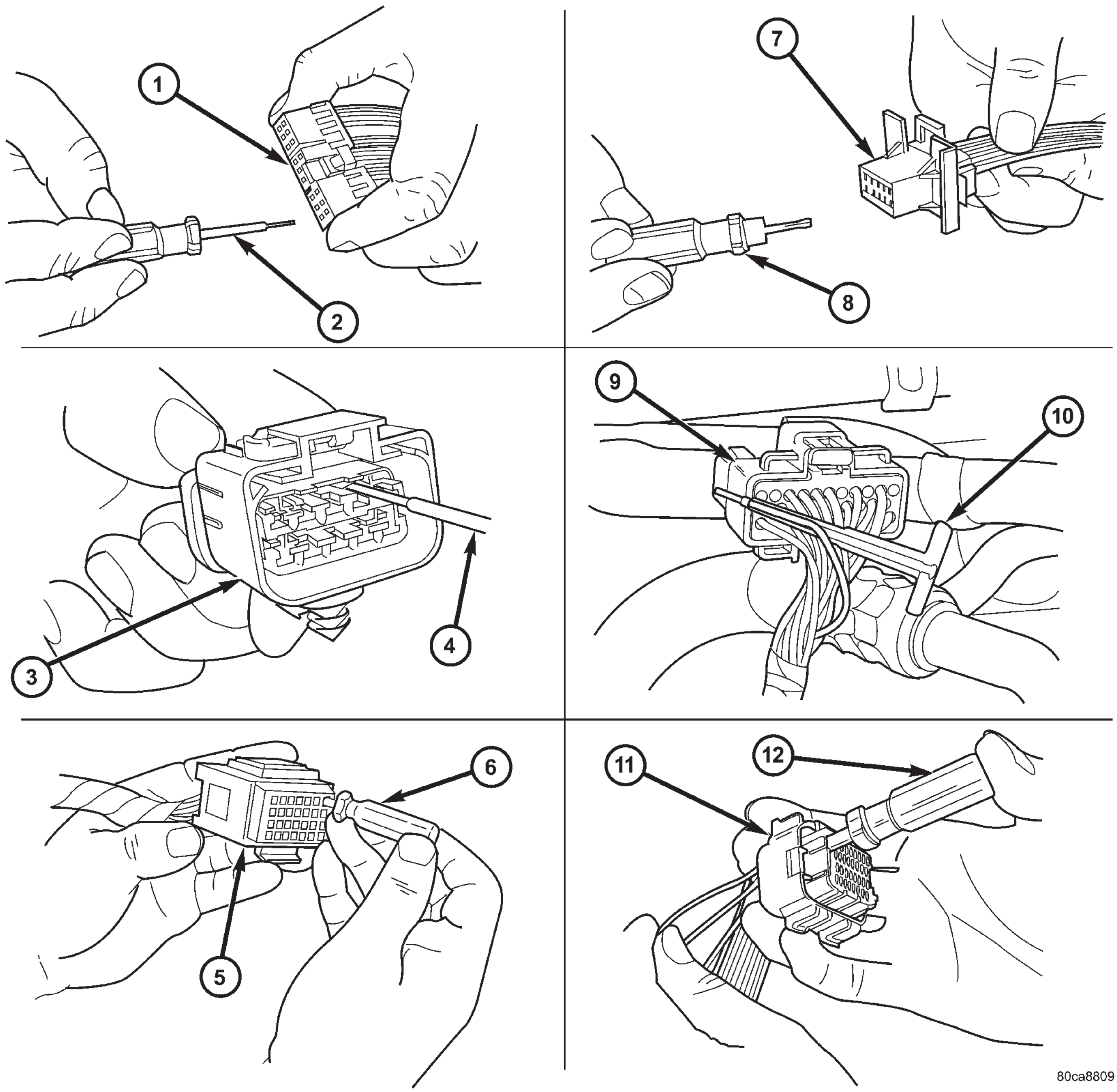


Fig. 12 TERMINAL REMOVAL

1 - TYPICAL CONNECTOR
2 - PICK FROM SPECIAL TOOL KIT 6680
3 - APEX CONNECTOR
4 - PICK FROM SPECIAL TOOL KIT 6680
5 - AUGAT CONNECTOR
6 - SPECIAL TOOL 6932
7 - MOLEX CONNECTOR
8 - SPECIAL TOOL 6742
9 - THOMAS AND BETTS CONNECTOR
10 - SPECIAL TOOL 6934
11 - TYCO CONNECTOR
12 - SPECIAL TOOL 8638

DIODE

REMOVAL

(1) Disconnect the battery.
(2) Locate the diode in the harness, and remove the protective covering.
(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 13).

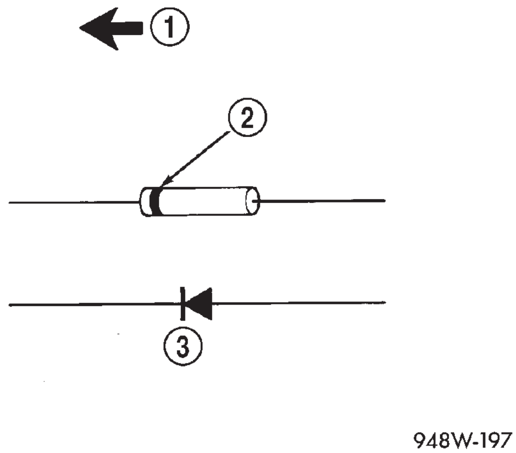


Fig. 13 DIODE IDENTIFICATION

1 - CURRENT FLOW
2 - BAND AROUND DIODE INDICATES CURRENT FLOW
3 - DIODE AS SHOWN IN THE DIAGRAMS

INSTALLATION

(1) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.
(2) Install the new diode in the harness, making sure current flow is correct. If necessary, refer to the appropriate wiring diagram for current flow (Fig. 13).
(3) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**
(4) Tape the diode to the harness using electrical tape. Make sure the diode is completely sealed from the elements.
(5) Re-connect the battery and test affected systems.

TERMINAL

REMOVAL

(1) Follow steps for removing terminals described in the connector removal section.
(2) Cut the wire 6 inches from the back of the connector.

INSTALLATION

(1) Select a wire from the terminal repair kit that best matches the color and gage of the wire being repaired.
(2) Cut the repair wire to the proper length and remove one–half (1/2) inch of insulation.
(3) Splice the repair wire to the wire harness (see wire splicing procedure).
(4) Insert the repaired wire into the connector.
(5) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.
(6) Re-tape the wire harness starting at 1–1/2 inches behind the connector and 2 inches past the repair.
(7) Connect battery and test all affected systems.

WIRE

STANDARD PROCEDURE - WIRE SPLICING

When splicing a wire, it is important that the correct gage be used as shown in the wiring diagrams.

(1) Remove one-half (1/2) inch of insulation from each wire that needs to be spliced.

(2) Place a piece of adhesive lined heat shrink tubing on one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(3) Place the strands of wire overlapping each other inside of the splice clip (Fig. 14).

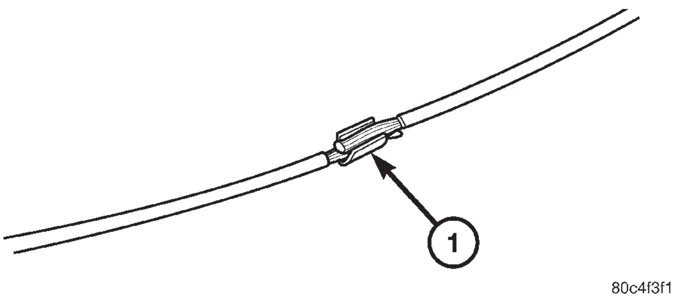


Fig. 14 SPLICE BAND

1 - SPLICE BAND

(4) Using crimping tool, Mopar p/n 05019912AA, crimp the splice clip and wires together (Fig. 15).

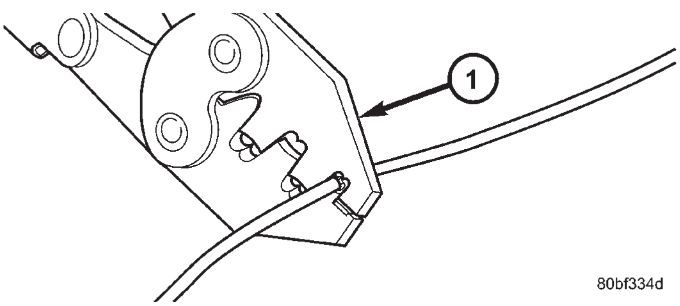


Fig. 15 CRIMPING TOOL

1 - CRIMPING TOOL

(5) Solder the connection together using rosin core type solder only (Fig. 16).

CAUTION: DO NOT USE ACID CORE SOLDER.

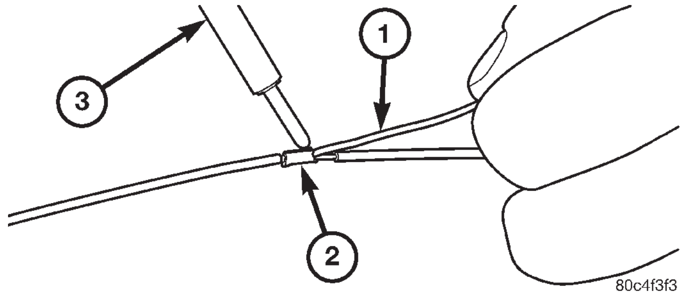


Fig. 16 SOLDER SPLICE

1 - SOLDER
2 - SPLICE BAND
3 - SOLDERING IRON

(6) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing (Fig. 17).

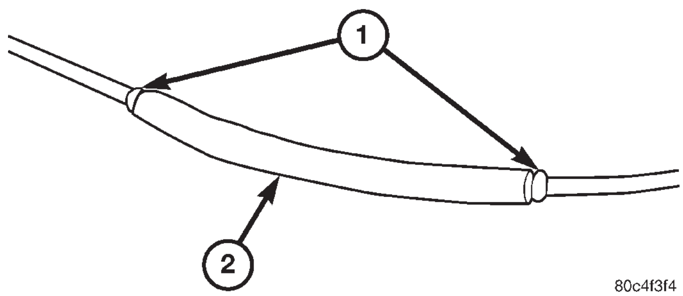


Fig. 17 HEAT SHRINK TUBE

1 - SEALANT
2 - HEAT SHRINK TUBE

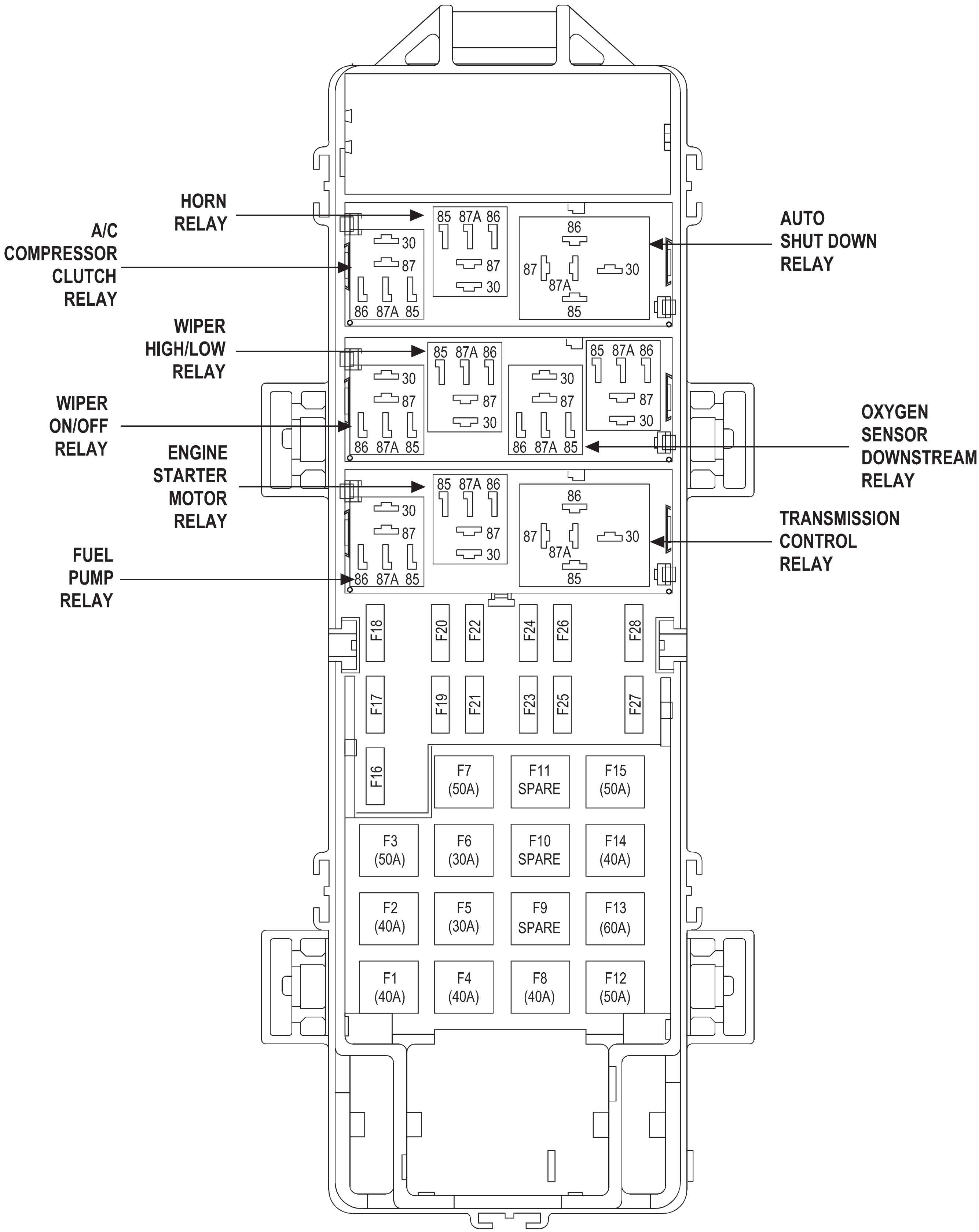
8W-02 COMPONENT INDEX

Component **Page**

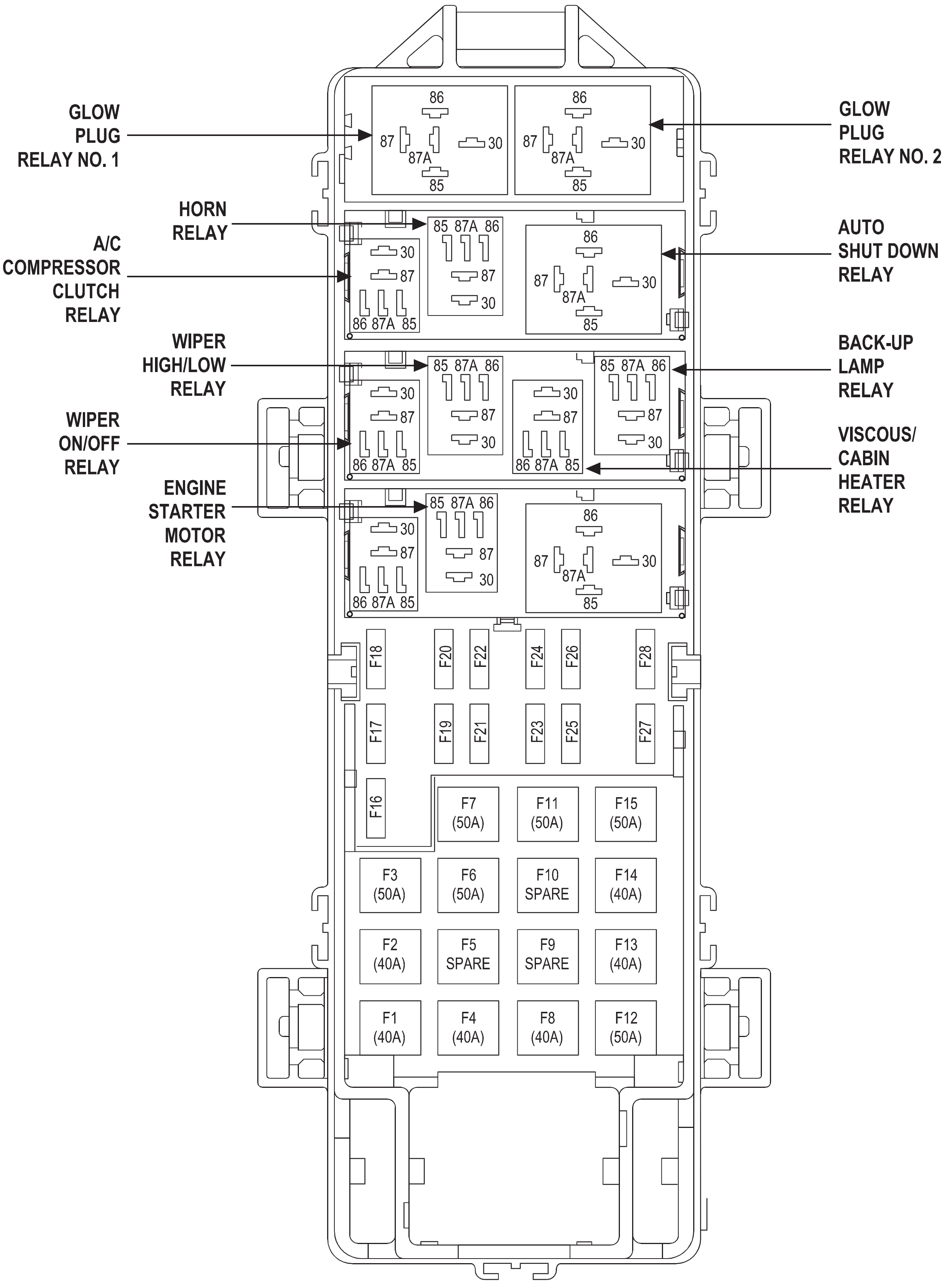
Component **Page**

8W-10 POWER DISTRIBUTION

POWER DISTRIBUTION CENTER



POWER DISTRIBUTION CENTER



FUSES (GAS)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	30A	A30 14RD/WT A30 14RD/WT ◇◇	FUSED B(+)
6	30A	A14 14RD/DG	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	-	-	-
12	50A	A146 10OR/WT	FUSED B(+)
13	60A	A80 10RD/LG	FUSED B(+)
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	15A	F142 18OR/DG F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD F62 18RD	FUSED B(+)
19	10A	A7 14RD/BK	FUSED B(+)
20	20A	A110 16VT/RD	FUSED B(+)
21	15A	A17 18RD/BK	FUSED B(+)
22	-	-	-
23	-	-	-
24	20A	A62 16VT/LB ●	FUSED B(+)
24	20A	A62 16VT/WT ●●	FUSED B(+)
25	20A	A20 12RD/DB	FUSED B(+)
26	15A	F42 18DG/LG F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	15A	T15 18YL/BR ◇	FUSED TRANSMISSION CONTROL RELAY OUTPUT

◇ 4.0L ● LHD
◇◇ 4.7L ●● RHD

J028W-19 WJI01004

FUSES (DIESEL)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	-	-	-
6	50A	A105 10DB/RD	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	50A	A110 10VT/RD	FUSED B(+)
12	50A	A146 10OR/WT	FUSED B(+)
13	40A	A14 14RD/WT	FUSED B(+)
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	20A	F15 18DB/WT F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD F62 18RD	FUSED B(+)
19	-	-	-
20	-	-	-
21	15A	A17 14RD/BK	FUSED B(+)
22	10A	F300 18RD/BK	FUSED B(+)
23	15A	A80 18RD/LG	FUSED B(+)
24	-	-	-
25	20A	A20 12RD/DB	FUSED B(+)
26	20A	F142 14OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	-	-	-

RELAYS

A/C COMPRESSOR CLUTCH RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A17 14RD/BK	FUSED B(+)
85	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	C2 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

A/C COMPRESSOR CLUTCH RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A17 18RD/BK	FUSED B(+)
85	C13 18DB/OR ●	A/C COMPRESSOR CLUTCH RELAY CONTROL
	C13 20DB/OR ●●	A/C COMPRESSOR CLUTCH RELAY CONTROL
86	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	C2 18DB/YL	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

AUTO SHUT DOWN RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A14 14RD/WT	FUSED B(+)
85	K51 18DB/YL	AUTO SHUT DOWN RELAY CONTROL
86	A14 14RD/WT	FUSED B(+)
87	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
87A	-	-

● LHD
●● RHD

AUTO SHUT DOWN RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A14 14RD/DG	FUSED B(+)
85	K51 18DB/YL	AUTO SHUT DOWN RELAY CONTROL
86	F991 18OR/DB ●	FUSED IGNITION SWITCH OUTPUT (RUN-START)
	F991 20OR/DB ●●	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
87A	-	-

BACK-UP LAMP RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
85	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
86	T2 18TN/BK	TRS T2 SENSE
87	L1 18VT/BK	BACK-UP LAMP FEED
87A	-	-

ENGINE STARTER MOTOR RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A1 12RD	FUSED B(+)
85	T752 18DG/OR	ENGINE STARTER MOTOR RELAY CONTROL
86	F45 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
87	T40 12BR	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

● LHD
●● RHD

WJI01007 J028W-19

ENGINE STARTER MOTOR RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A1 12RD	FUSED B(+)
85	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
	T41 18BK/WT ●●	PARK/NEUTRAL POSITION SWITCH SENSE
86	F45 18YL/RD ⁕	FUSED IGNITION SWITCH OUTPUT (START)
	F45 18YL/RD ◇◇	FUSED IGNITION SWITCH OUTPUT (START)
86	F45 20YL/RD ⁕⁕	FUSED IGNITION SWITCH OUTPUT (START)
87	T40 12LG	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

FUEL PUMP RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A62 16VT/LB ●	FUSED B(+)
30	A62 16VT/WT ●●	FUSED B(+)
85	K31 18BR	FUEL PUMP RELAY CONTROL
86	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
	F991 20OR/DB ●●	FUSED IGNITION SWITCH OUTPUT (RUN-START)
	F991 18OR/DB ●	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	A141 16DG/WT ●	FUEL PUMP RELAY OUTPUT
87	A141 16DG/BK ●●	FUEL PUMP RELAY OUTPUT
87A	-	-

GLOW PLUG RELAY NO. 1 (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A105 10DB/RD	FUSED B(+)
85	K152 18WT	GLOW PLUG RELAY NO. 1 CONTROL
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	K154 10GY	GLOW PLUG RELAY NO. 1 OUTPUT
87A	-	-

● LHD
●● RHD
⁕ EXCEPT 4.0L RHD
⁕⁕ 4.0L RHD
◇◇ 4.7L

J028W-19 WJI01008

GLOW PLUG RELAY NO. 2 (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A110 10VT/RD	FUSED B(+)
85	K236 18GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	K254 10GY/YL	GLOW PLUG RELAY NO. 2 OUTPUT
87A	-	-

HORN RELAY

CAVITY	CIRCUIT	FUNCTION
30	F62 18RD	FUSED B(+)
85	X3 20BK/RD	HORN RELAY CONTROL
86	F62 18RD	FUSED B(+)
87	X2 18DG/RD	HORN RELAY OUTPUT
	X2 18DG/RD ▽	HORN RELAY OUTPUT
87A	-	-

OXYGEN SENSOR DOWNSTREAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
85	K512 18RD/YL	OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
86	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	K200 18VT/OR	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
87A	-	-

TRANSMISSION CONTROL RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A30 14RD/WT	FUSED B(+)
85	K125 18WT/DB ◇	GENERATOR SOURCE
85	Z307 18BK ◇◇	GROUND
86	K30 20PK/YL ●	TRANSMISSION CONTROL RELAY CONTROL
86	K30 20PK ●●	TRANSMISSION CONTROL RELAY CONTROL
87	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
87A	-	-

● LHD
●● RHD
▽ GAS
◇ 4.0L
◇◇ 4.7L

VISCOUS/ CABIN HEATER RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A80 18RD/LG	FUSED B(+)
85	K132 18BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	A82 18PK/LG	VISCOUS/CABIN HEATER RELAY OUTPUT
87A	-	-

WIPER HIGH/LOW RELAY

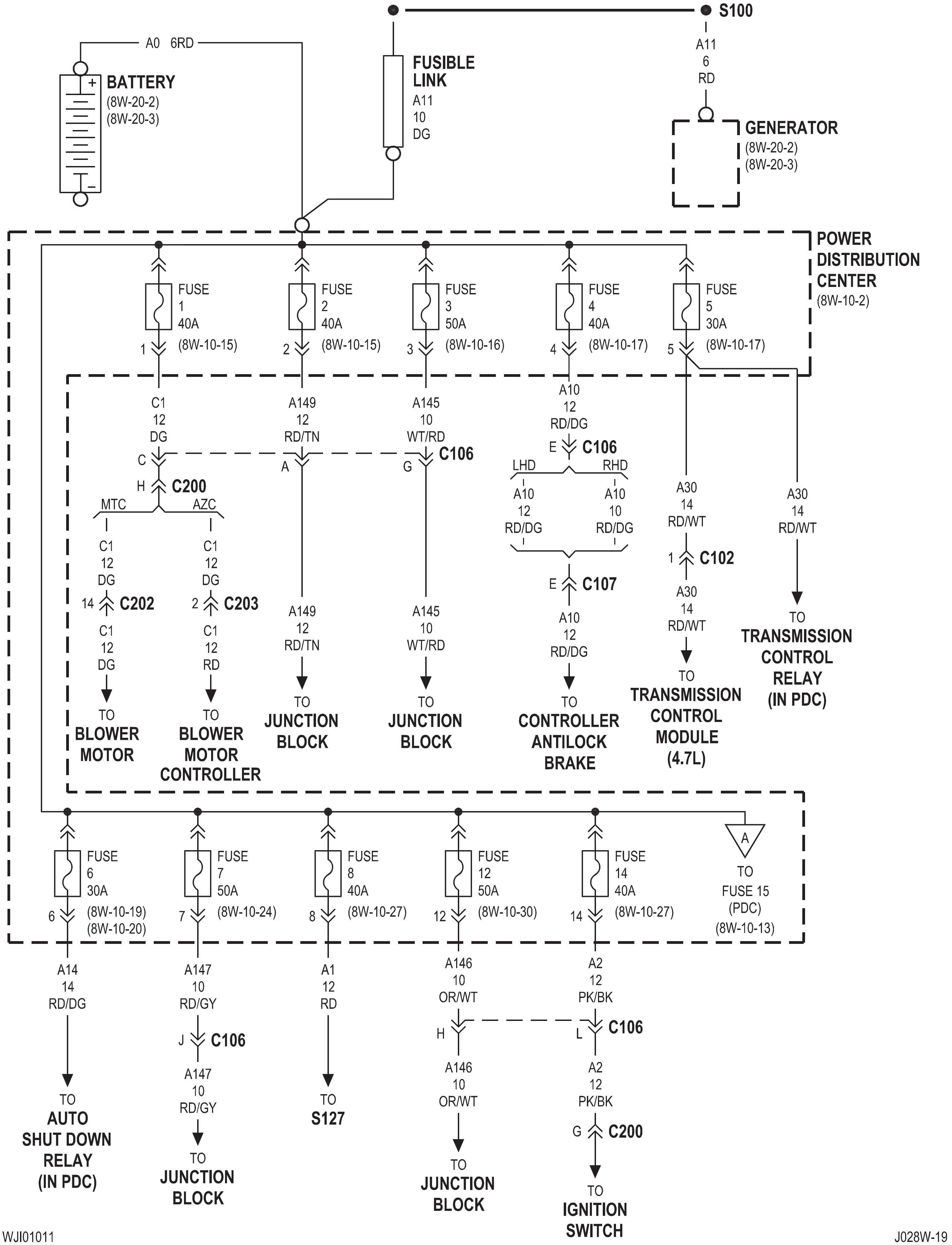
CAVITY	CIRCUIT	FUNCTION
30	V60 16YL/DG ▿	WIPER ON/OFF RELAY OUTPUT
30	V60 16TN/RD ▿▿	WIPER ON/OFF RELAY OUTPUT
85	V16 20VT	WIPER HIGH/LOW RELAY CONTROL
86	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	V6 16DB ▿▿	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V4 16RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
87A	V3 16BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT

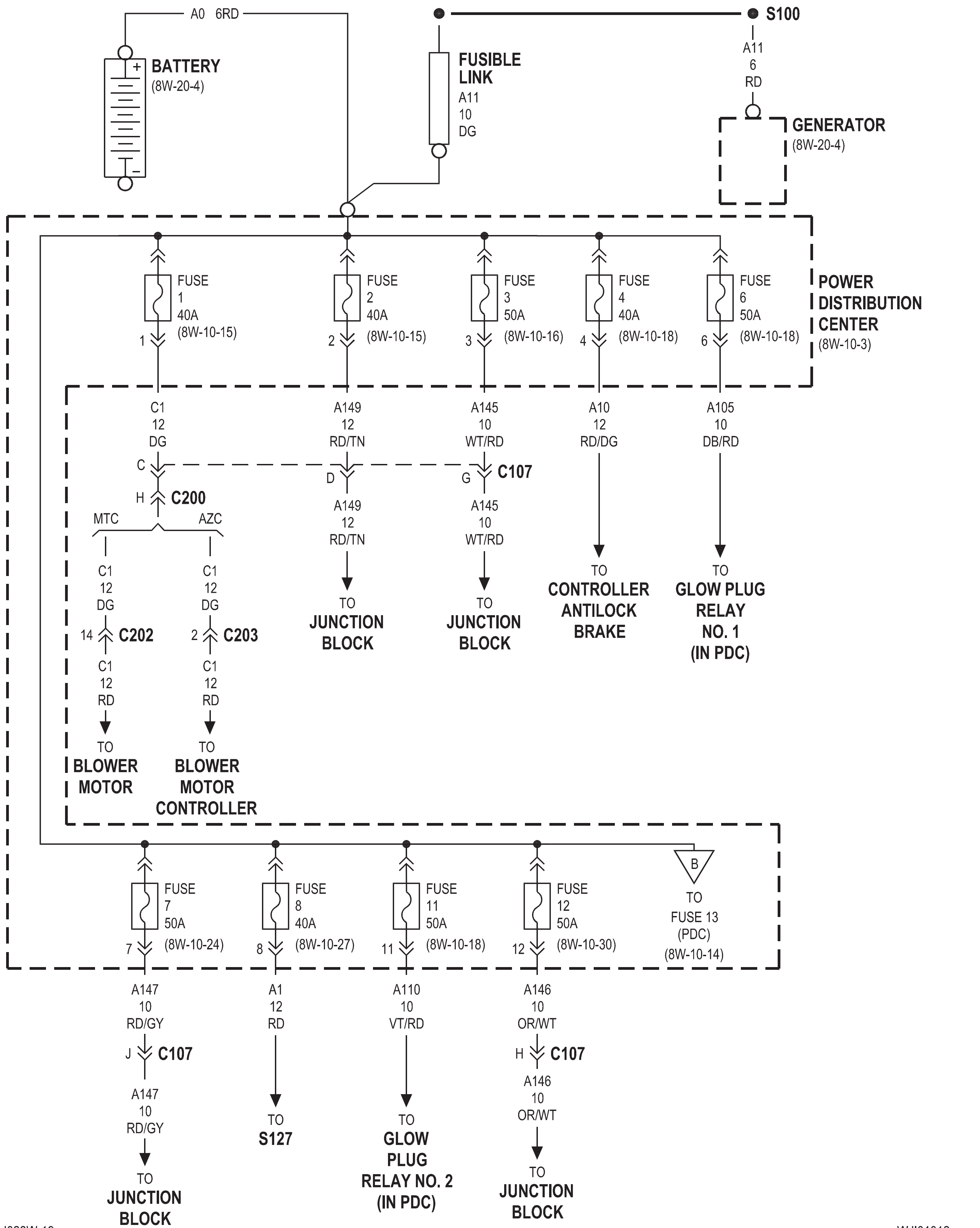
WIPER ON/OFF RELAY

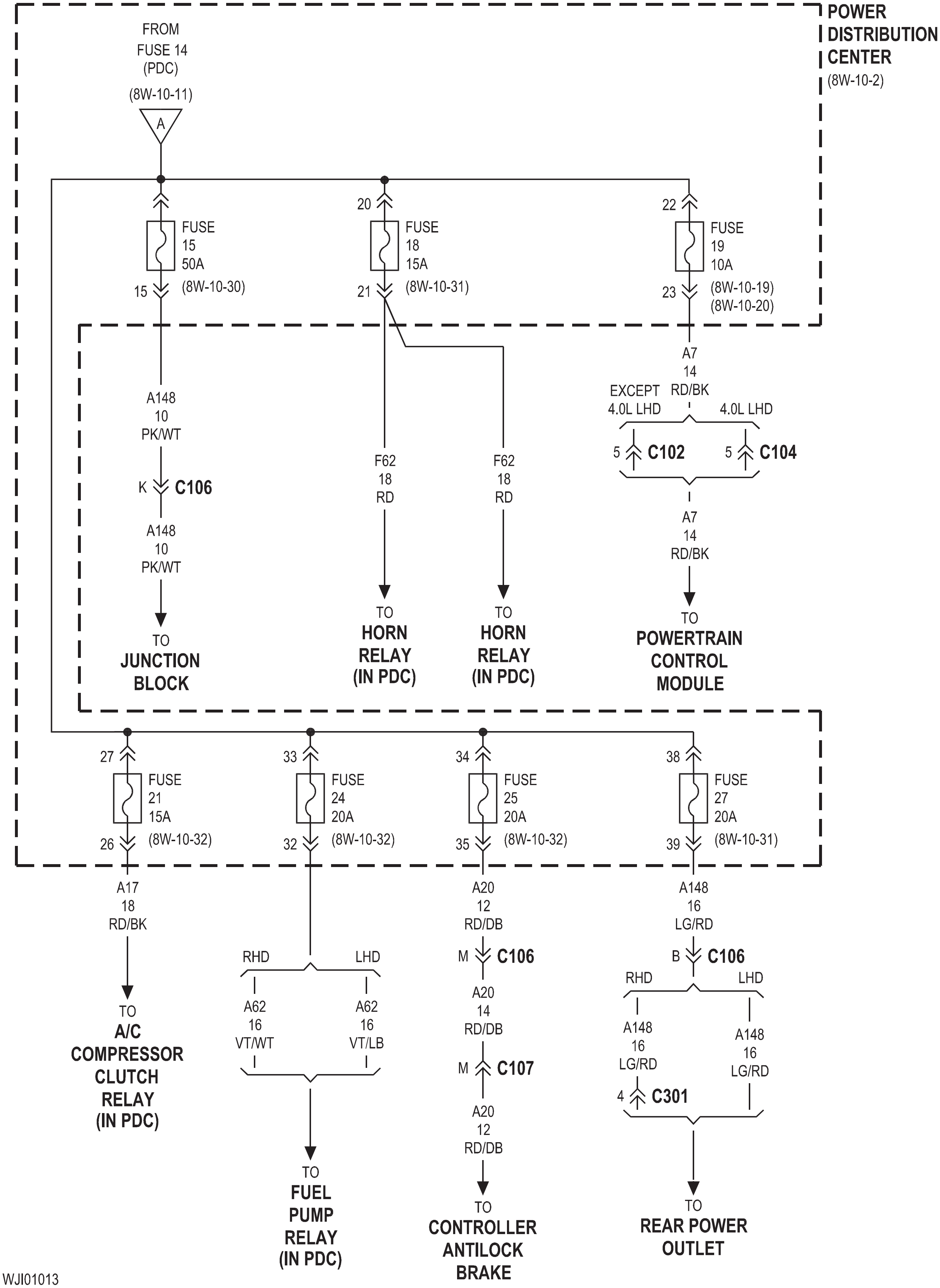
CAVITY	CIRCUIT	FUNCTION
30	V60 16YL/DG ▿	WIPER ON/OFF RELAY OUTPUT
30	V60 16TN/RD ▿▿	WIPER ON/OFF RELAY OUTPUT
85	V14 20RD/VT	WIPER ON/OFF RELAY CONTROL
86	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87A	V55 16TN/RD	WIPER PARK SWITCH SENSE
	V55 16TN/RD ▿▿	WIPER PARK SWITCH SENSE

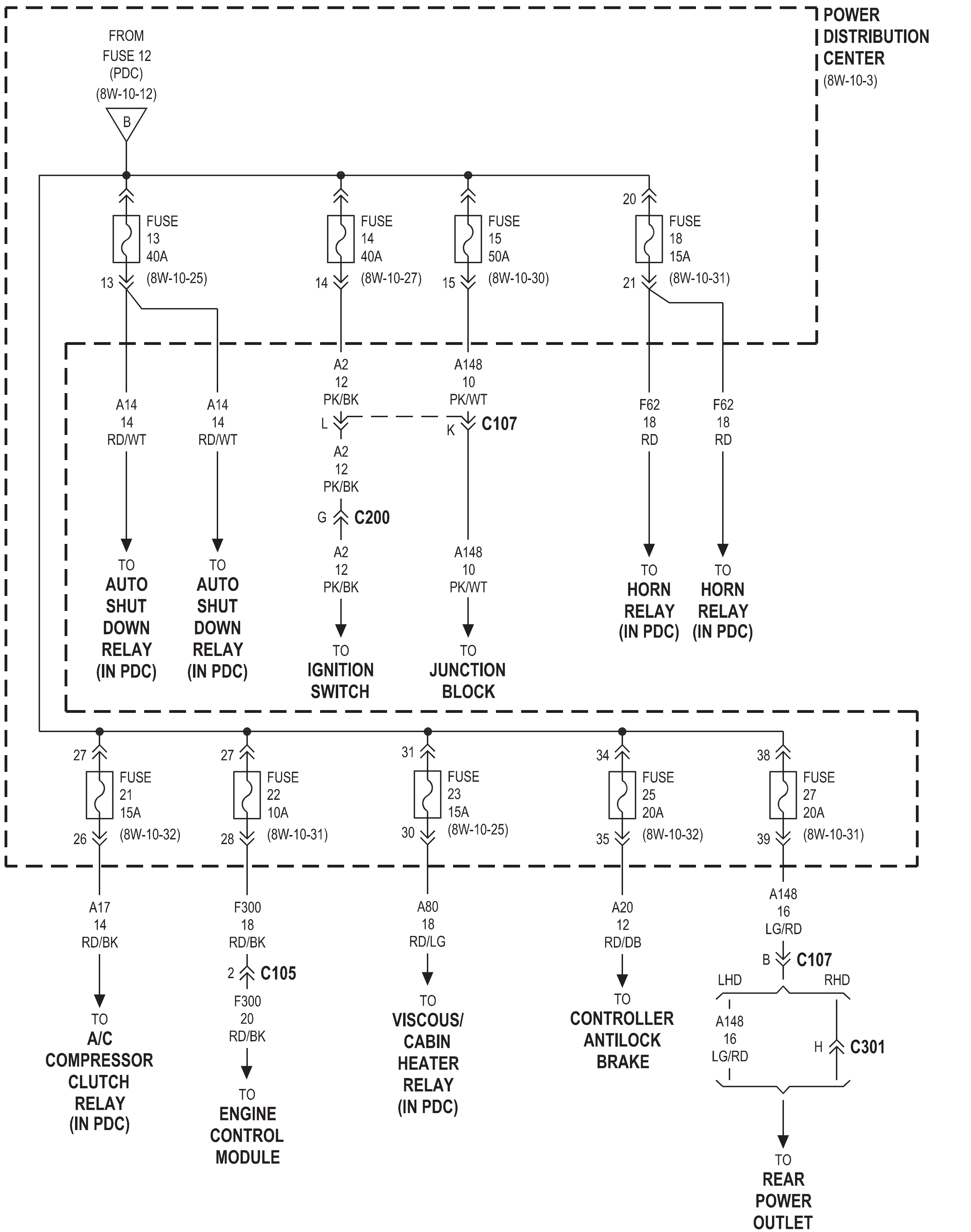
▿ GAS
▿▿ DIESEL

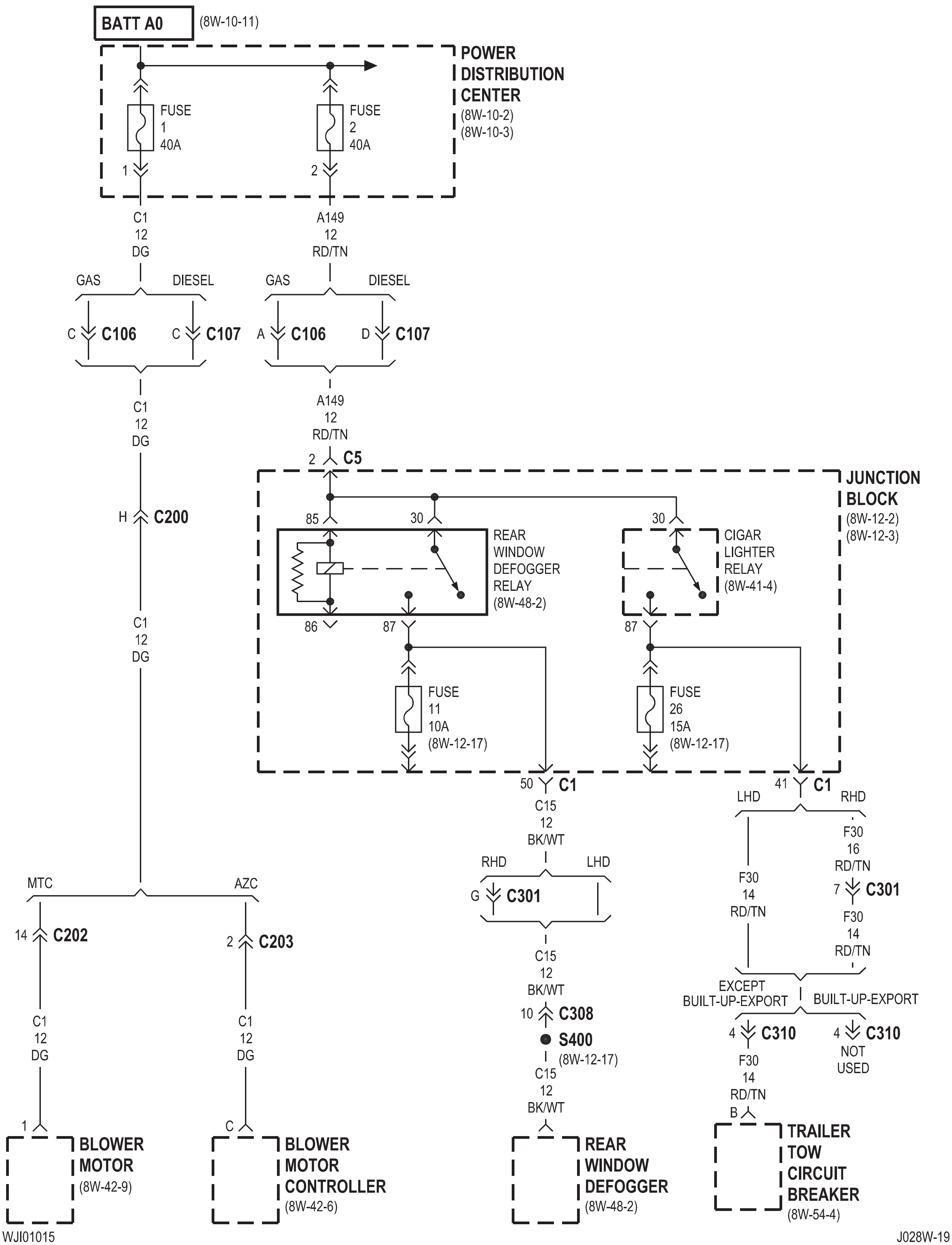
GAS

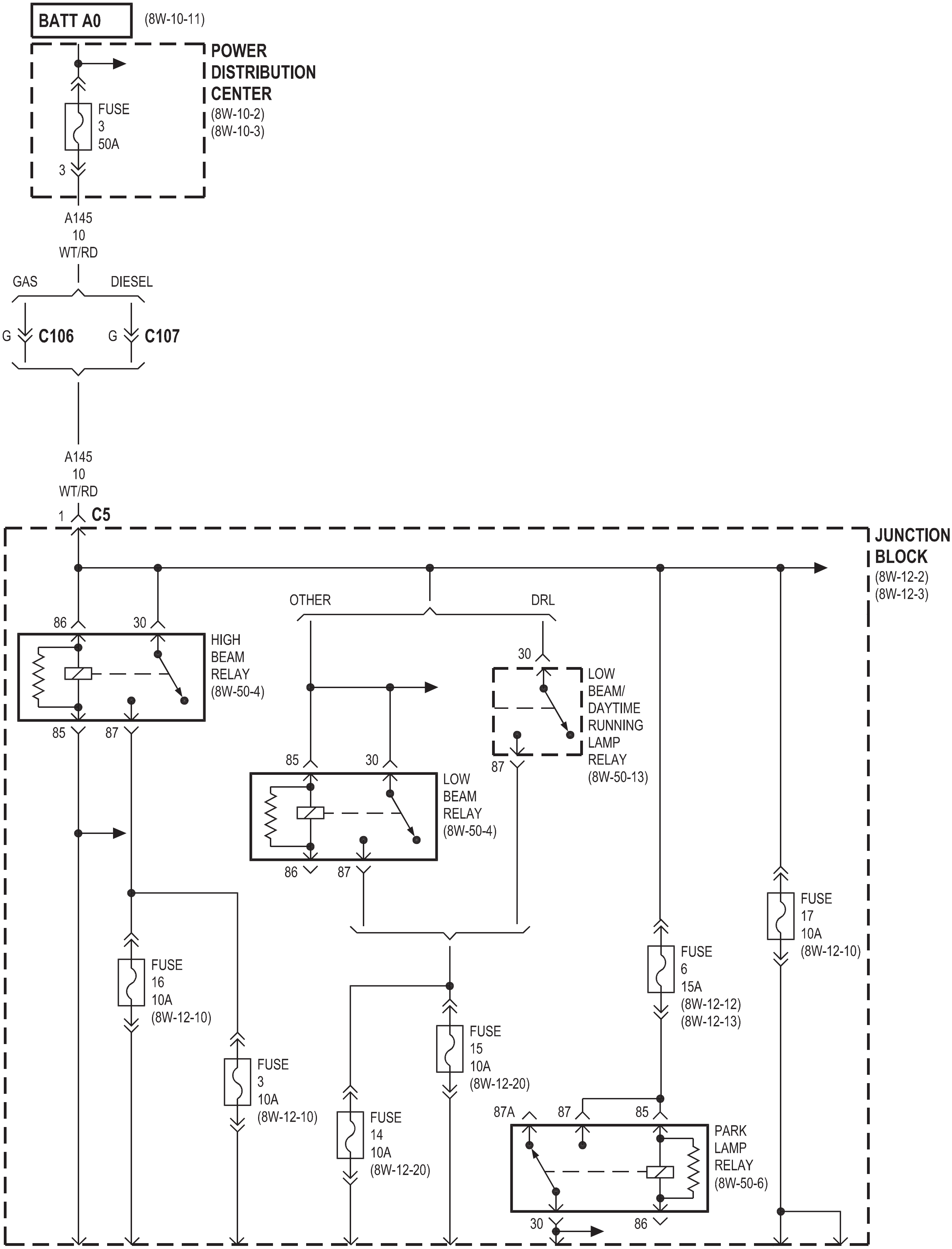

S100
A11
6
RD
A0 6RD
BATTERY
(8W-20-2)
(8W-20-3)
FUSIBLE
LINK
A11
10
DG
GENERATOR
(8W-20-2)
(8W-20-3)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
1
40A
(8W-10-15)
FUSE
2
40A
(8W-10-15)
FUSE
3
50A
(8W-10-16)
FUSE
4
40A
(8W-10-17)
FUSE
5
30A
(8W-10-17)
C1
12
DG
A149
12
RD/TN
A145
10
WT/RD
C106
A10
12
RD/DG
C106
LHD
RHD
C200
MTC
AZC
A10
12
RD/DG
A10
10
RD/DG
A30
14
RD/WT
C102
C107
C202
C203
C1
12
RD
TO
BLOWER
MOTOR
TO
BLOWER
MOTOR
CONTROLLER
TO
JUNCTION
BLOCK
TO
CONTROLLER
ANTILOCK
BRAKE
TO
TRANSMISSION
CONTROL
MODULE
(4.7L)
TO
TRANSMISSION
CONTROL
RELAY
(IN PDC)
FUSE
6
30A
(8W-10-19)
(8W-10-20)
FUSE
7
50A
(8W-10-24)
FUSE
8
40A
(8W-10-27)
FUSE
12
50A
(8W-10-30)
FUSE
14
40A
(8W-10-27)
TO
FUSE 15
(PDC)
(8W-10-13)
A14
14
RD/DG
A147
10
RD/GY
A1
12
RD
A146
10
OR/WT
A2
12
PK/BK
C106
C200
TO
AUTO
SHUT DOWN
RELAY
(IN PDC)
TO
S127
TO
IGNITION
SWITCH

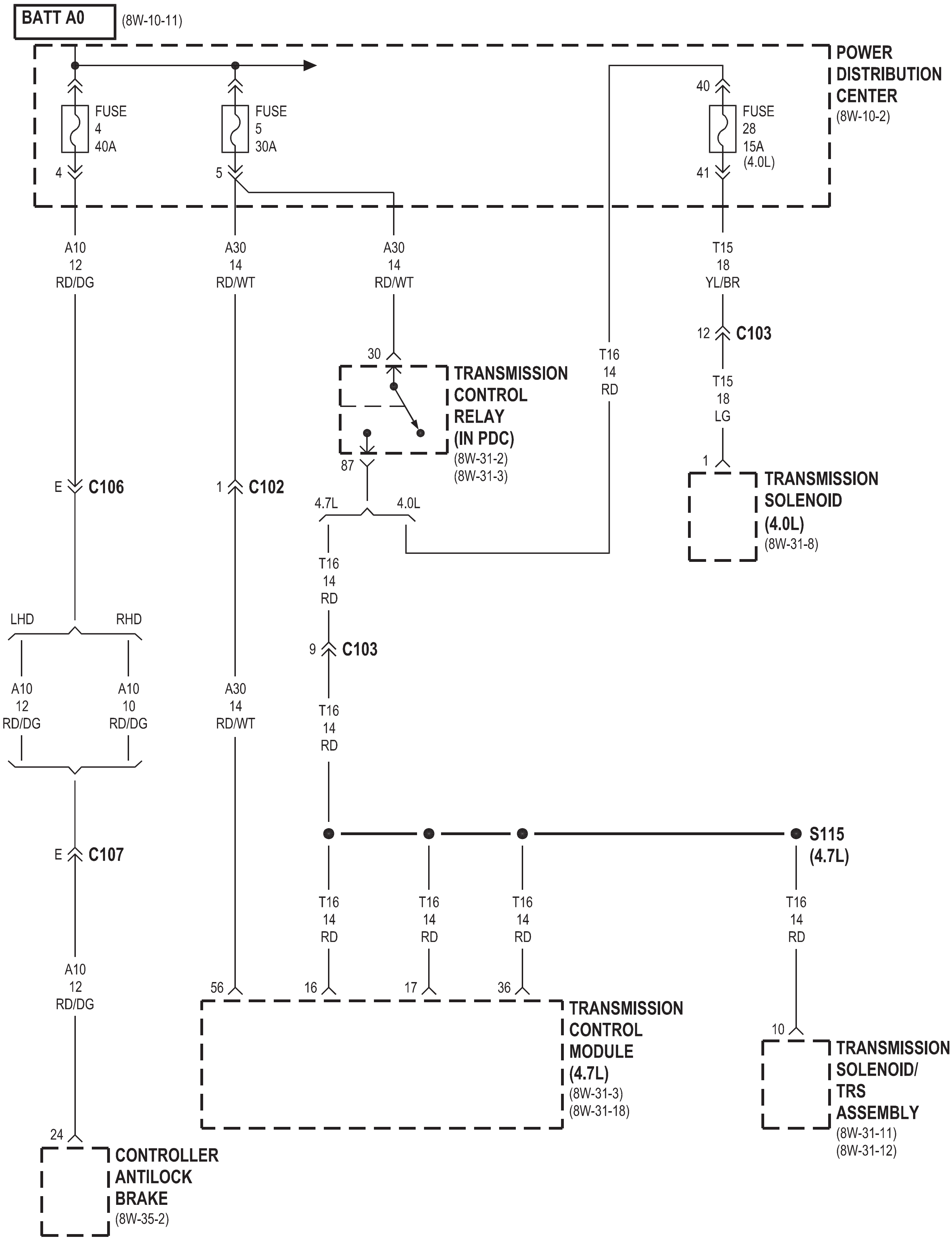

A0 6RD
BATTERY
(8W-20-4)
FUSIBLE LINK
A11
10
DG
S100
A11
6
RD
GENERATOR
(8W-20-4)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 1 40A (8W-10-15)
FUSE 2 40A (8W-10-15)
FUSE 3 50A (8W-10-16)
FUSE 4 40A (8W-10-18)
FUSE 6 50A (8W-10-18)
C1 12 DG
A149 12 RD/TN
A145 10 WT/RD
A10 12 RD/DG
A105 10 DB/RD
C107
C200
MTC
AZC
C1 12 DG
C202
C203
C1 12 RD
TO BLOWER MOTOR
TO BLOWER MOTOR CONTROLLER
TO JUNCTION BLOCK
TO CONTROLLER ANTILOCK BRAKE
TO GLOW PLUG RELAY NO. 1 (IN PDC)
FUSE 7 50A (8W-10-24)
FUSE 8 40A (8W-10-27)
FUSE 11 50A (8W-10-18)
FUSE 12 50A (8W-10-30)
B
TO FUSE 13 (PDC) (8W-10-14)
A147 10 RD/GY
A1 12 RD
A110 10 VT/RD
A146 10 OR/WT
TO S127
TO GLOW PLUG RELAY NO. 2 (IN PDC)
TO JUNCTION BLOCK

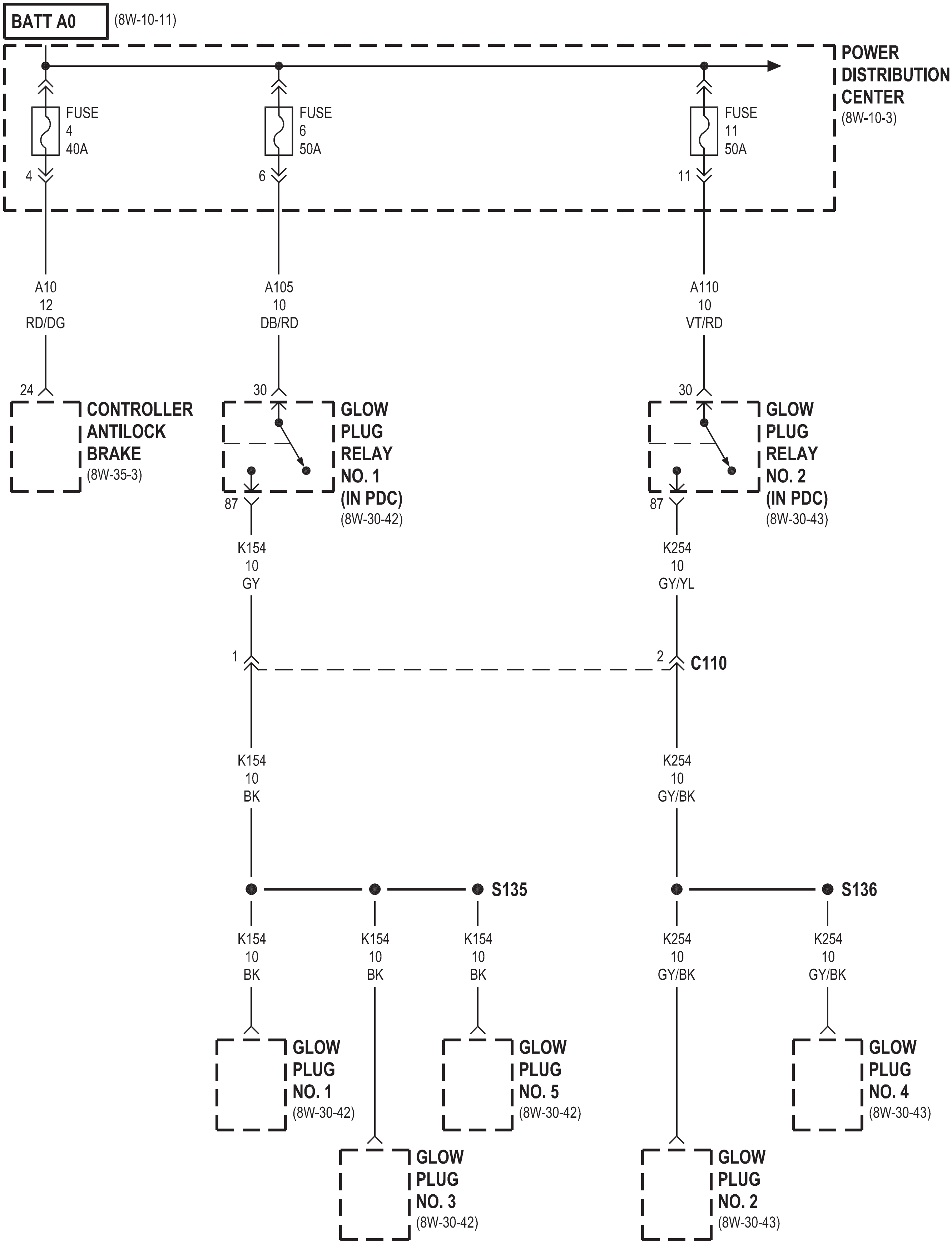

POWER DISTRIBUTION CENTER
(8W-10-2)
FROM FUSE 14 (PDC)
(8W-10-11)
A
FUSE 15 50A
(8W-10-30)
15
20
FUSE 18 15A
21
(8W-10-31)
22
FUSE 19 10A
23
(8W-10-19)
(8W-10-20)
A148 10 PK/WT
K
C106
A148 10 PK/WT
TO JUNCTION BLOCK
F62 18 RD
TO HORN RELAY (IN PDC)
F62 18 RD
TO HORN RELAY (IN PDC)
A7 14 RD/BK
EXCEPT 4.0L LHD
4.0L LHD
5
C102
5
C104
A7 14 RD/BK
TO POWERTRAIN CONTROL MODULE
27
FUSE 21 15A
26
(8W-10-32)
33
FUSE 24 20A
32
(8W-10-32)
34
FUSE 25 20A
35
(8W-10-32)
38
FUSE 27 20A
39
(8W-10-31)
A17 18 RD/BK
TO A/C COMPRESSOR CLUTCH RELAY (IN PDC)
RHD
LHD
A62 16 VT/WT
A62 16 VT/LB
TO FUEL PUMP RELAY (IN PDC)
A20 12 RD/DB
M
C106
A20 14 RD/DB
M
C107
A20 12 RD/DB
TO CONTROLLER ANTILOCK BRAKE
A148 16 LG/RD
B
C106
RHD
LHD
A148 16 LG/RD
4
C301
A148 16 LG/RD
TO REAR POWER OUTLET

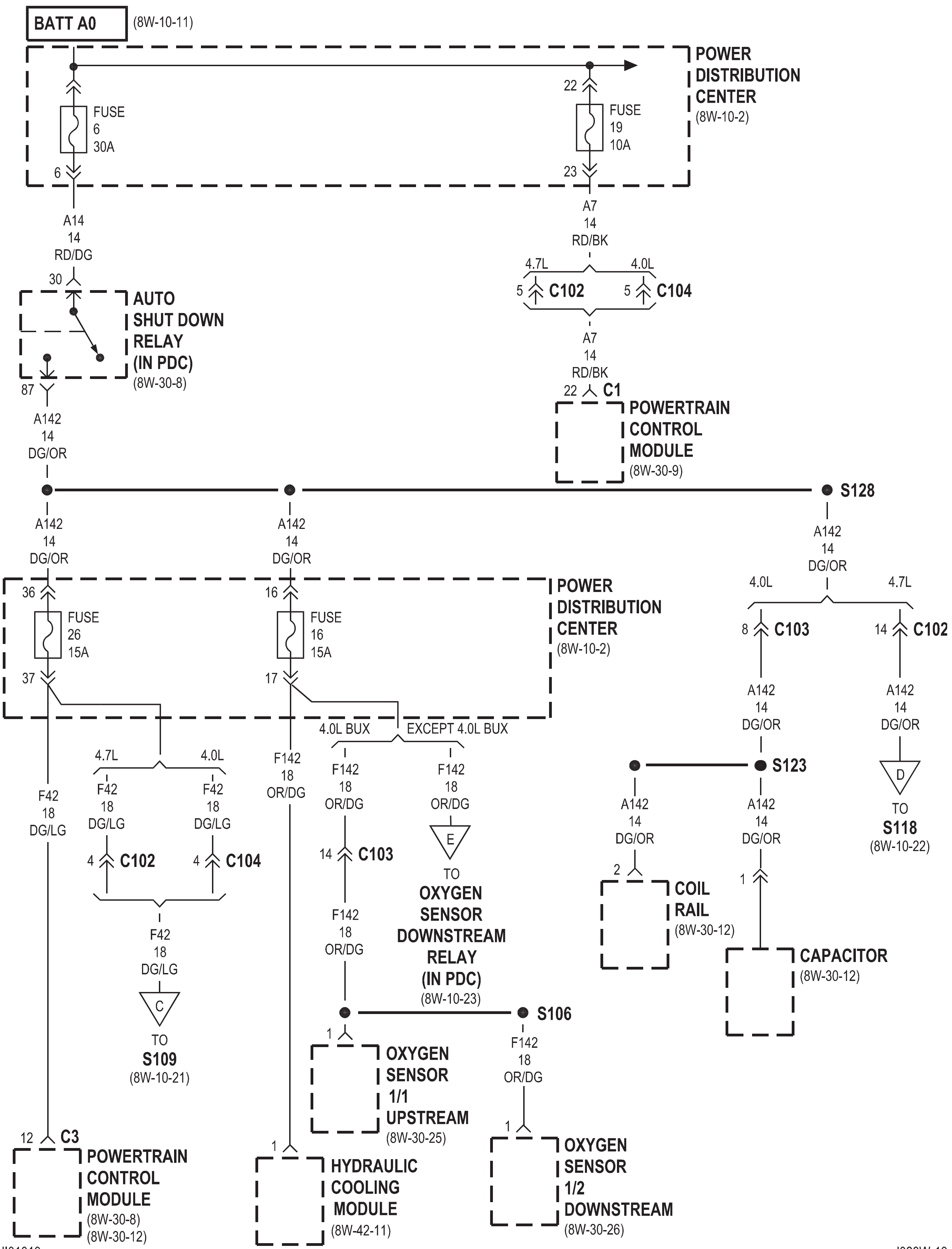

POWER
DISTRIBUTION
CENTER
(8W-10-3)
FROM
FUSE 12
(PDC)
(8W-10-12)
B
20
FUSE
13
40A
(8W-10-25)
13
FUSE
14
40A
(8W-10-27)
14
FUSE
15
50A
(8W-10-30)
15
FUSE
18
15A
(8W-10-31)
21
A14
14
RD/WT
A14
14
RD/WT
A2
12
PK/BK
L
A148
10
PK/WT
K
C107
A2
12
PK/BK
G
C200
A2
12
PK/BK
A148
10
PK/WT
F62
18
RD
F62
18
RD
TO
AUTO
SHUT
DOWN
RELAY
(IN PDC)
TO
AUTO
SHUT
DOWN
RELAY
(IN PDC)
TO
IGNITION
SWITCH
TO
JUNCTION
BLOCK
TO
HORN
RELAY
(IN PDC)
TO
HORN
RELAY
(IN PDC)
27
FUSE
21
15A
(8W-10-32)
26
27
FUSE
22
10A
(8W-10-31)
28
31
FUSE
23
15A
(8W-10-25)
30
34
FUSE
25
20A
(8W-10-32)
35
38
FUSE
27
20A
(8W-10-31)
39
A17
14
RD/BK
F300
18
RD/BK
2
C105
F300
20
RD/BK
A80
18
RD/LG
A20
12
RD/DB
A148
16
LG/RD
B
C107
LHD
RHD
A148
16
LG/RD
H
C301
TO
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
TO
ENGINE
CONTROL
MODULE
TO
VISCOUS/
CABIN
HEATER
RELAY
(IN PDC)
TO
CONTROLLER
ANTILOCK
BRAKE
TO
REAR
POWER
OUTLET

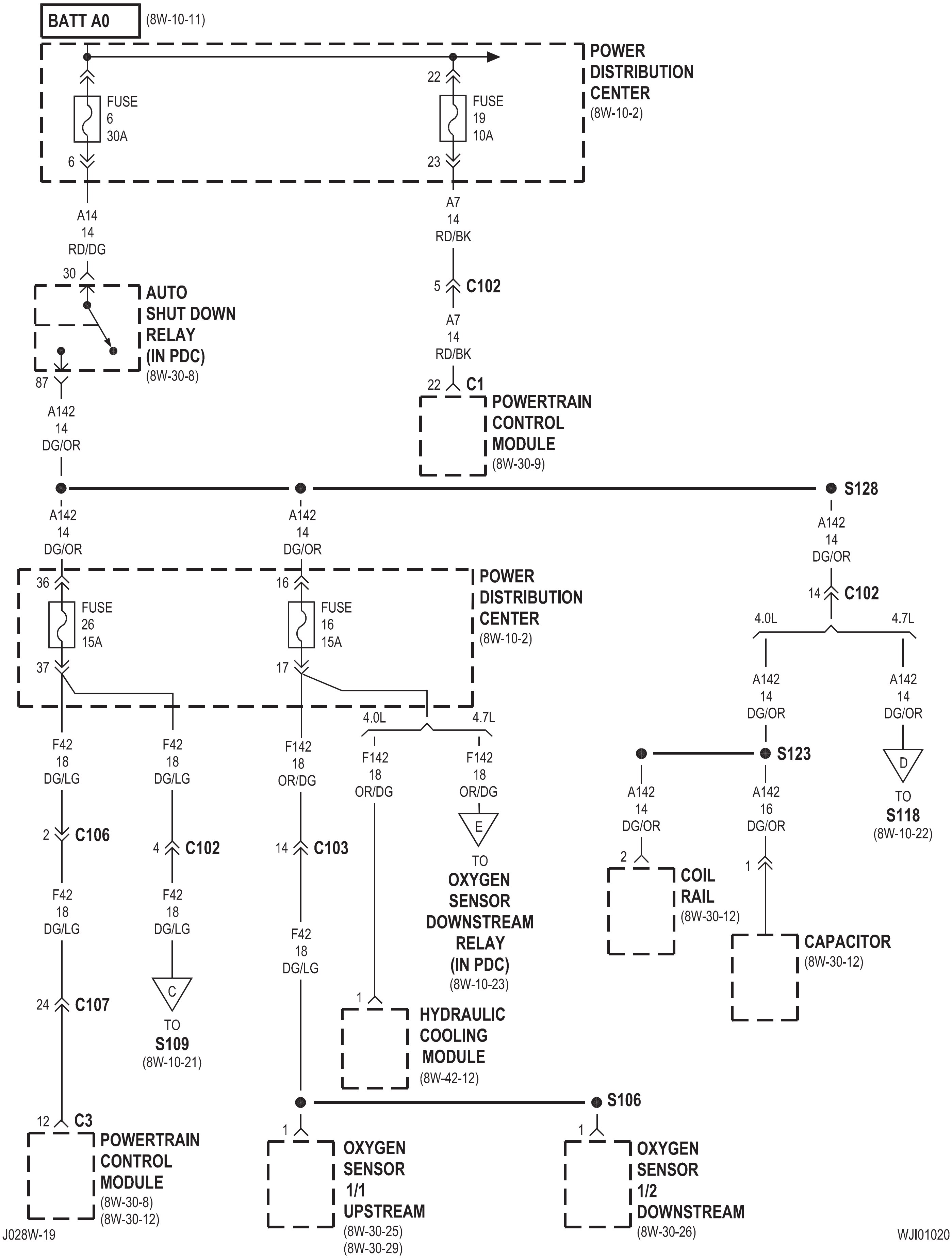

BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
FUSE
1
40A
FUSE
2
40A
C1
12
DG
A149
12
RD/TN
GAS
DIESEL
C106
C107
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
C5
REAR
WINDOW
DEFOGGER
RELAY
(8W-48-2)
CIGAR
LIGHTER
RELAY
(8W-41-4)
FUSE
11
10A
(8W-12-17)
FUSE
26
15A
(8W-12-17)
C200
C1
C15
12
BK/WT
RHD
LHD
C301
C308
S400
(8W-12-17)
F30
16
RD/TN
F30
14
RD/TN
EXCEPT
BUILT-UP-EXPORT
BUILT-UP-EXPORT
C310
NOT
USED
MTC
AZC
C202
C203
BLOWER
MOTOR
(8W-42-9)
BLOWER
MOTOR
CONTROLLER
(8W-42-6)
REAR
WINDOW
DEFOGGER
(8W-48-2)
TRAILER
TOW
CIRCUIT
BREAKER
(8W-54-4)
WJI01015
J028W-19

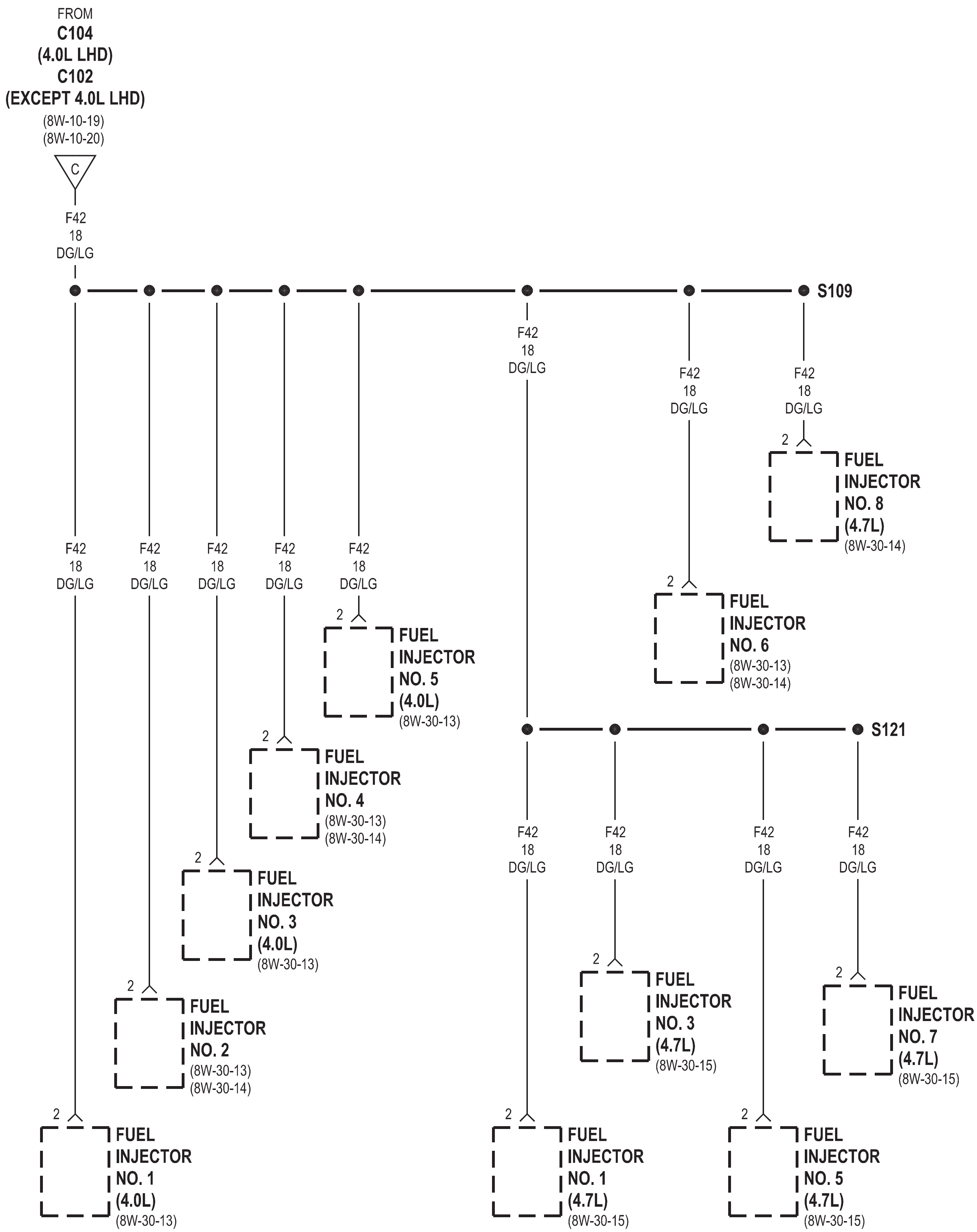

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 3 50A
3
A145 10 WT/RD
GAS
DIESEL
G C106
G C107
A145 10 WT/RD
1 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
30
HIGH BEAM RELAY (8W-50-4)
85
87
OTHER
DRL
30
LOW BEAM/ DAYTIME RUNNING LAMP RELAY (8W-50-13)
87
85
30
LOW BEAM RELAY (8W-50-4)
86
87
FUSE 16 10A (8W-12-10)
FUSE 3 10A (8W-12-10)
FUSE 15 10A (8W-12-20)
FUSE 14 10A (8W-12-20)
FUSE 6 15A (8W-12-12) (8W-12-13)
FUSE 17 10A (8W-12-10)
87A
87
85
PARK LAMP RELAY (8W-50-6)
30
86


BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
4
40A
FUSE
5
30A
FUSE
28
15A
(4.0L)
40
41
4
5
A10
12
RD/DG
A30
14
RD/WT
A30
14
RD/WT
T15
18
YL/BR
12 C103
T15
18
LG
1
TRANSMISSION
SOLENOID
(4.0L)
(8W-31-8)
30
TRANSMISSION
CONTROL
RELAY
(IN PDC)
(8W-31-2)
(8W-31-3)
87
T16
14
RD
4.7L
4.0L
E C106
1 C102
T16
14
RD
LHD
RHD
A10
12
RD/DG
A10
10
RD/DG
A30
14
RD/WT
9 C103
T16
14
RD
S115
(4.7L)
E C107
T16
14
RD
T16
14
RD
T16
14
RD
T16
14
RD
A10
12
RD/DG
56
16
17
36
TRANSMISSION
CONTROL
MODULE
(4.7L)
(8W-31-3)
(8W-31-18)
10
TRANSMISSION
SOLENOID/
TRS
ASSEMBLY
(8W-31-11)
(8W-31-12)
24
CONTROLLER
ANTILOCK
BRAKE
(8W-35-2)

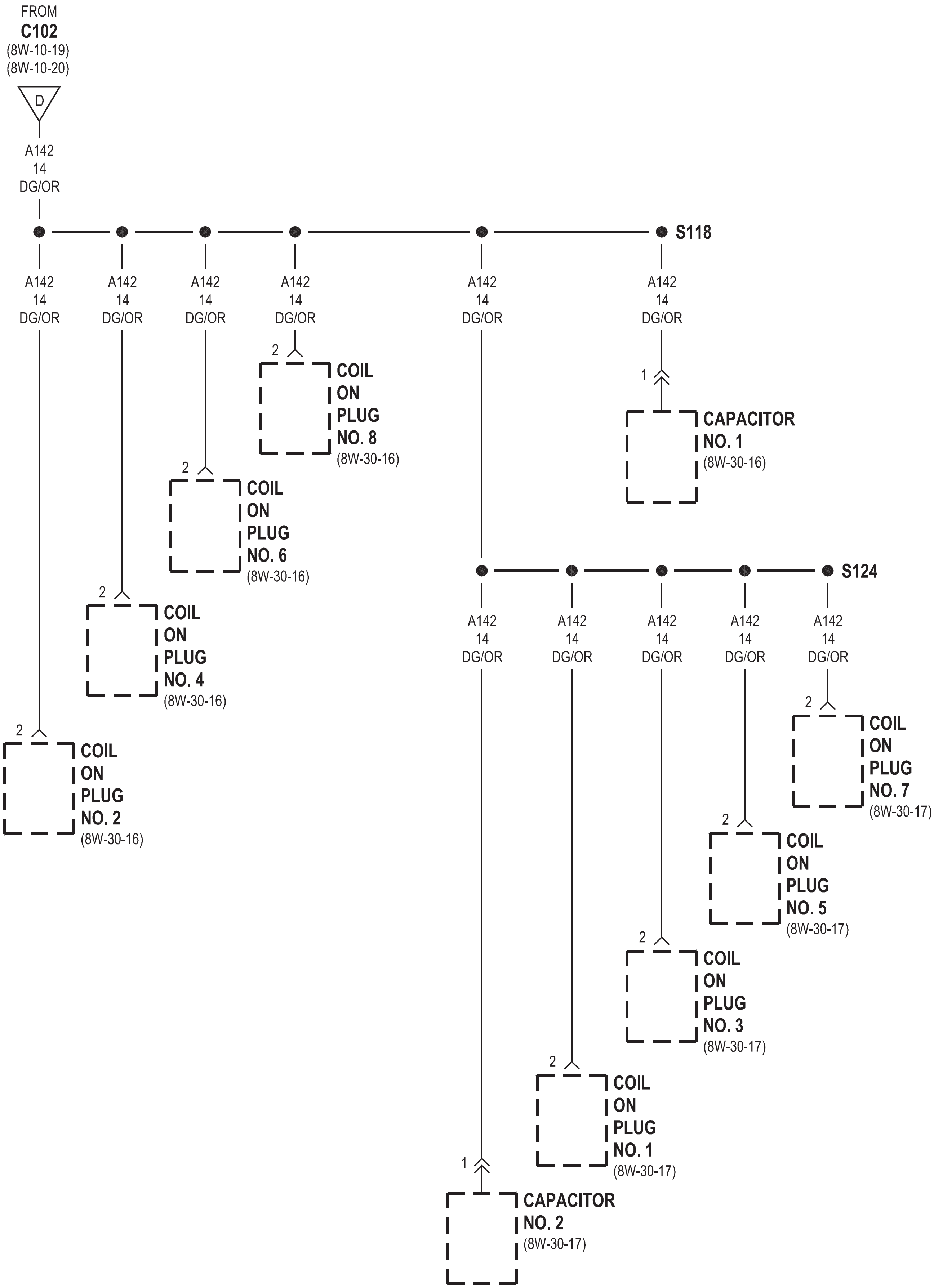

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 4 40A
FUSE 6 50A
FUSE 11 50A
4
6
11
A10 12 RD/DG
A105 10 DB/RD
A110 10 VT/RD
24
CONTROLLER ANTILOCK BRAKE
(8W-35-3)
30
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-42)
GLOW PLUG RELAY NO. 2 (IN PDC)
(8W-30-43)
87
K154 10 GY
K254 10 GY/YL
1
2
C110
K154 10 BK
K254 10 GY/BK
S135
S136
GLOW PLUG NO. 1
(8W-30-42)
GLOW PLUG NO. 5
(8W-30-42)
GLOW PLUG NO. 4
(8W-30-43)
GLOW PLUG NO. 3
(8W-30-42)
GLOW PLUG NO. 2
(8W-30-43)

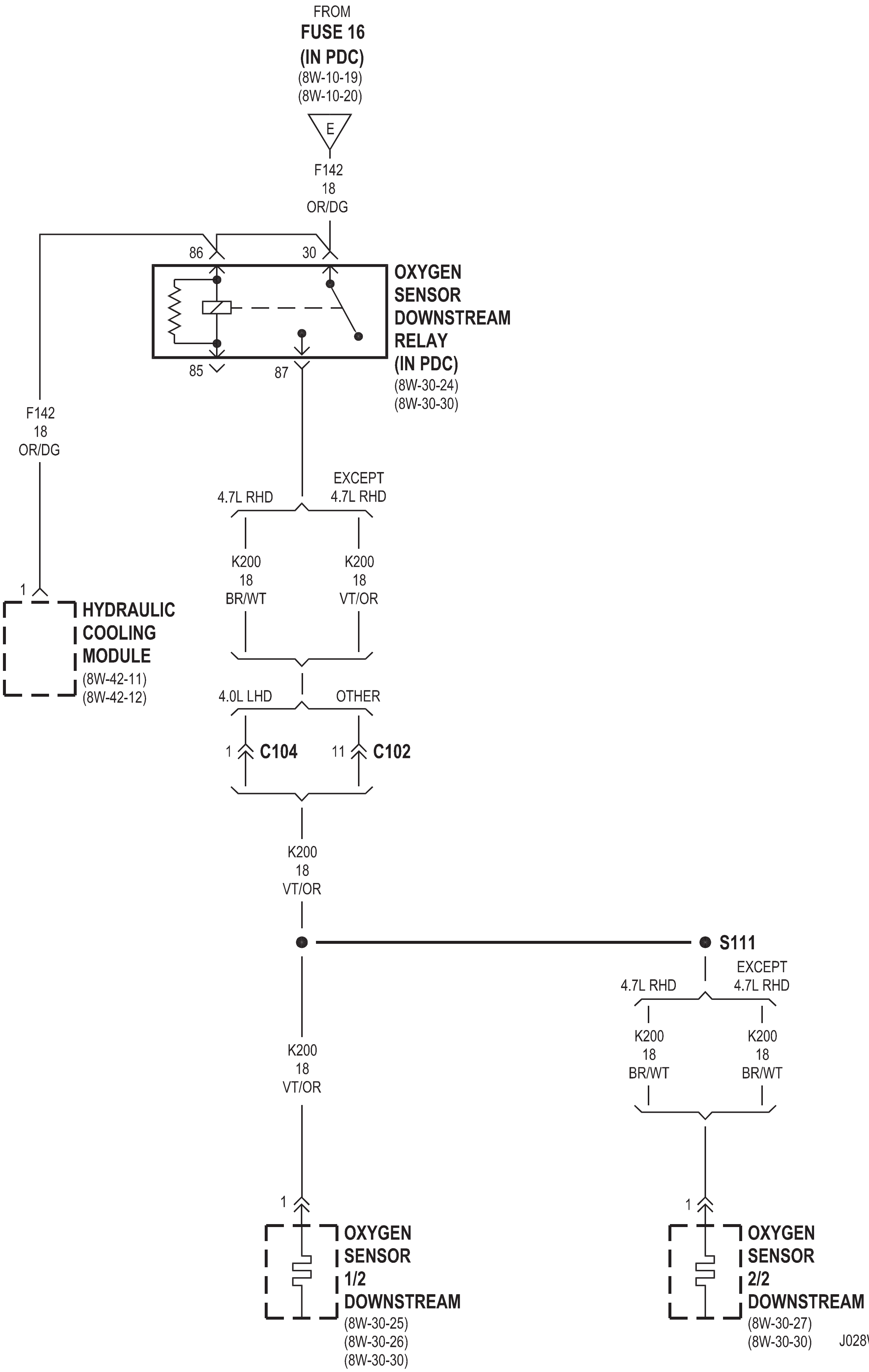

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A
FUSE 19 10A
A14 14 RD/DG
A7 14 RD/BK
4.7L
4.0L
C102
C104
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-8)
C1
POWERTRAIN CONTROL MODULE
(8W-30-9)
A142 14 DG/OR
S128
FUSE 26 15A
FUSE 16 15A
C103
4.0L BUX
EXCEPT 4.0L BUX
F42 18 DG/LG
F142 18 OR/DG
S123
TO S118
(8W-10-22)
TO OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
(8W-10-23)
COIL RAIL
(8W-30-12)
CAPACITOR
(8W-30-12)
TO S109
(8W-10-21)
S106
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-25)
C3
POWERTRAIN CONTROL MODULE
(8W-30-8)
(8W-30-12)
HYDRAULIC COOLING MODULE
(8W-42-11)
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-26)

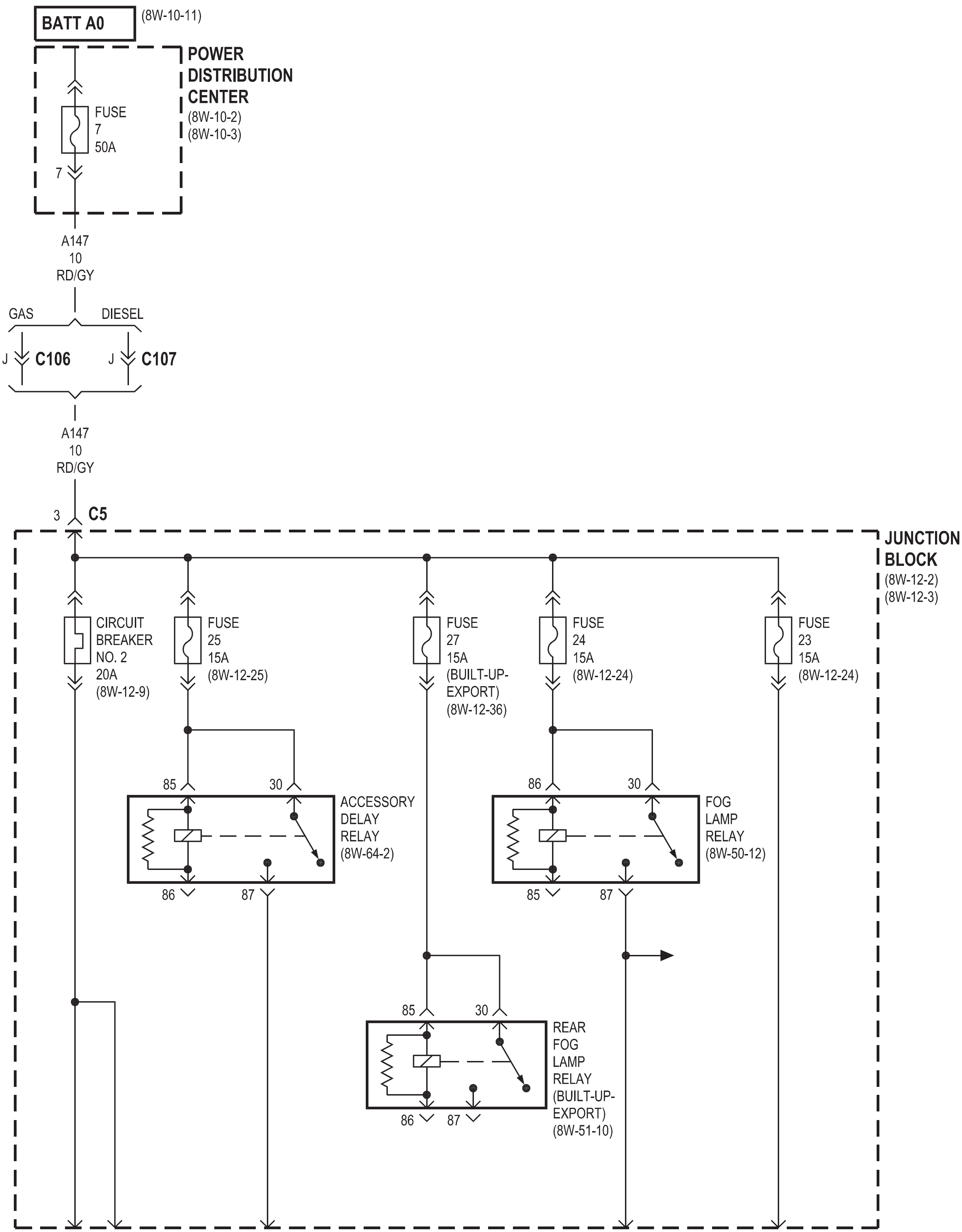

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A
6
FUSE 19 10A
22
23
A14 14 RD/DG
30
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-8)
87
A142 14 DG/OR
A7 14 RD/BK
5 C102
A7 14 RD/BK
22 C1
POWERTRAIN CONTROL MODULE
(8W-30-9)
S128
A142 14 DG/OR
A142 14 DG/OR
A142 14 DG/OR
14 C102
4.0L
4.7L
POWER DISTRIBUTION CENTER
(8W-10-2)
36
FUSE 26 15A
37
16
FUSE 16 15A
17
A142 14 DG/OR
A142 14 DG/OR
4.0L
4.7L
F42 18 DG/LG
F42 18 DG/LG
F142 18 OR/DG
F142 18 OR/DG
F142 18 OR/DG
S123
A142 14 DG/OR
A142 16 DG/OR
D
TO S118
(8W-10-22)
2 C106
4 C102
14 C103
E
TO OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
(8W-10-23)
2
COIL RAIL
(8W-30-12)
1
CAPACITOR
(8W-30-12)
F42 18 DG/LG
F42 18 DG/LG
F42 18 DG/LG
C
TO S109
(8W-10-21)
24 C107
1
HYDRAULIC COOLING MODULE
(8W-42-12)
S106
12 C3
POWERTRAIN CONTROL MODULE
(8W-30-8)
(8W-30-12)
1
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-25)
(8W-30-29)
1
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-26)
J028W-19
WJI01020


FROM
C104
(4.0L LHD)
C102
(EXCEPT 4.0L LHD)
(8W-10-19)
(8W-10-20)
C
F42
18
DG/LG
S109
S121
2
FUEL
INJECTOR
NO. 8
(4.7L)
(8W-30-14)
FUEL
INJECTOR
NO. 6
(8W-30-13)
(8W-30-14)
FUEL
INJECTOR
NO. 5
(4.0L)
(8W-30-13)
FUEL
INJECTOR
NO. 4
(8W-30-13)
(8W-30-14)
FUEL
INJECTOR
NO. 3
(4.0L)
(8W-30-13)
FUEL
INJECTOR
NO. 2
(8W-30-13)
(8W-30-14)
FUEL
INJECTOR
NO. 1
(4.0L)
(8W-30-13)
FUEL
INJECTOR
NO. 3
(4.7L)
(8W-30-15)
FUEL
INJECTOR
NO. 7
(4.7L)
(8W-30-15)
FUEL
INJECTOR
NO. 1
(4.7L)
(8W-30-15)
FUEL
INJECTOR
NO. 5
(4.7L)
(8W-30-15)

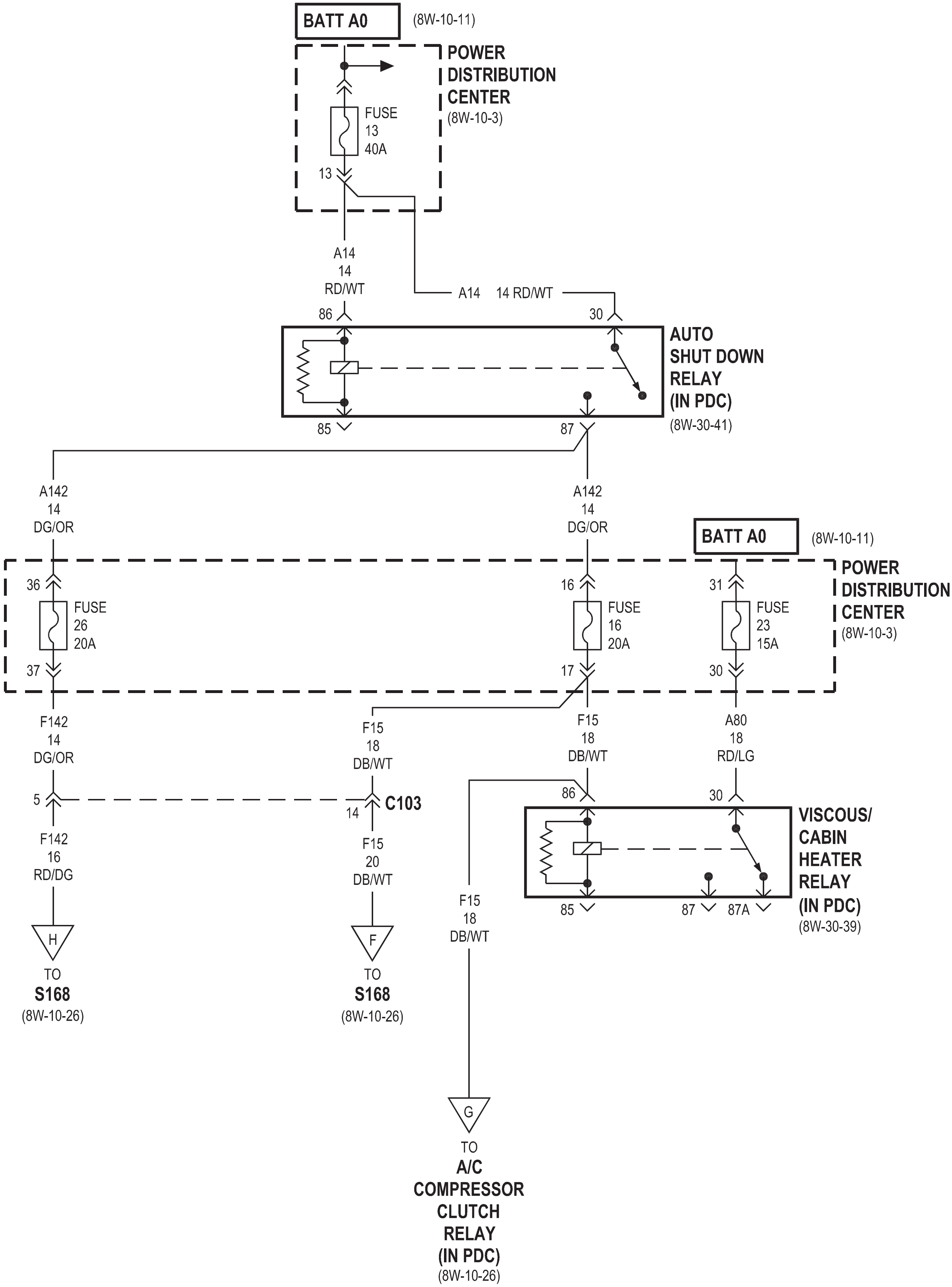
4.7L


FROM
C102
(8W-10-19)
(8W-10-20)
D
A142
14
DG/OR
S118
A142
14
DG/OR
2
COIL
ON
PLUG
NO. 8
(8W-30-16)
COIL
ON
PLUG
NO. 6
(8W-30-16)
COIL
ON
PLUG
NO. 4
(8W-30-16)
COIL
ON
PLUG
NO. 2
(8W-30-16)
1
CAPACITOR
NO. 1
(8W-30-16)
S124
COIL
ON
PLUG
NO. 7
(8W-30-17)
COIL
ON
PLUG
NO. 5
(8W-30-17)
COIL
ON
PLUG
NO. 3
(8W-30-17)
COIL
ON
PLUG
NO. 1
(8W-30-17)
CAPACITOR
NO. 2
(8W-30-17)

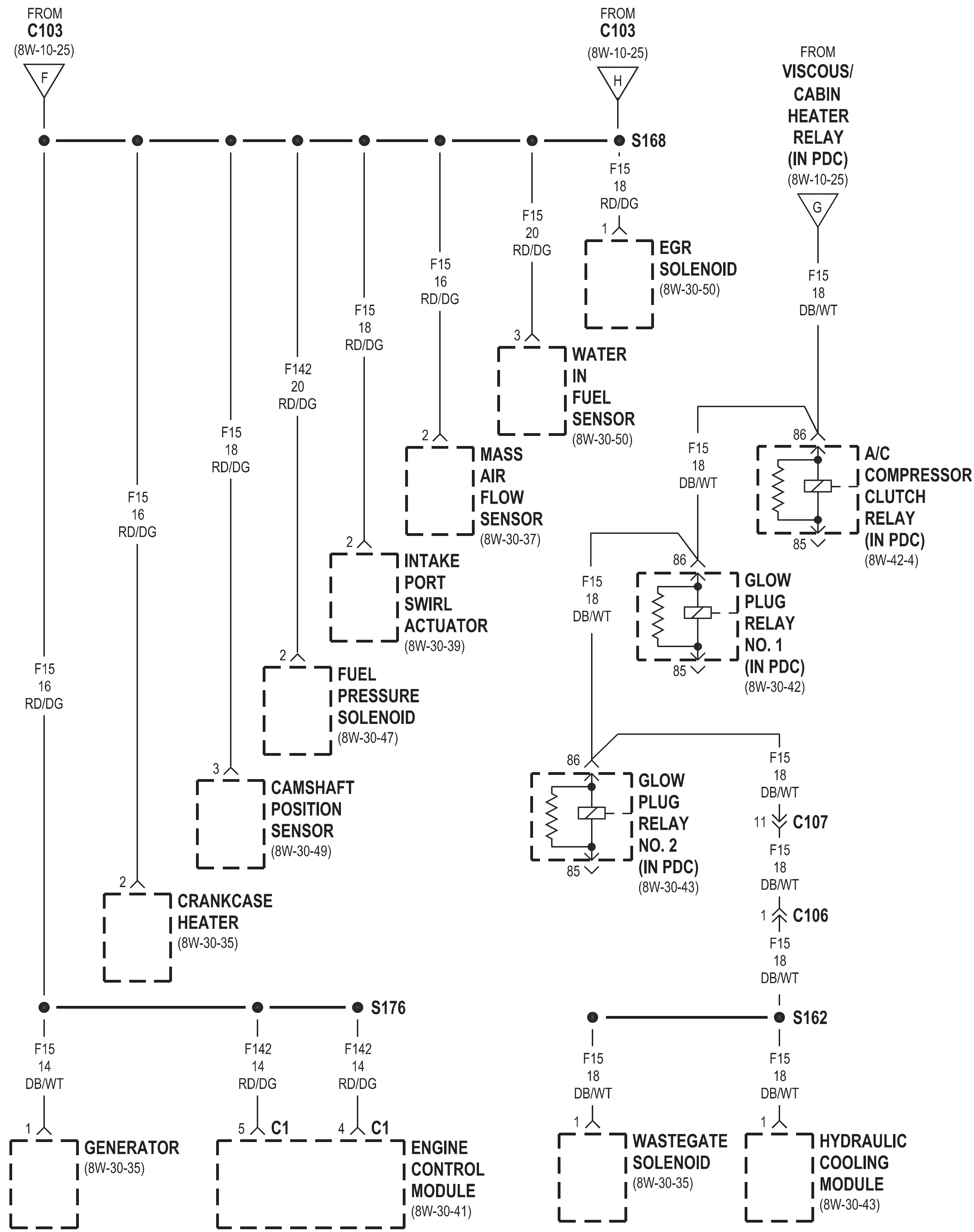

FROM
FUSE 16
(IN PDC)
(8W-10-19)
(8W-10-20)
E
F142
18
OR/DG
86
30
OXYGEN
SENSOR
DOWNSTREAM
RELAY
(IN PDC)
(8W-30-24)
(8W-30-30)
85
87
F142
18
OR/DG
4.7L RHD
EXCEPT
4.7L RHD
K200
18
BR/WT
K200
18
VT/OR
1
HYDRAULIC
COOLING
MODULE
(8W-42-11)
(8W-42-12)
4.0L LHD
OTHER
1
C104
11
C102
K200
18
VT/OR
S111
4.7L RHD
EXCEPT
4.7L RHD
K200
18
VT/OR
K200
18
BR/WT
K200
18
BR/WT
1
OXYGEN
SENSOR
1/2
DOWNSTREAM
(8W-30-25)
(8W-30-26)
(8W-30-30)
1
OXYGEN
SENSOR
2/2
DOWNSTREAM
(8W-30-27)
(8W-30-30)

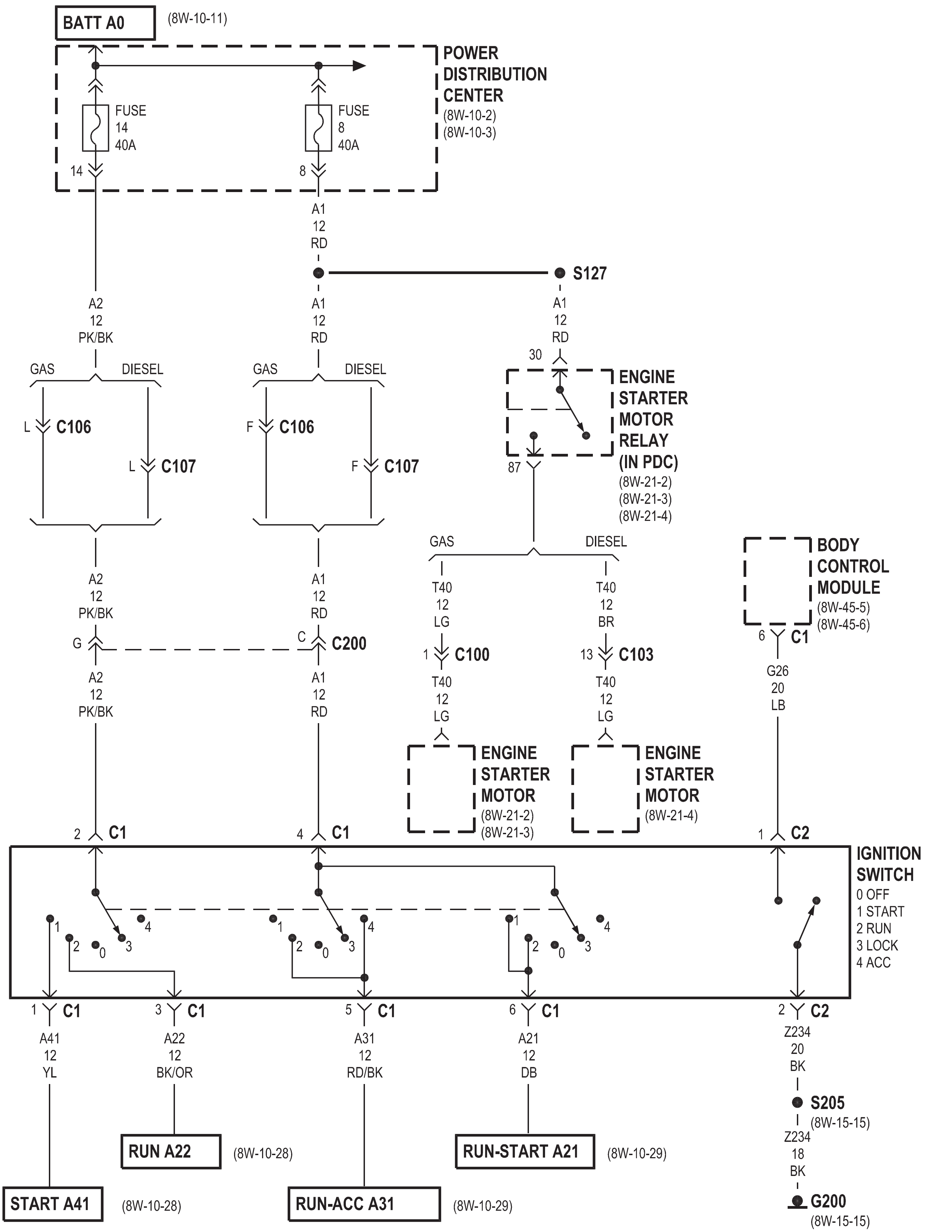

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 7 50A
7
A147 10 RD/GY
GAS
DIESEL
J C106
J C107
A147 10 RD/GY
3 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A (8W-12-9)
FUSE 25 15A (8W-12-25)
FUSE 27 15A (BUILT-UP-EXPORT) (8W-12-36)
FUSE 24 15A (8W-12-24)
FUSE 23 15A (8W-12-24)
85
30
86
87
ACCESSORY DELAY RELAY (8W-64-2)
86
30
85
87
FOG LAMP RELAY (8W-50-12)
85
30
86
87
REAR FOG LAMP RELAY (BUILT-UP-EXPORT) (8W-51-10)

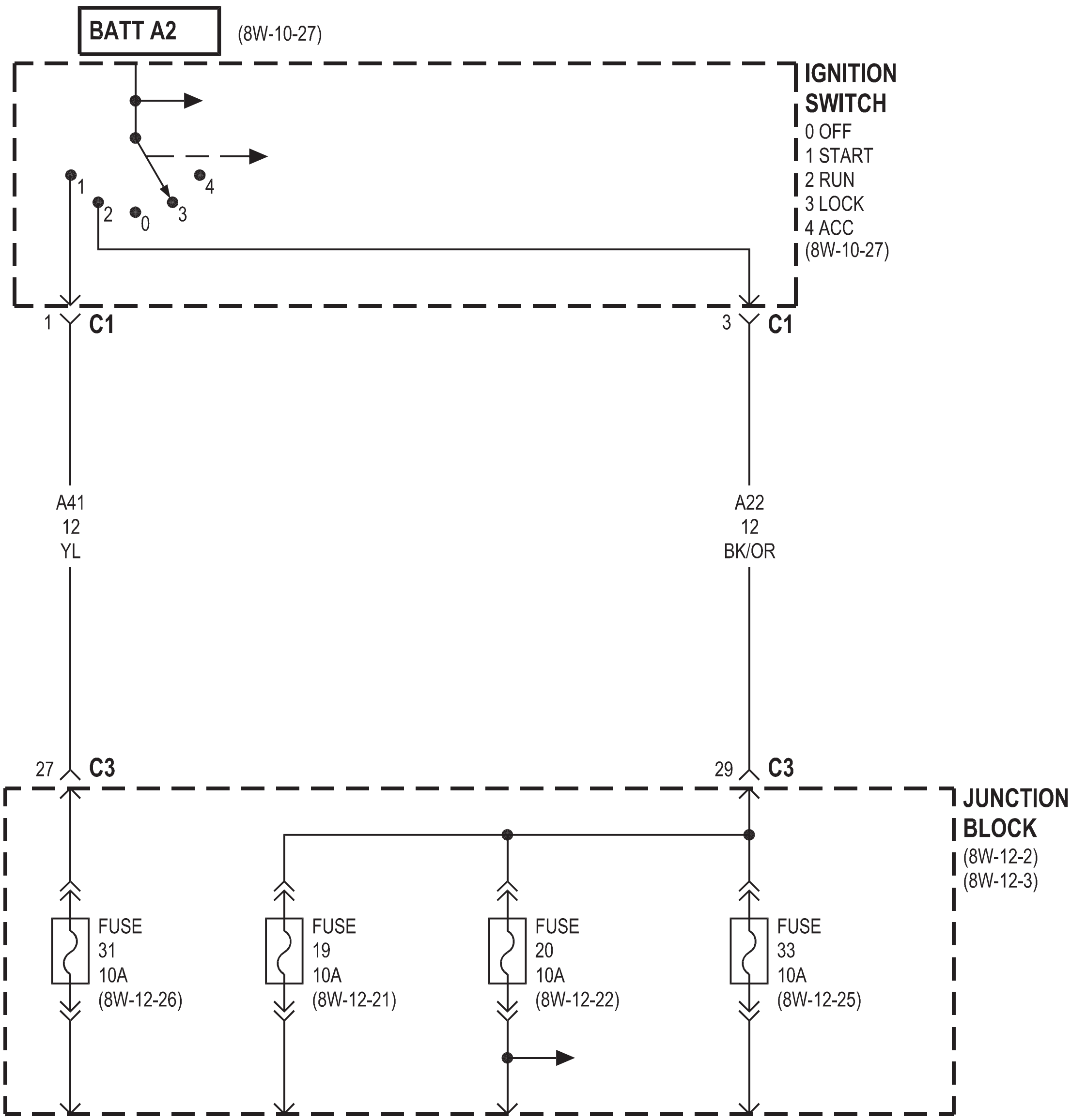
DIESEL



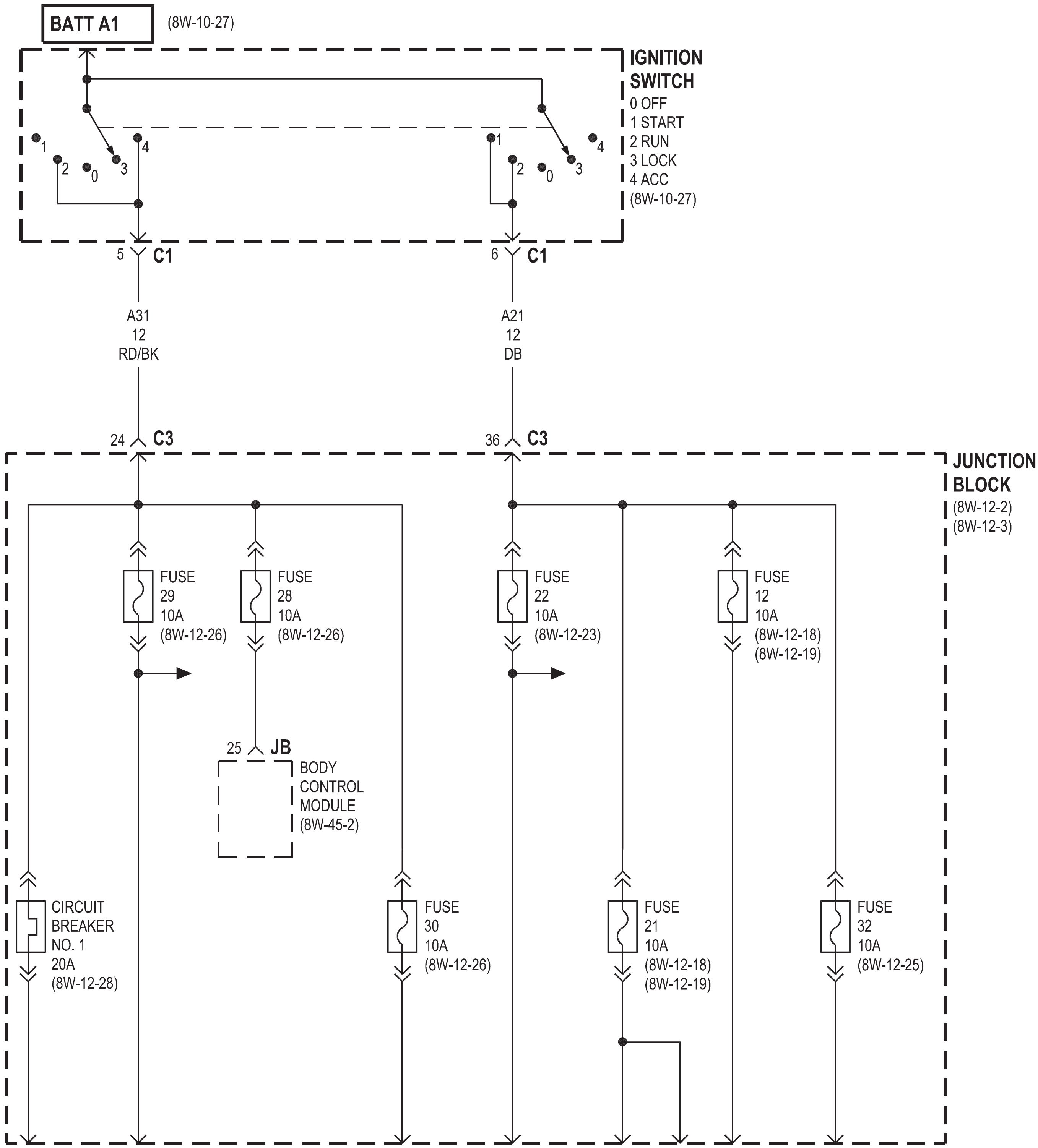
BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-3)
FUSE
13
40A
13
A14
14
RD/WT
A14 14 RD/WT
86
30
AUTO
SHUT DOWN
RELAY
(IN PDC)
(8W-30-41)
85
87
A142
14
DG/OR
A142
14
DG/OR
BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-3)
36
FUSE
26
20A
37
16
FUSE
16
20A
17
31
FUSE
23
15A
30
F142
14
DG/OR
F15
18
DB/WT
F15
18
DB/WT
A80
18
RD/LG
5
C103
14
86
30
VISCOUS/
CABIN
HEATER
RELAY
(IN PDC)
(8W-30-39)
85
87
87A
F142
16
RD/DG
F15
20
DB/WT
F15
18
DB/WT
H
TO
S168
(8W-10-26)
F
TO
S168
(8W-10-26)
G
TO
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-10-26)

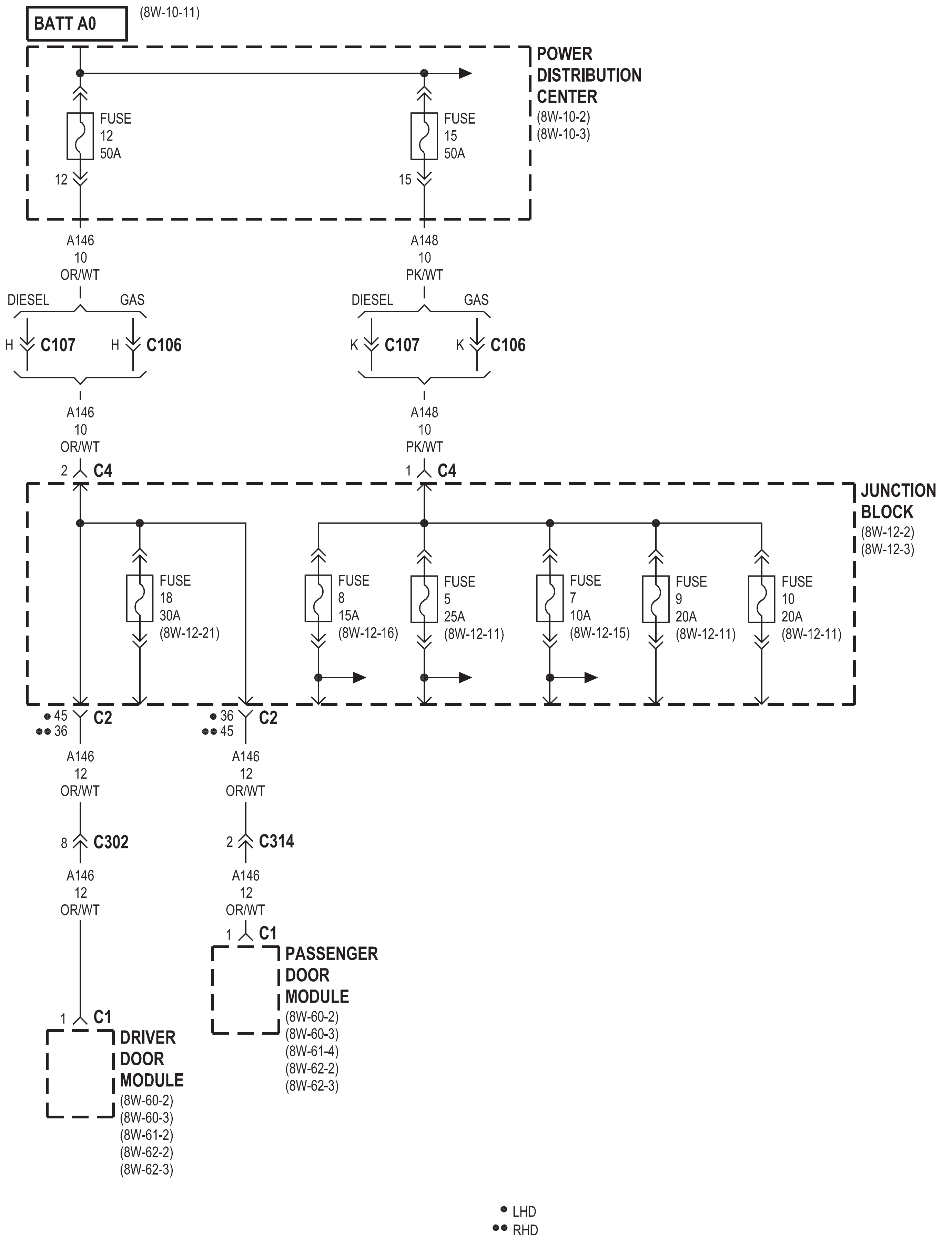

FROM
C103
(8W-10-25)
F
FROM
C103
(8W-10-25)
H
FROM
VISCOUS/
CABIN
HEATER
RELAY
(IN PDC)
(8W-10-25)
G
S168
F15
18
RD/DG
1
EGR
SOLENOID
(8W-30-50)
F15
20
RD/DG
3
WATER
IN
FUEL
SENSOR
(8W-30-50)
F15
16
RD/DG
2
MASS
AIR
FLOW
SENSOR
(8W-30-37)
F15
18
RD/DG
2
INTAKE
PORT
SWIRL
ACTUATOR
(8W-30-39)
F142
20
RD/DG
2
FUEL
PRESSURE
SOLENOID
(8W-30-47)
F15
18
RD/DG
3
CAMSHAFT
POSITION
SENSOR
(8W-30-49)
F15
16
RD/DG
2
CRANKCASE
HEATER
(8W-30-35)
F15
16
RD/DG
F15
18
DB/WT
86
85
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-42-4)
F15
18
DB/WT
86
85
GLOW
PLUG
RELAY
NO. 1
(IN PDC)
(8W-30-42)
F15
18
DB/WT
86
85
GLOW
PLUG
RELAY
NO. 2
(IN PDC)
(8W-30-43)
F15
18
DB/WT
11
C107
F15
18
DB/WT
1
C106
F15
18
DB/WT
S162
F15
18
DB/WT
1
WASTEGATE
SOLENOID
(8W-30-35)
F15
18
DB/WT
1
HYDRAULIC
COOLING
MODULE
(8W-30-43)
S176
F15
14
DB/WT
1
GENERATOR
(8W-30-35)
F142
14
RD/DG
5
C1
F142
14
RD/DG
4
C1
ENGINE
CONTROL
MODULE
(8W-30-41)

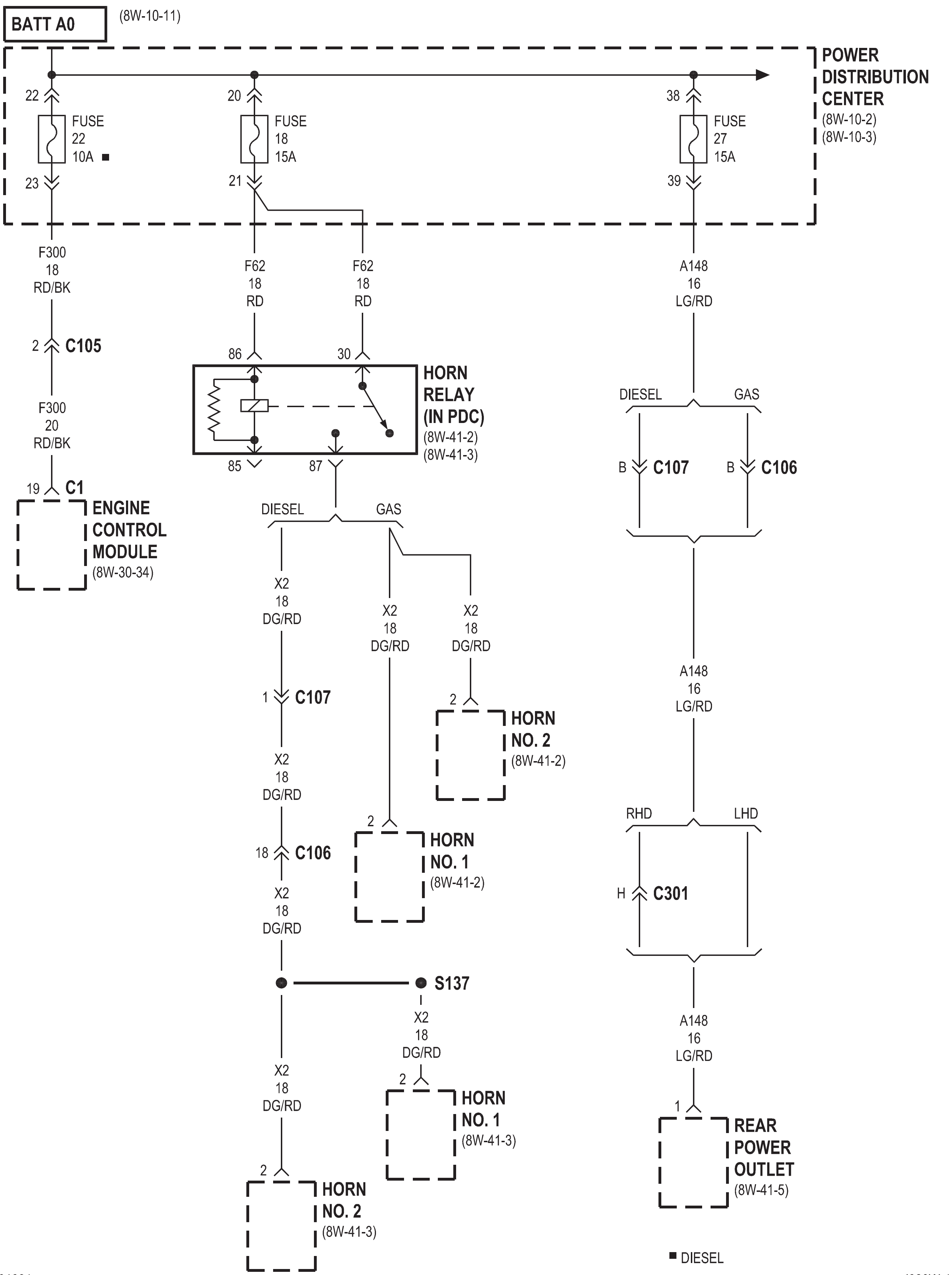

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 14 40A
FUSE 8 40A
14
8
A1 12 RD
S127
A2 12 PK/BK
A1 12 RD
A1 12 RD
30
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
(8W-21-4)
87
GAS
DIESEL
L C106
L C107
F C106
F C107
GAS
DIESEL
T40 12 LG
T40 12 BR
1 C100
13 C103
T40 12 LG
T40 12 LG
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
6 C1
G26 20 LB
A2 12 PK/BK
A1 12 RD
G
C C200
A2 12 PK/BK
A1 12 RD
ENGINE STARTER MOTOR
(8W-21-2)
(8W-21-3)
ENGINE STARTER MOTOR
(8W-21-4)
2 C1
4 C1
1 C2
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
1 C1
3 C1
5 C1
6 C1
2 C2
A41 12 YL
A22 12 BK/OR
A31 12 RD/BK
A21 12 DB
Z234 20 BK
S205
(8W-15-15)
Z234 18 BK
RUN A22
(8W-10-28)
RUN-START A21
(8W-10-29)
START A41
(8W-10-28)
RUN-ACC A31
(8W-10-29)
G200
(8W-15-15)



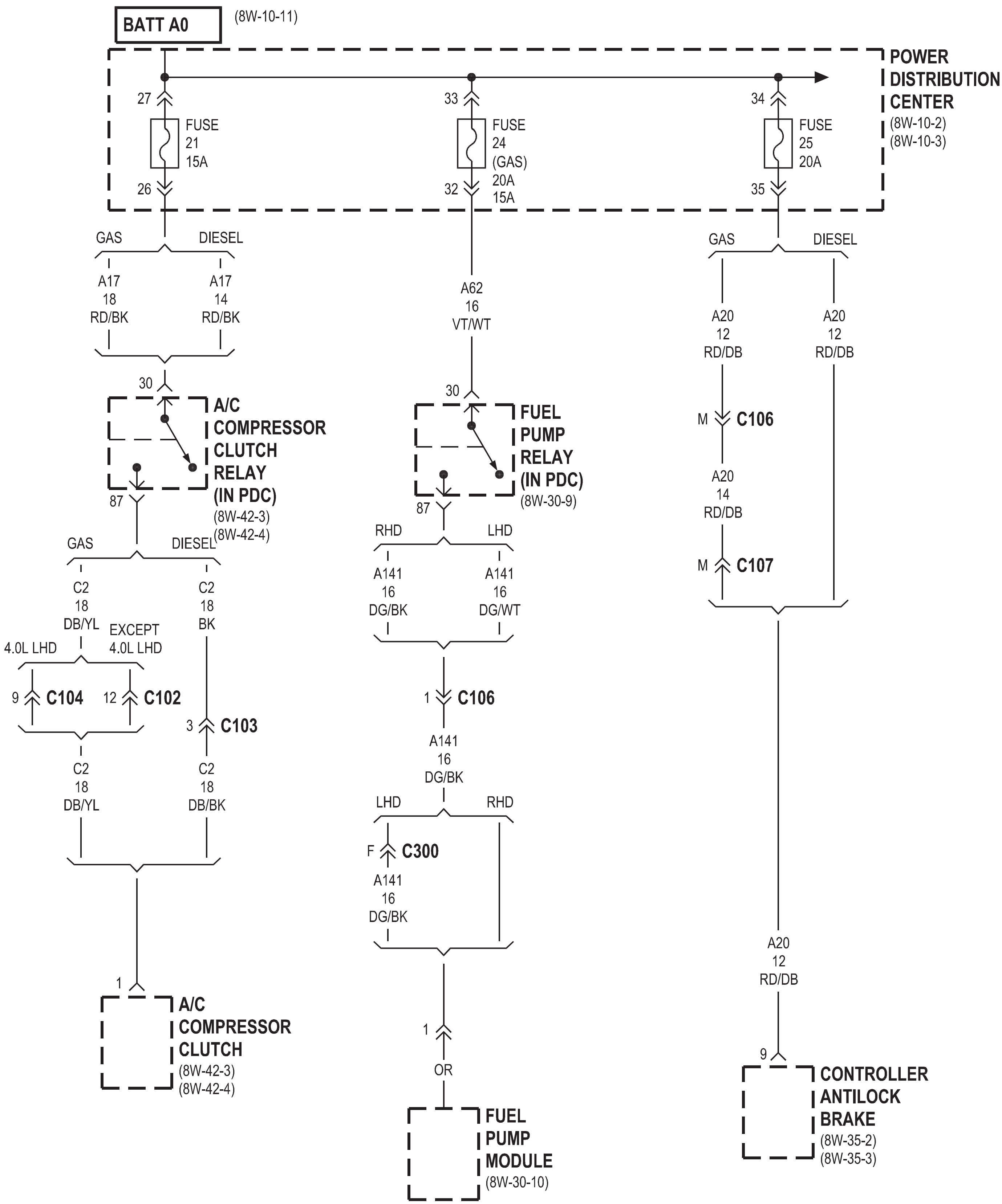
BATT A2
(8W-10-27)
IGNITION
SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-27)
1
2
0
3
4
1 C1
3 C1
A41
12
YL
A22
12
BK/OR
27 C3
29 C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
31
10A
(8W-12-26)
FUSE
19
10A
(8W-12-21)
FUSE
20
10A
(8W-12-22)
FUSE
33
10A
(8W-12-25)


BATT A1
(8W-10-27)
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-27)
5 C1
6 C1
A31
12
RD/BK
A21
12
DB
24 C3
36 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
29
10A
(8W-12-26)
FUSE
28
10A
(8W-12-26)
FUSE
22
10A
(8W-12-23)
FUSE
12
10A
(8W-12-18)
(8W-12-19)
25 JB
BODY CONTROL MODULE
(8W-45-2)
CIRCUIT BREAKER NO. 1
20A
(8W-12-28)
FUSE
30
10A
(8W-12-26)
FUSE
21
10A
(8W-12-18)
(8W-12-19)
FUSE
32
10A
(8W-12-25)

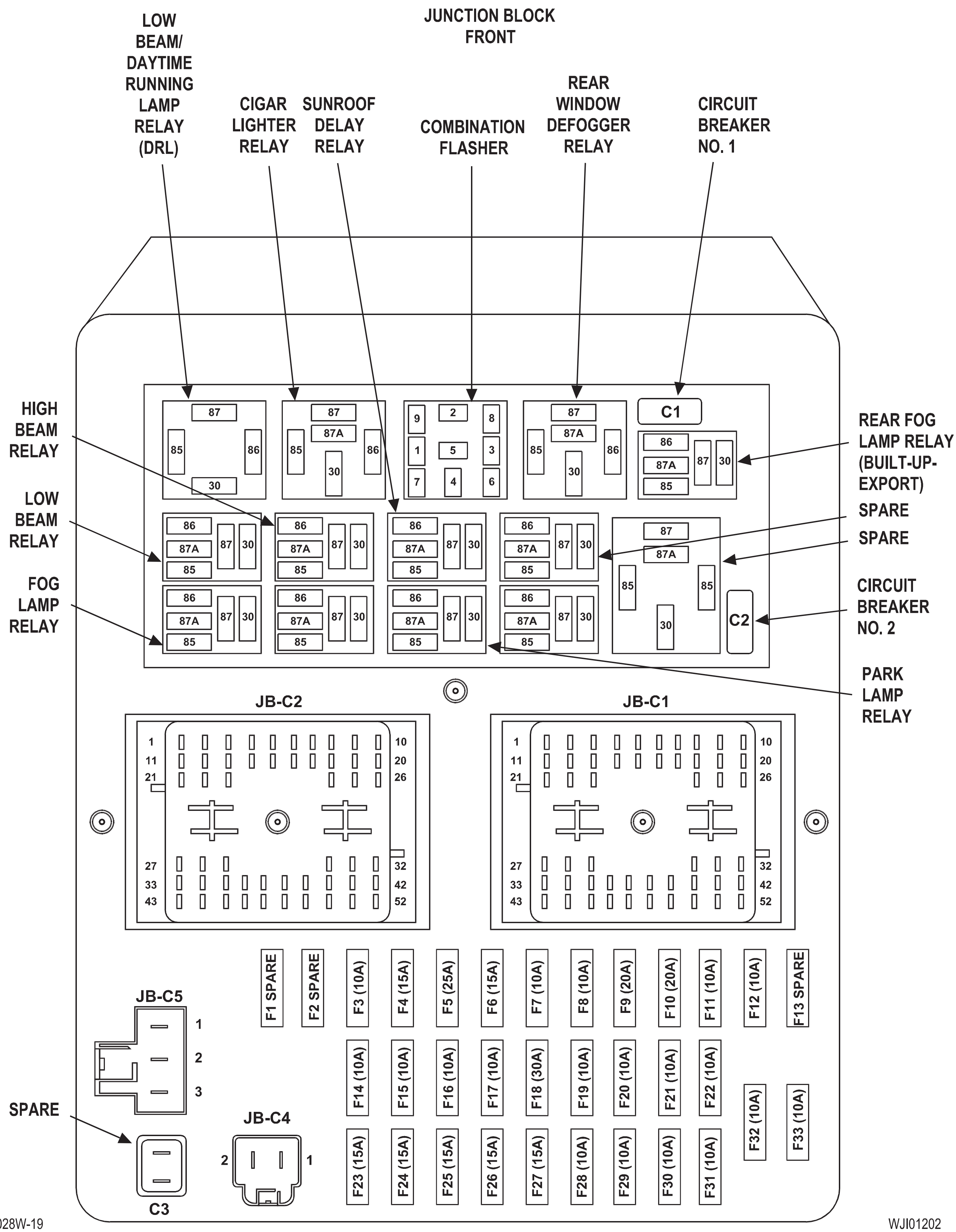

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 12 50A
FUSE 15 50A
12
15
A146 10 OR/WT
A148 10 PK/WT
DIESEL
GAS
H C107
H C106
K C107
K C106
A146 10 OR/WT
A148 10 PK/WT
2 C4
1 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 18 30A (8W-12-21)
FUSE 8 15A (8W-12-16)
FUSE 5 25A (8W-12-11)
FUSE 7 10A (8W-12-15)
FUSE 9 20A (8W-12-11)
FUSE 10 20A (8W-12-11)
● 45
●● 36
C2
● 36
●● 45
C2
A146 12 OR/WT
A146 12 OR/WT
8 C302
2 C314
A146 12 OR/WT
A146 12 OR/WT
1 C1
PASSENGER DOOR MODULE
(8W-60-2)
(8W-60-3)
(8W-61-4)
(8W-62-2)
(8W-62-3)
1 C1
DRIVER DOOR MODULE
(8W-60-2)
(8W-60-3)
(8W-61-2)
(8W-62-2)
(8W-62-3)
● LHD
●● RHD



BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 22 10A ■
FUSE 18 15A
FUSE 27 15A
22
23
20
21
38
39
F300 18 RD/BK
C105
F300 20 RD/BK
C1
ENGINE CONTROL MODULE
(8W-30-34)
F62 18 RD
F62 18 RD
86
30
85
87
HORN RELAY (IN PDC)
(8W-41-2)
(8W-41-3)
DIESEL
GAS
X2 18 DG/RD
C107
C106
HORN NO. 2
(8W-41-2)
HORN NO. 1
(8W-41-2)
S137
HORN NO. 1
(8W-41-3)
HORN NO. 2
(8W-41-3)
A148 16 LG/RD
B C107
B C106
RHD
LHD
H C301
REAR POWER OUTLET
(8W-41-5)
■ DIESEL

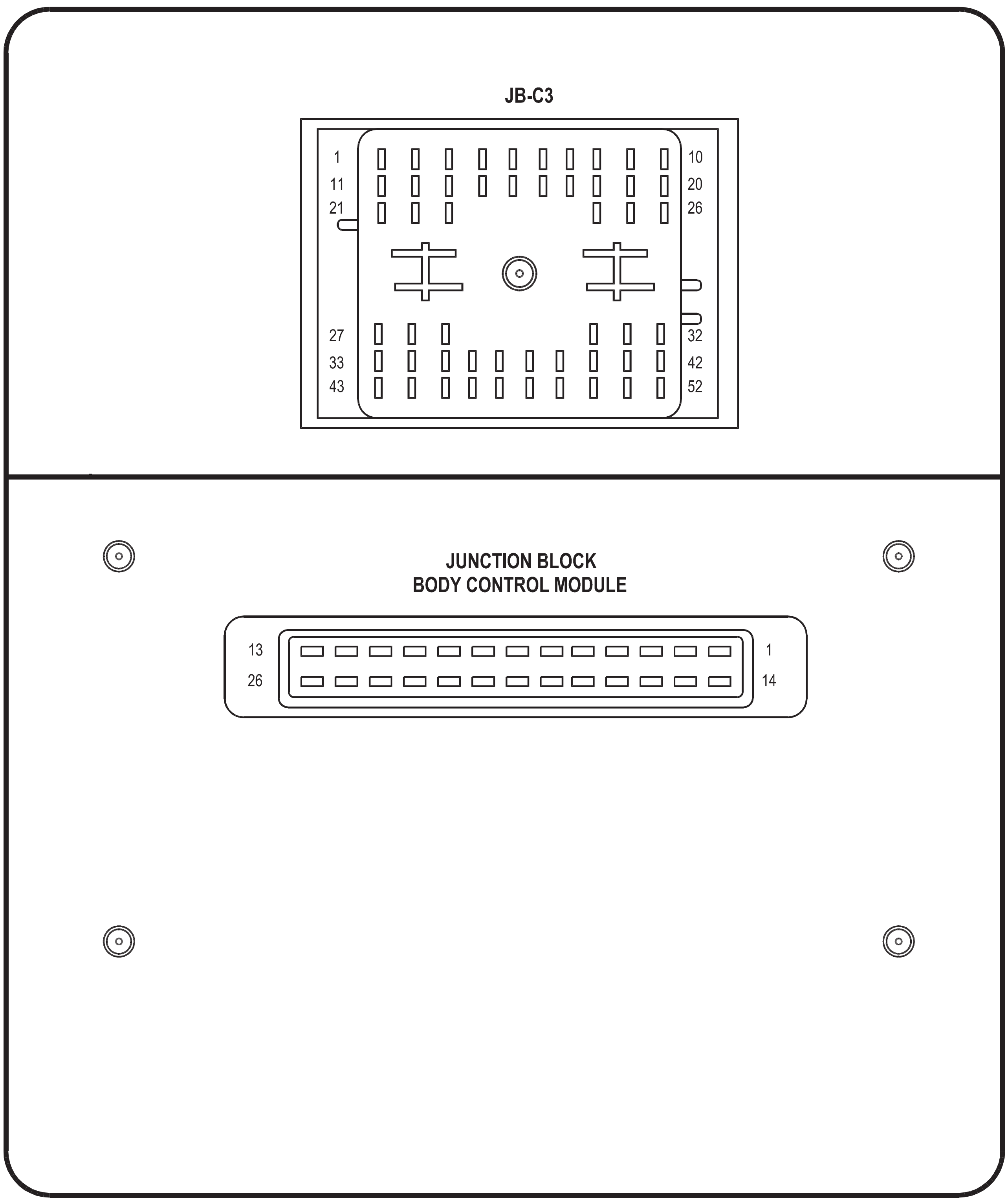

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
27
FUSE 21 15A
26
33
FUSE 24 (GAS) 20A 15A
32
34
FUSE 25 20A
35
GAS
DIESEL
A17 18 RD/BK
A17 14 RD/BK
A62 16 VT/WT
A20 12 RD/DB
A20 12 RD/DB
30
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-3)
(8W-42-4)
87
FUEL PUMP RELAY (IN PDC)
(8W-30-9)
M C106
A20 14 RD/DB
M C107
RHD
LHD
A141 16 DG/BK
A141 16 DG/WT
C2 18 DB/YL
C2 18 BK
EXCEPT 4.0L LHD
4.0L LHD
9 C104
12 C102
3 C103
1 C106
A141 16 DG/BK
C2 18 DB/YL
C2 18 DB/BK
F C300
A141 16 DG/BK
A20 12 RD/DB
1
A/C COMPRESSOR CLUTCH
(8W-42-3)
(8W-42-4)
1
OR
FUEL PUMP MODULE
(8W-30-10)
9
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
(8W-35-3)

8W-12 JUNCTION BLOCK



J028W-19 WJI01202

JUNCTION BLOCK
BACK



FUSES

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
1	-	-	-
2	-	-	-
3	10A	L33 18RD	FUSED HIGH BEAM RELAY OUTPUT
4	15A	INTERNAL	FUSED B(+)
5	25A	INTERNAL	FUSED B(+)
6	15A	INTERNAL	FUSED B(+)
7	10A	INTERNAL	FUSED B(+)
8	15A	INTERNAL	FUSED B(+)
9	20A	INTERNAL	FUSED B(+)
10 ✳	20A	F72 16RD/YL	FUSED B(+)
11	10A	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
12	10A	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-	-
14	10A	L43 18VT	FUSED LOW BEAM RELAY OUTPUT
15	10A	L44 18VT/RD	FUSED LOW BEAM RELAY OUTPUT
16	10A	L34 18RD/OR	FUSED HIGH BEAM RELAY OUTPUT
17	10A	INTERNAL	FUSED B(+)
18	30A	F9 20RD/BK	FUSED B(+)
19	10A	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
20	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
22	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	15A	F32 20PK/DB	FUSED B(+)
24	15A	INTERNAL	FUSED B(+)
25	15A	INTERNAL	FUSED B(+)
26	15A	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
27 ●	15A	INTERNAL	FUSED B(+)
28	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
29	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 18RD/WT ●●	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
		X12 16WT/RD ■	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
31	10A	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
32	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
33	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)

●● RHD ■ LHD ● BUILT-UP-EXPORT ✳EBUX

J028W-19 WJI01204

CIRCUIT BREAKERS

C.B.	AMPS	FUSED CIRCUIT	FUNCTION
1	20A	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	20A	F37 16RD/LB	FUSED B(+)
3	-	-	-

JUNCTION BLOCK
BODY CONTROL MODULE

CAVITY	CIRCUIT	FUNCTION
1	L308	PARK LAMP RELAY CONTROL
2	L26	FOG LAMP RELAY CONTROL
3	Q29	SUNROOF DELAY RELAY CONTROL
4	L307	LOW BEAM RELAY CONTROL
5	G5	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	X3	HORN RELAY CONTROL
7	V16	WIPER HIGH/LOW RELAY CONTROL
8	G80	LIFTGATE FLIP-UP AJAR SWITCH SENSE
9	L309	HIGH BEAM RELAY CONTROL
10	L91	HAZARD SWITCH SENSE
11	C80	REAR WINDOW DEFOGGER RELAY CONTROL
12	Z132	GROUND
13 ▲▲	L96	REAR FOG LAMP RELAY CONTROL
14	L7	PARK LAMP RELAY OUTPUT
15	Z234	GROUND
16	M2	COURTESY LAMPS DRIVER
17	-	-
18	-	-
19	M20	COURTESY LAMPS DRIVER
20	V55	WIPER PARK SWITCH SENSE
21	G78	LIFTGATE AJAR SWITCH SENSE
23	G77	LEFT REAR DOOR AJAR SWITCH SENSE
24	G73	LIFTGATE COURTESY DISABLE
25	V23	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
26	M1	FUSED B(+)

▲▲ BUILT-UP-EXPORT

ACCESSORY DELAY RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	ACCESSORY DELAY RELAY CONTROL
87	Q30 16TN	ACCESSORY DELAY RELAY OUTPUT
87A	-	-

CIGAR LIGHTER RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
86	INTERNAL	GROUND
87	INTERNAL	CIGAR LIGHTER RELAY OUTPUT
87A	-	-

COMBINATION FLASHER

CAVITY	CIRCUIT	FUNCTION
1	INTERNAL	FUSED B(+)
2	INTERNAL	LEFT TURN SIGNAL
3	INTERNAL	RIGHT TURN SIGNAL
4	L63 20DG/RD	LEFT TURN SIGNAL
5	L62 20BR/RD	RIGHT TURN SIGNAL
6	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
7	L305 20LB/WT	LEFT TURN SWITCH SENSE
8	L302 20LB/YL	RIGHT TURN SWITCH SENSE
9	INTERNAL	HAZARD SWITCH SENSE

J028W-19 WJI01206

FOG LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FOG LAMP RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	FOG LAMP RELAY OUTPUT
87A	-	-

HIGH BEAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	HIGH BEAM RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	HIGH BEAM RELAY OUTPUT
87A	-	-

LOW BEAM/ DAYTIME RUNNING LAMP RELAY (DRL)

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	GROUND
86	INTERNAL	RELAY CONTROL
87	INTERNAL	RELAY OUTPUT
87A	-	-

LOW BEAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	LOW BEAM RELAY CONTROL
87	INTERNAL	LOW BEAM RELAY OUTPUT
87A	-	-

PARK LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	PARK LAMP RELAY OUTPUT
85	INTERNAL	FUSED B(+)
86	INTERNAL	PARK LAMP RELAY CONTROL
87	INTERNAL	FUSED B(+)
87A	INTERNAL	GROUND

REAR FOG LAMP RELAY (BUILT-UP-EXPORT)

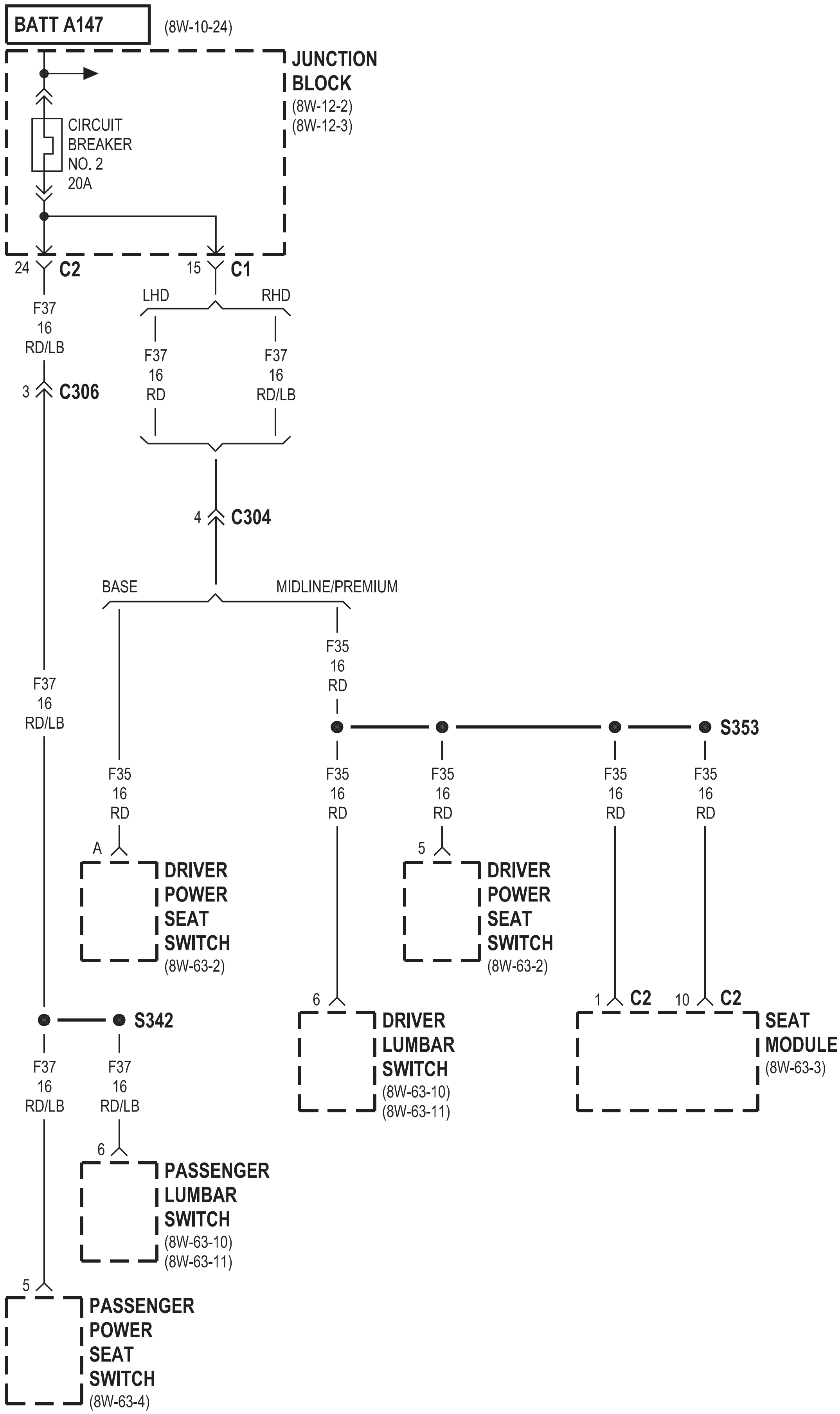
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	REAR FOG LAMP RELAY CONTROL
87	L95 18DG/YL	REAR FOG LAMP RELAY OUTPUT
87A	-	-

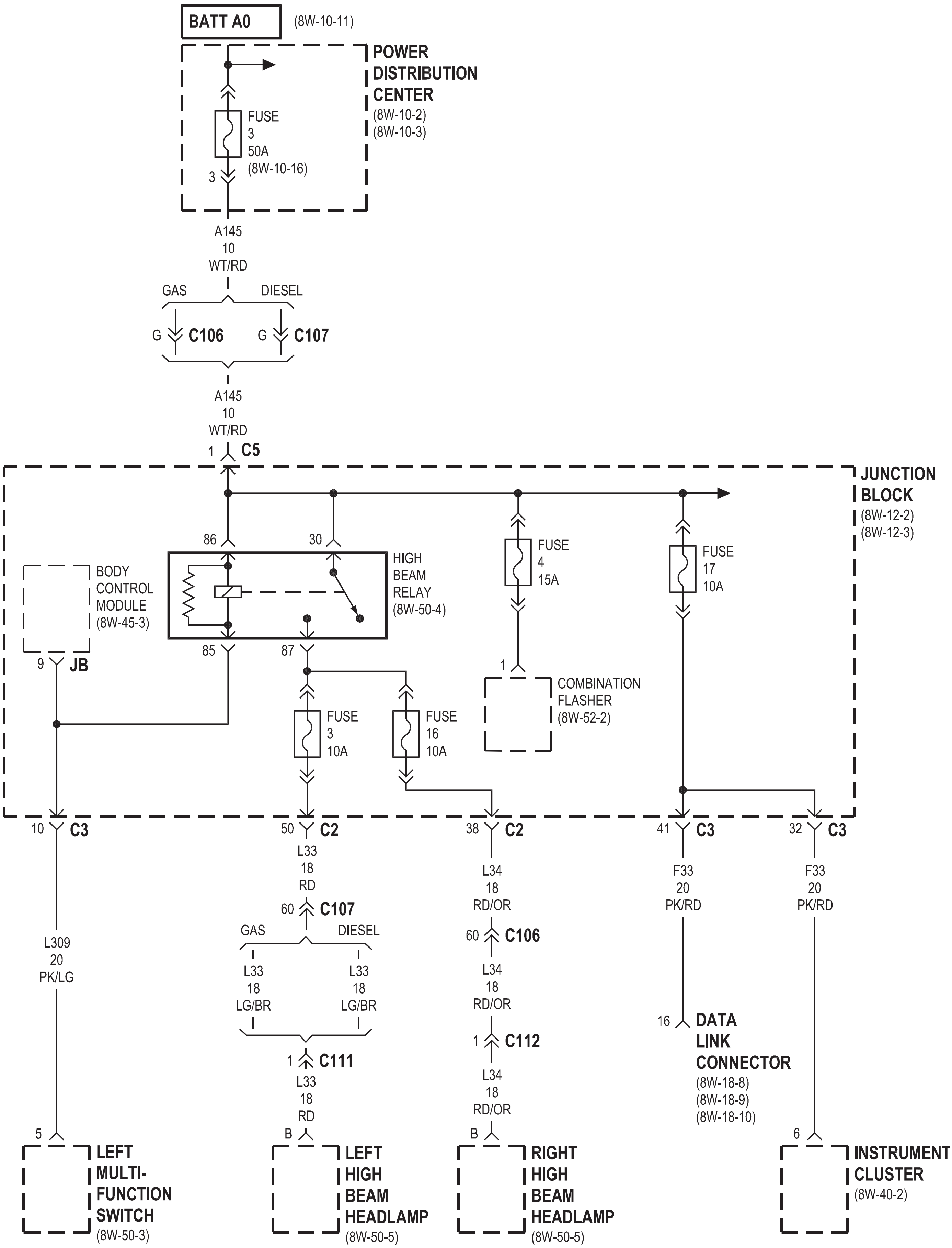
REAR WINDOW DEFOGGER RELAY

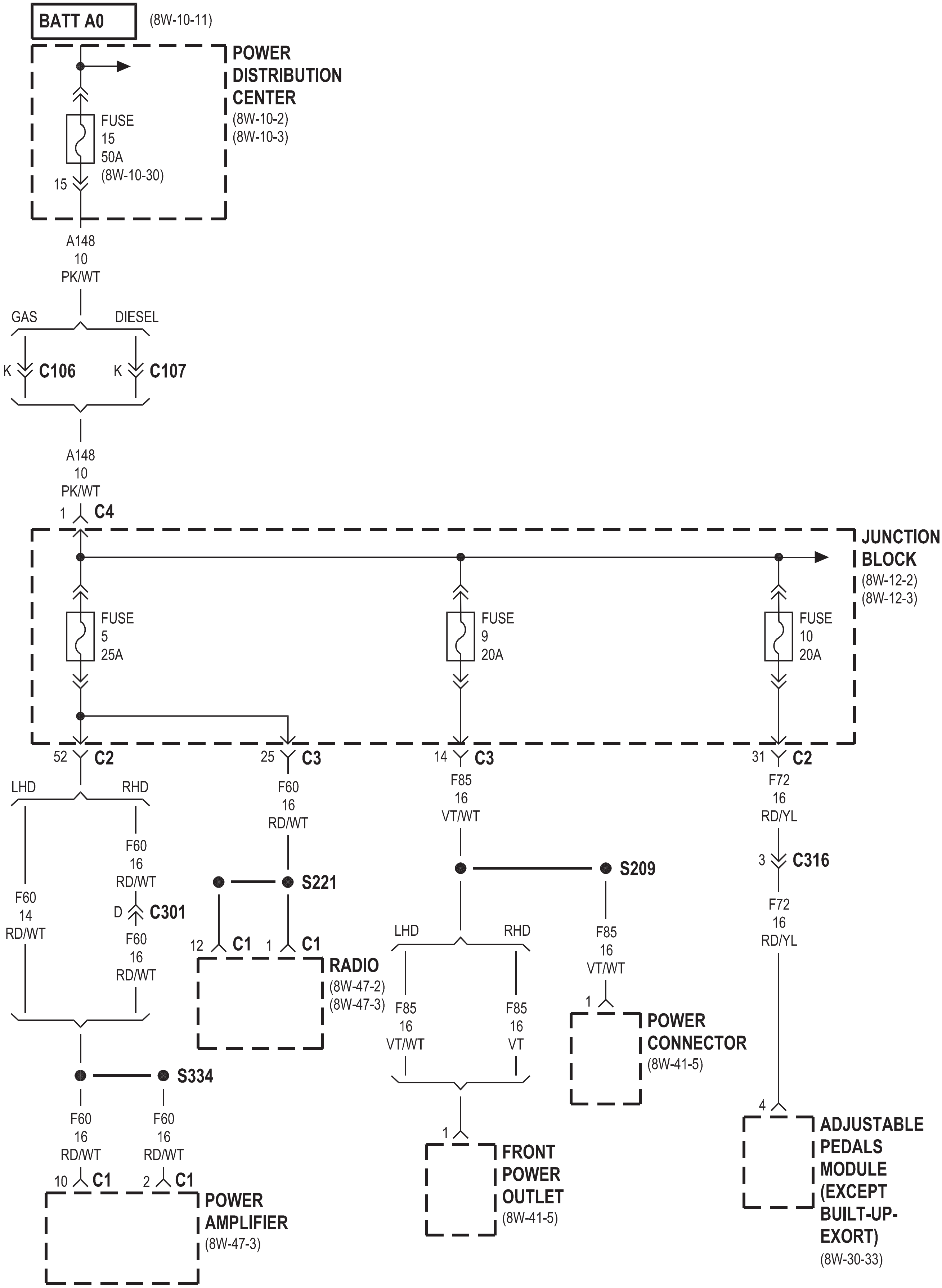
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	REAR WINDOW DEFOGGER RELAY CONTROL
87	INTERNAL	REAR WINDOW DEFOGGER RELAY OUTPUT
87A	-	-

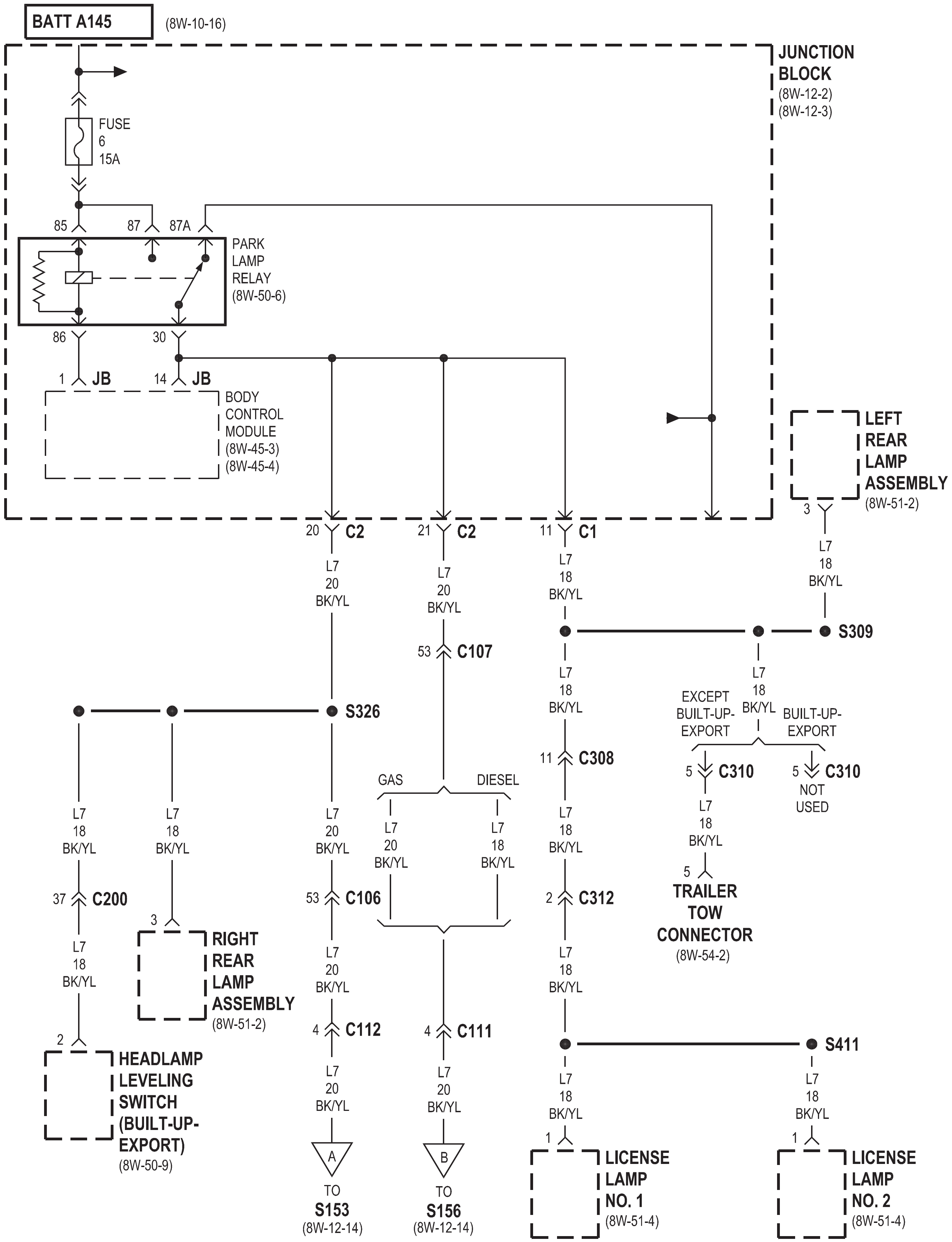
● LHD
●● RHD

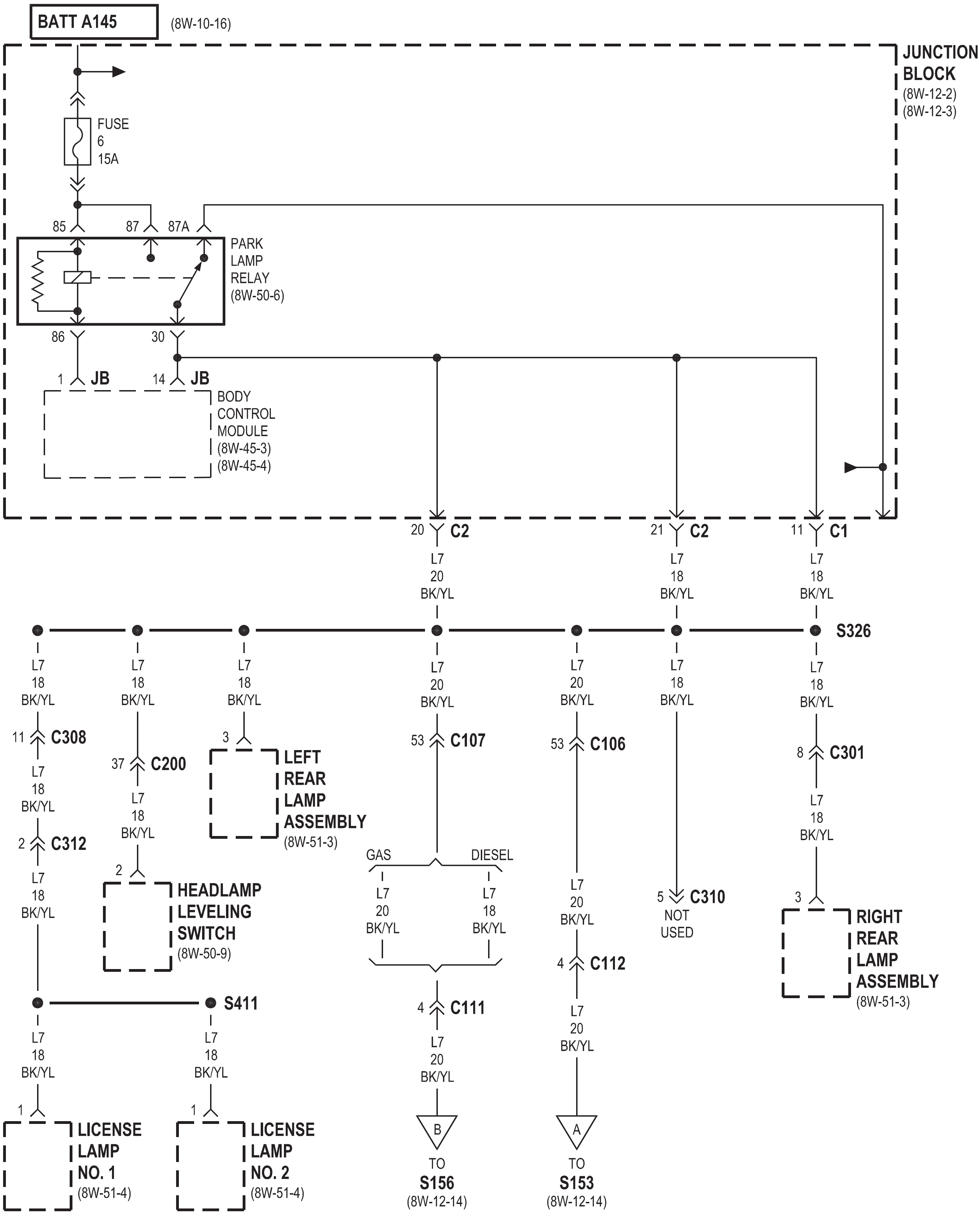
POWER SEATS

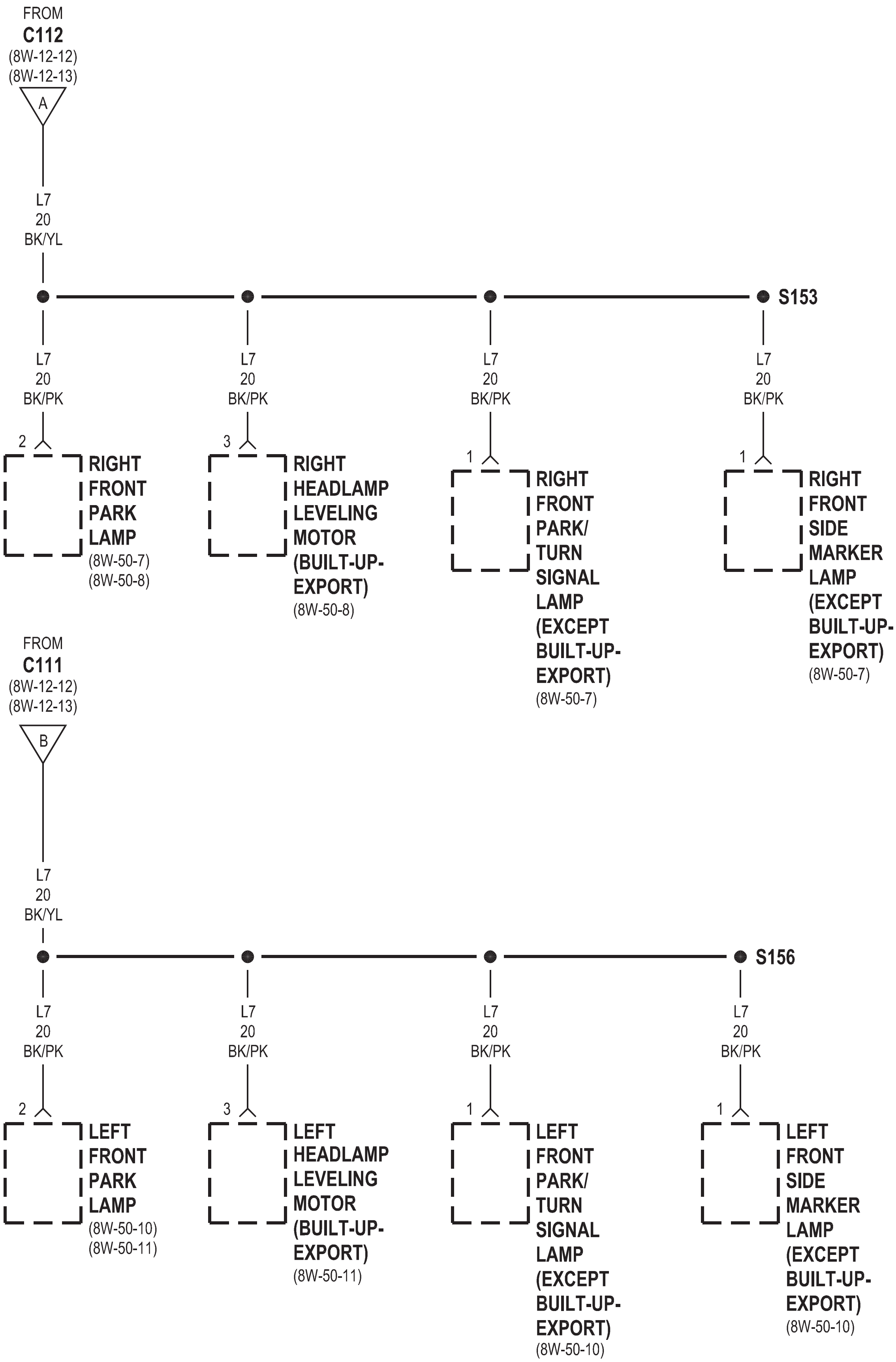

BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A
24 C2
15 C1
F37 16 RD/LB
LHD
RHD
F37 16 RD
F37 16 RD/LB
3 C306
4 C304
BASE
MIDLINE/PREMIUM
F35 16 RD
S353
F37 16 RD/LB
A
DRIVER POWER SEAT SWITCH
(8W-63-2)
5
DRIVER POWER SEAT SWITCH
(8W-63-2)
6
DRIVER LUMBAR SWITCH
(8W-63-10)
(8W-63-11)
1 C2
10 C2
SEAT MODULE
(8W-63-3)
S342
6
PASSENGER LUMBAR SWITCH
(8W-63-10)
(8W-63-11)
5
PASSENGER POWER SEAT SWITCH
(8W-63-4)

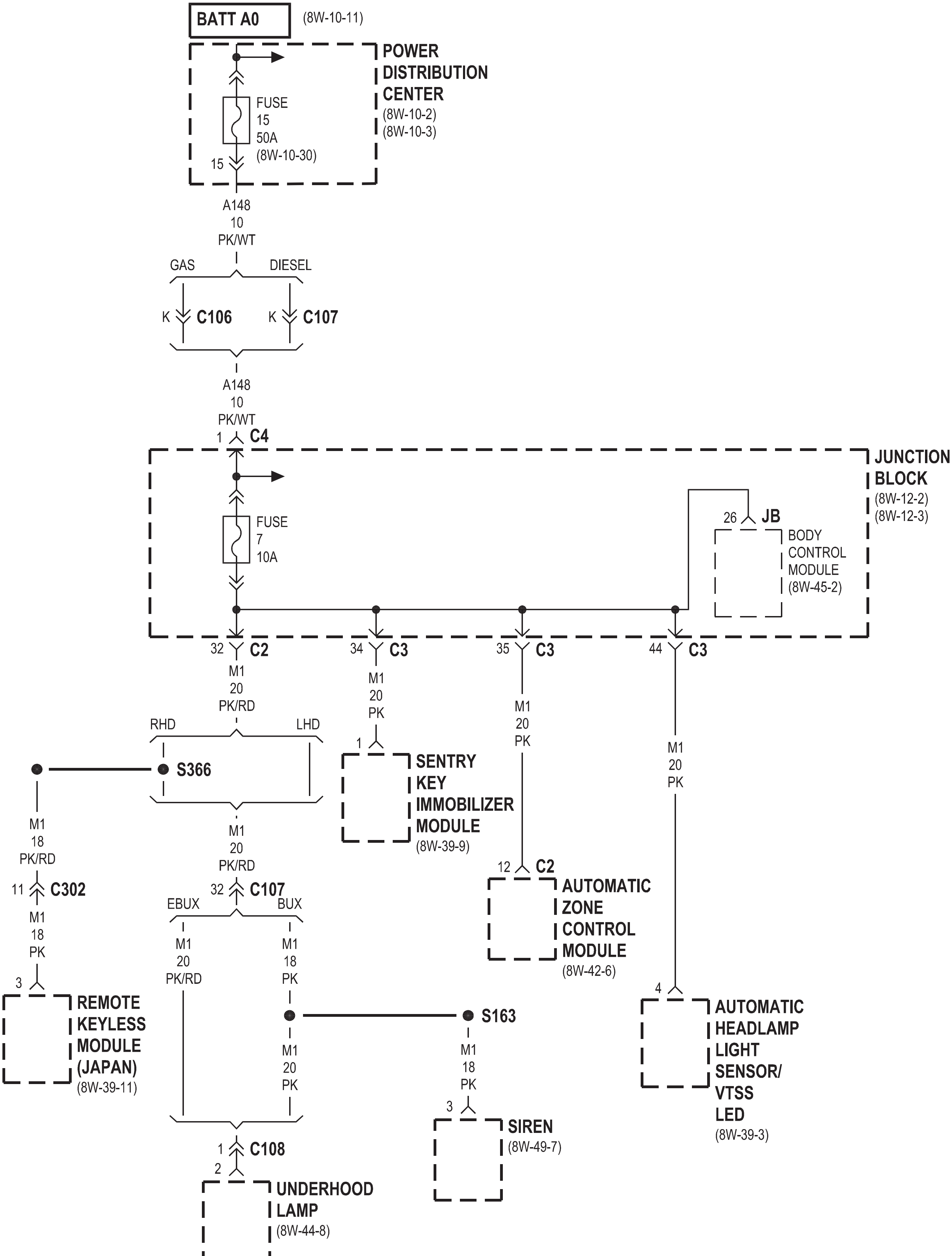

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 3 50A (8W-10-16)
3
A145 10 WT/RD
GAS
DIESEL
G C106
G C107
A145 10 WT/RD
1 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
30
HIGH BEAM RELAY (8W-50-4)
BODY CONTROL MODULE (8W-45-3)
FUSE 4 15A
FUSE 17 10A
85
87
9 JB
1
COMBINATION FLASHER (8W-52-2)
FUSE 3 10A
FUSE 16 10A
10 C3
50 C2
38 C2
41 C3
32 C3
L33 18 RD
L34 18 RD/OR
F33 20 PK/RD
F33 20 PK/RD
60 C107
GAS
DIESEL
L309 20 PK/LG
L33 18 LG/BR
L33 18 LG/BR
60 C106
L34 18 RD/OR
1 C112
L34 18 RD/OR
1 C111
L33 18 RD
16 DATA LINK CONNECTOR (8W-18-8) (8W-18-9) (8W-18-10)
5
B
B
6
LEFT MULTI-FUNCTION SWITCH (8W-50-3)
LEFT HIGH BEAM HEADLAMP (8W-50-5)
RIGHT HIGH BEAM HEADLAMP (8W-50-5)
INSTRUMENT CLUSTER (8W-40-2)

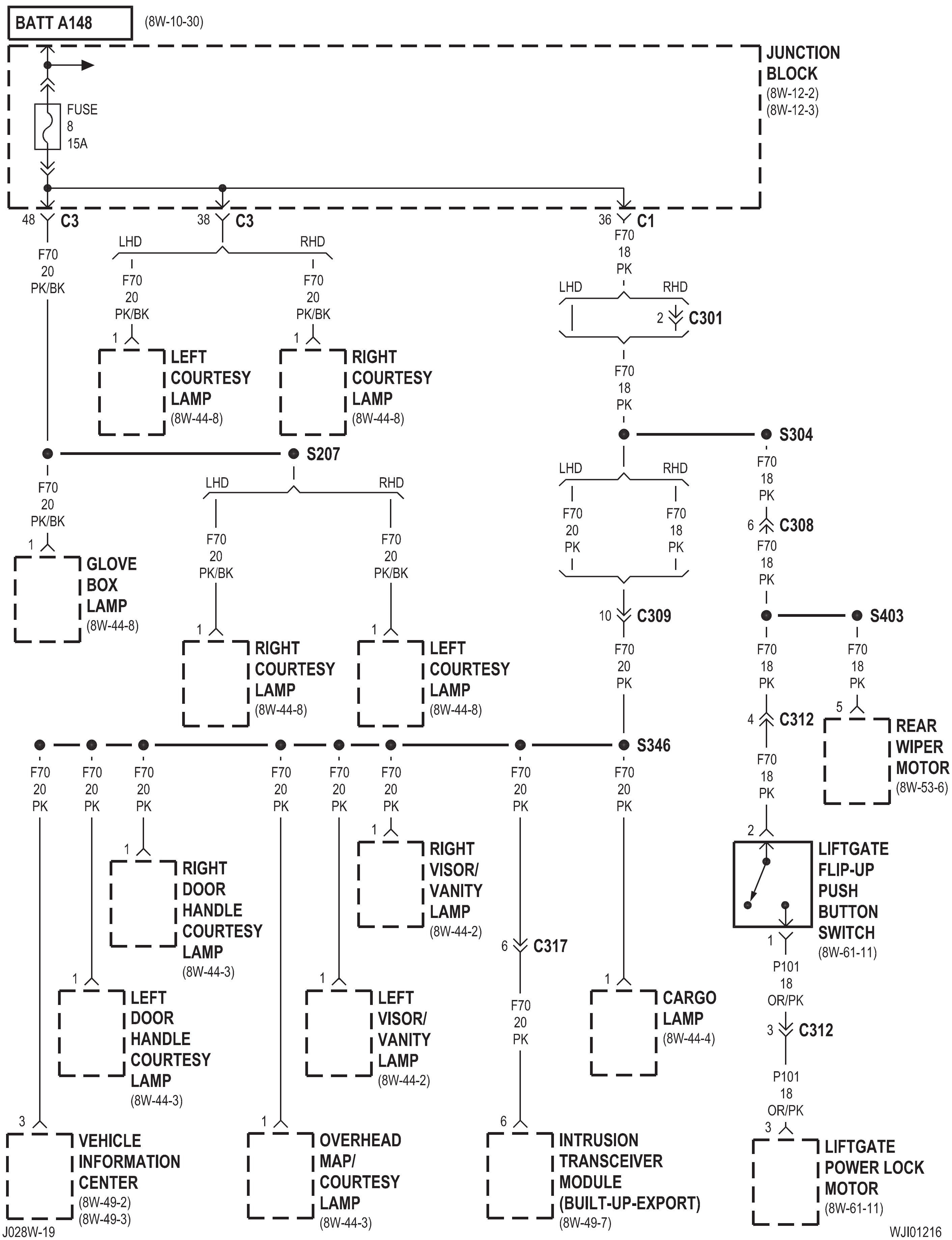

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 15 50A (8W-10-30)
15
A148 10 PK/WT
GAS
DIESEL
K C106
K C107
A148 10 PK/WT
1 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 25A
FUSE 9 20A
FUSE 10 20A
52 C2
25 C3
14 C3
31 C2
LHD
RHD
F60 16 RD/WT
F85 16 VT/WT
F72 16 RD/YL
3 C316
S209
S221
D C301
F60 14 RD/WT
12 C1
1 C1
RADIO
(8W-47-2)
(8W-47-3)
F85 16 VT
POWER CONNECTOR
(8W-41-5)
S334
10 C1
2 C1
POWER AMPLIFIER
(8W-47-3)
FRONT POWER OUTLET
(8W-41-5)
4
ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXORT)
(8W-30-33)

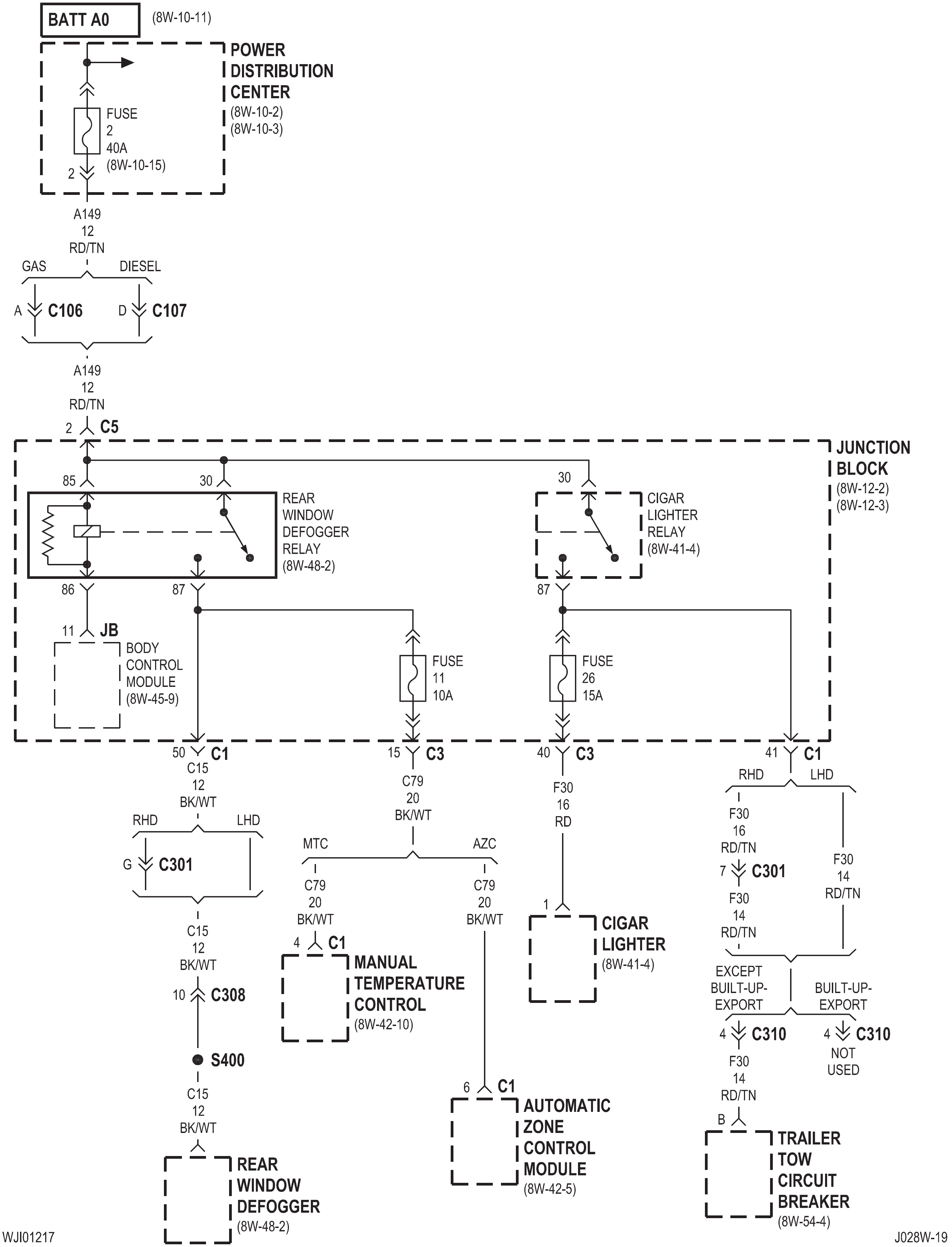

BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 15A
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1 JB
14 JB
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
LEFT REAR LAMP ASSEMBLY
(8W-51-2)
3
20 C2
21 C2
11 C1
L7 20 BK/YL
L7 18 BK/YL
53 C107
S309
S326
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
11 C308
5 C310
5 C310
NOT USED
GAS
DIESEL
37 C200
3
RIGHT REAR LAMP ASSEMBLY
(8W-51-2)
53 C106
2 C312
5
TRAILER TOW CONNECTOR
(8W-54-2)
4 C112
4 C111
S411
2
HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT)
(8W-50-9)
A
TO S153
(8W-12-14)
B
TO S156
(8W-12-14)
1
LICENSE LAMP NO. 1
(8W-51-4)
1
LICENSE LAMP NO. 2
(8W-51-4)


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 15A
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1 JB
14 JB
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
20 C2
21 C2
11 C1
L7 20 BK/YL
L7 18 BK/YL
L7 18 BK/YL
S326
L7 18 BK/YL
11 C308
2 C312
37 C200
2
HEADLAMP LEVELING SWITCH
(8W-50-9)
3
LEFT REAR LAMP ASSEMBLY
(8W-51-3)
L7 20 BK/YL
53 C107
GAS
DIESEL
L7 20 BK/YL
L7 18 BK/YL
4 C111
B
TO S156
(8W-12-14)
L7 20 BK/YL
53 C106
4 C112
A
TO S153
(8W-12-14)
5 C310
NOT USED
8 C301
3
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
S411
1
LICENSE LAMP NO. 1
(8W-51-4)
1
LICENSE LAMP NO. 2
(8W-51-4)

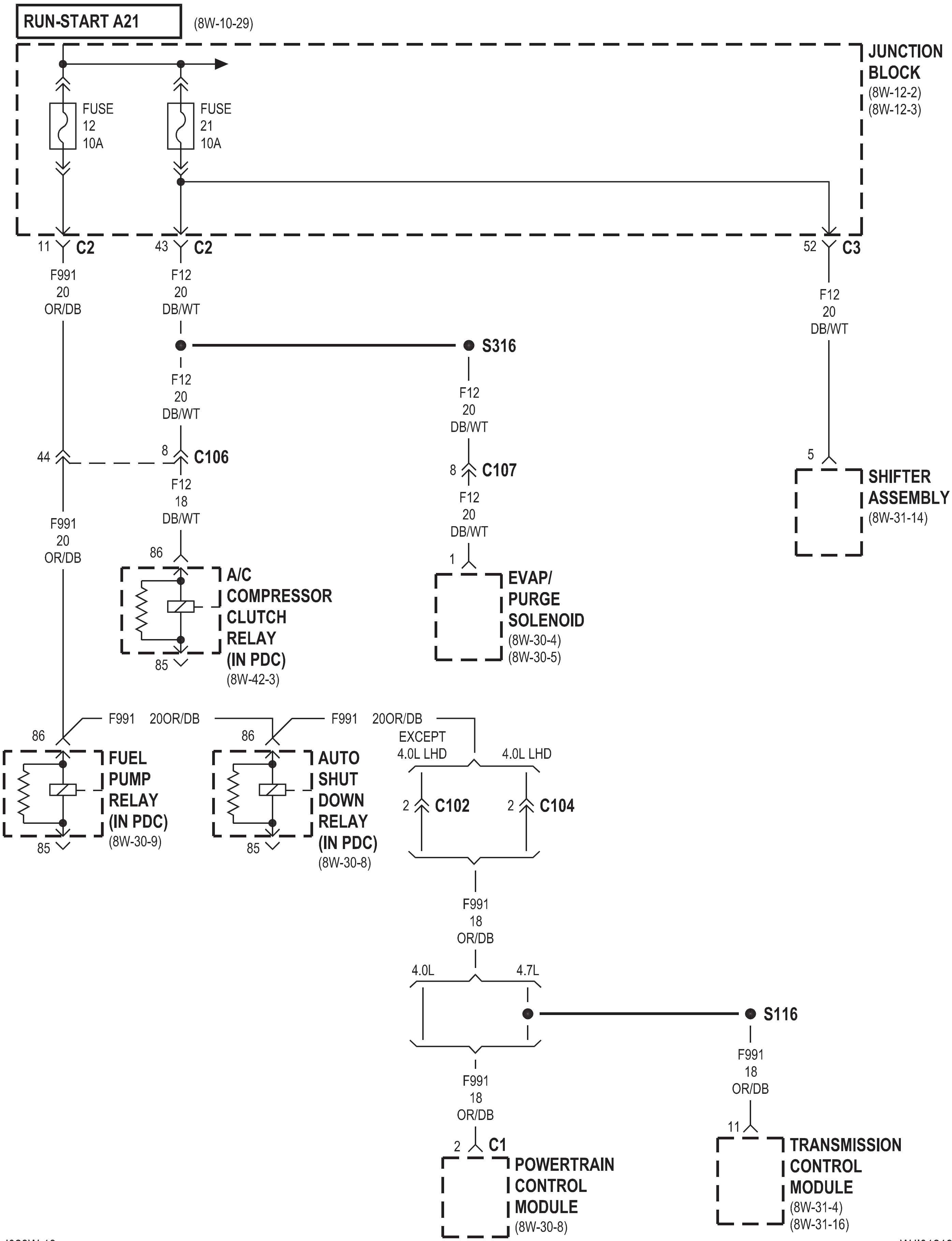

FROM
C112
(8W-12-12)
(8W-12-13)
A
L7
20
BK/YL
S153
L7
20
BK/PK
2
RIGHT FRONT PARK LAMP
(8W-50-7)
(8W-50-8)
3
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)
(8W-50-8)
1
RIGHT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)
(8W-50-7)
1
RIGHT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT)
(8W-50-7)
FROM
C111
(8W-12-12)
(8W-12-13)
B
L7
20
BK/YL
S156
L7
20
BK/PK
2
LEFT FRONT PARK LAMP
(8W-50-10)
(8W-50-11)
3
LEFT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)
(8W-50-11)
1
LEFT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)
(8W-50-10)
1
LEFT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT)
(8W-50-10)


BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 15 50A (8W-10-30)
15
A148 10 PK/WT
GAS
DIESEL
K C106
K C107
A148 10 PK/WT
1 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 7 10A
26 JB
BODY CONTROL MODULE
(8W-45-2)
32 C2
34 C3
35 C3
44 C3
M1 20 PK/RD
RHD
LHD
S366
M1 20 PK
1
SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
M1 20 PK
12 C2
AUTOMATIC ZONE CONTROL MODULE
(8W-42-6)
M1 20 PK
4
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
(8W-39-3)
M1 18 PK/RD
11 C302
M1 18 PK
3
REMOTE KEYLESS MODULE (JAPAN)
(8W-39-11)
M1 20 PK/RD
32 C107
EBUX
BUX
M1 20 PK/RD
M1 18 PK
S163
M1 20 PK
M1 18 PK
3
SIREN
(8W-49-7)
1 C108
2
UNDERHOOD LAMP
(8W-44-8)

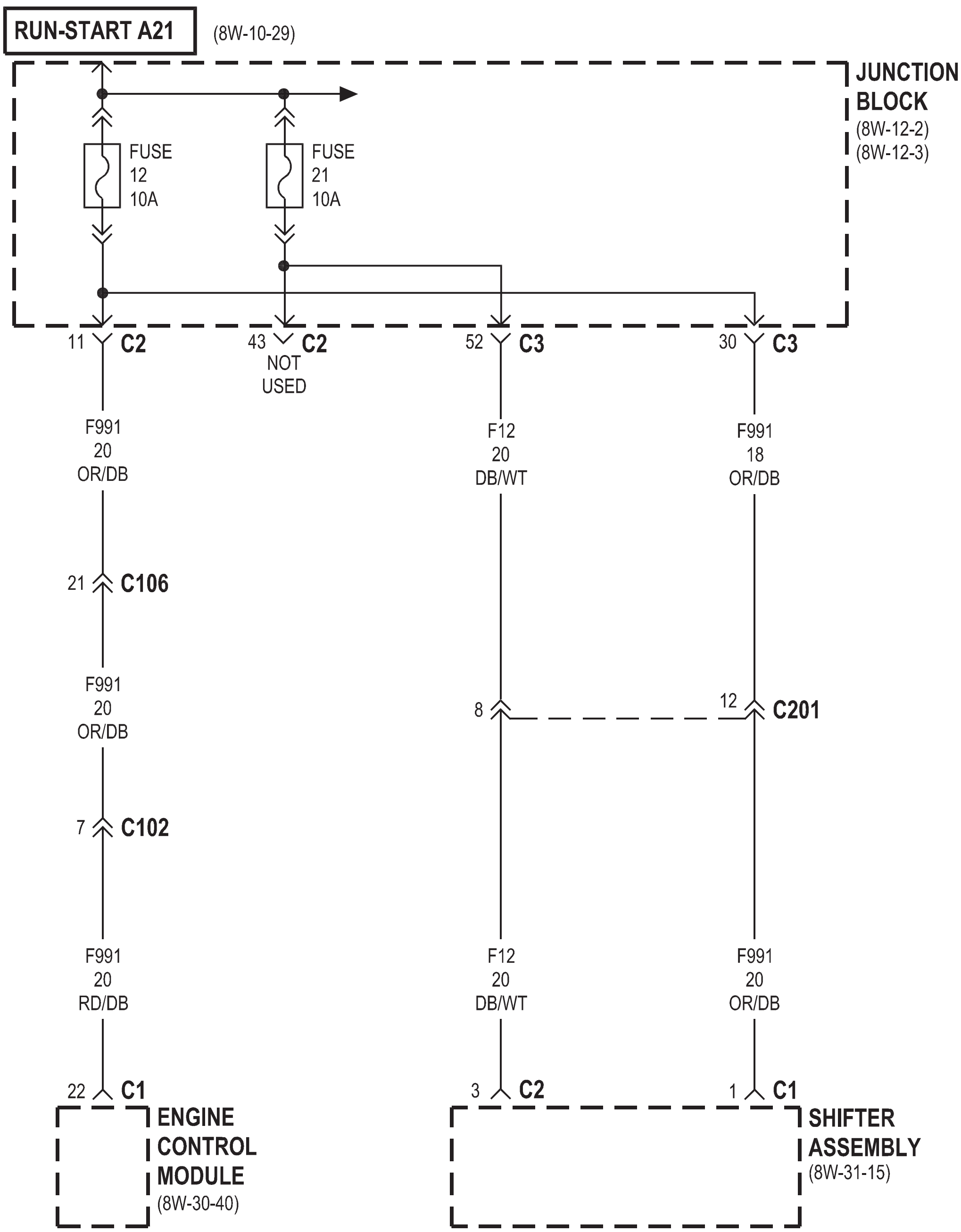

BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 8 15A
48 C3
38 C3
36 C1
F70 20 PK/BK
LHD
RHD
F70 18 PK
C301
LEFT COURTESY LAMP (8W-44-8)
RIGHT COURTESY LAMP (8W-44-8)
S207
S304
GLOVE BOX LAMP (8W-44-8)
C308
C309
S403
REAR WIPER MOTOR (8W-53-6)
C312
S346
F70 20 PK
RIGHT DOOR HANDLE COURTESY LAMP (8W-44-3)
RIGHT VISOR/ VANITY LAMP (8W-44-2)
LIFTGATE FLIP-UP PUSH BUTTON SWITCH (8W-61-11)
C317
P101 18 OR/PK
LEFT DOOR HANDLE COURTESY LAMP (8W-44-3)
LEFT VISOR/ VANITY LAMP (8W-44-2)
CARGO LAMP (8W-44-4)
VEHICLE INFORMATION CENTER (8W-49-2) (8W-49-3)
OVERHEAD MAP/ COURTESY LAMP (8W-44-3)
INTRUSION TRANSCEIVER MODULE (BUILT-UP-EXPORT) (8W-49-7)
LIFTGATE POWER LOCK MOTOR (8W-61-11)
J028W-19
WJI01216

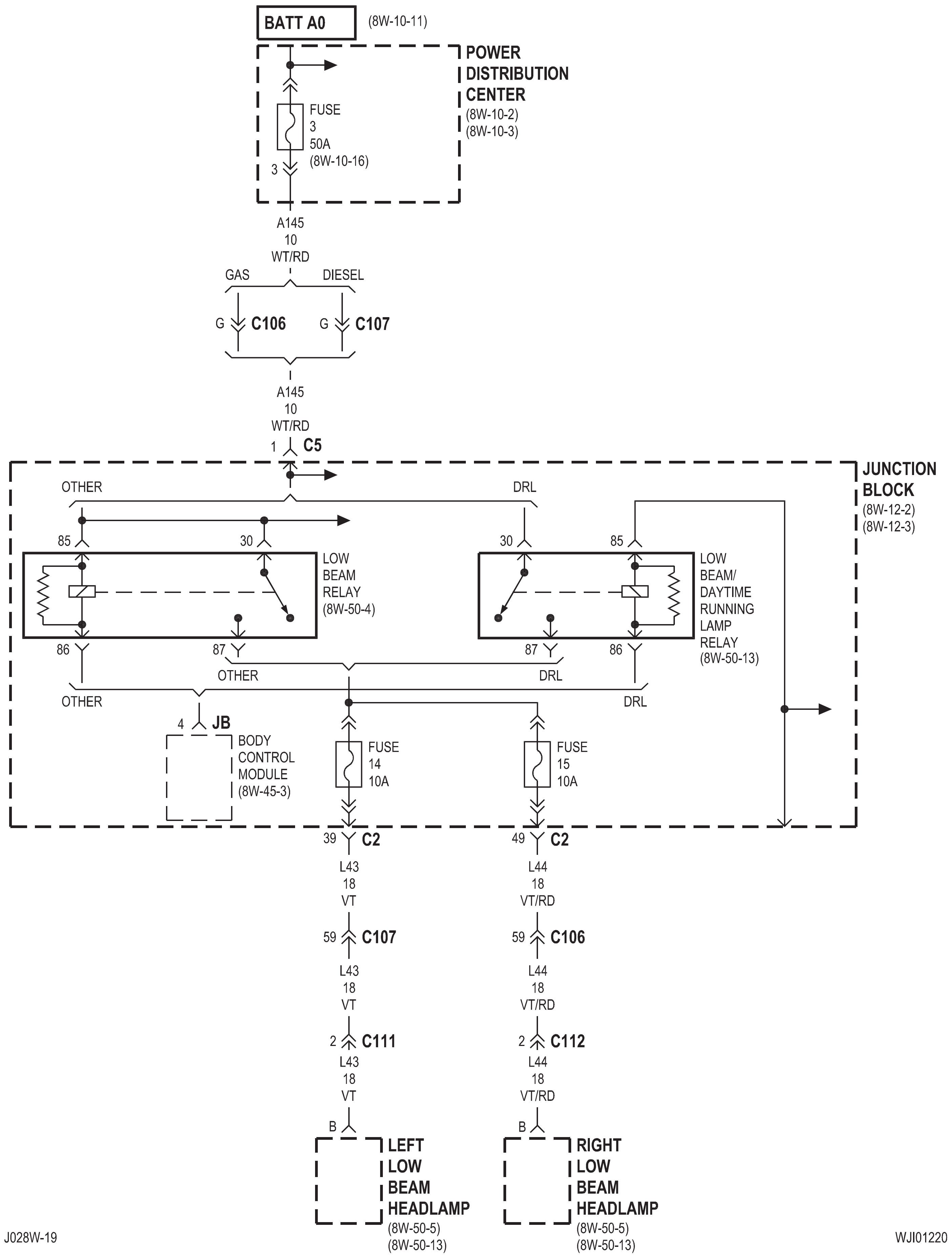

BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
FUSE
2
40A
(8W-10-15)
2
A149
12
RD/TN
GAS
DIESEL
A
C106
D
C107
A149
12
RD/TN
2
C5
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
85
30
REAR
WINDOW
DEFOGGER
RELAY
(8W-48-2)
30
CIGAR
LIGHTER
RELAY
(8W-41-4)
86
87
87
11
JB
BODY
CONTROL
MODULE
(8W-45-9)
FUSE
11
10A
FUSE
26
15A
50
C1
C15
12
BK/WT
15
C3
C79
20
BK/WT
40
C3
F30
16
RD
41
C1
RHD
LHD
G
C301
MTC
AZC
C79
20
BK/WT
C79
20
BK/WT
4
C1
MANUAL
TEMPERATURE
CONTROL
(8W-42-10)
1
CIGAR
LIGHTER
(8W-41-4)
RHD
LHD
F30
16
RD/TN
7
C301
F30
14
RD/TN
F30
14
RD/TN
C15
12
BK/WT
10
C308
S400
C15
12
BK/WT
REAR
WINDOW
DEFOGGER
(8W-48-2)
6
C1
AUTOMATIC
ZONE
CONTROL
MODULE
(8W-42-5)
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
4
C310
4
C310
NOT
USED
F30
14
RD/TN
B
TRAILER
TOW
CIRCUIT
BREAKER
(8W-54-4)

GAS

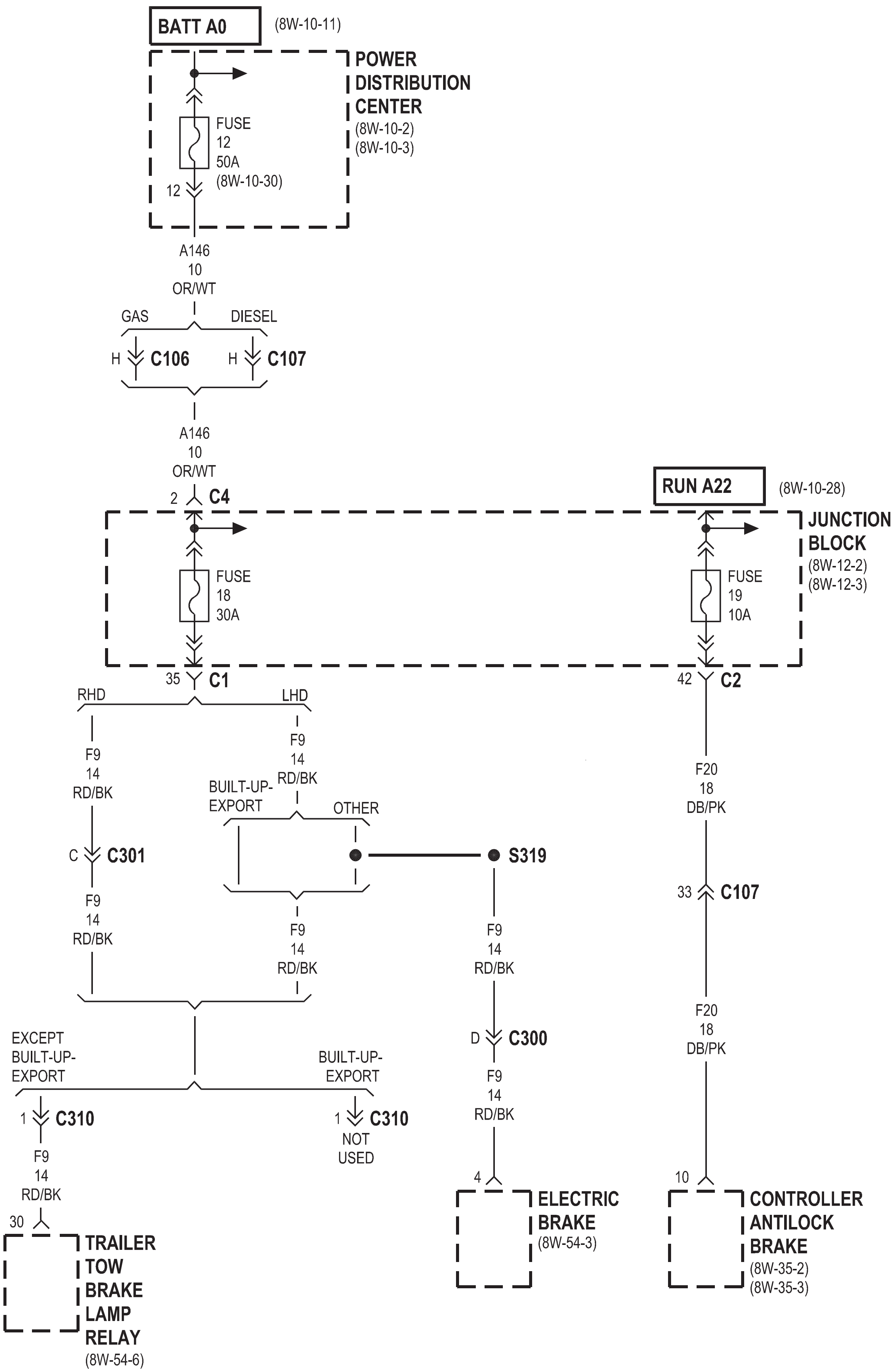


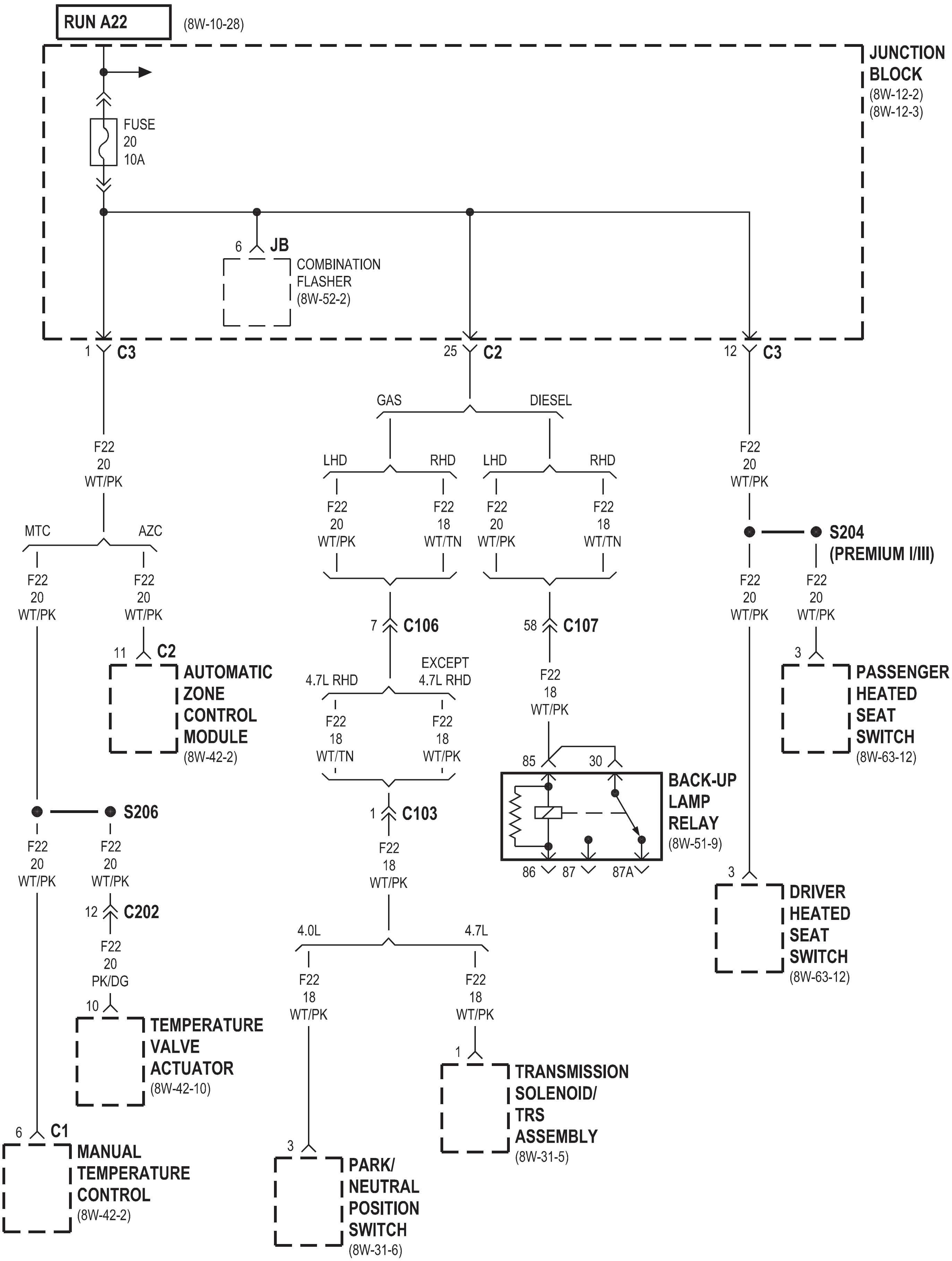
RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 10A
FUSE 21 10A
11 C2
43 C2
52 C3
F991 20 OR/DB
F12 20 DB/WT
S316
F12 20 DB/WT
F12 20 DB/WT
44
8 C106
F12 18 DB/WT
8 C107
F12 20 DB/WT
5
SHIFTER ASSEMBLY
(8W-31-14)
F991 20 OR/DB
86
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
85
(8W-42-3)
1
EVAP/ PURGE SOLENOID
(8W-30-4)
(8W-30-5)
F991 20OR/DB
F991 20OR/DB
86
FUEL PUMP RELAY (IN PDC)
85
(8W-30-9)
86
AUTO SHUT DOWN RELAY (IN PDC)
85
(8W-30-8)
EXCEPT 4.0L LHD
4.0L LHD
2 C102
2 C104
F991 18 OR/DB
4.0L
4.7L
S116
F991 18 OR/DB
F991 18 OR/DB
2 C1
POWERTRAIN CONTROL MODULE
(8W-30-8)
11
TRANSMISSION CONTROL MODULE
(8W-31-4)
(8W-31-16)


RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 10A
FUSE 21 10A
11 C2
43 C2
NOT USED
52 C3
30 C3
F991 20 OR/DB
F12 20 DB/WT
F991 18 OR/DB
21 C106
F991 20 OR/DB
8
12 C201
7 C102
F991 20 RD/DB
F12 20 DB/WT
F991 20 OR/DB
22 C1
3 C2
1 C1
ENGINE CONTROL MODULE
(8W-30-40)
SHIFTER ASSEMBLY
(8W-31-15)

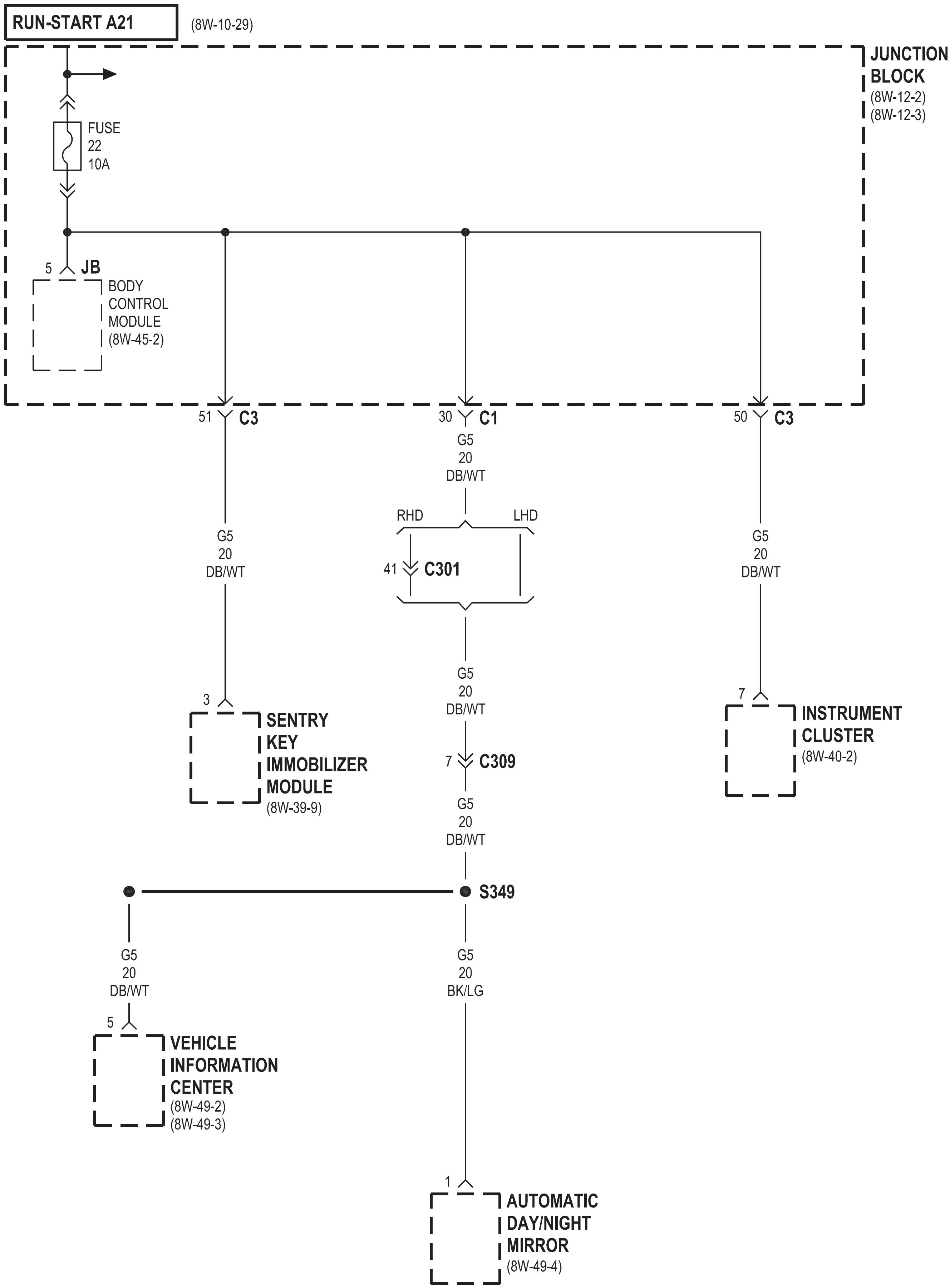


BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
FUSE
3
50A
(8W-10-16)
3
A145
10
WT/RD
GAS
DIESEL
G
C106
G
C107
A145
10
WT/RD
1
C5
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
OTHER
DRL
85
30
30
85
LOW
BEAM
RELAY
(8W-50-4)
LOW
BEAM/
DAYTIME
RUNNING
LAMP
RELAY
(8W-50-13)
86
87
87
86
OTHER
DRL
OTHER
DRL
4
JB
BODY
CONTROL
MODULE
(8W-45-3)
FUSE
14
10A
FUSE
15
10A
39
C2
49
C2
L43
18
VT
L44
18
VT/RD
59
C107
59
C106
L43
18
VT
L44
18
VT/RD
2
C111
2
C112
L43
18
VT
L44
18
VT/RD
B
B
LEFT
LOW
BEAM
HEADLAMP
(8W-50-5)
(8W-50-13)
RIGHT
LOW
BEAM
HEADLAMP
(8W-50-5)
(8W-50-13)
J028W-19
WJI01220

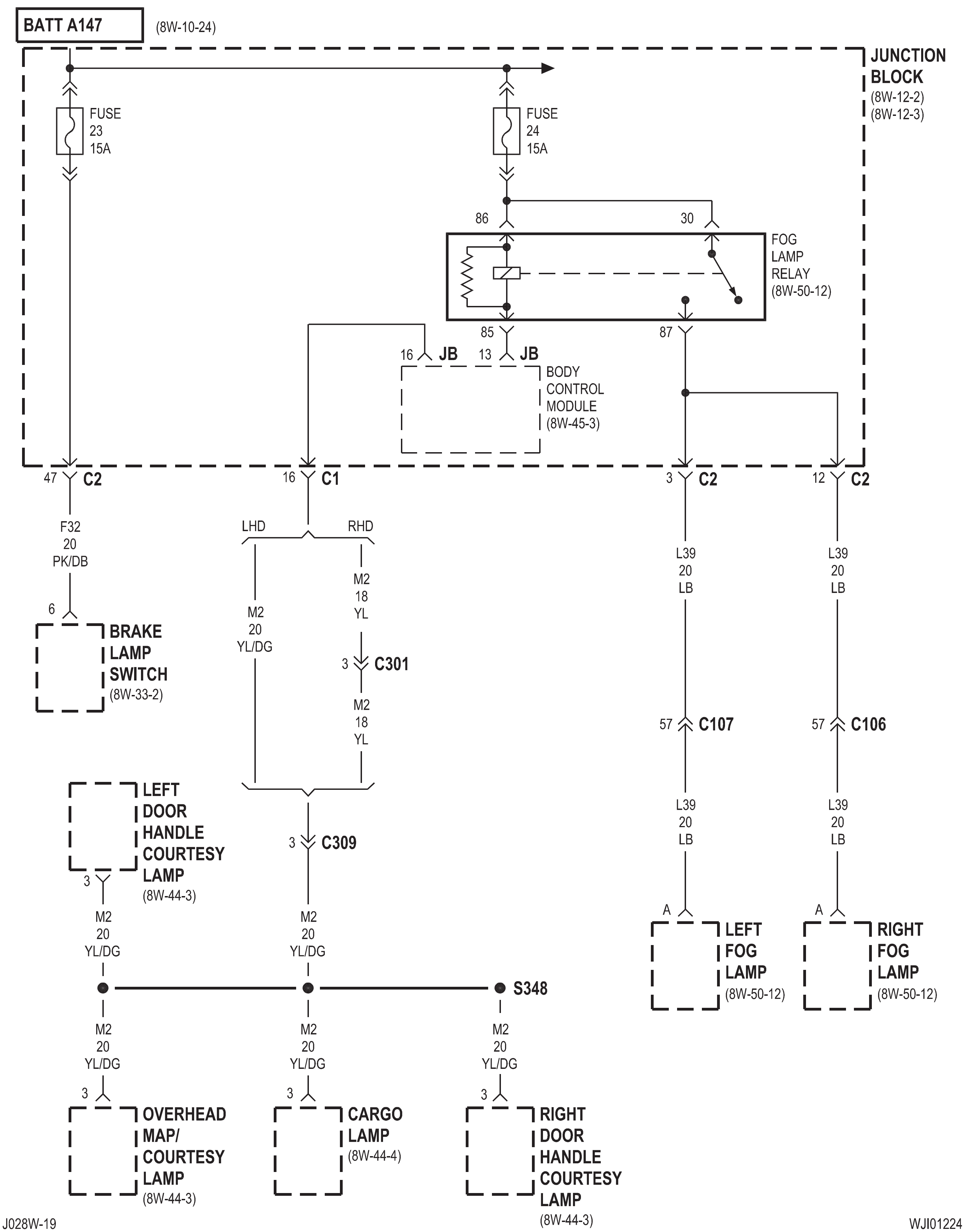

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 12 50A (8W-10-30)
12
A146 10 OR/WT
GAS
DIESEL
H C106
H C107
A146 10 OR/WT
2 C4
RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 18 30A
FUSE 19 10A
35 C1
42 C2
RHD
LHD
F9 14 RD/BK
F9 14 RD/BK
BUILT-UP-EXPORT
OTHER
S319
C C301
F9 14 RD/BK
F9 14 RD/BK
F9 14 RD/BK
D C300
F9 14 RD/BK
F20 18 DB/PK
33 C107
F20 18 DB/PK
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
1 C310
1 C310
NOT USED
F9 14 RD/BK
30
TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
4
ELECTRIC BRAKE
(8W-54-3)
10
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
(8W-35-3)



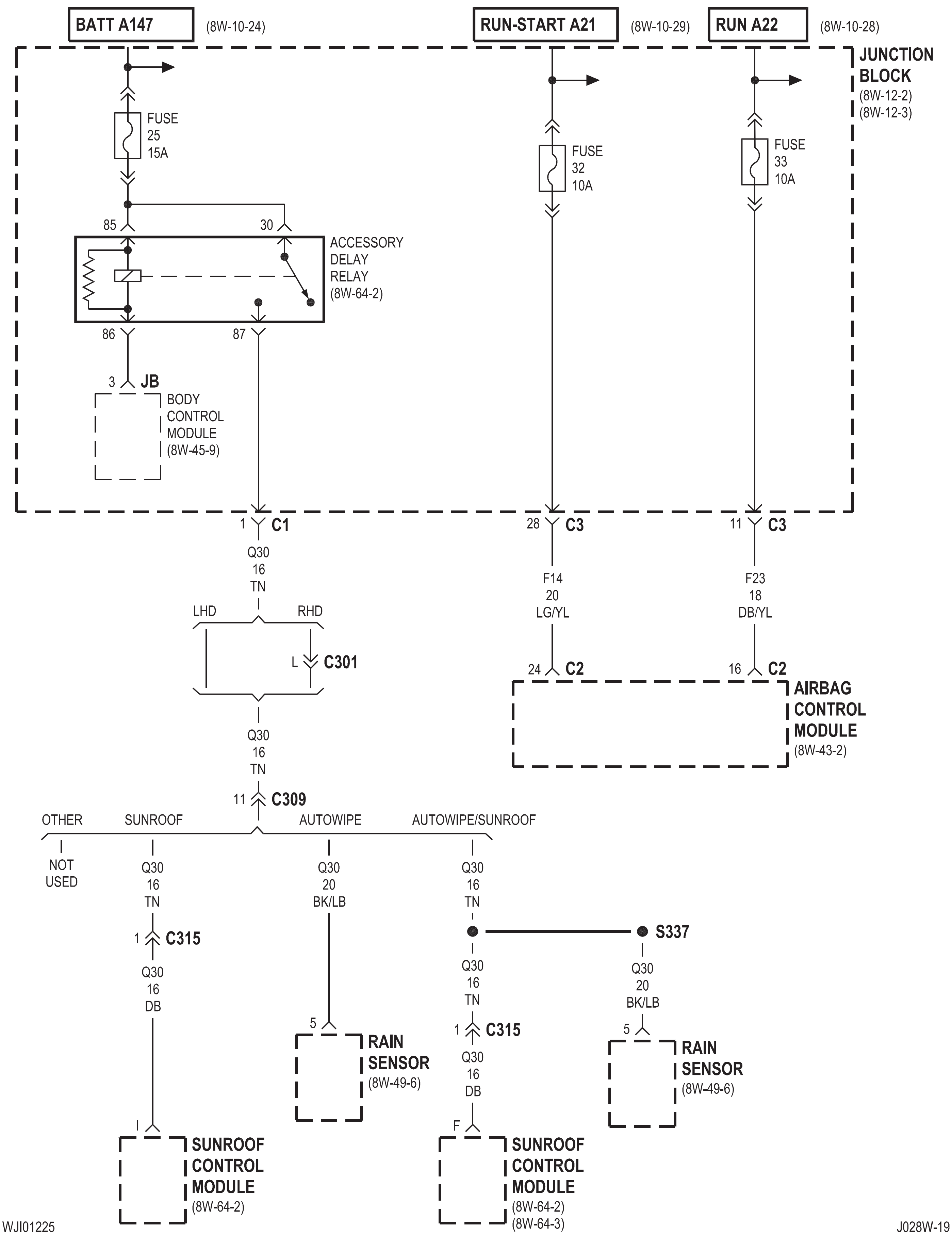
RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
6
JB
COMBINATION FLASHER
(8W-52-2)
1
C3
25
C2
12
C3
GAS
DIESEL
LHD
RHD
LHD
RHD
F22
20
WT/PK
F22
18
WT/TN
F22
20
WT/PK
F22
18
WT/TN
7
C106
58
C107
4.7L RHD
EXCEPT 4.7L RHD
F22
18
WT/TN
F22
18
WT/PK
1
C103
F22
18
WT/PK
4.0L
4.7L
F22
18
WT/PK
F22
18
WT/PK
3
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
1
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
F22
18
WT/PK
85
30
BACK-UP LAMP RELAY
(8W-51-9)
86
87
87A
F22
20
WT/PK
MTC
AZC
F22
20
WT/PK
F22
20
WT/PK
11
C2
AUTOMATIC ZONE CONTROL MODULE
(8W-42-2)
S206
F22
20
WT/PK
F22
20
WT/PK
12
C202
F22
20
PK/DG
10
TEMPERATURE VALVE ACTUATOR
(8W-42-10)
6
C1
MANUAL TEMPERATURE CONTROL
(8W-42-2)
F22
20
WT/PK
S204
(PREMIUM I/III)
F22
20
WT/PK
F22
20
WT/PK
3
PASSENGER HEATED SEAT SWITCH
(8W-63-12)
3
DRIVER HEATED SEAT SWITCH
(8W-63-12)

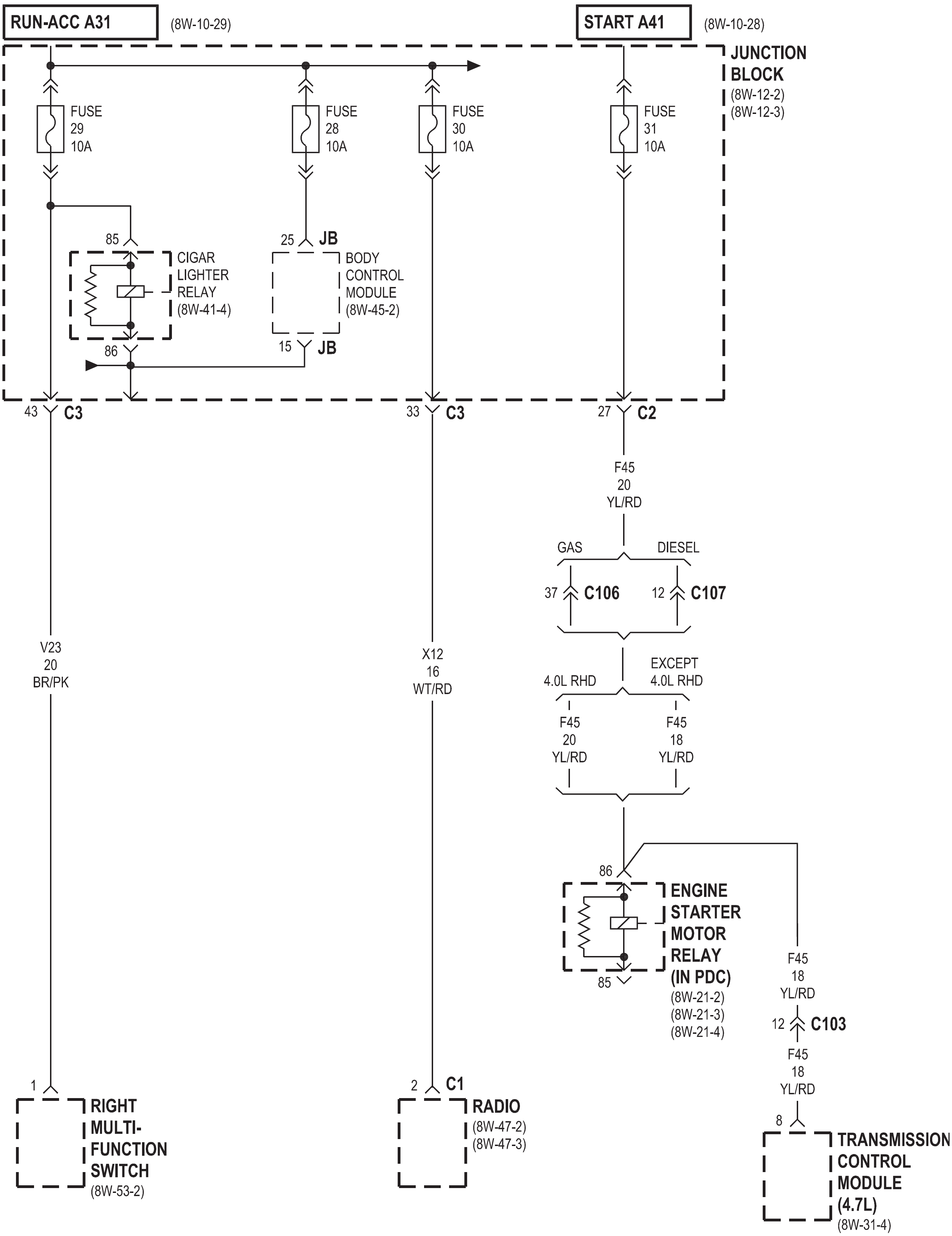


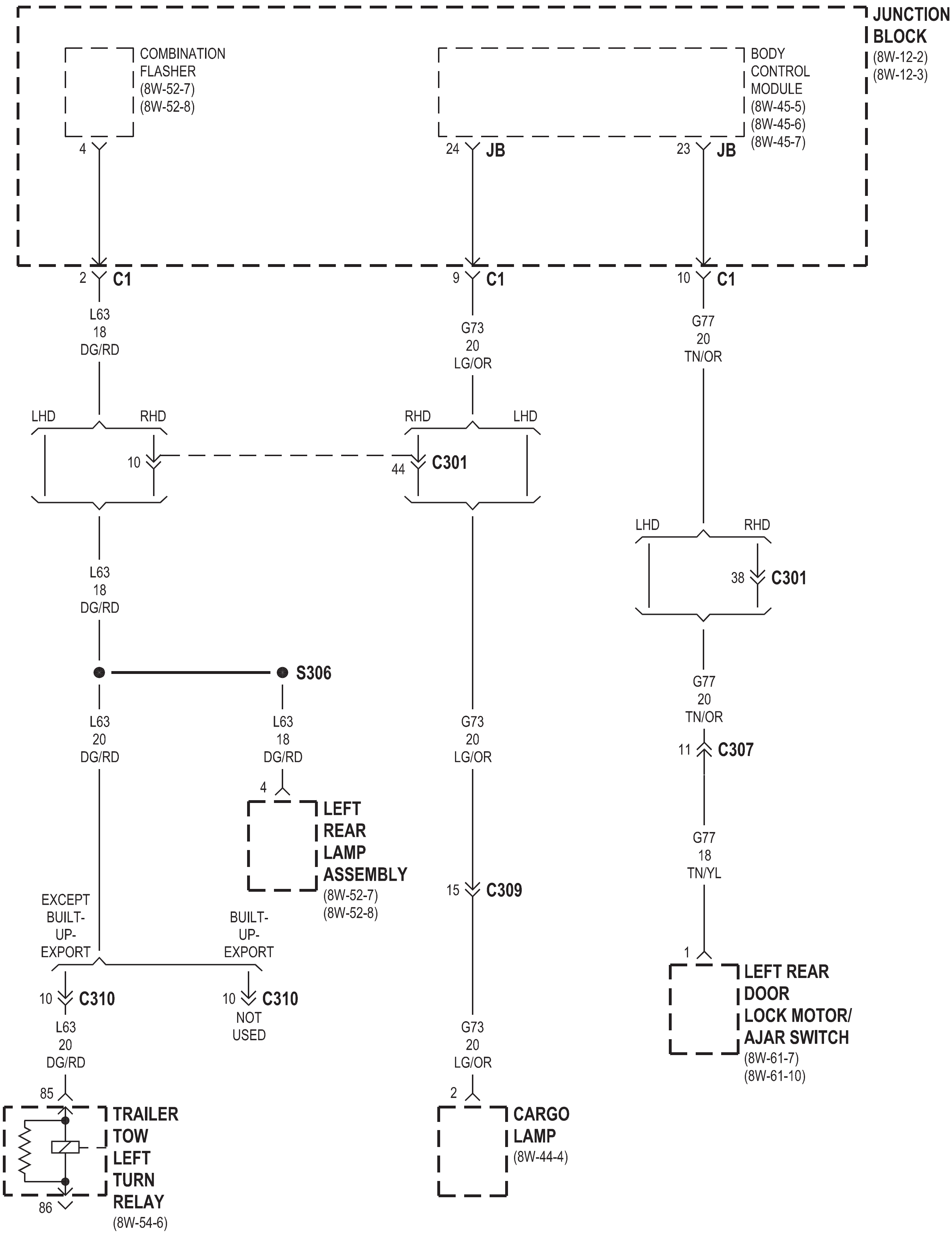
RUN-START A21
(8W-10-29)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
5
JB
BODY
CONTROL
MODULE
(8W-45-2)
51
C3
30
C1
50
C3
G5
20
DB/WT
RHD
LHD
41
C301
G5
20
DB/WT
G5
20
DB/WT
3
SENTRY
KEY
IMMOBILIZER
MODULE
(8W-39-9)
G5
20
DB/WT
7
C309
G5
20
DB/WT
G5
20
DB/WT
7
INSTRUMENT
CLUSTER
(8W-40-2)
S349
G5
20
DB/WT
G5
20
BK/LG
5
VEHICLE
INFORMATION
CENTER
(8W-49-2)
(8W-49-3)
1
AUTOMATIC
DAY/NIGHT
MIRROR
(8W-49-4)

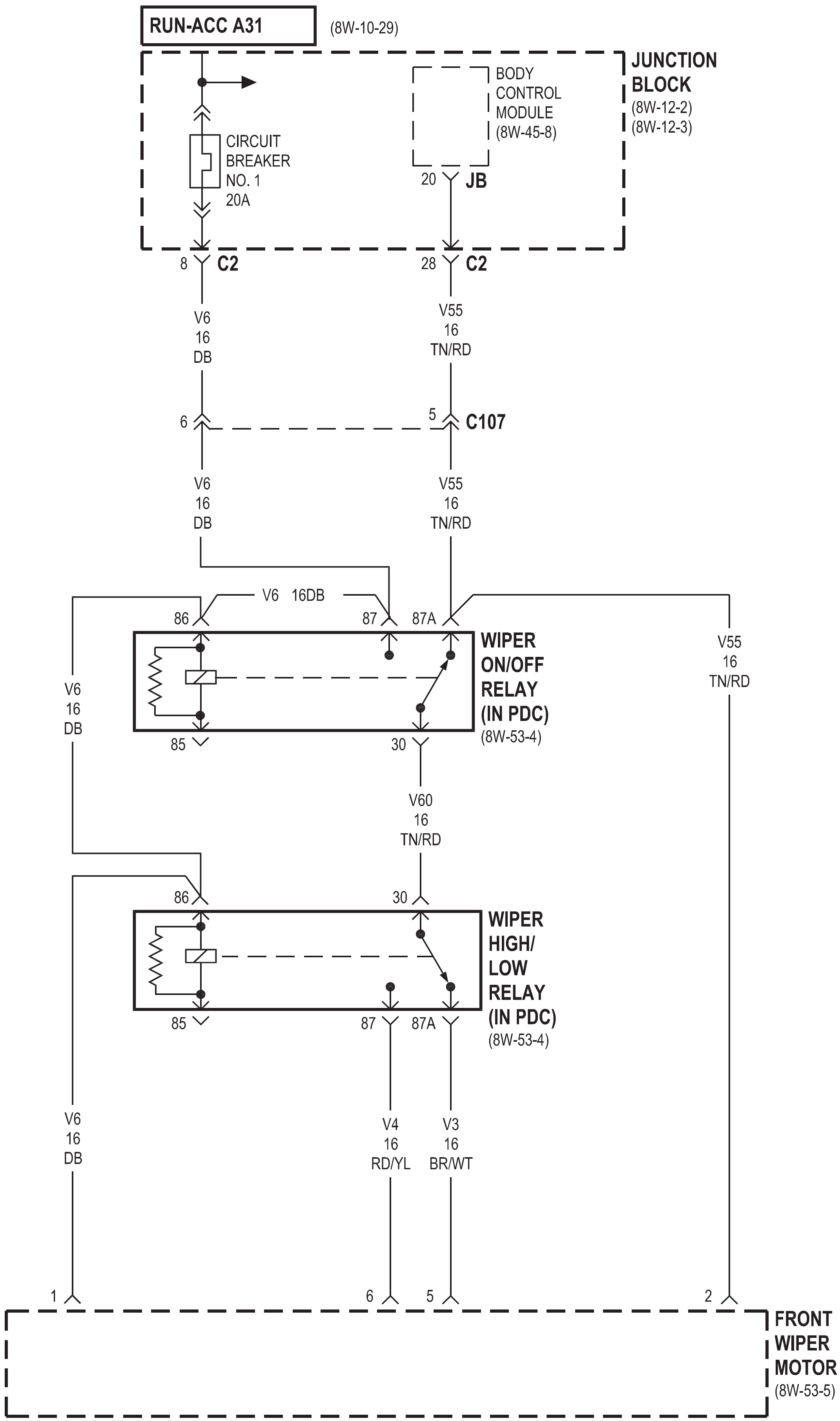


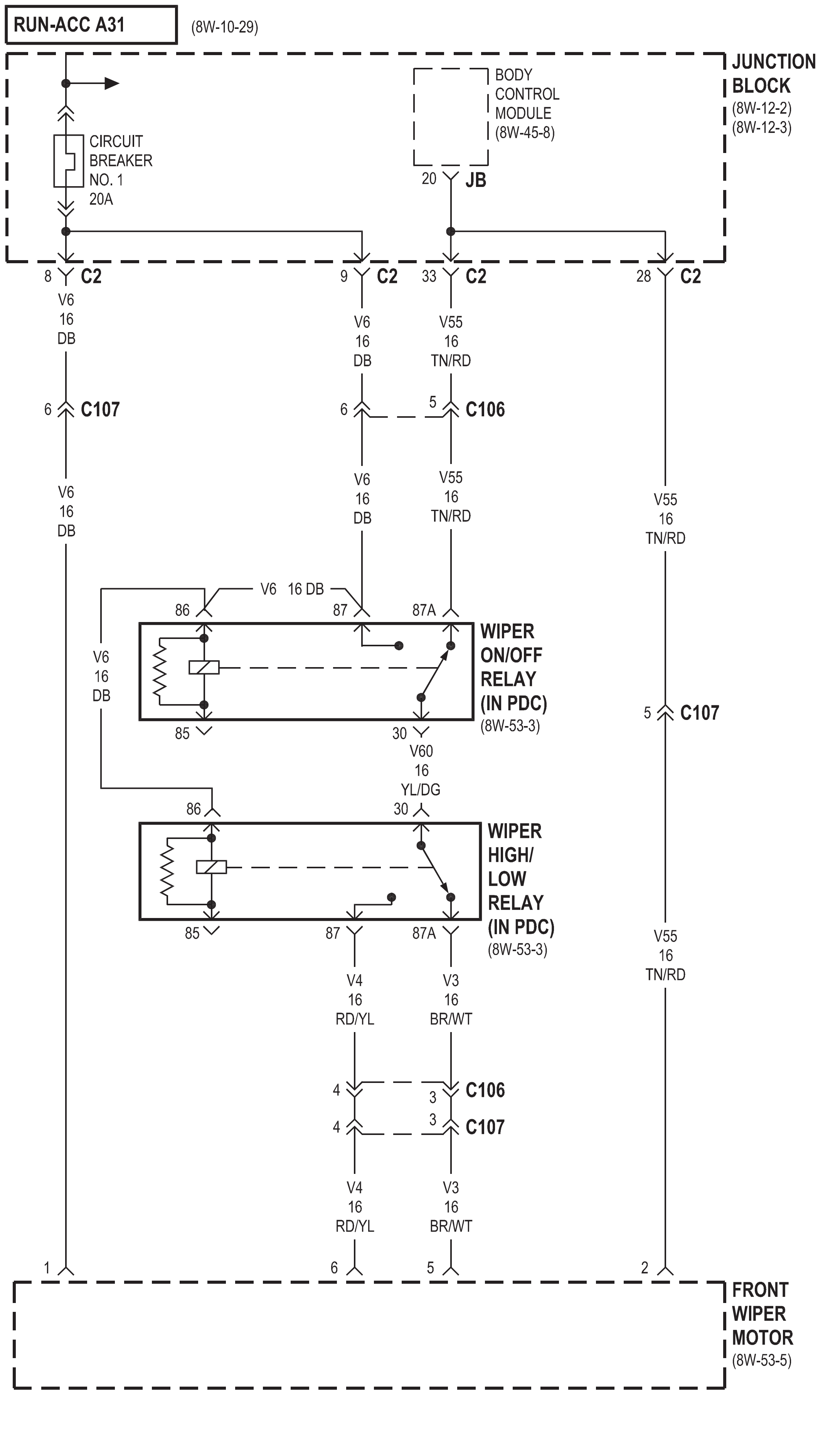
BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 23 15A
FUSE 24 15A
86
30
FOG LAMP RELAY
(8W-50-12)
85
87
16 JB
13 JB
BODY CONTROL MODULE
(8W-45-3)
47 C2
16 C1
3 C2
12 C2
F32 20 PK/DB
6
BRAKE LAMP SWITCH
(8W-33-2)
LHD
RHD
M2 20 YL/DG
M2 18 YL
3 C301
M2 18 YL
3 C309
L39 20 LB
57 C107
57 C106
L39 20 LB
A
LEFT FOG LAMP
(8W-50-12)
A
RIGHT FOG LAMP
(8W-50-12)
LEFT DOOR HANDLE COURTESY LAMP
(8W-44-3)
3
M2 20 YL/DG
M2 20 YL/DG
S348
M2 20 YL/DG
M2 20 YL/DG
M2 20 YL/DG
3
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)
3
CARGO LAMP
(8W-44-4)
3
RIGHT DOOR HANDLE COURTESY LAMP
(8W-44-3)

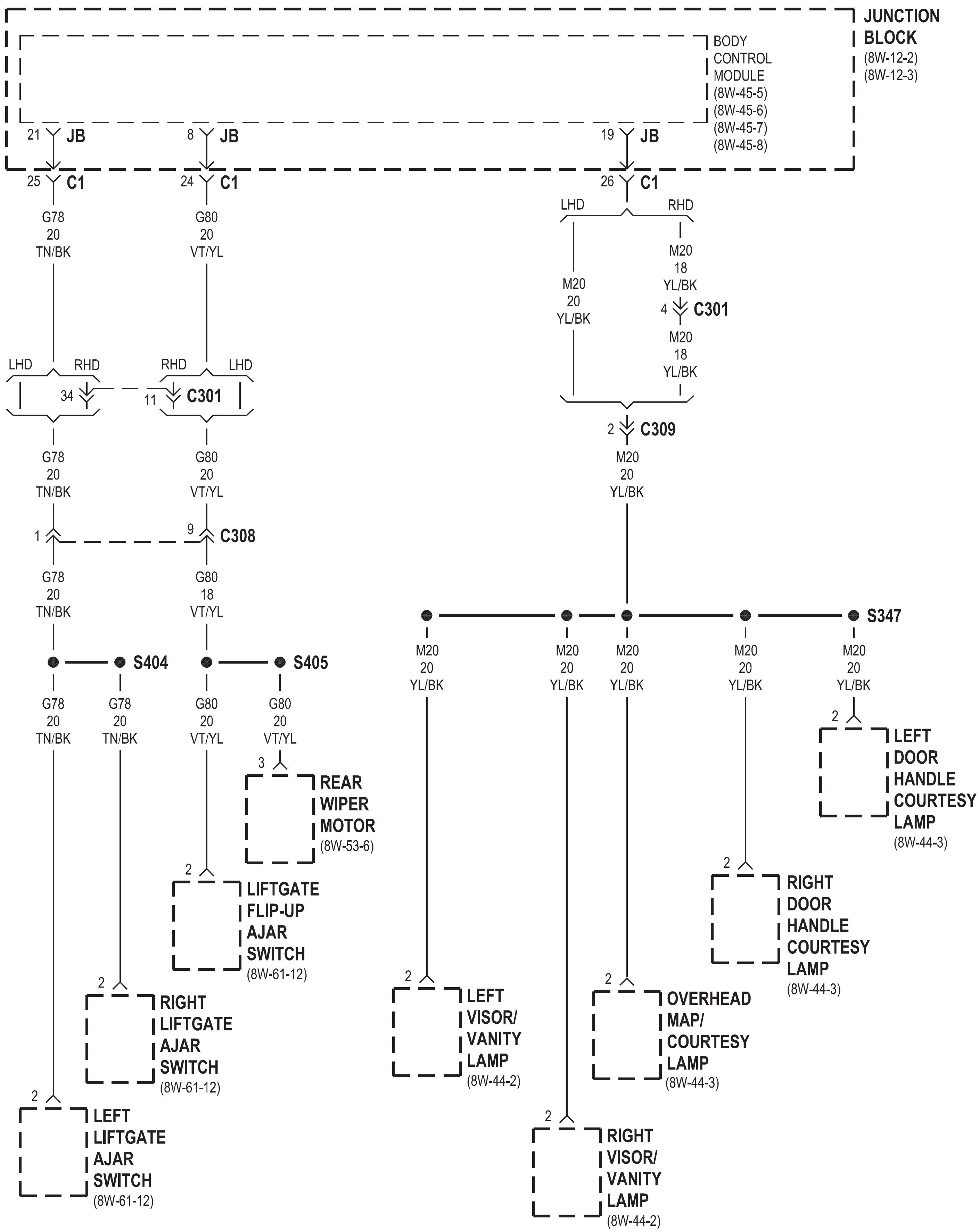

BATT A147
(8W-10-24)
RUN-START A21
(8W-10-29)
RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 25 15A
FUSE 32 10A
FUSE 33 10A
85
30
ACCESSORY DELAY RELAY
(8W-64-2)
86
87
3 JB
BODY CONTROL MODULE
(8W-45-9)
1 C1
28 C3
11 C3
Q30 16 TN
F14 20 LG/YL
F23 18 DB/YL
LHD
RHD
L C301
24 C2
16 C2
AIRBAG CONTROL MODULE
(8W-43-2)
Q30 16 TN
11 C309
OTHER
SUNROOF
AUTOWIPE
AUTOWIPE/SUNROOF
NOT USED
Q30 16 TN
Q30 20 BK/LB
Q30 16 TN
S337
1 C315
Q30 16 DB
5
RAIN SENSOR
(8W-49-6)
Q30 16 TN
Q30 20 BK/LB
1 C315
Q30 16 DB
5
RAIN SENSOR
(8W-49-6)
I
SUNROOF CONTROL MODULE
(8W-64-2)
F
SUNROOF CONTROL MODULE
(8W-64-2)
(8W-64-3)

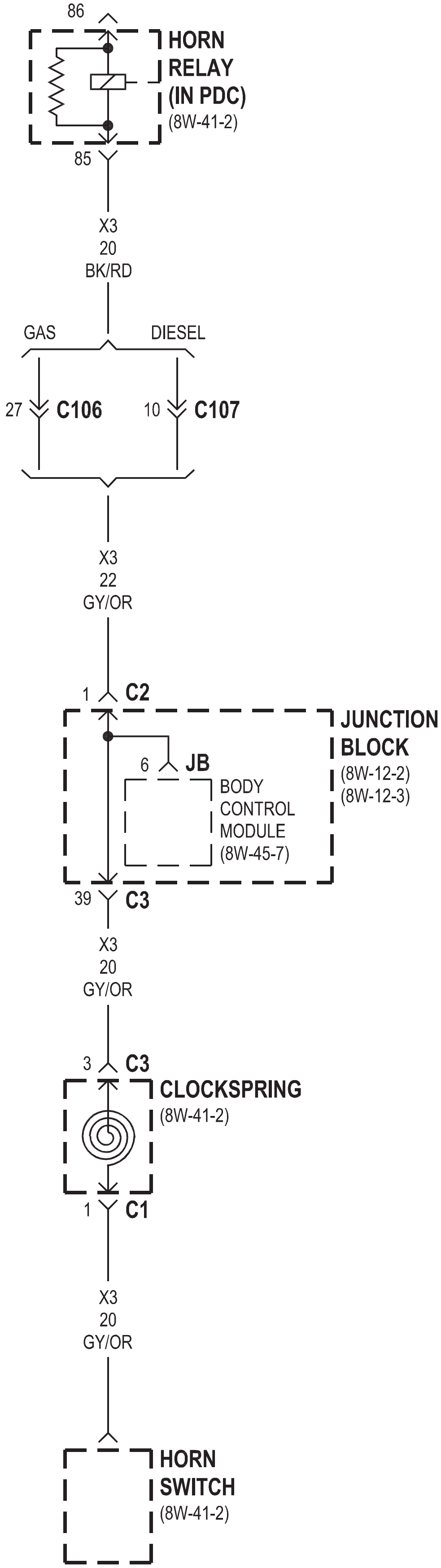

RUN-ACC A31
(8W-10-29)
START A41
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 29 10A
FUSE 28 10A
FUSE 30 10A
FUSE 31 10A
85
CIGAR LIGHTER RELAY
(8W-41-4)
86
25 JB
BODY CONTROL MODULE
(8W-45-2)
15 JB
43 C3
33 C3
27 C2
F45 20 YL/RD
GAS
DIESEL
37 C106
12 C107
4.0L RHD
EXCEPT 4.0L RHD
F45 20 YL/RD
F45 18 YL/RD
V23 20 BR/PK
X12 16 WT/RD
86
ENGINE STARTER MOTOR RELAY (IN PDC)
85
(8W-21-2)
(8W-21-3)
(8W-21-4)
F45 18 YL/RD
12 C103
F45 18 YL/RD
1
RIGHT MULTI-FUNCTION SWITCH
(8W-53-2)
2 C1
RADIO
(8W-47-2)
(8W-47-3)
8
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)

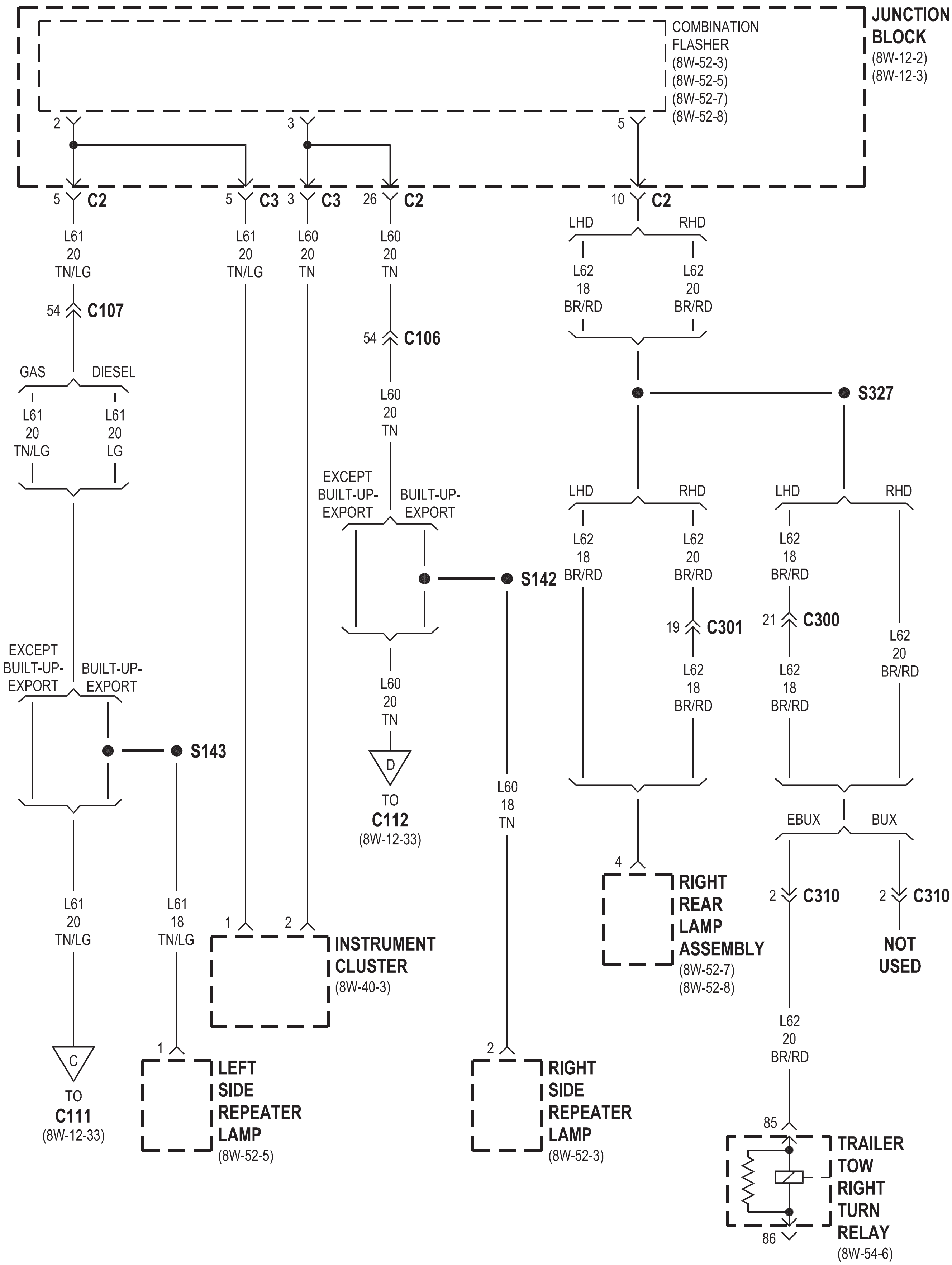

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-7)
(8W-52-8)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
(8W-45-7)
4
24 JB
23 JB
2 C1
9 C1
10 C1
L63 18 DG/RD
G73 20 LG/OR
G77 20 TN/OR
LHD
RHD
10
44 C301
38 C301
S306
L63 20 DG/RD
L63 18 DG/RD
G77 20 TN/OR
11 C307
G77 18 TN/YL
LEFT REAR LAMP ASSEMBLY
(8W-52-7)
(8W-52-8)
15 C309
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
10 C310
NOT USED
L63 20 DG/RD
G73 20 LG/OR
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
(8W-61-10)
85
86
TRAILER TOW LEFT TURN RELAY
(8W-54-6)
2
CARGO LAMP
(8W-44-4)

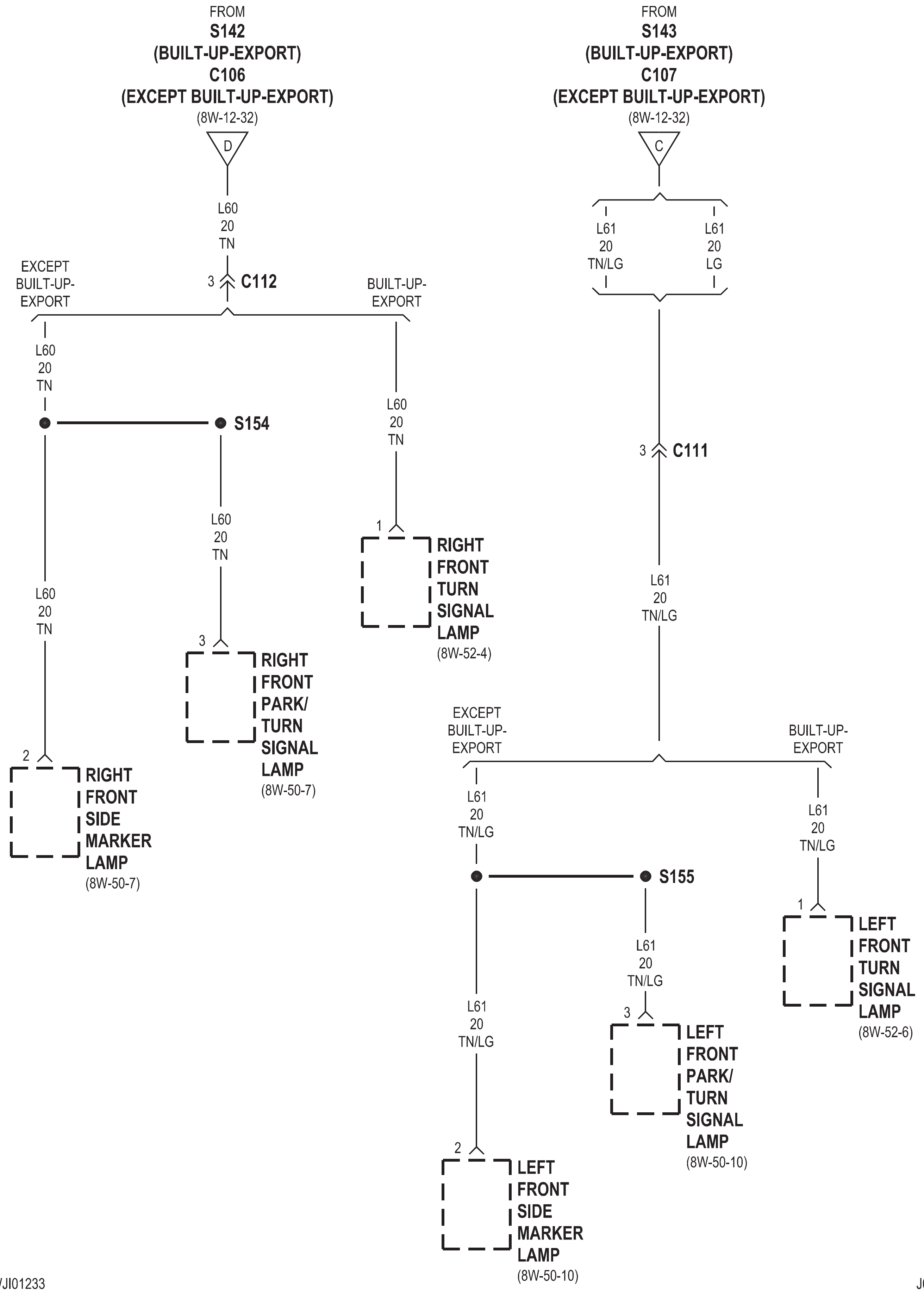

RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1 20A
BODY CONTROL MODULE
(8W-45-8)
20 JB
8 C2
28 C2
V6 16 DB
V55 16 TN/RD
6
5 C107
V6 16 DB
V55 16 TN/RD
V6 16DB
86
87
87A
WIPER ON/OFF RELAY (IN PDC)
(8W-53-4)
V6 16 DB
V55 16 TN/RD
85
30
V60 16 TN/RD
86
30
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-4)
85
87
87A
V6 16 DB
V4 16 RD/YL
V3 16 BR/WT
1
6
5
2
FRONT WIPER MOTOR
(8W-53-5)

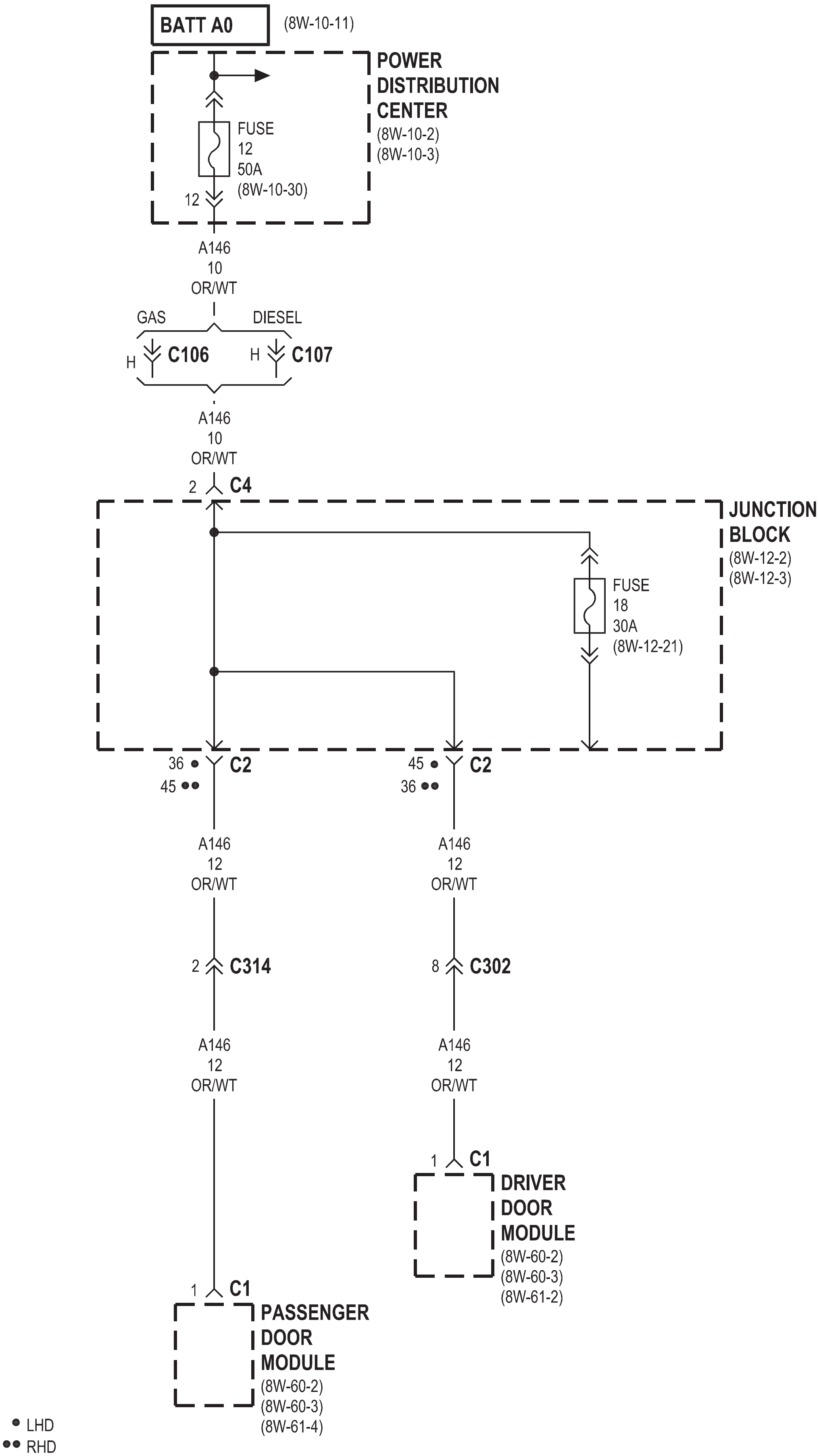

RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1 20A
BODY CONTROL MODULE
(8W-45-8)
20 JB
8 C2
9 C2
33 C2
28 C2
V6 16 DB
V55 16 TN/RD
6 C107
6
5 C106
V6 16 DB
86
87
87A
WIPER ON/OFF RELAY (IN PDC)
(8W-53-3)
85
30
V60 16 YL/DG
5 C107
86
30
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-3)
85
87
87A
V4 16 RD/YL
V3 16 BR/WT
4
3 C106
4
3 C107
1
6
5
2
FRONT WIPER MOTOR
(8W-53-5)

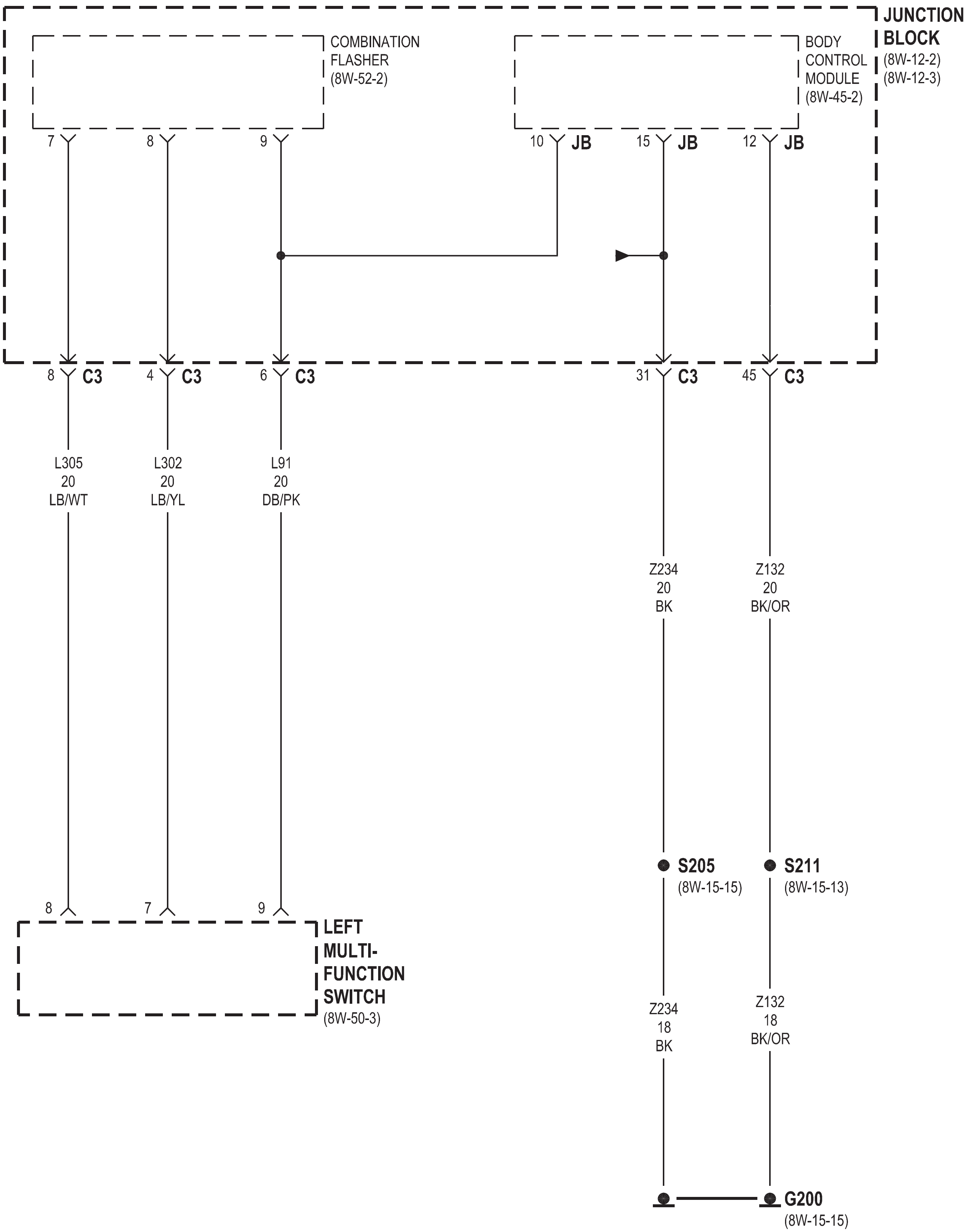

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
(8W-45-7)
(8W-45-8)
21 JB
8 JB
19 JB
25 C1
24 C1
26 C1
G78 20 TN/BK
G80 20 VT/YL
LHD
RHD
M20 20 YL/BK
M20 18 YL/BK
4 C301
M20 18 YL/BK
LHD
RHD
RHD
LHD
34
11 C301
2 C309
M20 20 YL/BK
G78 20 TN/BK
G80 20 VT/YL
1
9 C308
G78 20 TN/BK
G80 18 VT/YL
S404
S405
S347
G78 20 TN/BK
G78 20 TN/BK
G80 20 VT/YL
G80 20 VT/YL
M20 20 YL/BK
M20 20 YL/BK
M20 20 YL/BK
M20 20 YL/BK
M20 20 YL/BK
3
REAR WIPER MOTOR
(8W-53-6)
2
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-12)
2
RIGHT LIFTGATE AJAR SWITCH
(8W-61-12)
2
LEFT LIFTGATE AJAR SWITCH
(8W-61-12)
2
LEFT VISOR/ VANITY LAMP
(8W-44-2)
2
RIGHT VISOR/ VANITY LAMP
(8W-44-2)
2
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)
2
RIGHT DOOR HANDLE COURTESY LAMP
(8W-44-3)
2
LEFT DOOR HANDLE COURTESY LAMP
(8W-44-3)


86
HORN
RELAY
(IN PDC)
(8W-41-2)
85
X3
20
BK/RD
GAS
DIESEL
27
C106
10
C107
X3
22
GY/OR
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
JB
BODY
CONTROL
MODULE
(8W-45-7)
39
C3
X3
20
GY/OR
3
C3
CLOCKSPRING
(8W-41-2)
1
C1
X3
20
GY/OR
HORN
SWITCH
(8W-41-2)

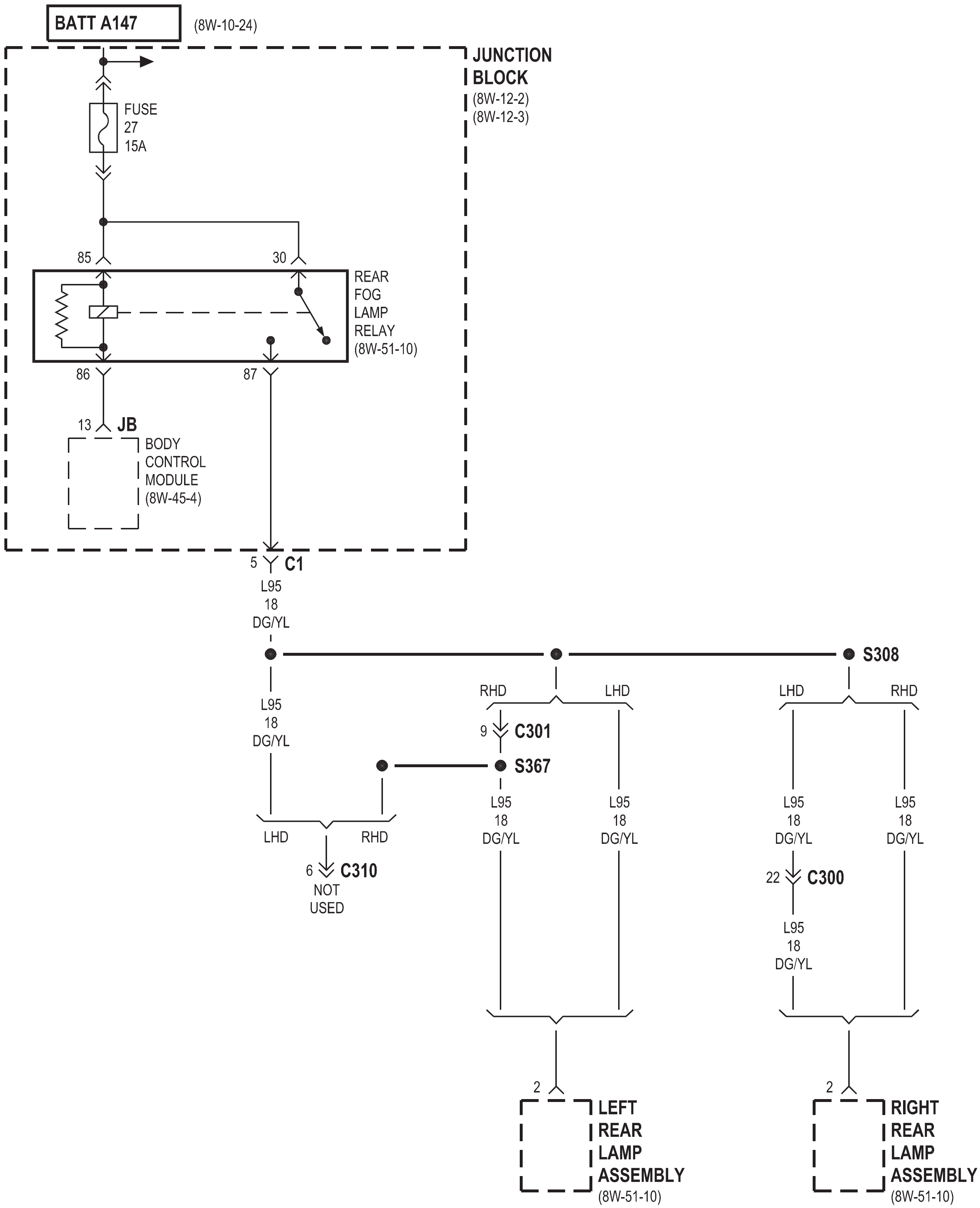

COMBINATION FLASHER
(8W-52-3)
(8W-52-5)
(8W-52-7)
(8W-52-8)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
2
3
5
5 C2
5 C3
3 C3
26 C2
10 C2
L61 20 TN/LG
L61 20 TN/LG
L60 20 TN
L60 20 TN
LHD
RHD
L62 18 BR/RD
L62 20 BR/RD
54 C107
54 C106
GAS
DIESEL
L61 20 TN/LG
L61 20 LG
L60 20 TN
S327
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
LHD
RHD
L62 18 BR/RD
L62 20 BR/RD
LHD
RHD
L62 18 BR/RD
S142
19 C301
21 C300
L62 20 BR/RD
L62 18 BR/RD
L62 18 BR/RD
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
L60 20 TN
S143
D
TO C112 (8W-12-33)
L60 18 TN
EBUX
BUX
4
RIGHT REAR LAMP ASSEMBLY
(8W-52-7)
(8W-52-8)
2 C310
2 C310
NOT USED
L61 20 TN/LG
L61 18 TN/LG
1
2
INSTRUMENT CLUSTER
(8W-40-3)
L62 20 BR/RD
C
TO C111 (8W-12-33)
1
LEFT SIDE REPEATER LAMP
(8W-52-5)
2
RIGHT SIDE REPEATER LAMP
(8W-52-3)
85
TRAILER TOW RIGHT TURN RELAY
(8W-54-6)
86


FROM
S142
(BUILT-UP-EXPORT)
C106
(EXCEPT BUILT-UP-EXPORT)
(8W-12-32)
D
L60
20
TN
3
C112
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
L60
20
TN
S154
L60
20
TN
L60
20
TN
L60
20
TN
1
RIGHT
FRONT
TURN
SIGNAL
LAMP
(8W-52-4)
3
RIGHT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-7)
2
RIGHT
FRONT
SIDE
MARKER
LAMP
(8W-50-7)
FROM
S143
(BUILT-UP-EXPORT)
C107
(EXCEPT BUILT-UP-EXPORT)
(8W-12-32)
C
L61
20
TN/LG
L61
20
LG
3
C111
L61
20
TN/LG
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
L61
20
TN/LG
S155
L61
20
TN/LG
L61
20
TN/LG
1
LEFT
FRONT
TURN
SIGNAL
LAMP
(8W-52-6)
3
LEFT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-10)
L61
20
TN/LG
2
LEFT
FRONT
SIDE
MARKER
LAMP
(8W-50-10)


BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
FUSE
12
50A
(8W-10-30)
12
A146
10
OR/WT
GAS
DIESEL
H
C106
H
C107
A146
10
OR/WT
2
C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
18
30A
(8W-12-21)
36 •
45 ••
C2
45 •
36 ••
C2
A146
12
OR/WT
A146
12
OR/WT
2
C314
8
C302
A146
12
OR/WT
A146
12
OR/WT
1
C1
DRIVER
DOOR
MODULE
(8W-60-2)
(8W-60-3)
(8W-61-2)
1
C1
PASSENGER
DOOR
MODULE
(8W-60-2)
(8W-60-3)
(8W-61-4)
• LHD
•• RHD

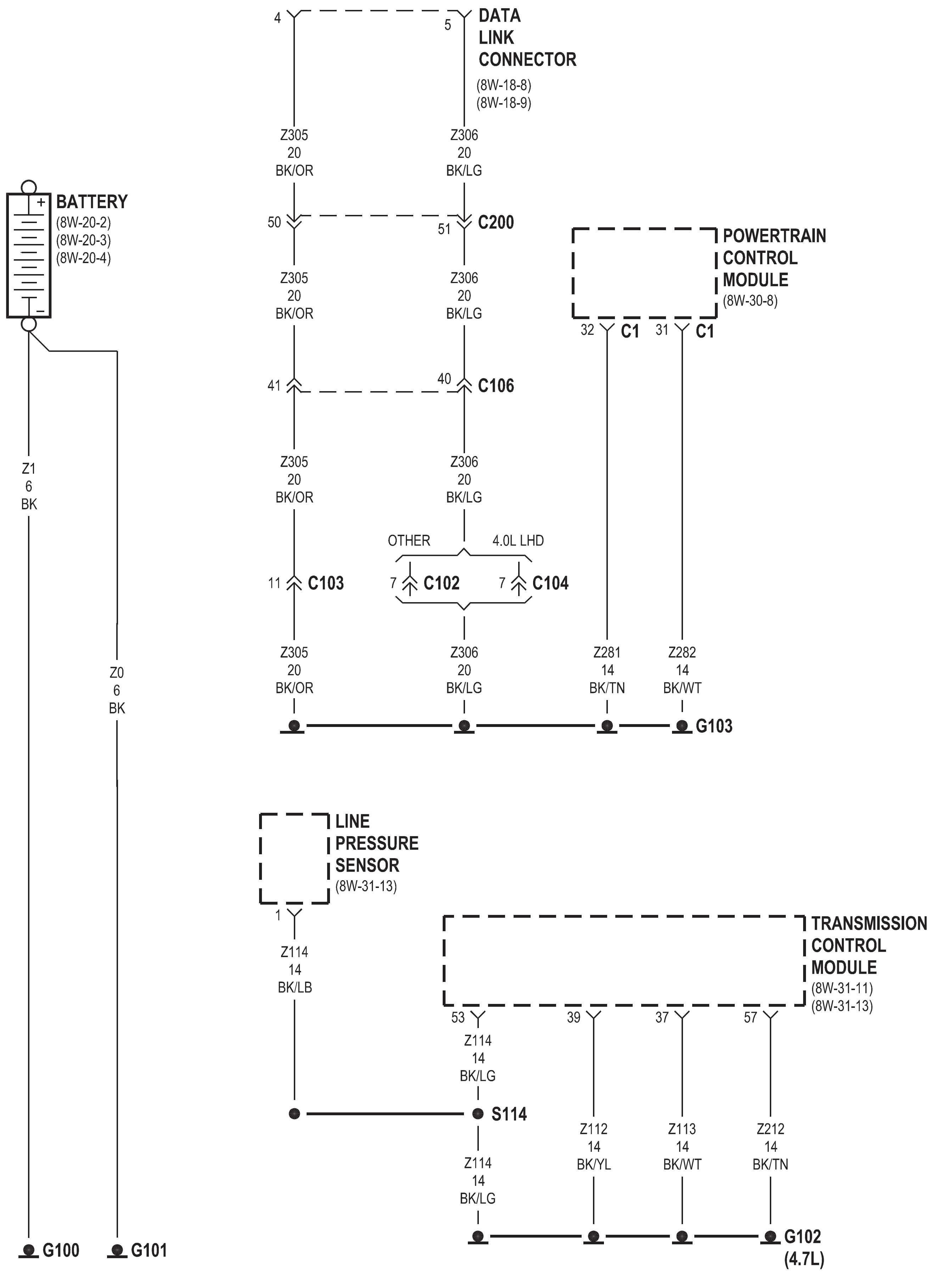

JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION
FLASHER
(8W-52-2)
BODY
CONTROL
MODULE
(8W-45-2)
7
8
9
10 JB
15 JB
12 JB
8 C3
4 C3
6 C3
31 C3
45 C3
L305
20
LB/WT
L302
20
LB/YL
L91
20
DB/PK
Z234
20
BK
Z132
20
BK/OR
S205
(8W-15-15)
S211
(8W-15-13)
8
7
9
LEFT
MULTI-
FUNCTION
SWITCH
(8W-50-3)
Z234
18
BK
Z132
18
BK/OR
G200
(8W-15-15)

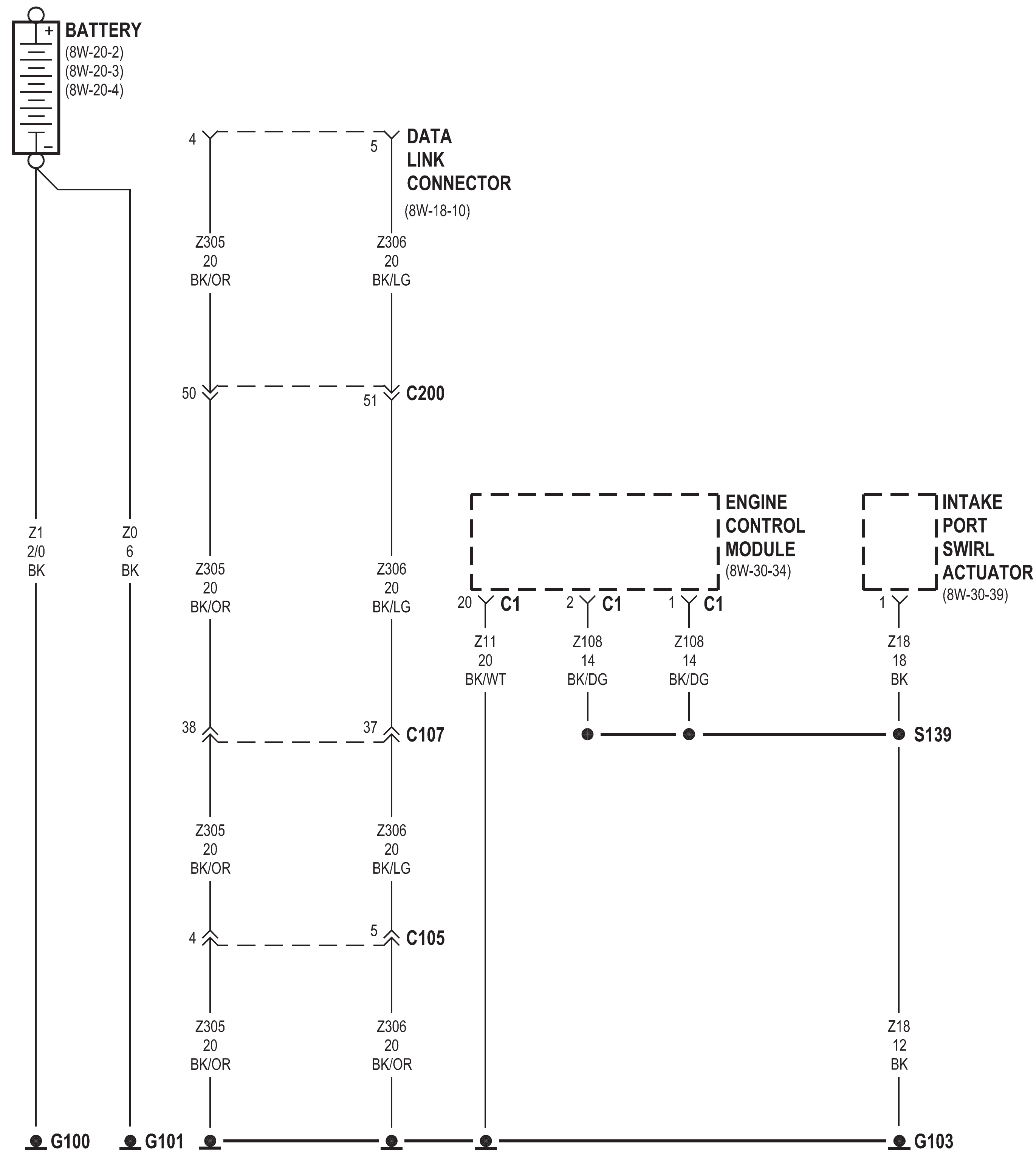
BUILT-UP-EXPORT

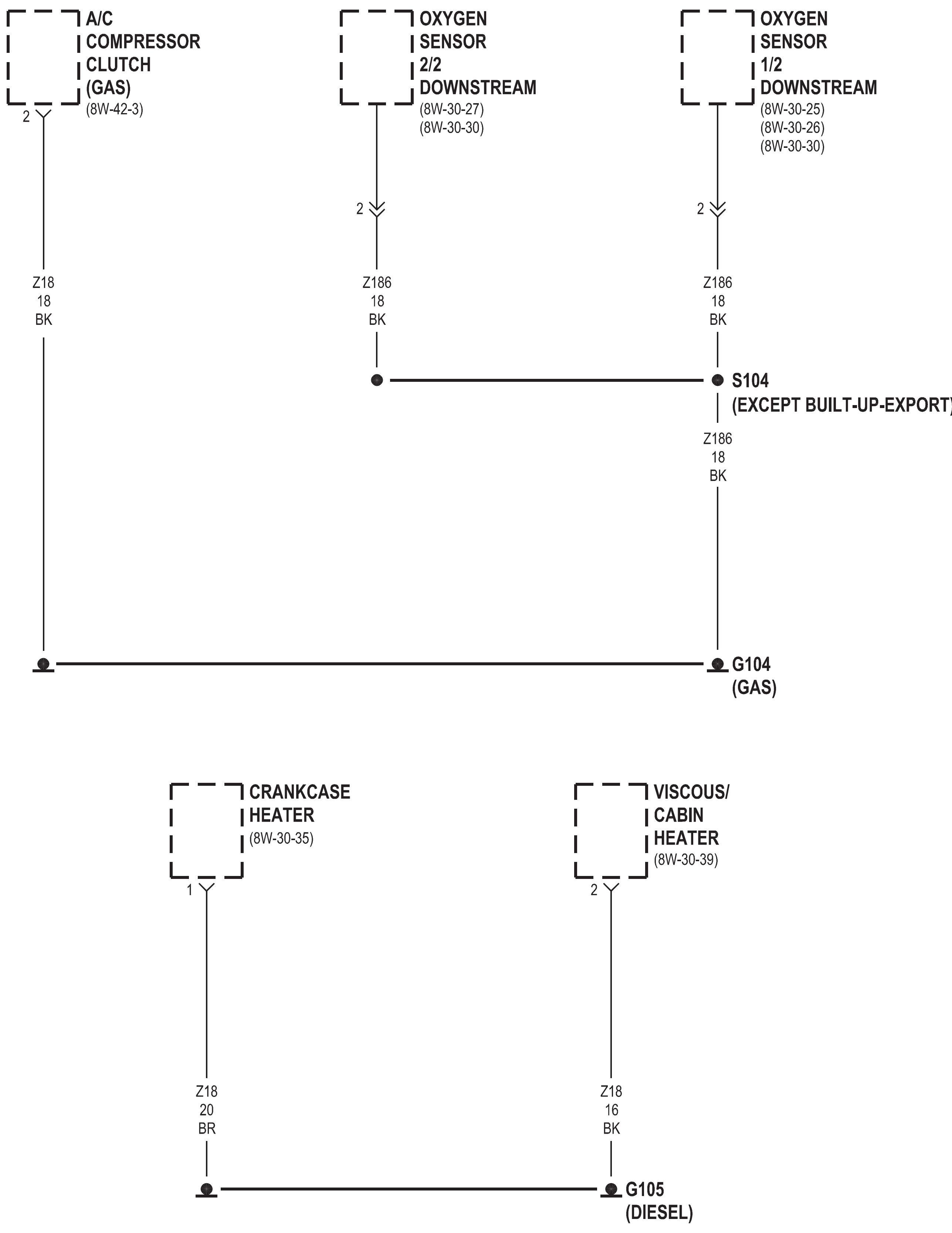


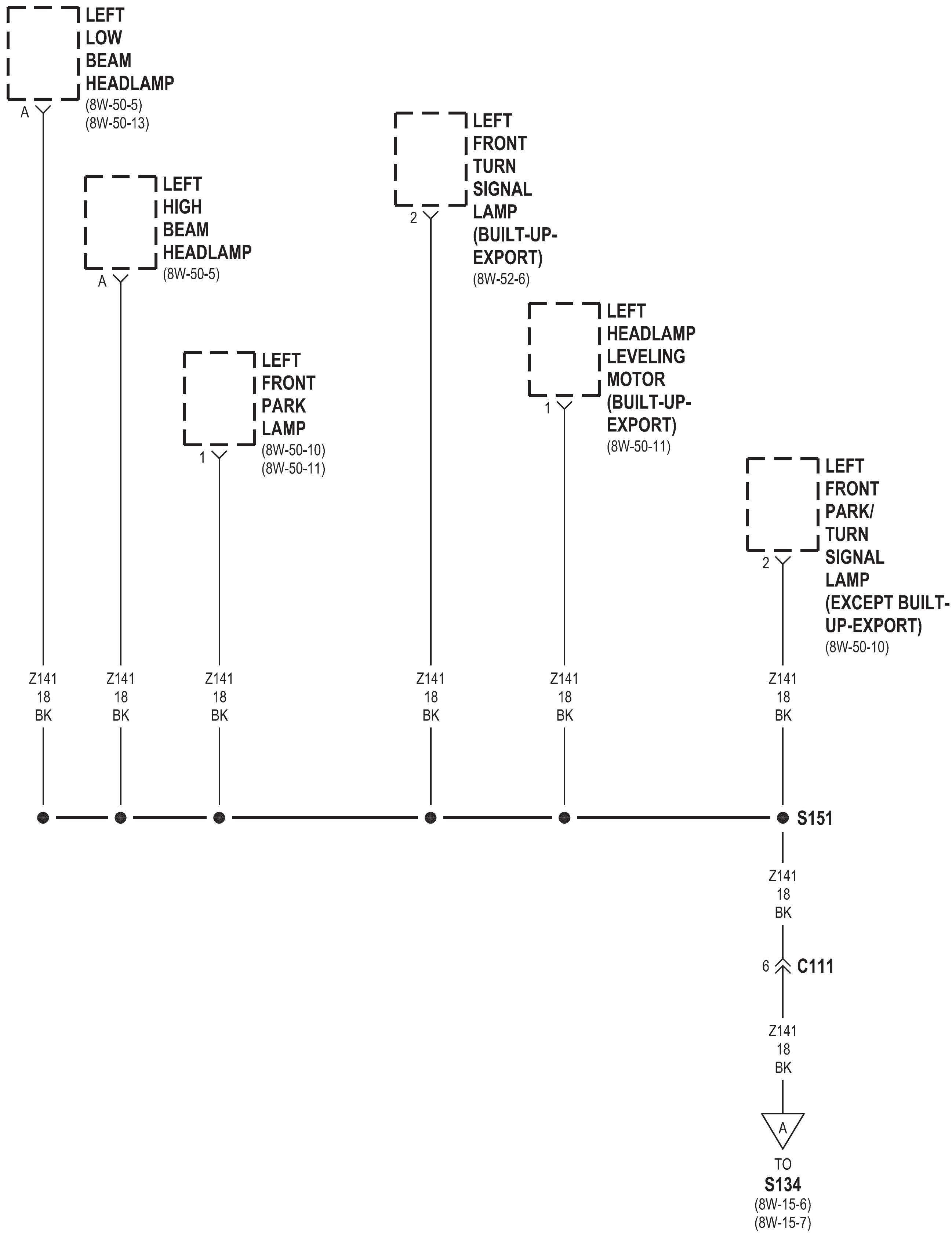
8W-15 GROUND DISTRIBUTION

GAS

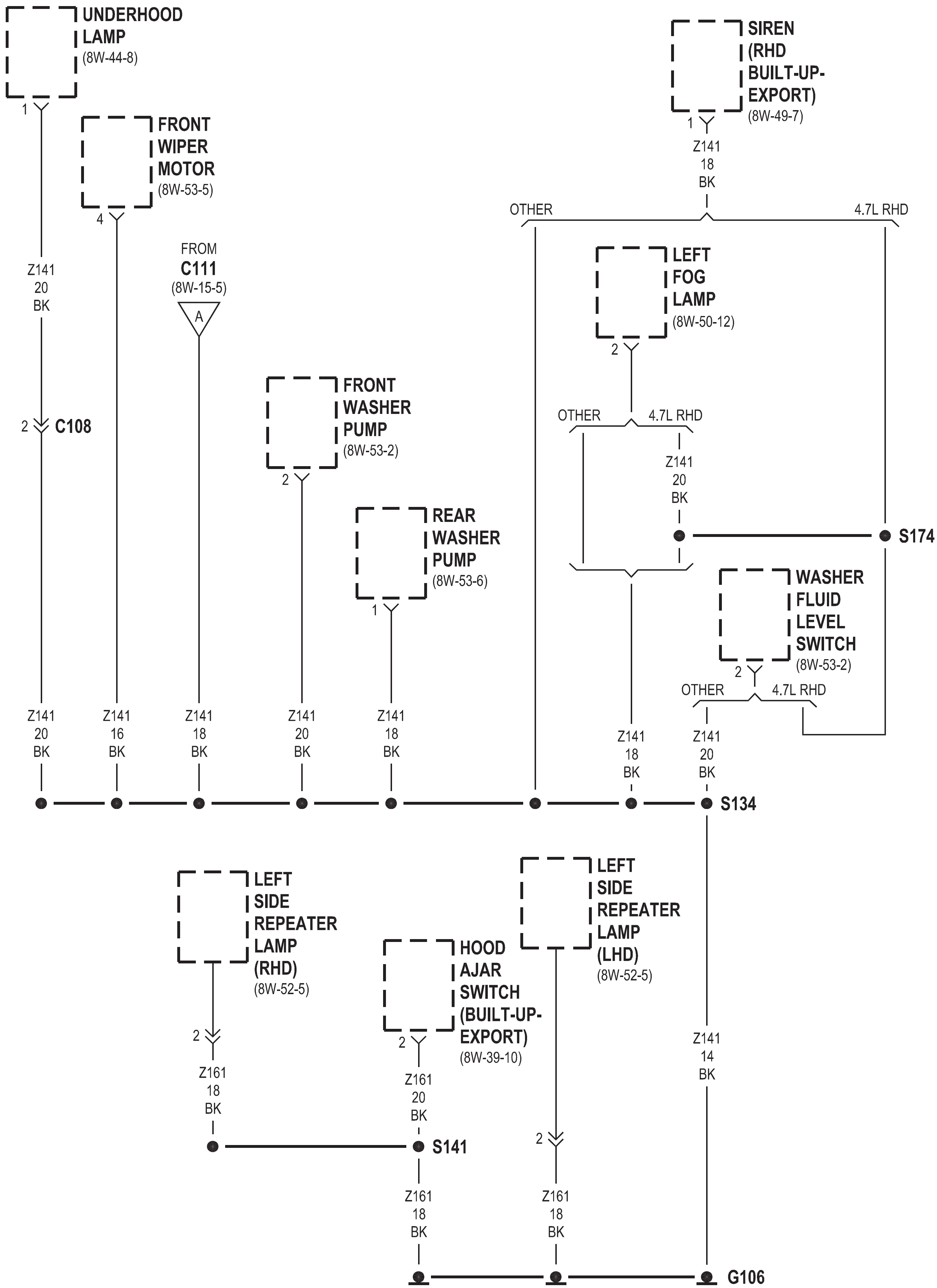

DATA LINK CONNECTOR
(8W-18-8)
(8W-18-9)
4
5
Z305 20 BK/OR
Z306 20 BK/LG
BATTERY
(8W-20-2)
(8W-20-3)
(8W-20-4)
50
51
C200
POWERTRAIN CONTROL MODULE
(8W-30-8)
32 C1
31 C1
41
40
C106
Z1 6 BK
OTHER
4.0L LHD
11 C103
7 C102
7 C104
Z0 6 BK
Z281 14 BK/TN
Z282 14 BK/WT
G103
LINE PRESSURE SENSOR
(8W-31-13)
1
Z114 14 BK/LB
TRANSMISSION CONTROL MODULE
(8W-31-11)
(8W-31-13)
53
39
37
57
Z114 14 BK/LG
S114
Z112 14 BK/YL
Z113 14 BK/WT
Z212 14 BK/TN
G100
G101
G102 (4.7L)

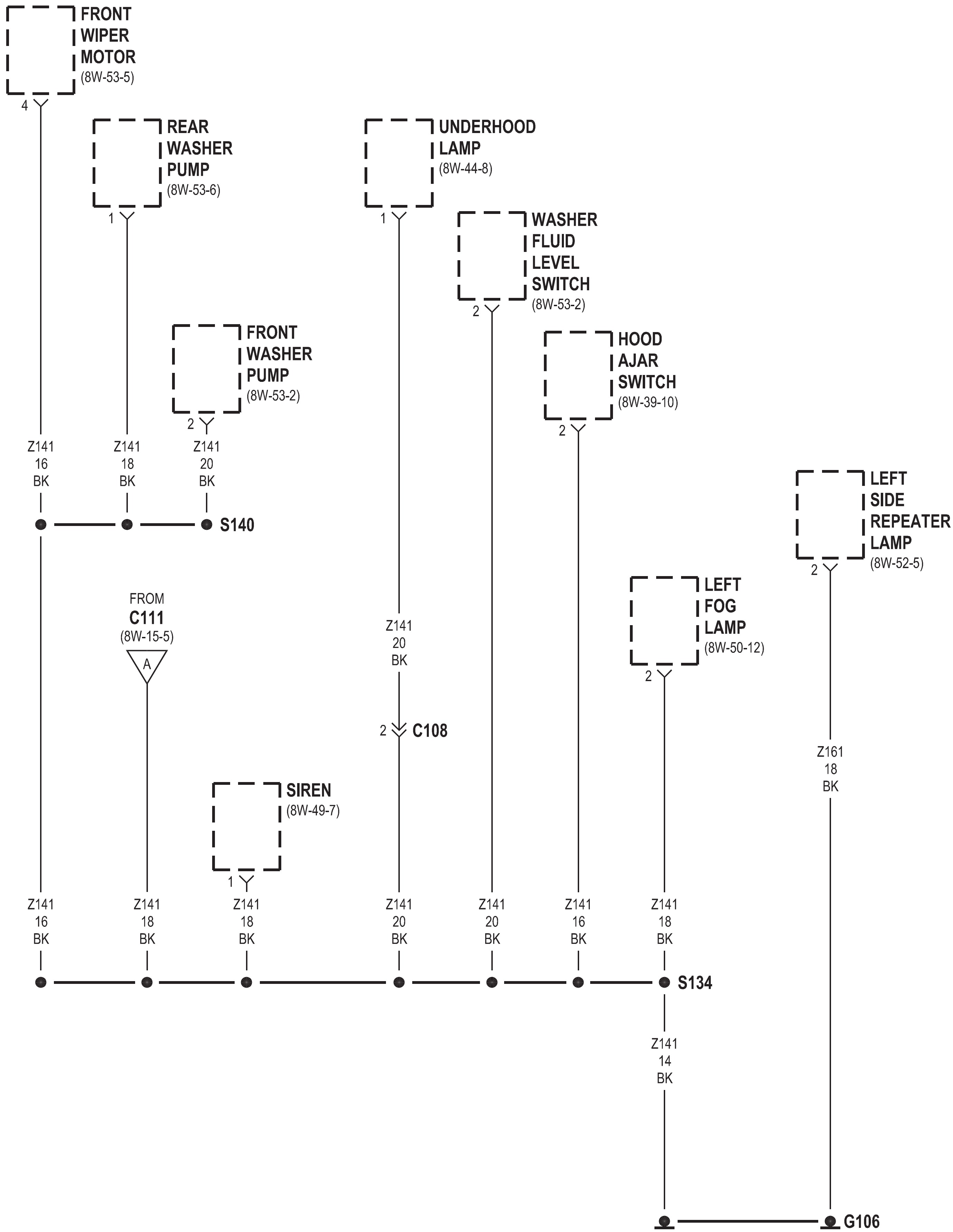

BATTERY
(8W-20-2)
(8W-20-3)
(8W-20-4)
DATA LINK CONNECTOR
(8W-18-10)
4
5
Z305 20 BK/OR
Z306 20 BK/LG
50
51
C200
Z1 2/0 BK
Z0 6 BK
ENGINE CONTROL MODULE
(8W-30-34)
INTAKE PORT SWIRL ACTUATOR
(8W-30-39)
20 C1
2 C1
1 C1
1
Z11 20 BK/WT
Z108 14 BK/DG
Z108 14 BK/DG
Z18 18 BK
38
37
C107
S139
4
5
C105
Z305 20 BK/OR
Z306 20 BK/OR
Z18 12 BK
G100
G101
G103

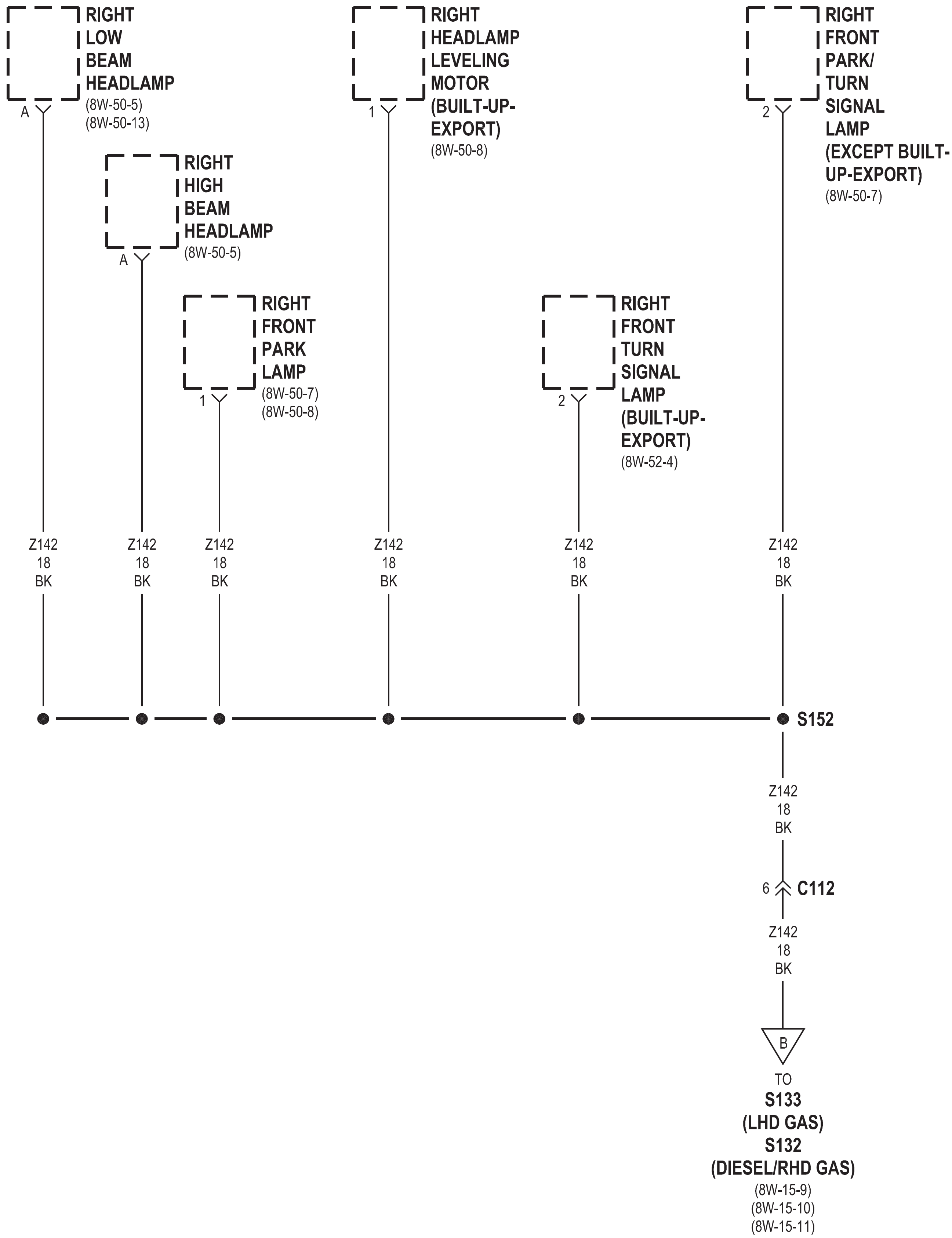

A/C
COMPRESSOR
CLUTCH
(GAS)
(8W-42-3)
OXYGEN
SENSOR
2/2
DOWNSTREAM
(8W-30-27)
(8W-30-30)
OXYGEN
SENSOR
1/2
DOWNSTREAM
(8W-30-25)
(8W-30-26)
(8W-30-30)
2
2
2
Z18
18
BK
Z186
18
BK
Z186
18
BK
S104
(EXCEPT BUILT-UP-EXPORT)
Z186
18
BK
G104
(GAS)
CRANKCASE
HEATER
(8W-30-35)
VISCOUS/
CABIN
HEATER
(8W-30-39)
1
2
Z18
20
BR
Z18
16
BK
G105
(DIESEL)


LEFT
LOW
BEAM
HEADLAMP
(8W-50-5)
(8W-50-13)
A
LEFT
HIGH
BEAM
HEADLAMP
(8W-50-5)
A
LEFT
FRONT
PARK
LAMP
(8W-50-10)
(8W-50-11)
1
LEFT
FRONT
TURN
SIGNAL
LAMP
(BUILT-UP-
EXPORT)
(8W-52-6)
2
LEFT
HEADLAMP
LEVELING
MOTOR
(BUILT-UP-
EXPORT)
(8W-50-11)
1
LEFT
FRONT
PARK/
TURN
SIGNAL
LAMP
(EXCEPT BUILT-
UP-EXPORT)
(8W-50-10)
2
Z141
18
BK
S151
6
C111
A
TO
S134
(8W-15-6)
(8W-15-7)

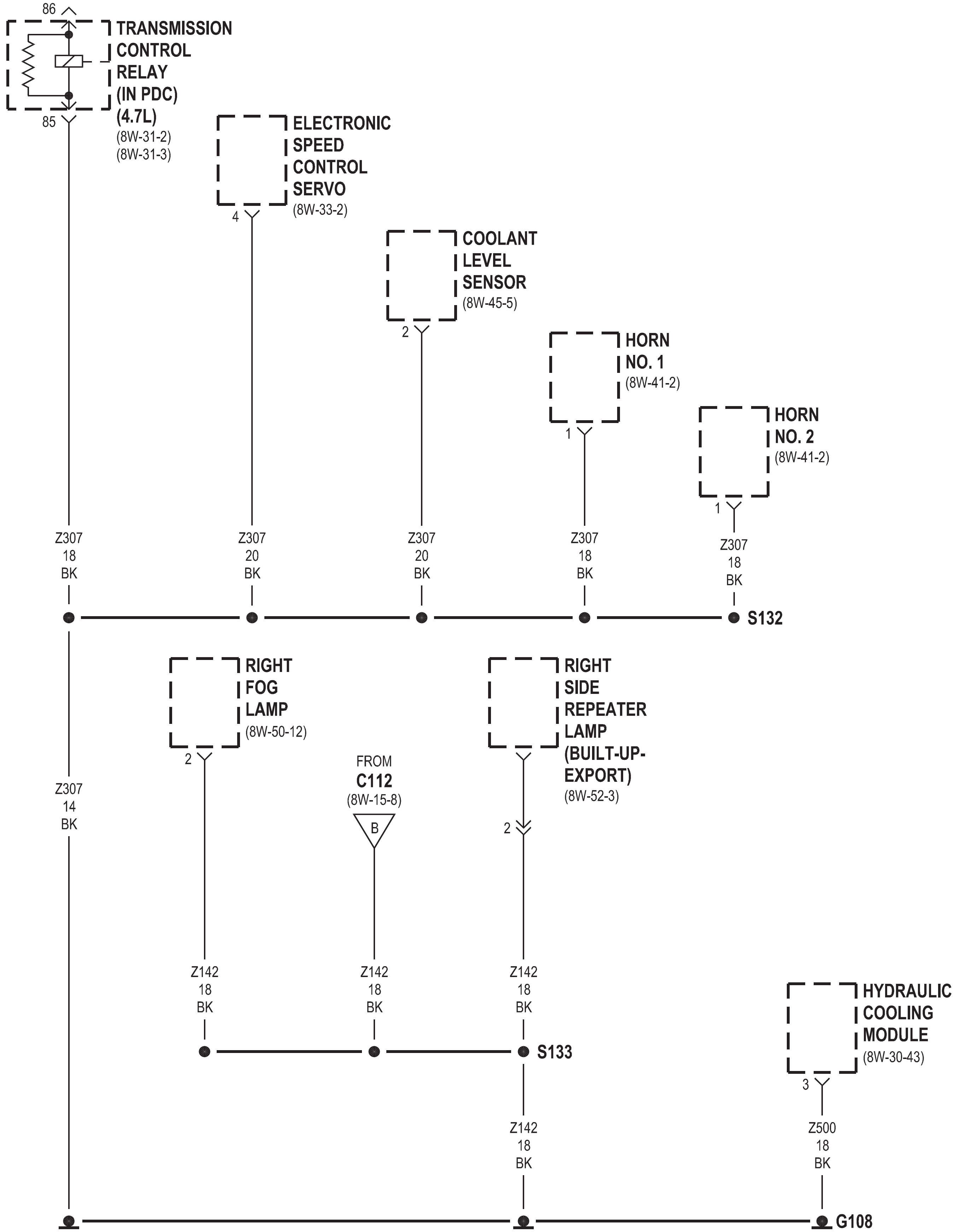
GAS

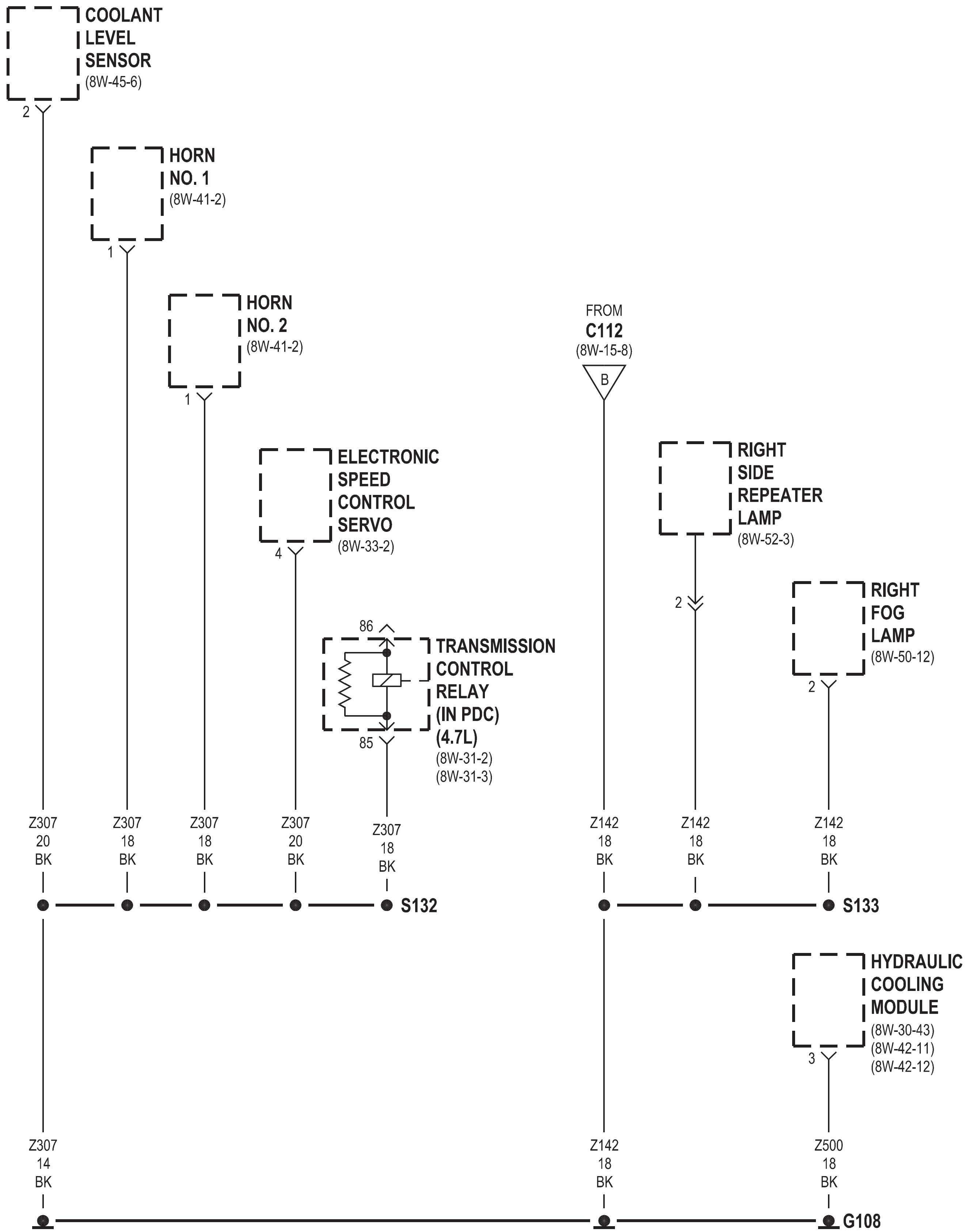

UNDERHOOD LAMP (8W-44-8)
FRONT WIPER MOTOR (8W-53-5)
FROM C111 (8W-15-5)
A
Z141 20 BK
C108
FRONT WASHER PUMP (8W-53-2)
REAR WASHER PUMP (8W-53-6)
SIREN (RHD BUILT-UP-EXPORT) (8W-49-7)
Z141 18 BK
OTHER
4.7L RHD
LEFT FOG LAMP (8W-50-12)
Z141 20 BK
S174
WASHER FLUID LEVEL SWITCH (8W-53-2)
Z141 16 BK
Z141 18 BK
Z141 14 BK
S134
LEFT SIDE REPEATER LAMP (RHD) (8W-52-5)
HOOD AJAR SWITCH (BUILT-UP-EXPORT) (8W-39-10)
LEFT SIDE REPEATER LAMP (LHD) (8W-52-5)
Z161 18 BK
Z161 20 BK
S141
G106


FRONT WIPER MOTOR (8W-53-5)
4
REAR WASHER PUMP (8W-53-6)
1
UNDERHOOD LAMP (8W-44-8)
1
WASHER FLUID LEVEL SWITCH (8W-53-2)
2
FRONT WASHER PUMP (8W-53-2)
2
HOOD AJAR SWITCH (8W-39-10)
2
Z141 16 BK
Z141 18 BK
Z141 20 BK
S140
LEFT SIDE REPEATER LAMP (8W-52-5)
2
LEFT FOG LAMP (8W-50-12)
2
FROM C111 (8W-15-5)
A
Z141 20 BK
2 C108
Z161 18 BK
SIREN (8W-49-7)
1
Z141 16 BK
Z141 18 BK
Z141 18 BK
Z141 20 BK
Z141 20 BK
Z141 16 BK
Z141 18 BK
S134
Z141 14 BK
G106

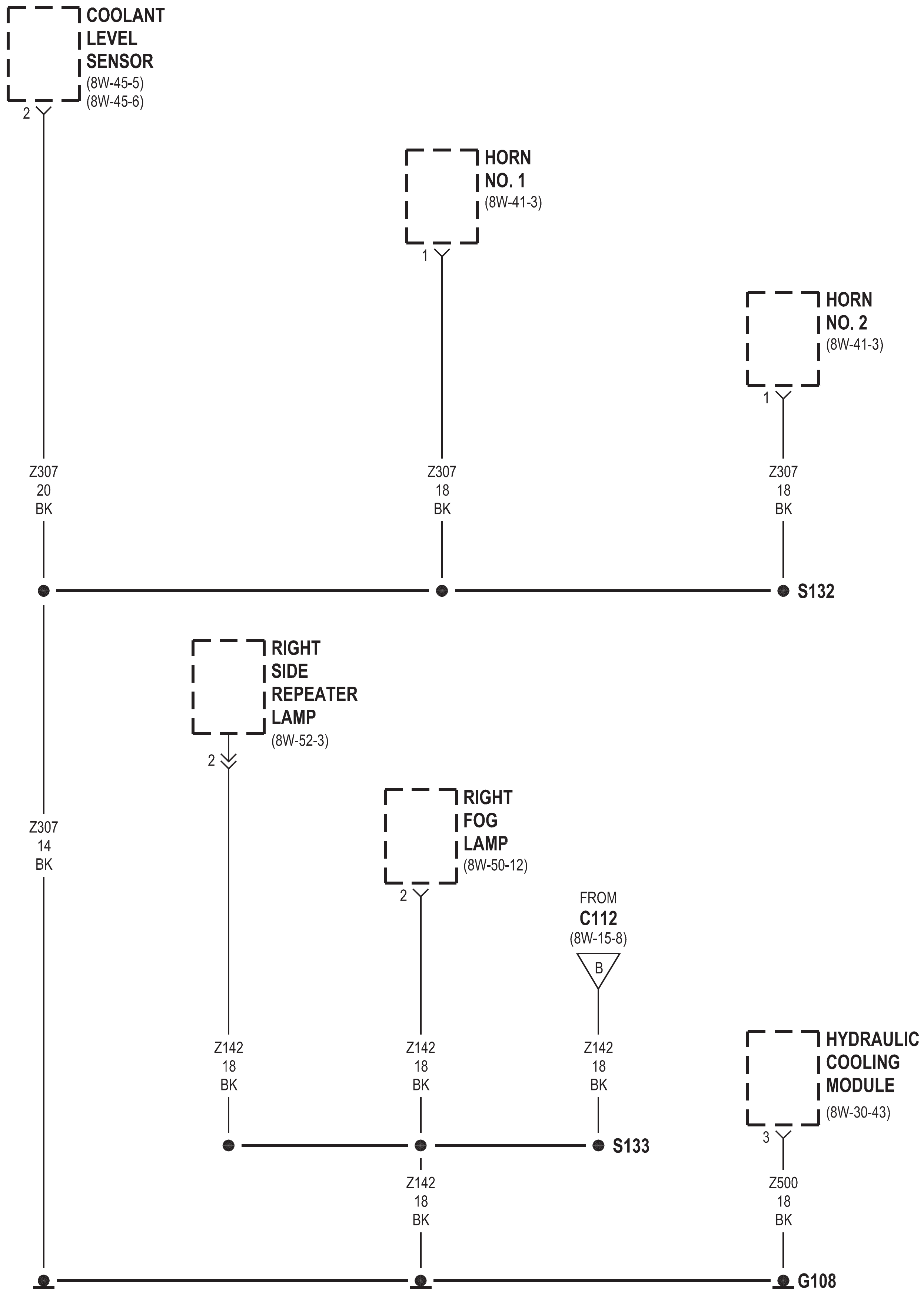

RIGHT LOW BEAM HEADLAMP
(8W-50-5)
(8W-50-13)
A
RIGHT HIGH BEAM HEADLAMP
(8W-50-5)
A
RIGHT FRONT PARK LAMP
(8W-50-7)
(8W-50-8)
1
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)
(8W-50-8)
1
RIGHT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT)
(8W-52-4)
2
RIGHT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)
(8W-50-7)
2
Z142 18 BK
Z142 18 BK
Z142 18 BK
Z142 18 BK
Z142 18 BK
Z142 18 BK
S152
Z142 18 BK
6
C112
Z142 18 BK
B
TO
S133
(LHD GAS)
S132
(DIESEL/RHD GAS)
(8W-15-9)
(8W-15-10)
(8W-15-11)

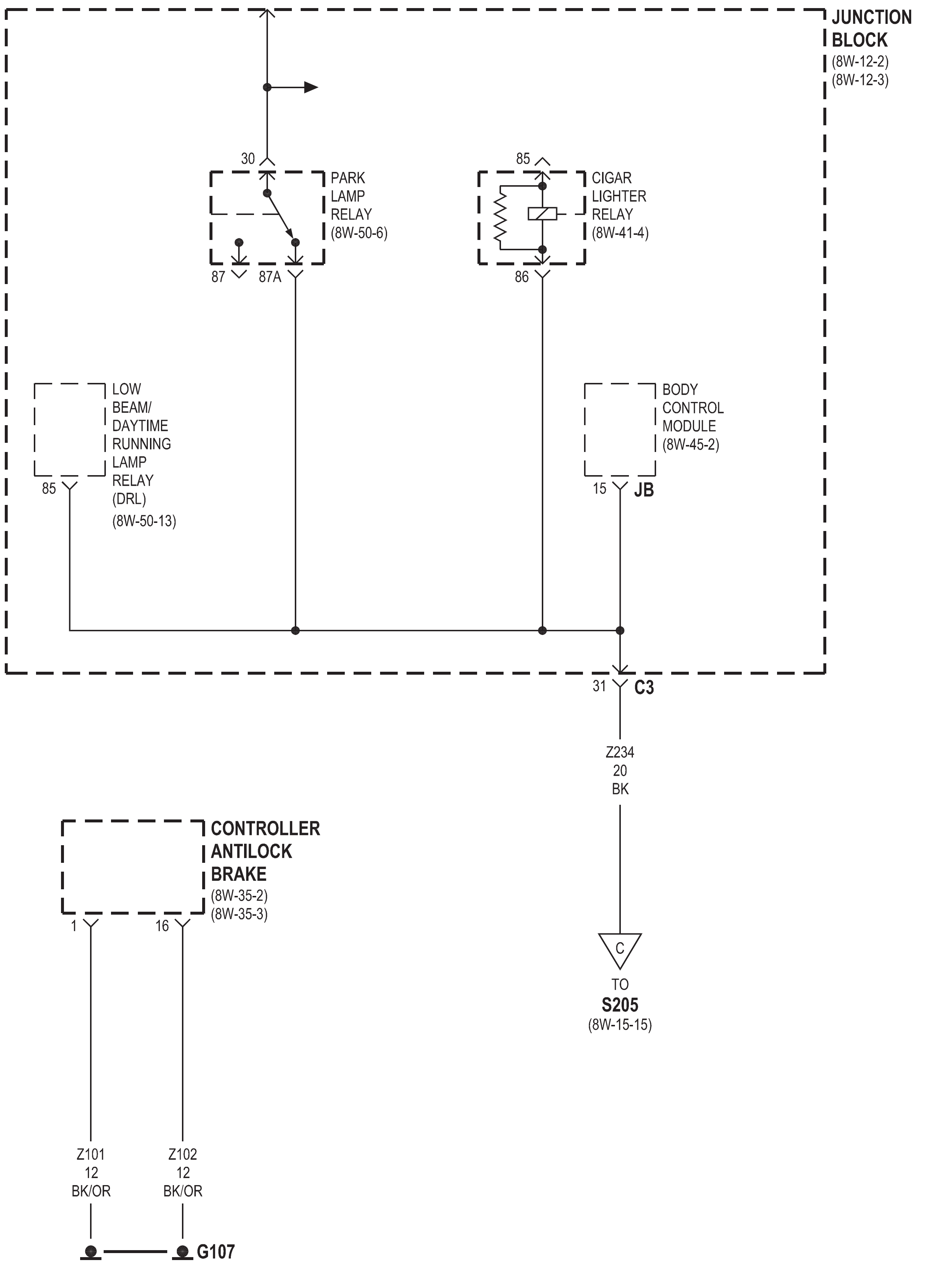
LHD GAS


86
TRANSMISSION CONTROL RELAY (IN PDC) (4.7L)
(8W-31-2)
(8W-31-3)
85
ELECTRONIC SPEED CONTROL SERVO
(8W-33-2)
4
COOLANT LEVEL SENSOR
(8W-45-5)
2
HORN NO. 1
(8W-41-2)
1
HORN NO. 2
(8W-41-2)
1
Z307 18 BK
Z307 20 BK
Z307 20 BK
Z307 18 BK
Z307 18 BK
S132
RIGHT FOG LAMP
(8W-50-12)
2
FROM C112
(8W-15-8)
B
RIGHT SIDE REPEATER LAMP (BUILT-UP-EXPORT)
(8W-52-3)
2
Z307 14 BK
Z142 18 BK
Z142 18 BK
Z142 18 BK
S133
Z142 18 BK
HYDRAULIC COOLING MODULE
(8W-30-43)
3
Z500 18 BK
G108

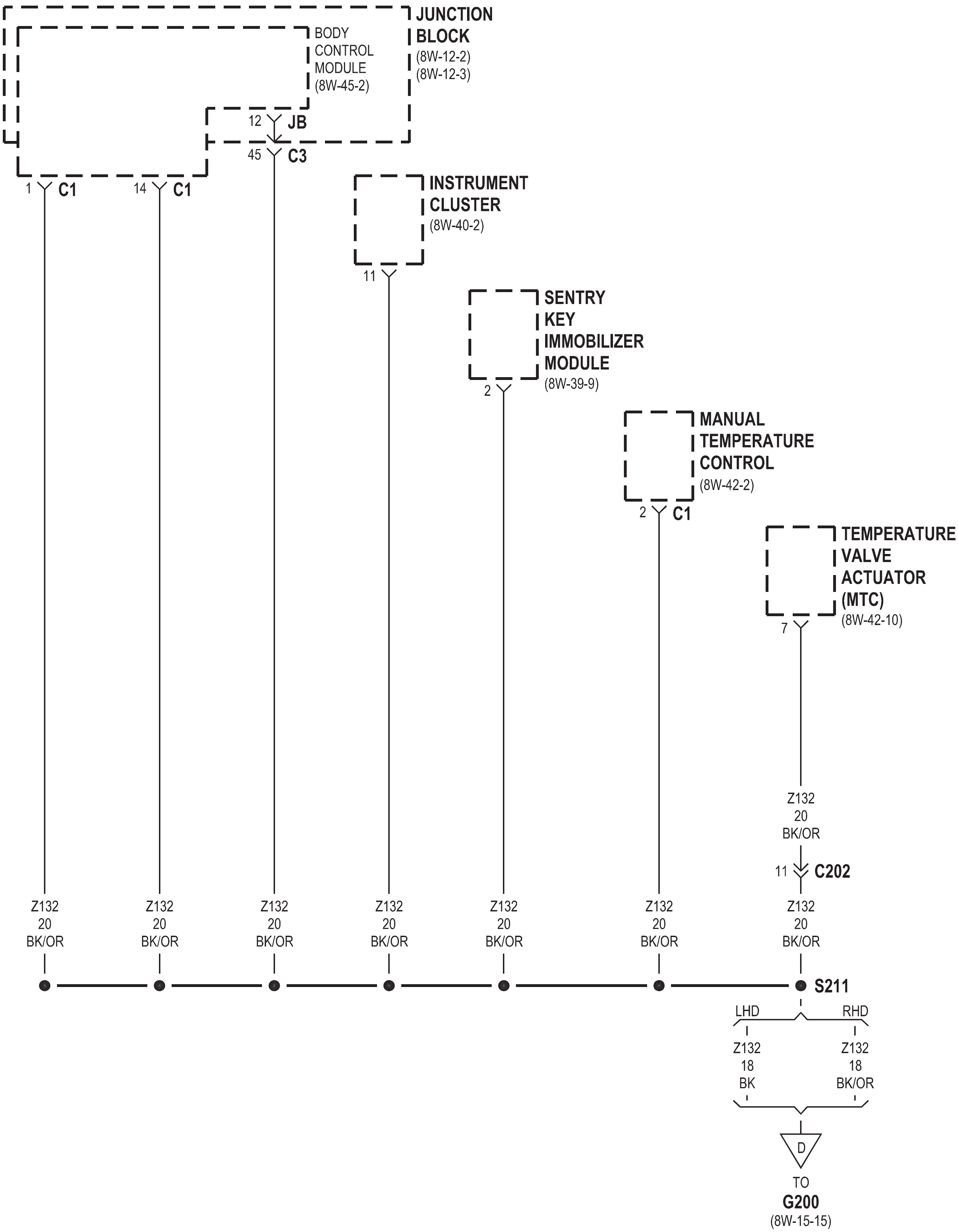

COOLANT LEVEL SENSOR
(8W-45-6)
2
HORN NO. 1
(8W-41-2)
1
HORN NO. 2
(8W-41-2)
1
ELECTRONIC SPEED CONTROL SERVO
(8W-33-2)
4
86
TRANSMISSION CONTROL RELAY (IN PDC) (4.7L)
(8W-31-2)
(8W-31-3)
85
FROM
C112
(8W-15-8)
B
RIGHT SIDE REPEATER LAMP
(8W-52-3)
2
RIGHT FOG LAMP
(8W-50-12)
2
Z307 20 BK
Z307 18 BK
Z307 18 BK
Z307 20 BK
Z307 18 BK
S132
Z142 18 BK
Z142 18 BK
Z142 18 BK
S133
HYDRAULIC COOLING MODULE
(8W-30-43)
(8W-42-11)
(8W-42-12)
3
Z307 14 BK
Z142 18 BK
Z500 18 BK
G108

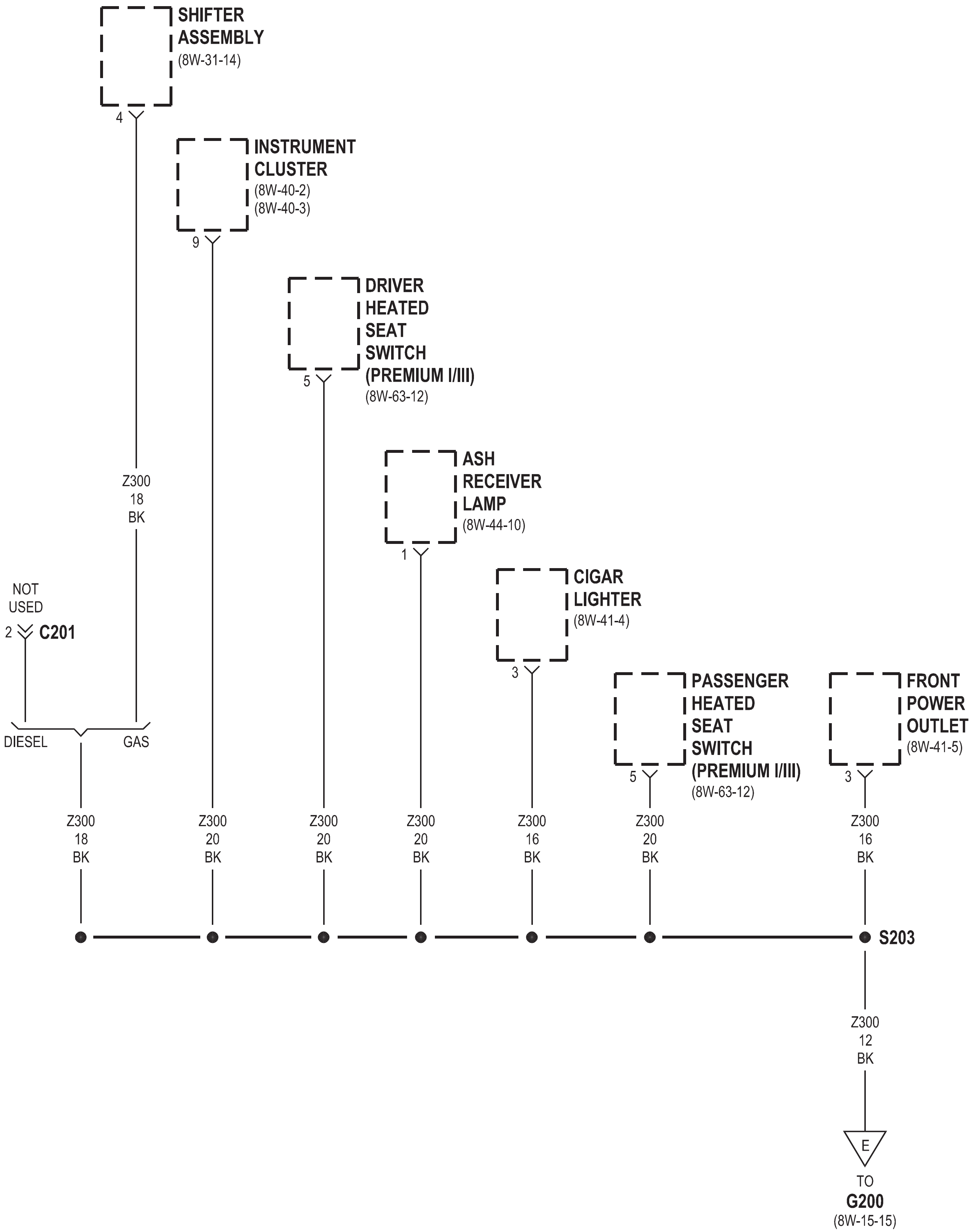
DIESEL

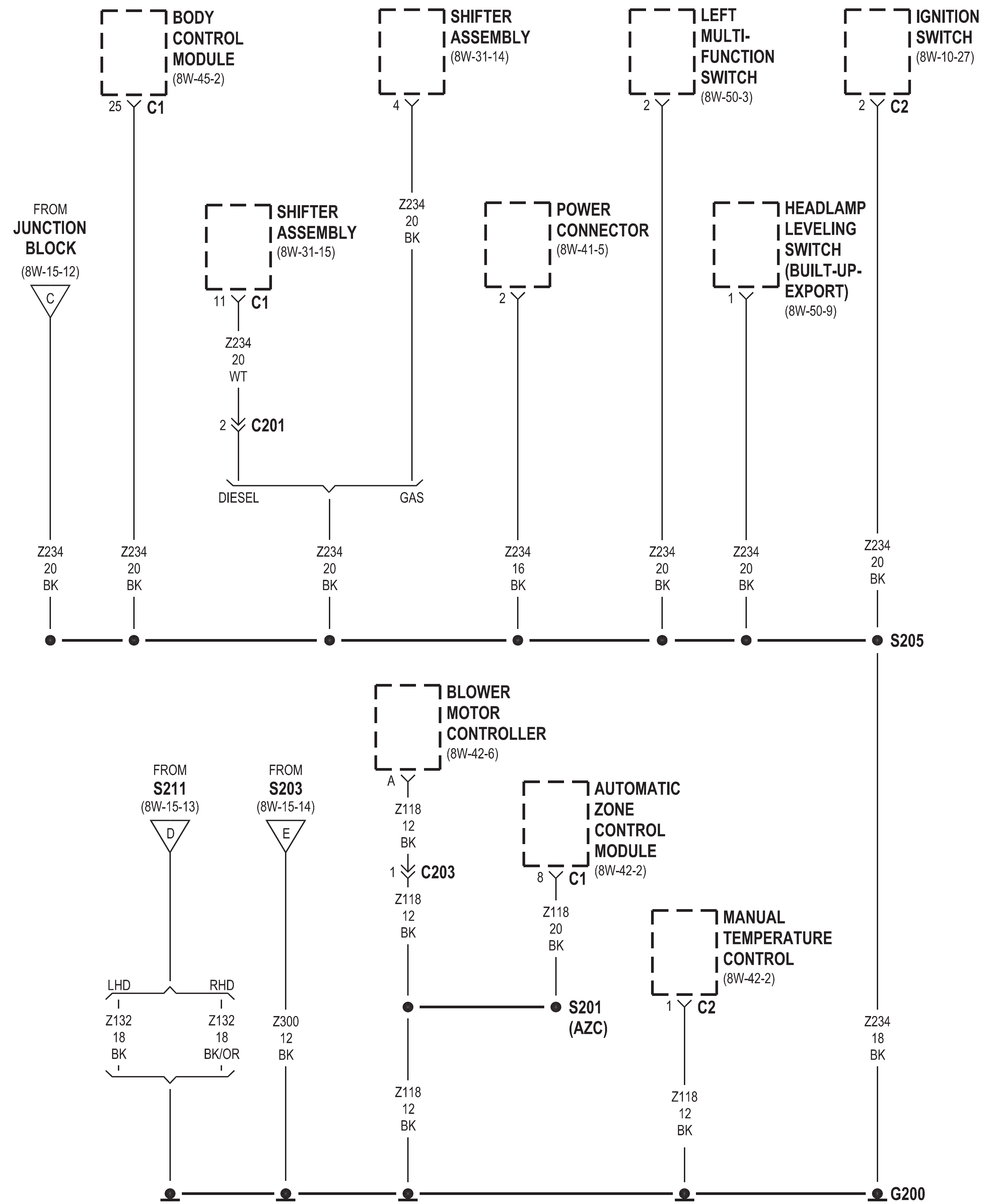

COOLANT
LEVEL
SENSOR
(8W-45-5)
(8W-45-6)
2
HORN
NO. 1
(8W-41-3)
1
HORN
NO. 2
(8W-41-3)
1
Z307
20
BK
Z307
18
BK
Z307
18
BK
S132
RIGHT
SIDE
REPEATER
LAMP
(8W-52-3)
2
Z307
14
BK
RIGHT
FOG
LAMP
(8W-50-12)
2
FROM
C112
(8W-15-8)
B
Z142
18
BK
Z142
18
BK
Z142
18
BK
HYDRAULIC
COOLING
MODULE
(8W-30-43)
3
S133
Z142
18
BK
Z500
18
BK
G108

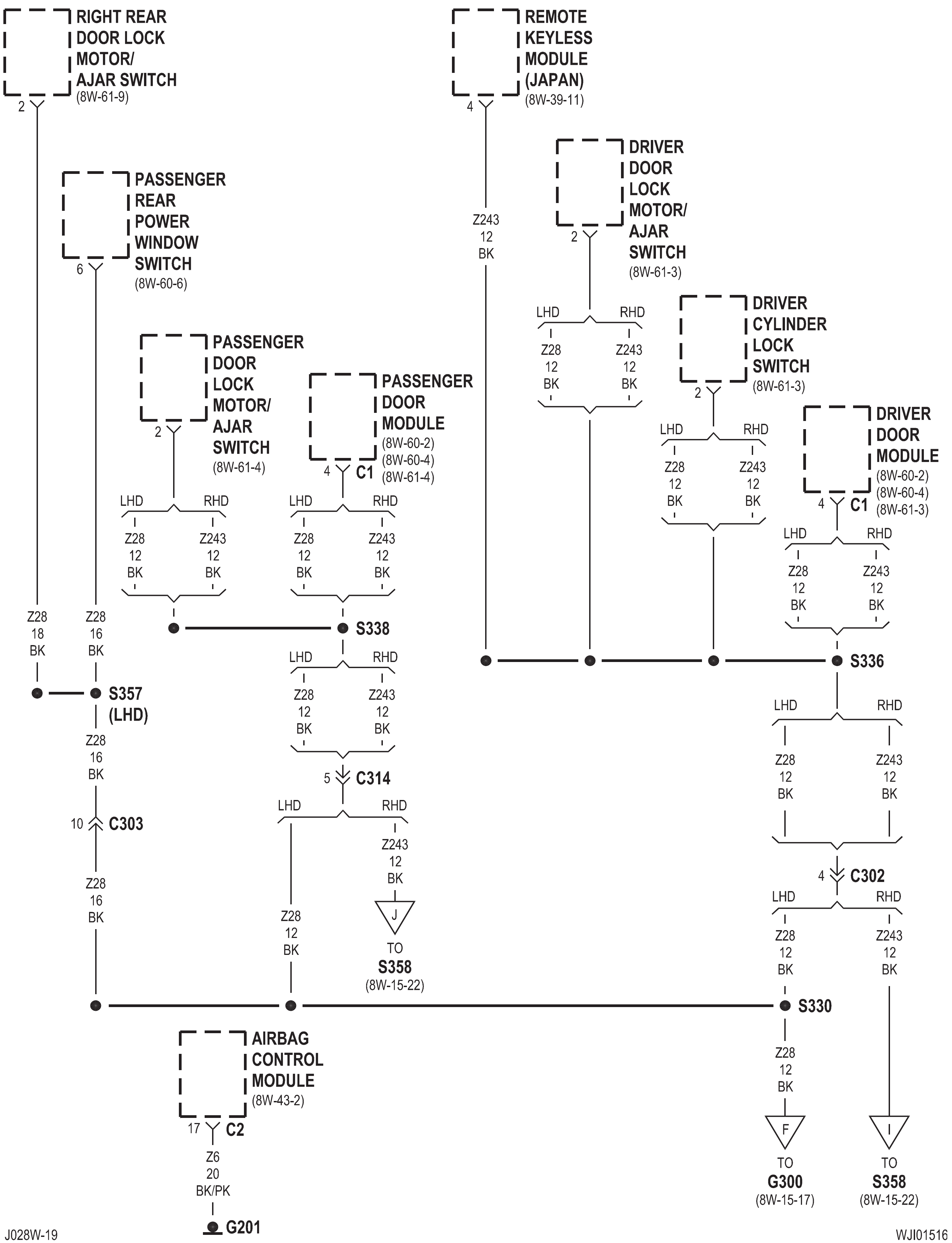


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
PARK LAMP RELAY
(8W-50-6)
87
87A
85
CIGAR LIGHTER RELAY
(8W-41-4)
86
LOW BEAM/ DAYTIME RUNNING LAMP RELAY (DRL)
(8W-50-13)
85
BODY CONTROL MODULE
(8W-45-2)
15
JB
31
C3
Z234
20
BK
C
TO
S205
(8W-15-15)
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
(8W-35-3)
1
16
Z101
12
BK/OR
Z102
12
BK/OR
G107


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-2)
12 JB
45 C3
1 C1
14 C1
INSTRUMENT CLUSTER
(8W-40-2)
11
SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
2
MANUAL TEMPERATURE CONTROL
(8W-42-2)
2 C1
TEMPERATURE VALVE ACTUATOR (MTC)
(8W-42-10)
7
Z132 20 BK/OR
11 C202
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
S211
LHD
RHD
Z132 18 BK
Z132 18 BK/OR
D
TO
G200
(8W-15-15)

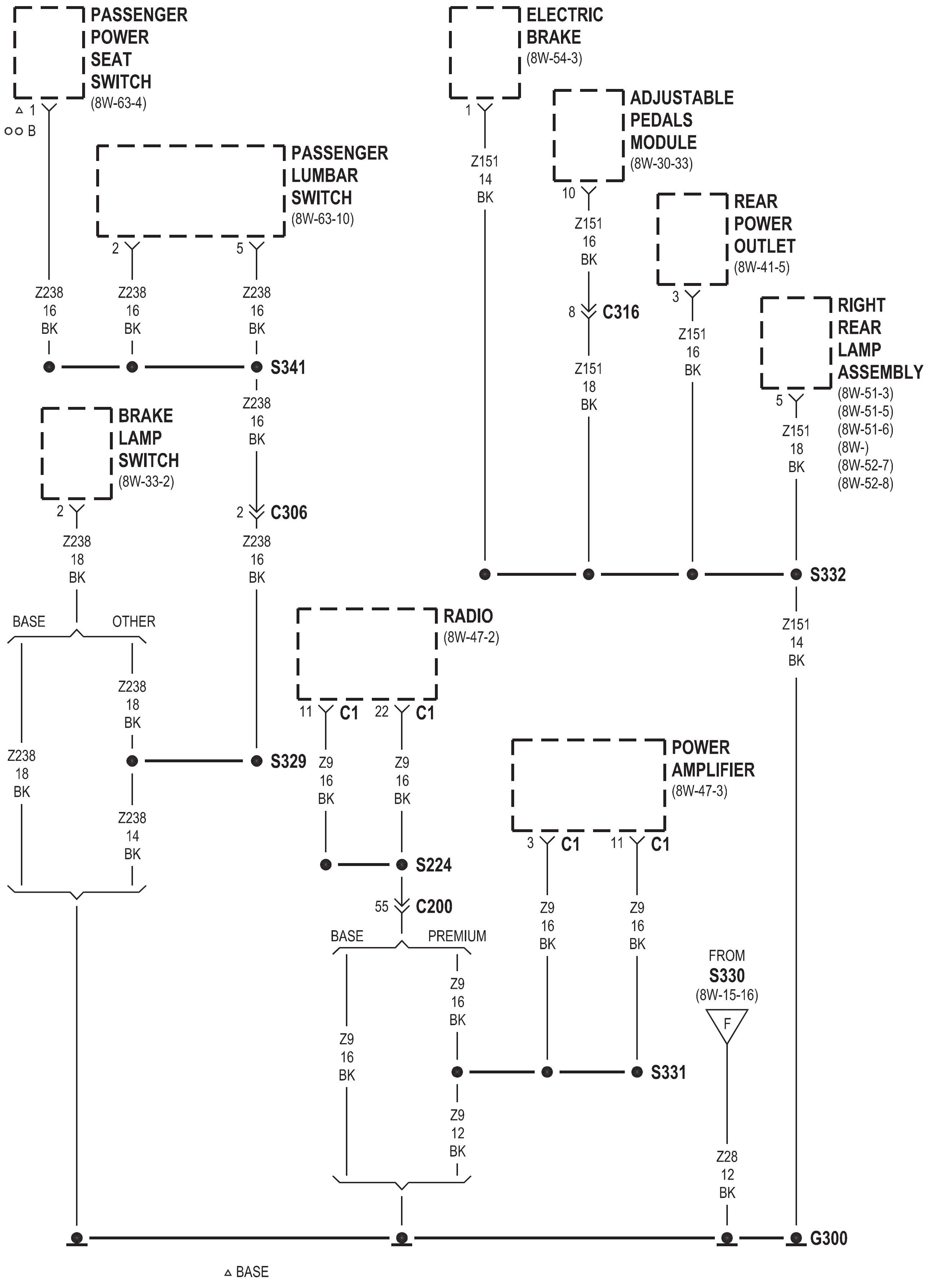

SHIFTER ASSEMBLY
(8W-31-14)
4
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-3)
9
DRIVER HEATED SEAT SWITCH (PREMIUM I/III)
(8W-63-12)
5
ASH RECEIVER LAMP
(8W-44-10)
1
CIGAR LIGHTER
(8W-41-4)
3
PASSENGER HEATED SEAT SWITCH (PREMIUM I/III)
(8W-63-12)
5
FRONT POWER OUTLET
(8W-41-5)
3
Z300 18 BK
NOT USED
2
C201
DIESEL
GAS
Z300 18 BK
Z300 20 BK
Z300 20 BK
Z300 20 BK
Z300 16 BK
Z300 20 BK
Z300 16 BK
S203
Z300 12 BK
E
TO
G200
(8W-15-15)


BODY CONTROL MODULE
(8W-45-2)
25
C1
SHIFTER ASSEMBLY
(8W-31-14)
4
LEFT MULTI-FUNCTION SWITCH
(8W-50-3)
2
IGNITION SWITCH
(8W-10-27)
2
C2
FROM
JUNCTION BLOCK
(8W-15-12)
C
SHIFTER ASSEMBLY
(8W-31-15)
11
C1
Z234
20
WT
2
C201
Z234
20
BK
POWER CONNECTOR
(8W-41-5)
2
HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT)
(8W-50-9)
1
DIESEL
GAS
Z234
20
BK
Z234
16
BK
S205
BLOWER MOTOR CONTROLLER
(8W-42-6)
A
Z118
12
BK
1
C203
AUTOMATIC ZONE CONTROL MODULE
(8W-42-2)
8
C1
Z118
20
BK
MANUAL TEMPERATURE CONTROL
(8W-42-2)
1
C2
FROM
S211
(8W-15-13)
D
FROM
S203
(8W-15-14)
E
LHD
RHD
Z132
18
BK
Z132
18
BK/OR
Z300
12
BK
S201
(AZC)
Z234
18
BK
Z118
12
BK
G200

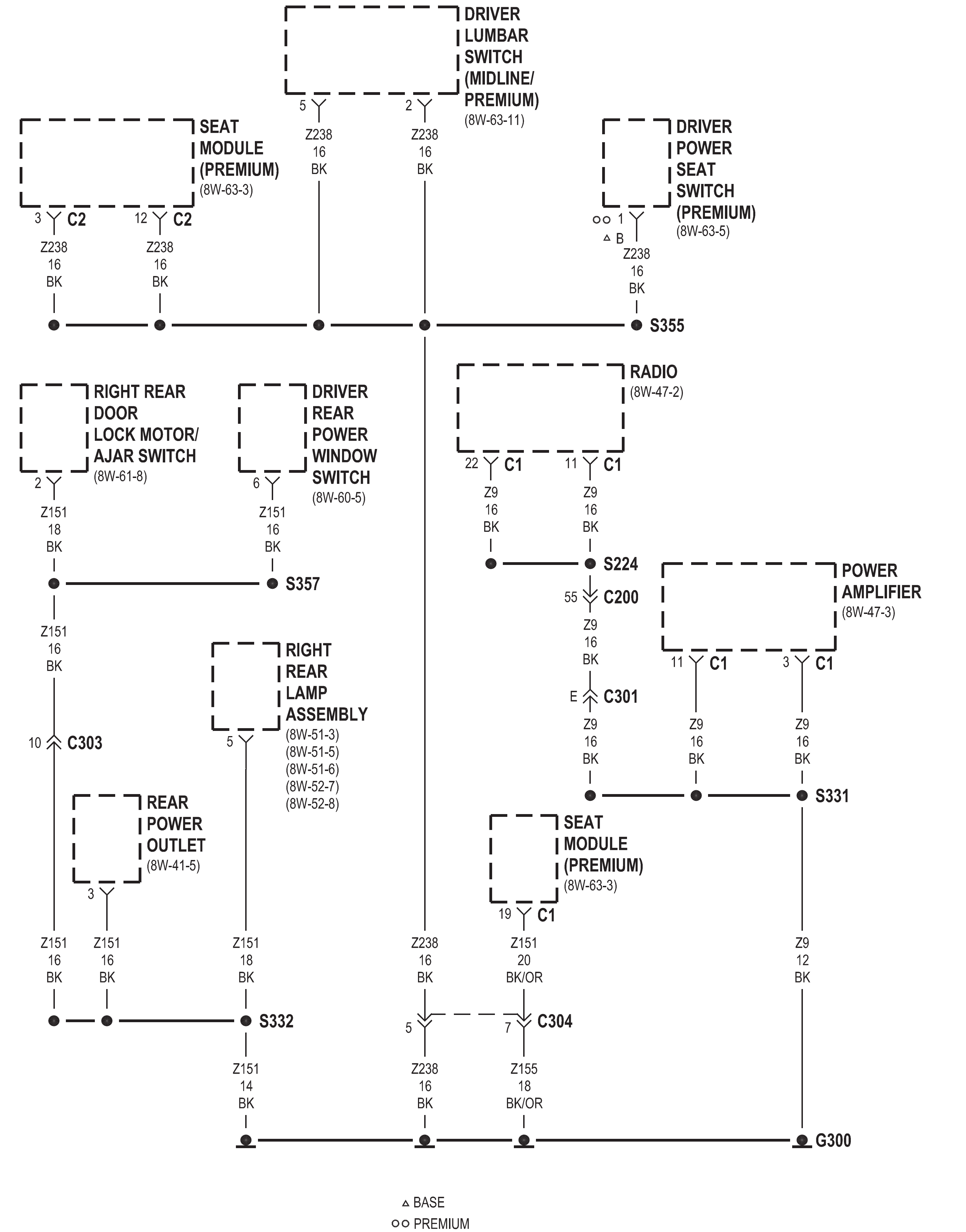


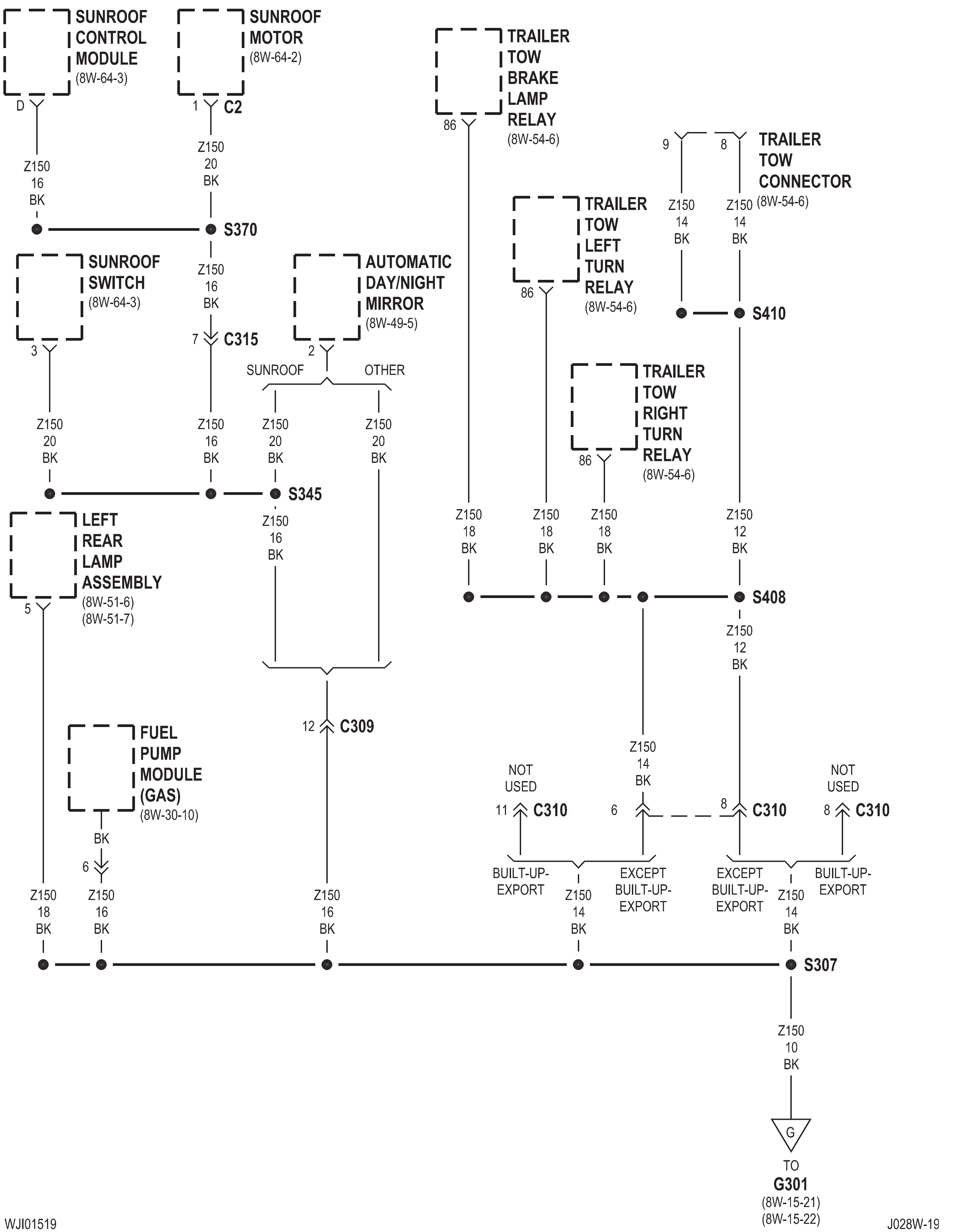
J028W-19 WJI01516

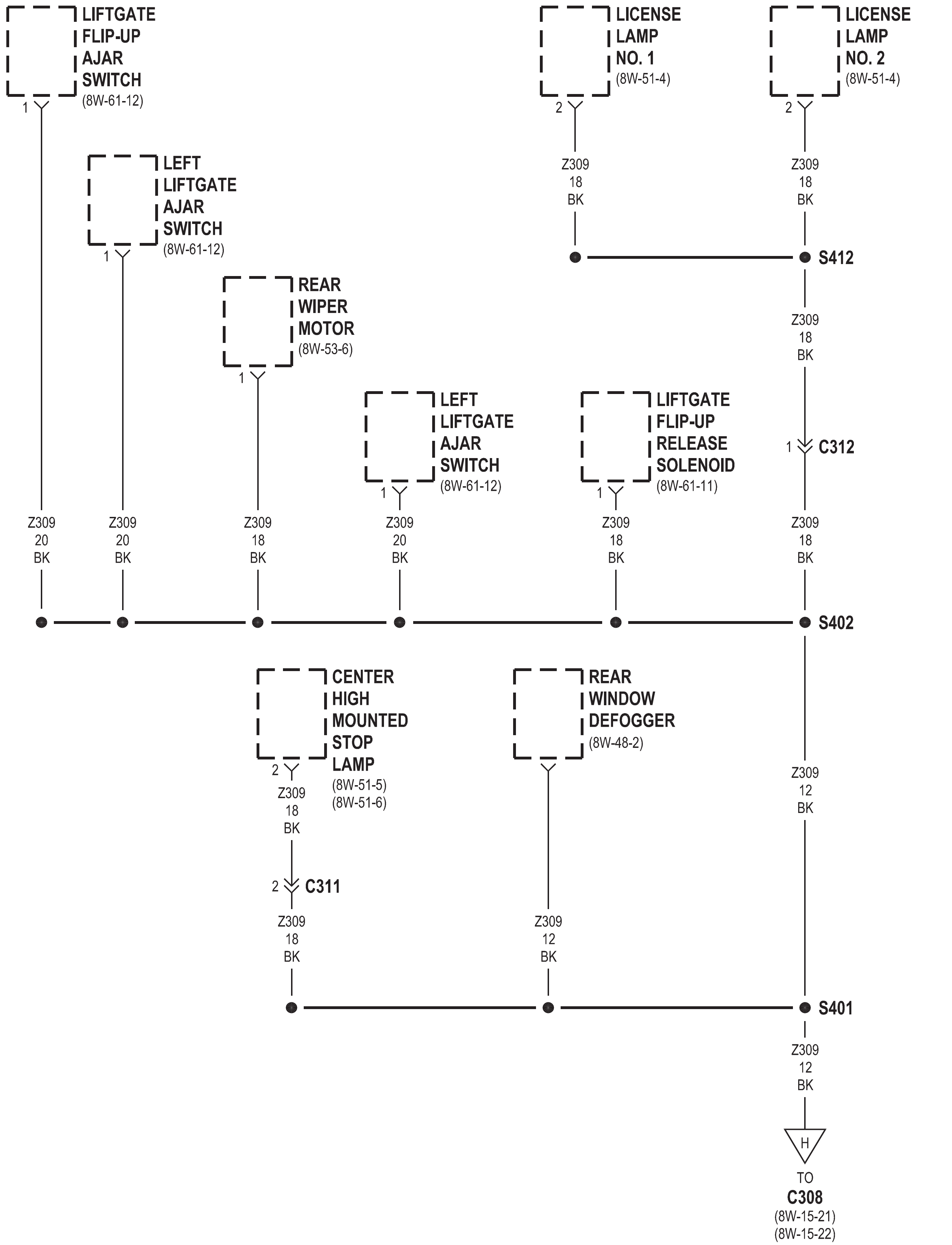
LHD

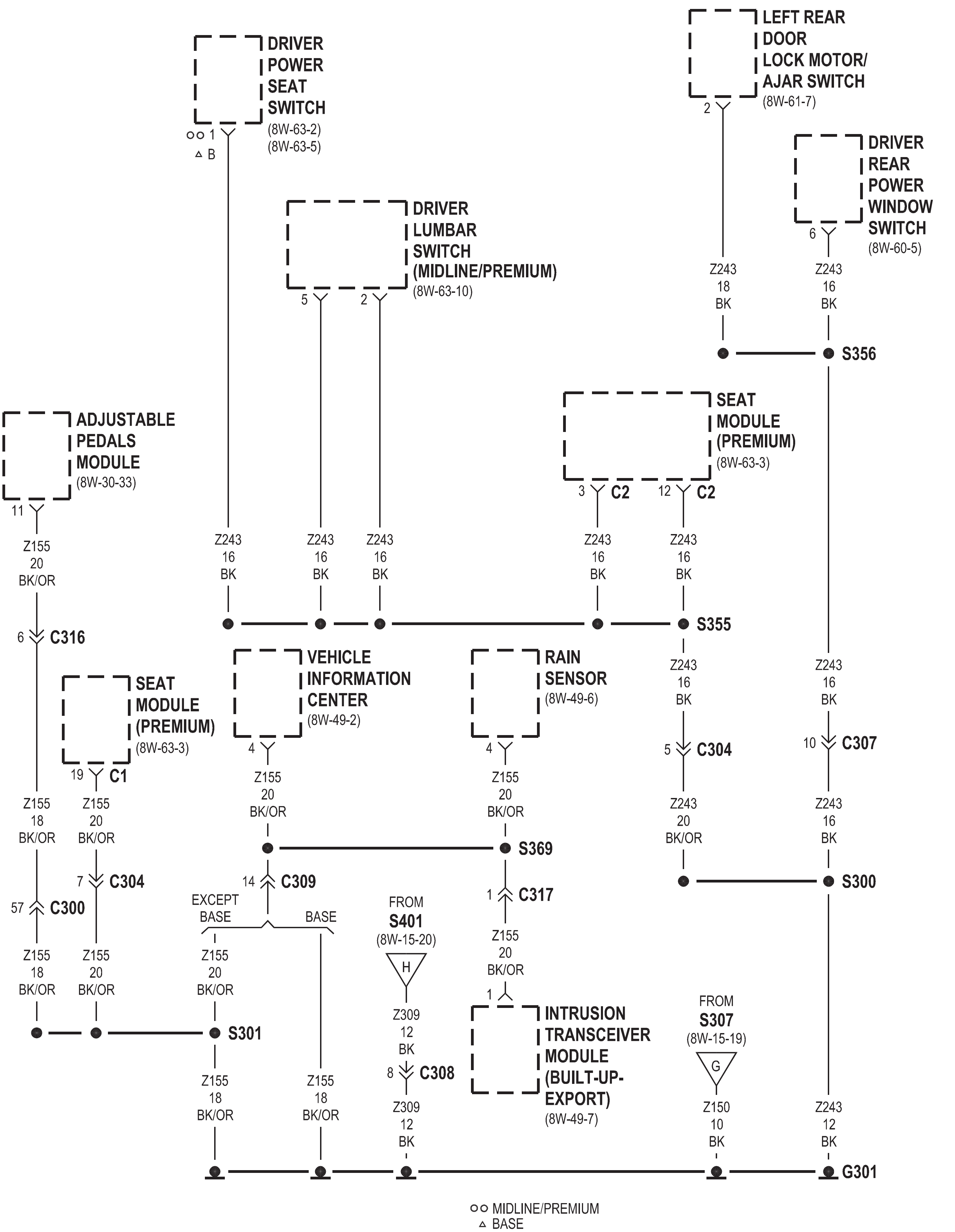

PASSENGER POWER SEAT SWITCH (8W-63-4)
PASSENGER LUMBAR SWITCH (8W-63-10)
ELECTRIC BRAKE (8W-54-3)
ADJUSTABLE PEDALS MODULE (8W-30-33)
REAR POWER OUTLET (8W-41-5)
RIGHT REAR LAMP ASSEMBLY (8W-51-3) (8W-51-5) (8W-51-6) (8W-) (8W-52-7) (8W-52-8)
BRAKE LAMP SWITCH (8W-33-2)
RADIO (8W-47-2)
POWER AMPLIFIER (8W-47-3)
Z238 16 BK
Z238 18 BK
Z238 14 BK
Z151 14 BK
Z151 16 BK
Z151 18 BK
Z9 16 BK
Z9 12 BK
Z28 12 BK
S341
S329
S332
S224
S331
C306
C316
C200
C1
G300
BASE
OTHER
PREMIUM
FROM S330 (8W-15-16)
F
BASE
PREMIUM

RHD

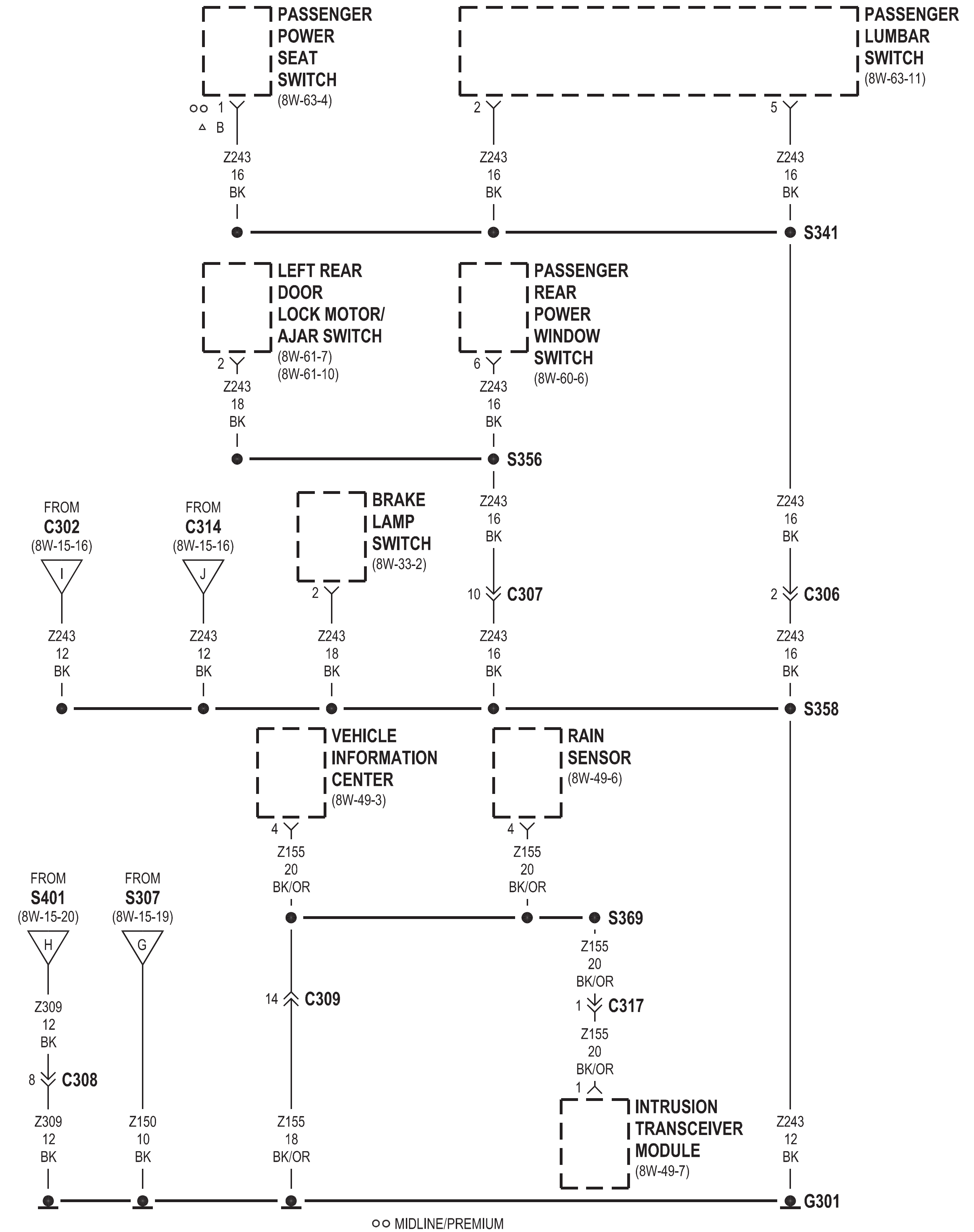

DRIVER LUMBAR SWITCH (MIDLINE/ PREMIUM)
(8W-63-11)
5
2
Z238
16
BK
SEAT MODULE (PREMIUM)
(8W-63-3)
3 C2
12 C2
DRIVER POWER SEAT SWITCH (PREMIUM)
(8W-63-5)
1
B
S355
RADIO
(8W-47-2)
22 C1
11 C1
Z9
16
BK
S224
55 C200
E C301
POWER AMPLIFIER
(8W-47-3)
11 C1
3 C1
S331
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-8)
2
Z151
18
BK
DRIVER REAR POWER WINDOW SWITCH
(8W-60-5)
6
Z151
16
BK
S357
10 C303
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
(8W-51-5)
(8W-51-6)
(8W-52-7)
(8W-52-8)
5
REAR POWER OUTLET
(8W-41-5)
3
SEAT MODULE (PREMIUM)
(8W-63-3)
19 C1
Z151
20
BK/OR
Z9
12
BK
S332
5
7 C304
Z151
14
BK
Z155
18
BK/OR
G300
BASE
PREMIUM


SUNROOF CONTROL MODULE
(8W-64-3)
D
Z150
16
BK
SUNROOF MOTOR
(8W-64-2)
1
C2
Z150
20
BK
S370
Z150
16
BK
7
C315
SUNROOF SWITCH
(8W-64-3)
3
Z150
20
BK
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-5)
2
SUNROOF
OTHER
Z150
16
BK
Z150
20
BK
Z150
20
BK
S345
Z150
16
BK
LEFT REAR LAMP ASSEMBLY
(8W-51-6)
(8W-51-7)
5
12
C309
FUEL PUMP MODULE (GAS)
(8W-30-10)
BK
6
Z150
18
BK
Z150
16
BK
Z150
16
BK
TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
86
TRAILER TOW LEFT TURN RELAY
(8W-54-6)
86
TRAILER TOW RIGHT TURN RELAY
(8W-54-6)
86
9
8
TRAILER TOW CONNECTOR
(8W-54-6)
Z150
14
BK
Z150
14
BK
S410
Z150
18
BK
Z150
18
BK
Z150
18
BK
Z150
12
BK
S408
Z150
12
BK
Z150
14
BK
NOT USED
11
C310
6
8
C310
NOT USED
8
C310
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
Z150
14
BK
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
Z150
14
BK
S307
Z150
10
BK
G
TO
G301
(8W-15-21)
(8W-15-22)

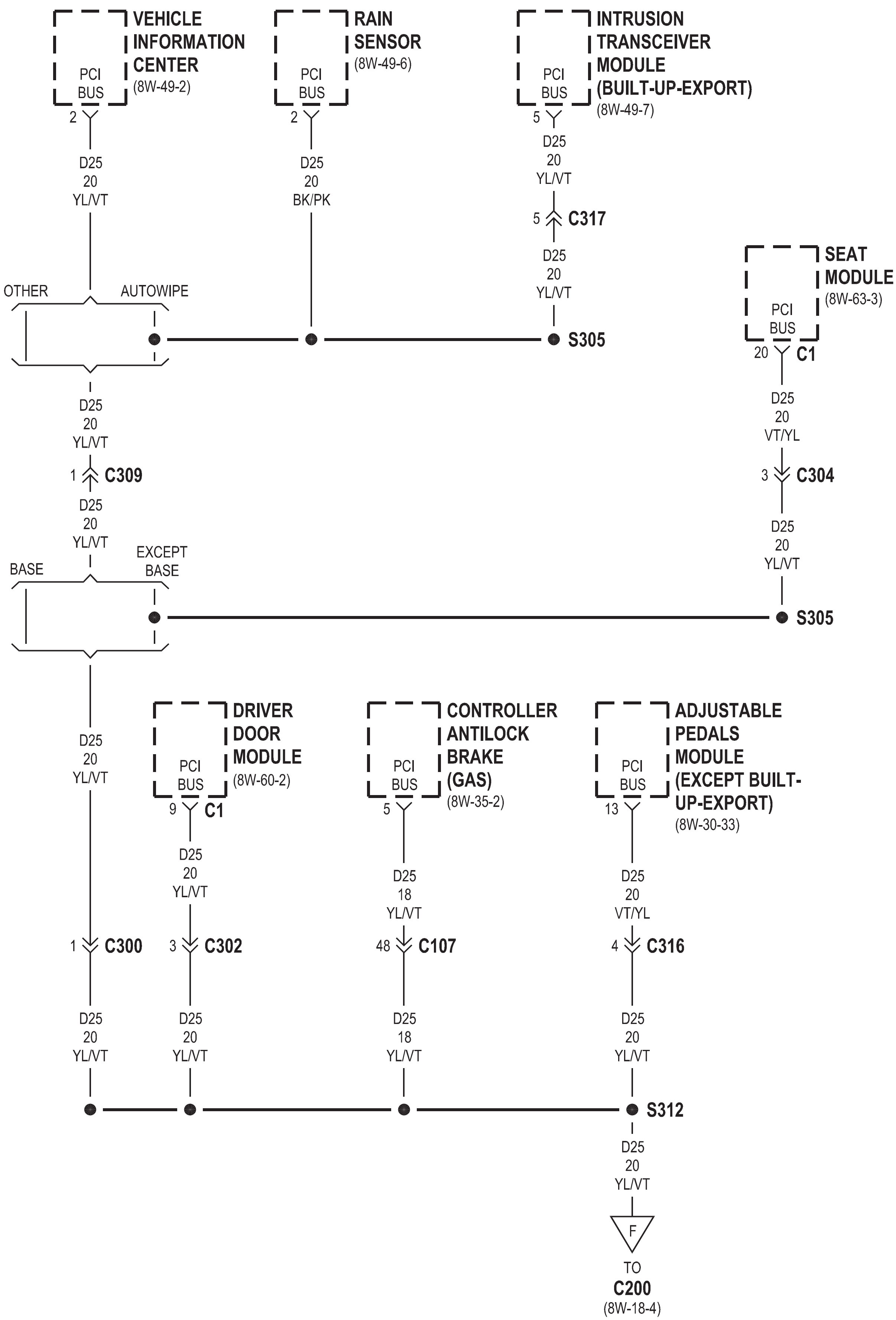

LIFTGATE FLIP-UP AJAR SWITCH (8W-61-12)
LICENSE LAMP NO. 1 (8W-51-4)
LICENSE LAMP NO. 2 (8W-51-4)
LEFT LIFTGATE AJAR SWITCH (8W-61-12)
REAR WIPER MOTOR (8W-53-6)
LEFT LIFTGATE AJAR SWITCH (8W-61-12)
LIFTGATE FLIP-UP RELEASE SOLENOID (8W-61-11)
Z309 18 BK
S412
C312
Z309 20 BK
Z309 18 BK
S402
CENTER HIGH MOUNTED STOP LAMP (8W-51-5) (8W-51-6)
REAR WINDOW DEFOGGER (8W-48-2)
Z309 12 BK
C311
S401
H
TO C308 (8W-15-21) (8W-15-22)


DRIVER POWER SEAT SWITCH
(8W-63-2)
(8W-63-5)
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
DRIVER REAR POWER WINDOW SWITCH
(8W-60-5)
DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM)
(8W-63-10)
S356
SEAT MODULE (PREMIUM)
(8W-63-3)
C2
ADJUSTABLE PEDALS MODULE
(8W-30-33)
Z155
20
BK/OR
Z243
16
BK
S355
C316
VEHICLE INFORMATION CENTER
(8W-49-2)
RAIN SENSOR
(8W-49-6)
SEAT MODULE (PREMIUM)
(8W-63-3)
C1
C304
C307
S369
C309
C300
S300
EXCEPT BASE
BASE
FROM S401
(8W-15-20)
C317
Z309
12
BK
C308
INTRUSION TRANSCEIVER MODULE (BUILT-UP-EXPORT)
(8W-49-7)
FROM S307
(8W-15-19)
Z150
10
BK
S301
G301
MIDLINE/PREMIUM
BASE

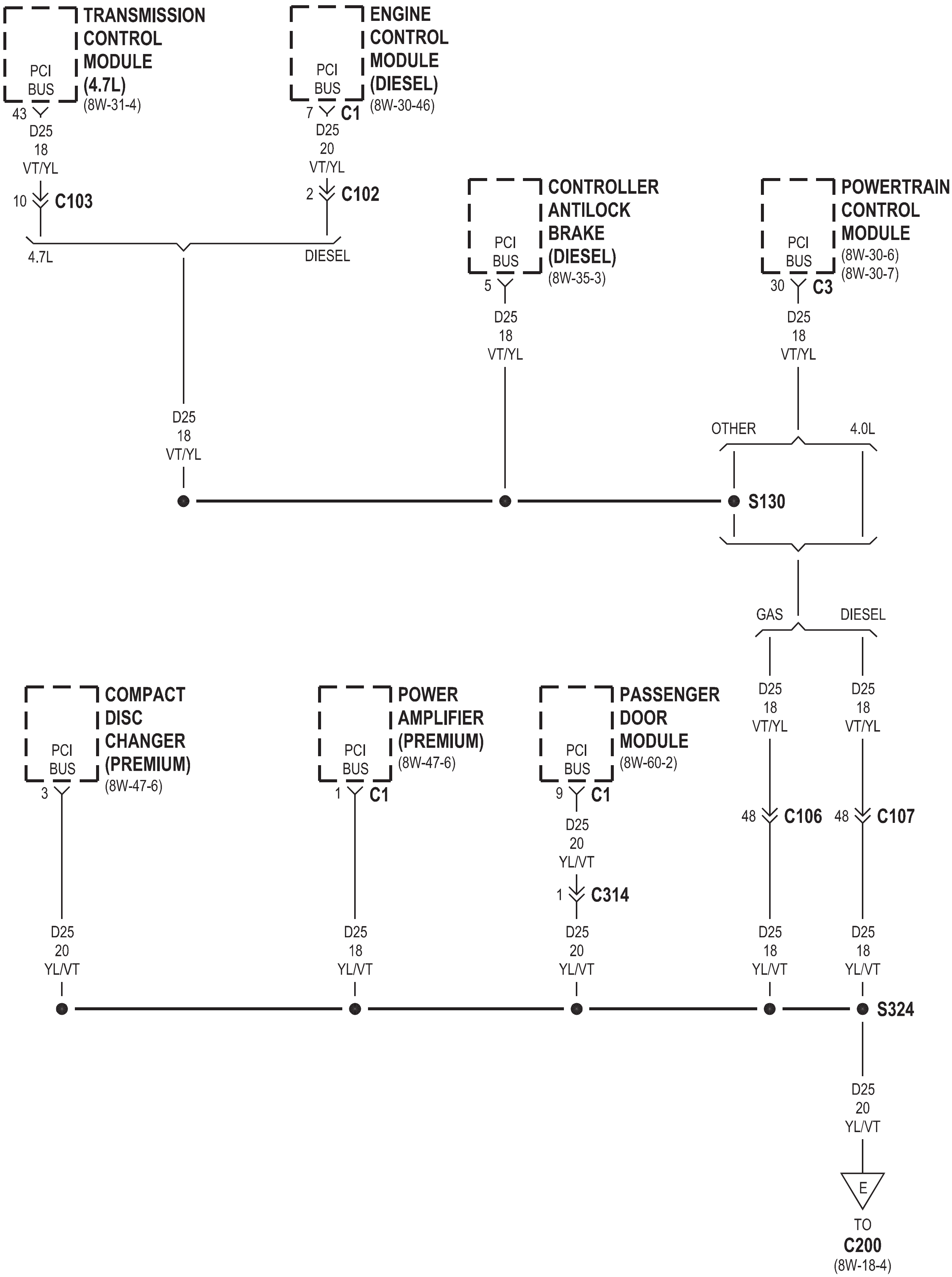
RHD


PASSENGER POWER SEAT SWITCH
(8W-63-4)
PASSENGER LUMBAR SWITCH
(8W-63-11)
1
B
2
5
Z243
16
BK
S341
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
(8W-61-10)
PASSENGER REAR POWER WINDOW SWITCH
(8W-60-6)
Z243
18
BK
6
S356
FROM
C302
(8W-15-16)
I
FROM
C314
(8W-15-16)
J
BRAKE LAMP SWITCH
(8W-33-2)
10
C307
C306
Z243
12
BK
S358
VEHICLE INFORMATION CENTER
(8W-49-3)
RAIN SENSOR
(8W-49-6)
4
Z155
20
BK/OR
S369
FROM
S401
(8W-15-20)
H
FROM
S307
(8W-15-19)
G
14
C309
C317
Z309
12
BK
8
C308
Z150
10
BK
Z155
18
BK/OR
INTRUSION TRANSCEIVER MODULE
(8W-49-7)
G301
MIDLINE/PREMIUM
BASE

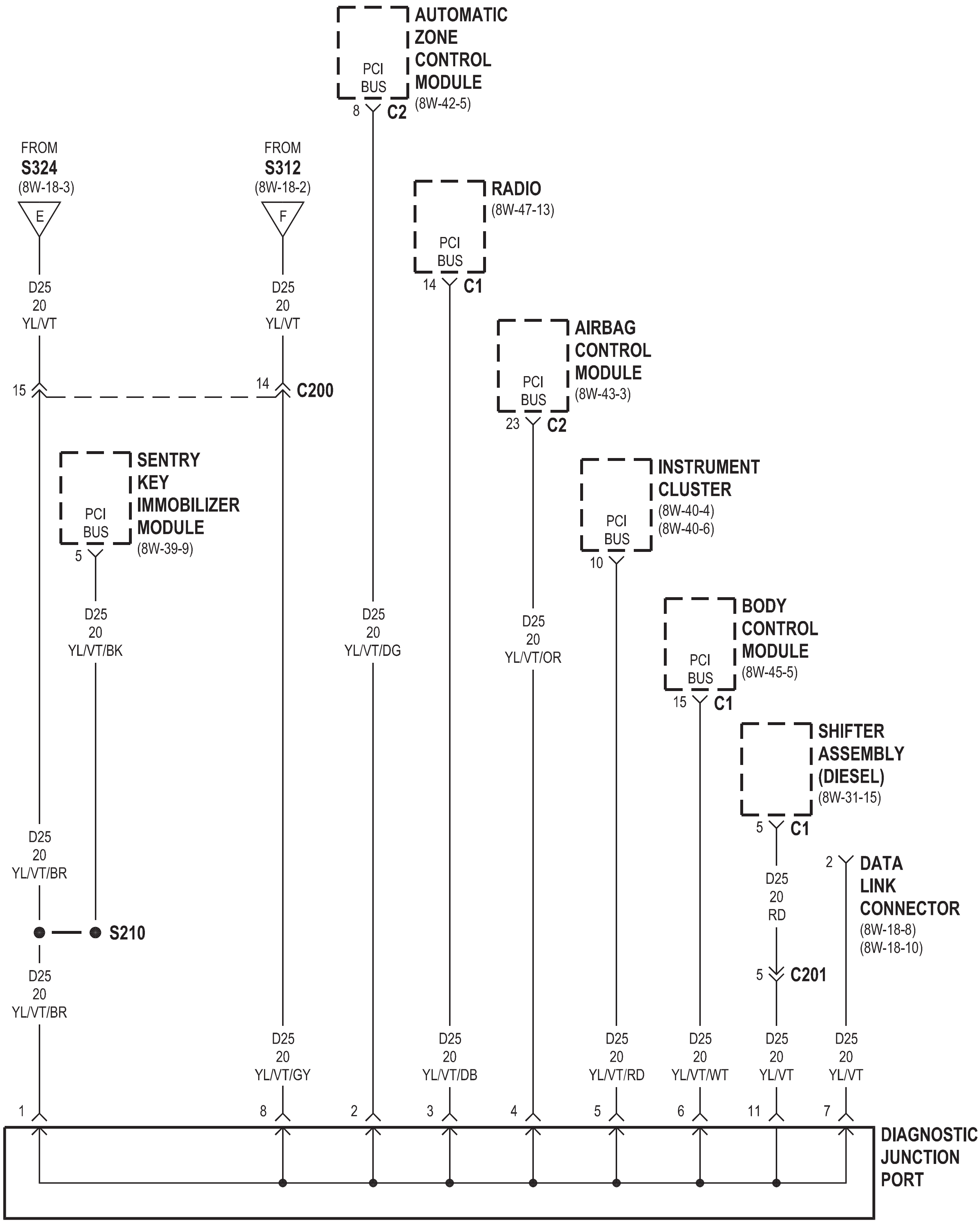
8W-18 BUS COMMUNICATIONS

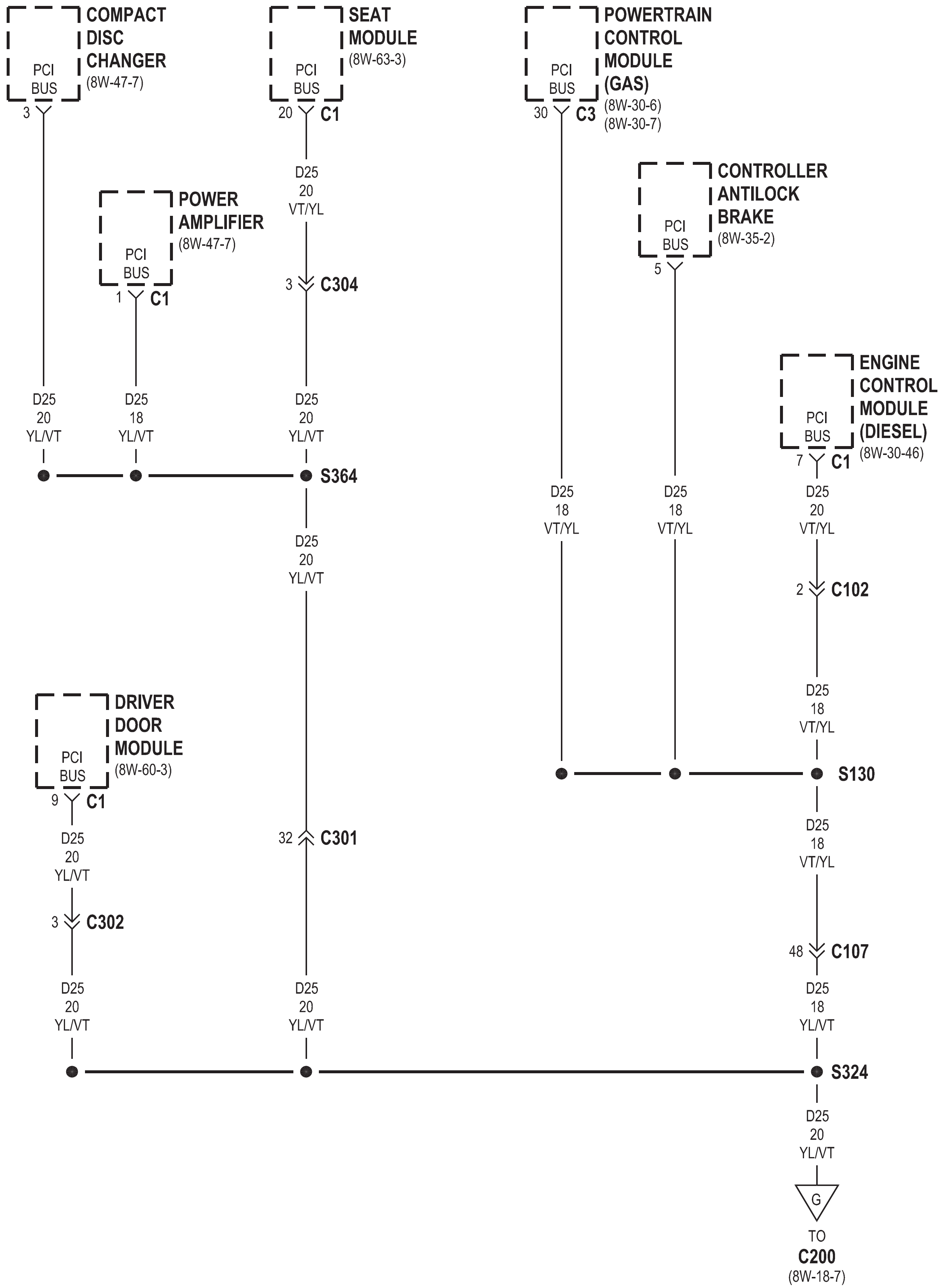

VEHICLE INFORMATION CENTER
PCI BUS
(8W-49-2)
RAIN SENSOR
(8W-49-6)
INTRUSION TRANSCEIVER MODULE (BUILT-UP-EXPORT)
(8W-49-7)
D25
20
YL/VT
BK/PK
C317
OTHER
AUTOWIPE
S305
SEAT MODULE
(8W-63-3)
C1
VT/YL
C304
C309
BASE
EXCEPT BASE
DRIVER DOOR MODULE
(8W-60-2)
CONTROLLER ANTILOCK BRAKE (GAS)
(8W-35-2)
ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT)
(8W-30-33)
18
C300
C302
C107
C316
S312
F
TO
C200
(8W-18-4)

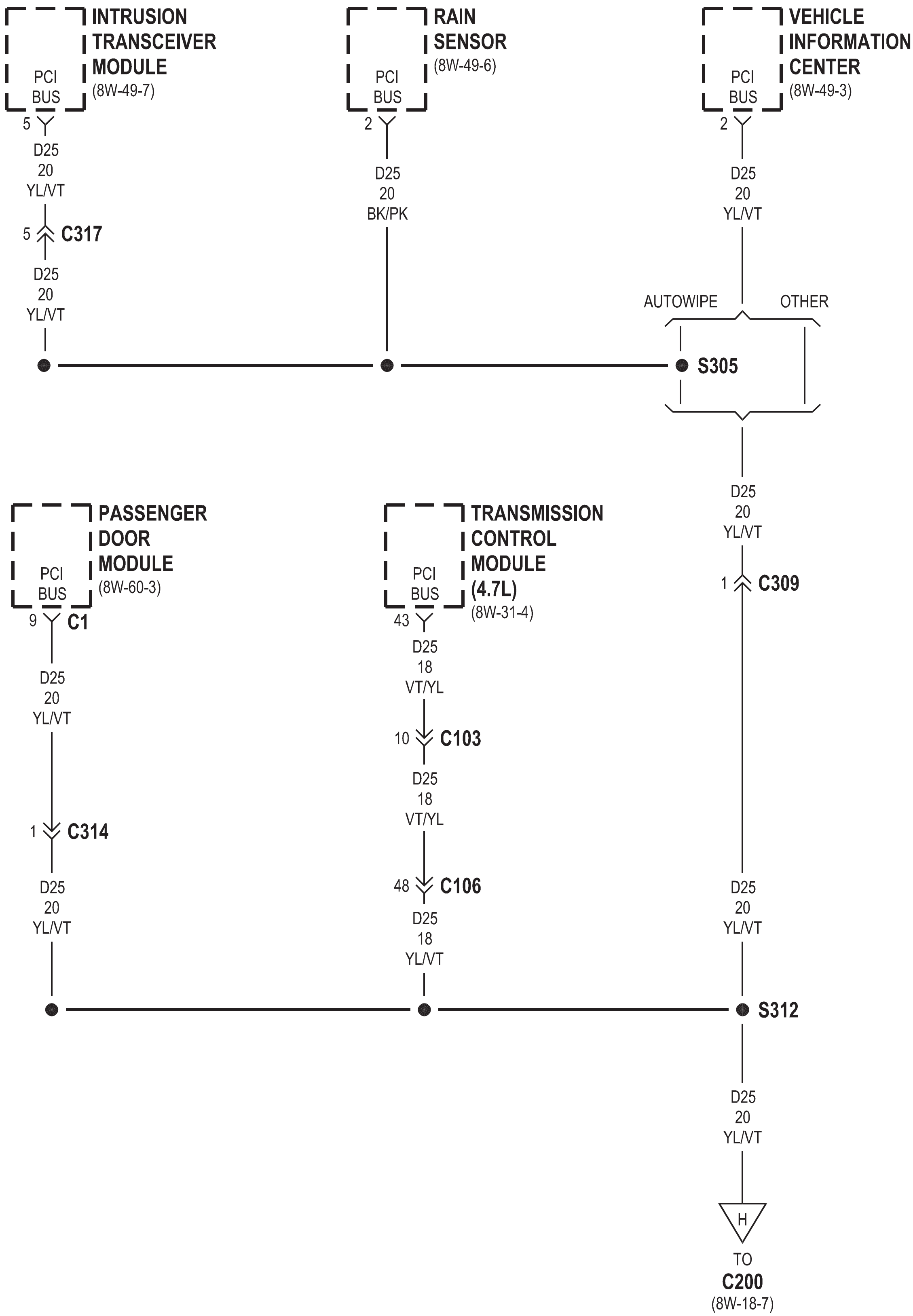
LHD


TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
PCI BUS
43
D25
18
VT/YL
10
C103
4.7L
ENGINE CONTROL MODULE (DIESEL)
(8W-30-46)
PCI BUS
7
C1
D25
20
VT/YL
2
C102
DIESEL
D25
18
VT/YL
CONTROLLER ANTILOCK BRAKE (DIESEL)
(8W-35-3)
PCI BUS
5
D25
18
VT/YL
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)
PCI BUS
30
C3
D25
18
VT/YL
OTHER
4.0L
S130
GAS
DIESEL
D25
18
VT/YL
48
C106
D25
18
VT/YL
48
C107
COMPACT DISC CHANGER (PREMIUM)
(8W-47-6)
PCI BUS
3
D25
20
YL/VT
POWER AMPLIFIER (PREMIUM)
(8W-47-6)
PCI BUS
1
C1
D25
18
YL/VT
PASSENGER DOOR MODULE
(8W-60-2)
PCI BUS
9
C1
D25
20
YL/VT
1
C314
D25
20
YL/VT
D25
18
YL/VT
D25
18
YL/VT
S324
D25
20
YL/VT
E
TO
C200
(8W-18-4)

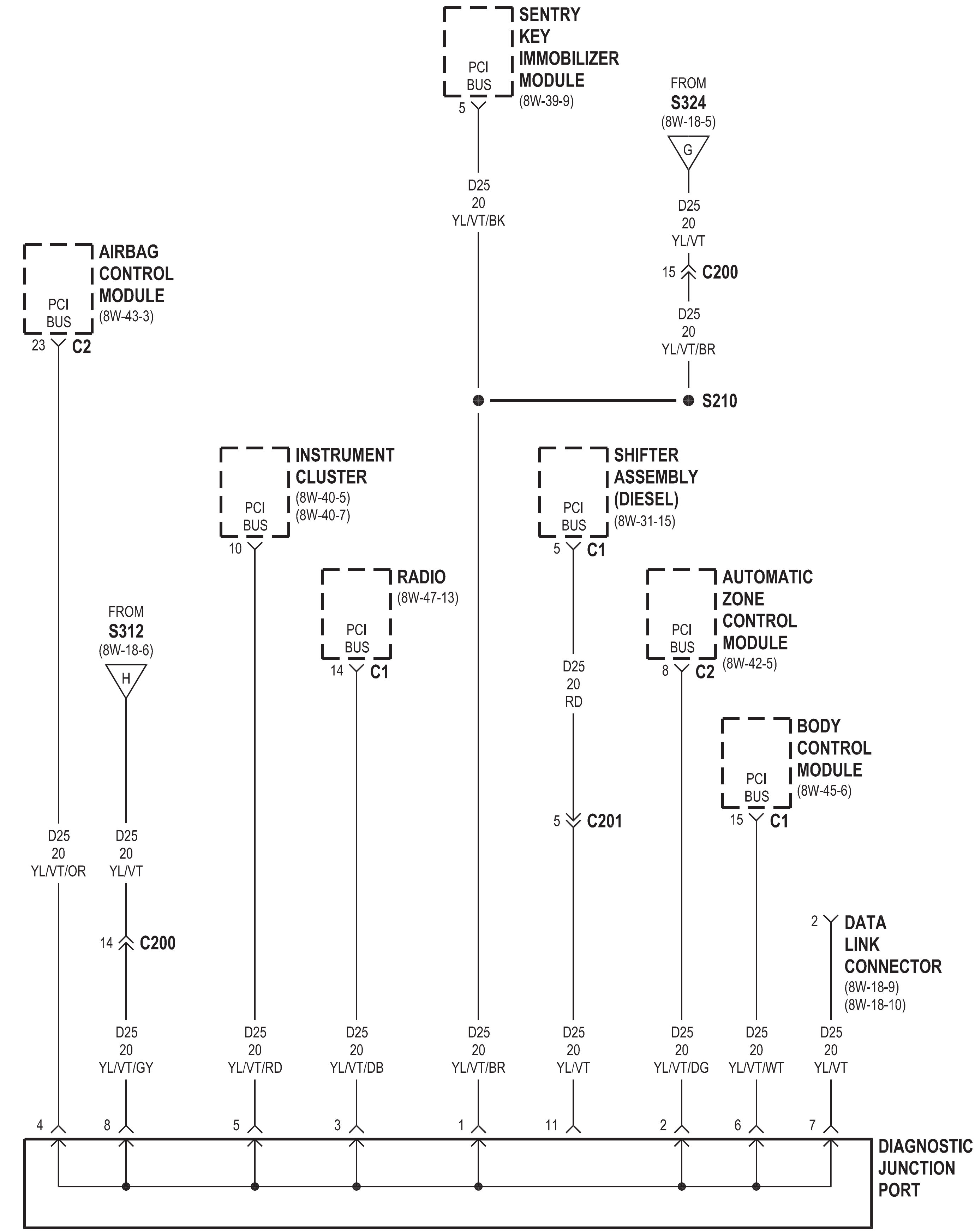
LHD


AUTOMATIC ZONE CONTROL MODULE
PCI BUS
(8W-42-5)
8 C2
FROM S324 (8W-18-3)
E
FROM S312 (8W-18-2)
F
RADIO
(8W-47-13)
PCI BUS
14 C1
D25 20 YL/VT
AIRBAG CONTROL MODULE
PCI BUS
(8W-43-3)
23 C2
15
14 C200
SENTRY KEY IMMOBILIZER MODULE
PCI BUS
(8W-39-9)
5
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-6)
PCI BUS
10
D25 20 YL/VT/BK
D25 20 YL/VT/DG
D25 20 YL/VT/OR
BODY CONTROL MODULE
PCI BUS
(8W-45-5)
15 C1
SHIFTER ASSEMBLY (DIESEL)
(8W-31-15)
5 C1
D25 20 YL/VT/BR
2
DATA LINK CONNECTOR
(8W-18-8)
(8W-18-10)
D25 20 RD
S210
5 C201
D25 20 YL/VT/BR
D25 20 YL/VT/GY
D25 20 YL/VT/DB
D25 20 YL/VT/RD
D25 20 YL/VT/WT
1 8 2 3 4 5 6 11 7
DIAGNOSTIC JUNCTION PORT

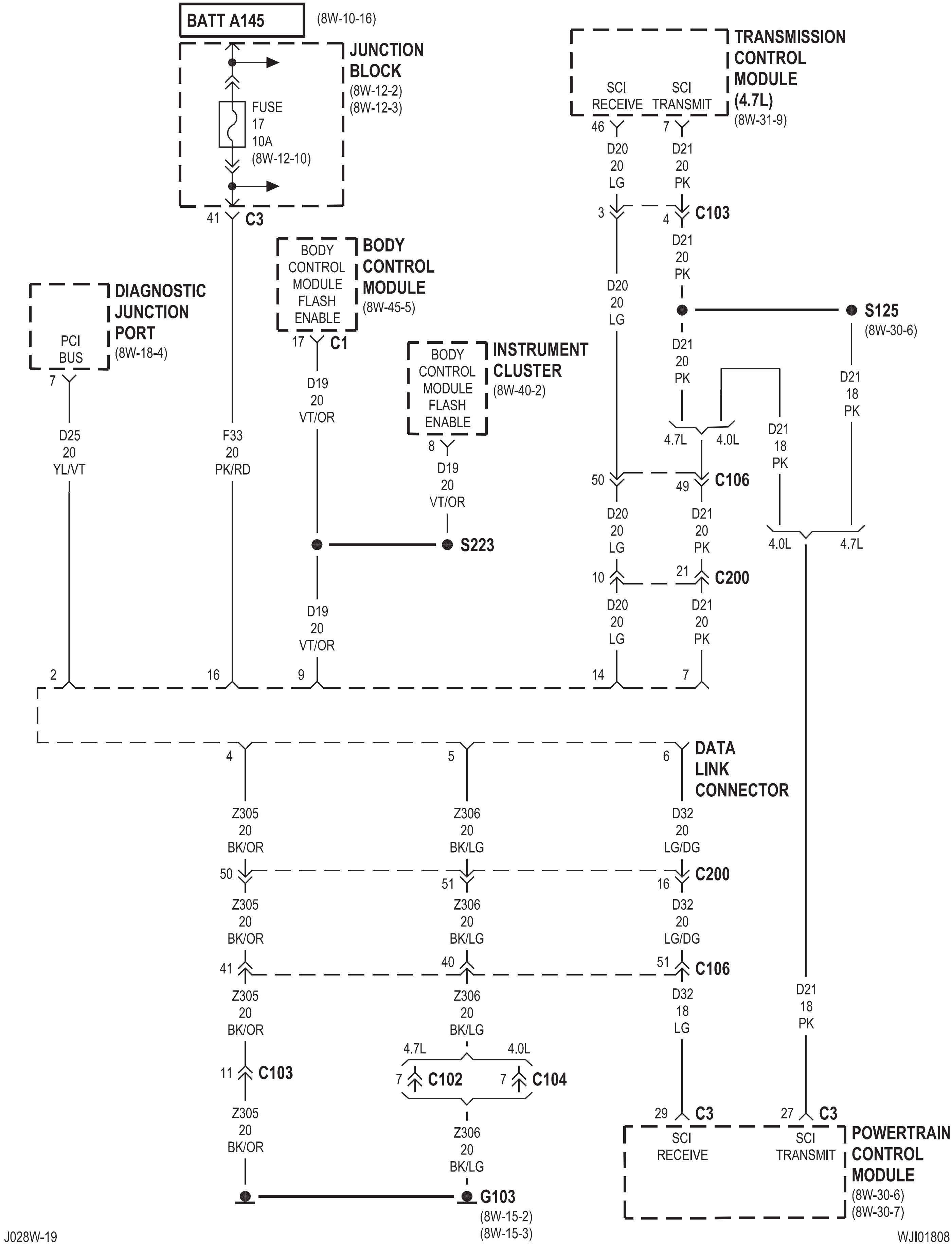

COMPACT DISC CHANGER
(8W-47-7)
PCI BUS
3
SEAT MODULE
(8W-63-3)
PCI BUS
20 C1
POWERTRAIN CONTROL MODULE (GAS)
(8W-30-6)
(8W-30-7)
PCI BUS
30 C3
POWER AMPLIFIER
(8W-47-7)
PCI BUS
1 C1
D25
20
VT/YL
3 C304
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
PCI BUS
5
ENGINE CONTROL MODULE (DIESEL)
(8W-30-46)
PCI BUS
7 C1
D25
20
YL/VT
D25
18
YL/VT
D25
20
YL/VT
S364
D25
18
VT/YL
D25
18
VT/YL
D25
20
VT/YL
D25
20
YL/VT
2 C102
D25
18
VT/YL
DRIVER DOOR MODULE
(8W-60-3)
PCI BUS
9 C1
S130
D25
20
YL/VT
32 C301
D25
18
VT/YL
3 C302
48 C107
D25
20
YL/VT
D25
20
YL/VT
D25
18
YL/VT
S324
D25
20
YL/VT
G
TO
C200
(8W-18-7)

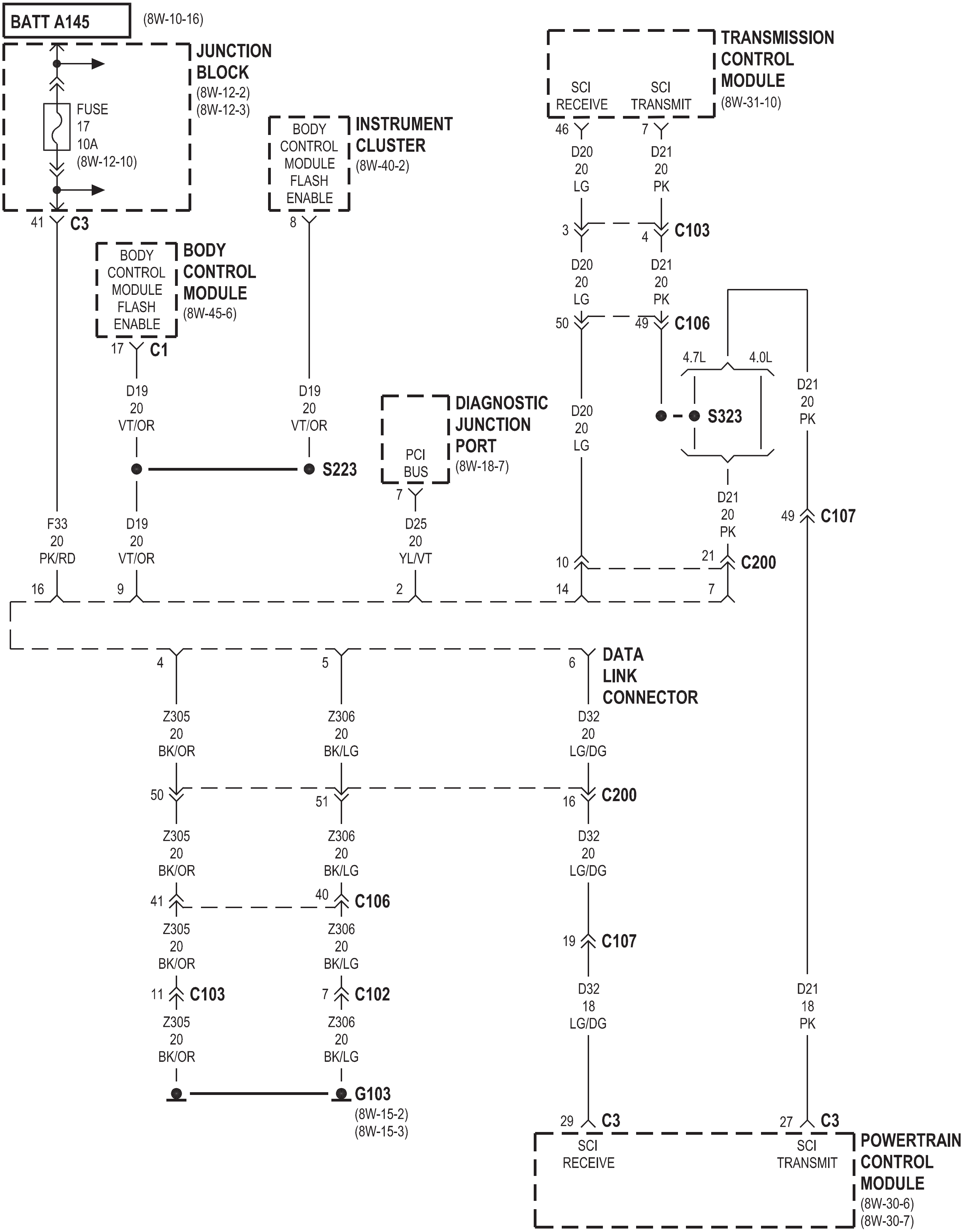

INTRUSION TRANSCEIVER MODULE
(8W-49-7)
PCI BUS
5
D25 20 YL/VT
5 C317
D25 20 YL/VT
RAIN SENSOR
(8W-49-6)
PCI BUS
2
D25 20 BK/PK
VEHICLE INFORMATION CENTER
(8W-49-3)
PCI BUS
2
D25 20 YL/VT
AUTOWIPE
OTHER
S305
D25 20 YL/VT
1 C309
D25 20 YL/VT
PASSENGER DOOR MODULE
(8W-60-3)
PCI BUS
9 C1
D25 20 YL/VT
1 C314
D25 20 YL/VT
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
PCI BUS
43
D25 18 VT/YL
10 C103
D25 18 VT/YL
48 C106
D25 18 YL/VT
S312
D25 20 YL/VT
H
TO
C200
(8W-18-7)

RHD

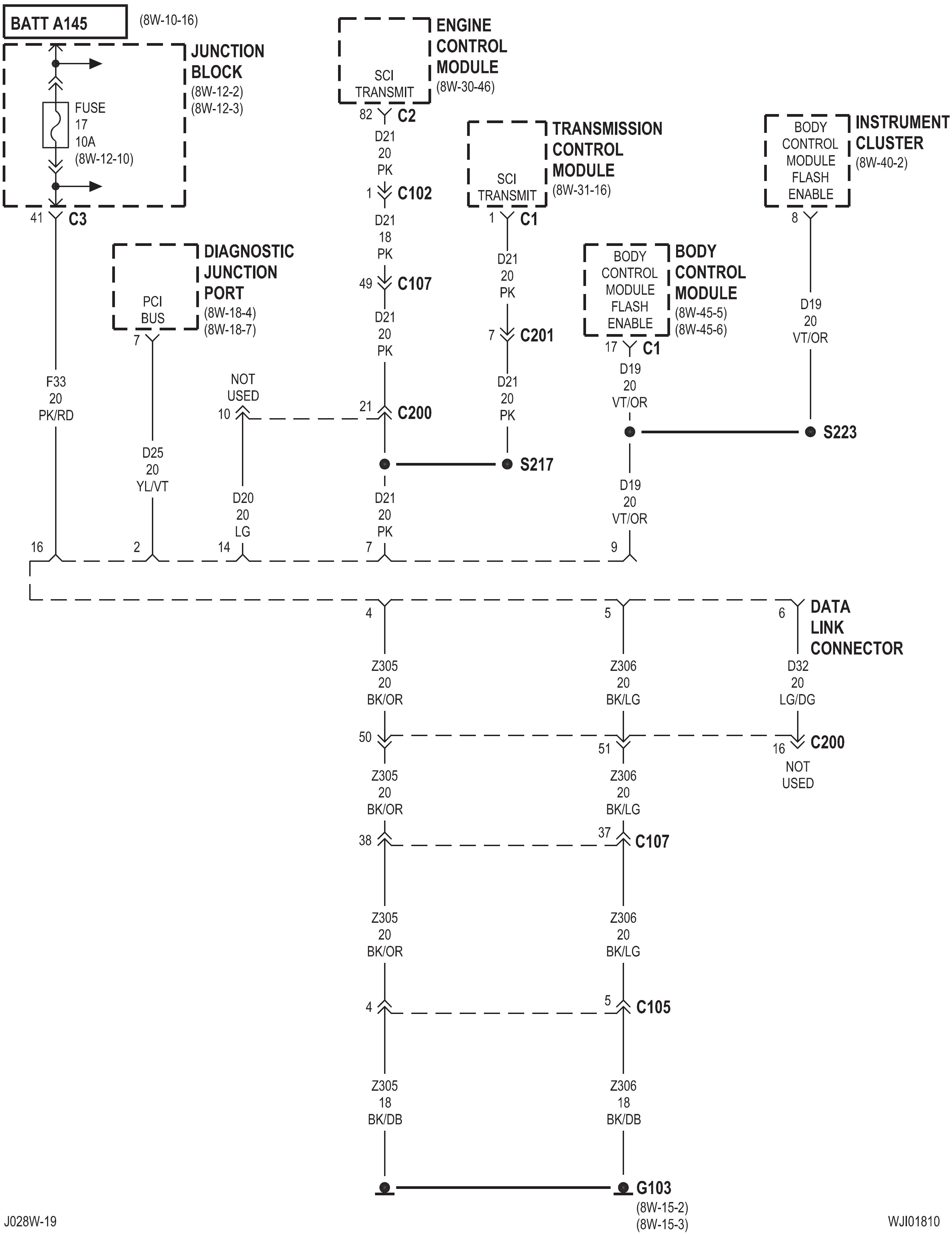

SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
PCI BUS
5
D25 20 YL/VT/BK
FROM S324 (8W-18-5)
G
D25 20 YL/VT
15 C200
D25 20 YL/VT/BR
S210
AIRBAG CONTROL MODULE
(8W-43-3)
PCI BUS
23 C2
D25 20 YL/VT/OR
FROM S312 (8W-18-6)
H
D25 20 YL/VT
14 C200
D25 20 YL/VT/GY
INSTRUMENT CLUSTER
(8W-40-5)
(8W-40-7)
PCI BUS
10
D25 20 YL/VT/RD
RADIO
(8W-47-13)
PCI BUS
14 C1
D25 20 YL/VT/DB
D25 20 YL/VT/BR
SHIFTER ASSEMBLY (DIESEL)
(8W-31-15)
PCI BUS
5 C1
D25 20 RD
5 C201
D25 20 YL/VT
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
PCI BUS
8 C2
D25 20 YL/VT/DG
BODY CONTROL MODULE
(8W-45-6)
PCI BUS
15 C1
D25 20 YL/VT/WT
2
DATA LINK CONNECTOR
(8W-18-9)
(8W-18-10)
D25 20 YL/VT
4 8 5 3 1 11 2 6 7
DIAGNOSTIC JUNCTION PORT

LHD GAS


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
41 C3
F33
20
PK/RD
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-9)
SCI RECEIVE
SCI TRANSMIT
46
7
D20
20
LG
D21
20
PK
3
4
C103
S125
(8W-30-6)
D21
18
PK
4.7L
4.0L
50
49
C106
10
21
C200
14
7
BODY CONTROL MODULE FLASH ENABLE
BODY CONTROL MODULE
(8W-45-5)
17 C1
D19
20
VT/OR
INSTRUMENT CLUSTER
(8W-40-2)
8
S223
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
PCI BUS
7
D25
20
YL/VT
2
16
9
4
5
6
DATA LINK CONNECTOR
Z305
20
BK/OR
Z306
20
BK/LG
D32
20
LG/DG
50
51
16
C200
41
40
51
C106
D32
18
LG
11 C103
7 C102
7 C104
G103
(8W-15-2)
(8W-15-3)
29 C3
27 C3
SCI RECEIVE
SCI TRANSMIT
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)
J028W-19
WJI01808


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
41 C3
F33 20 PK/RD
BODY CONTROL MODULE FLASH ENABLE
BODY CONTROL MODULE
(8W-45-6)
17 C1
D19 20 VT/OR
S223
BODY CONTROL MODULE FLASH ENABLE
INSTRUMENT CLUSTER
(8W-40-2)
8
DIAGNOSTIC JUNCTION PORT
PCI BUS
(8W-18-7)
7
D25 20 YL/VT
TRANSMISSION CONTROL MODULE
SCI RECEIVE
SCI TRANSMIT
(8W-31-10)
46
7
D20 20 LG
D21 20 PK
3
4
C103
50
49
C106
4.7L
4.0L
S323
D21 20 PK
49 C107
10
21
C200
16
9
2
14
7
4
5
6
DATA LINK CONNECTOR
Z305 20 BK/OR
Z306 20 BK/LG
D32 20 LG/DG
50
51
16 C200
41
40 C106
19 C107
11 C103
7 C102
D32 18 LG/DG
D21 18 PK
G103
(8W-15-2)
(8W-15-3)
29 C3
27 C3
SCI RECEIVE
SCI TRANSMIT
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)

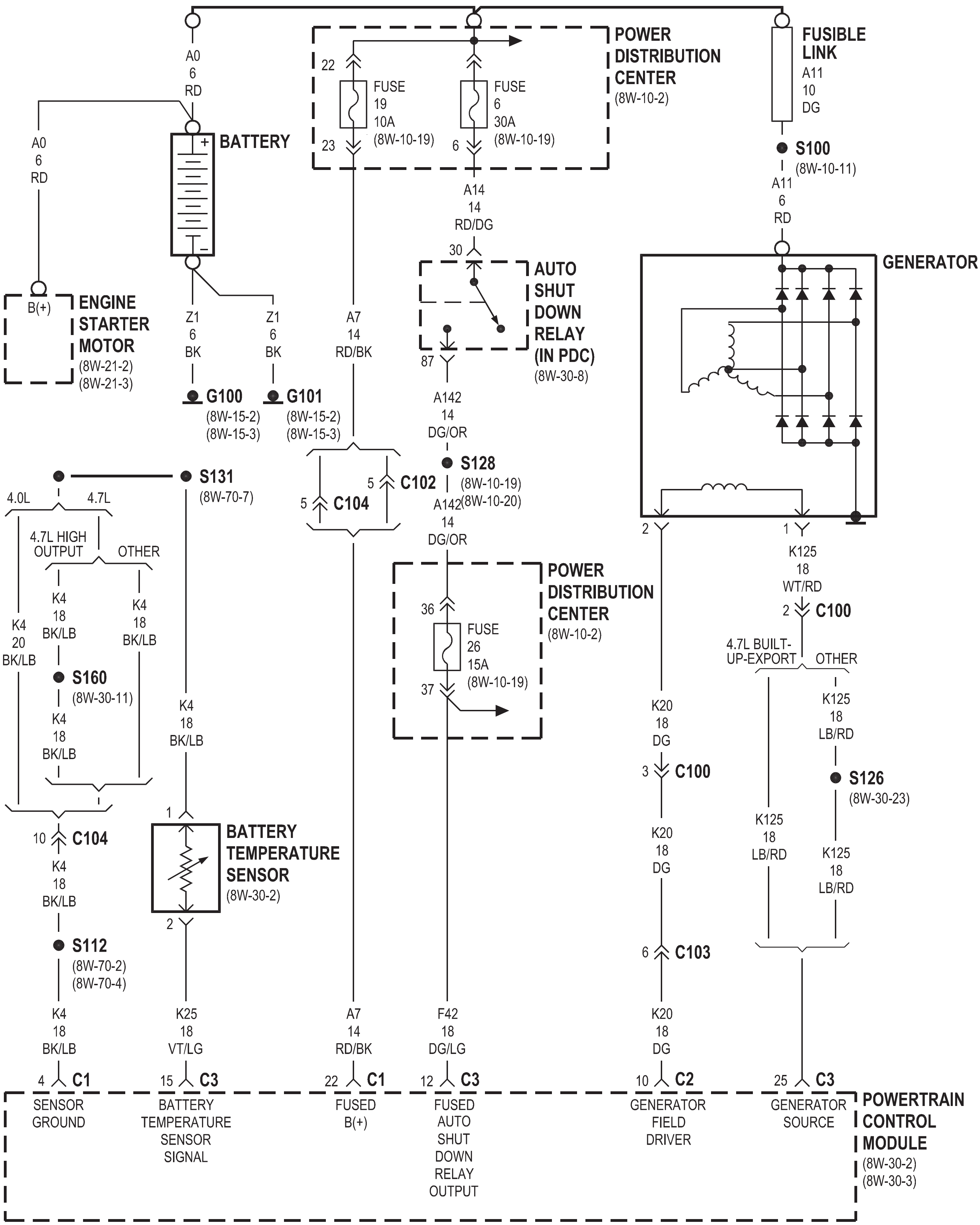
DIESEL


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
41 C3
F33
20
PK/RD
ENGINE CONTROL MODULE
(8W-30-46)
SCI TRANSMIT
82 C2
D21
20
PK
1 C102
D21
18
PK
49 C107
D21
20
PK
21 C200
NOT USED
10
S217
D21
20
PK
TRANSMISSION CONTROL MODULE
(8W-31-16)
SCI TRANSMIT
1 C1
D21
20
PK
7 C201
D21
20
PK
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
PCI BUS
7
D25
20
YL/VT
D20
20
LG
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
BODY CONTROL MODULE FLASH ENABLE
17 C1
D19
20
VT/OR
S223
D19
20
VT/OR
INSTRUMENT CLUSTER
(8W-40-2)
BODY CONTROL MODULE FLASH ENABLE
8
D19
20
VT/OR
16
2
14
7
9
4
5
6
DATA LINK CONNECTOR
Z305
20
BK/OR
Z306
20
BK/LG
D32
20
LG/DG
50
51
16 C200
NOT USED
Z305
20
BK/OR
Z306
20
BK/LG
38
37 C107
Z305
20
BK/OR
Z306
20
BK/LG
4
5 C105
Z305
18
BK/DB
Z306
18
BK/DB
G103
(8W-15-2)
(8W-15-3)
J028W-19
WJI01810

8W-20 CHARGING SYSTEM

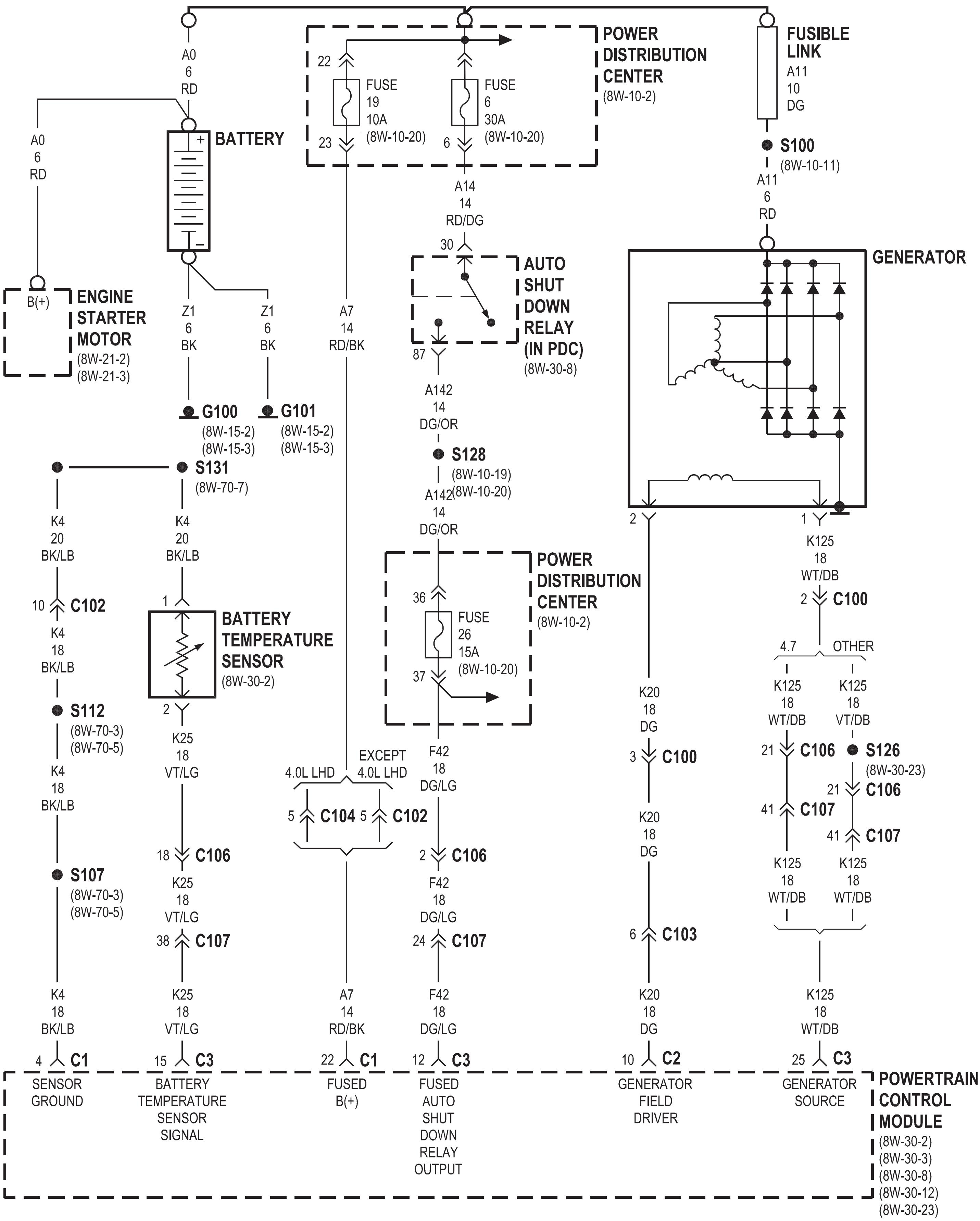
Component **Page**

GAS LHD

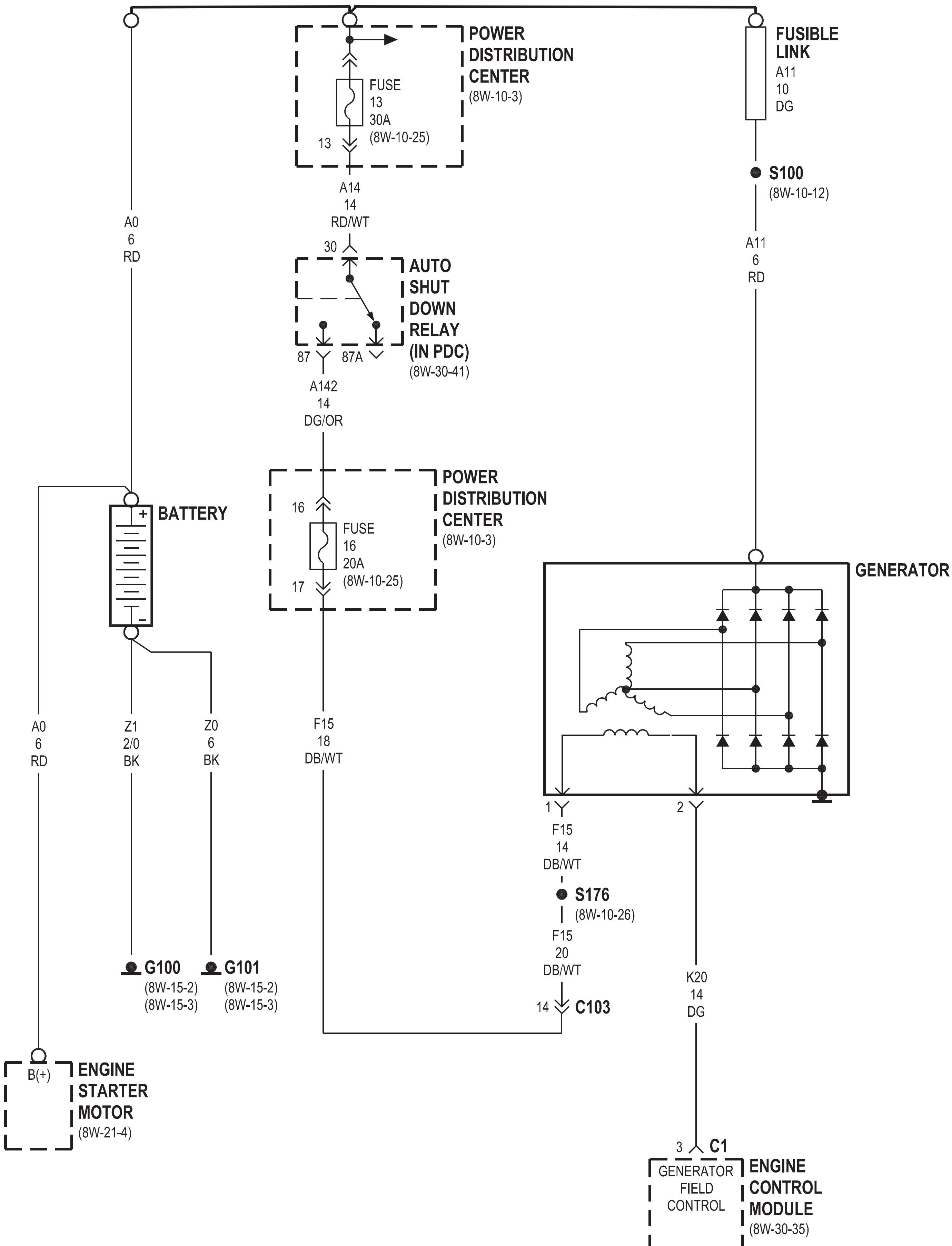


POWER DISTRIBUTION CENTER
(8W-10-2)
FUSIBLE LINK
A11
10
DG
A0
6
RD
BATTERY
FUSE
19
10A
(8W-10-19)
FUSE
6
30A
(8W-10-19)
22
23
6
S100
(8W-10-11)
A11
6
RD
A14
14
RD/DG
30
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-8)
87
GENERATOR
ENGINE STARTER MOTOR
B(+)
(8W-21-2)
(8W-21-3)
Z1
6
BK
G100
(8W-15-2)
(8W-15-3)
G101
(8W-15-2)
(8W-15-3)
A7
14
RD/BK
A142
14
DG/OR
S128
(8W-10-19)
(8W-10-20)
S131
(8W-70-7)
4.0L
4.7L
4.7L HIGH OUTPUT
OTHER
5
C102
C104
K4
20
BK/LB
K4
18
BK/LB
S160
(8W-30-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
36
FUSE
26
15A
(8W-10-19)
37
2
1
K125
18
WT/RD
C100
4.7L BUILT-UP-EXPORT
K20
18
DG
3
S126
(8W-30-23)
K125
18
LB/RD
10
BATTERY TEMPERATURE SENSOR
(8W-30-2)
S112
(8W-70-2)
(8W-70-4)
6
C103
K25
18
VT/LG
F42
18
DG/LG
4
C1
15
C3
12
C2
25
SENSOR GROUND
BATTERY TEMPERATURE SENSOR SIGNAL
FUSED B(+)
FUSED AUTO SHUT DOWN RELAY OUTPUT
GENERATOR FIELD DRIVER
GENERATOR SOURCE
POWERTRAIN CONTROL MODULE
(8W-30-2)
(8W-30-3)

GAS RHD


POWER DISTRIBUTION CENTER (8W-10-2)
FUSE 19 10A (8W-10-20)
FUSE 6 30A (8W-10-20)
22
23
6
FUSIBLE LINK A11 10 DG
A0 6 RD
A0 6 RD
BATTERY
S100 (8W-10-11)
A11 6 RD
A14 14 RD/DG
30
AUTO SHUT DOWN RELAY (IN PDC) (8W-30-8)
87
GENERATOR
ENGINE STARTER MOTOR (8W-21-2) (8W-21-3)
B(+)
Z1 6 BK
Z1 6 BK
A7 14 RD/BK
G100 (8W-15-2) (8W-15-3)
G101 (8W-15-2) (8W-15-3)
A142 14 DG/OR
S128 (8W-10-19) (8W-10-20)
A142 14 DG/OR
S131 (8W-70-7)
K4 20 BK/LB
K4 20 BK/LB
2
1
K125 18 WT/DB
2 C100
POWER DISTRIBUTION CENTER (8W-10-2)
36
FUSE 26 15A (8W-10-20)
37
10 C102
K4 18 BK/LB
1
BATTERY TEMPERATURE SENSOR (8W-30-2)
2
4.7
OTHER
K125 18 WT/DB
K125 18 VT/DB
S112 (8W-70-3) (8W-70-5)
K25 18 VT/LG
K20 18 DG
K4 18 BK/LB
EXCEPT 4.0L LHD
4.0L LHD
F42 18 DG/LG
3 C100
21 C106
S126 (8W-30-23)
5 C104
5 C102
21 C106
41 C107
K20 18 DG
41 C107
18 C106
2 C106
S107 (8W-70-3) (8W-70-5)
K25 18 VT/LG
F42 18 DG/LG
K125 18 WT/DB
K125 18 WT/DB
38 C107
24 C107
6 C103
K4 18 BK/LB
K25 18 VT/LG
A7 14 RD/BK
F42 18 DG/LG
K20 18 DG
K125 18 WT/DB
4 C1
15 C3
22 C1
12 C3
10 C2
25 C3
SENSOR GROUND
BATTERY TEMPERATURE SENSOR SIGNAL
FUSED B(+)
FUSED AUTO SHUT DOWN RELAY OUTPUT
GENERATOR FIELD DRIVER
GENERATOR SOURCE
POWERTRAIN CONTROL MODULE (8W-30-2) (8W-30-3) (8W-30-8) (8W-30-12) (8W-30-23)

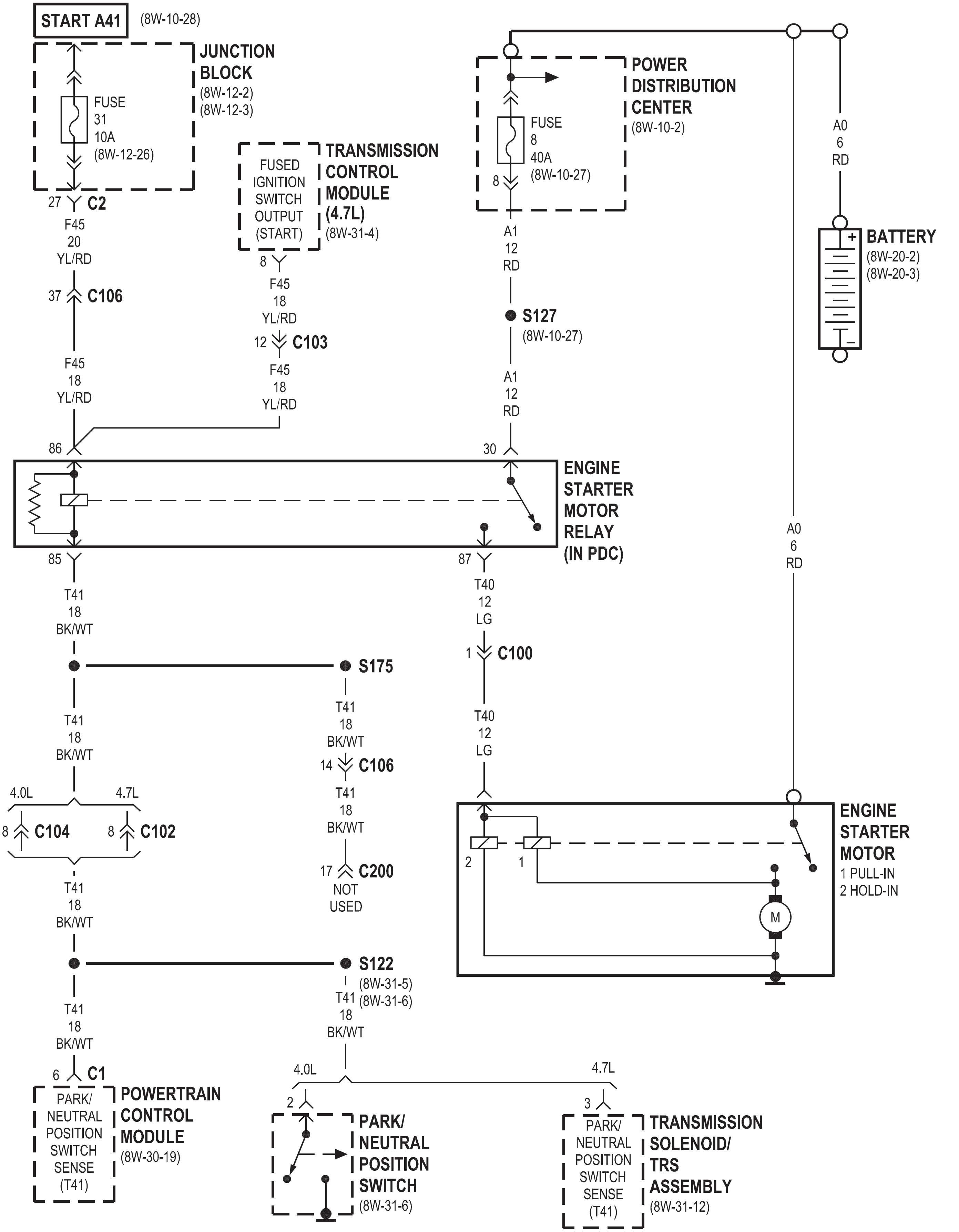
DIESEL



POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 13 30A (8W-10-25)
13
FUSIBLE LINK
A11 10 DG
S100
(8W-10-12)
A14 14 RD/WT
A0 6 RD
30
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-41)
87
87A
A11 6 RD
A142 14 DG/OR
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE 16 20A (8W-10-25)
17
BATTERY
+
−
GENERATOR
A0 6 RD
Z1 2/0 BK
Z0 6 BK
F15 18 DB/WT
1
2
F15 14 DB/WT
S176
(8W-10-26)
F15 20 DB/WT
14
C103
K20 14 DG
G100
(8W-15-2)
(8W-15-3)
G101
(8W-15-2)
(8W-15-3)
B(+)
ENGINE STARTER MOTOR
(8W-21-4)
3
C1
GENERATOR FIELD CONTROL
ENGINE CONTROL MODULE
(8W-30-35)

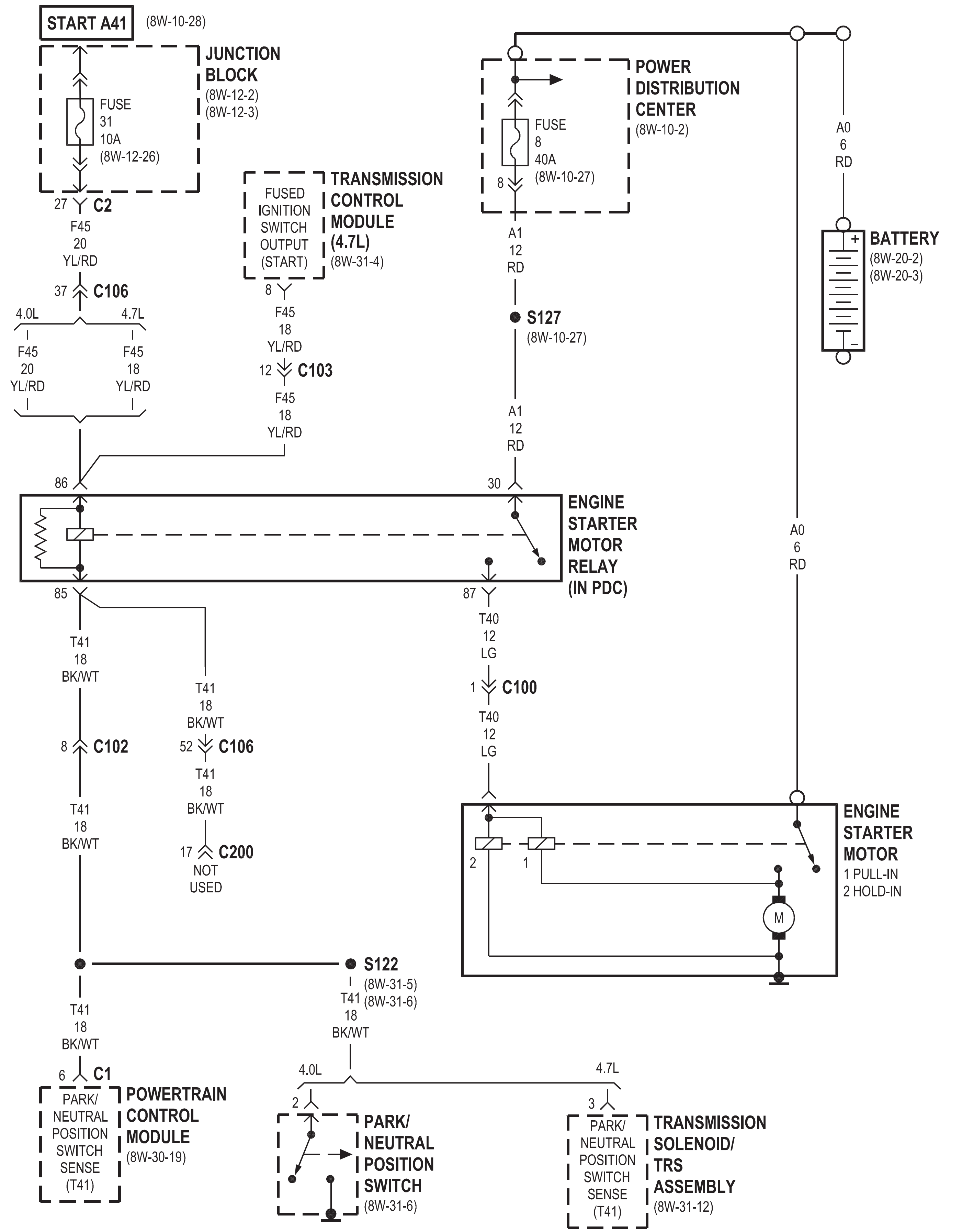
8W-21 STARTING SYSTEM

GAS LHD

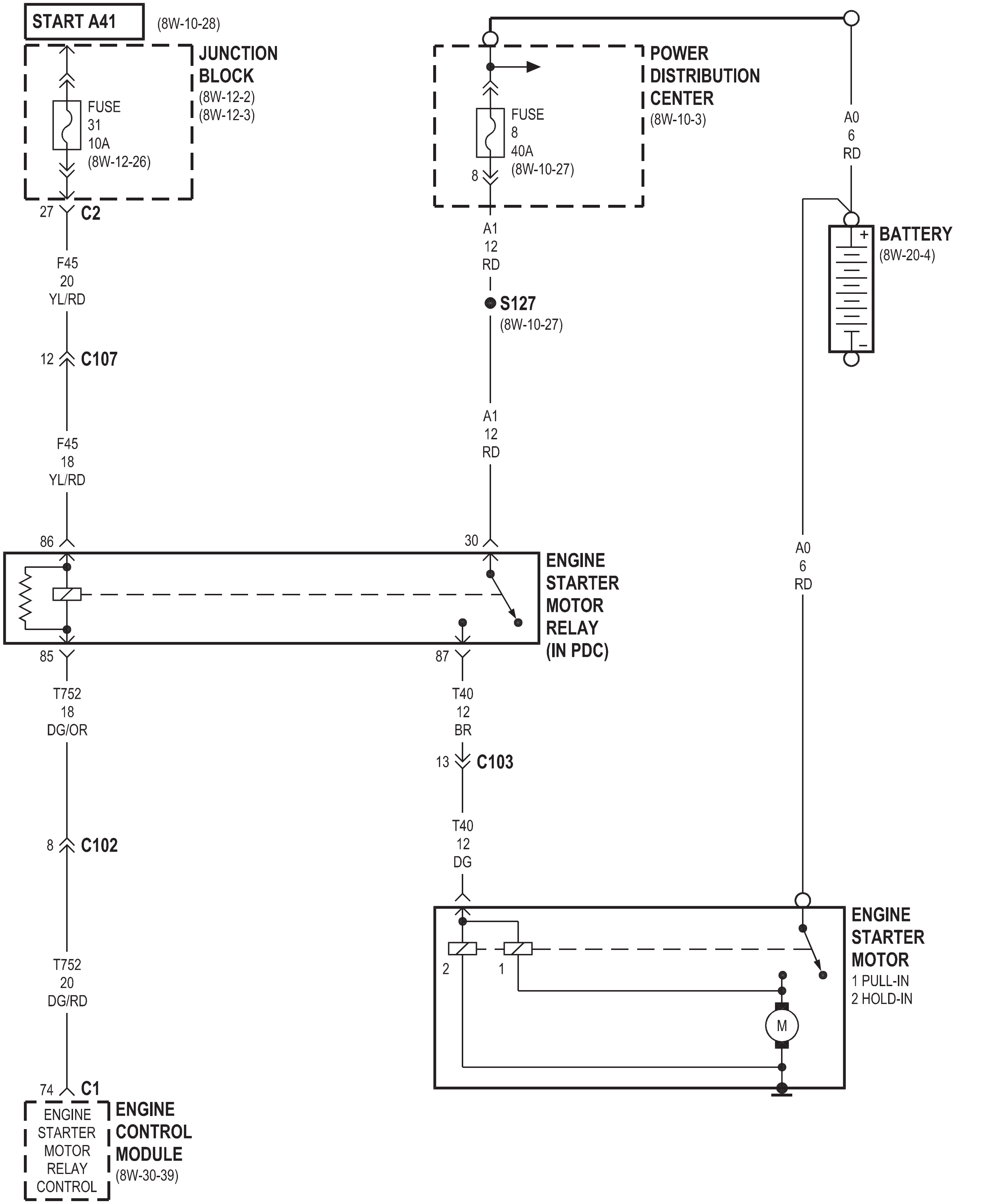


START A41
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
31
10A
(8W-12-26)
27 C2
F45
20
YL/RD
37 C106
F45
18
YL/RD
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
FUSED IGNITION SWITCH OUTPUT (START)
8
F45
18
YL/RD
12 C103
F45
18
YL/RD
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
8
40A
(8W-10-27)
8
A1
12
RD
S127
(8W-10-27)
A1
12
RD
A0
6
RD
BATTERY
(8W-20-2)
(8W-20-3)
86
30
ENGINE STARTER MOTOR RELAY (IN PDC)
85
87
T41
18
BK/WT
T40
12
LG
A0
6
RD
1 C100
T40
12
LG
S175
T41
18
BK/WT
14 C106
T41
18
BK/WT
17 C200
NOT USED
T41
18
BK/WT
4.0L
4.7L
8 C104
8 C102
T41
18
BK/WT
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN
2
1
M
S122
(8W-31-5)
(8W-31-6)
T41
18
BK/WT
T41
18
BK/WT
6 C1
POWERTRAIN CONTROL MODULE
(8W-30-19)
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
4.0L
4.7L
2
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
3
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-12)
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)

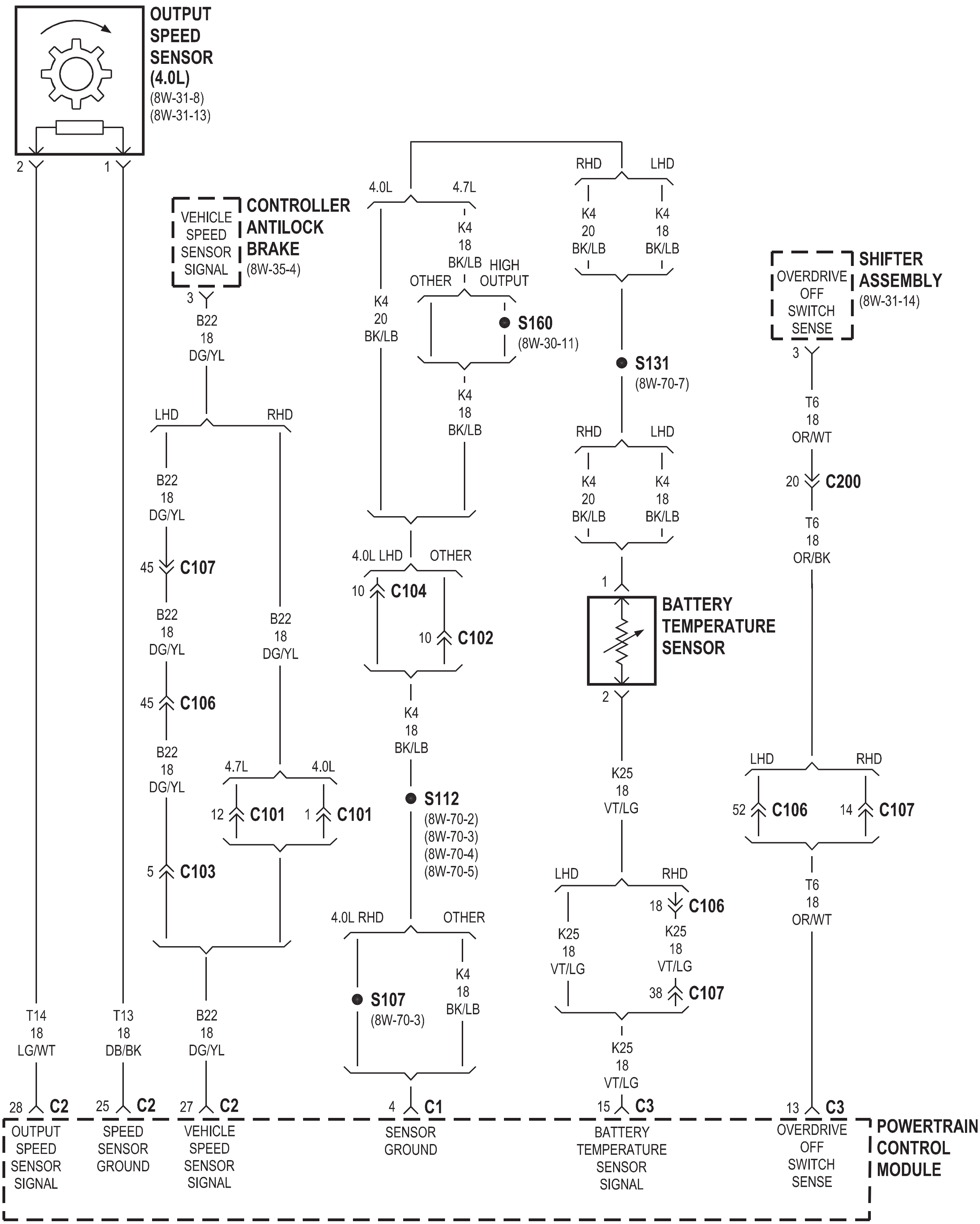
GAS RHD

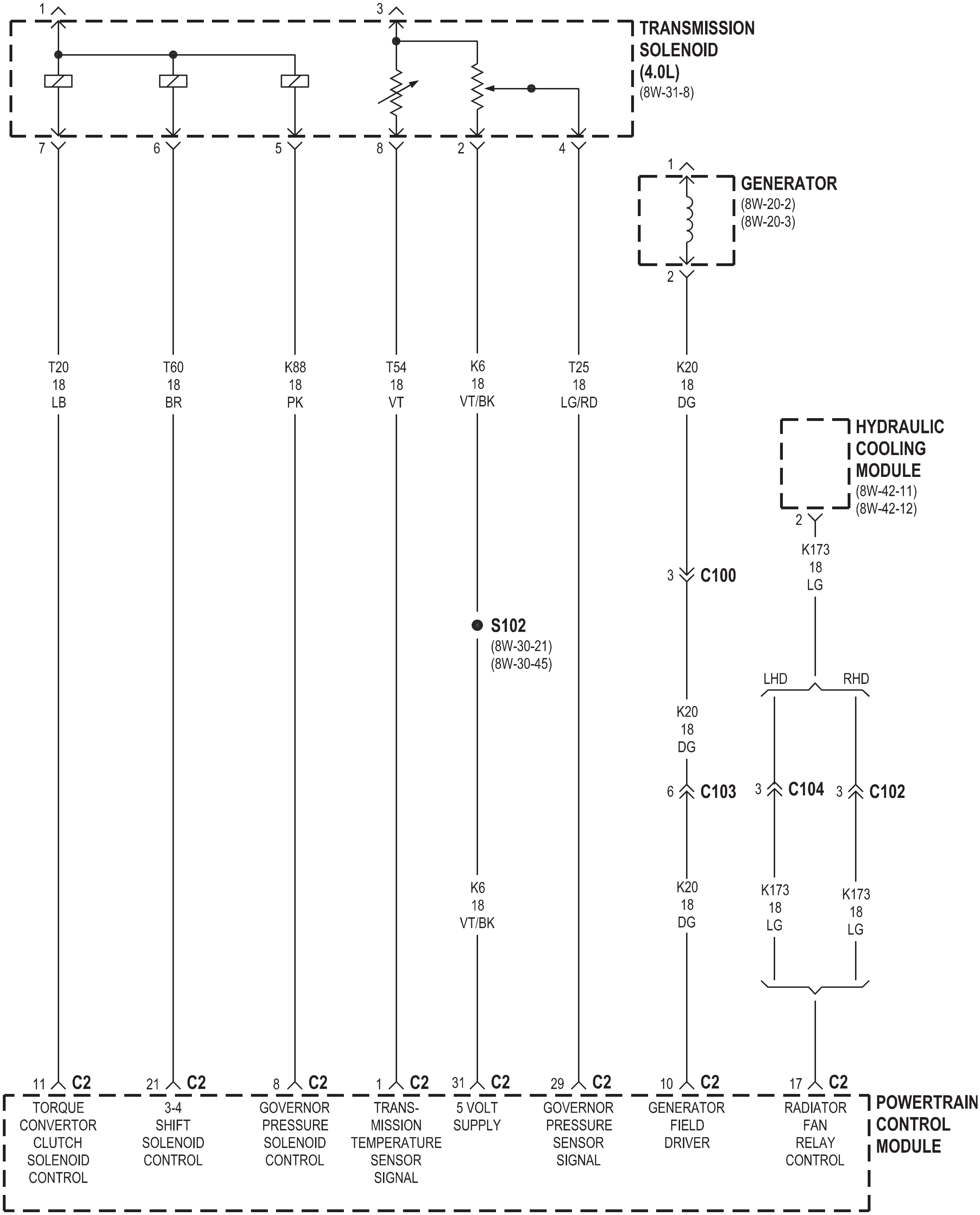

START A41
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 31 10A (8W-12-26)
27 C2
F45 20 YL/RD
37 C106
4.0L
4.7L
F45 20 YL/RD
F45 18 YL/RD
FUSED IGNITION SWITCH OUTPUT (START)
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
8
F45 18 YL/RD
12 C103
F45 18 YL/RD
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 8 40A (8W-10-27)
8
A1 12 RD
S127
(8W-10-27)
A1 12 RD
A0 6 RD
BATTERY
(8W-20-2)
(8W-20-3)
86
30
ENGINE STARTER MOTOR RELAY (IN PDC)
85
87
A0 6 RD
T41 18 BK/WT
T41 18 BK/WT
T40 12 LG
1 C100
T40 12 LG
8 C102
52 C106
T41 18 BK/WT
T41 18 BK/WT
17 C200
NOT USED
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN
2
1
M
S122
(8W-31-5)
(8W-31-6)
T41 18 BK/WT
T41 18 BK/WT
6 C1
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
POWERTRAIN CONTROL MODULE
(8W-30-19)
4.0L
4.7L
2
3
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-12)

DIESEL

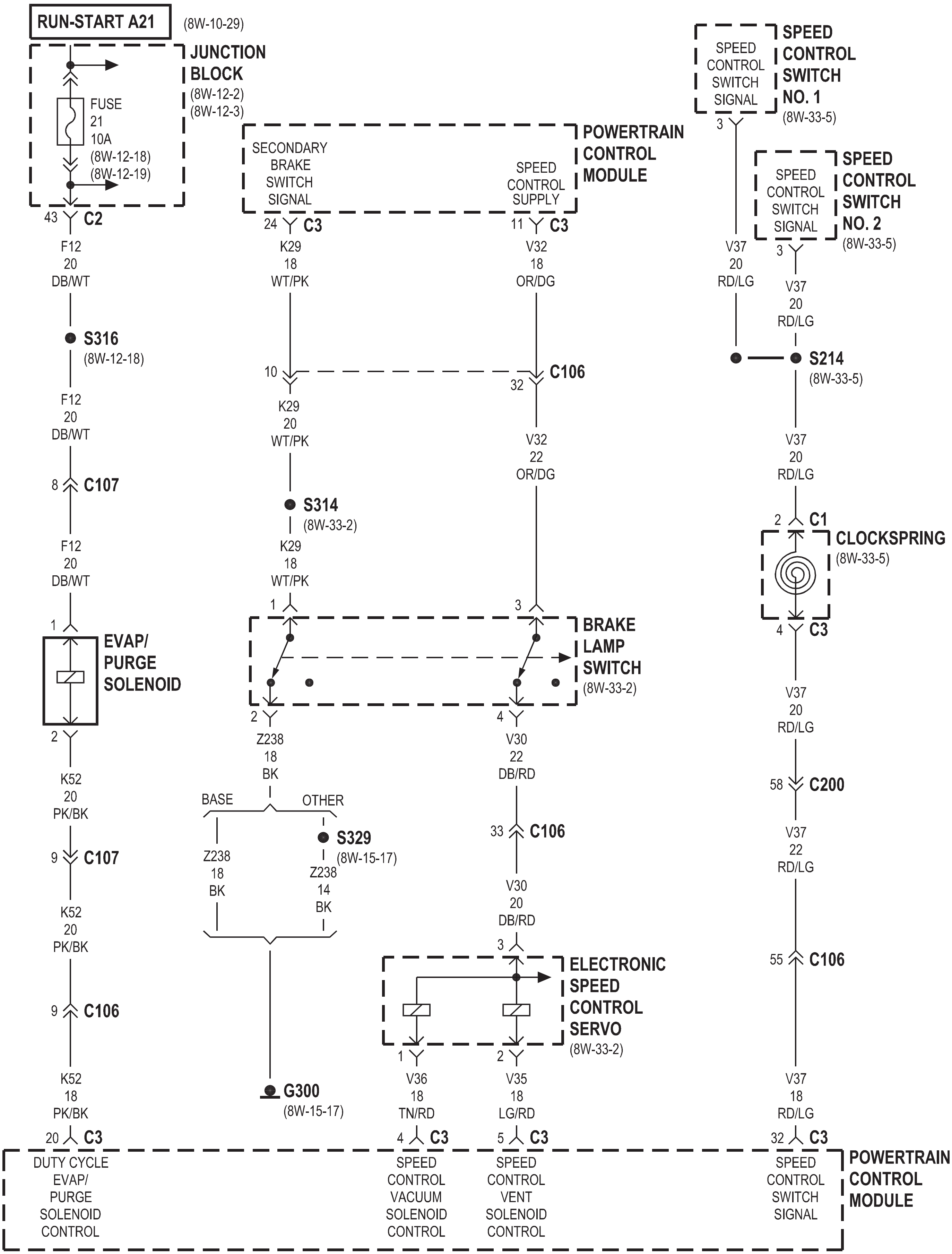

START A41
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
31
10A
(8W-12-26)
27
C2
F45
20
YL/RD
12
C107
F45
18
YL/RD
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE
8
40A
(8W-10-27)
8
A1
12
RD
S127
(8W-10-27)
A1
12
RD
A0
6
RD
BATTERY
(8W-20-4)
86
30
ENGINE STARTER MOTOR RELAY (IN PDC)
85
87
A0
6
RD
T752
18
DG/OR
T40
12
BR
13
C103
8
C102
T40
12
DG
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN
2
1
M
T752
20
DG/RD
74
C1
ENGINE STARTER MOTOR RELAY CONTROL
ENGINE CONTROL MODULE
(8W-30-39)

8W-30 FUEL/IGNITION SYSTEM

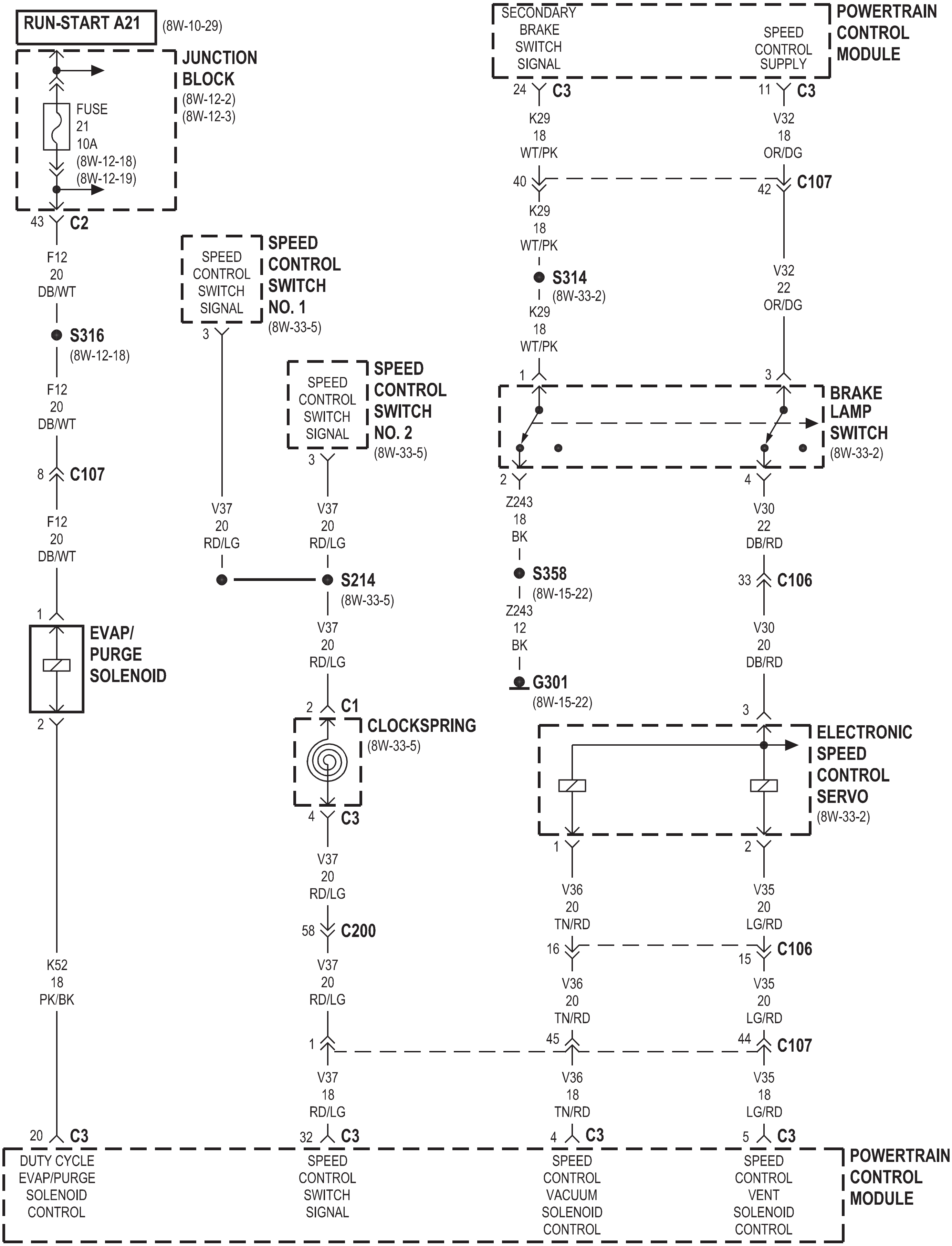

OUTPUT SPEED SENSOR (4.0L)
(8W-31-8)
(8W-31-13)
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
VEHICLE SPEED SENSOR SIGNAL
B22 18 DG/YL
LHD
RHD
C107
C106
C103
C101
4.7L
4.0L
T14 18 LG/WT
T13 18 DB/BK
4.0L LHD
OTHER
K4 20 BK/LB
K4 18 BK/LB
HIGH OUTPUT
S160
(8W-30-11)
C104
C102
S112
(8W-70-2)
(8W-70-3)
(8W-70-4)
(8W-70-5)
4.0L RHD
S107
(8W-70-3)
S131
(8W-70-7)
BATTERY TEMPERATURE SENSOR
K25 18 VT/LG
SHIFTER ASSEMBLY
(8W-31-14)
OVERDRIVE OFF SWITCH SENSE
T6 18 OR/WT
C200
T6 18 OR/BK
C2
C1
C3
OUTPUT SPEED SENSOR SIGNAL
SPEED SENSOR GROUND
VEHICLE SPEED SENSOR SIGNAL
SENSOR GROUND
BATTERY TEMPERATURE SENSOR SIGNAL
OVERDRIVE OFF SWITCH SENSE
POWERTRAIN CONTROL MODULE

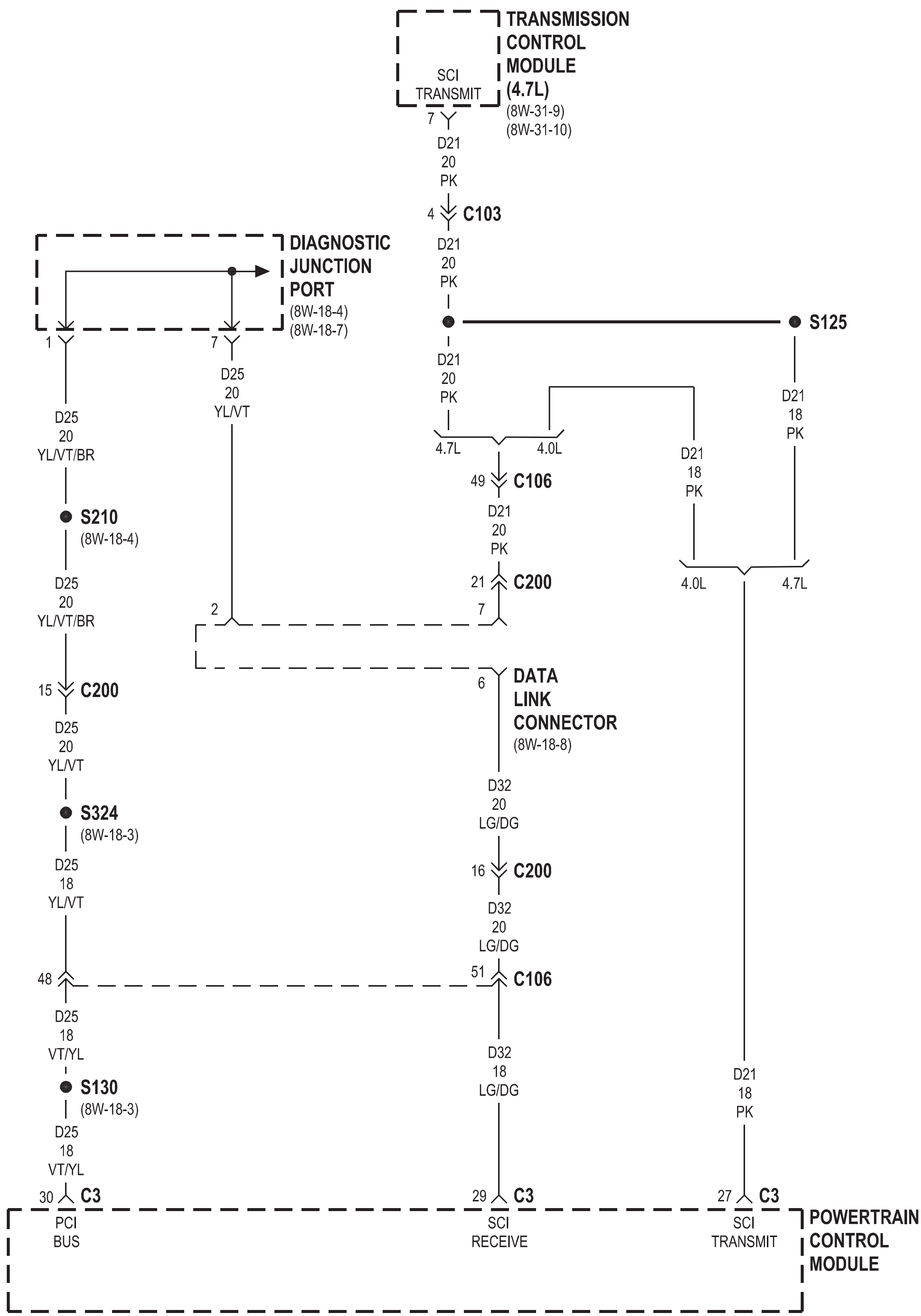


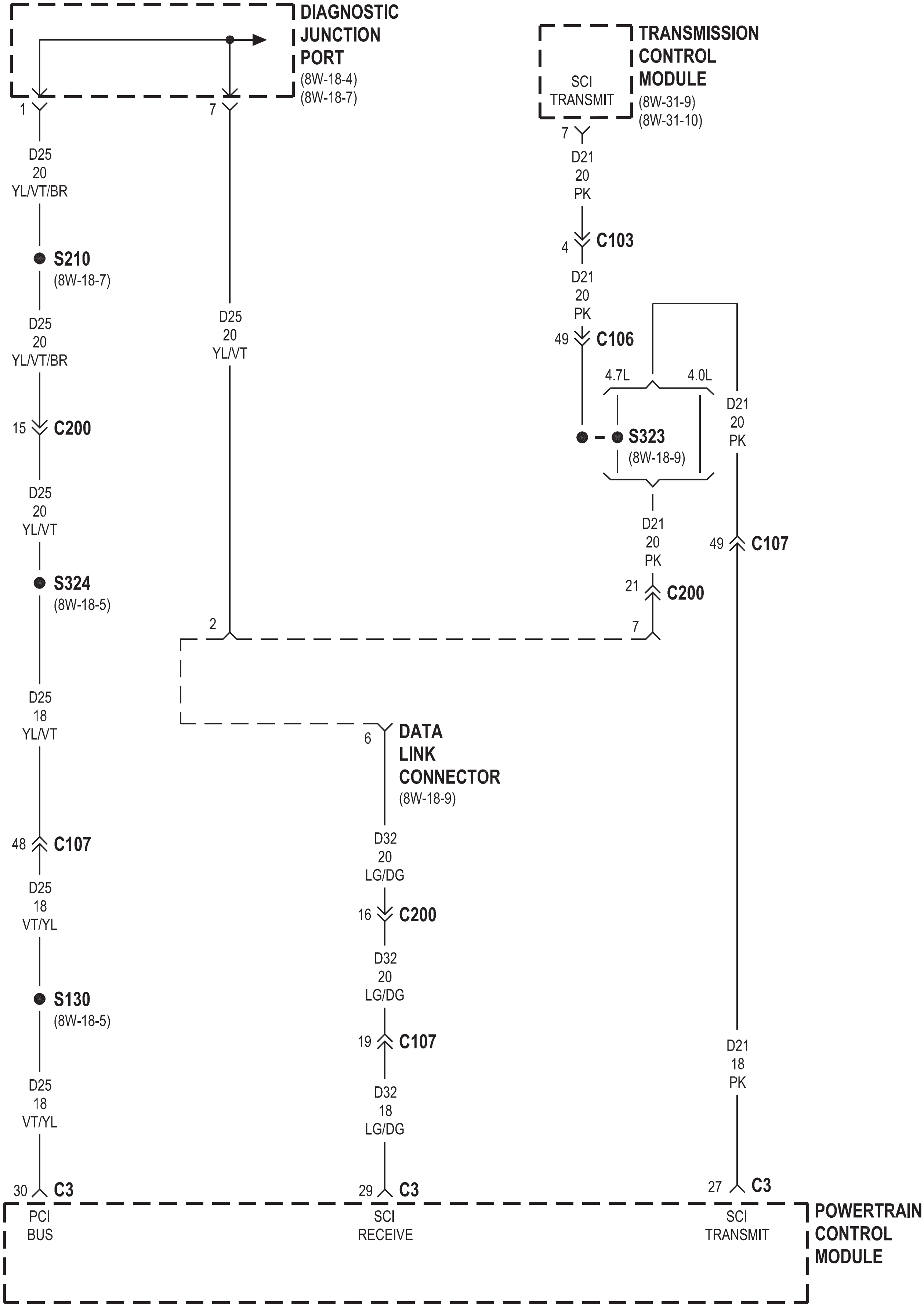
TRANSMISSION SOLENOID (4.0L)
(8W-31-8)
GENERATOR
(8W-20-2)
(8W-20-3)
HYDRAULIC COOLING MODULE
(8W-42-11)
(8W-42-12)
T20 18 LB
T60 18 BR
K88 18 PK
T54 18 VT
K6 18 VT/BK
T25 18 LG/RD
K20 18 DG
K173 18 LG
C100
S102
(8W-30-21)
(8W-30-45)
LHD
RHD
C103
C104
C102
C2
POWERTRAIN CONTROL MODULE
TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
3-4 SHIFT SOLENOID CONTROL
GOVERNOR PRESSURE SOLENOID CONTROL
TRANS-MISSION TEMPERATURE SENSOR SIGNAL
5 VOLT SUPPLY
GOVERNOR PRESSURE SENSOR SIGNAL
GENERATOR FIELD DRIVER
RADIATOR FAN RELAY CONTROL

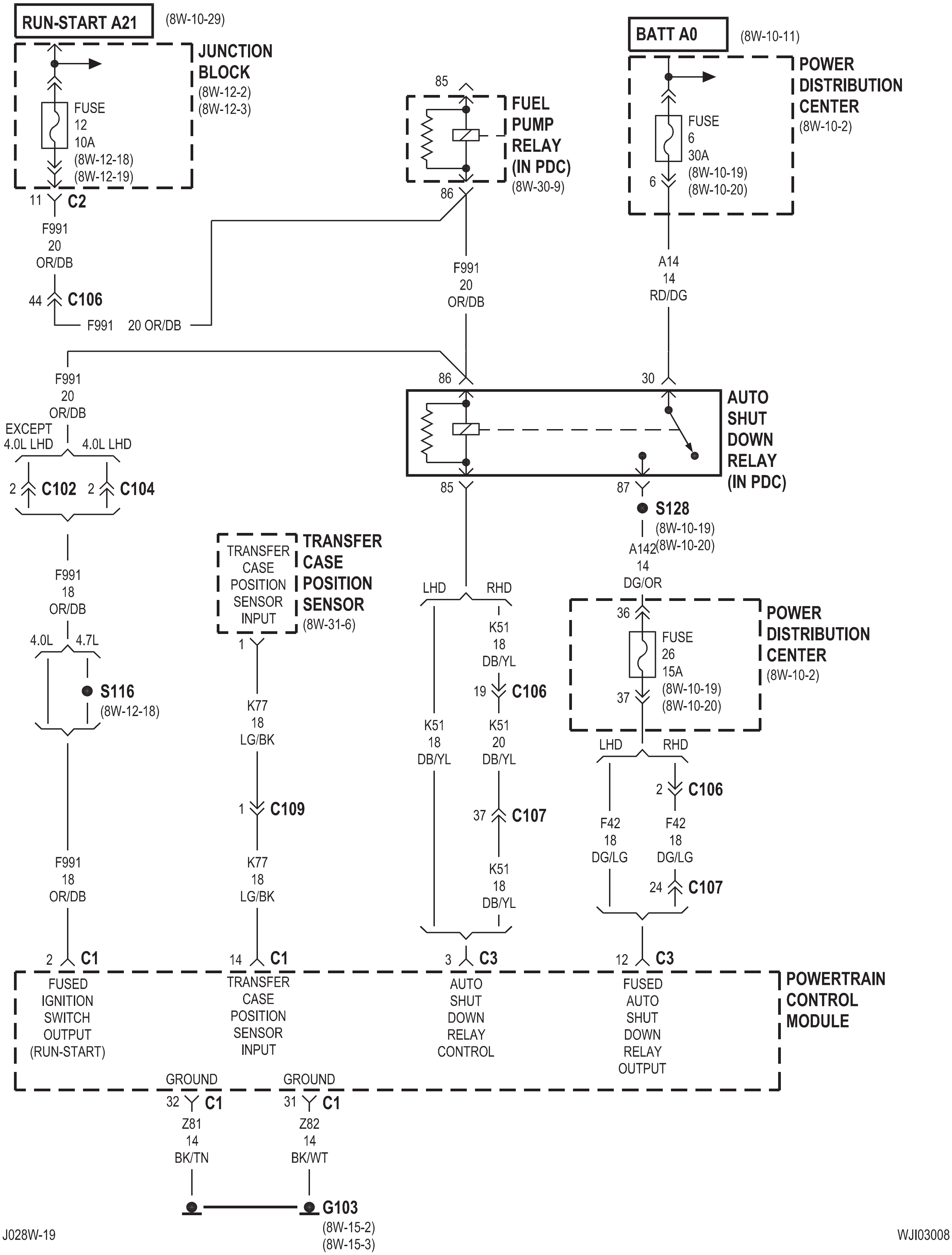

RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A
(8W-12-18)
(8W-12-19)
43 C2
F12 20 DB/WT
S316
(8W-12-18)
F12 20 DB/WT
8 C107
F12 20 DB/WT
1
EVAP/ PURGE SOLENOID
2
K52 20 PK/BK
9 C107
K52 20 PK/BK
9 C106
K52 18 PK/BK
20 C3
POWERTRAIN CONTROL MODULE
SECONDARY BRAKE SWITCH SIGNAL
SPEED CONTROL SUPPLY
24 C3
11 C3
K29 18 WT/PK
V32 18 OR/DG
10
C106
32
K29 20 WT/PK
V32 22 OR/DG
S314
(8W-33-2)
K29 18 WT/PK
1
3
BRAKE LAMP SWITCH
(8W-33-2)
2
4
Z238 18 BK
V30 22 DB/RD
BASE
OTHER
S329
(8W-15-17)
Z238 18 BK
Z238 14 BK
33 C106
V30 20 DB/RD
3
ELECTRONIC SPEED CONTROL SERVO
(8W-33-2)
1
2
G300
(8W-15-17)
V36 18 TN/RD
V35 18 LG/RD
4 C3
5 C3
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL SWITCH NO. 1
(8W-33-5)
3
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL SWITCH NO. 2
(8W-33-5)
3
V37 20 RD/LG
V37 20 RD/LG
S214
(8W-33-5)
V37 20 RD/LG
2 C1
CLOCKSPRING
(8W-33-5)
4 C3
V37 20 RD/LG
58 C200
V37 22 RD/LG
55 C106
V37 18 RD/LG
32 C3
DUTY CYCLE EVAP/ PURGE SOLENOID CONTROL
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL SWITCH SIGNAL
POWERTRAIN CONTROL MODULE

RHD


RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
21
10A
(8W-12-18)
(8W-12-19)
43 C2
F12
20
DB/WT
S316
(8W-12-18)
F12
20
DB/WT
8 C107
F12
20
DB/WT
1
EVAP/ PURGE SOLENOID
2
K52
18
PK/BK
20 C3
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL SWITCH NO. 1
(8W-33-5)
3
V37
20
RD/LG
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL SWITCH NO. 2
(8W-33-5)
3
V37
20
RD/LG
S214
(8W-33-5)
V37
20
RD/LG
2 C1
CLOCKSPRING
(8W-33-5)
4 C3
V37
20
RD/LG
58 C200
V37
20
RD/LG
1
V37
18
RD/LG
32 C3
SECONDARY BRAKE SWITCH SIGNAL
SPEED CONTROL SUPPLY
POWERTRAIN CONTROL MODULE
24 C3
11 C3
K29
18
WT/PK
V32
18
OR/DG
40
42 C107
K29
18
WT/PK
S314
(8W-33-2)
K29
18
WT/PK
V32
22
OR/DG
1
3
BRAKE LAMP SWITCH
(8W-33-2)
2
4
Z243
18
BK
S358
(8W-15-22)
Z243
12
BK
G301
(8W-15-22)
V30
22
DB/RD
33 C106
V30
20
DB/RD
3
ELECTRONIC SPEED CONTROL SERVO
(8W-33-2)
1
2
V36
20
TN/RD
V35
20
LG/RD
16
15 C106
V36
20
TN/RD
V35
20
LG/RD
45
44 C107
V36
18
TN/RD
V35
18
LG/RD
4 C3
5 C3
DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
POWERTRAIN CONTROL MODULE

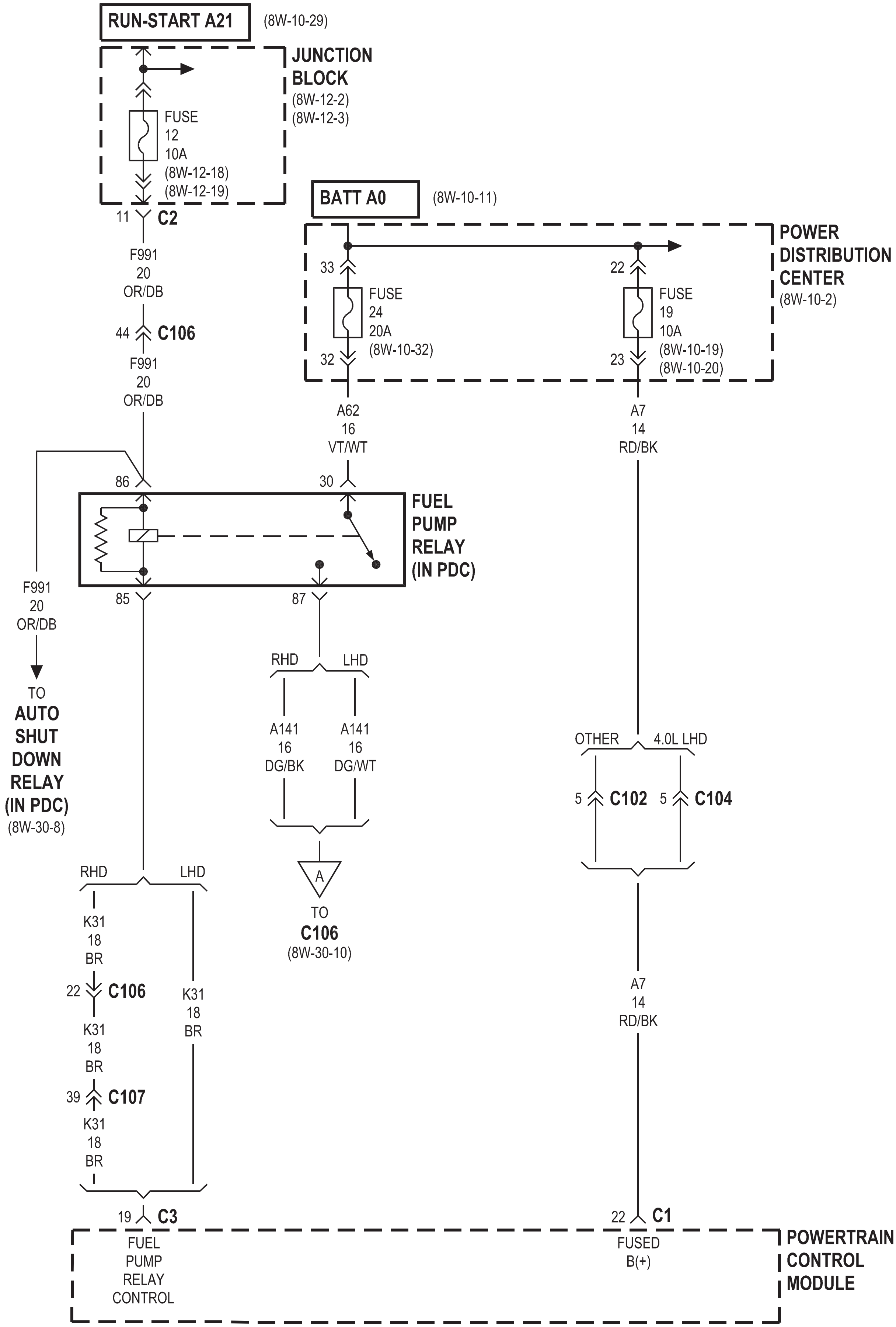

TRANSMISSION
CONTROL
MODULE
(4.7L)
(8W-31-9)
(8W-31-10)
SCI
TRANSMIT
7
D21
20
PK
4
C103
D21
20
PK
S125
D21
20
PK
4.7L
4.0L
D21
18
PK
D21
18
PK
49
C106
D21
20
PK
21
C200
4.0L
4.7L
7
DIAGNOSTIC
JUNCTION
PORT
(8W-18-4)
(8W-18-7)
1
7
D25
20
YL/VT
D25
20
YL/VT/BR
S210
(8W-18-4)
D25
20
YL/VT/BR
2
15
C200
D25
20
YL/VT
6
DATA
LINK
CONNECTOR
(8W-18-8)
D32
20
LG/DG
S324
(8W-18-3)
D25
18
YL/VT
16
C200
D32
20
LG/DG
48
51
C106
D25
18
VT/YL
S130
(8W-18-3)
D32
18
LG/DG
D21
18
PK
D25
18
VT/YL
30
C3
29
C3
27
C3
PCI
BUS
SCI
RECEIVE
SCI
TRANSMIT
POWERTRAIN
CONTROL
MODULE

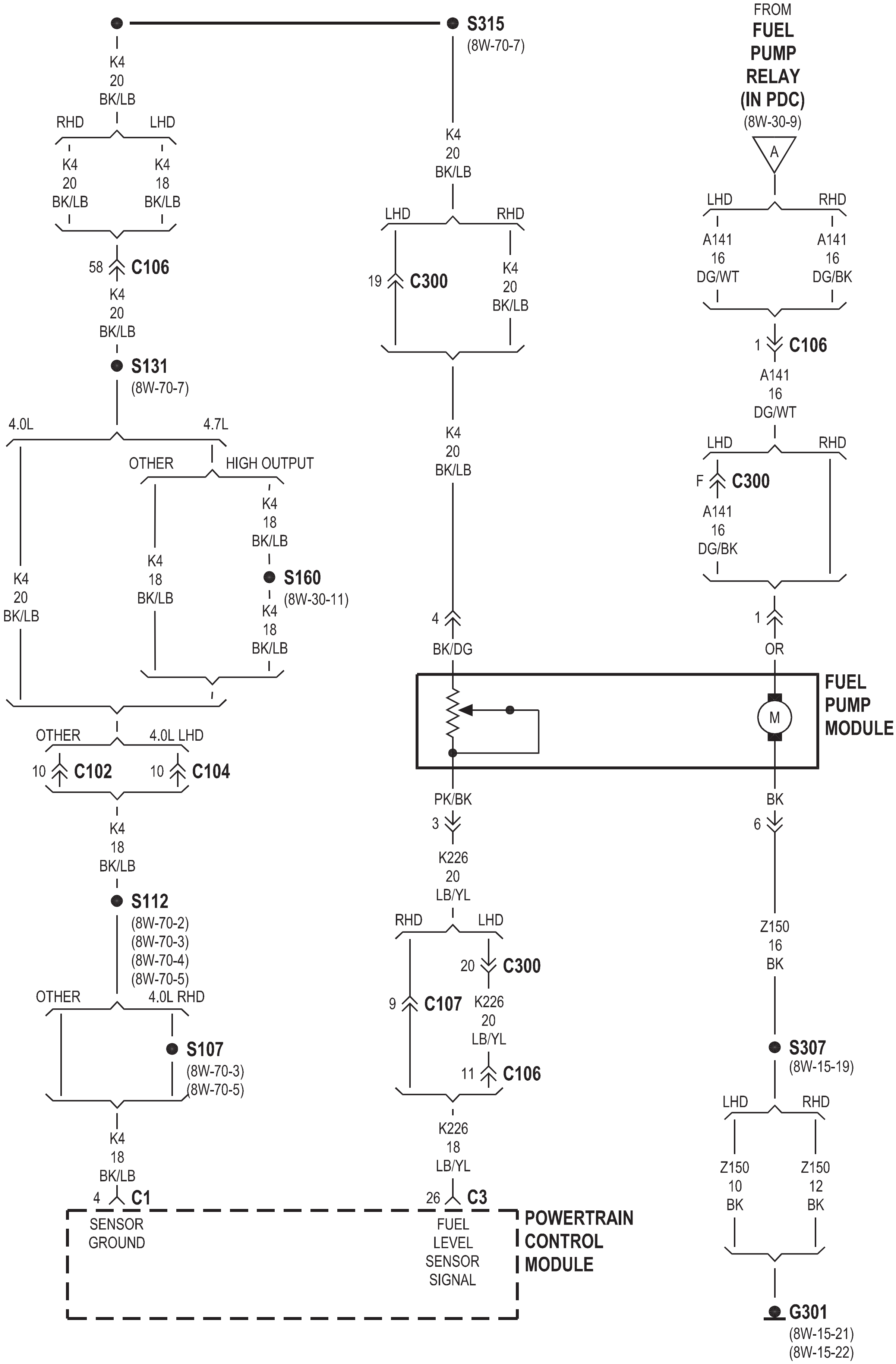

DIAGNOSTIC
JUNCTION
PORT
(8W-18-4)
(8W-18-7)
1
7
D25
20
YL/VT/BR
S210
(8W-18-7)
D25
20
YL/VT/BR
D25
20
YL/VT
15 C200
D25
20
YL/VT
S324
(8W-18-5)
D25
18
YL/VT
48 C107
D25
18
VT/YL
S130
(8W-18-5)
D25
18
VT/YL
30 C3
TRANSMISSION
CONTROL
MODULE
SCI
TRANSMIT
(8W-31-9)
(8W-31-10)
7
D21
20
PK
4 C103
D21
20
PK
49 C106
4.7L
4.0L
S323
(8W-18-9)
D21
20
PK
D21
20
PK
49 C107
21 C200
7
2
6
DATA
LINK
CONNECTOR
(8W-18-9)
D32
20
LG/DG
16 C200
D32
20
LG/DG
19 C107
D32
18
LG/DG
29 C3
D21
18
PK
27 C3
PCI
BUS
SCI
RECEIVE
SCI
TRANSMIT
POWERTRAIN
CONTROL
MODULE

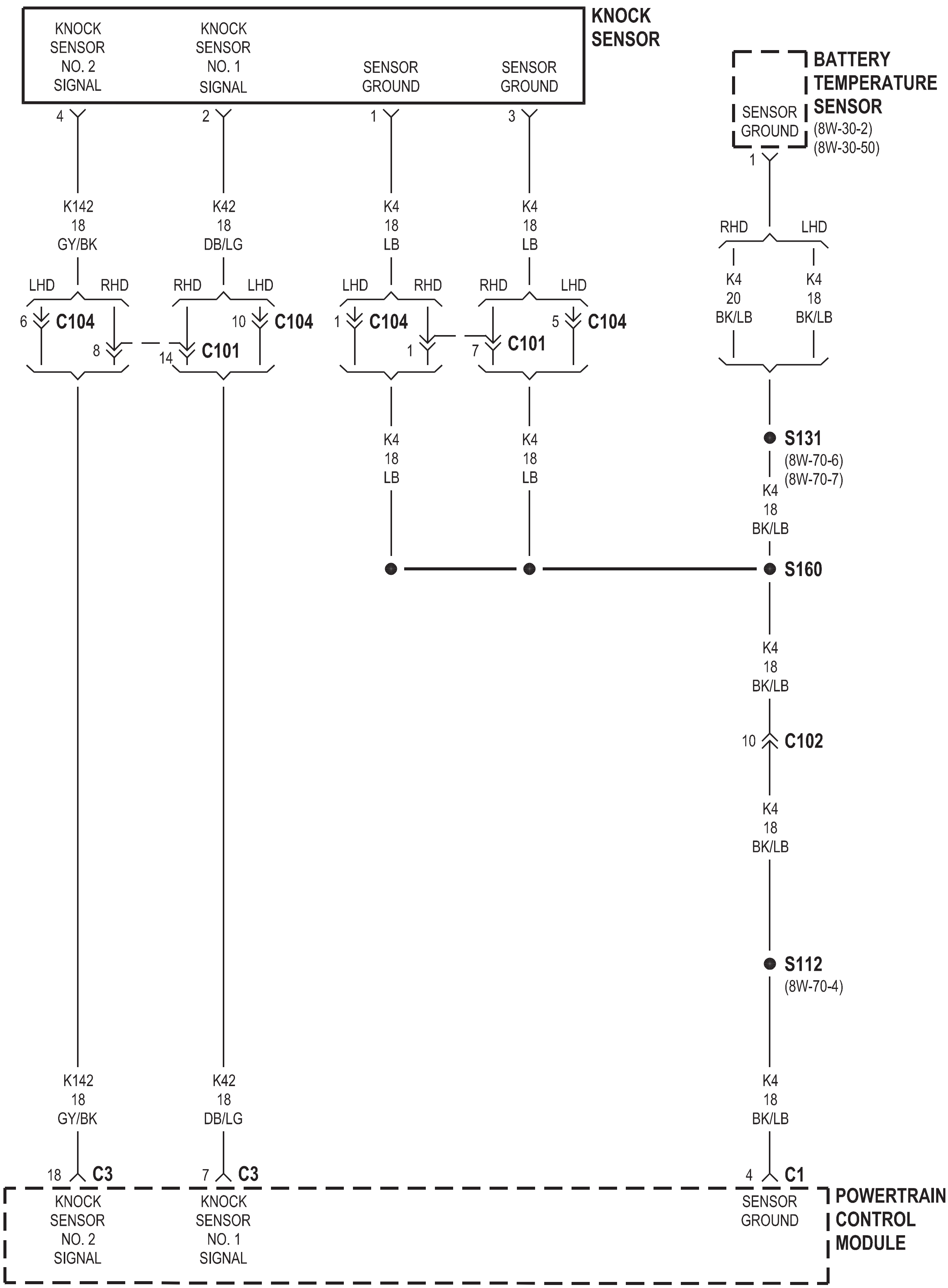


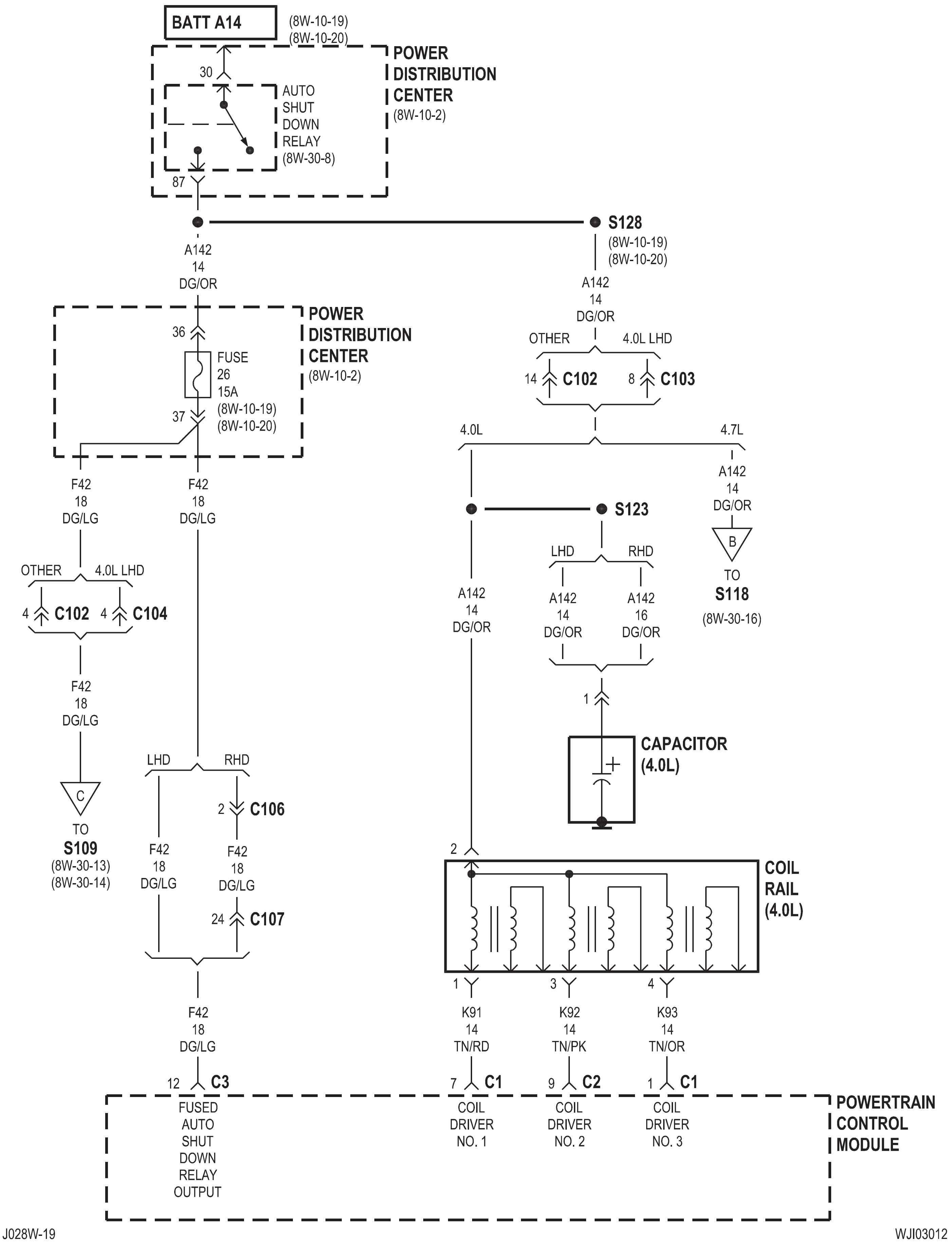
J028W-19

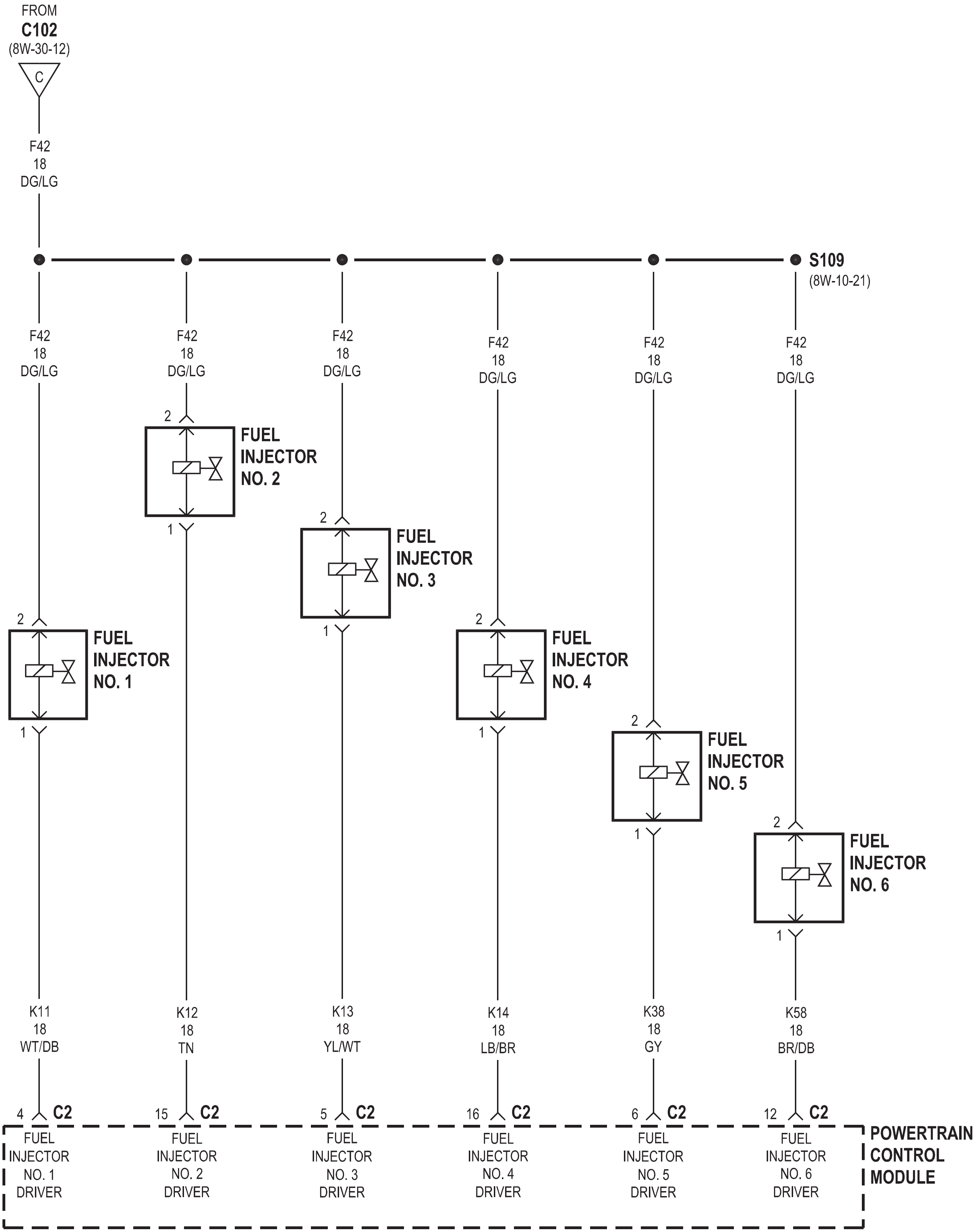
WJI03008

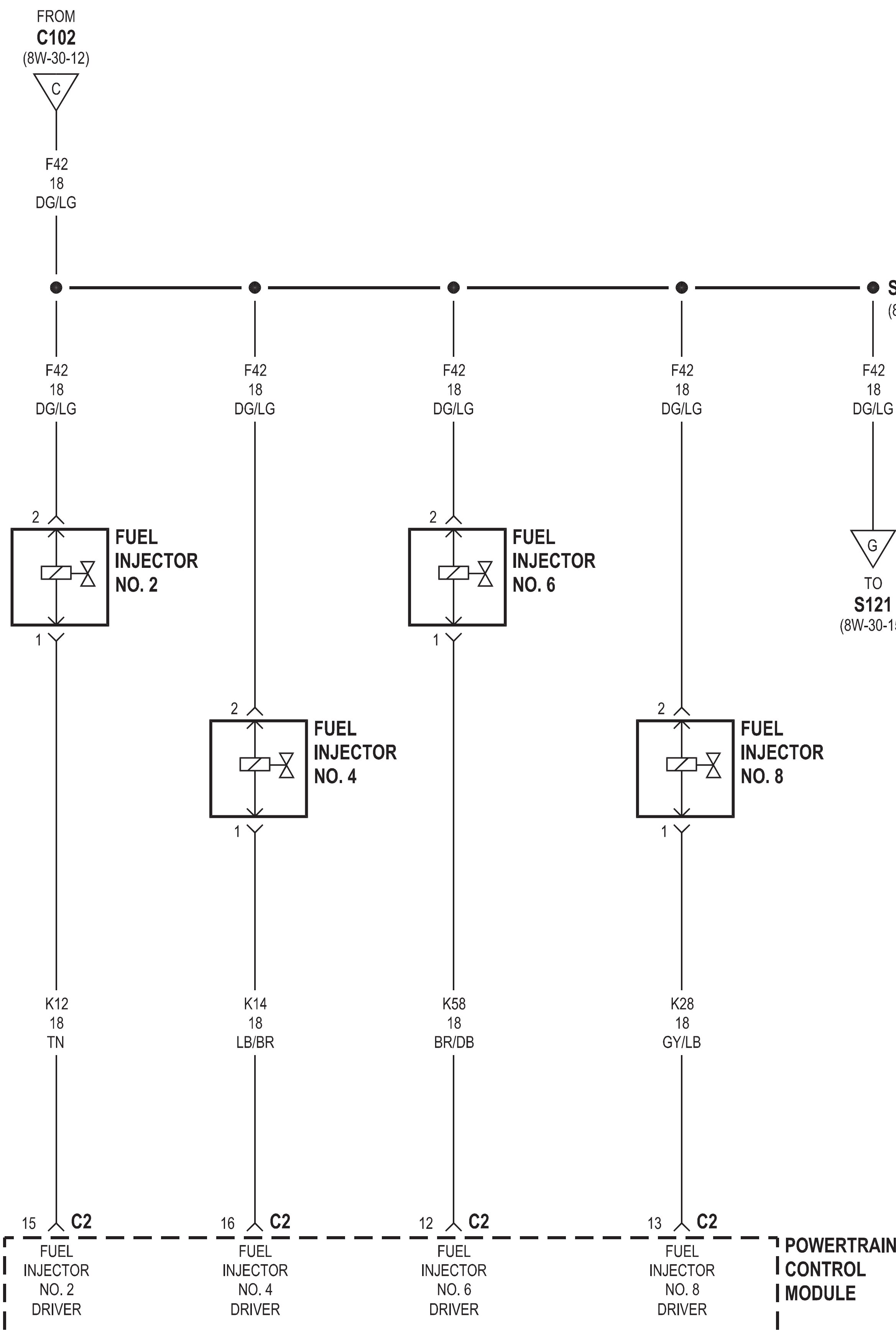

RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
10A
(8W-12-18)
(8W-12-19)
11 C2
F991
20
OR/DB
44 C106
F991
20
OR/DB
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
33
FUSE
24
20A
(8W-10-32)
32
22
FUSE
19
10A
(8W-10-19)
(8W-10-20)
23
A62
16
VT/WT
A7
14
RD/BK
86
30
FUEL PUMP RELAY (IN PDC)
85
87
F991
20
OR/DB
TO
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-8)
RHD
LHD
A141
16
DG/BK
A141
16
DG/WT
A
TO
C106
(8W-30-10)
OTHER
4.0L LHD
5 C102
5 C104
A7
14
RD/BK
RHD
LHD
K31
18
BR
22 C106
K31
18
BR
K31
18
BR
39 C107
K31
18
BR
19 C3
22 C1
FUEL PUMP RELAY CONTROL
FUSED B(+)
POWERTRAIN CONTROL MODULE

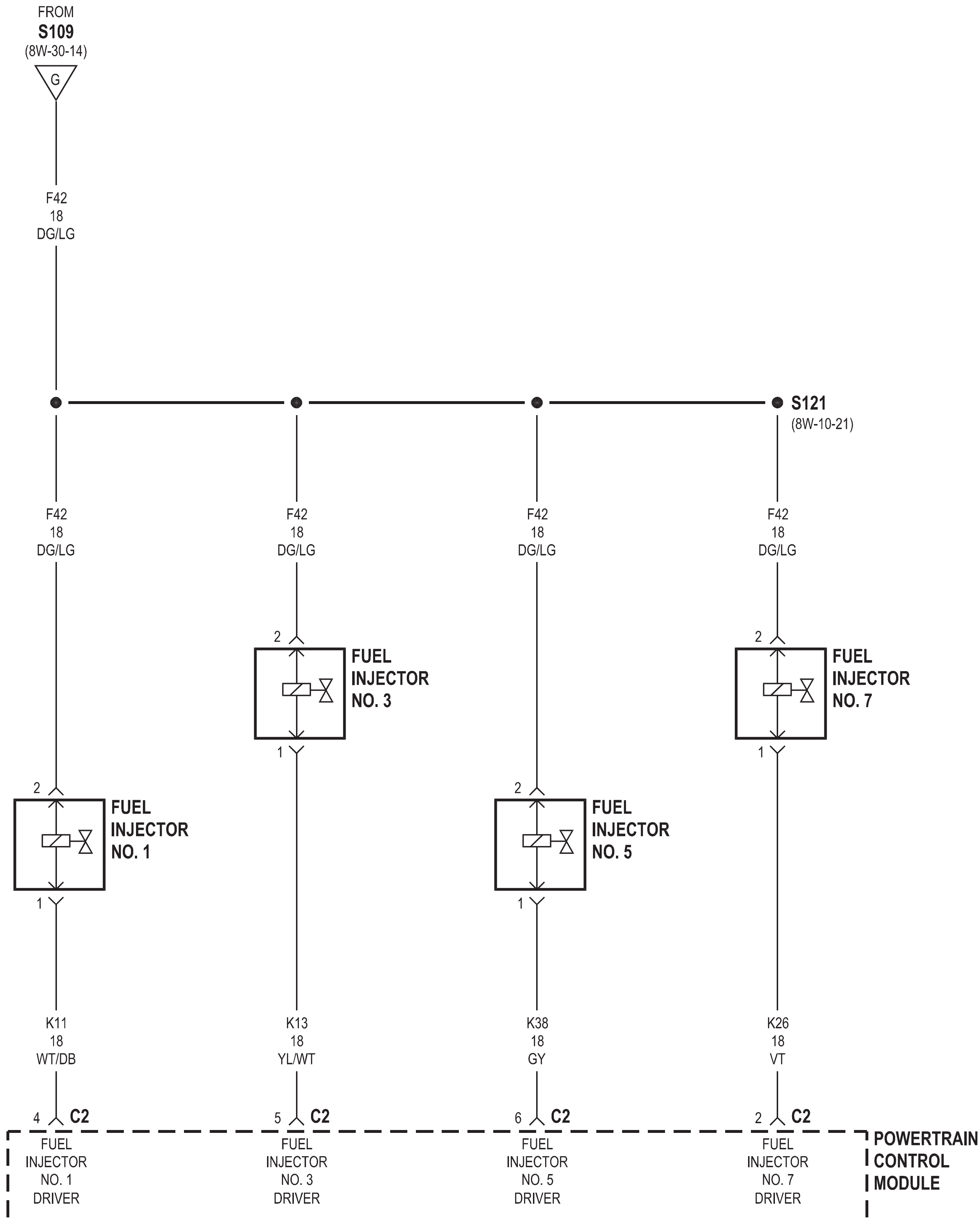

S315
(8W-70-7)
FROM
FUEL
PUMP
RELAY
(IN PDC)
(8W-30-9)
A
K4
20
BK/LB
RHD
LHD
K4
18
BK/LB
58
C106
S131
(8W-70-7)
4.0L
4.7L
OTHER
HIGH OUTPUT
S160
(8W-30-11)
LHD
RHD
19
C300
A141
16
DG/WT
DG/BK
1
C106
F
C300
4
BK/DG
OR
FUEL
PUMP
MODULE
M
PK/BK
BK
3
6
K226
20
LB/YL
Z150
16
BK
OTHER
4.0L LHD
10
C102
C104
S112
(8W-70-2)
(8W-70-3)
(8W-70-4)
(8W-70-5)
4.0L RHD
S107
(8W-70-3)
(8W-70-5)
20
9
C107
11
S307
(8W-15-19)
Z150
10
12
K226
18
LB/YL
C1
26
C3
SENSOR
GROUND
FUEL
LEVEL
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE
G301
(8W-15-21)
(8W-15-22)

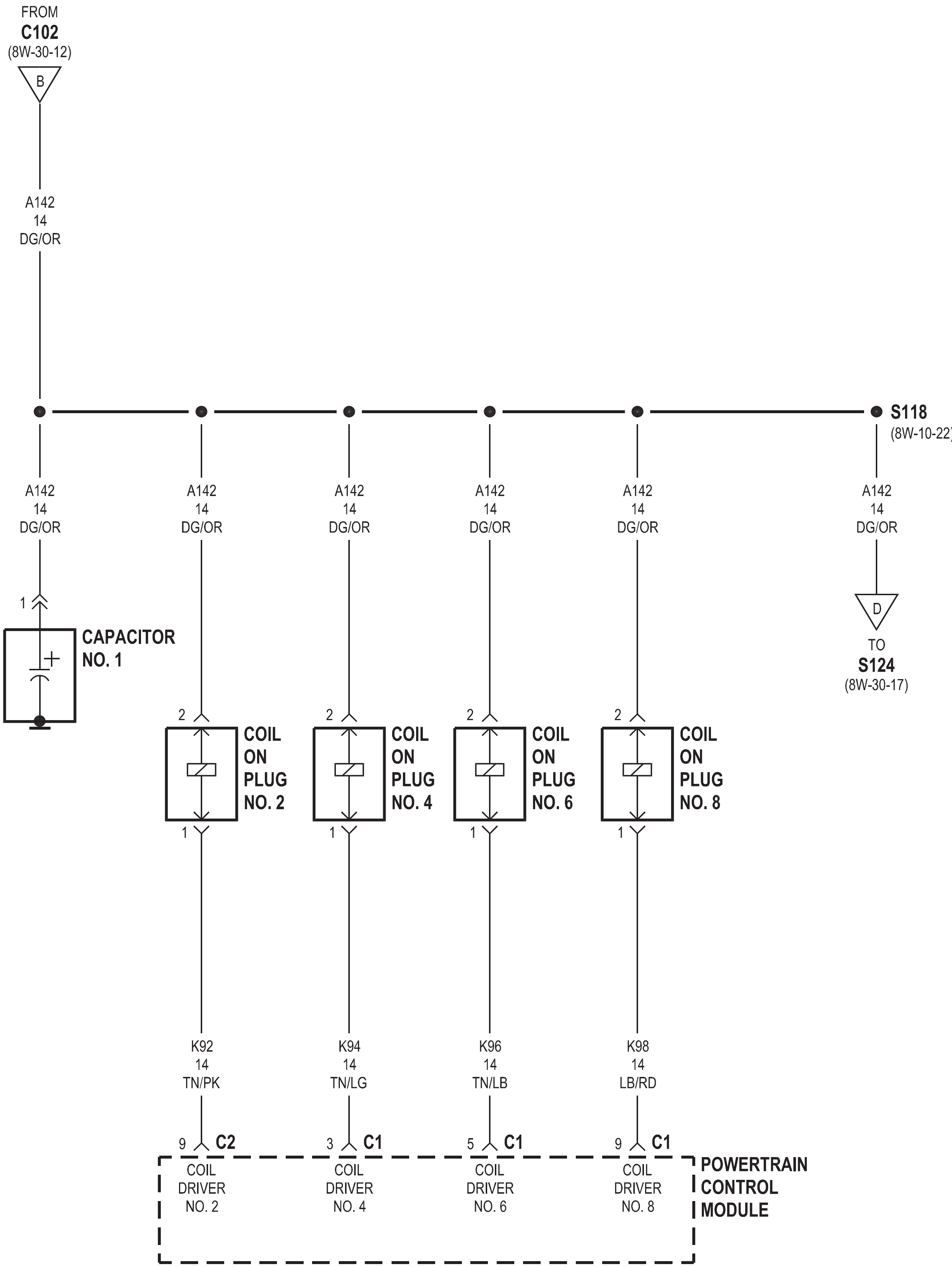

KNOCK SENSOR
KNOCK SENSOR NO. 2 SIGNAL
KNOCK SENSOR NO. 1 SIGNAL
SENSOR GROUND
SENSOR GROUND
4
2
1
3
K142 18 GY/BK
K42 18 DB/LG
K4 18 LB
K4 18 LB
LHD RHD
6 C104
8
14 C101
10 C104
1 C104
1
7 C101
5 C104
BATTERY TEMPERATURE SENSOR (8W-30-2) (8W-30-50)
SENSOR GROUND
1
RHD LHD
K4 20 BK/LB
K4 18 BK/LB
S131 (8W-70-6) (8W-70-7)
K4 18 BK/LB
S160
10 C102
S112 (8W-70-4)
18 C3
7 C3
4 C1
POWERTRAIN CONTROL MODULE
KNOCK SENSOR NO. 2 SIGNAL
KNOCK SENSOR NO. 1 SIGNAL
SENSOR GROUND


BATT A14
(8W-10-19)
(8W-10-20)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
AUTO SHUT DOWN RELAY
(8W-30-8)
87
S128
(8W-10-19)
(8W-10-20)
A142
14
DG/OR
36
FUSE 26 15A
(8W-10-19)
(8W-10-20)
37
OTHER
4.0L LHD
14 C102
8 C103
4.0L
4.7L
F42
18
DG/LG
S123
LHD
RHD
A142
16
DG/OR
B
TO S118
(8W-30-16)
4 C102
4 C104
1
CAPACITOR (4.0L)
C
TO S109
(8W-30-13)
(8W-30-14)
2 C106
24 C107
2
COIL RAIL (4.0L)
1
3
4
K91
14
TN/RD
K92
14
TN/PK
K93
14
TN/OR
12 C3
7 C1
9 C2
1 C1
FUSED AUTO SHUT DOWN RELAY OUTPUT
COIL DRIVER NO. 1
COIL DRIVER NO. 2
COIL DRIVER NO. 3
POWERTRAIN CONTROL MODULE
J028W-19
WJI03012

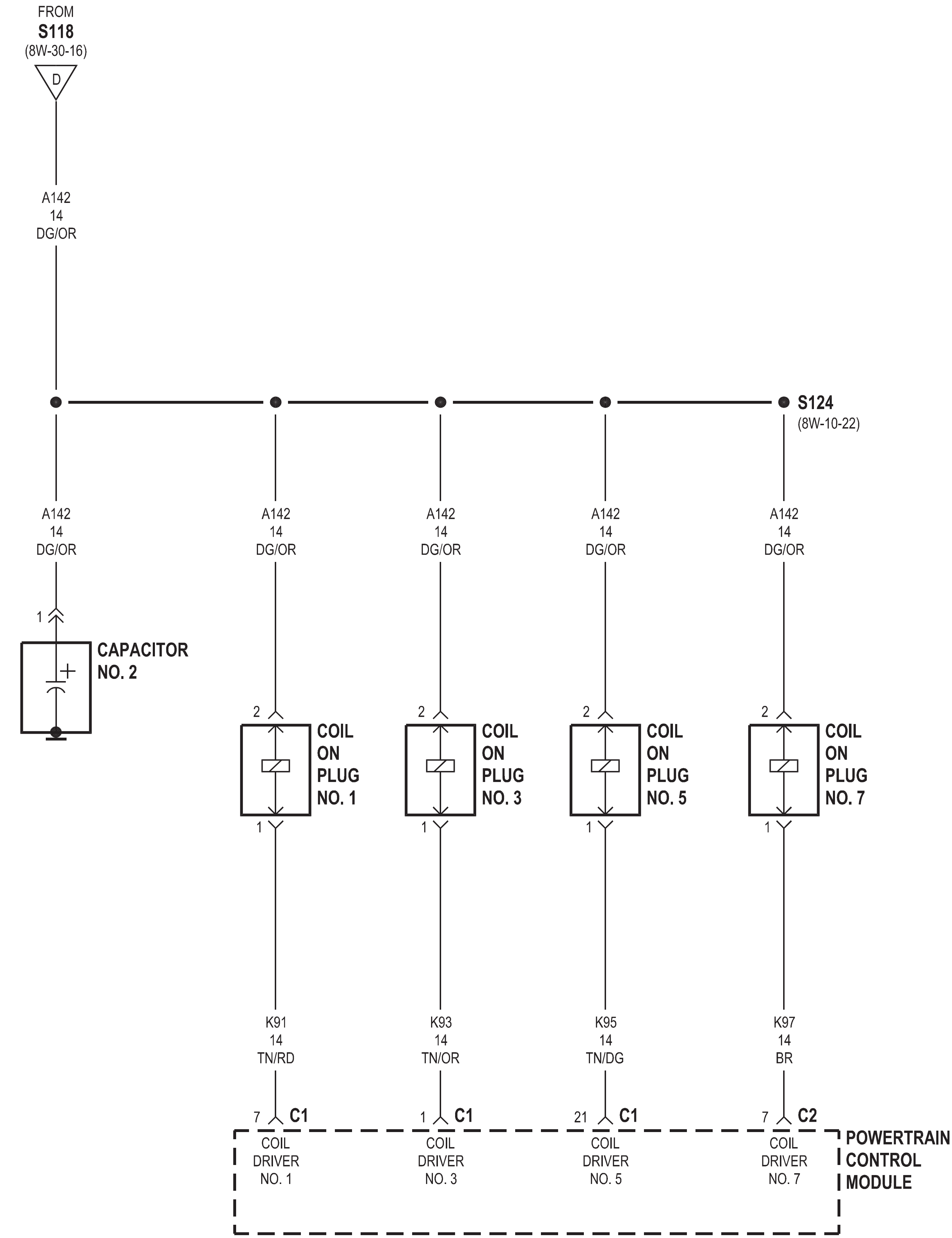

FROM
C102
(8W-30-12)
C
F42
18
DG/LG
S109
(8W-10-21)
F42
18
DG/LG
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 4
FUEL
INJECTOR
NO. 5
FUEL
INJECTOR
NO. 6
K11
18
WT/DB
K12
18
TN
K13
18
YL/WT
K14
18
LB/BR
K38
18
GY
K58
18
BR/DB
4 C2
15 C2
5 C2
16 C2
6 C2
12 C2
FUEL
INJECTOR
NO. 1
DRIVER
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 3
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
FUEL
INJECTOR
NO. 5
DRIVER
FUEL
INJECTOR
NO. 6
DRIVER
POWERTRAIN
CONTROL
MODULE

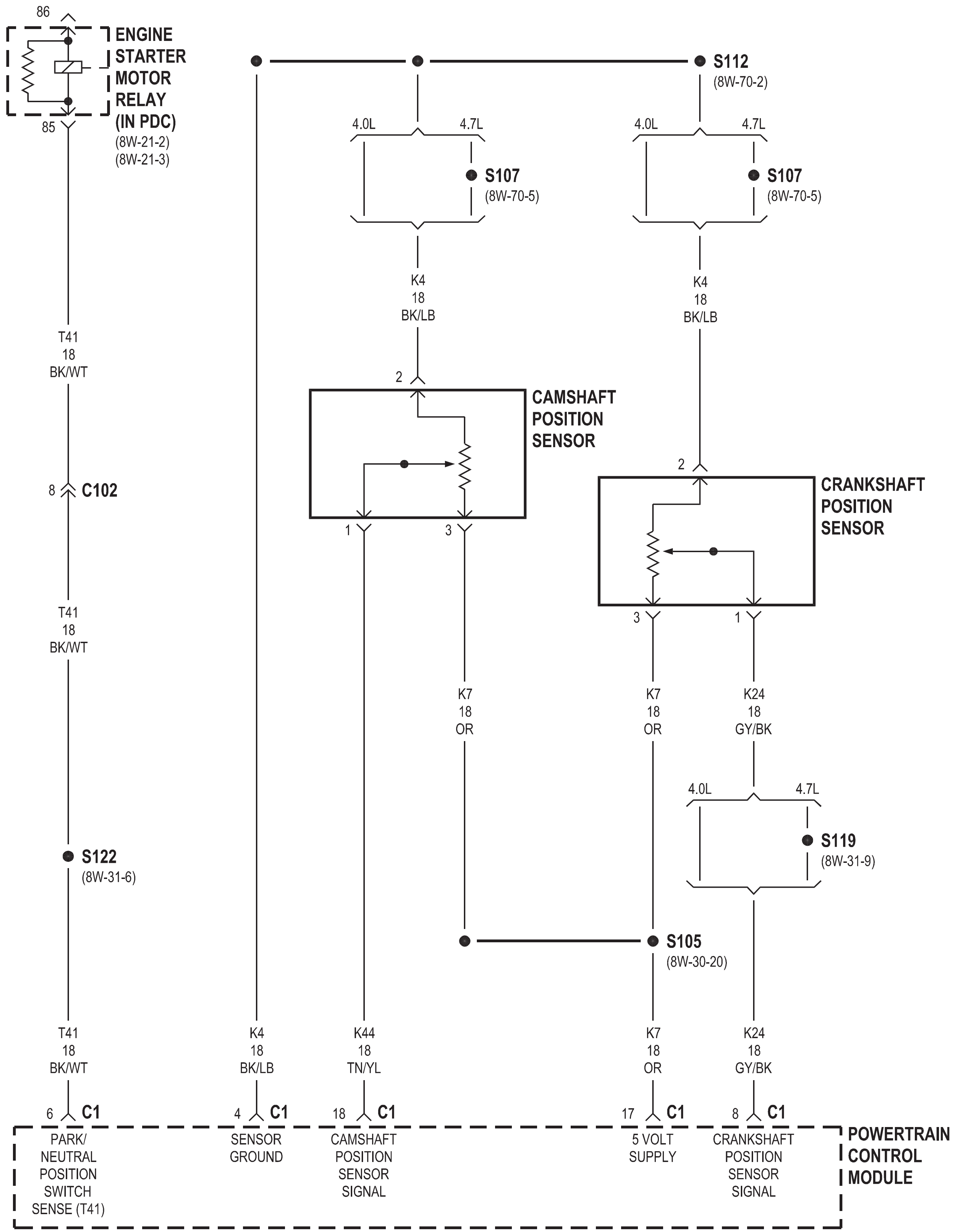

FROM
C102
(8W-30-12)
C
F42
18
DG/LG
S109
(8W-10-21)
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
2
FUEL
INJECTOR
NO. 2
1
2
FUEL
INJECTOR
NO. 6
1
G
TO
S121
(8W-30-15)
2
FUEL
INJECTOR
NO. 4
1
2
FUEL
INJECTOR
NO. 8
1
K12
18
TN
K14
18
LB/BR
K58
18
BR/DB
K28
18
GY/LB
15 C2
16 C2
12 C2
13 C2
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
FUEL
INJECTOR
NO. 6
DRIVER
FUEL
INJECTOR
NO. 8
DRIVER
POWERTRAIN
CONTROL
MODULE

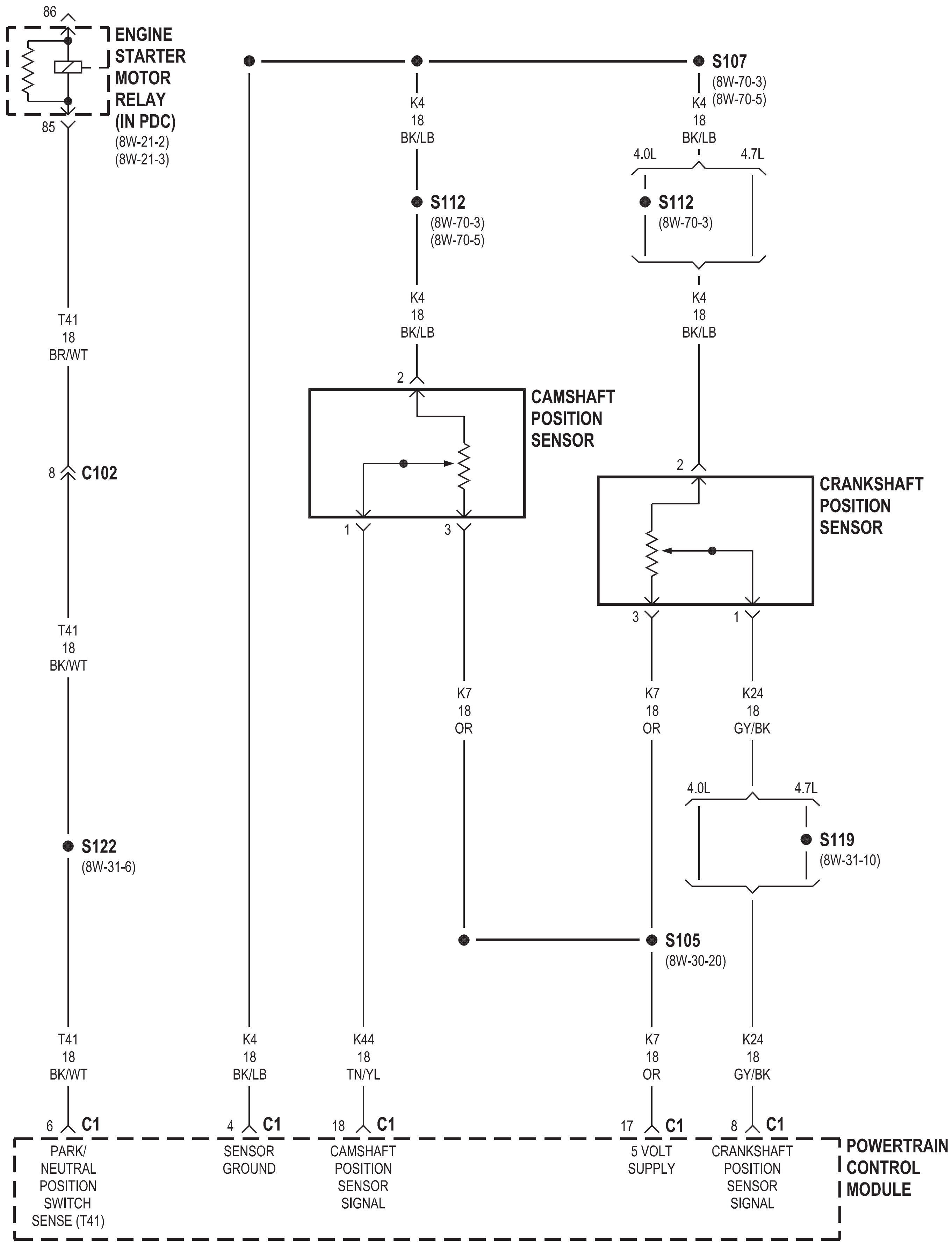

FROM
S109
(8W-30-14)
G
F42
18
DG/LG
S121
(8W-10-21)
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
FUEL INJECTOR NO. 1
FUEL INJECTOR NO. 3
FUEL INJECTOR NO. 5
FUEL INJECTOR NO. 7
2
1
K11
18
WT/DB
K13
18
YL/WT
K38
18
GY
K26
18
VT
4 C2
5 C2
6 C2
2 C2
FUEL INJECTOR NO. 1 DRIVER
FUEL INJECTOR NO. 3 DRIVER
FUEL INJECTOR NO. 5 DRIVER
FUEL INJECTOR NO. 7 DRIVER
POWERTRAIN CONTROL MODULE

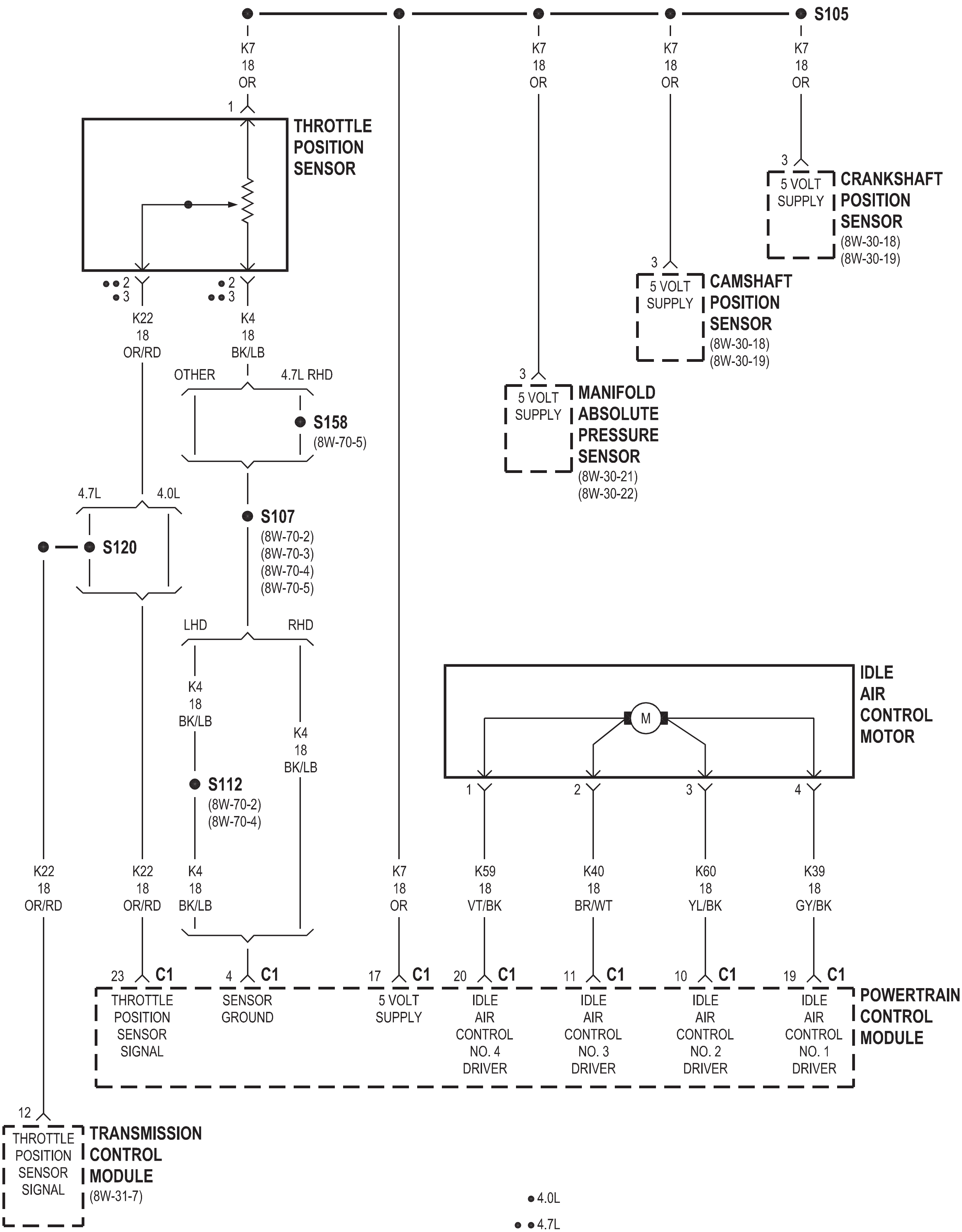


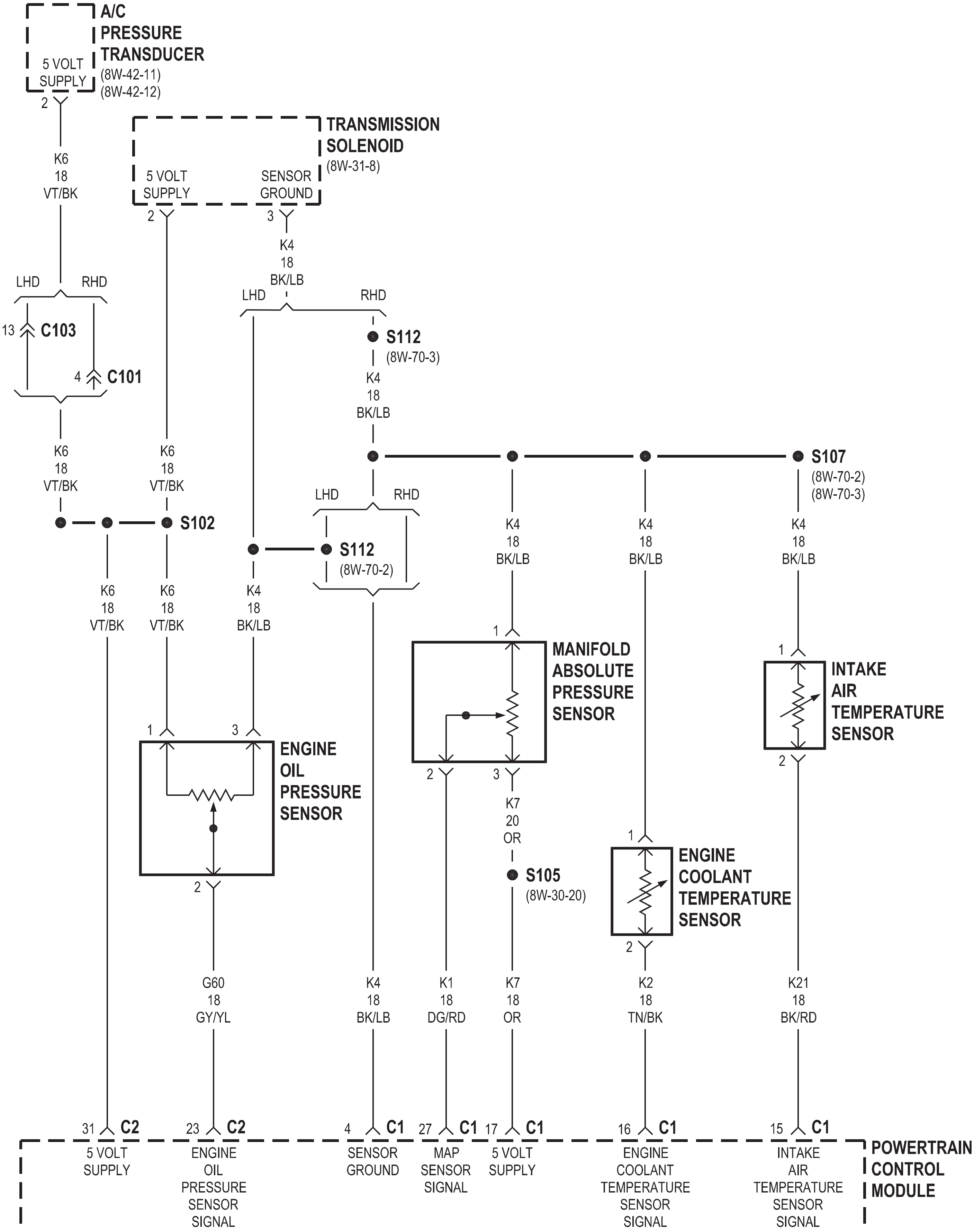
FROM
C102
(8W-30-12)
B
A142
14
DG/OR
S118
(8W-10-22)
A142 14 DG/OR
1
CAPACITOR
NO. 1
D
TO
S124
(8W-30-17)
2
COIL ON PLUG NO. 2
COIL ON PLUG NO. 4
COIL ON PLUG NO. 6
COIL ON PLUG NO. 8
1
K92 14 TN/PK
K94 14 TN/LG
K96 14 TN/LB
K98 14 LB/RD
9 C2
3 C1
5 C1
9 C1
COIL DRIVER NO. 2
COIL DRIVER NO. 4
COIL DRIVER NO. 6
COIL DRIVER NO. 8
POWERTRAIN CONTROL MODULE

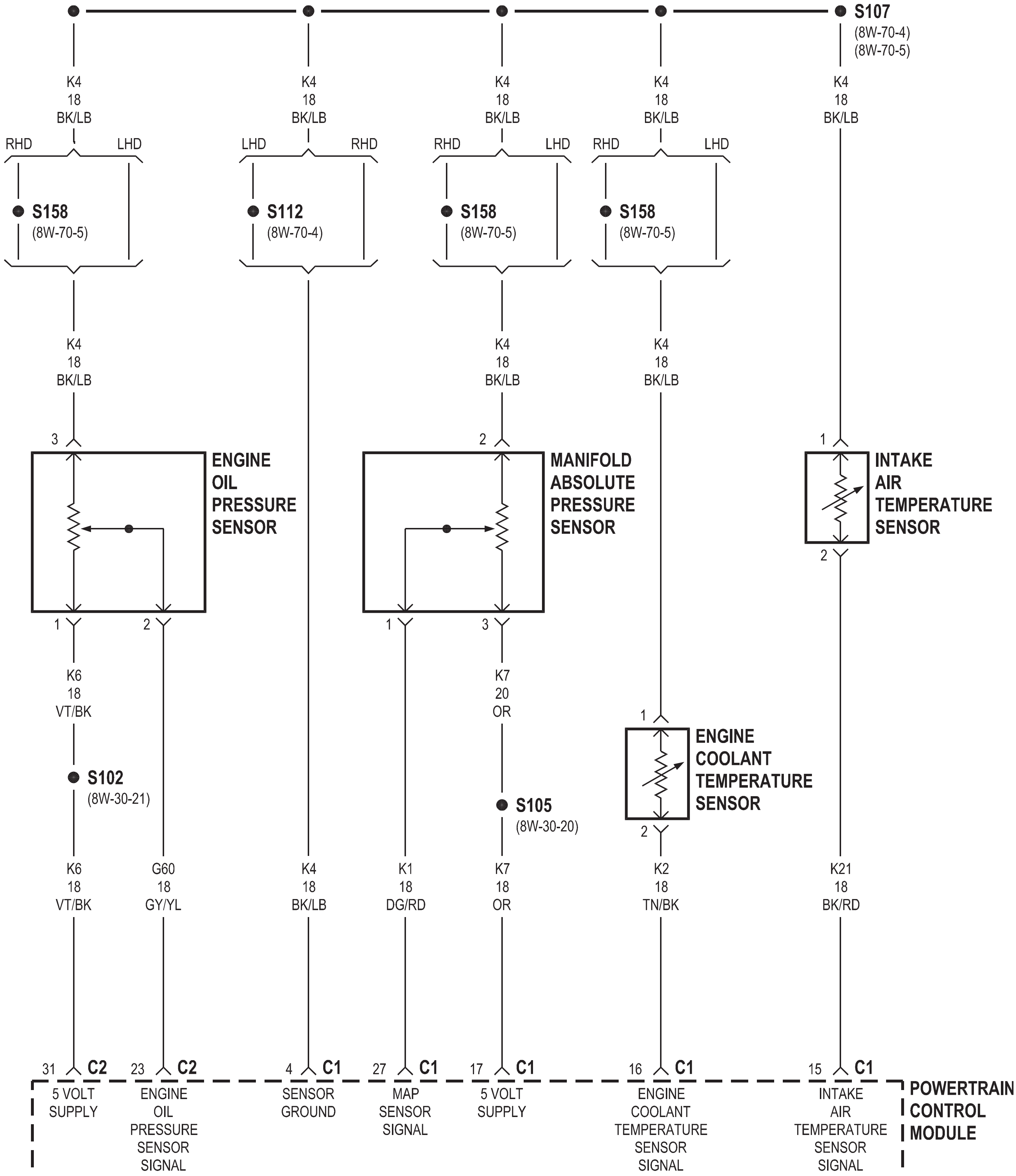

FROM
S118
(8W-30-16)
D
A142
14
DG/OR
S124
(8W-10-22)
A142
14
DG/OR
1
CAPACITOR
NO. 2
2
COIL
ON
PLUG
NO. 1
COIL
ON
PLUG
NO. 3
COIL
ON
PLUG
NO. 5
COIL
ON
PLUG
NO. 7
1
K91
14
TN/RD
K93
14
TN/OR
K95
14
TN/DG
K97
14
BR
7 C1
1 C1
21 C1
7 C2
COIL
DRIVER
NO. 1
COIL
DRIVER
NO. 3
COIL
DRIVER
NO. 5
COIL
DRIVER
NO. 7
POWERTRAIN
CONTROL
MODULE

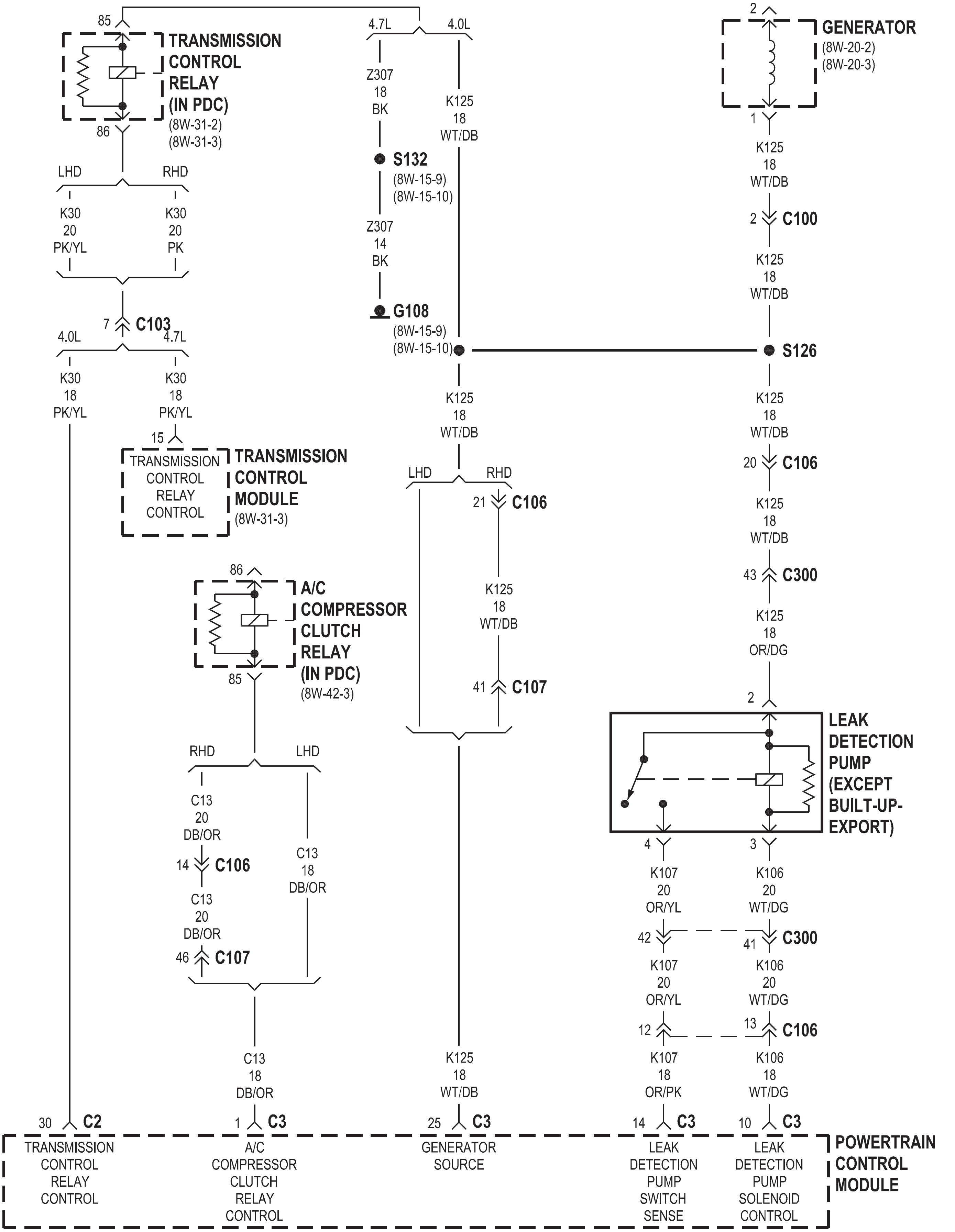

86
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
85
T41 18 BK/WT
8 C102
T41 18 BK/WT
S122
(8W-31-6)
T41 18 BK/WT
S112
(8W-70-2)
4.0L
4.7L
S107
(8W-70-5)
4.0L
4.7L
S107
(8W-70-5)
K4 18 BK/LB
K4 18 BK/LB
2
CAMSHAFT POSITION SENSOR
1
3
2
CRANKSHAFT POSITION SENSOR
3
1
K7 18 OR
K7 18 OR
K24 18 GY/BK
4.0L
4.7L
S119
(8W-31-9)
S105
(8W-30-20)
K4 18 BK/LB
K44 18 TN/YL
K7 18 OR
K24 18 GY/BK
6 C1
4 C1
18 C1
17 C1
8 C1
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

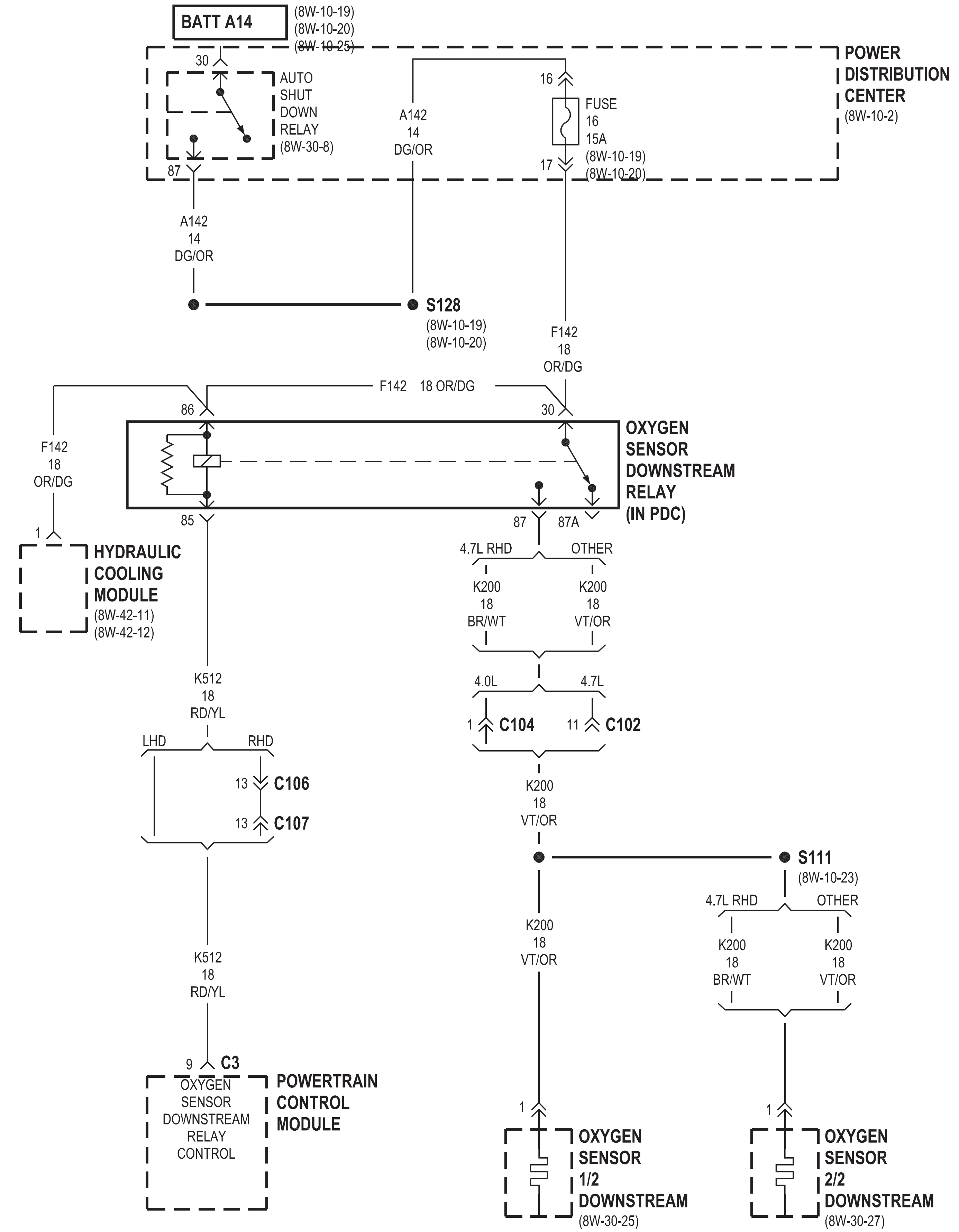

86
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
85
T41
18
BR/WT
8
C102
T41
18
BK/WT
S122
(8W-31-6)
T41
18
BK/WT
S107
(8W-70-3)
(8W-70-5)
K4
18
BK/LB
S112
(8W-70-3)
(8W-70-5)
4.0L
4.7L
S112
(8W-70-3)
K4
18
BK/LB
2
CAMSHAFT POSITION SENSOR
1
3
CRANKSHAFT POSITION SENSOR
K7
18
OR
K24
18
GY/BK
4.0L
4.7L
S119
(8W-31-10)
S105
(8W-30-20)
K4
18
BK/LB
K44
18
TN/YL
6 C1
4 C1
18 C1
17 C1
8 C1
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

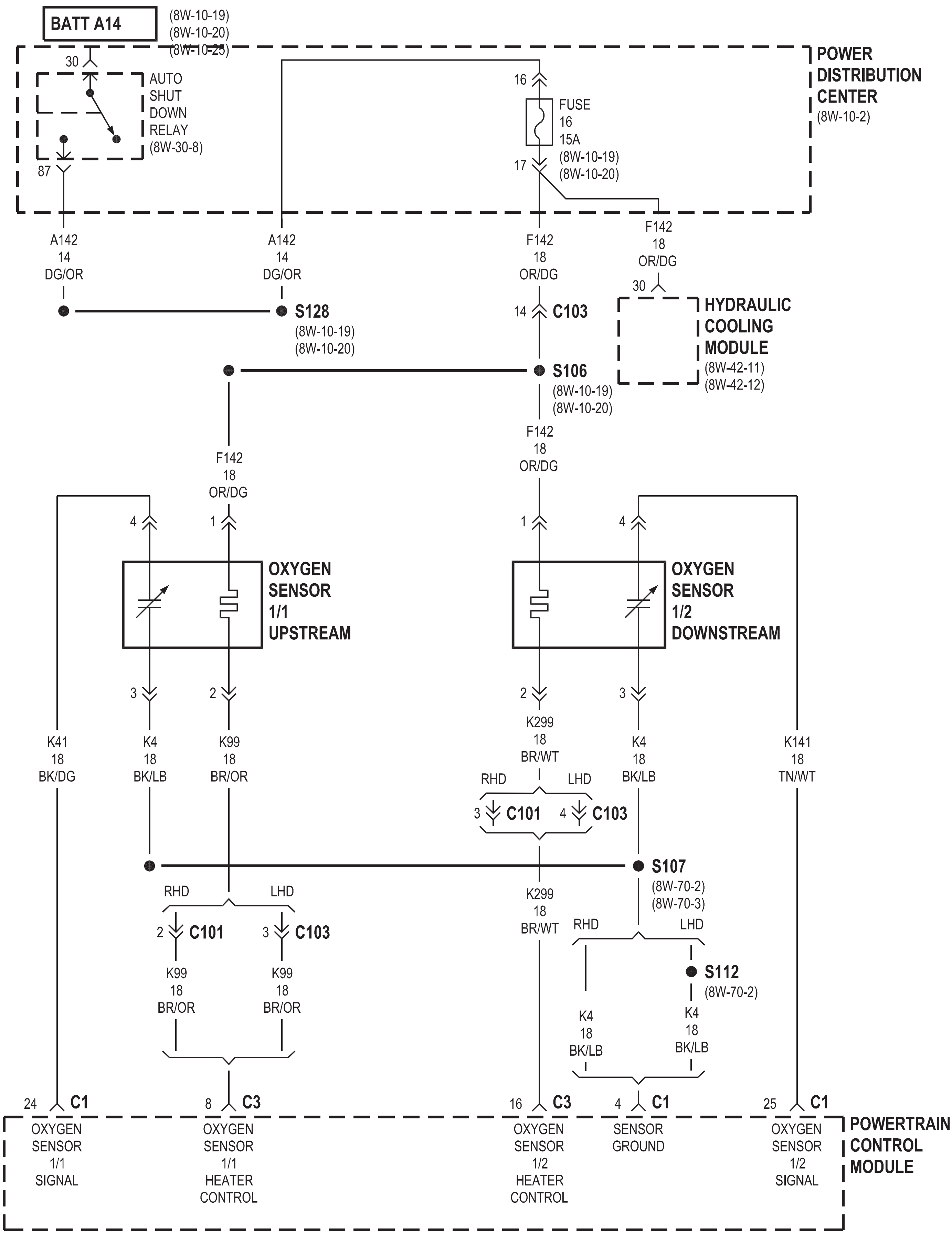

S105
K7
18
OR
THROTTLE POSITION SENSOR
1
2
3
K22
18
OR/RD
K4
18
BK/LB
OTHER
4.7L RHD
S158
(8W-70-5)
4.7L
4.0L
S120
S107
(8W-70-2)
(8W-70-3)
(8W-70-4)
(8W-70-5)
LHD
RHD
S112
(8W-70-2)
(8W-70-4)
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR
(8W-30-18)
(8W-30-19)
CAMSHAFT POSITION SENSOR
(8W-30-18)
(8W-30-19)
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-21)
(8W-30-22)
IDLE AIR CONTROL MOTOR
M
K59
18
VT/BK
K40
18
BR/WT
K60
18
YL/BK
K39
18
GY/BK
23 C1
4 C1
17 C1
20 C1
11 C1
10 C1
19 C1
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
5 VOLT SUPPLY
IDLE AIR CONTROL NO. 4 DRIVER
IDLE AIR CONTROL NO. 3 DRIVER
IDLE AIR CONTROL NO. 2 DRIVER
IDLE AIR CONTROL NO. 1 DRIVER
POWERTRAIN CONTROL MODULE
12
THROTTLE POSITION SENSOR SIGNAL
TRANSMISSION CONTROL MODULE
(8W-31-7)
● 4.0L
● ● 4.7L

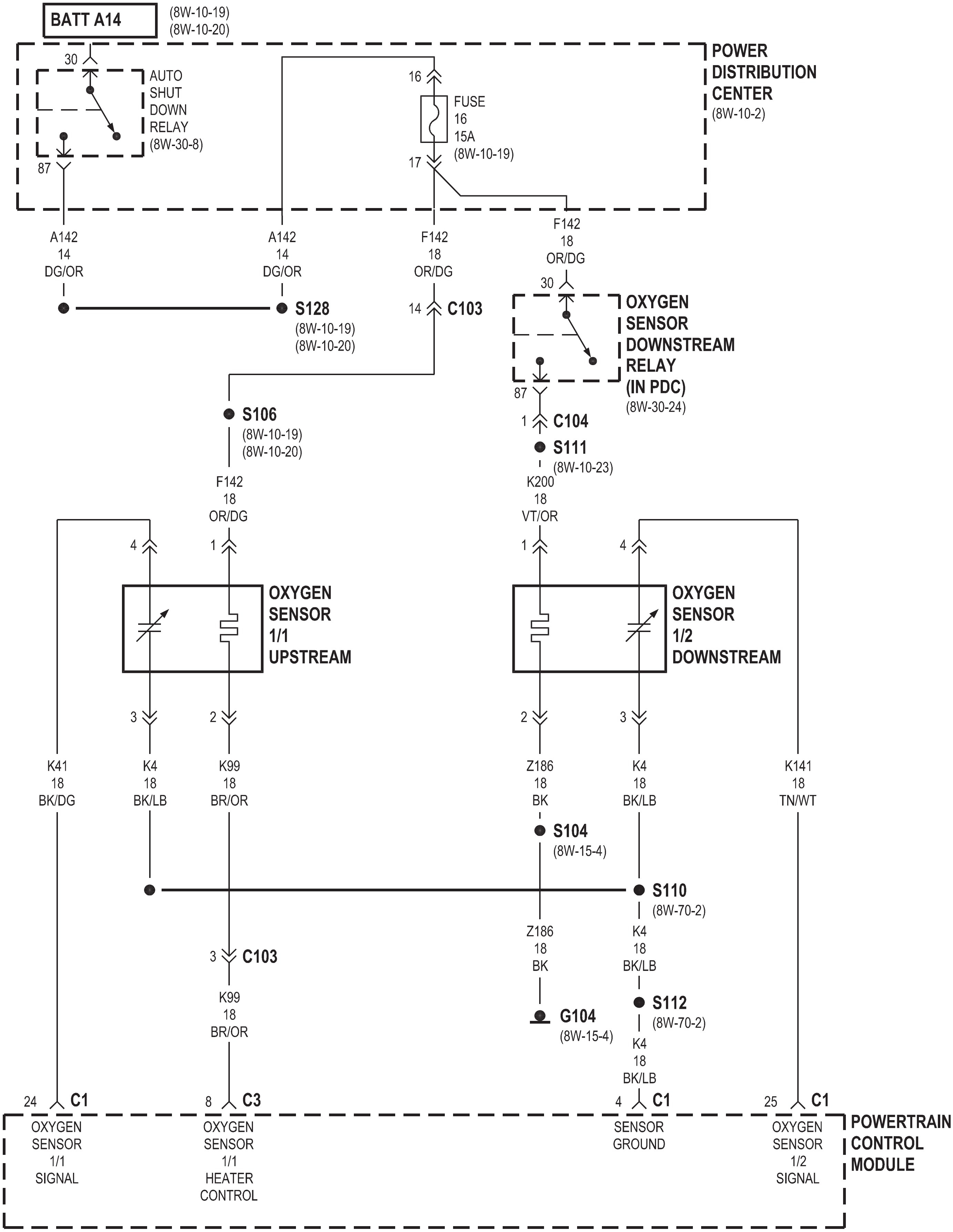

A/C PRESSURE TRANSDUCER
(8W-42-11)
(8W-42-12)
5 VOLT SUPPLY
TRANSMISSION SOLENOID
(8W-31-8)
5 VOLT SUPPLY
SENSOR GROUND
K6 18 VT/BK
K4 18 BK/LB
LHD
RHD
C103
C101
S112
(8W-70-3)
(8W-70-2)
S102
S107
(8W-70-2)
(8W-70-3)
MANIFOLD ABSOLUTE PRESSURE SENSOR
INTAKE AIR TEMPERATURE SENSOR
ENGINE OIL PRESSURE SENSOR
K7 20 OR
S105
(8W-30-20)
ENGINE COOLANT TEMPERATURE SENSOR
G60 18 GY/YL
K1 18 DG/RD
K7 18 OR
K2 18 TN/BK
K21 18 BK/RD
31 C2
23 C2
4 C1
27 C1
17 C1
16 C1
15 C1
5 VOLT SUPPLY
ENGINE OIL PRESSURE SENSOR SIGNAL
SENSOR GROUND
MAP SENSOR SIGNAL
5 VOLT SUPPLY
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
INTAKE AIR TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

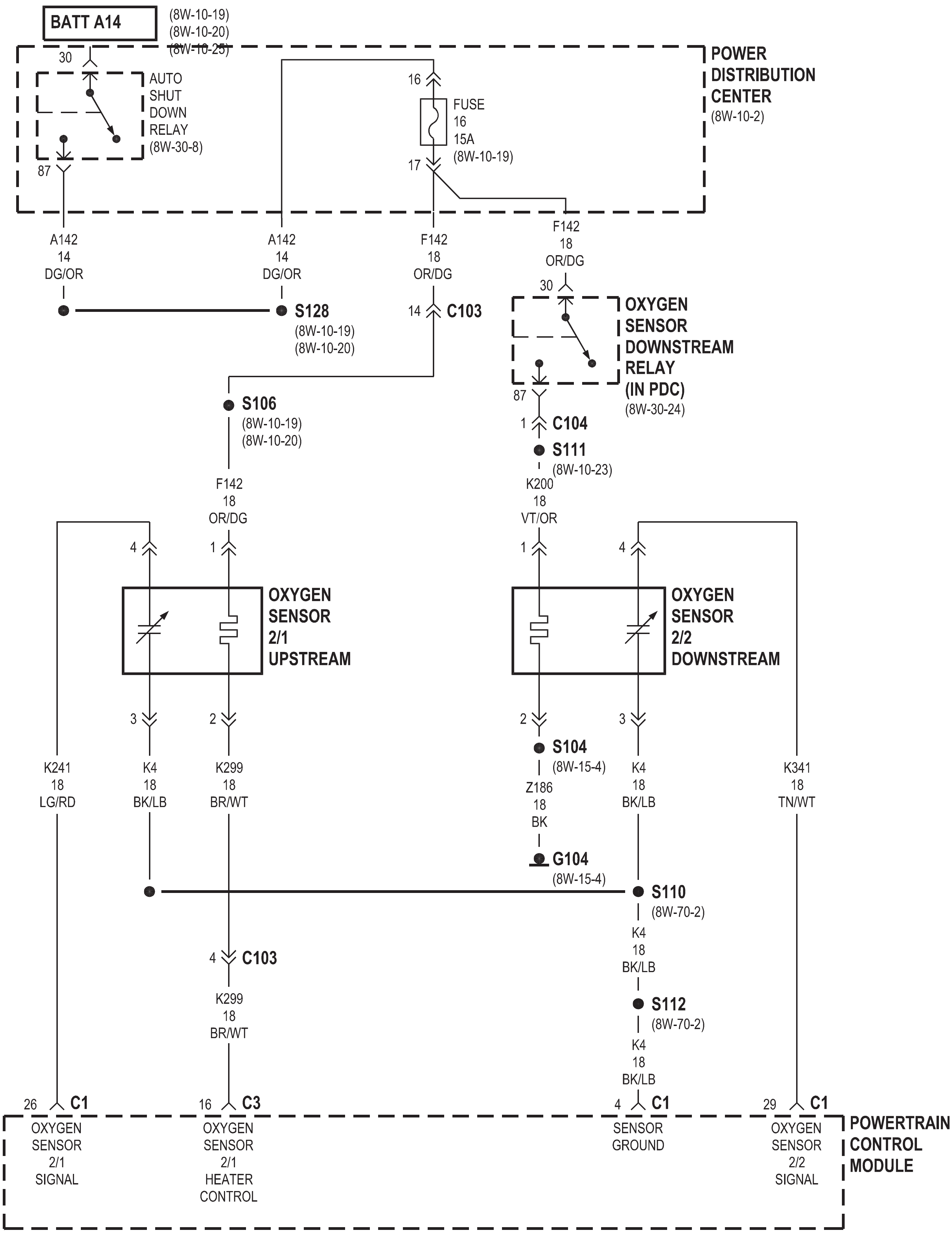

S107
(8W-70-4)
(8W-70-5)
K4
18
BK/LB
RHD
LHD
S158
(8W-70-5)
S112
(8W-70-4)
S158
(8W-70-5)
S158
(8W-70-5)
ENGINE
OIL
PRESSURE
SENSOR
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
INTAKE
AIR
TEMPERATURE
SENSOR
K6
18
VT/BK
S102
(8W-30-21)
K7
20
OR
S105
(8W-30-20)
ENGINE
COOLANT
TEMPERATURE
SENSOR
G60
18
GY/YL
K1
18
DG/RD
K7
18
OR
K2
18
TN/BK
K21
18
BK/RD
31 C2
23 C2
4 C1
27 C1
17 C1
16 C1
15 C1
5 VOLT
SUPPLY
ENGINE
OIL
PRESSURE
SENSOR
SIGNAL
SENSOR
GROUND
MAP
SENSOR
SIGNAL
5 VOLT
SUPPLY
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
INTAKE
AIR
TEMPERATURE
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE


TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
(8W-31-3)
85
86
LHD
RHD
K30 20 PK/YL
K30 20 PK
7 C103
4.0L
4.7L
K30 18 PK/YL
K30 18 PK/YL
15
TRANSMISSION CONTROL RELAY CONTROL
TRANSMISSION CONTROL MODULE
(8W-31-3)
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-3)
86
85
RHD
LHD
C13 20 DB/OR
14 C106
C13 20 DB/OR
46 C107
C13 18 DB/OR
C13 18 DB/OR
4.7L
4.0L
Z307 18 BK
S132
(8W-15-9)
(8W-15-10)
Z307 14 BK
G108
(8W-15-9)
(8W-15-10)
K125 18 WT/DB
K125 18 WT/DB
LHD
RHD
21 C106
K125 18 WT/DB
41 C107
K125 18 WT/DB
GENERATOR
(8W-20-2)
(8W-20-3)
2
1
K125 18 WT/DB
2 C100
K125 18 WT/DB
S126
K125 18 WT/DB
20 C106
K125 18 WT/DB
43 C300
K125 18 OR/DG
2
LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)
4
3
K107 20 OR/YL
K106 20 WT/DG
42 C300 41
K107 20 OR/YL
K106 20 WT/DG
12 C106 13
K107 18 OR/PK
K106 18 WT/DG
30 C2
1 C3
25 C3
14 C3
10 C3
TRANSMISSION CONTROL RELAY CONTROL
A/C COMPRESSOR CLUTCH RELAY CONTROL
GENERATOR SOURCE
LEAK DETECTION PUMP SWITCH SENSE
LEAK DETECTION PUMP SOLENOID CONTROL
POWERTRAIN CONTROL MODULE

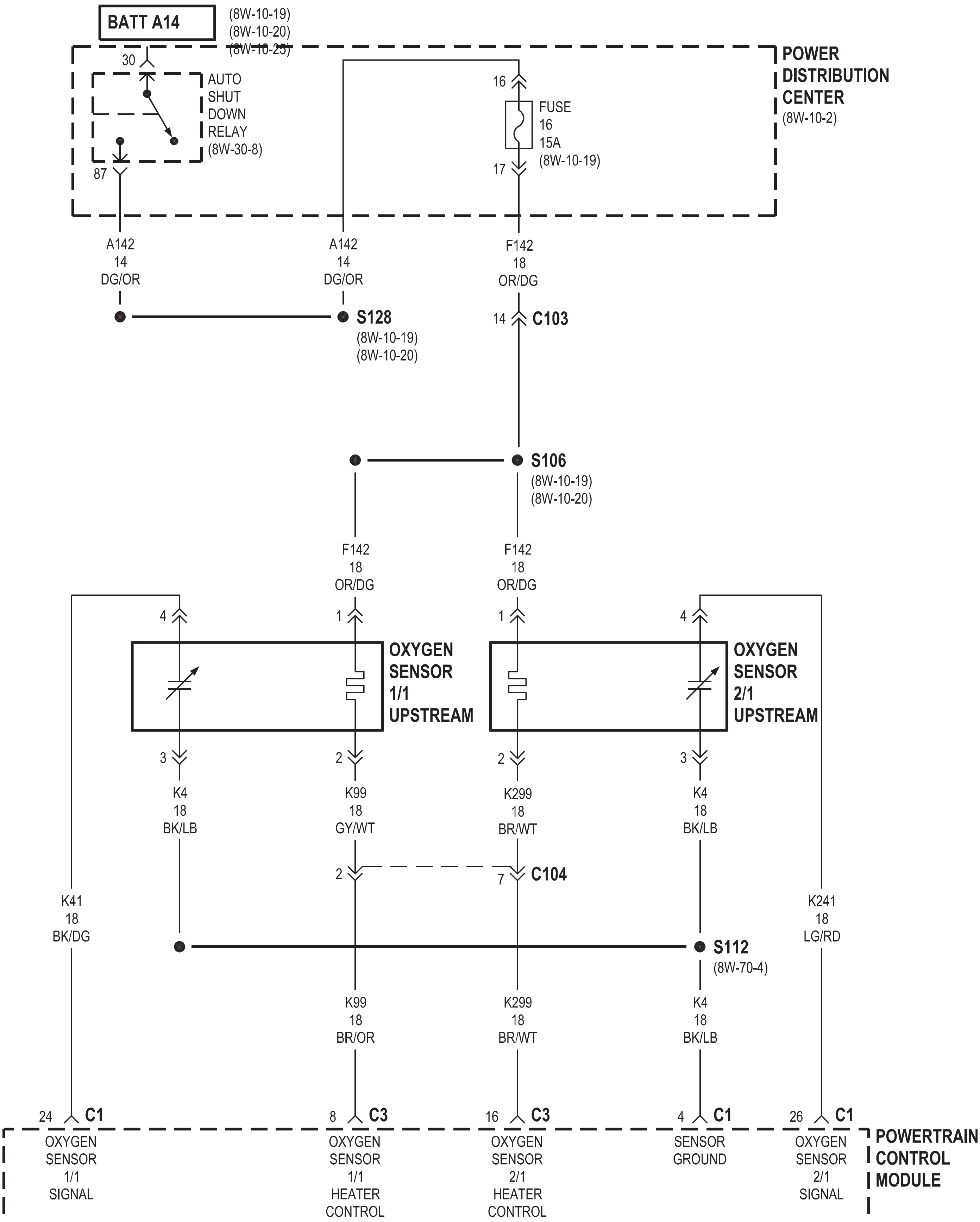

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
AUTO SHUT DOWN RELAY
(8W-30-8)
87
A142
14
DG/OR
16
FUSE
16
15A
(8W-10-19)
(8W-10-20)
17
A142
14
DG/OR
S128
(8W-10-19)
(8W-10-20)
F142
18
OR/DG
F142 18 OR/DG
86
30
OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
F142
18
OR/DG
85
87
87A
1
HYDRAULIC COOLING MODULE
(8W-42-11)
(8W-42-12)
4.7L RHD
OTHER
K200
18
BR/WT
K200
18
VT/OR
4.0L
4.7L
1
C104
11
C102
K200
18
VT/OR
K512
18
RD/YL
LHD
RHD
13
C106
13
C107
S111
(8W-10-23)
4.7L RHD
OTHER
K200
18
BR/WT
K200
18
VT/OR
K200
18
VT/OR
K512
18
RD/YL
9
C3
OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
POWERTRAIN CONTROL MODULE
1
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-25)
1
OXYGEN SENSOR 2/2 DOWNSTREAM
(8W-30-27)

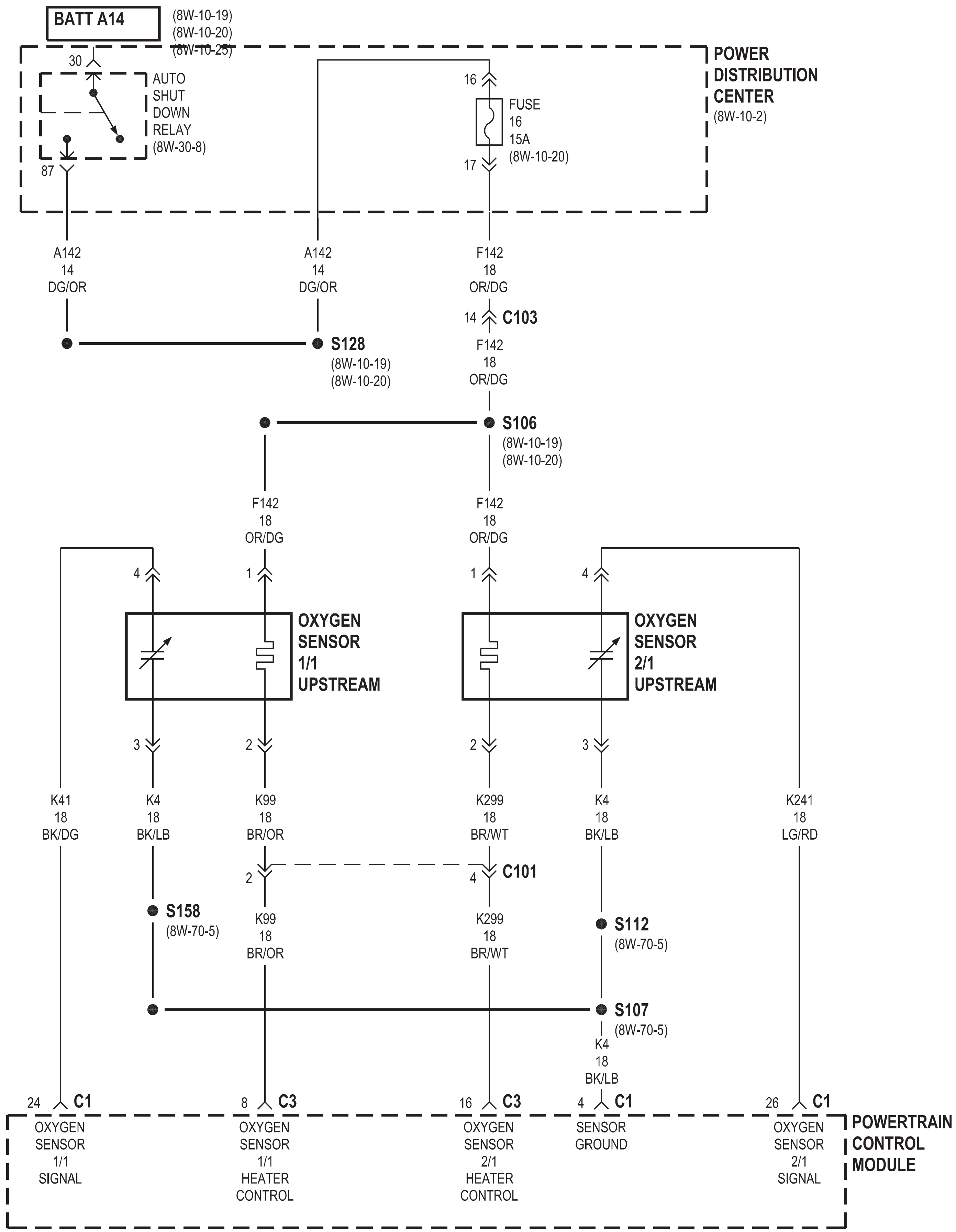

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
30
AUTO SHUT DOWN RELAY
(8W-30-8)
87
16
FUSE 16 15A
(8W-10-19)
(8W-10-20)
17
POWER DISTRIBUTION CENTER
(8W-10-2)
A142 14 DG/OR
A142 14 DG/OR
F142 18 OR/DG
F142 18 OR/DG
30
S128
(8W-10-19)
(8W-10-20)
14 C103
HYDRAULIC COOLING MODULE
(8W-42-11)
(8W-42-12)
S106
(8W-10-19)
(8W-10-20)
F142 18 OR/DG
F142 18 OR/DG
4
1
1
4
OXYGEN SENSOR 1/1 UPSTREAM
OXYGEN SENSOR 1/2 DOWNSTREAM
3
2
2
3
K299 18 BR/WT
K41 18 BK/DG
K4 18 BK/LB
K99 18 BR/OR
K4 18 BK/LB
K141 18 TN/WT
RHD
LHD
3 C101
4 C103
S107
(8W-70-2)
(8W-70-3)
RHD
LHD
2 C101
3 C103
K299 18 BR/WT
RHD
LHD
S112
(8W-70-2)
K99 18 BR/OR
K99 18 BR/OR
K4 18 BK/LB
K4 18 BK/LB
24 C1
8 C3
16 C3
4 C1
25 C1
OXYGEN SENSOR 1/1 SIGNAL
OXYGEN SENSOR 1/1 HEATER CONTROL
OXYGEN SENSOR 1/2 HEATER CONTROL
SENSOR GROUND
OXYGEN SENSOR 1/2 SIGNAL
POWERTRAIN CONTROL MODULE


BATT A14
(8W-10-19)
(8W-10-20)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
AUTO SHUT DOWN RELAY
(8W-30-8)
87
16
FUSE 16 15A
(8W-10-19)
17
A142 14 DG/OR
A142 14 DG/OR
F142 18 OR/DG
F142 18 OR/DG
S128
(8W-10-19)
(8W-10-20)
14 C103
30
OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
(8W-30-24)
87
1 C104
S111
(8W-10-23)
S106
(8W-10-19)
(8W-10-20)
F142 18 OR/DG
K200 18 VT/OR
4
1
1
4
OXYGEN SENSOR 1/1 UPSTREAM
OXYGEN SENSOR 1/2 DOWNSTREAM
3
2
2
3
K41 18 BK/DG
K4 18 BK/LB
K99 18 BR/OR
Z186 18 BK
K4 18 BK/LB
K141 18 TN/WT
S104
(8W-15-4)
S110
(8W-70-2)
3 C103
Z186 18 BK
K4 18 BK/LB
K99 18 BR/OR
G104
(8W-15-4)
S112
(8W-70-2)
K4 18 BK/LB
24 C1
8 C3
4 C1
25 C1
OXYGEN SENSOR 1/1 SIGNAL
OXYGEN SENSOR 1/1 HEATER CONTROL
SENSOR GROUND
OXYGEN SENSOR 1/2 SIGNAL
POWERTRAIN CONTROL MODULE

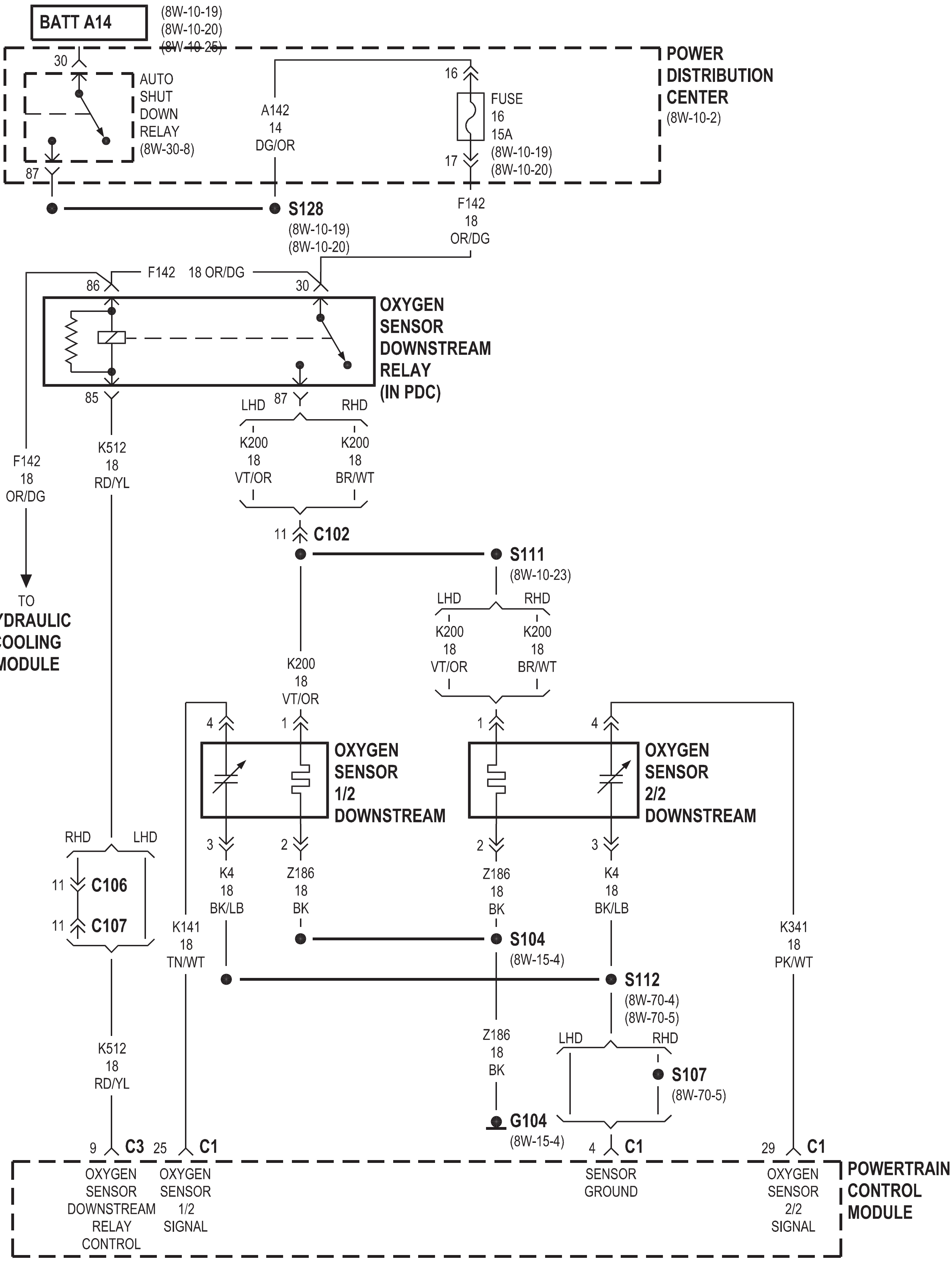

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
30
AUTO SHUT DOWN RELAY
(8W-30-8)
87
16
FUSE 16 15A
(8W-10-19)
17
POWER DISTRIBUTION CENTER
(8W-10-2)
A142 14 DG/OR
A142 14 DG/OR
F142 18 OR/DG
F142 18 OR/DG
S128
(8W-10-19)
(8W-10-20)
14 C103
30
OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
(8W-30-24)
87
S106
(8W-10-19)
(8W-10-20)
1 C104
S111
(8W-10-23)
F142 18 OR/DG
K200 18 VT/OR
4
1
1
4
OXYGEN SENSOR 2/1 UPSTREAM
OXYGEN SENSOR 2/2 DOWNSTREAM
3
2
2
3
S104
(8W-15-4)
K241 18 LG/RD
K4 18 BK/LB
K299 18 BR/WT
Z186 18 BK
K4 18 BK/LB
K341 18 TN/WT
G104
(8W-15-4)
S110
(8W-70-2)
4 C103
K4 18 BK/LB
K299 18 BR/WT
S112
(8W-70-2)
K4 18 BK/LB
26 C1
16 C3
4 C1
29 C1
OXYGEN SENSOR 2/1 SIGNAL
OXYGEN SENSOR 2/1 HEATER CONTROL
SENSOR GROUND
OXYGEN SENSOR 2/2 SIGNAL
POWERTRAIN CONTROL MODULE

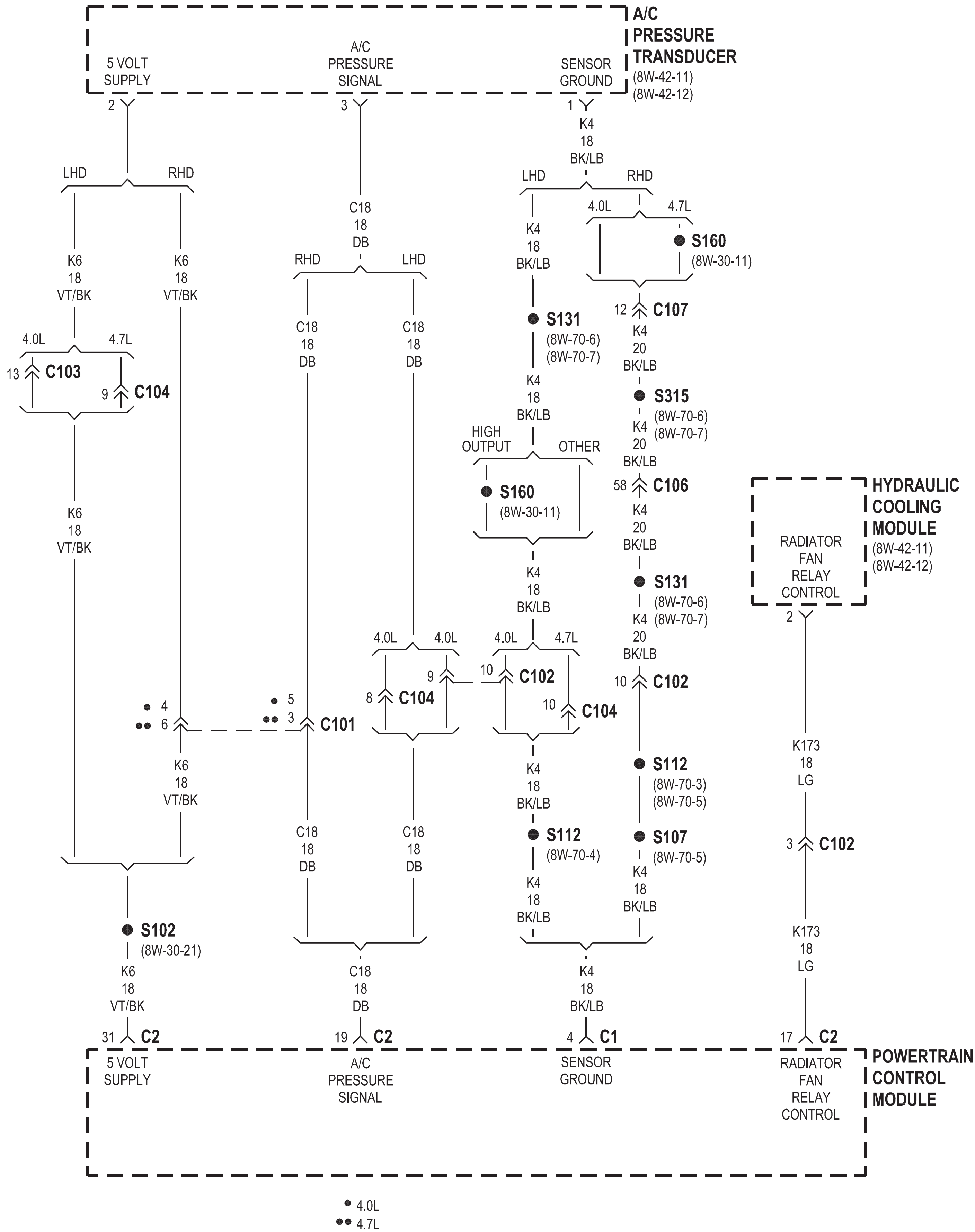
4.7L LHD

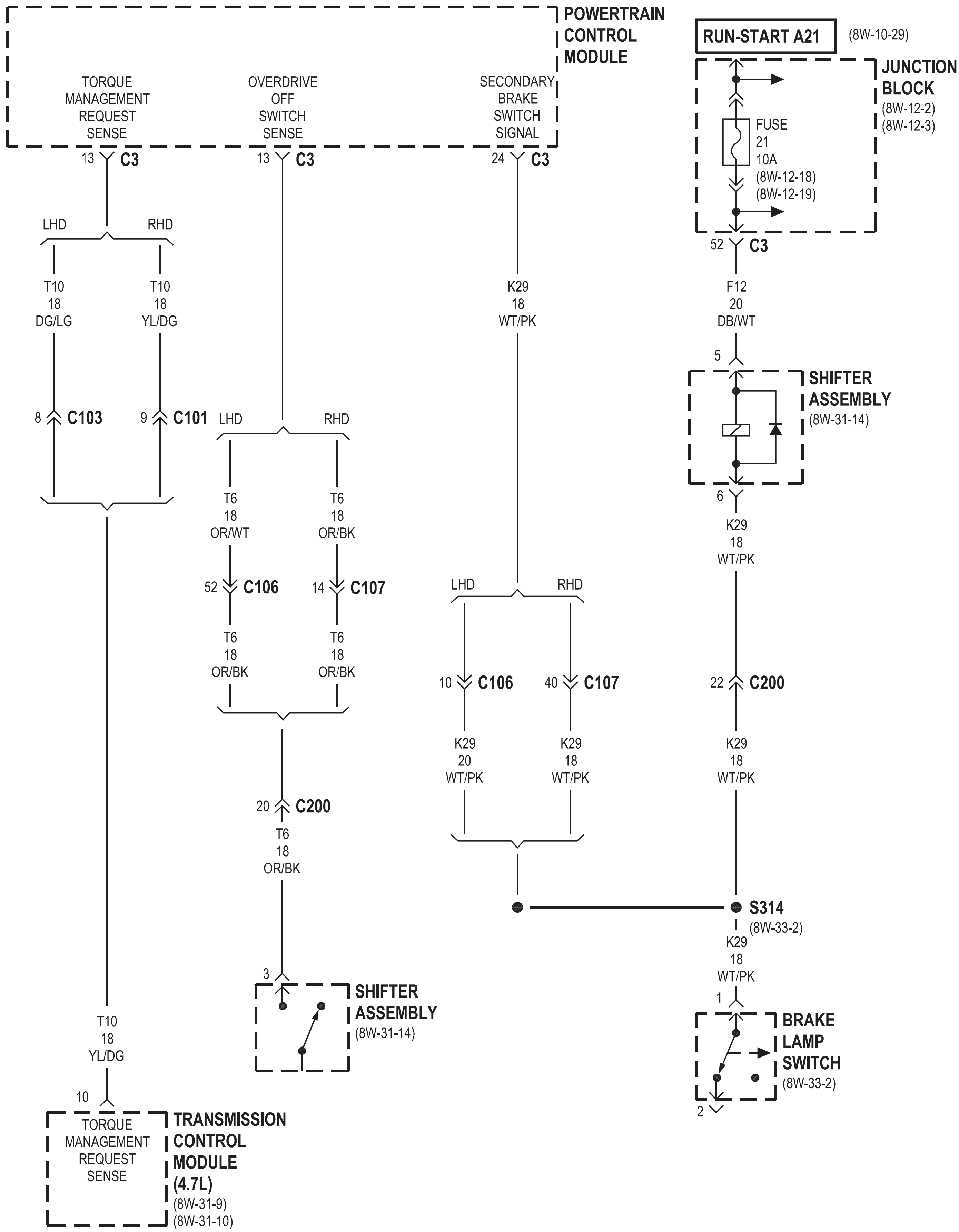

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
30
AUTO SHUT DOWN RELAY (8W-30-8)
87
16
FUSE 16 15A (8W-10-19)
17
POWER DISTRIBUTION CENTER (8W-10-2)
A142 14 DG/OR
A142 14 DG/OR
F142 18 OR/DG
S128 (8W-10-19) (8W-10-20)
14 C103
S106 (8W-10-19) (8W-10-20)
F142 18 OR/DG
F142 18 OR/DG
4
1
1
4
OXYGEN SENSOR 1/1 UPSTREAM
OXYGEN SENSOR 2/1 UPSTREAM
3
2
2
3
K4 18 BK/LB
K99 18 GY/WT
K299 18 BR/WT
K4 18 BK/LB
2
7 C104
K41 18 BK/DG
K241 18 LG/RD
S112 (8W-70-4)
K99 18 BR/OR
K299 18 BR/WT
K4 18 BK/LB
24 C1
8 C3
16 C3
4 C1
26 C1
OXYGEN SENSOR 1/1 SIGNAL
OXYGEN SENSOR 1/1 HEATER CONTROL
OXYGEN SENSOR 2/1 HEATER CONTROL
SENSOR GROUND
OXYGEN SENSOR 2/1 SIGNAL
POWERTRAIN CONTROL MODULE

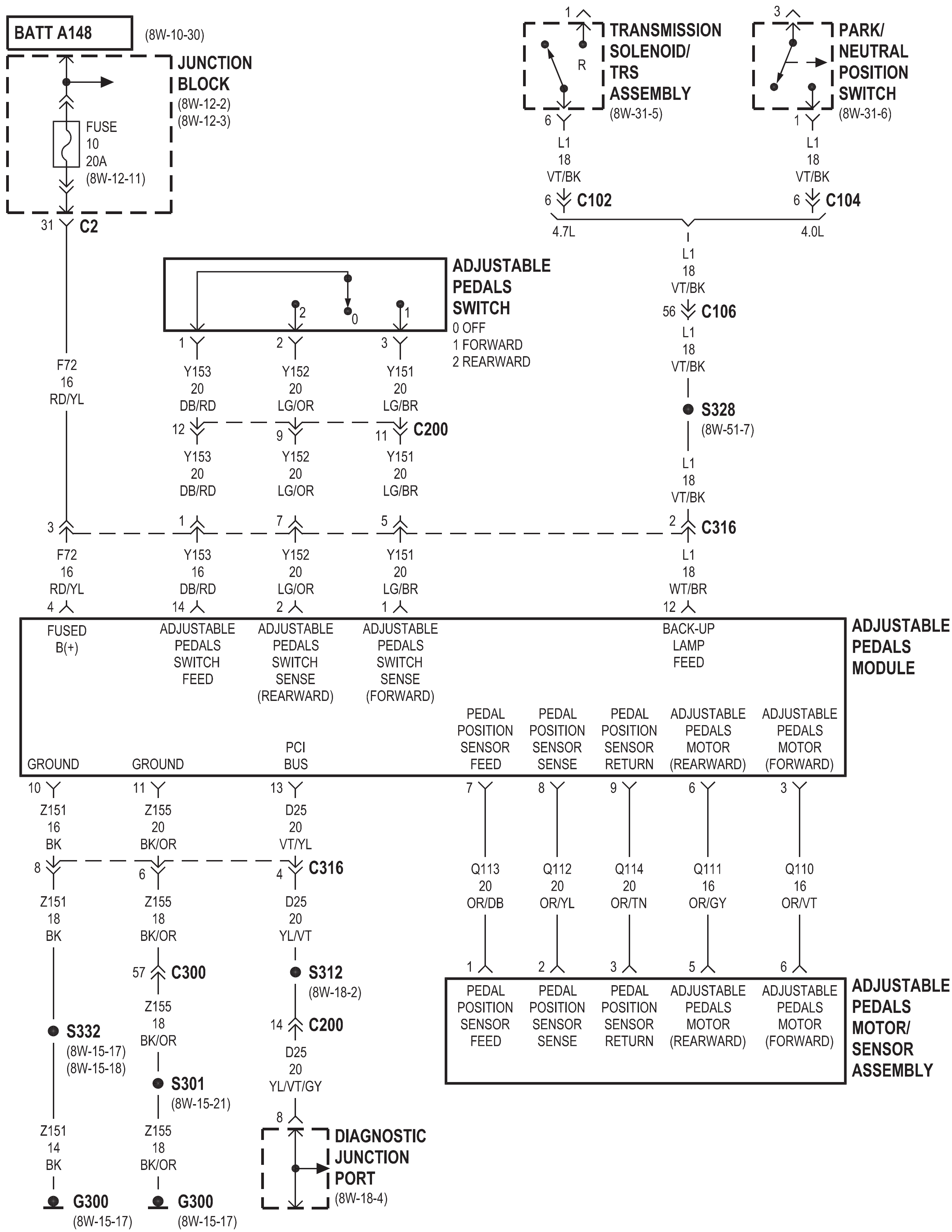

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-23)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
AUTO SHUT DOWN RELAY
(8W-30-8)
87
16
FUSE 16 15A
(8W-10-20)
17
A142 14 DG/OR
A142 14 DG/OR
F142 18 OR/DG
14 C103
F142 18 OR/DG
S128
(8W-10-19)
(8W-10-20)
S106
(8W-10-19)
(8W-10-20)
F142 18 OR/DG
F142 18 OR/DG
4
1
1
4
OXYGEN SENSOR 1/1 UPSTREAM
OXYGEN SENSOR 2/1 UPSTREAM
3
2
2
3
K41 18 BK/DG
K4 18 BK/LB
K99 18 BR/OR
K299 18 BR/WT
K4 18 BK/LB
K241 18 LG/RD
2
4 C101
S158
(8W-70-5)
K99 18 BR/OR
K299 18 BR/WT
S112
(8W-70-5)
S107
(8W-70-5)
K4 18 BK/LB
24 C1
8 C3
16 C3
4 C1
26 C1
OXYGEN SENSOR 1/1 SIGNAL
OXYGEN SENSOR 1/1 HEATER CONTROL
OXYGEN SENSOR 2/1 HEATER CONTROL
SENSOR GROUND
OXYGEN SENSOR 2/1 SIGNAL
POWERTRAIN CONTROL MODULE

4.7L

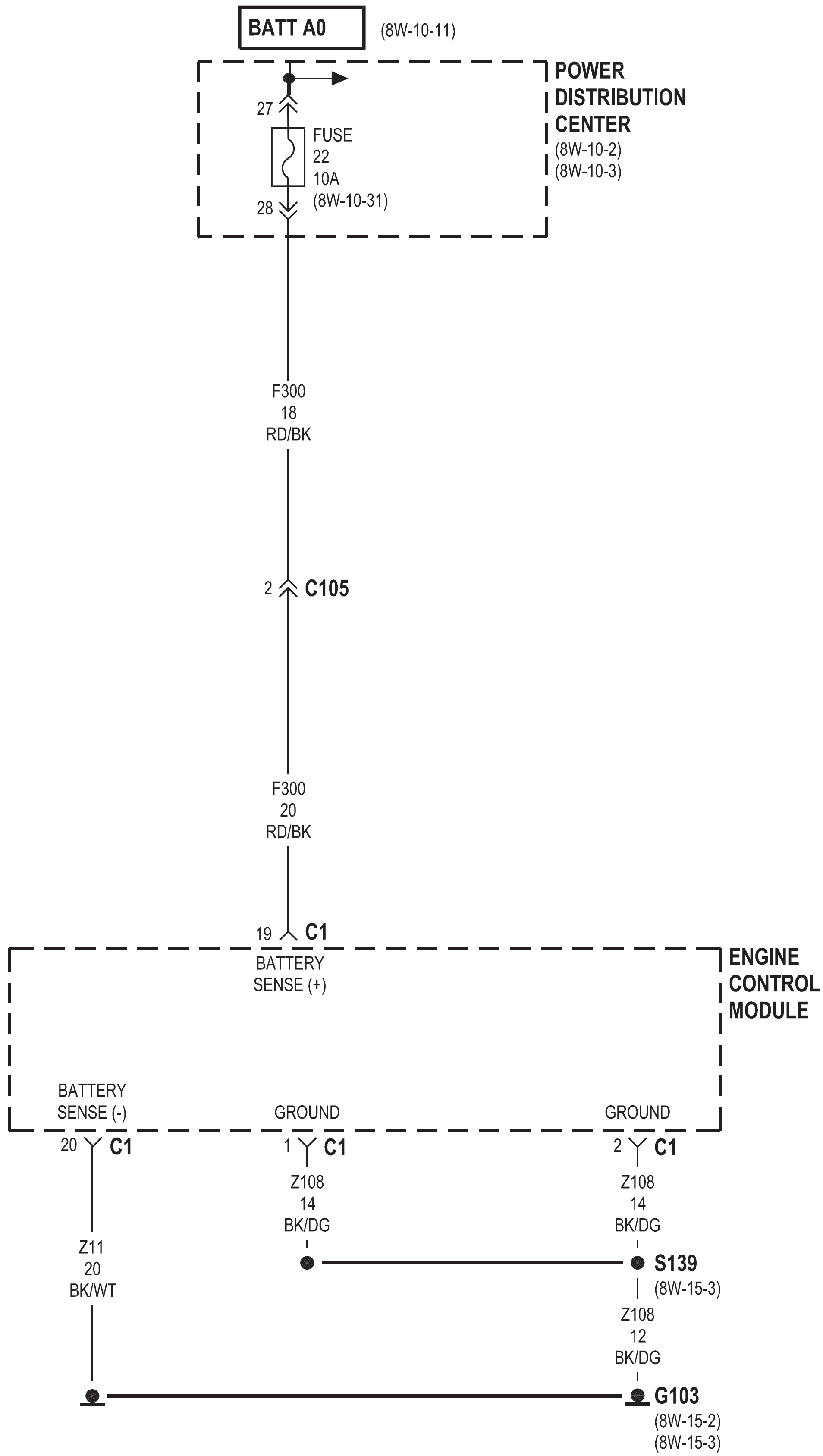

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
POWER DISTRIBUTION CENTER
(8W-10-2)
AUTO SHUT DOWN RELAY
(8W-30-8)
A142
14
DG/OR
FUSE
16
15A
(8W-10-19)
(8W-10-20)
S128
(8W-10-19)
(8W-10-20)
F142
18
OR/DG
F142 18 OR/DG
OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
LHD
RHD
K200
18
VT/OR
K200
18
BR/WT
K512
18
RD/YL
C102
S111
(8W-10-23)
TO HYDRAULIC COOLING MODULE
OXYGEN SENSOR 1/2 DOWNSTREAM
OXYGEN SENSOR 2/2 DOWNSTREAM
K4
18
BK/LB
Z186
18
BK
C106
C107
K141
18
TN/WT
S104
(8W-15-4)
S112
(8W-70-4)
(8W-70-5)
K341
18
PK/WT
S107
(8W-70-5)
G104
(8W-15-4)
C3
C1
POWERTRAIN CONTROL MODULE
OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
OXYGEN SENSOR 1/2 SIGNAL
SENSOR GROUND
OXYGEN SENSOR 2/2 SIGNAL

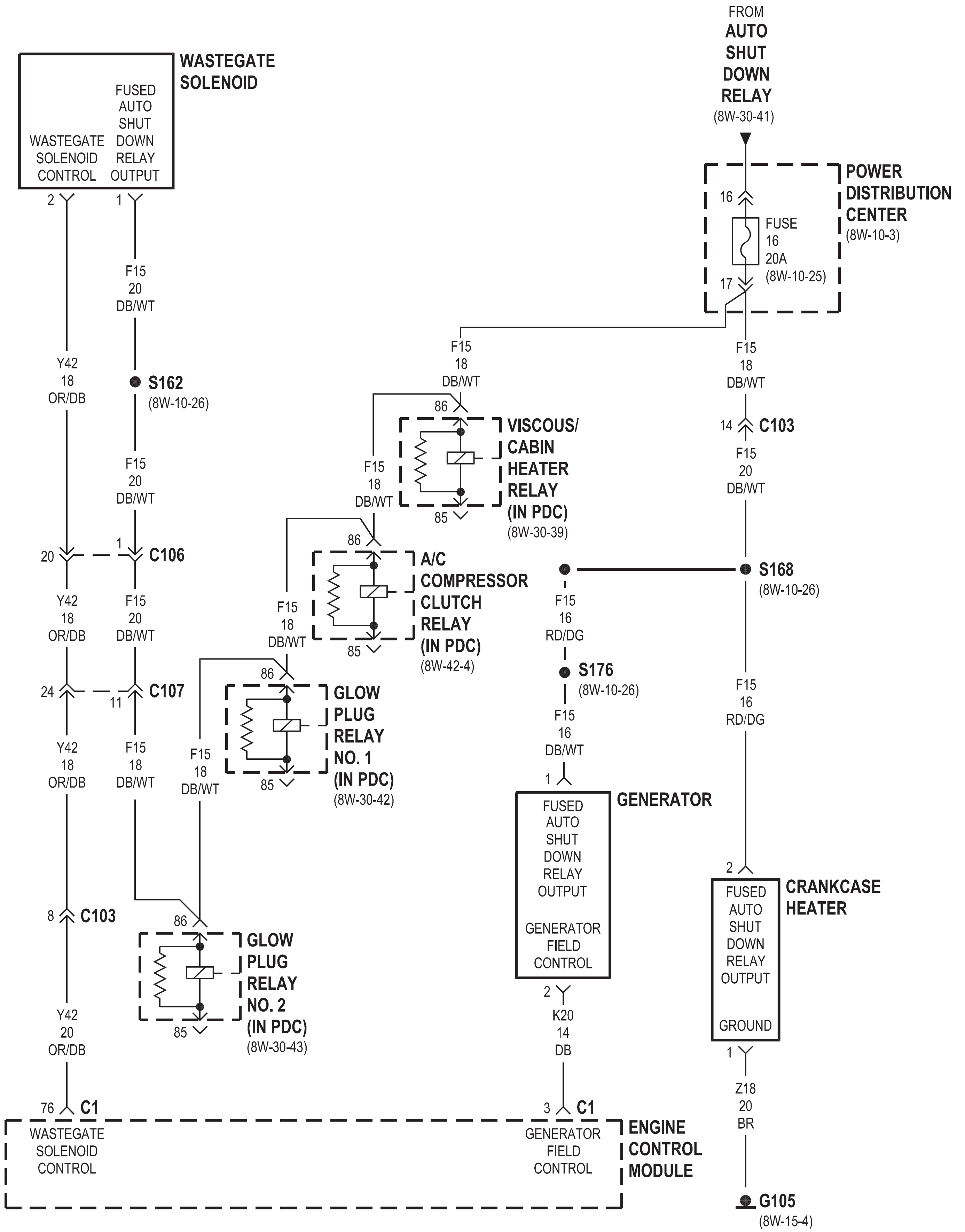

A/C PRESSURE TRANSDUCER
(8W-42-11)
(8W-42-12)
5 VOLT SUPPLY
A/C PRESSURE SIGNAL
SENSOR GROUND
LHD
RHD
K6 18 VT/BK
C18 18 DB
K4 18 BK/LB
4.0L
4.7L
C103
C104
S160
(8W-30-11)
C107
K4 20 BK/LB
S131
(8W-70-6)
(8W-70-7)
S315
HIGH OUTPUT
OTHER
C106
HYDRAULIC COOLING MODULE
RADIATOR FAN RELAY CONTROL
C101
C102
S112
(8W-70-3)
(8W-70-5)
(8W-70-4)
S107
(8W-70-5)
K173 18 LG
S102
(8W-30-21)
C2
C1
POWERTRAIN CONTROL MODULE
• 4.0L
•• 4.7L

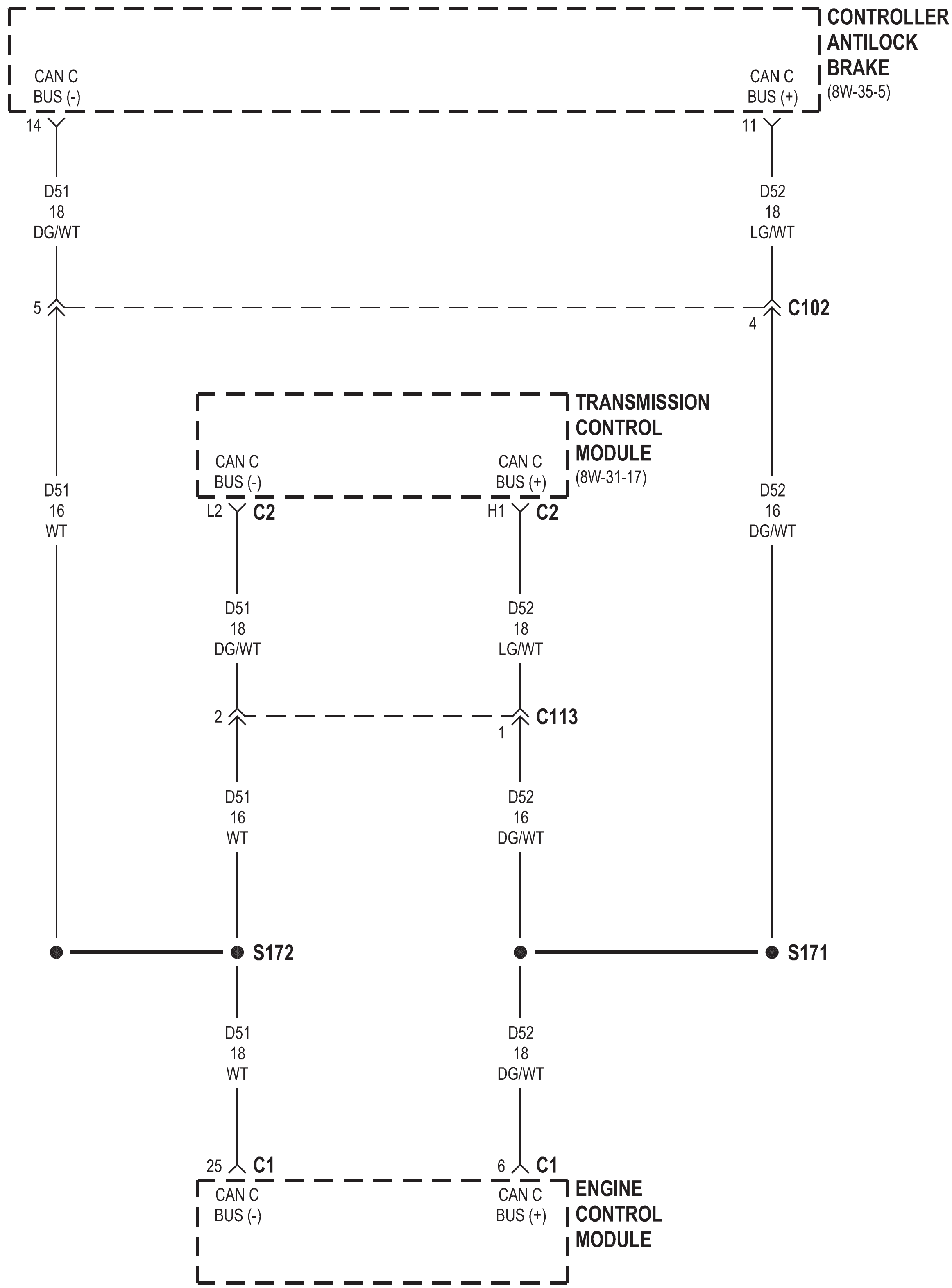

POWERTRAIN CONTROL MODULE
TORQUE MANAGEMENT REQUEST SENSE
OVERDRIVE OFF SWITCH SENSE
SECONDARY BRAKE SWITCH SIGNAL
13 C3
13 C3
24 C3
RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A
(8W-12-18)
(8W-12-19)
52 C3
LHD
RHD
T10 18 DG/LG
T10 18 YL/DG
K29 18 WT/PK
F12 20 DB/WT
5
SHIFTER ASSEMBLY
(8W-31-14)
8 C103
9 C101
LHD
RHD
6
K29 18 WT/PK
T6 18 OR/WT
T6 18 OR/BK
52 C106
14 C107
LHD
RHD
T6 18 OR/BK
T6 18 OR/BK
10 C106
40 C107
22 C200
K29 20 WT/PK
K29 18 WT/PK
K29 18 WT/PK
20 C200
T6 18 OR/BK
S314
(8W-33-2)
K29 18 WT/PK
3
SHIFTER ASSEMBLY
(8W-31-14)
1
BRAKE LAMP SWITCH
(8W-33-2)
2
T10 18 YL/DG
10
TORQUE MANAGEMENT REQUEST SENSE
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-9)
(8W-31-10)

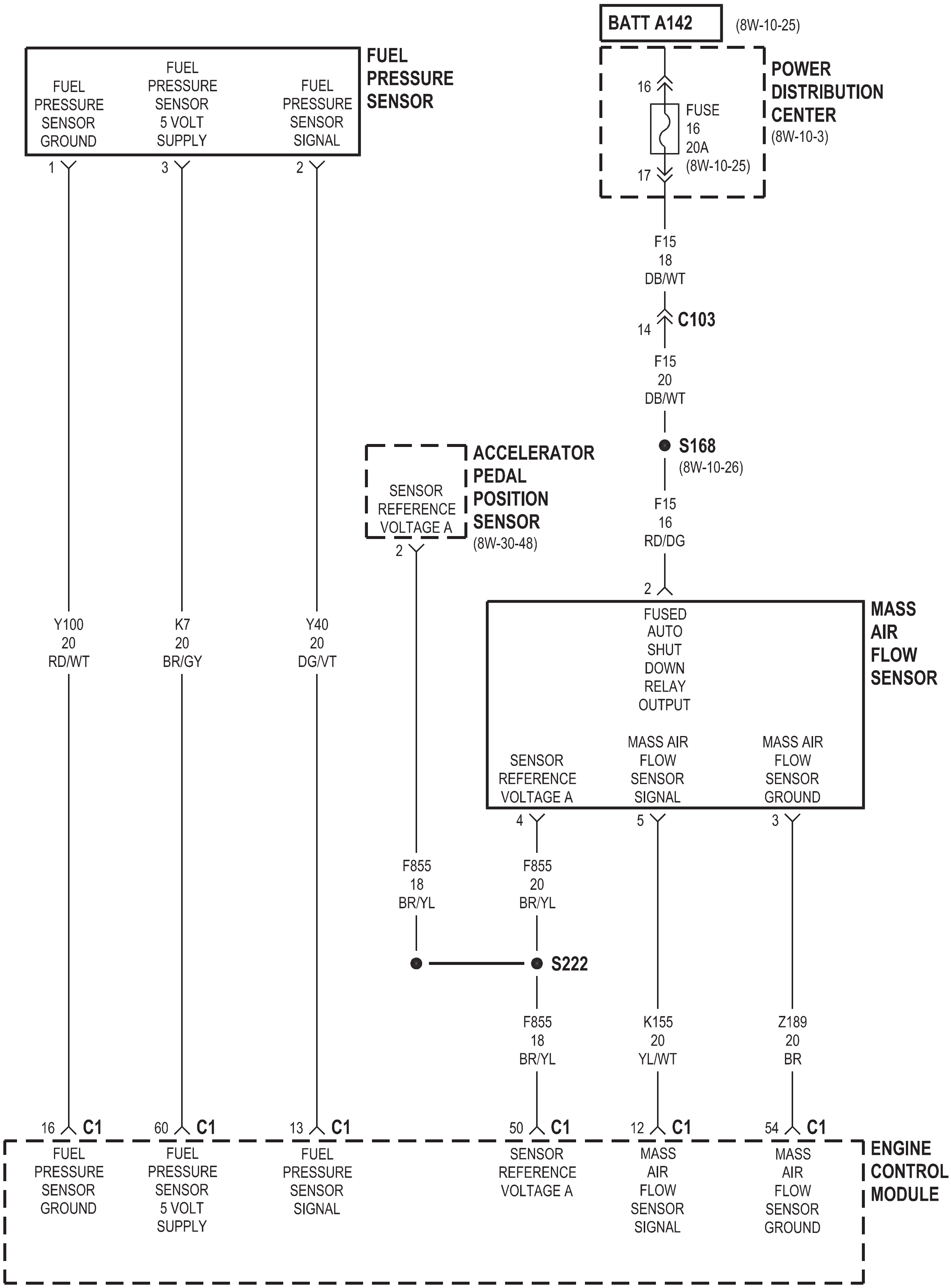


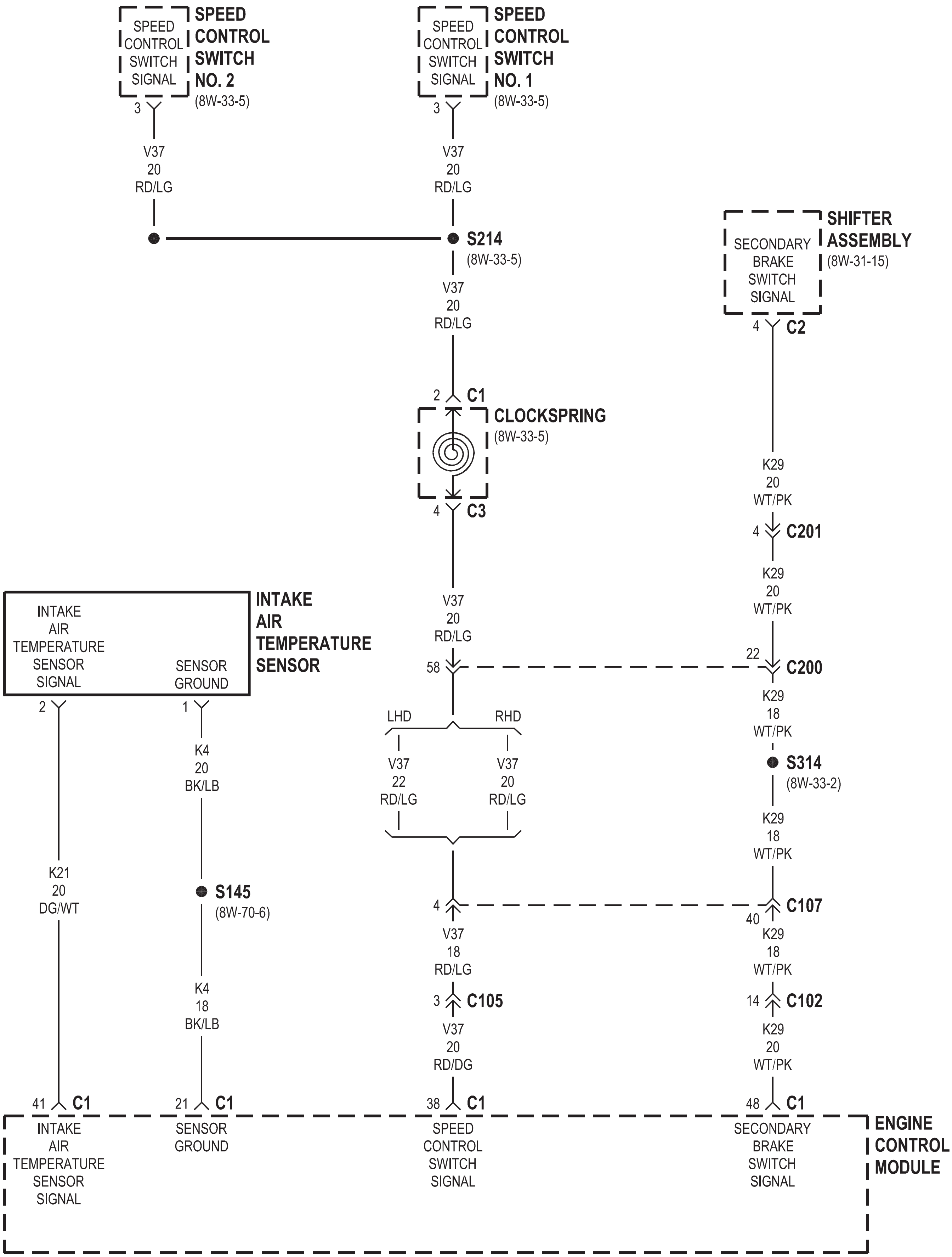
BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 10 20A (8W-12-11)
31 C2
F72 16 RD/YL
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
R
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
L1 18 VT/BK
6 C102
6 C104
4.7L
4.0L
56 C106
S328
(8W-51-7)
ADJUSTABLE PEDALS SWITCH
0 OFF
1 FORWARD
2 REARWARD
Y153 20 DB/RD
Y152 20 LG/OR
Y151 20 LG/BR
C200
C316
Y153 16 DB/RD
L1 18 WT/BR
ADJUSTABLE PEDALS MODULE
FUSED B(+)
ADJUSTABLE PEDALS SWITCH FEED
ADJUSTABLE PEDALS SWITCH SENSE (REARWARD)
ADJUSTABLE PEDALS SWITCH SENSE (FORWARD)
BACK-UP LAMP FEED
GROUND
GROUND
PCI BUS
PEDAL POSITION SENSOR FEED
PEDAL POSITION SENSOR SENSE
PEDAL POSITION SENSOR RETURN
ADJUSTABLE PEDALS MOTOR (REARWARD)
ADJUSTABLE PEDALS MOTOR (FORWARD)
Z151 16 BK
Z155 20 BK/OR
D25 20 VT/YL
C316
Z151 18 BK
Z155 18 BK/OR
D25 20 YL/VT
57 C300
S312
(8W-18-2)
14 C200
D25 20 YL/VT/GY
S332
(8W-15-17)
(8W-15-18)
S301
(8W-15-21)
Z151 14 BK
G300
(8W-15-17)
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
Q113 20 OR/DB
Q112 20 OR/YL
Q114 20 OR/TN
Q111 16 OR/GY
Q110 16 OR/VT
ADJUSTABLE PEDALS MOTOR/ SENSOR ASSEMBLY

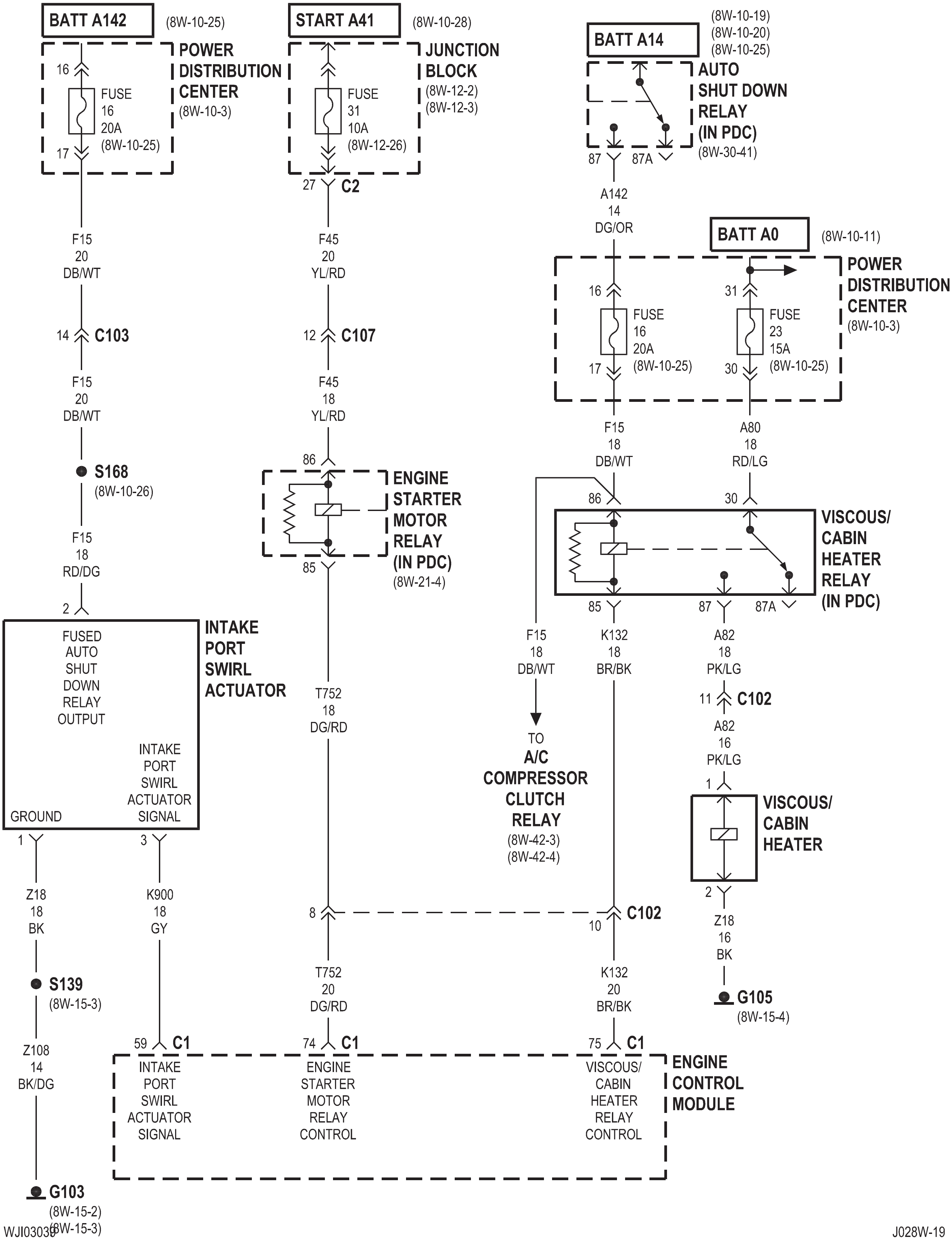

BATT A0
(8W-10-11)
27
FUSE
22
10A
(8W-10-31)
28
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
F300
18
RD/BK
2
C105
F300
20
RD/BK
19
C1
BATTERY
SENSE (+)
ENGINE
CONTROL
MODULE
BATTERY
SENSE (-)
GROUND
GROUND
20
C1
1
C1
2
C1
Z108
14
BK/DG
Z108
14
BK/DG
Z11
20
BK/WT
S139
(8W-15-3)
Z108
12
BK/DG
G103
(8W-15-2)
(8W-15-3)

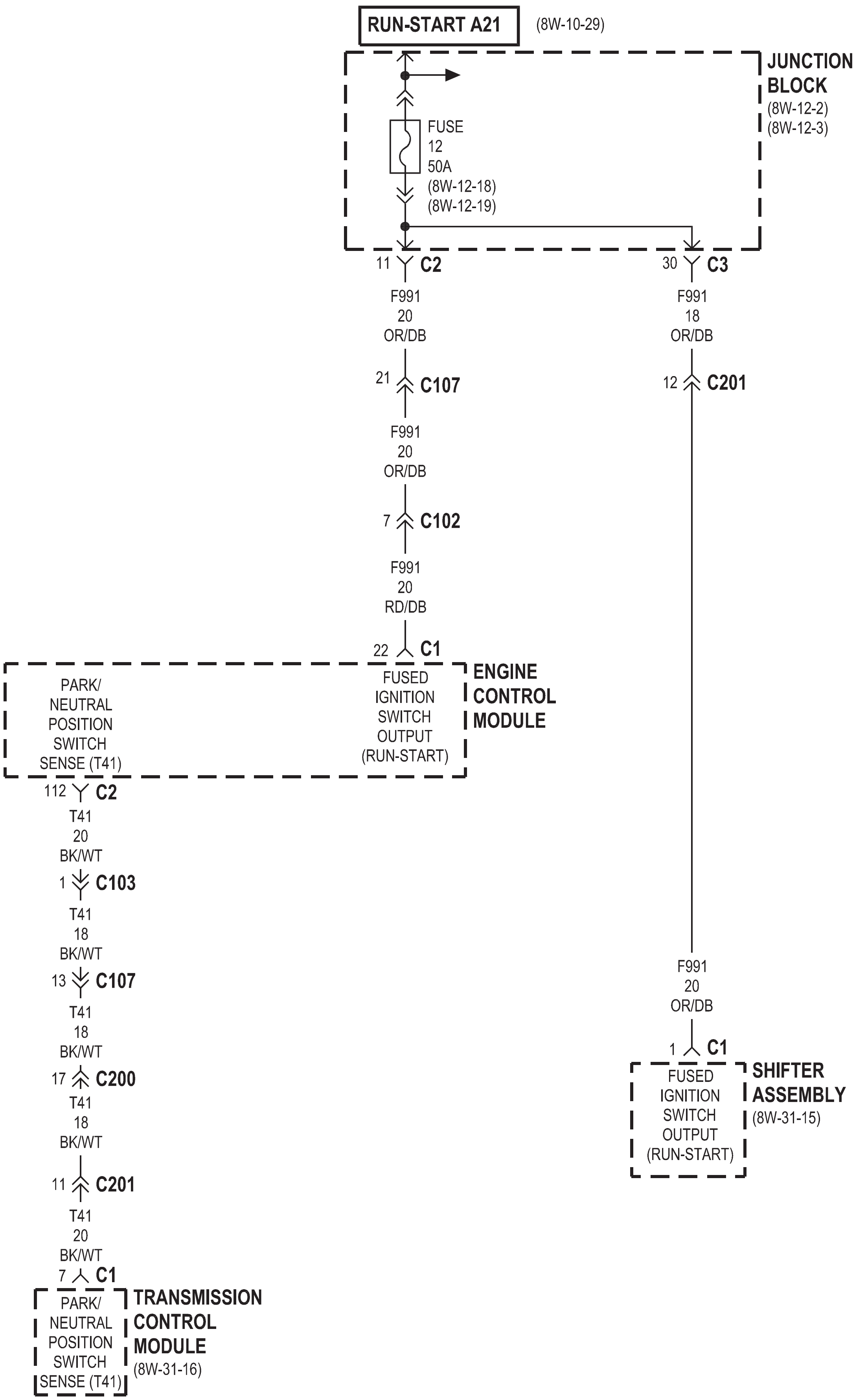

FROM
AUTO
SHUT
DOWN
RELAY
(8W-30-41)
WASTEGATE
SOLENOID
FUSED AUTO SHUT DOWN RELAY OUTPUT
WASTEGATE SOLENOID CONTROL
POWER
DISTRIBUTION
CENTER
(8W-10-3)
FUSE
16
20A
(8W-10-25)
F15
20
DB/WT
F15
18
DB/WT
Y42
18
OR/DB
S162
(8W-10-26)
C103
VISCOUS/
CABIN
HEATER
RELAY
(IN PDC)
(8W-30-39)
C106
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-42-4)
S168
(8W-10-26)
F15
16
RD/DG
S176
(8W-10-26)
C107
GLOW
PLUG
RELAY
NO. 1
(IN PDC)
(8W-30-42)
F15
16
DB/WT
GENERATOR
FUSED AUTO SHUT DOWN RELAY OUTPUT
GENERATOR FIELD CONTROL
CRANKCASE
HEATER
GROUND
GLOW
PLUG
RELAY
NO. 2
(IN PDC)
(8W-30-43)
Y42
20
OR/DB
K20
14
DB
Z18
20
BR
C1
ENGINE
CONTROL
MODULE
WASTEGATE SOLENOID CONTROL
GENERATOR FIELD CONTROL
G105
(8W-15-4)

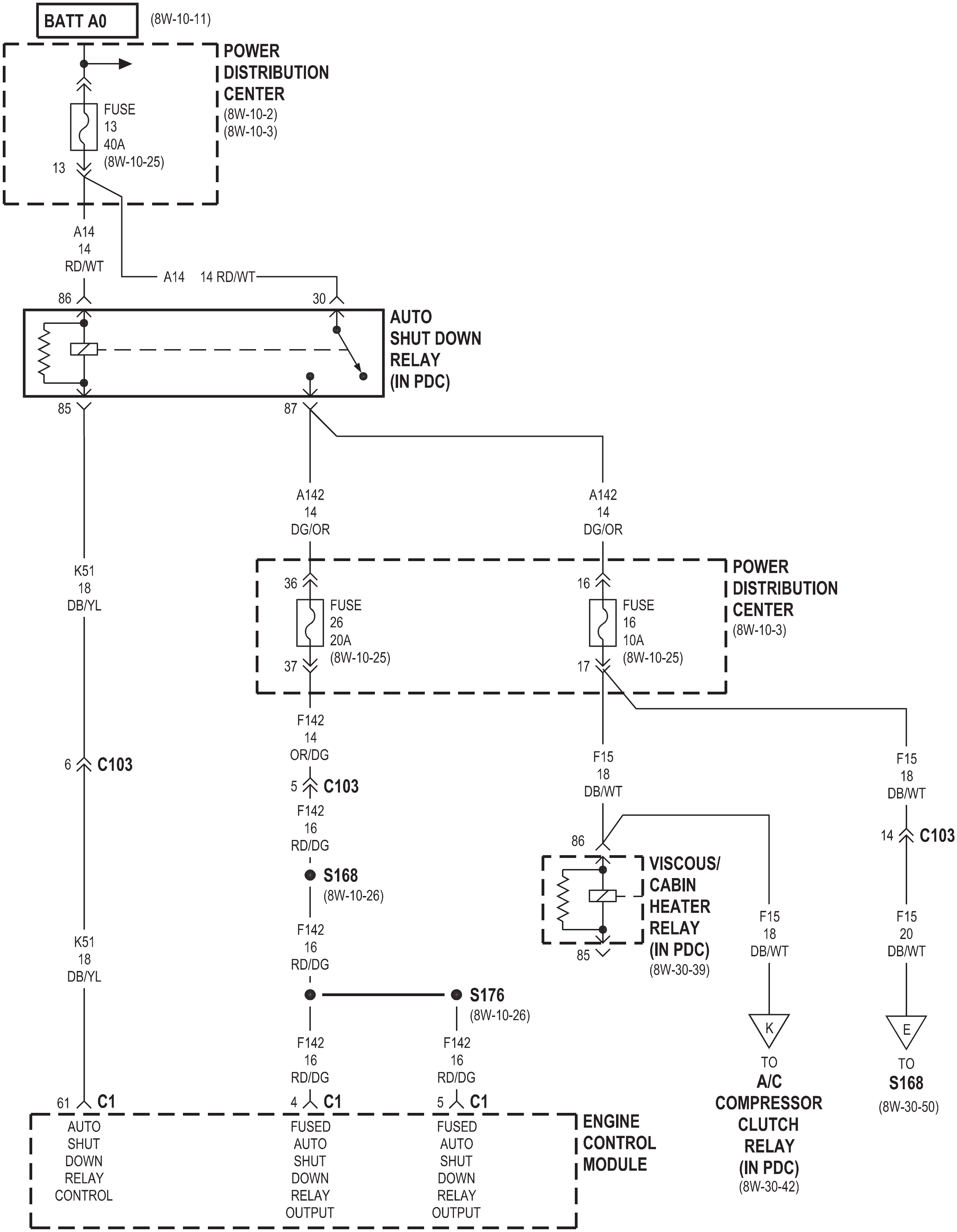

CONTROLLER
ANTILOCK
BRAKE
(8W-35-5)
CAN C
BUS (-)
CAN C
BUS (+)
14
11
D51
18
DG/WT
D52
18
LG/WT
5
4
C102
TRANSMISSION
CONTROL
MODULE
(8W-31-17)
CAN C
BUS (-)
CAN C
BUS (+)
D51
16
WT
D52
16
DG/WT
L2
C2
H1
C2
D51
18
DG/WT
D52
18
LG/WT
2
1
C113
D51
16
WT
D52
16
DG/WT
S172
S171
D51
18
WT
D52
18
DG/WT
25
C1
6
C1
CAN C
BUS (-)
CAN C
BUS (+)
ENGINE
CONTROL
MODULE

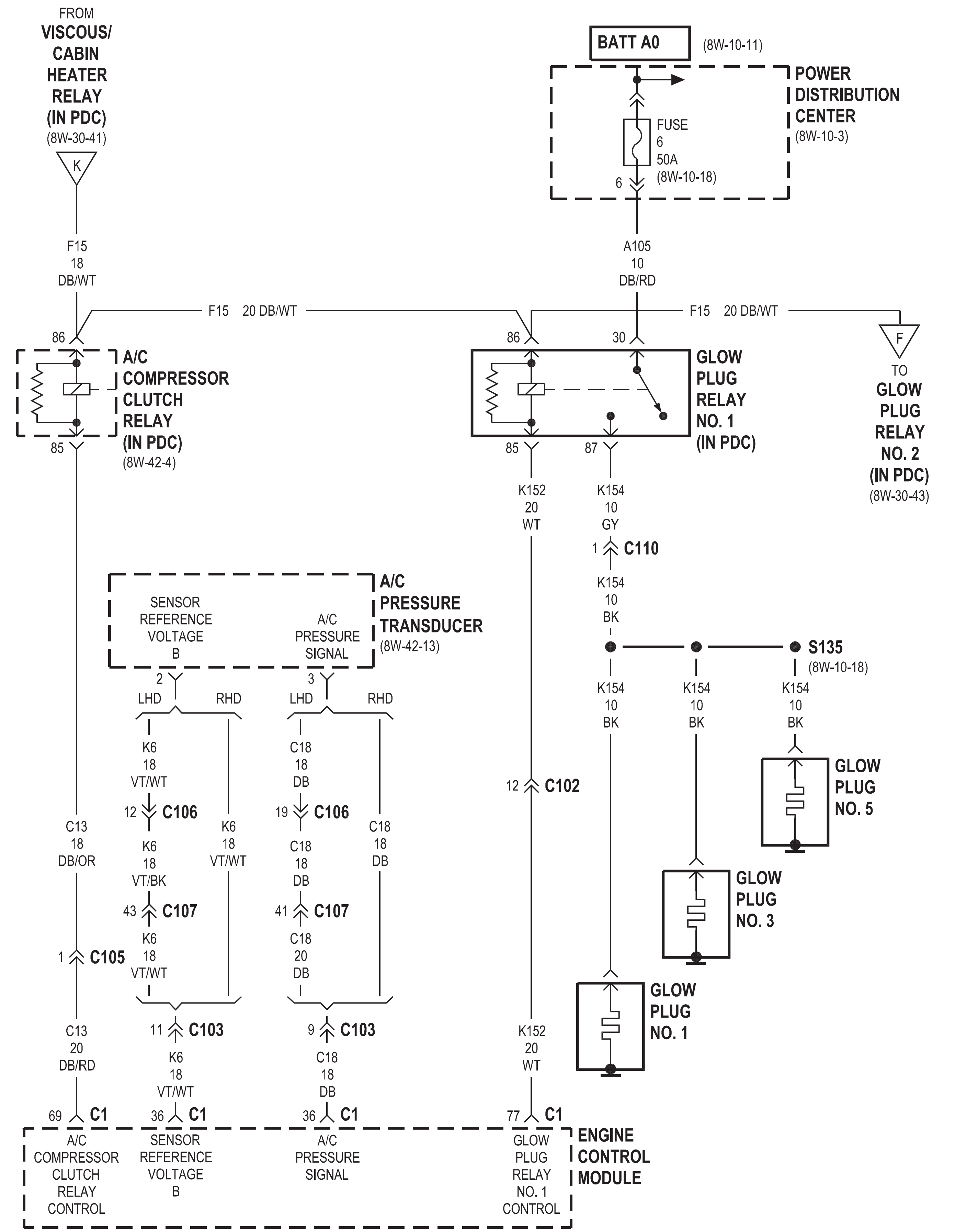

BATT A142
(8W-10-25)
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE 16 20A
(8W-10-25)
17
F15 18 DB/WT
14
C103
F15 20 DB/WT
S168
(8W-10-26)
F15 16 RD/DG
FUEL PRESSURE SENSOR
FUEL PRESSURE SENSOR GROUND
FUEL PRESSURE SENSOR 5 VOLT SUPPLY
FUEL PRESSURE SENSOR SIGNAL
1
3
2
Y100 20 RD/WT
K7 20 BR/GY
Y40 20 DG/VT
ACCELERATOR PEDAL POSITION SENSOR
(8W-30-48)
SENSOR REFERENCE VOLTAGE A
2
MASS AIR FLOW SENSOR
2
FUSED AUTO SHUT DOWN RELAY OUTPUT
SENSOR REFERENCE VOLTAGE A
MASS AIR FLOW SENSOR SIGNAL
MASS AIR FLOW SENSOR GROUND
4
5
3
F855 18 BR/YL
F855 20 BR/YL
S222
F855 18 BR/YL
K155 20 YL/WT
Z189 20 BR
16 C1
60 C1
13 C1
50 C1
12 C1
54 C1
ENGINE CONTROL MODULE
FUEL PRESSURE SENSOR GROUND
FUEL PRESSURE SENSOR 5 VOLT SUPPLY
FUEL PRESSURE SENSOR SIGNAL
SENSOR REFERENCE VOLTAGE A
MASS AIR FLOW SENSOR SIGNAL
MASS AIR FLOW SENSOR GROUND

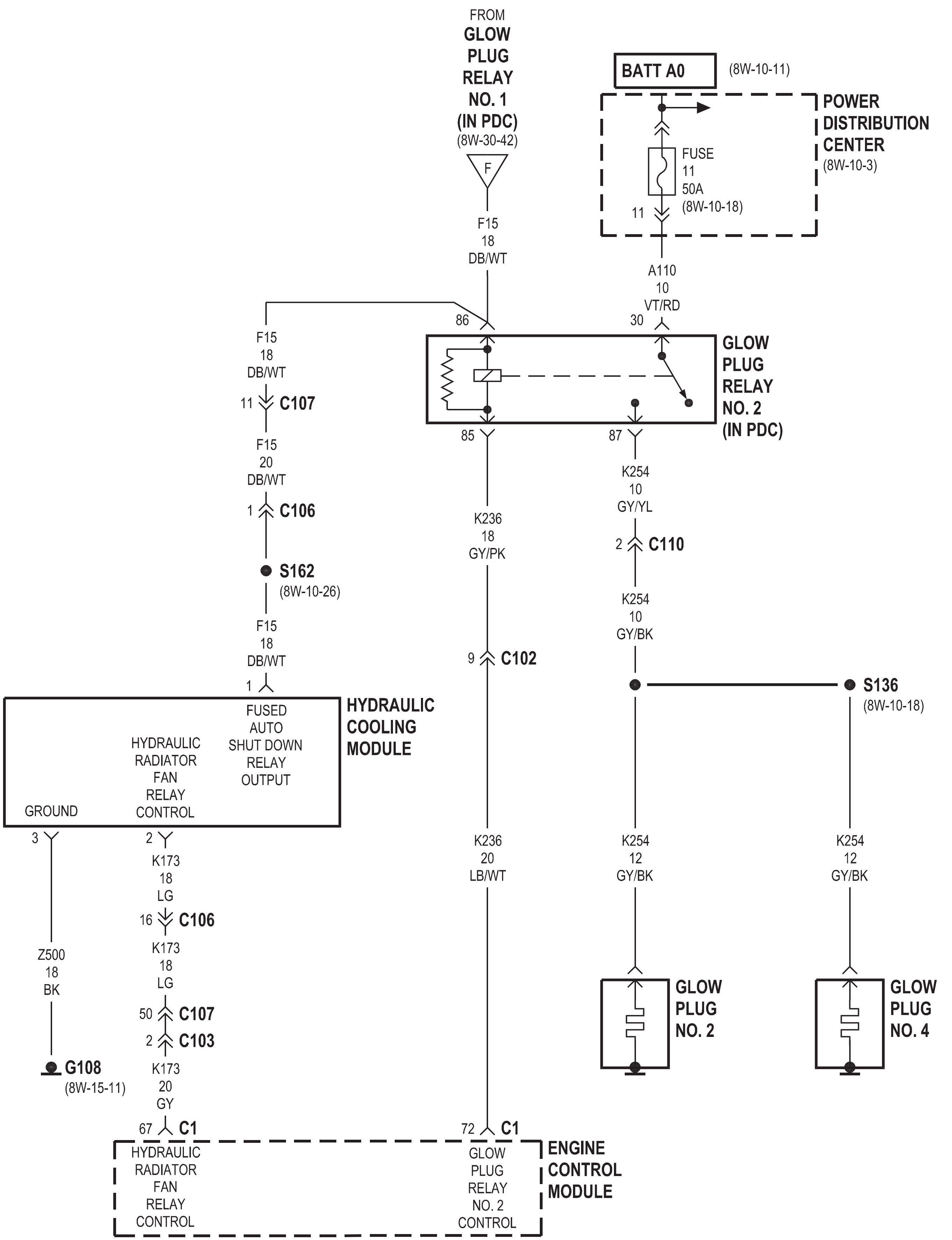

SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL SWITCH NO. 2
(8W-33-5)
SPEED CONTROL SWITCH NO. 1
(8W-33-5)
3
V37
20
RD/LG
S214
(8W-33-5)
SHIFTER ASSEMBLY
(8W-31-15)
SECONDARY BRAKE SWITCH SIGNAL
4 C2
2 C1
CLOCKSPRING
(8W-33-5)
4 C3
K29
20
WT/PK
4 C201
INTAKE AIR TEMPERATURE SENSOR
INTAKE AIR TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
58
22 C200
K29
18
WT/PK
LHD
RHD
V37
22
RD/LG
S314
(8W-33-2)
K4
20
BK/LB
K21
20
DG/WT
S145
(8W-70-6)
4
C107
40
V37
18
RD/LG
3 C105
14 C102
K4
18
BK/LB
V37
20
RD/DG
41 C1
21 C1
38 C1
48 C1
ENGINE CONTROL MODULE
SPEED CONTROL SWITCH SIGNAL

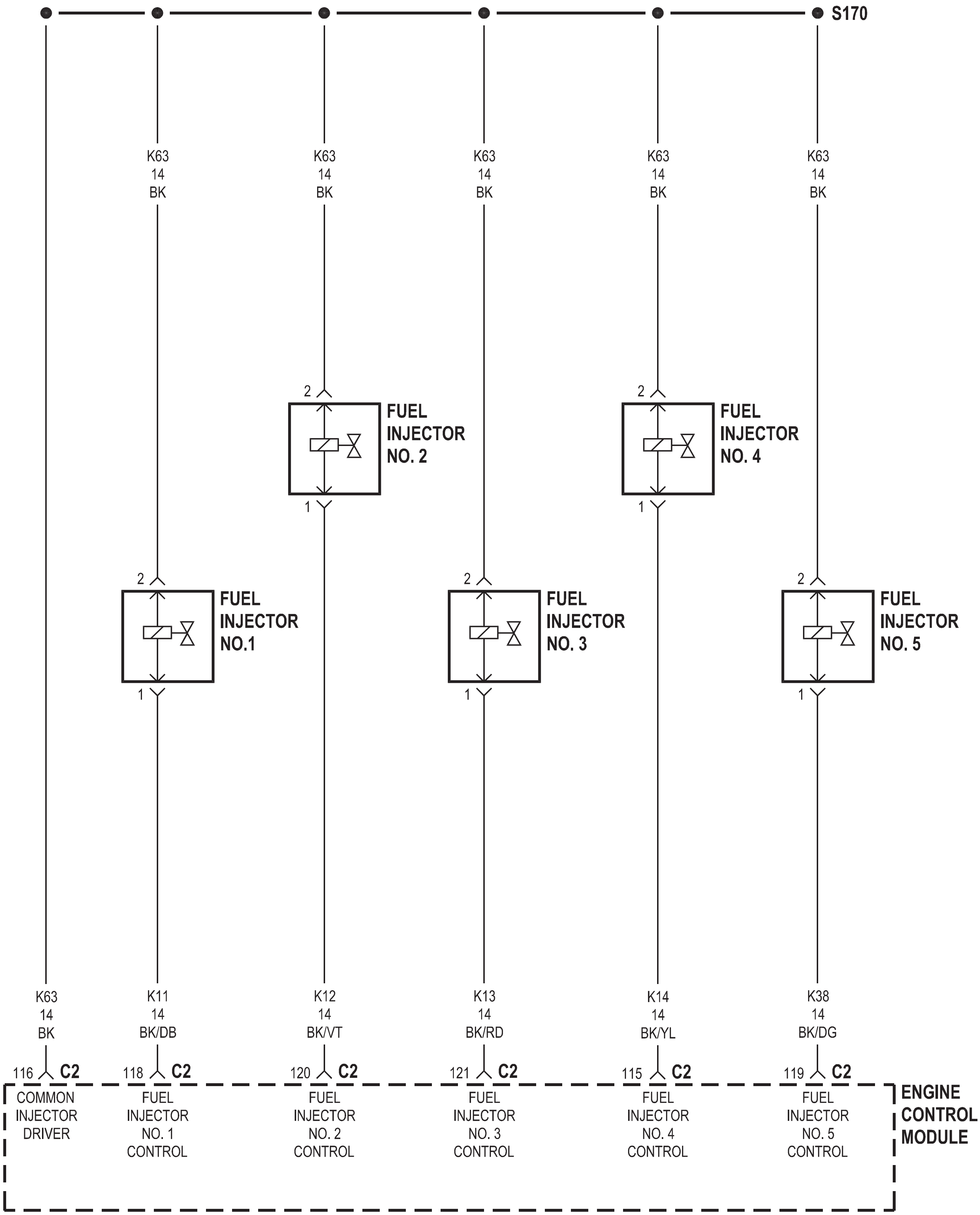

BATT A142
(8W-10-25)
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE 16 20A (8W-10-25)
17
F15 20 DB/WT
14 C103
F15 20 DB/WT
S168
(8W-10-26)
F15 18 RD/DG
2
INTAKE PORT SWIRL ACTUATOR
FUSED AUTO SHUT DOWN RELAY OUTPUT
INTAKE PORT SWIRL ACTUATOR SIGNAL
GROUND
1
3
Z18 18 BK
K900 18 GY
S139
(8W-15-3)
Z108 14 BK/DG
G103
(8W-15-2)
(8W-15-3)
START A41
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 31 10A (8W-12-26)
27 C2
F45 20 YL/RD
12 C107
F45 18 YL/RD
86
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-4)
85
T752 18 DG/RD
8
T752 20 DG/RD
BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-41)
87
87A
A142 14 DG/OR
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE 16 20A (8W-10-25)
17
31
FUSE 23 15A (8W-10-25)
30
F15 18 DB/WT
A80 18 RD/LG
86
30
VISCOUS/ CABIN HEATER RELAY (IN PDC)
85
87
87A
F15 18 DB/WT
TO A/C COMPRESSOR CLUTCH RELAY
(8W-42-3)
(8W-42-4)
K132 18 BR/BK
A82 18 PK/LG
11 C102
A82 16 PK/LG
1
VISCOUS/ CABIN HEATER
2
Z18 16 BK
G105
(8W-15-4)
10 C102
K132 20 BR/BK
59 C1
74 C1
75 C1
ENGINE CONTROL MODULE
INTAKE PORT SWIRL ACTUATOR SIGNAL
ENGINE STARTER MOTOR RELAY CONTROL
VISCOUS/ CABIN HEATER RELAY CONTROL
WJI03030
J028W-19

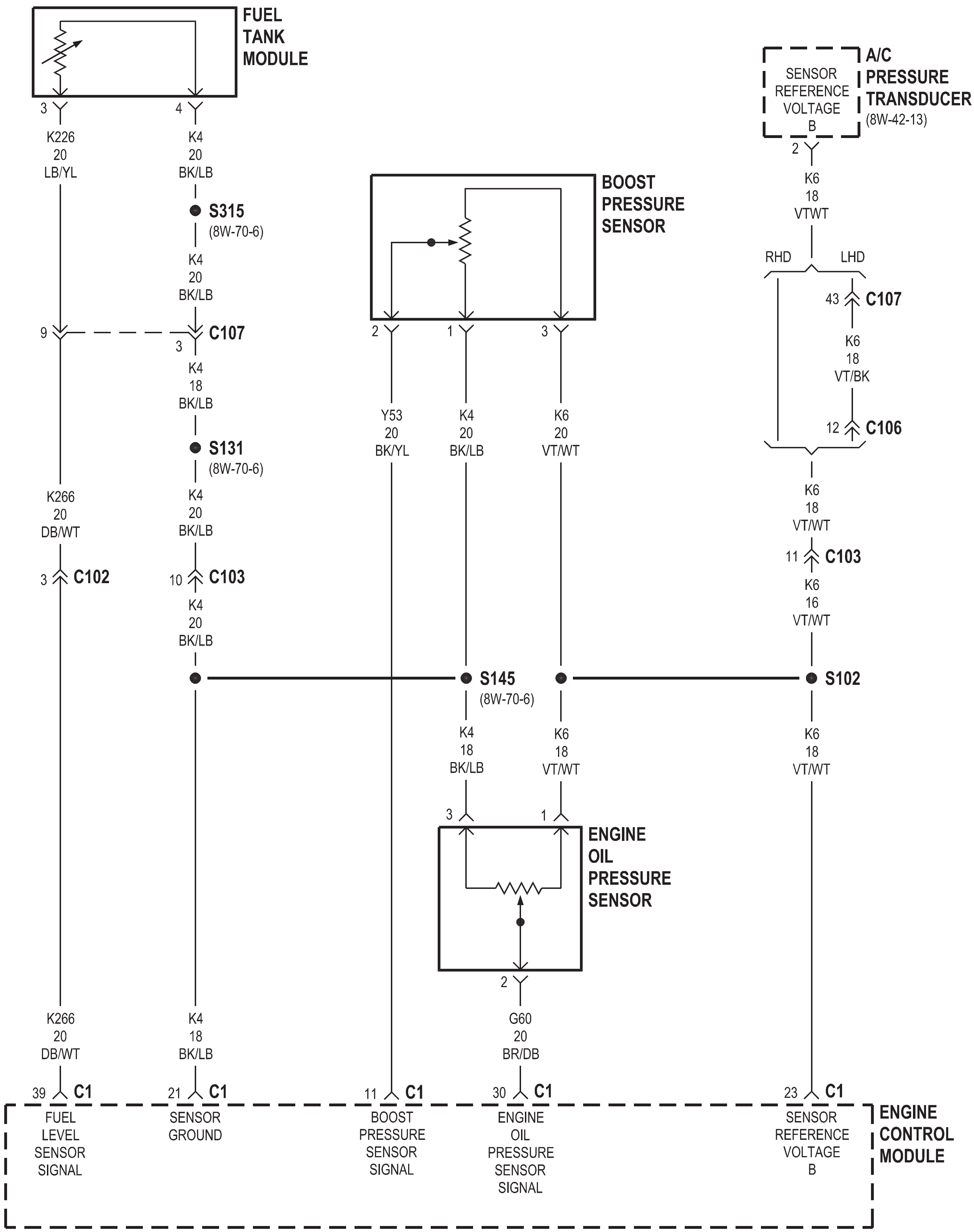

RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
50A
(8W-12-18)
(8W-12-19)
11 C2
30 C3
F991
20
OR/DB
F991
18
OR/DB
21 C107
12 C201
F991
20
OR/DB
7 C102
F991
20
RD/DB
22 C1
ENGINE CONTROL MODULE
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
112 C2
T41
20
BK/WT
1 C103
T41
18
BK/WT
13 C107
T41
18
BK/WT
17 C200
T41
18
BK/WT
11 C201
T41
20
BK/WT
7 C1
TRANSMISSION CONTROL MODULE
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
(8W-31-16)
F991
20
OR/DB
1 C1
SHIFTER ASSEMBLY
FUSED IGNITION SWITCH OUTPUT (RUN-START)
(8W-31-15)

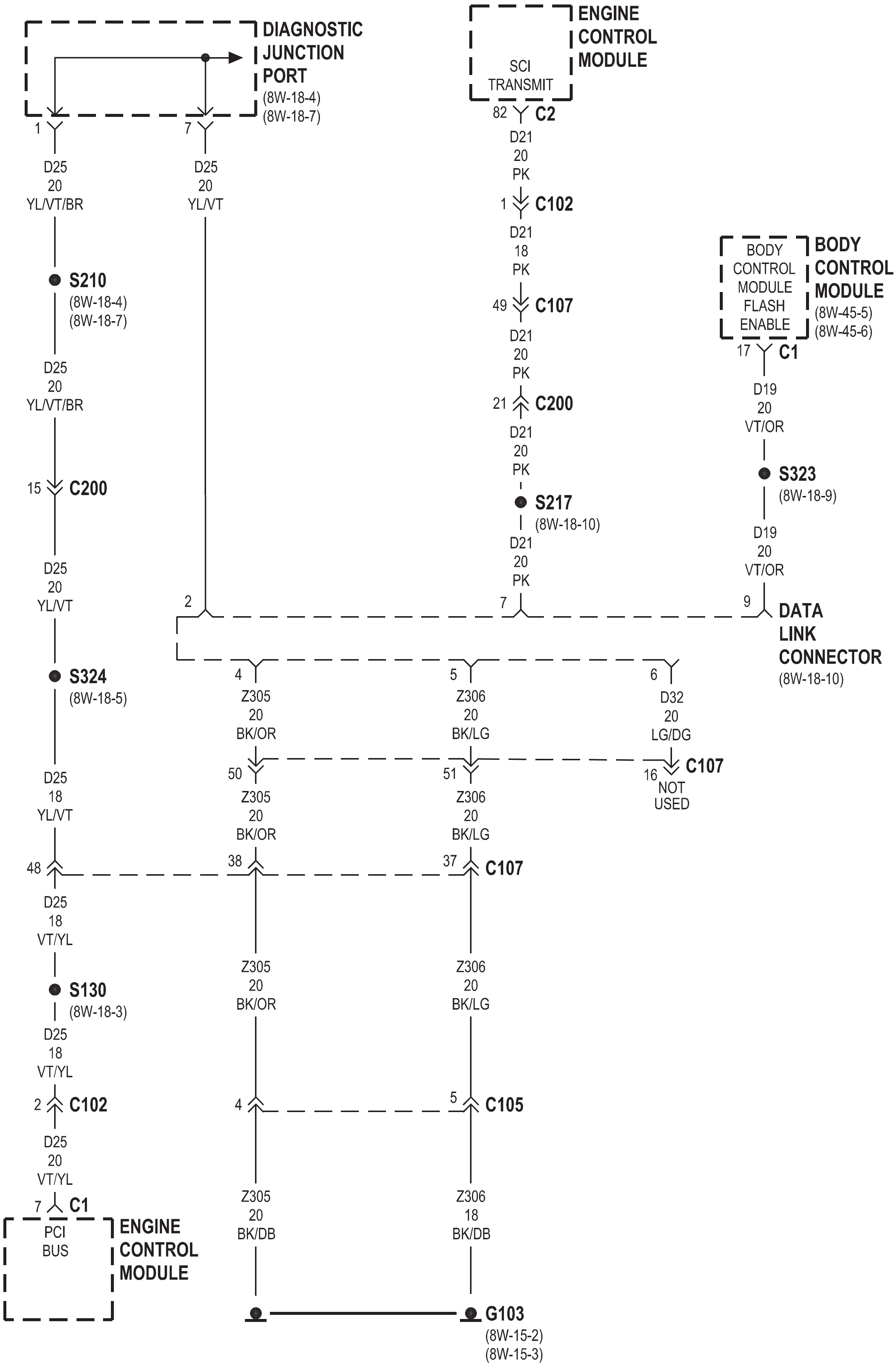

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 13 40A (8W-10-25)
13
A14 14 RD/WT
A14 14 RD/WT
86
30
AUTO SHUT DOWN RELAY (IN PDC)
85
87
K51 18 DB/YL
A142 14 DG/OR
A142 14 DG/OR
POWER DISTRIBUTION CENTER
(8W-10-3)
36
FUSE 26 20A (8W-10-25)
37
16
FUSE 16 10A (8W-10-25)
17
F142 14 OR/DG
6 C103
5 C103
F142 16 RD/DG
S168
(8W-10-26)
F15 18 DB/WT
F15 18 DB/WT
14 C103
86
VISCOUS/ CABIN HEATER RELAY (IN PDC)
(8W-30-39)
85
F15 18 DB/WT
F15 20 DB/WT
K51 18 DB/YL
F142 16 RD/DG
S176
(8W-10-26)
K
E
F142 16 RD/DG
F142 16 RD/DG
TO A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-30-42)
TO S168
(8W-30-50)
61 C1
4 C1
5 C1
ENGINE CONTROL MODULE
AUTO SHUT DOWN RELAY CONTROL
FUSED AUTO SHUT DOWN RELAY OUTPUT
FUSED AUTO SHUT DOWN RELAY OUTPUT

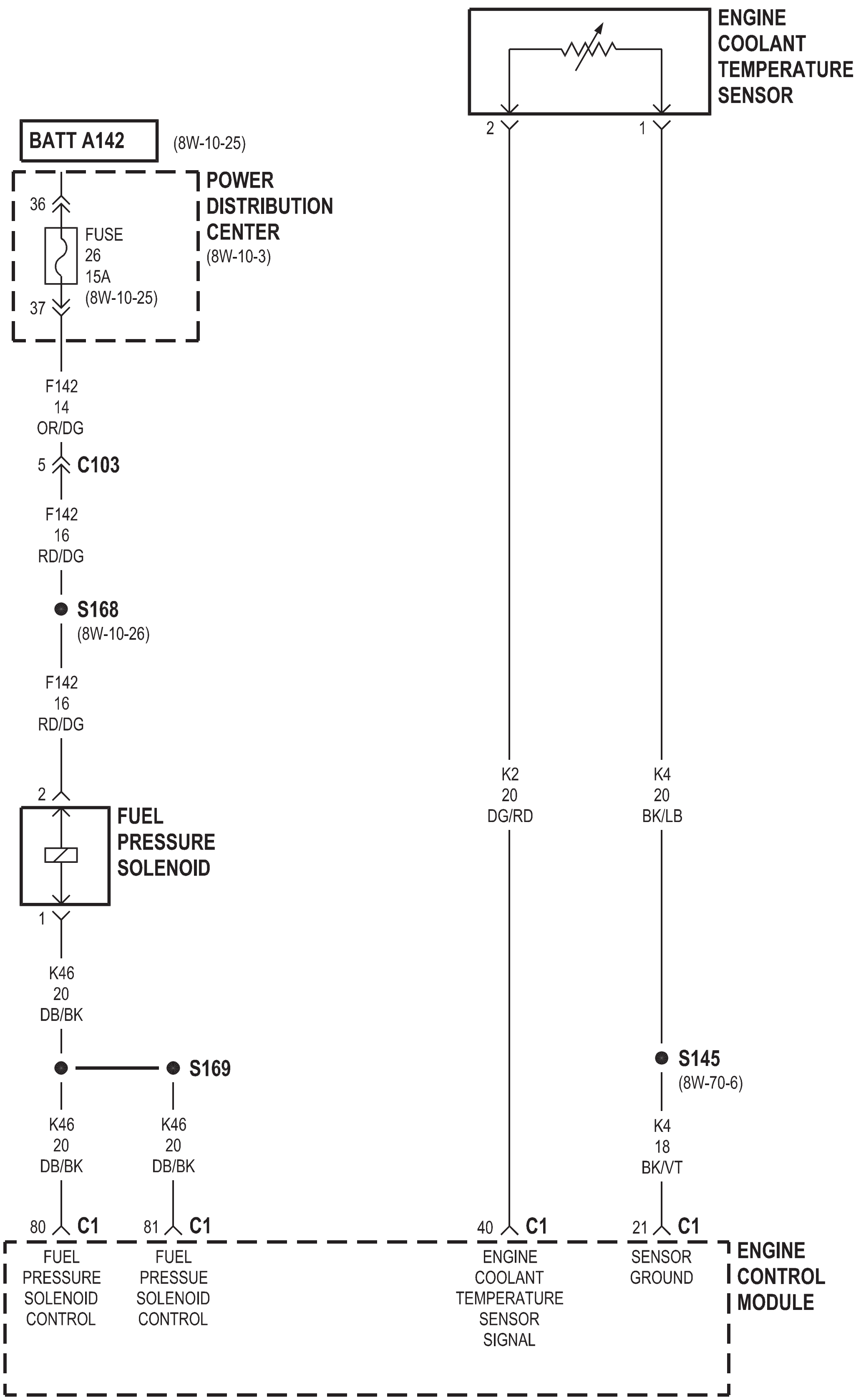

FROM
VISCOUS/ CABIN HEATER RELAY (IN PDC)
(8W-30-41)
K
F15
18
DB/WT
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE
6
50A
(8W-10-18)
6
A105
10
DB/RD
F15 20 DB/WT
F15 20 DB/WT
86
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-4)
85
86
30
GLOW PLUG RELAY NO. 1 (IN PDC)
85
87
F
TO
GLOW PLUG RELAY NO. 2 (IN PDC)
(8W-30-43)
K152
20
WT
K154
10
GY
1
C110
K154
10
BK
A/C PRESSURE TRANSDUCER
(8W-42-13)
SENSOR REFERENCE VOLTAGE B
A/C PRESSURE SIGNAL
2
3
LHD
RHD
LHD
RHD
S135
(8W-10-18)
K154
10
BK
K154
10
BK
K154
10
BK
K6
18
VT/WT
C18
18
DB
12
C102
GLOW PLUG NO. 5
12
C106
19
C106
C13
18
DB/OR
K6
18
VT/BK
K6
18
VT/WT
C18
18
DB
C18
18
DB
GLOW PLUG NO. 3
43
C107
41
C107
K6
18
VT/WT
C18
20
DB
1
C105
GLOW PLUG NO. 1
C13
20
DB/RD
11
C103
9
C103
K152
20
WT
K6
18
VT/WT
C18
18
DB
69
C1
36
C1
36
C1
77
C1
ENGINE CONTROL MODULE
A/C COMPRESSOR CLUTCH RELAY CONTROL
SENSOR REFERENCE VOLTAGE B
A/C PRESSURE SIGNAL
GLOW PLUG RELAY NO. 1 CONTROL

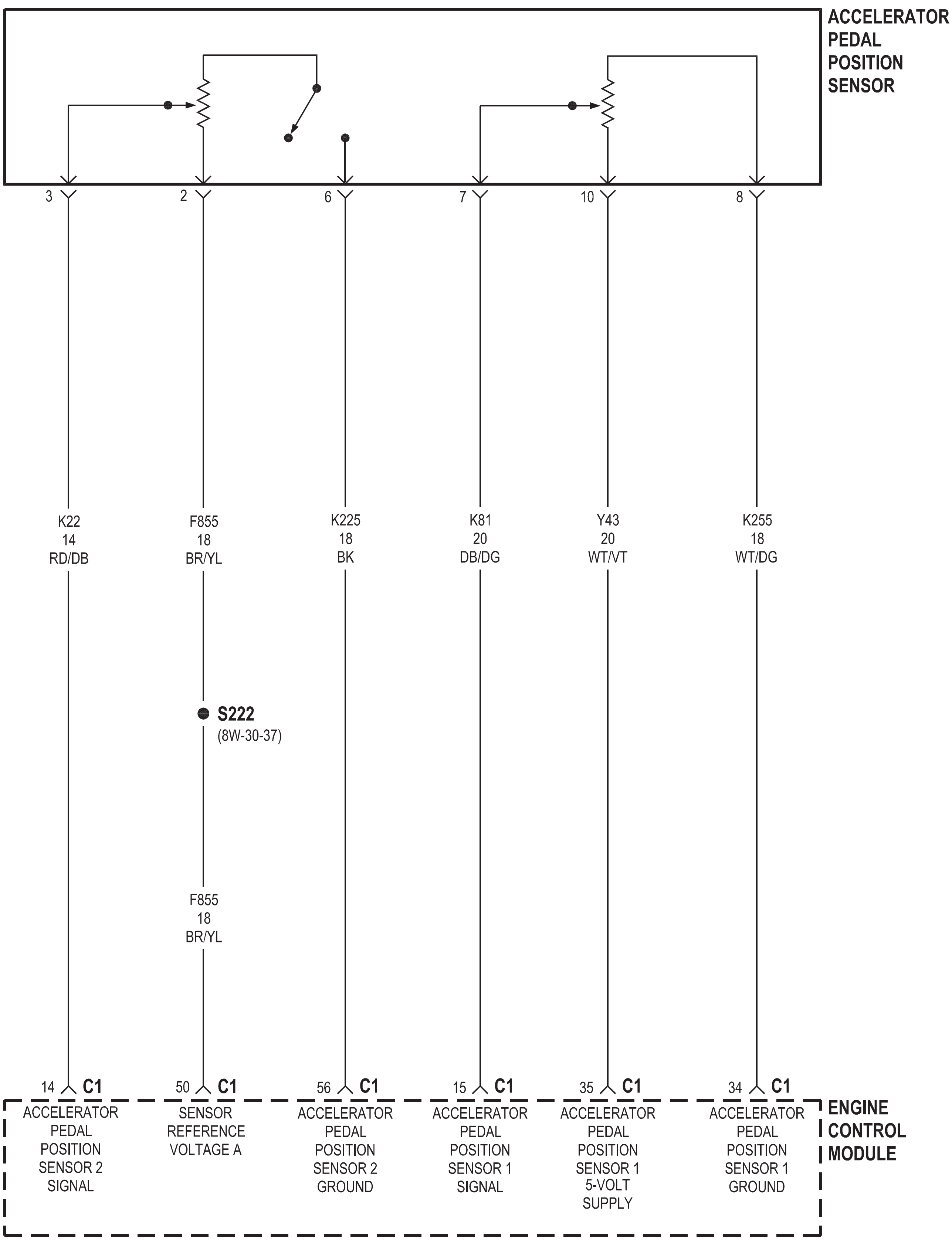

FROM
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-42)
F
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE
11
50A
(8W-10-18)
11
F15
18
DB/WT
A110
10
VT/RD
86
30
GLOW PLUG RELAY NO. 2 (IN PDC)
85
87
F15
18
DB/WT
11
C107
F15
20
DB/WT
1
C106
S162
(8W-10-26)
F15
18
DB/WT
1
K236
18
GY/PK
K254
10
GY/YL
2
C110
K254
10
GY/BK
9
C102
S136
(8W-10-18)
HYDRAULIC COOLING MODULE
FUSED AUTO SHUT DOWN RELAY OUTPUT
HYDRAULIC RADIATOR FAN RELAY CONTROL
GROUND
3
2
K173
18
LG
16
C106
K173
18
LG
50
C107
2
C103
K173
20
GY
Z500
18
BK
G108
(8W-15-11)
K236
20
LB/WT
K254
12
GY/BK
K254
12
GY/BK
GLOW PLUG NO. 2
GLOW PLUG NO. 4
67
C1
72
C1
ENGINE CONTROL MODULE
HYDRAULIC RADIATOR FAN RELAY CONTROL
GLOW PLUG RELAY NO. 2 CONTROL

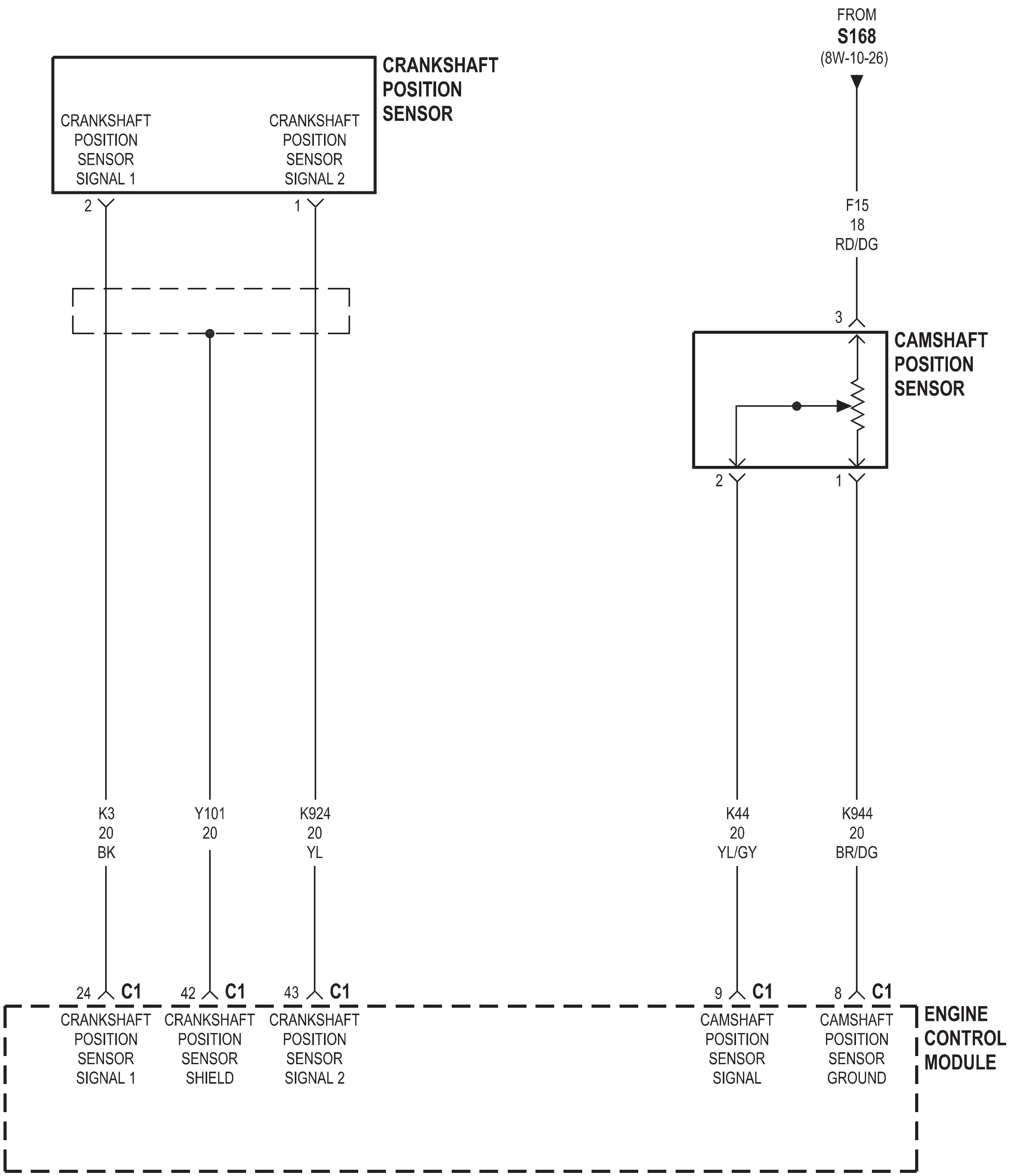

S170
K63
14
BK
FUEL INJECTOR NO.1
FUEL INJECTOR NO. 2
FUEL INJECTOR NO. 3
FUEL INJECTOR NO. 4
FUEL INJECTOR NO. 5
2
1
K63 14 BK
K11 14 BK/DB
K12 14 BK/VT
K13 14 BK/RD
K14 14 BK/YL
K38 14 BK/DG
116 C2
118 C2
120 C2
121 C2
115 C2
119 C2
COMMON INJECTOR DRIVER
FUEL INJECTOR NO. 1 CONTROL
FUEL INJECTOR NO. 2 CONTROL
FUEL INJECTOR NO. 3 CONTROL
FUEL INJECTOR NO. 4 CONTROL
FUEL INJECTOR NO. 5 CONTROL
ENGINE CONTROL MODULE

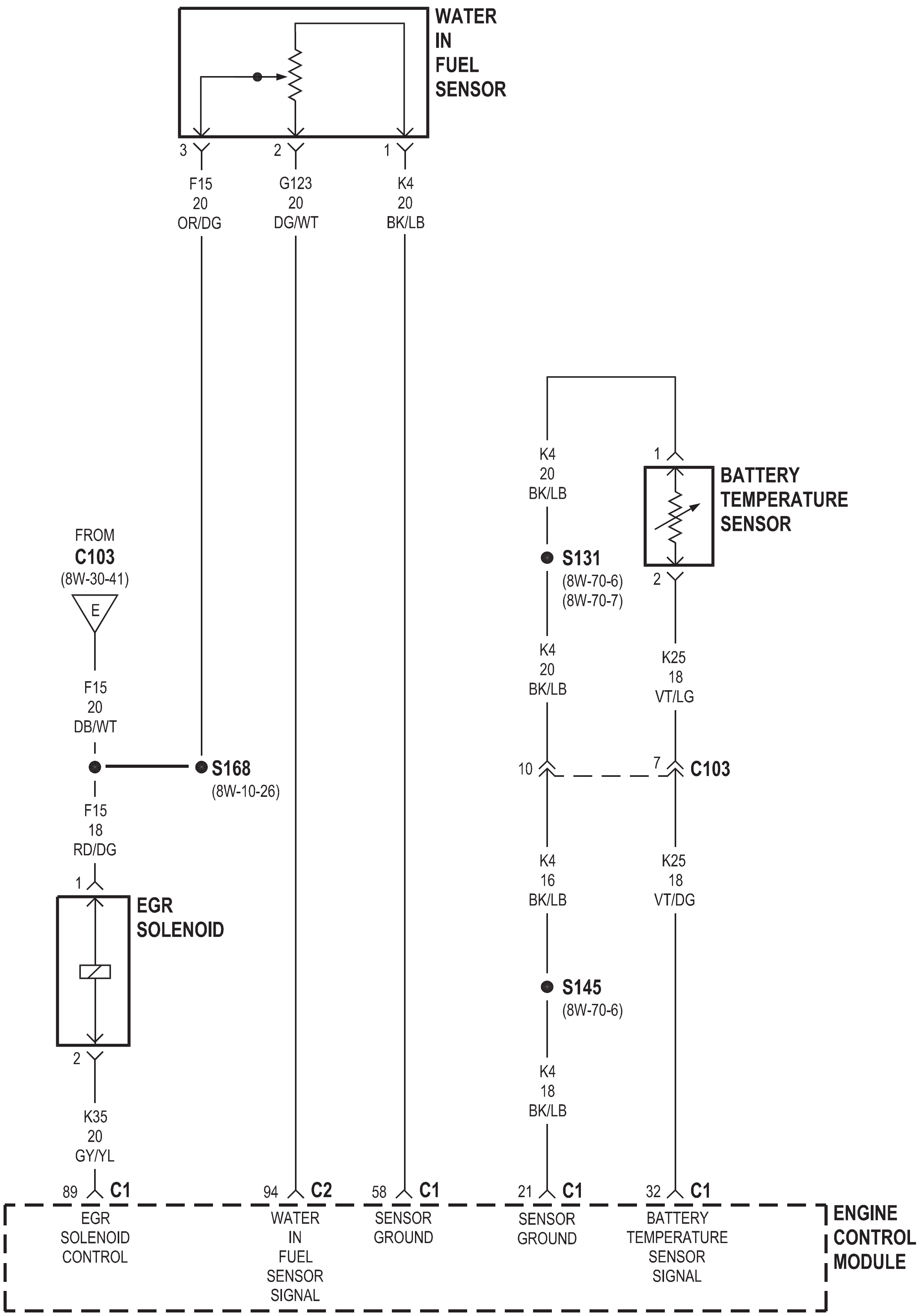

FUEL
TANK
MODULE
3
4
K226
20
LB/YL
K4
20
BK/LB
S315
(8W-70-6)
K4
20
BK/LB
9
C107
3
K4
18
BK/LB
S131
(8W-70-6)
K4
20
BK/LB
K266
20
DB/WT
3
C102
10
C103
K4
20
BK/LB
BOOST
PRESSURE
SENSOR
2
1
3
Y53
20
BK/YL
K4
20
BK/LB
K6
20
VT/WT
A/C
PRESSURE
TRANSDUCER
(8W-42-13)
SENSOR
REFERENCE
VOLTAGE
B
2
K6
18
VTWT
RHD
LHD
43
C107
K6
18
VT/BK
12
C106
K6
18
VT/WT
11
C103
K6
16
VT/WT
S145
(8W-70-6)
S102
K4
18
BK/LB
K6
18
VT/WT
K6
18
VT/WT
3
1
ENGINE
OIL
PRESSURE
SENSOR
2
K266
20
DB/WT
K4
18
BK/LB
G60
20
BR/DB
39
C1
21
C1
11
C1
30
C1
23
C1
FUEL
LEVEL
SENSOR
SIGNAL
SENSOR
GROUND
BOOST
PRESSURE
SENSOR
SIGNAL
ENGINE
OIL
PRESSURE
SENSOR
SIGNAL
SENSOR
REFERENCE
VOLTAGE
B
ENGINE
CONTROL
MODULE

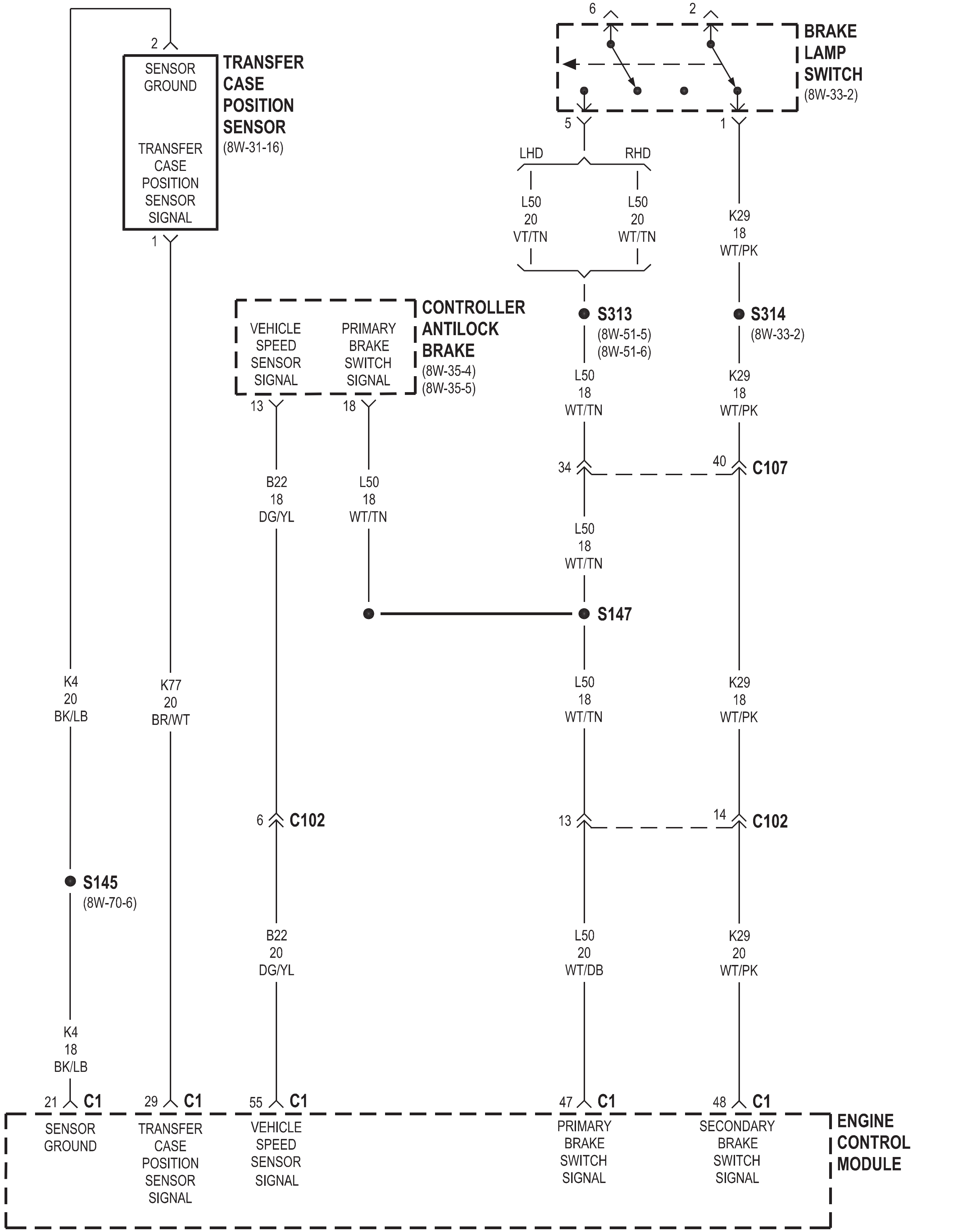

DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
ENGINE CONTROL MODULE
SCI TRANSMIT
82 C2
D21 20 PK
1 C102
D21 18 PK
49 C107
D21 20 PK
21 C200
D21 20 PK
S217
(8W-18-10)
D21 20 PK
BODY CONTROL MODULE FLASH ENABLE
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
17 C1
D19 20 VT/OR
S323
(8W-18-9)
D19 20 VT/OR
1
7
D25 20 YL/VT/BR
D25 20 YL/VT
S210
(8W-18-4)
(8W-18-7)
D25 20 YL/VT/BR
15 C200
D25 20 YL/VT
2
7
9
DATA LINK CONNECTOR
(8W-18-10)
S324
(8W-18-5)
4
5
6
Z305 20 BK/OR
Z306 20 BK/LG
D32 20 LG/DG
50
51
16 C107
NOT USED
D25 18 YL/VT
Z305 20 BK/OR
Z306 20 BK/LG
48
38
37 C107
D25 18 VT/YL
Z305 20 BK/OR
Z306 20 BK/LG
S130
(8W-18-3)
D25 18 VT/YL
2 C102
4
5 C105
D25 20 VT/YL
Z305 20 BK/DB
Z306 18 BK/DB
7 C1
PCI BUS
ENGINE CONTROL MODULE
G103
(8W-15-2)
(8W-15-3)


ENGINE
COOLANT
TEMPERATURE
SENSOR
2
1
BATT A142
(8W-10-25)
POWER
DISTRIBUTION
CENTER
(8W-10-3)
36
FUSE
26
15A
(8W-10-25)
37
F142
14
OR/DG
5
C103
F142
16
RD/DG
S168
(8W-10-26)
F142
16
RD/DG
2
FUEL
PRESSURE
SOLENOID
1
K46
20
DB/BK
S169
K46
20
DB/BK
K46
20
DB/BK
K2
20
DG/RD
K4
20
BK/LB
S145
(8W-70-6)
K4
18
BK/VT
80 C1
81 C1
40 C1
21 C1
FUEL
PRESSURE
SOLENOID
CONTROL
FUEL
PRESSUE
SOLENOID
CONTROL
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
SENSOR
GROUND
ENGINE
CONTROL
MODULE


ACCELERATOR PEDAL POSITION SENSOR
3
2
6
7
10
8
K22
14
RD/DB
F855
18
BR/YL
K225
18
BK
K81
20
DB/DG
Y43
20
WT/VT
K255
18
WT/DG
S222
(8W-30-37)
F855
18
BR/YL
14 C1
50 C1
56 C1
15 C1
35 C1
34 C1
ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
SENSOR REFERENCE VOLTAGE A
ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY
ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
ENGINE CONTROL MODULE

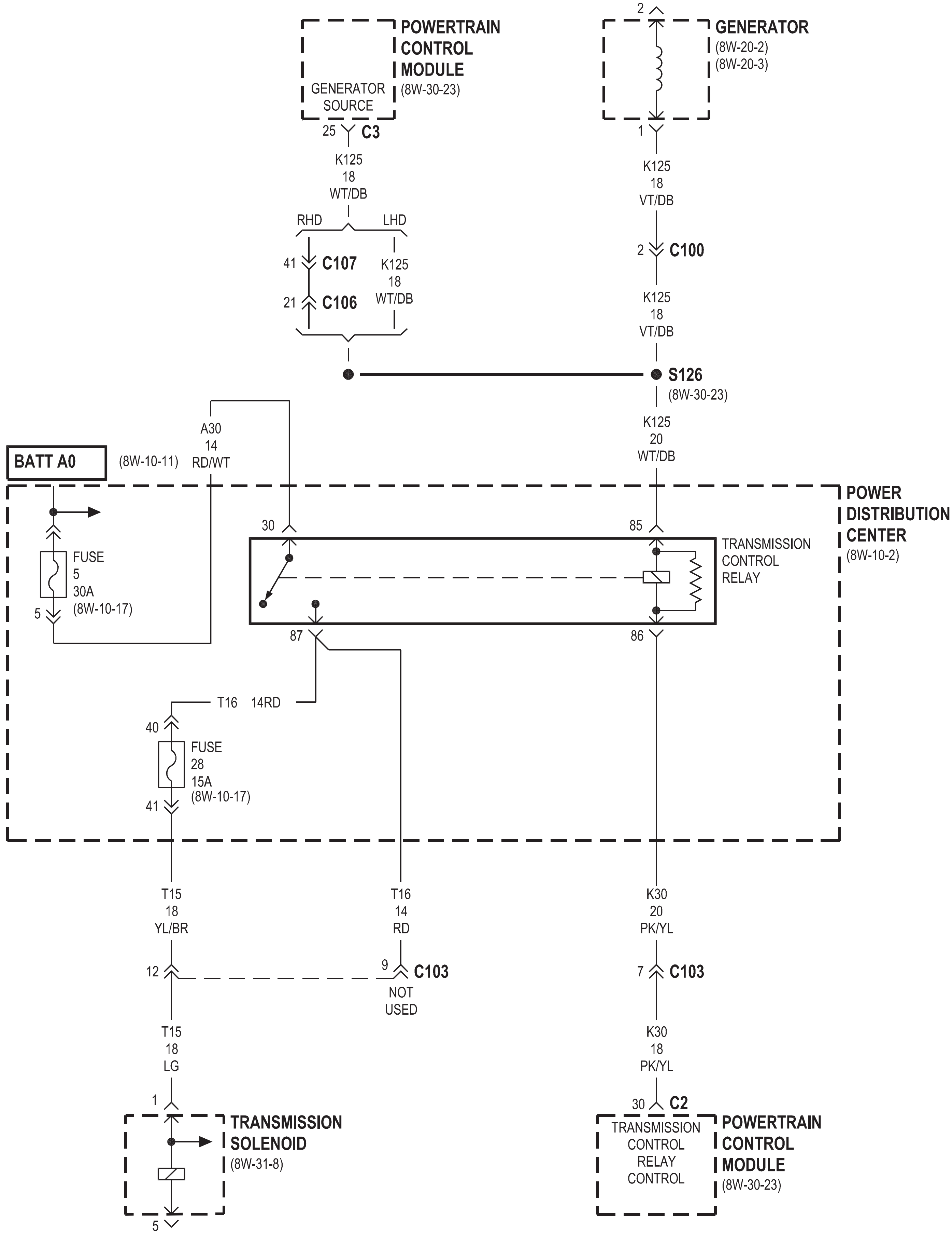

FROM
S168
(8W-10-26)
CRANKSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR SIGNAL 1
CRANKSHAFT POSITION SENSOR SIGNAL 2
2
1
F15
18
RD/DG
3
CAMSHAFT POSITION SENSOR
2
1
K3
20
BK
Y101
20
K924
20
YL
K44
20
YL/GY
K944
20
BR/DG
24 C1
42 C1
43 C1
9 C1
8 C1
CRANKSHAFT POSITION SENSOR SIGNAL 1
CRANKSHAFT POSITION SENSOR SHIELD
CRANKSHAFT POSITION SENSOR SIGNAL 2
CAMSHAFT POSITION SENSOR SIGNAL
CAMSHAFT POSITION SENSOR GROUND
ENGINE CONTROL MODULE

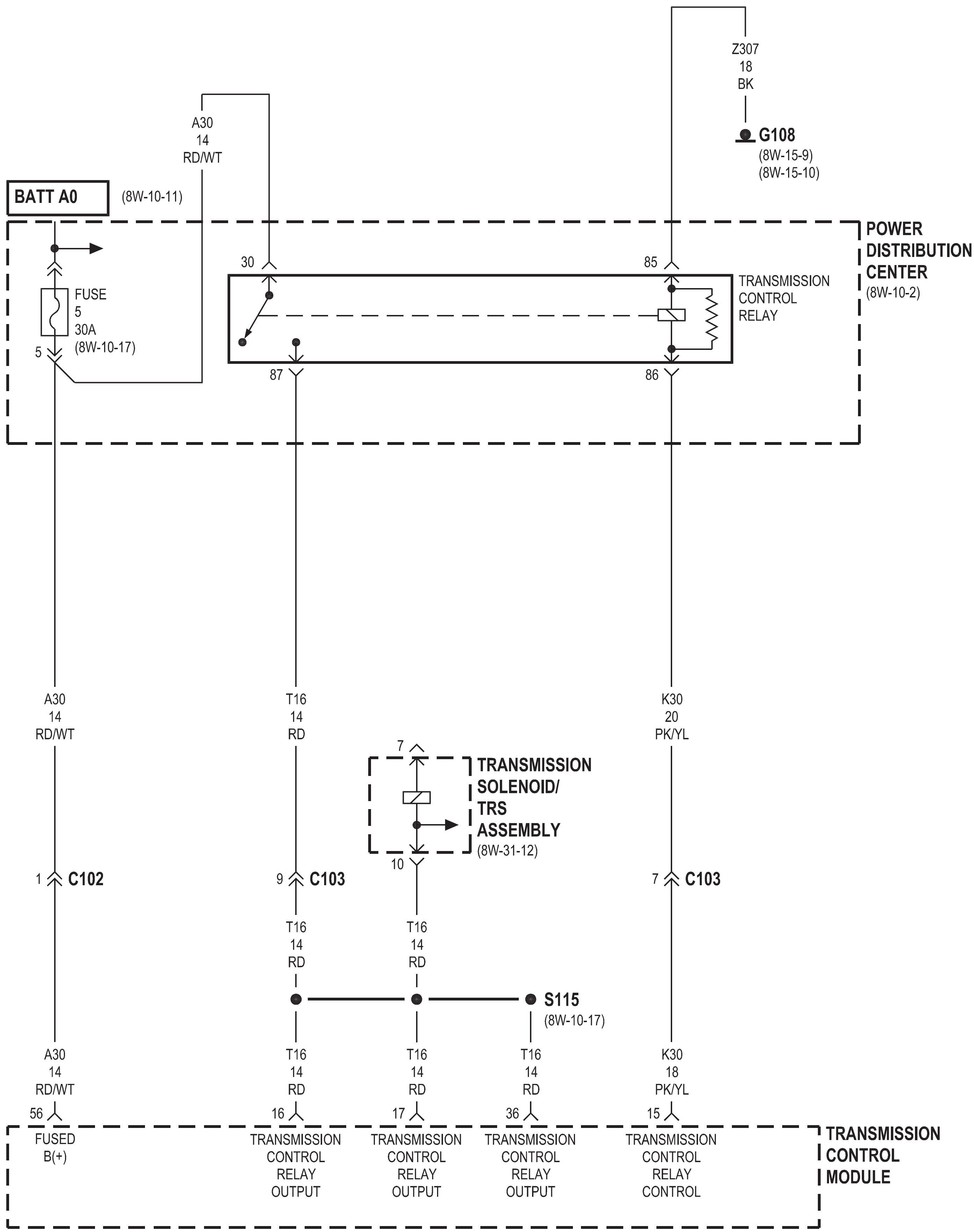

WATER
IN
FUEL
SENSOR
3
2
1
F15
20
OR/DG
G123
20
DG/WT
K4
20
BK/LB
K4
20
BK/LB
1
BATTERY
TEMPERATURE
SENSOR
S131
(8W-70-6)
(8W-70-7)
2
K4
20
BK/LB
K25
18
VT/LG
FROM
C103
(8W-30-41)
E
F15
20
DB/WT
S168
(8W-10-26)
10
7
C103
F15
18
RD/DG
1
EGR
SOLENOID
K4
16
BK/LB
K25
18
VT/DG
S145
(8W-70-6)
2
K4
18
BK/LB
K35
20
GY/YL
89 C1
94 C2
58 C1
21 C1
32 C1
EGR
SOLENOID
CONTROL
WATER
IN
FUEL
SENSOR
SIGNAL
SENSOR
GROUND
SENSOR
GROUND
BATTERY
TEMPERATURE
SENSOR
SIGNAL
ENGINE
CONTROL
MODULE

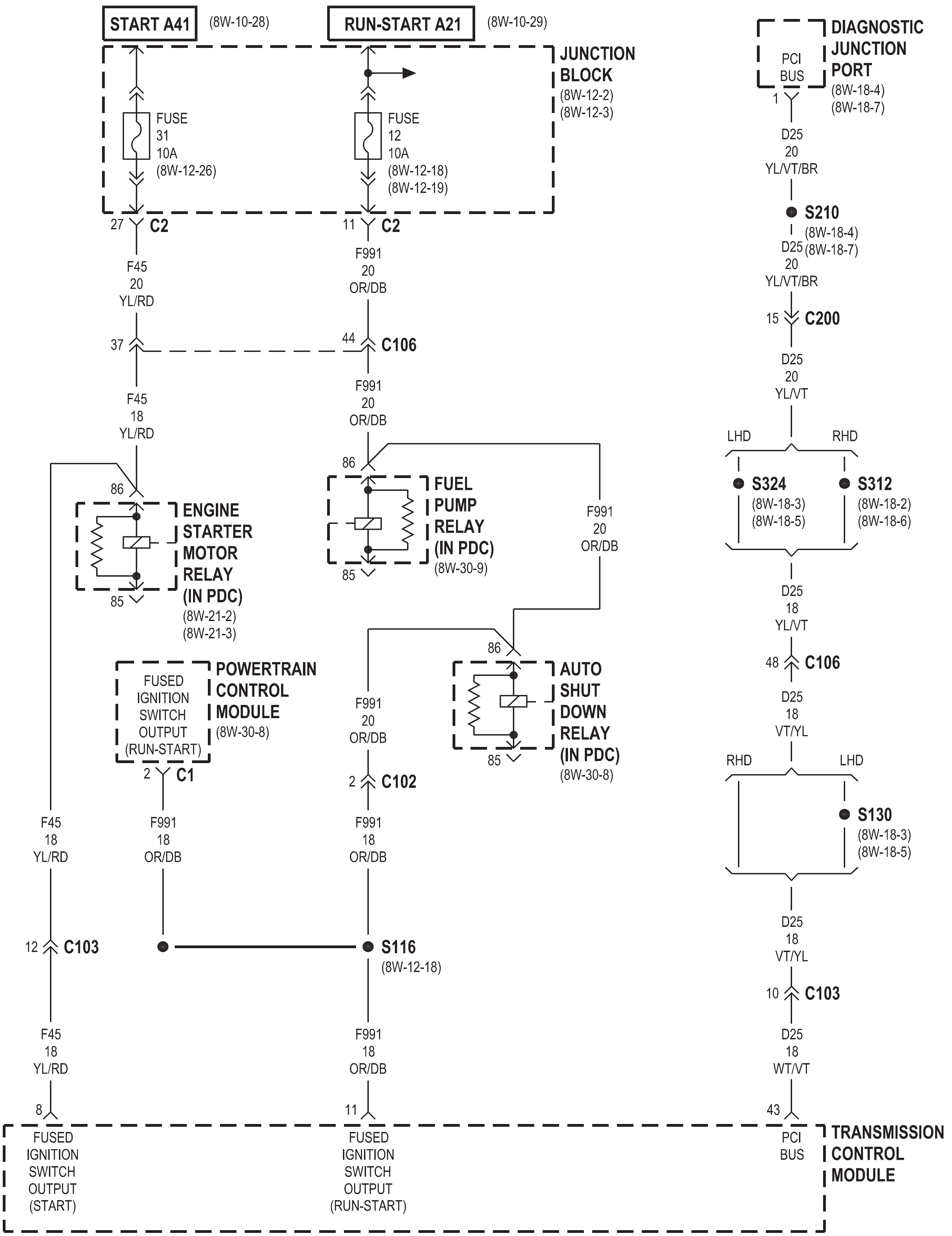

2
SENSOR GROUND
TRANSFER CASE POSITION SENSOR SIGNAL
1
TRANSFER CASE POSITION SENSOR
(8W-31-16)
6
2
BRAKE LAMP SWITCH
(8W-33-2)
5
1
LHD
RHD
L50 20 VT/TN
L50 20 WT/TN
K29 18 WT/PK
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
(8W-35-5)
VEHICLE SPEED SENSOR SIGNAL
PRIMARY BRAKE SWITCH SIGNAL
13
18
S313
(8W-51-5)
(8W-51-6)
S314
(8W-33-2)
L50 18 WT/TN
K29 18 WT/PK
34
40
C107
B22 18 DG/YL
L50 18 WT/TN
L50 18 WT/TN
S147
K4 20 BK/LB
K77 20 BR/WT
L50 18 WT/TN
K29 18 WT/PK
6
C102
13
14
C102
S145
(8W-70-6)
B22 20 DG/YL
L50 20 WT/DB
K29 20 WT/PK
K4 18 BK/LB
21 C1
29 C1
55 C1
47 C1
48 C1
SENSOR GROUND
TRANSFER CASE POSITION SENSOR SIGNAL
VEHICLE SPEED SENSOR SIGNAL
PRIMARY BRAKE SWITCH SIGNAL
SECONDARY BRAKE SWITCH SIGNAL
ENGINE CONTROL MODULE

8W-31 TRANSMISSION CONTROL SYSTEM

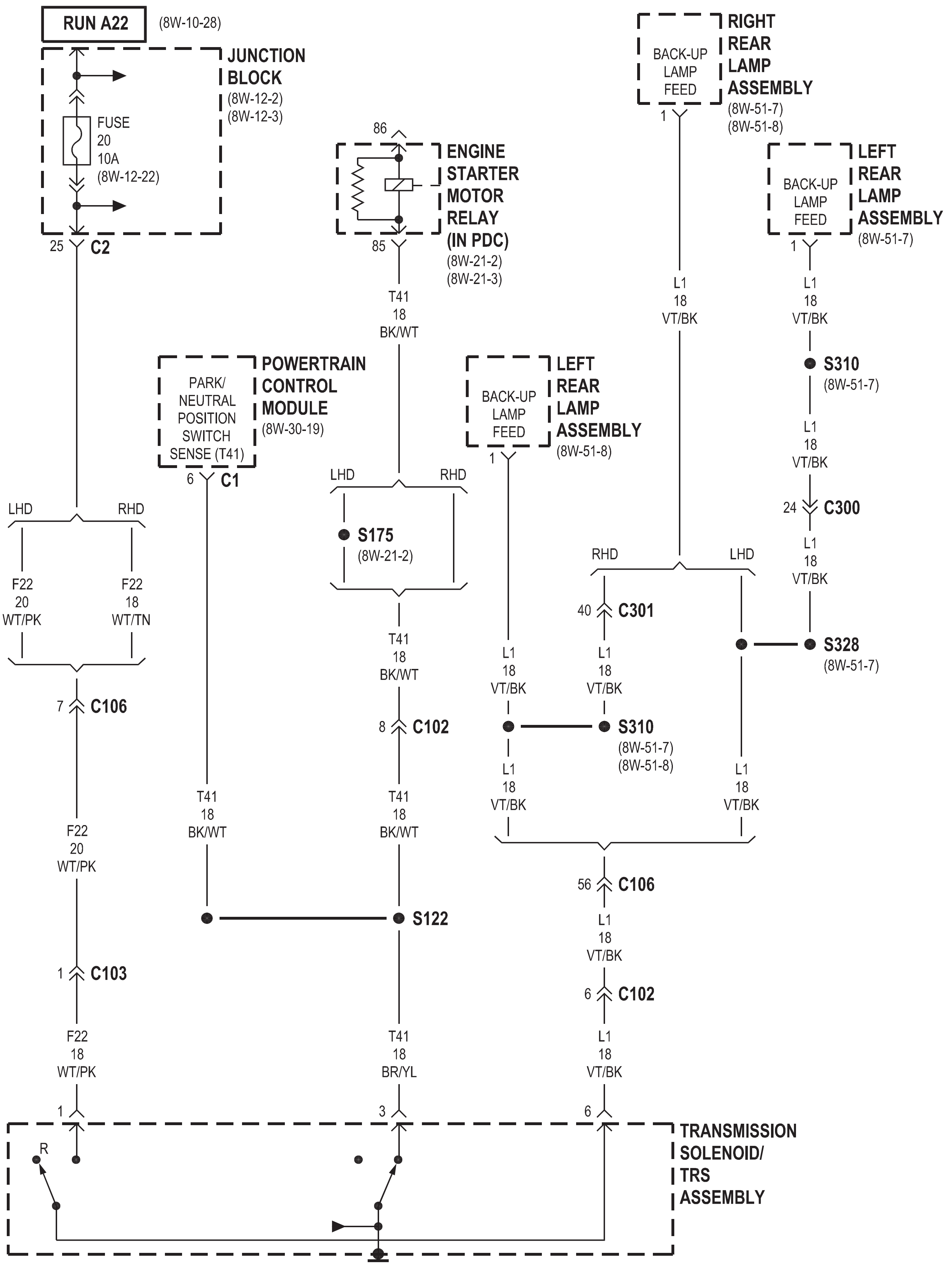
4.0L GAS


POWERTRAIN CONTROL MODULE
GENERATOR SOURCE
(8W-30-23)
25 C3
K125 18 WT/DB
RHD
LHD
41 C107
21 C106
K125 18 WT/DB
GENERATOR
(8W-20-2)
(8W-20-3)
2
1
K125 18 VT/DB
2 C100
K125 18 VT/DB
S126
(8W-30-23)
K125 20 WT/DB
A30 14 RD/WT
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 5 30A (8W-10-17)
5
30
85
87
86
TRANSMISSION CONTROL RELAY
T16 14RD
40
FUSE 28 15A (8W-10-17)
41
T15 18 YL/BR
T16 14 RD
K30 20 PK/YL
12
9 C103
NOT USED
7 C103
T15 18 LG
K30 18 PK/YL
1
TRANSMISSION SOLENOID
(8W-31-8)
5
30 C2
TRANSMISSION CONTROL RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-23)

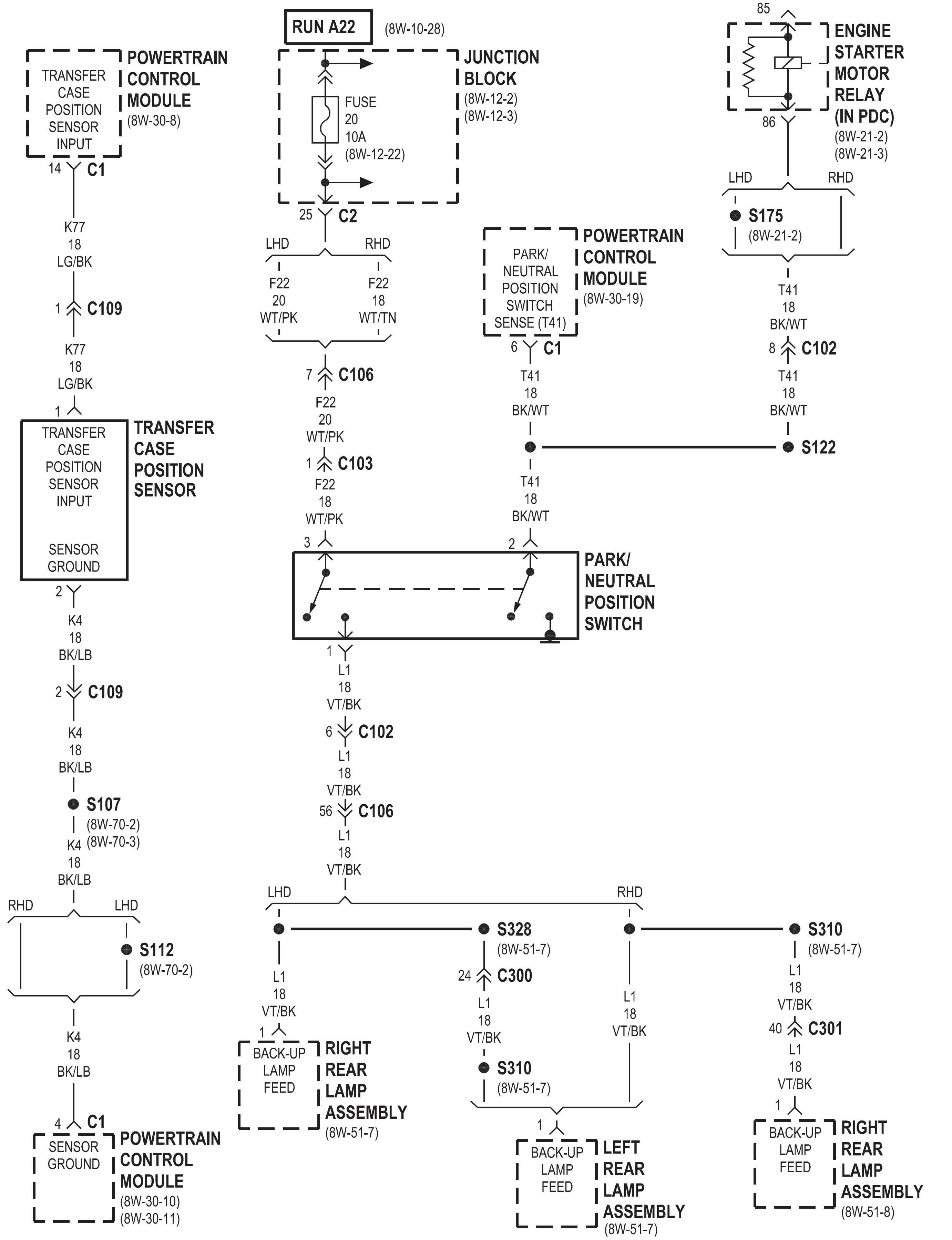

Z307
18
BK
G108
(8W-15-9)
(8W-15-10)
A30
14
RD/WT
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
85
FUSE
5
30A
(8W-10-17)
5
TRANSMISSION CONTROL RELAY
87
86
A30
14
RD/WT
T16
14
RD
K30
20
PK/YL
7
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-12)
10
1 C102
9 C103
7 C103
T16
14
RD
T16
14
RD
S115
(8W-10-17)
A30
14
RD/WT
T16
14
RD
T16
14
RD
T16
14
RD
K30
18
PK/YL
56
16
17
36
15
FUSED B(+)
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY CONTROL
TRANSMISSION CONTROL MODULE

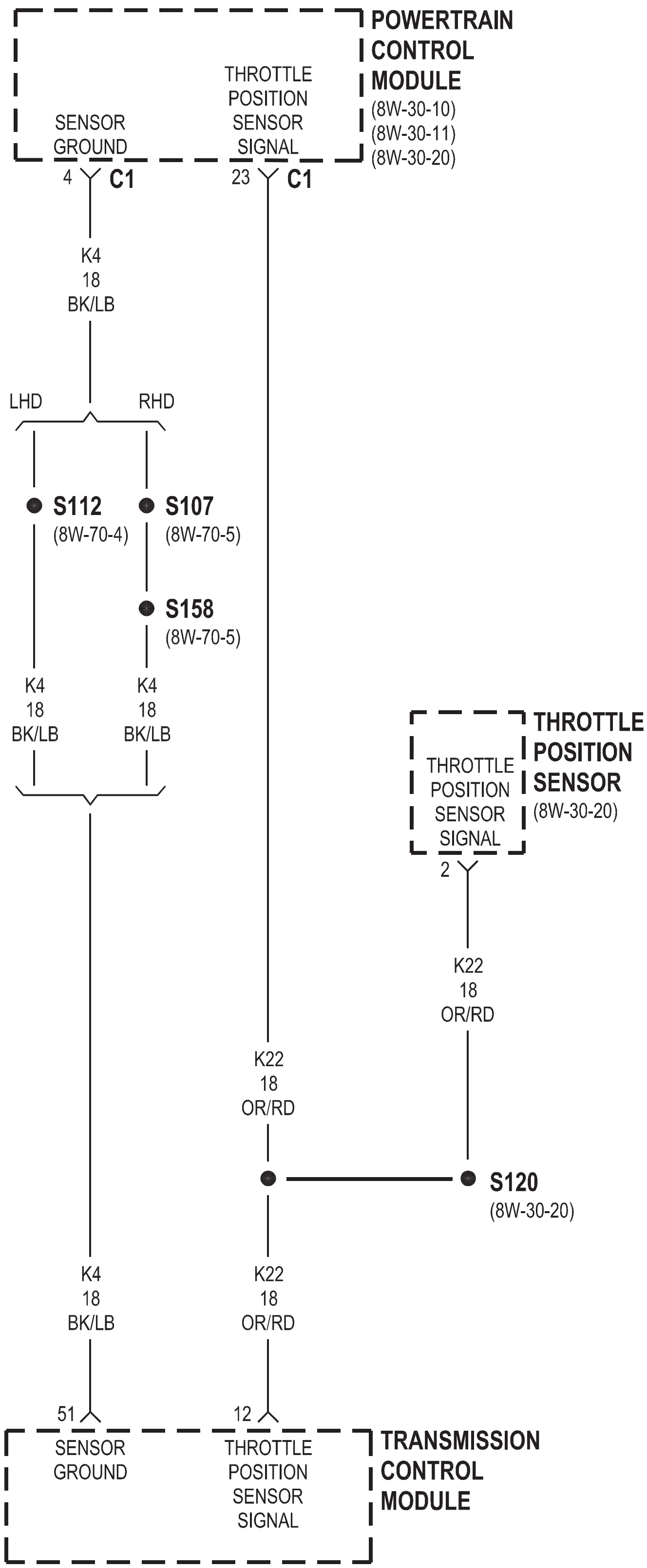

START A41
(8W-10-28)
RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 31 10A
(8W-12-26)
FUSE 12 10A
(8W-12-18)
(8W-12-19)
27 C2
11 C2
F45 20 YL/RD
F991 20 OR/DB
37
44 C106
F45 18 YL/RD
F991 20 OR/DB
86
85
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
FUEL PUMP RELAY (IN PDC)
(8W-30-9)
F991 20 OR/DB
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-8)
POWERTRAIN CONTROL MODULE
(8W-30-8)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
2 C1
2 C102
F45 18 YL/RD
F991 18 OR/DB
12 C103
S116
(8W-12-18)
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
PCI BUS
1
D25 20 YL/VT/BR
S210
(8W-18-4)
(8W-18-7)
15 C200
D25 20 YL/VT
LHD
RHD
S324
(8W-18-3)
(8W-18-5)
S312
(8W-18-2)
(8W-18-6)
D25 18 YL/VT
48 C106
D25 18 VT/YL
S130
(8W-18-3)
(8W-18-5)
10 C103
D25 18 WT/VT
8
11
43
TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (START)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PCI BUS

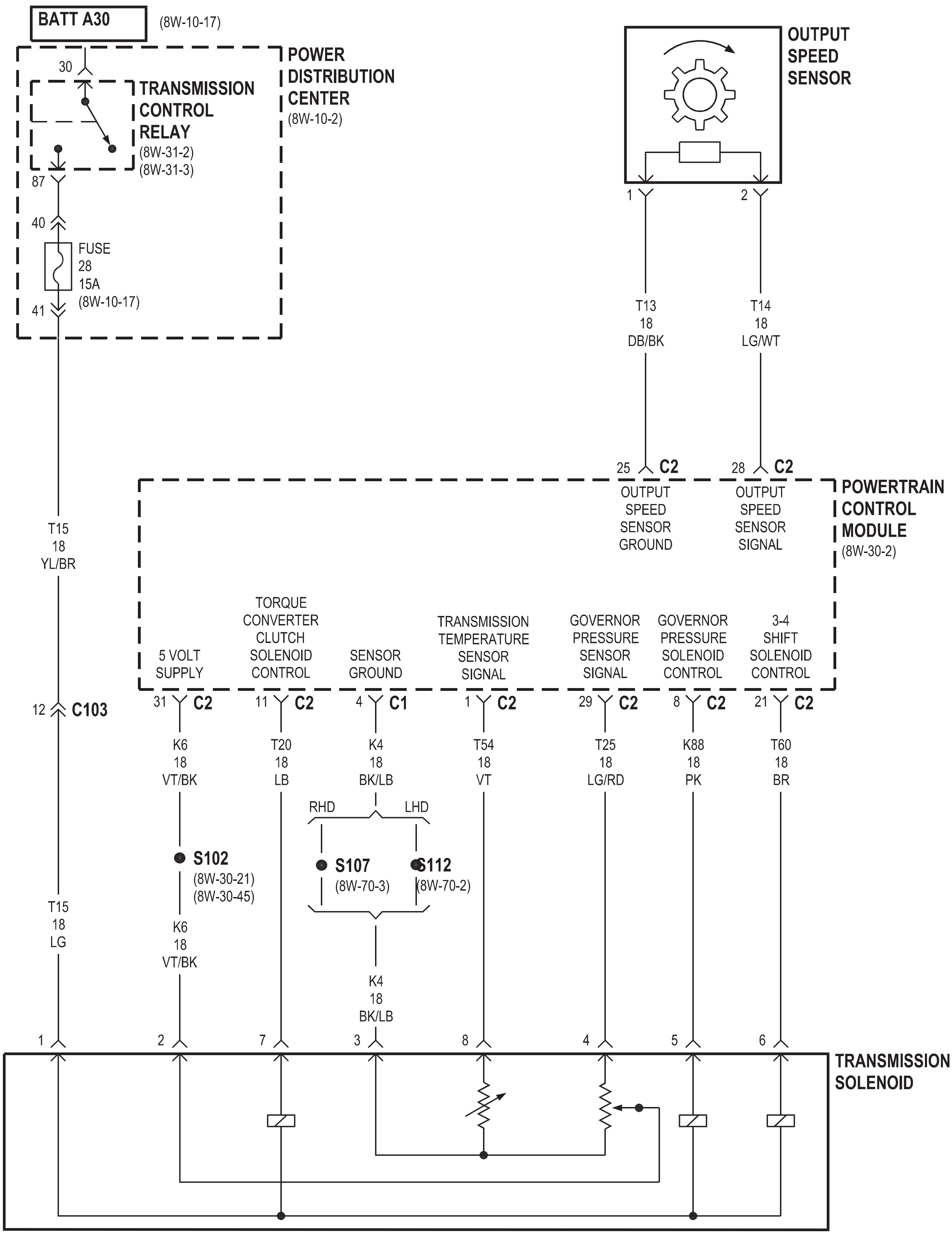
4.7L

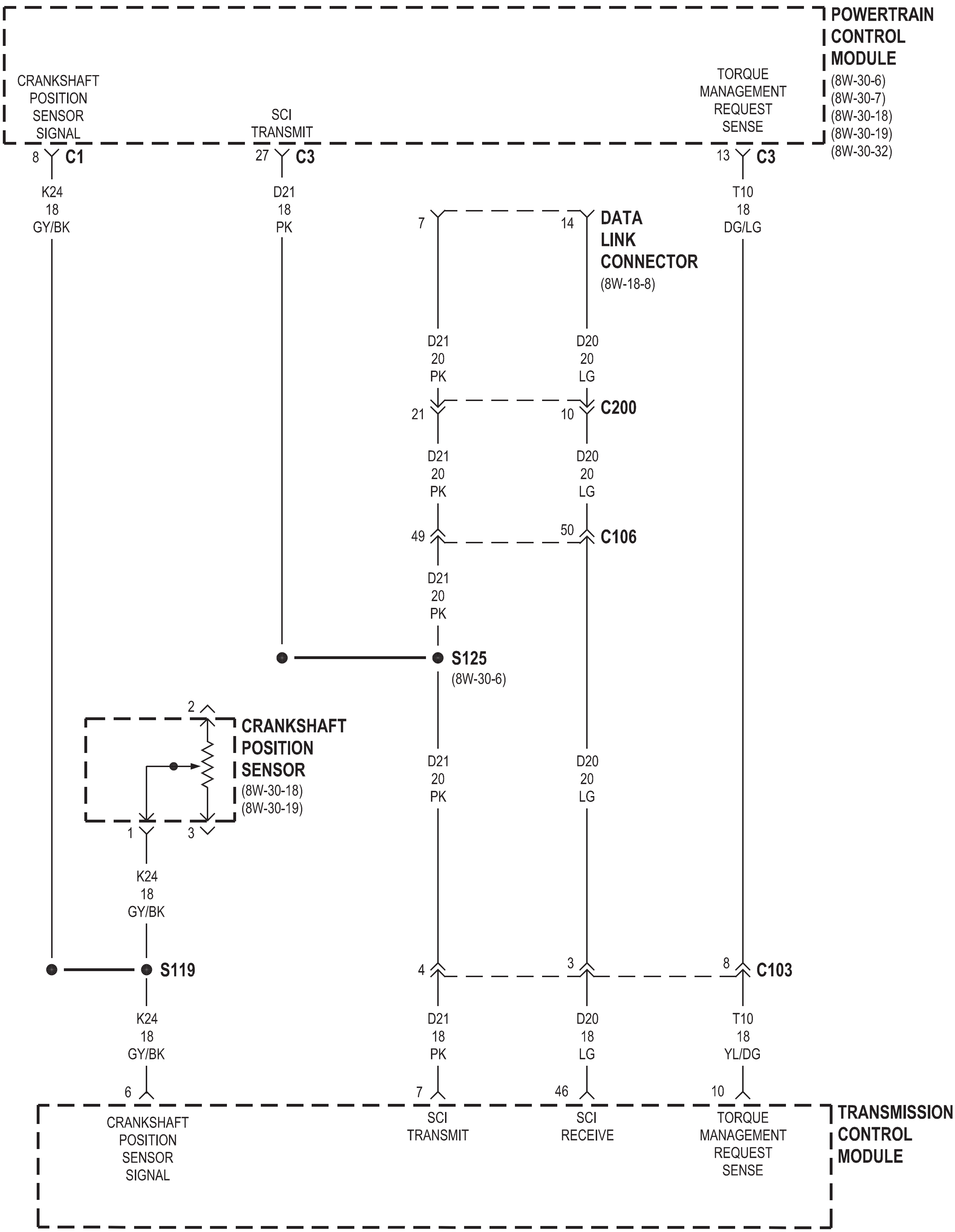

RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 20 10A (8W-12-22)
25 C2
86
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
85
T41 18 BK/WT
RIGHT REAR LAMP ASSEMBLY
BACK-UP LAMP FEED
(8W-51-7)
(8W-51-8)
LEFT REAR LAMP ASSEMBLY
BACK-UP LAMP FEED
(8W-51-7)
L1 18 VT/BK
S310
(8W-51-7)
24 C300
POWERTRAIN CONTROL MODULE
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
(8W-30-19)
6 C1
LEFT REAR LAMP ASSEMBLY
BACK-UP LAMP FEED
(8W-51-8)
LHD
RHD
F22 20 WT/PK
F22 18 WT/TN
S175
(8W-21-2)
40 C301
S328
(8W-51-7)
7 C106
8 C102
S310
(8W-51-7)
(8W-51-8)
T41 18 BK/WT
56 C106
S122
1 C103
6 C102
F22 18 WT/PK
T41 18 BR/YL
TRANSMISSION SOLENOID/ TRS ASSEMBLY
R

4.0L

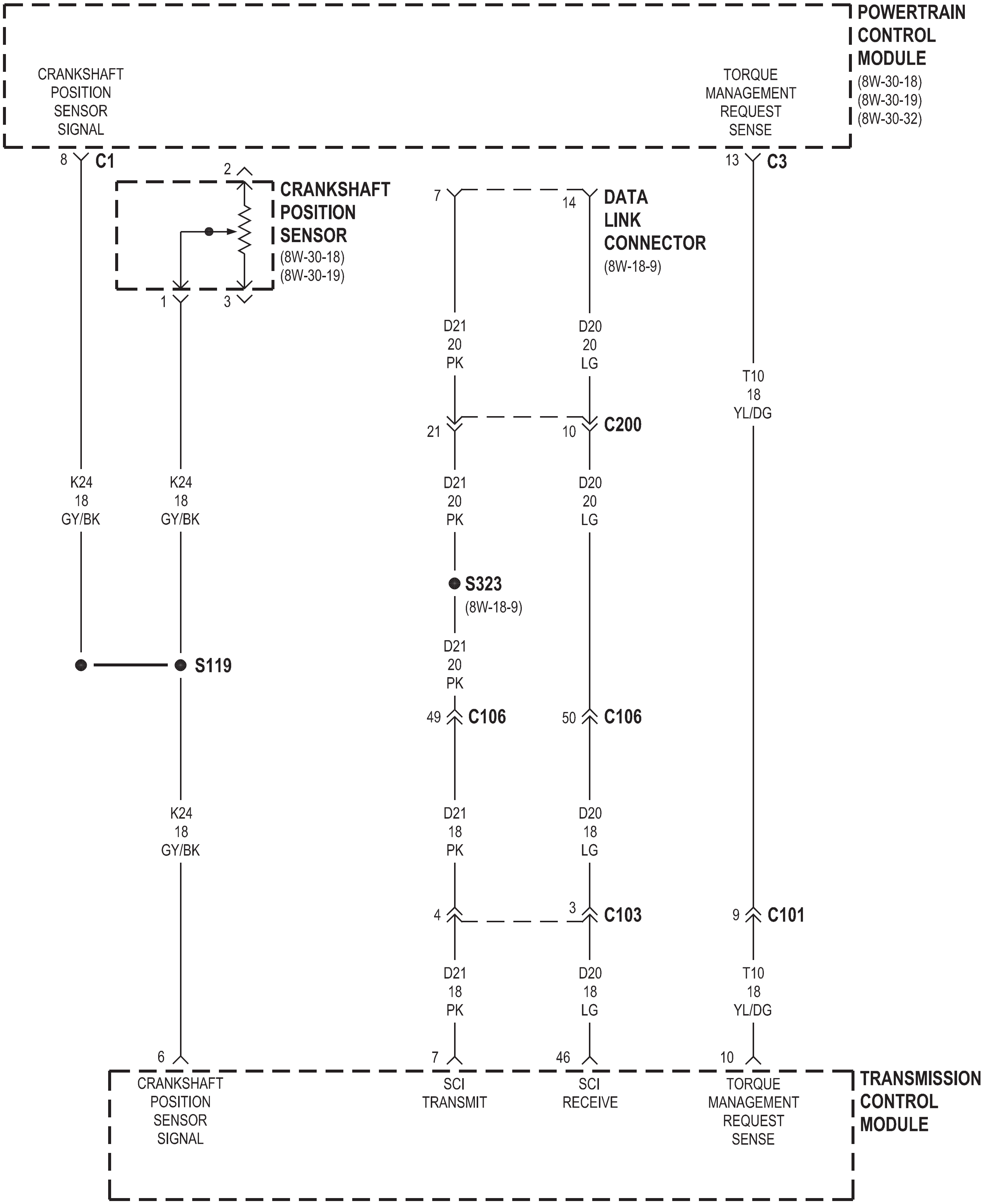

RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
25 C2
LHD RHD
F22 20 WT/PK
F22 18 WT/TN
7 C106
F22 20 WT/PK
1 C103
F22 18 WT/PK
POWERTRAIN CONTROL MODULE
TRANSFER CASE POSITION SENSOR INPUT
(8W-30-8)
14 C1
K77 18 LG/BK
1 C109
K77 18 LG/BK
TRANSFER CASE POSITION SENSOR
TRANSFER CASE POSITION SENSOR INPUT
SENSOR GROUND
2
K4 18 BK/LB
2 C109
K4 18 BK/LB
S107
(8W-70-2)
(8W-70-3)
K4 18 BK/LB
RHD LHD
S112
(8W-70-2)
K4 18 BK/LB
4 C1
SENSOR GROUND
POWERTRAIN CONTROL MODULE
(8W-30-10)
(8W-30-11)
85
ENGINE STARTER MOTOR RELAY (IN PDC)
86
(8W-21-2)
(8W-21-3)
LHD RHD
S175
(8W-21-2)
T41 18 BK/WT
8 C102
T41 18 BK/WT
S122
POWERTRAIN CONTROL MODULE
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
(8W-30-19)
6 C1
T41 18 BK/WT
T41 18 BK/WT
3
2
PARK/ NEUTRAL POSITION SWITCH
1
L1 18 VT/BK
6 C102
L1 18 VT/BK
56 C106
L1 18 VT/BK
LHD RHD
S328
(8W-51-7)
S310
(8W-51-7)
L1 18 VT/BK
1
BACK-UP LAMP FEED
RIGHT REAR LAMP ASSEMBLY
(8W-51-7)
24 C300
L1 18 VT/BK
S310
(8W-51-7)
L1 18 VT/BK
1
BACK-UP LAMP FEED
LEFT REAR LAMP ASSEMBLY
(8W-51-7)
L1 18 VT/BK
40 C301
L1 18 VT/BK
1
BACK-UP LAMP FEED
RIGHT REAR LAMP ASSEMBLY
(8W-51-8)


POWERTRAIN CONTROL MODULE
(8W-30-10)
(8W-30-11)
(8W-30-20)
SENSOR GROUND
THROTTLE POSITION SENSOR SIGNAL
4 C1
23 C1
K4
18
BK/LB
LHD
RHD
S112
(8W-70-4)
S107
(8W-70-5)
S158
(8W-70-5)
K4
18
BK/LB
K4
18
BK/LB
THROTTLE POSITION SENSOR
(8W-30-20)
THROTTLE POSITION SENSOR SIGNAL
2
K22
18
OR/RD
K22
18
OR/RD
S120
(8W-30-20)
K4
18
BK/LB
K22
18
OR/RD
51
12
SENSOR GROUND
THROTTLE POSITION SENSOR SIGNAL
TRANSMISSION CONTROL MODULE

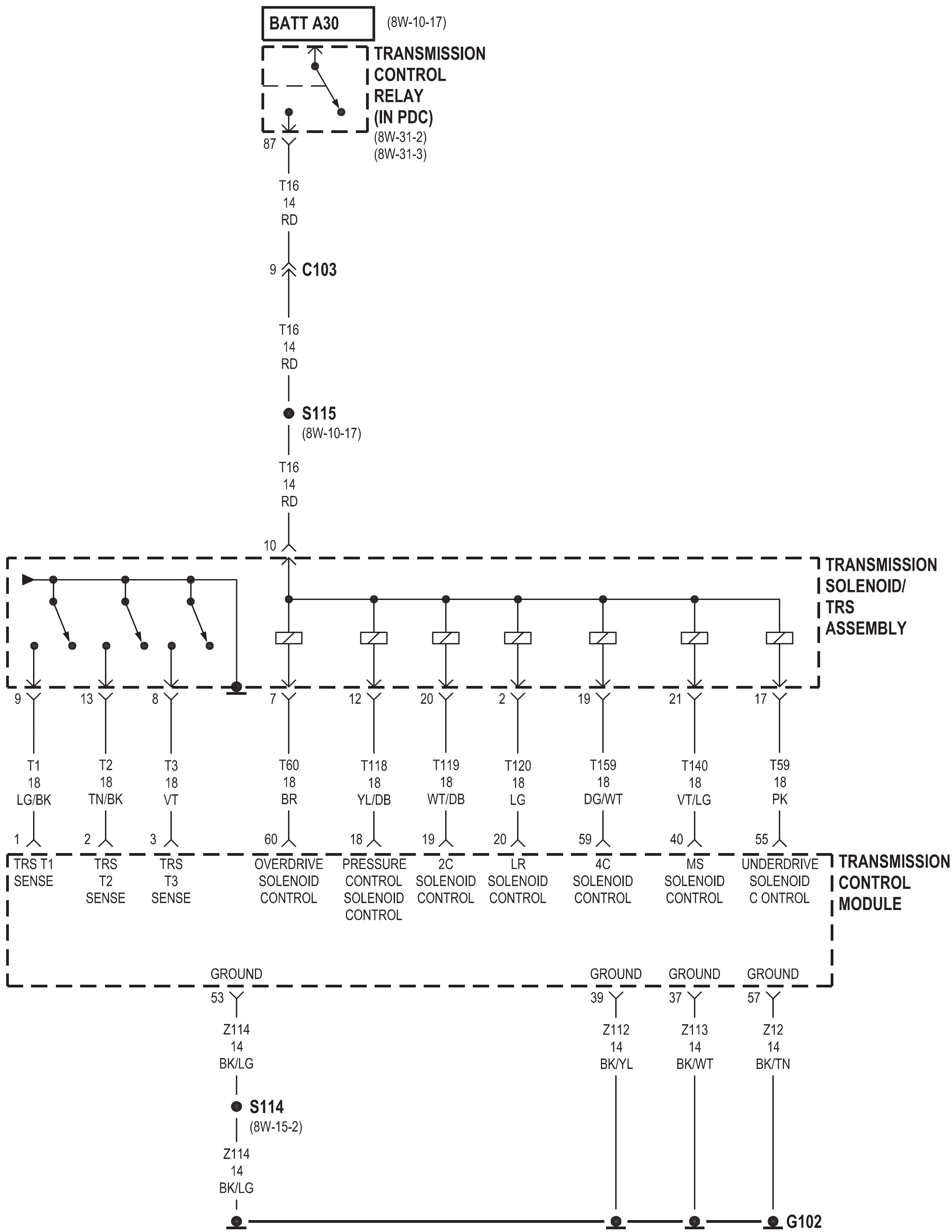

BATT A30
(8W-10-17)
30
POWER
DISTRIBUTION
CENTER
(8W-10-2)
TRANSMISSION
CONTROL
RELAY
(8W-31-2)
(8W-31-3)
87
40
FUSE
28
15A
(8W-10-17)
41
OUTPUT
SPEED
SENSOR
1
2
T13
18
DB/BK
T14
18
LG/WT
25 C2
28 C2
OUTPUT
SPEED
SENSOR
GROUND
OUTPUT
SPEED
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE
(8W-30-2)
T15
18
YL/BR
5 VOLT
SUPPLY
TORQUE
CONVERTER
CLUTCH
SOLENOID
CONTROL
SENSOR
GROUND
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
GOVERNOR
PRESSURE
SENSOR
SIGNAL
GOVERNOR
PRESSURE
SOLENOID
CONTROL
3-4
SHIFT
SOLENOID
CONTROL
12 C103
31 C2
11 C2
4 C1
1 C2
29 C2
8 C2
21 C2
K6
18
VT/BK
T20
18
LB
K4
18
BK/LB
T54
18
VT
T25
18
LG/RD
K88
18
PK
T60
18
BR
RHD
LHD
S102
(8W-30-21)
(8W-30-45)
S107
(8W-70-3)
S112
(8W-70-2)
T15
18
LG
K6
18
VT/BK
K4
18
BK/LB
1
2
7
3
8
4
5
6
TRANSMISSION
SOLENOID


POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)
(8W-30-18)
(8W-30-19)
(8W-30-32)
CRANKSHAFT POSITION SENSOR SIGNAL
SCI TRANSMIT
TORQUE MANAGEMENT REQUEST SENSE
8 C1
27 C3
13 C3
K24 18 GY/BK
D21 18 PK
T10 18 DG/LG
7
14
DATA LINK CONNECTOR
(8W-18-8)
D21 20 PK
D20 20 LG
21
10
C200
49
50
C106
S125
(8W-30-6)
CRANKSHAFT POSITION SENSOR
(8W-30-18)
(8W-30-19)
2
1
3
S119
4
3
8
C103
K24 18 GY/BK
D21 18 PK
D20 18 LG
T10 18 YL/DG
6
7
46
10
SCI TRANSMIT
SCI RECEIVE
TRANSMISSION CONTROL MODULE

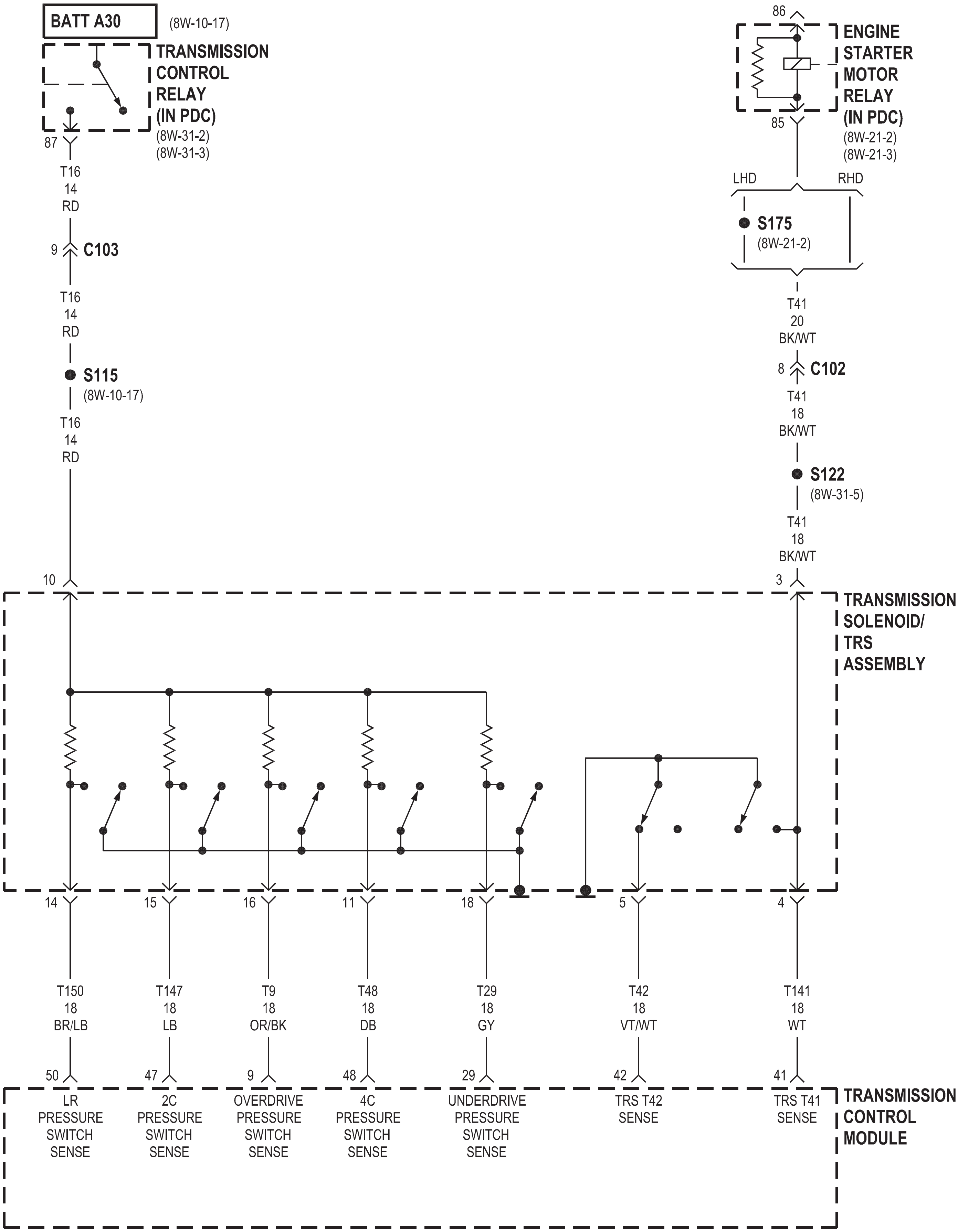
4.7L RHD

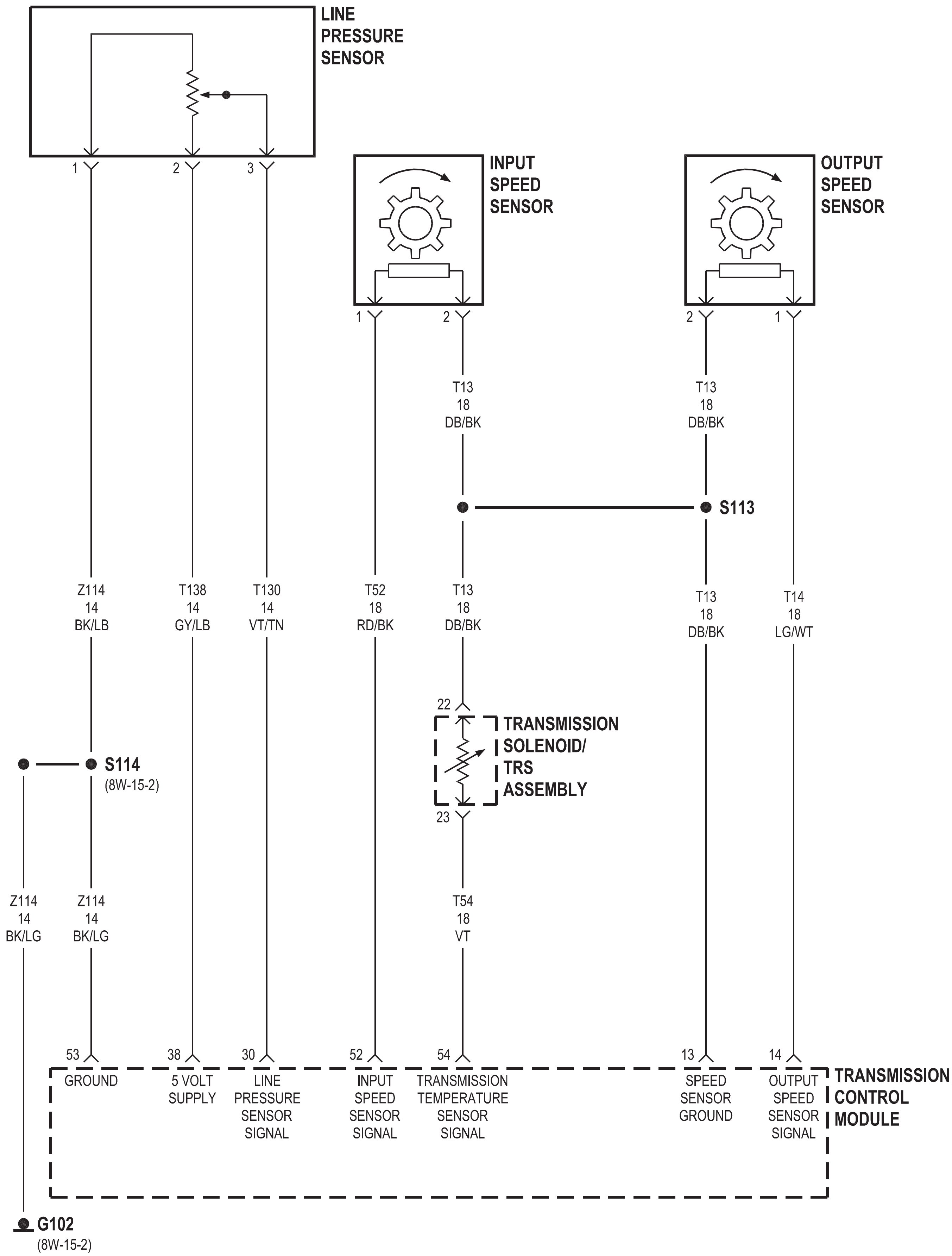

POWERTRAIN CONTROL MODULE
(8W-30-18)
(8W-30-19)
(8W-30-32)
CRANKSHAFT POSITION SENSOR SIGNAL
TORQUE MANAGEMENT REQUEST SENSE
8
C1
13
C3
2
CRANKSHAFT POSITION SENSOR
(8W-30-18)
(8W-30-19)
1
3
7
14
DATA LINK CONNECTOR
(8W-18-9)
D21 20 PK
D20 20 LG
T10 18 YL/DG
21
10
C200
K24 18 GY/BK
K24 18 GY/BK
D21 20 PK
D20 20 LG
S323
(8W-18-9)
S119
D21 20 PK
49
C106
50
C106
K24 18 GY/BK
D21 18 PK
D20 18 LG
4
3
C103
9
C101
D21 18 PK
D20 18 LG
T10 18 YL/DG
6
7
46
10
CRANKSHAFT POSITION SENSOR SIGNAL
SCI TRANSMIT
SCI RECEIVE
TORQUE MANAGEMENT REQUEST SENSE
TRANSMISSION CONTROL MODULE

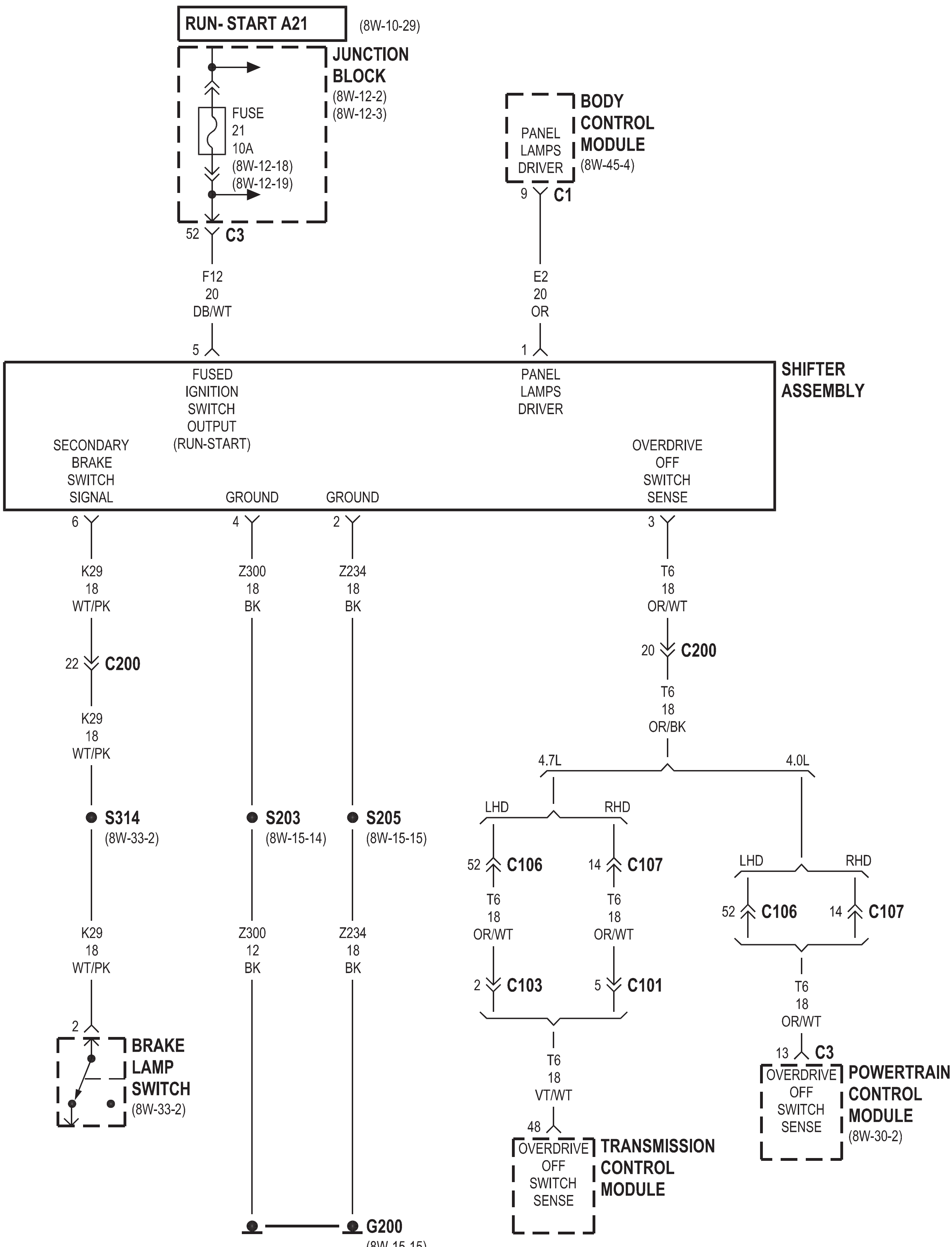
4.7L

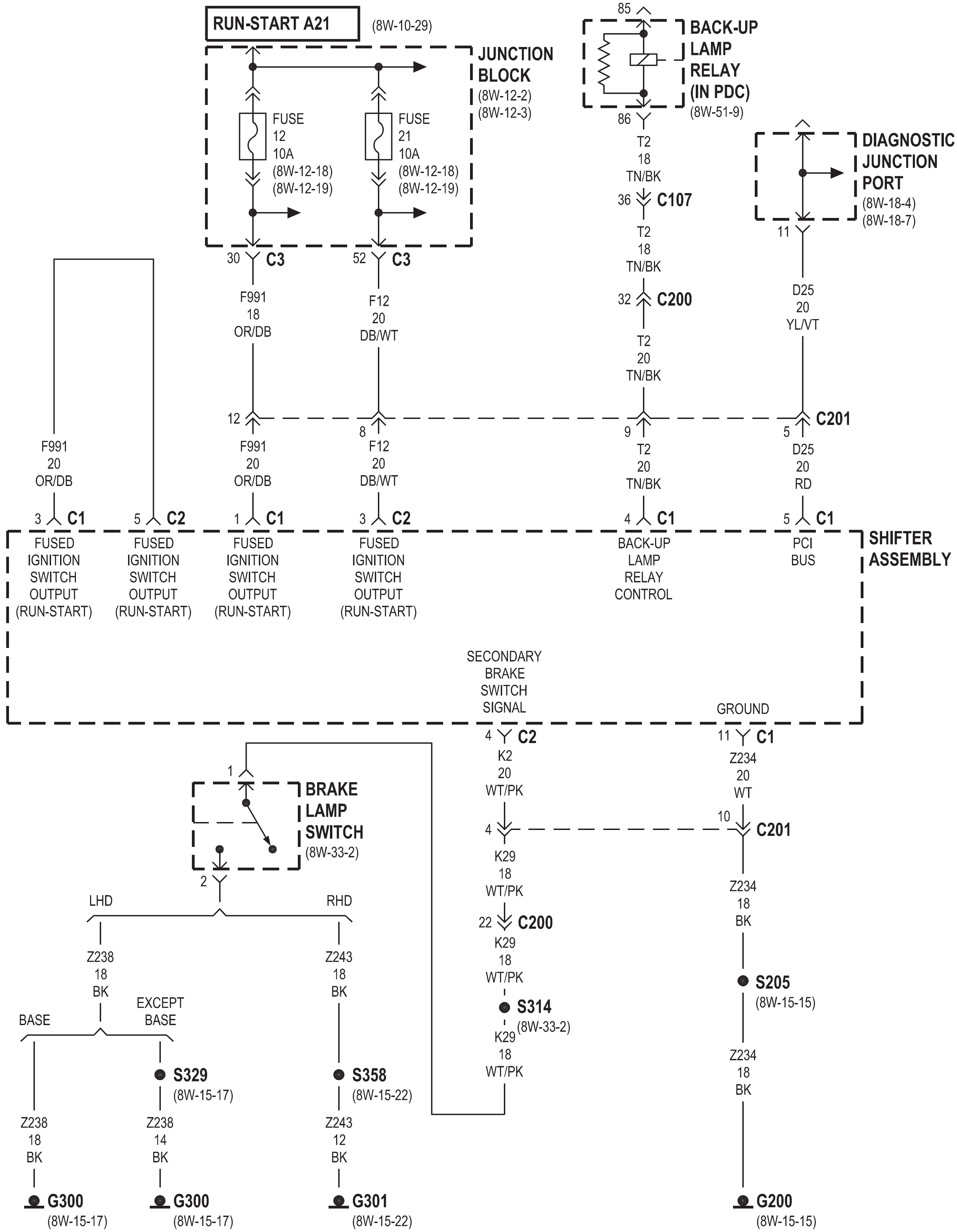

BATT A30
(8W-10-17)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
(8W-31-3)
87
T16 14 RD
9 C103
T16 14 RD
S115
(8W-10-17)
T16 14 RD
10
TRANSMISSION SOLENOID/ TRS ASSEMBLY
9 13 8 7 12 20 2 19 21 17
T1 18 LG/BK
T2 18 TN/BK
T3 18 VT
T60 18 BR
T118 18 YL/DB
T119 18 WT/DB
T120 18 LG
T159 18 DG/WT
T140 18 VT/LG
T59 18 PK
1 2 3 60 18 19 20 59 40 55
TRS T1 SENSE
TRS T2 SENSE
TRS T3 SENSE
OVERDRIVE SOLENOID CONTROL
PRESSURE CONTROL SOLENOID CONTROL
2C SOLENOID CONTROL
LR SOLENOID CONTROL
4C SOLENOID CONTROL
MS SOLENOID CONTROL
UNDERDRIVE SOLENOID C ONTROL
TRANSMISSION CONTROL MODULE
GROUND
GROUND
GROUND
GROUND
53 39 37 57
Z114 14 BK/LG
Z112 14 BK/YL
Z113 14 BK/WT
Z12 14 BK/TN
S114
(8W-15-2)
Z114 14 BK/LG
G102
(8W-15-2)

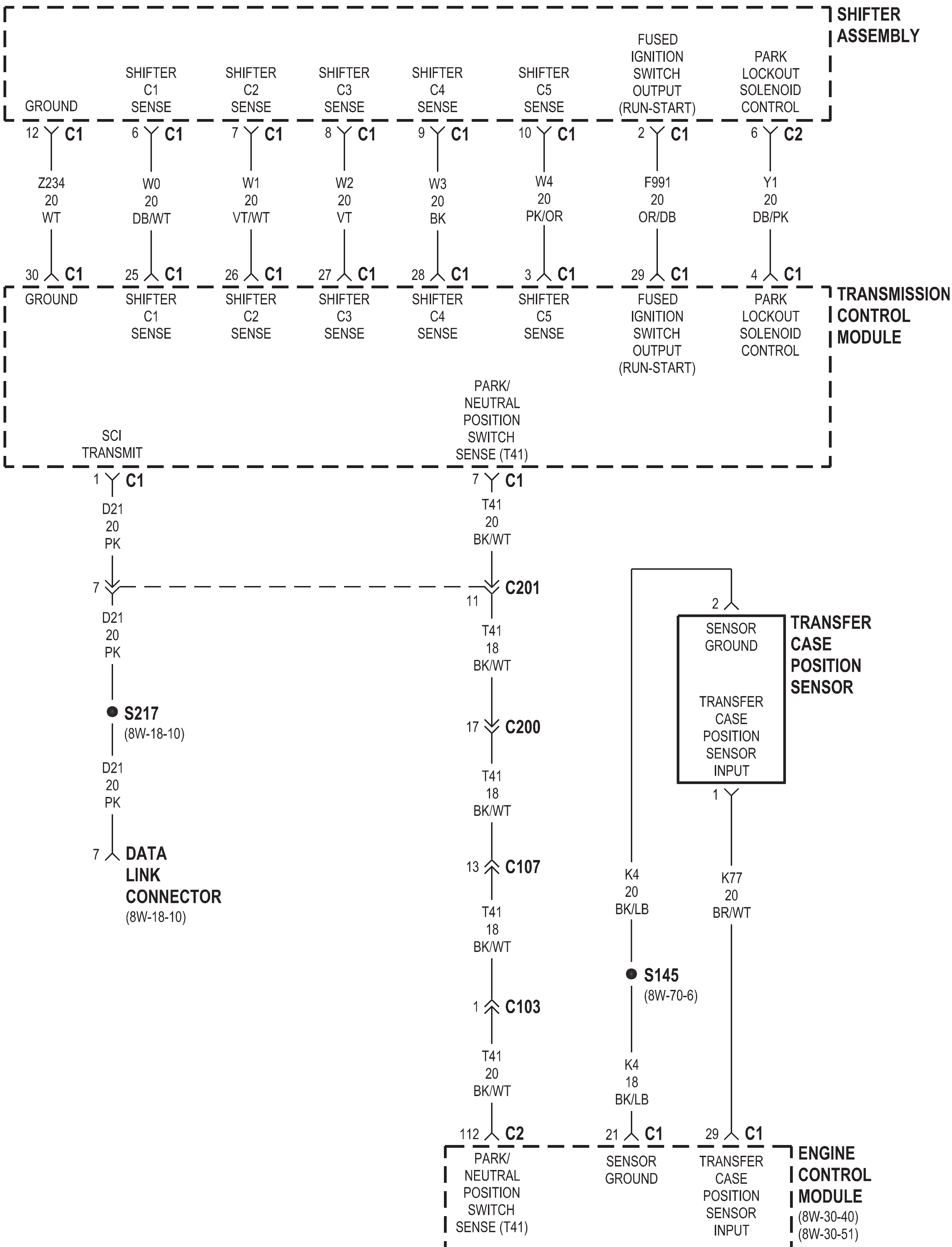
4.7L

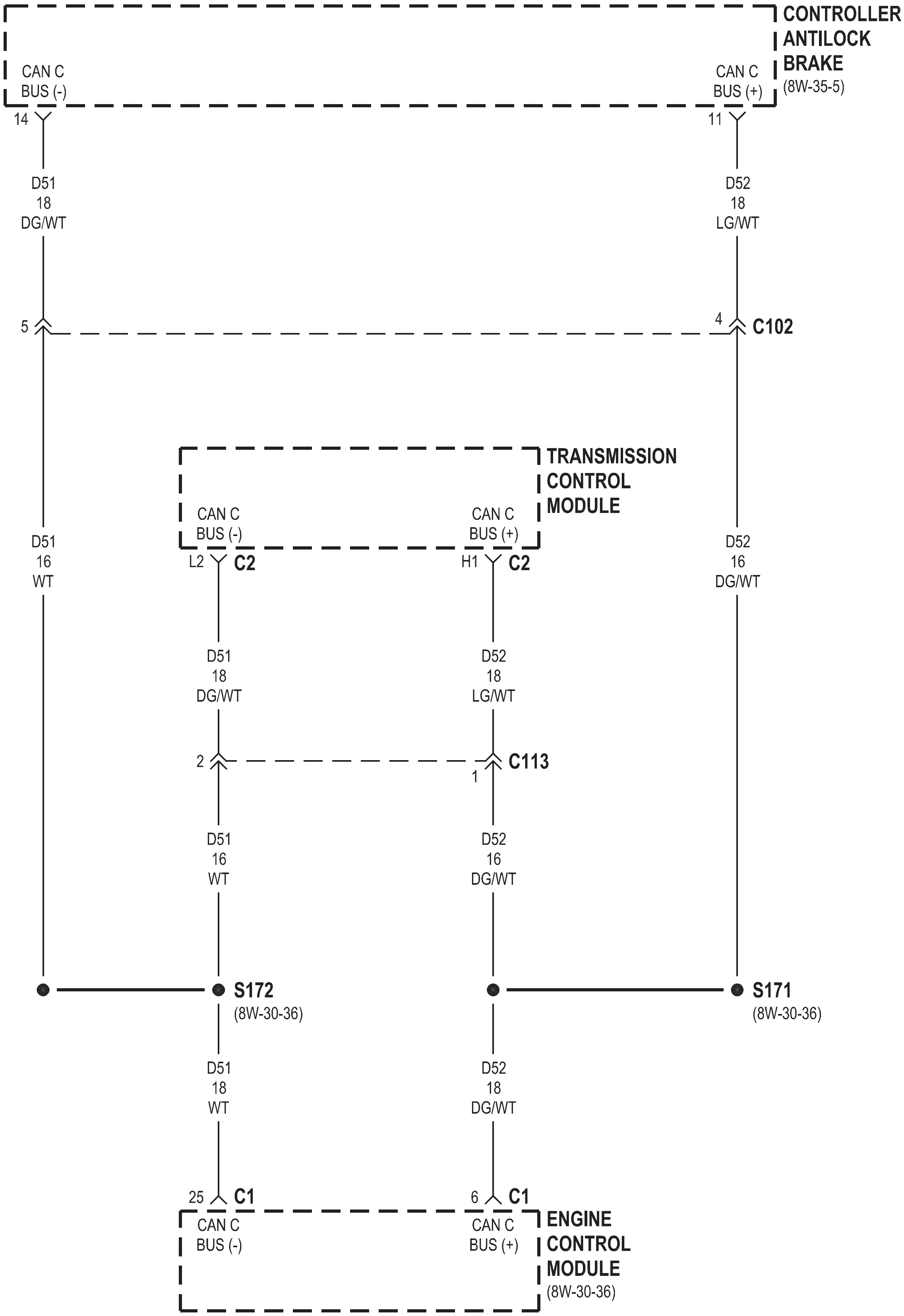

BATT A30
(8W-10-17)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
(8W-31-3)
87
T16
14
RD
9
C103
T16
14
RD
S115
(8W-10-17)
T16
14
RD
10
86
ENGINE STARTER MOTOR RELAY (IN PDC)
85
(8W-21-2)
(8W-21-3)
LHD
RHD
S175
(8W-21-2)
T41
20
BK/WT
8
C102
T41
18
BK/WT
S122
(8W-31-5)
T41
18
BK/WT
3
TRANSMISSION SOLENOID/ TRS ASSEMBLY
14
15
16
11
18
5
4
T150
18
BR/LB
T147
18
LB
T9
18
OR/BK
T48
18
DB
T29
18
GY
T42
18
VT/WT
T141
18
WT
50
47
9
48
29
42
41
LR PRESSURE SWITCH SENSE
2C PRESSURE SWITCH SENSE
OVERDRIVE PRESSURE SWITCH SENSE
4C PRESSURE SWITCH SENSE
UNDERDRIVE PRESSURE SWITCH SENSE
TRS T42 SENSE
TRS T41 SENSE
TRANSMISSION CONTROL MODULE

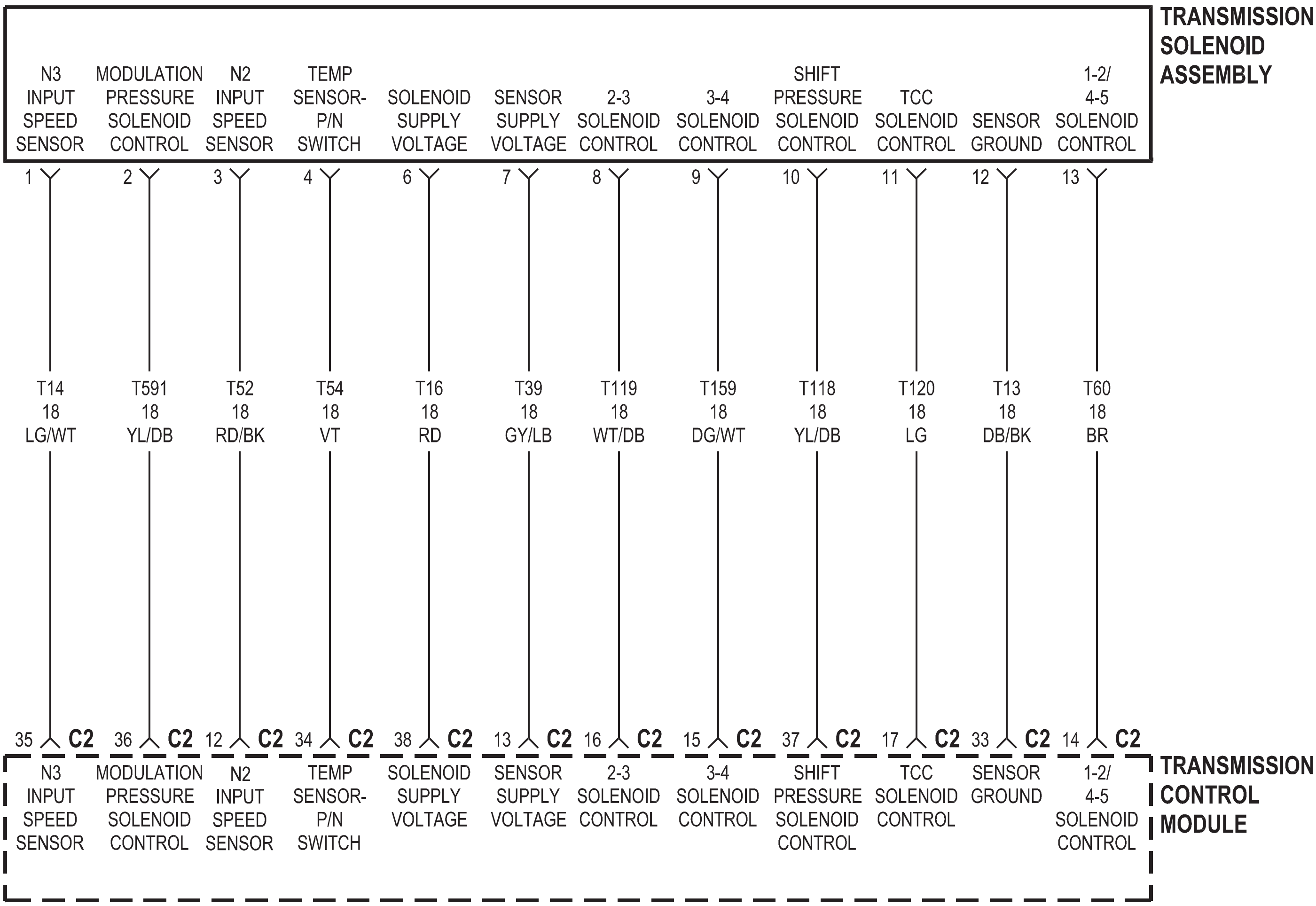

LINE PRESSURE SENSOR
1
2
3
INPUT SPEED SENSOR
1
2
OUTPUT SPEED SENSOR
2
1
T13
18
DB/BK
T13
18
DB/BK
S113
Z114
14
BK/LB
T138
14
GY/LB
T130
14
VT/TN
T52
18
RD/BK
T13
18
DB/BK
T13
18
DB/BK
T14
18
LG/WT
22
TRANSMISSION SOLENOID/ TRS ASSEMBLY
23
S114
(8W-15-2)
Z114
14
BK/LG
Z114
14
BK/LG
T54
18
VT
53
38
30
52
54
13
14
GROUND
5 VOLT SUPPLY
LINE PRESSURE SENSOR SIGNAL
INPUT SPEED SENSOR SIGNAL
TRANSMISSION TEMPERATURE SENSOR SIGNAL
SPEED SENSOR GROUND
OUTPUT SPEED SENSOR SIGNAL
TRANSMISSION CONTROL MODULE
G102
(8W-15-2)


RUN- START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
21
10A
(8W-12-18)
(8W-12-19)
52 C3
F12
20
DB/WT
BODY CONTROL MODULE
(8W-45-4)
PANEL LAMPS DRIVER
9 C1
E2
20
OR
5
1
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PANEL LAMPS DRIVER
SHIFTER ASSEMBLY
SECONDARY BRAKE SWITCH SIGNAL
GROUND
GROUND
OVERDRIVE OFF SWITCH SENSE
6
4
2
3
K29
18
WT/PK
Z300
18
BK
Z234
18
BK
T6
18
OR/WT
22 C200
20 C200
T6
18
OR/BK
4.7L
4.0L
LHD
RHD
S314
(8W-33-2)
S203
(8W-15-14)
S205
(8W-15-15)
52 C106
14 C107
LHD
RHD
52 C106
14 C107
T6
18
OR/WT
K29
18
WT/PK
Z300
12
BK
Z234
18
BK
2 C103
5 C101
T6
18
OR/WT
13 C3
2
BRAKE LAMP SWITCH
(8W-33-2)
T6
18
VT/WT
48
OVERDRIVE OFF SWITCH SENSE
TRANSMISSION CONTROL MODULE
OVERDRIVE OFF SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-2)
G200
(8W-15-15)


RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 10A (8W-12-18) (8W-12-19)
FUSE 21 10A (8W-12-18) (8W-12-19)
30 C3
52 C3
F991 18 OR/DB
F12 20 DB/WT
85
86
BACK-UP LAMP RELAY (IN PDC)
(8W-51-9)
T2 18 TN/BK
36 C107
T2 18 TN/BK
32 C200
T2 20 TN/BK
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
11
D25 20 YL/VT
12
8
9
5 C201
F991 20 OR/DB
F991 20 OR/DB
F12 20 DB/WT
T2 20 TN/BK
D25 20 RD
3 C1
5 C2
1 C1
3 C2
4 C1
5 C1
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
BACK-UP LAMP RELAY CONTROL
PCI BUS
SHIFTER ASSEMBLY
SECONDARY BRAKE SWITCH SIGNAL
GROUND
4 C2
11 C1
K2 20 WT/PK
Z234 20 WT
4
10 C201
K29 18 WT/PK
Z234 18 BK
22 C200
K29 18 WT/PK
S314
(8W-33-2)
K29 18 WT/PK
S205
(8W-15-15)
Z234 18 BK
1
BRAKE LAMP SWITCH
(8W-33-2)
2
LHD
RHD
Z238 18 BK
Z243 18 BK
BASE
EXCEPT BASE
S329
(8W-15-17)
S358
(8W-15-22)
Z238 18 BK
Z238 14 BK
Z243 12 BK
G300
(8W-15-17)
G300
(8W-15-17)
G301
(8W-15-22)
G200
(8W-15-15)

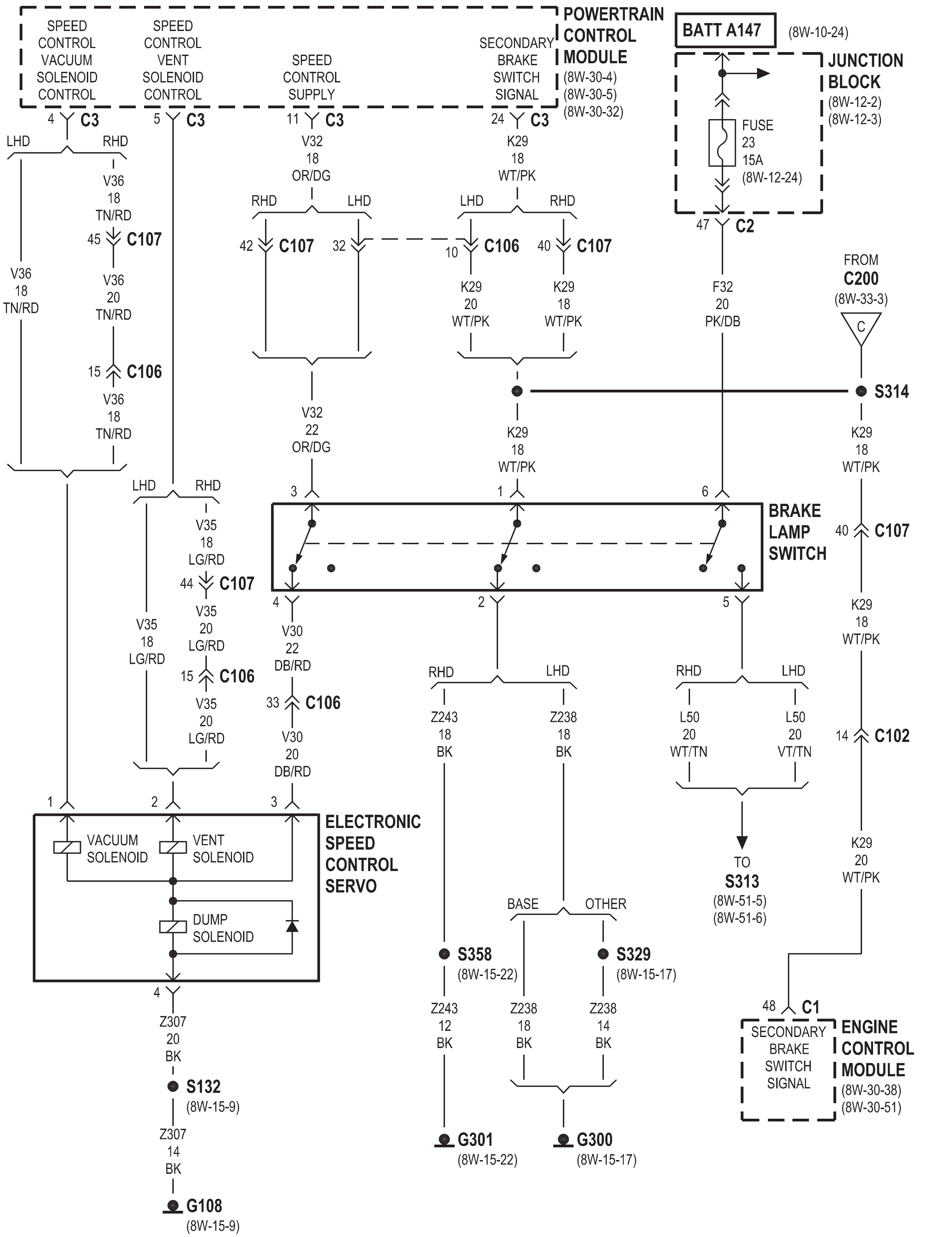

SHIFTER ASSEMBLY
GROUND
SHIFTER C1 SENSE
SHIFTER C2 SENSE
SHIFTER C3 SENSE
SHIFTER C4 SENSE
SHIFTER C5 SENSE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PARK LOCKOUT SOLENOID CONTROL
12 C1
6 C1
7 C1
8 C1
9 C1
10 C1
2 C1
6 C2
Z234 20 WT
W0 20 DB/WT
W1 20 VT/WT
W2 20 VT
W3 20 BK
W4 20 PK/OR
F991 20 OR/DB
Y1 20 DB/PK
30 C1
25 C1
26 C1
27 C1
28 C1
3 C1
29 C1
4 C1
TRANSMISSION CONTROL MODULE
GROUND
SHIFTER C1 SENSE
SHIFTER C2 SENSE
SHIFTER C3 SENSE
SHIFTER C4 SENSE
SHIFTER C5 SENSE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PARK LOCKOUT SOLENOID CONTROL
SCI TRANSMIT
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
1 C1
7 C1
D21 20 PK
T41 20 BK/WT
7
11 C201
D21 20 PK
T41 18 BK/WT
S217 (8W-18-10)
17 C200
D21 20 PK
T41 18 BK/WT
7 DATA LINK CONNECTOR (8W-18-10)
13 C107
T41 18 BK/WT
1 C103
T41 20 BK/WT
2
TRANSFER CASE POSITION SENSOR
SENSOR GROUND
TRANSFER CASE POSITION SENSOR INPUT
1
K4 20 BK/LB
K77 20 BR/WT
S145 (8W-70-6)
K4 18 BK/LB
112 C2
21 C1
29 C1
ENGINE CONTROL MODULE (8W-30-40) (8W-30-51)
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
SENSOR GROUND
TRANSFER CASE POSITION SENSOR INPUT


CONTROLLER ANTILOCK BRAKE
(8W-35-5)
CAN C BUS (-)
CAN C BUS (+)
14
11
D51 18 DG/WT
D52 18 LG/WT
5
4
C102
TRANSMISSION CONTROL MODULE
CAN C BUS (-)
CAN C BUS (+)
L2 C2
H1 C2
D51 16 WT
D52 16 DG/WT
D51 18 DG/WT
D52 18 LG/WT
2
1
C113
D51 16 WT
D52 16 DG/WT
S172
(8W-30-36)
S171
(8W-30-36)
D51 18 WT
D52 18 DG/WT
25 C1
6 C1
CAN C BUS (-)
CAN C BUS (+)
ENGINE CONTROL MODULE
(8W-30-36)

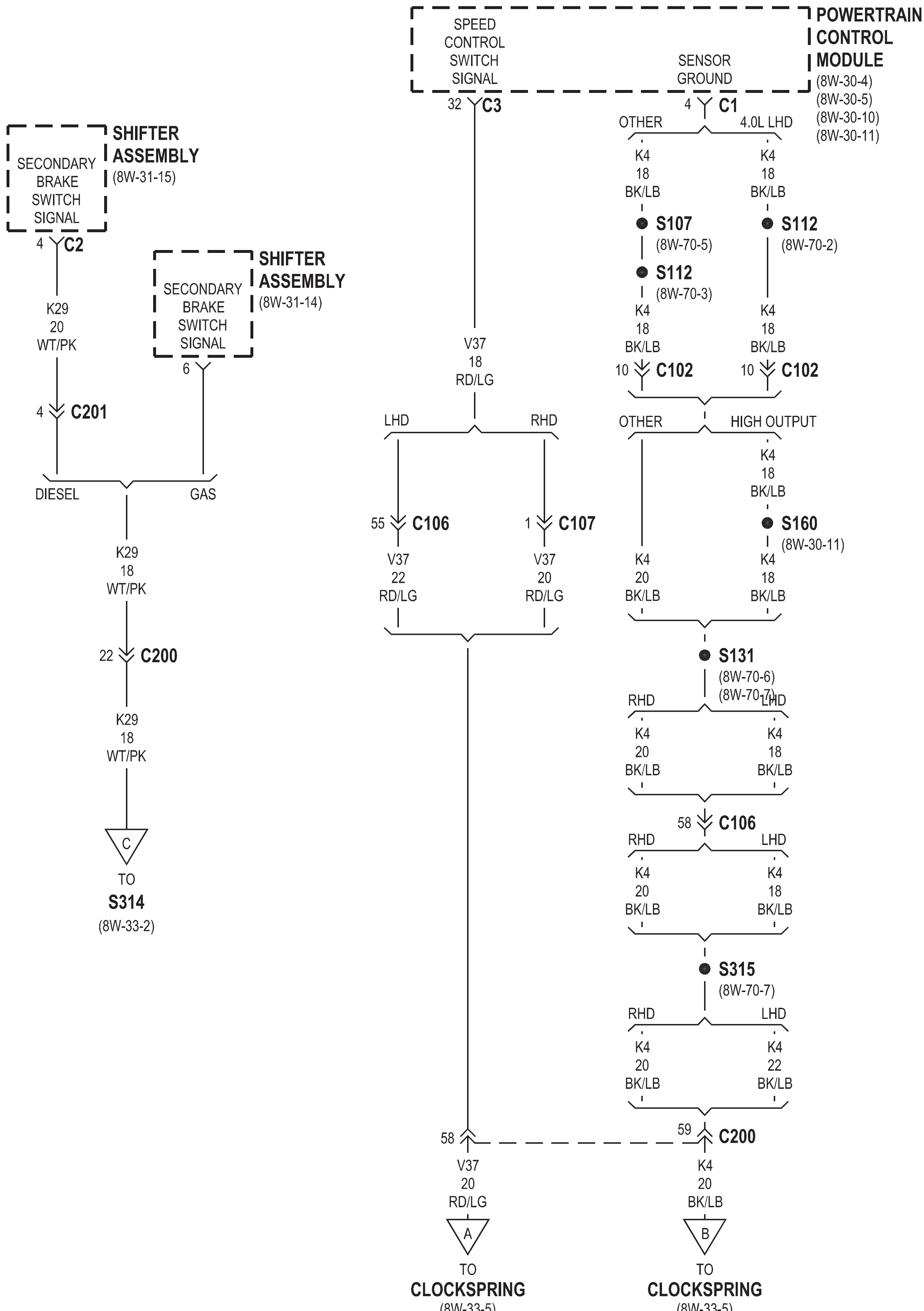

TRANSMISSION SOLENOID ASSEMBLY
N3 INPUT SPEED SENSOR
MODULATION PRESSURE SOLENOID CONTROL
N2 INPUT SPEED SENSOR
TEMP SENSOR- P/N SWITCH
SOLENOID SUPPLY VOLTAGE
SENSOR SUPPLY VOLTAGE
2-3 SOLENOID CONTROL
3-4 SOLENOID CONTROL
SHIFT PRESSURE SOLENOID CONTROL
TCC SOLENOID CONTROL
SENSOR GROUND
1-2/ 4-5 SOLENOID CONTROL
1
2
3
4
6
7
8
9
10
11
12
13
T14 18 LG/WT
T591 18 YL/DB
T52 18 RD/BK
T54 18 VT
T16 18 RD
T39 18 GY/LB
T119 18 WT/DB
T159 18 DG/WT
T118 18 YL/DB
T120 18 LG
T13 18 DB/BK
T60 18 BR
35 C2
36 C2
12 C2
34 C2
38 C2
13 C2
16 C2
15 C2
37 C2
17 C2
33 C2
14 C2
TRANSMISSION CONTROL MODULE
N3 INPUT SPEED SENSOR
MODULATION PRESSURE SOLENOID CONTROL
N2 INPUT SPEED SENSOR
TEMP SENSOR- P/N SWITCH
SOLENOID SUPPLY VOLTAGE
SENSOR SUPPLY VOLTAGE
2-3 SOLENOID CONTROL
3-4 SOLENOID CONTROL
SHIFT PRESSURE SOLENOID CONTROL
TCC SOLENOID CONTROL
SENSOR GROUND
1-2/ 4-5 SOLENOID CONTROL

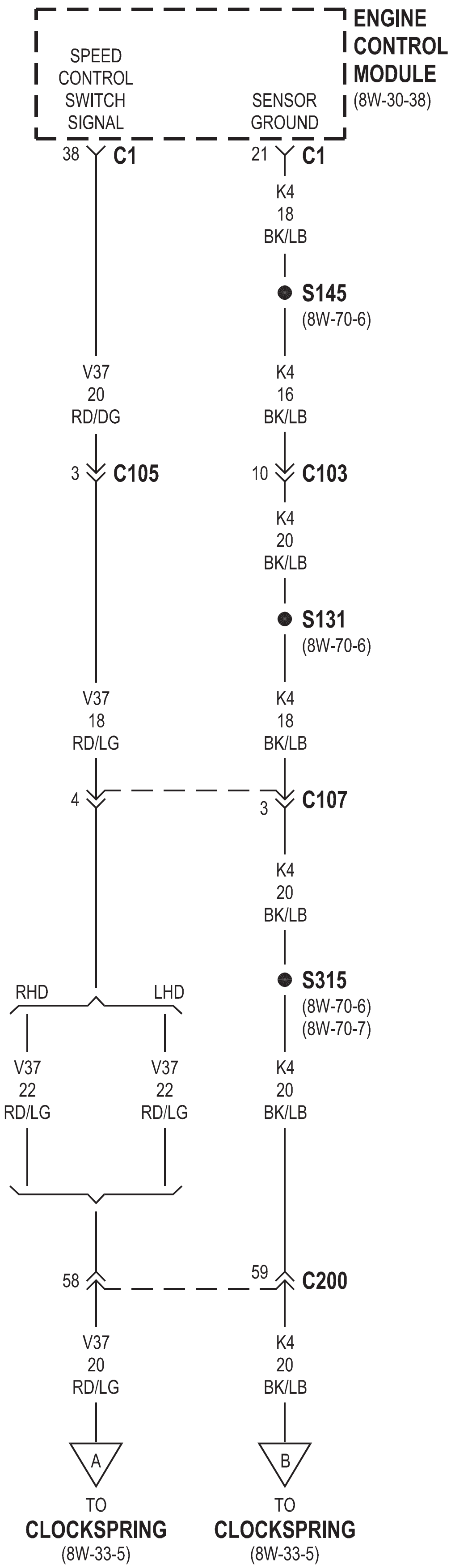
WJI03118

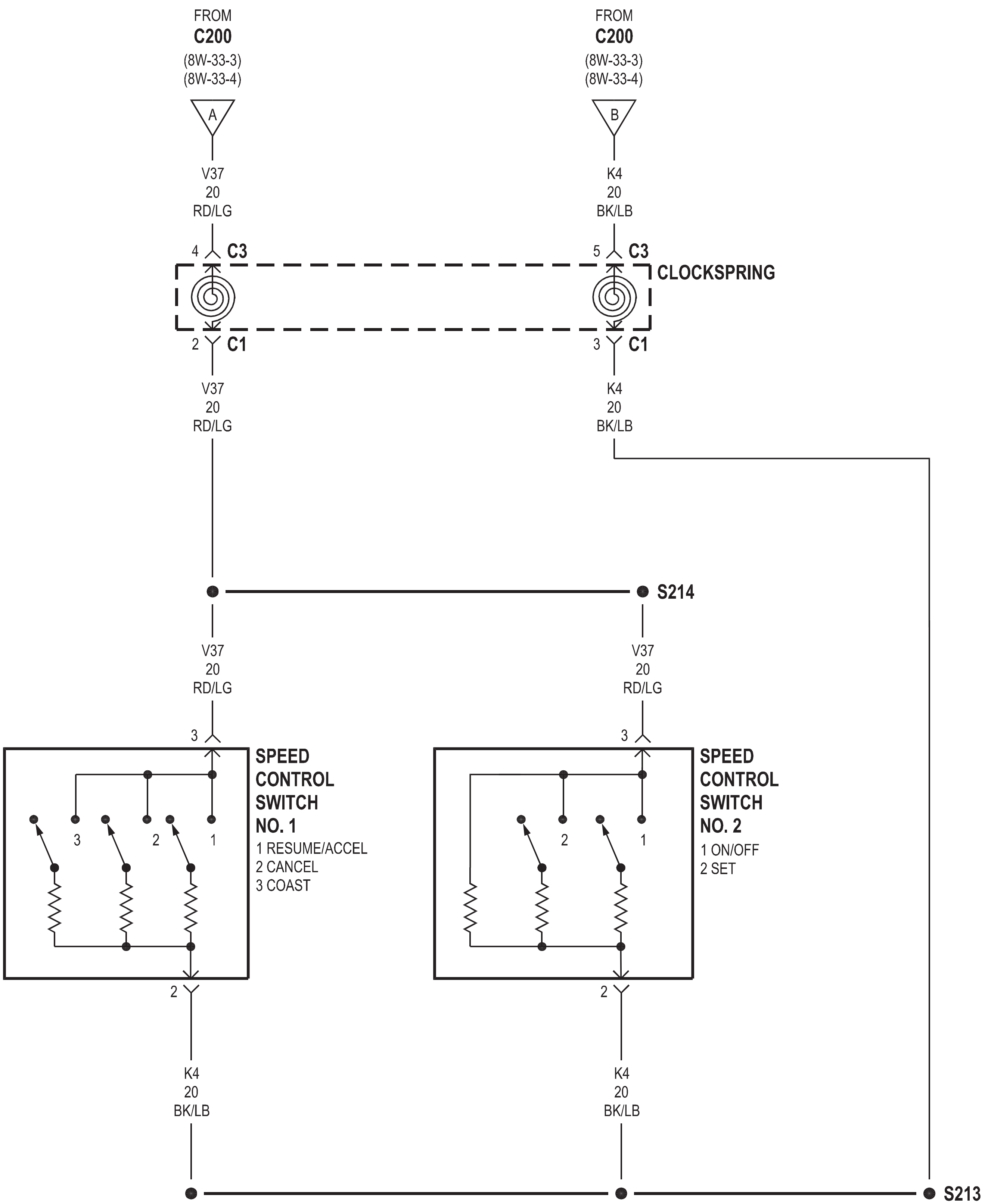
8W-33 VEHICLE SPEED CONTROL


SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL SUPPLY
SECONDARY BRAKE SWITCH SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-5)
(8W-30-32)
BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 23 15A (8W-12-24)
47 C2
4 C3
5 C3
11 C3
24 C3
LHD RHD
V36 18 TN/RD
45 C107
V36 20 TN/RD
15 C106
V32 18 OR/DG
42 C107
32
10 C106
40 C107
K29 18 WT/PK
K29 20 WT/PK
F32 20 PK/DB
FROM C200 (8W-33-3)
C
S314
V32 22 OR/DG
BRAKE LAMP SWITCH
V35 18 LG/RD
44 C107
V35 20 LG/RD
15 C106
V30 22 DB/RD
33 C106
V30 20 DB/RD
C102
14
ELECTRONIC SPEED CONTROL SERVO
VACUUM SOLENOID
VENT SOLENOID
DUMP SOLENOID
Z243 18 BK
Z238 18 BK
L50 20 WT/TN
L50 20 VT/TN
TO S313 (8W-51-5) (8W-51-6)
K29 20 WT/PK
BASE OTHER
S358 (8W-15-22)
S329 (8W-15-17)
Z243 12 BK
Z238 14 BK
Z307 20 BK
S132 (8W-15-9)
Z307 14 BK
G108 (8W-15-9)
G301 (8W-15-22)
G300 (8W-15-17)
48 C1
ENGINE CONTROL MODULE
(8W-30-38)
(8W-30-51)

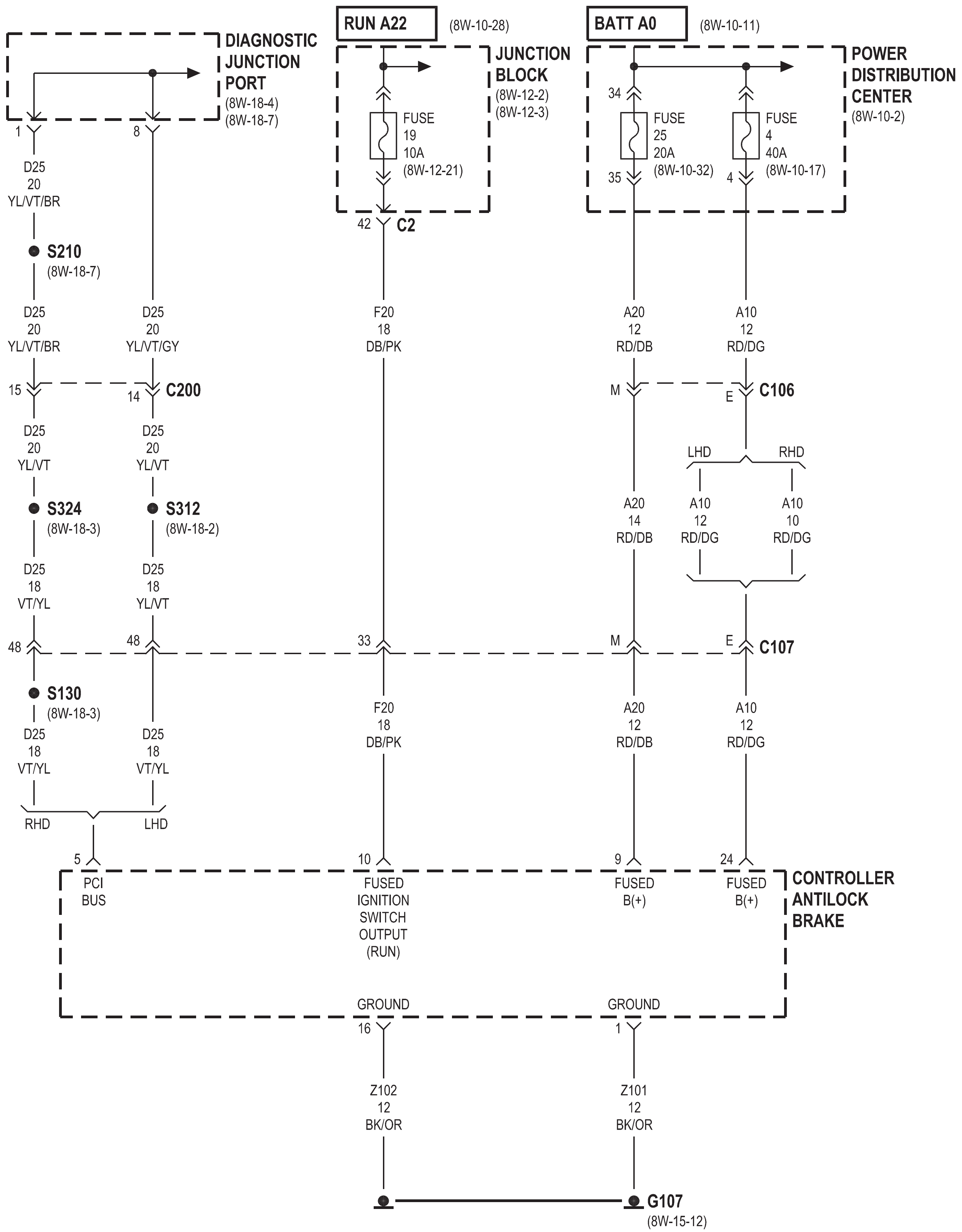
GAS

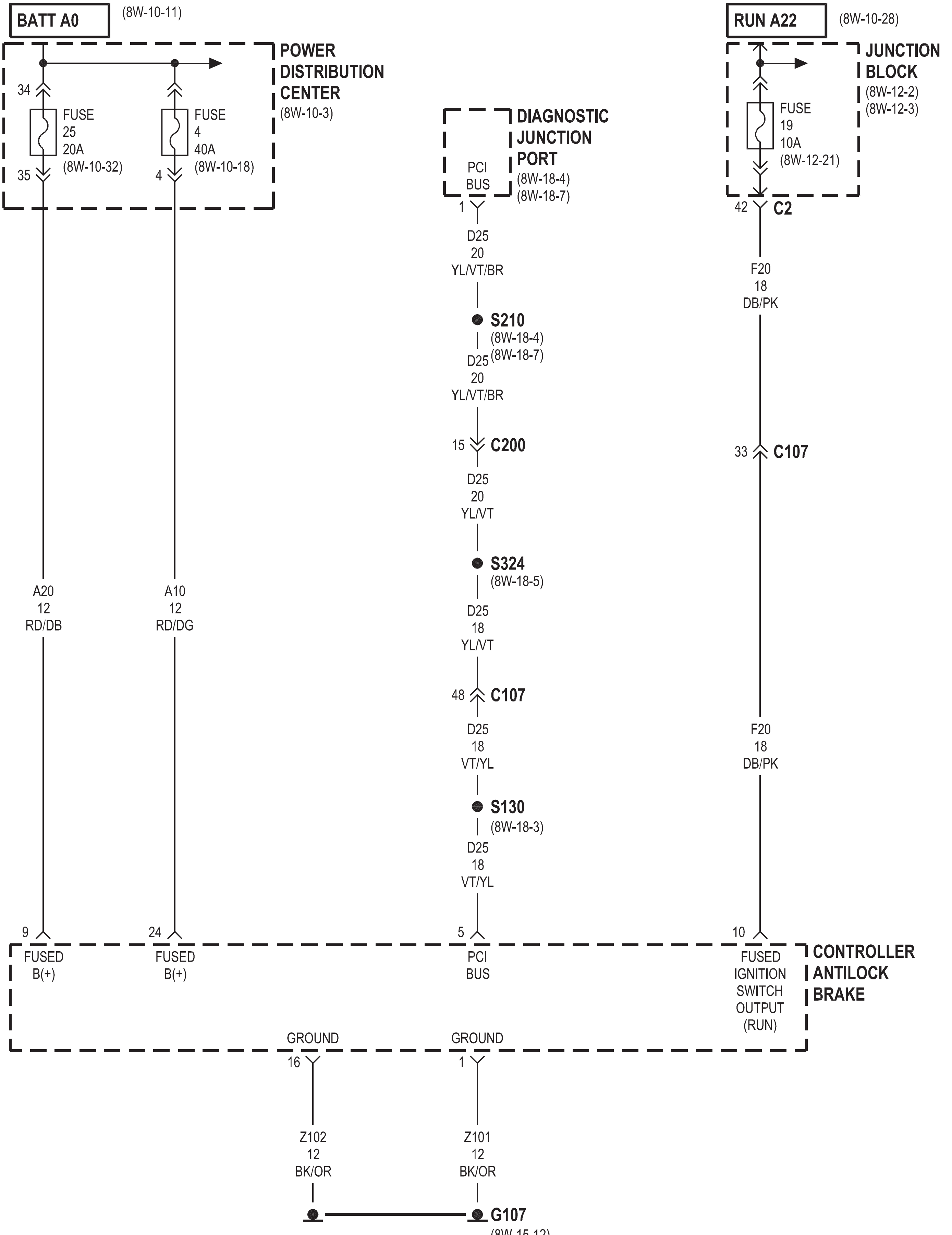

POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-5)
(8W-30-10)
(8W-30-11)
SPEED CONTROL SWITCH SIGNAL
SENSOR GROUND
32 C3
4 C1
OTHER
4.0L LHD
K4 18 BK/LB
S107 (8W-70-5)
S112 (8W-70-3)
S112 (8W-70-2)
10 C102
HIGH OUTPUT
S160 (8W-30-11)
K4 20 BK/LB
K4 22 BK/LB
S131 (8W-70-6) (8W-70-7)
RHD
LHD
58 C106
S315 (8W-70-7)
59 C200
SHIFTER ASSEMBLY (8W-31-15)
SECONDARY BRAKE SWITCH SIGNAL
4 C2
K29 20 WT/PK
4 C201
SHIFTER ASSEMBLY (8W-31-14)
6
DIESEL
GAS
K29 18 WT/PK
22 C200
C
TO S314 (8W-33-2)
V37 18 RD/LG
55 C106
1 C107
V37 22 RD/LG
V37 20 RD/LG
58
A
TO CLOCKSPRING (8W-33-5)
B
TO CLOCKSPRING (8W-33-5)


ENGINE
CONTROL
MODULE
(8W-30-38)
SPEED CONTROL SWITCH SIGNAL
SENSOR GROUND
38 C1
21 C1
K4 18 BK/LB
S145
(8W-70-6)
V37 20 RD/DG
K4 16 BK/LB
3 C105
10 C103
K4 20 BK/LB
S131
(8W-70-6)
V37 18 RD/LG
K4 18 BK/LB
4
3 C107
K4 20 BK/LB
S315
(8W-70-6)
(8W-70-7)
RHD
LHD
V37 22 RD/LG
V37 22 RD/LG
K4 20 BK/LB
58
59 C200
V37 20 RD/LG
K4 20 BK/LB
A
B
TO
CLOCKSPRING
(8W-33-5)
TO
CLOCKSPRING
(8W-33-5)

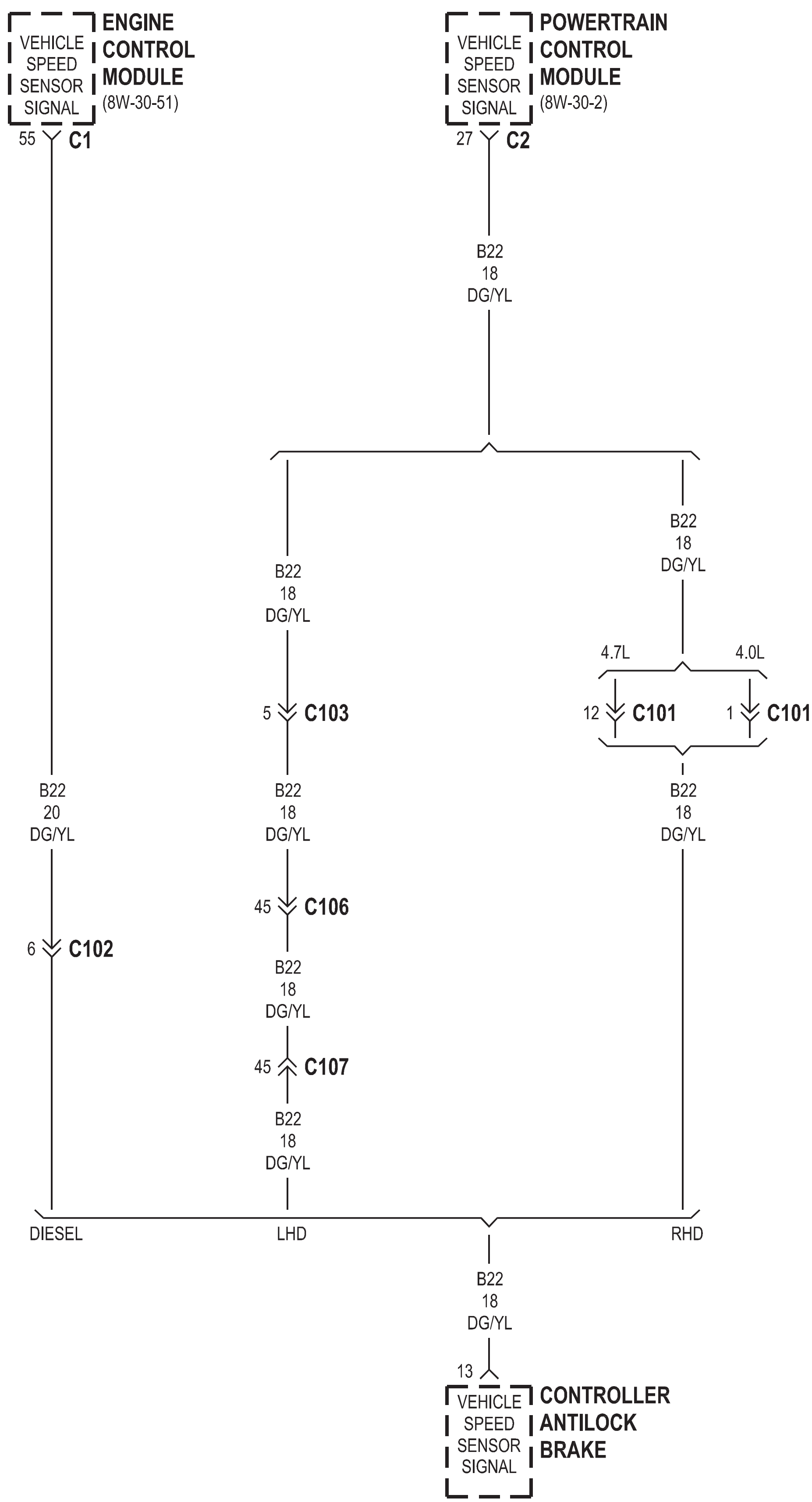

FROM
C200
(8W-33-3)
(8W-33-4)
A
V37
20
RD/LG
4
C3
2
C1
FROM
C200
(8W-33-3)
(8W-33-4)
B
K4
20
BK/LB
5
C3
3
C1
CLOCKSPRING
S214
3
SPEED
CONTROL
SWITCH
NO. 1
1 RESUME/ACCEL
2 CANCEL
3 COAST
SPEED
CONTROL
SWITCH
NO. 2
1 ON/OFF
2 SET
2
K4
20
BK/LB
S213

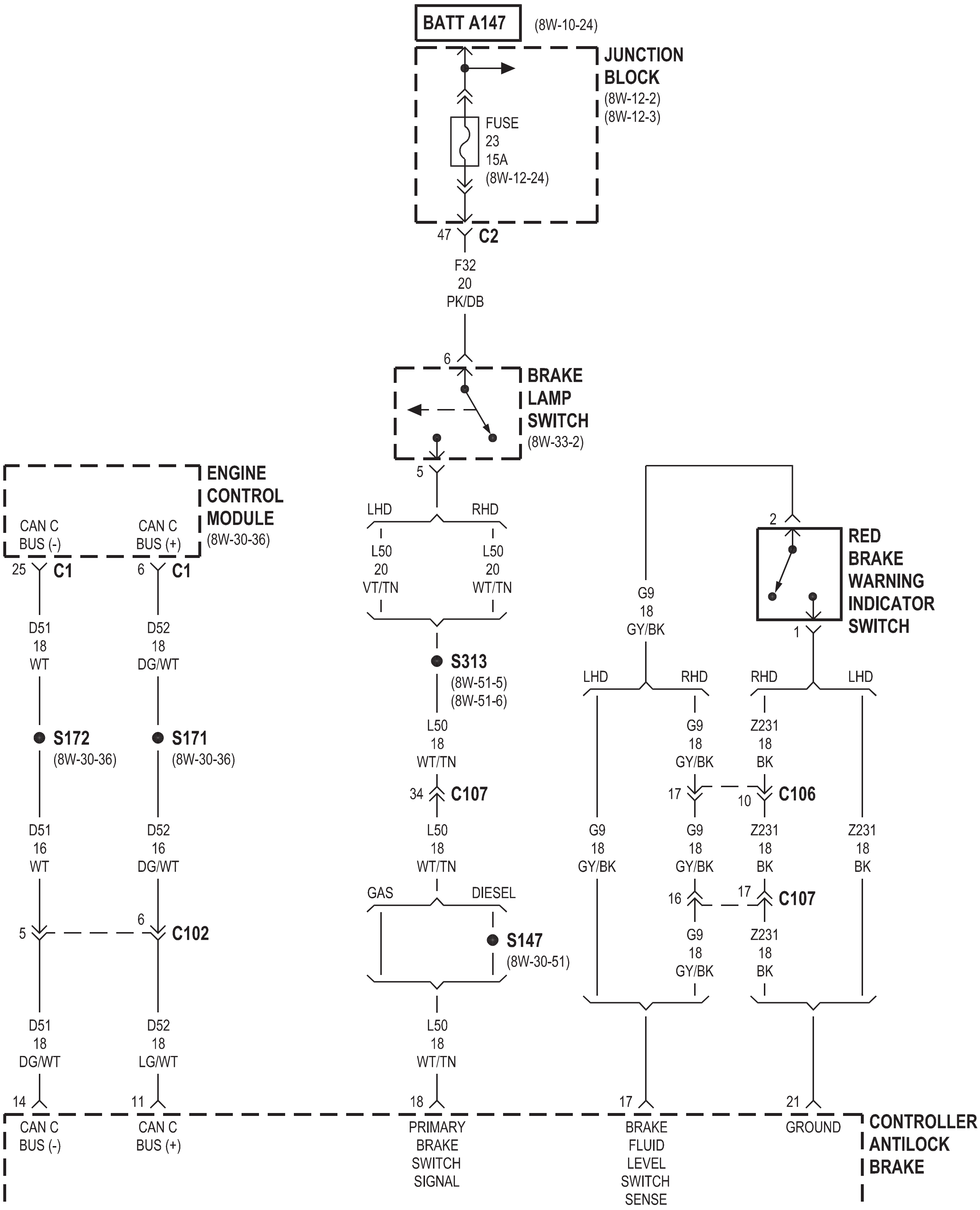
8W-35 ANTILOCK BRAKES

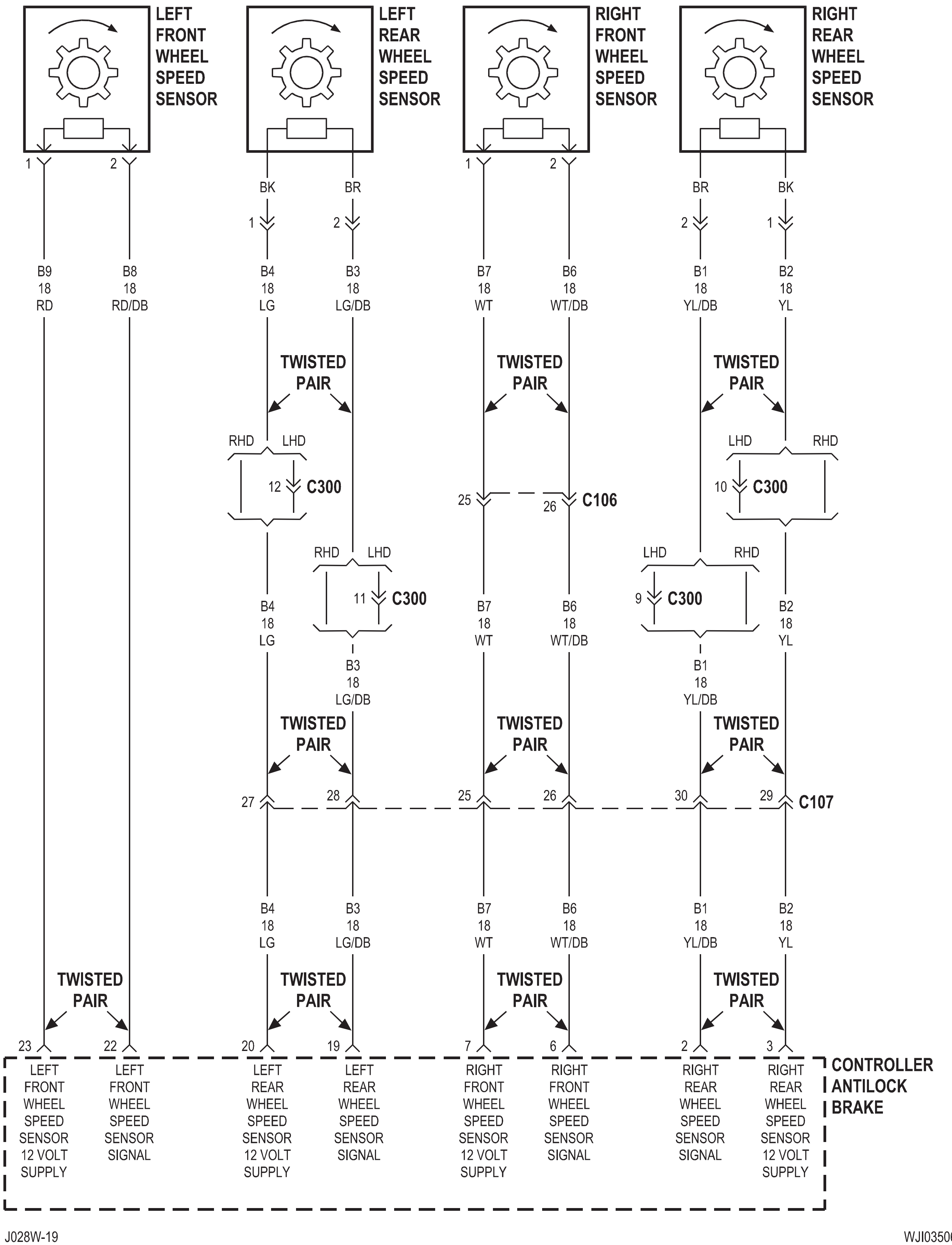

RUN A22
(8W-10-28)
BATT A0
(8W-10-11)
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 19 10A (8W-12-21)
FUSE 25 20A (8W-10-32)
FUSE 4 40A (8W-10-17)
1
8
34
35
4
42
C2
D25 20 YL/VT/BR
S210
(8W-18-7)
D25 20 YL/VT/BR
D25 20 YL/VT/GY
F20 18 DB/PK
A20 12 RD/DB
A10 12 RD/DG
15
14
C200
M
E
C106
D25 20 YL/VT
D25 20 YL/VT
LHD
RHD
S324
(8W-18-3)
S312
(8W-18-2)
A20 14 RD/DB
A10 12 RD/DG
A10 10 RD/DG
D25 18 VT/YL
D25 18 YL/VT
48
48
33
M
E
C107
S130
(8W-18-3)
D25 18 VT/YL
D25 18 VT/YL
F20 18 DB/PK
A20 12 RD/DB
A10 12 RD/DG
RHD
LHD
5
10
9
24
PCI BUS
FUSED IGNITION SWITCH OUTPUT (RUN)
FUSED B(+)
FUSED B(+)
CONTROLLER ANTILOCK BRAKE
GROUND
GROUND
16
1
Z102 12 BK/OR
Z101 12 BK/OR
G107
(8W-15-12)



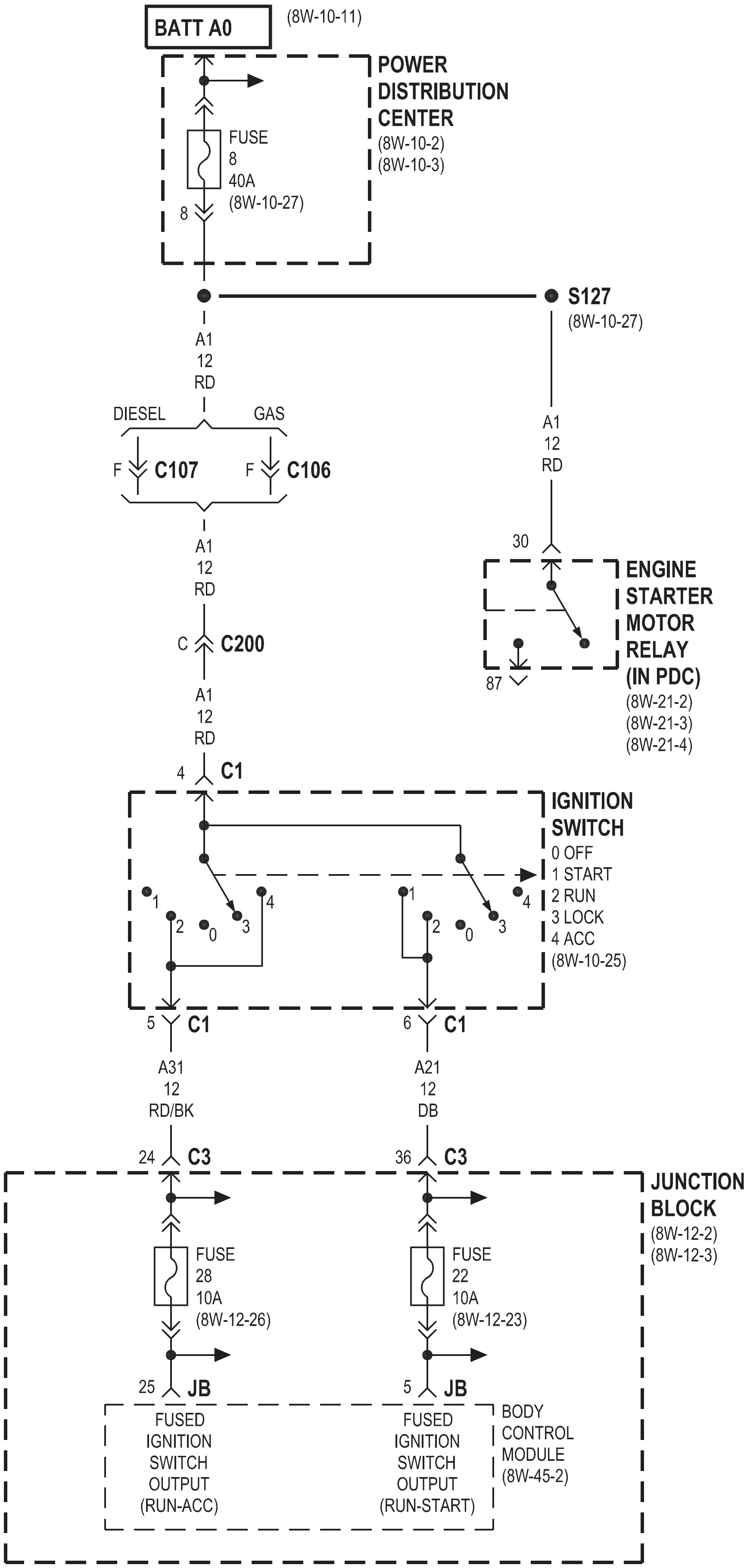
WJI03503 J028W-19

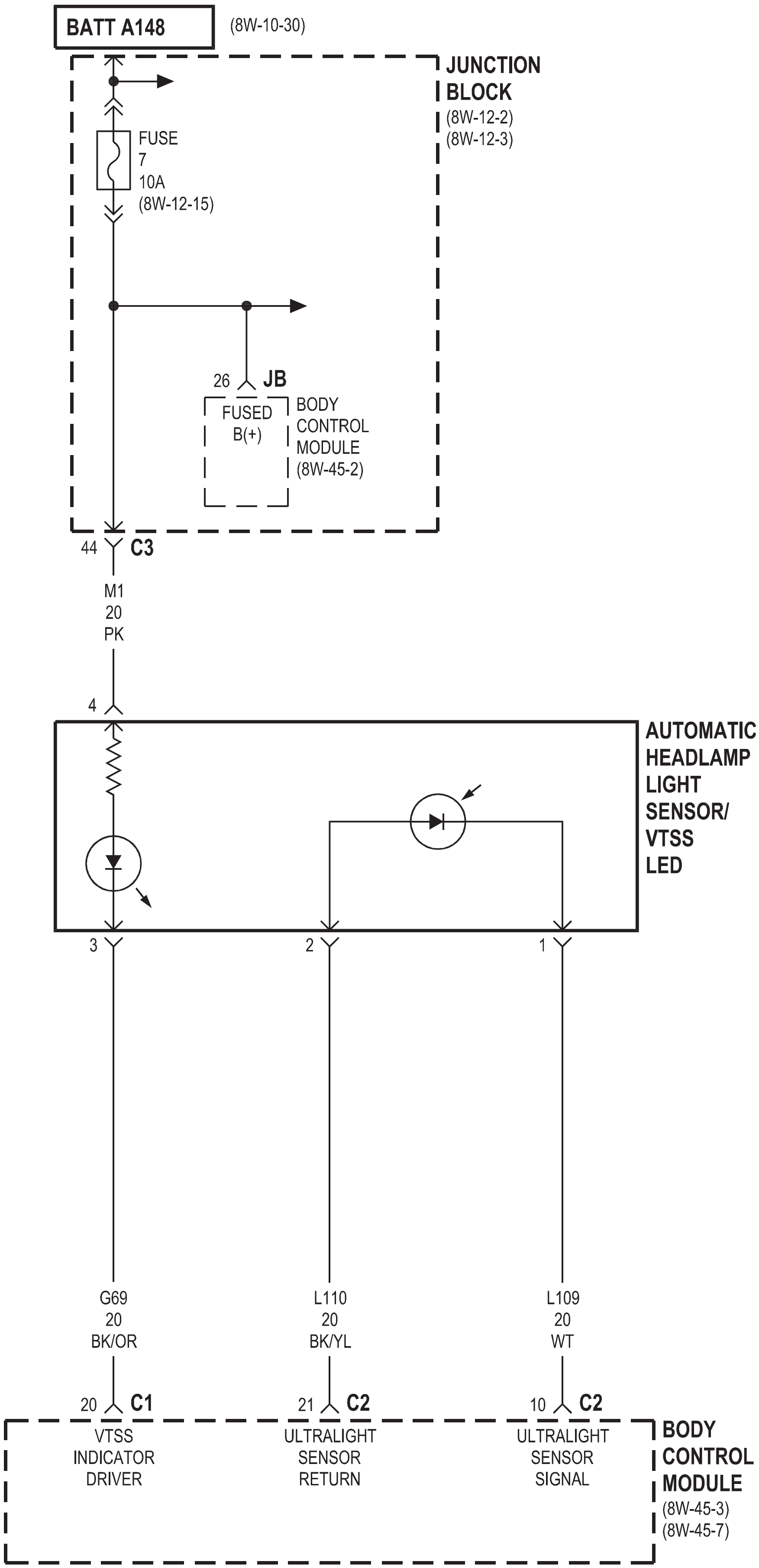

VEHICLE SPEED SENSOR SIGNAL
ENGINE CONTROL MODULE
(8W-30-51)
55
C1
VEHICLE SPEED SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-2)
27
C2
B22
18
DG/YL
B22
18
DG/YL
B22
18
DG/YL
4.7L
4.0L
12
C101
1
C101
5
C103
B22
20
DG/YL
B22
18
DG/YL
B22
18
DG/YL
45
C106
6
C102
B22
18
DG/YL
45
C107
B22
18
DG/YL
DIESEL
LHD
RHD
B22
18
DG/YL
13
VEHICLE SPEED SENSOR SIGNAL
CONTROLLER ANTILOCK BRAKE

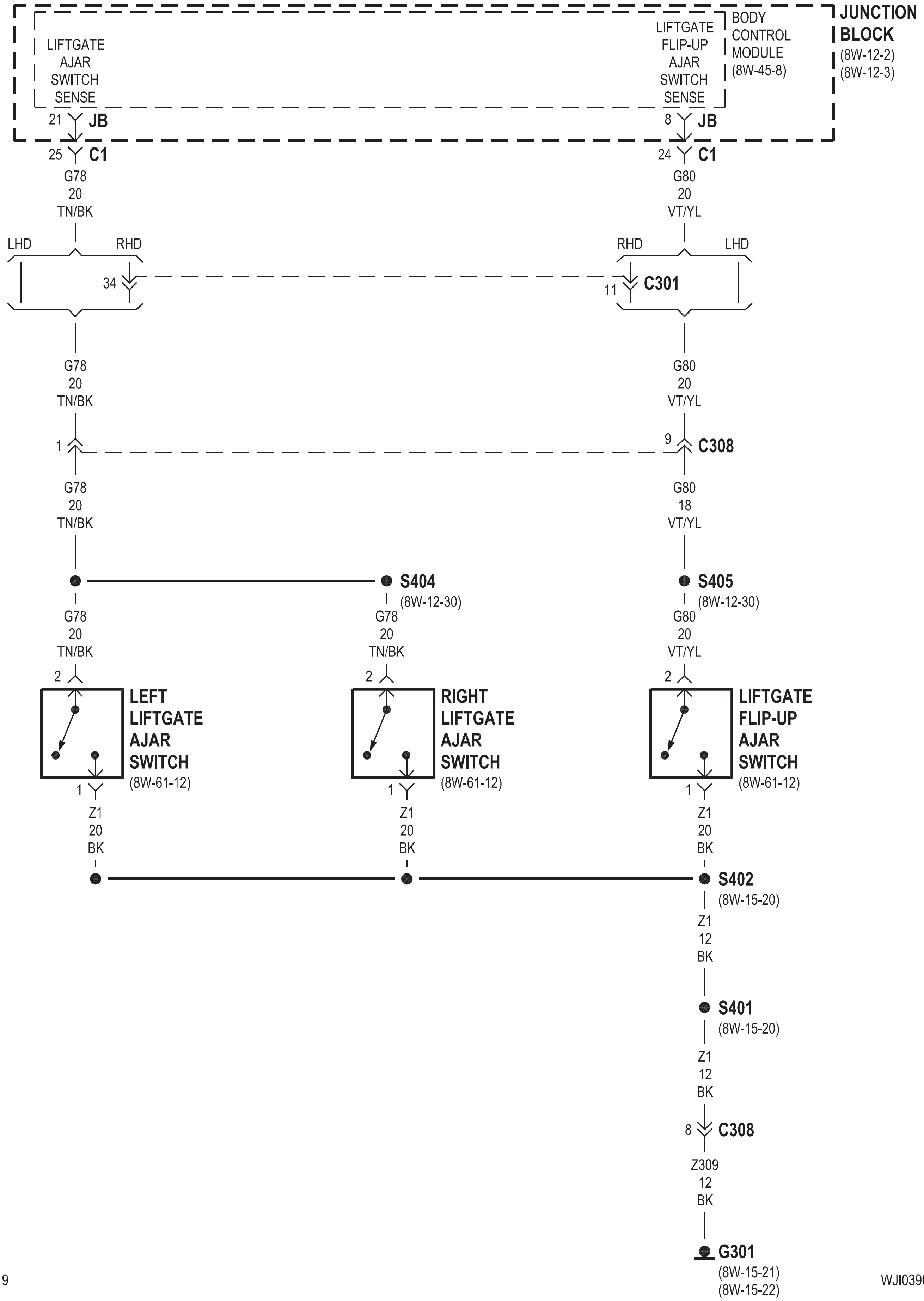

BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
23
15A
(8W-12-24)
47
C2
F32
20
PK/DB
6
BRAKE LAMP SWITCH
(8W-33-2)
5
ENGINE CONTROL MODULE
(8W-30-36)
CAN C BUS (-)
CAN C BUS (+)
25
C1
6
C1
LHD
RHD
L50
20
VT/TN
L50
20
WT/TN
D51
18
WT
D52
18
DG/WT
S313
(8W-51-5)
(8W-51-6)
S172
(8W-30-36)
S171
(8W-30-36)
L50
18
WT/TN
34
C107
D51
16
WT
D52
16
DG/WT
L50
18
WT/TN
GAS
DIESEL
5
6
C102
S147
(8W-30-51)
D51
18
DG/WT
D52
18
LG/WT
L50
18
WT/TN
2
RED BRAKE WARNING INDICATOR SWITCH
1
G9
18
GY/BK
LHD
RHD
RHD
LHD
G9
18
GY/BK
Z231
18
BK
17
10
C106
G9
18
GY/BK
G9
18
GY/BK
Z231
18
BK
Z231
18
BK
16
17
C107
G9
18
GY/BK
Z231
18
BK
14
11
18
17
21
CAN C BUS (-)
CAN C BUS (+)
PRIMARY BRAKE SWITCH SIGNAL
BRAKE FLUID LEVEL SWITCH SENSE
GROUND
CONTROLLER ANTILOCK BRAKE

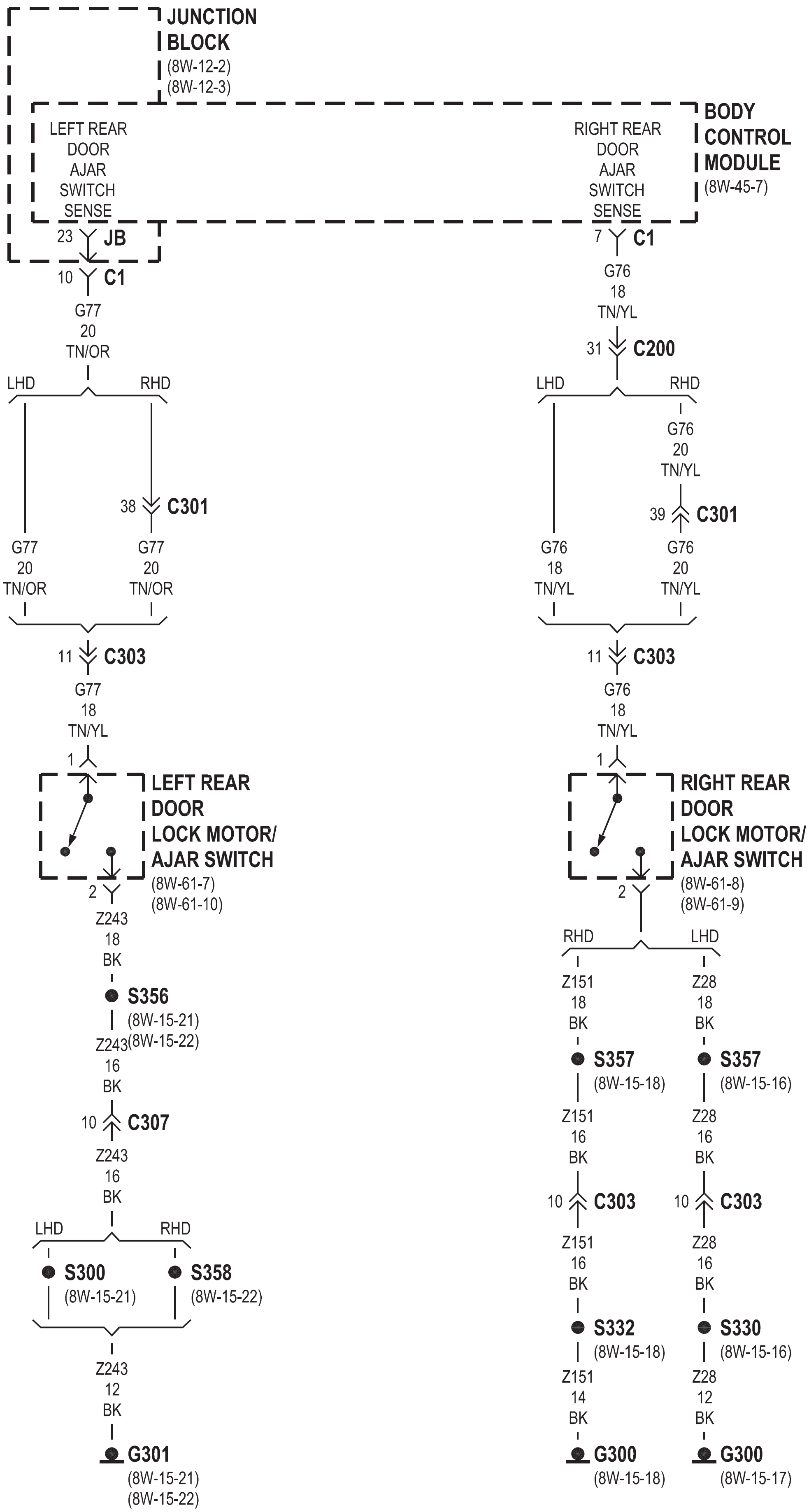

LEFT FRONT WHEEL SPEED SENSOR
LEFT REAR WHEEL SPEED SENSOR
RIGHT FRONT WHEEL SPEED SENSOR
RIGHT REAR WHEEL SPEED SENSOR
BK
BR
B9 18 RD
B8 18 RD/DB
B4 18 LG
B3 18 LG/DB
B7 18 WT
B6 18 WT/DB
B1 18 YL/DB
B2 18 YL
TWISTED PAIR
RHD
LHD
C300
C106
C107
CONTROLLER ANTILOCK BRAKE
LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
LEFT FRONT WHEEL SPEED SENSOR SIGNAL
LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
LEFT REAR WHEEL SPEED SENSOR SIGNAL
RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
RIGHT REAR WHEEL SPEED SENSOR SIGNAL
RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
J028W-19
WJI03506

8W-39 VEHICLE THEFT SECURITY SYSTEM


BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
8
40A
(8W-10-27)
8
S127
(8W-10-27)
A1
12
RD
DIESEL
GAS
F
C107
F
C106
A1
12
RD
C
C200
A1
12
RD
4
C1
30
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
(8W-21-4)
87
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-25)
5
C1
6
C1
A31
12
RD/BK
A21
12
DB
24
C3
36
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
28
10A
(8W-12-26)
FUSE
22
10A
(8W-12-23)
25
JB
5
JB
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
BODY CONTROL MODULE
(8W-45-2)

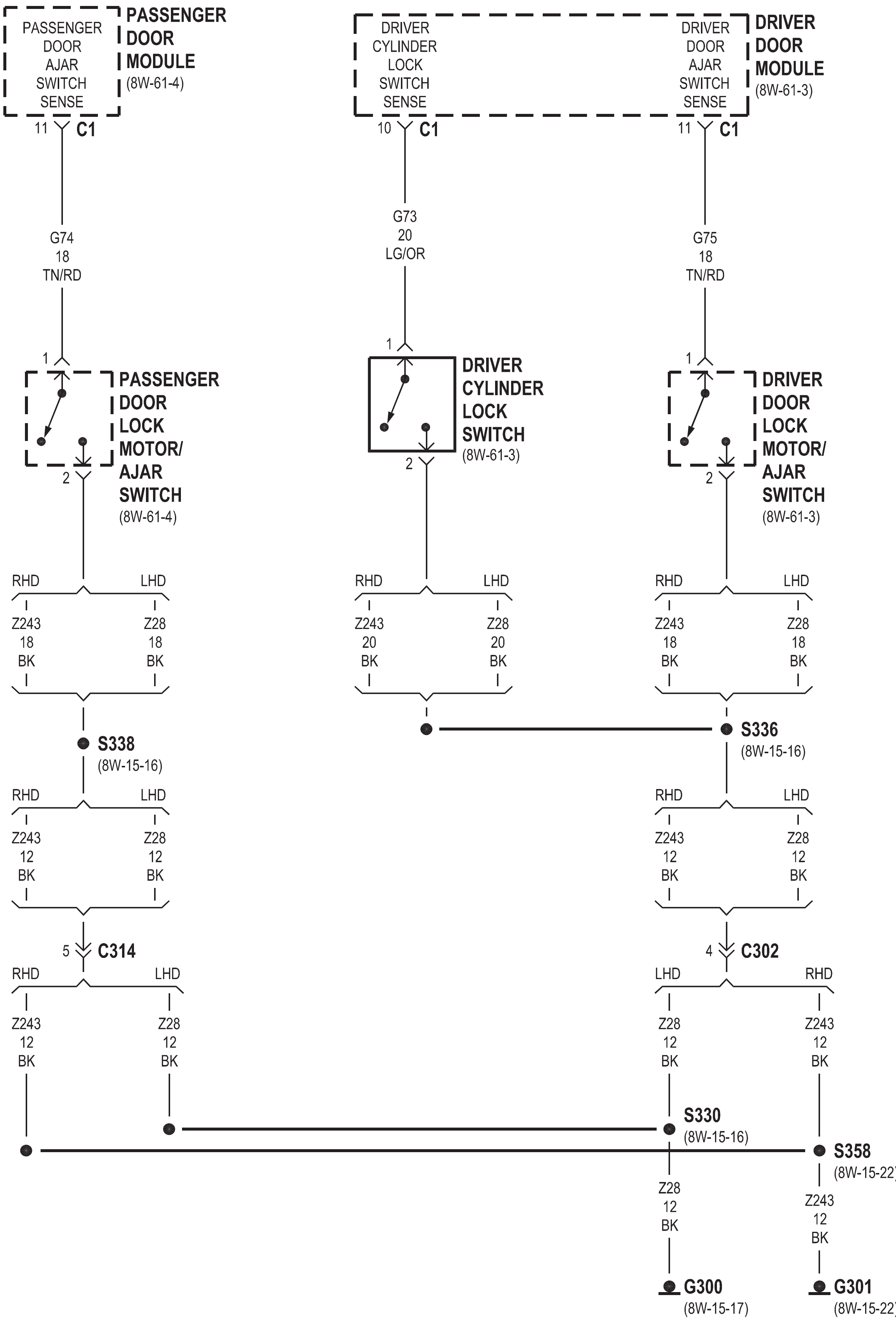

BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
26
JB
FUSED B(+)
BODY CONTROL MODULE
(8W-45-2)
44
C3
M1
20
PK
4
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
3
2
1
G69
20
BK/OR
L110
20
BK/YL
L109
20
WT
20
C1
21
C2
10
C2
VTSS INDICATOR DRIVER
ULTRALIGHT SENSOR RETURN
ULTRALIGHT SENSOR SIGNAL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-7)

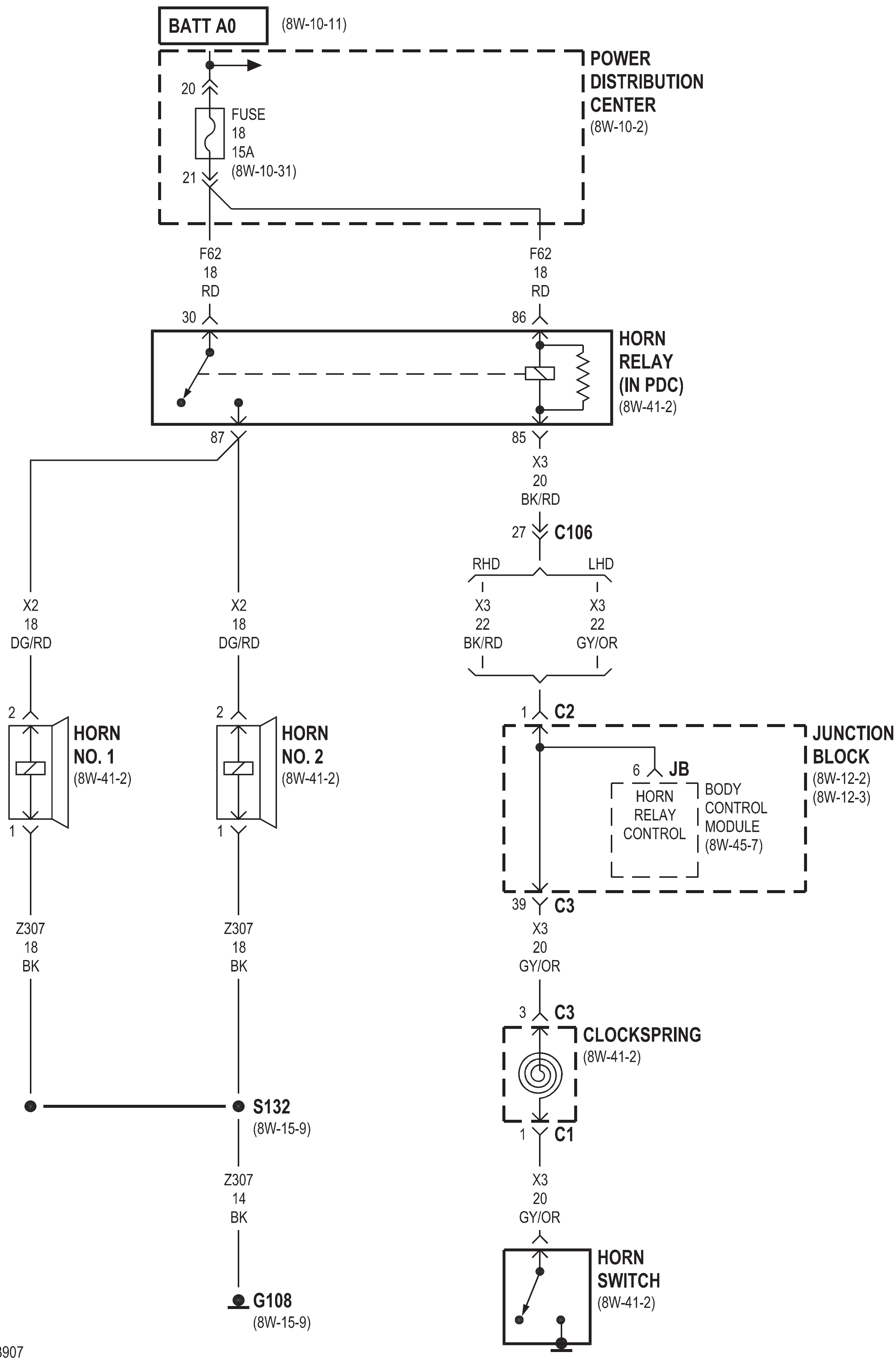

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
LIFTGATE AJAR SWITCH SENSE
LIFTGATE FLIP-UP AJAR SWITCH SENSE
21 JB
8 JB
25 C1
24 C1
G78 20 TN/BK
G80 20 VT/YL
LHD
RHD
34
11 C301
G78 20 TN/BK
G80 20 VT/YL
1
9 C308
G78 20 TN/BK
G80 18 VT/YL
S404
(8W-12-30)
S405
(8W-12-30)
G78 20 TN/BK
G78 20 TN/BK
G80 20 VT/YL
2
LEFT LIFTGATE AJAR SWITCH
(8W-61-12)
RIGHT LIFTGATE AJAR SWITCH
(8W-61-12)
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-12)
1
Z1 20 BK
S402
(8W-15-20)
Z1 12 BK
S401
(8W-15-20)
Z1 12 BK
8 C308
Z309 12 BK
G301
(8W-15-21)
(8W-15-22)

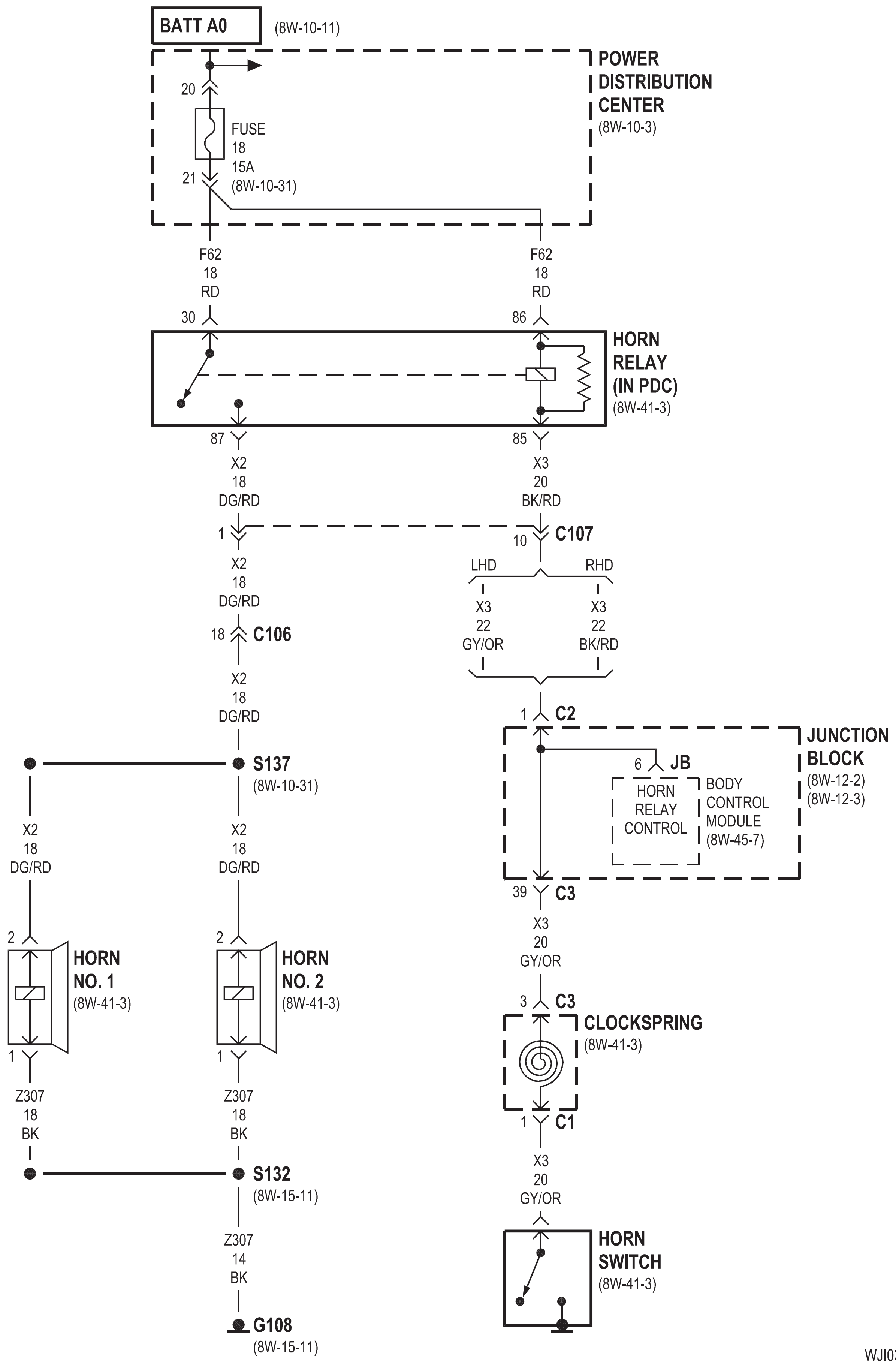


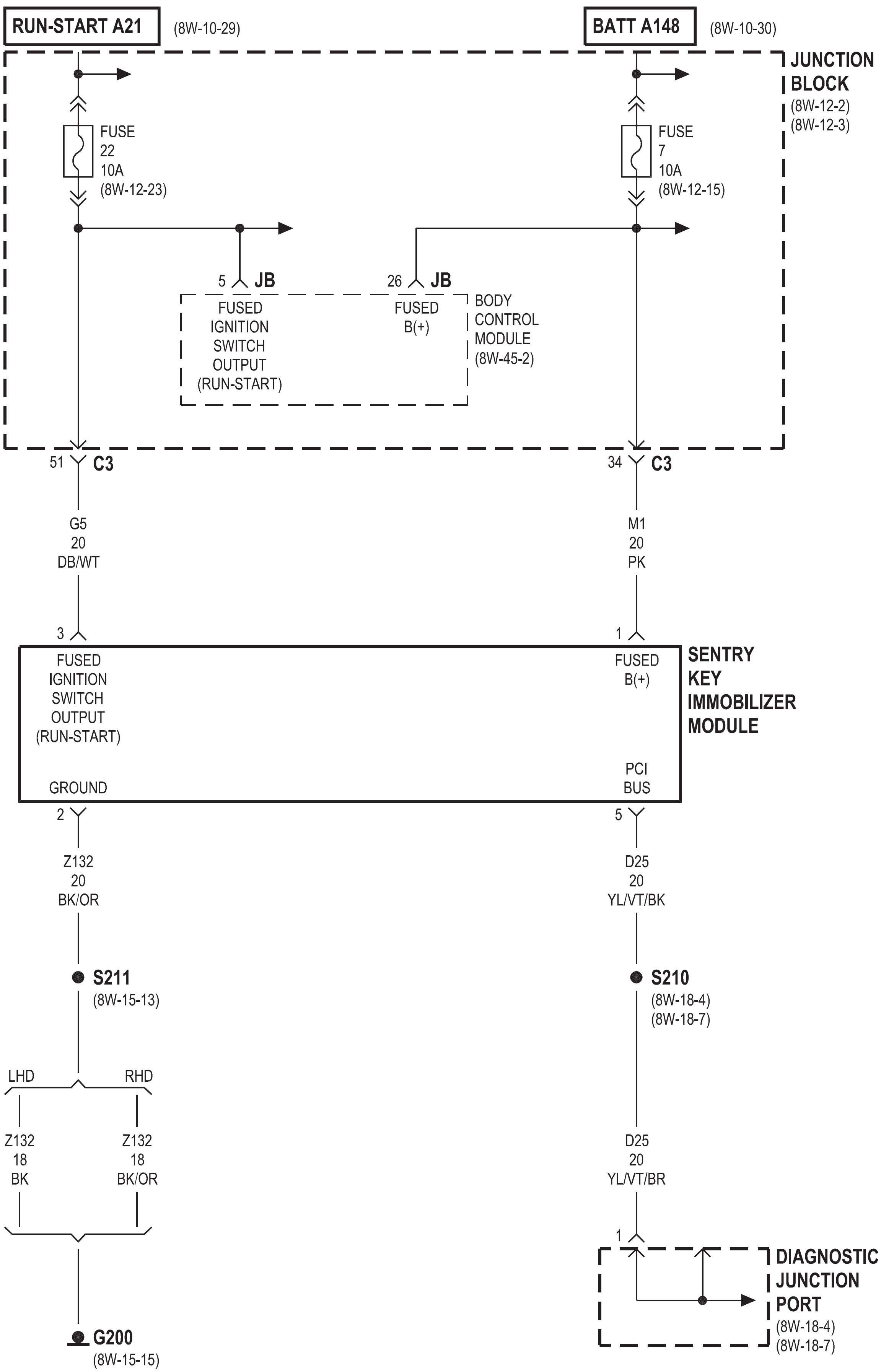
WJI03905

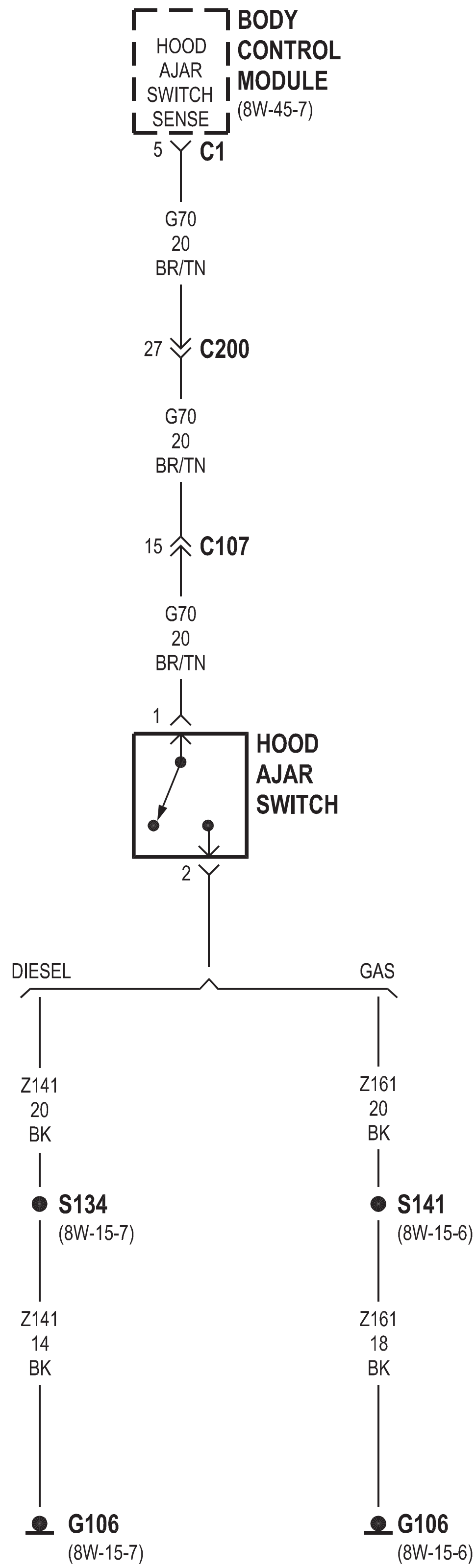
J028W-19

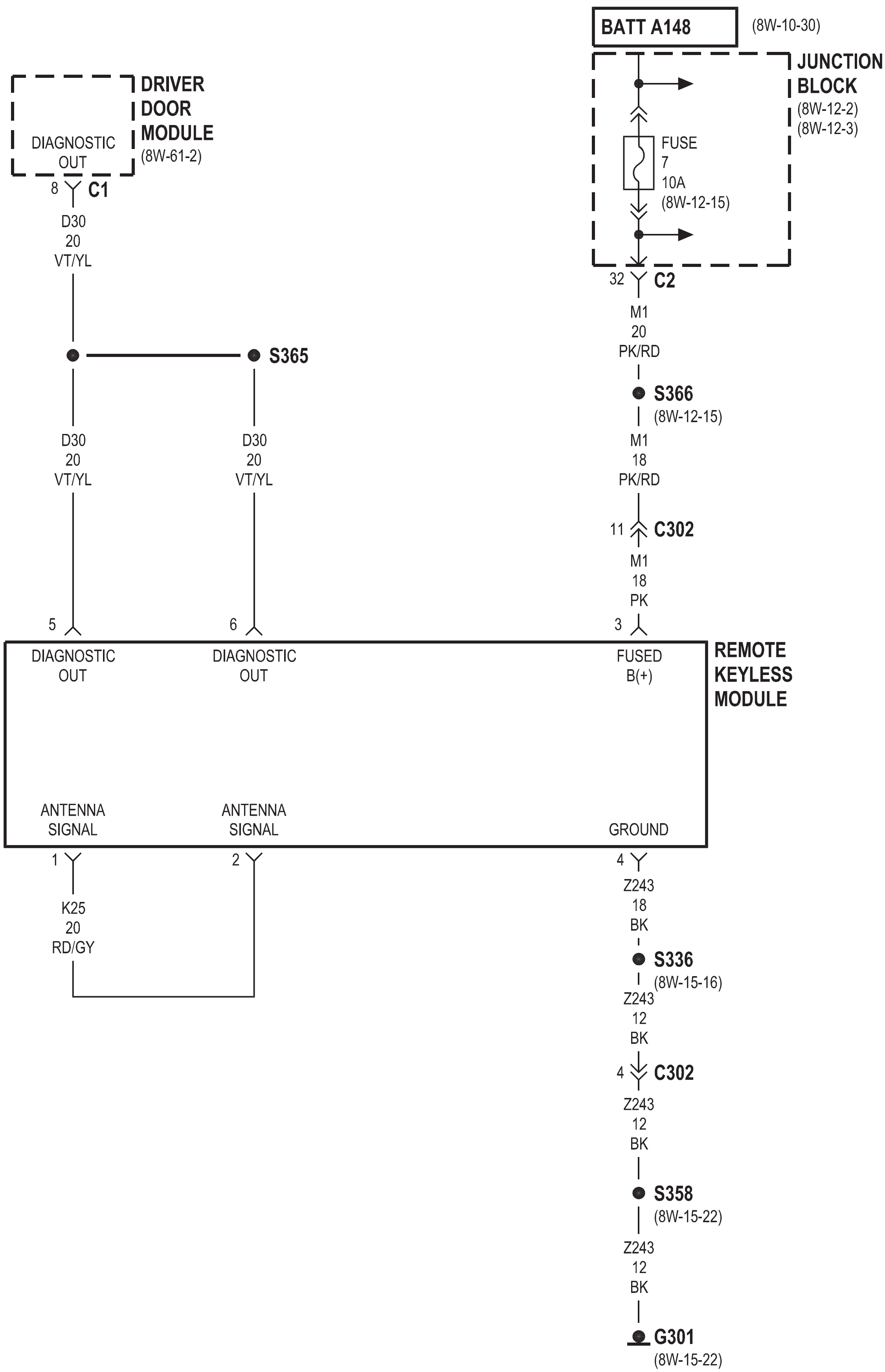

PASSENGER DOOR AJAR SWITCH SENSE
PASSENGER DOOR MODULE
(8W-61-4)
DRIVER CYLINDER LOCK SWITCH SENSE
DRIVER DOOR AJAR SWITCH SENSE
DRIVER DOOR MODULE
(8W-61-3)
11 C1
10 C1
11 C1
G74 18 TN/RD
G73 20 LG/OR
G75 18 TN/RD
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
DRIVER CYLINDER LOCK SWITCH
(8W-61-3)
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-3)
RHD LHD
Z243 18 BK
Z28 18 BK
Z243 20 BK
Z28 20 BK
S338
(8W-15-16)
S336
(8W-15-16)
Z243 12 BK
Z28 12 BK
5 C314
4 C302
S330
(8W-15-16)
S358
(8W-15-22)
G300
(8W-15-17)
G301
(8W-15-22)


BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
20
FUSE
18
15A
(8W-10-31)
21
F62
18
RD
F62
18
RD
30
86
HORN
RELAY
(IN PDC)
(8W-41-2)
87
85
X3
20
BK/RD
27
C106
RHD
LHD
X3
22
BK/RD
X3
22
GY/OR
X2
18
DG/RD
X2
18
DG/RD
2
HORN
NO. 1
(8W-41-2)
1
2
HORN
NO. 2
(8W-41-2)
1
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
JB
HORN
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
39
C3
X3
20
GY/OR
Z307
18
BK
Z307
18
BK
3
C3
CLOCKSPRING
(8W-41-2)
S132
(8W-15-9)
1
C1
Z307
14
BK
X3
20
GY/OR
HORN
SWITCH
(8W-41-2)
G108
(8W-15-9)

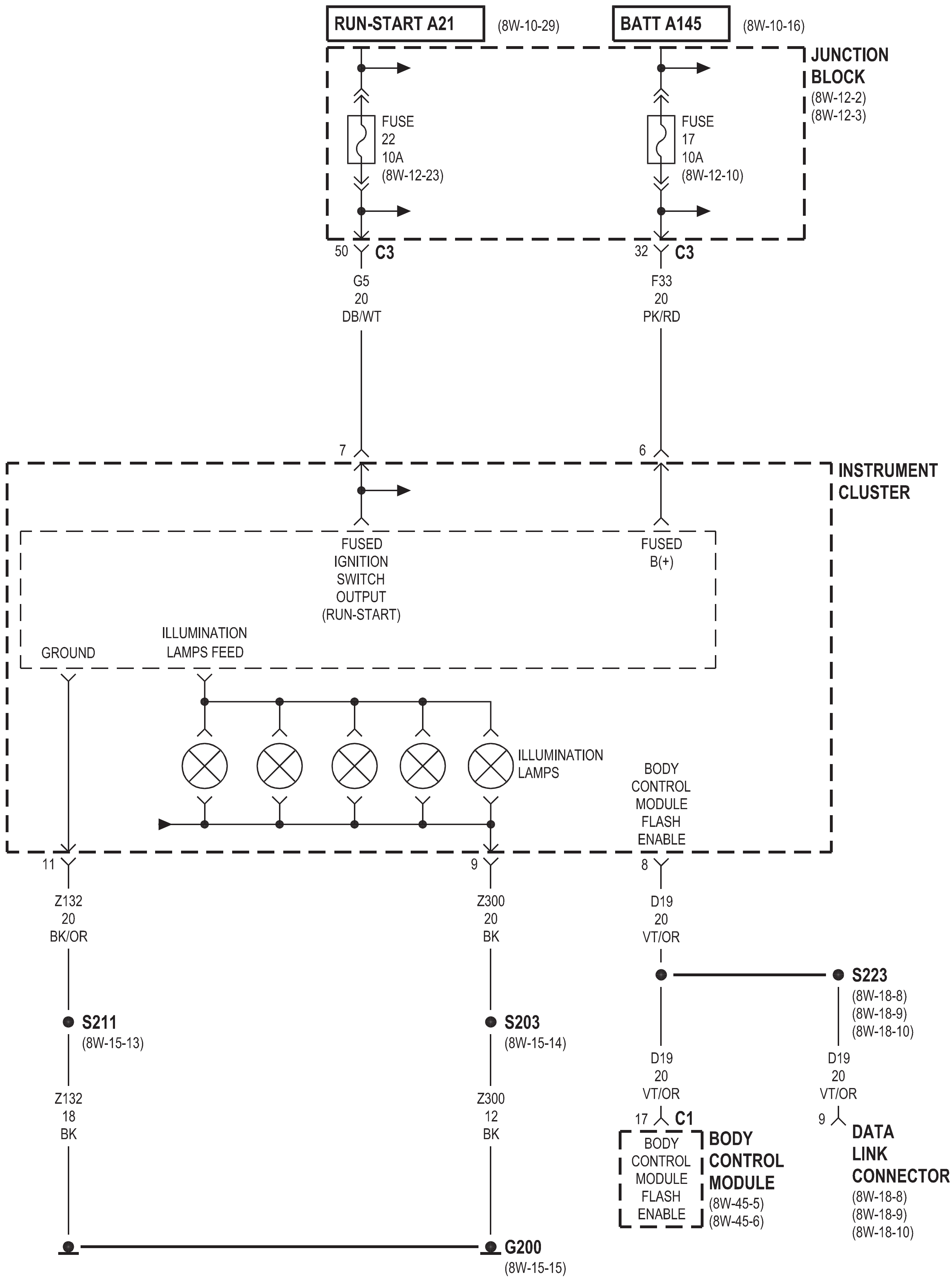

BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-3)
20
FUSE
18
15A
(8W-10-31)
21
F62
18
RD
F62
18
RD
30
86
HORN
RELAY
(IN PDC)
(8W-41-3)
87
85
X2
18
DG/RD
X3
20
BK/RD
1
10
C107
LHD
RHD
X3
22
GY/OR
X3
22
BK/RD
X2
18
DG/RD
18
C106
X2
18
DG/RD
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
JB
HORN
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
S137
(8W-10-31)
X2
18
DG/RD
X2
18
DG/RD
39
C3
X3
20
GY/OR
2
HORN
NO. 1
(8W-41-3)
2
HORN
NO. 2
(8W-41-3)
3
C3
CLOCKSPRING
(8W-41-3)
1
1
1
C1
Z307
18
BK
Z307
18
BK
X3
20
GY/OR
S132
(8W-15-11)
Z307
14
BK
HORN
SWITCH
(8W-41-3)
G108
(8W-15-11)

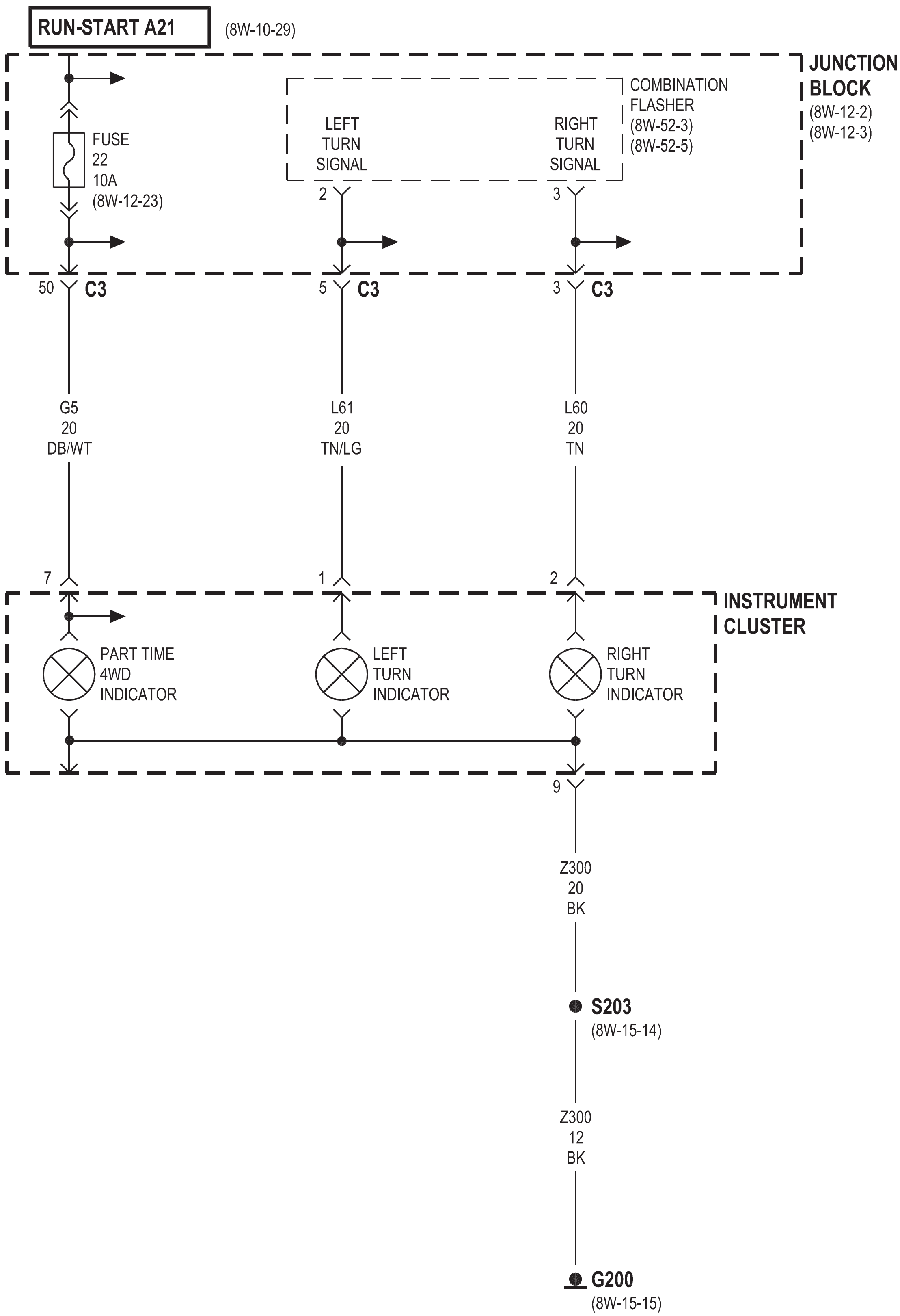

RUN-START A21
(8W-10-29)
BATT A148
(8W-10-30)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
(8W-12-23)
FUSE
7
10A
(8W-12-15)
5
JB
26
JB
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
FUSED
B(+)
BODY
CONTROL
MODULE
(8W-45-2)
51
C3
34
C3
G5
20
DB/WT
M1
20
PK
3
1
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
FUSED
B(+)
SENTRY
KEY
IMMOBILIZER
MODULE
GROUND
PCI
BUS
2
5
Z132
20
BK/OR
D25
20
YL/VT/BK
S211
(8W-15-13)
S210
(8W-18-4)
(8W-18-7)
LHD
RHD
Z132
18
BK
Z132
18
BK/OR
D25
20
YL/VT/BR
1
DIAGNOSTIC
JUNCTION
PORT
(8W-18-4)
(8W-18-7)
G200
(8W-15-15)


BODY
CONTROL
MODULE
(8W-45-7)
HOOD
AJAR
SWITCH
SENSE
5
C1
G70
20
BR/TN
27
C200
G70
20
BR/TN
15
C107
G70
20
BR/TN
1
HOOD
AJAR
SWITCH
2
DIESEL
GAS
Z141
20
BK
Z161
20
BK
S134
(8W-15-7)
S141
(8W-15-6)
Z141
14
BK
Z161
18
BK
G106
(8W-15-7)
G106
(8W-15-6)

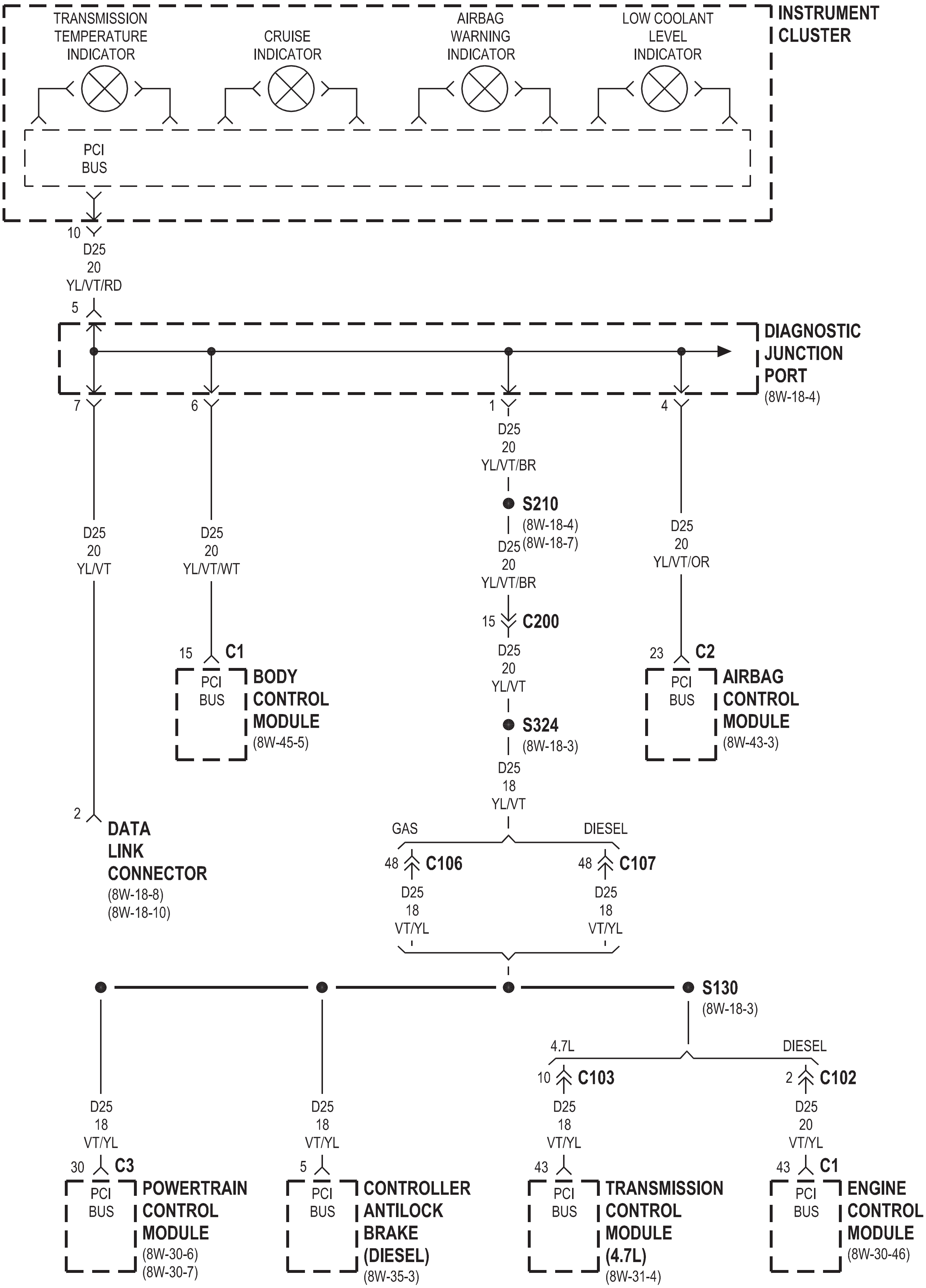

BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
32
C2
M1
20
PK/RD
S366
(8W-12-15)
M1
18
PK/RD
11
C302
M1
18
PK
DRIVER DOOR MODULE
DIAGNOSTIC OUT
(8W-61-2)
8
C1
D30
20
VT/YL
S365
D30
20
VT/YL
D30
20
VT/YL
5
6
3
DIAGNOSTIC OUT
DIAGNOSTIC OUT
FUSED B(+)
REMOTE KEYLESS MODULE
ANTENNA SIGNAL
ANTENNA SIGNAL
GROUND
1
2
4
K25
20
RD/GY
Z243
18
BK
S336
(8W-15-16)
Z243
12
BK
4
C302
Z243
12
BK
S358
(8W-15-22)
Z243
12
BK
G301
(8W-15-22)

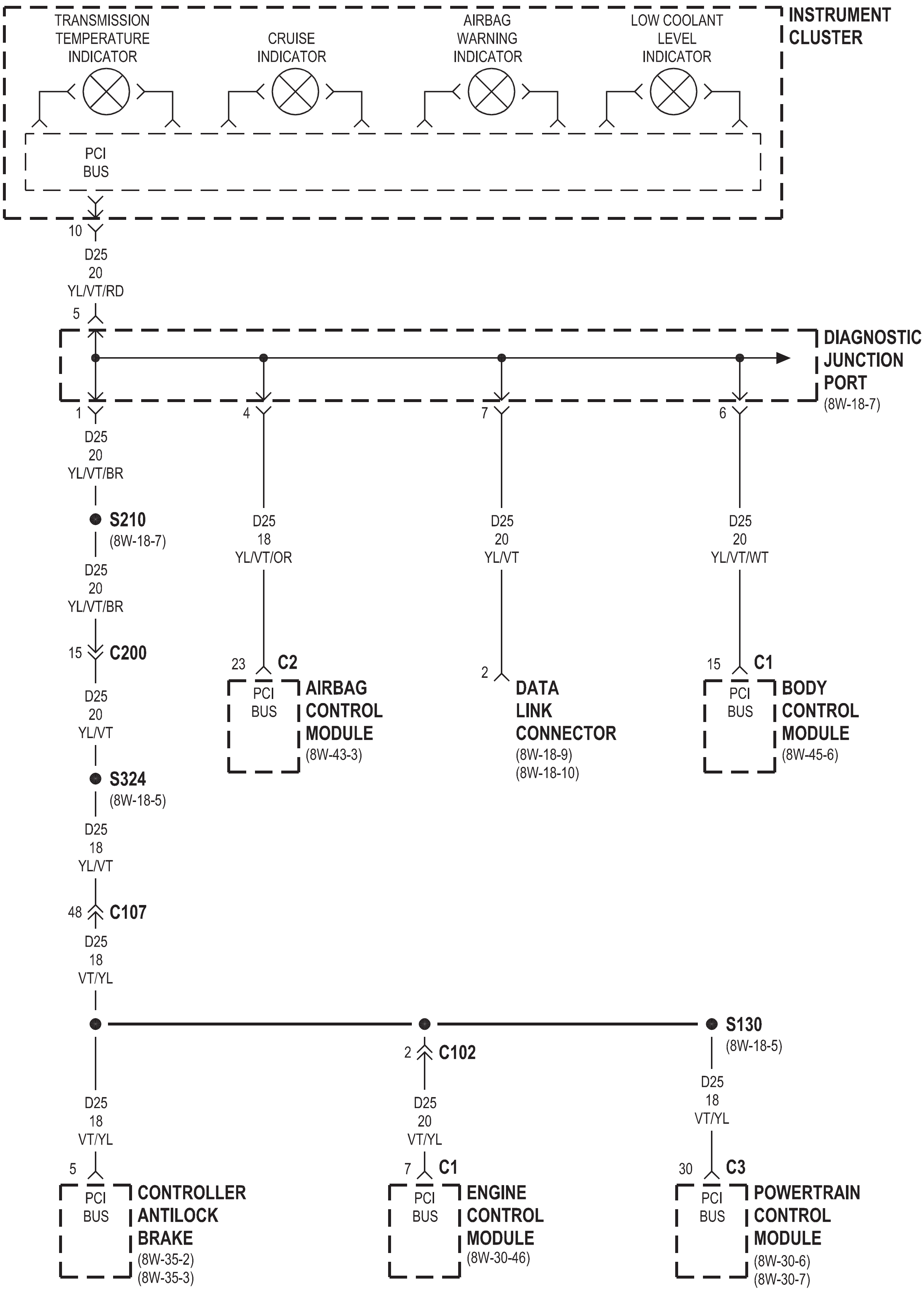
8W-40 INSTRUMENT CLUSTER


RUN-START A21
(8W-10-29)
BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
(8W-12-23)
FUSE
17
10A
(8W-12-10)
50
C3
32
C3
G5
20
DB/WT
F33
20
PK/RD
7
6
INSTRUMENT CLUSTER
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED B(+)
GROUND
ILLUMINATION LAMPS FEED
ILLUMINATION LAMPS
BODY CONTROL MODULE FLASH ENABLE
11
9
8
Z132
20
BK/OR
Z300
20
BK
D19
20
VT/OR
S223
(8W-18-8)
(8W-18-9)
(8W-18-10)
S211
(8W-15-13)
S203
(8W-15-14)
D19
20
VT/OR
D19
20
VT/OR
Z132
18
BK
Z300
12
BK
17
C1
BODY CONTROL MODULE FLASH ENABLE
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
9
DATA LINK CONNECTOR
(8W-18-8)
(8W-18-9)
(8W-18-10)
G200
(8W-15-15)

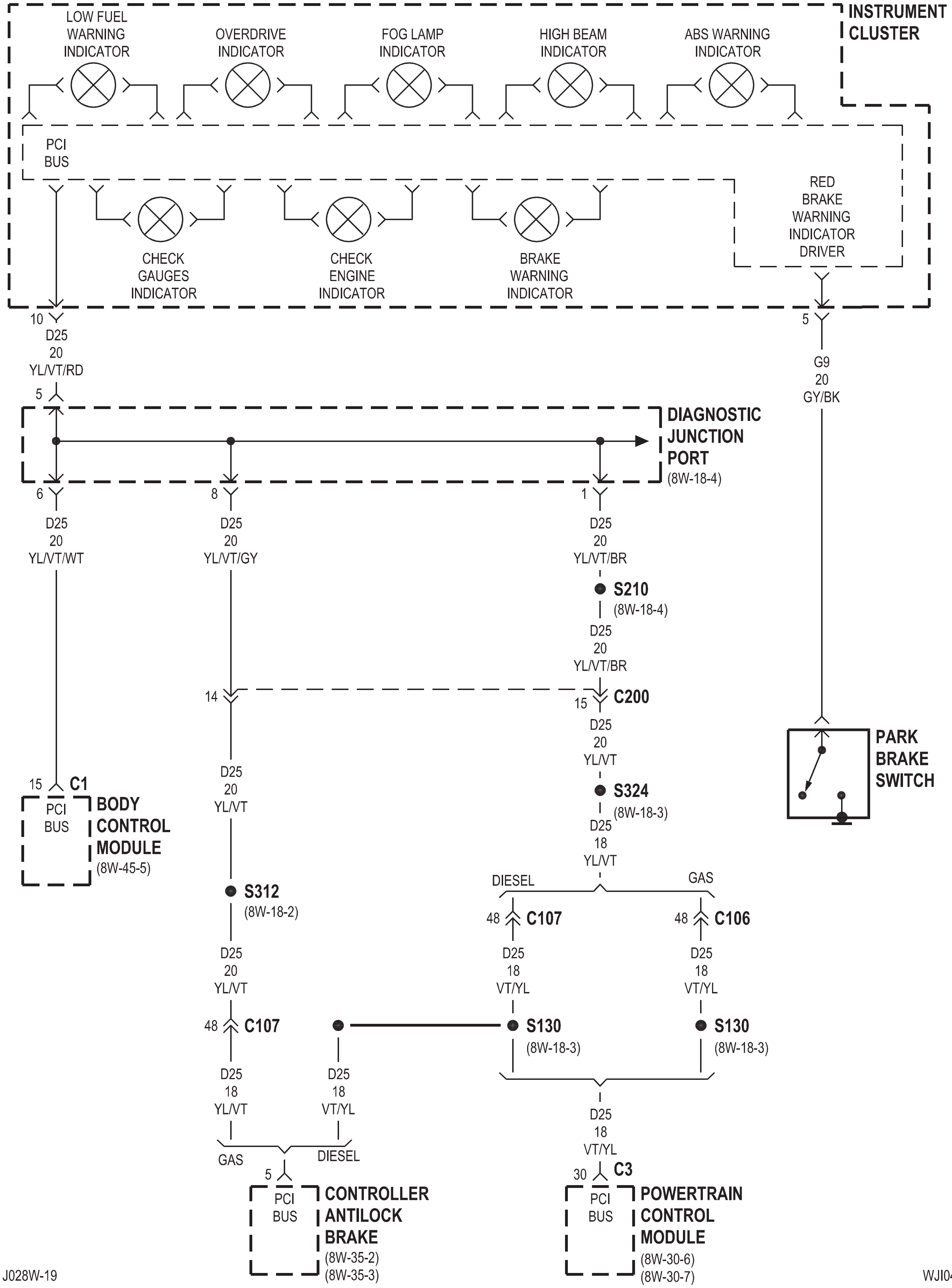

RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-3)
(8W-52-5)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
FUSE
22
10A
(8W-12-23)
2
3
50
C3
5
C3
3
C3
G5
20
DB/WT
L61
20
TN/LG
L60
20
TN
7
1
2
INSTRUMENT CLUSTER
PART TIME 4WD INDICATOR
LEFT TURN INDICATOR
RIGHT TURN INDICATOR
9
Z300
20
BK
S203
(8W-15-14)
Z300
12
BK
G200
(8W-15-15)

LHD

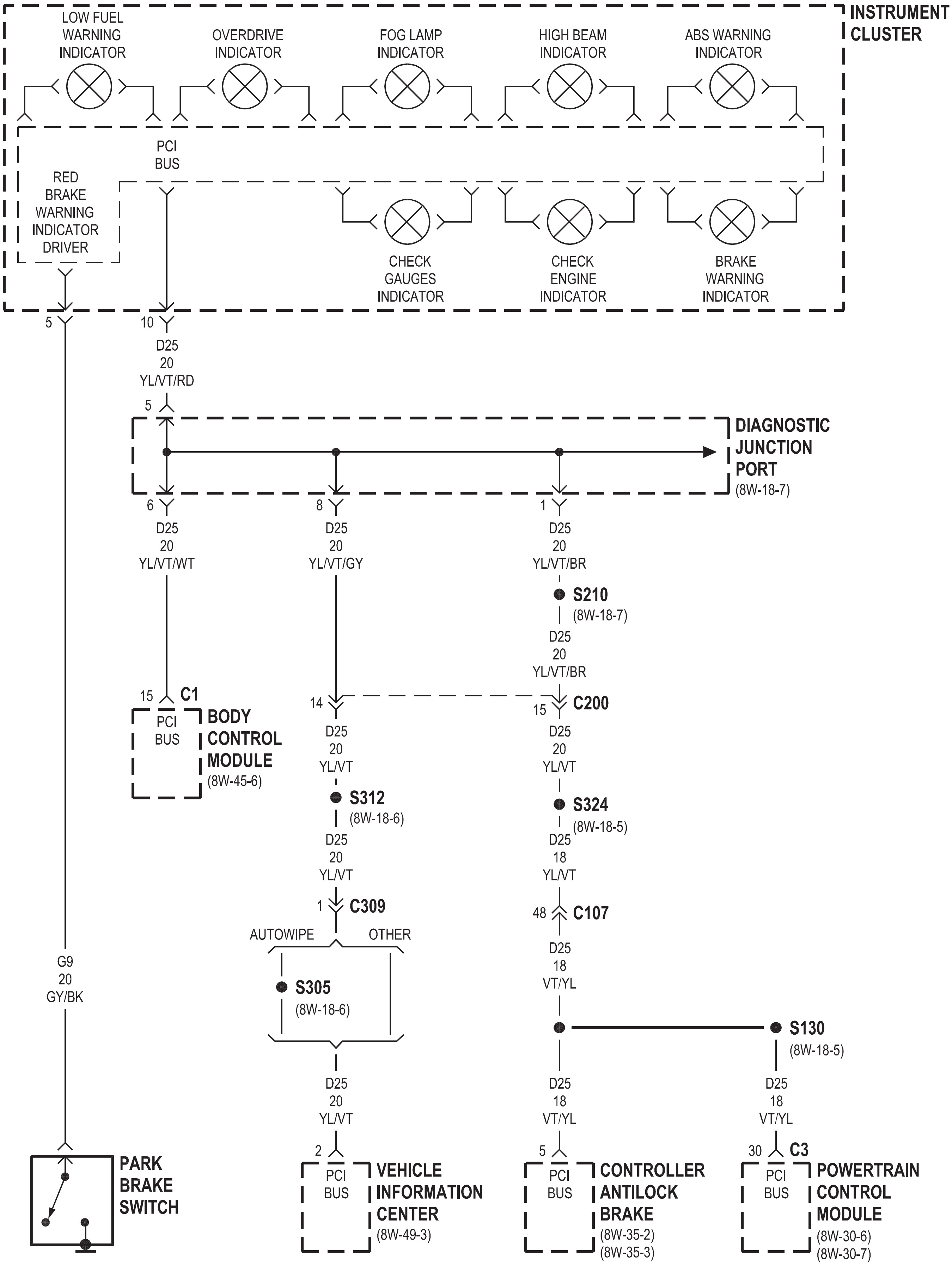

TRANSMISSION TEMPERATURE INDICATOR
CRUISE INDICATOR
AIRBAG WARNING INDICATOR
LOW COOLANT LEVEL INDICATOR
INSTRUMENT CLUSTER
PCI BUS
10
D25
20
YL/VT/RD
5
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
7
6
1
4
D25
20
YL/VT/BR
S210
(8W-18-4)
(8W-18-7)
D25
20
YL/VT/BR
15
C200
D25
20
YL/VT
S324
(8W-18-3)
D25
18
YL/VT
D25
20
YL/VT
D25
20
YL/VT/WT
D25
20
YL/VT/OR
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
23
C2
PCI BUS
AIRBAG CONTROL MODULE
(8W-43-3)
2
DATA LINK CONNECTOR
(8W-18-8)
(8W-18-10)
GAS
DIESEL
48
C106
48
C107
D25
18
VT/YL
D25
18
VT/YL
S130
(8W-18-3)
4.7L
DIESEL
10
C103
2
C102
D25
18
VT/YL
D25
18
VT/YL
D25
18
VT/YL
D25
20
VT/YL
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)
5
PCI BUS
CONTROLLER ANTILOCK BRAKE (DIESEL)
(8W-35-3)
43
PCI BUS
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
43
C1
PCI BUS
ENGINE CONTROL MODULE
(8W-30-46)

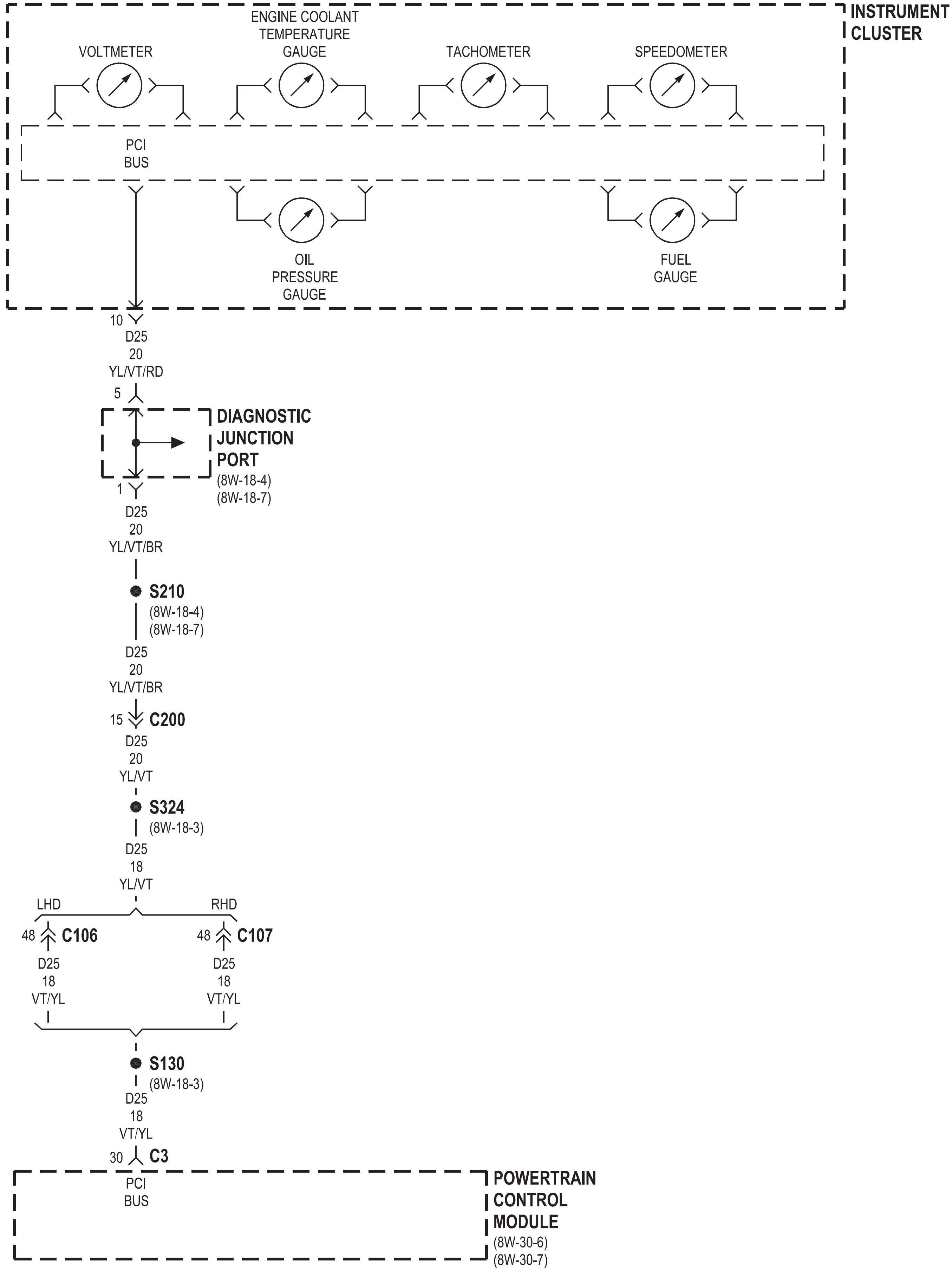

INSTRUMENT CLUSTER
TRANSMISSION TEMPERATURE INDICATOR
CRUISE INDICATOR
AIRBAG WARNING INDICATOR
LOW COOLANT LEVEL INDICATOR
PCI BUS
10
D25
20
YL/VT/RD
5
DIAGNOSTIC JUNCTION PORT
(8W-18-7)
1
4
7
6
D25
20
YL/VT/BR
S210
(8W-18-7)
D25
20
YL/VT/BR
15
C200
D25
20
YL/VT
S324
(8W-18-5)
D25
18
YL/VT
48
C107
D25
18
VT/YL
D25
18
YL/VT/OR
23
C2
PCI BUS
AIRBAG CONTROL MODULE
(8W-43-3)
D25
20
YL/VT
2
DATA LINK CONNECTOR
(8W-18-9)
(8W-18-10)
D25
20
YL/VT/WT
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-6)
S130
(8W-18-5)
2
C102
D25
18
VT/YL
5
PCI BUS
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
(8W-35-3)
D25
20
VT/YL
7
C1
PCI BUS
ENGINE CONTROL MODULE
(8W-30-46)
D25
18
VT/YL
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)

LHD

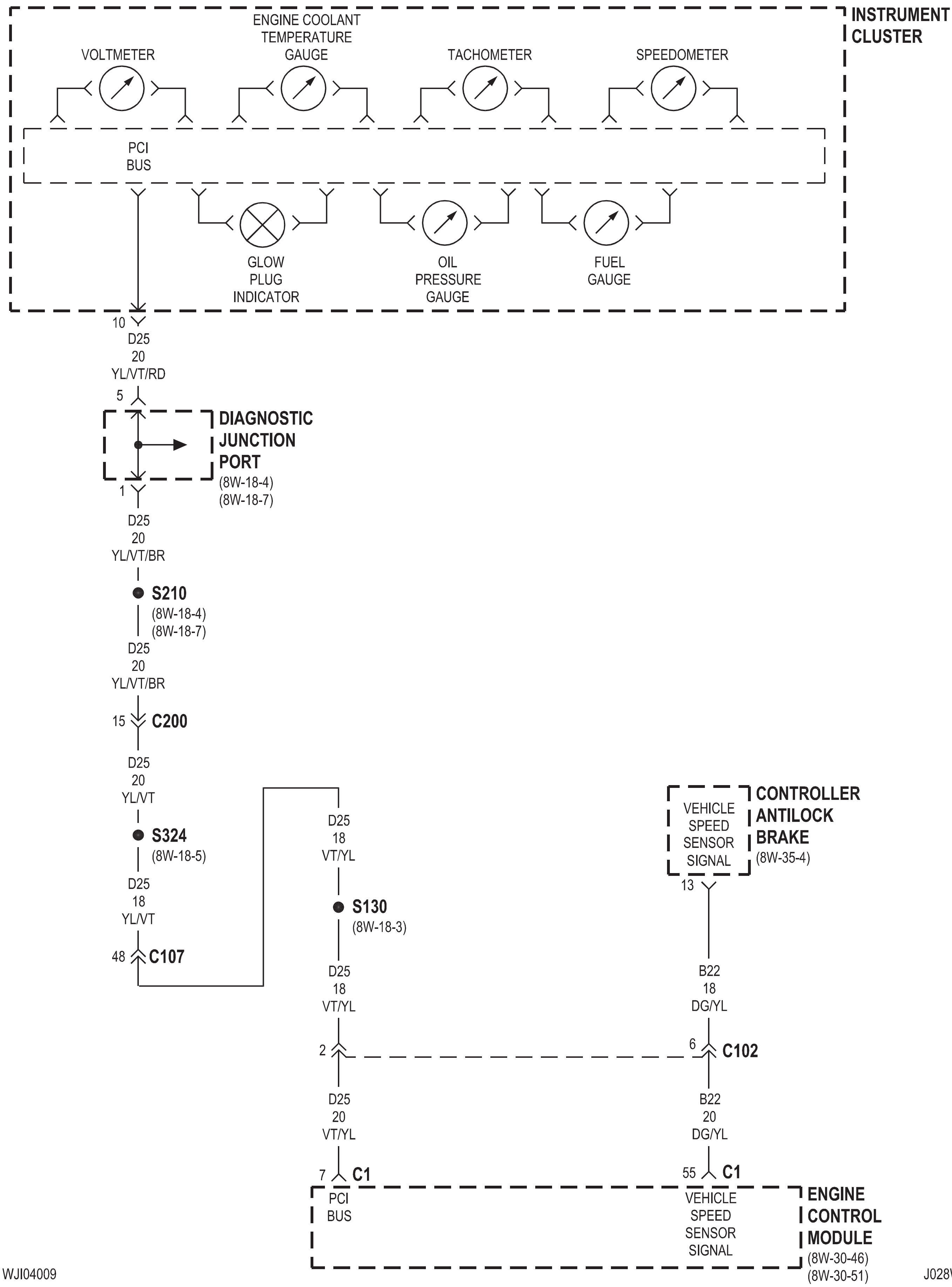

INSTRUMENT CLUSTER
LOW FUEL WARNING INDICATOR
OVERDRIVE INDICATOR
FOG LAMP INDICATOR
HIGH BEAM INDICATOR
ABS WARNING INDICATOR
PCI BUS
RED BRAKE WARNING INDICATOR DRIVER
CHECK GAUGES INDICATOR
CHECK ENGINE INDICATOR
BRAKE WARNING INDICATOR
10
D25
20
YL/VT/RD
5
5
G9
20
GY/BK
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
6
8
1
D25
20
YL/VT/WT
D25
20
YL/VT/GY
D25
20
YL/VT/BR
S210
(8W-18-4)
D25
20
YL/VT/BR
14
15
C200
D25
20
YL/VT
D25
20
YL/VT
S324
(8W-18-3)
D25
18
YL/VT
DIESEL
GAS
48
C107
48
C106
D25
18
VT/YL
D25
18
VT/YL
PARK BRAKE SWITCH
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
S312
(8W-18-2)
D25
20
YL/VT
48
C107
S130
(8W-18-3)
S130
(8W-18-3)
D25
18
YL/VT
D25
18
VT/YL
GAS
DIESEL
D25
18
VT/YL
5
30
C3
PCI BUS
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
(8W-35-3)
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)

RHD

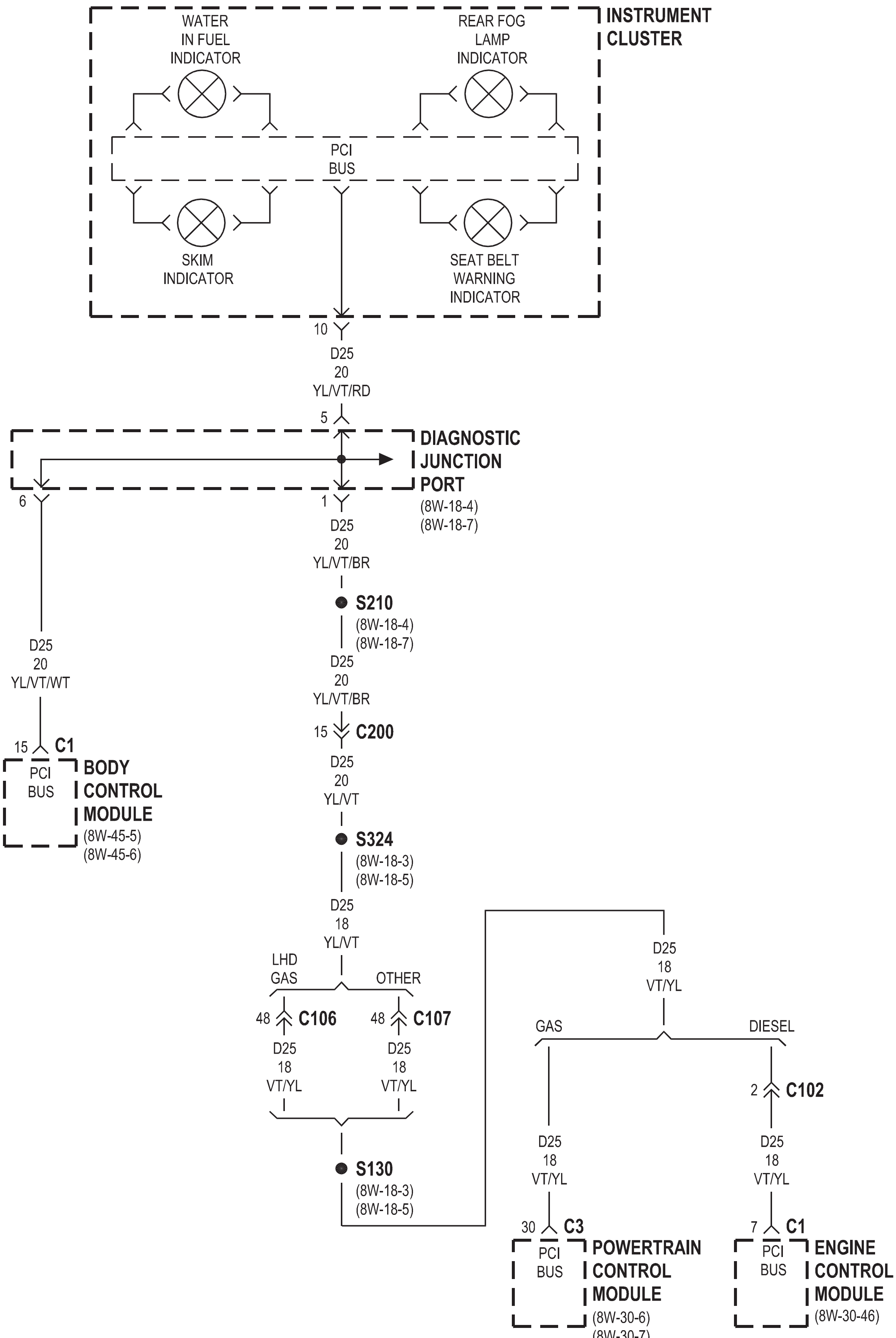

INSTRUMENT CLUSTER
LOW FUEL WARNING INDICATOR
OVERDRIVE INDICATOR
FOG LAMP INDICATOR
HIGH BEAM INDICATOR
ABS WARNING INDICATOR
PCI BUS
RED BRAKE WARNING INDICATOR DRIVER
CHECK GAUGES INDICATOR
CHECK ENGINE INDICATOR
BRAKE WARNING INDICATOR
5
10
D25
20
YL/VT/RD
5
DIAGNOSTIC JUNCTION PORT
(8W-18-7)
6
8
1
D25
20
YL/VT/WT
D25
20
YL/VT/GY
D25
20
YL/VT/BR
S210
(8W-18-7)
D25
20
YL/VT/BR
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-6)
14
15
C200
D25
20
YL/VT
D25
20
YL/VT
S312
(8W-18-6)
S324
(8W-18-5)
D25
20
YL/VT
D25
18
YL/VT
1
C309
48
C107
AUTOWIPE
OTHER
S305
(8W-18-6)
D25
18
VT/YL
G9
20
GY/BK
S130
(8W-18-5)
D25
20
YL/VT
D25
18
VT/YL
D25
18
VT/YL
2
5
30
C3
PARK BRAKE SWITCH
PCI BUS
VEHICLE INFORMATION CENTER
(8W-49-3)
PCI BUS
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
(8W-35-3)
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)


INSTRUMENT CLUSTER
VOLTMETER
ENGINE COOLANT TEMPERATURE GAUGE
TACHOMETER
SPEEDOMETER
PCI BUS
OIL PRESSURE GAUGE
FUEL GAUGE
10
D25
20
YL/VT/RD
5
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
1
D25
20
YL/VT/BR
S210
(8W-18-4)
(8W-18-7)
D25
20
YL/VT/BR
15
C200
D25
20
YL/VT
S324
(8W-18-3)
D25
18
YL/VT
LHD
RHD
48
C106
48
C107
D25
18
VT/YL
D25
18
VT/YL
S130
(8W-18-3)
D25
18
VT/YL
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)

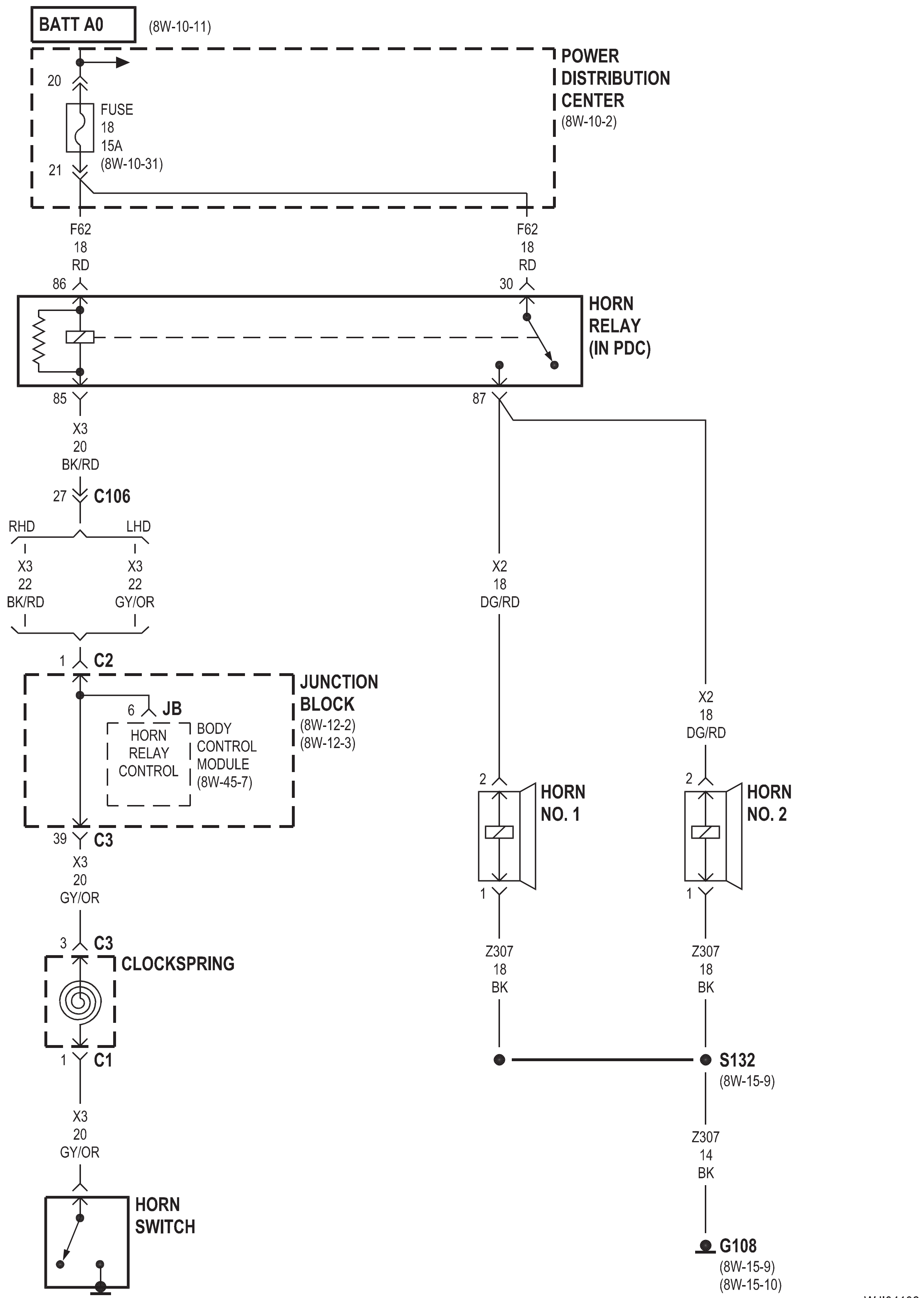
DIESEL

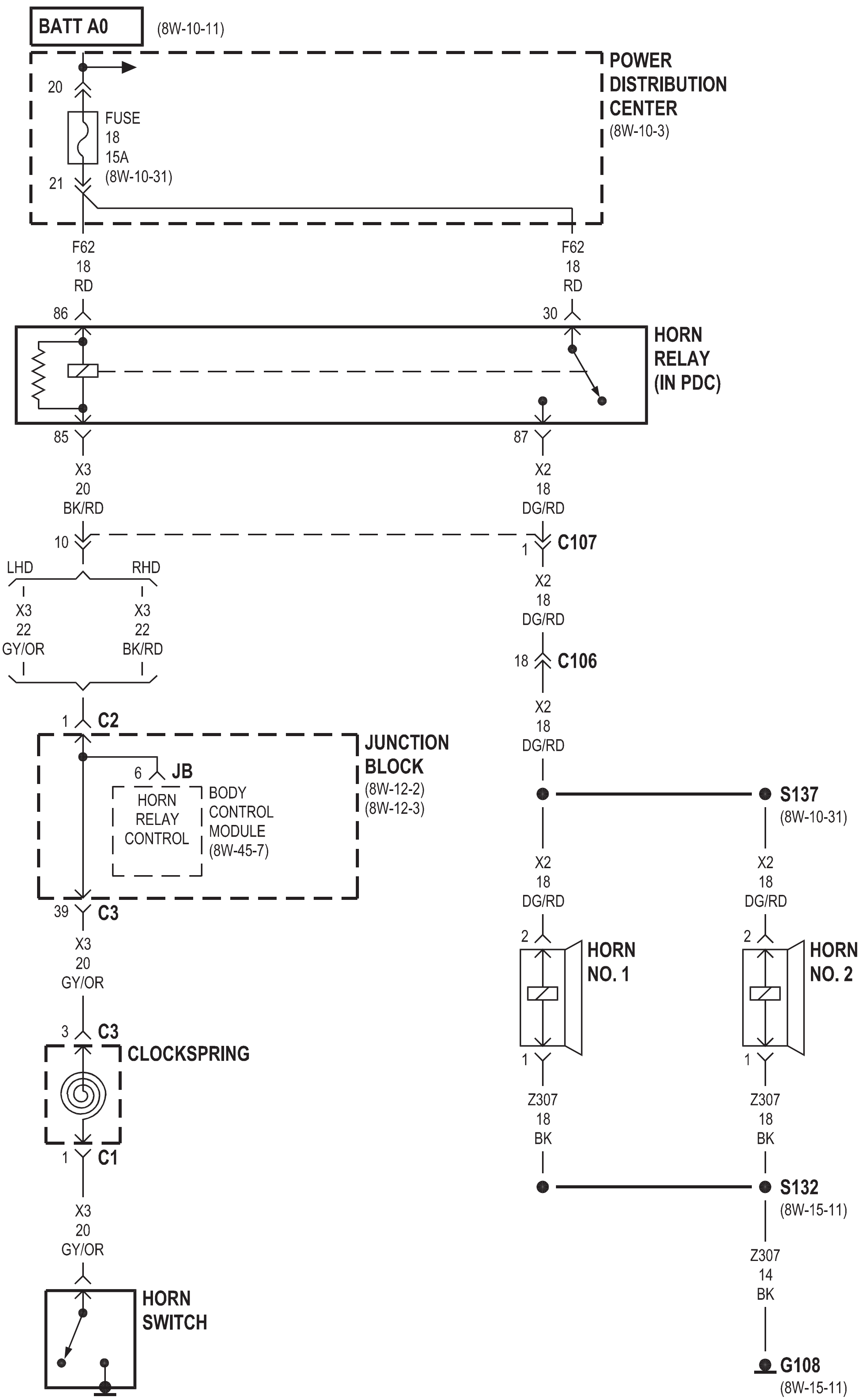


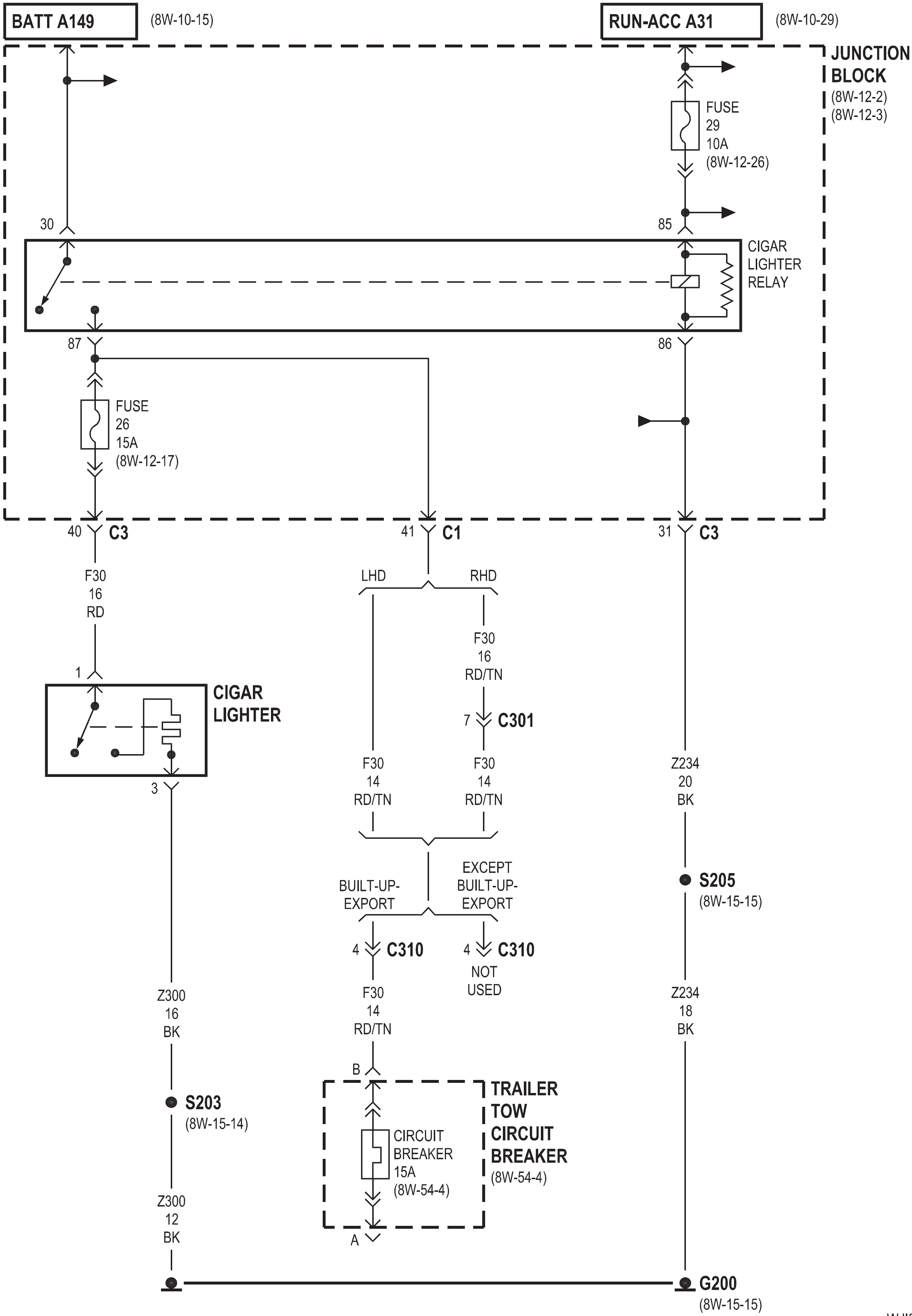
WJI04009 J028W-19

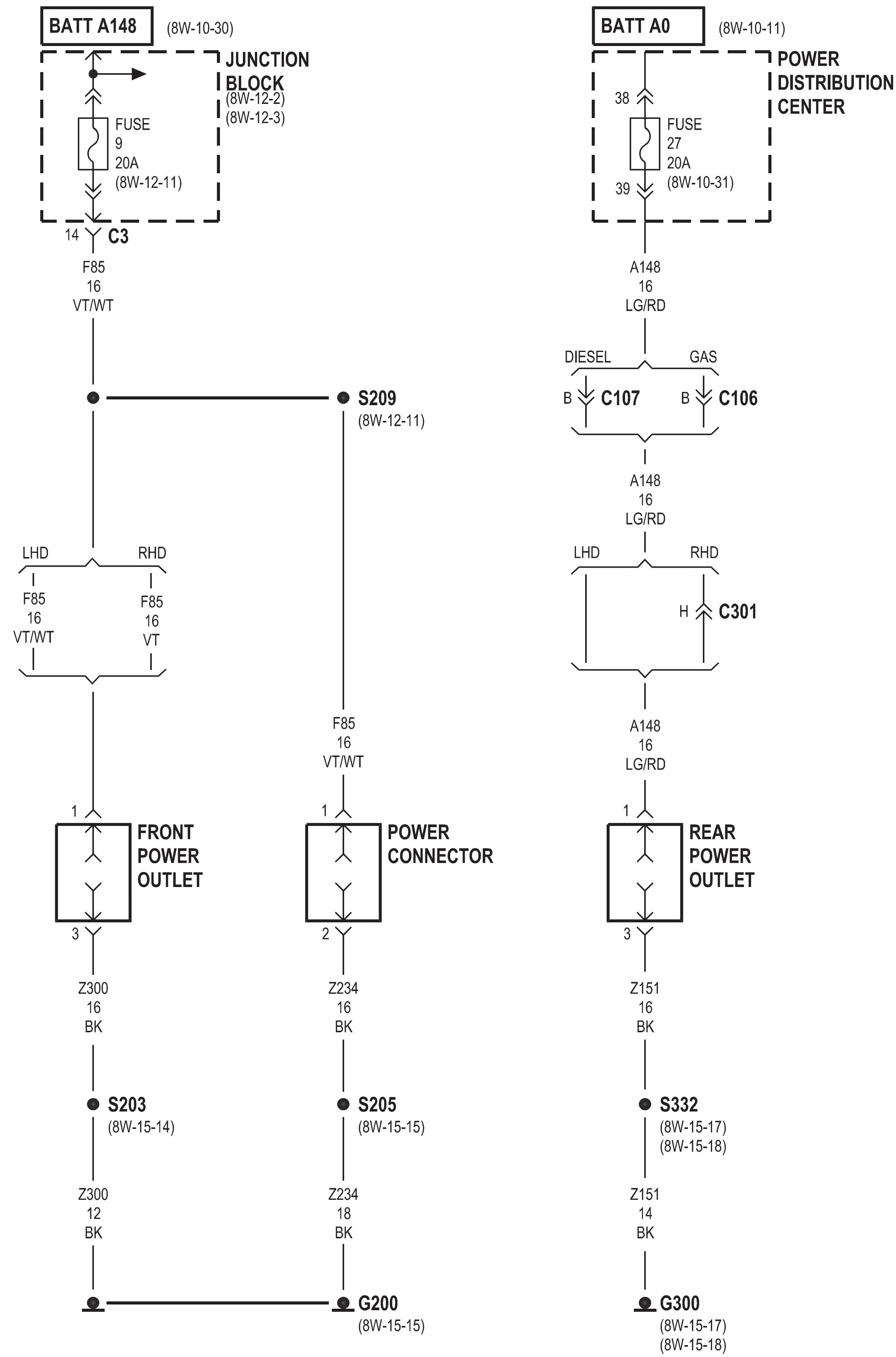

INSTRUMENT CLUSTER
WATER IN FUEL INDICATOR
REAR FOG LAMP INDICATOR
PCI BUS
SKIM INDICATOR
SEAT BELT WARNING INDICATOR
10
D25
20
YL/VT/RD
5
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
6
1
D25
20
YL/VT/BR
S210
(8W-18-4)
(8W-18-7)
D25
20
YL/VT/WT
D25
20
YL/VT/BR
15
C200
D25
20
YL/VT
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
S324
(8W-18-3)
(8W-18-5)
D25
18
YL/VT
LHD GAS
OTHER
48
C106
48
C107
D25
18
VT/YL
D25
18
VT/YL
S130
(8W-18-3)
(8W-18-5)
D25
18
VT/YL
GAS
DIESEL
2
C102
D25
18
VT/YL
D25
18
VT/YL
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-6)
(8W-30-7)
7
C1
PCI BUS
ENGINE CONTROL MODULE
(8W-30-46)

8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

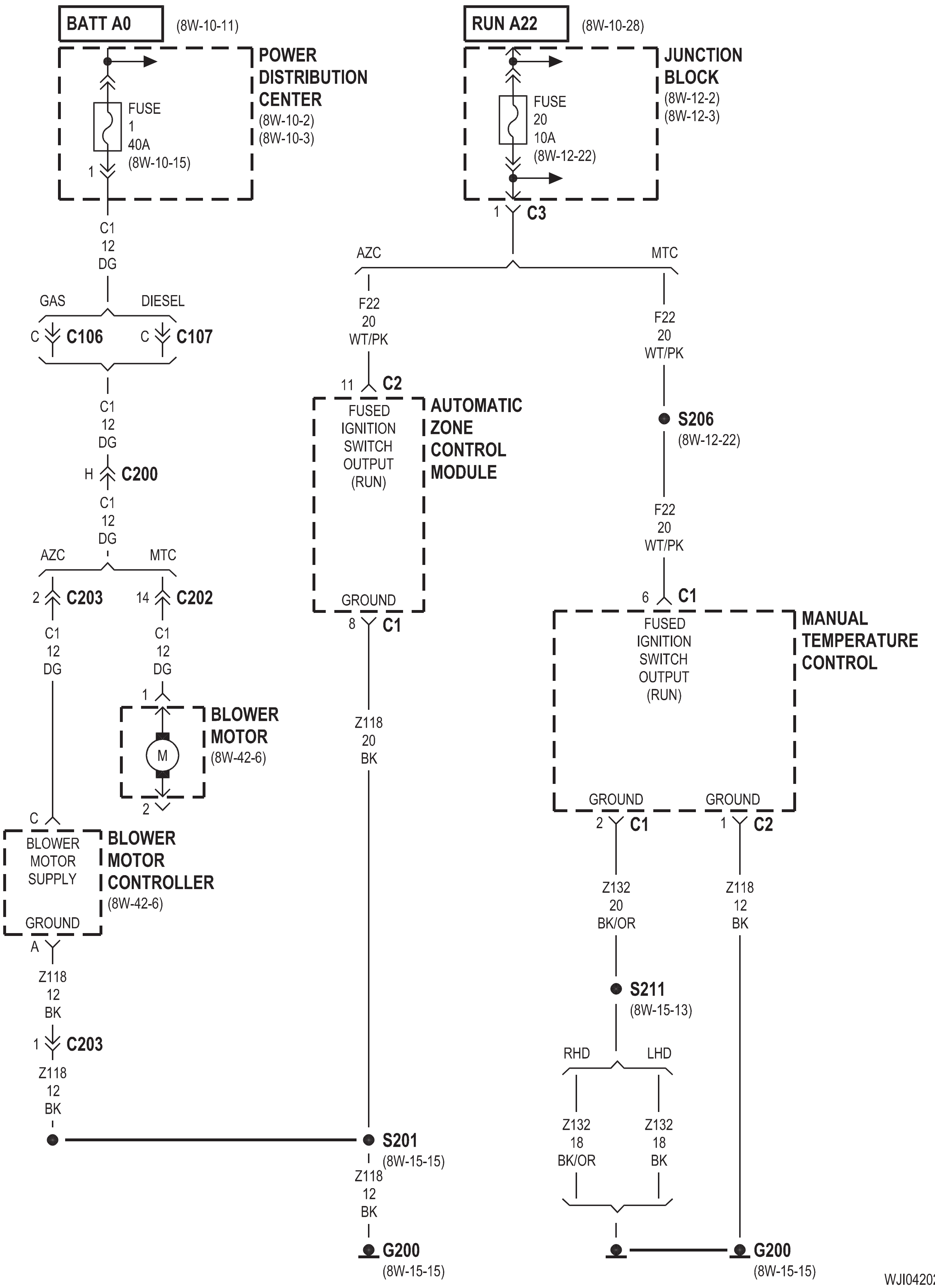

BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
20
FUSE
18
15A
(8W-10-31)
21
F62
18
RD
F62
18
RD
86
30
HORN
RELAY
(IN PDC)
85
87
X3
20
BK/RD
27
C106
RHD
LHD
X3
22
BK/RD
X3
22
GY/OR
X2
18
DG/RD
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
JB
HORN
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
X2
18
DG/RD
2
HORN
NO. 1
2
HORN
NO. 2
39
C3
X3
20
GY/OR
1
1
3
C3
CLOCKSPRING
Z307
18
BK
Z307
18
BK
1
C1
S132
(8W-15-9)
X3
20
GY/OR
Z307
14
BK
HORN
SWITCH
G108
(8W-15-9)
(8W-15-10)


BATT A0
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-3)
20
FUSE
18
15A
(8W-10-31)
21
F62
18
RD
F62
18
RD
86
30
HORN
RELAY
(IN PDC)
85
87
X3
20
BK/RD
X2
18
DG/RD
10
1
C107
LHD
RHD
X3
22
GY/OR
X3
22
BK/RD
X2
18
DG/RD
18
C106
X2
18
DG/RD
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
JB
HORN
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
S137
(8W-10-31)
39
C3
X2
18
DG/RD
X2
18
DG/RD
X3
20
GY/OR
2
HORN
NO. 1
2
HORN
NO. 2
3
C3
CLOCKSPRING
1
1
Z307
18
BK
Z307
18
BK
1
C1
S132
(8W-15-11)
X3
20
GY/OR
Z307
14
BK
HORN
SWITCH
G108
(8W-15-11)


BATT A149
(8W-10-15)
RUN-ACC A31
(8W-10-29)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
29
10A
(8W-12-26)
30
85
CIGAR
LIGHTER
RELAY
87
86
FUSE
26
15A
(8W-12-17)
40
C3
41
C1
31
C3
F30
16
RD
LHD
RHD
F30
16
RD/TN
7
C301
1
CIGAR
LIGHTER
3
F30
14
RD/TN
F30
14
RD/TN
Z234
20
BK
BUILT-UP-
EXPORT
EXCEPT
BUILT-UP-
EXPORT
S205
(8W-15-15)
4
C310
4
C310
NOT
USED
Z300
16
BK
F30
14
RD/TN
Z234
18
BK
B
S203
(8W-15-14)
CIRCUIT
BREAKER
15A
(8W-54-4)
TRAILER
TOW
CIRCUIT
BREAKER
(8W-54-4)
Z300
12
BK
A
G200
(8W-15-15)

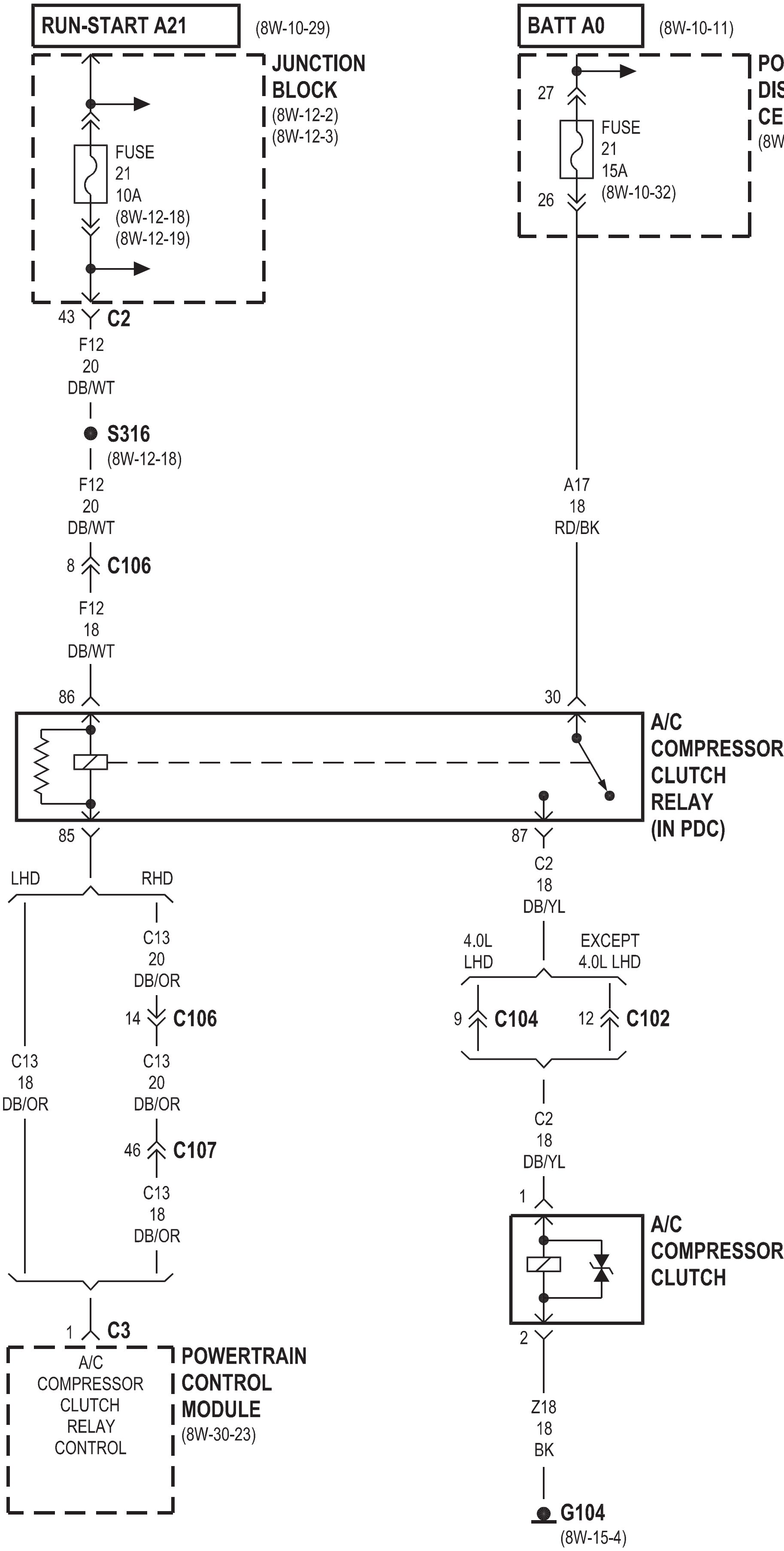

BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
20A
(8W-12-11)
14
C3
F85
16
VT/WT
S209
(8W-12-11)
LHD
RHD
F85
16
VT/WT
F85
16
VT
F85
16
VT/WT
1
FRONT POWER OUTLET
3
1
POWER CONNECTOR
2
Z300
16
BK
S203
(8W-15-14)
Z300
12
BK
Z234
16
BK
S205
(8W-15-15)
Z234
18
BK
G200
(8W-15-15)
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
38
FUSE
27
20A
(8W-10-31)
39
A148
16
LG/RD
DIESEL
GAS
B
C107
B
C106
A148
16
LG/RD
LHD
RHD
H
C301
A148
16
LG/RD
1
REAR POWER OUTLET
3
Z151
16
BK
S332
(8W-15-17)
(8W-15-18)
Z151
14
BK
G300
(8W-15-17)
(8W-15-18)

8W-42 AIR CONDITIONING-HEATER

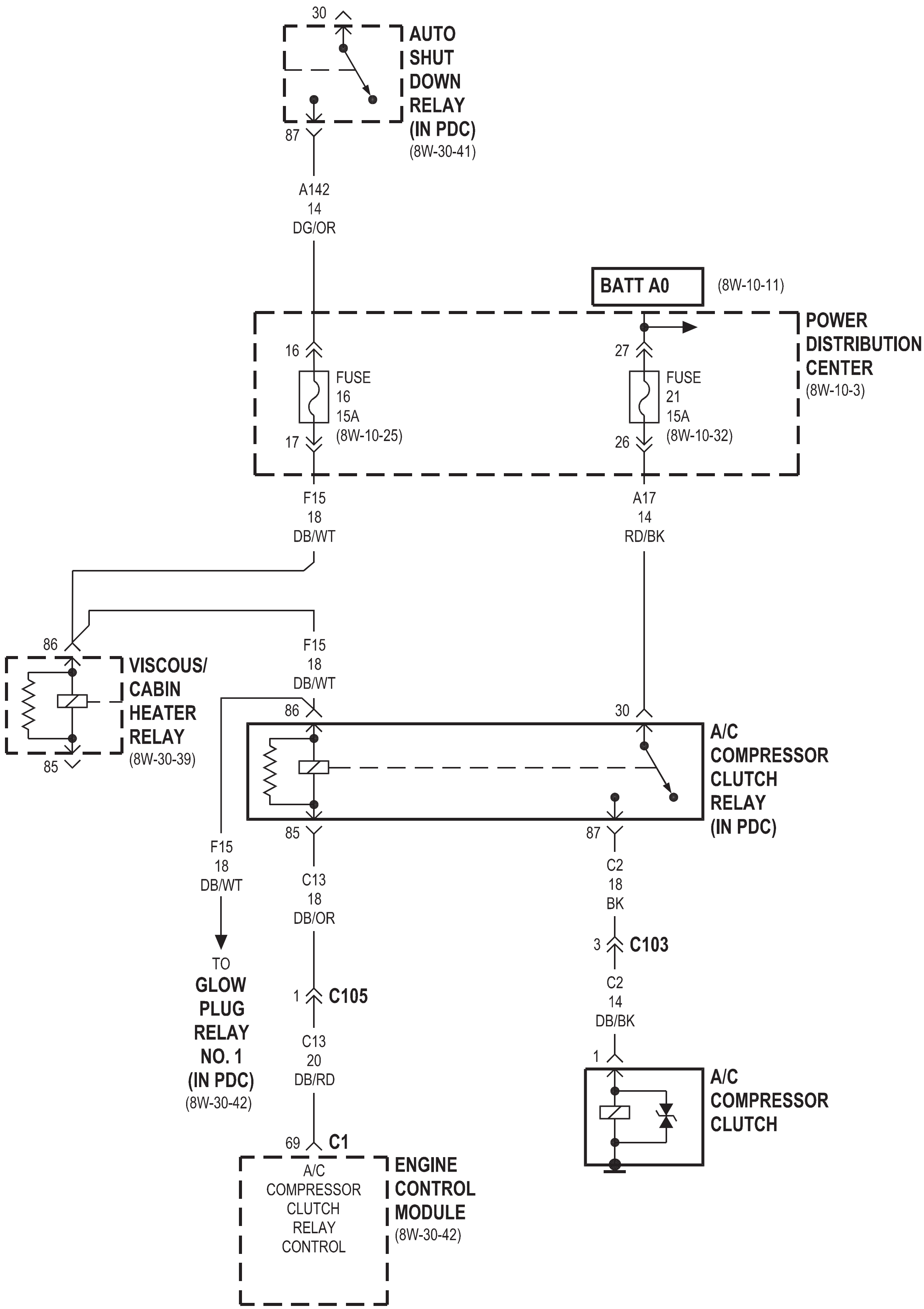


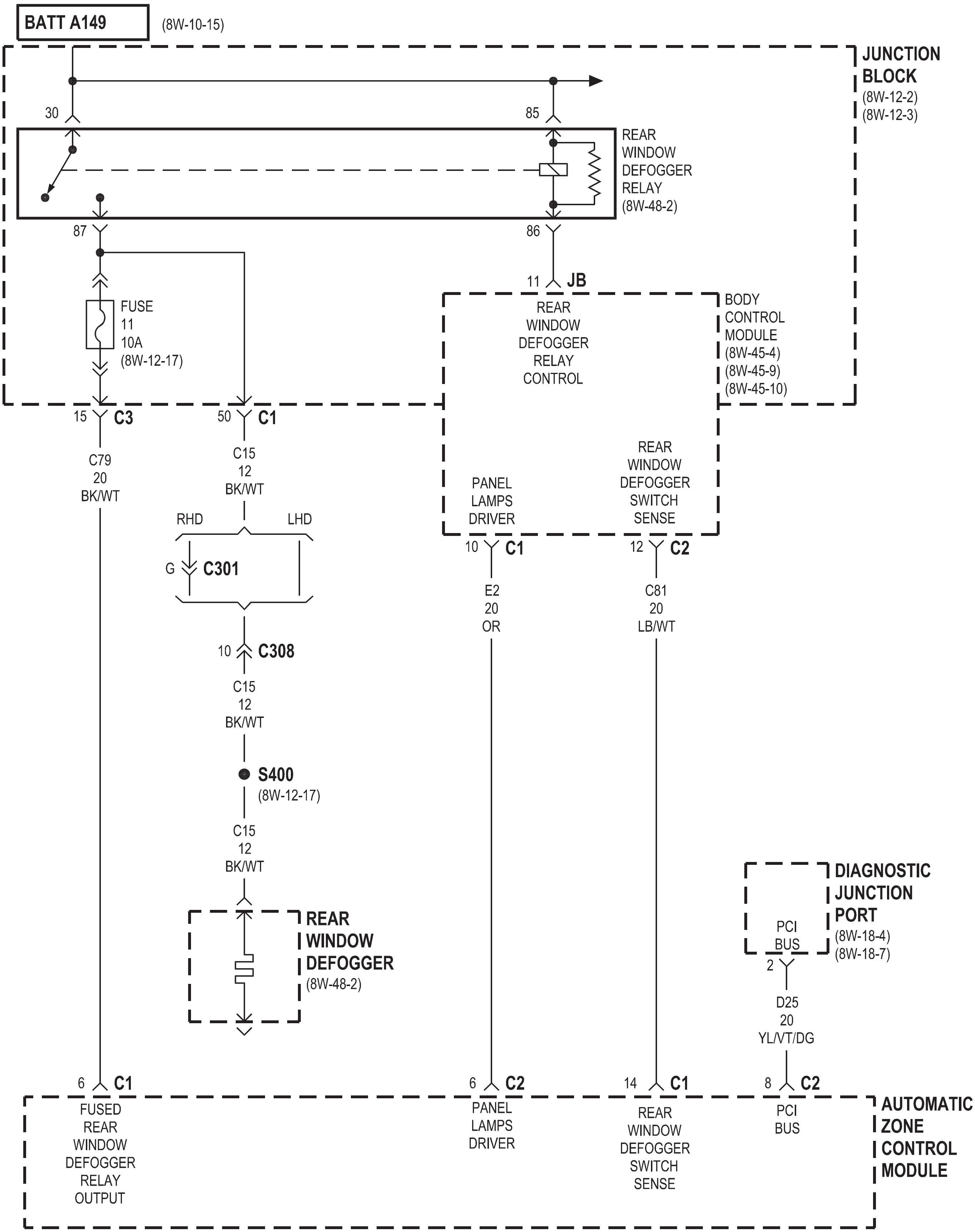
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
1
40A
(8W-10-15)
C1
12
DG
GAS
DIESEL
C106
C107
C200
AZC
MTC
C203
C202
BLOWER MOTOR
(8W-42-6)
BLOWER MOTOR SUPPLY
GROUND
BLOWER MOTOR CONTROLLER
(8W-42-6)
Z118
12
BK
RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
C3
F22
20
WT/PK
C2
AUTOMATIC ZONE CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN)
GROUND
C1
Z118
20
BK
S201
(8W-15-15)
G200
(8W-15-15)
S206
(8W-12-22)
MANUAL TEMPERATURE CONTROL
Z132
20
BK/OR
S211
(8W-15-13)
RHD
LHD
Z132
18
BK/OR
BK

GAS

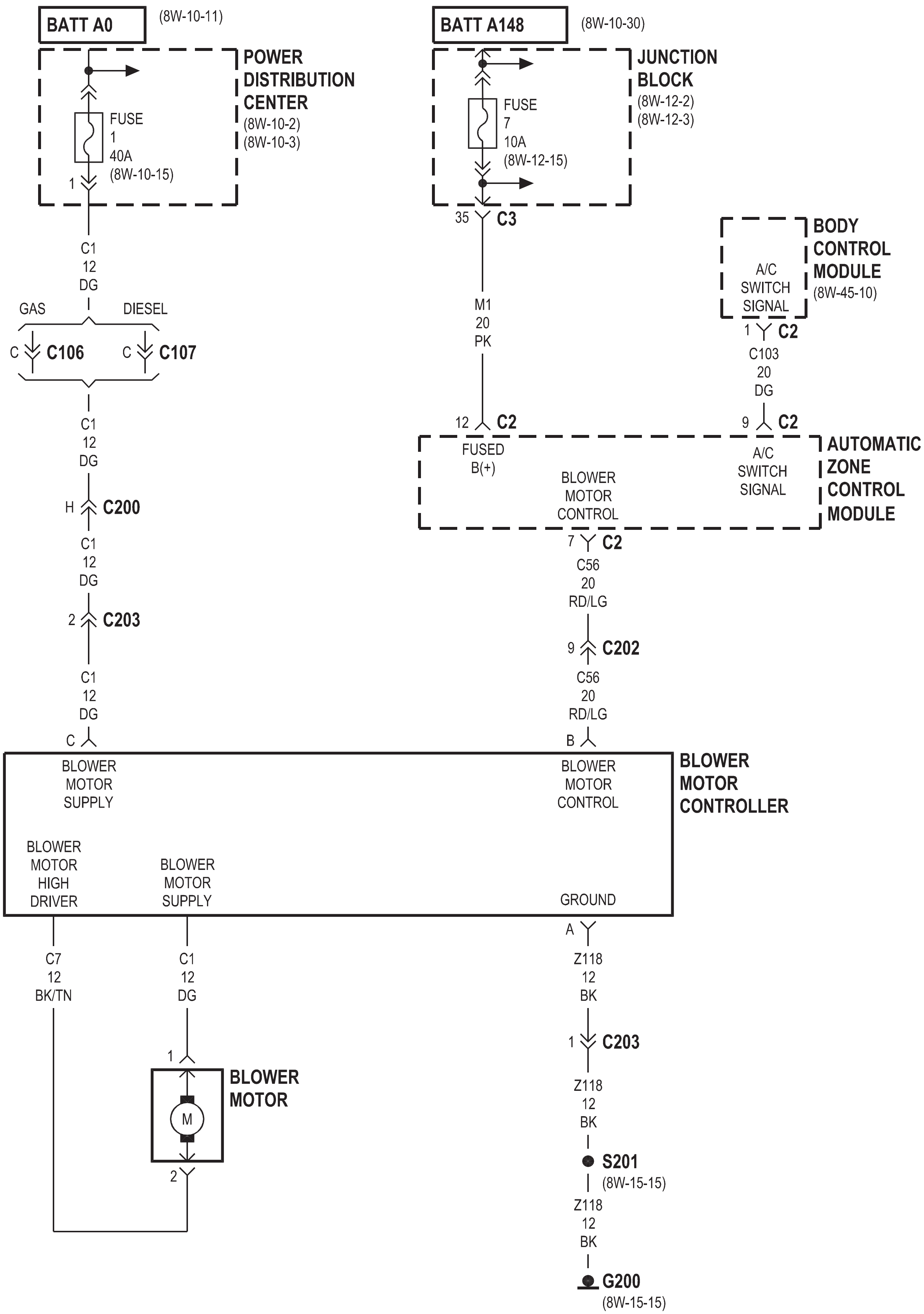

RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
21
10A
(8W-12-18)
(8W-12-19)
43
C2
F12
20
DB/WT
S316
(8W-12-18)
F12
20
DB/WT
8
C106
F12
18
DB/WT
86
85
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
27
FUSE
21
15A
(8W-10-32)
26
A17
18
RD/BK
30
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
87
LHD
RHD
C13
20
DB/OR
14
C106
C13
18
DB/OR
C13
20
DB/OR
46
C107
C13
18
DB/OR
1
C3
A/C COMPRESSOR CLUTCH RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-23)
C2
18
DB/YL
4.0L LHD
EXCEPT 4.0L LHD
9
C104
12
C102
C2
18
DB/YL
1
A/C COMPRESSOR CLUTCH
2
Z18
18
BK
G104
(8W-15-4)

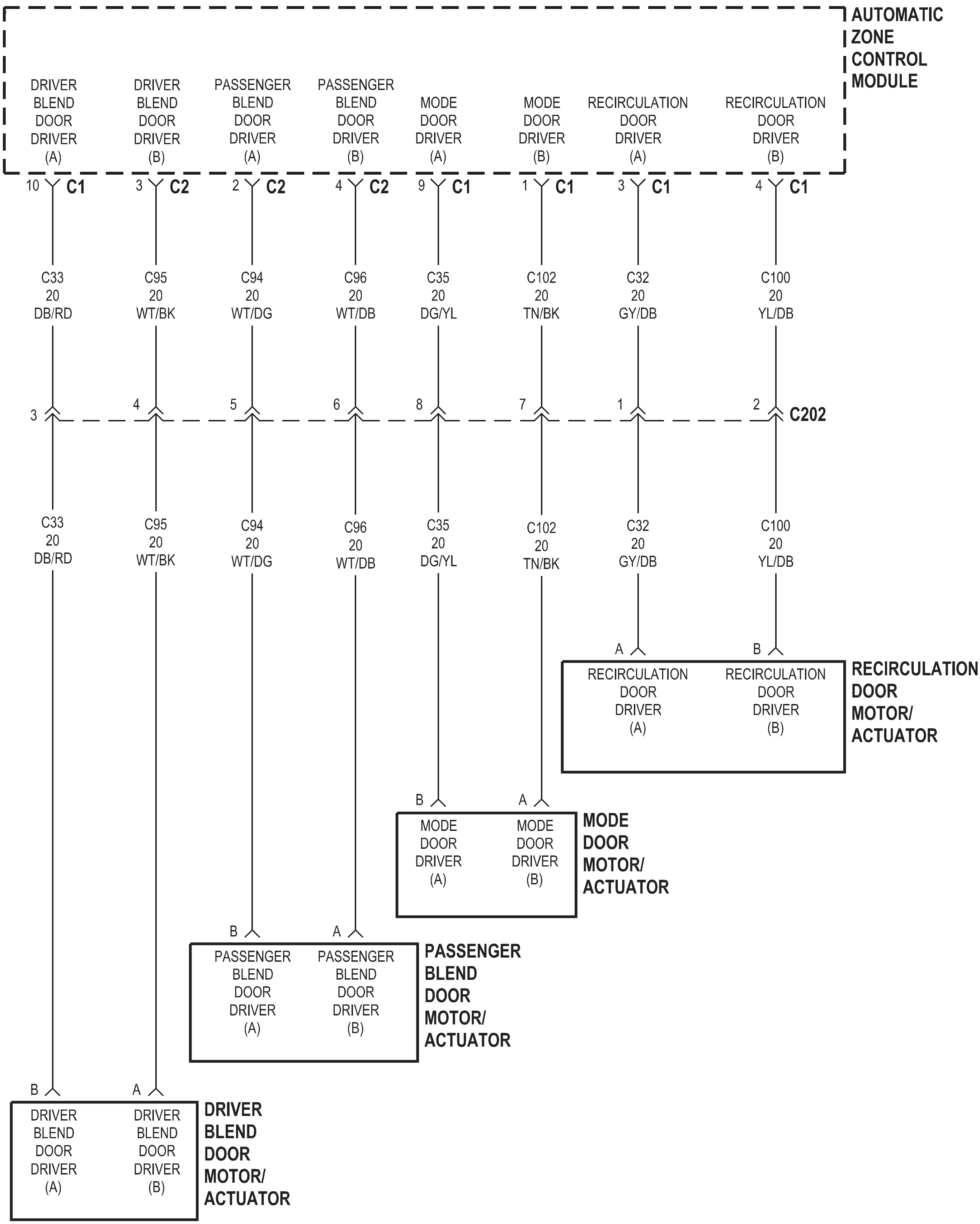
DIESEL

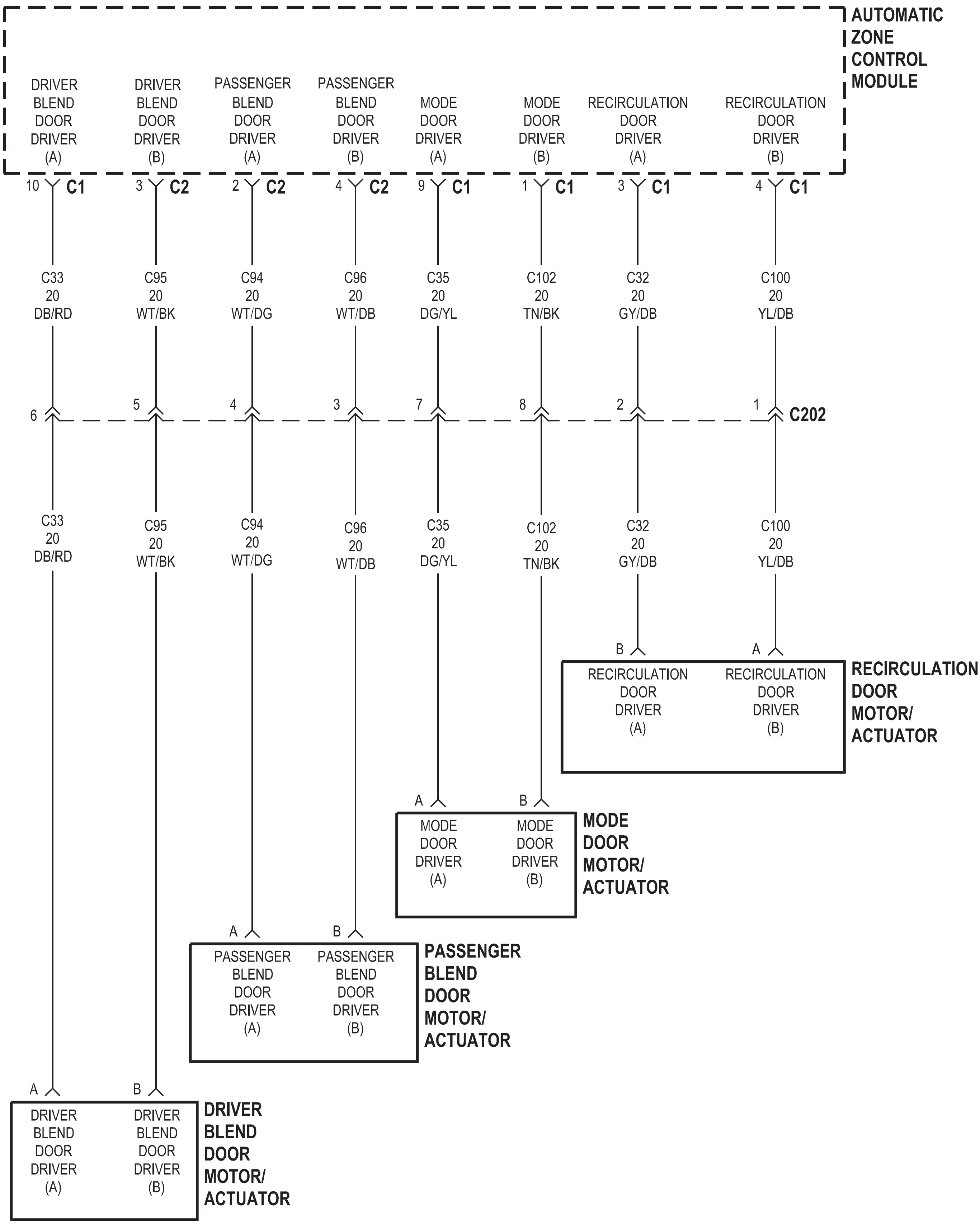

30
AUTO SHUT DOWN RELAY (IN PDC)
(8W-30-41)
87
A142
14
DG/OR
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE
16
15A
(8W-10-25)
17
27
FUSE
21
15A
(8W-10-32)
26
F15
18
DB/WT
A17
14
RD/BK
86
VISCOUS/ CABIN HEATER RELAY
(8W-30-39)
85
F15
18
DB/WT
86
30
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
85
87
F15
18
DB/WT
TO
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-42)
C13
18
DB/OR
1
C105
C13
20
DB/RD
69
C1
A/C COMPRESSOR CLUTCH RELAY CONTROL
ENGINE CONTROL MODULE
(8W-30-42)
C2
18
BK
3
C103
C2
14
DB/BK
1
A/C COMPRESSOR CLUTCH

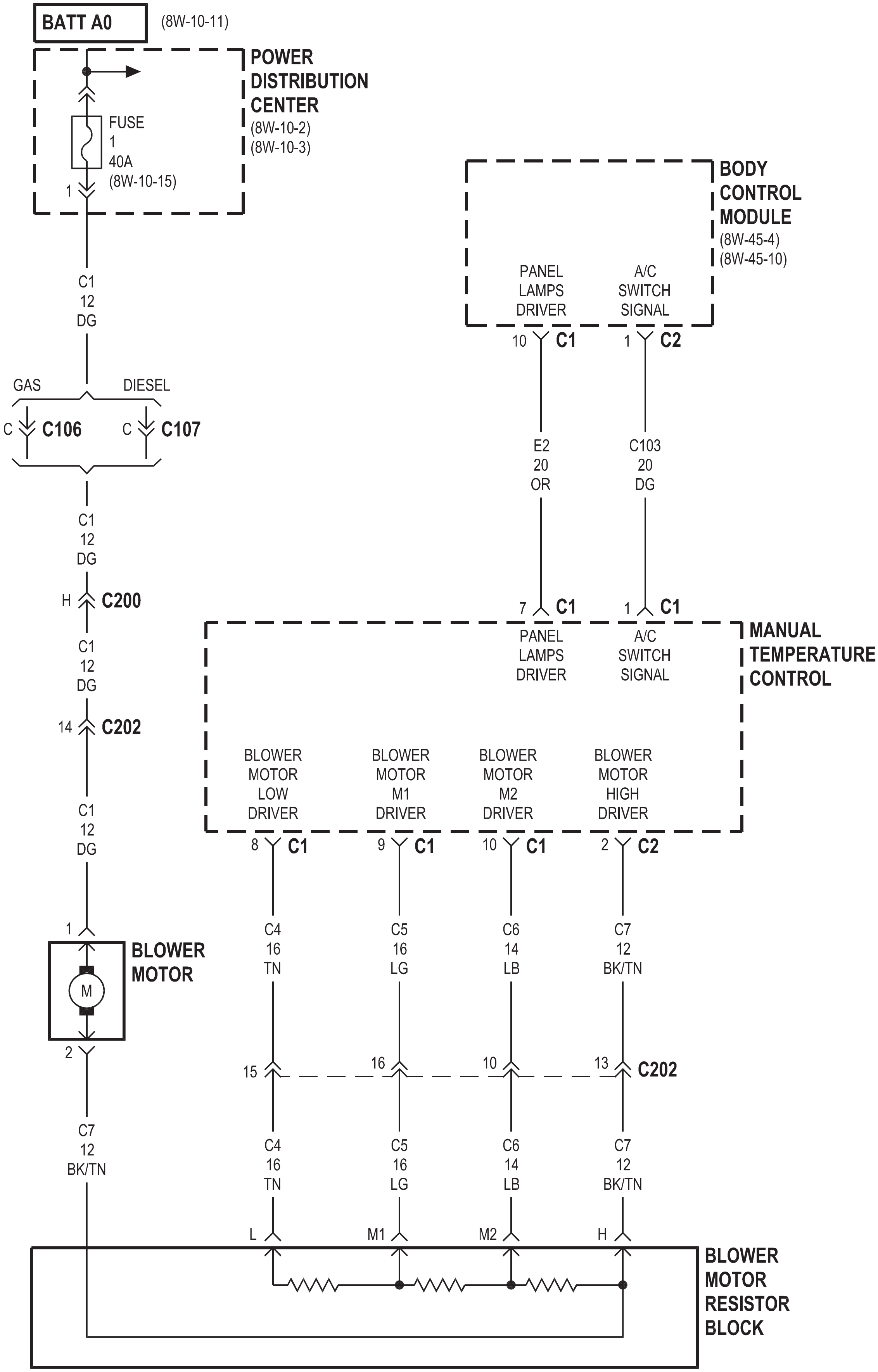

BATT A149
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
85
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
87
86
11 JB
FUSE 11 10A (8W-12-17)
REAR WINDOW DEFOGGER RELAY CONTROL
BODY CONTROL MODULE
(8W-45-4)
(8W-45-9)
(8W-45-10)
15 C3
50 C1
C79 20 BK/WT
C15 12 BK/WT
RHD
LHD
G C301
PANEL LAMPS DRIVER
REAR WINDOW DEFOGGER SWITCH SENSE
10 C1
12 C2
E2 20 OR
C81 20 LB/WT
10 C308
C15 12 BK/WT
S400
(8W-12-17)
C15 12 BK/WT
REAR WINDOW DEFOGGER
(8W-48-2)
DIAGNOSTIC JUNCTION PORT
PCI BUS
(8W-18-4)
(8W-18-7)
2
D25 20 YL/VT/DG
6 C1
6 C2
14 C1
8 C2
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
PANEL LAMPS DRIVER
REAR WINDOW DEFOGGER SWITCH SENSE
PCI BUS
AUTOMATIC ZONE CONTROL MODULE

AZC

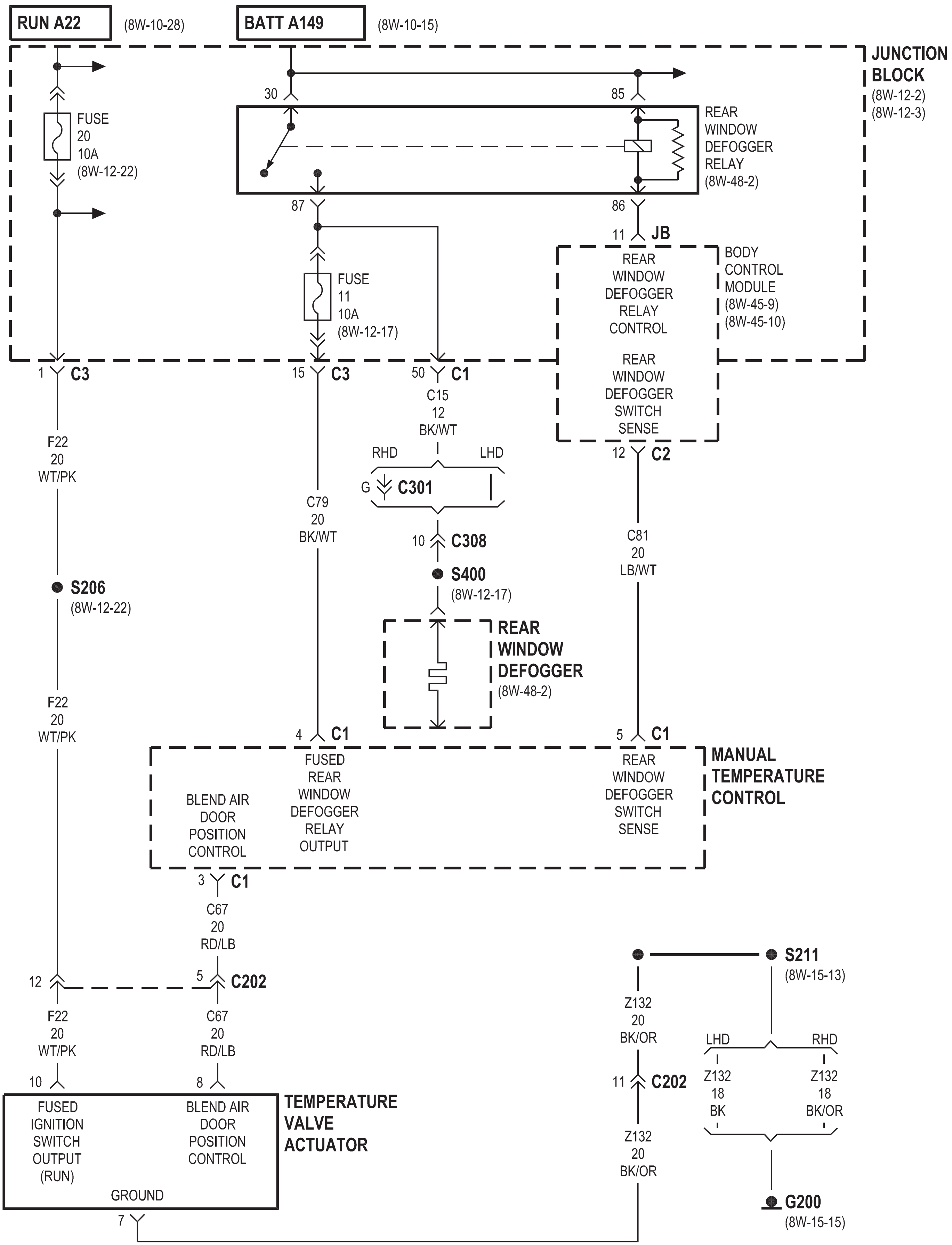

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
1
40A
(8W-10-15)
1
C1
12
DG
GAS
DIESEL
C
C106
C
C107
C1
12
DG
H
C200
C1
12
DG
2
C203
C1
12
DG
C
BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
35
C3
M1
20
PK
BODY CONTROL MODULE
(8W-45-10)
A/C SWITCH SIGNAL
1
C2
C103
20
DG
12
C2
9
C2
AUTOMATIC ZONE CONTROL MODULE
FUSED B(+)
BLOWER MOTOR CONTROL
A/C SWITCH SIGNAL
7
C2
C56
20
RD/LG
9
C202
C56
20
RD/LG
B
BLOWER MOTOR CONTROLLER
BLOWER MOTOR SUPPLY
BLOWER MOTOR CONTROL
BLOWER MOTOR HIGH DRIVER
BLOWER MOTOR SUPPLY
GROUND
A
C7
12
BK/TN
C1
12
DG
1
BLOWER MOTOR
M
2
Z118
12
BK
1
C203
Z118
12
BK
S201
(8W-15-15)
Z118
12
BK
G200
(8W-15-15)

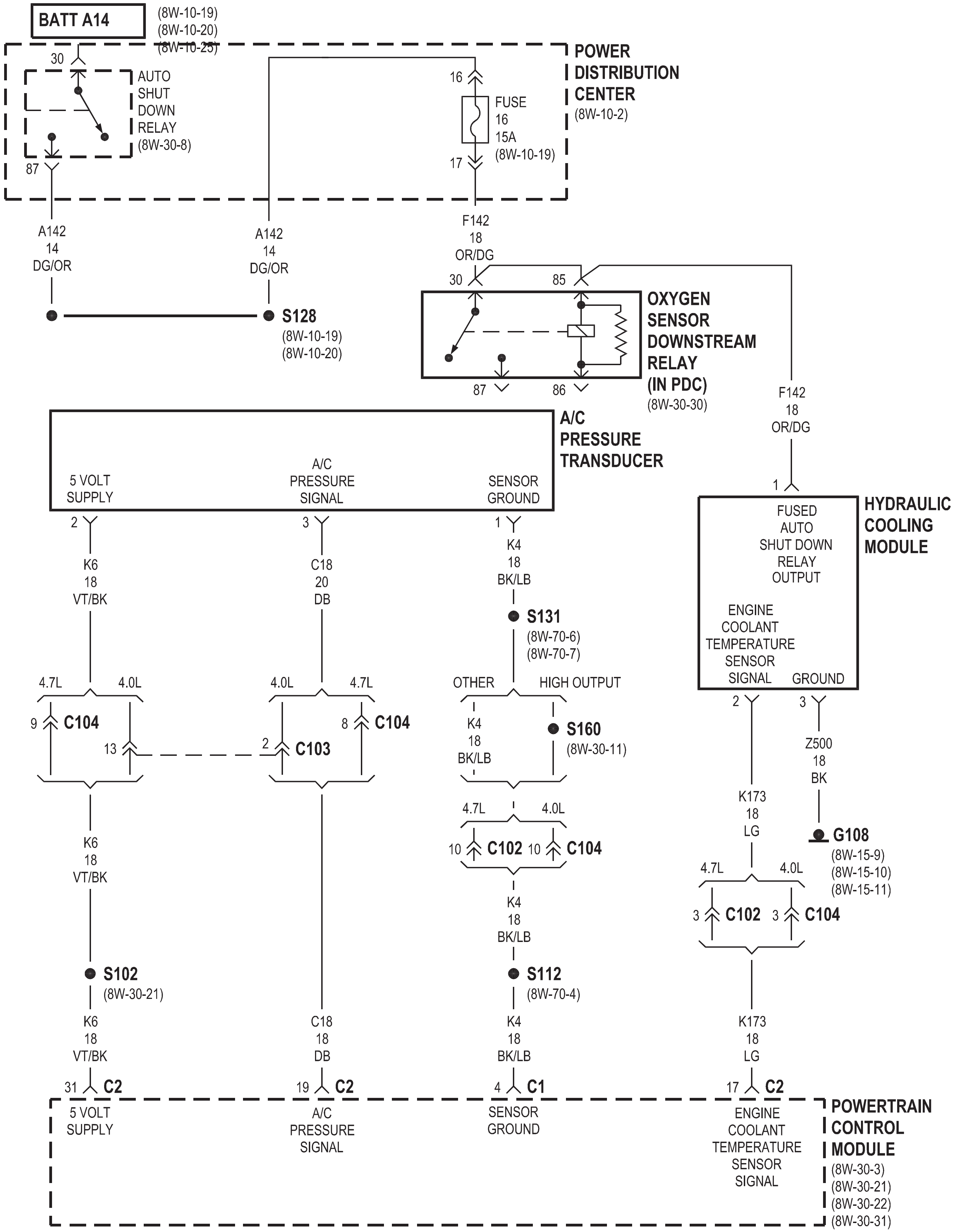

AUTOMATIC ZONE CONTROL MODULE
DRIVER BLEND DOOR DRIVER (A)
DRIVER BLEND DOOR DRIVER (B)
PASSENGER BLEND DOOR DRIVER (A)
PASSENGER BLEND DOOR DRIVER (B)
MODE DOOR DRIVER (A)
MODE DOOR DRIVER (B)
RECIRCULATION DOOR DRIVER (A)
RECIRCULATION DOOR DRIVER (B)
10 C1
3 C2
2 C2
4 C2
9 C1
1 C1
3 C1
4 C1
C33 20 DB/RD
C95 20 WT/BK
C94 20 WT/DG
C96 20 WT/DB
C35 20 DG/YL
C102 20 TN/BK
C32 20 GY/DB
C100 20 YL/DB
3
4
5
6
8
7
1
2
C202
C33 20 DB/RD
C95 20 WT/BK
C94 20 WT/DG
C96 20 WT/DB
C35 20 DG/YL
C102 20 TN/BK
C32 20 GY/DB
C100 20 YL/DB
A
B
RECIRCULATION DOOR DRIVER (A)
RECIRCULATION DOOR DRIVER (B)
RECIRCULATION DOOR MOTOR/ ACTUATOR
B
A
MODE DOOR DRIVER (A)
MODE DOOR DRIVER (B)
MODE DOOR MOTOR/ ACTUATOR
B
A
PASSENGER BLEND DOOR DRIVER (A)
PASSENGER BLEND DOOR DRIVER (B)
PASSENGER BLEND DOOR MOTOR/ ACTUATOR
B
A
DRIVER BLEND DOOR DRIVER (A)
DRIVER BLEND DOOR DRIVER (B)
DRIVER BLEND DOOR MOTOR/ ACTUATOR

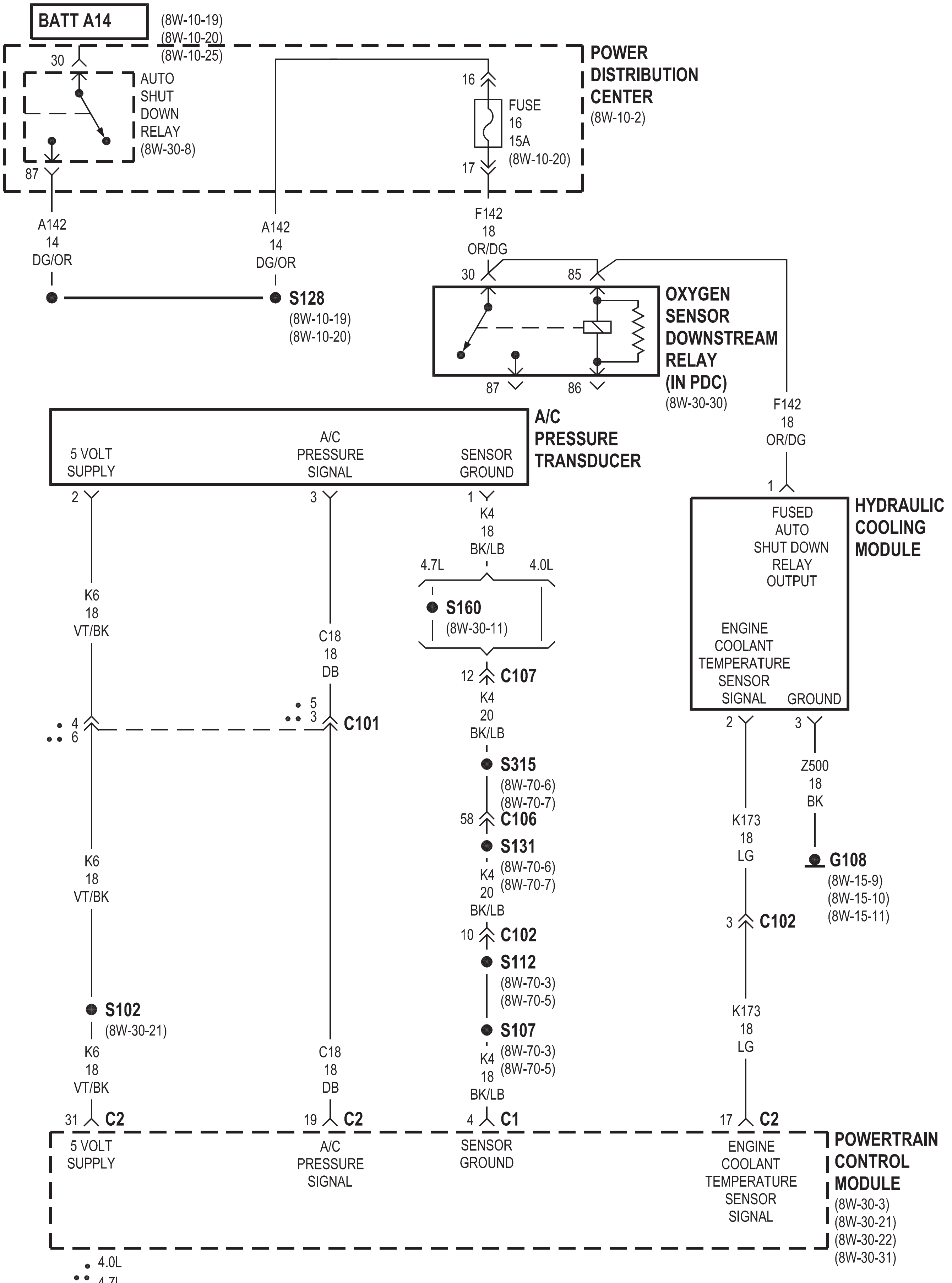

AUTOMATIC ZONE CONTROL MODULE
DRIVER BLEND DOOR DRIVER (A)
DRIVER BLEND DOOR DRIVER (B)
PASSENGER BLEND DOOR DRIVER (A)
PASSENGER BLEND DOOR DRIVER (B)
MODE DOOR DRIVER (A)
MODE DOOR DRIVER (B)
RECIRCULATION DOOR DRIVER (A)
RECIRCULATION DOOR DRIVER (B)
10 C1
3 C2
2 C2
4 C2
9 C1
1 C1
3 C1
4 C1
C33 20 DB/RD
C95 20 WT/BK
C94 20 WT/DG
C96 20 WT/DB
C35 20 DG/YL
C102 20 TN/BK
C32 20 GY/DB
C100 20 YL/DB
6
5
4
3
7
8
2
1
C202
C33 20 DB/RD
C95 20 WT/BK
C94 20 WT/DG
C96 20 WT/DB
C35 20 DG/YL
C102 20 TN/BK
C32 20 GY/DB
C100 20 YL/DB
B
A
RECIRCULATION DOOR DRIVER (A)
RECIRCULATION DOOR DRIVER (B)
RECIRCULATION DOOR MOTOR/ ACTUATOR
A
B
MODE DOOR DRIVER (A)
MODE DOOR DRIVER (B)
MODE DOOR MOTOR/ ACTUATOR
A
B
PASSENGER BLEND DOOR DRIVER (A)
PASSENGER BLEND DOOR DRIVER (B)
PASSENGER BLEND DOOR MOTOR/ ACTUATOR
A
B
DRIVER BLEND DOOR DRIVER (A)
DRIVER BLEND DOOR DRIVER (B)
DRIVER BLEND DOOR MOTOR/ ACTUATOR

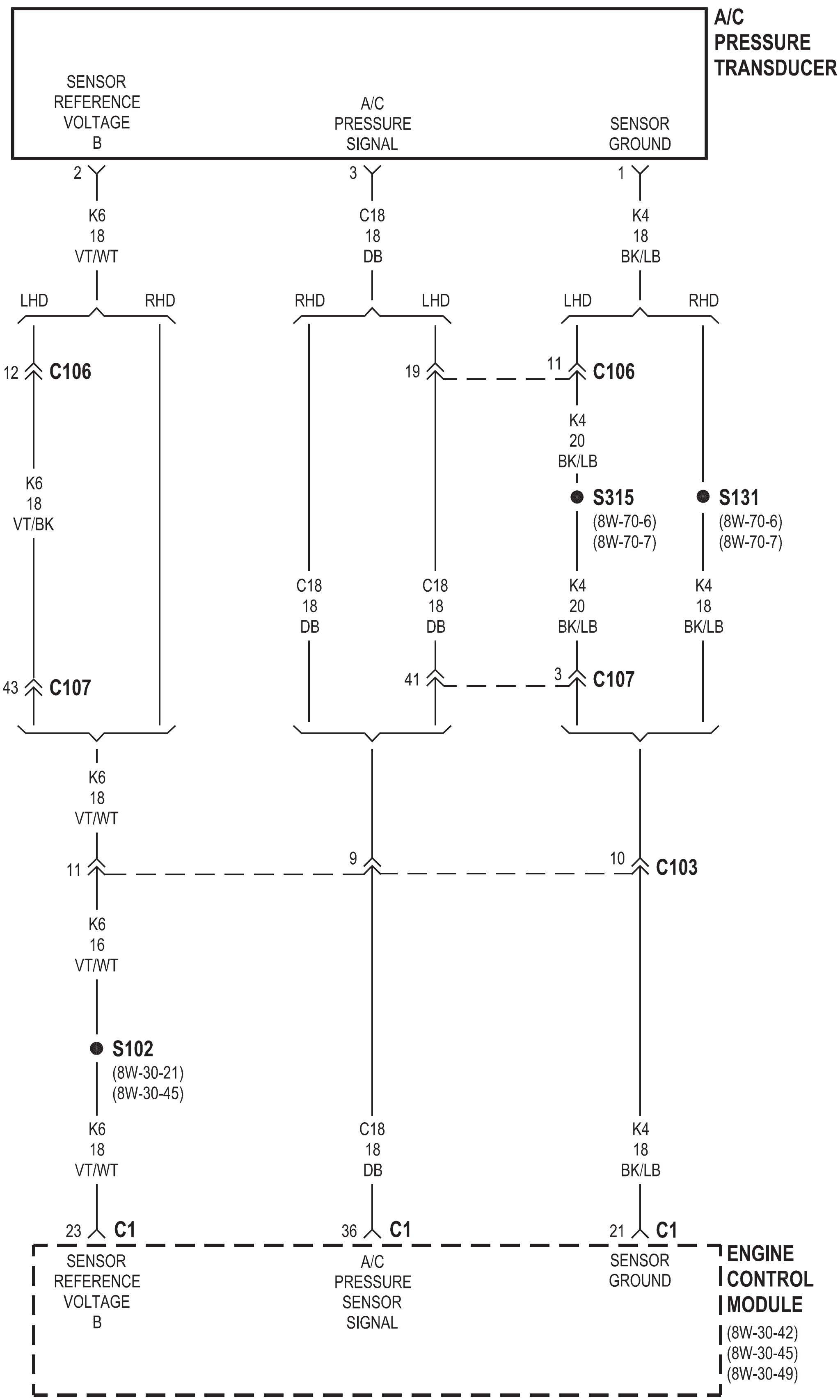

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
1
40A
(8W-10-15)
1
C1
12
DG
GAS
DIESEL
C
C106
C
C107
C1
12
DG
H
C200
C1
12
DG
14
C202
C1
12
DG
1
BLOWER MOTOR
M
2
C7
12
BK/TN
BODY CONTROL MODULE
(8W-45-4)
(8W-45-10)
PANEL LAMPS DRIVER
A/C SWITCH SIGNAL
10
C1
1
C2
E2
20
OR
C103
20
DG
7
C1
1
C1
MANUAL TEMPERATURE CONTROL
PANEL LAMPS DRIVER
A/C SWITCH SIGNAL
BLOWER MOTOR LOW DRIVER
BLOWER MOTOR M1 DRIVER
BLOWER MOTOR M2 DRIVER
BLOWER MOTOR HIGH DRIVER
8
C1
9
C1
10
C1
2
C2
C4
16
TN
C5
16
LG
C6
14
LB
C7
12
BK/TN
15
16
10
13
C202
C4
16
TN
C5
16
LG
C6
14
LB
C7
12
BK/TN
L
M1
M2
H
BLOWER MOTOR RESISTOR BLOCK

MTC

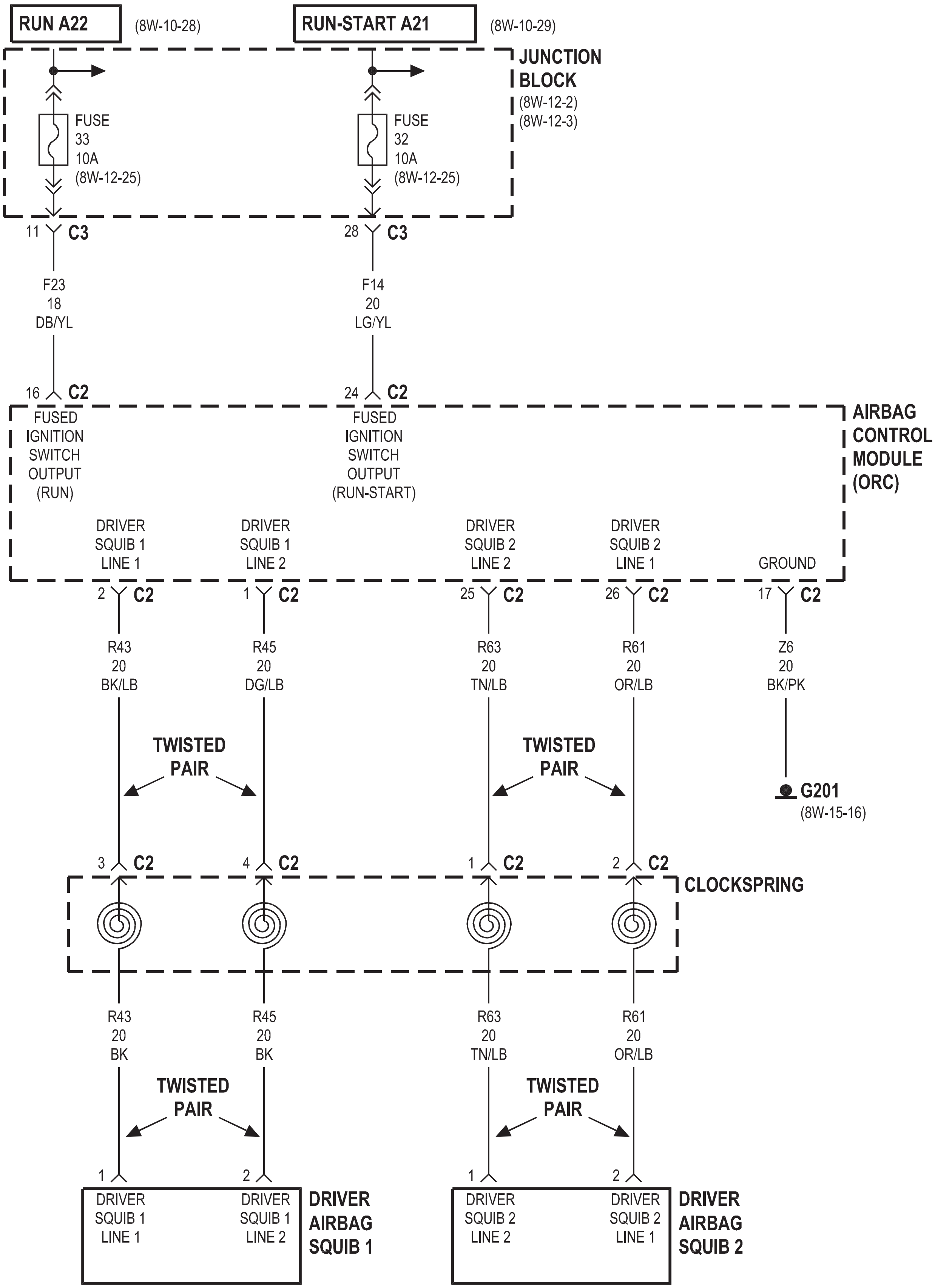

RUN A22
(8W-10-28)
BATT A149
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
30
85
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
87
86
11
JB
FUSE
11
10A
(8W-12-17)
BODY CONTROL MODULE
(8W-45-9)
(8W-45-10)
REAR WINDOW DEFOGGER RELAY CONTROL
REAR WINDOW DEFOGGER SWITCH SENSE
1
C3
15
C3
50
C1
C15
12
BK/WT
12
C2
F22
20
WT/PK
RHD
LHD
G
C301
C79
20
BK/WT
10
C308
C81
20
LB/WT
S206
(8W-12-22)
S400
(8W-12-17)
REAR WINDOW DEFOGGER
(8W-48-2)
F22
20
WT/PK
4
C1
5
C1
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
BLEND AIR DOOR POSITION CONTROL
REAR WINDOW DEFOGGER SWITCH SENSE
MANUAL TEMPERATURE CONTROL
3
C1
C67
20
RD/LB
S211
(8W-15-13)
12
5
C202
Z132
20
BK/OR
LHD
RHD
F22
20
WT/PK
C67
20
RD/LB
Z132
18
BK
Z132
18
BK/OR
10
8
11
C202
FUSED IGNITION SWITCH OUTPUT (RUN)
BLEND AIR DOOR POSITION CONTROL
GROUND
TEMPERATURE VALVE ACTUATOR
Z132
20
BK/OR
G200
(8W-15-15)
7

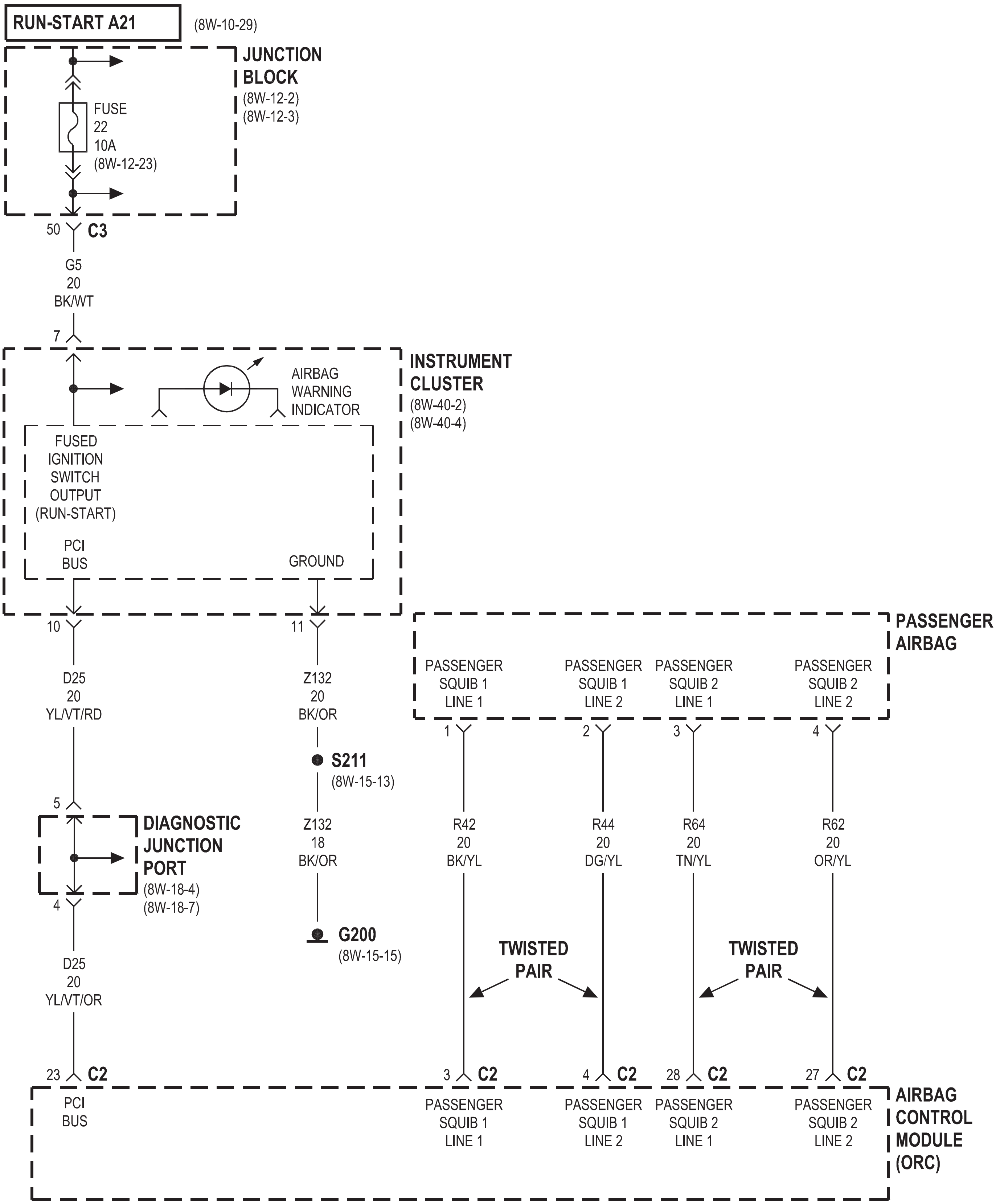

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
30
AUTO
SHUT
DOWN
RELAY
(8W-30-8)
87
16
FUSE
16
15A
(8W-10-19)
17
POWER
DISTRIBUTION
CENTER
(8W-10-2)
A142
14
DG/OR
A142
14
DG/OR
S128
(8W-10-19)
(8W-10-20)
F142
18
OR/DG
30
85
OXYGEN
SENSOR
DOWNSTREAM
RELAY
(IN PDC)
(8W-30-30)
87
86
F142
18
OR/DG
A/C
PRESSURE
TRANSDUCER
5 VOLT
SUPPLY
A/C
PRESSURE
SIGNAL
SENSOR
GROUND
2
3
1
K6
18
VT/BK
C18
20
DB
K4
18
BK/LB
S131
(8W-70-6)
(8W-70-7)
1
HYDRAULIC
COOLING
MODULE
FUSED
AUTO
SHUT DOWN
RELAY
OUTPUT
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
GROUND
2
3
4.7L
4.0L
9
C104
13
4.0L
4.7L
2
C103
8
C104
OTHER
HIGH OUTPUT
K4
18
BK/LB
S160
(8W-30-11)
Z500
18
BK
G108
(8W-15-9)
(8W-15-10)
(8W-15-11)
4.7L
4.0L
10
C102
10
C104
K173
18
LG
4.7L
4.0L
3
C102
3
C104
K6
18
VT/BK
K4
18
BK/LB
S102
(8W-30-21)
S112
(8W-70-4)
K6
18
VT/BK
C18
18
DB
K4
18
BK/LB
K173
18
LG
31
C2
19
C2
4
C1
17
C2
5 VOLT
SUPPLY
A/C
PRESSURE
SIGNAL
SENSOR
GROUND
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE
(8W-30-3)
(8W-30-21)
(8W-30-22)
(8W-30-31)

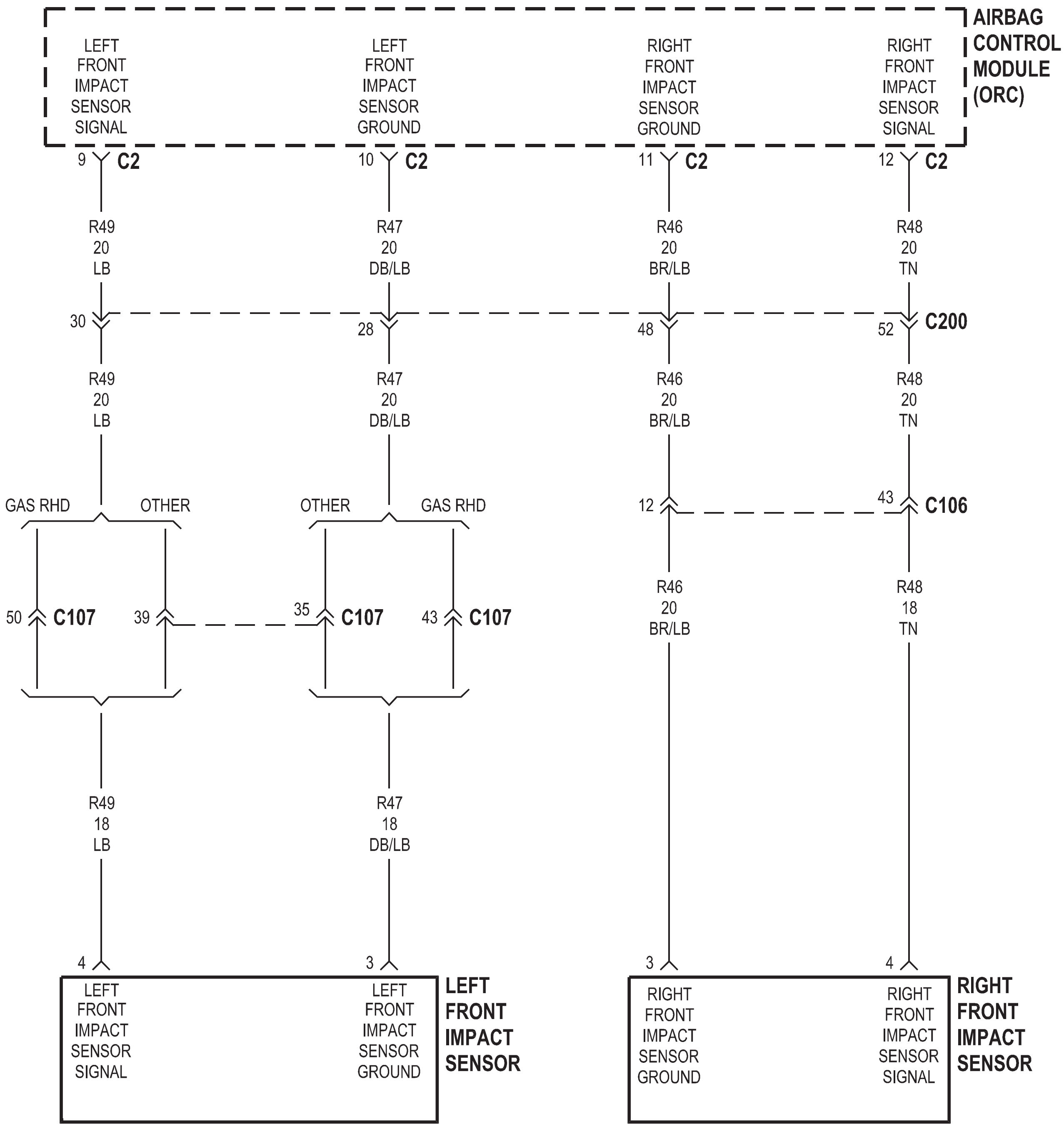

BATT A14
(8W-10-19)
(8W-10-20)
(8W-10-25)
30
AUTO SHUT DOWN RELAY (8W-30-8)
87
16
FUSE 16 15A (8W-10-20)
17
POWER DISTRIBUTION CENTER
(8W-10-2)
A142 14 DG/OR
A142 14 DG/OR
S128
(8W-10-19)
(8W-10-20)
F142 18 OR/DG
30
85
OXYGEN SENSOR DOWNSTREAM RELAY (IN PDC)
(8W-30-30)
87
86
F142 18 OR/DG
A/C PRESSURE TRANSDUCER
5 VOLT SUPPLY
A/C PRESSURE SIGNAL
SENSOR GROUND
2
3
1
K4 18 BK/LB
4.7L
4.0L
S160
(8W-30-11)
HYDRAULIC COOLING MODULE
FUSED AUTO SHUT DOWN RELAY OUTPUT
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
GROUND
K6 18 VT/BK
C18 18 DB
12 C107
K4 20 BK/LB
4 6
5 3
C101
S315
(8W-70-6)
(8W-70-7)
58 C106
S131
(8W-70-6)
(8W-70-7)
K4 20 BK/LB
10 C102
S112
(8W-70-3)
(8W-70-5)
S107
(8W-70-3)
(8W-70-5)
K4 18 BK/LB
K6 18 VT/BK
S102
(8W-30-21)
K6 18 VT/BK
C18 18 DB
Z500 18 BK
G108
(8W-15-9)
(8W-15-10)
(8W-15-11)
K173 18 LG
3 C102
K173 18 LG
31 C2
19 C2
4 C1
17 C2
5 VOLT SUPPLY
A/C PRESSURE SIGNAL
SENSOR GROUND
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-21)
(8W-30-22)
(8W-30-31)
• 4.0L
•• 4.7L

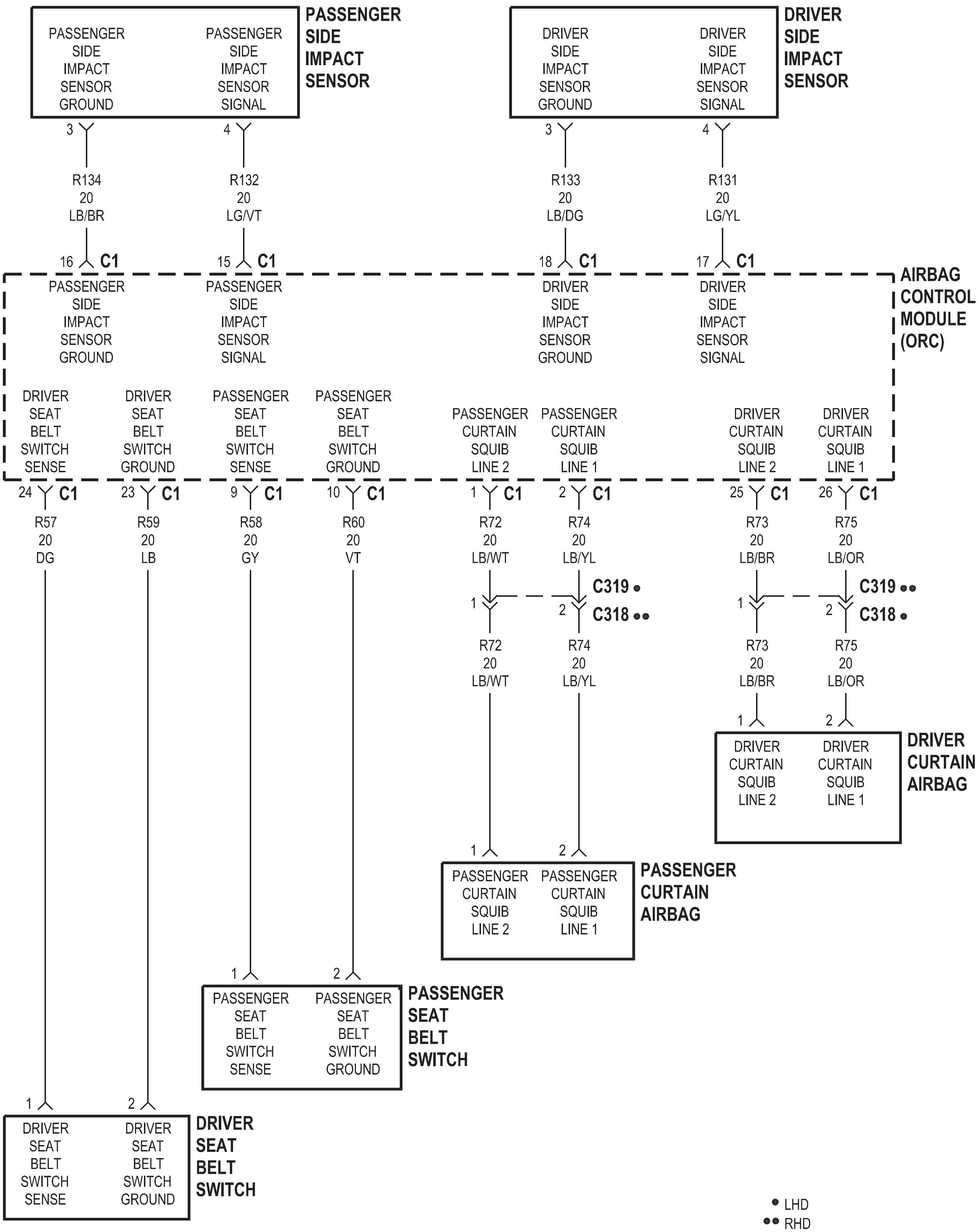

A/C PRESSURE TRANSDUCER
SENSOR REFERENCE VOLTAGE B
A/C PRESSURE SIGNAL
SENSOR GROUND
2
3
1
K6 18 VT/WT
C18 18 DB
K4 18 BK/LB
LHD
RHD
RHD
LHD
LHD
RHD
12
C106
19
11
C106
K6 18 VT/BK
K4 20 BK/LB
S315
(8W-70-6)
(8W-70-7)
S131
(8W-70-6)
(8W-70-7)
C18 18 DB
C18 18 DB
K4 20 BK/LB
K4 18 BK/LB
43
C107
41
3
C107
K6 18 VT/WT
11
9
10
C103
K6 16 VT/WT
S102
(8W-30-21)
(8W-30-45)
K6 18 VT/WT
C18 18 DB
K4 18 BK/LB
23 C1
36 C1
21 C1
SENSOR REFERENCE VOLTAGE B
A/C PRESSURE SENSOR SIGNAL
SENSOR GROUND
ENGINE CONTROL MODULE
(8W-30-42)
(8W-30-45)
(8W-30-49)

8W-43 AIRBAG SYSTEM

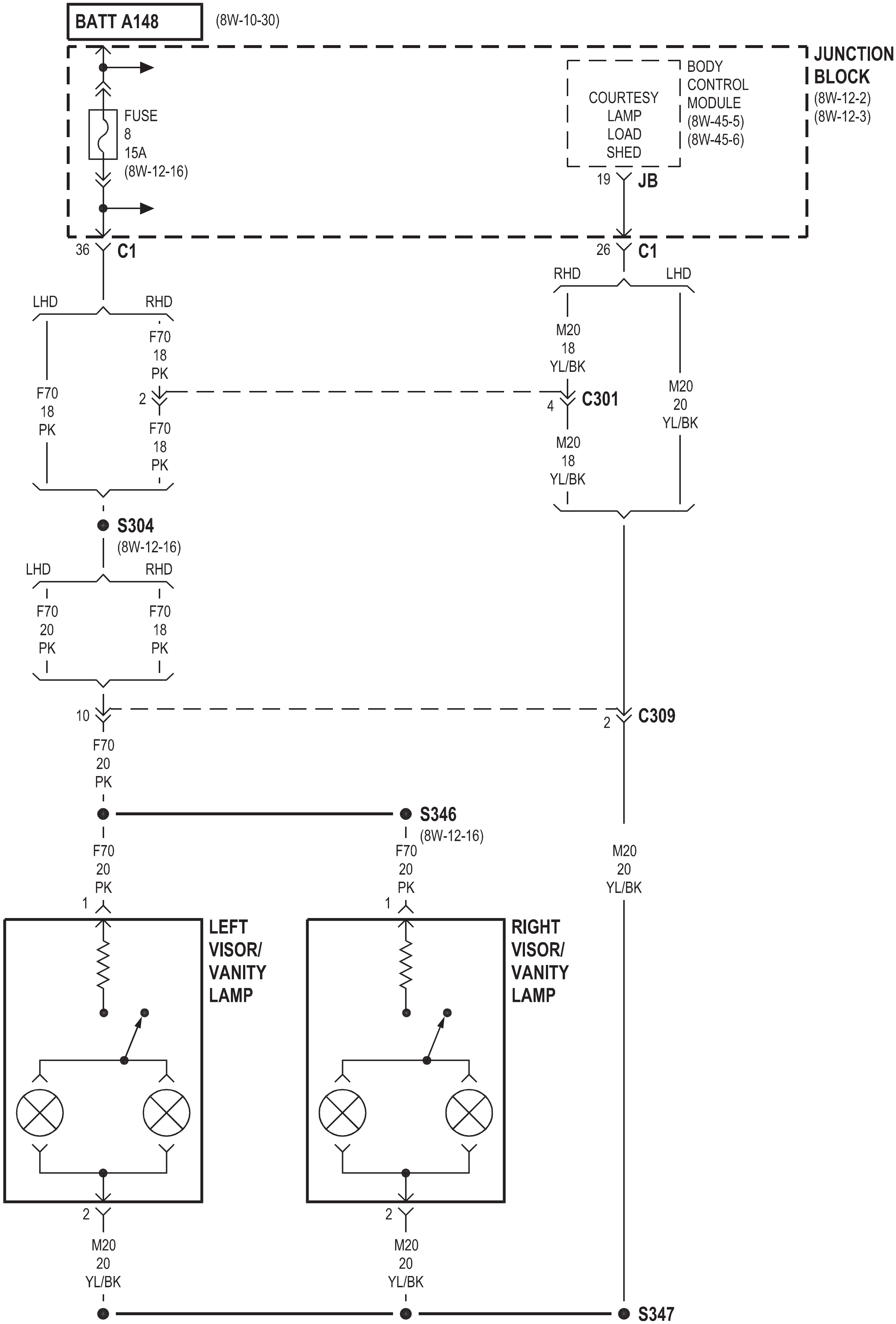

RUN A22
(8W-10-28)
RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 33 10A (8W-12-25)
FUSE 32 10A (8W-12-25)
11 C3
28 C3
F23 18 DB/YL
F14 20 LG/YL
16 C2
24 C2
FUSED IGNITION SWITCH OUTPUT (RUN)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
AIRBAG CONTROL MODULE (ORC)
DRIVER SQUIB 1 LINE 1
DRIVER SQUIB 1 LINE 2
DRIVER SQUIB 2 LINE 2
DRIVER SQUIB 2 LINE 1
GROUND
2 C2
1 C2
25 C2
26 C2
17 C2
R43 20 BK/LB
R45 20 DG/LB
R63 20 TN/LB
R61 20 OR/LB
Z6 20 BK/PK
TWISTED PAIR
TWISTED PAIR
G201
(8W-15-16)
3 C2
4 C2
1 C2
2 C2
CLOCKSPRING
R43 20 BK
R45 20 BK
R63 20 TN/LB
R61 20 OR/LB
TWISTED PAIR
TWISTED PAIR
1
2
1
2
DRIVER SQUIB 1 LINE 1
DRIVER SQUIB 1 LINE 2
DRIVER AIRBAG SQUIB 1
DRIVER SQUIB 2 LINE 2
DRIVER SQUIB 2 LINE 1
DRIVER AIRBAG SQUIB 2

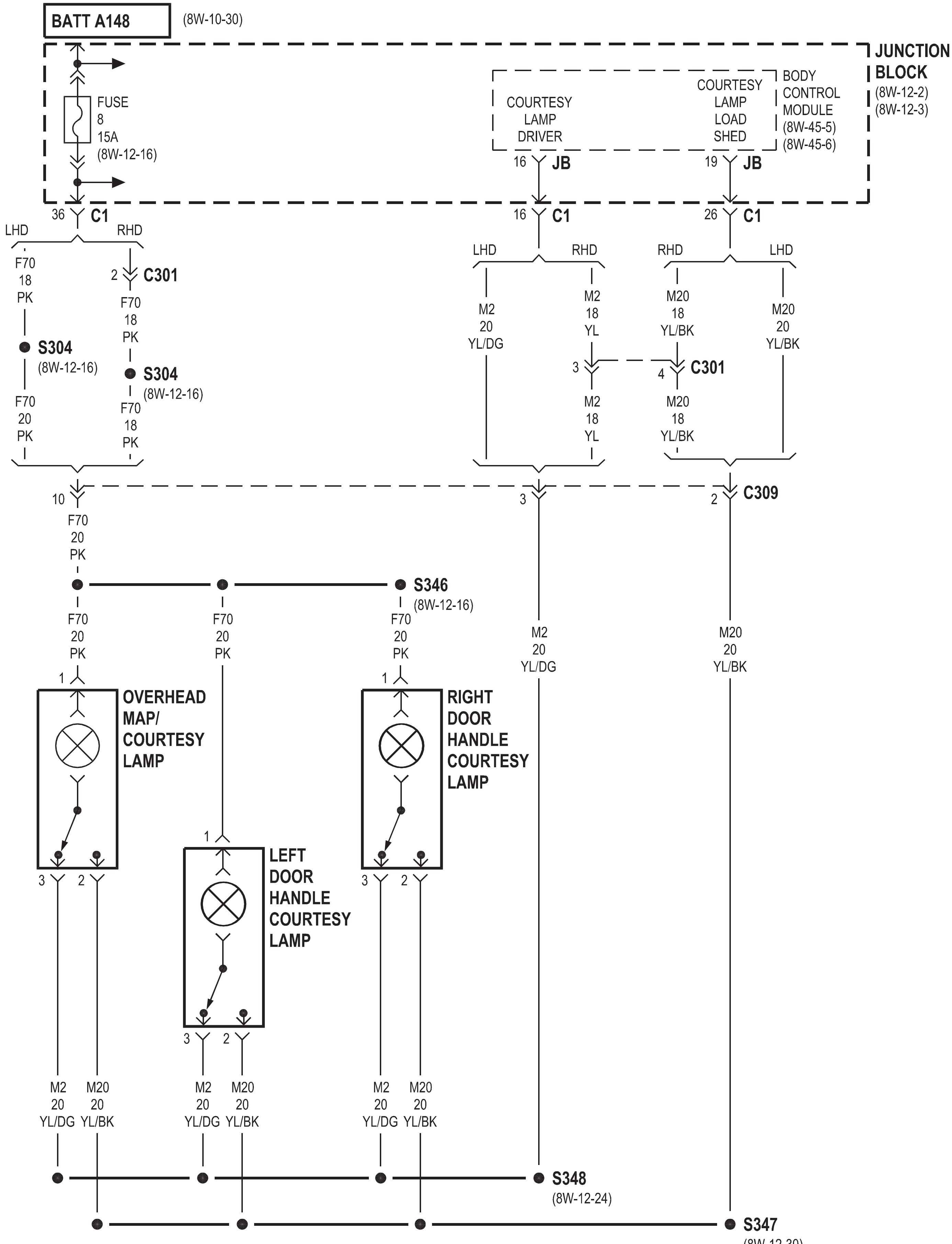

RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 22 10A (8W-12-23)
50 C3
G5 20 BK/WT
7
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-4)
AIRBAG WARNING INDICATOR
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PCI BUS
GROUND
10
11
D25 20 YL/VT/RD
Z132 20 BK/OR
S211
(8W-15-13)
Z132 18 BK/OR
G200
(8W-15-15)
5
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
4
D25 20 YL/VT/OR
PASSENGER AIRBAG
PASSENGER SQUIB 1 LINE 1
PASSENGER SQUIB 1 LINE 2
PASSENGER SQUIB 2 LINE 1
PASSENGER SQUIB 2 LINE 2
1
2
3
4
R42 20 BK/YL
R44 20 DG/YL
R64 20 TN/YL
R62 20 OR/YL
TWISTED PAIR
TWISTED PAIR
23 C2
3 C2
4 C2
28 C2
27 C2
PCI BUS
PASSENGER SQUIB 1 LINE 1
PASSENGER SQUIB 1 LINE 2
PASSENGER SQUIB 2 LINE 1
PASSENGER SQUIB 2 LINE 2
AIRBAG CONTROL MODULE (ORC)

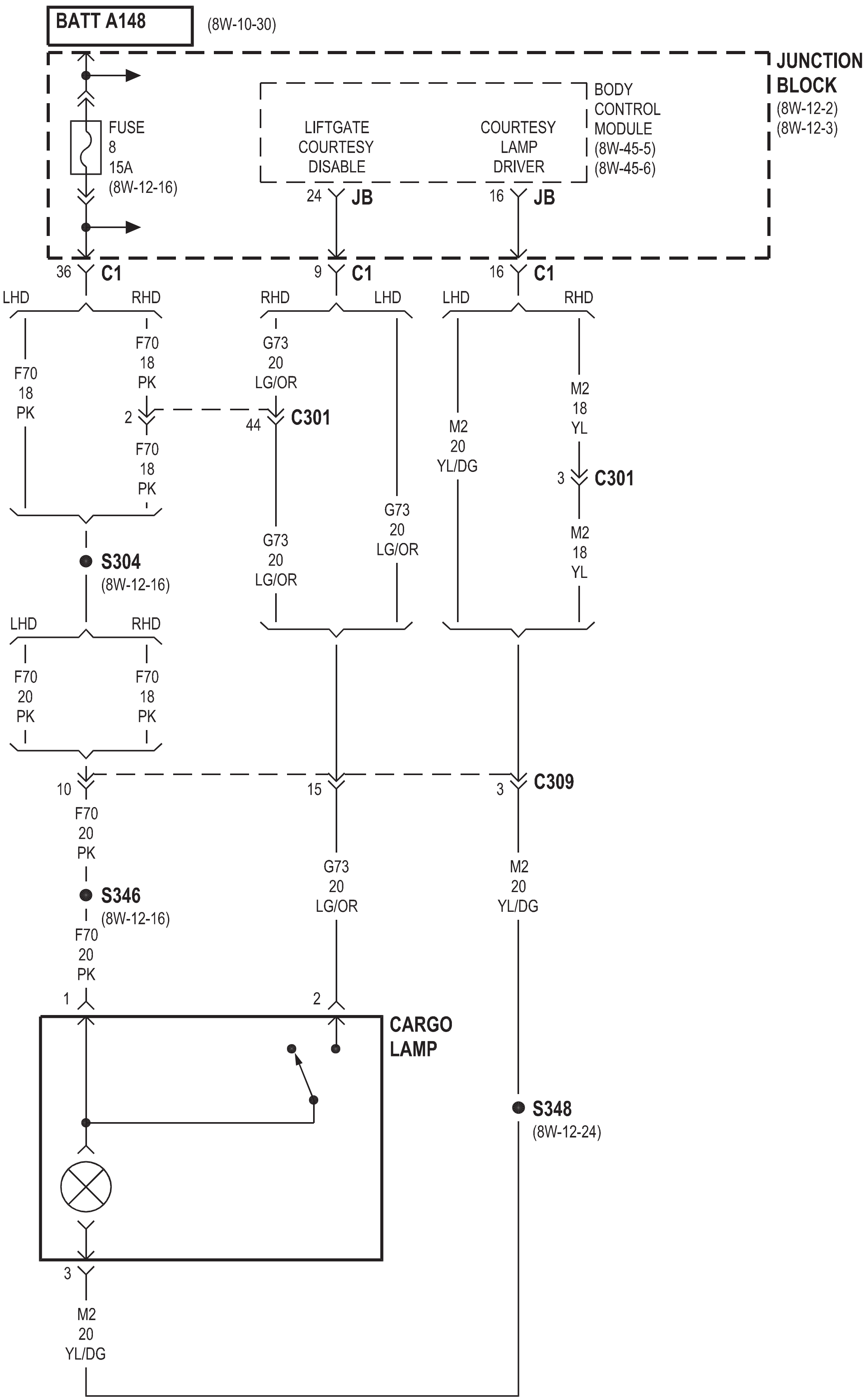

AIRBAG CONTROL MODULE (ORC)
LEFT FRONT IMPACT SENSOR SIGNAL
LEFT FRONT IMPACT SENSOR GROUND
RIGHT FRONT IMPACT SENSOR GROUND
RIGHT FRONT IMPACT SENSOR SIGNAL
9 C2
10 C2
11 C2
12 C2
R49 20 LB
R47 20 DB/LB
R46 20 BR/LB
R48 20 TN
30
28
48
52
C200
R49 20 LB
R47 20 DB/LB
R46 20 BR/LB
R48 20 TN
GAS RHD
OTHER
OTHER
GAS RHD
12
43
C106
50 C107
39
35 C107
43 C107
R46 20 BR/LB
R48 18 TN
R49 18 LB
R47 18 DB/LB
4
3
3
4
LEFT FRONT IMPACT SENSOR SIGNAL
LEFT FRONT IMPACT SENSOR GROUND
LEFT FRONT IMPACT SENSOR
RIGHT FRONT IMPACT SENSOR GROUND
RIGHT FRONT IMPACT SENSOR SIGNAL
RIGHT FRONT IMPACT SENSOR

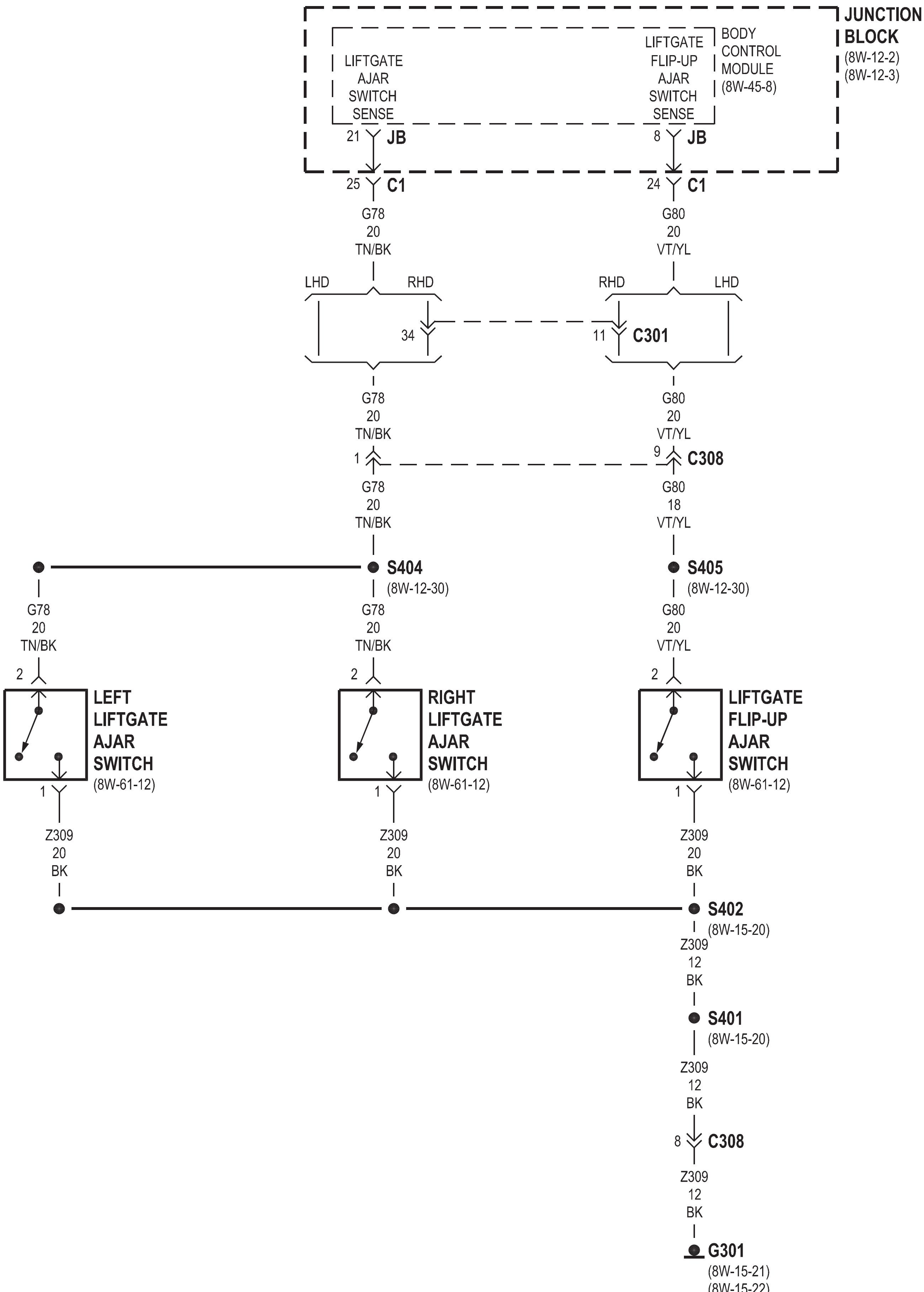

PASSENGER SIDE IMPACT SENSOR
PASSENGER SIDE IMPACT SENSOR GROUND
PASSENGER SIDE IMPACT SENSOR SIGNAL
3
4
R134 20 LB/BR
R132 20 LG/VT
16 C1
15 C1
DRIVER SIDE IMPACT SENSOR
DRIVER SIDE IMPACT SENSOR GROUND
DRIVER SIDE IMPACT SENSOR SIGNAL
3
4
R133 20 LB/DG
R131 20 LG/YL
18 C1
17 C1
AIRBAG CONTROL MODULE (ORC)
PASSENGER SIDE IMPACT SENSOR GROUND
PASSENGER SIDE IMPACT SENSOR SIGNAL
DRIVER SIDE IMPACT SENSOR GROUND
DRIVER SIDE IMPACT SENSOR SIGNAL
DRIVER SEAT BELT SWITCH SENSE
DRIVER SEAT BELT SWITCH GROUND
PASSENGER SEAT BELT SWITCH SENSE
PASSENGER SEAT BELT SWITCH GROUND
PASSENGER CURTAIN SQUIB LINE 2
PASSENGER CURTAIN SQUIB LINE 1
DRIVER CURTAIN SQUIB LINE 2
DRIVER CURTAIN SQUIB LINE 1
24 C1
23 C1
9 C1
10 C1
1 C1
2 C1
25 C1
26 C1
R57 20 DG
R59 20 LB
R58 20 GY
R60 20 VT
R72 20 LB/WT
R74 20 LB/YL
R73 20 LB/BR
R75 20 LB/OR
C319 •
C318 ••
C319 ••
C318 •
1
2
R72 20 LB/WT
R74 20 LB/YL
R73 20 LB/BR
R75 20 LB/OR
DRIVER CURTAIN AIRBAG
DRIVER CURTAIN SQUIB LINE 2
DRIVER CURTAIN SQUIB LINE 1
PASSENGER CURTAIN AIRBAG
PASSENGER CURTAIN SQUIB LINE 2
PASSENGER CURTAIN SQUIB LINE 1
PASSENGER SEAT BELT SWITCH
PASSENGER SEAT BELT SWITCH SENSE
PASSENGER SEAT BELT SWITCH GROUND
DRIVER SEAT BELT SWITCH
DRIVER SEAT BELT SWITCH SENSE
DRIVER SEAT BELT SWITCH GROUND
• LHD
•• RHD

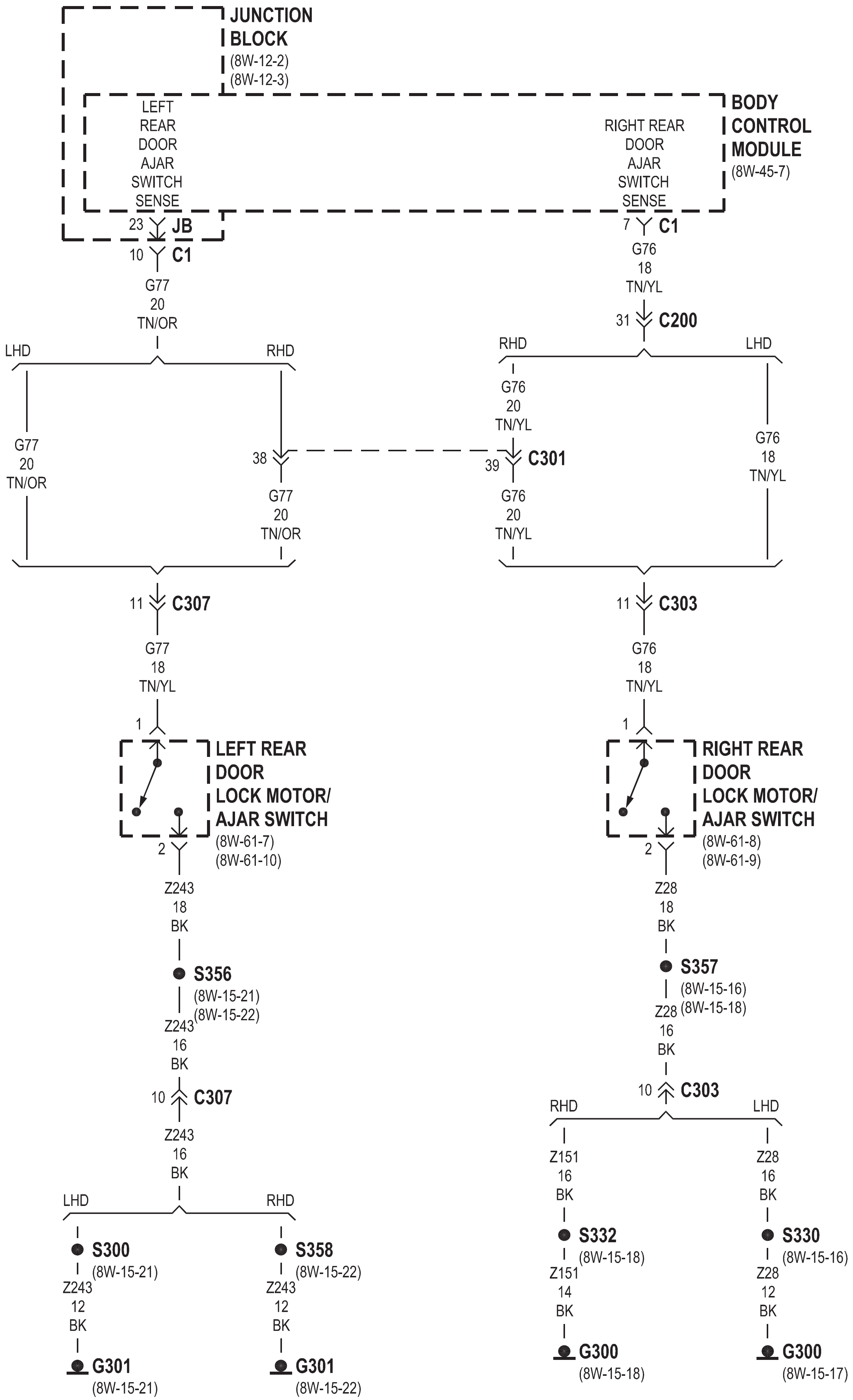
8W-44 INTERIOR LIGHTING

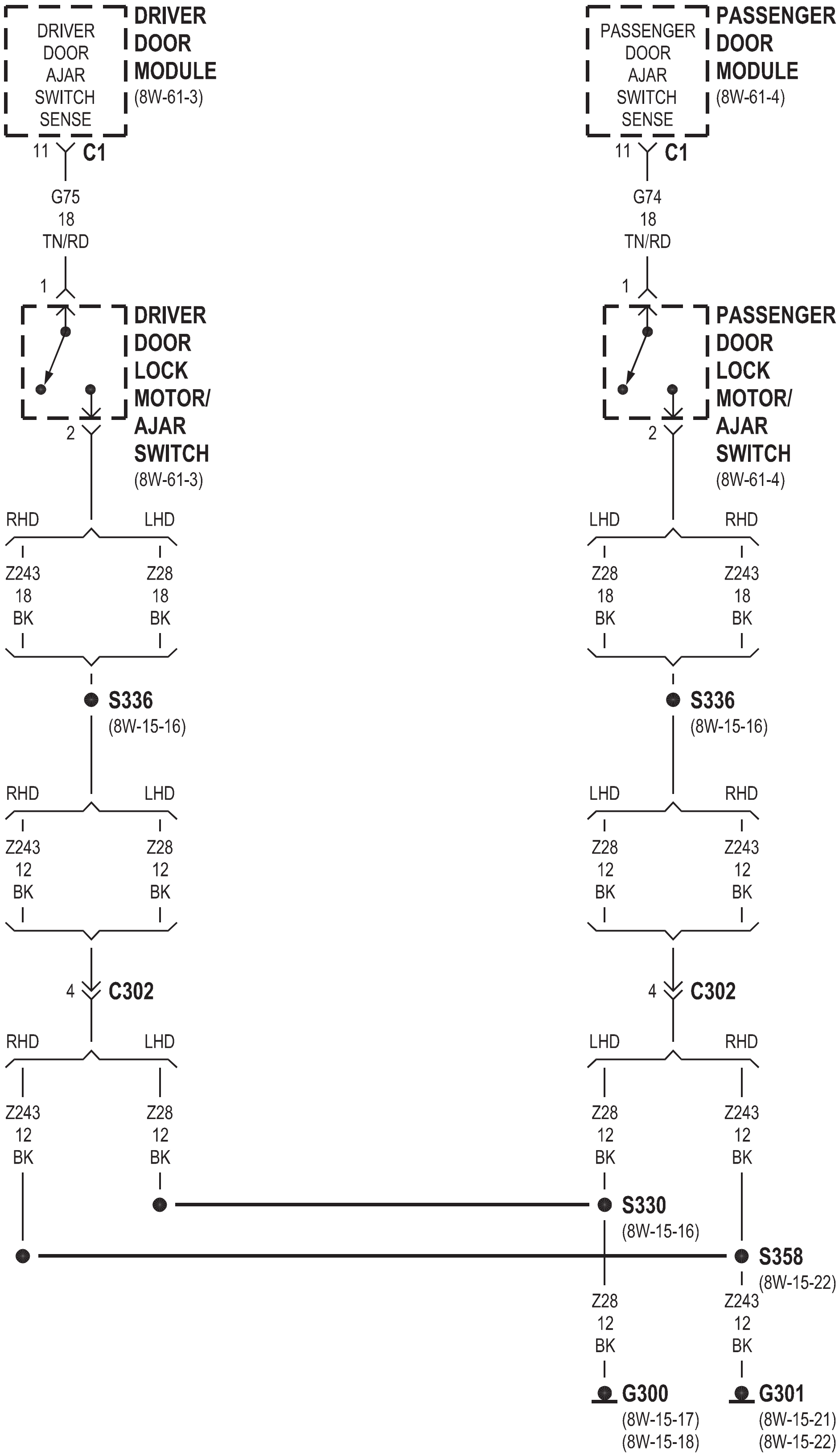

BATT A148
(8W-10-30)
FUSE
8
15A
(8W-12-16)
COURTESY
LAMP
LOAD
SHED
BODY
CONTROL
MODULE
(8W-45-5)
(8W-45-6)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
19
JB
36
C1
26
C1
LHD
RHD
F70
18
PK
2
RHD
LHD
M20
18
YL/BK
C301
4
M20
20
YL/BK
S304
(8W-12-16)
F70
20
PK
10
C309
2
S346
(8W-12-16)
1
LEFT
VISOR/
VANITY
LAMP
RIGHT
VISOR/
VANITY
LAMP
M20
20
YL/BK
S347
(8W-12-30)

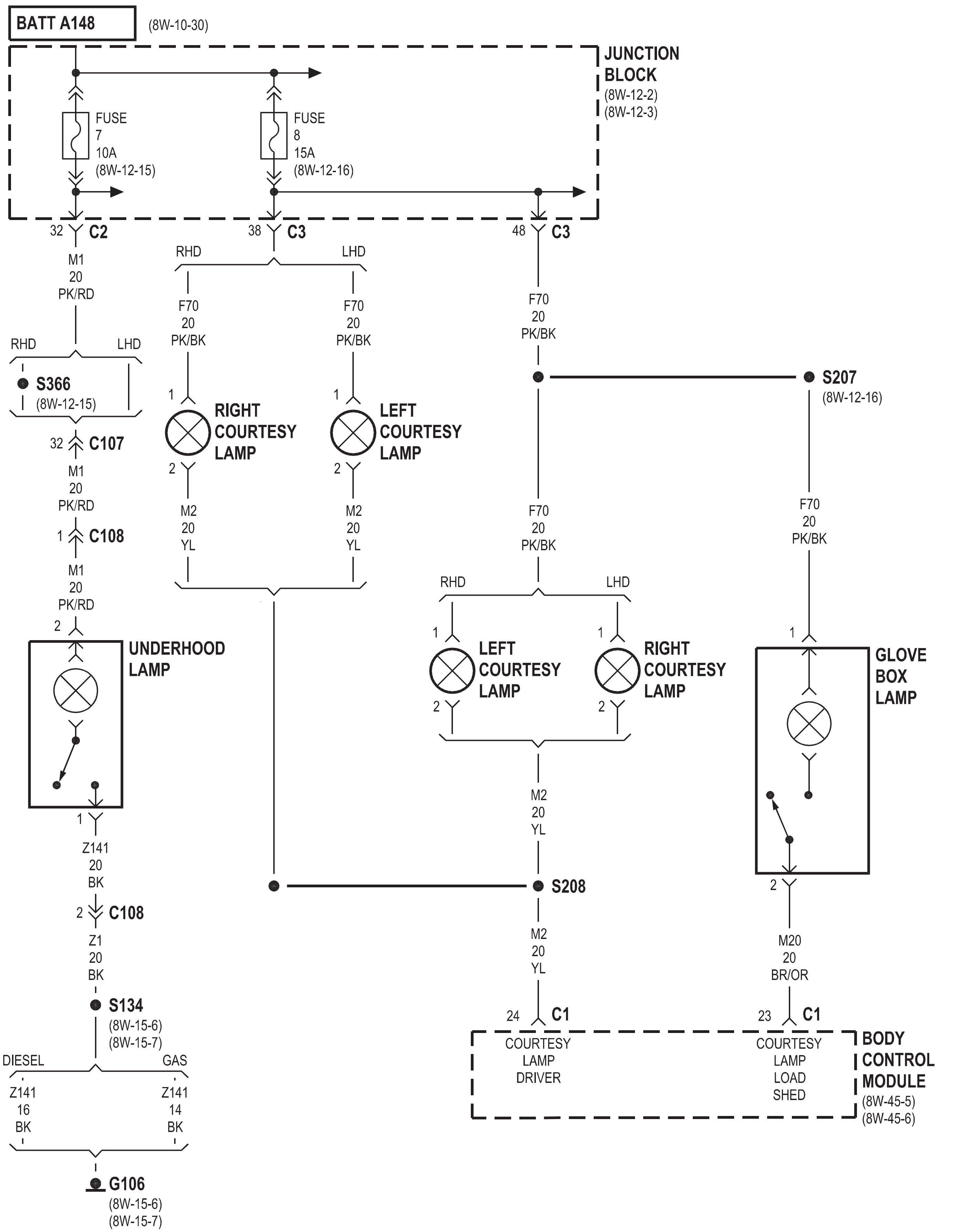

BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
COURTESY LAMP DRIVER
COURTESY LAMP LOAD SHED
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
16 JB
19 JB
36 C1
16 C1
26 C1
LHD
RHD
F70 18 PK
2 C301
S304
(8W-12-16)
F70 20 PK
M2 20 YL/DG
M2 18 YL
M20 18 YL/BK
M20 20 YL/BK
3 C301
4 C301
10
3
2 C309
S346
(8W-12-16)
OVERHEAD MAP/ COURTESY LAMP
LEFT DOOR HANDLE COURTESY LAMP
RIGHT DOOR HANDLE COURTESY LAMP
S348
(8W-12-24)
S347
(8W-12-30)

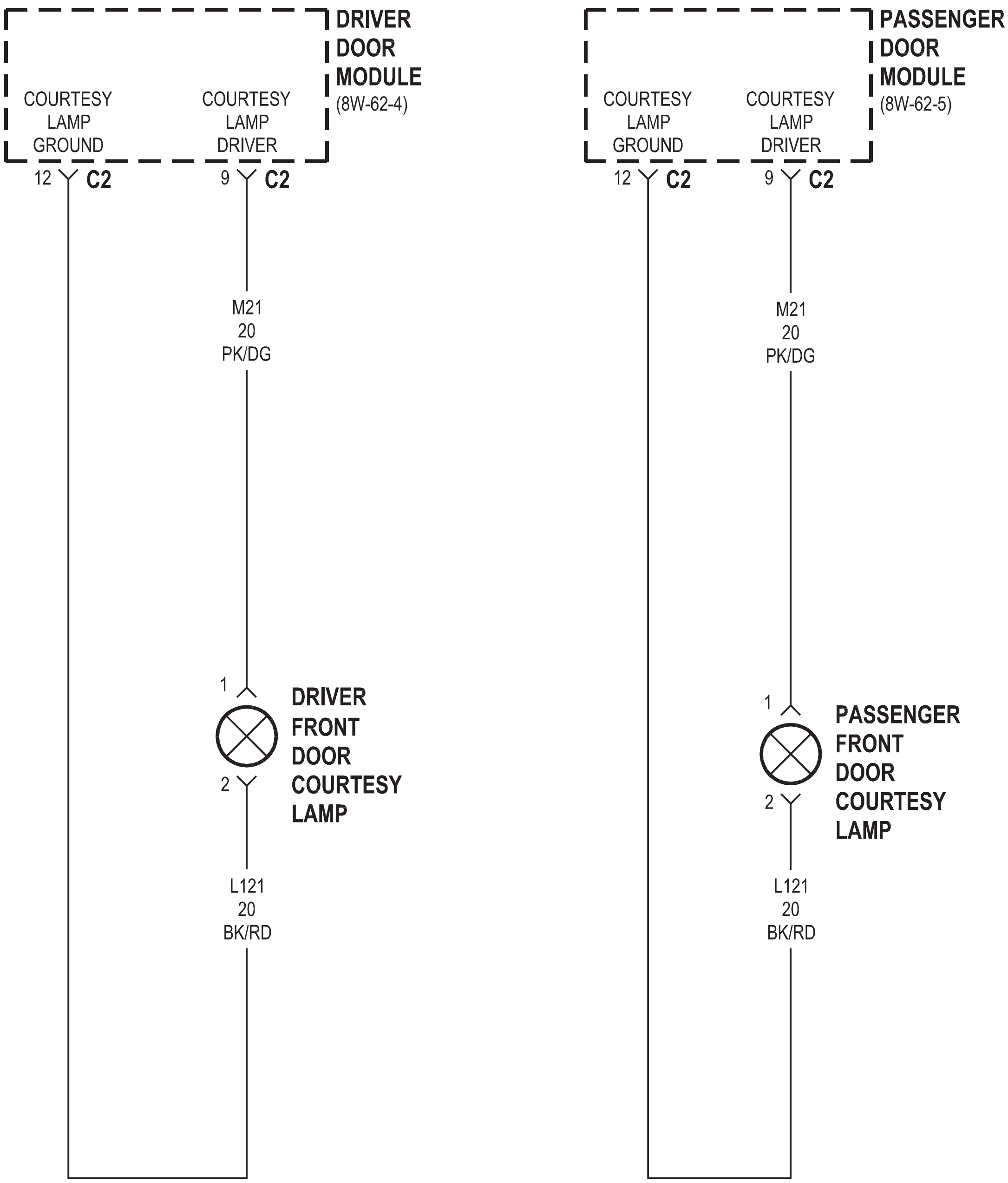

BATT A148
(8W-10-30)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
LIFTGATE
COURTESY
DISABLE
COURTESY
LAMP
DRIVER
BODY
CONTROL
MODULE
(8W-45-5)
(8W-45-6)
24 JB
16 JB
36 C1
9 C1
16 C1
LHD
RHD
F70
18
PK
G73
20
LG/OR
M2
20
YL/DG
M2
18
YL
2
44 C301
3 C301
S304
(8W-12-16)
F70
20
PK
10
15
3 C309
S346
(8W-12-16)
1
2
CARGO
LAMP
S348
(8W-12-24)
3

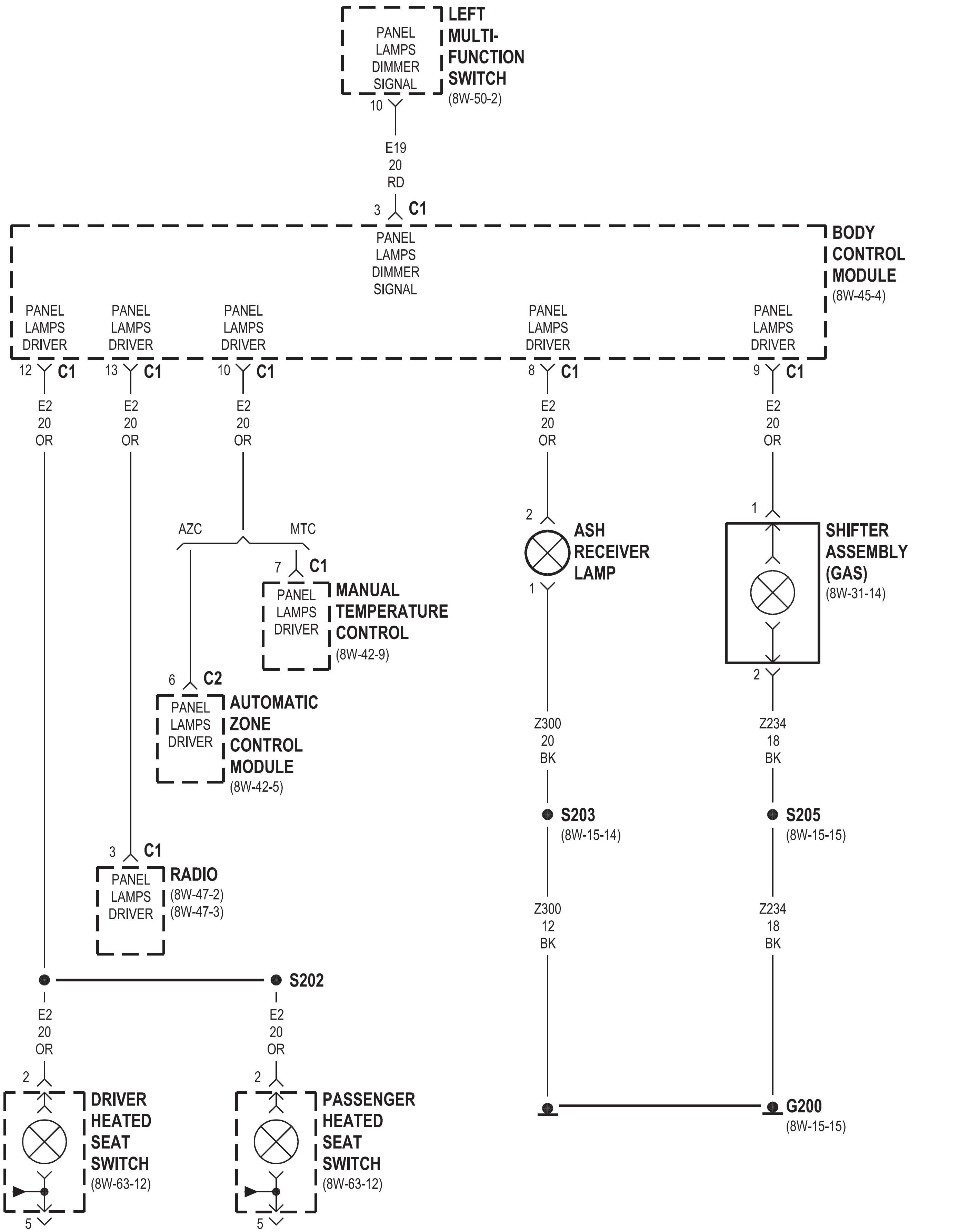

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
LIFTGATE AJAR SWITCH SENSE
LIFTGATE FLIP-UP AJAR SWITCH SENSE
21 JB
8 JB
25 C1
24 C1
G78 20 TN/BK
G80 20 VT/YL
LHD
RHD
RHD
LHD
34
11 C301
G78 20 TN/BK
G80 20 VT/YL
1
9 C308
G78 20 TN/BK
G80 18 VT/YL
S404
(8W-12-30)
S405
(8W-12-30)
G78 20 TN/BK
G78 20 TN/BK
G80 20 VT/YL
2
2
2
LEFT LIFTGATE AJAR SWITCH
(8W-61-12)
RIGHT LIFTGATE AJAR SWITCH
(8W-61-12)
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-12)
1
1
1
Z309 20 BK
Z309 20 BK
Z309 20 BK
S402
(8W-15-20)
Z309 12 BK
S401
(8W-15-20)
Z309 12 BK
8 C308
Z309 12 BK
G301
(8W-15-21)
(8W-15-22)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-7)
LEFT REAR DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
23 JB
10 C1
7 C1
G77 20 TN/OR
G76 18 TN/YL
31 C200
LHD
RHD
G76 20 TN/YL
38
39 C301
G77 20 TN/OR
G76 18 TN/YL
11 C307
11 C303
G77 18 TN/YL
G76 18 TN/YL
1
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
(8W-61-10)
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-8)
(8W-61-9)
2
Z243 18 BK
Z28 18 BK
S356
(8W-15-21)
(8W-15-22)
S357
(8W-15-16)
(8W-15-18)
Z243 16 BK
Z28 16 BK
10 C307
10 C303
Z151 16 BK
Z28 16 BK
S300
(8W-15-21)
S358
(8W-15-22)
S332
(8W-15-18)
S330
(8W-15-16)
Z243 12 BK
Z151 14 BK
Z28 12 BK
G301
(8W-15-21)
G301
(8W-15-22)
G300
(8W-15-18)
G300
(8W-15-17)

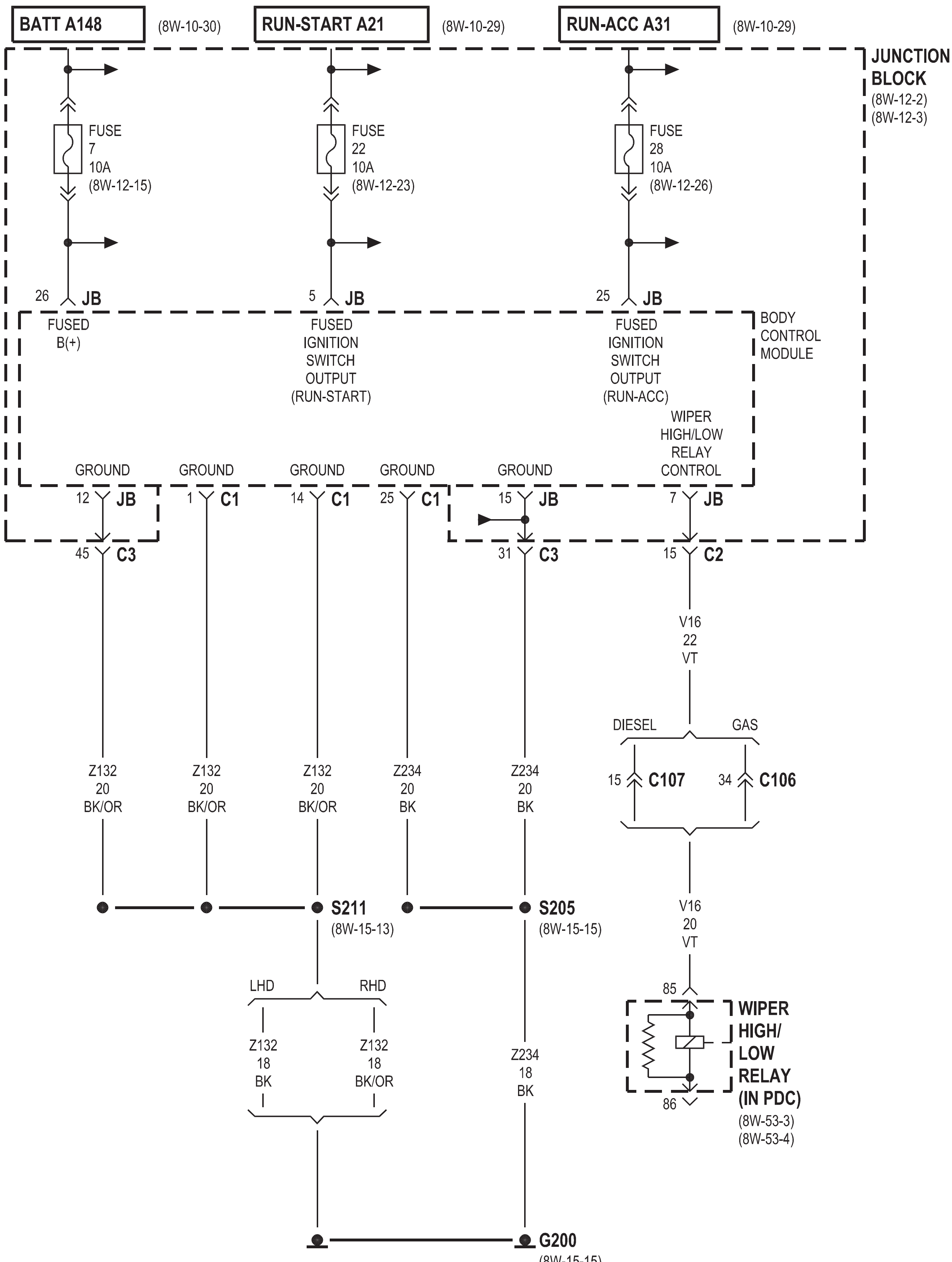

DRIVER DOOR AJAR SWITCH SENSE
DRIVER DOOR MODULE
(8W-61-3)
11 C1
G75
18
TN/RD
1
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-3)
2
RHD LHD
Z243 18 BK
Z28 18 BK
S336
(8W-15-16)
RHD LHD
Z243 12 BK
Z28 12 BK
4 C302
RHD LHD
Z243 12 BK
Z28 12 BK
PASSENGER DOOR AJAR SWITCH SENSE
PASSENGER DOOR MODULE
(8W-61-4)
11 C1
G74
18
TN/RD
1
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
2
LHD RHD
Z28 18 BK
Z243 18 BK
S336
(8W-15-16)
LHD RHD
Z28 12 BK
Z243 12 BK
4 C302
LHD RHD
Z28 12 BK
Z243 12 BK
S330
(8W-15-16)
S358
(8W-15-22)
Z28 12 BK
Z243 12 BK
G300
(8W-15-17)
(8W-15-18)
G301
(8W-15-21)
(8W-15-22)

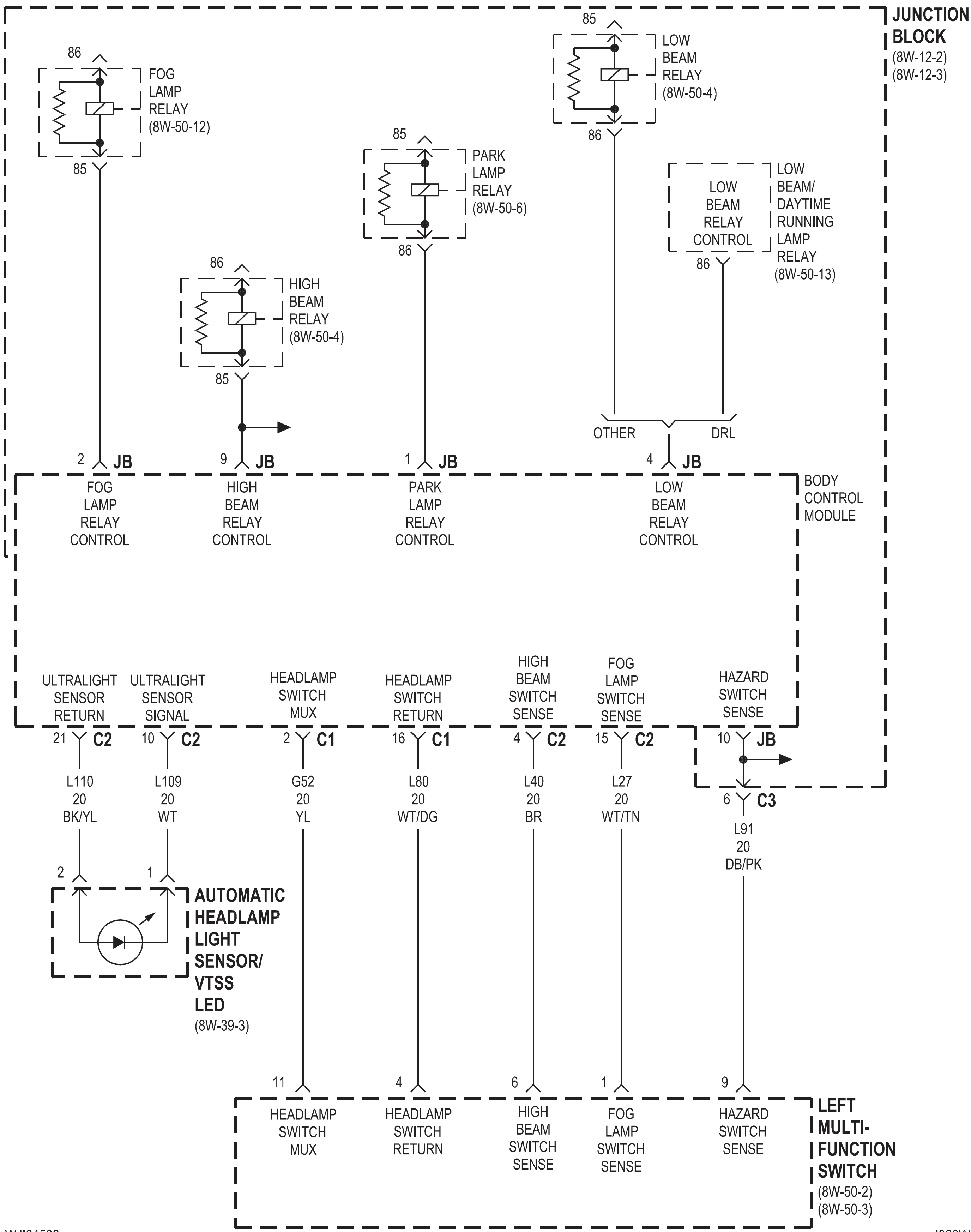

BATT A148
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 7 10A (8W-12-15)
FUSE 8 15A (8W-12-16)
32 C2
38 C3
48 C3
M1 20 PK/RD
RHD LHD
F70 20 PK/BK
S366 (8W-12-15)
32 C107
1 C108
2 C108
RIGHT COURTESY LAMP
LEFT COURTESY LAMP
M2 20 YL
S207 (8W-12-16)
UNDERHOOD LAMP
GLOVE BOX LAMP
Z141 20 BK
Z1 20 BK
S208
S134 (8W-15-6) (8W-15-7)
DIESEL GAS
Z141 16 BK
Z141 14 BK
G106 (8W-15-6) (8W-15-7)
M20 20 BR/OR
24 C1
23 C1
COURTESY LAMP DRIVER
COURTESY LAMP LOAD SHED
BODY CONTROL MODULE (8W-45-5) (8W-45-6)


DRIVER
DOOR
MODULE
(8W-62-4)
COURTESY
LAMP
GROUND
COURTESY
LAMP
DRIVER
12
C2
9
C2
M21
20
PK/DG
1
DRIVER
FRONT
DOOR
COURTESY
LAMP
2
L121
20
BK/RD
PASSENGER
DOOR
MODULE
(8W-62-5)
COURTESY
LAMP
GROUND
COURTESY
LAMP
DRIVER
12
C2
9
C2
M21
20
PK/DG
1
PASSENGER
FRONT
DOOR
COURTESY
LAMP
2
L121
20
BK/RD

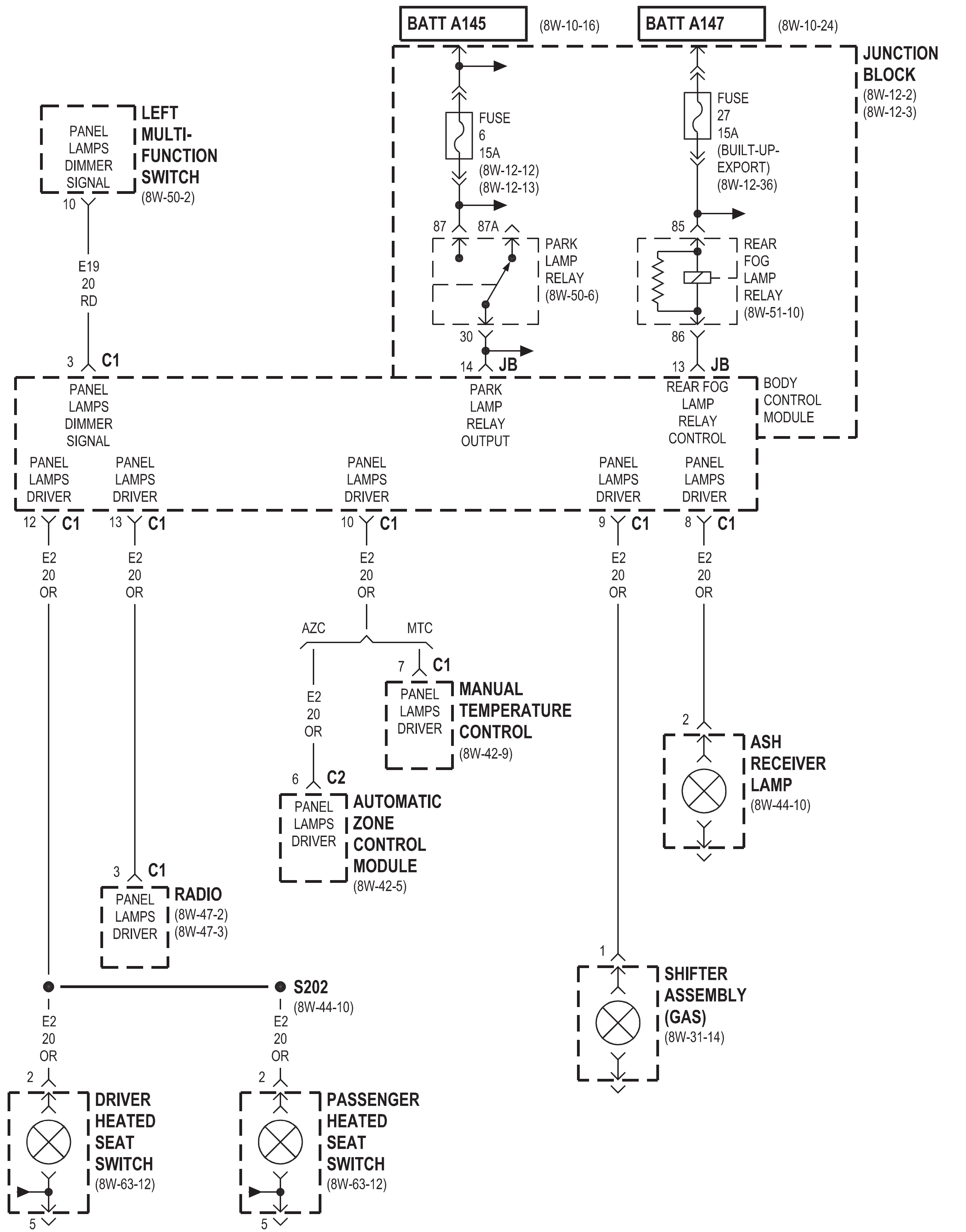

PANEL LAMPS DIMMER SIGNAL
LEFT MULTI-FUNCTION SWITCH
(8W-50-2)
10
E19
20
RD
3
C1
PANEL LAMPS DIMMER SIGNAL
BODY CONTROL MODULE
(8W-45-4)
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
12 C1
13 C1
10 C1
8 C1
9 C1
E2
20
OR
E2
20
OR
E2
20
OR
E2
20
OR
E2
20
OR
AZC
MTC
7 C1
PANEL LAMPS DRIVER
MANUAL TEMPERATURE CONTROL
(8W-42-9)
6 C2
PANEL LAMPS DRIVER
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
2
ASH RECEIVER LAMP
1
1
SHIFTER ASSEMBLY (GAS)
(8W-31-14)
2
Z300
20
BK
Z234
18
BK
S203
(8W-15-14)
S205
(8W-15-15)
Z300
12
BK
Z234
18
BK
3 C1
PANEL LAMPS DRIVER
RADIO
(8W-47-2)
(8W-47-3)
S202
E2
20
OR
E2
20
OR
2
2
DRIVER HEATED SEAT SWITCH
(8W-63-12)
PASSENGER HEATED SEAT SWITCH
(8W-63-12)
5
5
G200
(8W-15-15)

8W-45 BODY CONTROL MODULE

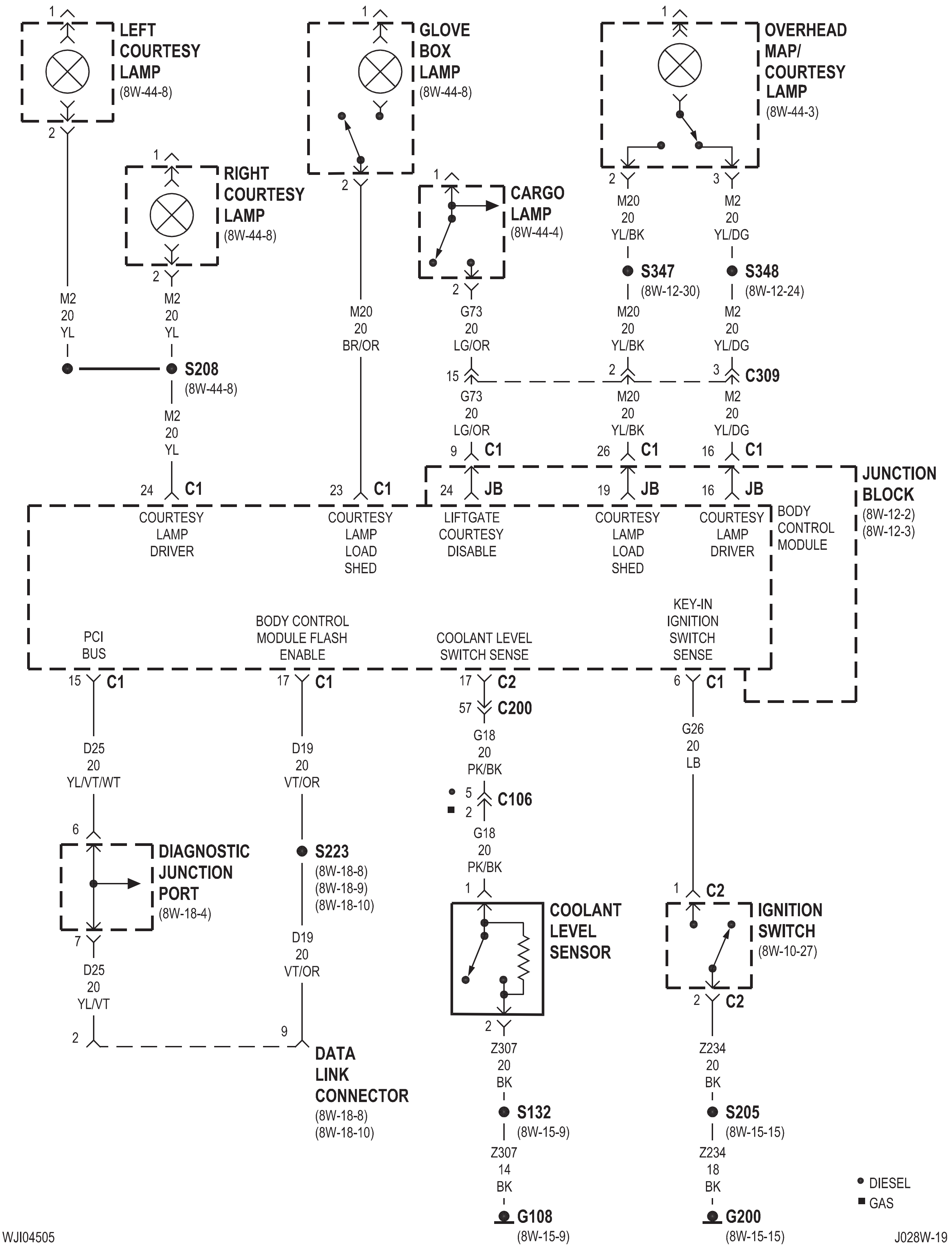

BATT A148
(8W-10-30)
RUN-START A21
(8W-10-29)
RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 7 10A (8W-12-15)
FUSE 22 10A (8W-12-23)
FUSE 28 10A (8W-12-26)
26 JB
5 JB
25 JB
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
BODY CONTROL MODULE
WIPER HIGH/LOW RELAY CONTROL
GROUND
GROUND
GROUND
GROUND
GROUND
12 JB
1 C1
14 C1
25 C1
15 JB
7 JB
45 C3
31 C3
15 C2
V16 22 VT
DIESEL
GAS
15 C107
34 C106
V16 20 VT
Z132 20 BK/OR
Z132 20 BK/OR
Z132 20 BK/OR
Z234 20 BK
Z234 20 BK
S211
(8W-15-13)
S205
(8W-15-15)
LHD
RHD
Z132 18 BK
Z132 18 BK/OR
Z234 18 BK
85
86
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-3)
(8W-53-4)
G200
(8W-15-15)



WJI04503 J028W-19

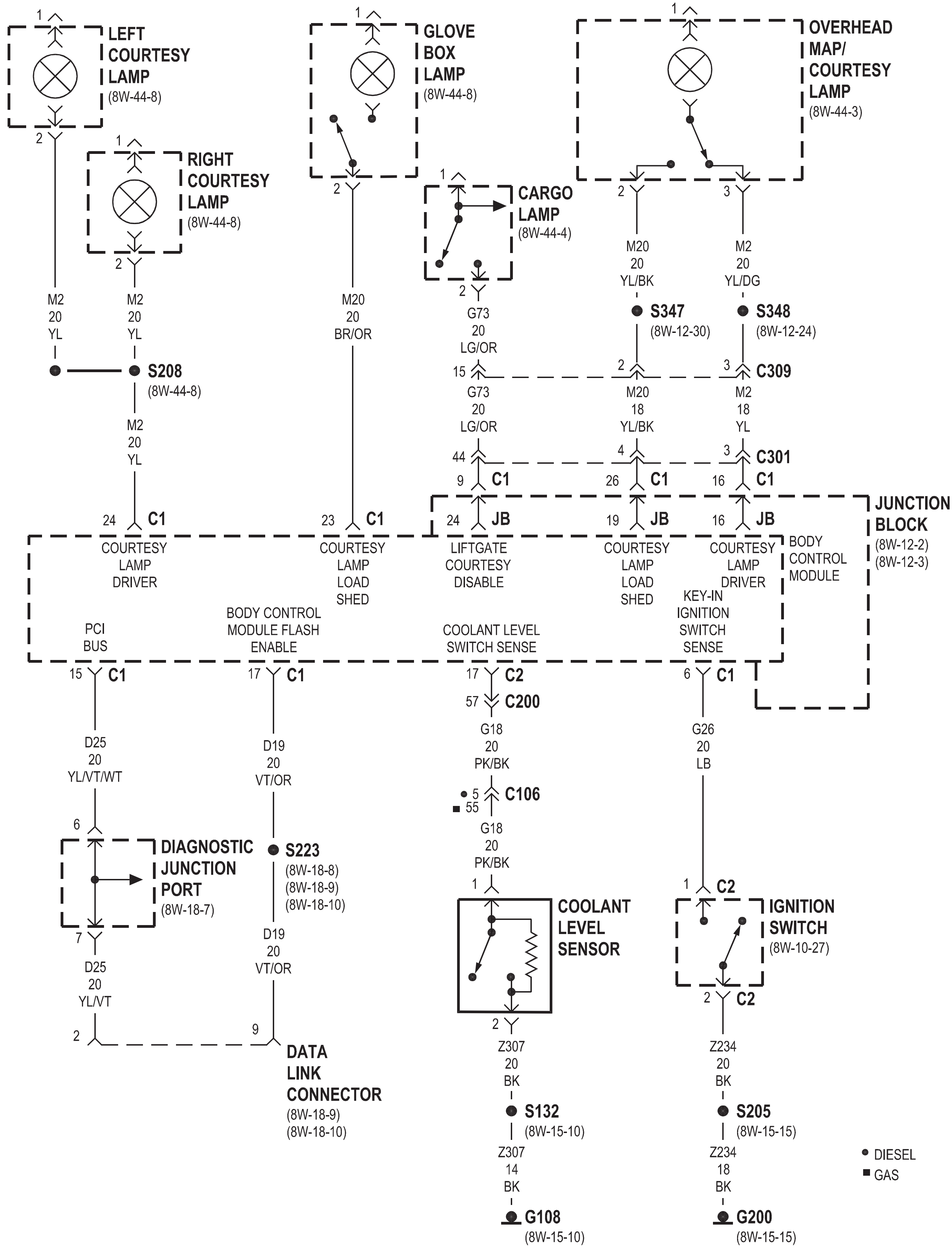

BATT A145
(8W-10-16)
BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
FUSE
27
15A
(BUILT-UP-EXPORT)
(8W-12-36)
87
87A
PARK LAMP RELAY
(8W-50-6)
85
REAR FOG LAMP RELAY
(8W-51-10)
30
86
14 JB
13 JB
LEFT MULTI-FUNCTION SWITCH
(8W-50-2)
PANEL LAMPS DIMMER SIGNAL
10
E19
20
RD
3 C1
PANEL LAMPS DIMMER SIGNAL
PARK LAMP RELAY OUTPUT
REAR FOG LAMP RELAY CONTROL
BODY CONTROL MODULE
PANEL LAMPS DRIVER
12 C1
13 C1
10 C1
9 C1
8 C1
E2
20
OR
AZC
MTC
7 C1
MANUAL TEMPERATURE CONTROL
(8W-42-9)
6 C2
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
3 C1
RADIO
(8W-47-2)
(8W-47-3)
2
ASH RECEIVER LAMP
(8W-44-10)
1
SHIFTER ASSEMBLY (GAS)
(8W-31-14)
S202
(8W-44-10)
DRIVER HEATED SEAT SWITCH
(8W-63-12)
PASSENGER HEATED SEAT SWITCH
(8W-63-12)
5

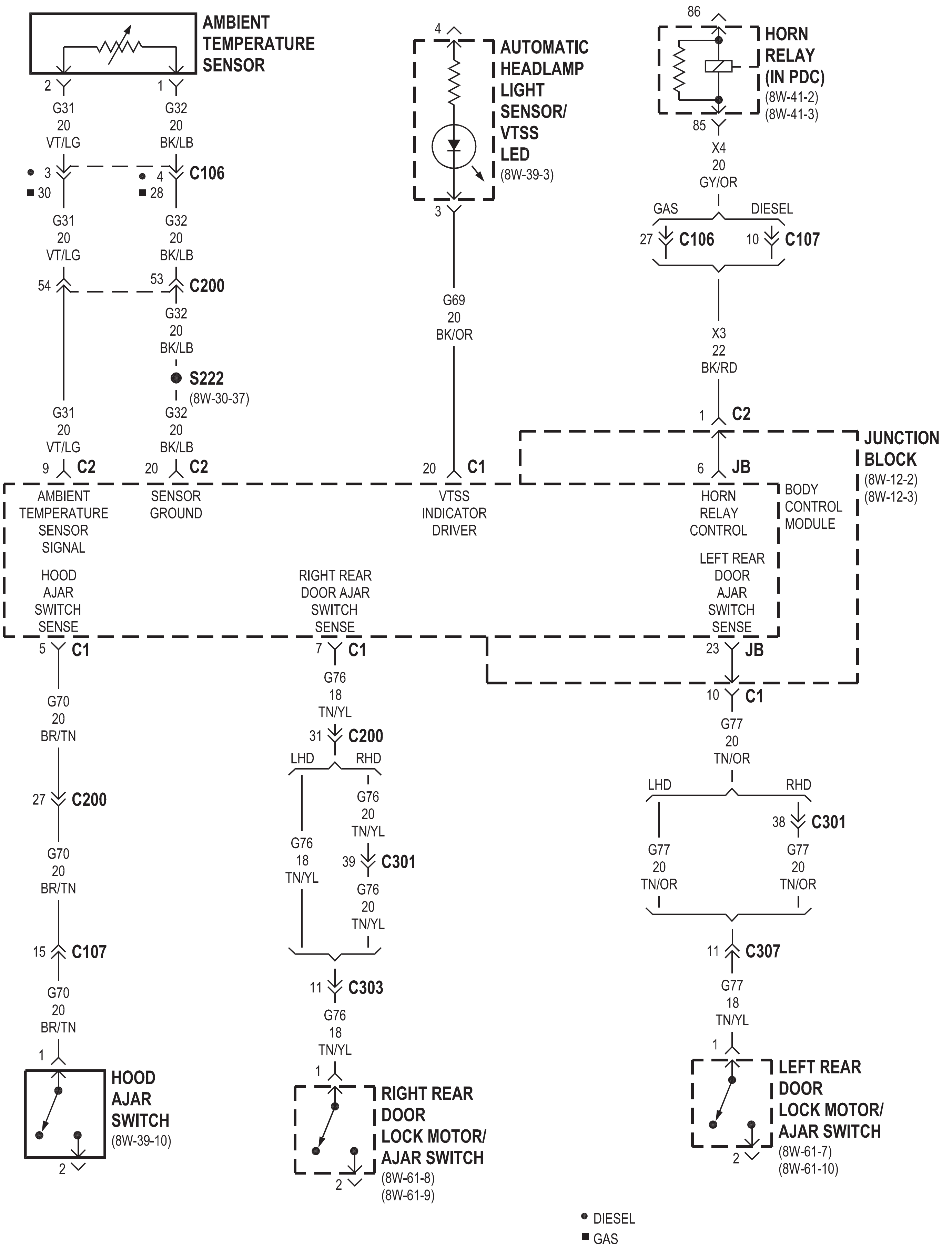
LHD

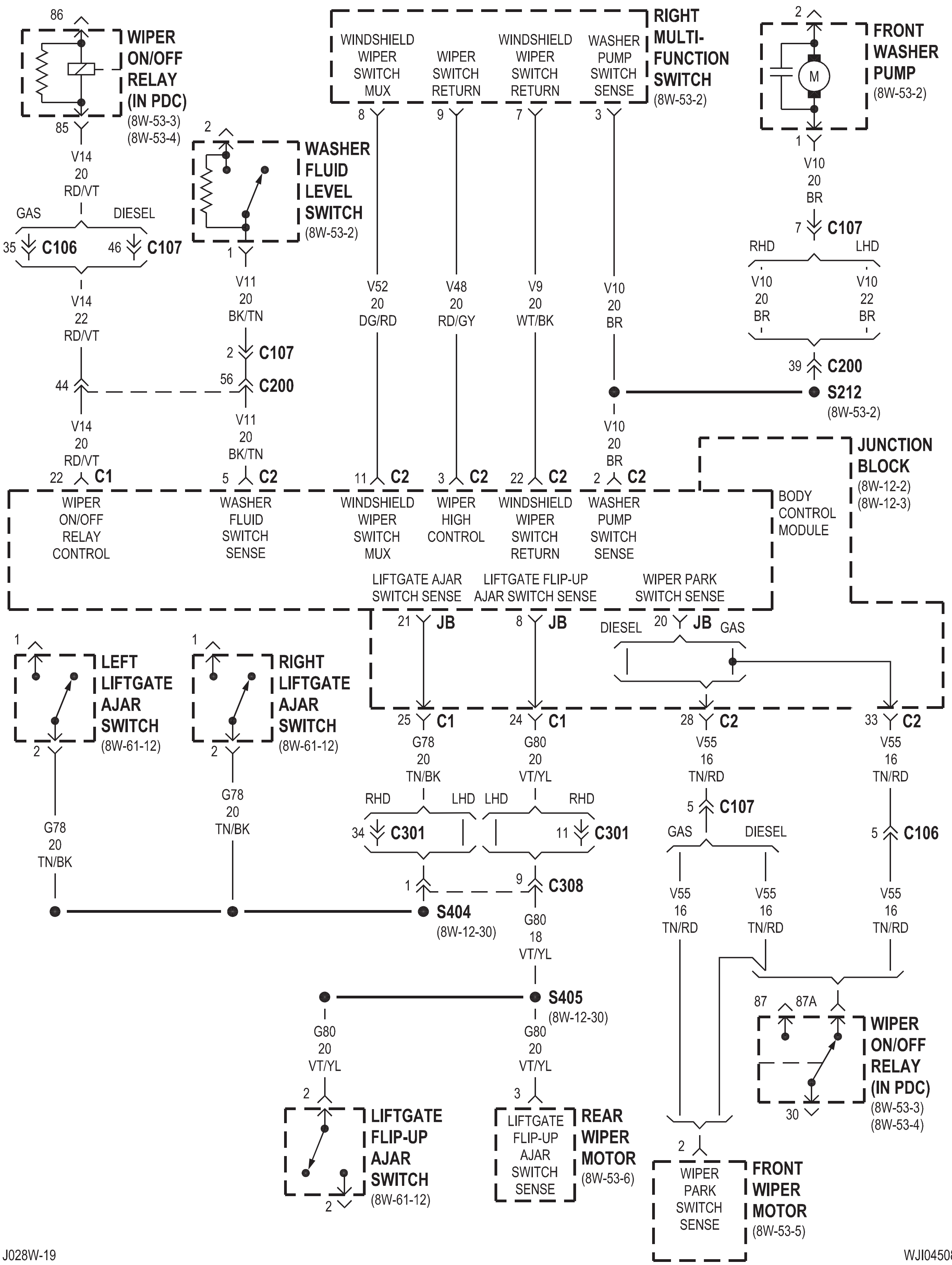


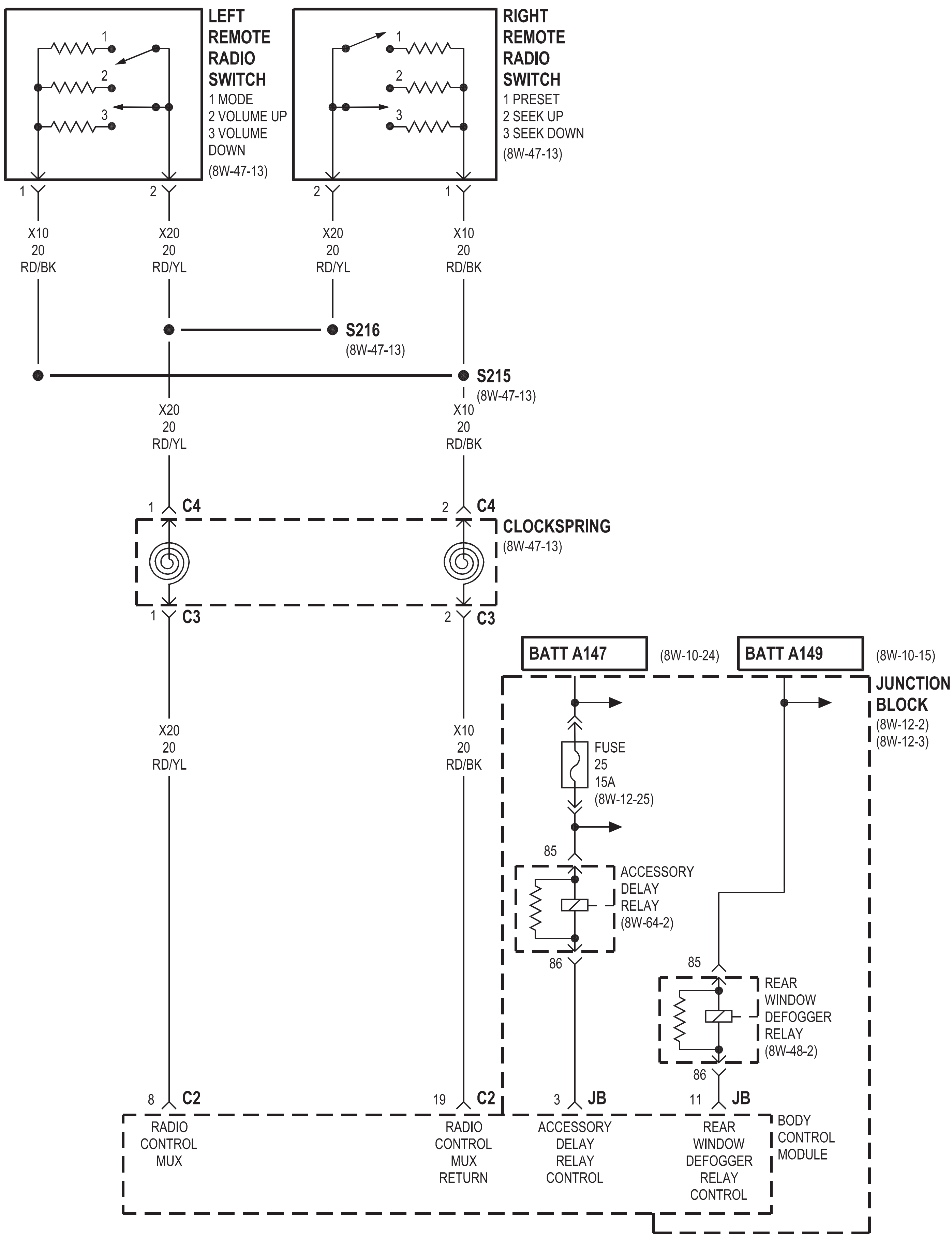
WJI04505 J028W-19

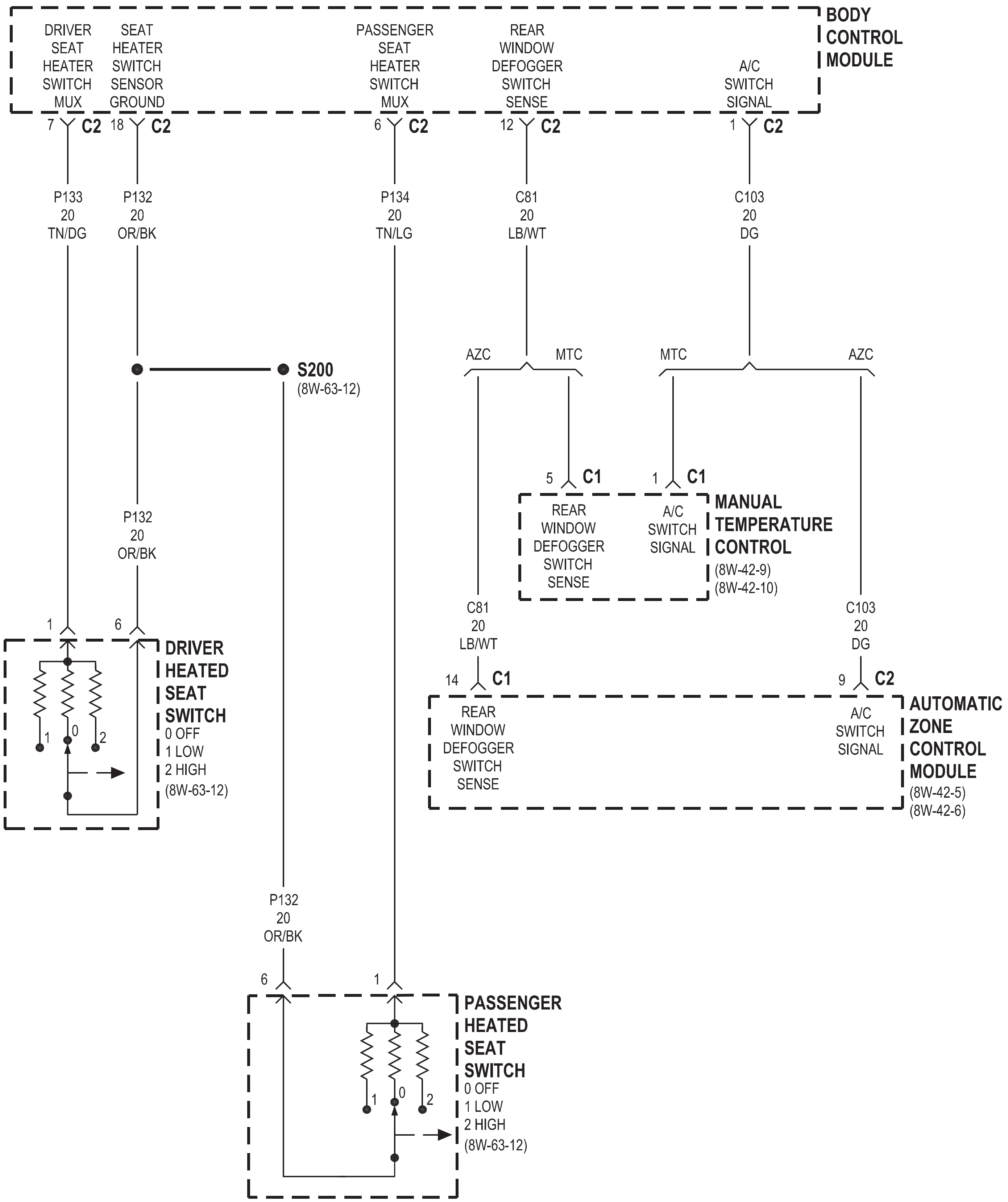
RHD


LEFT COURTESY LAMP
(8W-44-8)
RIGHT COURTESY LAMP
(8W-44-8)
GLOVE BOX LAMP
(8W-44-8)
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)
CARGO LAMP
(8W-44-4)
M2 20 YL
M20 20 BR/OR
G73 20 LG/OR
M20 20 YL/BK
M2 20 YL/DG
S347
(8W-12-30)
S348
(8W-12-24)
S208
(8W-44-8)
C309
M20 18 YL/BK
M2 18 YL
C301
C1
JB
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
COURTESY LAMP DRIVER
COURTESY LAMP LOAD SHED
LIFTGATE COURTESY DISABLE
KEY-IN IGNITION SWITCH SENSE
PCI BUS
BODY CONTROL MODULE FLASH ENABLE
COOLANT LEVEL SWITCH SENSE
C2
C200
D25 20 YL/VT/WT
D19 20 VT/OR
G18 20 PK/BK
G26 20 LB
C106
DIAGNOSTIC JUNCTION PORT
(8W-18-7)
S223
(8W-18-8)
(8W-18-9)
(8W-18-10)
COOLANT LEVEL SENSOR
IGNITION SWITCH
(8W-10-27)
D25 20 YL/VT
DATA LINK CONNECTOR
(8W-18-9)
(8W-18-10)
Z307 20 BK
Z234 20 BK
S132
(8W-15-10)
S205
(8W-15-15)
Z307 14 BK
Z234 18 BK
G108
(8W-15-10)
G200
(8W-15-15)
● DIESEL
■ GAS


AMBIENT TEMPERATURE SENSOR
G31 20 VT/LG
G32 20 BK/LB
C106
C200
S222
(8W-30-37)
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
(8W-39-3)
G69 20 BK/OR
HORN RELAY (IN PDC)
(8W-41-2)
(8W-41-3)
X4 20 GY/OR
GAS
DIESEL
C107
X3 22 BK/RD
C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
JB
C1
AMBIENT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
VTSS INDICATOR DRIVER
HORN RELAY CONTROL
BODY CONTROL MODULE
HOOD AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
LEFT REAR DOOR AJAR SWITCH SENSE
G70 20 BR/TN
G76 18 TN/YL
G76 20 TN/YL
LHD
RHD
C301
C303
G77 20 TN/OR
C307
G77 18 TN/YL
HOOD AJAR SWITCH
(8W-39-10)
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-8)
(8W-61-9)
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
(8W-61-10)
● DIESEL
■ GAS

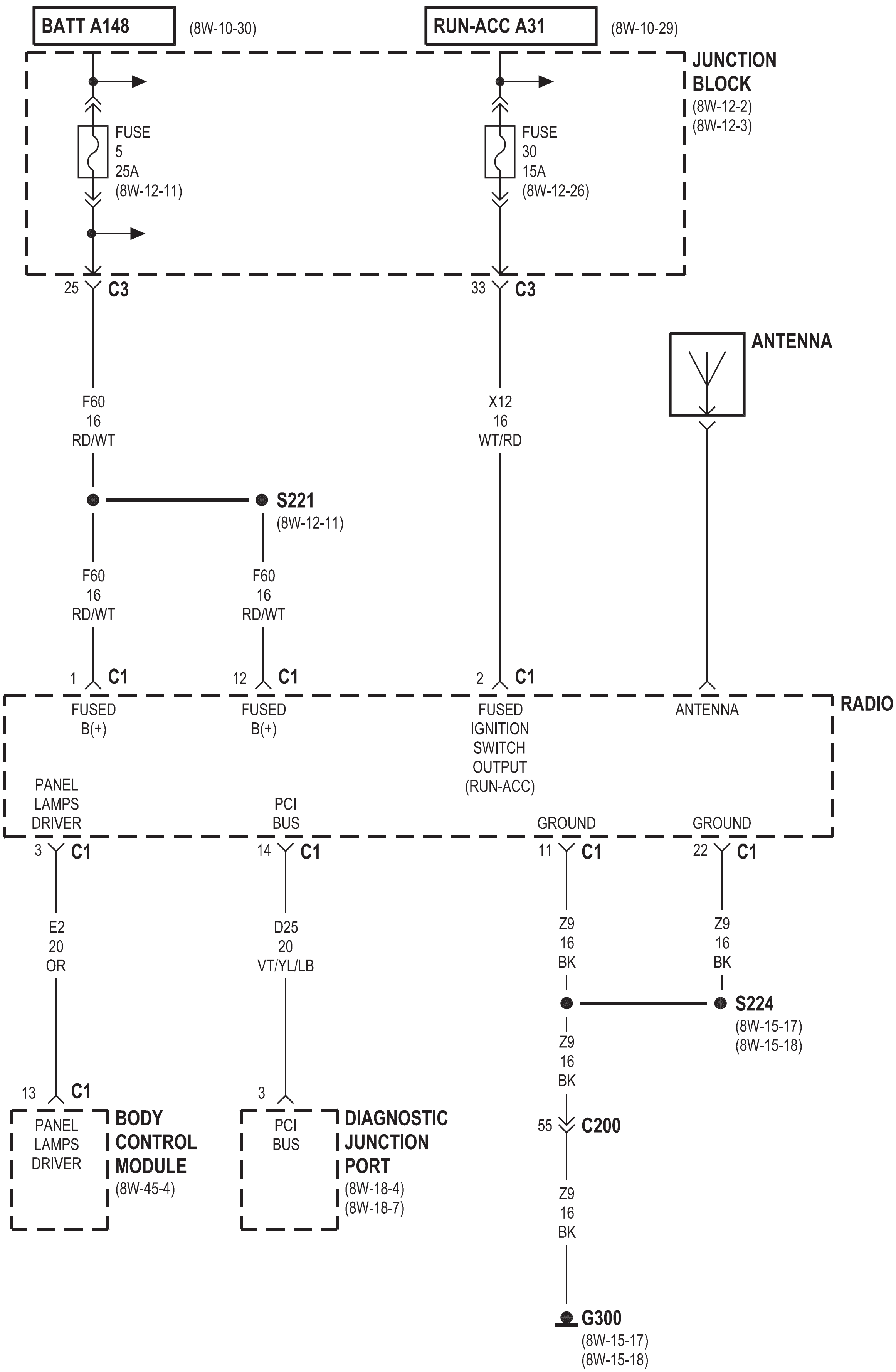

WIPER ON/OFF RELAY (IN PDC)
(8W-53-3)
(8W-53-4)
86
85
V14 20 RD/VT
GAS
DIESEL
35 C106
46 C107
V14 22 RD/VT
44 C200
V14 20 RD/VT
22 C1
WASHER FLUID LEVEL SWITCH
(8W-53-2)
V11 20 BK/TN
2 C107
56 C200
V11 20 BK/TN
5 C2
RIGHT MULTI-FUNCTION SWITCH
(8W-53-2)
WINDSHIELD WIPER SWITCH MUX
WIPER SWITCH RETURN
WINDSHIELD WIPER SWITCH RETURN
WASHER PUMP SWITCH SENSE
V52 20 DG/RD
V48 20 RD/GY
V9 20 WT/BK
V10 20 BR
11 C2
3 C2
22 C2
2 C2
FRONT WASHER PUMP
(8W-53-2)
M
V10 20 BR
7 C107
RHD
LHD
V10 20 BR
V10 22 BR
39 C200
S212
(8W-53-2)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
WIPER ON/OFF RELAY CONTROL
WASHER FLUID SWITCH SENSE
WINDSHIELD WIPER SWITCH MUX
WIPER HIGH CONTROL
WINDSHIELD WIPER SWITCH RETURN
WASHER PUMP SWITCH SENSE
LIFTGATE AJAR SWITCH SENSE
LIFTGATE FLIP-UP AJAR SWITCH SENSE
WIPER PARK SWITCH SENSE
21 JB
8 JB
20 JB
DIESEL
GAS
25 C1
24 C1
28 C2
33 C2
LEFT LIFTGATE AJAR SWITCH
(8W-61-12)
RIGHT LIFTGATE AJAR SWITCH
(8W-61-12)
G78 20 TN/BK
G80 20 VT/YL
V55 16 TN/RD
RHD
LHD
34 C301
11 C301
5 C107
5 C106
1 C308
9 C308
S404
(8W-12-30)
G80 18 VT/YL
S405
(8W-12-30)
G80 20 VT/YL
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-12)
REAR WIPER MOTOR
(8W-53-6)
LIFTGATE FLIP-UP AJAR SWITCH SENSE
87
87A
30
FRONT WIPER MOTOR
(8W-53-5)
WIPER PARK SWITCH SENSE

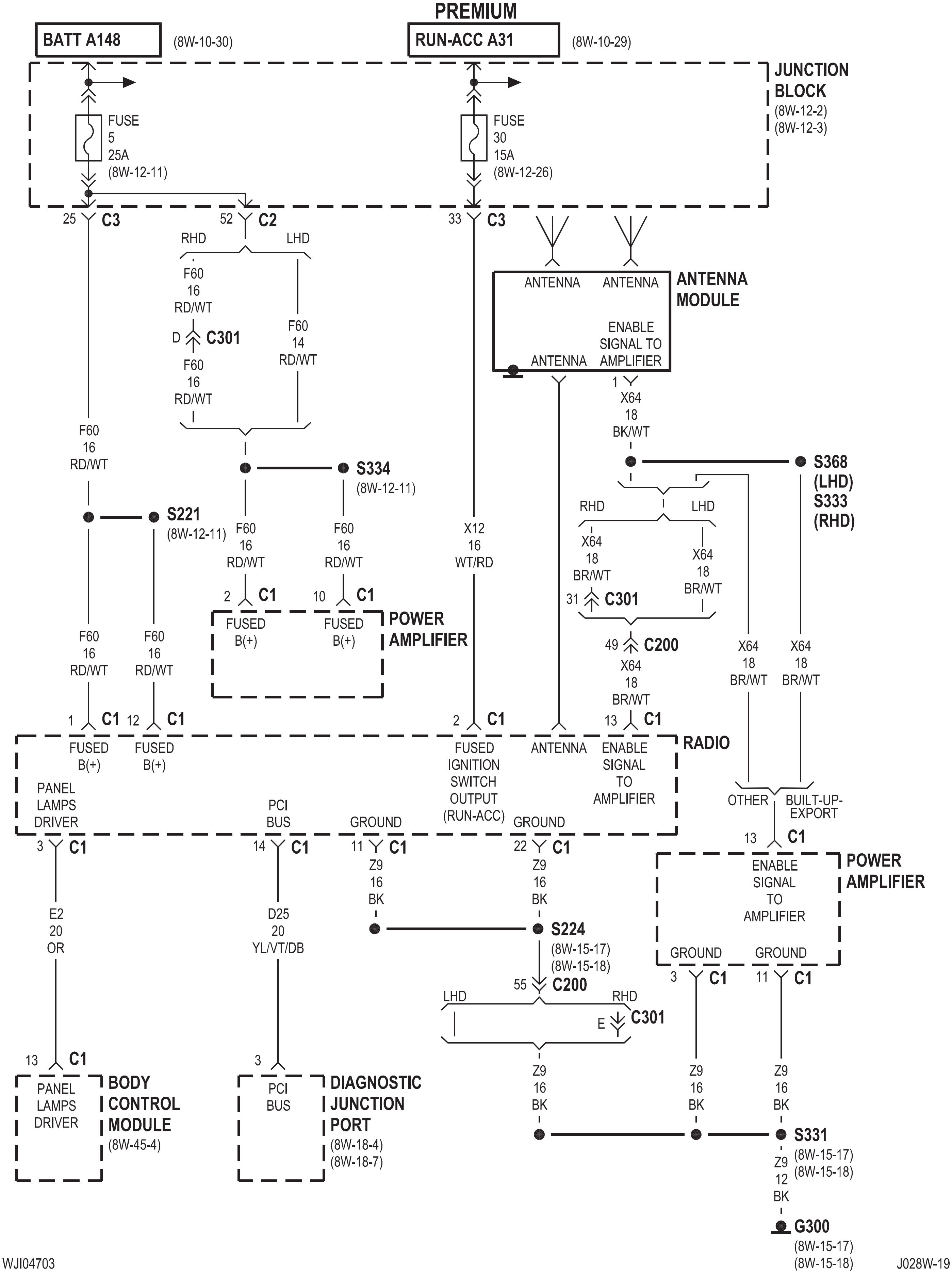

LEFT REMOTE RADIO SWITCH
1 MODE
2 VOLUME UP
3 VOLUME DOWN
(8W-47-13)
RIGHT REMOTE RADIO SWITCH
1 PRESET
2 SEEK UP
3 SEEK DOWN
(8W-47-13)
X10 20 RD/BK
X20 20 RD/YL
X20 20 RD/YL
X10 20 RD/BK
S216
(8W-47-13)
S215
(8W-47-13)
X20 20 RD/YL
X10 20 RD/BK
C4
C4
CLOCKSPRING
(8W-47-13)
C3
C3
BATT A147
(8W-10-24)
BATT A149
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 25 15A
(8W-12-25)
ACCESSORY DELAY RELAY
(8W-64-2)
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
X20 20 RD/YL
X10 20 RD/BK
C2
C2
JB
JB
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
ACCESSORY DELAY RELAY CONTROL
REAR WINDOW DEFOGGER RELAY CONTROL
BODY CONTROL MODULE

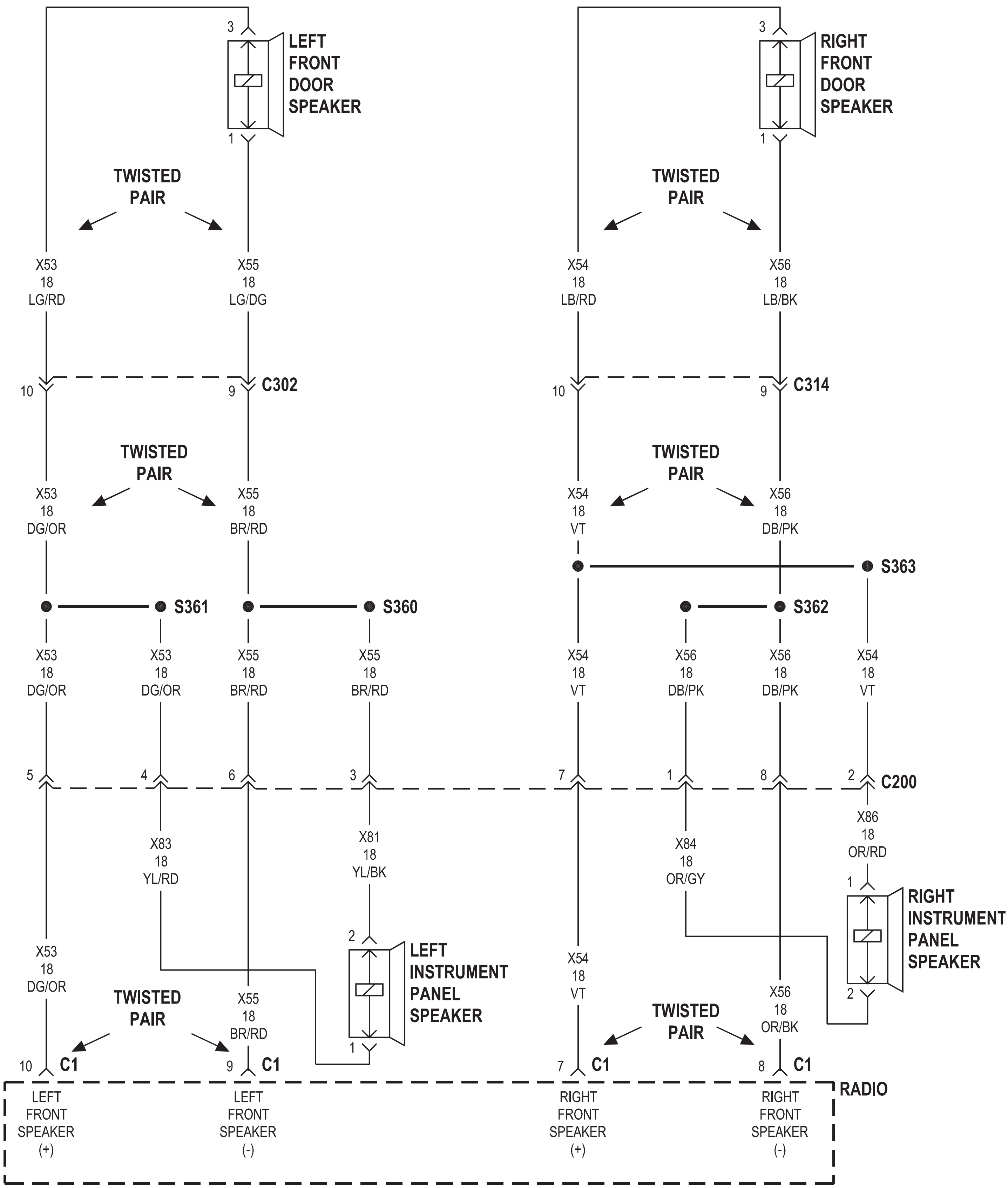

BODY CONTROL MODULE
DRIVER SEAT HEATER SWITCH MUX
SEAT HEATER SWITCH SENSOR GROUND
PASSENGER SEAT HEATER SWITCH MUX
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH SIGNAL
7 C2
18 C2
6 C2
12 C2
1 C2
P133 20 TN/DG
P132 20 OR/BK
P134 20 TN/LG
C81 20 LB/WT
C103 20 DG
AZC
MTC
MTC
AZC
S200 (8W-63-12)
5 C1
1 C1
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH SIGNAL
MANUAL TEMPERATURE CONTROL (8W-42-9) (8W-42-10)
P132 20 OR/BK
C81 20 LB/WT
C103 20 DG
1
6
DRIVER HEATED SEAT SWITCH
0 OFF
1 LOW
2 HIGH
(8W-63-12)
1 0 2
14 C1
9 C2
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH SIGNAL
AUTOMATIC ZONE CONTROL MODULE (8W-42-5) (8W-42-6)
P132 20 OR/BK
6
1
PASSENGER HEATED SEAT SWITCH
0 OFF
1 LOW
2 HIGH
(8W-63-12)
1 0 2

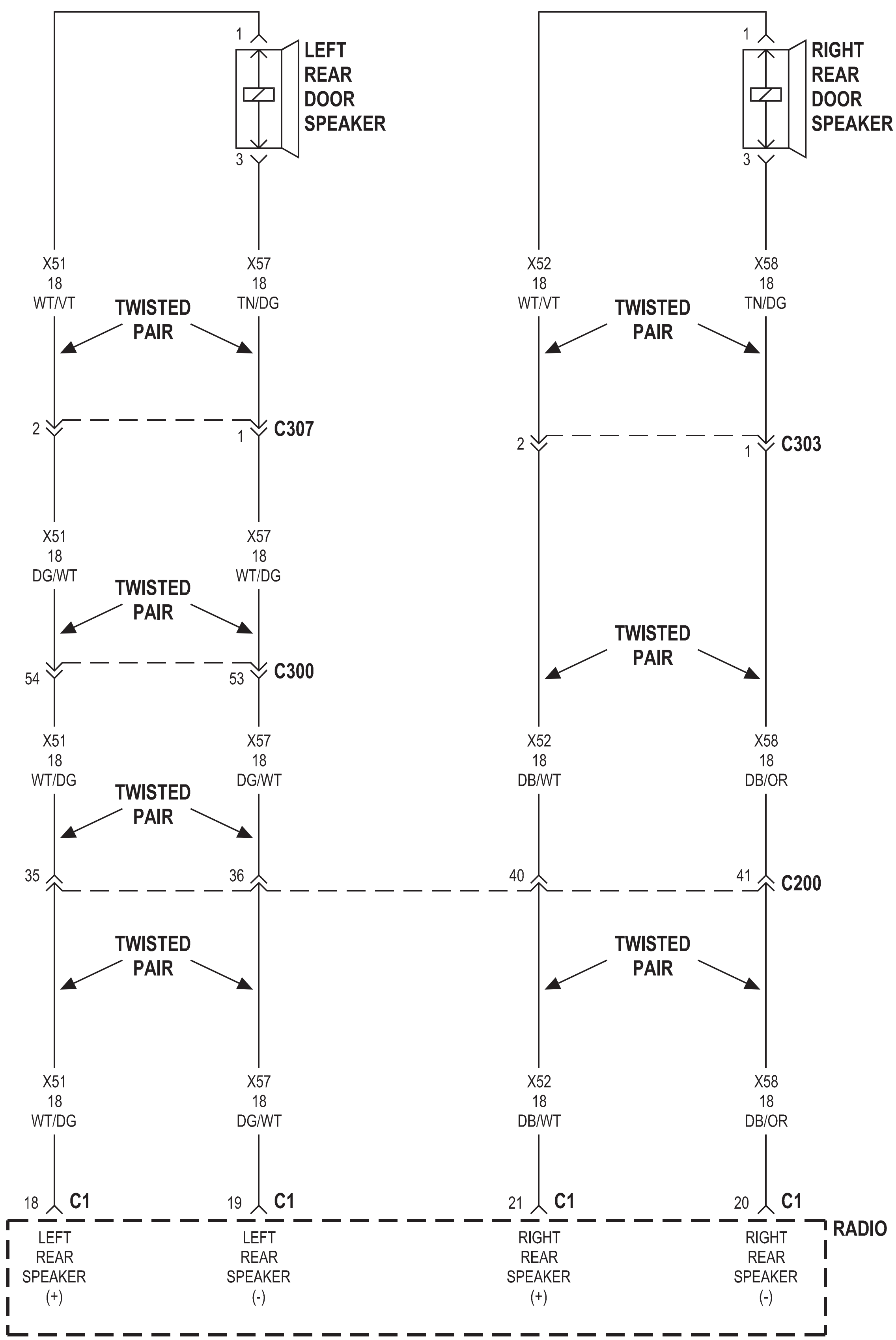
8W-47 AUDIO SYSTEM

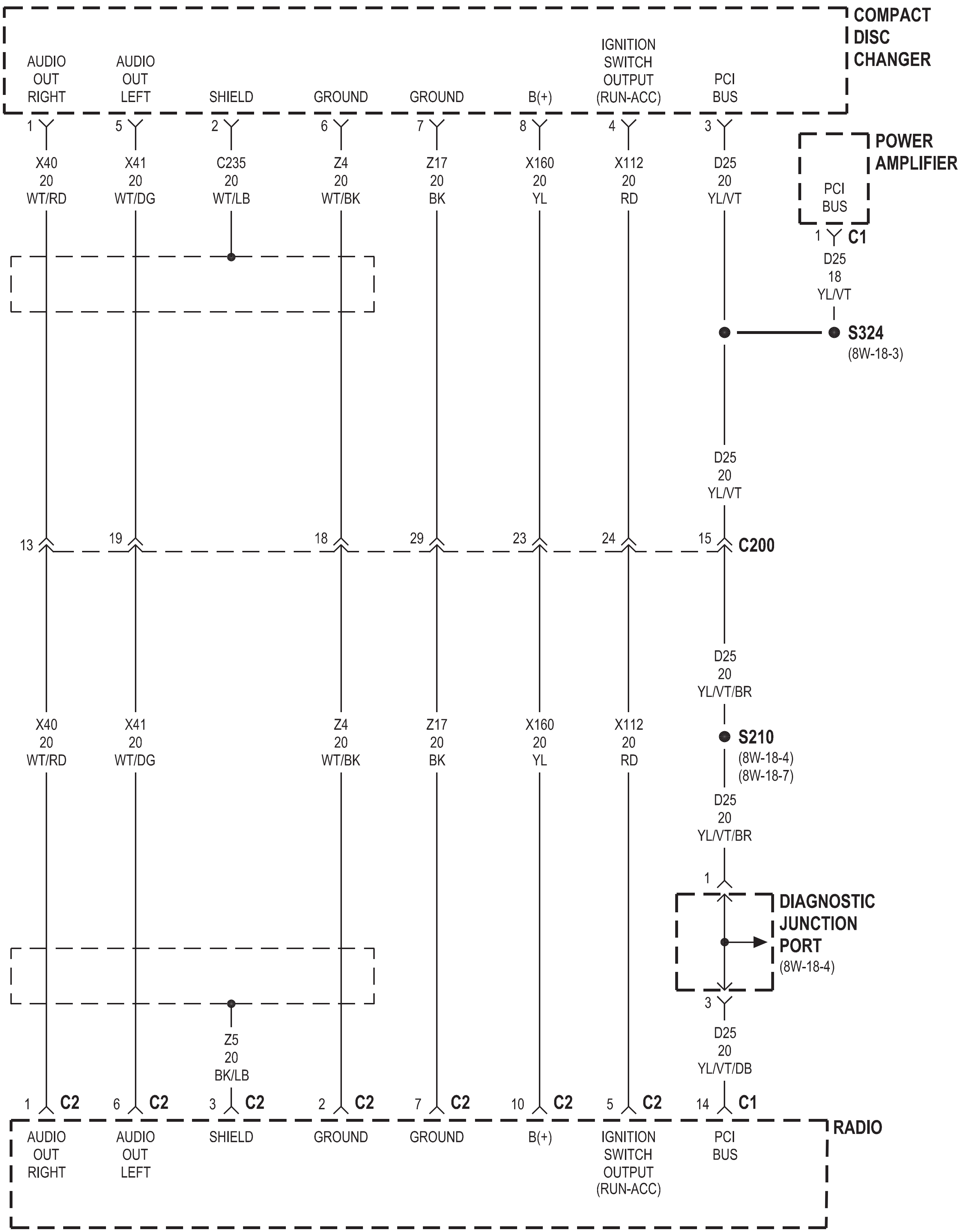
BASE


BATT A148
(8W-10-30)
RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 25A (8W-12-11)
FUSE 30 15A (8W-12-26)
25 C3
33 C3
ANTENNA
F60 16 RD/WT
X12 16 WT/RD
S221
(8W-12-11)
F60 16 RD/WT
F60 16 RD/WT
1 C1
12 C1
2 C1
RADIO
FUSED B(+)
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
ANTENNA
PANEL LAMPS DRIVER
PCI BUS
GROUND
GROUND
3 C1
14 C1
11 C1
22 C1
E2 20 OR
D25 20 VT/YL/LB
Z9 16 BK
Z9 16 BK
S224
(8W-15-17)
(8W-15-18)
Z9 16 BK
13 C1
3
PANEL LAMPS DRIVER
BODY CONTROL MODULE
(8W-45-4)
PCI BUS
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
55 C200
Z9 16 BK
G300
(8W-15-17)
(8W-15-18)

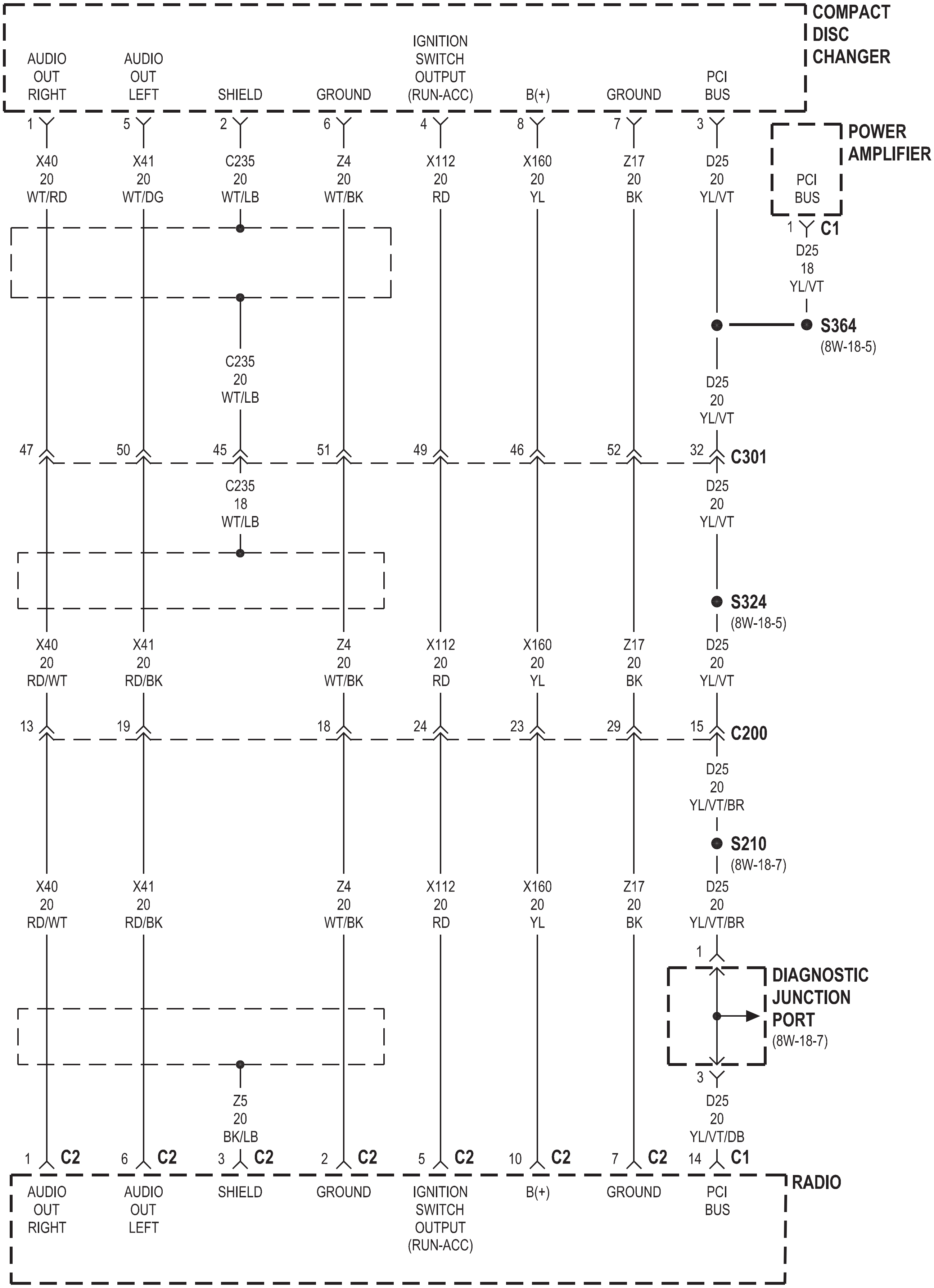

BATT A148
(8W-10-30)
RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 25A (8W-12-11)
FUSE 30 15A (8W-12-26)
25 C3
52 C2
33 C3
RHD
LHD
F60 16 RD/WT
D C301
F60 14 RD/WT
F60 16 RD/WT
S334
(8W-12-11)
S221
(8W-12-11)
X12 16 WT/RD
ANTENNA
ANTENNA
ANTENNA MODULE
ENABLE SIGNAL TO AMPLIFIER
ANTENNA
1
X64 18 BK/WT
S368 (LHD)
S333 (RHD)
RHD
LHD
X64 18 BR/WT
31 C301
49 C200
X64 18 BR/WT
2 C1
10 C1
FUSED B(+)
FUSED B(+)
POWER AMPLIFIER
1 C1
12 C1
2 C1
13 C1
RADIO
FUSED B(+)
FUSED B(+)
PANEL LAMPS DRIVER
PCI BUS
GROUND
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
ANTENNA
ENABLE SIGNAL TO AMPLIFIER
OTHER
BUILT-UP-EXPORT
13 C1
POWER AMPLIFIER
ENABLE SIGNAL TO AMPLIFIER
GROUND
GROUND
3 C1
14 C1
11 C1
22 C1
3 C1
11 C1
E2 20 OR
D25 20 YL/VT/DB
Z9 16 BK
S224
(8W-15-17)
(8W-15-18)
55 C200
LHD
RHD
E C301
13 C1
BODY CONTROL MODULE
(8W-45-4)
3
PCI BUS
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
S331
(8W-15-17)
(8W-15-18)
Z9 12 BK
G300
(8W-15-17)
(8W-15-18)


LEFT FRONT DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
TWISTED PAIR
X53 18 LG/RD
X55 18 LG/DG
X54 18 LB/RD
X56 18 LB/BK
C302
C314
X53 18 DG/OR
X55 18 BR/RD
X54 18 VT
X56 18 DB/PK
S361
S360
S362
S363
C200
X83 18 YL/RD
X81 18 YL/BK
X84 18 OR/GY
X86 18 OR/RD
LEFT INSTRUMENT PANEL SPEAKER
RIGHT INSTRUMENT PANEL SPEAKER
X56 18 OR/BK
C1
RADIO
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)

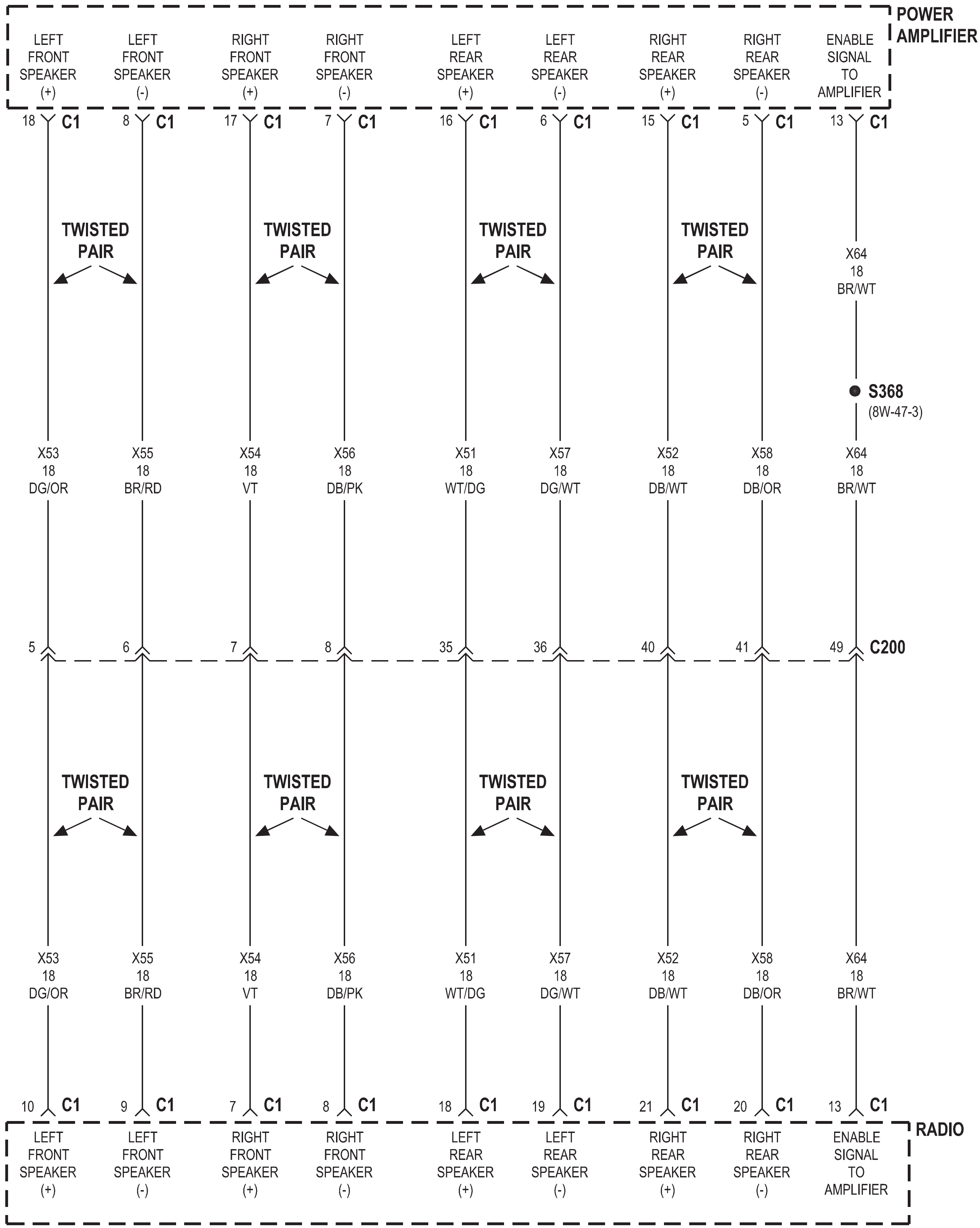

LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
1
3
X51 18 WT/VT
X57 18 TN/DG
X52 18 WT/VT
X58 18 TN/DG
TWISTED PAIR
C307
2
1
C303
2
1
X51 18 DG/WT
X57 18 WT/DG
TWISTED PAIR
C300
54
53
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
C200
35
36
40
41
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
18 C1
19 C1
21 C1
20 C1
RADIO
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)

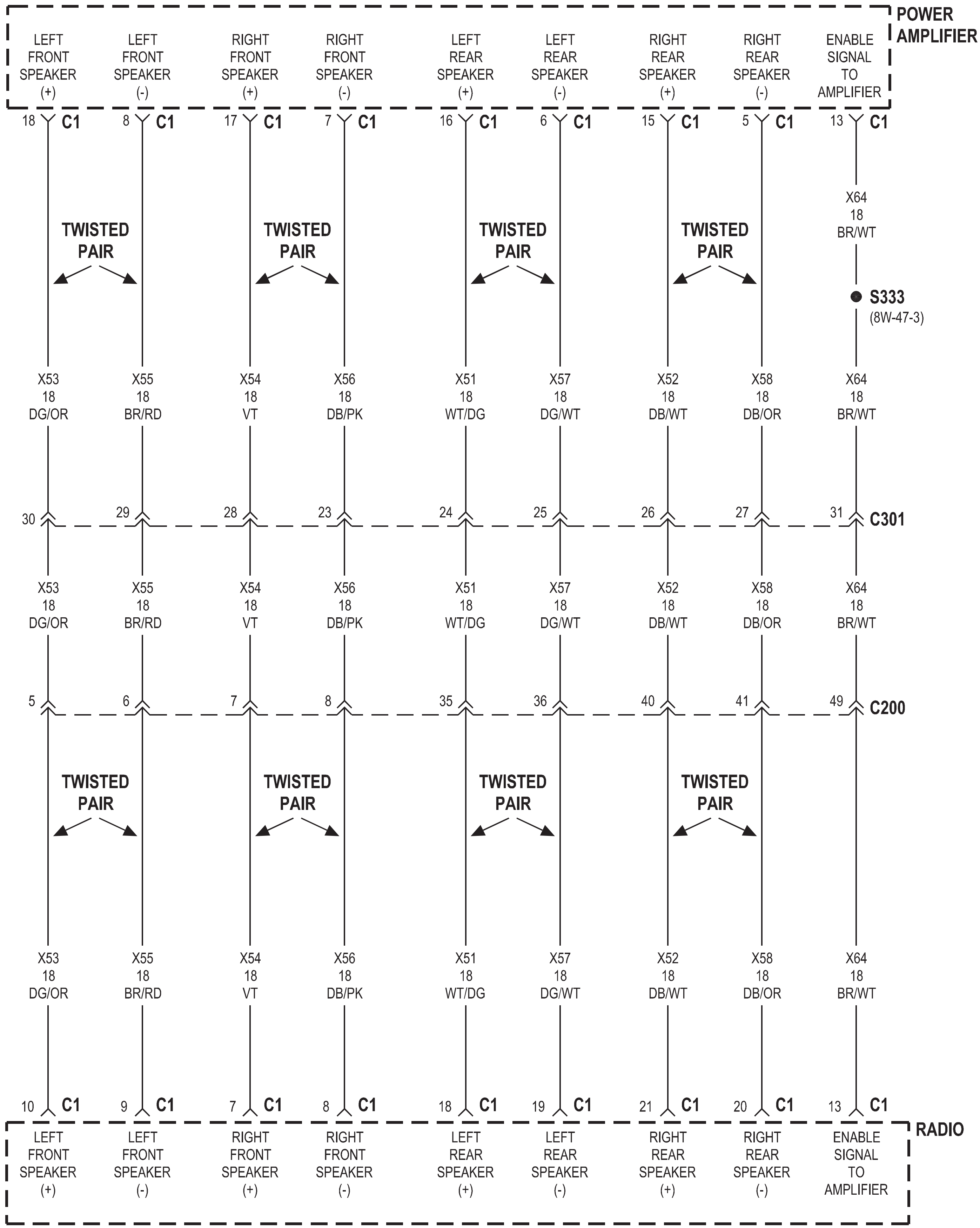

COMPACT DISC CHANGER
AUDIO OUT RIGHT
AUDIO OUT LEFT
SHIELD
GROUND
GROUND
B(+)
IGNITION SWITCH OUTPUT (RUN-ACC)
PCI BUS
1 5 2 6 7 8 4 3
X40 20 WT/RD
X41 20 WT/DG
C235 20 WT/LB
Z4 20 WT/BK
Z17 20 BK
X160 20 YL
X112 20 RD
D25 20 YL/VT
POWER AMPLIFIER
PCI BUS
1 C1
D25 18 YL/VT
S324
(8W-18-3)
D25 20 YL/VT
13 19 18 29 23 24 15 C200
D25 20 YL/VT/BR
X40 20 WT/RD
X41 20 WT/DG
Z4 20 WT/BK
Z17 20 BK
X160 20 YL
X112 20 RD
S210
(8W-18-4)
(8W-18-7)
D25 20 YL/VT/BR
1
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
3
D25 20 YL/VT/DB
Z5 20 BK/LB
1 C2
6 C2
3 C2
2 C2
7 C2
10 C2
5 C2
14 C1
RADIO
AUDIO OUT RIGHT
AUDIO OUT LEFT
SHIELD
GROUND
GROUND
B(+)
IGNITION SWITCH OUTPUT (RUN-ACC)
PCI BUS

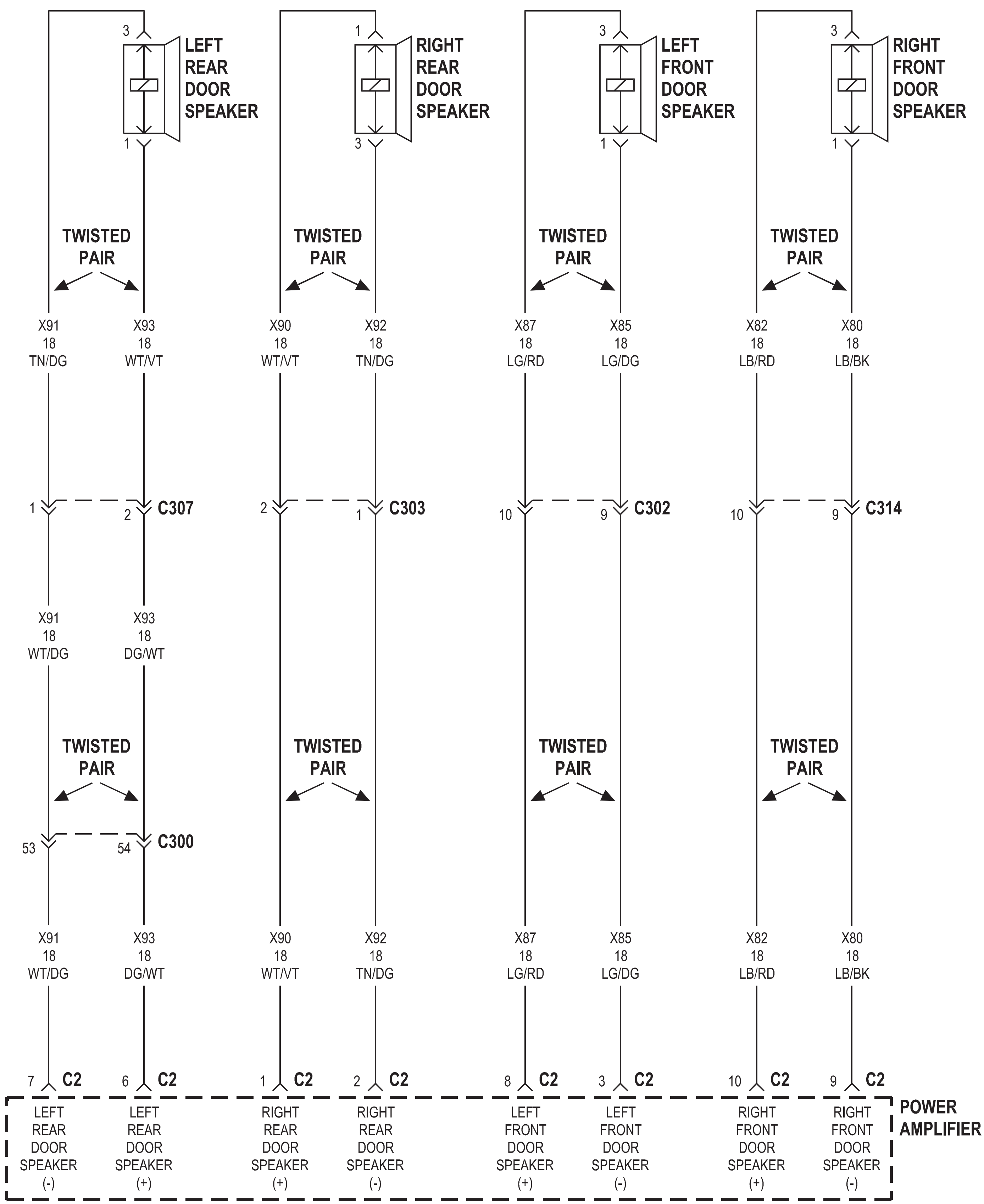
RHD PREMIUM

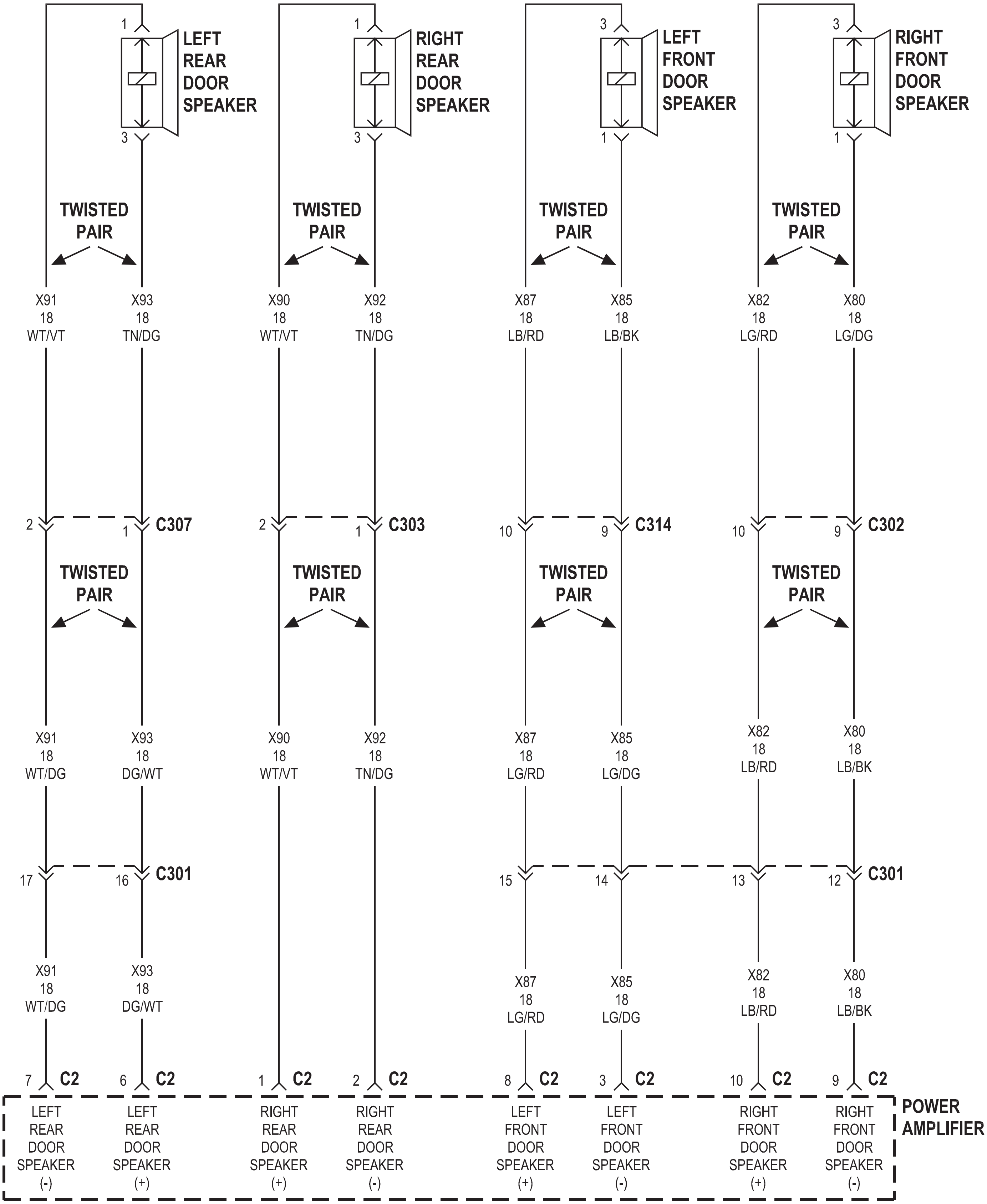

COMPACT DISC CHANGER
AUDIO OUT RIGHT
AUDIO OUT LEFT
SHIELD
GROUND
IGNITION SWITCH OUTPUT (RUN-ACC)
B(+)
GROUND
PCI BUS
POWER AMPLIFIER
PCI BUS
C1
X40 20 WT/RD
X41 20 WT/DG
C235 20 WT/LB
Z4 20 WT/BK
X112 20 RD
X160 20 YL
Z17 20 BK
D25 20 YL/VT
D25 18 YL/VT
S364 (8W-18-5)
C235 20 WT/LB
D25 20 YL/VT
C301
C235 18 WT/LB
D25 20 YL/VT
S324 (8W-18-5)
X40 20 RD/WT
X41 20 RD/BK
Z4 20 WT/BK
X112 20 RD
X160 20 YL
Z17 20 BK
D25 20 YL/VT
C200
D25 20 YL/VT/BR
S210 (8W-18-7)
X40 20 RD/WT
X41 20 RD/BK
Z4 20 WT/BK
X112 20 RD
X160 20 YL
Z17 20 BK
D25 20 YL/VT/BR
DIAGNOSTIC JUNCTION PORT (8W-18-7)
Z5 20 BK/LB
D25 20 YL/VT/DB
C2
C1
RADIO
AUDIO OUT RIGHT
AUDIO OUT LEFT
SHIELD
GROUND
IGNITION SWITCH OUTPUT (RUN-ACC)
B(+)
GROUND
PCI BUS

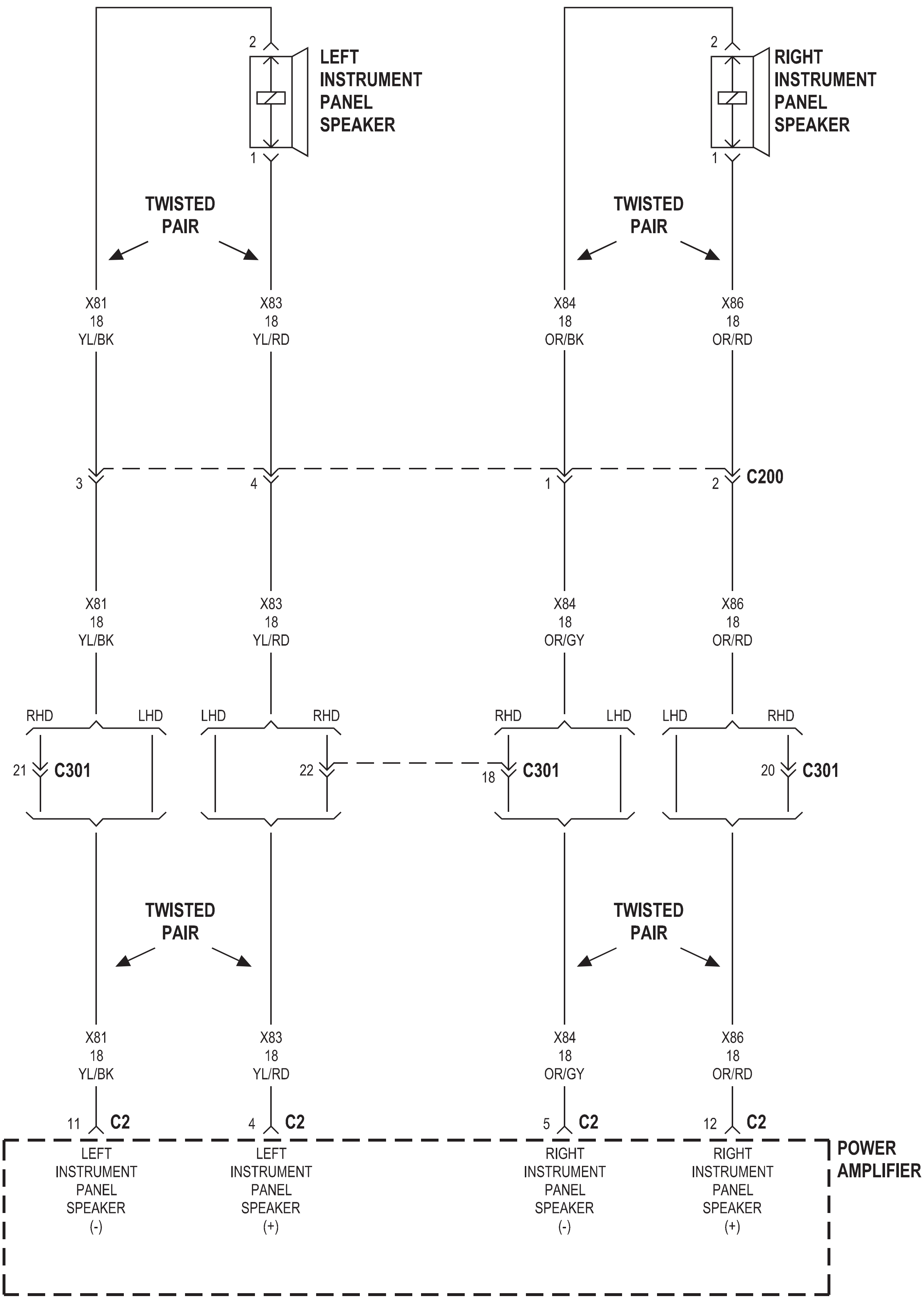
LHD PREMIUM


POWER AMPLIFIER
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
ENABLE SIGNAL TO AMPLIFIER
18 C1
8 C1
17 C1
7 C1
16 C1
6 C1
15 C1
5 C1
13 C1
TWISTED PAIR
X64 18 BR/WT
S368 (8W-47-3)
X53 18 DG/OR
X55 18 BR/RD
X54 18 VT
X56 18 DB/PK
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
X64 18 BR/WT
5 6 7 8 35 36 40 41 49 C200
10 C1
9 C1
7 C1
8 C1
18 C1
19 C1
21 C1
20 C1
13 C1
RADIO

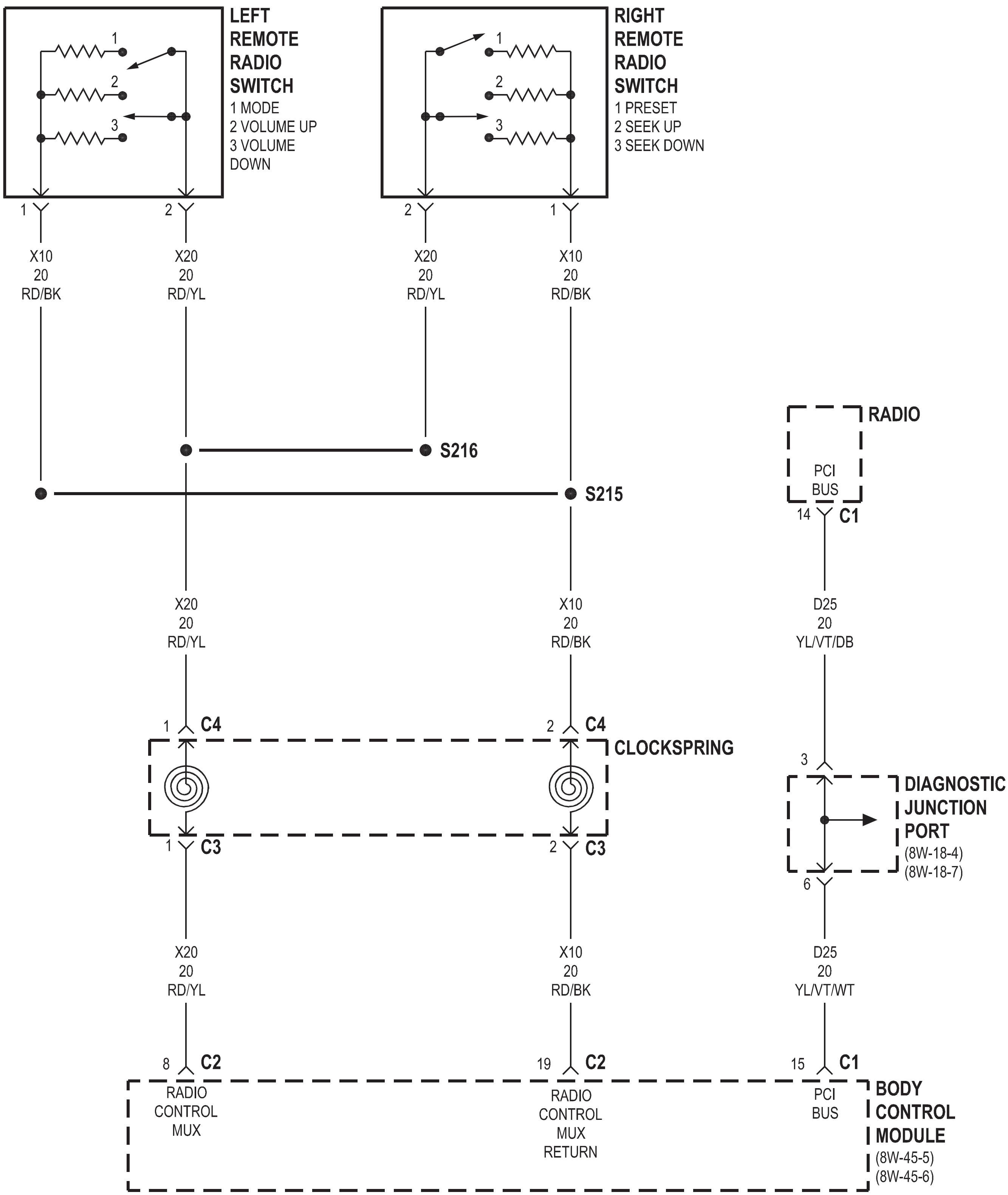

POWER AMPLIFIER
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
ENABLE SIGNAL TO AMPLIFIER
18 C1
8 C1
17 C1
7 C1
16 C1
6 C1
15 C1
5 C1
13 C1
TWISTED PAIR
X64 18 BR/WT
S333 (8W-47-3)
X53 18 DG/OR
X55 18 BR/RD
X54 18 VT
X56 18 DB/PK
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
X64 18 BR/WT
30 29 28 23 24 25 26 27 31 C301
5 6 7 8 35 36 40 41 49 C200
10 C1
9 C1
7 C1
8 C1
18 C1
19 C1
21 C1
20 C1
13 C1
RADIO
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
ENABLE SIGNAL TO AMPLIFIER


LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
LEFT FRONT DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
3
1
1
3
3
1
3
1
TWISTED PAIR
X91 18 TN/DG
X93 18 WT/VT
X90 18 WT/VT
X92 18 TN/DG
X87 18 LG/RD
X85 18 LG/DG
X82 18 LB/RD
X80 18 LB/BK
1 2 C307
2 1 C303
10 9 C302
10 9 C314
X91 18 WT/DG
X93 18 DG/WT
53 54 C300
X91 18 WT/DG
X93 18 DG/WT
X90 18 WT/VT
X92 18 TN/DG
X87 18 LG/RD
X85 18 LG/DG
X82 18 LB/RD
X80 18 LB/BK
7 C2
6 C2
1 C2
2 C2
8 C2
3 C2
10 C2
9 C2
LEFT REAR DOOR SPEAKER (-)
LEFT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (-)
LEFT FRONT DOOR SPEAKER (+)
LEFT FRONT DOOR SPEAKER (-)
RIGHT FRONT DOOR SPEAKER (+)
RIGHT FRONT DOOR SPEAKER (-)
POWER AMPLIFIER

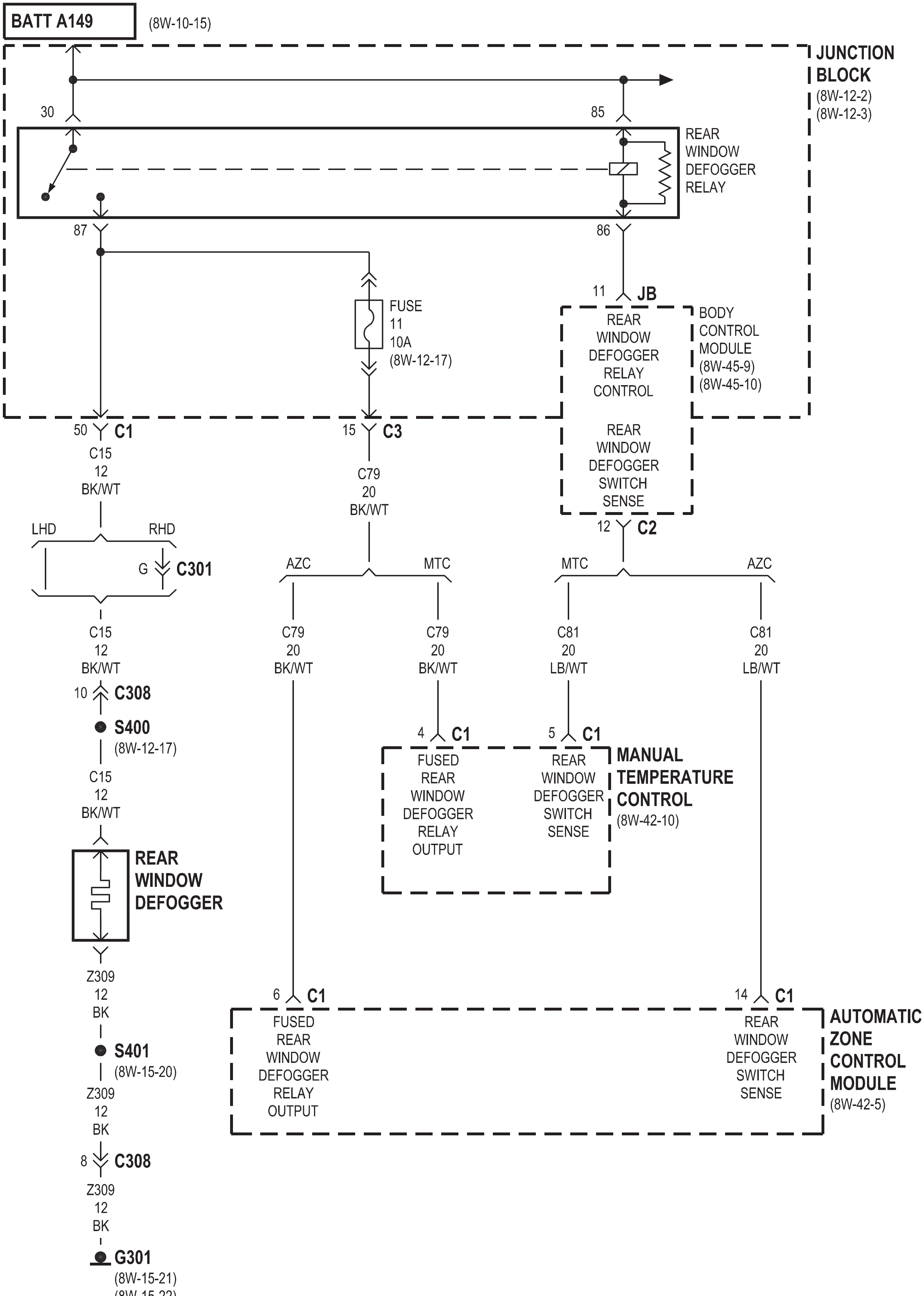

LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
LEFT FRONT DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
TWISTED PAIR
X91 18 WT/VT
X93 18 TN/DG
X90 18 WT/VT
X92 18 TN/DG
X87 18 LB/RD
X85 18 LB/BK
X82 18 LG/RD
X80 18 LG/DG
C307
C303
C314
C302
X91 18 WT/DG
X93 18 DG/WT
X87 18 LG/RD
X85 18 LG/DG
X82 18 LB/RD
X80 18 LB/BK
C301
C2
POWER AMPLIFIER
LEFT REAR DOOR SPEAKER (-)
LEFT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (-)
LEFT FRONT DOOR SPEAKER (+)
LEFT FRONT DOOR SPEAKER (-)
RIGHT FRONT DOOR SPEAKER (+)
RIGHT FRONT DOOR SPEAKER (-)



J028W-19 WJI04712

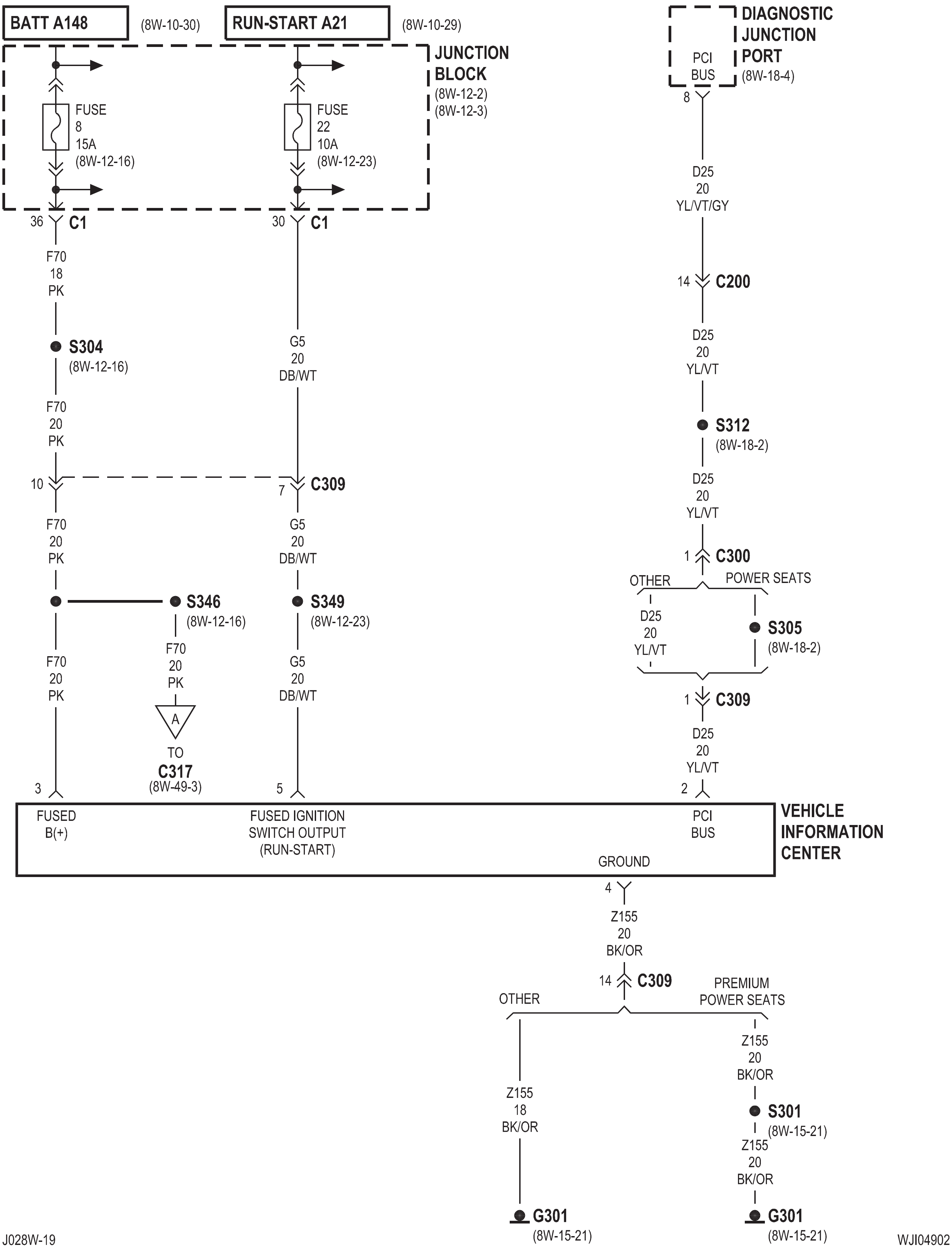

LEFT REMOTE RADIO SWITCH
1 MODE
2 VOLUME UP
3 VOLUME DOWN
RIGHT REMOTE RADIO SWITCH
1 PRESET
2 SEEK UP
3 SEEK DOWN
X10 20 RD/BK
X20 20 RD/YL
S216
S215
RADIO
PCI BUS
14 C1
D25 20 YL/VT/DB
C4
CLOCKSPRING
C3
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
D25 20 YL/VT/WT
8 C2
19 C2
15 C1
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)

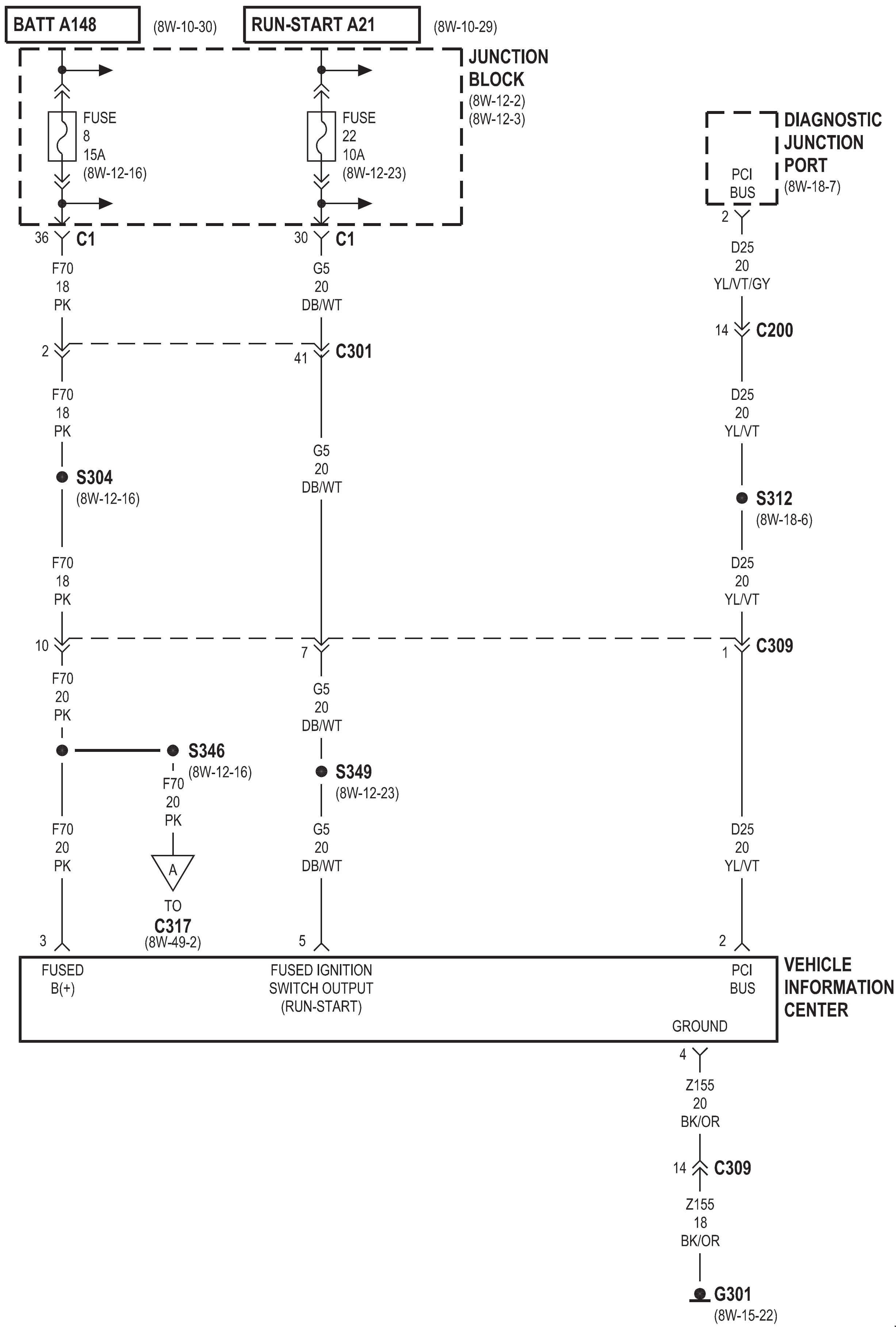
8W-48 REAR WINDOW DEFOGGER

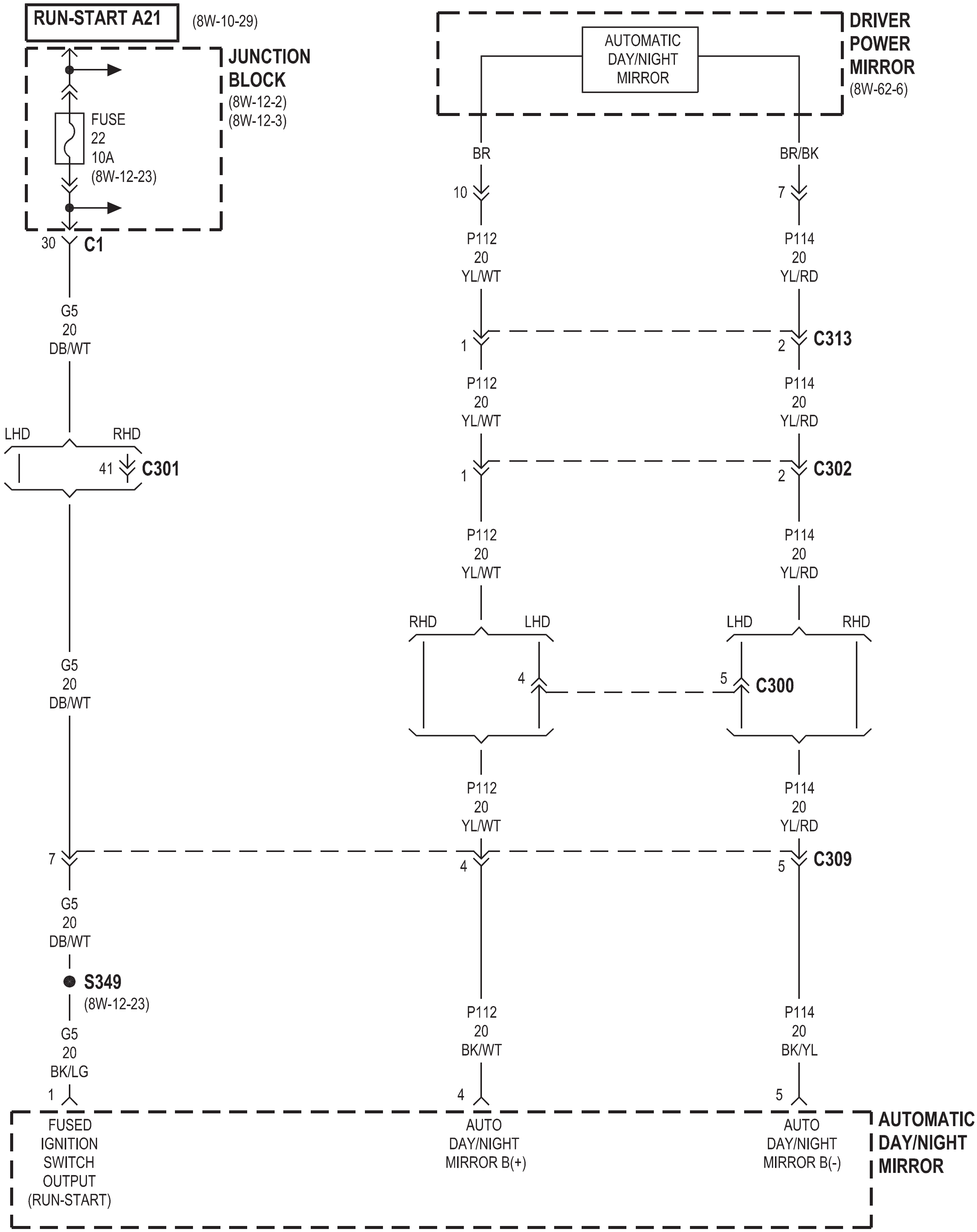

BATT A149
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
85
REAR WINDOW DEFOGGER RELAY
87
86
FUSE
11
10A
(8W-12-17)
11 JB
REAR WINDOW DEFOGGER RELAY CONTROL
REAR WINDOW DEFOGGER SWITCH SENSE
BODY CONTROL MODULE
(8W-45-9)
(8W-45-10)
50 C1
15 C3
12 C2
C15 12 BK/WT
C79 20 BK/WT
LHD
RHD
G C301
AZC
MTC
C81 20 LB/WT
10 C308
S400
(8W-12-17)
4 C1
5 C1
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
REAR WINDOW DEFOGGER SWITCH SENSE
MANUAL TEMPERATURE CONTROL
(8W-42-10)
REAR WINDOW DEFOGGER
Z309 12 BK
6 C1
14 C1
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
S401
(8W-15-20)
8 C308
G301
(8W-15-21)
(8W-15-22)

8W-49 OVERHEAD CONSOLE

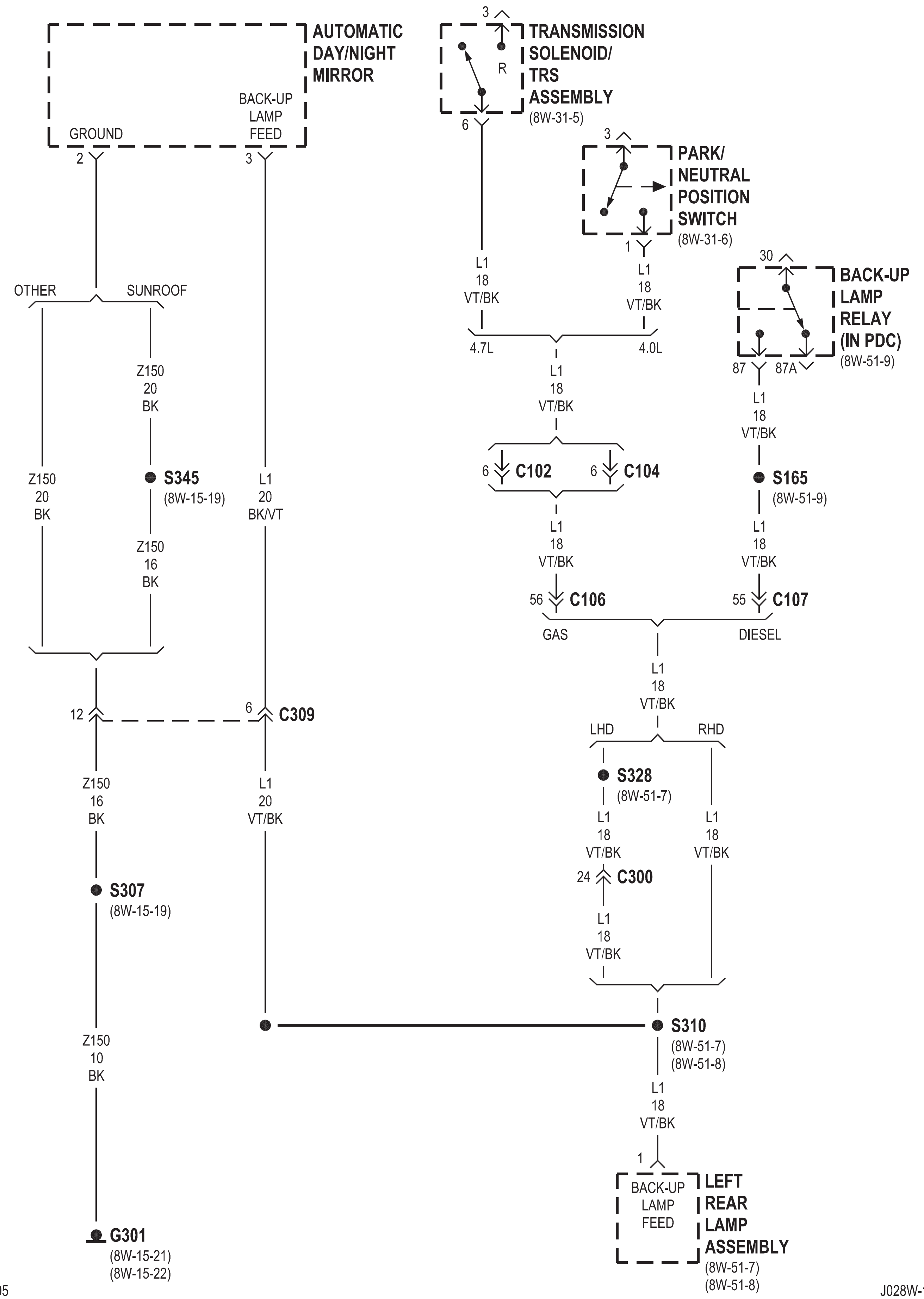
LHD


BATT A148
(8W-10-30)
RUN-START A21
(8W-10-29)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
FUSE
22
10A
(8W-12-23)
DIAGNOSTIC
JUNCTION
PORT
(8W-18-4)
PCI
BUS
8
D25
20
YL/VT/GY
36
C1
30
C1
F70
18
PK
14
C200
S304
(8W-12-16)
G5
20
DB/WT
D25
20
YL/VT
F70
20
PK
S312
(8W-18-2)
10
7
C309
F70
20
PK
G5
20
DB/WT
1
C300
OTHER
POWER SEATS
S346
(8W-12-16)
S349
(8W-12-23)
S305
(8W-18-2)
F70
20
PK
A
TO
C317
(8W-49-3)
1
C309
3
5
2
FUSED
B(+)
FUSED IGNITION
SWITCH OUTPUT
(RUN-START)
PCI
BUS
GROUND
VEHICLE
INFORMATION
CENTER
4
Z155
20
BK/OR
14
C309
OTHER
PREMIUM
POWER SEATS
Z155
18
BK/OR
S301
(8W-15-21)
G301
(8W-15-21)


BATT A148
(8W-10-30)
RUN-START A21
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 8 15A (8W-12-16)
FUSE 22 10A (8W-12-23)
DIAGNOSTIC JUNCTION PORT
(8W-18-7)
PCI BUS
2
36 C1
30 C1
F70 18 PK
G5 20 DB/WT
D25 20 YL/VT/GY
14 C200
2
41 C301
F70 18 PK
G5 20 DB/WT
D25 20 YL/VT
S304
(8W-12-16)
S312
(8W-18-6)
F70 18 PK
D25 20 YL/VT
10
7
1 C309
F70 20 PK
G5 20 DB/WT
S346
(8W-12-16)
F70 20 PK
S349
(8W-12-23)
F70 20 PK
G5 20 DB/WT
D25 20 YL/VT
A
TO C317
(8W-49-2)
3
5
2
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PCI BUS
GROUND
VEHICLE INFORMATION CENTER
4
Z155 20 BK/OR
14 C309
Z155 18 BK/OR
G301
(8W-15-22)



RUN-START A21
(8W-10-29)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
(8W-12-23)
30
C1
G5
20
DB/WT
LHD
RHD
41
C301
G5
20
DB/WT
7
G5
20
DB/WT
S349
(8W-12-23)
G5
20
BK/LG
1
AUTOMATIC
DAY/NIGHT
MIRROR
DRIVER
POWER
MIRROR
(8W-62-6)
BR
BR/BK
10
7
P112
20
YL/WT
P114
20
YL/RD
1
2
C313
P112
20
YL/WT
P114
20
YL/RD
1
2
C302
P112
20
YL/WT
P114
20
YL/RD
RHD
LHD
LHD
RHD
4
5
C300
P112
20
YL/WT
P114
20
YL/RD
4
5
C309
P112
20
BK/WT
P114
20
BK/YL
4
5
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
AUTO
DAY/NIGHT
MIRROR B(+)
AUTO
DAY/NIGHT
MIRROR B(-)
AUTOMATIC
DAY/NIGHT
MIRROR



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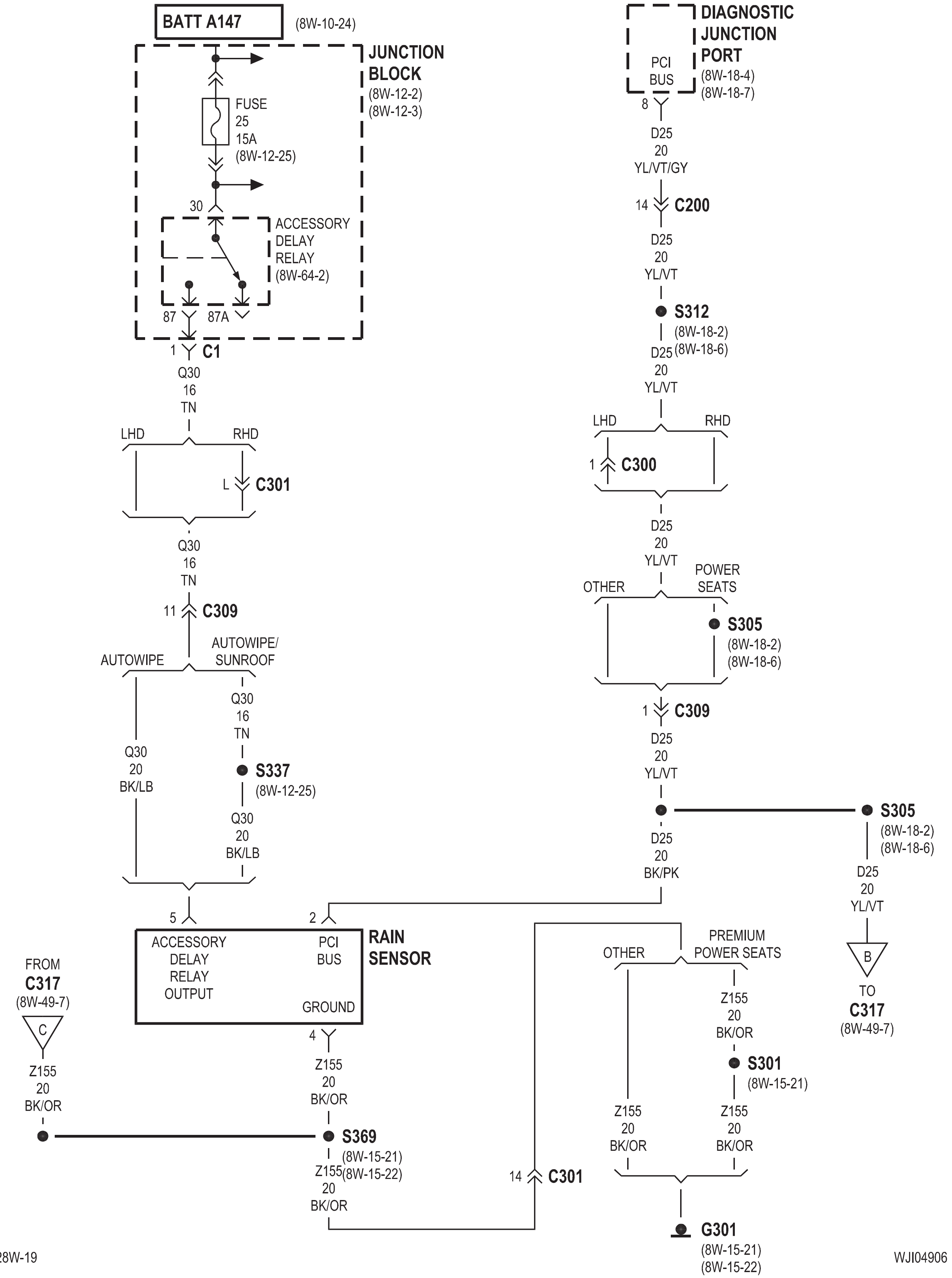
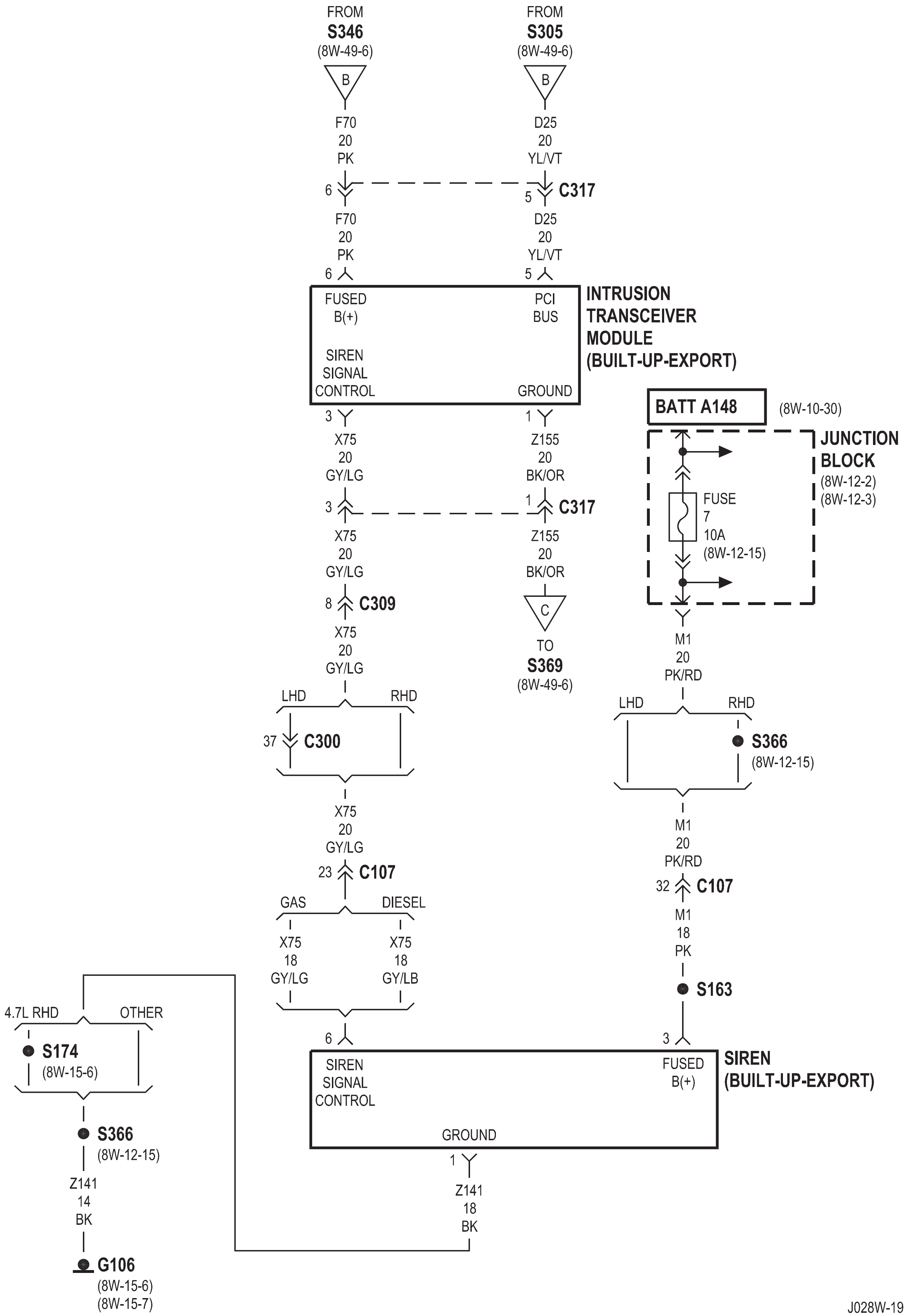
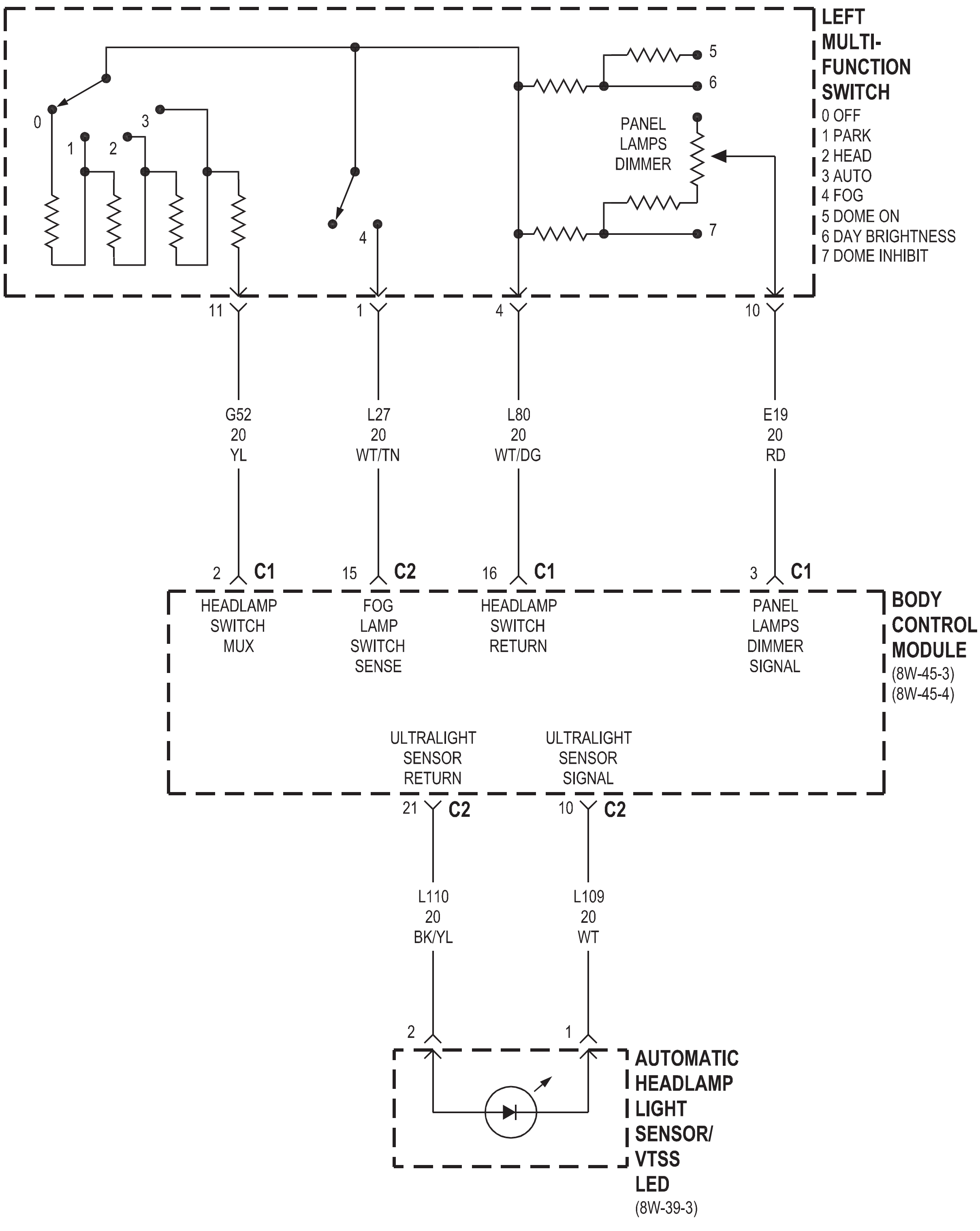
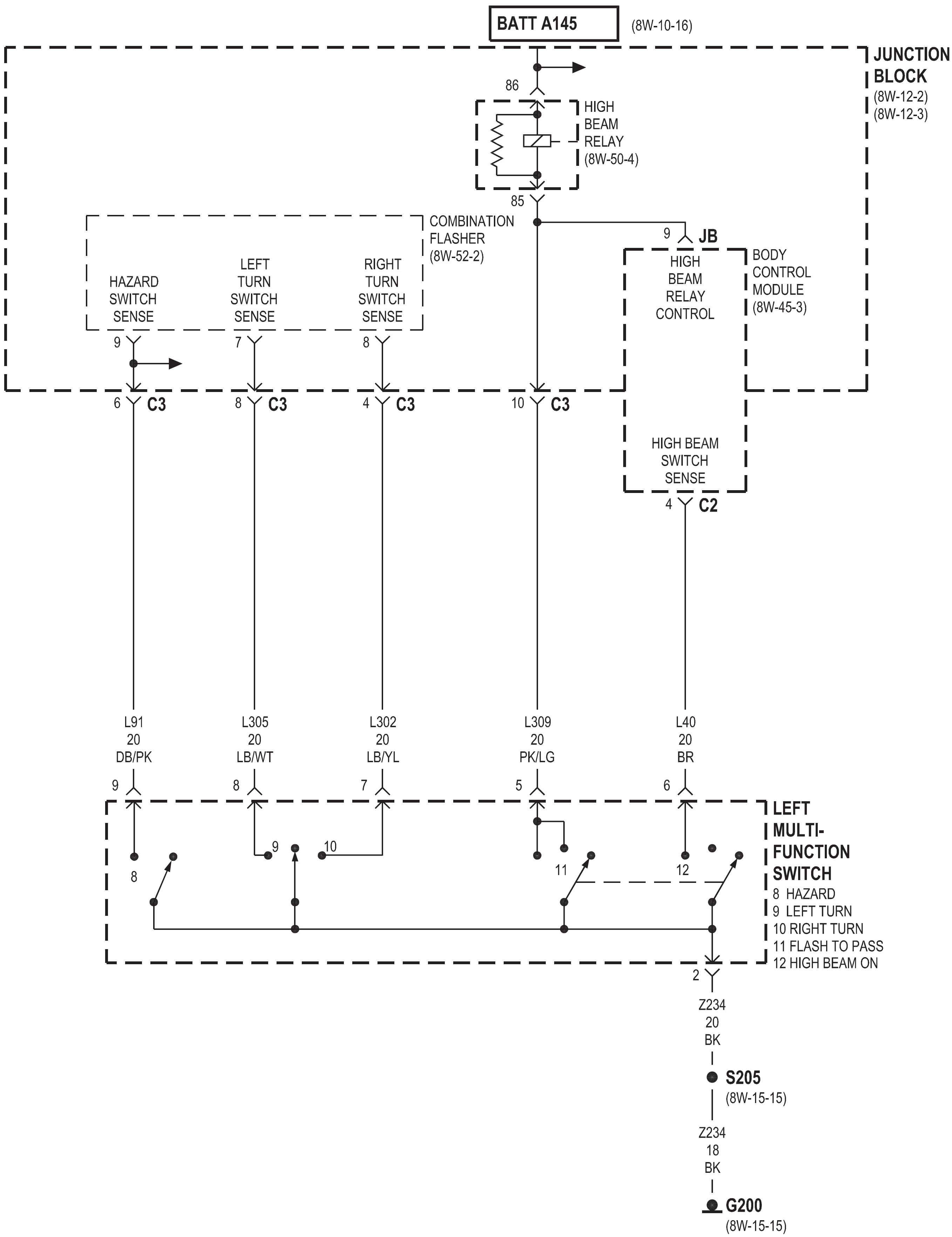
J028W-19

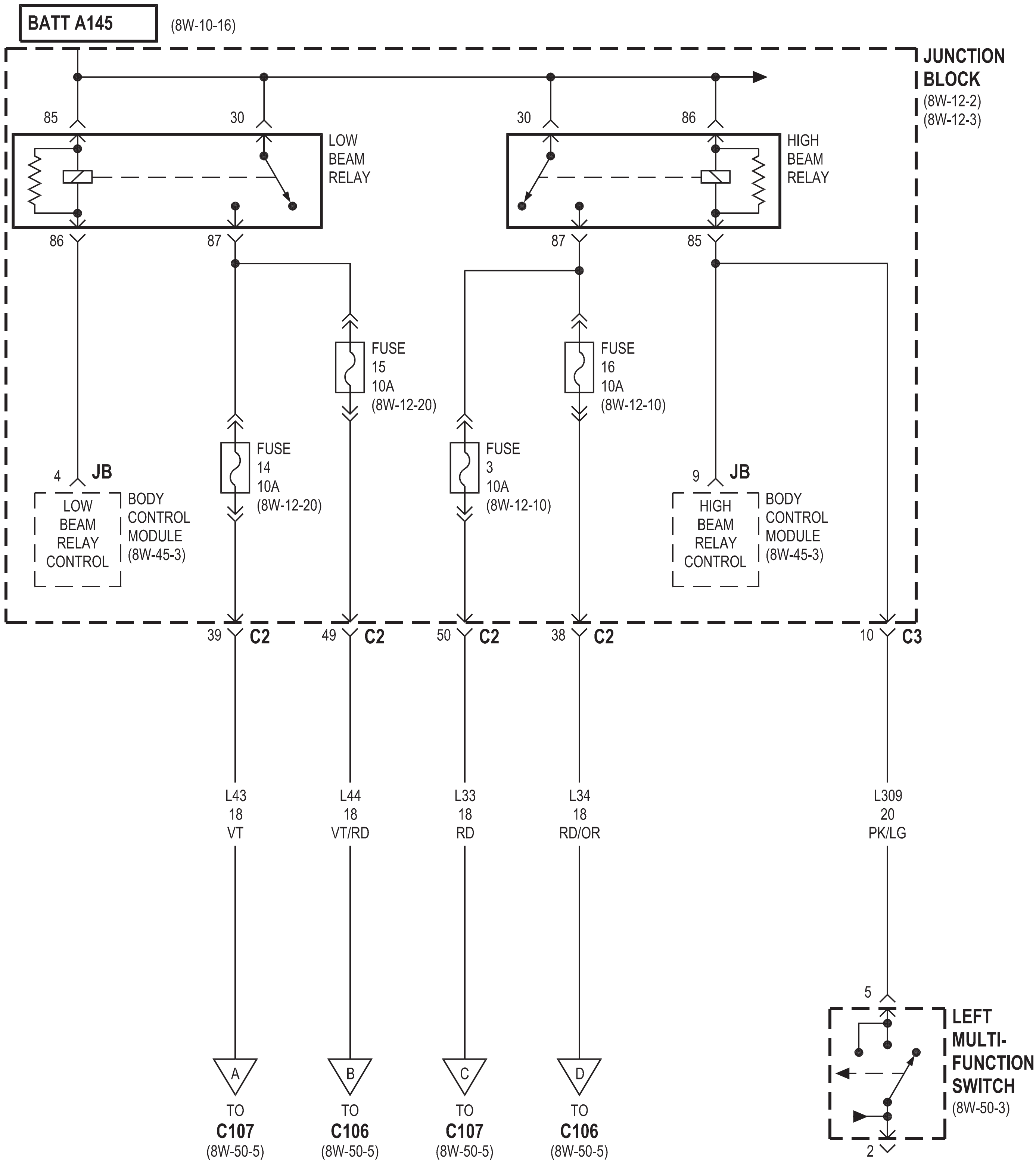

BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
25
15A
(8W-12-25)
30
ACCESSORY DELAY RELAY
(8W-64-2)
87
87A
1
C1
Q30
16
TN
LHD
RHD
L
C301
Q30
16
TN
11
C309
AUTOWIPE
AUTOWIPE/ SUNROOF
Q30
16
TN
S337
(8W-12-25)
Q30
20
BK/LB
Q30
20
BK/LB
5
2
RAIN SENSOR
ACCESSORY DELAY RELAY OUTPUT
PCI BUS
GROUND
4
Z155
20
BK/OR
S369
(8W-15-21)
(8W-15-22)
Z155
20
BK/OR
FROM
C317
(8W-49-7)
C
Z155
20
BK/OR
DIAGNOSTIC JUNCTION PORT
PCI BUS
(8W-18-4)
(8W-18-7)
8
D25
20
YL/VT/GY
14
C200
D25
20
YL/VT
S312
(8W-18-2)
(8W-18-6)
D25
20
YL/VT
LHD
RHD
1
C300
D25
20
YL/VT
OTHER
POWER SEATS
S305
(8W-18-2)
(8W-18-6)
1
C309
D25
20
YL/VT
S305
(8W-18-2)
(8W-18-6)
D25
20
BK/PK
D25
20
YL/VT
B
TO
C317
(8W-49-7)
OTHER
PREMIUM POWER SEATS
Z155
20
BK/OR
S301
(8W-15-21)
Z155
20
BK/OR
Z155
20
BK/OR
14
C301
G301
(8W-15-21)
(8W-15-22)


FROM
S346
(8W-49-6)
B
F70
20
PK
FROM
S305
(8W-49-6)
B
D25
20
YL/VT
6
5
C317
F70
20
PK
D25
20
YL/VT
6
5
FUSED
B(+)
PCI
BUS
SIREN
SIGNAL
CONTROL
GROUND
INTRUSION
TRANSCEIVER
MODULE
(BUILT-UP-EXPORT)
3
1
X75
20
GY/LG
Z155
20
BK/OR
3
1
C317
X75
20
GY/LG
Z155
20
BK/OR
8
C309
C
TO
S369
(8W-49-6)
X75
20
GY/LG
BATT A148
(8W-10-30)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
M1
20
PK/RD
LHD
RHD
37
C300
LHD
RHD
S366
(8W-12-15)
X75
20
GY/LG
M1
20
PK/RD
23
C107
32
C107
GAS
DIESEL
M1
18
PK
X75
18
GY/LG
X75
18
GY/LB
S163
4.7L RHD
OTHER
S174
(8W-15-6)
6
3
SIREN
SIGNAL
CONTROL
FUSED
B(+)
SIREN
(BUILT-UP-EXPORT)
GROUND
1
S366
(8W-12-15)
Z141
14
BK
Z141
18
BK
G106
(8W-15-6)
(8W-15-7)

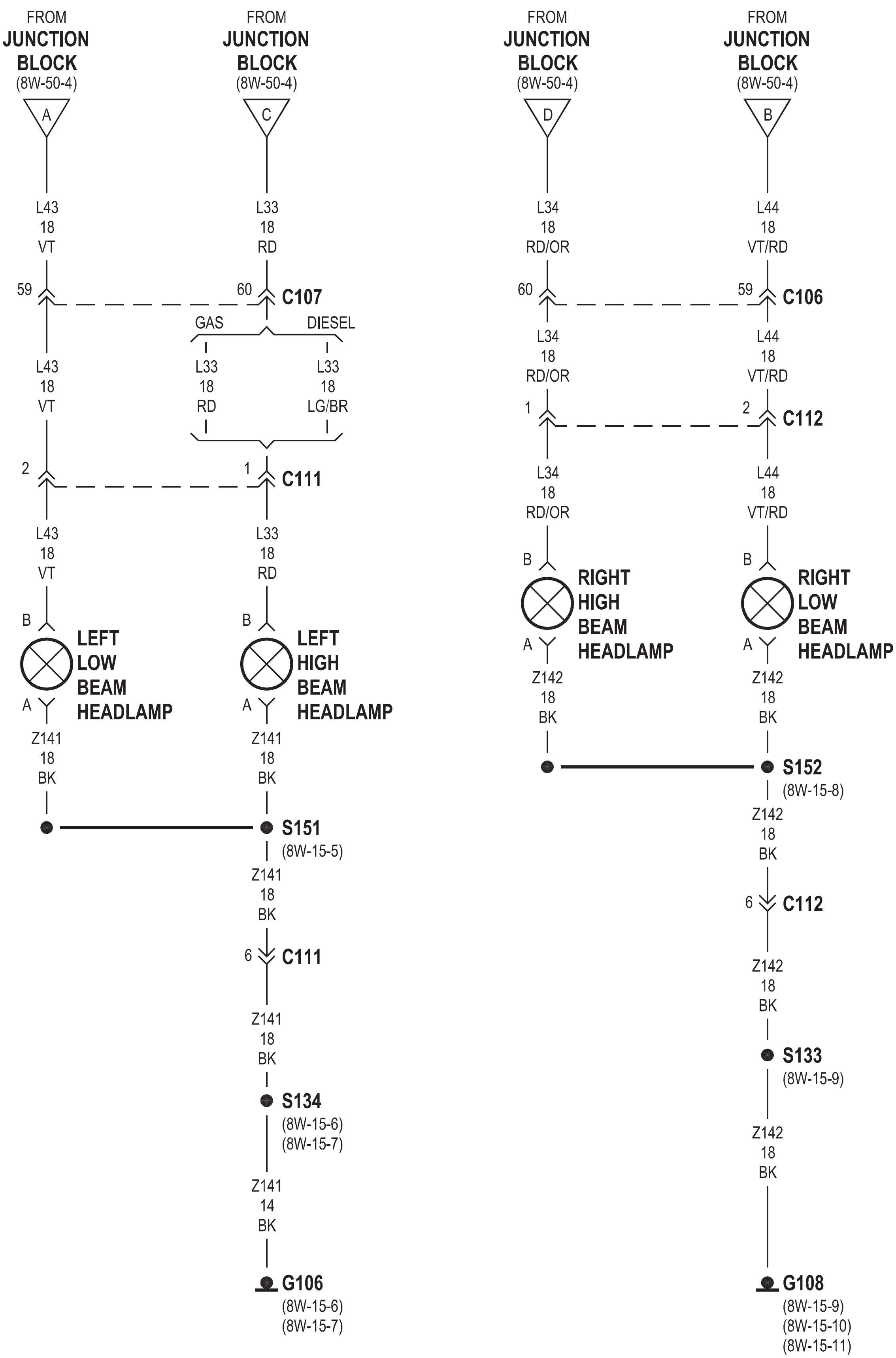
8W-50 FRONT LIGHTING

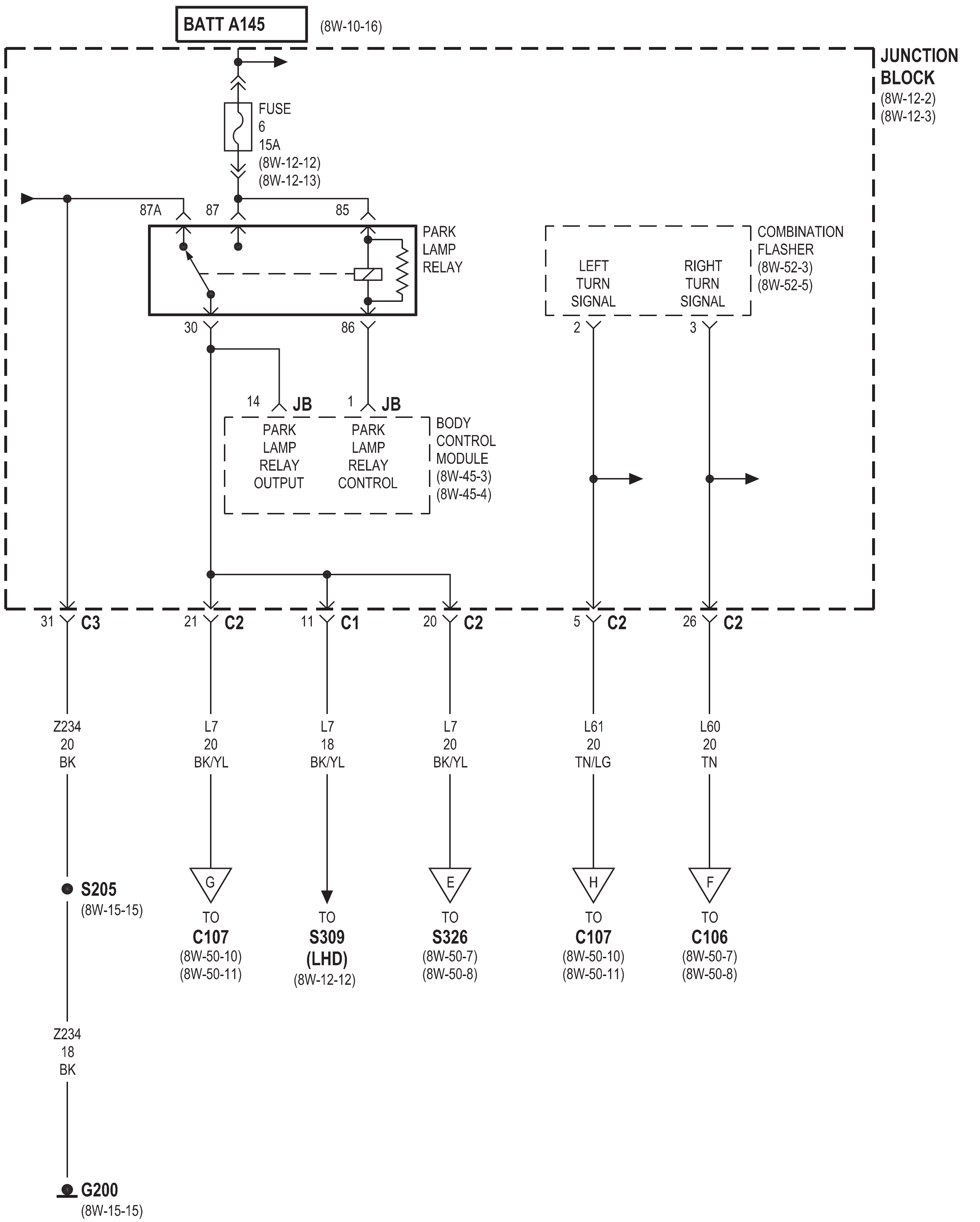

LEFT MULTI-FUNCTION SWITCH
0 OFF
1 PARK
2 HEAD
3 AUTO
4 FOG
5 DOME ON
6 DAY BRIGHTNESS
7 DOME INHIBIT
0
1
2
3
4
5
6
7
PANEL LAMPS DIMMER
11
1
4
10
G52 20 YL
L27 20 WT/TN
L80 20 WT/DG
E19 20 RD
2 C1
15 C2
16 C1
3 C1
HEADLAMP SWITCH MUX
FOG LAMP SWITCH SENSE
HEADLAMP SWITCH RETURN
PANEL LAMPS DIMMER SIGNAL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
ULTRALIGHT SENSOR RETURN
ULTRALIGHT SENSOR SIGNAL
21 C2
10 C2
L110 20 BK/YL
L109 20 WT
2
1
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
(8W-39-3)


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
HIGH BEAM RELAY
(8W-50-4)
85
COMBINATION FLASHER
(8W-52-2)
HAZARD SWITCH SENSE
LEFT TURN SWITCH SENSE
RIGHT TURN SWITCH SENSE
9
7
8
9 JB
HIGH BEAM RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
6 C3
8 C3
4 C3
10 C3
HIGH BEAM SWITCH SENSE
4 C2
L91
20
DB/PK
L305
20
LB/WT
L302
20
LB/YL
L309
20
PK/LG
L40
20
BR
9
8
7
5
6
LEFT MULTI-FUNCTION SWITCH
8 HAZARD
9 LEFT TURN
10 RIGHT TURN
11 FLASH TO PASS
12 HIGH BEAM ON
8
9
10
11
12
2
Z234
20
BK
S205
(8W-15-15)
Z234
18
BK
G200
(8W-15-15)

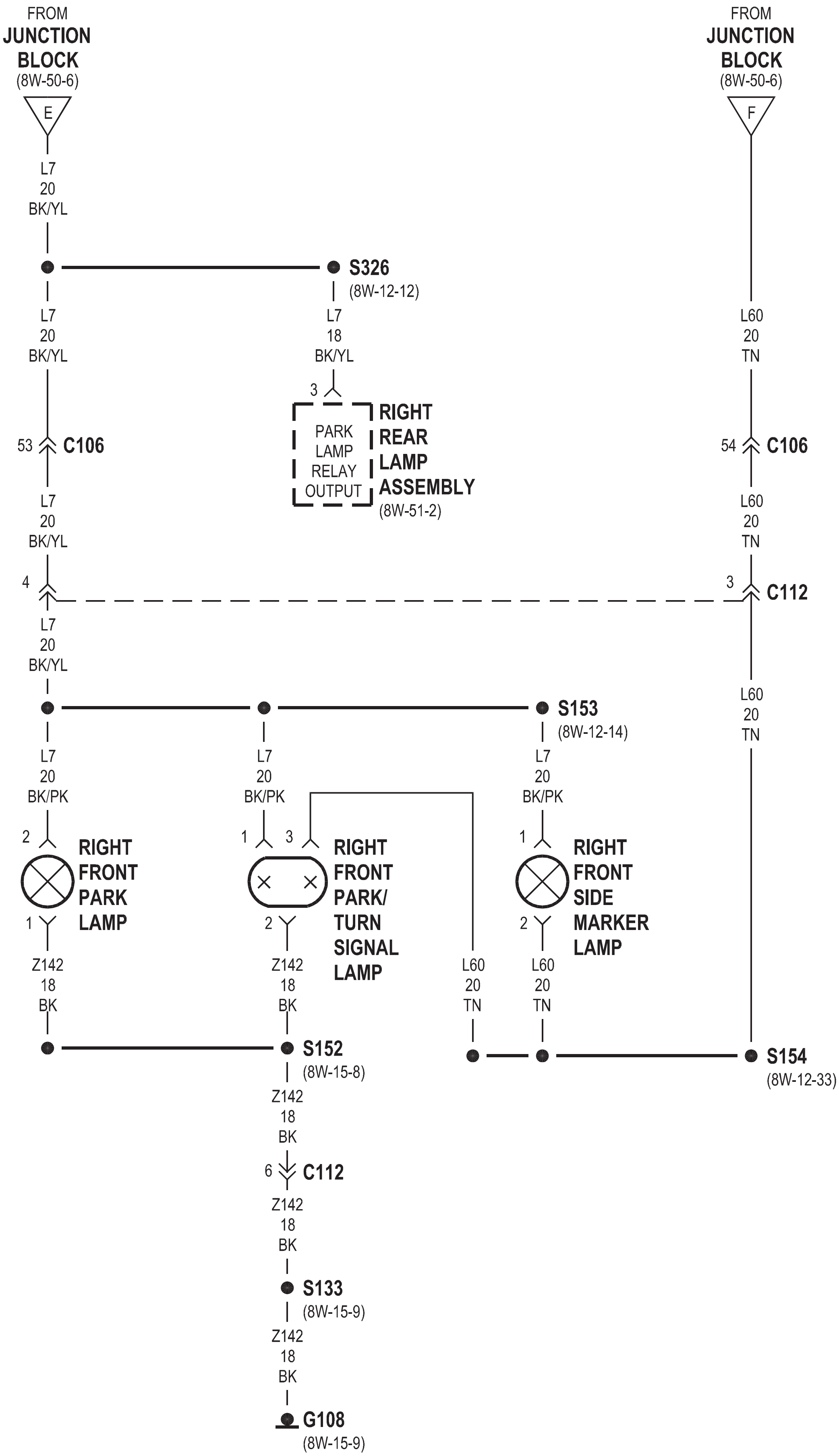


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
30
LOW BEAM RELAY
86
87
30
86
HIGH BEAM RELAY
87
85
FUSE 15 10A (8W-12-20)
FUSE 16 10A (8W-12-10)
FUSE 14 10A (8W-12-20)
FUSE 3 10A (8W-12-10)
4 JB
LOW BEAM RELAY CONTROL
BODY CONTROL MODULE (8W-45-3)
9 JB
HIGH BEAM RELAY CONTROL
BODY CONTROL MODULE (8W-45-3)
39 C2
49 C2
50 C2
38 C2
10 C3
L43 18 VT
L44 18 VT/RD
L33 18 RD
L34 18 RD/OR
L309 20 PK/LG
5
LEFT MULTI-FUNCTION SWITCH
(8W-50-3)
2
A
B
C
D
TO C107 (8W-50-5)
TO C106 (8W-50-5)
TO C107 (8W-50-5)
TO C106 (8W-50-5)

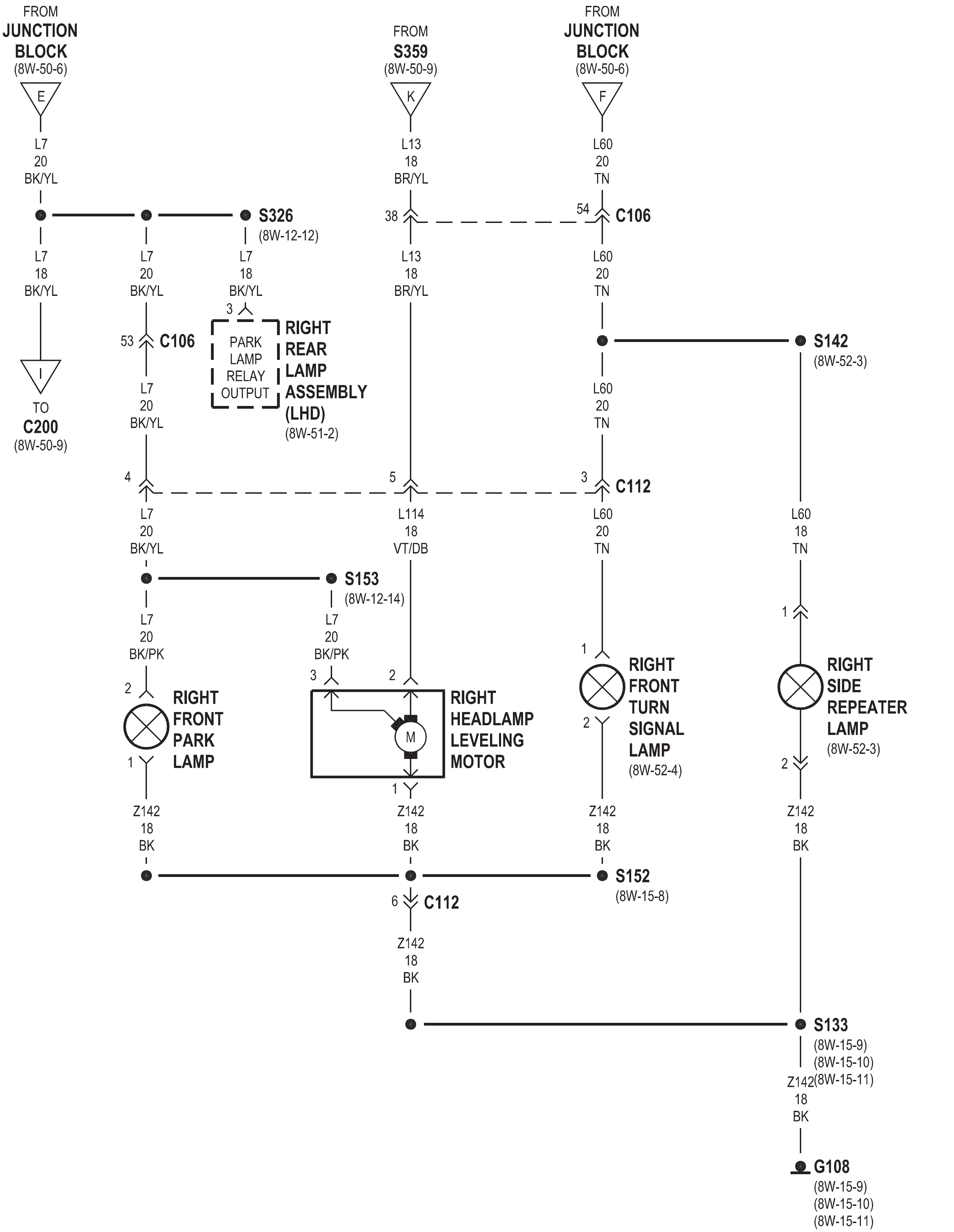

FROM
JUNCTION
BLOCK
(8W-50-4)
A
C
D
B
L43
18
VT
L33
18
RD
L34
18
RD/OR
L44
18
VT/RD
59
60
C107
C106
GAS
DIESEL
L33
18
LG/BR
1
2
C112
C111
B
A
LEFT
LOW
BEAM
HEADLAMP
LEFT
HIGH
BEAM
HEADLAMP
RIGHT
HIGH
BEAM
HEADLAMP
RIGHT
LOW
BEAM
HEADLAMP
Z141
18
BK
Z142
18
BK
S151
(8W-15-5)
S152
(8W-15-8)
6
S134
(8W-15-6)
(8W-15-7)
S133
(8W-15-9)
Z141
14
BK
G106
(8W-15-6)
(8W-15-7)
G108
(8W-15-9)
(8W-15-10)
(8W-15-11)

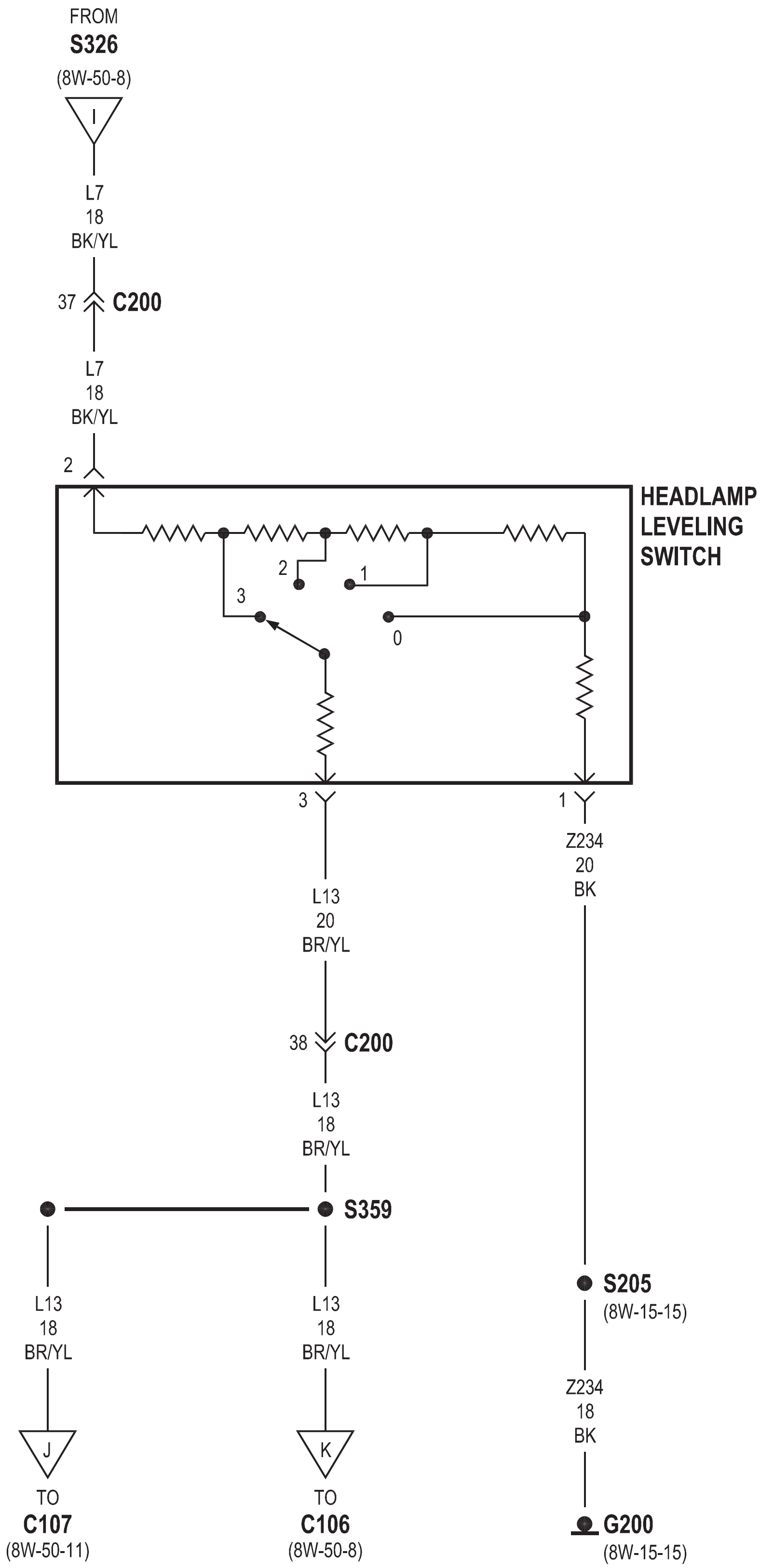


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
87A
87
85
PARK LAMP RELAY
30
86
COMBINATION FLASHER
(8W-52-3)
(8W-52-5)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
2
3
14 JB
1 JB
PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
31 C3
21 C2
11 C1
20 C2
5 C2
26 C2
Z234 20 BK
L7 20 BK/YL
L7 18 BK/YL
L7 20 BK/YL
L61 20 TN/LG
L60 20 TN
S205
(8W-15-15)
G
E
H
F
TO C107 (8W-50-10) (8W-50-11)
TO S309 (LHD) (8W-12-12)
TO S326 (8W-50-7) (8W-50-8)
TO C107 (8W-50-10) (8W-50-11)
TO C106 (8W-50-7) (8W-50-8)
Z234 18 BK
G200
(8W-15-15)

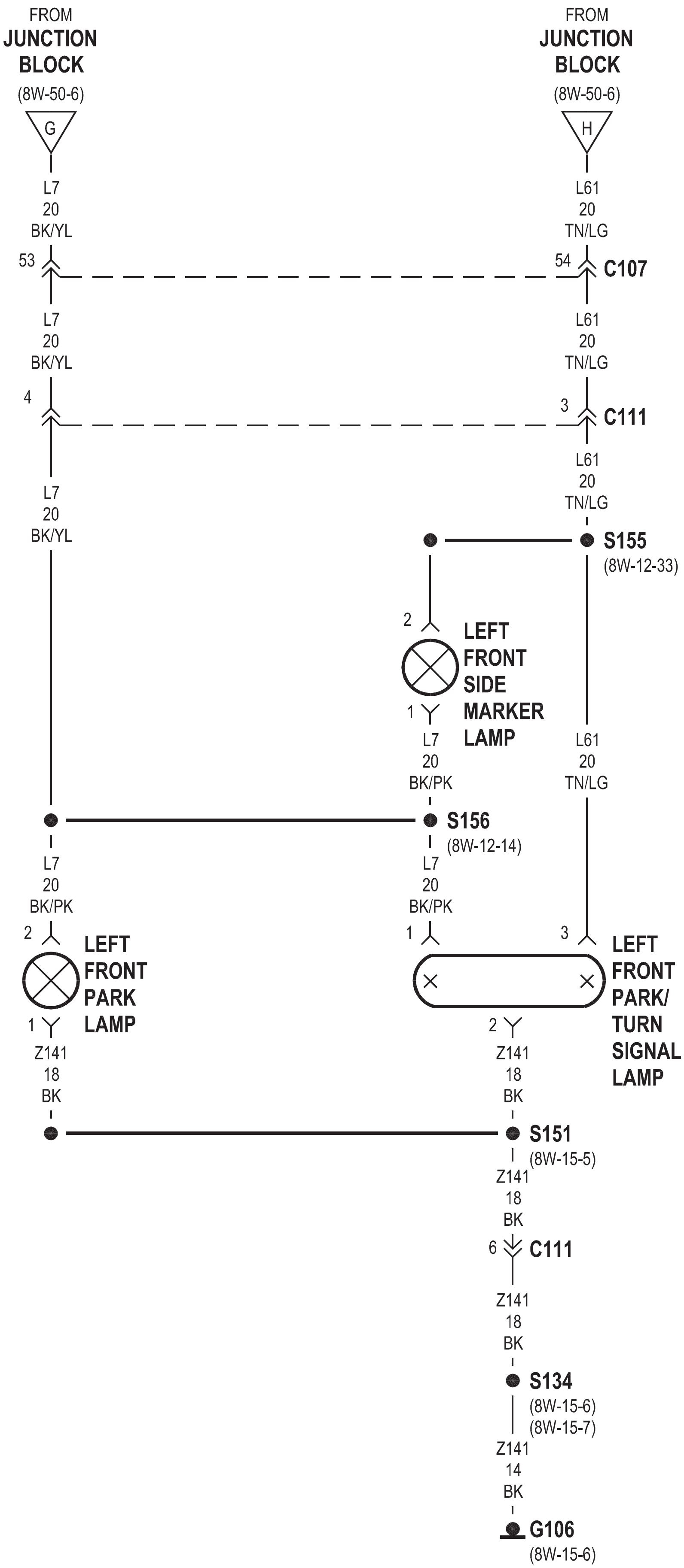

FROM
JUNCTION BLOCK
(8W-50-6)
E
FROM
JUNCTION BLOCK
(8W-50-6)
F
L7
20
BK/YL
S326
(8W-12-12)
L7
18
BK/YL
3
PARK LAMP RELAY OUTPUT
RIGHT REAR LAMP ASSEMBLY
(8W-51-2)
L60
20
TN
53
C106
54
C106
4
3
C112
S153
(8W-12-14)
L7
20
BK/PK
2
1
RIGHT FRONT PARK LAMP
1
3
2
RIGHT FRONT PARK/ TURN SIGNAL LAMP
1
2
RIGHT FRONT SIDE MARKER LAMP
Z142
18
BK
S152
(8W-15-8)
S154
(8W-12-33)
6
C112
S133
(8W-15-9)
G108
(8W-15-9)

BUILT-UP-EXPORT

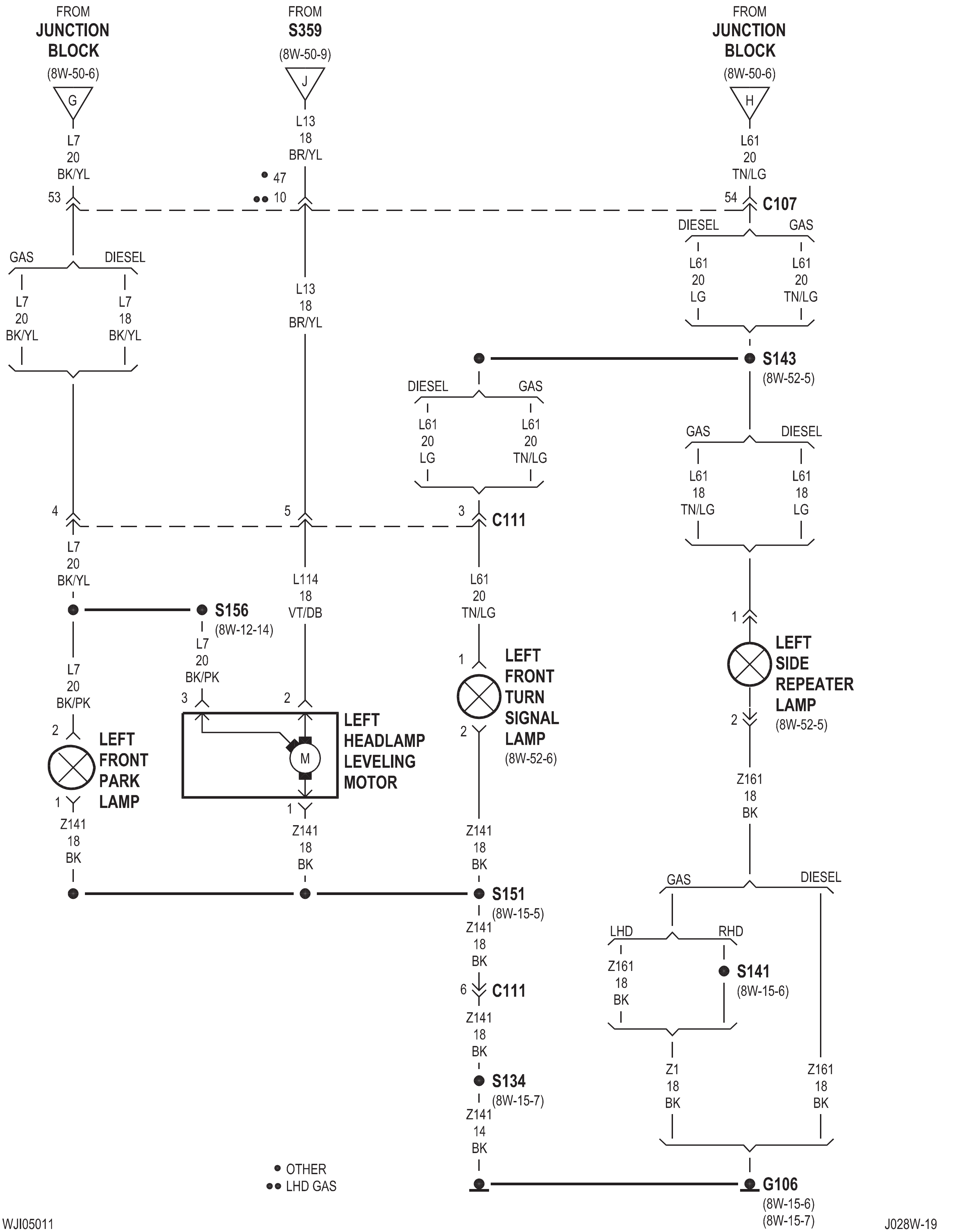



FROM
S326
(8W-50-8)
I
L7
18
BK/YL
37
C200
L7
18
BK/YL
2
HEADLAMP
LEVELING
SWITCH
2
1
3
0
3
1
Z234
20
BK
L13
20
BR/YL
38
C200
L13
18
BR/YL
S359
L13
18
BR/YL
L13
18
BR/YL
S205
(8W-15-15)
Z234
18
BK
J
K
TO
C107
(8W-50-11)
TO
C106
(8W-50-8)
G200
(8W-15-15)

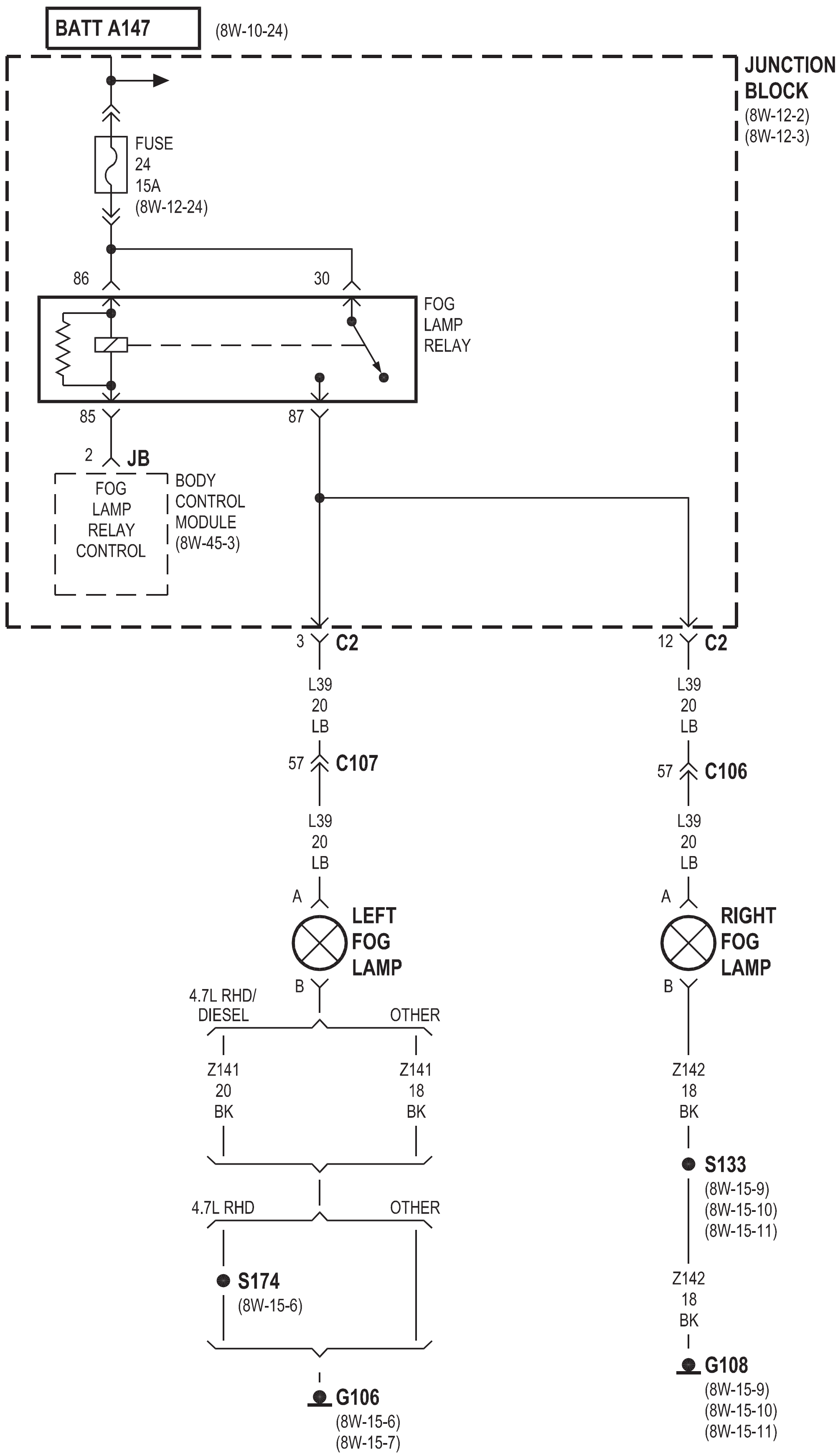
EXCEPT BUILT-UP-EXPORT



BUILT-UP-EXPORT

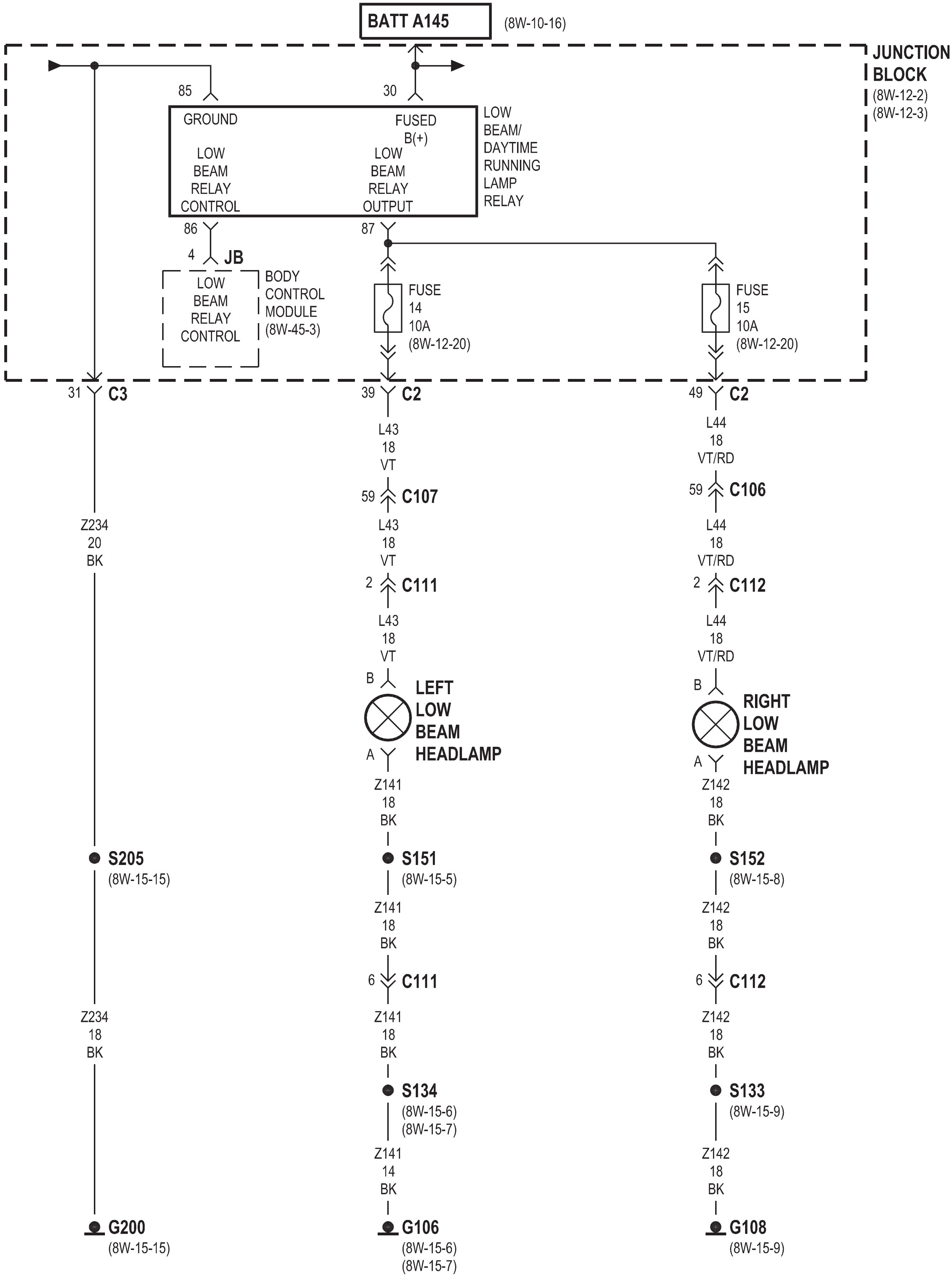


FOG LAMPS

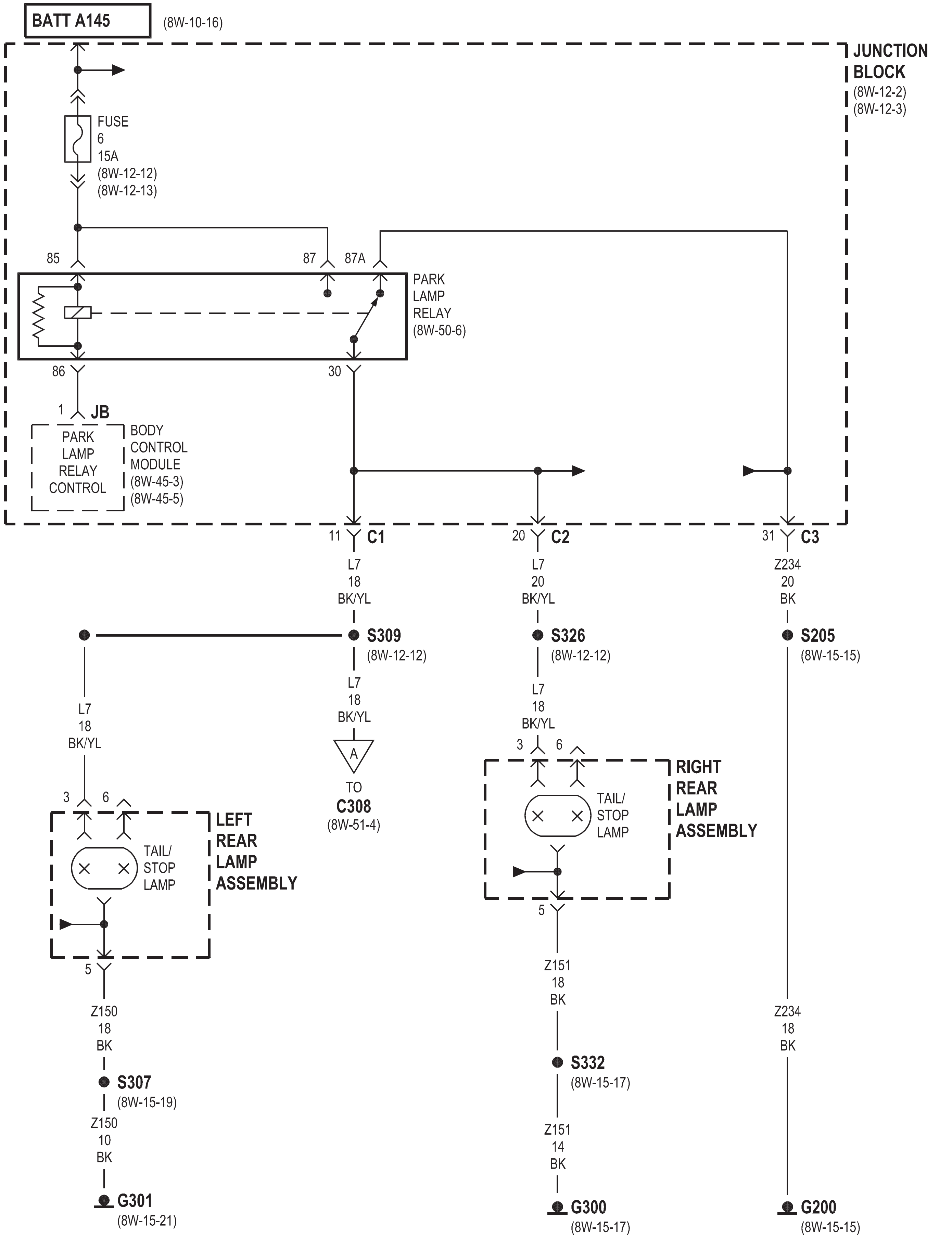


BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
24
15A
(8W-12-24)
86
30
FOG LAMP RELAY
85
87
2 JB
FOG LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
3 C2
12 C2
L39
20
LB
57 C107
57 C106
A
B
LEFT FOG LAMP
RIGHT FOG LAMP
4.7L RHD/ DIESEL
OTHER
Z141
20
BK
Z141
18
BK
Z142
18
BK
S133
(8W-15-9)
(8W-15-10)
(8W-15-11)
4.7L RHD
S174
(8W-15-6)
G106
(8W-15-6)
(8W-15-7)
G108

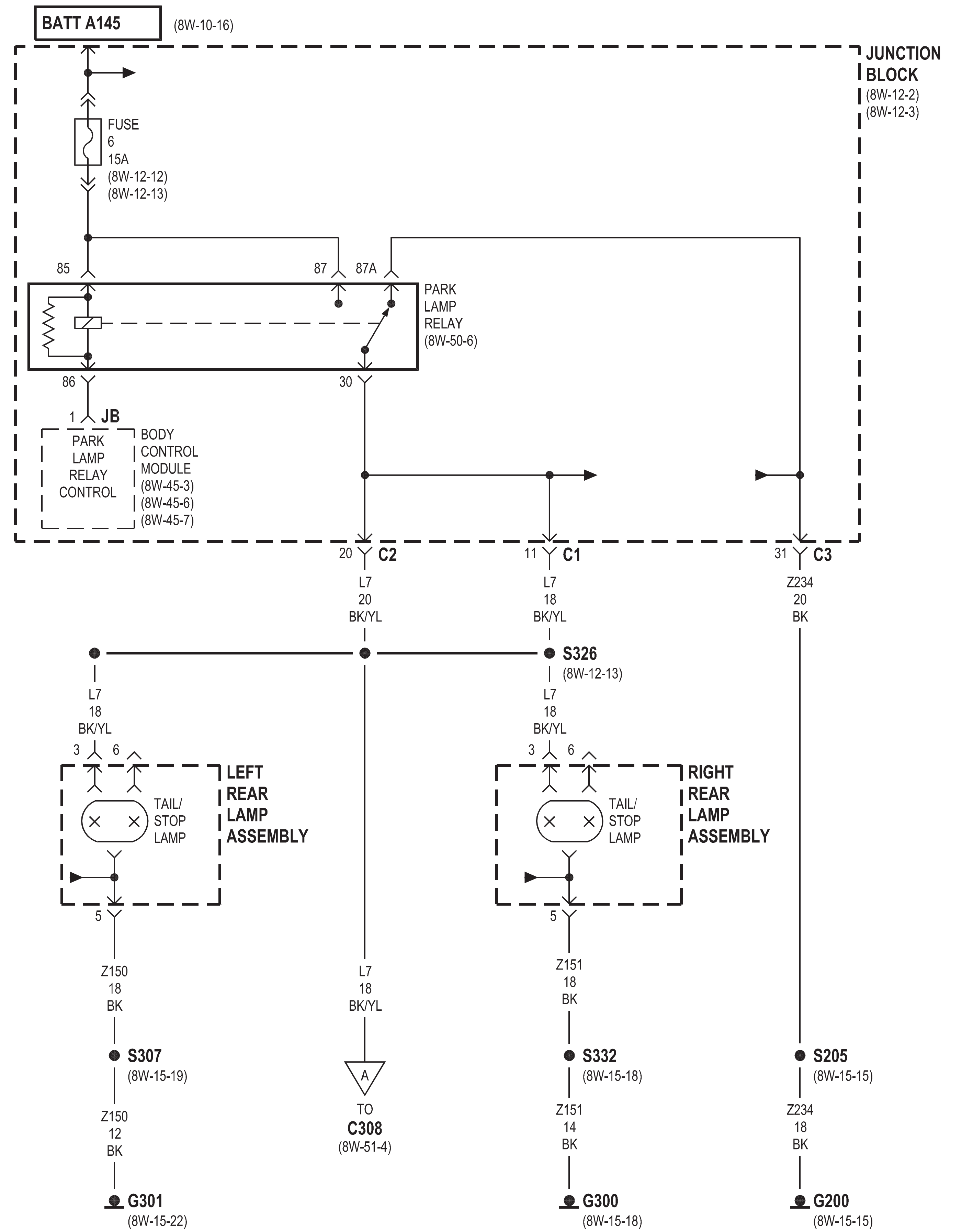
DRL

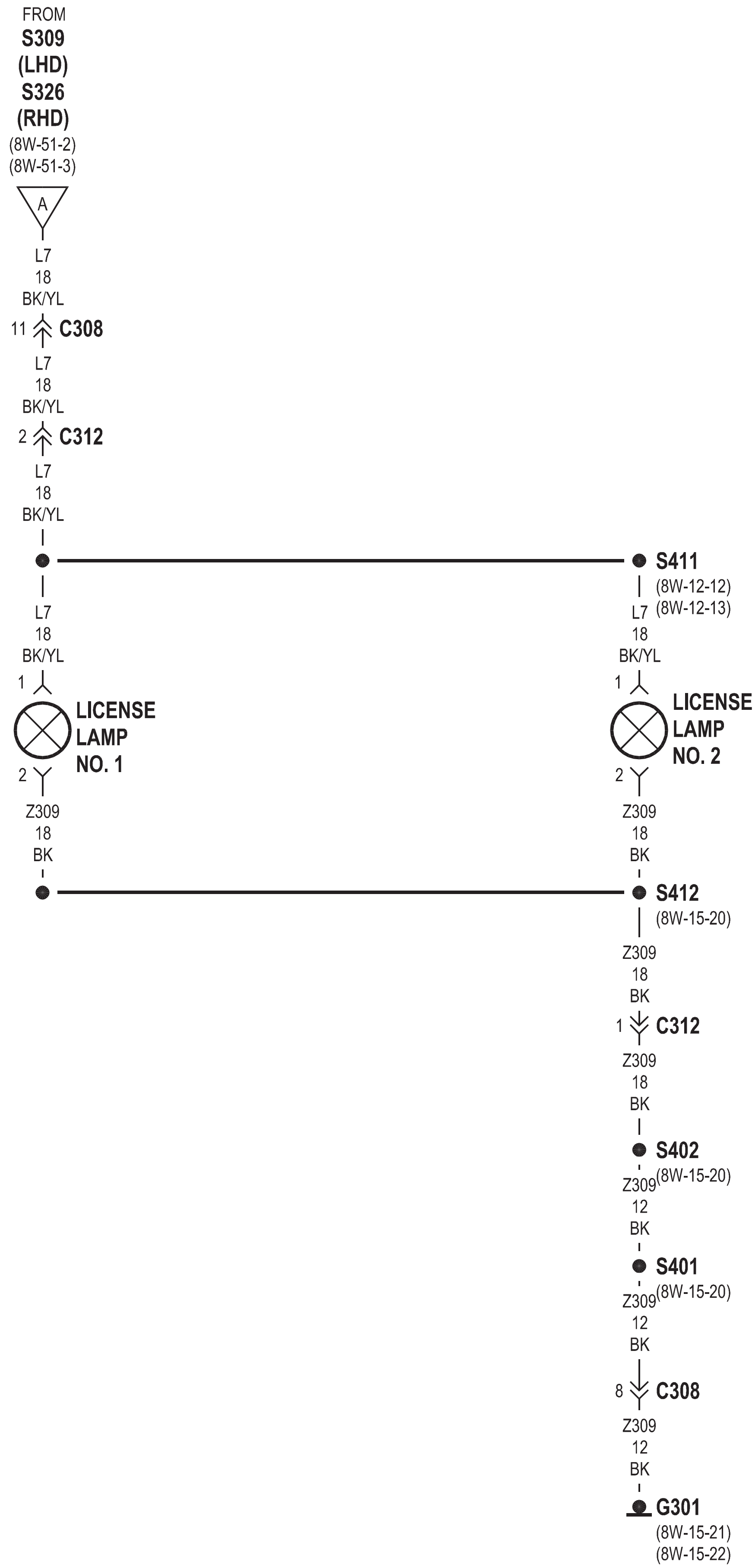

BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
30
GROUND
FUSED B(+)
LOW BEAM RELAY CONTROL
LOW BEAM RELAY OUTPUT
LOW BEAM/ DAYTIME RUNNING LAMP RELAY
86
87
4
JB
LOW BEAM RELAY CONTROL
BODY CONTROL MODULE (8W-45-3)
FUSE 14 10A (8W-12-20)
FUSE 15 10A (8W-12-20)
31 C3
39 C2
49 C2
L43 18 VT
L44 18 VT/RD
59 C107
59 C106
Z234 20 BK
2 C111
2 C112
B
LEFT LOW BEAM HEADLAMP
RIGHT LOW BEAM HEADLAMP
A
Z141 18 BK
Z142 18 BK
S205 (8W-15-15)
S151 (8W-15-5)
S152 (8W-15-8)
6 C111
6 C112
Z234 18 BK
S134 (8W-15-6) (8W-15-7)
S133 (8W-15-9)
Z141 14 BK
G200 (8W-15-15)
G106 (8W-15-6) (8W-15-7)
G108 (8W-15-9)

8W-51 REAR LIGHTING

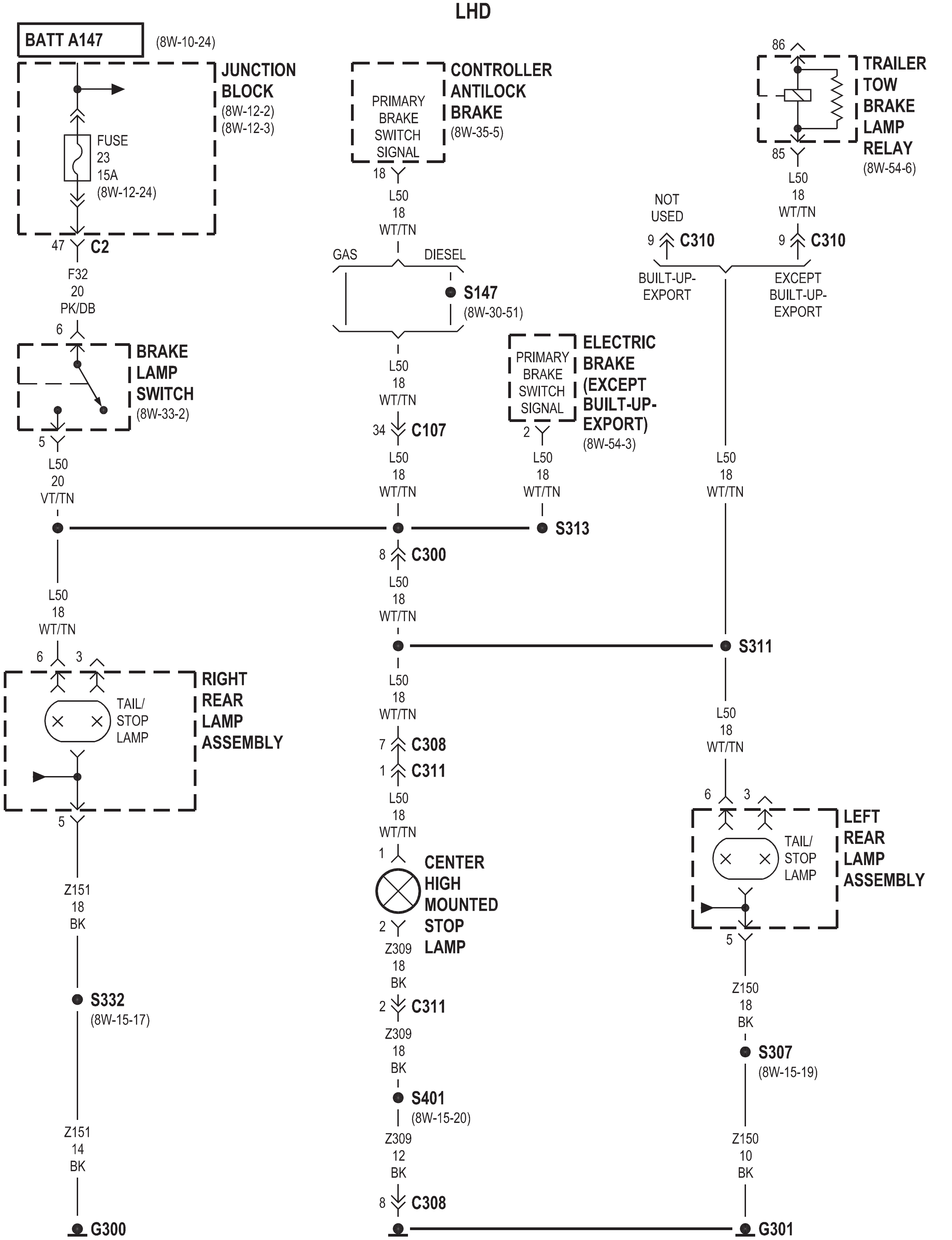


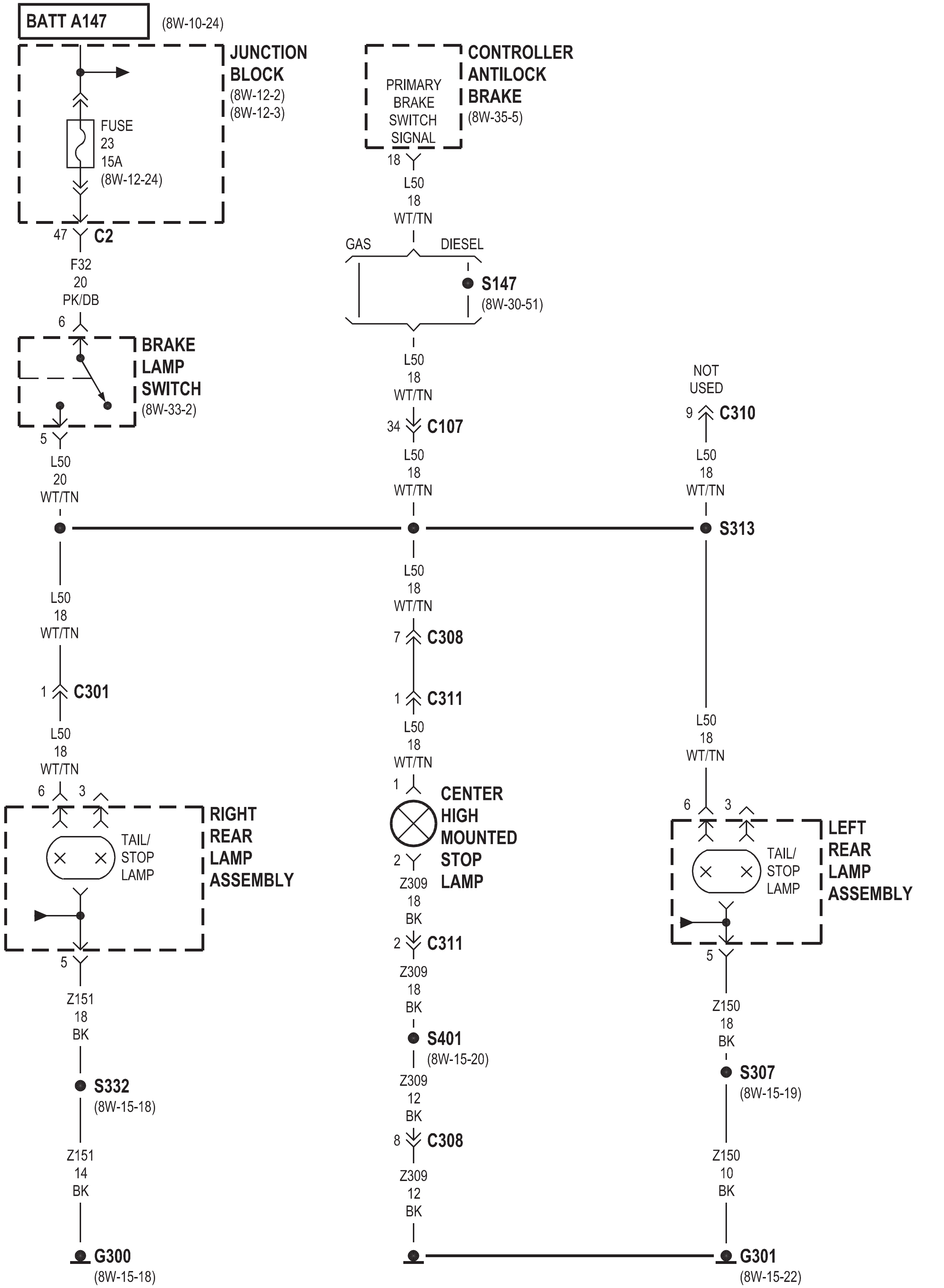
J028W-19 WJI05102


BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1 JB
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-6)
(8W-45-7)
20 C2
11 C1
31 C3
L7
20
BK/YL
L7
18
BK/YL
Z234
20
BK
S326
(8W-12-13)
L7
18
BK/YL
L7
18
BK/YL
3 6
3 6
TAIL/ STOP LAMP
LEFT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
RIGHT REAR LAMP ASSEMBLY
5
5
Z150
18
BK
L7
18
BK/YL
Z151
18
BK
S307
(8W-15-19)
A
TO
C308
(8W-51-4)
S332
(8W-15-18)
S205
(8W-15-15)
Z150
12
BK
Z151
14
BK
Z234
18
BK
G301
(8W-15-22)
G300
(8W-15-18)
G200
(8W-15-15)

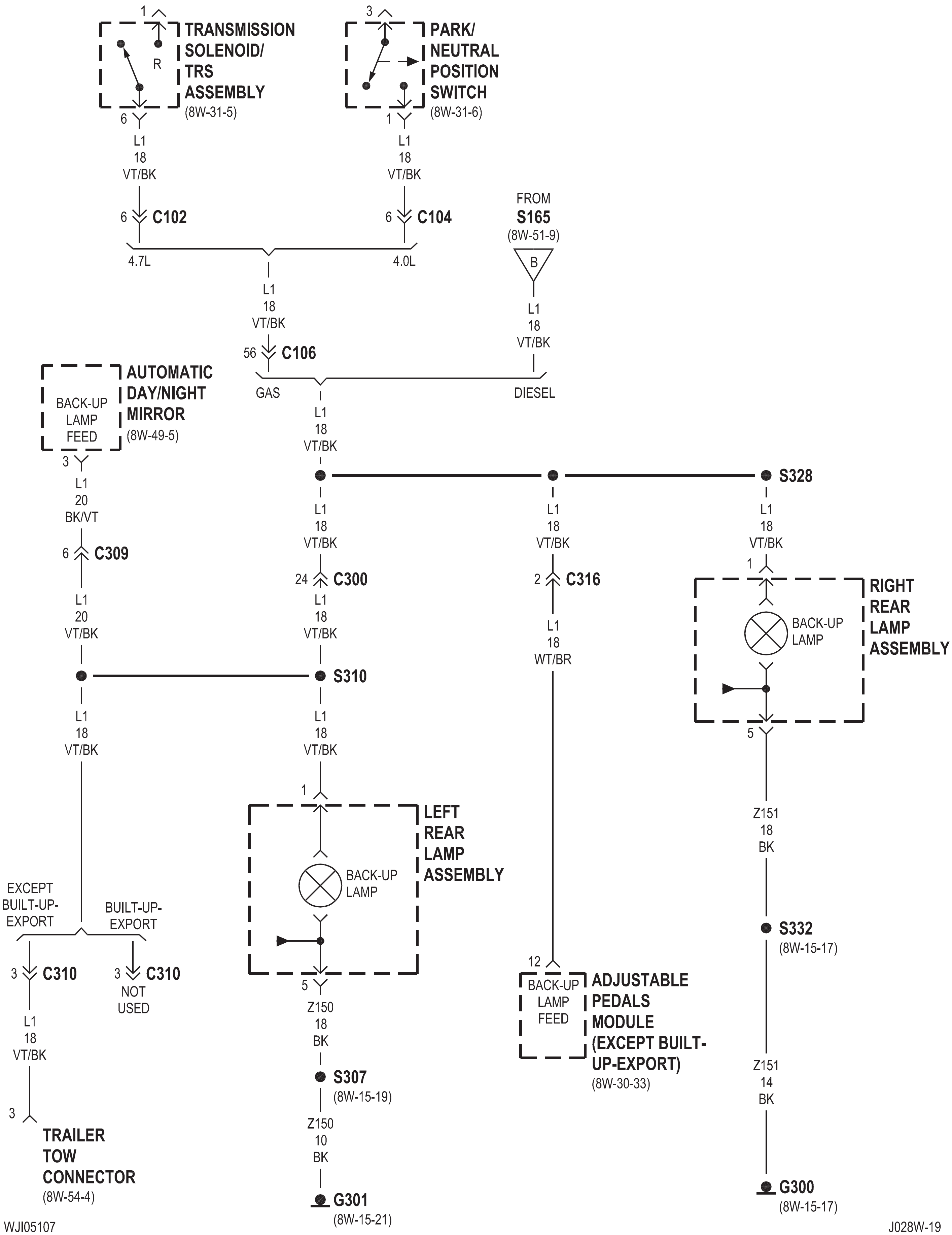


FROM
S309
(LHD)
S326
(RHD)
(8W-51-2)
(8W-51-3)
A
L7
18
BK/YL
11
C308
2
C312
S411
(8W-12-12)
(8W-12-13)
1
LICENSE LAMP NO. 1
LICENSE LAMP NO. 2
2
Z309
18
BK
S412
(8W-15-20)
1
S402
(8W-15-20)
Z309
12
BK
S401
(8W-15-20)
8
G301
(8W-15-21)
(8W-15-22)

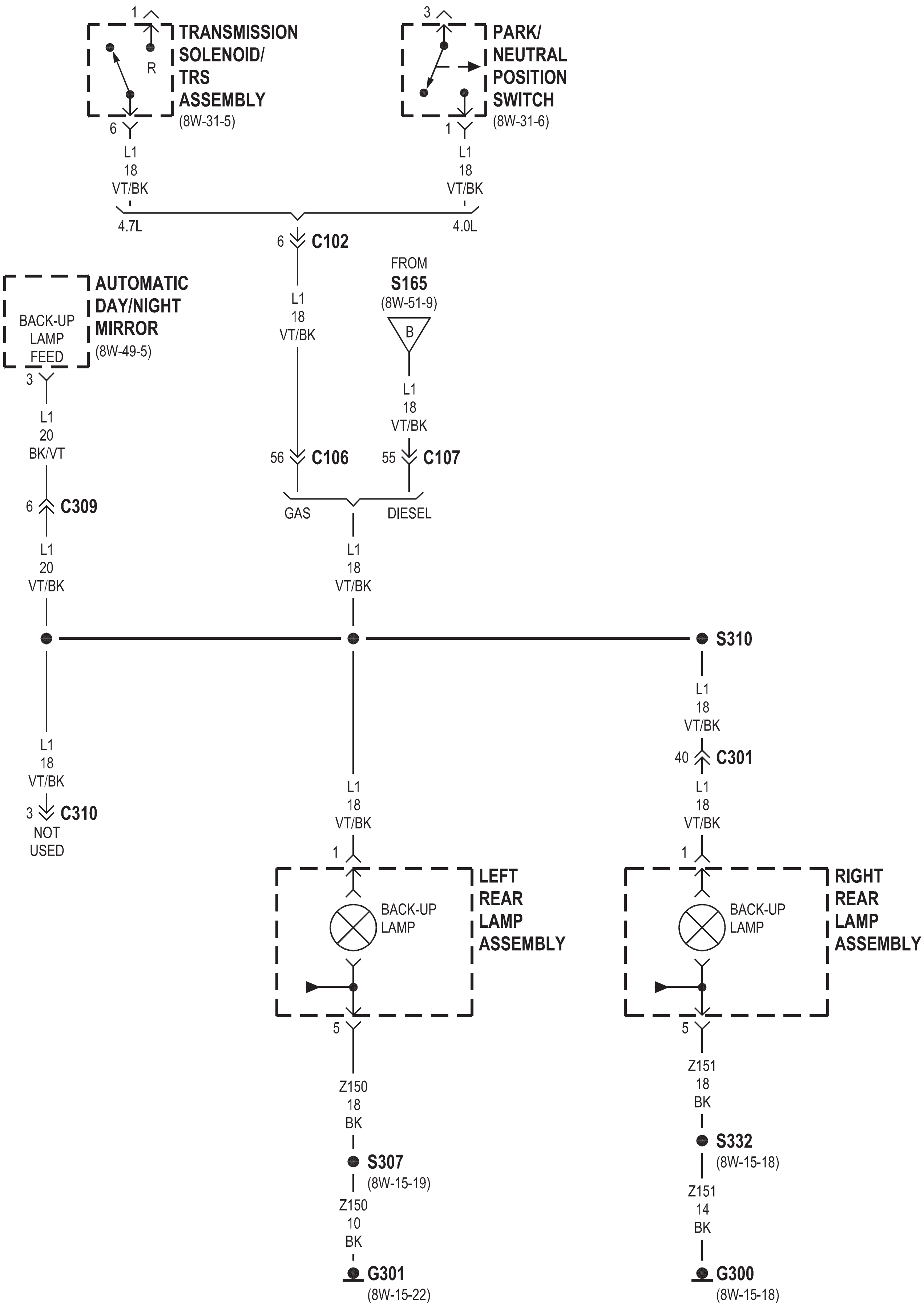

BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 23 15A
(8W-12-24)
47 C2
F32 20 PK/DB
BRAKE LAMP SWITCH
(8W-33-2)
L50 20 VT/TN
CONTROLLER ANTILOCK BRAKE
PRIMARY BRAKE SWITCH SIGNAL
(8W-35-5)
L50 18 WT/TN
GAS
DIESEL
S147
(8W-30-51)
34 C107
ELECTRIC BRAKE (EXCEPT BUILT-UP-EXPORT)
(8W-54-3)
S313
8 C300
TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
86
85
NOT USED
9 C310
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
S311
RIGHT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
Z151 18 BK
S332
(8W-15-17)
Z151 14 BK
G300
(8W-15-17)
7 C308
1 C311
CENTER HIGH MOUNTED STOP LAMP
Z309 18 BK
2 C311
S401
(8W-15-20)
Z309 12 BK
8 C308
LEFT REAR LAMP ASSEMBLY
Z150 18 BK
S307
(8W-15-19)
Z150 10 BK
G301
(8W-15-21)



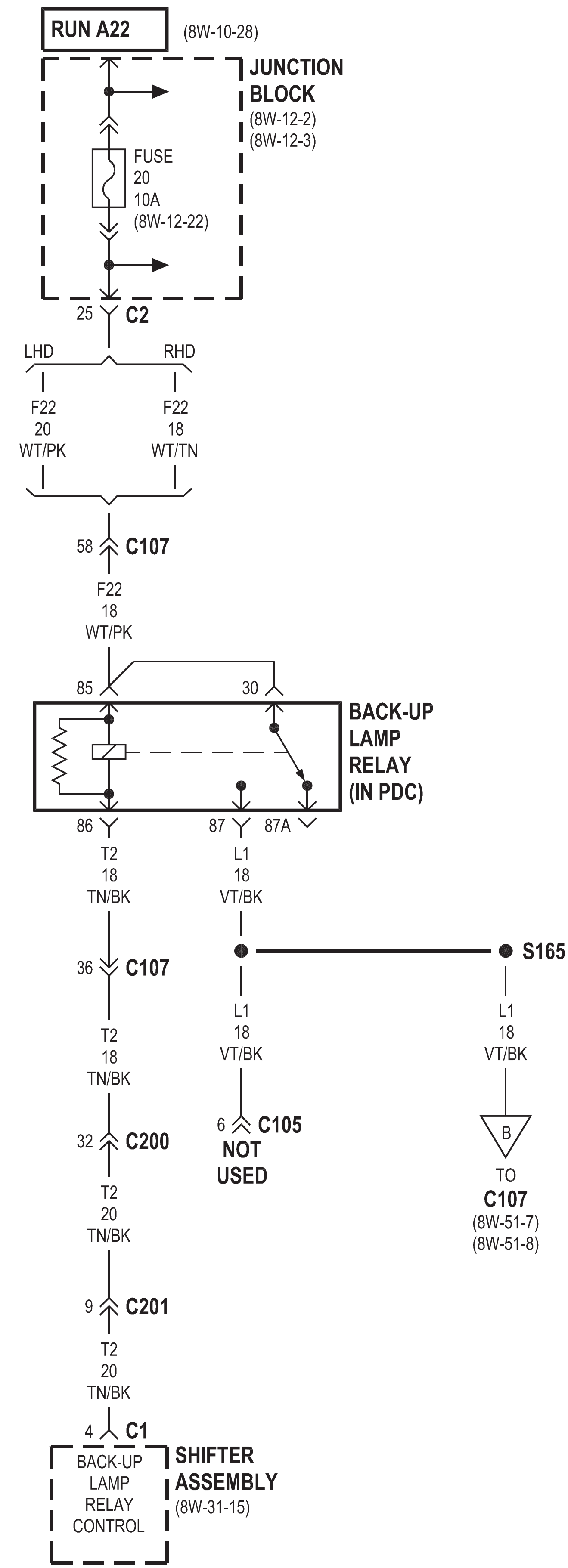
BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
23
15A
(8W-12-24)
47 C2
F32
20
PK/DB
6
BRAKE LAMP SWITCH
(8W-33-2)
5
L50
20
WT/TN
CONTROLLER ANTILOCK BRAKE
(8W-35-5)
PRIMARY BRAKE SWITCH SIGNAL
18
L50
18
WT/TN
GAS
DIESEL
S147
(8W-30-51)
L50
18
WT/TN
34 C107
L50
18
WT/TN
NOT USED
9 C310
L50
18
WT/TN
S313
L50
18
WT/TN
1 C301
L50
18
WT/TN
6 3
RIGHT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
5
Z151
18
BK
S332
(8W-15-18)
Z151
14
BK
G300
(8W-15-18)
L50
18
WT/TN
7 C308
1 C311
L50
18
WT/TN
1
CENTER HIGH MOUNTED STOP LAMP
2
Z309
18
BK
2 C311
Z309
18
BK
S401
(8W-15-20)
Z309
12
BK
8 C308
Z309
12
BK
L50
18
WT/TN
6 3
LEFT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
5
Z150
18
BK
S307
(8W-15-19)
Z150
10
BK
G301
(8W-15-22)


TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
R
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
L1 18 VT/BK
C102
C104
4.7L
4.0L
FROM S165
(8W-51-9)
B
L1 18 VT/BK
C106
GAS
DIESEL
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-5)
BACK-UP LAMP FEED
L1 20 BK/VT
C309
L1 20 VT/BK
S328
C300
C316
L1 18 WT/BR
S310
RIGHT REAR LAMP ASSEMBLY
BACK-UP LAMP
Z151 18 BK
S332
(8W-15-17)
Z151 14 BK
G300
(8W-15-17)
LEFT REAR LAMP ASSEMBLY
BACK-UP LAMP
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
C310
NOT USED
L1 18 VT/BK
TRAILER TOW CONNECTOR
(8W-54-4)
Z150 18 BK
S307
(8W-15-19)
Z150 10 BK
G301
(8W-15-21)
ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT)
(8W-30-33)
BACK-UP LAMP FEED

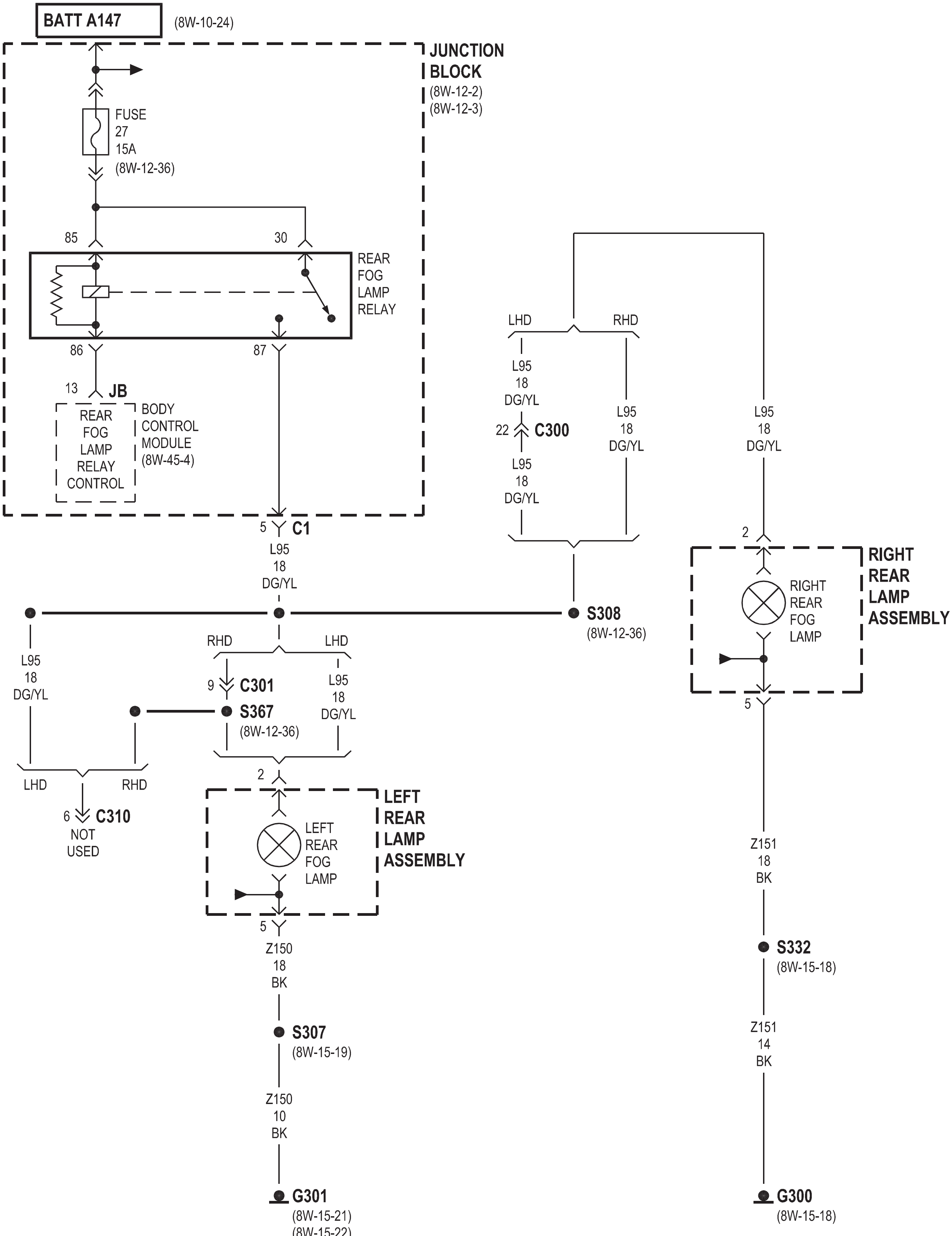
RHD



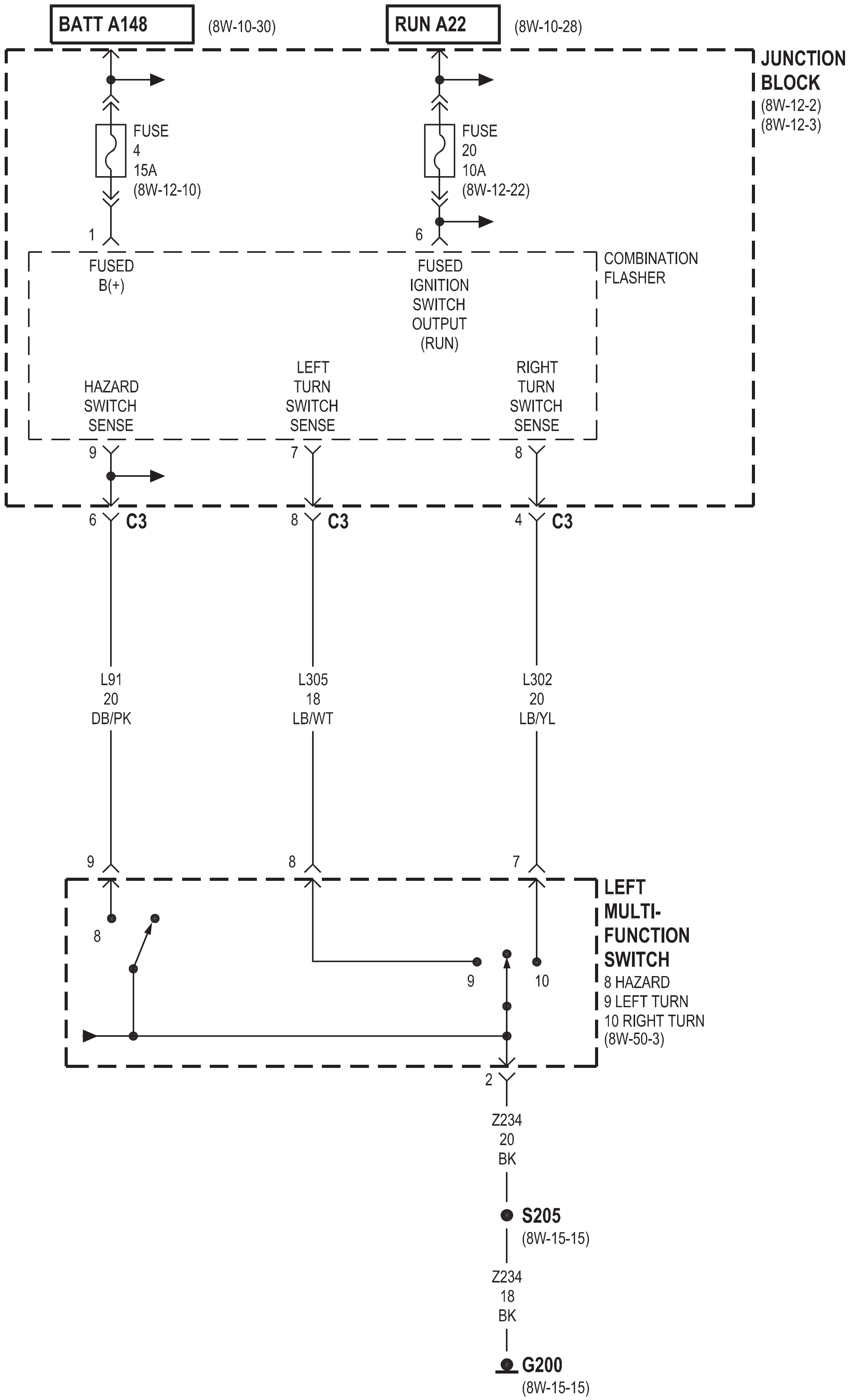
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
R
L1 18 VT/BK
4.7L
4.0L
C102
FROM S165 (8W-51-9)
B
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-5)
BACK-UP LAMP FEED
L1 20 BK/VT
C309
L1 20 VT/BK
C106
C107
GAS
DIESEL
S310
C301
C310
NOT USED
LEFT REAR LAMP ASSEMBLY
RIGHT REAR LAMP ASSEMBLY
BACK-UP LAMP
Z150 18 BK
Z151 18 BK
S307
(8W-15-19)
S332
(8W-15-18)
Z150 10 BK
Z151 14 BK
G301
(8W-15-22)
G300
(8W-15-18)

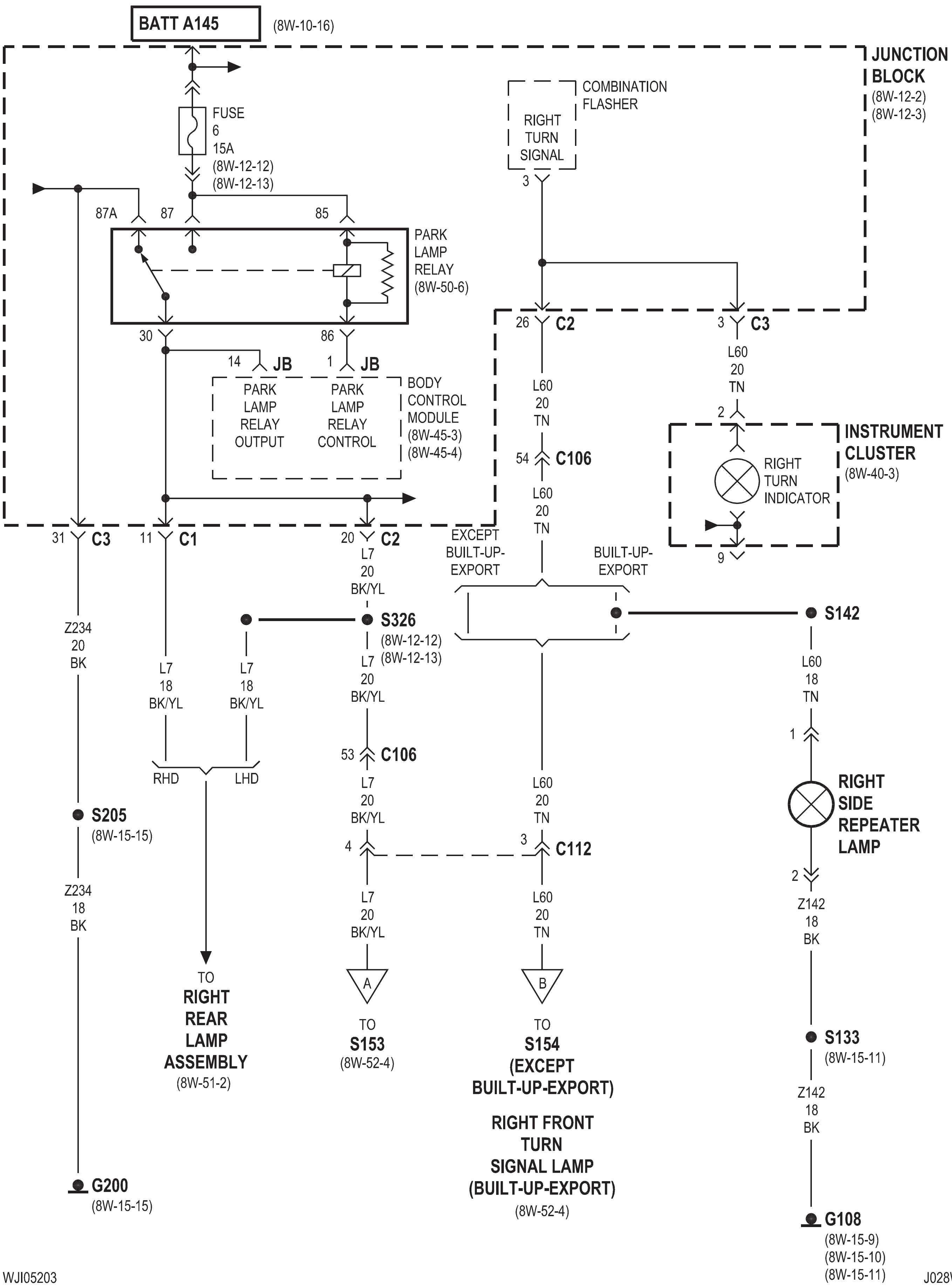

RUN A22
(8W-10-28)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
25
C2
LHD
RHD
F22
20
WT/PK
F22
18
WT/TN
58
C107
F22
18
WT/PK
85
30
BACK-UP
LAMP
RELAY
(IN PDC)
86
87
87A
T2
18
TN/BK
L1
18
VT/BK
S165
36
C107
L1
18
VT/BK
L1
18
VT/BK
T2
18
TN/BK
6
C105
NOT
USED
B
TO
C107
(8W-51-7)
(8W-51-8)
32
C200
T2
20
TN/BK
9
C201
T2
20
TN/BK
4
C1
BACK-UP
LAMP
RELAY
CONTROL
SHIFTER
ASSEMBLY
(8W-31-15)

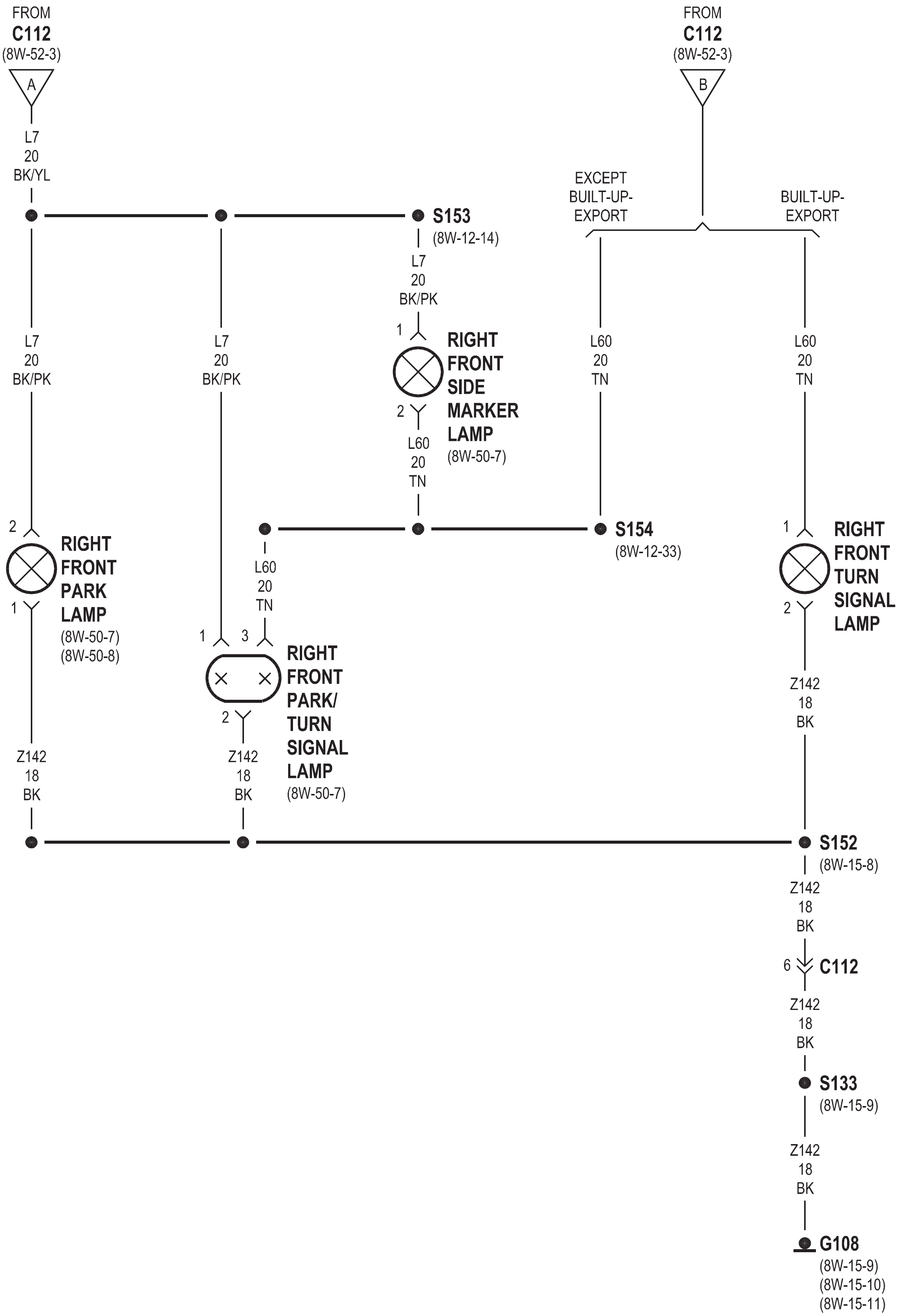
BUILT-UP-EXPORT



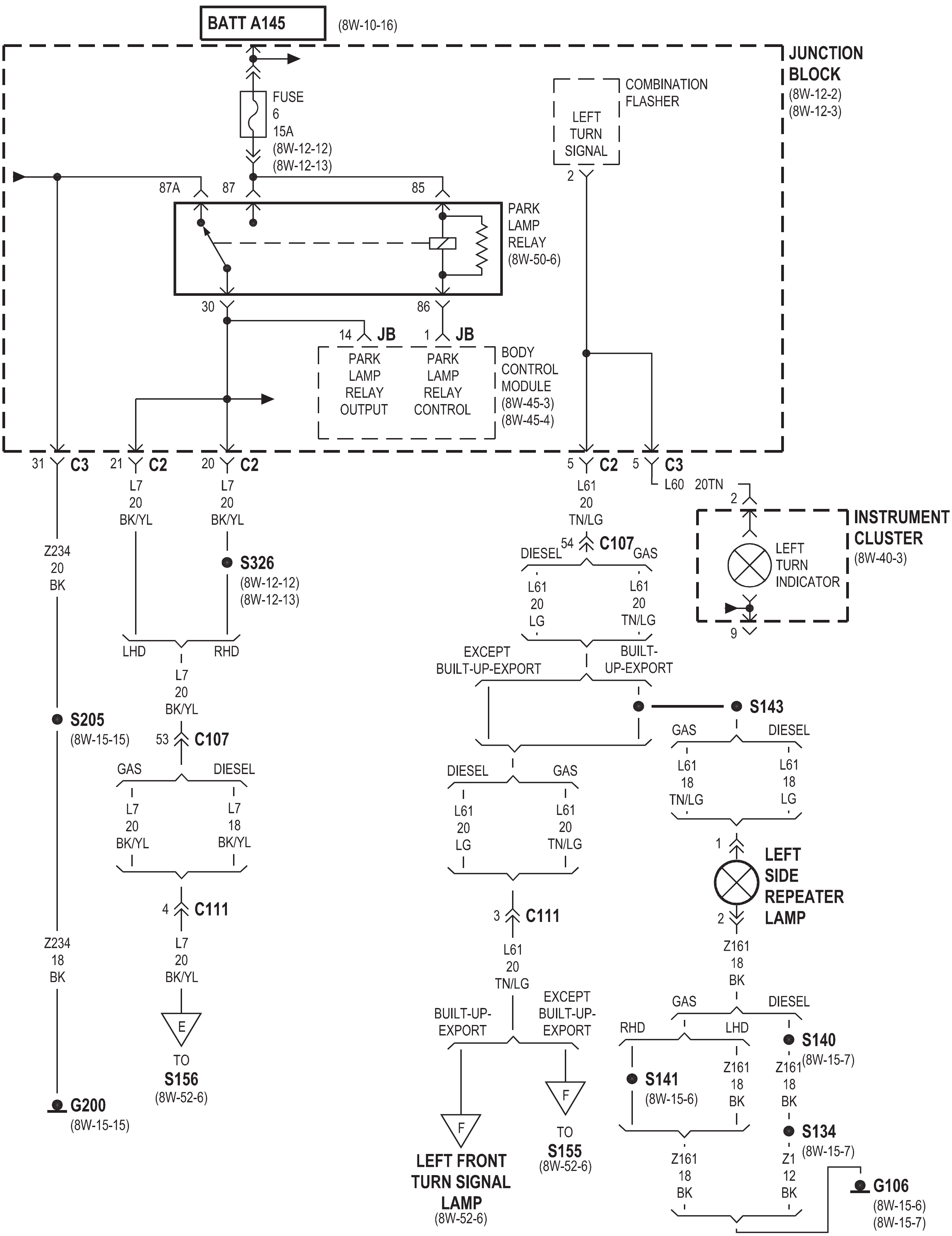
8W-52 TURN SIGNALS

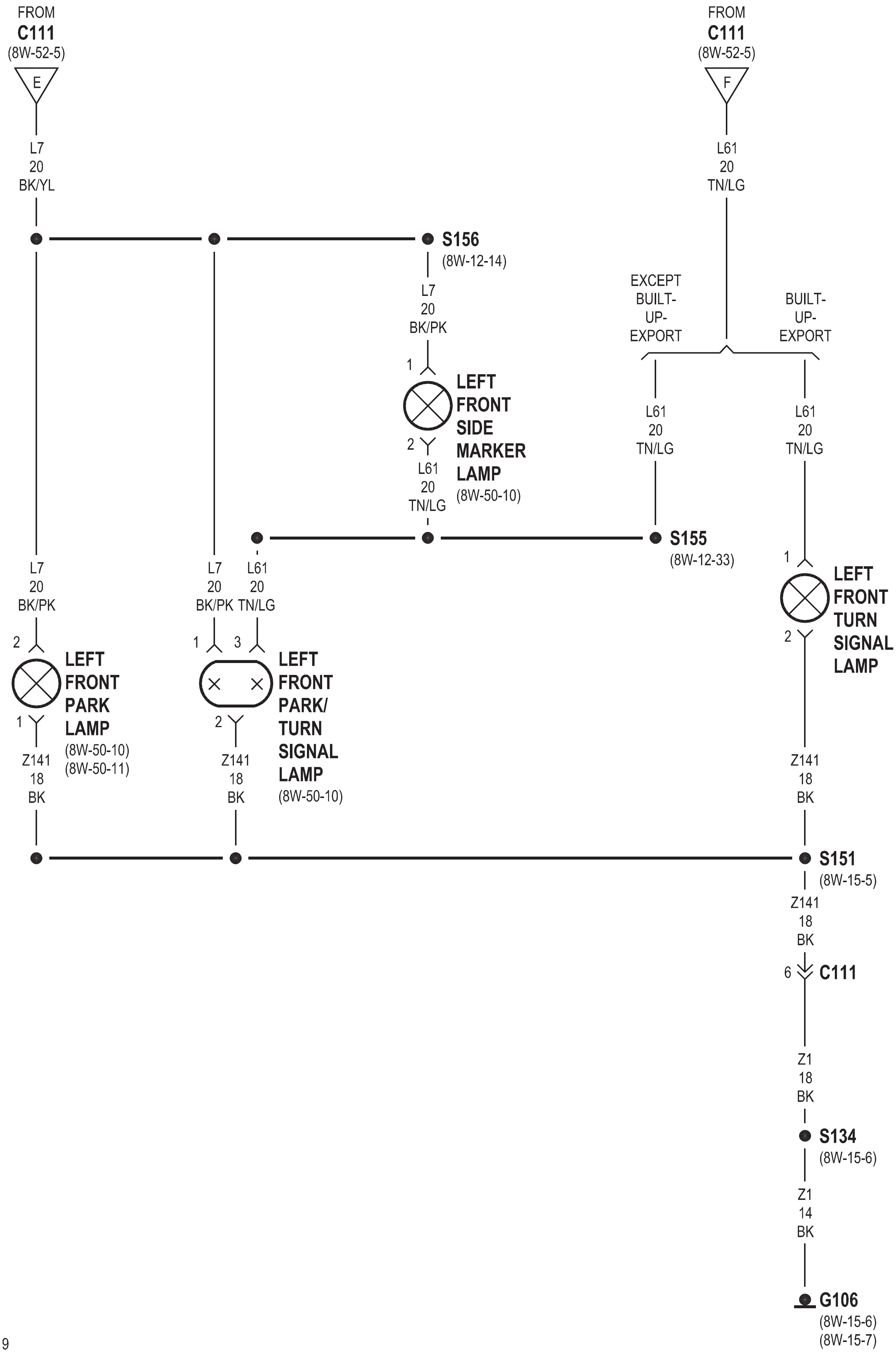

BATT A148
(8W-10-30)
RUN A22
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 15A (8W-12-10)
FUSE 20 10A (8W-12-22)
COMBINATION FLASHER
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN)
HAZARD SWITCH SENSE
LEFT TURN SWITCH SENSE
RIGHT TURN SWITCH SENSE
C3
L91 20 DB/PK
L305 18 LB/WT
L302 20 LB/YL
LEFT MULTI-FUNCTION SWITCH
8 HAZARD
9 LEFT TURN
10 RIGHT TURN
(8W-50-3)
Z234 20 BK
S205
(8W-15-15)
Z234 18 BK
G200
(8W-15-15)

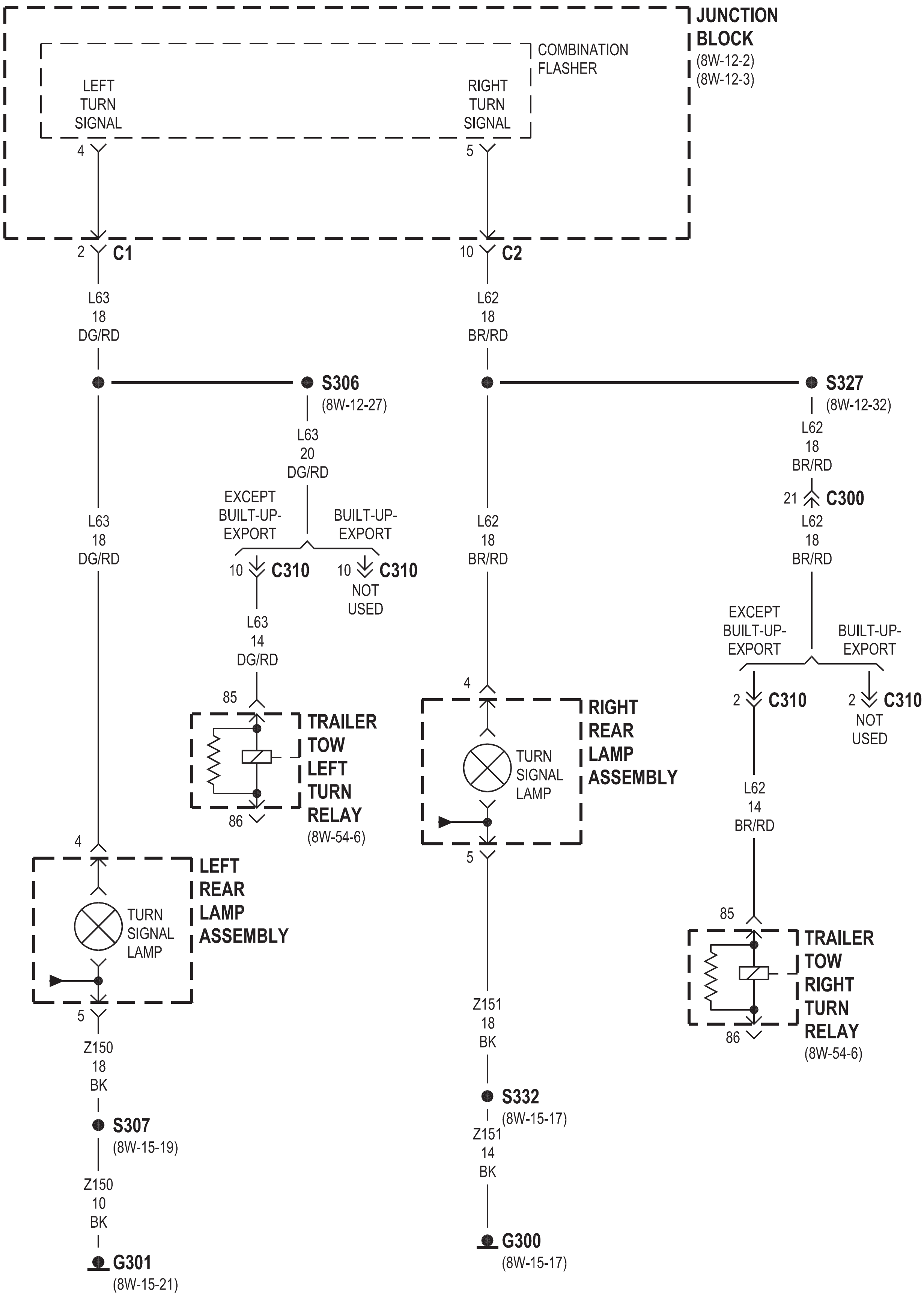

BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 15A
(8W-12-12)
(8W-12-13)
COMBINATION FLASHER
RIGHT TURN SIGNAL
87A
87
85
PARK LAMP RELAY
(8W-50-6)
30
86
14 JB
1 JB
PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
26 C2
3 C3
L60 20 TN
2
INSTRUMENT CLUSTER
(8W-40-3)
RIGHT TURN INDICATOR
9
54 C106
31 C3
11 C1
20 C2
L7 20 BK/YL
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S326
(8W-12-12)
(8W-12-13)
S142
Z234 20 BK
L7 18 BK/YL
L60 18 TN
53 C106
RHD
LHD
1
RIGHT SIDE REPEATER LAMP
S205
(8W-15-15)
3 C112
4
2
Z234 18 BK
Z142 18 BK
A
B
TO RIGHT REAR LAMP ASSEMBLY
(8W-51-2)
TO S153
(8W-52-4)
TO S154 (EXCEPT BUILT-UP-EXPORT)
RIGHT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT)
(8W-52-4)
S133
(8W-15-11)
G200
(8W-15-15)
G108
(8W-15-9)
(8W-15-10)
(8W-15-11)

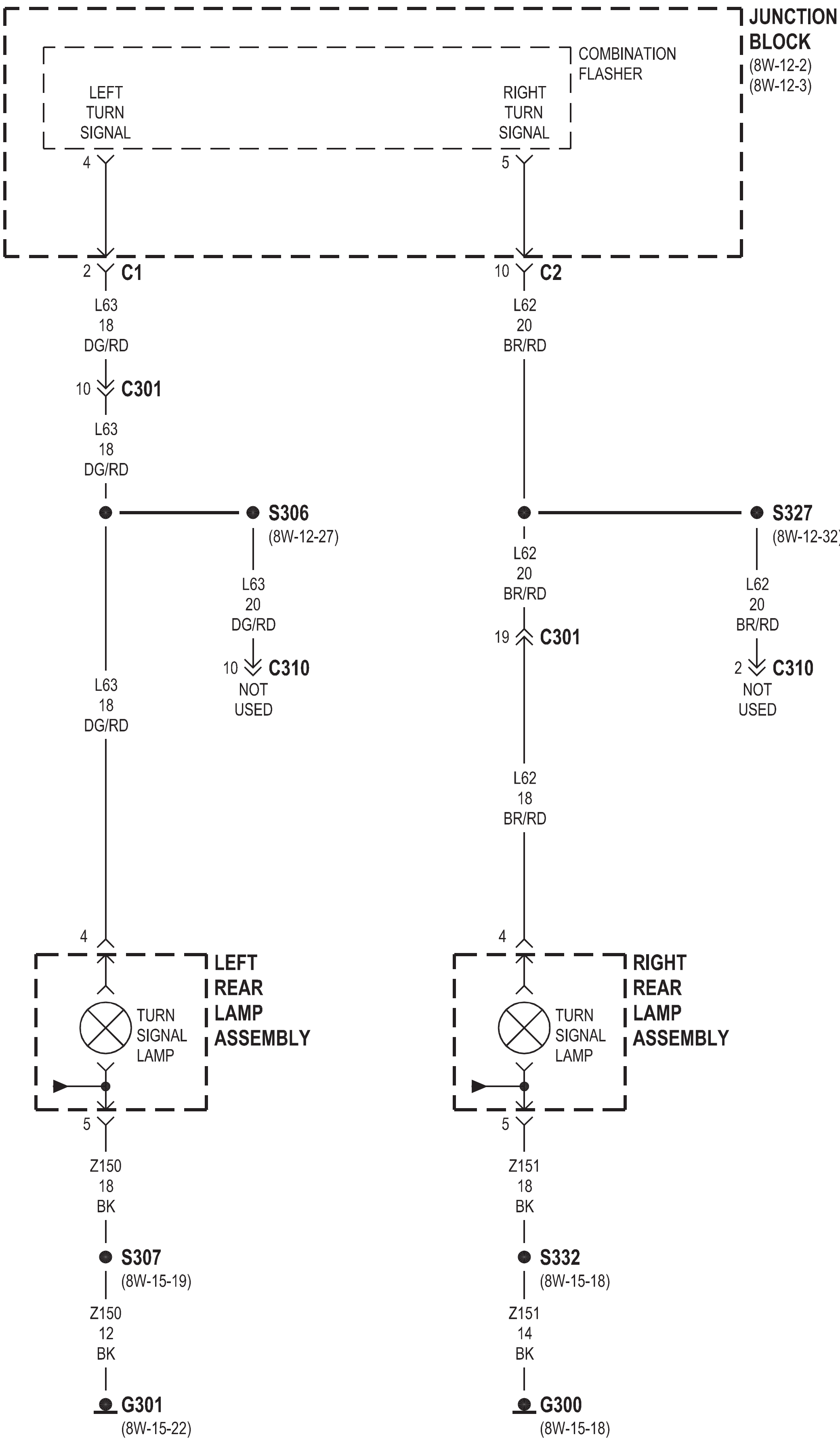


FROM
C112
(8W-52-3)
A
L7
20
BK/YL
FROM
C112
(8W-52-3)
B
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
S153
(8W-12-14)
L7
20
BK/PK
1
RIGHT
FRONT
SIDE
MARKER
LAMP
(8W-50-7)
2
L60
20
TN
L7
20
BK/PK
L7
20
BK/PK
L60
20
TN
L60
20
TN
S154
(8W-12-33)
2
RIGHT
FRONT
PARK
LAMP
(8W-50-7)
(8W-50-8)
1
L60
20
TN
1
3
RIGHT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-7)
2
1
RIGHT
FRONT
TURN
SIGNAL
LAMP
2
Z142
18
BK
Z142
18
BK
Z142
18
BK
S152
(8W-15-8)
Z142
18
BK
6
C112
Z142
18
BK
S133
(8W-15-9)
Z142
18
BK
G108
(8W-15-9)
(8W-15-10)
(8W-15-11)

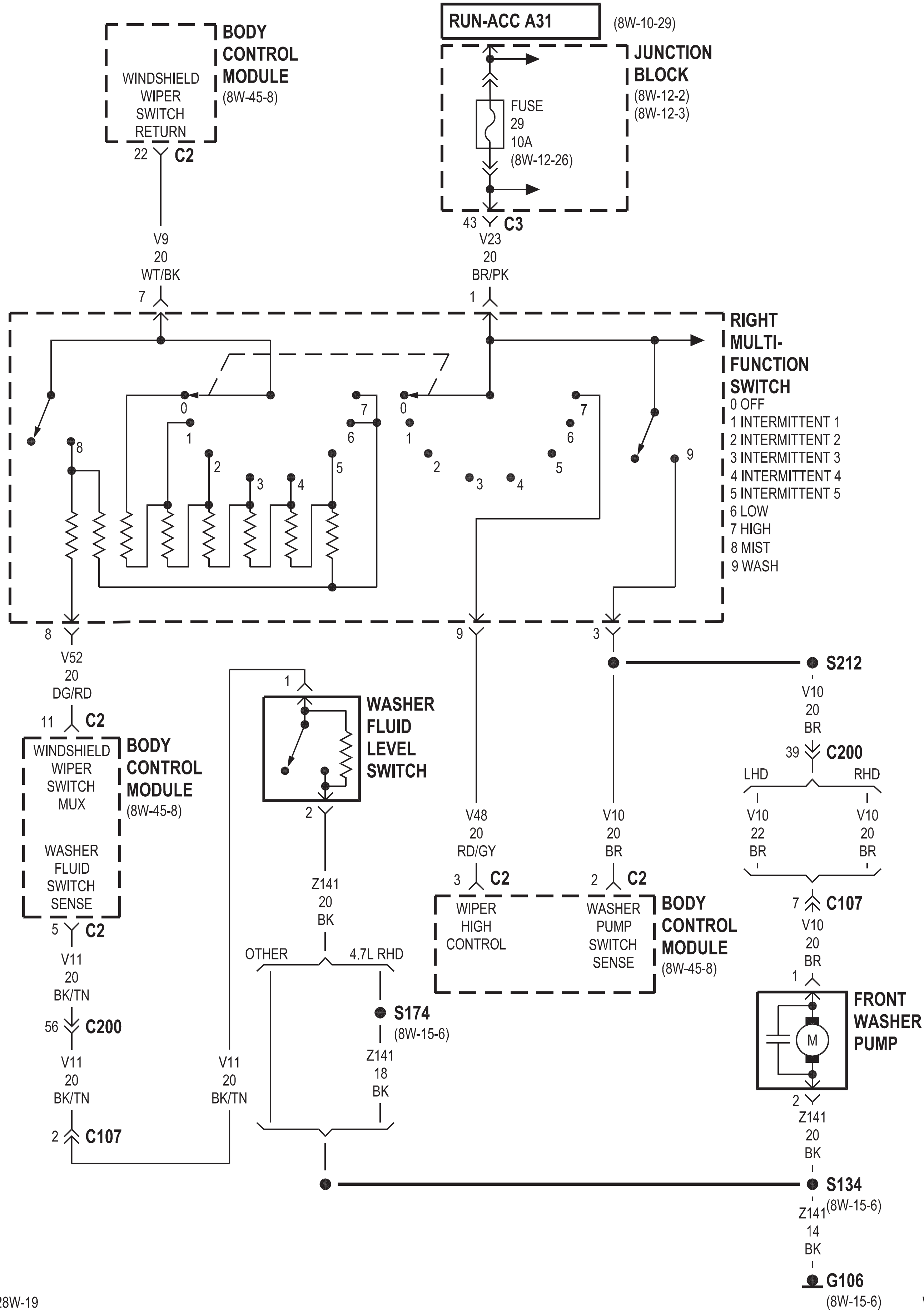

BATT A145
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 15A
(8W-12-12)
(8W-12-13)
COMBINATION FLASHER
LEFT TURN SIGNAL
87A
87
85
PARK LAMP RELAY
(8W-50-6)
30
86
14 JB
1 JB
PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
31 C3
21 C2
20 C2
5 C2
5 C3
L60 20TN
L7 20 BK/YL
L61 20 TN/LG
54 C107
DIESEL
GAS
INSTRUMENT CLUSTER
(8W-40-3)
LEFT TURN INDICATOR
Z234 20 BK
S326
(8W-12-12)
(8W-12-13)
L61 20 LG
L61 20 TN/LG
LHD
RHD
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S205
(8W-15-15)
53 C107
S143
L61 18 TN/LG
L61 18 LG
L7 18 BK/YL
LEFT SIDE REPEATER LAMP
4 C111
3 C111
Z234 18 BK
Z161 18 BK
TO S156
(8W-52-6)
G200
(8W-15-15)
S140
(8W-15-7)
S141
(8W-15-6)
S134
(8W-15-7)
Z1 12 BK
G106
(8W-15-6)
(8W-15-7)
LEFT FRONT TURN SIGNAL LAMP
(8W-52-6)
TO S155
(8W-52-6)

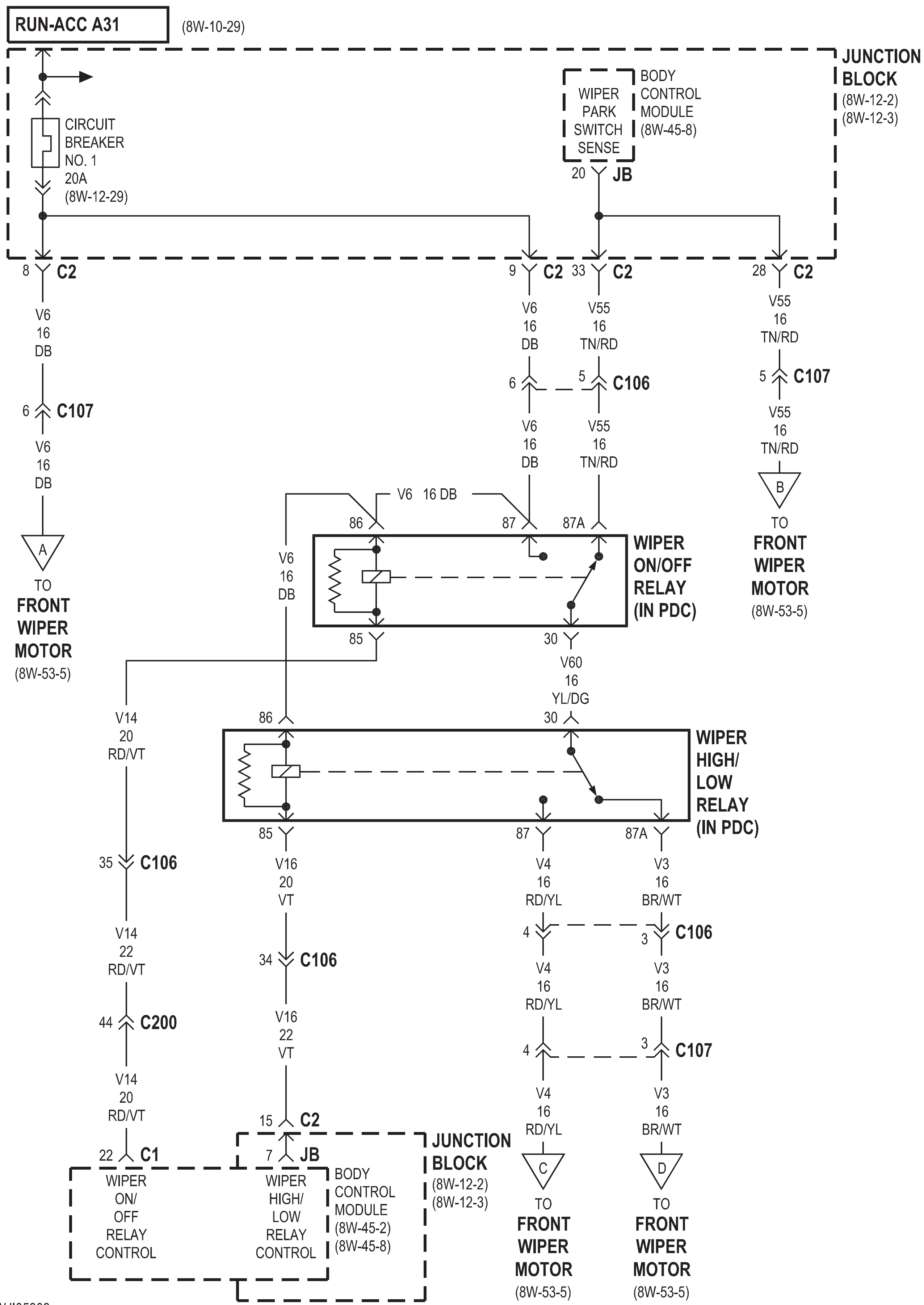

FROM
C111
(8W-52-5)
E
L7
20
BK/YL
FROM
C111
(8W-52-5)
F
L61
20
TN/LG
S156
(8W-12-14)
L7
20
BK/PK
EXCEPT
BUILT-
UP-
EXPORT
BUILT-
UP-
EXPORT
1
LEFT
FRONT
SIDE
MARKER
LAMP
(8W-50-10)
2
L61
20
TN/LG
L61
20
TN/LG
L61
20
TN/LG
S155
(8W-12-33)
L7
20
BK/PK
L7
20
BK/PK
L61
20
TN/LG
1
LEFT
FRONT
TURN
SIGNAL
LAMP
2
2
LEFT
FRONT
PARK
LAMP
(8W-50-10)
(8W-50-11)
1
1
3
LEFT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-10)
2
Z141
18
BK
Z141
18
BK
Z141
18
BK
S151
(8W-15-5)
Z141
18
BK
6
C111
Z1
18
BK
S134
(8W-15-6)
Z1
14
BK
G106
(8W-15-6)
(8W-15-7)

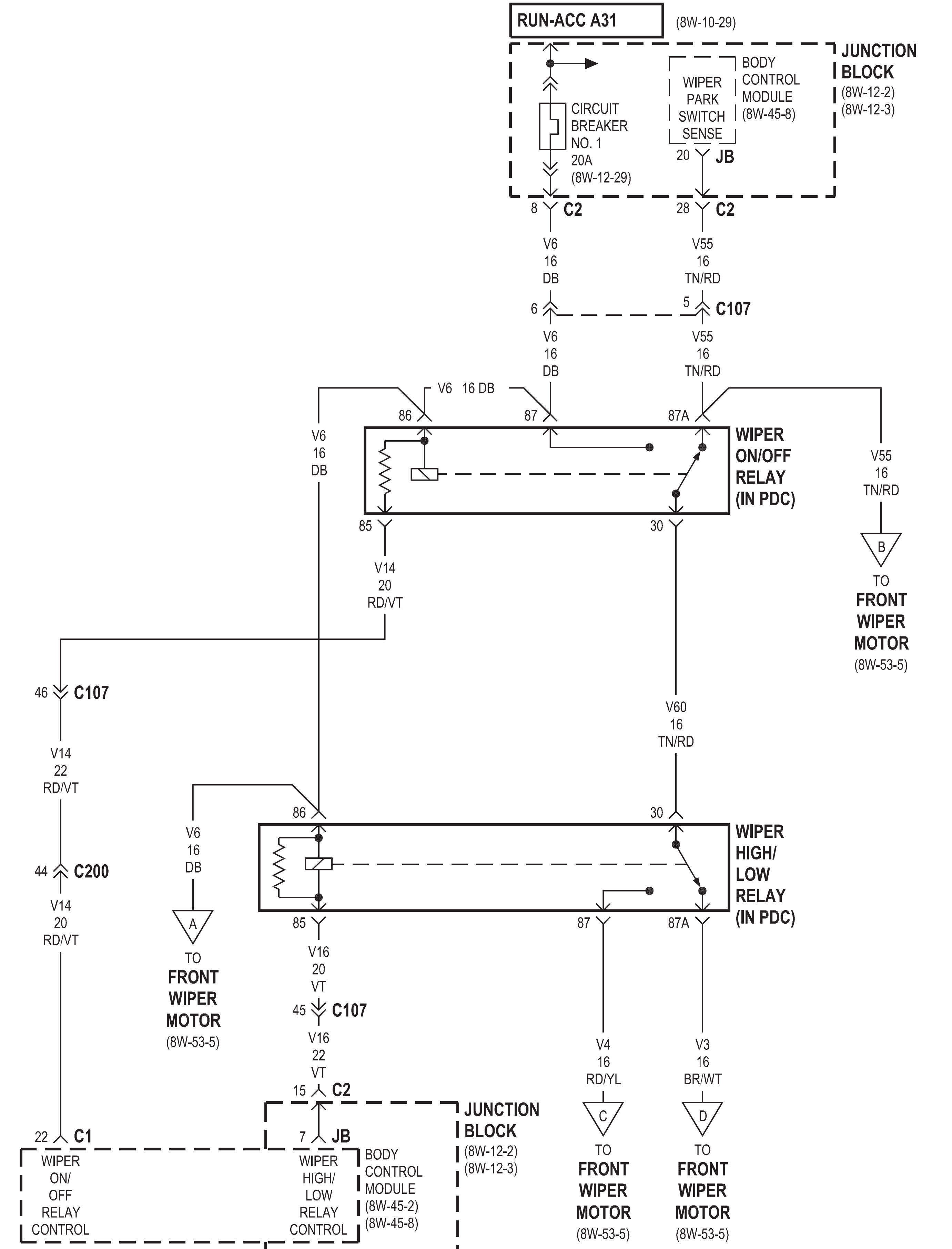

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
4
5
2
C1
10
C2
L63
18
DG/RD
L62
18
BR/RD
S306
(8W-12-27)
S327
(8W-12-32)
L63
20
DG/RD
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
10
C310
10
C310
NOT USED
L63
14
DG/RD
85
TRAILER TOW LEFT TURN RELAY
(8W-54-6)
86
L63
18
DG/RD
4
LEFT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
Z150
18
BK
S307
(8W-15-19)
Z150
10
BK
G301
(8W-15-21)
L62
18
BR/RD
4
RIGHT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
Z151
18
BK
S332
(8W-15-17)
Z151
14
BK
G300
(8W-15-17)
L62
18
BR/RD
21
C300
L62
18
BR/RD
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
2
C310
2
C310
NOT USED
L62
14
BR/RD
85
TRAILER TOW RIGHT TURN RELAY
(8W-54-6)
86

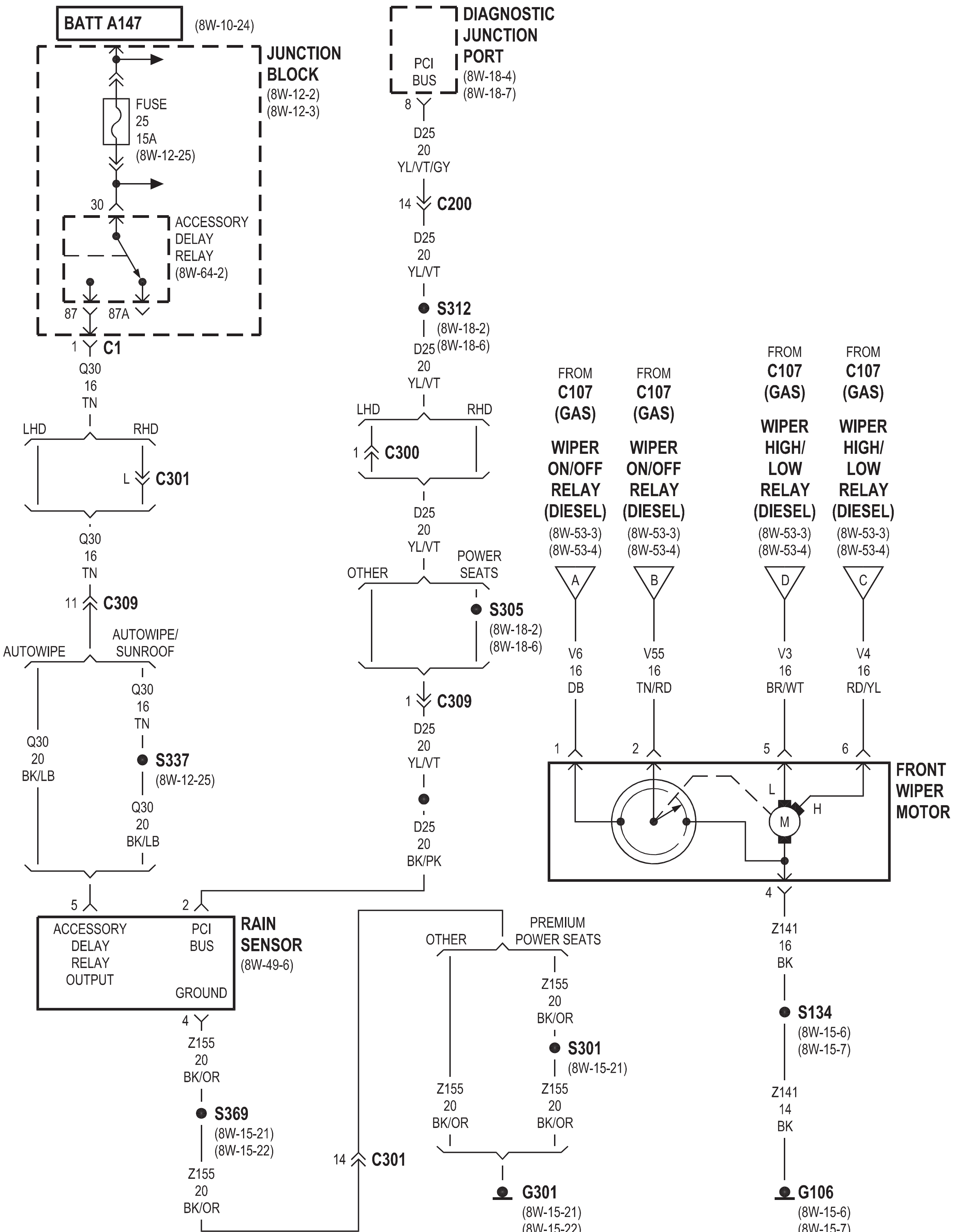

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
4
5
2
C1
10
C2
L63
18
DG/RD
L62
20
BR/RD
10
C301
L63
18
DG/RD
S306
(8W-12-27)
S327
(8W-12-32)
L63
20
DG/RD
L62
20
BR/RD
19
C301
10
C310
NOT USED
2
C310
NOT USED
L63
18
DG/RD
L62
18
BR/RD
4
4
LEFT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
RIGHT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
5
Z150
18
BK
Z151
18
BK
S307
(8W-15-19)
S332
(8W-15-18)
Z150
12
BK
Z151
14
BK
G301
(8W-15-22)
G300
(8W-15-18)

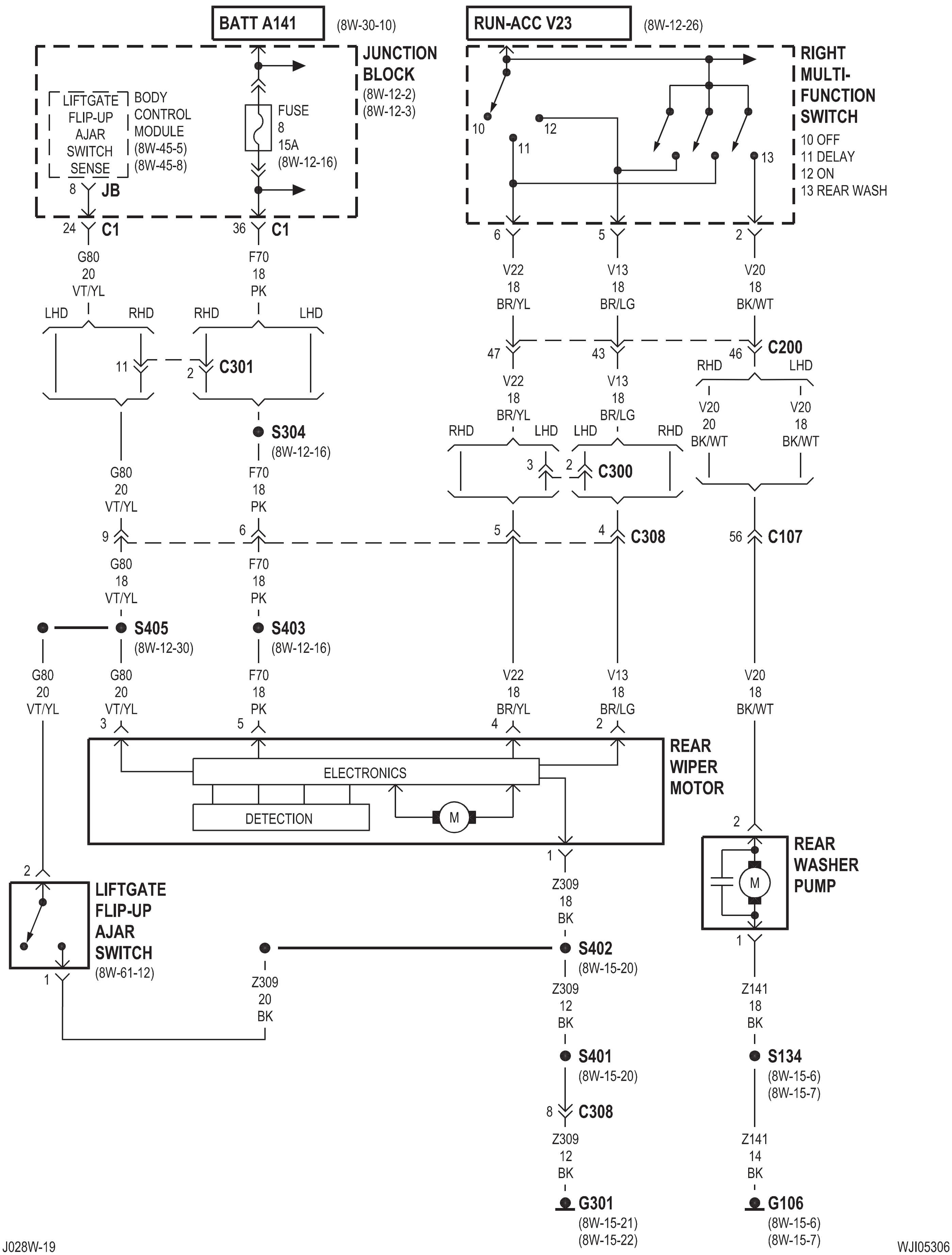
8W-53 WIPERS


BODY CONTROL MODULE
WINDSHIELD WIPER SWITCH RETURN
(8W-45-8)
22 C2
V9 20 WT/BK
RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 29 10A (8W-12-26)
43 C3
V23 20 BR/PK
7
1
RIGHT MULTI-FUNCTION SWITCH
0 OFF
1 INTERMITTENT 1
2 INTERMITTENT 2
3 INTERMITTENT 3
4 INTERMITTENT 4
5 INTERMITTENT 5
6 LOW
7 HIGH
8 MIST
9 WASH
8
9
3
V52 20 DG/RD
11 C2
BODY CONTROL MODULE
WINDSHIELD WIPER SWITCH MUX
WASHER FLUID SWITCH SENSE
(8W-45-8)
5 C2
V11 20 BK/TN
56 C200
V11 20 BK/TN
2 C107
V11 20 BK/TN
WASHER FLUID LEVEL SWITCH
1
2
Z141 20 BK
OTHER
4.7L RHD
S174
(8W-15-6)
Z141 18 BK
V48 20 RD/GY
3 C2
V10 20 BR
2 C2
BODY CONTROL MODULE
WIPER HIGH CONTROL
WASHER PUMP SWITCH SENSE
(8W-45-8)
S212
V10 20 BR
39 C200
LHD
RHD
V10 22 BR
V10 20 BR
7 C107
V10 20 BR
1
FRONT WASHER PUMP
M
2
Z141 20 BK
S134
(8W-15-6)
Z141 14 BK
G106
(8W-15-6)

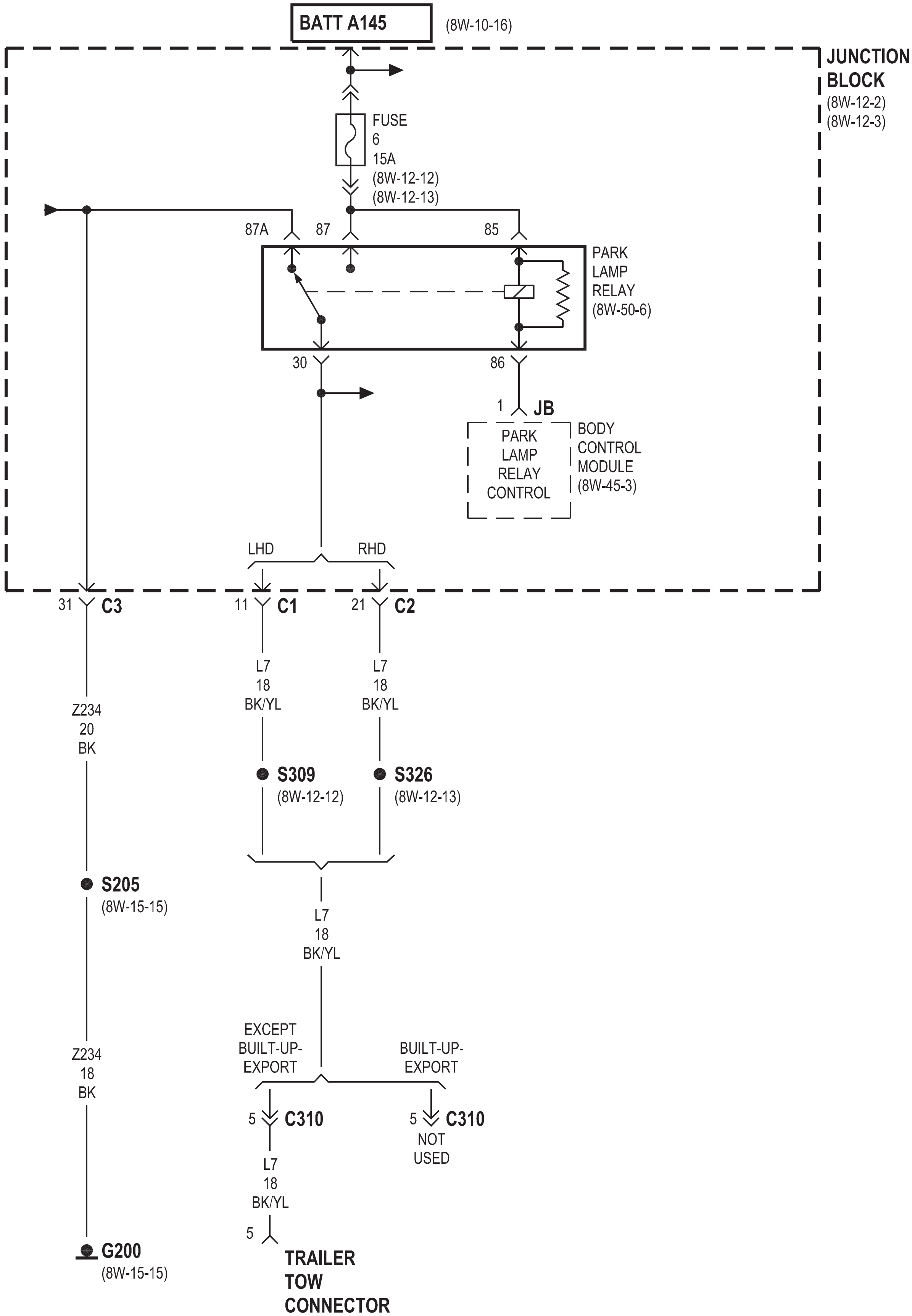

RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1 20A
(8W-12-29)
WIPER PARK SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
20 JB
8 C2
9 C2
33 C2
28 C2
V6 16 DB
V55 16 TN/RD
6 C107
6 5 C106
5 C107
A TO FRONT WIPER MOTOR (8W-53-5)
B TO FRONT WIPER MOTOR (8W-53-5)
V6 16 DB
86 87 87A
WIPER ON/OFF RELAY (IN PDC)
85 30
V60 16 YL/DG
V14 20 RD/VT
86 30
WIPER HIGH/ LOW RELAY (IN PDC)
85 87 87A
35 C106
V16 20 VT
V4 16 RD/YL
V3 16 BR/WT
4 3 C106
V14 22 RD/VT
34 C106
44 C200
V16 22 VT
4 3 C107
V14 20 RD/VT
15 C2
22 C1
7 JB
WIPER ON/ OFF RELAY CONTROL
WIPER HIGH/ LOW RELAY CONTROL
BODY CONTROL MODULE
(8W-45-2)
(8W-45-8)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
C TO FRONT WIPER MOTOR (8W-53-5)
D TO FRONT WIPER MOTOR (8W-53-5)

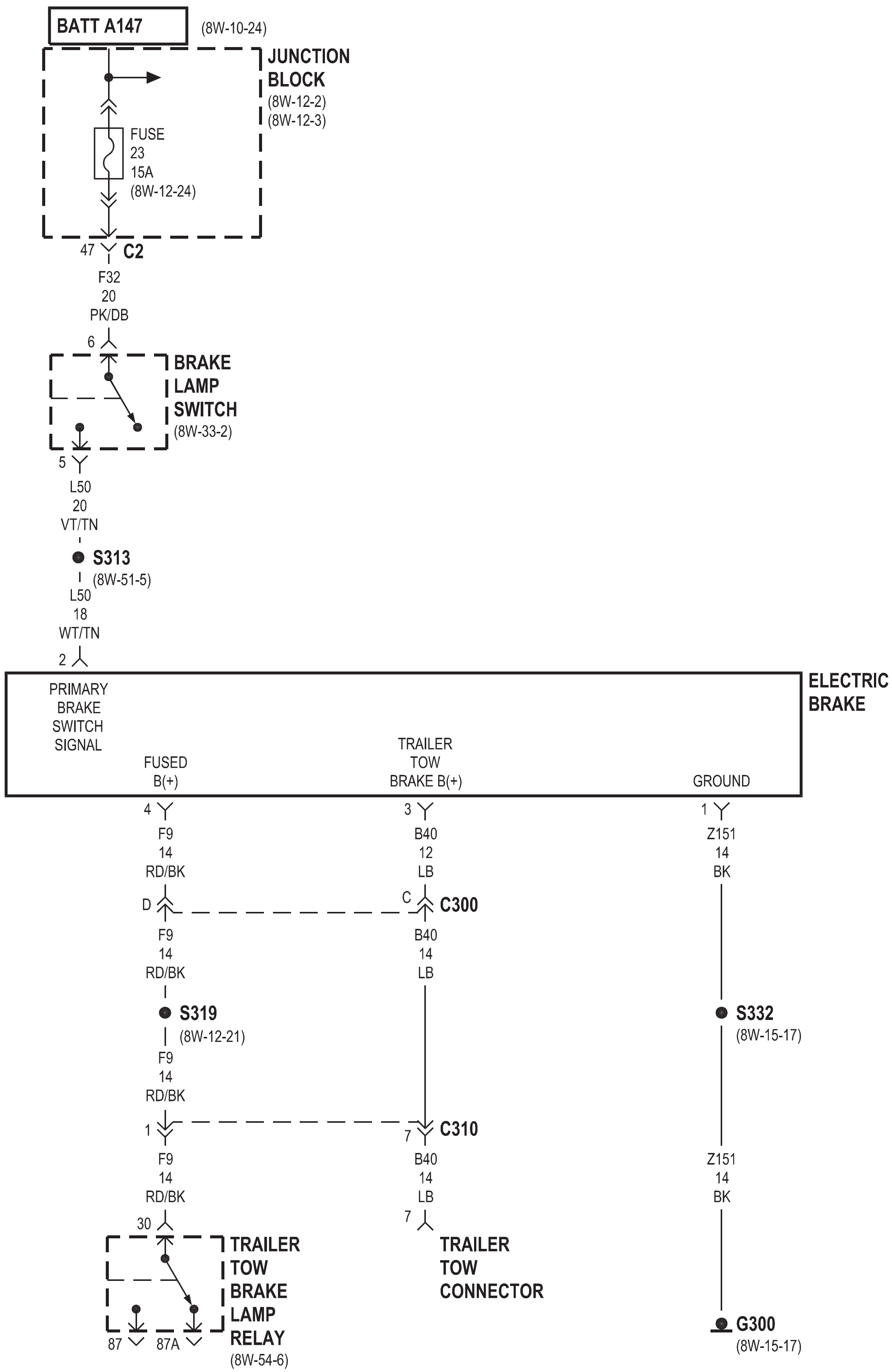

RUN-ACC A31
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1 20A
(8W-12-29)
WIPER PARK SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
20 JB
8 C2
28 C2
V6 16 DB
V55 16 TN/RD
6
5 C107
V6 16 DB
V55 16 TN/RD
V6 16 DB
86
87
87A
WIPER ON/OFF RELAY (IN PDC)
V6 16 DB
V55 16 TN/RD
B
TO FRONT WIPER MOTOR
(8W-53-5)
85
30
V14 20 RD/VT
46 C107
V14 22 RD/VT
V60 16 TN/RD
86
30
V6 16 DB
WIPER HIGH/ LOW RELAY (IN PDC)
44 C200
V14 20 RD/VT
A
TO FRONT WIPER MOTOR
(8W-53-5)
85
87
87A
V16 20 VT
45 C107
V16 22 VT
15 C2
V4 16 RD/YL
V3 16 BR/WT
C
D
TO FRONT WIPER MOTOR
(8W-53-5)
TO FRONT WIPER MOTOR
(8W-53-5)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
22 C1
7 JB
WIPER ON/ OFF RELAY CONTROL
WIPER HIGH/ LOW RELAY CONTROL
BODY CONTROL MODULE
(8W-45-2)
(8W-45-8)

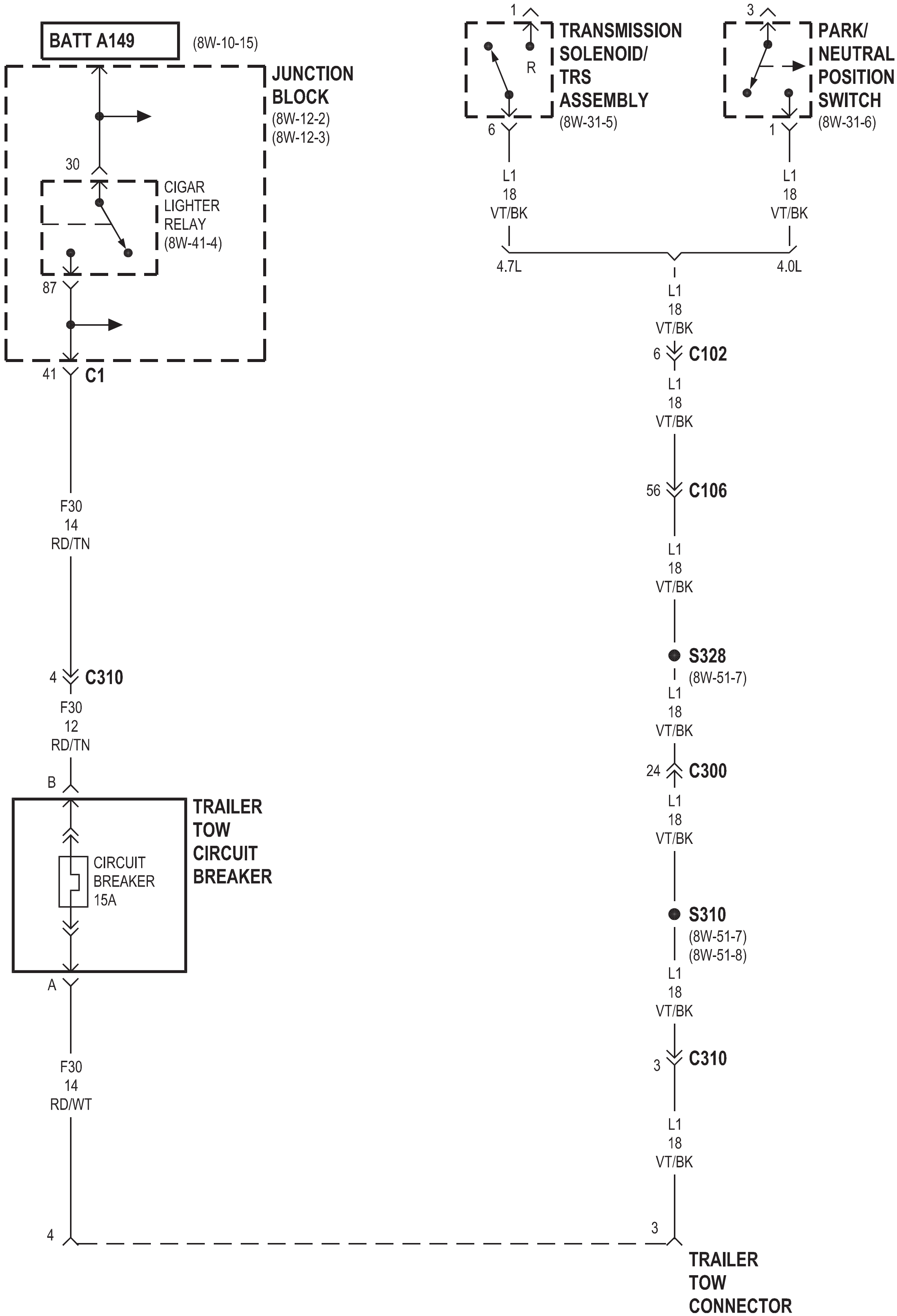

BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 25 15A (8W-12-25)
30
ACCESSORY DELAY RELAY (8W-64-2)
87 87A
1 C1
Q30 16 TN
LHD RHD
L C301
Q30 16 TN
11 C309
AUTOWIPE
AUTOWIPE/ SUNROOF
Q30 16 TN
S337
(8W-12-25)
Q30 20 BK/LB
Q30 20 BK/LB
5 2
ACCESSORY DELAY RELAY OUTPUT
PCI BUS
GROUND
RAIN SENSOR
(8W-49-6)
4
Z155 20 BK/OR
S369
(8W-15-21)
(8W-15-22)
Z155 20 BK/OR
14 C301
DIAGNOSTIC JUNCTION PORT
PCI BUS
(8W-18-4)
(8W-18-7)
8
D25 20 YL/VT/GY
14 C200
D25 20 YL/VT
S312
(8W-18-2)
(8W-18-6)
D25 20 YL/VT
LHD RHD
1 C300
D25 20 YL/VT
OTHER
POWER SEATS
S305
(8W-18-2)
(8W-18-6)
1 C309
D25 20 YL/VT
D25 20 BK/PK
OTHER
PREMIUM POWER SEATS
Z155 20 BK/OR
S301
(8W-15-21)
Z155 20 BK/OR
Z155 20 BK/OR
G301
(8W-15-21)
(8W-15-22)
FROM C107 (GAS)
WIPER ON/OFF RELAY (DIESEL)
(8W-53-3)
(8W-53-4)
FROM C107 (GAS)
WIPER HIGH/ LOW RELAY (DIESEL)
A B D C
V6 16 DB
V55 16 TN/RD
V3 16 BR/WT
V4 16 RD/YL
1 2 5 6
L H M
FRONT WIPER MOTOR
4
Z141 16 BK
S134
(8W-15-6)
(8W-15-7)
Z141 14 BK
G106
(8W-15-6)
(8W-15-7)

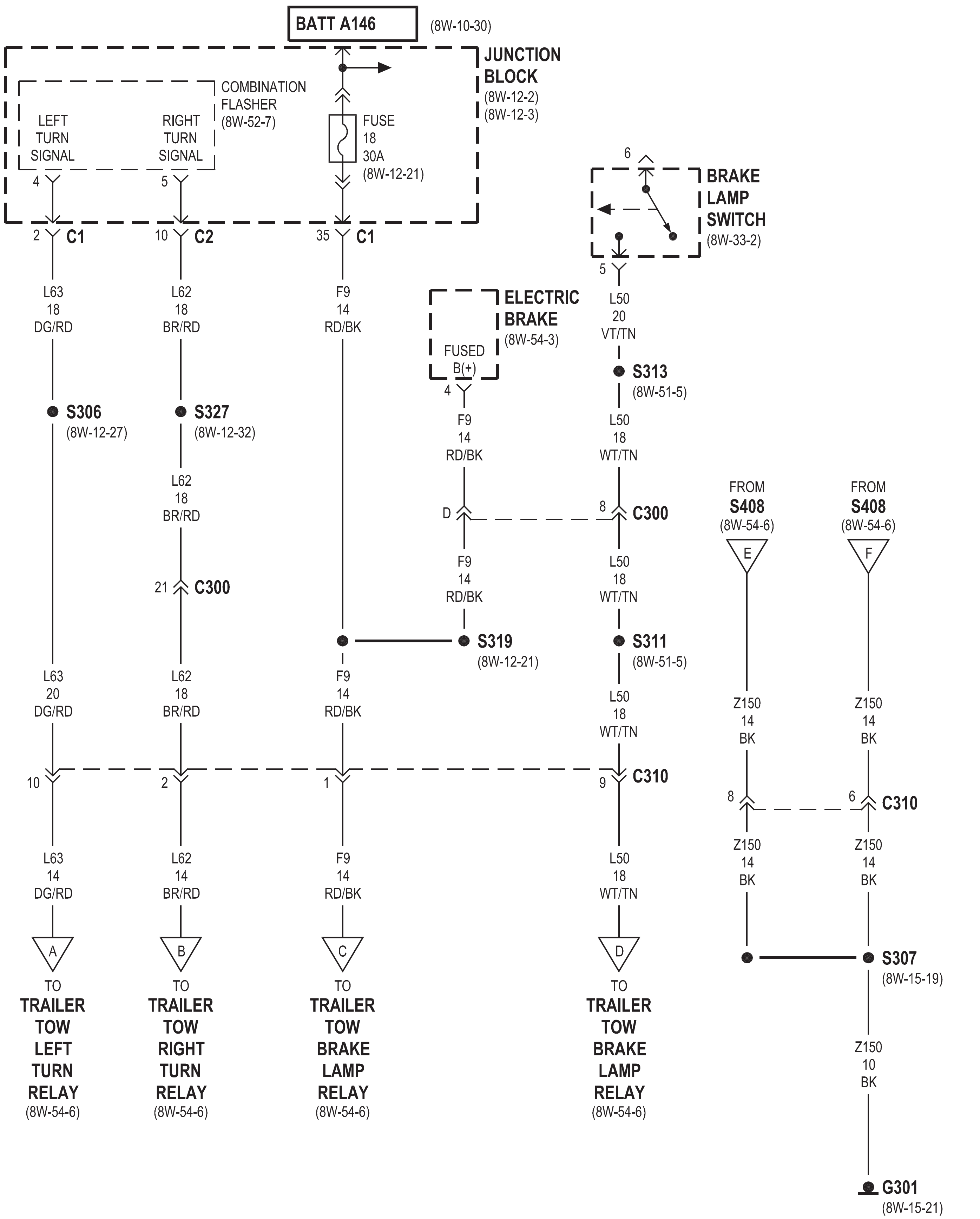

BATT A141
(8W-30-10)
RUN-ACC V23
(8W-12-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
LIFTGATE FLIP-UP AJAR SWITCH SENSE
BODY CONTROL MODULE
(8W-45-5)
(8W-45-8)
8 JB
FUSE 8 15A
(8W-12-16)
RIGHT MULTI-FUNCTION SWITCH
10 OFF
11 DELAY
12 ON
13 REAR WASH
24 C1
36 C1
G80 20 VT/YL
F70 18 PK
6 V22 18 BR/YL
5 V13 18 BR/LG
2 V20 18 BK/WT
LHD RHD RHD LHD
11 2 C301
47 43 46 C200
RHD LHD
V22 18 BR/YL
V13 18 BR/LG
V20 20 BK/WT
V20 18 BK/WT
S304
(8W-12-16)
RHD LHD LHD RHD
3 2 C300
G80 20 VT/YL
F70 18 PK
9 6 5 4 C308
56 C107
G80 18 VT/YL
F70 18 PK
S405
(8W-12-30)
S403
(8W-12-16)
G80 20 VT/YL
G80 20 VT/YL
F70 18 PK
V22 18 BR/YL
V13 18 BR/LG
V20 18 BK/WT
3 5 4 2
ELECTRONICS
DETECTION
M
REAR WIPER MOTOR
1
Z309 18 BK
2
REAR WASHER PUMP
1
2
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-12)
1
S402
(8W-15-20)
Z309 20 BK
Z309 12 BK
Z141 18 BK
S401
(8W-15-20)
S134
(8W-15-6)
(8W-15-7)
8 C308
Z309 12 BK
Z141 14 BK
G301
(8W-15-21)
(8W-15-22)
G106
(8W-15-6)
(8W-15-7)
J028W-19
WJI05306

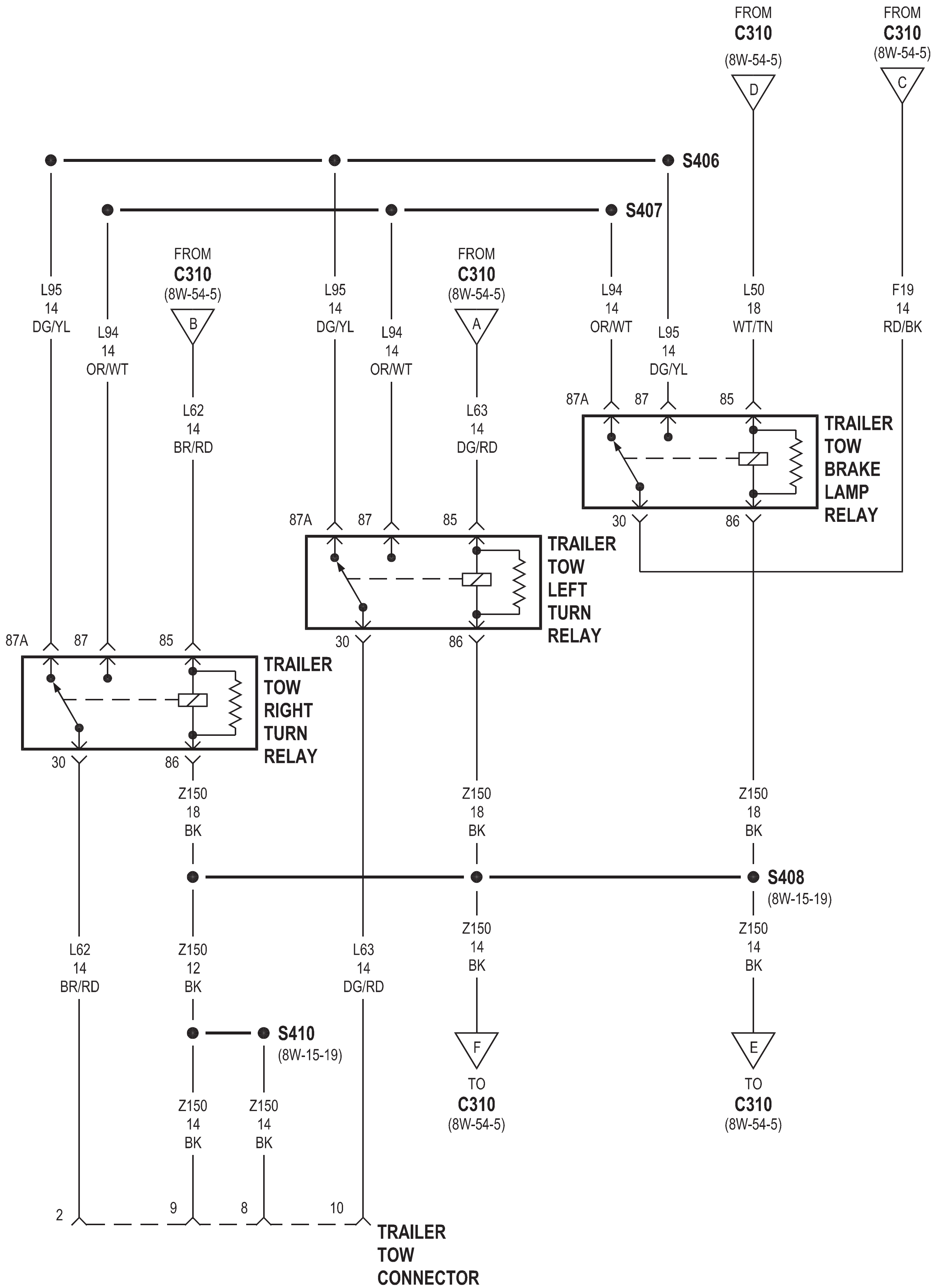
8W-54 TRAILER TOW


BATT A145
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
87A
87
85
PARK
LAMP
RELAY
(8W-50-6)
30
86
1
JB
PARK
LAMP
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-3)
LHD
RHD
31
C3
11
C1
21
C2
L7
18
BK/YL
L7
18
BK/YL
Z234
20
BK
S309
(8W-12-12)
S326
(8W-12-13)
S205
(8W-15-15)
L7
18
BK/YL
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
Z234
18
BK
5
C310
5
C310
NOT
USED
L7
18
BK/YL
5
G200
(8W-15-15)
TRAILER
TOW
CONNECTOR


BATT A147
(8W-10-24)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
23
15A
(8W-12-24)
47
C2
F32
20
PK/DB
6
BRAKE
LAMP
SWITCH
(8W-33-2)
5
L50
20
VT/TN
S313
(8W-51-5)
L50
18
WT/TN
2
ELECTRIC
BRAKE
PRIMARY
BRAKE
SWITCH
SIGNAL
FUSED
B(+)
TRAILER
TOW
BRAKE B(+)
GROUND
4
F9
14
RD/BK
3
B40
12
LB
1
Z151
14
BK
D
C
C300
F9
14
RD/BK
B40
14
LB
S319
(8W-12-21)
S332
(8W-15-17)
F9
14
RD/BK
1
7
C310
F9
14
RD/BK
B40
14
LB
Z151
14
BK
30
7
TRAILER
TOW
BRAKE
LAMP
RELAY
(8W-54-6)
87
87A
TRAILER
TOW
CONNECTOR
G300
(8W-15-17)

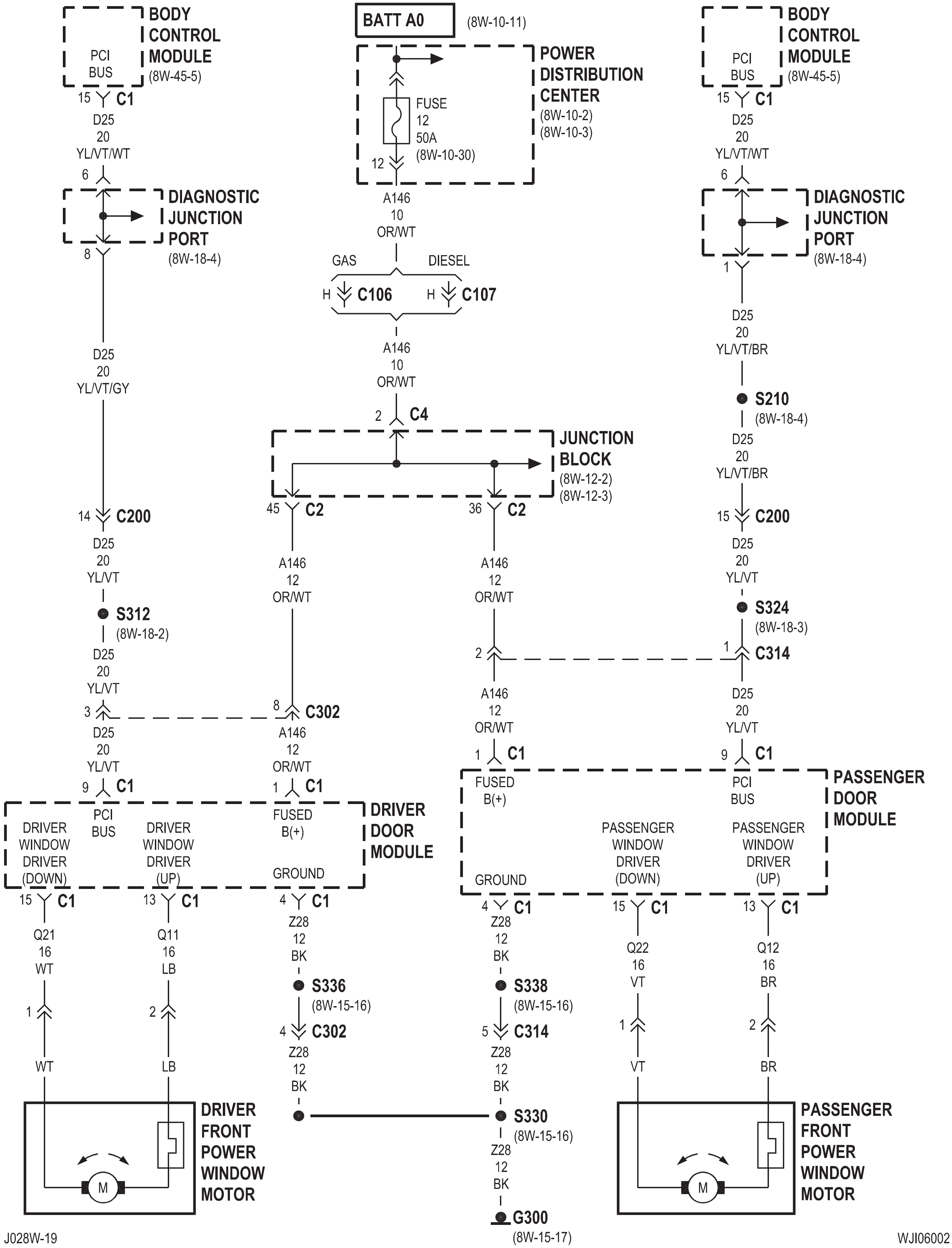

BATT A149
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
CIGAR LIGHTER RELAY
(8W-41-4)
87
41
C1
F30
14
RD/TN
4
C310
F30
12
RD/TN
B
TRAILER TOW CIRCUIT BREAKER
CIRCUIT BREAKER 15A
A
F30
14
RD/WT
4
1
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
R
6
3
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
1
L1
18
VT/BK
4.7L
4.0L
6
C102
56
C106
S328
(8W-51-7)
24
C300
S310
(8W-51-7)
(8W-51-8)
3
C310
3
TRAILER TOW CONNECTOR


BATT A146
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-7)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
FUSE
18
30A
(8W-12-21)
4
5
2 C1
10 C2
35 C1
L63 18 DG/RD
L62 18 BR/RD
F9 14 RD/BK
S306
(8W-12-27)
S327
(8W-12-32)
L62 18 BR/RD
21 C300
BRAKE LAMP SWITCH
(8W-33-2)
6
5
L50 20 VT/TN
S313
(8W-51-5)
L50 18 WT/TN
ELECTRIC BRAKE
(8W-54-3)
FUSED B(+)
4
F9 14 RD/BK
D
8 C300
F9 14 RD/BK
L50 18 WT/TN
S319
(8W-12-21)
S311
(8W-51-5)
L63 20 DG/RD
L62 18 BR/RD
F9 14 RD/BK
L50 18 WT/TN
10
2
1
9 C310
L63 14 DG/RD
L62 14 BR/RD
F9 14 RD/BK
L50 18 WT/TN
A
B
C
D
TO TRAILER TOW LEFT TURN RELAY
(8W-54-6)
TO TRAILER TOW RIGHT TURN RELAY
(8W-54-6)
TO TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
TO TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
FROM S408
(8W-54-6)
E
FROM S408
(8W-54-6)
F
Z150 14 BK
Z150 14 BK
8
6 C310
Z150 14 BK
Z150 14 BK
S307
(8W-15-19)
Z150 10 BK
G301
(8W-15-21)

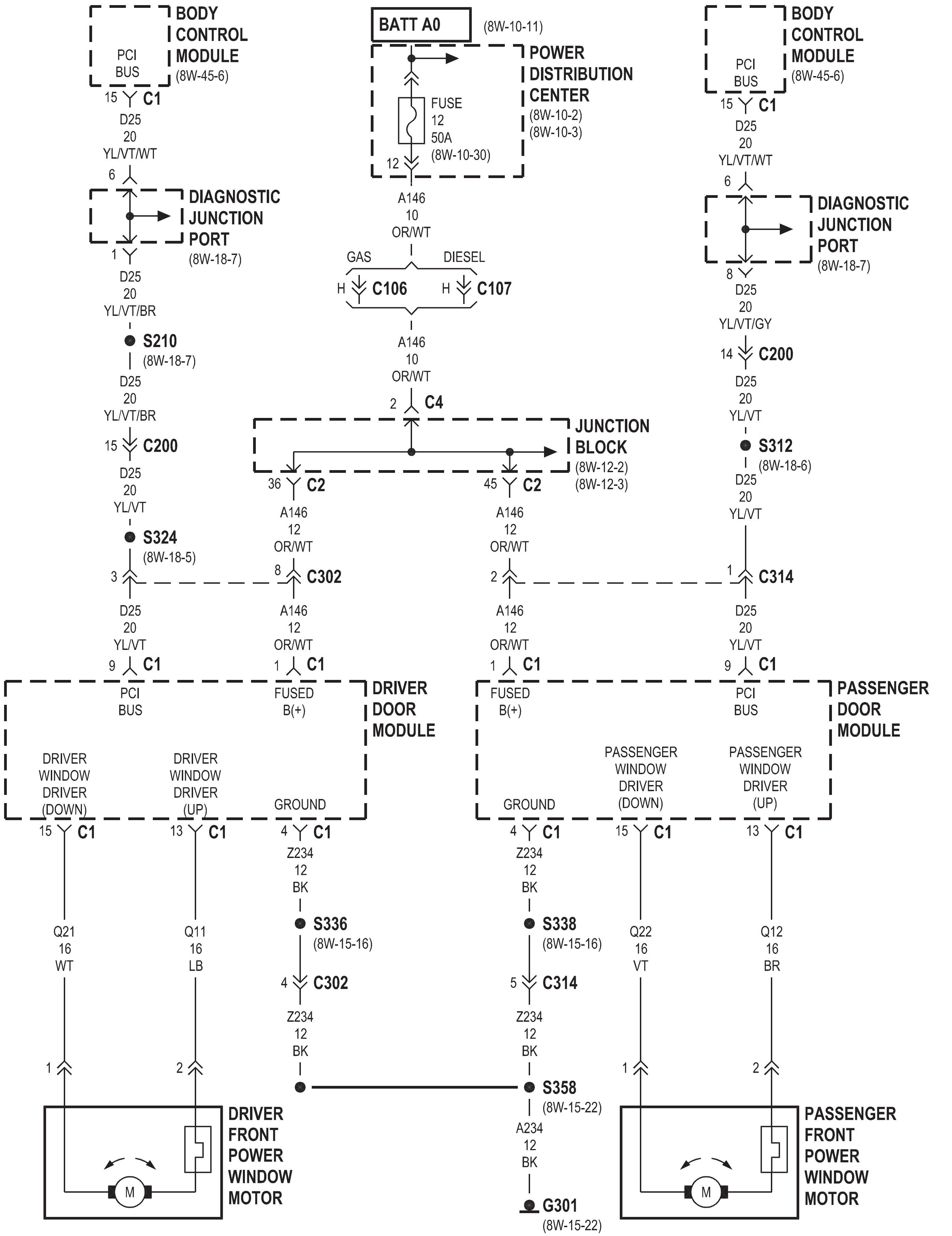

FROM
C310
(8W-54-5)
D
FROM
C310
(8W-54-5)
C
S406
S407
FROM
C310
(8W-54-5)
B
FROM
C310
(8W-54-5)
A
L95
14
DG/YL
L94
14
OR/WT
L62
14
BR/RD
L63
14
DG/RD
L50
18
WT/TN
F19
14
RD/BK
87A
87
85
30
86
TRAILER
TOW
BRAKE
LAMP
RELAY
TRAILER
TOW
LEFT
TURN
RELAY
TRAILER
TOW
RIGHT
TURN
RELAY
Z150
18
BK
S408
(8W-15-19)
Z150
14
BK
Z150
12
BK
S410
(8W-15-19)
F
TO
C310
(8W-54-5)
E
TO
C310
(8W-54-5)
2
9
8
10
TRAILER
TOW
CONNECTOR

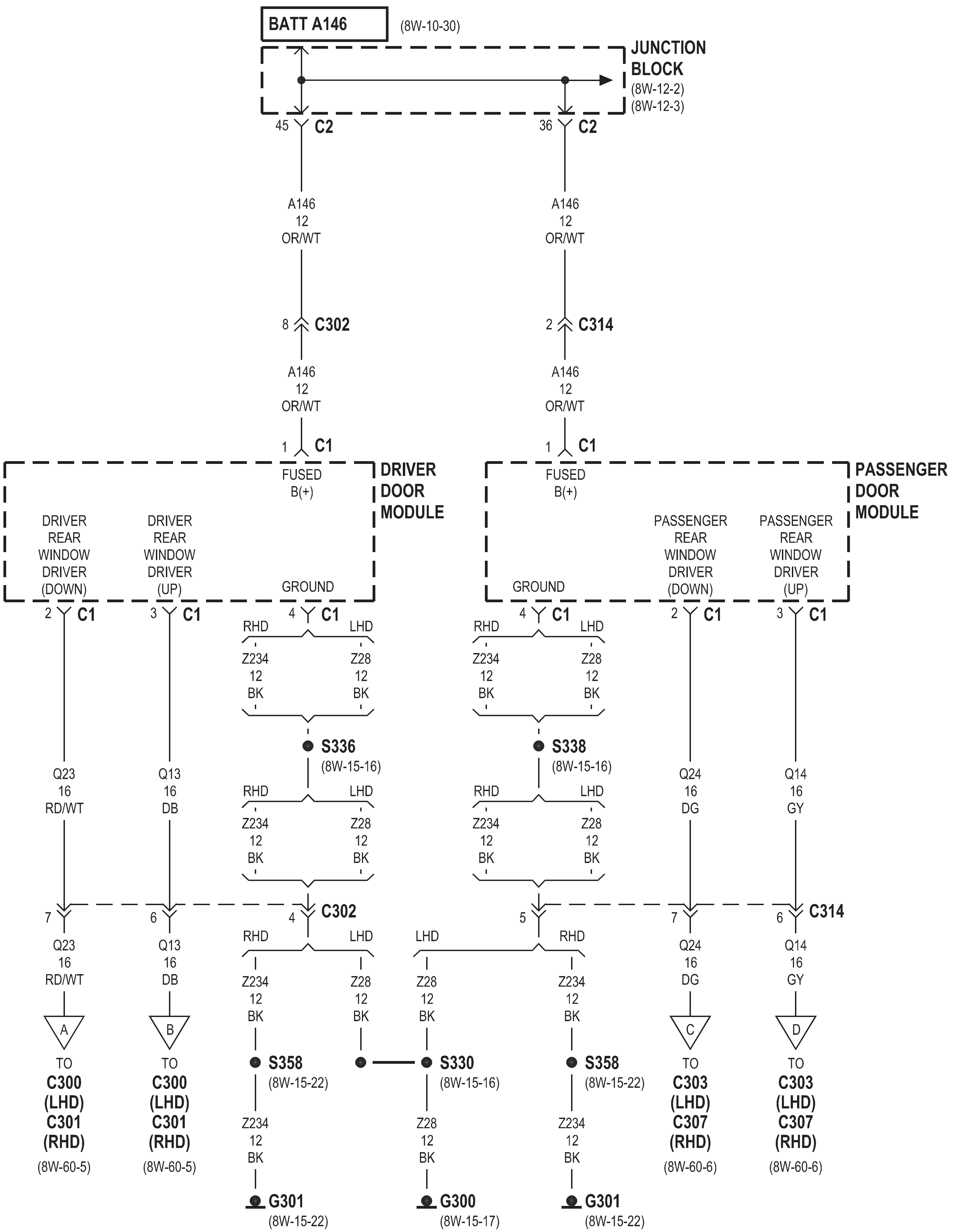
8W-60 POWER WINDOWS

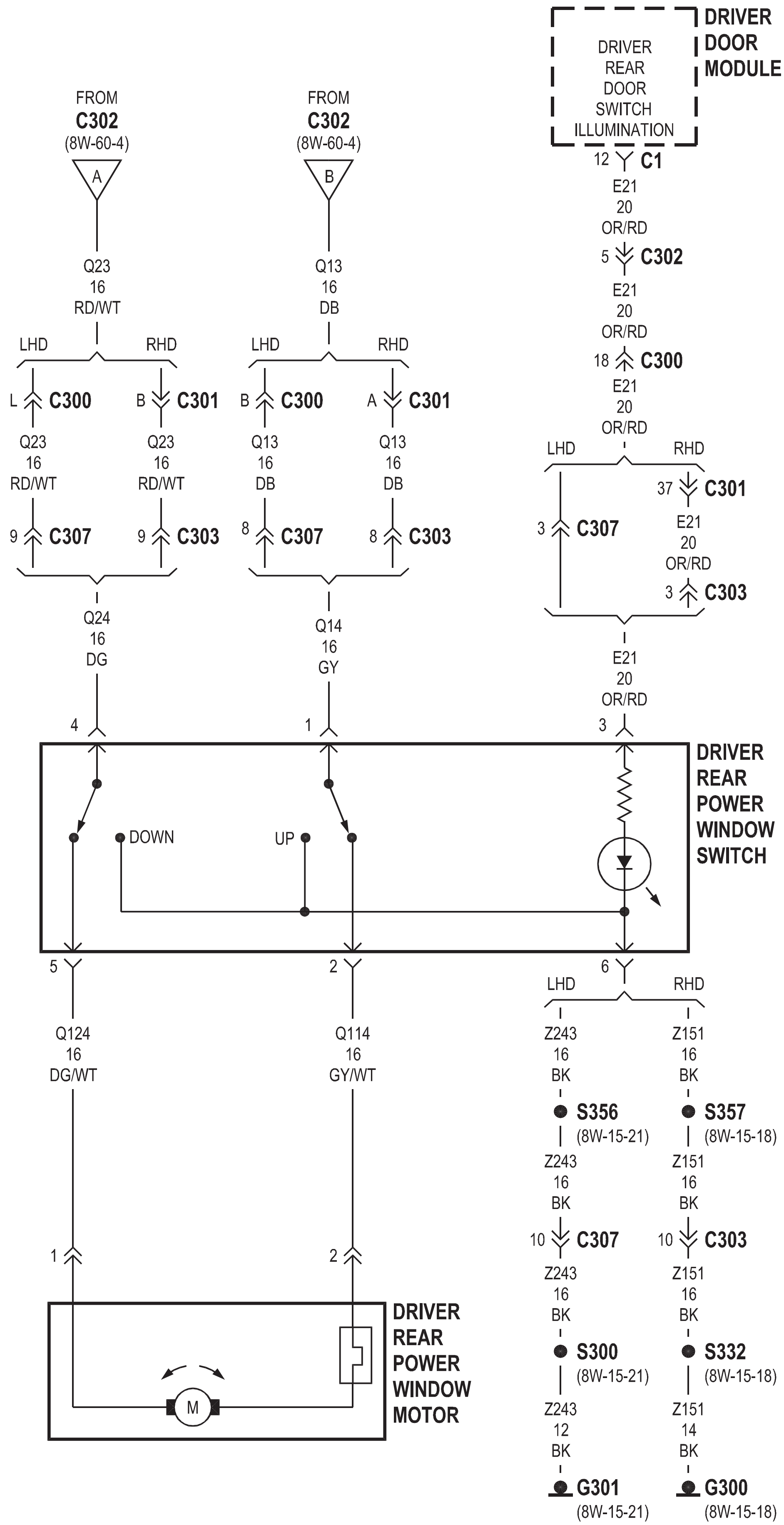
LHD



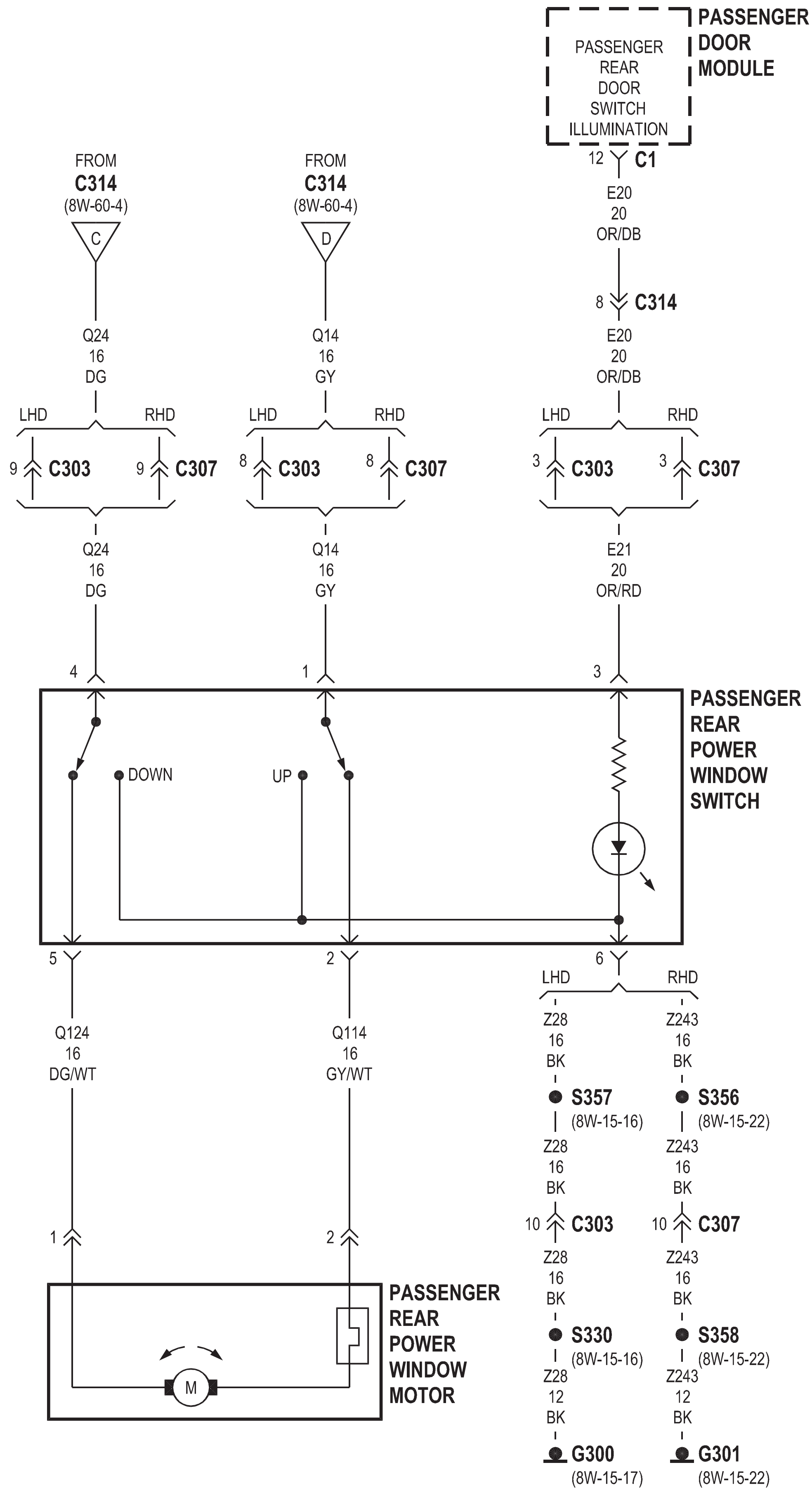
J028W-19 WJI06002


BODY CONTROL MODULE
(8W-45-6)
PCI BUS
15 C1
D25 20 YL/VT/WT
6
DIAGNOSTIC JUNCTION PORT
(8W-18-7)
1
D25 20 YL/VT/BR
S210
(8W-18-7)
D25 20 YL/VT/BR
15 C200
D25 20 YL/VT
S324
(8W-18-5)
3
D25 20 YL/VT
9 C1
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 12 50A
(8W-10-30)
12
A146 10 OR/WT
GAS
DIESEL
H C106
H C107
A146 10 OR/WT
2 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
36 C2
45 C2
A146 12 OR/WT
8 C302
2
A146 12 OR/WT
1 C1
BODY CONTROL MODULE
(8W-45-6)
PCI BUS
15 C1
D25 20 YL/VT/WT
6
DIAGNOSTIC JUNCTION PORT
(8W-18-7)
8
D25 20 YL/VT/GY
14 C200
D25 20 YL/VT
S312
(8W-18-6)
D25 20 YL/VT
1 C314
D25 20 YL/VT
9 C1
DRIVER DOOR MODULE
PCI BUS
FUSED B(+)
DRIVER WINDOW DRIVER (DOWN)
DRIVER WINDOW DRIVER (UP)
GROUND
15 C1
13 C1
4 C1
PASSENGER DOOR MODULE
FUSED B(+)
PCI BUS
GROUND
PASSENGER WINDOW DRIVER (DOWN)
PASSENGER WINDOW DRIVER (UP)
4 C1
15 C1
13 C1
Q21 16 WT
Q11 16 LB
Z234 12 BK
S336
(8W-15-16)
4 C302
Z234 12 BK
Z234 12 BK
S338
(8W-15-16)
5 C314
Z234 12 BK
Q22 16 VT
Q12 16 BR
1
2
S358
(8W-15-22)
A234 12 BK
G301
(8W-15-22)
1
2
DRIVER FRONT POWER WINDOW MOTOR
M
PASSENGER FRONT POWER WINDOW MOTOR
M

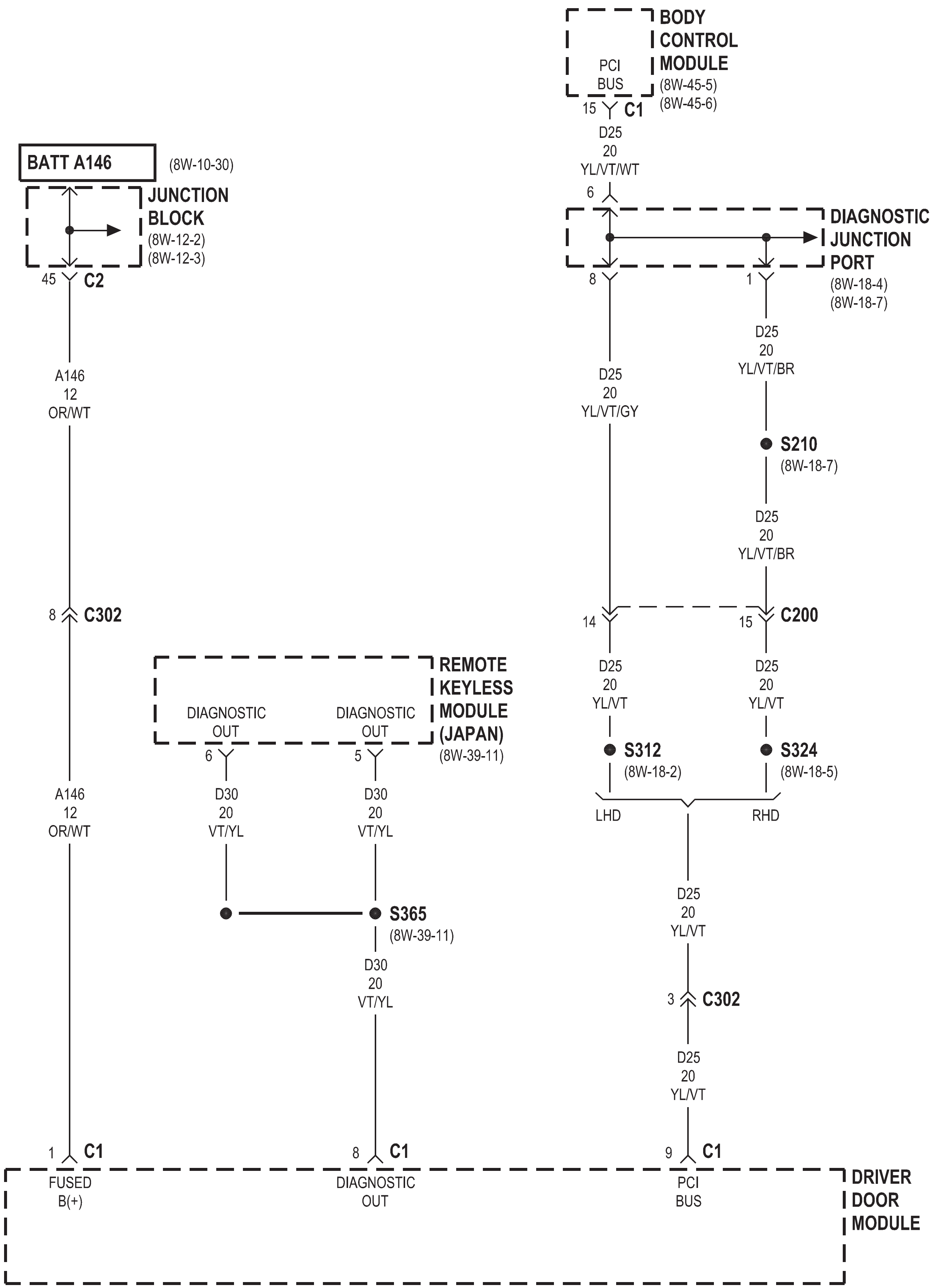

BATT A146
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
45 C2
36 C2
A146 12 OR/WT
8 C302
2 C314
A146 12 OR/WT
1 C1
FUSED B(+)
DRIVER DOOR MODULE
DRIVER REAR WINDOW DRIVER (DOWN)
DRIVER REAR WINDOW DRIVER (UP)
GROUND
PASSENGER DOOR MODULE
PASSENGER REAR WINDOW DRIVER (DOWN)
PASSENGER REAR WINDOW DRIVER (UP)
2 C1
3 C1
4 C1
RHD
LHD
Z234 12 BK
Z28 12 BK
S336
(8W-15-16)
S338
(8W-15-16)
Q23 16 RD/WT
Q13 16 DB
Q24 16 DG
Q14 16 GY
7
6
4 C302
5
C314
A
B
C
D
TO C300 (LHD) C301 (RHD)
(8W-60-5)
TO C303 (LHD) C307 (RHD)
(8W-60-6)
S358
(8W-15-22)
S330
(8W-15-16)
G301
(8W-15-22)
G300
(8W-15-17)

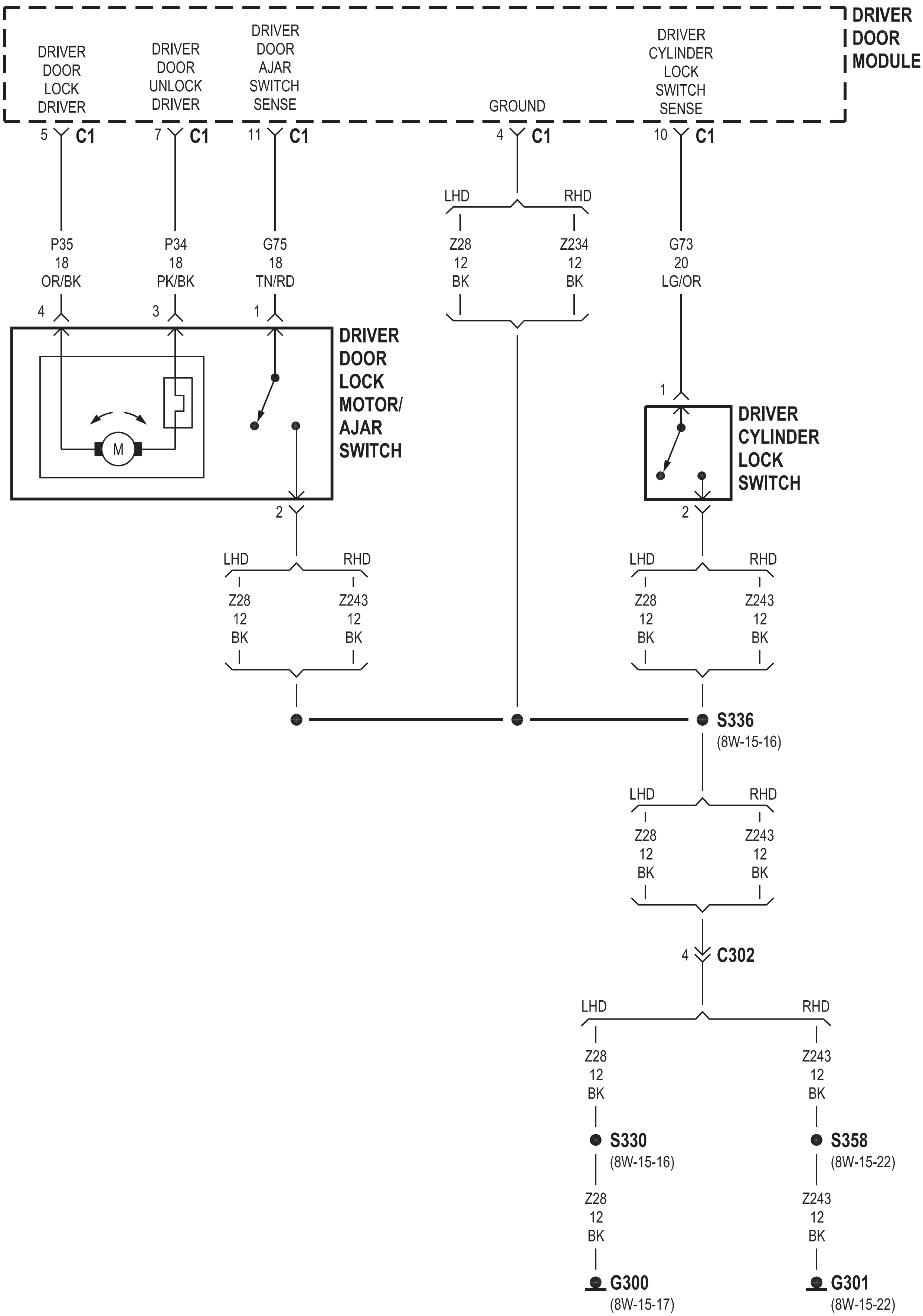


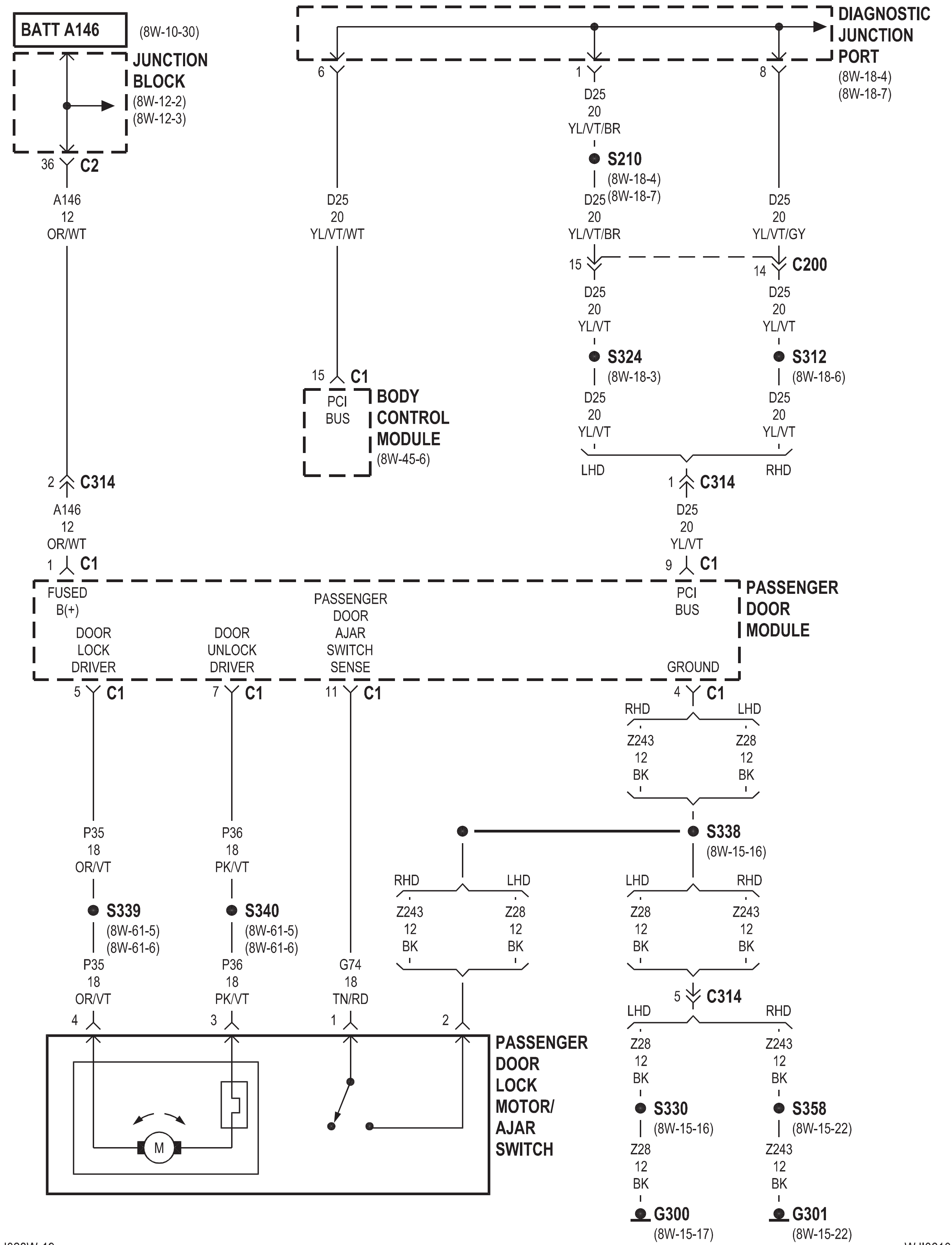
DRIVER REAR DOOR SWITCH ILLUMINATION
DRIVER DOOR MODULE
FROM C302 (8W-60-4)
A
B
Q23 16 RD/WT
Q13 16 DB
LHD
RHD
L C300
B C301
B C300
A C301
12 C1
E21 20 OR/RD
5 C302
18 C300
37 C301
9 C307
9 C303
8 C307
8 C303
3 C307
3 C303
Q24 16 DG
Q14 16 GY
DOWN
UP
DRIVER REAR POWER WINDOW SWITCH
Q124 16 DG/WT
Q114 16 GY/WT
Z243 16 BK
Z151 16 BK
S356 (8W-15-21)
S357 (8W-15-18)
10 C307
10 C303
S300 (8W-15-21)
S332 (8W-15-18)
Z243 12 BK
Z151 14 BK
G301 (8W-15-21)
G300 (8W-15-18)
M
DRIVER REAR POWER WINDOW MOTOR


PASSENGER DOOR MODULE
PASSENGER REAR DOOR SWITCH ILLUMINATION
12 C1
E20 20 OR/DB
8 C314
E20 20 OR/DB
FROM C314 (8W-60-4) C
Q24 16 DG
FROM C314 (8W-60-4) D
Q14 16 GY
LHD RHD
9 C303 9 C307
8 C303 8 C307
3 C303 3 C307
Q24 16 DG
Q14 16 GY
E21 20 OR/RD
4 1 3
DOWN
UP
PASSENGER REAR POWER WINDOW SWITCH
5 2 6
Q124 16 DG/WT
Q114 16 GY/WT
Z28 16 BK
Z243 16 BK
S357 (8W-15-16)
S356 (8W-15-22)
10 C303
10 C307
S330 (8W-15-16)
S358 (8W-15-22)
Z28 12 BK
Z243 12 BK
G300 (8W-15-17)
G301 (8W-15-22)
1 2
M
PASSENGER REAR POWER WINDOW MOTOR

8W-61 POWER DOOR LOCKS

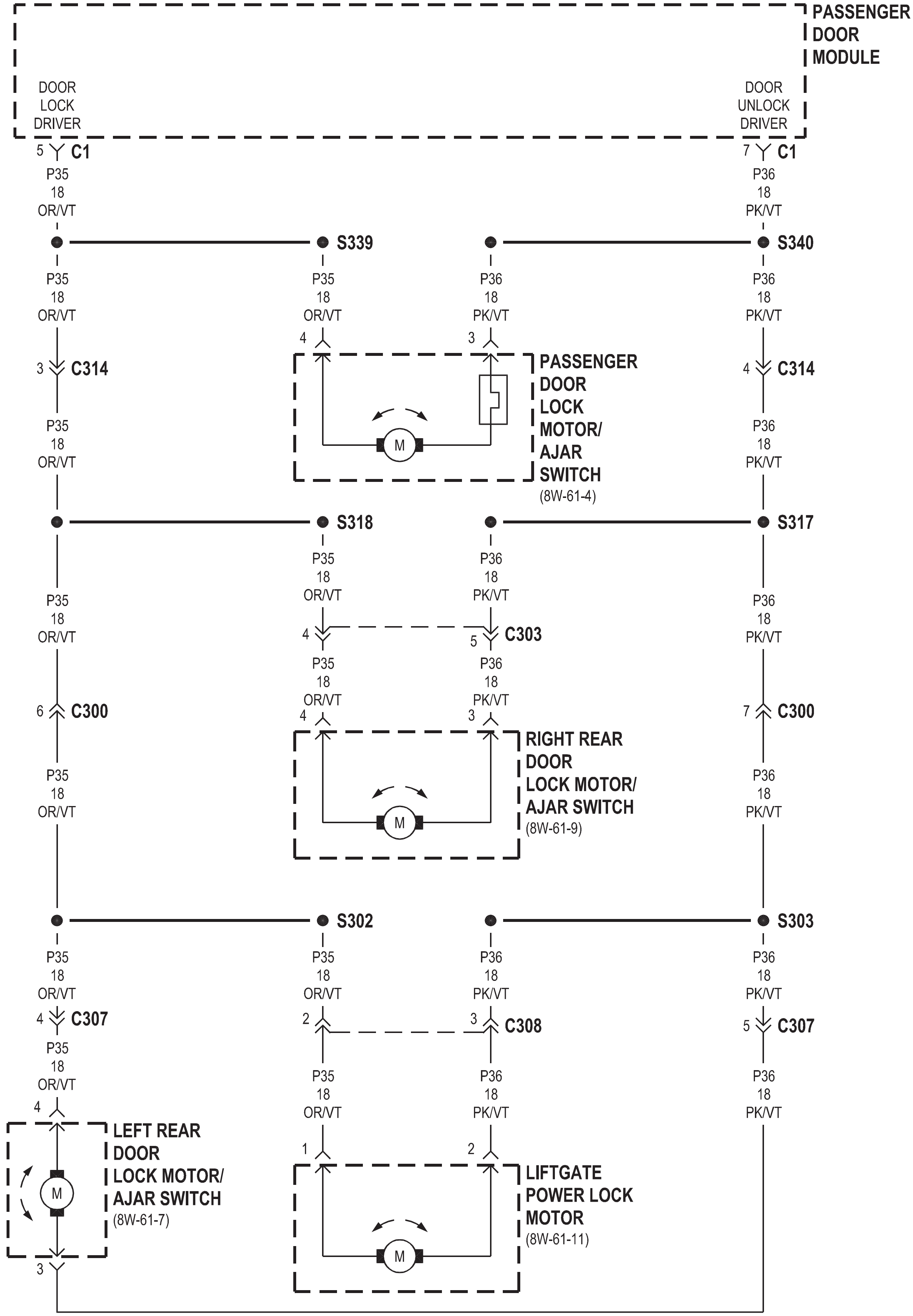

BODY CONTROL MODULE
PCI BUS
(8W-45-5)
(8W-45-6)
15 C1
D25 20 YL/VT/WT
6
DIAGNOSTIC JUNCTION PORT
(8W-18-4)
(8W-18-7)
8
1
BATT A146
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
45 C2
A146 12 OR/WT
D25 20 YL/VT/GY
D25 20 YL/VT/BR
S210
(8W-18-7)
D25 20 YL/VT/BR
8 C302
14
15 C200
REMOTE KEYLESS MODULE (JAPAN)
(8W-39-11)
DIAGNOSTIC OUT
DIAGNOSTIC OUT
6
5
D25 20 YL/VT
D25 20 YL/VT
S312
(8W-18-2)
S324
(8W-18-5)
LHD
RHD
A146 12 OR/WT
D30 20 VT/YL
D30 20 VT/YL
S365
(8W-39-11)
D30 20 VT/YL
D25 20 YL/VT
3 C302
D25 20 YL/VT
1 C1
8 C1
9 C1
FUSED B(+)
DIAGNOSTIC OUT
PCI BUS
DRIVER DOOR MODULE


DRIVER DOOR MODULE
DRIVER DOOR LOCK DRIVER
DRIVER DOOR UNLOCK DRIVER
DRIVER DOOR AJAR SWITCH SENSE
GROUND
DRIVER CYLINDER LOCK SWITCH SENSE
5 C1
7 C1
11 C1
4 C1
10 C1
P35 18 OR/BK
P34 18 PK/BK
G75 18 TN/RD
LHD RHD
Z28 12 BK
Z234 12 BK
G73 20 LG/OR
4
3
1
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
M
2
1
DRIVER CYLINDER LOCK SWITCH
2
Z28 12 BK
Z243 12 BK
S336 (8W-15-16)
4 C302
S330 (8W-15-16)
S358 (8W-15-22)
G300 (8W-15-17)
G301 (8W-15-22)

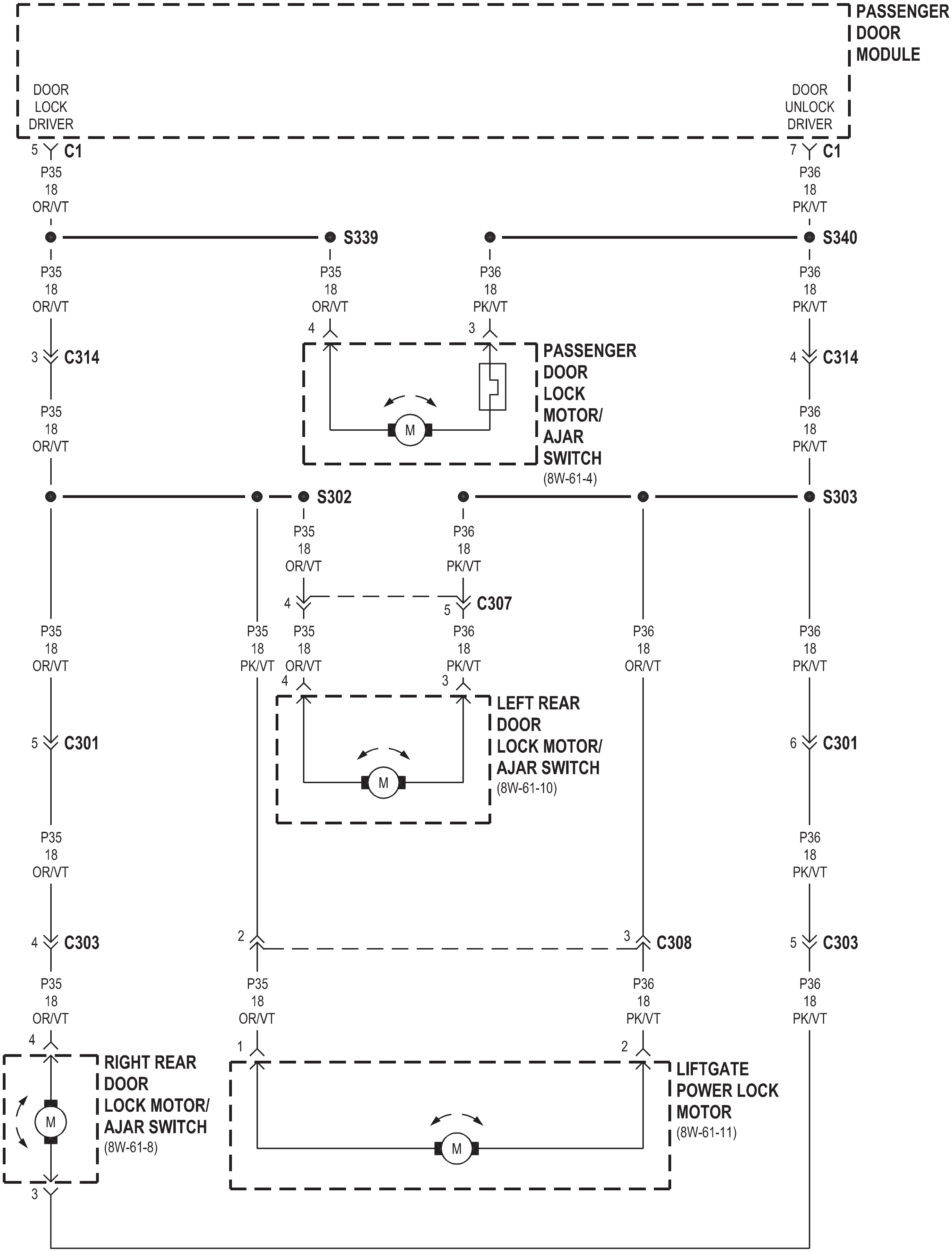


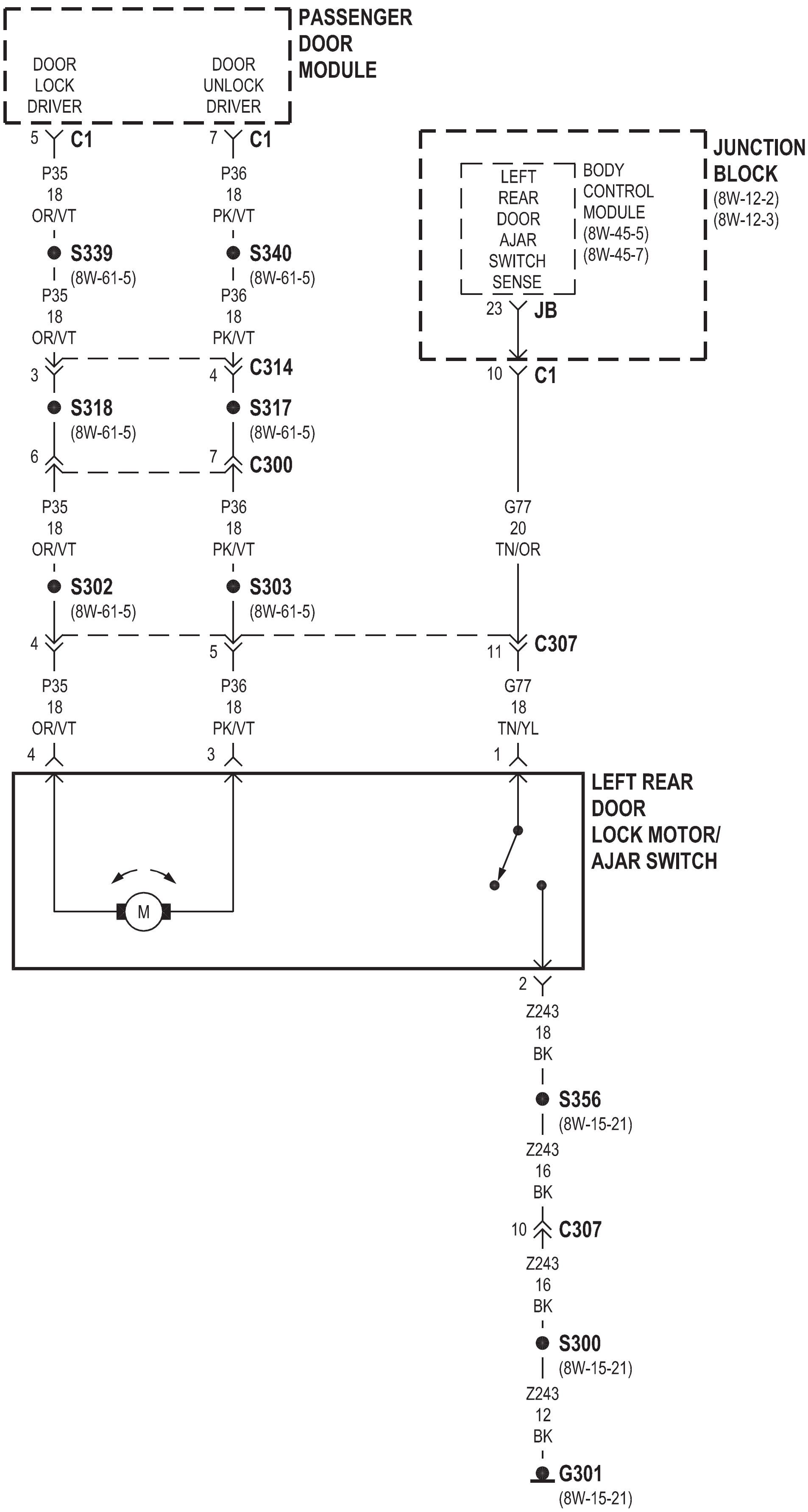
J028W-19 WJI06104

LHD

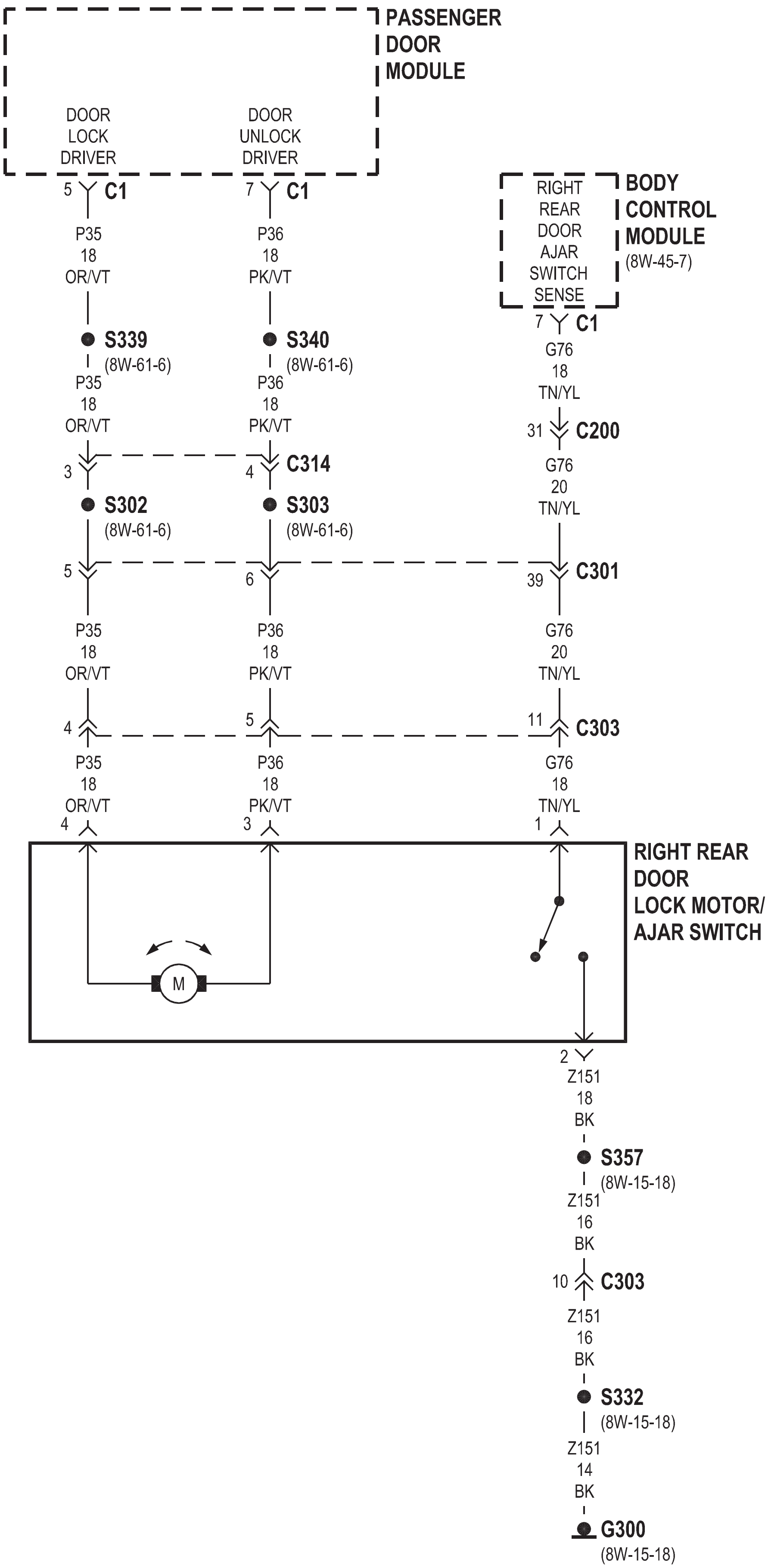

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339
S340
C314
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
S318
S317
C303
C300
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-9)
S302
S303
C307
C308
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
LIFTGATE POWER LOCK MOTOR
(8W-61-11)
M

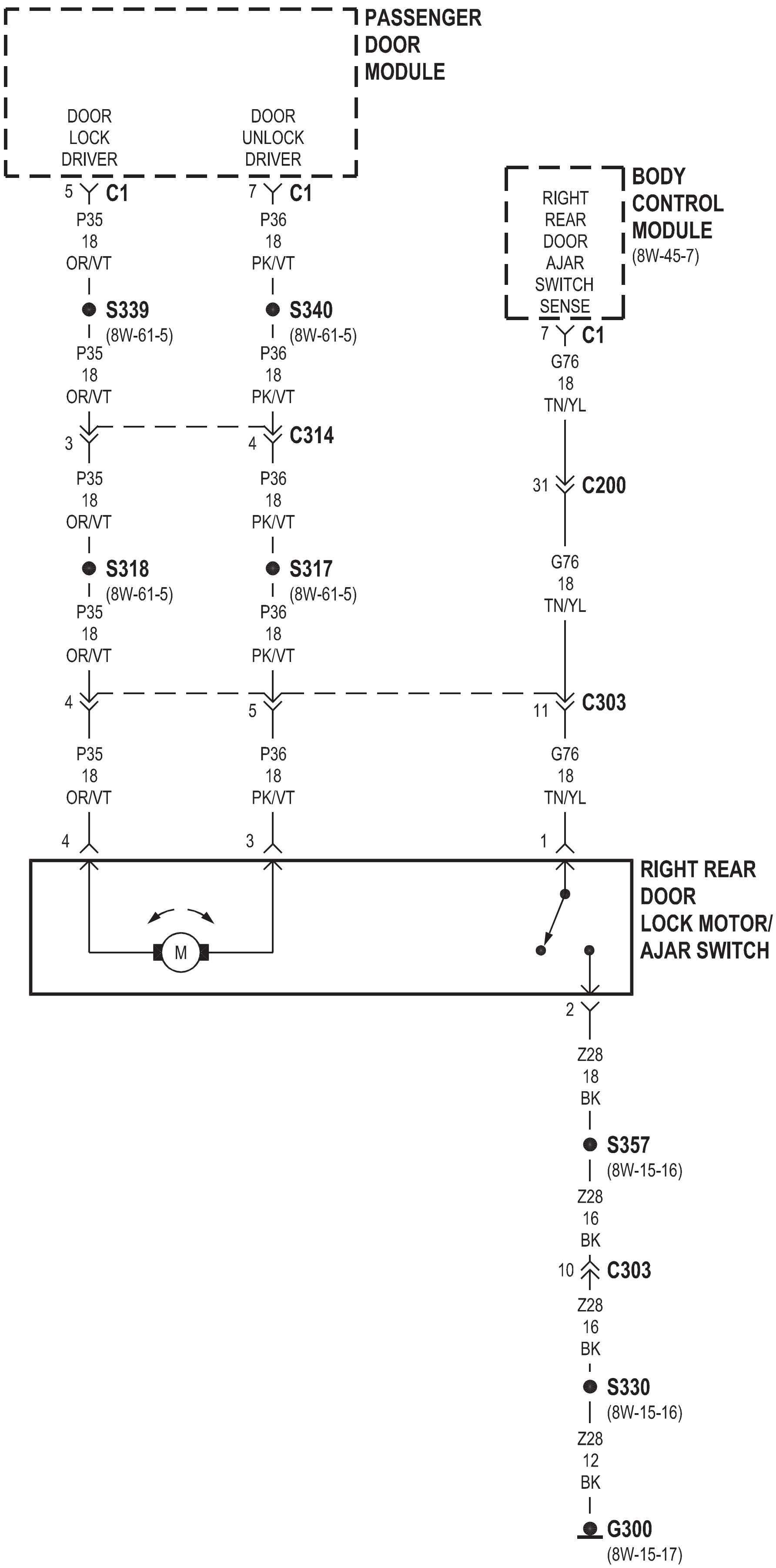
RHD

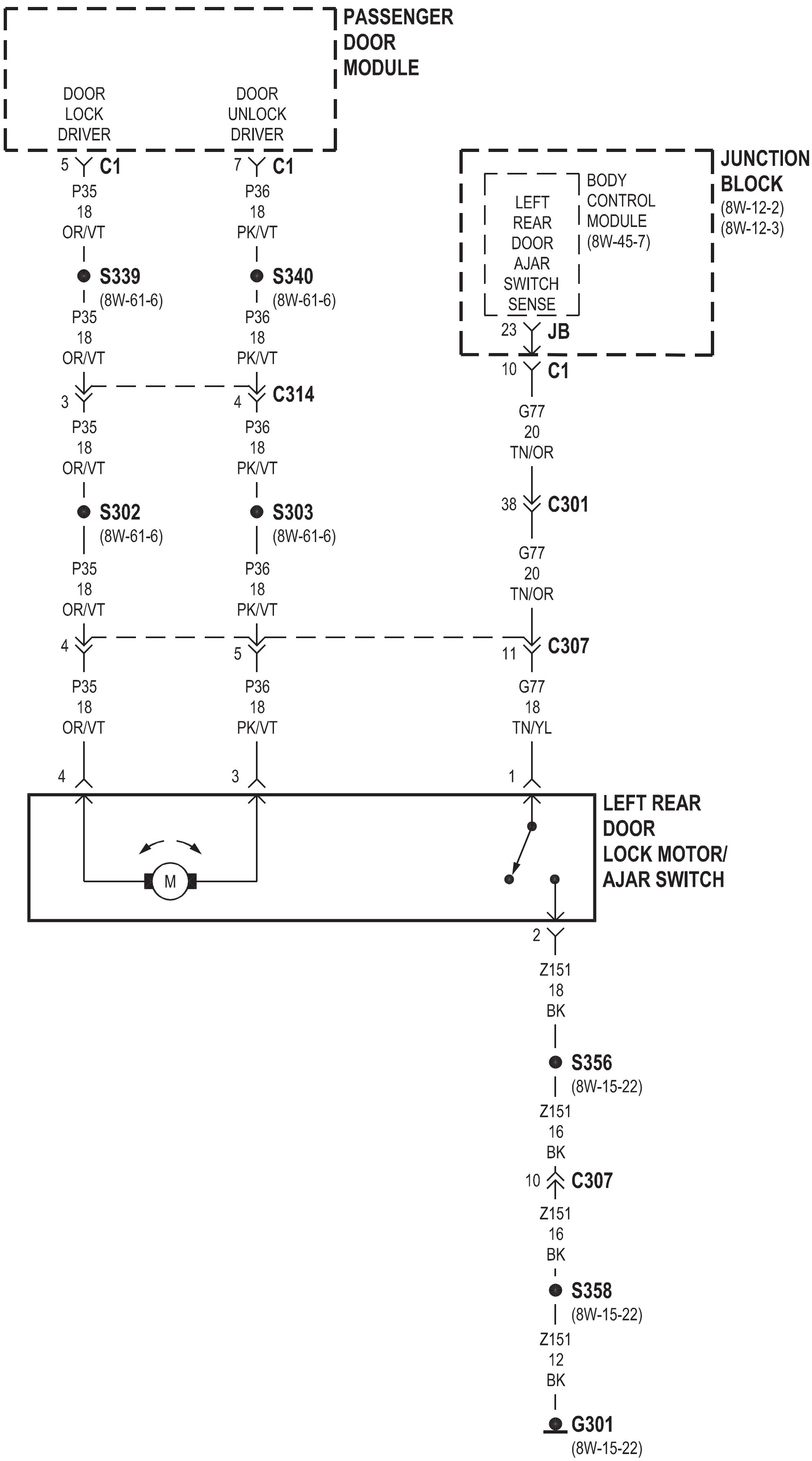

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339
S340
4
3
C314
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH (8W-61-4)
M
S302
S303
C307
P35 18 PK/VT
P36 18 OR/VT
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH (8W-61-10)
5 C301
6 C301
C308
4 C303
5 C303
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH (8W-61-8)
LIFTGATE POWER LOCK MOTOR (8W-61-11)

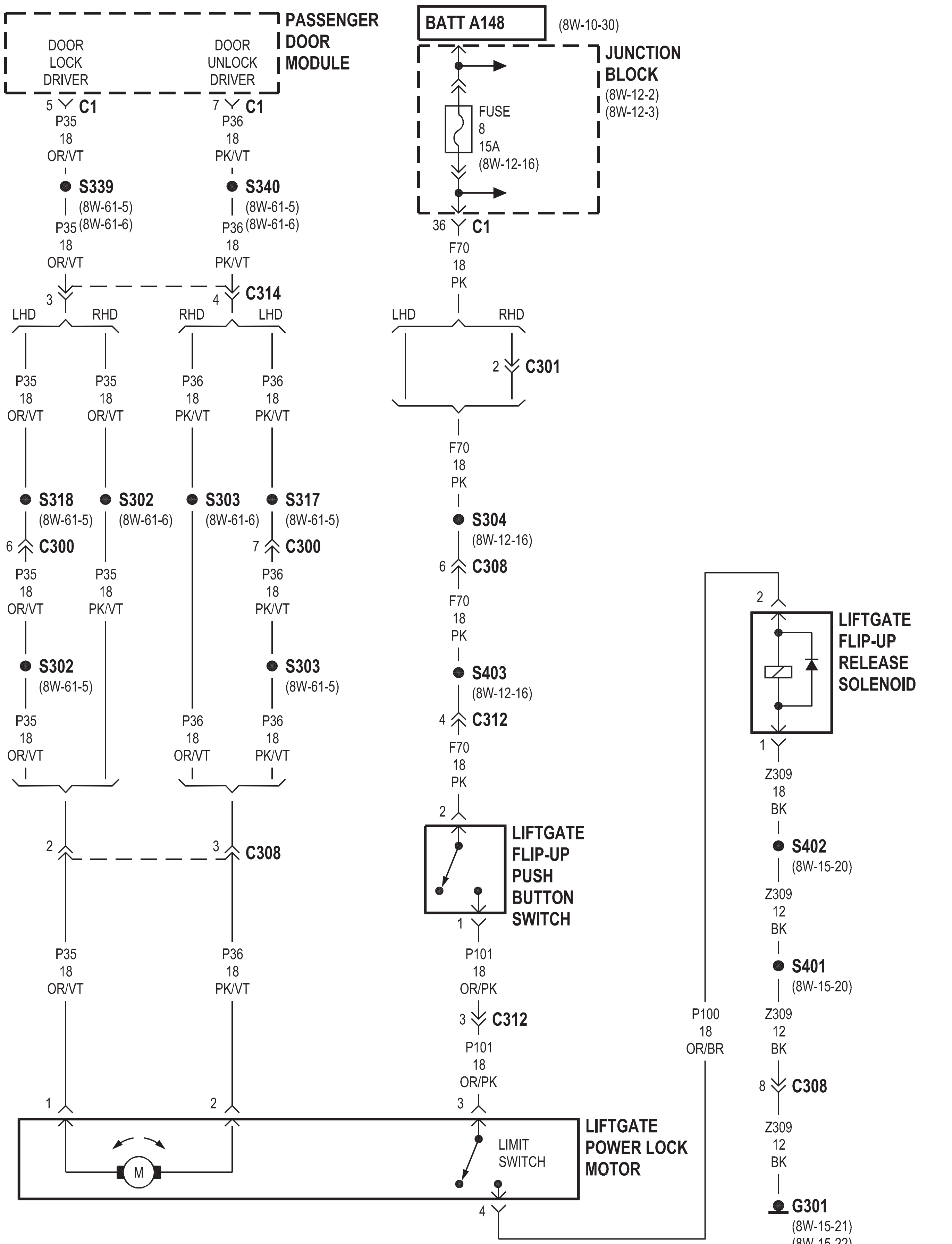

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339 (8W-61-5)
S340 (8W-61-5)
P35 18 OR/VT
P36 18 PK/VT
3 4 C314
S318 (8W-61-5)
S317 (8W-61-5)
6 7 C300
P35 18 OR/VT
P36 18 PK/VT
S302 (8W-61-5)
S303 (8W-61-5)
4 5 11 C307
P35 18 OR/VT
P36 18 PK/VT
G77 18 TN/YL
4 3 1
JUNCTION BLOCK (8W-12-2) (8W-12-3)
LEFT REAR DOOR AJAR SWITCH SENSE
BODY CONTROL MODULE (8W-45-5) (8W-45-7)
23 JB
10 C1
G77 20 TN/OR
M
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
2
Z243 18 BK
S356 (8W-15-21)
Z243 16 BK
10 C307
Z243 16 BK
S300 (8W-15-21)
Z243 12 BK
G301 (8W-15-21)

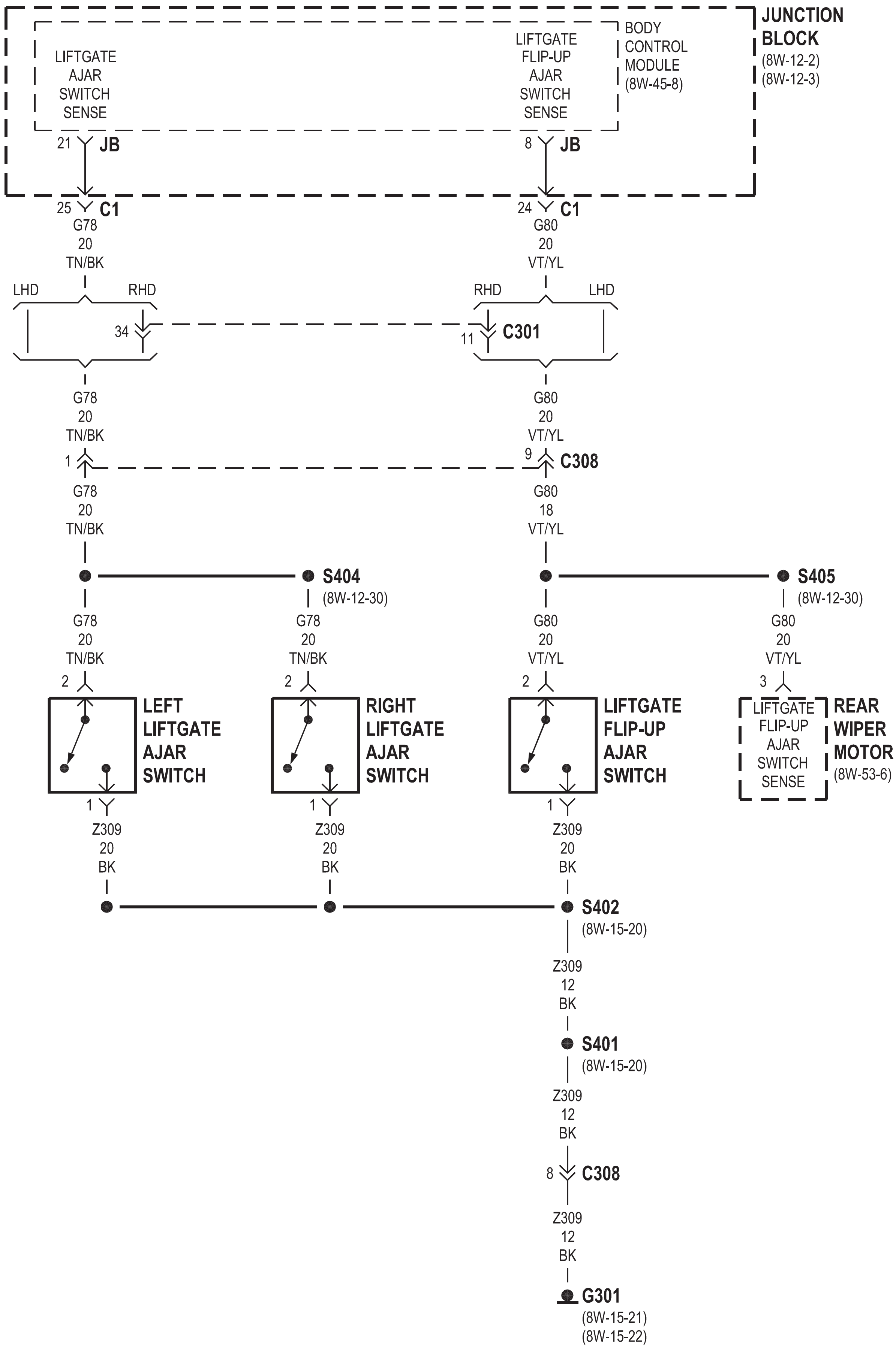
RHD


PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
BODY CONTROL MODULE
(8W-45-7)
RIGHT REAR DOOR AJAR SWITCH SENSE
7 C1
G76 18 TN/YL
S339
(8W-61-6)
S340
(8W-61-6)
31 C200
G76 20 TN/YL
3
4 C314
S302
(8W-61-6)
S303
(8W-61-6)
5
6
39 C301
4
5
11 C303
G76 18 TN/YL
4
3
1
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
M
2
Z151 18 BK
S357
(8W-15-18)
Z151 16 BK
10 C303
S332
(8W-15-18)
Z151 14 BK
G300
(8W-15-18)


PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339 (8W-61-5)
S340 (8W-61-5)
BODY CONTROL MODULE (8W-45-7)
RIGHT REAR DOOR AJAR SWITCH SENSE
7 C1
G76 18 TN/YL
3 4 C314
31 C200
S318 (8W-61-5)
S317 (8W-61-5)
4 5 11 C303
4 3 1
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
M
2
Z28 18 BK
S357 (8W-15-16)
Z28 16 BK
10 C303
S330 (8W-15-16)
Z28 12 BK
G300 (8W-15-17)

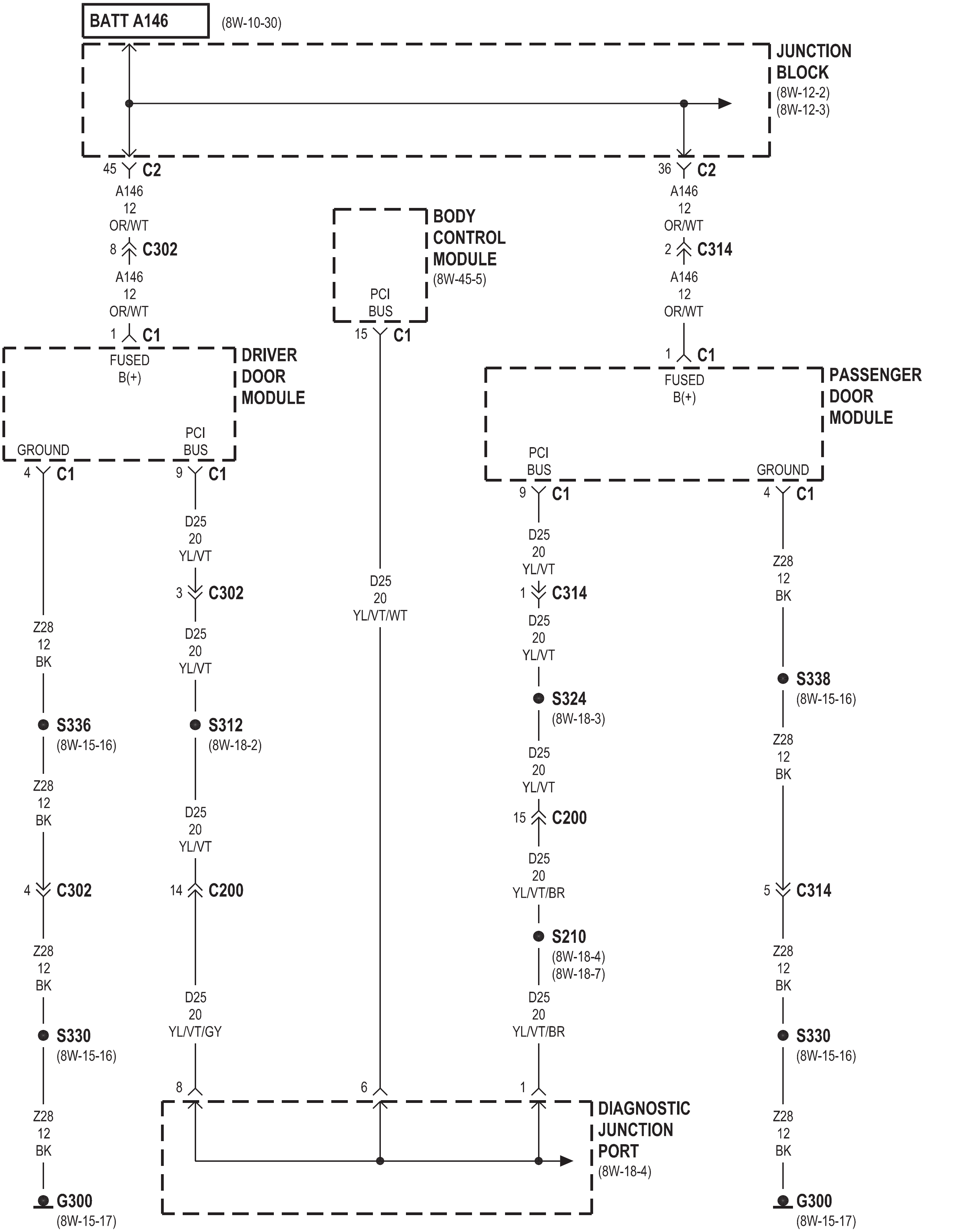

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339 (8W-61-6)
S340 (8W-61-6)
3 4 C314
S302 (8W-61-6)
S303 (8W-61-6)
4 5 11 C307
JUNCTION BLOCK (8W-12-2) (8W-12-3)
BODY CONTROL MODULE (8W-45-7)
LEFT REAR DOOR AJAR SWITCH SENSE
23 JB
10 C1
G77 20 TN/OR
38 C301
G77 18 TN/YL
4 3 1
M
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
2
Z151 18 BK
S356 (8W-15-22)
Z151 16 BK
10 C307
S358 (8W-15-22)
Z151 12 BK
G301 (8W-15-22)

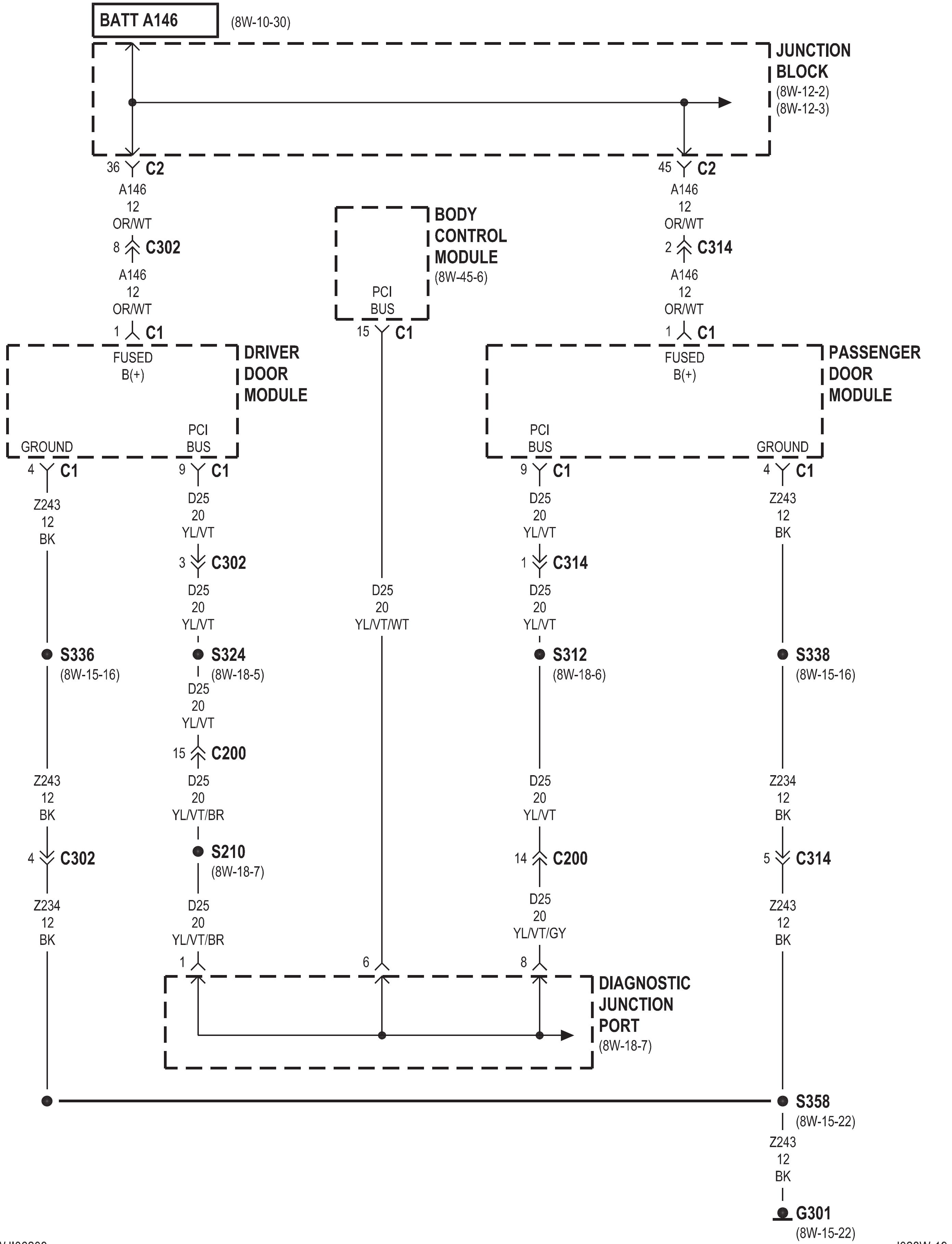

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1 P35 18 OR/VT
7 C1 P36 18 PK/VT
S339 (8W-61-5) (8W-61-6)
S340 (8W-61-5) (8W-61-6)
3 C314 4
LHD RHD RHD LHD
S318 (8W-61-5)
S302 (8W-61-6)
S303 (8W-61-6)
S317 (8W-61-5)
6 C300
7 C300
P35 18 PK/VT
P36 18 OR/VT
S302 (8W-61-5)
S303 (8W-61-5)
2 C308 3
BATT A148 (8W-10-30)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
FUSE 8 15A (8W-12-16)
36 C1
F70 18 PK
LHD RHD
2 C301
S304 (8W-12-16)
6 C308
S403 (8W-12-16)
4 C312
LIFTGATE FLIP-UP PUSH BUTTON SWITCH
P101 18 OR/PK
3 C312
LIFTGATE FLIP-UP RELEASE SOLENOID
Z309 18 BK
S402 (8W-15-20)
Z309 12 BK
S401 (8W-15-20)
8 C308
G301 (8W-15-21) (8W-15-22)
P100 18 OR/BR
LIFTGATE POWER LOCK MOTOR
M
LIMIT SWITCH

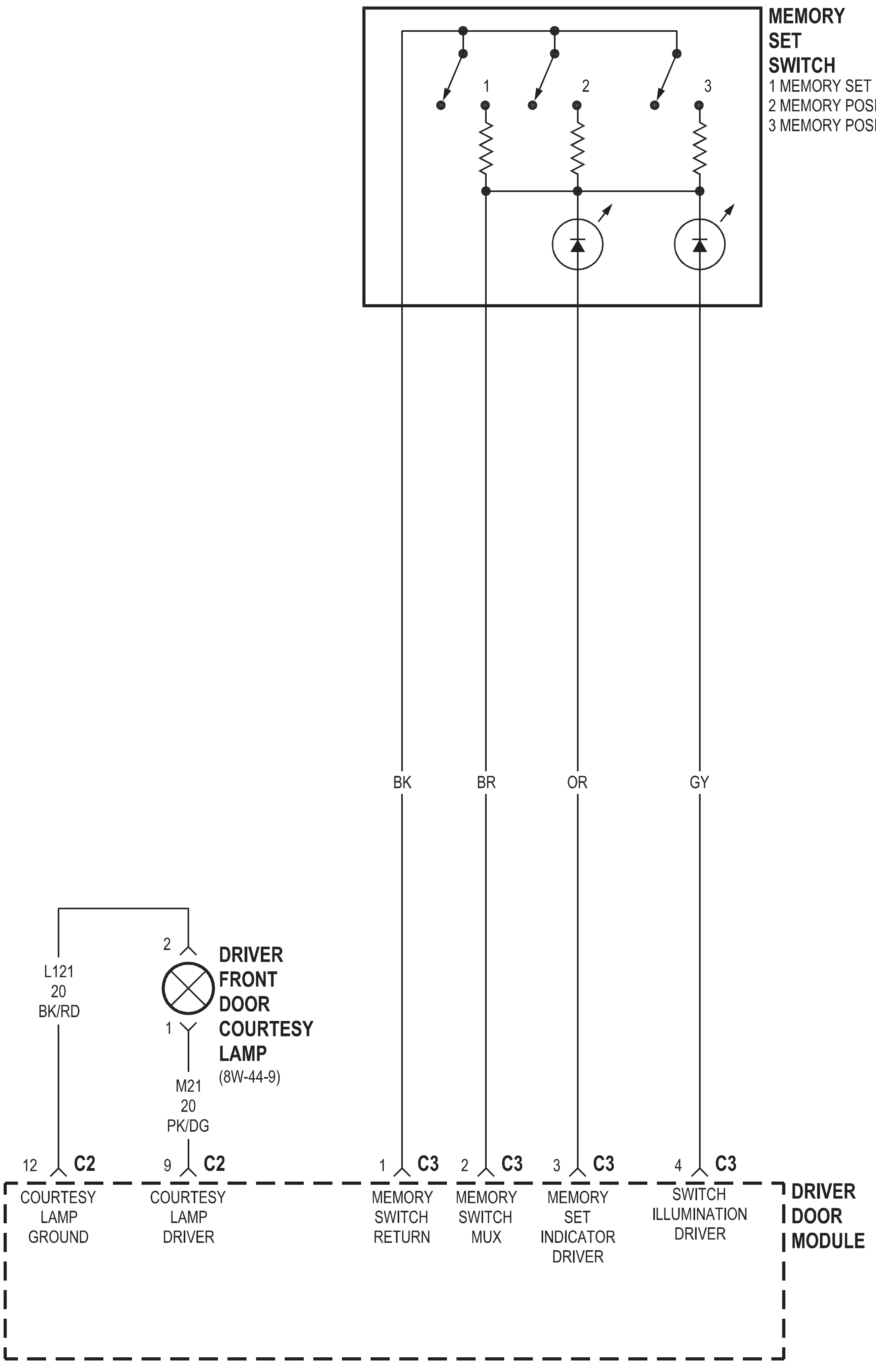

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
LIFTGATE AJAR SWITCH SENSE
LIFTGATE FLIP-UP AJAR SWITCH SENSE
21 JB
8 JB
25 C1
24 C1
G78 20 TN/BK
G80 20 VT/YL
LHD
RHD
RHD
LHD
34
11 C301
G78 20 TN/BK
G80 20 VT/YL
1
9 C308
G78 20 TN/BK
G80 18 VT/YL
S404
(8W-12-30)
S405
(8W-12-30)
G78 20 TN/BK
G78 20 TN/BK
G80 20 VT/YL
G80 20 VT/YL
2
2
2
3
LEFT LIFTGATE AJAR SWITCH
RIGHT LIFTGATE AJAR SWITCH
LIFTGATE FLIP-UP AJAR SWITCH
LIFTGATE FLIP-UP AJAR SWITCH SENSE
REAR WIPER MOTOR
(8W-53-6)
1
1
1
Z309 20 BK
Z309 20 BK
Z309 20 BK
S402
(8W-15-20)
Z309 12 BK
S401
(8W-15-20)
Z309 12 BK
8 C308
Z309 12 BK
G301
(8W-15-21)
(8W-15-22)

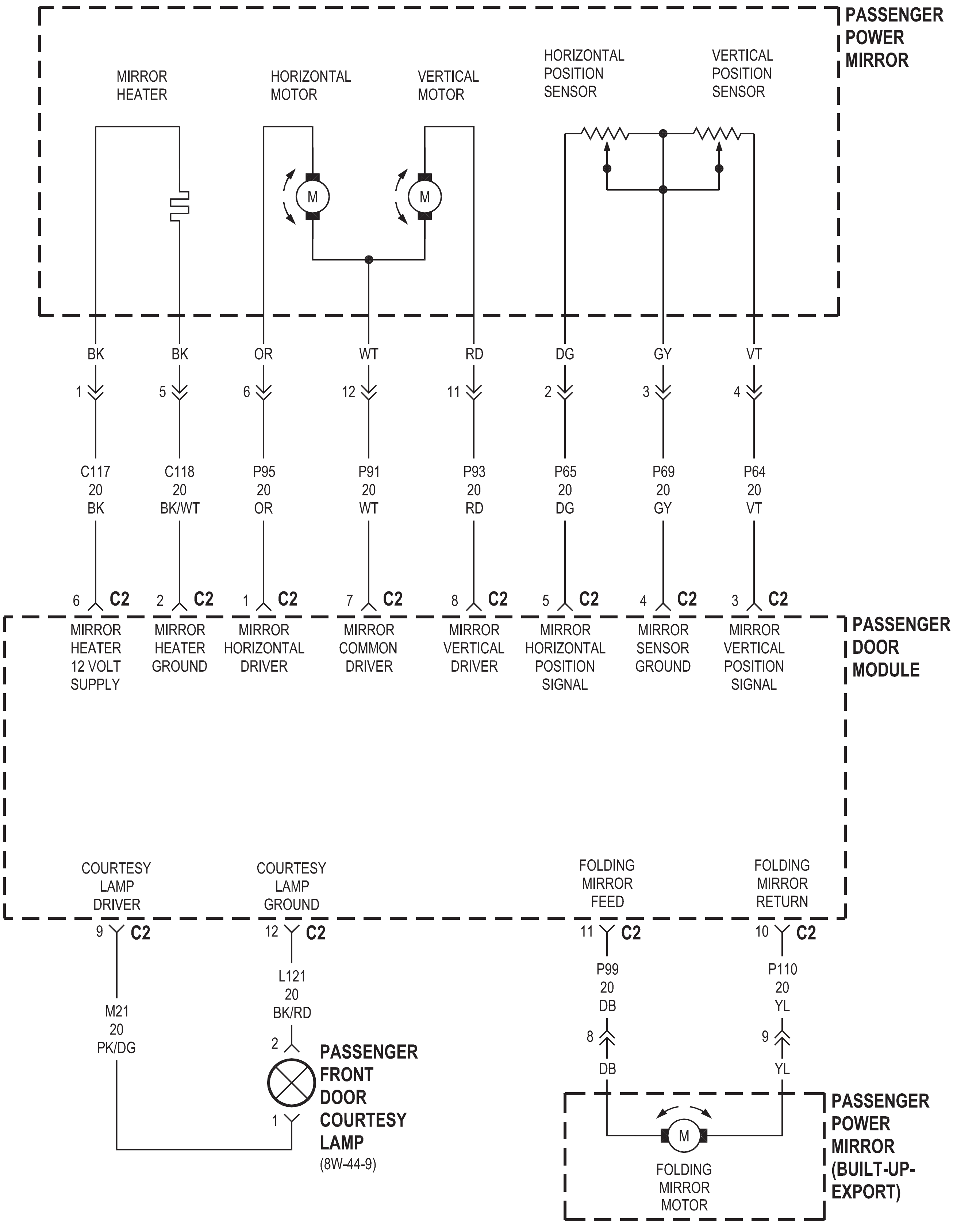
8W-62 POWER MIRRORS

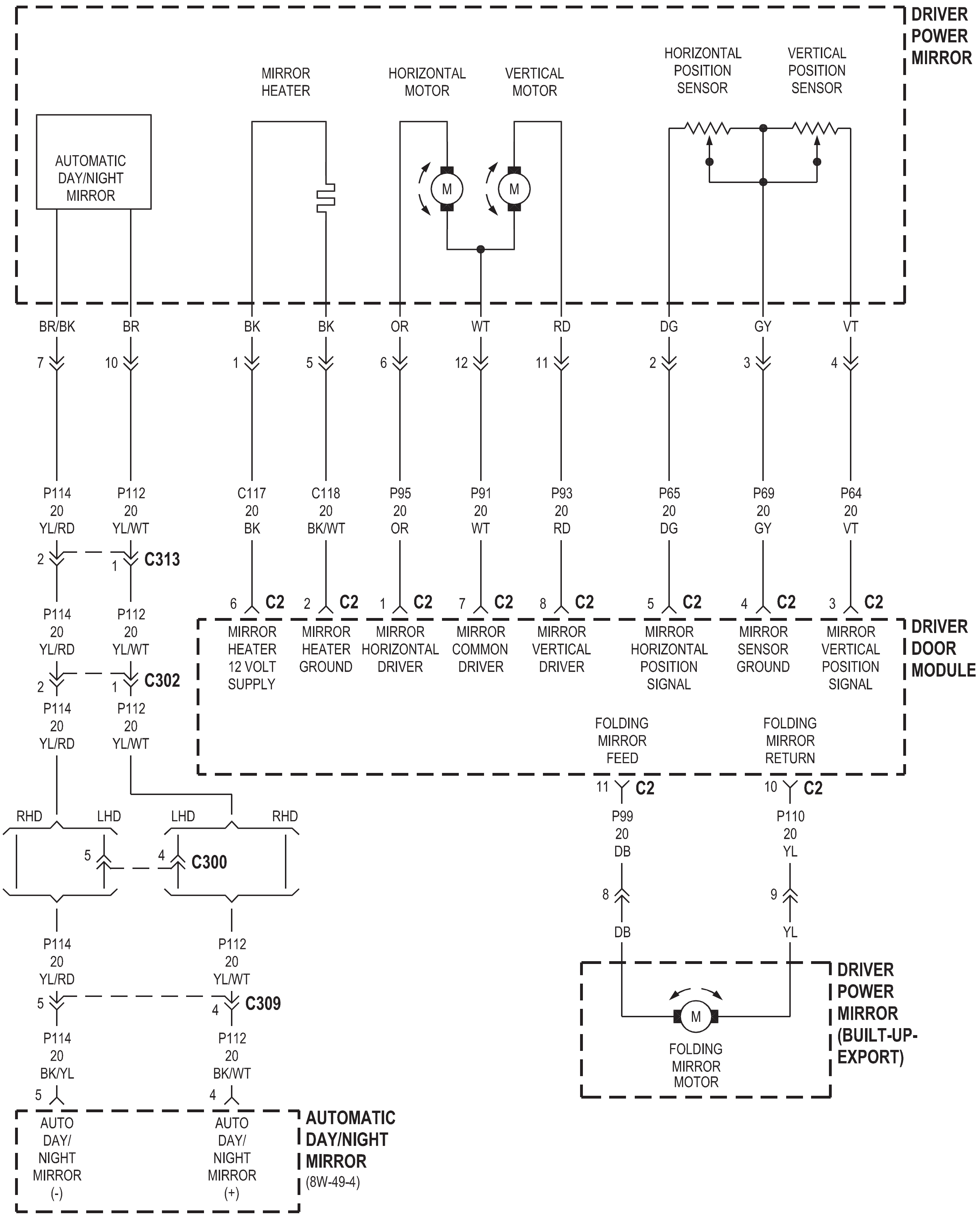
LHD


BATT A146
(8W-10-30)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
45 C2
A146
12
OR/WT
8 C302
A146
12
OR/WT
1 C1
FUSED
B(+)
DRIVER
DOOR
MODULE
GROUND
PCI
BUS
4 C1
9 C1
36 C2
A146
12
OR/WT
2 C314
A146
12
OR/WT
1 C1
FUSED
B(+)
PASSENGER
DOOR
MODULE
PCI
BUS
GROUND
9 C1
4 C1
BODY
CONTROL
MODULE
(8W-45-5)
PCI
BUS
15 C1
D25
20
YL/VT/WT
D25
20
YL/VT
3 C302
D25
20
YL/VT
S312
(8W-18-2)
D25
20
YL/VT
14 C200
D25
20
YL/VT/GY
Z28
12
BK
S336
(8W-15-16)
Z28
12
BK
4 C302
Z28
12
BK
S330
(8W-15-16)
Z28
12
BK
G300
(8W-15-17)
D25
20
YL/VT
1 C314
D25
20
YL/VT
S324
(8W-18-3)
D25
20
YL/VT
15 C200
D25
20
YL/VT/BR
S210
(8W-18-4)
(8W-18-7)
D25
20
YL/VT/BR
Z28
12
BK
S338
(8W-15-16)
Z28
12
BK
5 C314
Z28
12
BK
S330
(8W-15-16)
Z28
12
BK
G300
(8W-15-17)
8
6
1
DIAGNOSTIC
JUNCTION
PORT
(8W-18-4)


BATT A146
(8W-10-30)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
36 C2
A146
12
OR/WT
8 C302
A146
12
OR/WT
1 C1
FUSED
B(+)
DRIVER
DOOR
MODULE
GROUND
PCI
BUS
4 C1
9 C1
Z243
12
BK
D25
20
YL/VT
3 C302
D25
20
YL/VT
S336
(8W-15-16)
S324
(8W-18-5)
D25
20
YL/VT
15 C200
D25
20
YL/VT/BR
S210
(8W-18-7)
D25
20
YL/VT/BR
Z243
12
BK
4 C302
Z234
12
BK
BODY
CONTROL
MODULE
(8W-45-6)
PCI
BUS
15 C1
D25
20
YL/VT/WT
45 C2
A146
12
OR/WT
2 C314
A146
12
OR/WT
1 C1
FUSED
B(+)
PASSENGER
DOOR
MODULE
PCI
BUS
GROUND
9 C1
4 C1
D25
20
YL/VT
1 C314
D25
20
YL/VT
S312
(8W-18-6)
D25
20
YL/VT
14 C200
D25
20
YL/VT/GY
Z243
12
BK
S338
(8W-15-16)
Z234
12
BK
5 C314
Z243
12
BK
1
6
8
DIAGNOSTIC
JUNCTION
PORT
(8W-18-7)
S358
(8W-15-22)
Z243
12
BK
G301
(8W-15-22)


MEMORY
SET
SWITCH
1 MEMORY SET
2 MEMORY POSITION 1
3 MEMORY POSITION 2
1
2
3
BK
BR
OR
GY
L121
20
BK/RD
2
DRIVER
FRONT
DOOR
COURTESY
LAMP
(8W-44-9)
1
M21
20
PK/DG
12 C2
9 C2
1 C3
2 C3
3 C3
4 C3
COURTESY LAMP GROUND
COURTESY LAMP DRIVER
MEMORY SWITCH RETURN
MEMORY SWITCH MUX
MEMORY SET INDICATOR DRIVER
SWITCH ILLUMINATION DRIVER
DRIVER
DOOR
MODULE

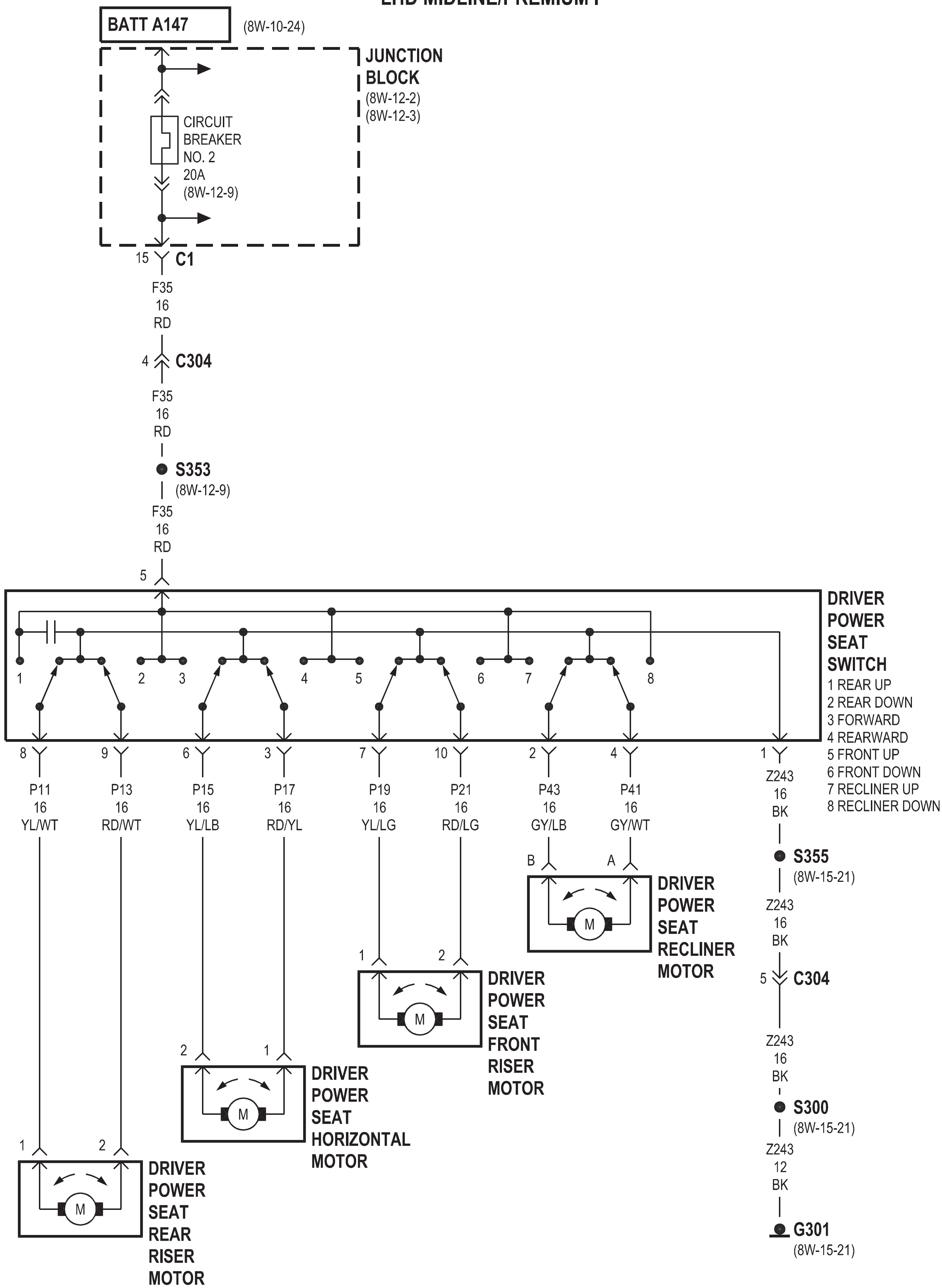

PASSENGER POWER MIRROR
MIRROR HEATER
HORIZONTAL MOTOR
VERTICAL MOTOR
HORIZONTAL POSITION SENSOR
VERTICAL POSITION SENSOR
M
M
BK
BK
OR
WT
RD
DG
GY
VT
1
5
6
12
11
2
3
4
C117 20 BK
C118 20 BK/WT
P95 20 OR
P91 20 WT
P93 20 RD
P65 20 DG
P69 20 GY
P64 20 VT
6 C2
2 C2
1 C2
7 C2
8 C2
5 C2
4 C2
3 C2
PASSENGER DOOR MODULE
MIRROR HEATER 12 VOLT SUPPLY
MIRROR HEATER GROUND
MIRROR HORIZONTAL DRIVER
MIRROR COMMON DRIVER
MIRROR VERTICAL DRIVER
MIRROR HORIZONTAL POSITION SIGNAL
MIRROR SENSOR GROUND
MIRROR VERTICAL POSITION SIGNAL
COURTESY LAMP DRIVER
COURTESY LAMP GROUND
FOLDING MIRROR FEED
FOLDING MIRROR RETURN
9 C2
12 C2
11 C2
10 C2
M21 20 PK/DG
L121 20 BK/RD
P99 20 DB
P110 20 YL
2
1
8
9
DB
YL
PASSENGER FRONT DOOR COURTESY LAMP
(8W-44-9)
M
FOLDING MIRROR MOTOR
PASSENGER POWER MIRROR (BUILT-UP-EXPORT)

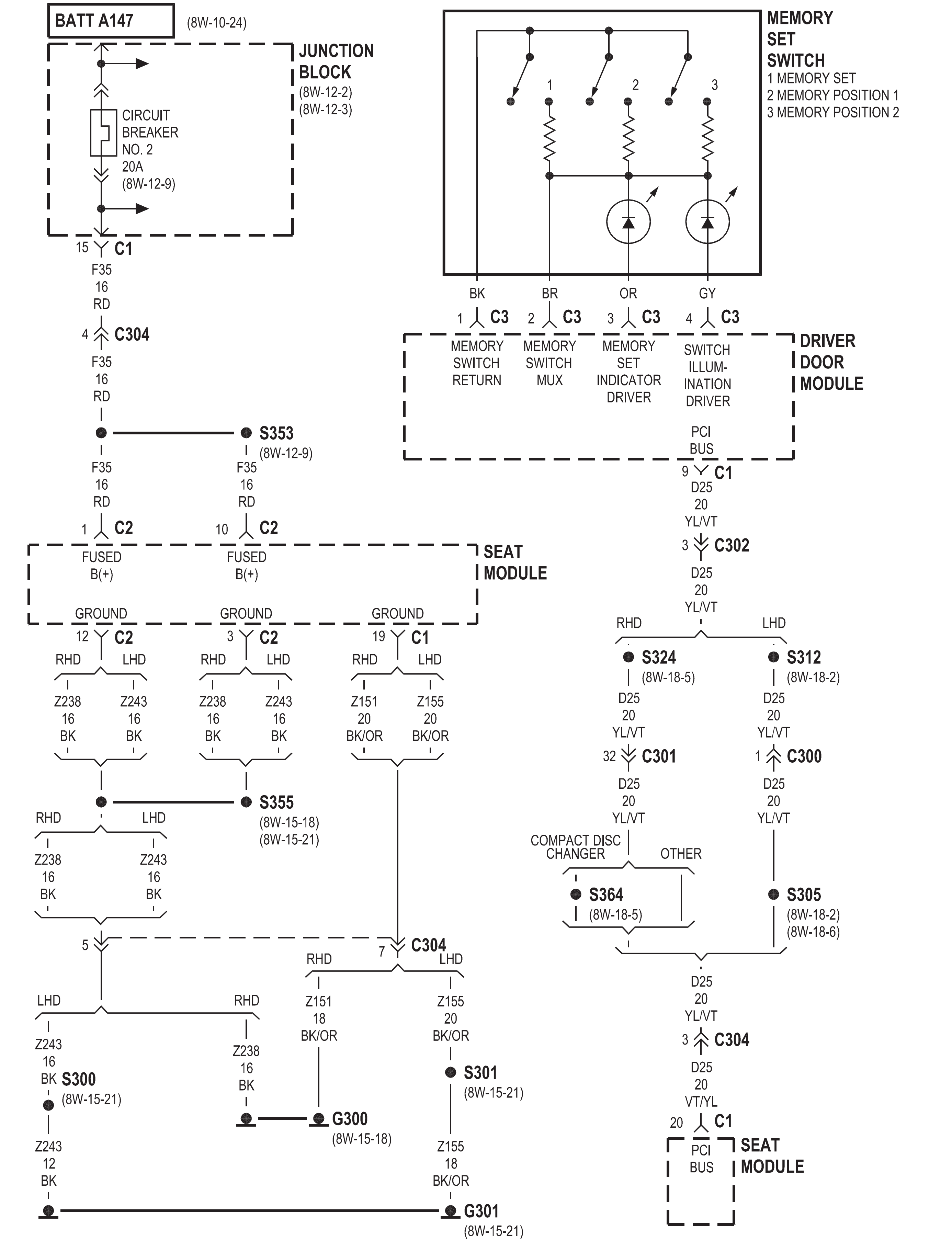


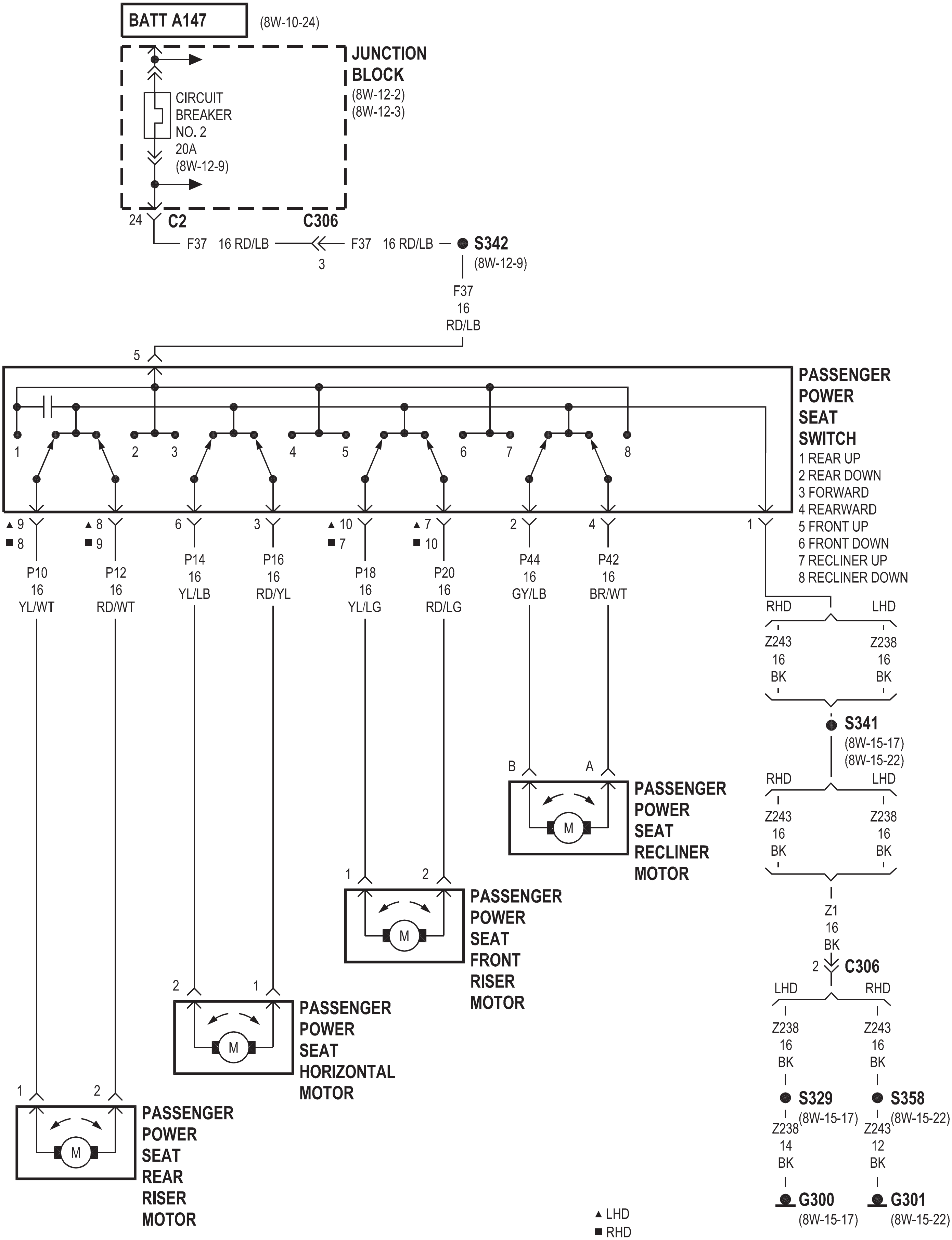
DRIVER POWER MIRROR
MIRROR HEATER
HORIZONTAL MOTOR
VERTICAL MOTOR
HORIZONTAL POSITION SENSOR
VERTICAL POSITION SENSOR
AUTOMATIC DAY/NIGHT MIRROR
M
M
BR/BK
BR
BK
BK
OR
WT
RD
DG
GY
VT
7
10
1
5
6
12
11
2
3
4
P114 20 YL/RD
P112 20 YL/WT
C117 20 BK
C118 20 BK/WT
P95 20 OR
P91 20 WT
P93 20 RD
P65 20 DG
P69 20 GY
P64 20 VT
2
1
C313
6 C2
2 C2
1 C2
7 C2
8 C2
5 C2
4 C2
3 C2
P114 20 YL/RD
P112 20 YL/WT
2
1
C302
P114 20 YL/RD
P112 20 YL/WT
DRIVER DOOR MODULE
MIRROR HEATER 12 VOLT SUPPLY
MIRROR HEATER GROUND
MIRROR HORIZONTAL DRIVER
MIRROR COMMON DRIVER
MIRROR VERTICAL DRIVER
MIRROR HORIZONTAL POSITION SIGNAL
MIRROR SENSOR GROUND
MIRROR VERTICAL POSITION SIGNAL
FOLDING MIRROR FEED
FOLDING MIRROR RETURN
11 C2
10 C2
P99 20 DB
P110 20 YL
RHD
LHD
LHD
RHD
5
4
C300
8
9
DB
YL
P114 20 YL/RD
P112 20 YL/WT
5
4
C309
P114 20 BK/YL
P112 20 BK/WT
5
4
DRIVER POWER MIRROR (BUILT-UP-EXPORT)
M
FOLDING MIRROR MOTOR
AUTO DAY/ NIGHT MIRROR (-)
AUTO DAY/ NIGHT MIRROR (+)
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-4)

8W-63 POWER SEATS

LHD MIDLINE/PREMIUM I

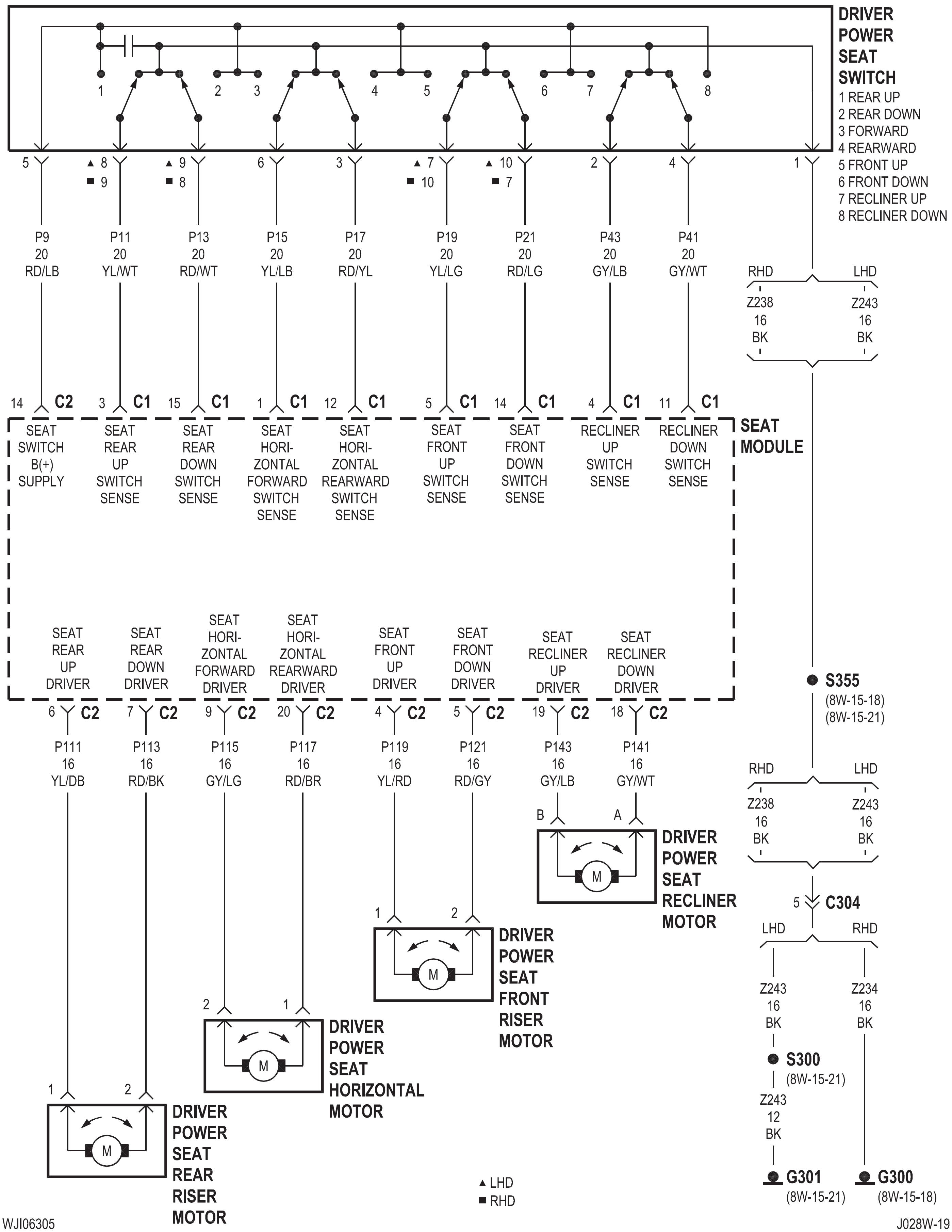


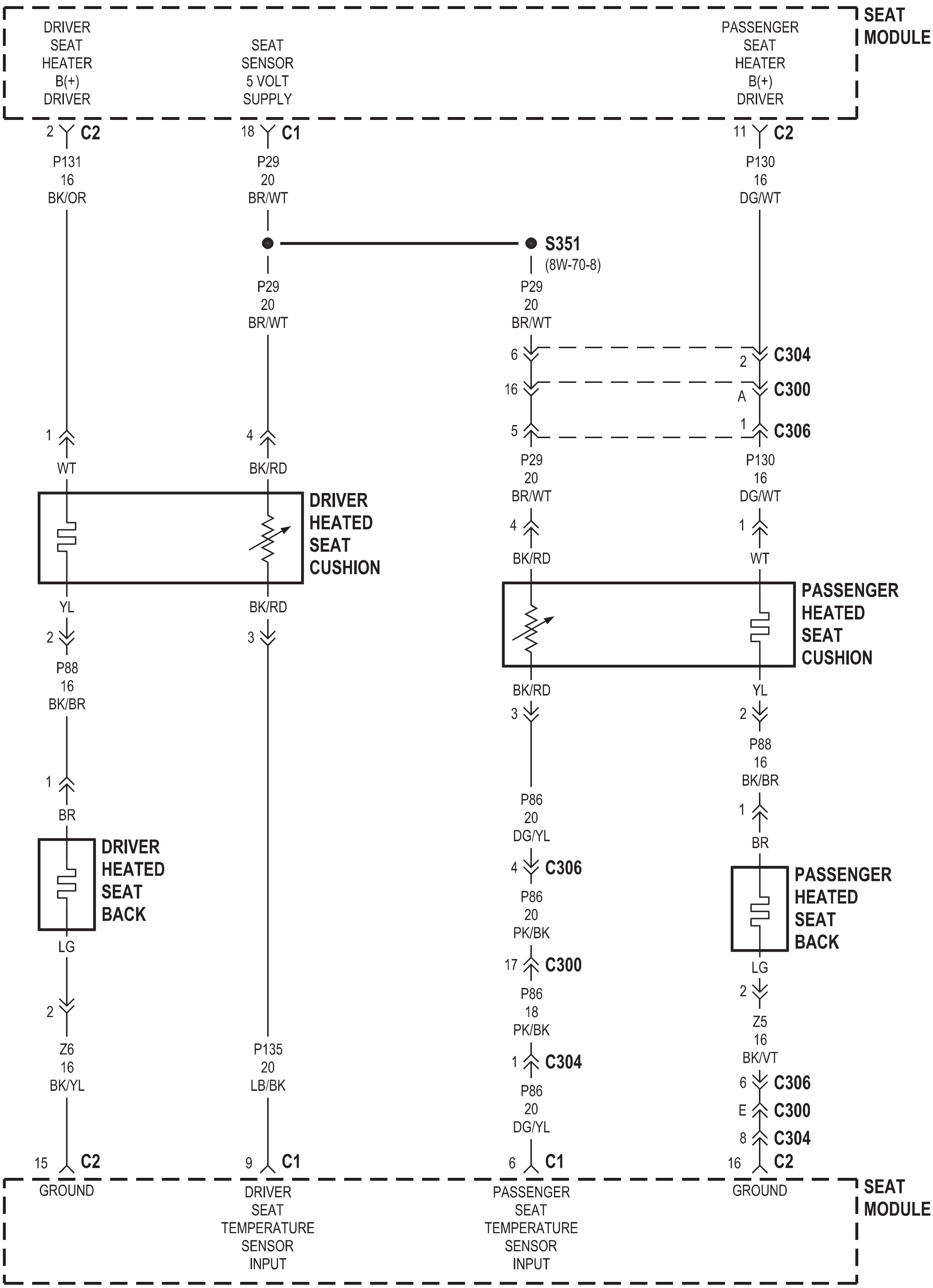

BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2
20A
(8W-12-9)
15 C1
F35
16
RD
4 C304
F35
16
RD
S353
(8W-12-9)
F35
16
RD
F35
16
RD
1 C2
10 C2
FUSED B(+)
FUSED B(+)
SEAT MODULE
GROUND
GROUND
GROUND
12 C2
3 C2
19 C1
RHD
LHD
Z238
16
BK
Z243
16
BK
Z151
20
BK/OR
Z155
20
BK/OR
S355
(8W-15-18)
(8W-15-21)
5
7 C304
Z243
16
BK
S300
(8W-15-21)
Z243
12
BK
Z238
16
BK
Z151
18
BK/OR
G300
(8W-15-18)
Z155
20
BK/OR
S301
(8W-15-21)
Z155
18
BK/OR
G301
(8W-15-21)
MEMORY SET SWITCH
1 MEMORY SET
2 MEMORY POSITION 1
3 MEMORY POSITION 2
1
2
3
BK
BR
OR
GY
1 C3
2 C3
3 C3
4 C3
MEMORY SWITCH RETURN
MEMORY SWITCH MUX
MEMORY SET INDICATOR DRIVER
SWITCH ILLUM-INATION DRIVER
PCI BUS
DRIVER DOOR MODULE
9 C1
D25
20
YL/VT
3 C302
D25
20
YL/VT
RHD
LHD
S324
(8W-18-5)
S312
(8W-18-2)
D25
20
YL/VT
32 C301
1 C300
D25
20
YL/VT
COMPACT DISC CHANGER
OTHER
S364
(8W-18-5)
S305
(8W-18-2)
(8W-18-6)
D25
20
YL/VT
3 C304
D25
20
VT/YL
20 C1
PCI BUS
SEAT MODULE

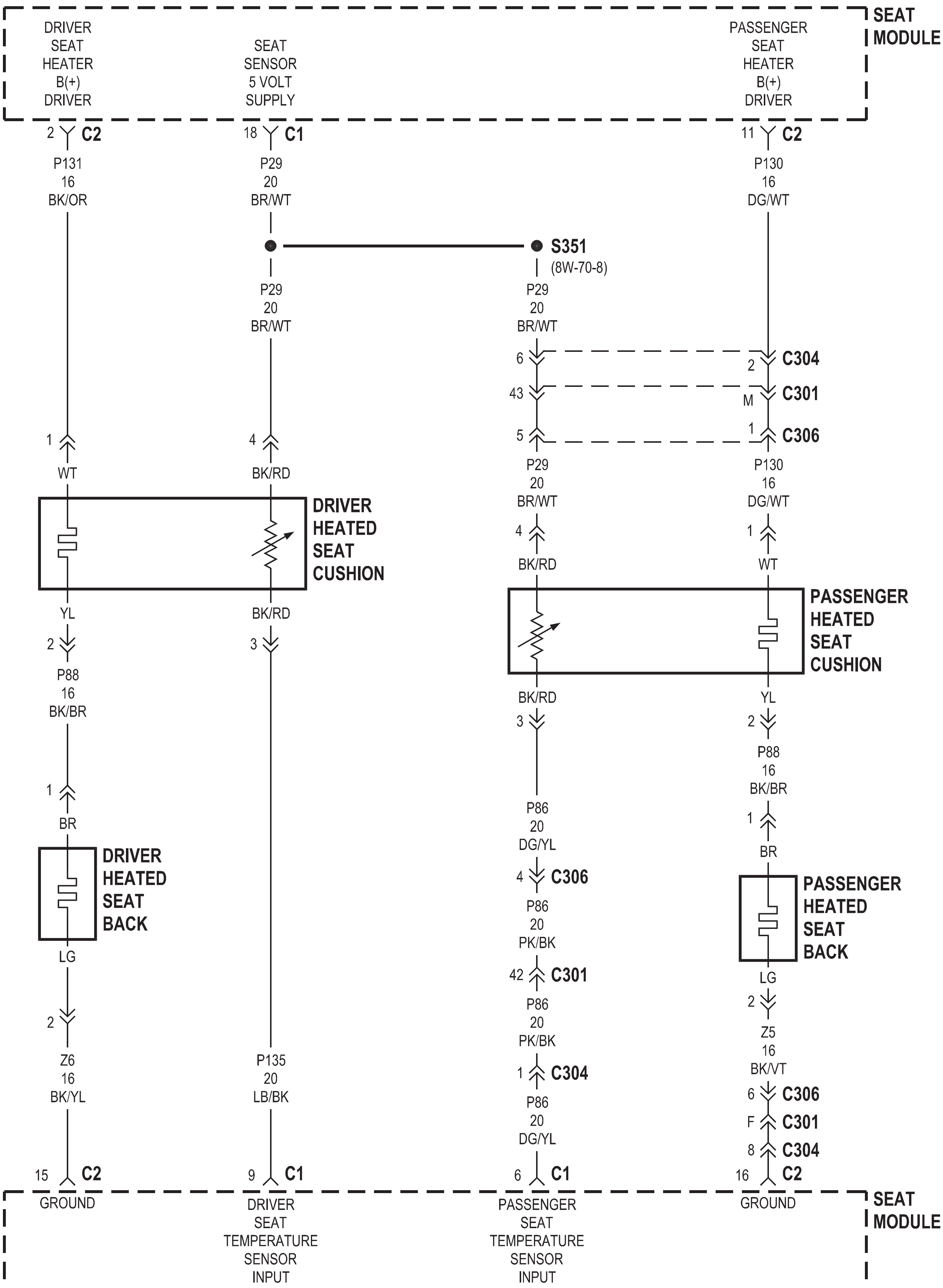


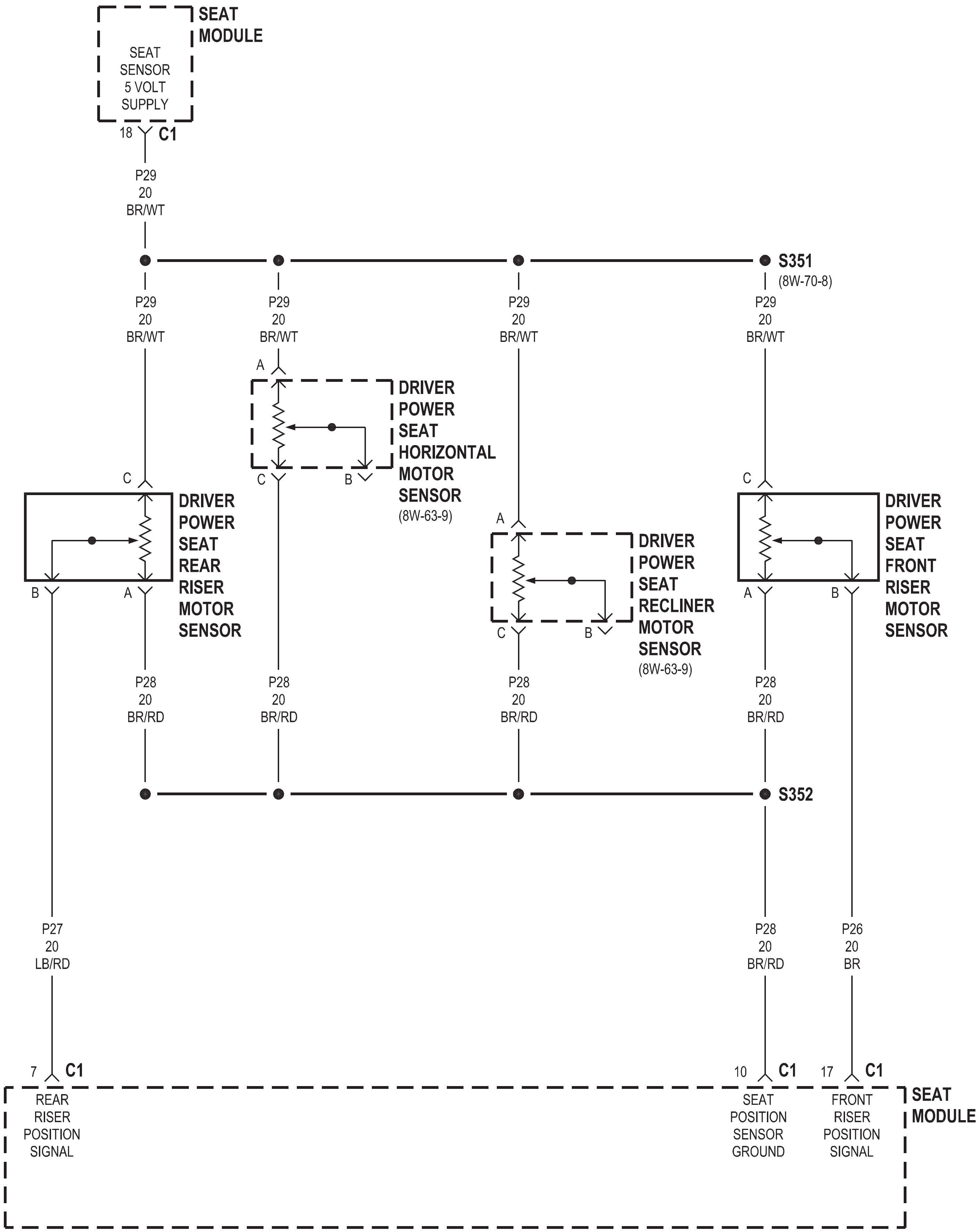
J028W-19

WJI06304

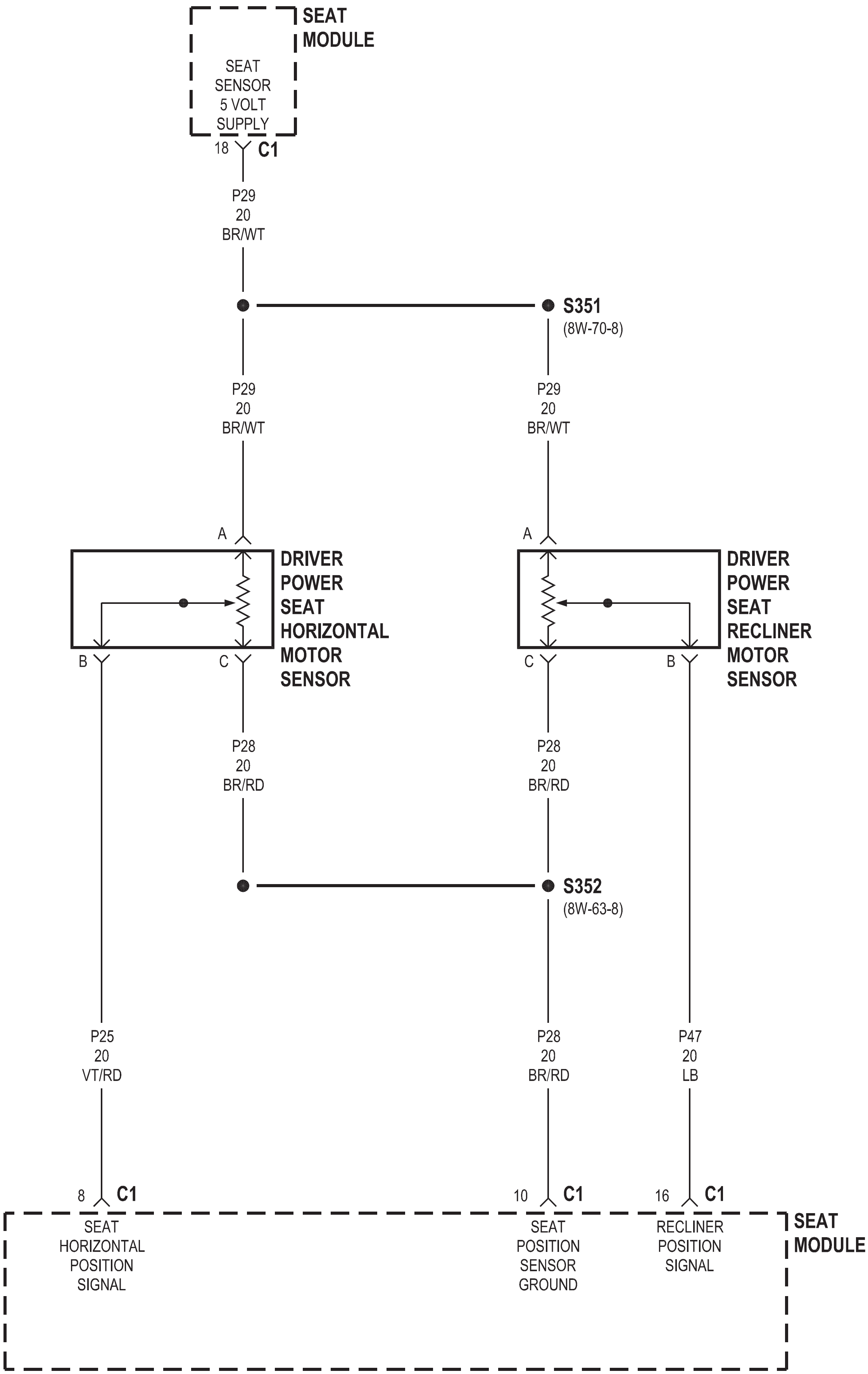

DRIVER POWER SEAT SWITCH
1 REAR UP
2 REAR DOWN
3 FORWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
7 RECLINER UP
8 RECLINER DOWN
P9 20 RD/LB
P11 20 YL/WT
P13 20 RD/WT
P15 20 YL/LB
P17 20 RD/YL
P19 20 YL/LG
P21 20 RD/LG
P43 20 GY/LB
P41 20 GY/WT
RHD Z238 16 BK
LHD Z243 16 BK
SEAT MODULE
SEAT SWITCH B(+) SUPPLY
SEAT REAR UP SWITCH SENSE
SEAT REAR DOWN SWITCH SENSE
SEAT HORI-ZONTAL FORWARD SWITCH SENSE
SEAT HORI-ZONTAL REARWARD SWITCH SENSE
SEAT FRONT UP SWITCH SENSE
SEAT FRONT DOWN SWITCH SENSE
RECLINER UP SWITCH SENSE
RECLINER DOWN SWITCH SENSE
SEAT REAR UP DRIVER
SEAT REAR DOWN DRIVER
SEAT HORI-ZONTAL FORWARD DRIVER
SEAT HORI-ZONTAL REARWARD DRIVER
SEAT FRONT UP DRIVER
SEAT FRONT DOWN DRIVER
SEAT RECLINER UP DRIVER
SEAT RECLINER DOWN DRIVER
P111 16 YL/DB
P113 16 RD/BK
P115 16 GY/LG
P117 16 RD/BR
P119 16 YL/RD
P121 16 RD/GY
P143 16 GY/LB
P141 16 GY/WT
S355 (8W-15-18) (8W-15-21)
C304
Z243 16 BK
Z234 16 BK
S300 (8W-15-21)
Z243 12 BK
G301 (8W-15-21)
G300 (8W-15-18)
DRIVER POWER SEAT RECLINER MOTOR
DRIVER POWER SEAT FRONT RISER MOTOR
DRIVER POWER SEAT HORIZONTAL MOTOR
DRIVER POWER SEAT REAR RISER MOTOR
▲ LHD
■ RHD


SEAT MODULE
DRIVER SEAT HEATER B(+) DRIVER
SEAT SENSOR 5 VOLT SUPPLY
PASSENGER SEAT HEATER B(+) DRIVER
2 C2
18 C1
11 C2
P131 16 BK/OR
P29 20 BR/WT
P130 16 DG/WT
S351
(8W-70-8)
P29 20 BR/WT
P29 20 BR/WT
6 2 C304
16 A C300
5 1 C306
1 WT
4 BK/RD
P29 20 BR/WT
P130 16 DG/WT
DRIVER HEATED SEAT CUSHION
4 BK/RD
1 WT
PASSENGER HEATED SEAT CUSHION
YL
2
BK/RD
3
P88 16 BK/BR
1 BR
DRIVER HEATED SEAT BACK
LG
2
BK/RD
3
YL
2
P88 16 BK/BR
1 BR
PASSENGER HEATED SEAT BACK
LG
2
P86 20 DG/YL
4 C306
P86 20 PK/BK
17 C300
P86 18 PK/BK
1 C304
P86 20 DG/YL
Z6 16 BK/YL
P135 20 LB/BK
Z5 16 BK/VT
6 C306
E C300
8 C304
15 C2
9 C1
6 C1
16 C2
GROUND
DRIVER SEAT TEMPERATURE SENSOR INPUT
PASSENGER SEAT TEMPERATURE SENSOR INPUT
GROUND
SEAT MODULE

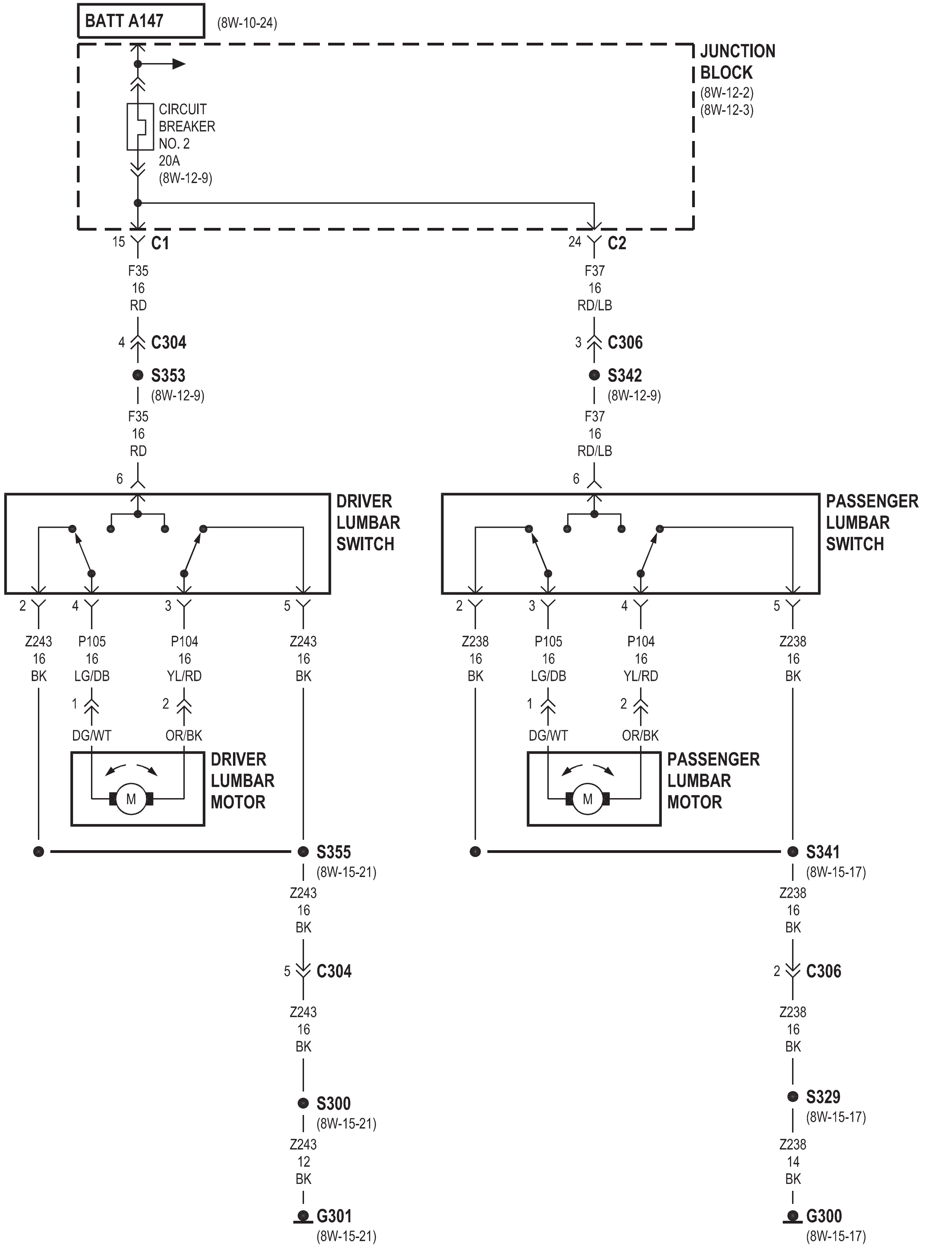

SEAT MODULE
DRIVER SEAT HEATER B(+) DRIVER
SEAT SENSOR 5 VOLT SUPPLY
PASSENGER SEAT HEATER B(+) DRIVER
2 C2
18 C1
11 C2
P131 16 BK/OR
P29 20 BR/WT
P130 16 DG/WT
S351 (8W-70-8)
P29 20 BR/WT
P29 20 BR/WT
6 C304 2
43 C301 M
5 C306 1
P29 20 BR/WT
P130 16 DG/WT
1 WT
4 BK/RD
DRIVER HEATED SEAT CUSHION
YL
BK/RD
2
3
P88 16 BK/BR
1 BR
DRIVER HEATED SEAT BACK
LG
2
Z6 16 BK/YL
P135 20 LB/BK
4 BK/RD
1 WT
PASSENGER HEATED SEAT CUSHION
BK/RD
YL
3
2
P88 16 BK/BR
1 BR
PASSENGER HEATED SEAT BACK
LG
2
Z5 16 BK/VT
P86 20 DG/YL
4 C306
P86 20 PK/BK
42 C301
P86 20 PK/BK
1 C304
P86 20 DG/YL
6 C306
F C301
8 C304
15 C2
9 C1
6 C1
16 C2
GROUND
DRIVER SEAT TEMPERATURE SENSOR INPUT
PASSENGER SEAT TEMPERATURE SENSOR INPUT
GROUND
SEAT MODULE



J028W-19 WJI06308

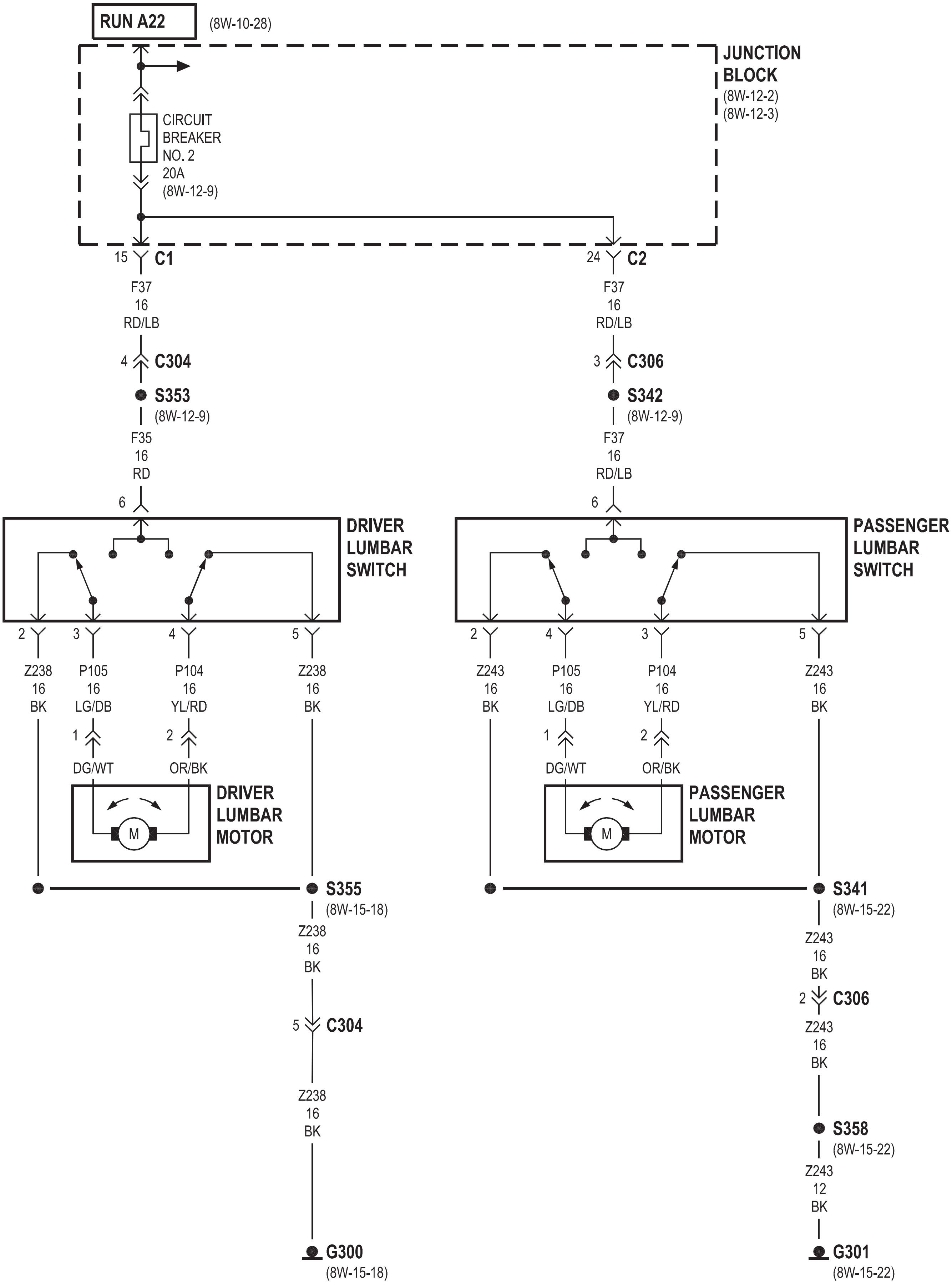

SEAT
MODULE
SEAT
SENSOR
5 VOLT
SUPPLY
18
C1
P29
20
BR/WT
S351
(8W-70-8)
P29
20
BR/WT
P29
20
BR/WT
A
A
DRIVER
POWER
SEAT
HORIZONTAL
MOTOR
SENSOR
DRIVER
POWER
SEAT
RECLINER
MOTOR
SENSOR
B
C
C
B
P28
20
BR/RD
P28
20
BR/RD
S352
(8W-63-8)
P25
20
VT/RD
P28
20
BR/RD
P47
20
LB
8
C1
10
C1
16
C1
SEAT
HORIZONTAL
POSITION
SIGNAL
SEAT
POSITION
SENSOR
GROUND
RECLINER
POSITION
SIGNAL
SEAT
MODULE

LHD MIDLINE/PREMIUM

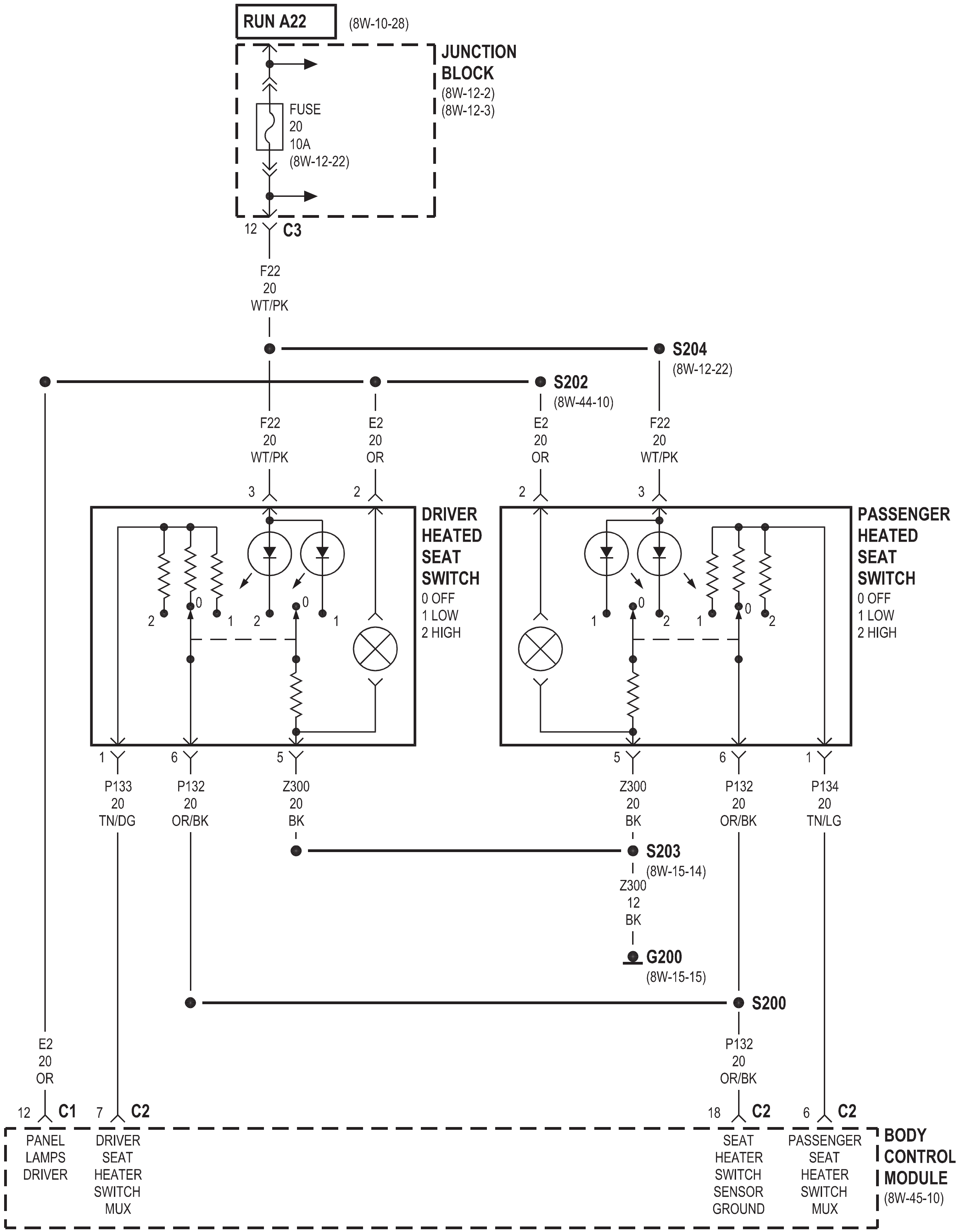


J028W-19 WJI06310

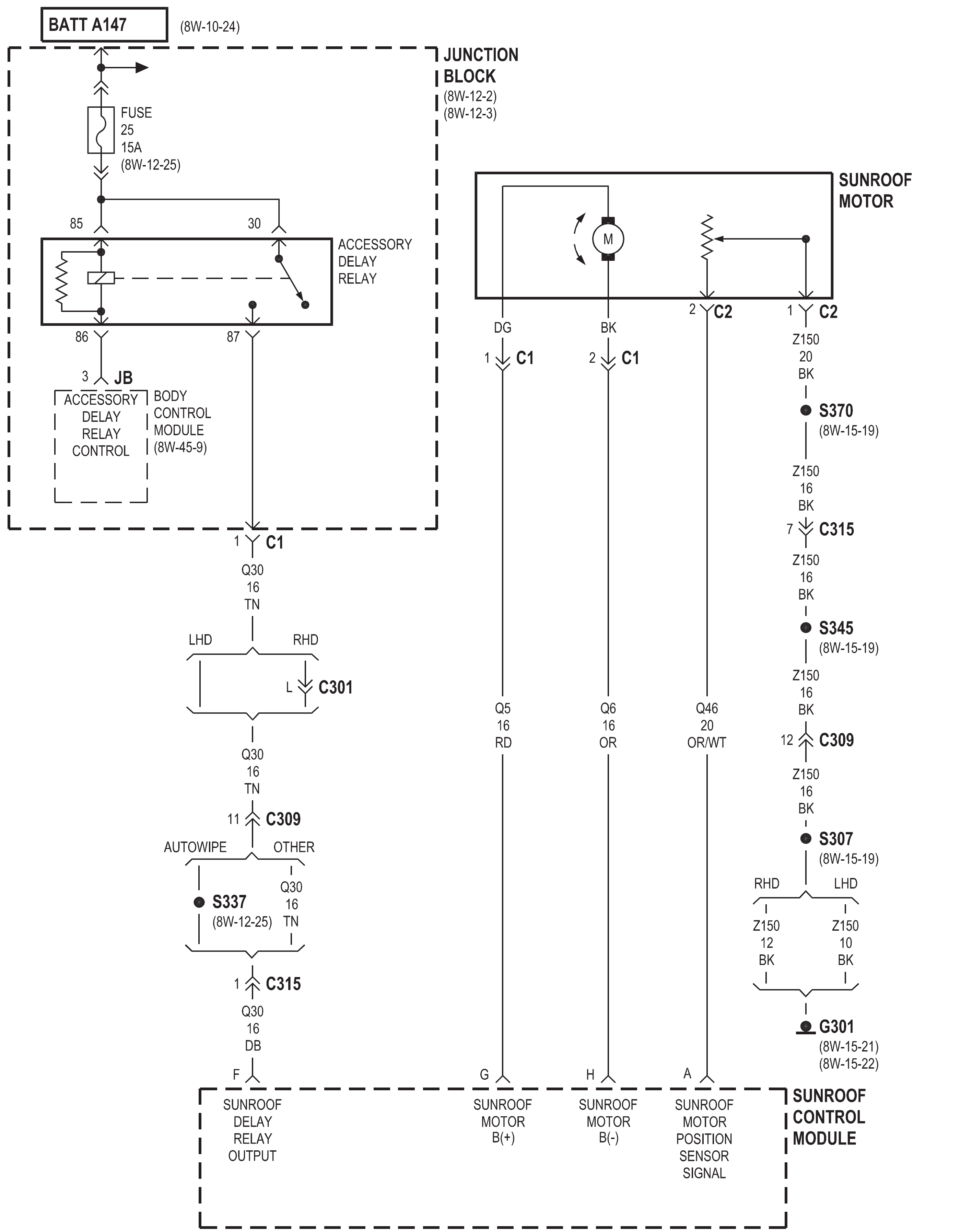
RHD MIDLINE/PREMIUM

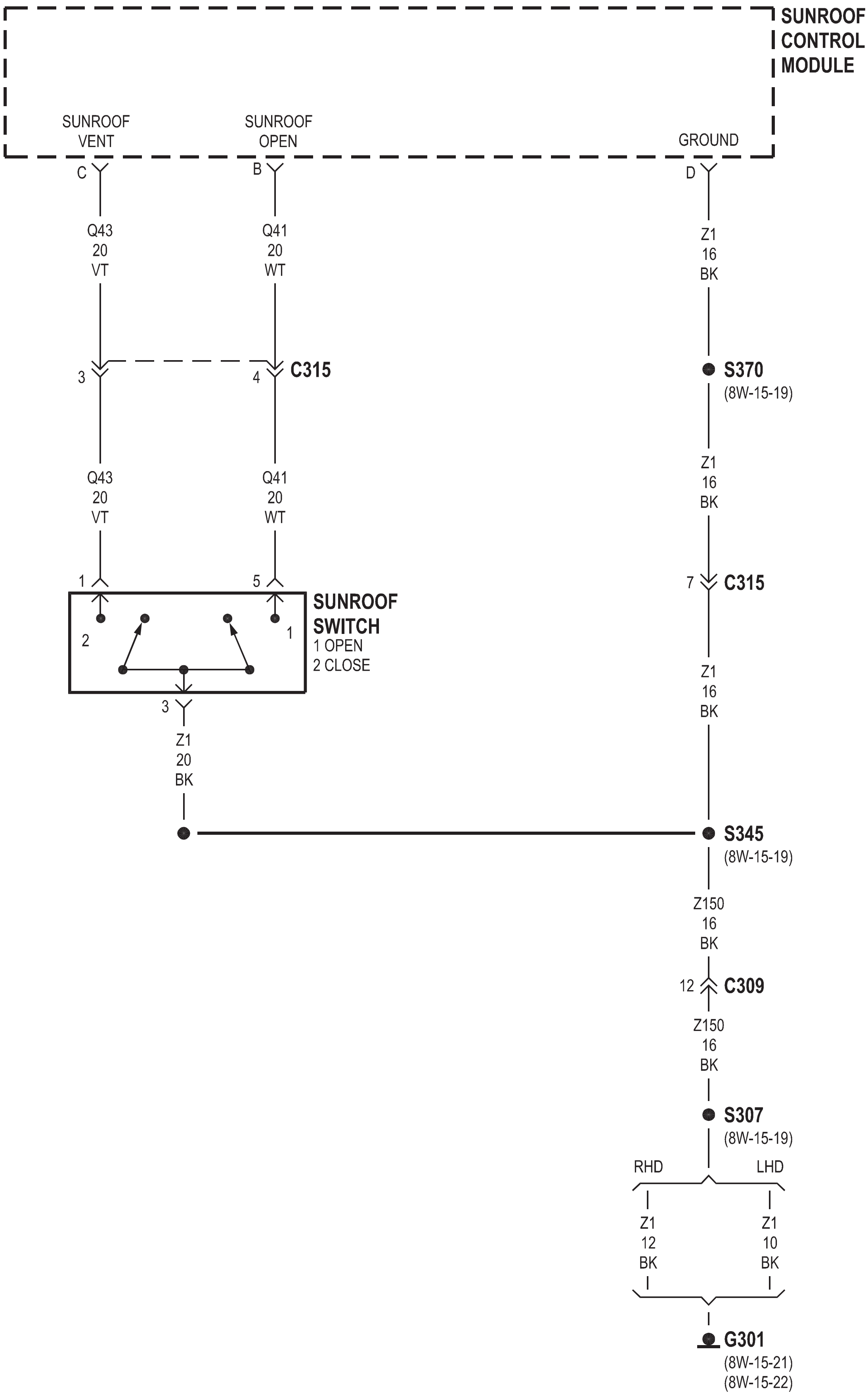


PREMIUM I/III



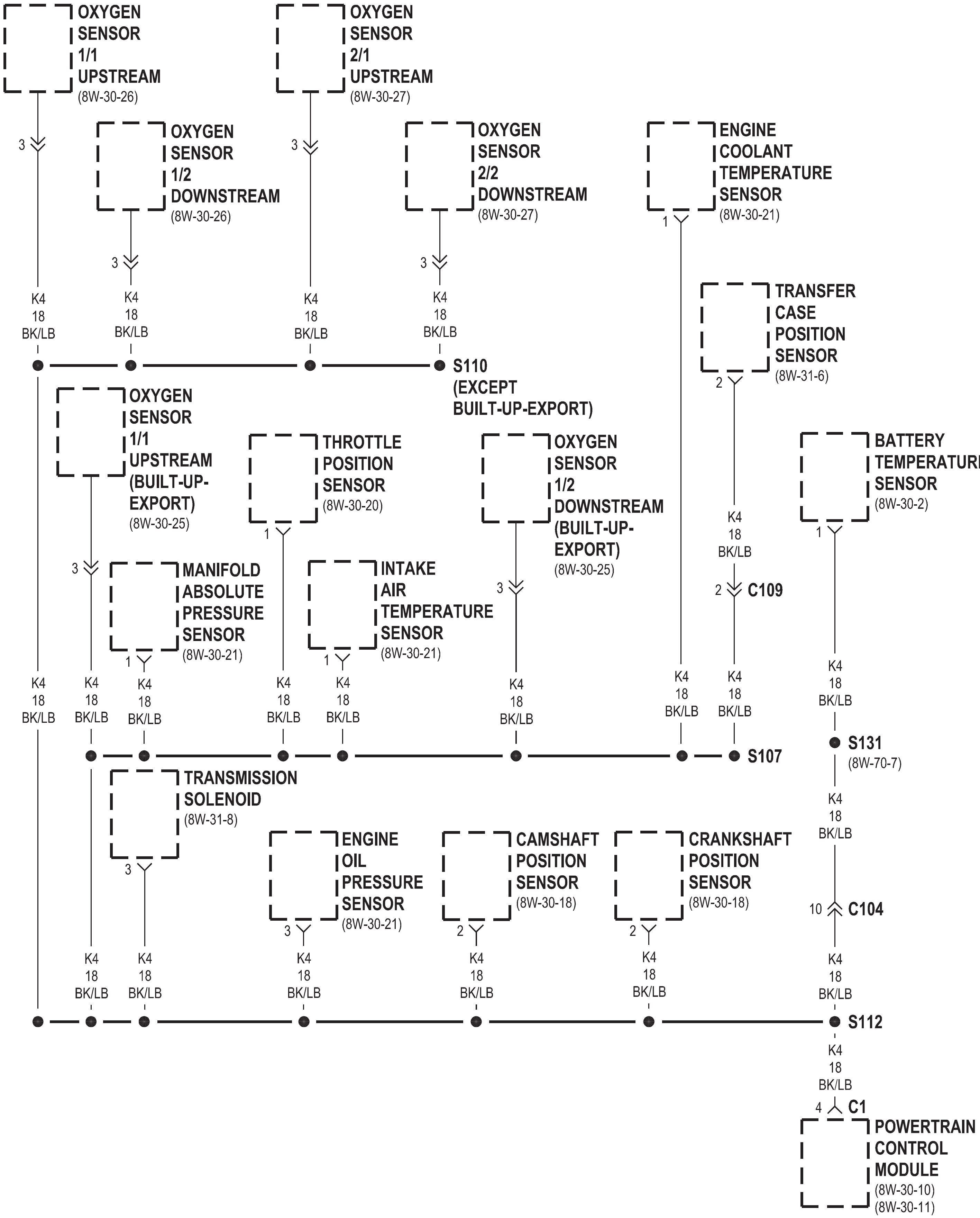
8W-64 POWER SUNROOF


BATT A147
(8W-10-24)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 25 15A (8W-12-25)
85
30
ACCESSORY DELAY RELAY
86
87
3 JB
ACCESSORY DELAY RELAY CONTROL
BODY CONTROL MODULE (8W-45-9)
1 C1
Q30 16 TN
LHD
RHD
L C301
Q30 16 TN
11 C309
AUTOWIPE
OTHER
S337 (8W-12-25)
Q30 16 TN
1 C315
Q30 16 DB
SUNROOF MOTOR
M
DG
BK
2 C2
1 C2
1 C1
2 C1
Z150 20 BK
S370 (8W-15-19)
Z150 16 BK
7 C315
Z150 16 BK
S345 (8W-15-19)
Z150 16 BK
12 C309
Z150 16 BK
S307 (8W-15-19)
RHD
LHD
Z150 12 BK
Z150 10 BK
G301 (8W-15-21) (8W-15-22)
Q5 16 RD
Q6 16 OR
Q46 20 OR/WT
F
G
H
A
SUNROOF DELAY RELAY OUTPUT
SUNROOF MOTOR B(+)
SUNROOF MOTOR B(-)
SUNROOF MOTOR POSITION SENSOR SIGNAL
SUNROOF CONTROL MODULE

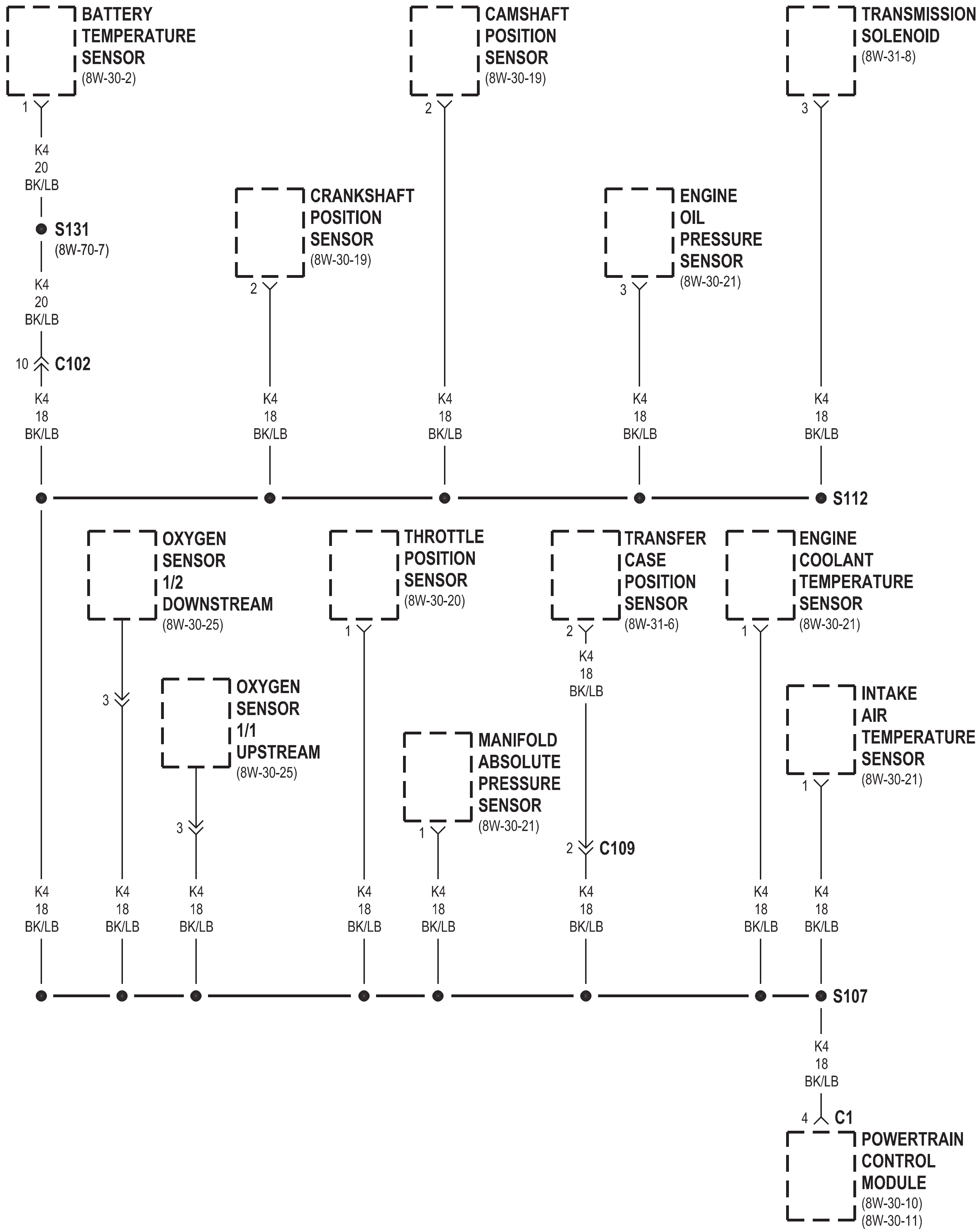

SUNROOF CONTROL MODULE
SUNROOF VENT
SUNROOF OPEN
GROUND
C
B
D
Q43 20 VT
Q41 20 WT
Z1 16 BK
3
4
C315
S370 (8W-15-19)
Q43 20 VT
Q41 20 WT
Z1 16 BK
1
5
7
C315
SUNROOF SWITCH
1 OPEN
2 CLOSE
2
1
3
Z1 20 BK
Z1 16 BK
S345 (8W-15-19)
Z150 16 BK
12
C309
Z150 16 BK
S307 (8W-15-19)
RHD
LHD
Z1 12 BK
Z1 10 BK
G301 (8W-15-21) (8W-15-22)

8W-70 SPLICE INFORMATION

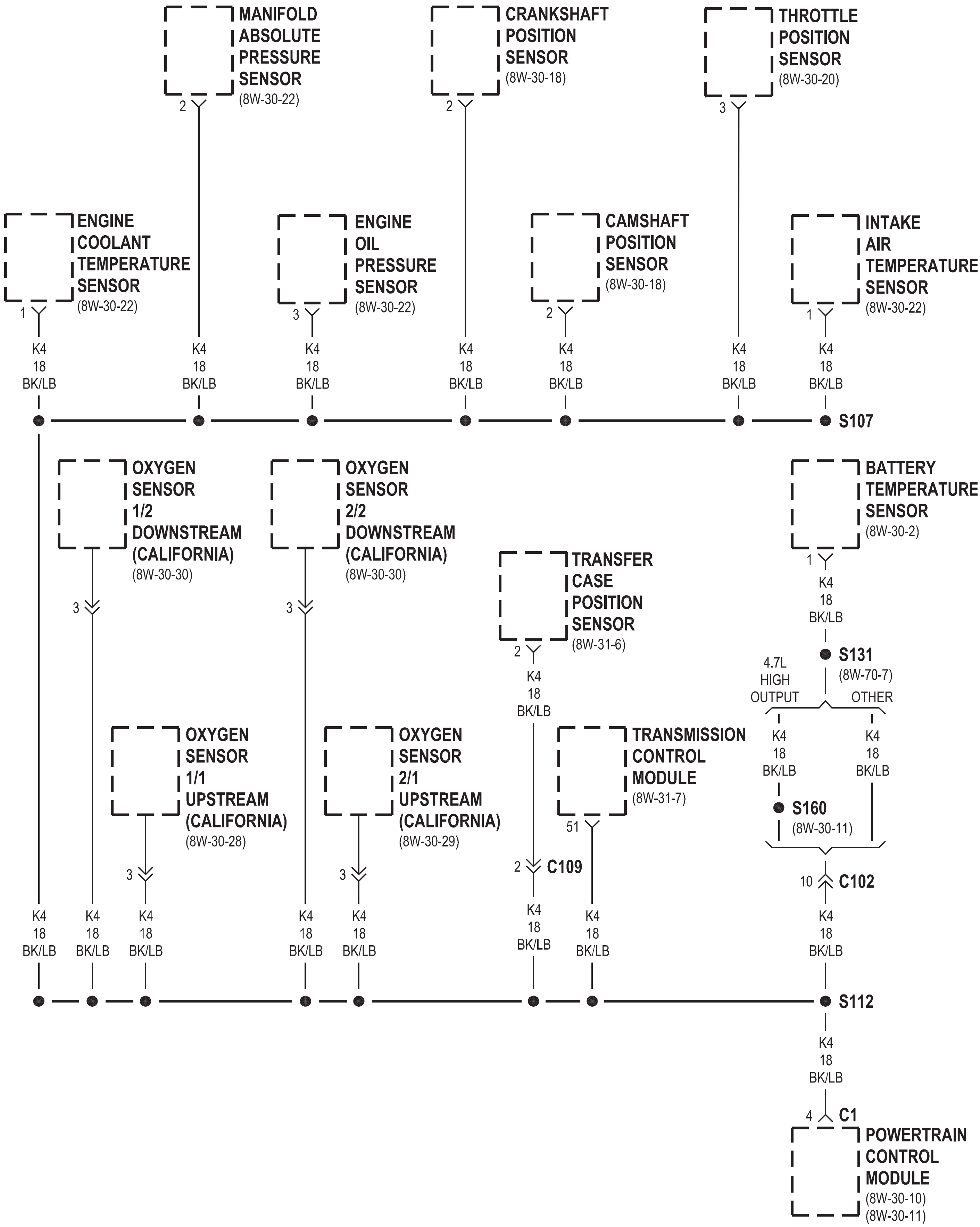
4.0L LHD


OXYGEN SENSOR 1/1 UPSTREAM (8W-30-26)
OXYGEN SENSOR 2/1 UPSTREAM (8W-30-27)
OXYGEN SENSOR 1/2 DOWNSTREAM (8W-30-26)
OXYGEN SENSOR 2/2 DOWNSTREAM (8W-30-27)
ENGINE COOLANT TEMPERATURE SENSOR (8W-30-21)
K4 18 BK/LB
S110 (EXCEPT BUILT-UP-EXPORT)
TRANSFER CASE POSITION SENSOR (8W-31-6)
OXYGEN SENSOR 1/1 UPSTREAM (BUILT-UP-EXPORT) (8W-30-25)
THROTTLE POSITION SENSOR (8W-30-20)
OXYGEN SENSOR 1/2 DOWNSTREAM (BUILT-UP-EXPORT) (8W-30-25)
BATTERY TEMPERATURE SENSOR (8W-30-2)
MANIFOLD ABSOLUTE PRESSURE SENSOR (8W-30-21)
INTAKE AIR TEMPERATURE SENSOR (8W-30-21)
C109
S107
S131 (8W-70-7)
TRANSMISSION SOLENOID (8W-31-8)
ENGINE OIL PRESSURE SENSOR (8W-30-21)
CAMSHAFT POSITION SENSOR (8W-30-18)
CRANKSHAFT POSITION SENSOR (8W-30-18)
C104
S112
C1
POWERTRAIN CONTROL MODULE (8W-30-10) (8W-30-11)

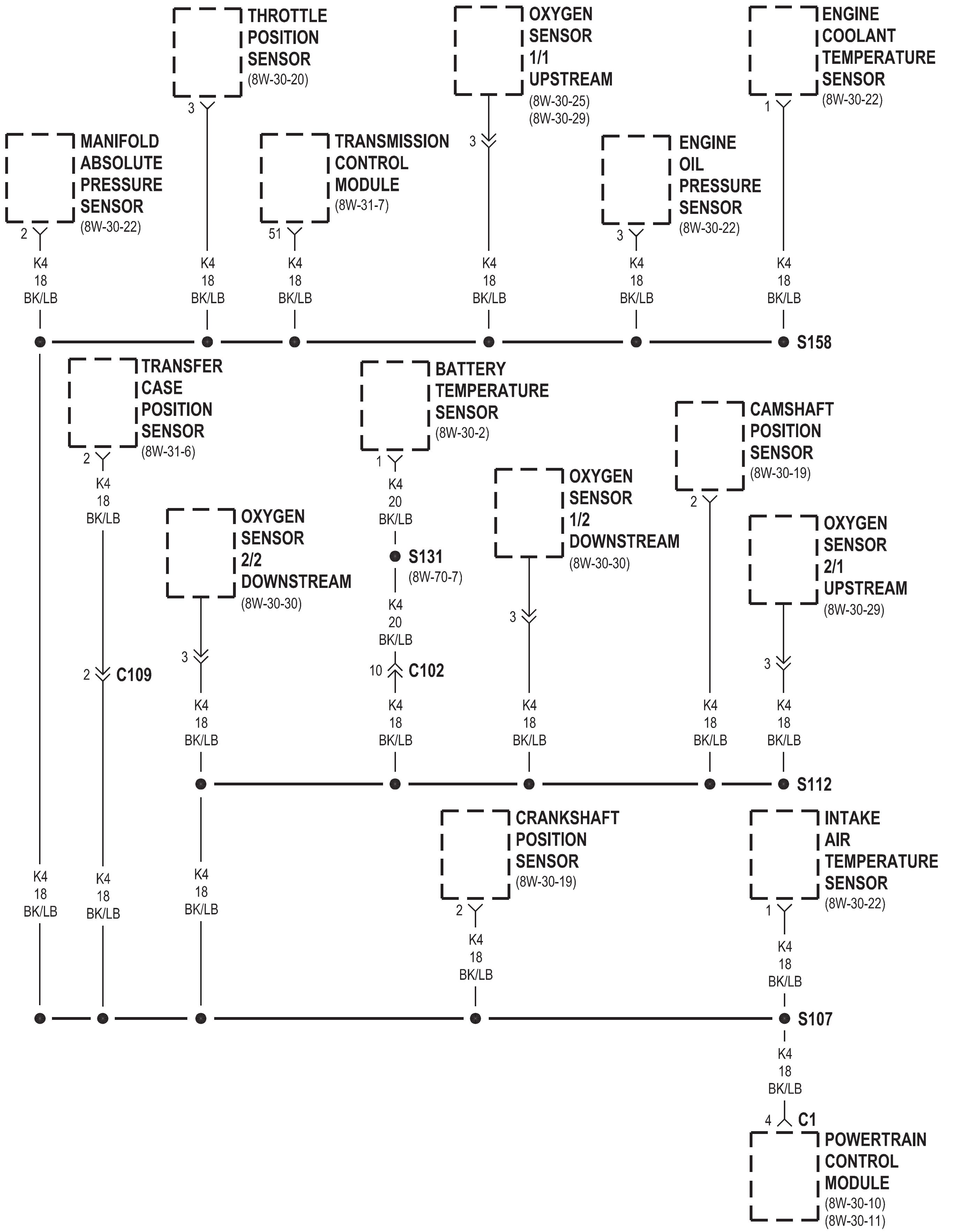
4.0L RHD


BATTERY TEMPERATURE SENSOR
(8W-30-2)
CAMSHAFT POSITION SENSOR
(8W-30-19)
TRANSMISSION SOLENOID
(8W-31-8)
K4
20
BK/LB
S131
(8W-70-7)
CRANKSHAFT POSITION SENSOR
(8W-30-19)
ENGINE OIL PRESSURE SENSOR
(8W-30-21)
C102
K4
18
BK/LB
S112
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-25)
THROTTLE POSITION SENSOR
(8W-30-20)
TRANSFER CASE POSITION SENSOR
(8W-31-6)
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-21)
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-25)
INTAKE AIR TEMPERATURE SENSOR
(8W-30-21)
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-21)
C109
S107
C1
POWERTRAIN CONTROL MODULE
(8W-30-10)
(8W-30-11)

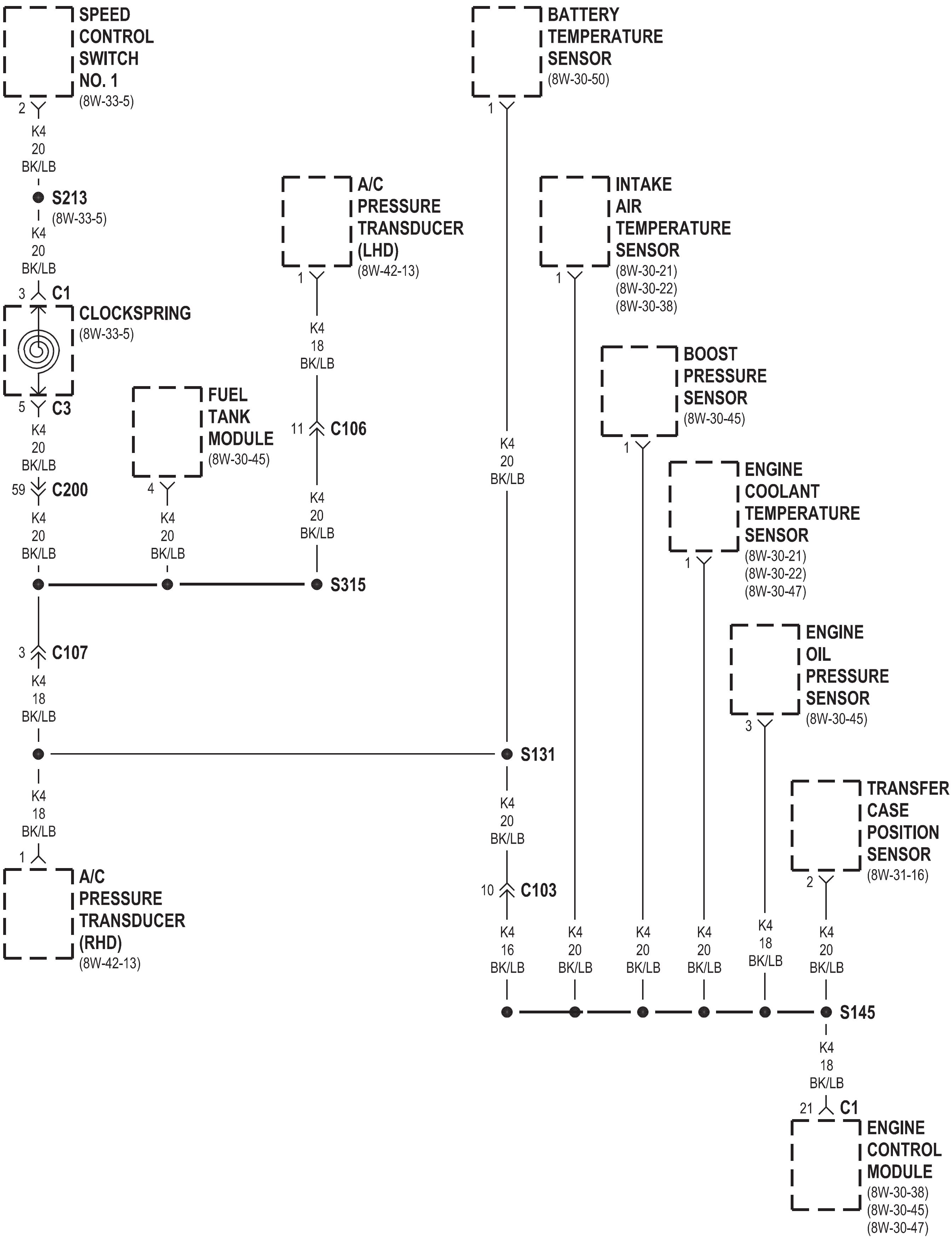
4.7L LHD


MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-22)
CRANKSHAFT POSITION SENSOR
(8W-30-18)
THROTTLE POSITION SENSOR
(8W-30-20)
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-22)
ENGINE OIL PRESSURE SENSOR
(8W-30-22)
CAMSHAFT POSITION SENSOR
(8W-30-18)
INTAKE AIR TEMPERATURE SENSOR
(8W-30-22)
K4
18
BK/LB
S107
OXYGEN SENSOR 1/2 DOWNSTREAM (CALIFORNIA)
(8W-30-30)
OXYGEN SENSOR 2/2 DOWNSTREAM (CALIFORNIA)
(8W-30-30)
BATTERY TEMPERATURE SENSOR
(8W-30-2)
TRANSFER CASE POSITION SENSOR
(8W-31-6)
S131
(8W-70-7)
4.7L HIGH OUTPUT
OTHER
OXYGEN SENSOR 1/1 UPSTREAM (CALIFORNIA)
(8W-30-28)
OXYGEN SENSOR 2/1 UPSTREAM (CALIFORNIA)
(8W-30-29)
TRANSMISSION CONTROL MODULE
(8W-31-7)
S160
(8W-30-11)
C109
C102
S112
C1
POWERTRAIN CONTROL MODULE
(8W-30-10)
(8W-30-11)

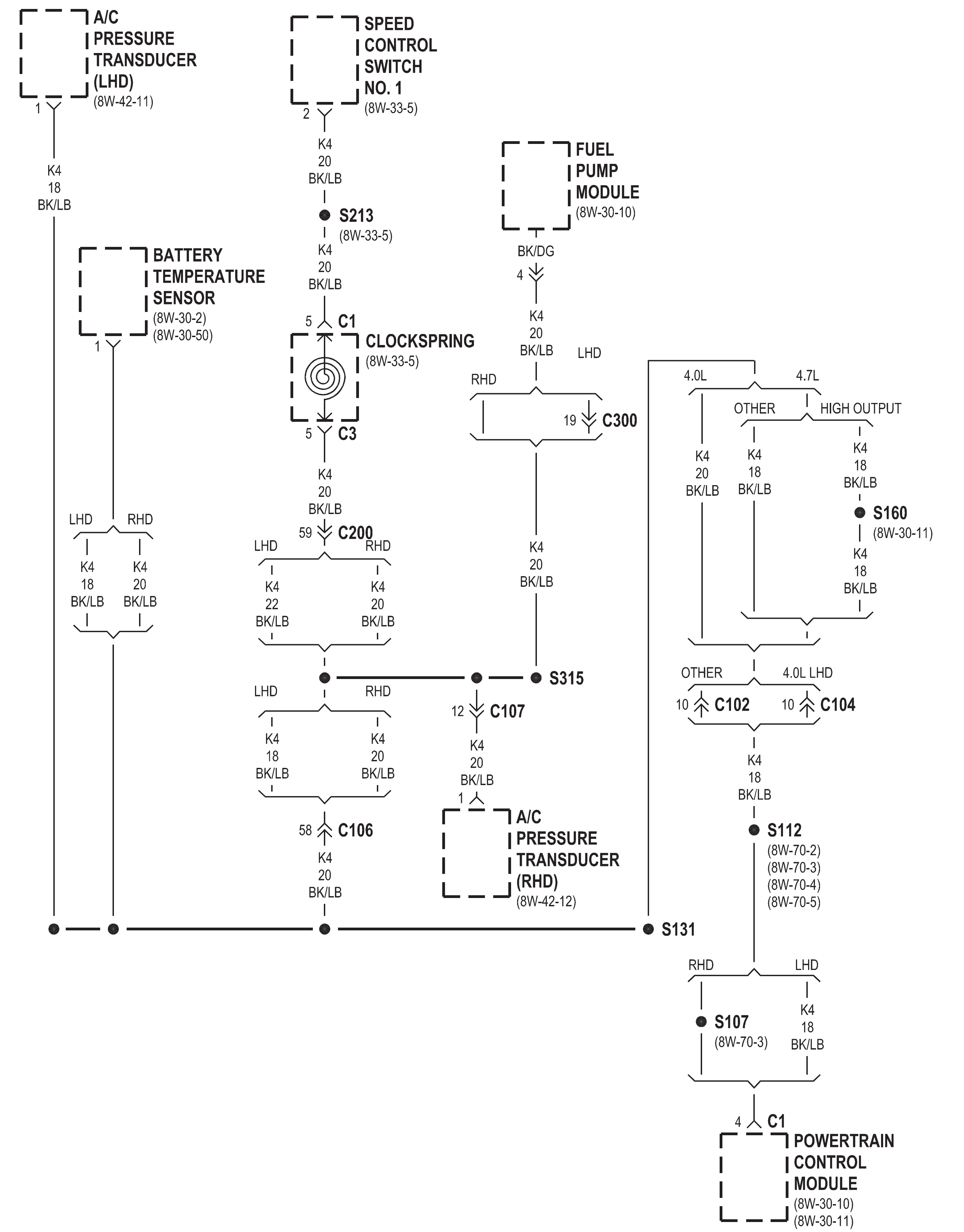
4.7L RHD

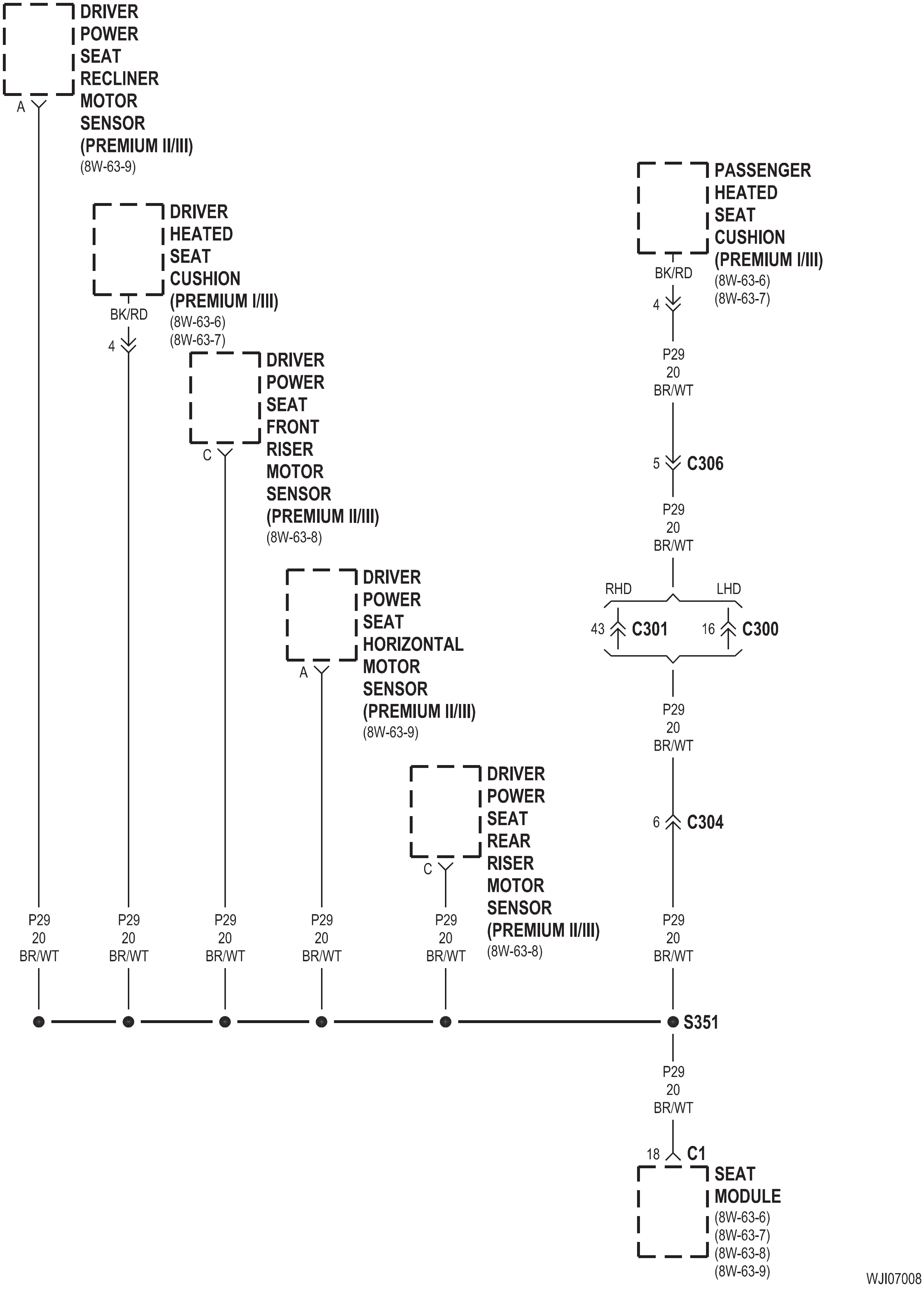

THROTTLE POSITION SENSOR (8W-30-20)
OXYGEN SENSOR 1/1 UPSTREAM (8W-30-25) (8W-30-29)
ENGINE COOLANT TEMPERATURE SENSOR (8W-30-22)
MANIFOLD ABSOLUTE PRESSURE SENSOR (8W-30-22)
TRANSMISSION CONTROL MODULE (8W-31-7)
ENGINE OIL PRESSURE SENSOR (8W-30-22)
K4 18 BK/LB
S158
TRANSFER CASE POSITION SENSOR (8W-31-6)
BATTERY TEMPERATURE SENSOR (8W-30-2)
CAMSHAFT POSITION SENSOR (8W-30-19)
OXYGEN SENSOR 1/2 DOWNSTREAM (8W-30-30)
OXYGEN SENSOR 2/2 DOWNSTREAM (8W-30-30)
OXYGEN SENSOR 2/1 UPSTREAM (8W-30-29)
K4 20 BK/LB
S131 (8W-70-7)
C109
C102
S112
CRANKSHAFT POSITION SENSOR (8W-30-19)
INTAKE AIR TEMPERATURE SENSOR (8W-30-22)
S107
C1
POWERTRAIN CONTROL MODULE (8W-30-10) (8W-30-11)

DIESEL

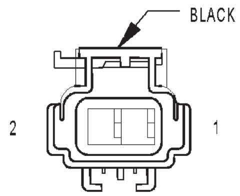


SPEED CONTROL SWITCH NO. 1
(8W-33-5)
2
K4
20
BK/LB
S213
(8W-33-5)
K4
20
BK/LB
3
C1
CLOCKSPRING
(8W-33-5)
5
C3
K4
20
BK/LB
59
C200
K4
20
BK/LB
FUEL TANK MODULE
(8W-30-45)
4
K4
20
BK/LB
A/C PRESSURE TRANSDUCER (LHD)
(8W-42-13)
1
K4
18
BK/LB
11
C106
K4
20
BK/LB
S315
3
C107
K4
18
BK/LB
K4
18
BK/LB
1
A/C PRESSURE TRANSDUCER (RHD)
(8W-42-13)
BATTERY TEMPERATURE SENSOR
(8W-30-50)
1
K4
20
BK/LB
S131
K4
20
BK/LB
10
C103
K4
16
BK/LB
INTAKE AIR TEMPERATURE SENSOR
(8W-30-21)
(8W-30-22)
(8W-30-38)
1
K4
20
BK/LB
BOOST PRESSURE SENSOR
(8W-30-45)
1
K4
20
BK/LB
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-21)
(8W-30-22)
(8W-30-47)
1
K4
20
BK/LB
ENGINE OIL PRESSURE SENSOR
(8W-30-45)
3
K4
18
BK/LB
TRANSFER CASE POSITION SENSOR
(8W-31-16)
2
K4
20
BK/LB
S145
K4
18
BK/LB
21
C1
ENGINE CONTROL MODULE
(8W-30-38)
(8W-30-45)
(8W-30-47)


A/C PRESSURE TRANSDUCER (LHD)
(8W-42-11)
SPEED CONTROL SWITCH NO. 1
(8W-33-5)
FUEL PUMP MODULE
(8W-30-10)
BATTERY TEMPERATURE SENSOR
(8W-30-2)
(8W-30-50)
S213
(8W-33-5)
C1
CLOCKSPRING
(8W-33-5)
C3
C300
C200
K4
20
BK/LB
K4
18
BK/LB
BK/DG
LHD
RHD
4.0L
4.7L
OTHER
HIGH OUTPUT
S160
(8W-30-11)
S315
C107
C102
C104
4.0L LHD
C106
A/C PRESSURE TRANSDUCER (RHD)
(8W-42-12)
S112
(8W-70-2)
(8W-70-3)
(8W-70-4)
(8W-70-5)
S131
S107
(8W-70-3)
POWERTRAIN CONTROL MODULE
(8W-30-10)
(8W-30-11)


DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III) (8W-63-9)
A
DRIVER HEATED SEAT CUSHION (PREMIUM I/III) (8W-63-6) (8W-63-7)
BK/RD
4
DRIVER POWER SEAT FRONT RISER MOTOR SENSOR (PREMIUM II/III) (8W-63-8)
C
DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR (PREMIUM II/III) (8W-63-9)
A
DRIVER POWER SEAT REAR RISER MOTOR SENSOR (PREMIUM II/III) (8W-63-8)
C
PASSENGER HEATED SEAT CUSHION (PREMIUM I/III) (8W-63-6) (8W-63-7)
BK/RD
4
P29 20 BR/WT
5 C306
P29 20 BR/WT
RHD
LHD
43 C301
16 C300
P29 20 BR/WT
6 C304
P29 20 BR/WT
S351
P29 20 BR/WT
18 C1
SEAT MODULE (8W-63-6) (8W-63-7) (8W-63-8) (8W-63-9)

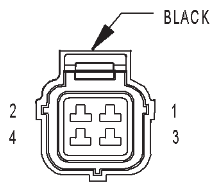
8W-80 CONNECTOR PIN-OUT



A/C COMPRESSOR CLUTCH

A/C COMPRESSOR CLUTCH - BLACK 2 WAY

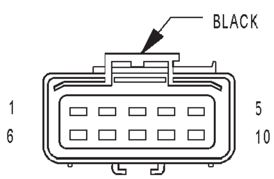
CAV	CIRCUIT	FUNCTION
1	C2 18DB/YL	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z18 18BK	GROUND



A/C PRESSURE TRANSDUCER

A/C PRESSURE TRANSDUCER - BLACK 4 WAY

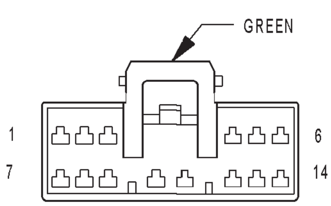
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K6 18VT/WT (DIESEL)	SENSOR REFERENCE VOLTAGE B
2	K6 18VT/BK (GAS)	5 VOLT SUPPLY
3	C18 18DB	A/C PRESSURE SIGNAL
4	-	-



ACCELERATOR PEDAL POSITION SENSOR (DIESEL)

ACCELERATOR PEDAL POSITION SENSOR (DIESEL) - BLACK 10 WAY

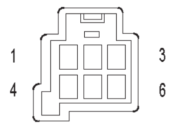
CAV	CIRCUIT	FUNCTION
1	-	-
2	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
3	K22 14RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
4	-	-
5	-	-
6	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
7	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
8	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
9	-	-
10	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY



ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT)

ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT) - GREEN 14 WAY

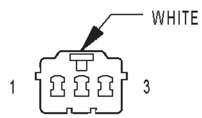
CAV	CIRCUIT	FUNCTION
1	Y151 20LG/BR	ADJUSTABLE PEDALS SWITCH SENSE (FORWARD)
2	Y152 20LG/OR	ADJUSTABLE PEDALS SWITCH SENSE (REARWARD)
3	Q110 16OR/VT	ADJUSTABLE PEDALS MOTOR (FORWARD)
4	F72 16RD/YL	FUSED B(+)
5	-	-
6	Q111 16OR/GY	ADJUSTABLE PEDALS MOTOR (REARWARD)
7	Q113 20OR/DB (MEMORY)	PEDAL POSITION SENSOR FEED
8	Q112 20OR/YL (MEMORY)	PEDAL POSITION SENSOR SENSE
9	Q114 20OR/TN (MEMORY)	PEDAL POSITION SENSOR RETURN
10	Z151 16BK	GROUND
11	Z155 20BK/OR	GROUND
12	L1 18WT/BR	BACK-UP LAMP FEED
13	D25 20VT/YL	PCI BUS
14	Y153 16DB/RD	ADJUSTABLE PEDALS SWITCH FEED



ADJUSTABLE PEDALS MOTOR/SENSOR ASSEMBLY (EXCEPT BUILT-UP-EXPORT)

ADJUSTABLE PEDALS MOTOR/SENSOR ASSEMBLY (EXCEPT BUILT-UP-EXPORT) - 6 WAY

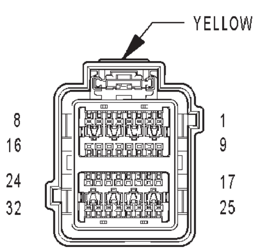
CAV	CIRCUIT	FUNCTION
1	Q113 20OR/DB	PEDAL POSITION SENSOR FEED
2	Q112 20OR/YL	PEDAL POSITION SENSOR SENSE
3	Q114 20OR/TN	PEDAL POSITION SENSOR RETURN
4	-	-
5	Q111 16OR/GY	AJDUSTABLE PEDALS MOTOR (REARWARD)
6	Q110 16OR/VT	ADJUSTABLE PEDALS MOTOR (FORWARD)



ADJUSTABLE PEDALS SWITCH (EXCEPT BUILT-UP-EXPORT)

ADJUSTABLE PEDALS SWITCH (EXCEPT BUILT-UP-EXPORT) - WHITE 3 WAY

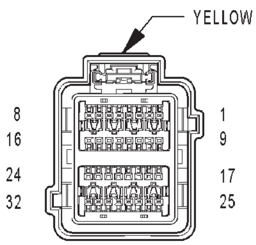
CAV	CIRCUIT	FUNCTION
1	Y153 20BD/RD	ADJUSTABLE PEDALS SWITCH FEED
2	Y152 20LG/OR	ADJUSTABLE PEDALS SWITCH SENSE (REARWARD)
3	Y151 20LG/BR	ADJUSTABLE PEDALS SWITCH SENSE (FORWARD)



AIRBAG CONTROL MODULE C1 (ORC C1)

AIRBAG CONTROL MODULE C1 (ORC C1) - YELLOW 32 WAY

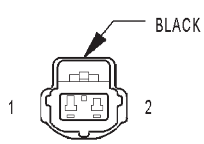
CAV	CIRCUIT	FUNCTION
1	R72 20LB/WT (SIDE AIRBAGS)	PASSENGER CURTAIN SQUIB LINE 2
2	R74 20LB/YL (SIDE AIRBAGS)	PASSENGER CURTAIN SQUIB LINE 1
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-
9	R58 20GY	PASSENGER SEAT BELT SWITCH SENSE
10	R60 20VT	PASSENGER SEAT BELT SWITCH GROUND
11	-	-
12	-	-
13	-	-
14	-	-
15	R132 20LG/VT (SIDE AIRBAGS)	PASSENGER SIDE IMPACT SENSOR SIGNAL
16	R134 20LB/BR (SIDE AIRBAGS)	PASSENGER SIDE IMPACT SENSOR GROUND
17	R131 20LG/YL (SIDE AIRBAGS)	DRIVER SIDE IMPACT SENSOR SIGNAL
18	R133 20LB/DG (SIDE AIRBAGS)	DRIVER SIDE IMPACT SENSOR GROUND
19	-	-
20	-	-
21	-	-
22	-	-
23	R59 20LB	DRIVER SEAT BELT SWITCH GROUND
24	R57 20DG	DRIVER SEAT BELT SWITCH SENSE
25	R73 20LB/BR (SIDE AIRBAGS)	DRIVER CURTAIN SQUIB LINE 2
26	R75 20LB/OR (SIDE AIRBAGS)	DRIVER CURTAIN SQUIB LINE 1
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-



AIRBAG CONTROL MODULE C2 (ORC C2)

AIRBAG CONTROL MODULE C2 (ORC C2) - YELLOW 32 WAY

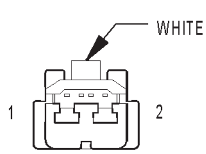
CAV	CIRCUIT	FUNCTION
1	R45 20DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 20BK/LB	DRIVER SQUIB 1 LINE 1
3	R42 20BK/YL	PASSENGER SQUIB 1 LINE 1
4	R44 20DG/YL	PASSENGER SQUIB 1 LINE 2
5	-	-
6	-	-
7	-	-
8	-	-
9	R49 20LB	LEFT FRONT IMPACT SENSOR SIGNAL
10	R47 20DB/LB	LEFT FRONT IMPACT SENSOR GROUND
11	R46 20BR/LB	RIGHT FRONT IMPACT SENSOR GROUND
12	R48 20TN	RIGHT FRONT IMPACT SENSOR SIGNAL
13	-	-
14	-	-
15	-	-
16	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
17	Z6 20BK/PK	GROUND
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	D25 20YL/VT/OR	PCI BUS
24	F14 20LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
25	R63 20TN/LB	DRIVER SQUIB 2 LINE 2
26	R61 20OR/LB	DRIVER SQUIB 2 LINE 1
27	R62 20OR/YL	PASSENGER SQUIB 2 LINE 2
28	R64 20TN/YL	PASSENGER SQUIB 2 LINE 1
29	-	-
30	-	-
31	-	-
32	-	-



AMBIENT TEMPERATURE SENSOR

AMBIENT TEMPERATURE SENSOR - BLACK 2 WAY

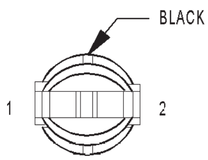
CAV	CIRCUIT	FUNCTION
1	G32 20BK/LB	SENSOR GROUND
2	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL



ANTENNA MODULE (BUILT-UP-EXPORT)

ANTENNA MODULE (BUILT-UP-EXPORT) - WHITE 2 WAY

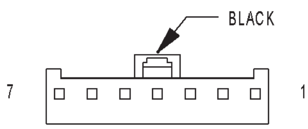
CAV	CIRCUIT	FUNCTION
1	X64 18BK/WT	ENABLE SIGNAL TO AMPLIFIER
2	-	-



ASH RECEIVER LAMP

ASH RECEIVER LAMP - BLACK 2 WAY

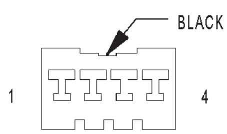
CAV	CIRCUIT	FUNCTION
1	Z300 20BK	GROUND
2	E2 20OR	PANEL LAMPS DRIVER



AUTOMATIC DAY/ NIGHT MIRROR

AUTOMATIC DAY/NIGHT MIRROR - BLACK 7 WAY

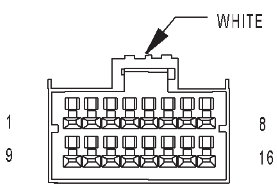
CAV	CIRCUIT	FUNCTION
1	G5 20BK/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	Z150 20BK	GROUND
3	L1 20BK/VT	BACK-UP LAMP FEED
4	P112 20BK/WT	AUTO DAY/NIGHT MIRROR (+)
5	P114 20BK/YL	AUTO DAY/NIGHT MIRROR (-)
6	-	-
7	-	-



AUTOMATIC HEADLAMP LIGHT SENSOR/VTSS LED

AUTOMATIC HEADLAMP LIGHT SENSOR/VTSS LED - BLACK 4 WAY

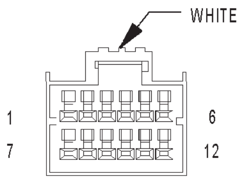
CAV	CIRCUIT	FUNCTION
1	L109 20WT	ULTRALIGHT SENSOR SIGNAL
2	L110 20BK/YL	ULTRALIGHT SENSOR RETURN
3	G69 20BK/OR	VTSS INDICATOR DRIVER
4	M1 20PK	FUSED B(+)



AUTOMATIC ZONE CONTROL MODULE C1 (AZC)

AUTOMATIC ZONE CONTROL MODULE C1 (AZC) - WHITE 16 WAY

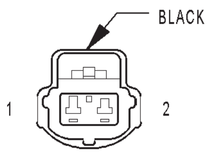
CAV	CIRCUIT	FUNCTION
1	C102 20TN/BK	MODE DOOR DRIVER (B)
2	-	-
3	C32 20GY/DB	RECIRCULATION DOOR DRIVER (A)
4	C100 20YL/DB	RECIRCULATION DOOR DRIVER (B)
5	-	-
6	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
7	-	-
8	Z118 20BK	GROUND
9	C35 20DG/YL	MODE DOOR DRIVER (A)
10	C33 20DB/RD	DRIVER BLEND DOOR DRIVER (A)
11	-	-
12	-	-
13	-	-
14	C81 20LB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
15	-	-
16	-	-



AUTOMATIC ZONE CONTROL MODULE C2 (AZC)

AUTOMATIC ZONE CONTROL MODULE C2 (AZC) - WHITE 12 WAY

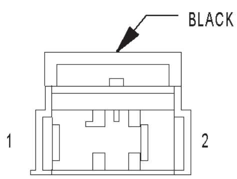
CAV	CIRCUIT	FUNCTION
1	-	-
2	C94 20WT/DG	PASSENGER BLEND DOOR DRIVER (A)
3	C95 20WT/BK	DRIVER BLEND DOOR DRIVER (B)
4	C96 20WT/DB	PASSENGER BLEND DOOR DRIVER (B)
5	-	-
6	E2 20OR	PANEL LAMPS DRIVER
7	C56 20RD/LG	BLOWER MOTOR CONTROL
8	D25 20YL/VT/DG	PCI BUS
9	C103 20DG	A/C SWITCH SIGNAL
10	-	-
11	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
12	M1 20PK	FUSED B(+)



BATTERY TEMPERATURE SENSOR

BATTERY TEMPERATURE SENSOR - BLACK 2 WAY

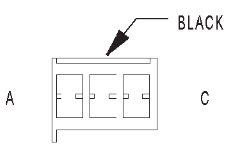
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB (GAS LHD)	SENSOR GROUND
1	K4 20BK/LB (DIESEL/RHD)	SENSOR GROUND
2	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL



BLOWER MOTOR

BLOWER MOTOR - BLACK 2 WAY

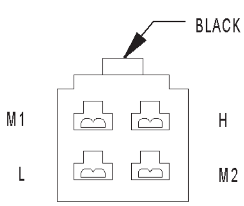
CAV	CIRCUIT	FUNCTION
1	C1 12DG	BLOWER MOTOR SUPPLY
2	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER



BLOWER MOTOR CONTROLLER (AZC)

BLOWER MOTOR CONTROLLER (AZC) - BLACK 3 WAY

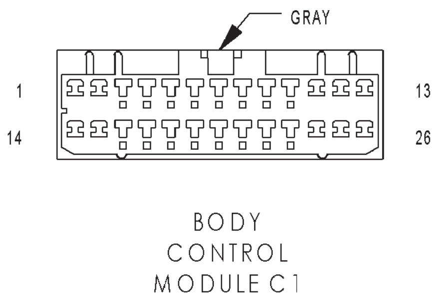
CAV	CIRCUIT	FUNCTION
A	Z118 12BK	GROUND
B	C56 20RD/LG	BLOWER MOTOR CONTROL
C	C1 12DG	BLOWER MOTOR SUPPLY



BLOWER MOTOR RESISTOR BLOCK (MTC)

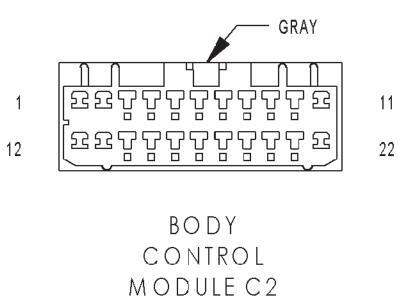
BLOWER MOTOR RESISTOR BLOCK (MTC) - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
H	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER
L	C4 16TN	BLOWER MOTOR LOW DRIVER
M1	C5 16LG	BLOWER MOTOR M1 DRIVER
M2	C6 14LB	BLOWER MOTOR M2 DRIVER



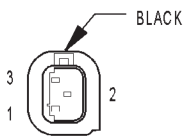
BODY CONTROL MODULE C1 - GRAY 26 WAY

CAV	CIRCUIT	FUNCTION
1	Z132 20BK/OR	GROUND
2	G52 20YL	HEADLAMP SWITCH MUX
3	E19 20RD	PANEL LAMPS DIMMER SIGNAL
4	-	-
5	G70 20BR/TN (BUILT-UP-EXPORT LHD RHD)	HOOD AJAR SWITCH SENSE
6	G26 20LB	KEY-IN IGNITION SWITCH SENSE
7	G76 18TN/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
8	E2 20OR	PANEL LAMPS DRIVER
9	E2 20OR	PANEL LAMPS DRIVER
10	E2 20OR	PANEL LAMPS DRIVER
11	-	-
12	E2 20OR	PANEL LAMPS DRIVER
13	E2 20OR	PANEL LAMPS DRIVER
14	Z132 20BK/OR	GROUND
15	D25 20YL/VT/WT	PCI BUS
16	L80 20WT/DG	HEADLAMP SWITCH RETURN
17	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
18	-	-
19	-	-
20	G69 20BK/OR	VTSS INDICATOR DRIVER
21	-	-
22	V14 20RD/VT	WIPER ON/OFF RELAY CONTROL
23	M20 20BR/OR	COURTESY LAMP LOAD SHED
24	M2 20YL	COURTESY LAMP DRIVER
25	Z234 20BK	GROUND
26	-	-



BODY CONTROL MODULE C2 - GRAY 22 WAY

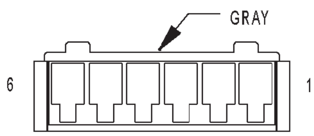
CAV	CIRCUIT	FUNCTION
1	C103 20DG	A/C SWITCH SIGNAL
2	V10 20BR	WASHER PUMP SWITCH SENSE
3	V48 20RD/GY	WIPER HIGH CONTROL
4	L40 20BR	HIGH BEAM SWITCH SENSE
5	V11 20BK/TN	WASHER FLUID SWITCH SENSE
6	P134 20TN/LG	PASSENGER SEAT HEATER SWITCH MUX
7	P133 20TN/DG	DRIVER SEAT HEATER SWITCH MUX
8	X20 20RD/YL	RADIO CONTROL MUX
9	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
10	L109 20WT	ULTRALIGHT SENSOR SIGNAL
11	V52 20DG/RD	WINDSHIELD WIPER SWITCH MUX
12	C81 20LB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
13	-	-
14	-	-
15	L27 20WT/TN	FOG LAMP SWITCH SENSE
16	C201 20LB/YL	EVAPORATOR TEMPERATURE SENSOR SIGNAL
17	G18 20PK/BK	COOLANT LEVEL SWITCH SENSE
18	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND
19	X10 20RD/BK	RADIO CONTROL MUX RETURN
20	G32 20BK/LB	SENSOR GROUND
21	L110 20BK/YL	ULTRALIGHT SENSOR RETURN
22	V9 20WT/BK	WINDSHIELD WIPER SWITCH RETURN



BOOST PRESSURE SENSOR (DIESEL)

BOOST PRESSURE SENSOR (DIESEL) - BLACK 3 WAY

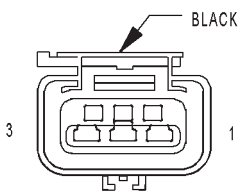
CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	Y53 20BK/YL	BOOST PRESSURE SENSOR SIGNAL
3	K6 20VT/WT	SENSOR REFERENCE VOLTAGE B



BRAKE LAMP SWITCH

BRAKE LAMP SWITCH - GRAY 6 WAY

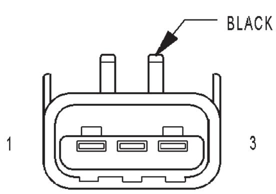
CAV	CIRCUIT	FUNCTION
1	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
2	Z238 18BK (LHD)	GROUND
2	Z243 18BK (RHD)	GROUND
3	V32 22OR/DG (GAS)	SPEED CONTROL POWER SUPPLY
4	V30 22DB/RD (GAS)	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 20VT/TN (LHD)	PRIMARY BRAKE SWITCH SIGNAL
5	L50 20WT/TN (RHD)	PRIMARY BRAKE SWITCH SIGNAL
6	F32 20PK/DB	FUSED B(+)



C100

C100 - BLACK (RIGHT HEADLAMP AND DASH SIDE)

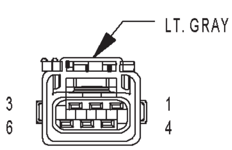
CAV	CIRCUIT
1	T40 12LG
2	K125 18WT/DB
3	K20 18DG



C100

C100 - BLACK (BATTERY SIDE)

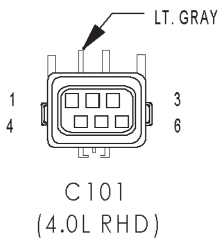
CAV	CIRCUIT
1	T40 12LG
2	K125 18WT/DB
3	K20 18DG



C101 (4.0L RHD)

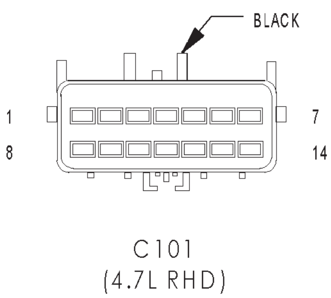
C101 (4.0L RHD) - LT. GRAY (ENGINE SIDE)

CAV	CIRCUIT
1	B22 18DG/YL
2	K99 18BR/OR
3	K299 18BR/WT
4	K6 18VT/BK
5	C18 18DB
6	-



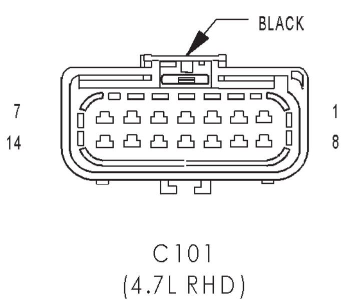
C101 (4.0L RHD) - LT. GRAY (HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	B22 18DG/YL
2	K99 18LB/OR
3	K299 18BR/WT
4	K6 18VT/BK
5	C18 18DB
6	-



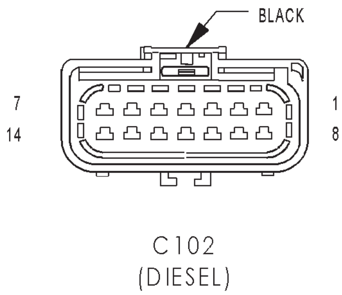
C101 (4.7L RHD) - BLACK (ENGINE SIDE)

CAV	CIRCUIT
1	K4 18BK/LB (HIGH OUTPUT)
2	K99 18BR/OR
3	C18 18DB
4	K299 18BR/WT
5	T6 18VT/WT
6	K6 18VT/BK
7	K4 18BK/LB (HIGH OUTPUT)
8	K142 18GY/BK (HIGH OUTPUT)
9	T10 18YL/DG
10	-
11	-
12	B22 18DG/YL
13	-
14	K42 18DB/LG (HIGH OUTPUT)



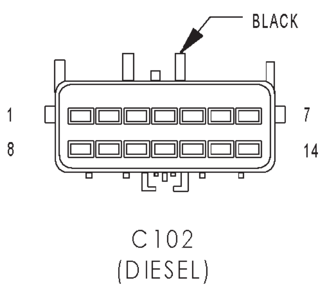
C101 (4.7L RHD) - BLACK (LEFT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	K4 18BK/LB
2	K99 18BR/OR
3	C18 18DB
4	K299 18BR/WT
5	T6 18OR/WT
6	K6 18VT/BK
7	K4 18BK/LB
8	K142 18GY/BK
9	T10 18YL/DG
10	-
11	-
12	B22 18DG/YL
13	-
14	K42 18DB/LG



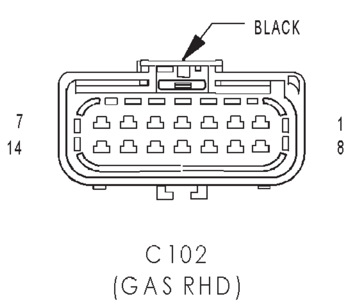
C102 (DIESEL) - BLACK (LEFT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	D21 18PK
2	D25 18VT/YL
3	K226 18DB/WT
4	D52 18LG/VT
5	D51 18DG/WT
6	B22 18DG/YL
7	F991 20OR/DB
8	T752 18DG/OR
9	K236 18GY/PK
10	K132 18BR/PK
11	A82 18PK/LG
12	K152 18WT
13	L50 18WT/TN
14	K29 18WT/PK



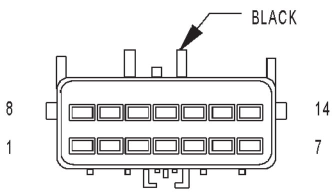
C102 (DIESEL) - BLACK (ENGINE SIDE)

CAV	CIRCUIT
1	D21 20PK
2	D25 20VT/YL
3	K226 20DB/WT
4	D52 16DG/WT
5	D51 16WT
6	B22 20DG/YL
7	F991 20RD/DB
8	T752 20DG/RD
9	K236 20GY/PK
10	K132 20BR/PK
11	A82 16PK/DG
12	K152 20WT
13	L50 20WT/DB
14	K29 20WT/PK



C102 (GAS RHD) - BLACK (RIGHT HEADLAMP AND DASH SIDE)

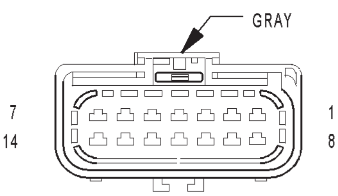
CAV	CIRCUIT
1	A30 14RD/WT (4.7L)
2	F991 20OR/DB
3	K173 18LG
4	F42 18DG/LG
5	A7 14RD/BK
6	L1 18VT/BK
7	Z306 20BK/LG
8	T41 18BK/WT
9	-
10	K4 20BK/LB
11	K200 18VT/OR (4.7L)
12	C2 18DB/YL
13	-
14	A142 14DG/OR



C102
(GAS RHD)

C102 (GAS RHD) - BLACK (ENGINE SIDE)

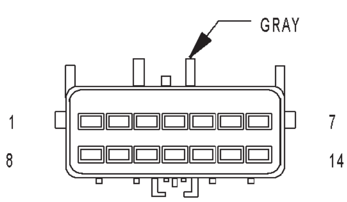
CAV	CIRCUIT
1	A30 14RD/WT (4.7L)
2	F991 18OR/DB
3	K173 18LG
4	F42 18DG/LG
5	A7 14RD/BK
6	L1 18VT/BK
7	Z306 20BK/LG
8	T41 18BK/WT
9	-
10	K4 18BK/LB
11	K200 18VT/OR (4.7L)
12	C2 18DB/YL
13	-
14	A142 14DG/OR



C103
(DIESEL)

C103 (DIESEL) - GRAY (LEFT HEADLAMP AND DASH SIDE)

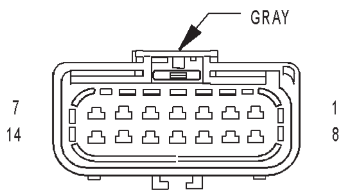
CAV	CIRCUIT
1	T41 18BK/WT
2	K173 18LG
3	C2 18DB/PK
4	-
5	F142 14OR/DG
6	K51 18DB/YL
7	K25 18VT/LG
8	Y42 18OR/DB
9	C18 18DB
10	K4 20BK/LB
11	K6 18VT/WT
12	-
13	T40 12BR
14	F15 18DB/WT



C103
(DIESEL)

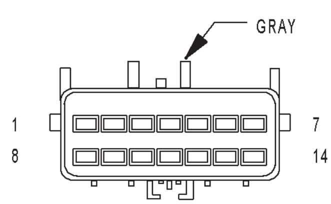
C103 (DIESEL) - GRAY (ENGINE SIDE)

CAV	CIRCUIT
1	T41 20BK/WT
2	K173 20GY
3	C3 14DB/BK
4	-
5	F142 16RD/DG
6	K51 20DB/YL
7	K25 20VT/DG
8	Y42 20RD/DB
9	C18 20DB
10	K4 16BK/LB
11	K6 16VT/WT
12	-
13	T40 12DG
14	F15 20DB/WT



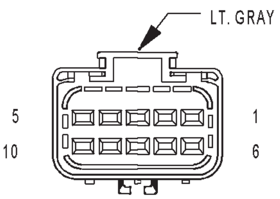
C103 (GAS) - GRAY (RIGHT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	F22 20WT/PK (EXCEPT 4.7L RHD)
1	F22 18WT/TN (4.7L RHD)
2	T6 18OR/WT (4.7L LHD)
2	C18 20DB (4.0L LHD BUILT-UP-EXPORT)
2	C18 18DB (4.0L EXCEPT BUILT-UP-EXPORT)
3	D20 20LG (4.7L LHD)
3	D20 18LG (4.7L RHD)
4	D21 20PK (4.7L LHD)
4	K299 18BR/WT (4.0L LHD)
4	D21 18PK (4.7L RHD)
5	B22 18DG/YL (LHD)
6	K20 18DG
7	K30 20PK (4.0L RHD)
7	K30 18PK/YL (4.7L RHD)
7	K30 20PK/YL (LHD)
8	A142 14DG/OR (4.0L LHD)
8	T10 18DG/LG (4.7L LHD)
9	T16 14RD (4.7L LHD)
10	D25 18VT/YL (4.7L RHD)
10	D25 18VT/YL (4.7L EXCEPT BUILT-UP-EXPORT)
10	D25 20VT/YL (4.7L LHD BUILT-UP-EXPORT)
11	Z305 20BK/OR
12	F45 18YL/RD (4.7L RHD)
12	T15 18YL/BR (4.0L)
12	F45 18YL/RD (4.7L EXCEPT BUILT-UP-EXPORT)
12	F45 20YL/RD (4.7L LHD BUILT-UP-EXPORT)
13	K6 18VT/BK (4.0L LHD)
14	F142 18OR/DG



C103 (GAS) - GRAY (ENGINE SIDE)

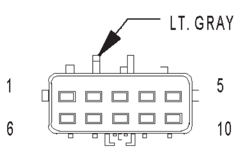
CAV	CIRCUIT
1	F22 18WT/PK
2	C18 18DB (4.0L LHD)
2	K200 18VT/OR (4.7L RHD)
3	K99 18BR/OR (4.0L LHD)
3	D20 18LG (4.7L RHD)
4	K299 18BR/WT (4.0L BUILT-UP-EXPORT)
4	D21 18PK (4.7L RHD)
5	B22 18DG/YL (4.0L LHD)
6	K20 18DG
7	K30 18PK/YL
8	A142 14DG/OR (4.0L LHD)
9	T16 14RD (4.7L)
10	D25 18WT/VT (4.7L)
11	Z305 20BK/OR
12	T15 18LG (4.0L LHD)
12	F45 18YL/RD (4.7L)
13	K6 18VT/BK (4.0L LHD)
13	K199 18DB/WT (4.7L LHD)
14	F142 18OR/DG



C104

C104 - LT. GRAY (RIGHT HEADLAMP AND DASH SIDE)

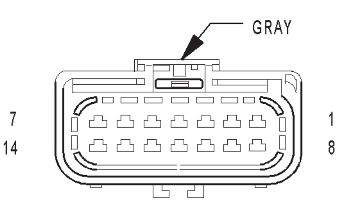
CAV	CIRCUIT
1	K200 18VT/OR (4.0L EXCEPT BUILT-UP-EXPORT)
1	K4 18BK/LB (4.7L HIGH OUTPUT)
2	K99 18BR/OR (4.7L)
2	F991 20OR/DB (4.0L)
3	K173 18LG (4.0L)
4	F42 18DG/LG (4.0L)
5	A7 14RD/BK (4.0L)
5	K4 18BK/LB (4.7L HIGH OUTPUT)
6	L1 18VT/BK (4.0L)
6	K142 18GY/BK (4.7L HIGH OUTPUT)
7	Z306 20BK/LG (4.0L)
7	K299 18BR/WT (4.7L)
8	C18 18DB (4.7L)
8	T41 18BK/WT (4.0L)
9	K6 18VT/BK (4.7L)
9	C2 18DB/YL (4.0L)
10	K4 18BK/LB (4.0L)
10	K42 18DB/LG (4.7L HIGH OUTPUT)



C104

C104 - LT. GRAY (ENGINE SIDE)

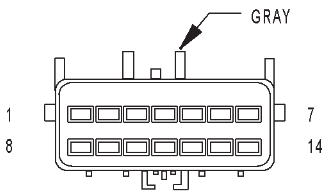
CAV	CIRCUIT
1	K200 18VT/OR (EXCEPT 4.0L BUILT-UP-EXPORT)
2	F991 18OR/DB
3	K173 18LG
4	F42 18DG/LG
5	A7 14RD/BK
6	L1 18VT/BK
7	Z306 20BK/LG
8	T41 18BK/WT
9	C2 18DB/YL
10	K4 18BK/LB



C105
(DIESEL)

C105 (DIESEL) - GRAY (LEFT HEADLAMP AND DASH SIDE)

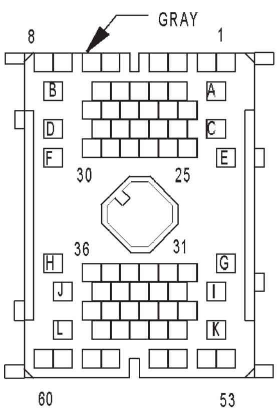
CAV	CIRCUIT
1	C13 18DB/OR
2	F300 18RD/BK
3	V37 18RD/LG
4	Z305 20BK/OR
5	Z306 20BK/LG
6	L1 18VT/BK
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-



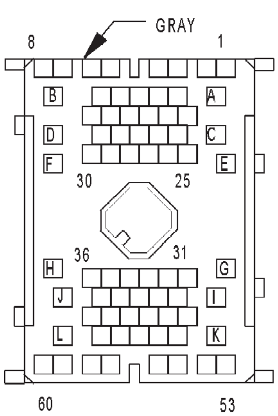
C105
(DIESEL)

C105 (DIESEL) - GRAY (ENGINE SIDE)

CAV	CIRCUIT
1	C13 20DB/RD
2	F300 20RD/BK
3	V37 20RD/DG
4	Z305 18BK/DB
5	Z306 18BK/DB
6	-
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-



C106
(RHD)
(DIESEL)



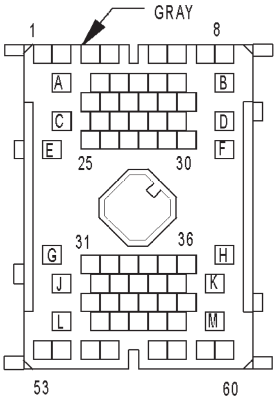
C106
(LHD)
(DIESEL)

C106 (DIESEL) - GRAY (BODY SIDE)

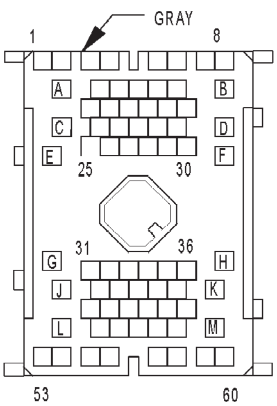
CAV	CIRCUIT
A	B10 14BR/WT (LHD)
B	-
C	-
D	-
E	-
F	-
G	-
H	-
J	-
K	-
L	-
M	B29 14DG/OR
1	F15 20DB/WT
2	-
3	G31 20VT/LG
4	G32 20DB/OR (RHD)
4	G32 20BK/LB (LHD)
5	G18 20PK/BK
6	-
7	-
8	F12 20DB/WT (LHD)
9	-
10	Z231 18BK (RHD)
11	K4 20BK/LB (LHD)
11	G9 18GY/BK (RHD)
12	K6 18VT/WT (LHD)
13	-
14	-
15	-
16	K173 18LG
17	-
18	X2 18DG/RD
19	C18 18DB (LHD)
20	Y42 18OR/DB
21	-

C106 (DIESEL) - GRAY (BODY SIDE)

CAV	CIRCUIT
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	-
40	-
41	-
42	R46 20BR/LB
43	R48 20TN
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	L7 20BK/YL
54	L60 20TN
55	-
56	-
57	L39 20LB
58	-
59	L44 18VT/RD
60	L34 18RD/OR



C106
(RHD)
(DIESEL)



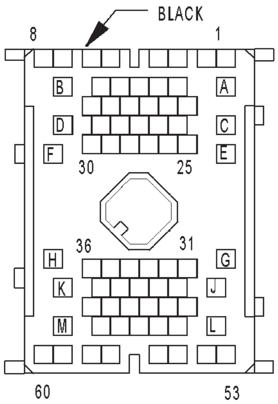
C106
(LHD)
(DIESEL)

C106 (DIESEL) - GRAY (RIGHT HEADLAMP AND DASH SIDE)

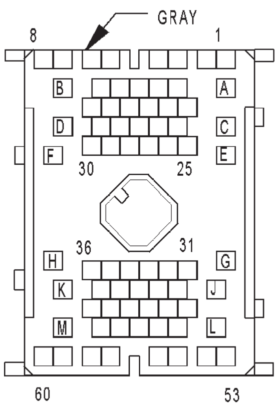
CAV	CIRCUIT
A	-
B	-
C	-
D	-
E	-
F	-
G	-
H	-
J	-
K	-
L	-
M	-
1	F15 18DB/WT
2	-
3	G31 20VT/LG
4	G32 20BK/LB
5	G18 20PK/BK
6	-
7	-
8	-
9	-
10	Z231 18BK (RHD)
11	K4 18BK/LB (LHD)
11	G9 18GY/BK (RHD)
12	K6 18VT/WT (LHD)
13	-
14	-
15	-
16	K173 18LG
17	-
18	X2 18DG/RD
19	C18 18DB (LHD)
20	Y42 18OR/DB
21	-
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	-
28	-
29	-
30	-
31	-

C106 (DIESEL) - GRAY (RIGHT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
32	-
33	-
34	-
35	-
36	-
37	-
38	L13 18BR/YL
39	-
40	-
41	-
42	R46 18BR/LB
43	R47 18TN
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	L7 20BK/YL
54	L60 20TN
55	-
56	-
57	L39 20LB
58	-
59	L44 18VT/RD
60	L34 18RD/OR



C106
(LHD GAS)



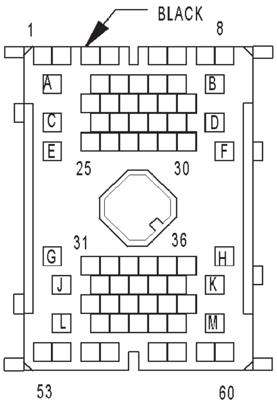
C106
(RHD GAS)

C106 (GAS) - GRAY/RHD BLACK/LHD (BODY SIDE)

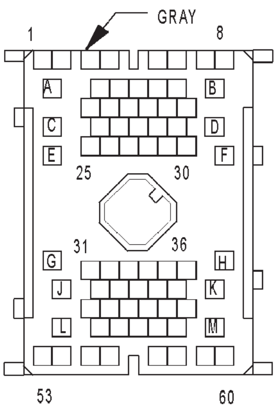
CAV	CIRCUIT
A	A149 12RD/TN
B	A148 16LG/RD
C	C1 12DG
D	-
E	A10 12RD/DG (LHD)
E	A10 10RD/DG (RHD)
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	A20 14RD/DB
1	A141 16DG/BK
2	G18 20PK/BK (LHD)
2	F42 18DG/LG (RHD)
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	F22 18WT/TN (RHD)
7	F22 20WT/PK (LHD)
8	F12 20DB/WT
9	K52 20PK/BK (LHD)
10	K29 20WT/PK (LHD)
10	Z231 18BK (RHD)
11	K512 18LB (RHD)
11	K226 20LB/YL (LHD)
12	K107 20OR/YL (LHD)
13	K251 18LB (RHD)
13	K106 20WT/DG (LHD)
14	T41 18BK/WT (LHD)
14	C13 20DB/OR (RHD)
15	V35 20LG/RD (RHD)
16	V36 20TN/RD (RHD)
17	G9 18GY/BK (RHD)
18	K25 18VT/LG (RHD)
19	K51 20DB/YL (RHD)
20	K125 18WT/DB (LHD)
21	K125 18WT/DB (RHD)
22	K31 18BR (RHD)
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	X3 22GY/OR (LHD)
27	X3 22BK/RD (RHD)
28	G32 20BK/LB (LHD)
28	G32 20DB/OR (RHD)
29	-
30	G31 20VT/LG
31	-
32	V32 22OR/DG (LHD)
33	V30 22DB/RD
34	V16 22VT

C106 (GAS) - GRAY/RHD BLACK/LHD (BODY SIDE)

CAV	CIRCUIT
35	V14 22RD/VT
36	-
37	F45 20YL/RD
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	-
40	Z306 20BK/LG
41	Z305 20BK/OR
42	R46 20BR/LB
43	R48 20TN
44	F991 20OR/DB
45	B22 18DG/YL (LHD)
46	-
47	-
48	D25 18YL/VT
49	D21 20PK
50	D20 20LG
51	D32 20LG/DG (LHD)
52	T41 18BK/WT (RHD)
52	T6 18OR/BK (LHD)
53	L7 20BK/YL
54	L60 20TN
55	G18 20PK/BK (RHD)
55	V37 22RD/LG (LHD)
56	L1 18VT/BK
57	L39 20LB
58	K4 18BK/LB (LHD)
58	K4 20BK/LB (RHD)
59	L44 18VT/RD
60	L34 18RD/OR



C106
(LHD GAS)



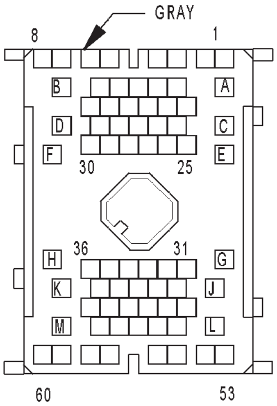
C106
(RHD GAS)

C106 (GAS) - GRAY/RHD BLACK/LHD (RIGHT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
A	A149 12RD/TN
B	A148 16LG/RD
C	C1 12DG
D	-
E	A10 12RD/DG
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
L	A2 12PK/BK
K	A148 10PK/WT
M	A20 12RD/DB
1	A141 16DG/BK (RHD)
1	A141 16DG/WT (LHD)
2	F42 18DG/LG (RHD)
2	G18 18PK/BK (LHD)
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	F22 18WT/TN (4.7L RHD)
7	F22 20WT/PK (EXCEPT 4.7L RHD)
8	F12 18DB/WT
9	K52 18PK/BK (LHD)
10	K29 18WT/PK (LHD)
10	Z231 18BK (RHD)
11	K226 18LB/YL (LHD)
11	K512 18RD/YL (4.7L RHD)
12	K107 18OR/PK (EXCEPT BUILT-UP-EXPORT)
13	K106 18WT/DG (EXCEPT BUILT-UP-EXPORT)
14	C13 18DB/OR (RHD)
14	T41 18BK/WT (LHD)
15	V35 20LG/RD (RHD)
16	V36 20TN/RD (RHD)
17	G9 18GY/BK (RHD)
18	K25 18VT/LG (RHD)
19	K51 18DB/YL (RHD)
20	K125 18WT/DB (EXCEPT BUILT-UP-EXPORT)
21	K125 18WT/DB (RHD)
22	K31 18BR (RHD)
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	X3 20BK/RD
28	G32 20BK/LB
29	-
30	G31 20VT/LG
31	-
32	V32 18OR/DG (LHD)
33	V30 20DB/RD
34	V16 20VT

C106 (GAS) - GRAY/RHD BLACK/LHD (RIGHT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
35	V14 20RD/VT
36	-
37	F45 18YL/RD (LHD/4.7L RHD)
37	F45 20YL/RD (RHD)
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	-
40	Z306 20BK/LG
41	Z305 20BK/OR
42	R46 18BR/LB
43	R48 18TN
44	F991 20OR/DB
45	B22 18DG/YL (LHD)
46	-
47	-
48	D25 18VT/YL (LHD/4.7L RHD)
49	D21 18PK (4.0L LHD/4.7L RHD)
49	D21 20PK (4.7L LHD)
50	D20 20LG (4.7L LHD)
50	D20 18LG (4.7L RHD)
51	D32 18LG (EXCEPT BUILT-UP-EXPORT)
51	D32 18LG/DG (LHD BUILT-UP-EXPORT)
52	T41 18BK/WT (RHD)
52	T6 18OR/WT (LHD)
53	L7 20BK/YL
54	L60 20TN
55	G18 20PK/BK (RHD)
55	V37 18RD/LG (LHD)
56	L1 18VT/BK
57	L39 20LB
58	K4 18BK/LB (LHD)
58	K4 20BK/LB (RHD)
59	L44 18VT/RD
60	L34 18RD/OR



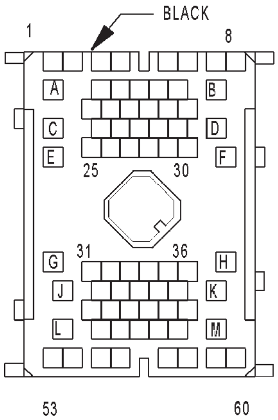
C107
(DIESEL)

C107 (DIESEL) - GRAY (BODY SIDE)

CAV	CIRCUIT
A	B10 14BR/WT
B	A148 16LG/RD
C	C1 12DG
D	A149 12RD/TN
E	-
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	B29 14DG/OR
1	X2 18DG/RD
2	V11 20BK/TN
3	K4 20BK/LB
4	V37 22RD/LG (LHD)
4	V37 20RD/LG (RHD)
5	V55 16TN/RD
6	V6 16DB
7	V10 22BR (LHD)
7	V10 20BR (RHD)
8	-
9	K226 18LB/YL (LHD)
9	K226 20LB/YL (RHD)
10	X3 22GY/OR (LHD)
10	X3 22BK/RD (RHD)
11	F15 20DB/WT
12	F45 20YL/RD
13	T41 18BK/WT
14	-
15	G70 20BR/TN
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	-
20	-
21	F991 20OR/DB
22	-
23	X75 20GY/LG
24	Y42 18OR/DB
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL

C107 (DIESEL) - GRAY (BODY SIDE)

CAV	CIRCUIT
30	B1 18YL/DB
31	-
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18WT/TN (RHD)
34	L50 18VT/TN (LHD)
35	R47 20DB/LB
36	T2 18TN/BK
37	Z305 20BK/OR
38	Z306 20BK/LG
39	R49 20LB
40	K29 18WT/PK
41	C18 20DB (LHD)
42	-
43	K6 18VT/WT (LHD)
44	-
45	V16 22VT
46	V14 22RD/VT
47	L13 18BR/YL
48	D25 18YL/VT
49	D21 20PK
50	K173 18LG
51	-
52	-
53	L7 20BK/YL
54	L61 20TN/LG
55	L1 18VT/BK
56	V20 18BK/WT (LHD)
56	V20 20BK/WT (RHD)
57	L39 20LB
58	F22 20WT/PK (LHD)
58	F22 18WT/TN (RHD)
59	L43 18VT
60	L33 18RD



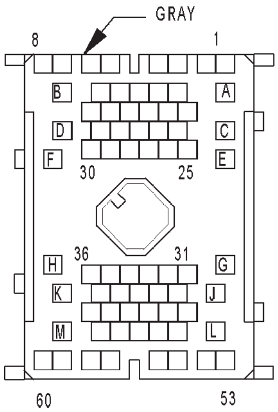
C107
(DIESEL)

C107 (DIESEL) - GRAY (LEFT HEADLAMP AND DASH SIDE)

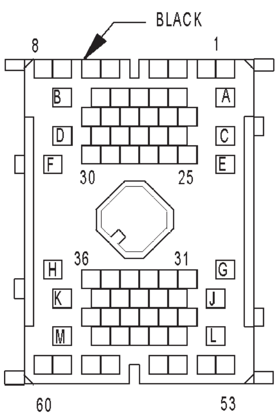
CAV	CIRCUIT
A	-
B	A148 16LG/RD
C	C1 12DG
D	A149 12RD/TN
E	-
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	-
1	X2 18DG/RD
2	V11 20BK/TN
3	K4 18BK/LB
4	V37 18RD/LG
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR
8	-
9	K226 18DB/WT
10	X3 20BK/RD
11	F15 18DB/WT
12	F45 18YL/RD
13	T41 18BK/WT
14	-
15	G70 20BR/TN
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	-
20	-
21	F991 20OR/DB
22	-
23	X75 18GY/LB
24	Y42 18OR/DB
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 18PK

C107 (DIESEL) - GRAY (LEFT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
33	F20 18DB/PK
34	L50 18WT/TN
35	R47 18DB/LB
36	T2 18TN/BK
37	Z305 20BK/OR
38	Z306 20BK/LG
39	R49 18LB
40	K29 18WT/PK
41	C18 18DB (RHD)
42	-
43	K6 18VT/WT (RHD)
44	-
45	V16 20VT
46	V14 20RD/VT
47	L13 18BR/YL
48	D25 18VT/YL
49	D21 18PK
50	K173 18LG
51	-
52	-
53	L7 18BK/YL
54	L61 20LG
55	L1 18VT/BK
56	V20 18BK/WT
57	L39 20LB
58	F22 18WT/PK
59	L43 18VT
60	L33 18LG/BR



C107
(RHD)
(GAS)



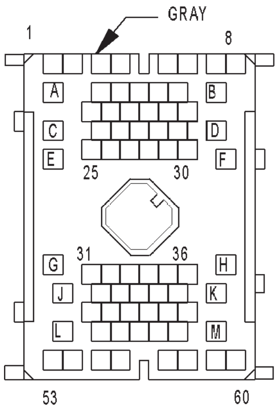
C107
(LHD)
(GAS)

C107 (GAS) - GRAY/RHD BLACK/LHD (BODY SIDE)

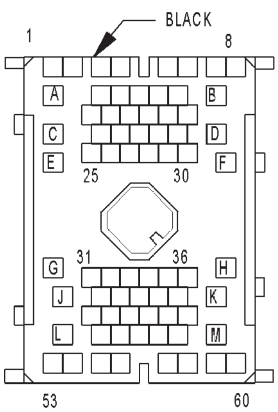
CAV	CIRCUIT
A	-
B	-
C	-
D	-
E	A10 12RD/DG (LHD)
E	A10 10RD/DG (RHD)
F	-
G	-
H	-
J	-
K	-
L	-
M	A20 14RD/DB
1	V37 20RD/LG (RHD)
2	V11 20BK/TN
3	V3 16BR/WT (GAS)
4	V4 16RD/YL (GAS)
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR (RHD)
7	V10 22BR (LHD)
8	F12 20DB/WT
9	K226 20LB/YL (RHD)
9	K52 20PK/BK (LHD)
10	L13 18BR/YL (BUILT-UP-EXPORT)
11	K512 18LB
12	K4 20BK/LB
13	-
14	T6 18OR/BK (RHD)
15	G70 20BR/TN (BUILT-UP-EXPORT)
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	D32 20LG/DG (RHD)
20	-
21	-
22	-
23	X75 20GY/LG (BUILT-UP-EXPORT)
24	F42 18DG/LG (RHD)
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18VT/TN (LHD)
34	L50 18WT/TN (RHD)
35	R47 20DB/LB (LHD)
36	-
37	K51 20DB/YL (RHD)
38	K25 18VT/LG (RHD)

C107 (GAS) - GRAY/RHD BLACK/LHD (BODY SIDE)

CAV	CIRCUIT
39	K31 18BR (RHD)
39	R49 20DB (LHD)
40	K29 18WT/PK (RHD)
41	K125 18WT/DB (RHD)
42	V32 22OR/DG (RHD)
43	R47 20DB/LB (RHD)
44	V35 20LG/RD (RHD)
45	B22 18DG/YL (LHD)
45	V36 20TN/RD (RHD)
46	C13 20DB/OR (RHD)
47	L13 18BR/YL (RHD)
48	D25 18YL/VT
49	D21 20PK (RHD)
50	R49 20LB (RHD)
51	-
52	-
53	L7 20BK/YL
54	L61 20TN/LG
55	-
56	V20 18BK/WT (LHD)
56	V20 20BK/WT (RHD)
57	L39 20LB
58	-
59	L43 18VT
60	L33 18RD



C107
(RHD)
(GAS)



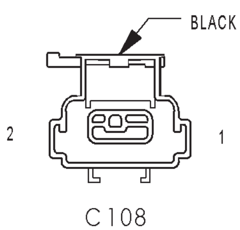
C107
(LHD)
(GAS)

C107 (GAS) - GRAY/RHD BLACK/LHD (LEFT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
A	-
B	-
C	-
D	-
E	A10 12RD/DG
F	-
G	-
H	-
J	-
K	-
L	-
M	A20 12RD/DB
1	V37 18RD/LG (RHD)
2	V11 20BK/TN
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR
8	F12 20DB/WT
9	K52 20PK/BK (LHD)
9	K226 18LB/YL (RHD)
10	-
11	K512 18RD/YL (4.7L RHD)
12	K4 18BK/LB (RHD)
13	-
14	T6 18OR/BK (4.0L RHD)
14	T6 18OR/WT (4.7L RHD)
15	G70 20BR/TN (RHD)
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	D32 18LG/DG (RHD)
20	-
21	-
22	-
23	X75 18GY/LG (RHD)
24	F42 18DG/LG (RHD)
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD (LHD)
32	M1 18PK (RHD)
33	F20 18DB/PK
34	L50 18WT/TN
35	R47 18DB/LB (LHD)
36	-
37	K51 18DB/YL (RHD)
38	K25 18VT/LG (RHD)
39	R49 18LB (LHD)

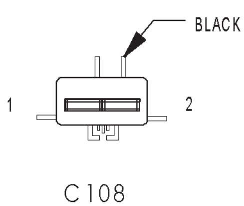
C107 (GAS) - GRAY/RHD BLACK/LHD (LEFT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
39	K31 18BR (RHD)
40	K29 18WT/PK (RHD)
41	K125 18WT/DB (RHD)
42	V32 18OR/DG (RHD)
43	R47 18DB/LB (RHD)
44	V35 18LG/RD (RHD)
45	B22 18DG/YL (LHD)
45	V36 18TN/RD (RHD)
46	C13 18DB/OR (RHD)
47	L13 18BR/YL (RHD)
48	D25 18VT/YL
49	D21 18PK (RHD)
50	R49 18LB (RHD)
51	-
52	-
53	L7 20BK/YL
54	L61 20TN/LG
55	-
56	V20 18BK/WT
57	L39 20LB
58	-
59	L43 18VT
60	L33 18RD



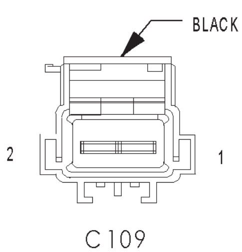
C108 - BLACK (LEFT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	M1 20PK (BUILT-UP-EXPORT)
1	M1 20PK/RD (EXCEPT BUILT-UP-EXPORT)
2	Z141 20BK



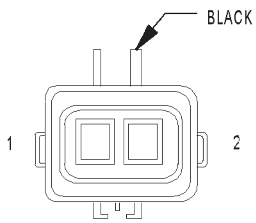
C108 - BLACK (UNDERHOOD LAMP SIDE)

CAV	CIRCUIT
1	M1 20PK/RD
2	Z141 20BK



C109 - BLACK (ENGINE SIDE)

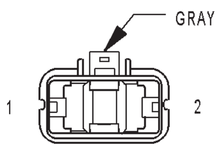
CAV	CIRCUIT
1	K77 18LG/BK
2	K4 18BK/LB



C109

C109 - BLACK (TRANSFER CASE JUMPER SIDE)

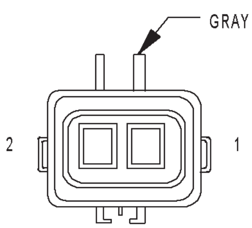
CAV	CIRCUIT
1	K77 18LG/BK
2	K4 18BK/LB



C110
(DIESEL)

C110 (DIESEL) - GRAY (LEFT HEADLAMP AND DASH SIDE)

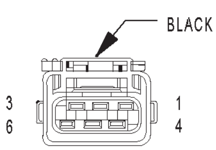
CAV	CIRCUIT
1	K154 10GY
2	K254 10GY/YL



C110
(DIESEL)

C110 (DIESEL) - GRAY (GLOW PLUG SIDE)

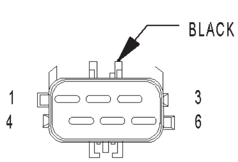
CAV	CIRCUIT
1	K154 10GY
2	K254 10GY/YL



C111

C111 - BLACK (LEFT FRONT LIGHTING MODULE SIDE)

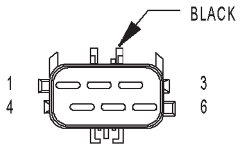
CAV	CIRCUIT
1	L33 18RD
2	L43 18VT
3	L61 20TN/LG
4	L7 20BK/YL
5	L114 18BR/YL (BUILT-UP-EXPORT)
6	Z141 18BK



C111

C111 - BLACK (LEFT HEADLAMP AND DASH SIDE)

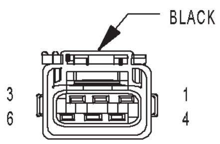
CAV	CIRCUIT
1	L33 18LG/BR (DIESEL)
1	L33 18RD (GAS)
2	L43 18VT
3	L61 20LG (DIESEL)
3	L61 20TN/LG (GAS)
4	L7 18BK/YL (DIESEL)
4	L7 20BK/YL (GAS)
5	L13 18BR/YL (BUILT-UP-EXPORT)
6	Z141 18BK



C112

C112 - BLACK (RIGHT HEADLAMP AND DASH SIDE)

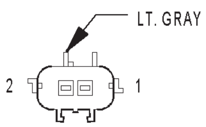
CAV	CIRCUIT
1	L34 18RD/OR
2	L44 18VT/RD
3	L60 20TN
4	L7 20BK/YL
5	L13 18BR/YL (BUILT-UP-EXPORT)
6	Z142 18BK



C112

C112 - BLACK (RIGHT FRONT LIGHTING MODULE SIDE)

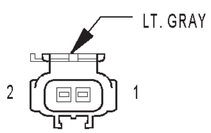
CAV	CIRCUIT
1	L34 18RD/OR
2	L44 18VT/RD
3	L60 20TN
4	L7 20BK/YL
5	L13 18BR/YL (BUILT-UP-EXPORT)
6	Z142 18BK



C113
(DIESEL)

C113 (DIESEL) - LT. GRAY (ENGINE SIDE)

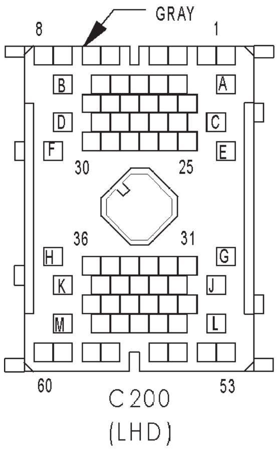
CAV	CIRCUIT
1	D51 16WT
2	D52 16DG/WT

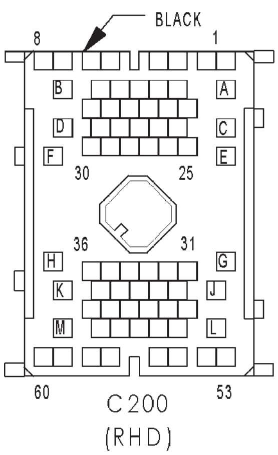


C113
(DIESEL)

C113 (DIESEL) - LT. GRAY (TRANSMISSION SIDE)

CAV	CIRCUIT
1	D52 18LG/WT
2	D51 18DG/WT



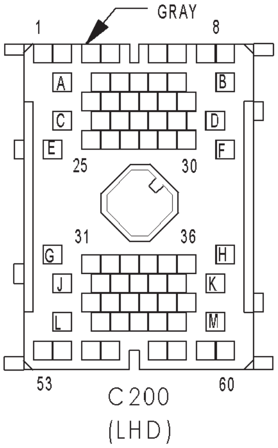


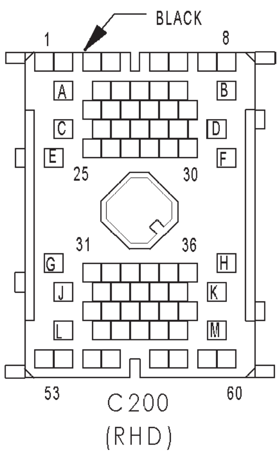
C200 - GRAY/LHD BLACK/RHD (LEFT BODY SIDE)

CAV	CIRCUIT
A	-
B	-
C	A1 12RD
D	-
E	-
F	-
G	A2 12PK/BK
H	C1 12DG
J	-
K	-
M	-
L	-
1	X56 18DB/PK (BASE)
1	X84 18OR/GY (EXCEPT BASE)
2	X86 18OR/RD (EXCEPT BASE)
2	X54 18VT (BASE)
3	X81 18YL/BK (EXCEPT BASE)
3	X55 18BR/RD (BASE)
4	X53 18DG/OR (BASE)
4	X83 18YL/RD (EXCEPT BASE)
5	X53 18DG/OR
6	X55 18BR/RD
7	X54 18VT
8	X56 18DB/PK
9	Y152 20LG/OR (EXCEPT BUILT-UP-EXPORT)
10	D20 20LG (GAS)
11	Y151 20LG/BR (EXCEPT BUILT-UP-EXPORT)
12	Y153 20DB/RD (EXCEPT BUILT-UP-EXPORT)
13	X40 20RD/WT (CD)
14	D25 20YL/VT
15	D25 20YL/VT
16	D32 20LG/DG (GAS)
17	T41 18BK/WT
18	Z4 20WT/BK (CD)
19	X41 20WT/DG (CD)
20	T6 18OR/BK (GAS)
21	D21 20PK (GAS)
22	K29 18WT/PK
23	X160 20YL (CD)
24	X112 20RD (CD)
25	-
26	-
27	G70 20BR/TN (BUILT-UP-EXPORT)
28	R47 20DB/LB
29	Z17 20BK (CD)
30	R49 20LB
31	G76 20TN/YL (RHD)
31	G76 18TN/YL (LHD)
32	T2 18TN/BK (DIESEL)
33	-
34	-

C200 - GRAY/LHD BLACK/RHD (LEFT BODY SIDE)

CAV	CIRCUIT
35	X51 18WT/DG
36	X57 18DG/WT
37	L7 18BK/YL (BUILT-UP-EXPORT)
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	V10 22BR (LHD)
39	V10 20BR (RHD)
40	X52 18DB/WT
41	X58 18DB/OR
42	-
43	V13 18BR/LG
44	V14 22RD/VT
45	-
46	V20 20BK/WT (RHD)
46	V20 18BK/WT (LHD)
47	V22 18BR/YL
48	R46 20BR/LB (RHD)
48	R46 18BK/LB (LHD)
49	X64 18BR/WT
50	Z305 20BK/OR
51	Z306 20BK/LG
52	R48 20TN
53	G32 20BK/LG (LHD)
53	G32 20DB/OR (RHD)
54	G31 20VT/LG
55	Z9 16BK
56	V11 20BK/TN
57	G18 20PK/BK
58	V37 22RD/LG (LHD)
58	V37 20RD/LG (RHD)
59	K4 20BK/LB
60	-



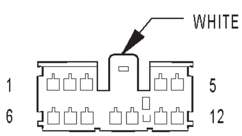


C200 - GRAY/LHD BLACK/RHD (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
A	-
B	-
C	A1 12RD
D	-
E	-
F	-
G	A2 12PK/BK
H	C1 12DG
J	-
K	-
L	-
M	-
1	X84 18OR/BK
2	X86 18OR/RD
3	X81 18YL/BK
4	X83 18YL/RD
5	X53 18DG/OR
6	X55 18BR/RD
7	X54 18VT
8	X56 18DB/PK
9	Y152 20LG/BR (EXCEPT BUILT-UP-EXPORT)
10	D20 20LG
11	Y151 20LG/BR (EXCEPT BUILT-UP-EXPORT)
12	Y153 20DB/RD (EXCEPT BUILT-UP-EXPORT)
13	X40 20WT/RD
14	D25 20YL/VT/GY
15	D25 20YL/VT/BR
16	D32 20LG/DG
17	T41 18BK/WT (DIESEL)
18	Z4 20WT/BK
19	X41 20WT/DG
20	T6 18OR/WT (GAS)
21	D21 20PK
22	K29 18WT/PK
23	X160 20YL
24	X112 20RD
25	-
26	-
27	G70 20BR/TN (BUILT-UP-EXPORT)
28	R47 20DB/LB
29	Z17 20BK
30	R49 20LB
31	G76 18TN/YL
32	T2 20TN/BK (DIESEL)
33	-
34	-
35	X51 18WT/DG
36	X57 18DG/WT
37	L7 18BK/YL (BUILT-UP-EXPORT)
38	L13 20BR/YL (BUILT-UP-EXPORT)
39	V10 20BR
40	X52 18DB/WT

C200 - GRAY/LHD BLACK/RHD (INSTRUMENT PANEL SIDE)

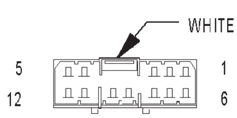
CAV	CIRCUIT
41	X58 18DB/OR
42	-
43	V13 18BR/LG
44	V14 20RD/VT
45	-
46	V20 18BK/WT
47	V22 18BR/YL
48	R46 20BR/LB
49	X64 18BR/WT
50	Z305 20BK/OR
51	Z306 20BK/LG
52	R48 20TN
53	G32 20BK/LB
54	G31 20VT/LG
55	Z9 16BK
56	V11 20BK/TN
57	G18 20PK/BK
58	V37 20RD/LG
59	K4 20BK/LB
60	-



C201
(DIESEL)

C201 (DIESEL) - WHITE (INSTRUMENT PANEL SIDE)

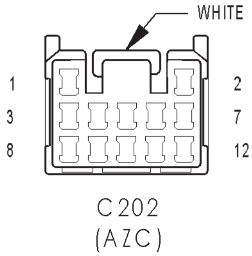
CAV	CIRCUIT
1	-
2	Z300 18BK
3	E2 20OR
4	K29 18WT/PK
5	D25 20YL/VT
6	D19 20VT/OR
7	D21 20PK
8	F12 20DB/WT
9	T2 20TN/BK
10	Z234 18BK
11	T41 18BK/WT
12	F991 18OR/DB



C201
(DIESEL)

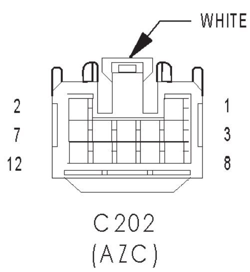
C201 (DIESEL) - WHITE (SHIFTER ASSEMBLY SIDE)

CAV	CIRCUIT
1	-
2	-
3	-
4	K2 20WT/PK
5	D25 20RD
6	-
7	D21 20PK
8	F12 20DB/WT
9	T2 20TN/BK
10	Z234 20WT
11	T41 20BK/WT
12	F991 20OR/DB



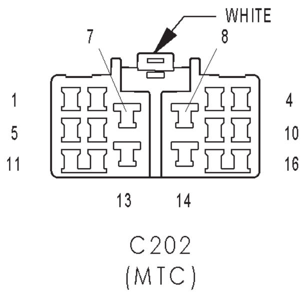
C202 (AZC) - WHITE (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
1	C100 20YL/DB (RHD)
1	C32 20GY/DB (LHD)
2	C100 20YL/DB (LHD)
2	C32 20GY/DB (RHD)
3	C96 20WT/DB (RHD)
3	C33 20DB/RD (LHD)
4	C94 20WT/DG (RHD)
4	C95 20WT/BK (LHD)
5	C95 20WT/BK (RHD)
5	C94 20WT/DG (LHD)
6	C33 20DB/RD (RHD)
6	C96 20WT/DB (LHD)
7	C35 20DG/YL (RHD)
7	C102 20TN/BK (LHD)
8	C35 20DG/YL (LHD)
8	C102 20TN/BK (RHD)
9	C56 20RD/LG
10	-
11	C201 20LB/YL
12	G32 20BK/LB



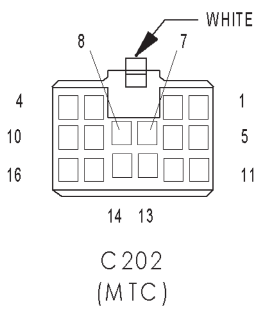
C202 (AZC) - WHITE (A/C SIDE)

CAV	CIRCUIT
1	C100 20YL/DB (RHD)
1	C32 20GY/DB (LHD)
2	C100 20YL/DB (LHD)
2	C32 20GY/DB (RHD)
3	C96 20WT/DB (RHD)
3	C33 20DB/RD (LHD)
4	C94 20WT/DG (RHD)
4	C95 20WT/BK (LHD)
5	C95 20WT/BK (RHD)
5	C94 20WT/DG (LHD)
6	C33 20DB/RD (RHD)
6	C96 20WT/DB (LHD)
7	C35 20DG/YL (RHD)
7	C102 20TN/BK (LHD)
8	C35 20DG/YL (LHD)
8	C102 20TN/BK (RHD)
9	C56 20RD/LG
10	-
11	C201 20LB/YL
12	G32 20BK/LB



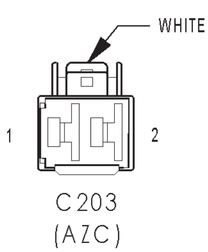
C202 (MTC) - WHITE (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
1	-
2	C201 20LB/YL
3	G32 20BK/LB
4	-
5	C67 20RD/LB
6	-
7	-
8	-
9	-
10	C6 14LB
11	Z132 20BK/OR
12	F22 20WT/PK
13	C7 12BK/TN
14	C1 12DG
15	C4 16TN
16	C5 16LG



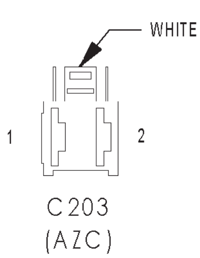
C202 (MTC) - WHITE (A/C SIDE)

CAV	CIRCUIT
1	-
2	C101 20LB/YL
3	G32 20BK/LB
4	-
5	C67 20RD/LB
6	-
7	-
8	-
9	-
10	C6 14LB
11	Z132 20BK/OR
12	F22 20WT/PK
13	C7 12BK/TN
14	C1 12DG
15	C4 16TN
16	C5 16LG



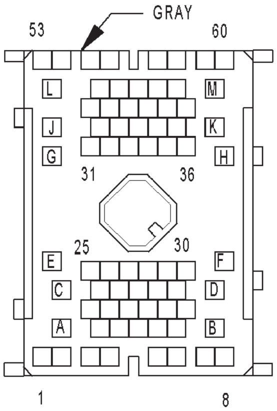
C203 (AZC) - WHITE (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
1	Z118 12BK
2	C1 12DG



C203 (AZC) - WHITE (A/C SIDE)

CAV	CIRCUIT
1	Z118 12BK
2	C1 12DG



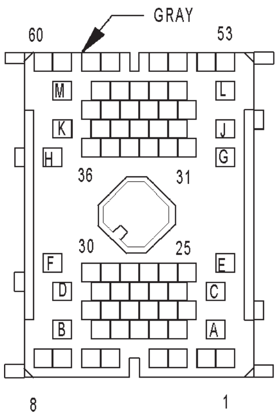
C300
(LHD)

C300 (LHD) - GRAY (RIGHT BODY SIDE)

CAV	CIRCUIT
A	P130 16DG/WT (EXCEPT BASE)
B	Q13 16DB
C	B40 12LB
D	F9 14RD/BK (EXCEPT BUILT-UP-EXPORT)
E	P144 16BK/LG (EXCEPT BASE)
F	A141 16DG/BK (GAS)
G	-
H	-
J	-
K	-
L	Q23 16RD/WT
M	-
1	D25 20YL/VT
2	V13 18BR/LG
3	V22 18BR/YL
4	P112 20YL/WT
5	P114 20YL/RD
6	P35 18OR/VT
7	P36 18PK/VT
8	L50 18WT/TN
9	B1 18YL/DB
10	B2 18YL
11	B3 18LG/DB
12	B4 18LG
13	-
14	-
15	-
16	P29 20BR/WT (EXCEPT BASE)
17	P86 20PK/BK (EXCEPT BASE)
18	E21 20OR/RD
19	K4 20BK/LB
20	K226 18LB/YL (DIESEL)
20	K226 20LB/YL (GAS)
21	L62 18BR/RD
22	L95 18DG/YL (BUILT-UP-EXPORT)
23	-
24	L1 18VT/BK
25	-
26	-
27	-
28	-
29	-
30	-
31	-

C300 (LHD) - GRAY (RIGHT BODY SIDE)

CAV	CIRCUIT
32	-
33	-
34	-
35	-
36	-
37	X75 20GY/LG (BUILT-UP-EXPORT)
38	-
39	-
40	-
41	K106 20WT/DG (EXCEPT BUILT-UP-EXPORT)
42	K107 20OR/YL (EXCEPT BUILT-UP-EXPORT)
43	K125 18WT/DB (EXCEPT BUILT-UP-EXPORT)
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	X57 18DG/WT (BASE)
53	X91 18WT/DG (EXCEPT BASE)
54	X51 18WT/DG (BASE)
54	X93 18DG/WT (EXCEPT BASE)
55	-
56	-
57	Z155 18BK/OR
58	-
59	-
60	-



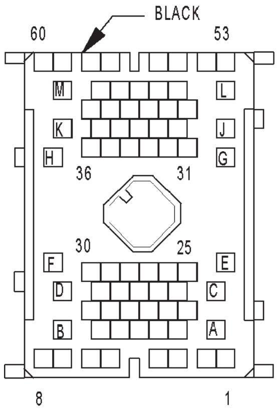
C300
(LHD)

C300 (LHD) - GRAY (LEFT BODY SIDE)

CAV	CIRCUIT
A	P130 16DG/WT (HEATED SEATS)
B	Q13 16DB
C	B40 14LB
D	F9 14RD/BK (EXCEPT BASE))
E	P144 16BK/VT (HEATED SEATS)
F	A141 16DG/BK (EXCEPT DIESEL)
G	-
H	-
J	-
K	-
L	Q23 16RD/WT
M	-
1	D25 20YL/VT
2	V13 18BR/LG
3	V22 18BR/YL
4	P112 20YL/WT
5	P114 20YL/RD
6	P35 18OR/VT
7	P36 18PK/VT
8	L50 18WT/TN
9	B1 18YL/DB
10	B2 18YL
11	B3 18LG/DB
12	B4 18LG
13	-
14	-
15	-
16	P29 20BR/WT (HEATED SEATS)
17	P86 18PK/BK (HEATED SEATS)
18	E21 20OR/RD
19	K4 20BK/LB
20	K226 20LB/YL
21	L62 18BR/RD
22	L95 18DG/YL (BUILT-UP-EXPORT)
23	-
24	L1 18VT/BK
25	-
26	-
27	-
28	-
29	-
30	-
31	-
32	-

C300 (LHD) - GRAY (LEFT BODY SIDE)

CAV	CIRCUIT
33	-
34	-
35	-
36	-
37	X75 20GY/LG (BUILT-UP-EXPORT)
38	-
39	-
40	-
41	K106 20WT/DG (EXCEPT BUILT-UP-EXPORT)
42	K107 20OR/YL (EXCEPT BUILT-UP-EXPORT)
43	K125 18OR/DG (EXCEPT BUILT-UP-EXPORT)
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	X91 18WT/DG (PREMIUM)
53	X57 18WT/DG (BASE)
54	X51 18DG/WT (BASE)
54	X93 18DG/WT (PREMIUM)
55	-
56	-
57	Z155 18BK/OR (EXCEPT BASE)
58	-
59	-
60	-



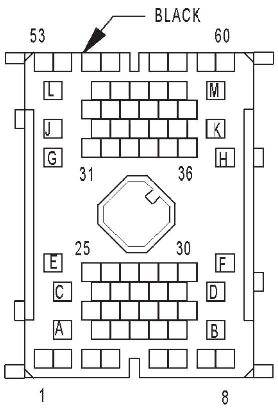
C301
(RHD)

C301 (RHD) - BLACK (LEFT BODY SIDE)

CAV	CIRCUIT
A	Q13 16DB
B	Q23 16RD/WT
C	F9 14RD/BK
D	F60 16RD/WT
E	Z9 16BK
F	Z5 16BK/VT
G	C15 12BK/WT
H	A148 16LG/RD
J	-
K	-
L	Q30 16TN
M	P130 16DG/WT
1	L50 18W/TTN
2	F70 18PK
3	M2 18YL
4	M20 18YL/BK
5	P35 18 OR/VT
6	P36 18PK/VT
7	F30 14RD/TN
8	L7 18BK/YL
9	L95 18DG/YL
10	L63 18DG/RD
11	G80 20VT/YL
12	X80 18LB/BK
13	X82 18LB/RD
14	X85 18LG/DG
15	X87 18LG/RD
16	X93 18DG/WT
17	X91 18WT/DG
18	X84 18OR/GY
19	L62 20BR/RD
20	X86 18OR/RD
21	X81 18YL/BK
22	X83 18YL/RD
23	X56 18DB/PK
24	X51 18WT/DG
25	X57 18DG/WT
26	X52 18DB/WT
27	X58 18DB/OR
28	X54 18VT
29	X55 18BR/RD
30	X53 18DG/OR
31	X64 18BR/WT
32	D25 20YL/VT

C301 (RHD) - BLACK (LEFT BODY SIDE)

CAV	CIRCUIT
33	-
34	G78 20TN/BK
35	-
36	-
37	E21 20OR/RD
38	G77 20TN/OR
39	G76 20TN/YL
40	L1 18VT/BK
41	G5 20DB/WT
42	P86 20PK/BK
43	P29 20BR/WT
44	G73 20LG/OR
45	C235 18WT/LB (CD)
46	X160 20YL (CD)
47	X40 20RD/WT (CD)
48	-
49	X112 20RD (CD)
50	X41 20RD/BK (CD)
51	Z4 20WT/BK (CD)
52	Z17 20BK (CD)
53	-
54	-
55	-
56	-
57	-
58	-
59	-
60	-



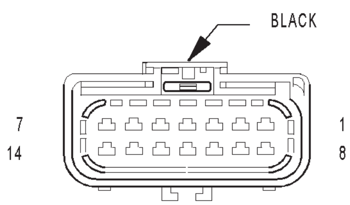
C301
(RHD)

C301 (RHD) - BLACK (RIGHT BODY SIDE)

CAV	CIRCUIT
A	Q13 16DB
B	Q23 16RD/WT
C	F9 14RD/BK
D	F60 16RD/WT
E	Z9 16BK
F	Z5 16BK/VT
G	C15 12BK/WT
H	A148 16LG/RD
J	-
K	-
L	Q30 16TN
M	P130 16DG/WT
1	L50 18WT/TN
2	F70 18PK
3	M2 18YL
4	M20 18YL/BK
5	P35 18OR/VT
6	P36 18PK/VT
7	F30 16RD/TN
8	L7 18BK/YL
9	L95 18DG/YL
10	L63 18DG/RD
11	G80 20VT/YL
12	X80 18LB/BK
13	X82 18LB/RD
14	X85 18LG/DG
15	X87 18LG/RD
16	X93 18DG/WT
17	X91 18WT/DG
18	X84 18OR/GY
19	L62 18BR/RD
20	X86 18OR/RD
21	X81 18YL/BK
22	X83 18YL/RD
23	X56 18DB/BK
24	X51 18WT/DG
25	X57 18DG/WT
26	X52 18DB/WT
27	X58 18DB/OR
28	X54 18VT
29	X55 18BR/RD
30	X53 18DG/OR
31	X64 18BR/WT
32	D25 20YL/VT
33	F22 20WT/PK
34	G78 20TN/BK
35	M1 18PK/RD
36	-
37	E21 20OR/RD
38	G77 20TN/OR
39	G76 20TN/YL
40	L1 18VT/BK
41	G5 20DB/WT
42	P86 20PK/BK
43	P29 20BR/WT

C301 (RHD) - BLACK (RIGHT BODY SIDE)

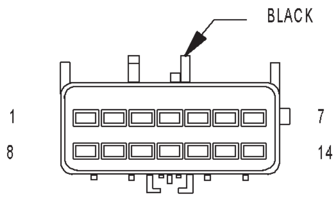
CAV	CIRCUIT
44	G73 20LG/OR
45	C235 20WT/LB (CD)
46	X160 20YL (CD)
47	X40 20WT/RD (CD)
48	-
49	X112 20RD (CD)
50	X41 20WT/DG (CD)
51	Z4 20WT/BK (CD)
52	Z17 20BK (CD)
53	-
54	-
55	-
56	-
57	-
58	-
59	-
60	-



C302

C302 - BLACK (BODY SIDE)

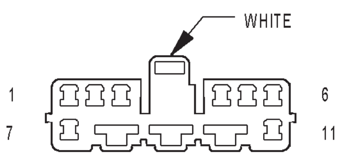
CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD
3	D25 20YL/VT
4	Z243 12BK (RHD)
4	Z28 12BK (LHD)
5	E21 20OR/RD
6	Q13 16DB
7	Q23 16RD/WT
8	A146 12OR/WT
9	X55 18BR/RD (LHD BASE)
9	X85 18LG/DG (LHD PREMIUM)
9	X80 18LB/BK (RHD PREMIUM)
10	X82 18LB/RD (RHD PREMIUM)
10	X53 18DG/OR (LHD BASE)
10	X87 18LG/RD (LHD PREMIUM)
11	M1 18PK/RD (JAPAN)
12	-
13	-
14	-



C302

C302 - BLACK (FRONT DRIVER DOOR SIDE)

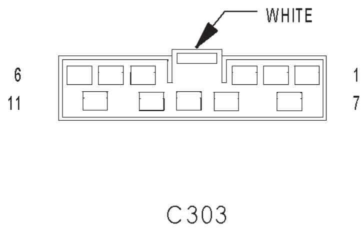
CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD
3	D25 20YL/VT
4	Z1 12BK
5	E21 20OR/RD
6	Q13 16DB
7	Q23 16RD/WT
8	A146 12OR/WT
9	X85 18LG/DG (LHD PREMIUM)
9	X80 18LG/DG (RHD PREMIUM)
9	X55 18LG/DG (BASE)
10	X53 18LG/RD (BASE)
10	X82 18LG/RD (RHD PREMIUM)
10	X87 18LG/RD (LHD PREMIUM)
11	M1 18PK (JAPAN)
12	-
13	-
14	-



C303

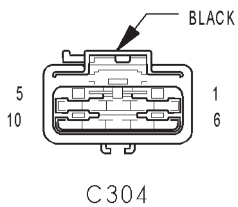
C303 - WHITE (RIGHT BODY SIDE)

CAV	CIRCUIT
1	X58 18DB/OR (BASE AUDIO)
1	X92 18TN/DG (PREMIUM AUDIO)
2	X52 18DB/WT (BASE AUDIO)
2	X90 18WT/VT (PREMIUM AUDIO)
3	E21 20OR/DB (RHD)
3	E20 20OR/DB (LHD)
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q13 16DB (RHD)
8	Q14 16GY (LHD)
9	Q24 16DG (LHD)
9	Q23 16RD/WT (RHD)
10	Z151 16BK (RHD)
10	Z28 16BK (LHD)
11	G76 18TN/YL (LHD)
11	G76 20TN/YL (RHD)



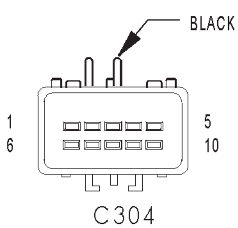
C303 - WHITE (REAR DOOR SIDE)

CAV	CIRCUIT
1	X58 18TN/DG (BASE)
1	X55
1	X92 18TN/DG (PREMIUM)
2	X52 18WT/VT (BASE)
2	X90 18WT/VT (PREMIUM)
3	E21 20OR/RD
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q14 16GY
9	Q24 16DG
10	Z1 16BK
11	G76 18TN/YL



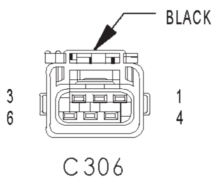
C304 - BLACK (BODY SIDE)

CAV	CIRCUIT
1	P86 20PK/BK (RHD)
1	P86 18PK/BK (LHD)
2	P130 16DG/WT
3	D25 20YL/VT
4	F37 16RD/LB (RHD)
4	F37 16RD (LHD)
5	Z238 16BK (RHD)
5	Z243 16BK (LHD)
6	P29 20BR/WT
7	Z155 18BK/OR (RHD)
7	Z155 20BK/OR (LHD)
8	Z5 16BK/VT (RHD)
8	P144 16BK/VT (LHD)
9	-
10	-



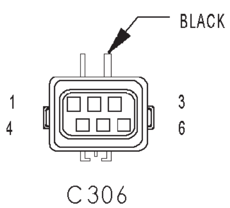
C304 - BLACK (POWER SEAT SIDE)

CAV	CIRCUIT
1	P86 20DG/YL (HEATED SEATS)
2	P130 16DG/WT (HEATED SEATS)
3	D25 20VT/YL (PREMIUM POWER SEATS)
4	F35 16RD
5	Z1 16BK
6	P29 20BR/WT (HEATED SEATS)
7	Z2 20BK/OR (PREMIUM POWER SEATS)
8	Z5 16BK/VT (HEATED SEATS)
9	-
10	-



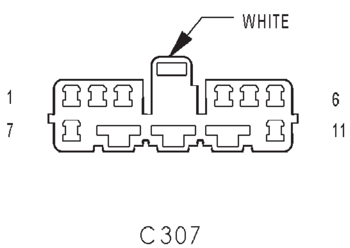
C306 - BLACK (BODY SIDE)

CAV	CIRCUIT
1	P130 16DG/WT
2	Z238 16BK
3	F37 16RD/LB
4	P86 20PK/BK
5	P29 20BR/WT
6	P144 16BK/LG



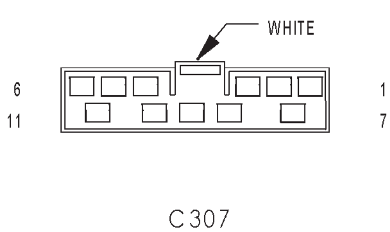
C306 - BLACK (POWER SEAT SIDE)

CAV	CIRCUIT
1	P130 16DG/WT (HEATED SEATS)
2	Z1 16BK
3	F37 16RD/LB
4	P86 20DG/YL (HEATED SEATS)
5	P29 20BR/WT (HEATED SEATS)
6	Z5 16BK/VT (HEATED SEATS)



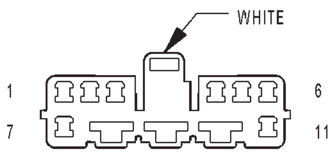
C307 - WHITE (BODY SIDE)

CAV	CIRCUIT
1	X93 18DG/WT (RHD)
1	X91 18WT/DG (LHD)
2	X93 18DG/WT (LHD)
2	X91 18WT/DG (RHD)
3	E20 20OR/DB (RHD)
3	E21 20OR/RD (LHD)
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q13 16DB (LHD)
8	Q14 16GY (RHD)
9	Q24 16DG (RHD)
9	Q23 16RD/TN (LHD)
10	Z243 16BK
11	G77 20TN/OR



C307 - WHITE (REAR DOOR SIDE)

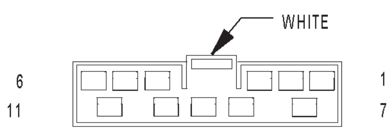
CAV	CIRCUIT
1	X57 18TN/DG (BASE)
1	X93 18TN/DG (PREMIUM)
2	X51 18WT/VT (BASE)
2	X91 18WT/VT (PREMIUM)
3	E21 20OR/RD
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q14 16GY
9	Q24 16DG
10	Z1 16BK
11	G76 18TN/YL



C308

C308 - WHITE (LEFT BODY SIDE)

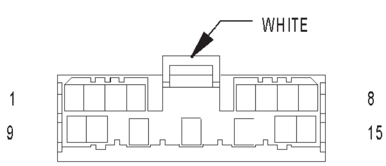
CAV	CIRCUIT
1	G78 20TN/BK
2	P35 18PK/VT (RHD)
2	P35 18OR/VT (LHD)
3	P36 18OR/VT (RHD)
3	P36 18PK/VT (LHD)
4	V13 18BR/LG
5	V22 18BR/YL
6	F70 18PK
7	L50 18WT/TN
8	Z309 12BK
9	G80 20VT/YL
10	C15 12BK/WT
11	L7 18BK/YL



C308

C308 - WHITE (LIFTGATE SIDE)

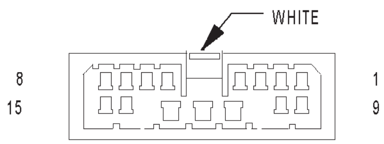
CAV	CIRCUIT
1	G78 20TN/BK
2	P35 18OR/VT
3	P36 18PK/VT
4	V13 18BR/LG
5	V22 18BR/YL
6	F70 18PK
7	L50 18WT/TN
8	Z1 12BK
9	G80 18VT/YL
10	C15 12BK/WT
11	L7 18BK/YL



C309

C309 - WHITE (OVERHEAD SIDE)

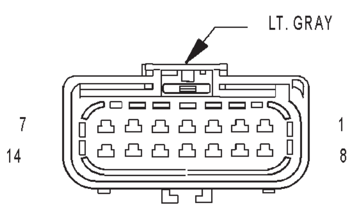
CAV	CIRCUIT
1	D25 20YL/VT
2	M20 20YL/BK
3	M2 20YL/DG
4	P112 20BK/WT
5	P114 20BK/YL
6	L1 20BK/VT
7	G5 20DB/WT
8	X75 20GY/LG (ALARM)
9	-
10	F70 20PK
11	Q30 20BK/LB (AUTOWIPE)
11	Q30 16TN (SUNROOF)
12	Z150 20BK (EXCEPT SUNROOF)
12	Z150 16BK (SUNROOF)
13	-
14	Z155 20BK/OR
15	G73 20LG/OR



C309

C309 - WHITE (LEFT BODY SIDE)

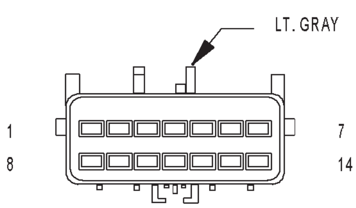
CAV	CIRCUIT
1	D25 20YL/VT
2	M20 18YL/BK (RHD)
2	M20 20YL/BK (LHD)
3	M2 18YL (RHD)
3	M2 20YL/DG (LHD)
4	P112 20YL/WT
5	P114 20YL/RD
6	L1 20VT/BK
7	G5 20DB/WT
8	X75 20GY/LG (BUILT-UP-EXPORT)
9	-
10	F70 20PK (LHD)
10	F70 18PK (RHD)
11	Q30 16TN
12	Z150 16BK
13	-
14	Z155 20BK/OR (EXCEPT LHD BASE)
14	Z155 18BK/OR (RHD/LHD BASE)
15	G73 20LG/OR



C310 (BUILT-UP-EXPORT)

C310 (BUILT-UP-EXPORT) - LT.GRAY (TRAILER TOW SIDE)

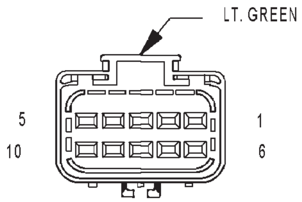
CAV	CIRCUIT
1	F9 14RD/BK
2	L62 20BR/RD
3	L1 18VT/BK
4	F30 14RD/TN
5	L7 18BK/YL
6	Z150 14RD/BK
7	B40 14LB
8	Z150 14BK
9	L50 18WT/TN
10	L63 20DG/RD
11	Z1 14BK
12	-
13	-
14	-



C310 (BUILT-UP-EXPORT)

C310 (BUILT-UP-EXPORT) - LT.GRAY (BODY SIDE)

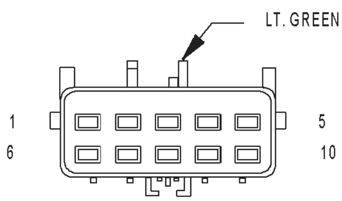
CAV	CIRCUIT
1	F9 14RD/BK
2	L62 18BR/RD (LHD)
2	L62 20BR/RD (RHD)
3	L1 18VT/BK
4	F30 14RD/TN
5	L7 18BK/YL
6	L95 18DG/YL
7	B40 14LB
8	Z150 14BK
9	L50 16WT/TN (RHD)
9	L50 18WT/TN (LHD)
10	L63 20DG/RD
11	Z150 14BK
12	-
13	-
14	-



C310
(EXCEPT BUILT-
UP-EXPORT)

C310 (EXCEPT BUILT-UP-EXPORT) - LT. GREEN
(TRAILER TOW SIDE)

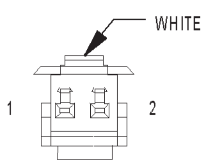
CAV	CIRCUIT
1	F9 14RD/BK
2	L62 20BR/RD
3	L1 18VT/BK
4	F30 14RD/TN
5	L7 18BK/YL
6	Z150 14RD/BK
7	B40 14LB
8	Z150 14BK
9	L50 18WT/TN
10	L63 20DG/RD



C310
(EXCEPT BUILT-
UP-EXPORT)

C310 (EXCEPT BUILT-UP-EXPORT) - LT. GREEN
(LEFT BODY SIDE)

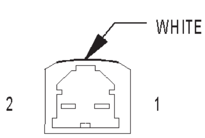
CAV	CIRCUIT
1	F9 14RD/BK
2	L62 18BR/RD
3	L1 18VT/BK
4	F30 14RD/TN
5	L7 18BK/YL
6	Z150 14BK
7	B40 14LB
8	Z150 14BK
9	L50 18WT/TN
10	L63 20DG/RD



C311

C311 - WHITE (LIFTGATE SIDE)

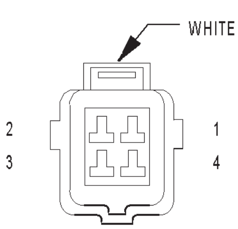
CAV	CIRCUIT
1	L50 18WT/TN
2	Z1 18BK



C311

C311 - WHITE (CHMSL SIDE)

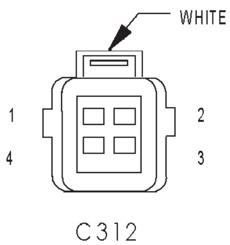
CAV	CIRCUIT
1	L50 18WT/TN
2	Z1 18BK



C312

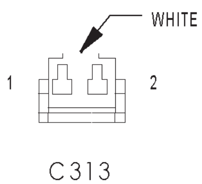
C312 - WHTE (LIFTGATE SIDE)

CAV	CIRCUIT
1	Z1 18BK
2	L7 18BK/YL
3	P101 18OR/PK
4	F70 18PK



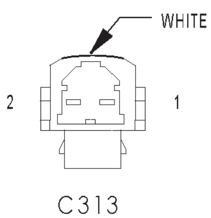
C312 - WHITE (LICENSE PLATE LAMP SIDE)

CAV	CIRCUIT
1	Z1 18BK
2	L7 18BK/YL
3	P101 18OR/PK
4	F70 18PK



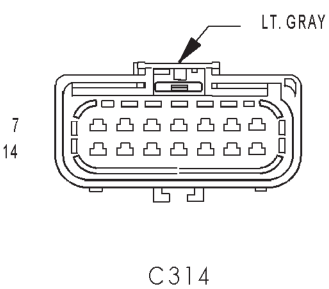
C313 - WHITE (FRONT DRIVER DOOR SIDE)

CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD



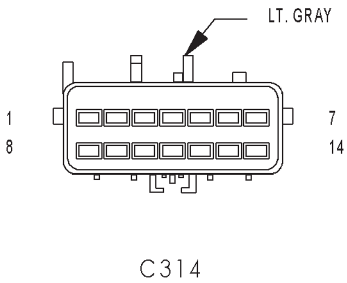
C313 - WHITE (MUX JUMPER SIDE)

CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD



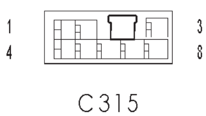
C314 - LT. GRAY (BODY SIDE)

CAV	CIRCUIT
1	D25 20YL/VT
2	A146 12OR/WT
3	P35 18OR/VT
4	P36 18PK/VT
5	Z28 12BK (LHD)
5	Z243 12BK (RHD)
6	Q14 16GY
7	Q24 16DG
8	E20 20OR/DB
9	X56 18DB/PK (BASE LHD)
9	X80 18LB/BK (PREMIUM LHD)
9	X85 18LG/DG (RHD)
10	X54 18VT (BASE)
10	X87 18LG/RD (RHD)
10	X82 18LB/RD (PREMIUM)
11	-
12	-
13	-
14	-



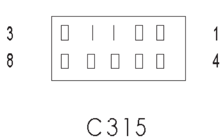
C314 - LT. GRAY (FRONT PASSENGER DOOR SIDE)

CAV	CIRCUIT
1	D25 20YL/VT
2	A146 12OR/WT
3	P35 18OR/VT
4	P36 18PK/VT
5	Z1 12BK
6	Q14 16GY
7	Q24 16DG
8	E20 20OR/DB
9	X80 18LB/BK (LHD PREMIUM)
9	X85 18LB/BK (RHD PREMIUM)
9	X56 18LB/BK (BASE)
10	X54 18LB/RD (BASE)
10	X87 18LB/RD (RHD PREMIUM)
10	X82 18LB/RD (LHD PREMIUM)
11	-
12	-
13	-
14	-



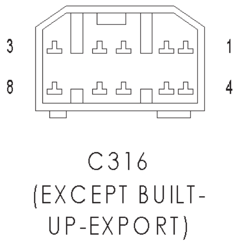
C315 - (OVERHEAD SIDE)

CAV	CIRCUIT
1	Q30 16TN
2	-
3	Q43 20VT
4	Q41 20WT
5	-
6	-
7	Z150 16BK
8	-



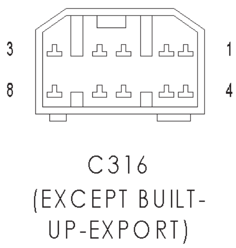
C315 - (SUN ROOF MODULE SIDE)

CAV	CIRCUIT
1	Q30 16DB
2	-
3	Q43 20VT
4	Q41 20WT
5	-
6	-
7	Z150 16BK
8	-



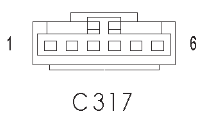
C316 (EXCEPT BUILT-UP-EXPORT) - (PEDAL SIDE)

CAV	CIRCUIT
1	Y153 16DB/RD
2	L1 18WT/BR
3	F72 16RD/YL
4	D25 20VT/YL
5	Y151 20LG/BR
6	Z155 20BK/OR
7	Y152 20LG/OR
8	Z151 16BK



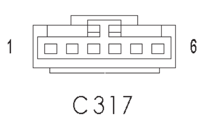
C316 (EXCEPT BUILT-UP-EXPORT) - (BODY SIDE)

CAV	CIRCUIT
1	Y153 20DB/RD
2	L1 18VT/BK
3	F72 16RD/YL
4	D25 20YL/VT
5	Y151 20LG/BR
6	Z155 18BK/OR
7	Y152 20LG/OR
8	Z151 18BK



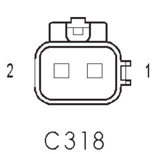
C317 - (OVERHEAD SIDE)

CAV	CIRCUIT
1	Z155 20BK/OR
2	-
3	X75 20GY/LG
4	-
5	D25 20YL/VT
6	F70 20PK



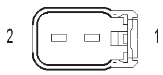
C317 - (INTRUSION TRANSCEIVER MODULE SIDE)

CAV	CIRCUIT
1	Z155 20BK
2	-
3	X75 20GY/LG
4	-
5	D25 20YL/VT
6	F70 20PK



C318 - (LEFT BODY SIDE (LHD)/ RIGHT BODY SIDE (RHD))

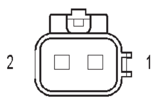
CAV	CIRCUIT
1	R73 20LB/BR
2	R75 20LB/OR



C318

C318 - (OVERLAY SIDE)

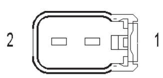
CAV	CIRCUIT
1	R72 20LB/WT (RHD)
1	R73 20LB/BR (LHD)
2	R74 20LB/YL (RHD)
2	R75 20LB/OR (LHD)



C319

C319 - (RIGHT BODY SIDE (LHD)/ LEFT BODY SIDE (RHD))

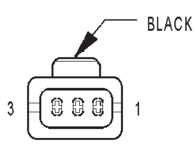
CAV	CIRCUIT
1	R72 20LB/WT (LHD)
2	R74 20LB/YL (LHD)



C319

C319 - (OVERLAY SIDE)

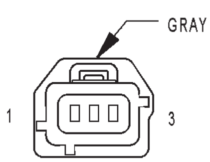
CAV	CIRCUIT
1	R73 20LB/BR (RHD)
1	R72 20LB/WT (LHD)
2	R75 20LB/OR (RHD)
2	R74 20LB/YL (LHD)



CAMSHAFT POSITION SENSOR (DIESEL)

CAMSHAFT POSITION SENSOR (DIESEL) - BLACK 3 WAY

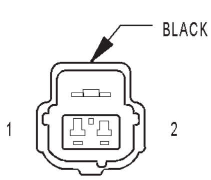
CAV	CIRCUIT	FUNCTION
1	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
2	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
3	F15 18RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT



CAMSHAFT POSITION SENSOR (GAS)

CAMSHAFT POSITION SENSOR (GAS) - GRAY 3 WAY

CAV	CIRCUIT	FUNCTION
1	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5 VOLT SUPPLY



CAPACITOR (4.0L)

CAPACITOR (4.0L) - BLACK 2 WAY

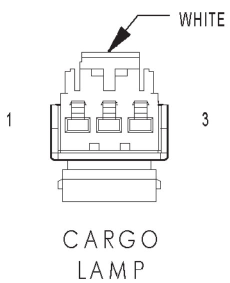
CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR (RHD)	AUTO SHUT DOWN RELAY OUTPUT
1	A142 14DG/OR (LHD)	AUTO SHUT DOWN RELAY OUTPUT
2	-	-

CAPACITOR NO. 1 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
2	-	-

CAPACITOR NO. 2 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
2	-	-

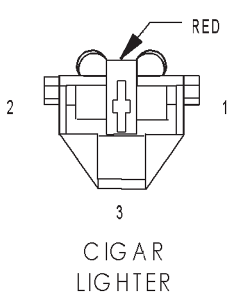


CARGO LAMP - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	G73 20LG/OR	LIFTGATE COURTESY DISABLE
3	M2 20YL/DG	COURTESY LAMP DRIVER

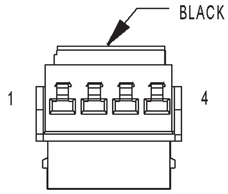
CENTER HIGH MOUNTED STOP LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
2	Z309 18BK	GROUND



CIGAR LIGHTER - RED 3 WAY

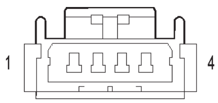
CAV	CIRCUIT	FUNCTION
1	F30 16RD	FUSED CIGAR LIGHTER RELAY OUTPUT
2	-	-
3	Z300 16BK	GROUND



CLOCKSPRING C1

CLOCKSPRING C1 - BLACK 4 WAY

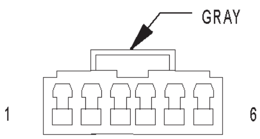
CAV	CIRCUIT	FUNCTION
1	X3 20GY/OR	HORN RELAY CONTROL
2	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
3	K4 20BK/LB	SENSOR GROUND
4	-	-



CLOCKSPRING C2

CLOCKSPRING C2 - 4 WAY

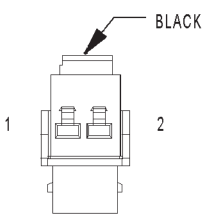
CAV	CIRCUIT	FUNCTION
1	R63 20TN/LB	DRIVER SQUIB 2 LINE 2
2	R61 20OR/LB	DRIVER SQUIB 2 LINE 1
3	R43 20BK/LB	DRIVER SQUIB 1 LINE 1
4	R45 20DG/LB	DRIVER SQUIB 1 LINE 2



CLOCKSPRING C3

CLOCKSPRING C3 - GRAY 6 WAY

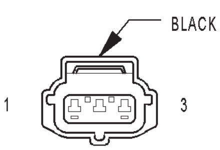
CAV	CIRCUIT	FUNCTION
1	X20 20RD/YL	RADIO CONTROL MUX
2	X10 20RD/BK	RADIO CONTROL MUX RETURN
3	X3 20GY/OR	HORN RELAY CONTROL
4	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
5	K4 20BK/LB	SENSOR GROUND
6	-	-



CLOCKSPRING C4

CLOCKSPRING C4 - BLACK 2 WAY

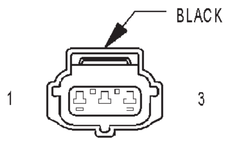
CAV	CIRCUIT	FUNCTION
1	X20 20RD/YL	RADIO CONTROL MUX
2	X10 20RD/BK	RADIO CONTROL MUX RETURN



COIL ON
PLUG NO. 1
(4.7L)

COIL ON PLUG NO. 1 (4.7L) - BLACK 3 WAY

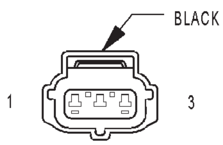
CAV	CIRCUIT	FUNCTION
1	K91 14TN/RD	COIL DRIVER NO. 1
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON
PLUG NO. 2
(4.7L)

COIL ON PLUG NO. 2 (4.7L) - BLACK 3 WAY

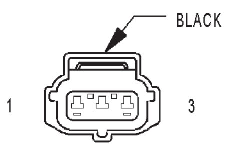
CAV	CIRCUIT	FUNCTION
1	K92 14TN/PK	COIL DRIVER NO. 2
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON
PLUG NO. 3
(4.7L)

COIL ON PLUG NO. 3 (4.7L) - BLACK 3 WAY

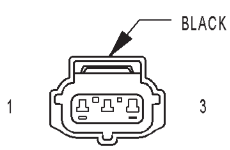
CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON
PLUG NO. 4
(4.7L)

COIL ON PLUG NO. 4 (4.7L) - BLACK 3 WAY

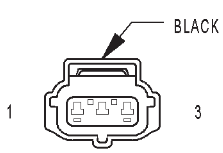
CAV	CIRCUIT	FUNCTION
1	K94 14TN/LG	COIL DRIVER NO. 4
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON
PLUG NO. 5
(4.7L)

COIL ON PLUG NO. 5 (4.7L) - BLACK 3 WAY

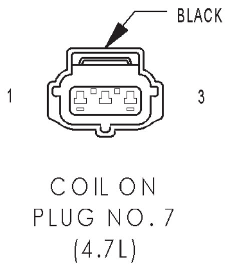
CAV	CIRCUIT	FUNCTION
1	K95 14TN/DG	COIL DRIVER NO. 5
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON
PLUG NO. 6
(4.7L)

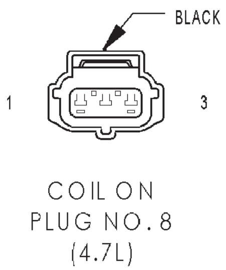
COIL ON PLUG NO. 6 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K96 14TN/LB	COIL DRIVER NO. 6
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



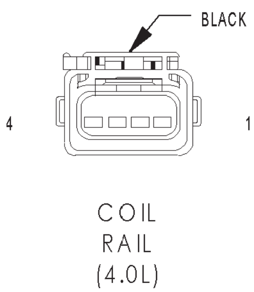
COIL ON PLUG NO. 7 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K97 14BR	COIL DRIVER NO. 7
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



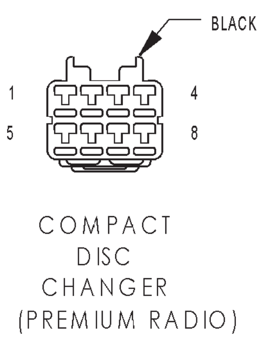
COIL ON PLUG NO. 8 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K98 14LB/RD	COIL DRIVER NO. 8
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



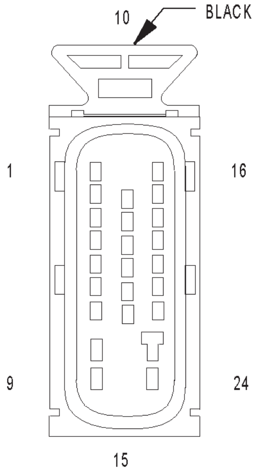
COIL RAIL (4.0L) - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	K91 14TN/RD	COIL DRIVER NO. 1
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	K92 14TN/PK	COIL DRIVER NO. 2
4	K93 14TN/OR	COIL DRIVER NO. 3



COMPACT DISC CHANGER (PREMIUM RADIO) - BLACK 8 WAY

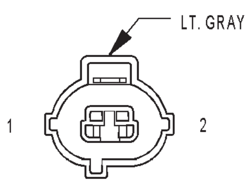
CAV	CIRCUIT	FUNCTION
1	X40 20WT/RD	AUDIO OUT RIGHT
2	C235 20WT/LB	SHIELD
3	D25 20YL/VT	PCI BUS
4	X112 20RD	IGNITION SWITCH OUTPUT (RUN-ACC)
5	X41 20WT/DG	AUDIO OUT LEFT
6	Z4 20WT/BK	GROUND
7	Z17 20BK	GROUND
8	X160 20YL	B(+)



CONTROLLER ANTILOCK BRAKE

CONTROLLER ANTILOCK BRAKE - BLACK 24 WAY

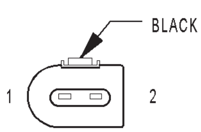
CAV	CIRCUIT	FUNCTION
1	Z101 12BK/OR	GROUND
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL
3	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
4	-	-
5	D25 18VT/YL	PCI BUS
6	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
7	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
8	-	-
9	A20 12RD/DB	FUSED B(+)
10	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	D52 18LG/WT (DIESEL)	CAN C BUS(+)
12	-	-
13	B22 18DG/YL	VEHICLE SPEED SENSOR SIGNAL
14	D51 18DG/WT (DIESEL)	CAN C BUS(-)
15	-	-
16	Z102 12BK/OR	GROUND
17	G9 18GY/BK	BRAKE FLUID LEVEL SWITCH SENSE
18	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
19	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL
20	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
21	Z231 18BK	GROUND
22	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
23	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
24	A10 12RD/DG	FUSED B(+)



COOLANT LEVEL SENSOR

COOLANT LEVEL SENSOR - LT. GRAY 2 WAY

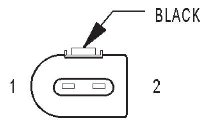
CAV	CIRCUIT	FUNCTION
1	G18 20PK/BK (EXCEPT LHD GAS)	COOLANT LEVEL SWITCH SENSE
1	G18 18PK/BK (LHD GAS)	COOLANT LEVEL SWITCH SENSE
2	Z307 20BK	GROUND



CRANKCASE HEATER (DIESEL)

CRANKCASE HEATER (DIESEL) - BLACK 2 WAY

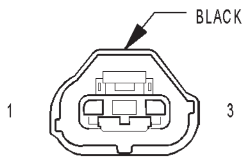
CAV	CIRCUIT	FUNCTION
1	Z18 20BR	GROUND
2	F15 20RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT



CRANKSHAFT POSITION SENSOR (DIESEL)

CRANKSHAFT POSITION SENSOR (DIESEL) - BLACK 2 WAY

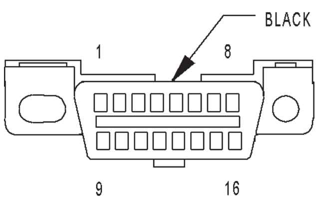
CAV	CIRCUIT	FUNCTION
1	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
2	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1



CRANKSHAFT POSITION SENSOR (GAS)

CRANKSHAFT POSITION SENSOR (GAS) - BLACK 3 WAY

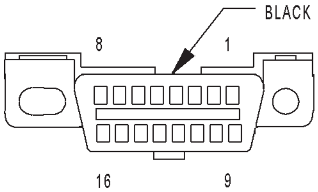
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5 VOLT SUPPLY



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

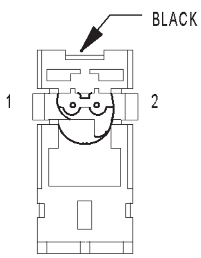
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z305 20BK/OR	GROUND
5	Z306 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)



DIAGNOSTIC JUNCTION PORT

DIAGNOSTIC JUNCTION PORT - BLACK 16 WAY

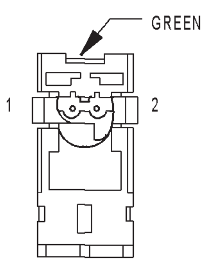
CAV	CIRCUIT	FUNCTION
1	D25 20YL/VT/BR	PCI BUS (PCM/ECM TCM PDM CD SKIM)
2	D25 20YL/VT/DG (AZC)	PCI BUS (AZC)
3	D25 20YL/VT/DB	PCI BUS (RADIO)
4	D25 20YL/VT/OR	PCI BUS (ACM)
5	D25 20YL/VT/RD	PCI BUS (MIC)
6	D25 20YL/VT/WT	PCI BUS (BCM)
7	D25 20YL/VT	PCI BUS (DLC)
8	D25 20YL/VT/GY	PCI BUS (DDM ABS MEM EVIC APM ITM RAIN SENSOR)
9	-	-
10	-	-
11	D25 20YL/VT (DIESEL)	PCI BUS (SHIFTER ASSEMBLY)
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-



DRIVER AIRBAG SQUIB 1

DRIVER AIRBAG SQUIB 1 - BLACK 2 WAY

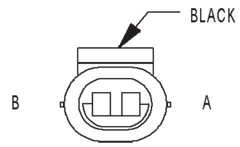
CAV	CIRCUIT	FUNCTION
1	R43 20BK	DRIVER SQUIB 1 LINE 1
2	R45 20BK	DRIVER SQUIB 1 LINE 2



DRIVER AIRBAG SQUIB 2

DRIVER AIRBAG SQUIB 2 - GREEN 2 WAY

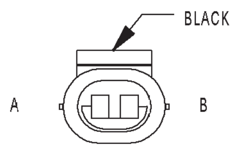
CAV	CIRCUIT	FUNCTION
1	R63 20TN/LB	DRIVER SQUIB 2 LINE 2
2	R61 20OR/LB	DRIVER SQUIB 2 LINE 1



DRIVER
BLEND DOOR
MOTOR/ACTUATOR
(LHD) (AZC)

DRIVER BLEND DOOR MOTOR/ACTUATOR (LHD) (AZC) - BLACK 2 WAY

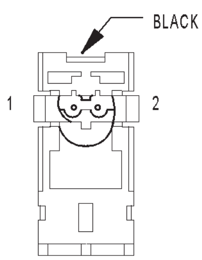
CAV	CIRCUIT	FUNCTION
A	C95 20WT/BK (LHD)	DRIVER BLEND DOOR DRIVER (B)
B	C33 20DB/RD (LHD)	DRIVER BLEND DOOR DRIVER (A)



DRIVER
BLEND DOOR MOTOR/
ACTUATOR
(RHD)(AZC)

DRIVER BLEND DOOR MOTOR/ACTUATOR (RHD) (AZC)- BLACK 2 WAY

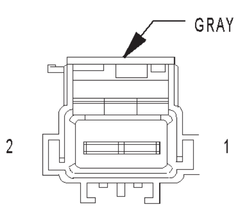
CAV	CIRCUIT	FUNCTION
A	C33 20DB/RD (RHD)	DRIVER BLEND DOOR DRIVER (A)
B	C95 20WT/BK (RHD)	DRIVER BLEND DOOR DRIVER (B)



DRIVER
CURTAIN
AIRBAG

DRIVER CURTAIN AIRBAG - BLACK 2 WAY

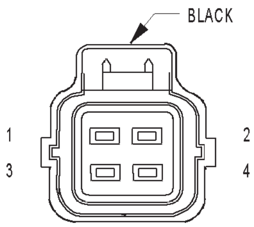
CAV	CIRCUIT	FUNCTION
1	R73 20LB/BR	DRIVER CURTAIN SQUIB LINE 2
2	R75 20LB/OR	DRIVER CURTAIN SQUIB LINE 1



DRIVER
CYLINDER
LOCK SWITCH

DRIVER CYLINDER LOCK SWITCH - GRAY 2 WAY

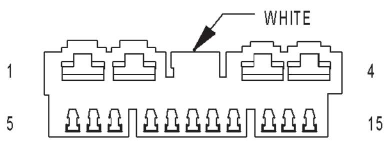
CAV	CIRCUIT	FUNCTION
1	G73 20LG/OR	DRIVER CYLINDER LOCK SWITCH SENSE
2	Z243 12BK (RHD)	GROUND
2	Z28 12BK (LHD)	GROUND



DRIVER DOOR LOCK MOTOR/ AJAR SWITCH

DRIVER DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

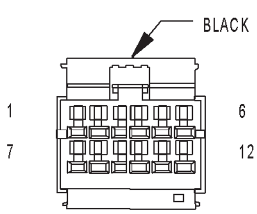
CAV	CIRCUIT	FUNCTION
1	G75 18TN/RD	DRIVER DOOR AJAR SWITCH SENSE
2	Z243 12BK (RHD)	GROUND
2	Z28 12BK (LHD)	GROUND
3	P34 18PK/BK	DRIVER DOOR UNLOCK DRIVER
4	P35 18OR/BK	DRIVER DOOR LOCK DRIVER



DRIVER DOOR MODULE C1

DRIVER DOOR MODULE C1 - WHITE 15 WAY

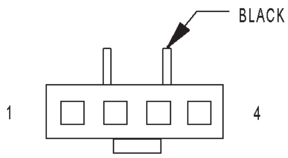
CAV	CIRCUIT	FUNCTION
1	A146 12OR/WT	FUSED B(+)
2	Q23 16RD/WT	DRIVER REAR WINDOW DRIVER (DOWN)
3	Q13 16DB	DRIVER REAR WINDOW DRIVER (UP)
4	Z28 12BK (LHD)	GROUND
4	Z234 12BK (RHD)	GROUND
5	P35 18OR/BK	DRIVER DOOR LOCK DRIVER
6	-	-
7	P34 18PK/BK	DRIVER DOOR UNLOCK DRIVER
8	D30 20VT/YL (JAPAN)	DIAGNOSTIC OUT
9	D25 20YL/VT	PCI BUS
10	G73 20LG/OR	DRIVER CYLINDER LOCK SWITCH SENSE
11	G75 18TN/RD	DRIVER DOOR AJAR SWITCH SENSE
12	E21 20OR/RD	DRIVER REAR DOOR SWITCH ILLUMINATION
13	Q11 16LB	DRIVER WINDOW DRIVER (UP)
14	-	-
15	Q21 16WT	DRIVER WINDOW DRIVER (DOWN)



DRIVER DOOR MODULE C2

DRIVER DOOR MODULE C2 - BLACK 12 WAY

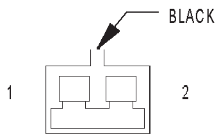
CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATER GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	M21 20PK/DG	COURTESY LAMP DRIVER
10	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
11	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
12	L121 20BK/RD	COURTESY LAMP GROUND



DRIVER
DOOR
MODULE C3

DRIVER DOOR MODULE C3 - BLACK 4 WAY

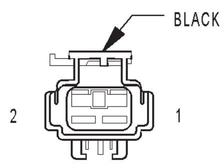
CAV	CIRCUIT	FUNCTION
1	BK	MEMORY SWITCH RETURN
2	BR	MEMORY SWITCH MUX
3	OR	MEMORY SET INDICATOR DRIVER
4	GY	SWITCH ILLUMINATION DRIVER



DRIVER
FRONT DOOR
COURTESY
LAMP

DRIVER FRONT DOOR COURTESY LAMP - BLACK 2 WAY

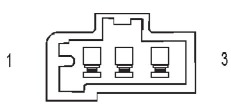
CAV	CIRCUIT	FUNCTION
1	M21 20PK/DG	COURTESY LAMP DRIVER
2	L121 20BK/RD	COURTESY LAMP GROUND



DRIVER FRONT
POWER
WINDOW MOTOR

DRIVER FRONT POWER WINDOW MOTOR - BLACK 2 WAY

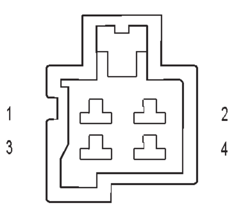
CAV	CIRCUIT	FUNCTION
1	Q21 16WT	DRIVER WINDOW DRIVER (DOWN)
2	Q11 16LB	DRIVER WINDOW DRIVER (UP)



DRIVER
HEATED SEAT
BACK
(PREMIUM I/III)

DRIVER HEATED SEAT BACK (PREMIUM I/III) - 3 WAY

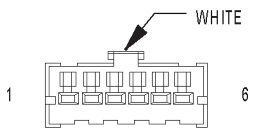
CAV	CIRCUIT	FUNCTION
1	P88 16BK/BR	HEATED SEAT DRIVER
2	Z6 16BK/YL	GROUND
3	-	-



DRIVER
HEATED SEAT
CUSHION
(PREMIUM I/III)

DRIVER HEATED SEAT CUSHION (PREMIUM I/III) - 4 WAY

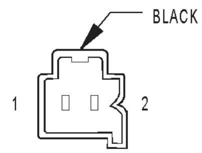
CAV	CIRCUIT	FUNCTION
1	P131 16BK/OR	DRIVER SEAT HEATER B(+) DRIVER
2	P88 16BK/BR	HEATED SEAT DRIVER
3	P135 20LB/BK	DRIVER SEAT TEMPERATURE SENSOR INPUT
4	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



DRIVER HEATED SEAT SWITCH

DRIVER HEATED SEAT SWITCH - WHITE 6 WAY

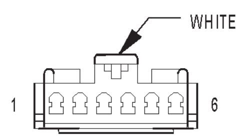
CAV	CIRCUIT	FUNCTION
1	P133 20TN/DG	DRIVER SEAT HEATER SWITCH MUX
2	E2 20OR	PANEL LAMPS DRIVER
3	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
4	-	-
5	Z300 20BK	GROUND
6	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND



DRIVER LUMBAR MOTOR (MIDLINE/PREMIUM)

DRIVER LUMBAR MOTOR (MIDLINE/PREMIUM) - BLACK 2 WAY

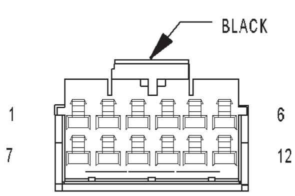
CAV	CIRCUIT	FUNCTION
1	P105 16LG/DB	LUMBAR FORWARD SWITCH SENSE
2	P104 16YL/RD	LUMBAR REARWARD SWITCH SENSE



DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM)

DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM) - WHITE 6 WAY

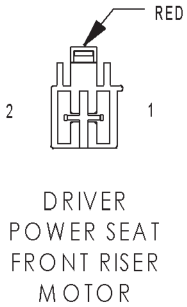
CAV	CIRCUIT	FUNCTION
1	-	-
2	Z238 16BK (RHD)	GROUND
2	Z243 16BK (LHD)	GROUND
3	P105 16LG/DB (RHD)	LUMBAR FORWARD SWITCH SENSE
3	P104 16YL/RD (LHD)	LUMBAR REAR WARD SWITCH SENSE
4	P104 16YL/RD (RHD)	LUMBAR REAR WARD SWITCH SENSE
4	P105 16LG/DB (LHD)	LUMBAR FORWARD SWITCH SENSE
5	Z238 16BK (RHD)	GROUND
5	Z243 16BK (LHD)	GROUND
6	F35 16RD	FUSED B(+)



DRIVER POWER MIRROR

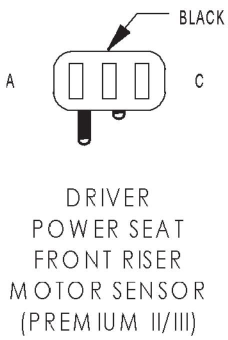
DRIVER POWER MIRROR - BLACK 12 WAY

CAV	CIRCUIT	FUNCTION
1	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
2	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
3	P69 20GY	MIRROR SENSOR GROUND
4	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
5	C118 20BK/WT	MIRROR HEATER GROUND
6	P95 20OR	MIRROR HORIZONTAL DRIVER
7	P114 20YL/RD	AUTO DAY/NIGHT MIRROR(-)
8	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
9	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
10	P112 20YL/WT	AUTO DAY/NIGHT MIRROR(+)
11	P93 20RD	MIRROR VERTICAL DRIVER
12	P91 20WT	MIRROR COMMON DRIVER



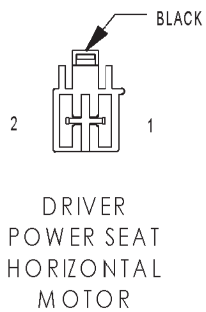
DRIVER POWER SEAT FRONT RISER MOTOR - RED 2 WAY

CAV	CIRCUIT	FUNCTION
1	P119 16YL/RD (PREMIUM II/III)	SEAT FRONT UP DRIVER
1	P19 16YL/LG (EXCEPT PREMIUM II/III)	DRIVER SEAT FRONT UP DRIVER
2	P121 16RD/GY (PREMIUM II/III)	SEAT FRONT DOWN DRIVER
2	P21 16RD/LG (EXCEPT PREMIUM II/III)	DRIVER SEAT FRONT DOWN DRIVER



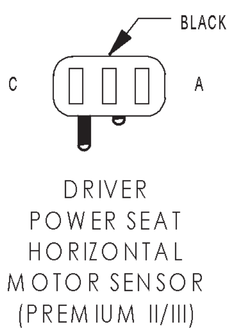
DRIVER POWER SEAT FRONT RISER MOTOR SENSOR (PREMIUM II/III) - 3 WAY

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSOR GROUND
B	P26 20BR	FRONT RISER POSITION SIGNAL
C	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



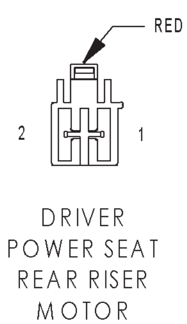
DRIVER POWER SEAT HORIZONTAL MOTOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	P17 16RD/YL (EXCEPT PREMIUM II/III)	DRIVER SEAT HORIZONTAL REARWARD DRIVER
1	P117 16RD/BR (PREMIUM II/III)	SEAT HORIZONTAL REARWARD DRIVER
2	P15 16YL/LB (EXCEPT PREMIUM II/III)	DRIVER SEAT HORIZONTAL FORWARD DRIVER
2	P115 16GY/LG (PREMIUM II/III)	SEAT HORIZONTAL FORWARD DRIVER



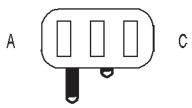
DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR (PREMIUM II/III) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY
B	P25 20VT/RD	SEAT HORIZONTAL POSITION SIGNAL
C	P28 20BR/RD	SEAT POSITION SENSOR GROUND



DRIVER POWER SEAT REAR RISER MOTOR - RED 2 WAY

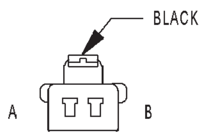
CAV	CIRCUIT	FUNCTION
1	P11 16YL/WT (EXCEPT PREMIUM II/III)	DRIVER SEAT REAR UP DRIVER
1	P111 16YL/DB (PREMIUM II/III)	SEAT REAR UP DRIVER
2	P13 16RD/WT (EXCEPT PREMIUM II/III)	DRIVER SEAT REAR DOWN DRIVER
2	P113 16RD/BK (PREMIUM II/III)	SEAT REAR DOWN DRIVER



DRIVER POWER SEAT REAR RISER MOTOR SENSOR (PREMIUM II/III)

DRIVER POWER SEAT REAR RISER MOTOR SENSOR (PREMIUM II/III) - 3 WAY

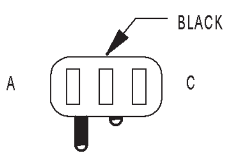
CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSOR GROUND
B	P27 20LB/RD	REAR RISER POSITION SIGNAL
C	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



DRIVER POWER SEAT RECLINER MOTOR

DRIVER POWER SEAT RECLINER MOTOR - BLACK 2 WAY

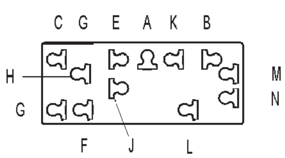
CAV	CIRCUIT	FUNCTION
A	P41 16GY/WT (MIDLINE/PREMIUM I)	DRIVER SEAT RECLINER DOWN DRIVER
A	P141 16GY/WT (PREMIUM II/III)	SEAT RECLINER DOWN DRIVER
B	P43 16GY/LB (MIDLINE/PREMIUM I)	DRIVER SEAT RECLINER UP DRIVER
B	P143 16GY/LB (PREMIUM II/III)	SEAT RECLINER UP DRIVER



DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III)

DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III) - BLACK 3 WAY

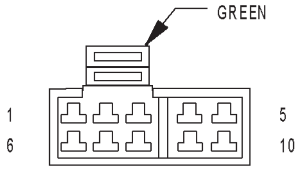
CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY
B	P47 20LB	RECLINER POSITION SIGNAL
C	P28 20BR/RD	SEAT POSITION SENSOR GROUND



DRIVER POWER SEAT SWITCH (EXCEPT MIDLINE/ PREMIUM)

DRIVER POWER SEAT SWITCH (EXCEPT MIDLINE/PREMIUM) - 12 WAY

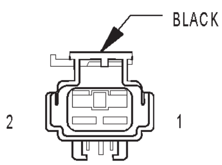
CAV	CIRCUIT	FUNCTION
A	F35 16RD	FUSED B(+)
B	Z1 16BK	GROUND
C	-	-
E	P21 16RD/LG (LHD)	DRIVER SEAT FRONT DOWN DRIVER
E	P19 16YL/LG (RHD)	DRIVER SEAT FRONT UP DRIVER
F	-	-
G	-	-
H	-	-
J	P19 16YL/LG (LHD)	DRIVER SEAT FRONT UP DRIVER
J	P21 16RD/LG (RHD)	DRIVER SEAT FRONT DOWN DRIVER
K	P15 16YL/LB	DRIVER SEAT HORIZONTAL FORWARD DRIVER
L	P17 16RD/YL	DRIVER SEAT HORIZONTAL REARWARD DRIVER
M	P13 16RD/WT (LHD)	DRIVER SEAT REAR DOWN DRIVER
M	P11 16YL/WT (RHD)	DRIVER SEAT REAR UP DRIVER
N	P11 16YL/WT (LHD)	DRIVER SEAT REAR UP DRIVER
N	P13 16RD/WT (RHD)	DRIVER SEAT REAR DOWN DRIVER



DRIVER POWER SEAT SWITCH (MIDLINE/PREMIUM)

DRIVER POWER SEAT SWITCH (MIDLINE/PREMIUM) - GREEN 10 WAY

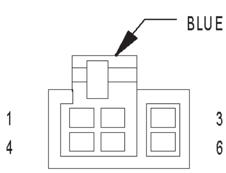
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	P43 16GY/LB (MIDLINE/PREMIUM I)	DRIVER SEAT RECLINER UP DRIVER
2	P43 20GY/LB (PREMIUM II/III)	RECLINER UP SWITCH SENSE
3	P17 16RD/YL (MIDLINE/PREMIUM I)	DRIVER SEAT HORIZONTAL REARWARD DRIVER
3	P17 20RD/YL (PREMIUM II/III)	DRIVER SEAT HORIZONTAL REARWARD SWITCH SENSE
4	P41 16GY/WT (MIDLINE/PREMIUM I)	DRIVER SEAT RECLINER DOWN DRIVER
4	P41 20GY/WT (PREMIUM II/III)	RECLINER DOWN SWITCH SENSE
5	F35 16RD (MIDLINE/PREMIUM I)	FUSED B(+)
5	P9 20RD/LB (PREMIUM II/III)	SEAT SWITCH B(+) SUPPLY
6	P15 16YL/LB (MIDLINE/PREMIUM I)	DRIVER SEAT HORIZONTAL FORWARD DRIVER
6	P15 20YL/LB (PREMIUM II/III)	DRIVER SEAT HORIZONTAL FORWARD SWITCH SENSE
7	P19 16YL/LG (MIDLINE/PREMIUM I)	SEAT FRONT UP SWITCH SENSE
7	P21 20RD/LG (RHD PREMIUM II/III)	SEAT FRONT DOWN SWITCH SENSE
7	P19 20YL/LG (PREMIUM II/III)	SEAT FRONT UP SWITCH SENSE
8	P13 20RD/WT (RHD PREMIUM II/III)	DRIVER SEAT REAR DOWN DRIVER
8	P11 20YL/WT (PREMIUM II/III)	SEAT REAR UP SWITCH SENSE
8	P11 16YL/WT (MIDLINE/PREMIUM I)	DRIVER SEAT REAR UP DRIVER
9	P13 20RD/WT (PREMIUM II/III)	SEAT REAR DOWN SWITCH SENSE
9	P13 16RD/WT (MIDLINE/PREMIUM I)	DRIVER SEAT REAR DOWN DRIVER
9	P11 20YL/WT (RHD PREMIUM II/III)	DRIVER SEAT REAR UP DRIVER
10	P21 16RD/LG (MIDLINE/PREMIUM I)	SEAT FRONT DOWN SWITCH SENSE
10	P21 20RD/LG (PREMIUM II/III)	SEAT FRONT DOWN SWITCH SENSE
10	P19 20YL/LG (RHD PREMIUM II/III)	SEAT FRONT UP SWITCH SENSE



DRIVER REAR POWER WINDOW MOTOR

DRIVER REAR POWER WINDOW MOTOR - BLACK 2 WAY

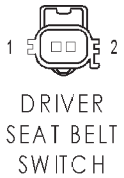
CAV	CIRCUIT	FUNCTION
1	Q124 16DG/WT	WINDOW DRIVER (DOWN)
2	Q114 16GY/WT	WINDOW DRIVER (UP)



DRIVER REAR POWER WINDOW SWITCH

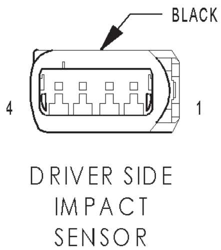
DRIVER REAR POWER WINDOW SWITCH - BLUE 6 WAY

CAV	CIRCUIT	FUNCTION
1	Q14 16GY	DRIVER REAR WINDOW DRIVER (UP)
2	Q114 16GY/WT	WINDOW DRIVER (UP)
3	E21 20OR/RD	DRIVER REAR DOOR SWITCH ILLUMINATION
4	Q24 16DG	DRIVER REAR WINDOW DRIVER (DOWN)
5	Q124 16DG/WT	WINDOW DRIVER (DOWN)
6	Z1 16BK	GROUND



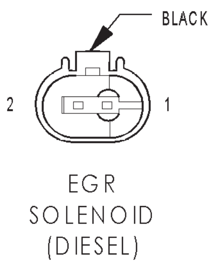
DRIVER SEAT BELT SWITCH - 2 WAY

CAV	CIRCUIT	FUNCTION
1	R57 20DG	DRIVER SEAT BELT SWITCH SENSE
2	R59 20LB	DRIVER SEAT BELT SWITCH GROUND



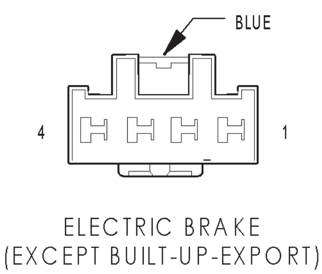
DRIVER SIDE IMPACT SENSOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R133 20LB/DG	DRIVER SIDE IMPACT SENSOR GROUND
4	R131 20LG/YL	DRIVER SIDE IMPACT SENSOR SIGNAL



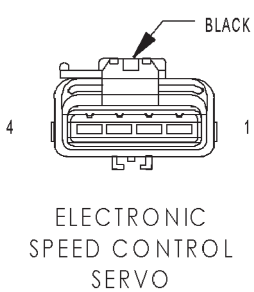
EGR SOLENOID (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	F15 18RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K35 20GY/YL	EGR SOLENOID CONTROL



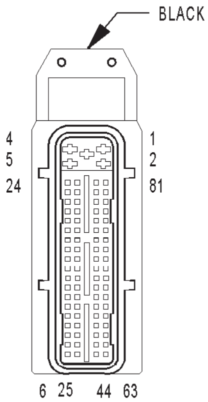
ELECTRIC BRAKE (EXCEPT BUILT-UP-EXPORT) - BLUE 4 WAY

CAV	CIRCUIT	FUNCTION
1	Z151 14BK	GROUND
2	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
3	B40 12LB	TRAILER TOW BRAKE B(+)
4	F9 14RD/BK	FUSED B(+)



ELECTRONIC SPEED CONTROL SERVO - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	V36 20TN/RD (RHD/GAS)	SPEED CONTROL VACUUM SOLENOID CONTROL
1	V36 18TN/RD (LHD GAS)	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 20LG/RD (RHD/GAS)	SPEED CONTROL VENT SOLENOID CONTROL
2	V35 18LG/RD (LHD GAS)	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
4	Z307 20BK	GROUND



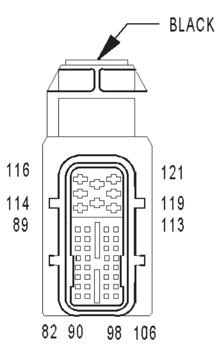
ENGINE CONTROL MODULE C1 (DIESEL)

ENGINE CONTROL MODULE C1 (DIESEL) - BLACK 81 WAY

CAV	CIRCUIT	FUNCTION
1	Z108 14BK/DG	GROUND
2	Z108 14BK/DG	GROUND
3	K20 14DB	GENERATOR FIELD CONTROL
4	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
5	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
6	D52 18DG/WT	CAN C BUS(+)
7	D25 20VT/YL	PCI BUS
8	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
9	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
10	-	-
11	Y53 20BK/YL	BOOST PRESSURE SENSOR SIGNAL
12	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL
13	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
14	K22 20RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
15	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
16	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
17	-	-
18	-	-
19	F300 20RD/BK	BATTERY SENSE (+)
20	Z11 20BK/WT	BATTERY SENSE (-)
21	K4 18BK/LB	SENSOR GROUND
22	F991 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
24	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1
25	D51 18WT	CAN C BUS(-)
26	-	-
27	-	-
28	-	-
29	K77 20BR/WT	TRANSFER CASE POSITION SENSOR INPUT
30	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
31	-	-
32	K25 20VT/DG	BATTERY TEMPERATURE SENSOR SIGNAL
33	-	-
34	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
35	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY
36	C18 20DB	A/C PRESSURE SENSOR SIGNAL
37	-	-
38	V37 20RD/DG	SPEED CONTROL SWITCH SIGNAL
39	K226 20DB/WT	FUEL LEVEL SENSOR SIGNAL
40	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
41	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL
42	Y101 20	CRANKSHAFT POSITION SENSOR SHIELD
43	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
44	-	-
45	-	-
46	-	-
47	L50 20WT/DB	PRIMARY BRAKE SWITCH SIGNAL
48	K29 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
49	-	-
50	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
51	-	-
52	-	-
53	-	-
54	Z189 20BR	MASS AIR FLOW SENSOR GROUND

ENGINE CONTROL MODULE C1 (DIESEL) - BLACK 81 WAY

CAV	CIRCUIT	FUNCTION
55	B22 20DG/YL	VEHICLE SPEED SENSOR SIGNAL
56	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
57	-	-
58	K4 20BK/LB	WATER IN FUEL SENSOR GROUND
59	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL
60	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY
61	K51 20DB/YL	AUTO SHUT DOWN RELAY CONTROL
62	-	-
63	-	-
64	-	-
65	-	-
66	-	-
67	K173 20GY	HYDRAULIC RADIATOR FAN SOLENOID CONTROL
68	-	-
69	C13 20DB/RD	A/C COMPRESSOR CLUTCH RELAY CONTROL
70	-	-
71	-	-
72	K236 20GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
73	-	-
74	T752 20DG/RD	ENGINE STARTER MOTOR RELAY CONTROL
75	K132 20BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
76	Y42 20BR/BK	WASTEGATE SOLENOID CONTROL
77	K152 20WT	GLOW PLUG RELAY NO. 1 CONTROL
78	-	-
79	-	-
80	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
81	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL



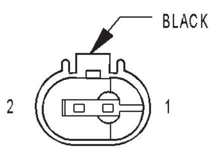
ENGINE CONTROL MODULE C2 (DIESEL)

ENGINE CONTROL MODULE C2 (DIESEL) - BLACK 40 WAY

CAV	CIRCUIT	FUNCTION
82	D21 20PK	SCI TRANSMIT
83	-	-
84	-	-
85	-	-
86	-	-
87	-	-
88	-	-
89	K35 20GY/YL	EGR SOLENOID CONTROL
90	-	-
91	-	-
92	-	-
93	-	-
94	G123 20DG/WT	WATER IN FUEL SENSOR SIGNAL
95	-	-
96	-	-
97	-	-
98	-	-
99	-	-
100	-	-
101	-	-
102	-	-
103	-	-
104	-	-

ENGINE CONTROL MODULE C2 (DIESEL) - BLACK 40 WAY

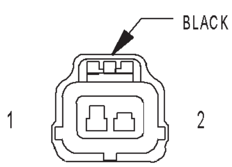
CAV	CIRCUIT	FUNCTION
105	-	-
106	-	-
107	-	-
108	-	-
109	-	-
110	-	-
111	-	-
112	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
113	-	-
114	-	-
115	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
116	K63 14BK	COMMON INJECTOR DRIVER
117	-	-
118	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
119	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
120	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
121	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL



ENGINE COOLANT TEMPERATURE SENSOR (DIESEL)

ENGINE COOLANT TEMPERATURE SENSOR (DIESEL) - BLACK 2 WAY

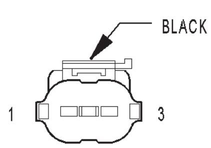
CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



ENGINE COOLANT TEMPERATURE SENSOR (GAS)

ENGINE COOLANT TEMPERATURE SENSOR (GAS) - BLACK 2 WAY

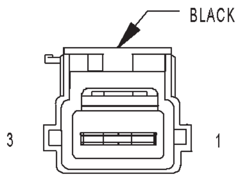
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



ENGINE OIL PRESSURE SENSOR (DIESEL)

ENGINE OIL PRESSURE SENSOR (DIESEL) - BLACK 3 WAY

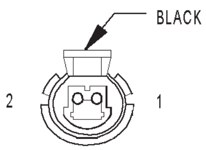
CAV	CIRCUIT	FUNCTION
1	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
2	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



ENGINE
OIL PRESSURE
SENSOR
(GAS)

ENGINE OIL PRESSURE SENSOR (GAS) - BLACK 3 WAY

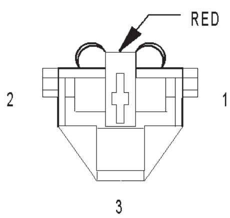
CAV	CIRCUIT	FUNCTION
1	K6 18VT/BK	5 VOLT SUPPLY
2	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



EVAP/PURGE
SOLENOID
(GAS)

EVAP/PURGE SOLENOID (GAS) - BLACK 2 WAY

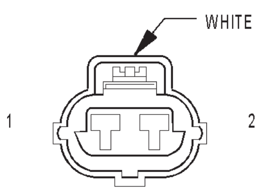
CAV	CIRCUIT	FUNCTION
1	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	K52 18PK/BK (RHD)	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
2	K52 20PK/BK (LHD)	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL



FRONT
POWER
OUTLET

FRONT POWER OUTLET - RED 3 WAY

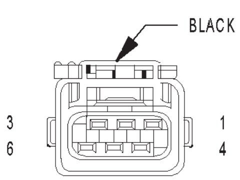
CAV	CIRCUIT	FUNCTION
1	F85 16VT (RHD)	FUSED B(+)
1	F85 16VT/WT (LHD)	FUSED B(+)
2	-	-
3	Z300 16BK	GROUND



FRONT
WASHER
PUMP

FRONT WASHER PUMP - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	V10 20BR	WASHER PUMP SWITCH SENSE
2	Z141 20BK	GROUND



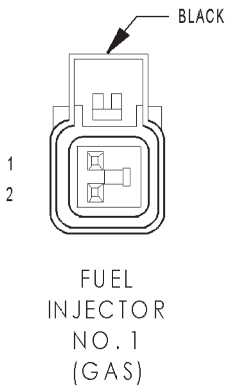
FRONT
WIPER
MOTOR

FRONT WIPER MOTOR - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V55 16TN/RD	WIPER PARK SWITCH SENSE
3	-	-
4	Z141 16BK	GROUND
5	V3 16BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
6	V4 16RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT

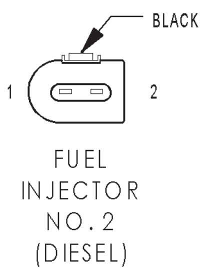
FUEL INJECTOR NO. 1 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



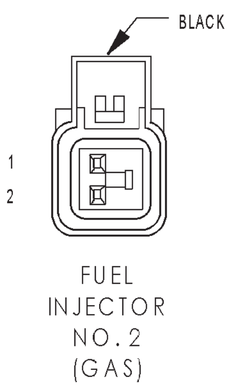
FUEL INJECTOR NO. 1 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



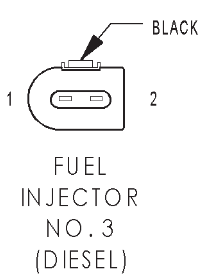
FUEL INJECTOR NO. 2 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



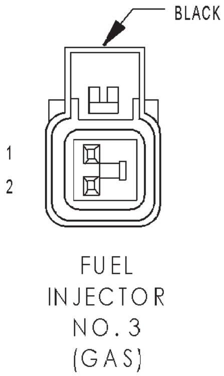
FUEL INJECTOR NO. 2 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



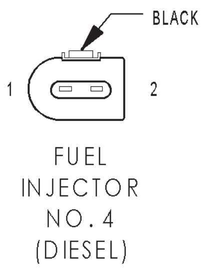
FUEL INJECTOR NO. 3 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



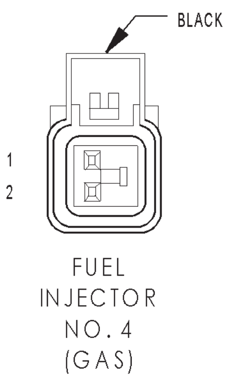
FUEL INJECTOR NO. 3 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



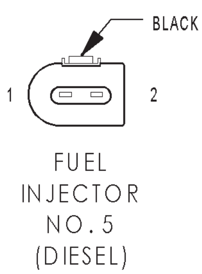
FUEL INJECTOR NO. 4 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



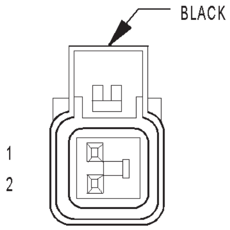
FUEL INJECTOR NO. 4 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



FUEL INJECTOR NO. 5 (DIESEL) - BLACK 2 WAY

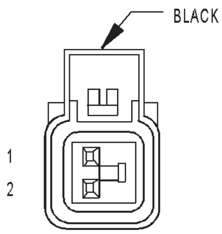
CAV	CIRCUIT	FUNCTION
1	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



FUEL INJECTOR NO.5 (GAS)

FUEL INJECTOR NO. 5 (GAS) - BLACK 2 WAY

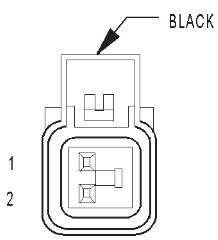
CAV	CIRCUIT	FUNCTION
1	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



FUEL INJECTOR NO.6 (GAS)

FUEL INJECTOR NO. 6 (GAS) - BLACK 2 WAY

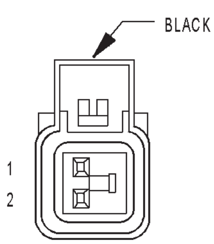
CAV	CIRCUIT	FUNCTION
1	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



FUEL INJECTOR NO.7 (4.7L)

FUEL INJECTOR NO. 7 (4.7L) - BLACK 2 WAY

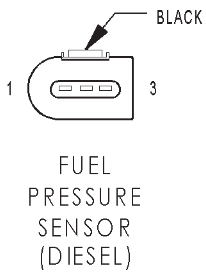
CAV	CIRCUIT	FUNCTION
1	K26 18VT	FUEL INJECTOR NO. 7 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



FUEL INJECTOR NO.8 (4.7L)

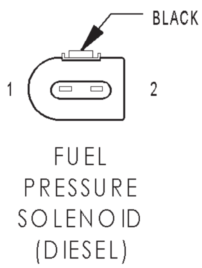
FUEL INJECTOR NO. 8 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K28 18GY/LB	FUEL INJECTOR NO. 8 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



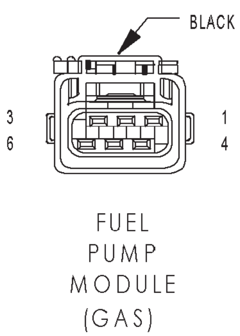
FUEL PRESSURE SENSOR (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
2	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
3	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY



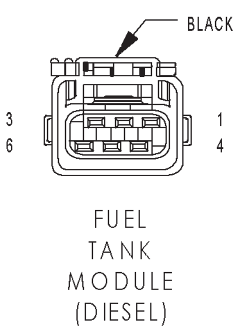
FUEL PRESSURE SOLENOID (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
2	F142 16RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT



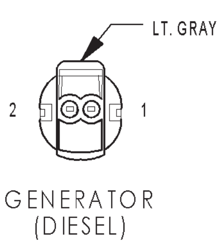
FUEL PUMP MODULE (GAS) - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	A141 16DG/BK	FUEL PUMP RELAY OUTPUT
2	-	-
3	K226 20LB/YL	FUEL LEVEL SENSOR SIGNAL
4	K4 20BK/LB	SENSOR GROUND
5	-	-
6	Z150 16BK	GROUND



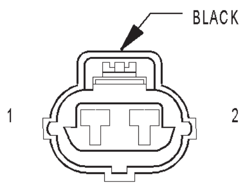
FUEL TANK MODULE (DIESEL) - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	K226 20LB/YL	FUEL LEVEL SENSOR SIGNAL
4	K4 20BK/LB	SENSOR GROUND
5	-	-
6	-	-



GENERATOR (DIESEL) - LT. GRAY 2 WAY

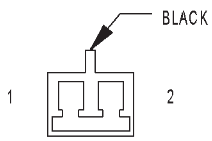
CAV	CIRCUIT	FUNCTION
1	F15 14DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K20 14DB	GENERATOR FIELD CONTROL



GENERATOR (GAS)

GENERATOR (GAS) - BLACK 2 WAY

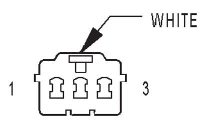
CAV	CIRCUIT	FUNCTION
1	K125 18WT/DB	GENERATOR SOURCE
2	K20 18DG	GENERATOR FIELD DRIVER



GLOVE BOX LAMP

GLOVE BOX LAMP - BLACK 2 WAY

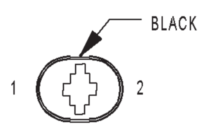
CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M20 20BR/OR	COURTESY LAMP LOAD SHED



HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT)

HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT) - WHITE 3 WAY

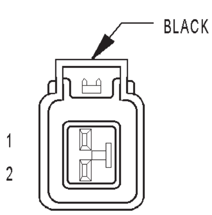
CAV	CIRCUIT	FUNCTION
1	Z234 20BK	GROUND
2	L7 18BK/YL	PARK LAMP RELAY OUTPUT
3	L13 20BR/YL	HEADLAMP ADJUST SIGNAL



HOOD AJAR SWITCH (BUILT-UP-EXPORT)

HOOD AJAR SWITCH (BUILT-UP-EXPORT) - BLACK 2 WAY

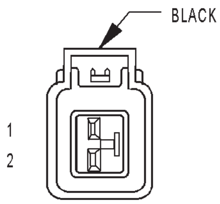
CAV	CIRCUIT	FUNCTION
1	G70 20BR/TN	HOOD AJAR SWITCH SENSE
2	Z141 20BK (DIESEL)	GROUND
2	Z161 20BK (GAS)	GROUND



HORN NO. 1

HORN NO. 1 - BLACK 2 WAY

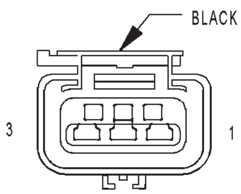
CAV	CIRCUIT	FUNCTION
1	Z307 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



HORN NO. 2

HORN NO. 2 - BLACK 2 WAY

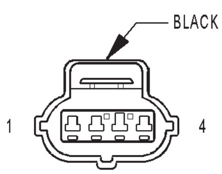
CAV	CIRCUIT	FUNCTION
1	Z307 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



HYDRAULIC COOLING MODULE

HYDRAULIC COOLING MODULE - BLACK 3 WAY

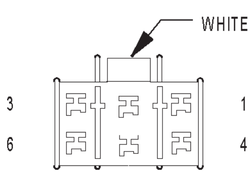
CAV	CIRCUIT	FUNCTION
1	F15 18DB/WT (DIESEL)	FUSED AUTO SHUT DOWN RELAY OUTPUT
1	F142 18OR/DG (GAS)	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K173 18LG (DIESEL)	HYDRAULIC RADIATOR FAN RELAY CONTROL
2	K173 18LG (GAS)	RADIATOR FAN RELAY CONTROL
3	Z500 18BK	GROUND



IDLE AIR CONTROL MOTOR

IDLE AIR CONTROL MOTOR - BLACK 4 WAY

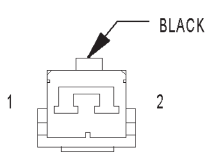
CAV	CIRCUIT	FUNCTION
1	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
4	K39 18GY/BK	IDLE AIR CONTROL NO. 1 DRIVER



IGNITION SWITCH C1

IGNITION SWITCH C1 - WHITE 6 WAY

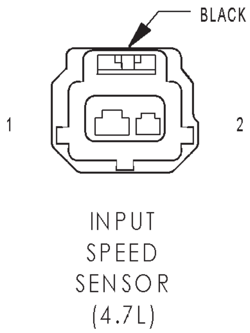
CAV	CIRCUIT	FUNCTION
1	A41 12YL	IGNITION SWITCH OUTPUT (START)
2	A2 12PK/BK	FUSED B(+)
3	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
4	A1 12RD	FUSED B(+)
5	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
6	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)



IGNITION SWITCH C2

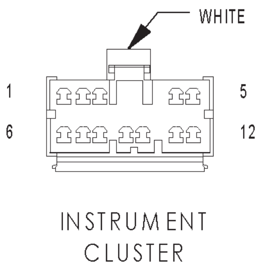
IGNITION SWITCH C2 - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	G26 20LB	KEY-IN IGNITION SWITCH SENSE
2	Z234 20BK	GROUND



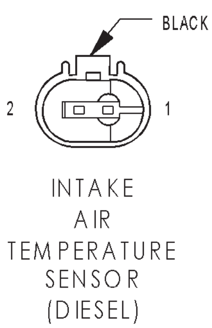
INPUT SPEED SENSOR (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



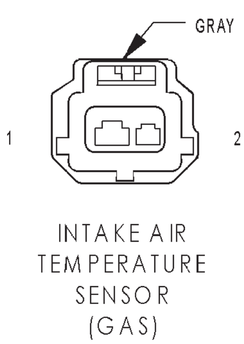
INSTRUMENT CLUSTER - WHITE 12 WAY

CAV	CIRCUIT	FUNCTION
1	L61 20TN/LG	LEFT TURN SIGNAL
2	L60 20TN	RIGHT TURN SIGNAL
3	-	-
4	-	-
5	G9 20GY/BK	RED BRAKE WARNING INDICATOR DRIVER
6	F33 20PK/RD	FUSED B(+)
7	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
8	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
9	Z300 20BK	GROUND
10	D25 20YL/VT/RD	PCI BUS
11	Z132 20BK/OR	GROUND
12	-	-



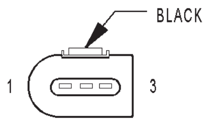
INTAKE AIR TEMPERATURE SENSOR (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL



INTAKE AIR TEMPERATURE SENSOR (GAS) - GRAY 2 WAY

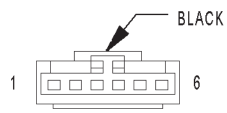
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL



INTAKE PORT SWIRL ACTUATOR (DIESEL)

INTAKE PORT SWIRL ACTUATOR (DIESEL) - BLACK 3 WAY

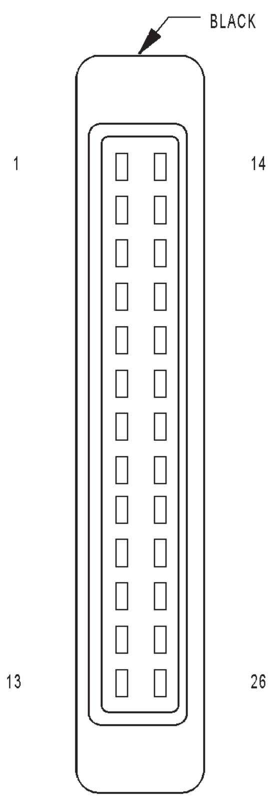
CAV	CIRCUIT	FUNCTION
1	Z18 18BK	GROUND
2	F15 18RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
3	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL



INTRUSION TRANSCEIVER MODULE (BUILT-UP-EXPORT)

INTRUSION TRANSCEIVER MODULE (BUILT-UP-EXPORT) - BLACK 6 WAY

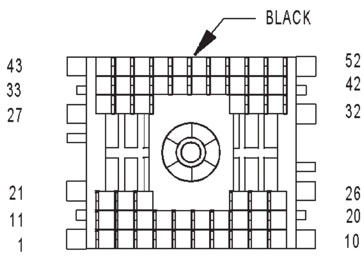
CAV	CIRCUIT	FUNCTION
1	Z155 20BK	GROUND
2	-	-
3	X75 20GY/LG	SIREN SIGNAL CONTROL
4	-	-
5	D25 20YL/VT	PCI BUS
6	F70 20PK	FUSED B(+)



JUNCTION BLOCK BODY CONTROL MODULE

JUNCTION BLOCK BODY CONTROL MODULE - BLACK 26 WAY

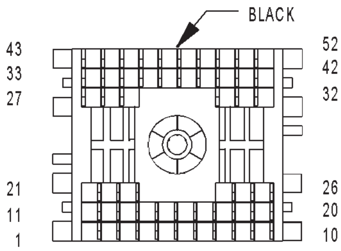
CAV	CIRCUIT	FUNCTION
1	L308	PARK LAMP RELAY CONTROL
2	L26	FOG LAMP RELAY CONTROL
3	Q29	ACCESSORY DELAY RELAY CONTROL
4	L307	LOW BEAM RELAY CONTROL
5	G5	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	X4	HORN RELAY CONTROL
7	V16	WIPER HIGH/LOW RELAY CONTROL
8	G80	LIFTGATE FLIP-UP AJAR SWITCH SENSE
9	L11	HIGH BEAM RELAY CONTROL
10	L91	HAZARD SWITCH SENSE
11	C80	REAR WINDOW DEFOGGER RELAY CONTROL
12	Z2	GROUND
13	L96 (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY CONTROL
14	L7	PARK LAMP RELAY OUTPUT
15	Z1	GROUND
16	M2	COURTESY LAMP DRIVER
17	-	-
18	-	-
19	M20	COURTESY LAMP LOAD SHED
20	V55	WIPER PARK SWITCH SENSE
21	G78	LIFTGATE AJAR SWITCH SENSE
22	G10	SEAT BELT SWITCH SENSE
23	G77	LEFT REAR DOOR AJAR SWITCH SENSE
24	G73	LIFTGATE COURTESY DISABLE
25	V23	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
26	M1	FUSED B(+)



JUNCTION BLOCK C1

JUNCTION BLOCK C1 - BLACK 52 WAY

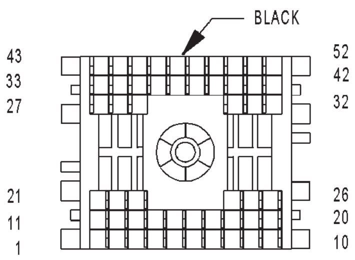
CAV	CIRCUIT	FUNCTION
1	Q30 16TN	ACCESSORY DELAY RELAY OUTPUT
2	L63 18DG/RD	LEFT TURN SIGNAL
3	-	-
4	-	-
5	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
6	-	-
7	-	-
8	-	-
9	G73 20LG/OR	LIFTGATE COURTESY DISABLE
10	G77 20TN/OR	LEFT REAR DOOR AJAR SWITCH SENSE
11	L7 18BK/YL	PARK LAMP RELAY OUTPUT
12	-	-
13	-	-
14	-	-
15	F37 16RD (LHD EXCEPT BASE)	FUSED B(+)
15	F37 16RD/LB (RHD)	FUSED B(+)
16	M2 18YL (RHD)	COURTESY LAMP DRIVER
16	M2 20YL/DG (LHD)	COURTESY LAMP DRIVER
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	F22 20WT/PK (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN)
23	-	-
24	G80 20VT/YL	LIFTGATE FLIP-UP AJAR SWITCH SENSE
25	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
26	M20 18YL/BK (RHD)	COURTESY LAMP LOAD SHED
26	M20 20YL/BK (LHD)	COURTESY LAMP LOAD SHED
27	-	-
28	-	-
29	-	-
30	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
31	-	-
32	M1 18PK/RD (RHD)	FUSED B(+)
33	-	-
34	-	-
35	F9 14RD/BK	FUSED B(+)
36	F70 18PK	FUSED B(+)
37	-	-
38	-	-
39	-	-
40	-	-
41	F30 14RD/TN (LHD)	CIGAR LIGHTER RELAY OUTPUT
41	F30 16RD/TN (RHD)	CIGAR LIGHTER RELAY OUTPUT
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-
50	C15 12BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
51	-	-
52	-	-



JUNCTION BLOCK C2 (LHD)

JUNCTION BLOCK C2 (LHD) - BLACK 52 WAY

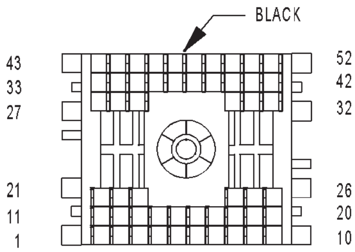
CAV	CIRCUIT	FUNCTION
1	X3 22GY/OR	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 18BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	WIPER HIGH/LOW RELAY CONTROL
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 20BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB (EXCEPT BASE)	FUSED B(+)
25	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	F72 16RD/YL	FUSED B(+)
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 14RD/WT (EXCEPT BASE)	FUSED B(+)



JUNCTION BLOCK C2 (RHD)

JUNCTION BLOCK C2 (RHD) - BLACK 52 WAY

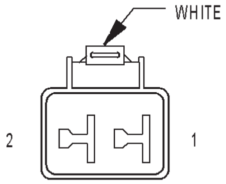
CAV	CIRCUIT	FUNCTION
1	X3 22BK/RD	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 20BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	-
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 18BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB	FUSED B(+)
25	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	-	-
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 16RD/WT	FUSED B(+)



JUNCTION BLOCK C3

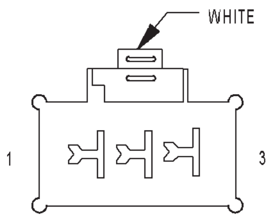
JUNCTION BLOCK C3 - BLACK 52 WAY

CAV	CIRCUIT	FUNCTION
1	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	L60 20TN	RIGHT TURN SIGNAL
4	L302 20LB/YL	RIGHT TURN SWITCH SENSE
5	L61 20TN/LG	LEFT TURN SIGNAL
6	L91 20DB/PK	HAZARD SWITCH SENSE
7	-	-
8	L305 20LB/WT	LEFT TURN SWITCH SENSE
9	-	-
10	L309 20PK/LG	HIGH BEAM RELAY CONTROL
11	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
12	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
13	-	-
14	F85 16VT/WT	FUSED B(+)
15	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
25	F60 16RD/WT	FUSED B(+)
26	-	-
27	A41 12YL	IGNITION SWITCH OUTPUT (START)
28	F14 20LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
29	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
30	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
31	Z234 20BK	GROUND
32	F33 20PK/RD	FUSED B(+)
33	X12 16WT/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
34	M1 20PK	FUSED B(+)
35	M1 20PK (AZC)	FUSED B(+)
36	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)
37	-	-
38	F70 20PK/BK	FUSED B(+)
39	X3 20GY/OR	HORN RELAY CONTROL
40	F30 16RD	FUSED CIGAR LIGHTER RELAY OUTPUT
41	F33 20PK/RD	FUSED B(+)
42	-	-
43	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
44	M1 20PK	FUSED B(+)
45	Z132 20BK/OR	GROUND
46	-	-
47	-	-
48	F70 20PK/BK	FUSED B(+)
49	-	-
50	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
51	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
52	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)



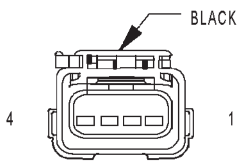
JUNCTION BLOCK C4 - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	A148 10PK/WT	FUSED B(+)
2	A148 10OR/WT	FUSED B(+)



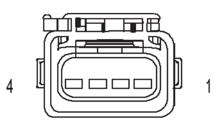
JUNCTION BLOCK C5 - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	A145 10WT/RD	FUSED B(+)
2	A149 12RD/TN	FUSED B(+)
3	A147 10RD/GY	FUSED B(+)



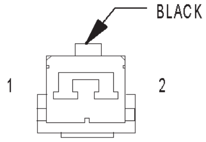
KNOCK SENSOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K42 18DB/LG	KNOCK SENSOR NO. 1 SIGNAL
3	K4 18BK/LB	SENSOR GROUND
4	K142 18GY/BK	KNOCK SENSOR NO. 2 SIGNAL



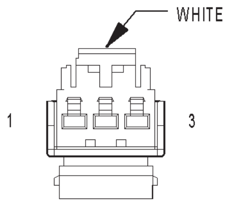
LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT) - 4 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	K125 18OR/DG	GENERATOR SOURCE
3	K106 20WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
4	K107 20OR/YL	LEAK DETECTION PUMP SWITCH SENSE



LEFT COURTESY LAMP - BLACK 2 WAY

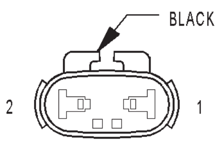
CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M2 20YL	COURTESY LAMP DRIVER



LEFT DOOR HANDLE COURTESY LAMP

LEFT DOOR HANDLE COURTESY LAMP - WHITE 3 WAY

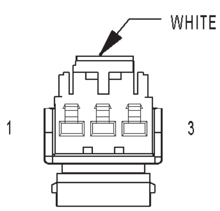
CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED
3	M2 20YL/DG	COURTESY LAMP DRIVER



LEFT FOG LAMP

LEFT FOG LAMP - BLACK 2 WAY

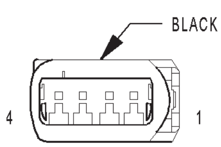
CAV	CIRCUIT	FUNCTION
1	L39 20LB	FOG LAMP RELAY OUTPUT
2	Z141 20BK (DIESEL/4.7L RHD)	GROUND
2	Z141 18BK (EXCEPT DIESEL/4.7L RHD)	GROUND



LEFT FRONT DOOR SPEAKER

LEFT FRONT DOOR SPEAKER - WHITE 3 WAY

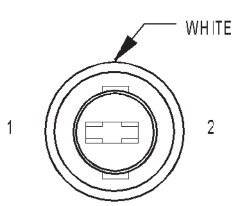
CAV	CIRCUIT	FUNCTION
1	X55 18LG/DG (BASE)	LEFT FRONT DOOR SPEAKER (-)
1	X85 18LB/BK (RHD PREMIUM)	LEFT FRONT DOOR SPEAKER (-)
1	X85 18LG/DG (LHD PREMIUM)	LEFT FRONT DOOR SPEAKER (-)
2	-	-
3	X53 18LG/RD (BASE)	LEFT FRONT DOOR SPEAKER (+)
3	X87 18LB/RD (RHD PREMIUM)	LEFT FRONT DOOR SPEAKER (+)
3	X87 18LG/RD (LHD PREMIUM)	LEFT FRONT DOOR SPEAKER (+)



LEFT FRONT IMPACT SENSOR

LEFT FRONT IMPACT SENSOR - BLACK 4 WAY

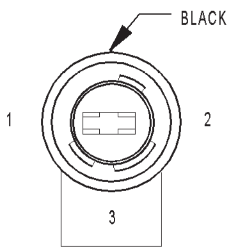
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R47 18DB/LB	LEFT FRONT IMPACT SENSOR GROUND
4	R49 18LB	LEFT FRONT IMPACT SENSOR SIGNAL



LEFT FRONT PARK LAMP

LEFT FRONT PARK LAMP - WHITE 2 WAY

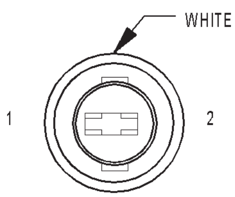
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 20BK/PK	PARK LAMP RELAY OUTPUT



LEFT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)

LEFT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT) - BLACK 3 WAY

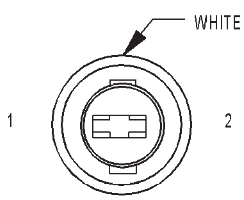
CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY CONTROL
2	Z1 18BK	GROUND
3	L61 20TN/LG	LEFT TURN SIGNAL



LEFT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT)

LEFT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT) - WHITE 2 WAY

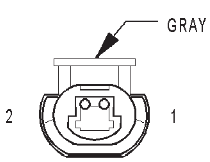
CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	L61 20TN/LG	LEFT TURN SIGNAL



LEFT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT)

LEFT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT) - WHITE 2 WAY

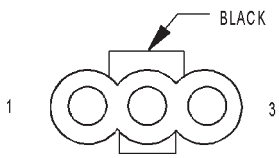
CAV	CIRCUIT	FUNCTION
1	L61 20TN/LG	LEFT TURN SIGNAL
2	Z1 18BK	GROUND



LEFT FRONT WHEEL SPEED SENSOR

LEFT FRONT WHEEL SPEED SENSOR - GRAY 2 WAY

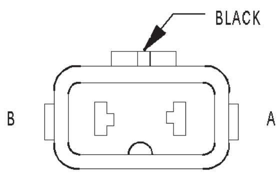
CAV	CIRCUIT	FUNCTION
1	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL



LEFT HEADLAMP
LEVELING MOTOR
(BUILT-UP-EXPORT)

LEFT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT) - BLACK 3 WAY

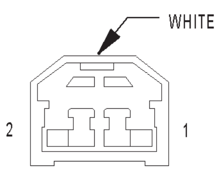
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L114 18VT/DB	HEADLAMP ADJUST SIGNAL
3	L7 20BK/PK	PARK LAMP RELAY OUTPUT



LEFT HIGH BEAM
HEADLAMP

LEFT HIGH BEAM HEADLAMP - BLACK 2 WAY

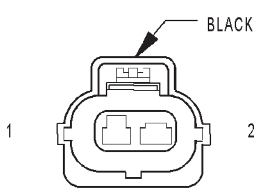
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT



LEFT
INSTRUMENT
PANEL
SPEAKER

LEFT INSTRUMENT PANEL SPEAKER - WHITE 2 WAY

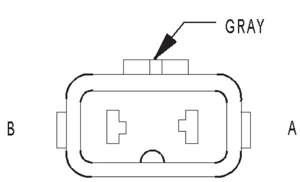
CAV	CIRCUIT	FUNCTION
1	X83 18YL/RD	LEFT INSTRUMENT PANEL SPEAKER (+)
2	X81 18YL/BK	LEFT INSTRUMENT PANEL SPEAKER (-)



LEFT
LIFTGATE
AJAR SWITCH

LEFT LIFTGATE AJAR SWITCH - BLACK 2 WAY

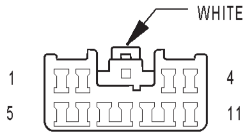
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE



LEFT LOW BEAM
HEADLAMP

LEFT LOW BEAM HEADLAMP - GRAY 2 WAY

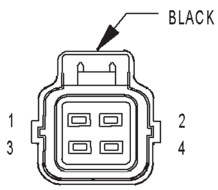
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L43 18VT	FUSED LEFT LOW BEAM OUTPUT



LEFT MULTI-FUNCTION SWITCH

LEFT MULTI-FUNCTION SWITCH - WHITE 11 WAY

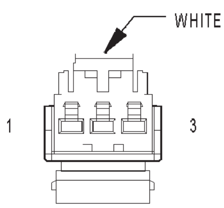
CAV	CIRCUIT	FUNCTION
1	L27 20WT/TN	FOG LAMP SWITCH SENSE
2	Z234 20BK	GROUND
3	-	-
4	L80 20WT/DG	HEADLAMP SWITCH RETURN
5	L309 20PK/LG	HIGH BEAM RELAY CONTROL
6	L40 20BR	HIGH BEAM SWITCH SENSE
7	L302 20LB/YL	RIGHT TURN SWITCH SENSE
8	L305 20LB/WT	LEFT TURN SWITCH SENSE
9	L91 20DB/PK	HAZARD SWITCH SENSE
10	E19 20RD	PANEL LAMPS DIMMER SIGNAL
11	G52 20YL	HEADLAMP SWITCH MUX



LEFT REAR DOOR LOCK MOTOR/AJAR SWITCH

LEFT REAR DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

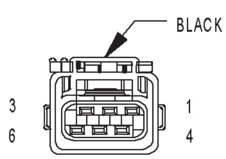
CAV	CIRCUIT	FUNCTION
1	G77 18TN/YL	LEFT REAR DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



LEFT REAR DOOR SPEAKER

LEFT REAR DOOR SPEAKER - WHITE 3 WAY

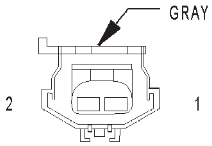
CAV	CIRCUIT	FUNCTION
1	X51 18WT/VT (BASE)	LEFT REAR DOOR SPEAKER (+)
1	X91 18WT/VT (PREMIUM)	LEFT REAR DOOR SPEAKER (+)
2	-	-
3	X57 18TN/DG (BASE)	LEFT REAR DOOR SPEAKER (-)
3	X93 18TN/DG (PREMIUM)	LEFT REAR DOOR SPEAKER (-)



LEFT REAR LAMP ASSEMBLY

LEFT REAR LAMP ASSEMBLY - BLACK 6 WAY

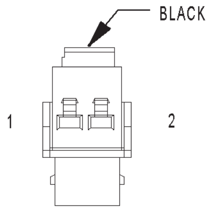
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L63 18DG/RD	LEFT TURN SIGNAL
5	Z150 18BK	GROUND
6	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL



LEFT REAR WHEEL SPEED SENSOR

LEFT REAR WHEEL SPEED SENSOR - GRAY 2 WAY

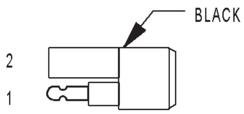
CAV	CIRCUIT	FUNCTION
1	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL



LEFT REMOTE RADIO SWITCH

LEFT REMOTE RADIO SWITCH - BLACK 2 WAY

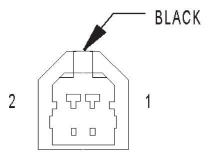
CAV	CIRCUIT	FUNCTION
1	X10 20RD/BK	RADIO CONTROL MUX RETURN
2	X20 20RD/YL	RADIO CONTROL MUX



LEFT SIDE REPEATER LAMP (BUILT-UP-EXPORT)

LEFT SIDE REPEATER LAMP (BUILT-UP-EXPORT) - BLACK 2 WAY

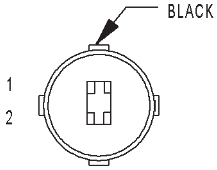
CAV	CIRCUIT	FUNCTION
1	L61 18LG (DIESEL)	LEFT TURN SIGNAL
1	L61 18TN/LG (GAS)	LEFT TURN SIGNAL
2	Z161 18BK	GROUND



LEFT VISOR/ VANITY LAMP

LEFT VISOR/VANITY LAMP - BLACK 2 WAY

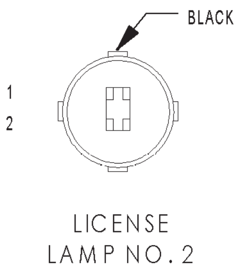
CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED



LICENSE LAMP NO. 1

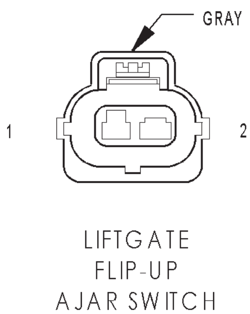
LICENSE LAMP NO. 1 - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND



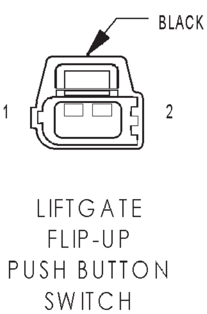
LICENSE LAMP NO. 2 - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND



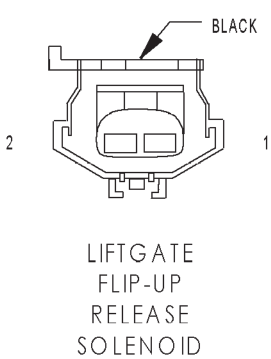
LIFTGATE FLIP-UP AJAR SWITCH - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G80 20VT/YL	LIFTGATE FLIP-UP AJAR SWITCH SENSE



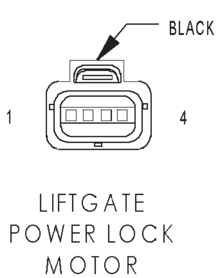
LIFTGATE FLIP-UP PUSH BUTTON SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	P101 18OR/PK	LIFTGATE FLIP-UP SWITCH OUTPUT
2	F70 18PK	FUSED B(+)



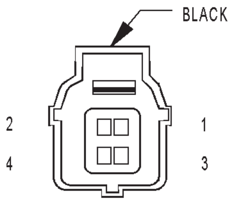
LIFTGATE FLIP-UP RELEASE SOLENOID - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	P100 18OR/BR	LIFTGATE GLASS LIMIT SWITCH OUTPUT



LIFTGATE POWER LOCK MOTOR - BLACK 4 WAY

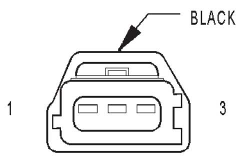
CAV	CIRCUIT	FUNCTION
1	P35 18OR/VT	DOOR LOCK DRIVER
2	P36 18PK/VT	DOOR UNLOCK DRIVER
3	P101 18OR/PK	LIFTGATE FLIP-UP SWITCH OUTPUT
4	P100 18OR/BR	LIFTGATE GLASS LIMIT SWITCH OUTPUT



LINE PRESSURE SENSOR (4.7L)

LINE PRESSURE SENSOR (4.7L) - BLACK 4 WAY

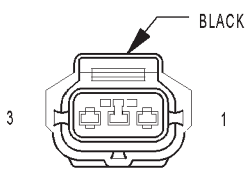
CAV	CIRCUIT	FUNCTION
1	Z114 14BK/LB	GROUND
2	T138 14GY/LB	5 VOLT SUPPLY
3	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
4	-	-



MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L)

MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L) - BLACK 3 WAY

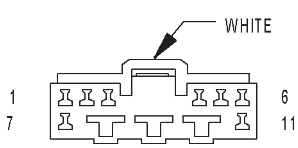
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K1 18DG/RD	MAP SENSOR SIGNAL
3	K7 18OR	5 VOLT SUPPLY



MANIFOLD ABSOLUTE PRESSURE SENSOR (4.7L)

MANIFOLD ABSOLUTE PRESSURE SENSOR (4.7L) - BLACK 3 WAY

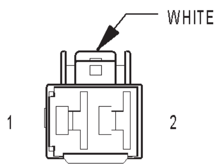
CAV	CIRCUIT	FUNCTION
1	K1 18DG/RD	MAP SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5 VOLT SUPPLY



MANUAL TEMPERATURE CONTROL C1 (MTC)

MANUAL TEMPERATURE CONTROL C1 (MTC) - WHITE 11 WAY

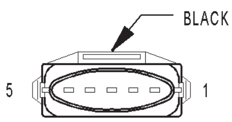
CAV	CIRCUIT	FUNCTION
1	C103 20DG	A/C SWITCH SIGNAL
2	Z123 20BK/OR	GROUND
3	C67 20RD/LB	BLEND AIR DOOR POSITION CONTROL
4	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	C81 20LB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
6	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
7	E2 20OR	PANEL LAMPS DRIVER
8	C4 16TN	BLOWER MOTOR LOW DRIVER
9	C5 16LG	BLOWER MOTOR M1 DRIVER
10	C6 14LB	BLOWER MOTOR M2 DRIVER
11	-	-



MANUAL TEMPERATURE CONTROL C2 (MTC)

MANUAL TEMPERATURE CONTROL C2 (MTC) - WHITE 2 WAY

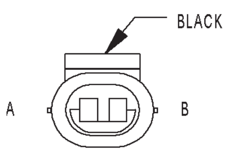
CAV	CIRCUIT	FUNCTION
1	Z118 12BK	GROUND
2	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER



MASS AIR FLOW SENSOR (DIESEL)

MASS AIR FLOW SENSOR (DIESEL) - BLACK 5 WAY

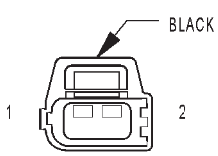
CAV	CIRCUIT	FUNCTION
1	-	-
2	F15 16RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
3	Z189 20BR	MASS AIR FLOW SENSOR GROUND
4	F855 20BR/YL	SENSOR REFERENCE VOLTAGE A
5	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL



MODE DOOR MOTOR/ ACTUATOR (AZC)

MODE DOOR MOTOR/ACTUATOR (AZC) - BLACK 2 WAY

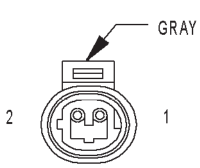
CAV	CIRCUIT	FUNCTION
A	C102 20TN/BK (LHD)	MODE DOOR DRIVER (B)
A	C35 20DG/YL (RHD)	MODE DOOR DRIVER (A)
B	C35 20DG/YL (LHD)	MODE DOOR DRIVER (A)
B	C102 20TN/BK (RHD)	MODE DOOR DRIVER (B)



NEEDLE MOVEMENT SENSOR (DIESEL)

NEEDLE MOVEMENT SENSOR (DIESEL) - BLACK 2 WAY

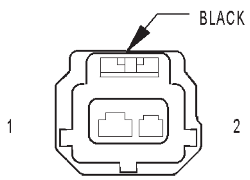
CAV	CIRCUIT	FUNCTION
1	K67 18BR/BK	NEEDLE MOVEMENT SENSOR SIGNAL
2	K68 18LG/YL	NEEDLE MOVEMENT SENSOR GROUND



OUTPUT SPEED SENSOR (4.0L)

OUTPUT SPEED SENSOR (4.0L) - GRAY 2 WAY

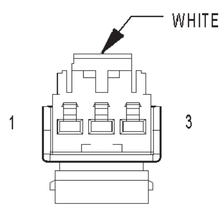
CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL



OUTPUT SPEED SENSOR (4.7L)

OUTPUT SPEED SENSOR (4.7L) - BLACK 2 WAY

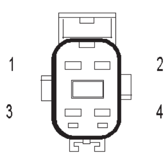
CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



OVERHEAD MAP/ COURTESY LAMP

OVERHEAD MAP/COURTESY LAMP - WHITE 3 WAY

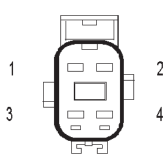
CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED
3	M2 20YL/DG	COURTESY LAMP DRIVER



OXYGEN SENSOR 1/1 UPSTREAM

OXYGEN SENSOR 1/1 UPSTREAM - 4 WAY

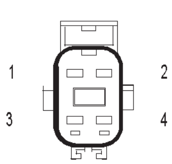
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
3	K4 18BK/LB	SENSOR GROUND
4	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL



OXYGEN SENSOR 1/2 DOWNSTREAM

OXYGEN SENSOR 1/2 DOWNSTREAM - 4 WAY

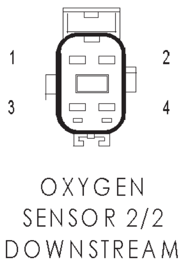
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG (4.0L BUILT-UP-EXPORT)	FUSED AUTO SHUT DOWN RELAY OUTPUT
1	K200 18VT/OR (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
2	K299 18BR/WT (4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR 1/2 HEATER CONTROL
2	Z186 18BK (EXCEPT 4.0L BUILT-UP-EXPORT)	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL



OXYGEN SENSOR 2/1 UPSTREAM

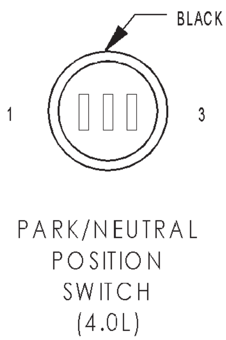
OXYGEN SENSOR 2/1 UPSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K299 18BR/WT	OXYGEN SENSOR 2/1 HEATER CONTROL
3	K4 18BK/LB	SENSOR GROUND
4	K241 18LG/RD	OXYGEN SENSOR 2/1 SIGNAL



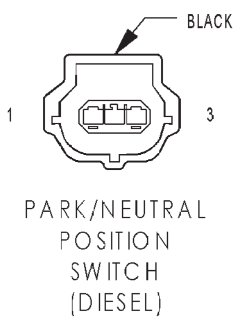
OXYGEN SENSOR 2/2 DOWNSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	K200 18VT/OR (4.0L)	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
1	K200 18BR/WT (4.7L)	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
2	Z186 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K341 18TN/WT (4.0L)	OXYGEN SENSOR 2/2 SIGNAL
4	K341 18PK/WT (4.7L)	OXYGEN SENSOR 2/2 SIGNAL



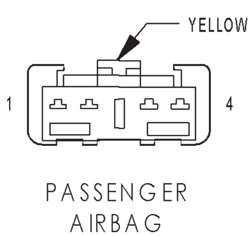
PARK/NEUTRAL POSITION SWITCH (4.0L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
3	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)



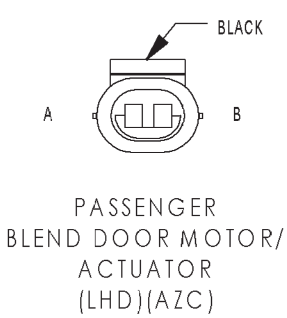
PARK/NEUTRAL POSITION SWITCH (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	T41 18BR/YL	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
3	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)



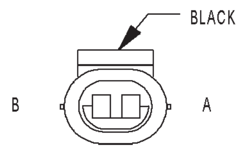
PASSENGER AIRBAG - YELLOW 4 WAY

CAV	CIRCUIT	FUNCTION
1	R42 20BK/YL	PASSENGER SQUIB 1 LINE 1
2	R44 20DG/YL	PASSENGER SQUIB 1 LINE 2
3	R64 20TN/YL	PASSENGER SQUIB 2 LINE 1
4	R62 20OR/YL	PASSENGER SQUIB 2 LINE 2



PASSENGER BLEND DOOR MOTOR/ACTUATOR (LHD) (AZC) - BLACK 2 WAY

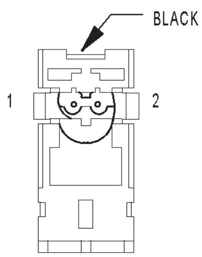
CAV	CIRCUIT	FUNCTION
A	C96 20WT/DB (LHD)	PASSENGER BLEND DOOR DRIVER (B)
B	C94 20WT/DG (LHD)	PASSENGER BLEND DOOR DRIVER (A)



PASSENGER BLEND DOOR MOTOR/ACTUATOR (RHD) (AZC)

PASSENGER BLEND DOOR MOTOR/ACTUATOR (RHD) (AZC) - BLACK 2 WAY

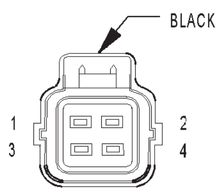
CAV	CIRCUIT	FUNCTION
A	C94 20WT/DG (RHD)	PASSENGER BLEND DOOR DRIVER (A)
B	C96 20WT/DB (RHD)	PASSENGER BLEND DOOR DRIVER (B)



PASSENGER CURTAIN AIRBAG

PASSENGER CURTAIN AIRBAG - BLACK 2 WAY

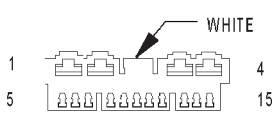
CAV	CIRCUIT	FUNCTION
1	R72 20LB/WT	PASSENGER CURTAIN SQUIB LINE 2
2	R74 20LB/YL	PASSENGER CURTAIN SQUIB LINE 1



PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH

PASSENGER DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

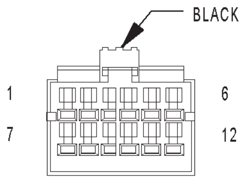
CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



PASSENGER DOOR MODULE C1

PASSENGER DOOR MODULE C1 - WHITE 15 WAY

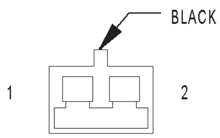
CAV	CIRCUIT	FUNCTION
1	A146 12OR/WT	FUSED B(+)
2	Q24 16DG	PASSENGER REAR WINDOW DRIVER (DOWN)
3	Q14 16GY	PASSENGER REAR WINDOW DRIVER (UP)
4	Z1 12BK	GROUND
5	P35 18OR/VT	DOOR LOCK DRIVER
6	-	-
7	P36 18PK/VT	DOOR UNLOCK DRIVER
8	-	-
9	D25 20YL/VT	PCI BUS
10	-	-
11	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
12	E20 20OR/DB	PASSENGER REAR DOOR SWITCH ILLUMINATION
13	Q12 16BR	PASSENGER WINDOW DRIVER (UP)
14	-	-
15	Q22 16VT	PASSENGER WINDOW DRIVER (DOWN)



PASSENGER DOOR MODULE C2

PASSENGER DOOR MODULE C2 - BLACK 12 WAY

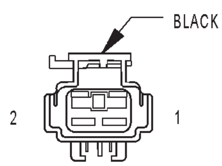
CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATER GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	M21 20PK/DG	COURTESY LAMP DRIVER
10	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
11	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
12	L121 20BK/RD	COURTESY LAMP GROUND



PASSENGER FRONT DOOR COURTESY LAMP

PASSENGER FRONT DOOR COURTESY LAMP - BLACK 2 WAY

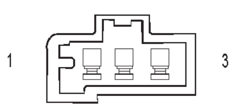
CAV	CIRCUIT	FUNCTION
1	M21 20PK/DG	COURTESY LAMP DRIVER
2	L121 20BK/RD	COURTESY LAMP GROUND



PASSENGER FRONT POWER WINDOW MOTOR

PASSENGER FRONT POWER WINDOW MOTOR - BLACK 2 WAY

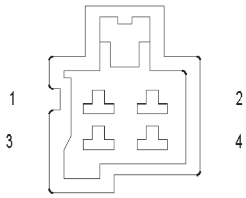
CAV	CIRCUIT	FUNCTION
1	Q22 16VT	PASSENGER WINDOW DRIVER (DOWN)
2	Q12 16BR	PASSENGER WINDOW DRIVER (UP)



PASSENGER HEATED SEAT BACK (PREMIUM I/III)

PASSENGER HEATED SEAT BACK (PREMIUM I/III) - 3 WAY

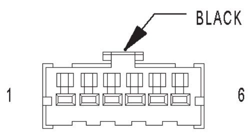
CAV	CIRCUIT	FUNCTION
1	P88 16BK/BR	HEATED SEAT DRIVER
2	Z5 16BK/VT	GROUND
3	-	-



PASSENGER
HEATED SEAT
CUSHION
(PREMIUM I/III)

PASSENGER HEATED SEAT CUSHION (PREMIUM I/III) - 4 WAY

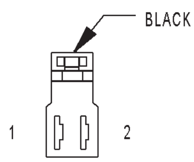
CAV	CIRCUIT	FUNCTION
1	P130 16DG/WT	PASSENGER SEAT HEATER B(+) DRIVER
2	P88 16BK/BR	HEATED SEAT DRIVER
3	P86 20DG/YL	PASSENGER SEAT TEMPERATURE SENSOR INPUT
4	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



PASSENGER
HEATED SEAT
SWITCH

PASSENGER HEATED SEAT SWITCH - BLACK 6 WAY

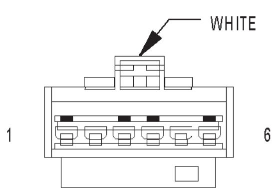
CAV	CIRCUIT	FUNCTION
1	P134 20TN/LG	PASSENGER SEAT HEATER SWITCH MUX
2	E2 20OR	PANEL LAMPS DRIVER
3	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
4	-	-
5	Z300 20BK	GROUND
6	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND



PASSENGER
LUMBAR
MOTOR
(MIDLINE/PREMIUM)

PASSENGER LUMBAR MOTOR (MIDLINE/PREMIUM) - BLACK 2 WAY

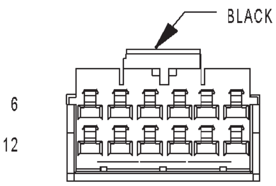
CAV	CIRCUIT	FUNCTION
1	P105 16LG/DG	LUMBAR FORWARD SWITCH SENSE
2	P104 16YL/RD	LUMBAR REARWARD SWITCH SENSE



PASSENGER
LUMBAR
SWITCH
(MIDLINE/PREMIUM)

PASSENGER LUMBAR SWITCH (MIDLINE/PREMIUM) - WHITE 6 WAY

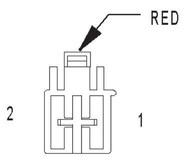
CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 16BK	GROUND
3	P104 16YL/RD (RHD)	LUMBAR REARWARD SWITCH SENSE
3	P105 16LG/DB (LHD)	LUMBAR FORWARD SWITCH SENSE
4	P105 16LG/DB (RHD)	LUMBAR FORWARD SWITCH SENSE
4	P104 16YL/RD (LHD)	LUMBAR REARWARD SWITCH SENSE
5	Z1 16BK	GROUND
6	F37 16RD/LB	FUSED B(+)



PASSENGER POWER MIRROR

PASSENGER POWER MIRROR - BLACK 12 WAY

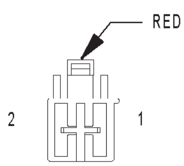
CAV	CIRCUIT	FUNCTION
1	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
2	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
3	P69 2GY	MIRROR SENSOR GROUND
4	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
5	C118 20BK/WT	MIRROR HEATER GROUND
6	P95 20OR	MIRROR HORIZONTAL DRIVER
7	-	-
8	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
9	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
10	-	-
11	P93 20RD	MIRROR VERTICAL DRIVER
12	P91 20WT	MIRROR COMMON DRIVER



PASSENGER POWER SEAT FRONT RISER MOTOR

PASSENGER POWER SEAT FRONT RISER MOTOR - RED 2 WAY

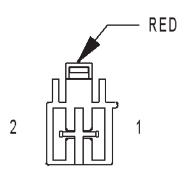
CAV	CIRCUIT	FUNCTION
1	P18 16YL/LG	PASSENGER SEAT FRONT UP DRIVER
2	P20 16RD/LG	PASSENGER SEAT FRONT DOWN DRIVER



PASSENGER POWER SEAT HORIZONTAL MOTOR

PASSENGER POWER SEAT HORIZONTAL MOTOR - RED 2 WAY

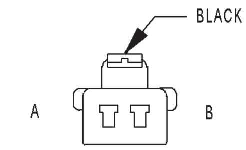
CAV	CIRCUIT	FUNCTION
1	P16 16RD/YL	PASSENGER SEAT HORIZONTAL REARWARD DRIVER
2	P14 16YL/LB	PASSENGER SEAT HORIZONTAL FORWARD DRIVER



PASSENGER POWER SEAT REAR RISER MOTOR

PASSENGER POWER SEAT REAR RISER MOTOR - RED 2 WAY

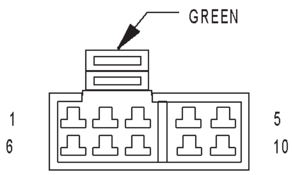
CAV	CIRCUIT	FUNCTION
1	P10 16YL/WT	PASSENGER SEAT REAR UP DRIVER
2	P12 16RD/WT	PASSENGER SEAT REAR DOWN DRIVER



PASSENGER POWER SEAT RECLINER MOTOR (MIDLINE/PREMIUM)

PASSENGER POWER SEAT RECLINER MOTOR (MIDLINE/PREMIUM) - BLACK 2 WAY

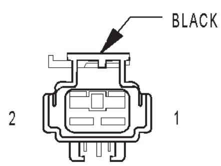
CAV	CIRCUIT	FUNCTION
A	P42 16BR/WT	PASSENGER SEAT RECLINER DOWN DRIVER
B	P44 16GY/LB	PASSENGER SEAT RECLINER UP DRIVER



PASSENGER POWER SEAT SWITCH (MIDLINE/PREMIUM)

PASSENGER POWER SEAT SWITCH (MIDLINE/PREMIUM) - GREEN 10 WAY

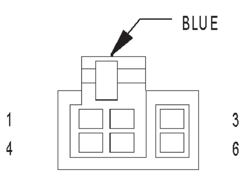
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	P44 16GY/LB	PASSENGER SEAT RECLINER UP DRIVER
3	P16 16RD/YL	PASSENGER SEAT HORIZONTAL REARWARD DRIVER
4	P42 16BR/WT	PASSENGER SEAT RECLINER DOWN DRIVER
5	F37 16RD/LB	FUSED B(+)
6	P14 16YL/LB	PASSENGER SEAT HORIZONTAL FORWARD DRIVER
7	P18 16YL/LG (RHD)	PASSENGER SEAT FRONT UP DRIVER
7	P20 16RD/LG (LHD)	PASSENGER SEAT FRONT DOWN DRIVER
8	P10 16YL/WT (RHD)	PASSENGER SEAT REAR UP DRIVER
8	P12 16RD/WT (LHD)	PASSENGER SEAT REAR DOWN DRIVER
9	P12 16RD/WT (RHD)	PASSENGER SEAT REAR DOWN DRIVER
9	P10 16YL/WT (LHD)	PASSENGER SEAT REAR UP DRIVER
10	P20 16RD/LG (RHD)	PASSENGER SEAT FRONT DOWN DRIVER
10	P18 16YL/LG (LHD)	PASSENGER SEAT FRONT UP DRIVER



PASSENGER REAR POWER WINDOW MOTOR

PASSENGER REAR POWER WINDOW MOTOR - BLACK 2 WAY

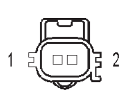
CAV	CIRCUIT	FUNCTION
1	Q124 16DG/WT	WINDOW DRIVER (DOWN)
2	Q114 16GY/WT	WINDOW DRIVER (UP)



PASSENGER REAR POWER WINDOW SWITCH

PASSENGER REAR POWER WINDOW SWITCH - BLUE 6 WAY

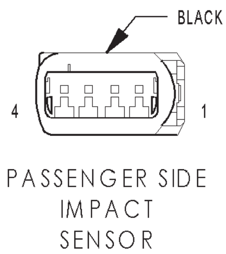
CAV	CIRCUIT	FUNCTION
1	Q14 16GY	PASSENGER REAR WINDOW DRIVER (UP)
2	Q114 16GY/WT	WINDOW DRIVER (UP)
3	E21 20OR/RD	PASSENGER REAR DOOR SWITCH ILLUMINATION
4	Q24 16DG	PASSENGER REAR WINDOW DRIVER (DOWN)
5	Q124 16DG/WT	WINDOW DRIVER (DOWN)
6	Z1 16BK	GROUND



PASSENGER SEAT BELT SWITCH

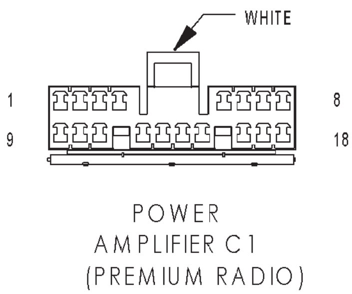
PASSENGER SEAT BELT SWITCH - 2 WAY

CAV	CIRCUIT	FUNCTION
1	R58 20GY	PASSENGER SEAT BELT SWITCH SENSE
2	R60 20VT	PASSENGER SEAT BELT SWITCH GROUND



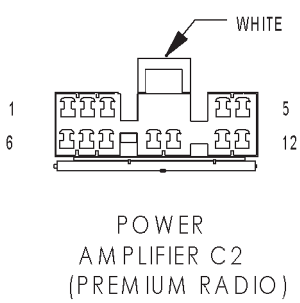
PASSENGER SIDE IMPACT SENSOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R134 20LB/BR	PASSENGER SIDE IMPACT SENSOR GROUND
4	R132 20LG/VT	PASSENGER SIDE IMPACT SENSOR SIGNAL



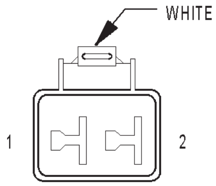
POWER AMPLIFIER C1 (PREMIUM RADIO) - WHITE 18 WAY

CAV	CIRCUIT	FUNCTION
1	D25 18YL/VT	PCI BUS
2	F60 16RD/WT	FUSED B(+)
3	Z9 16BK	GROUND
4	-	-
5	X58 18DB/OR	RIGHT REAR SPEAKER (-)
6	X57 18DG/WT	LEFT REAR SPEAKER (-)
7	X56 18DB/PK	RIGHT FRONT SPEAKER (-)
8	X55 18BR/RD	LEFT FRONT SPEAKER (-)
9	-	-
10	F60 16RD/WT	FUSED B(+)
11	Z9 16BK	GROUND
12	-	-
13	X64 18BR/WT	ENABLE SIGNAL TO AMPLIFIER
14	-	-
15	X52 18DB/WT	RIGHT REAR SPEAKER (+)
16	X51 18WT/DG	LEFT REAR SPEAKER (+)
17	X54 18VT	RIGHT FRONT SPEAKER (+)
18	X53 18DG/OR	LEFT FRONT SPEAKER (+)



POWER AMPLIFIER C2 (PREMIUM RADIO) - WHITE 12 WAY

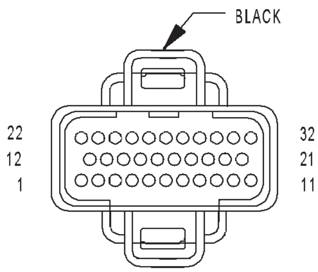
CAV	CIRCUIT	FUNCTION
1	X90 18WT/VT	RIGHT REAR DOOR SPEAKER (+)
2	X92 18TN/DG	RIGHT REAR DOOR SPEAKER (-)
3	X85 18LG/DG	LEFT FRONT DOOR SPEAKER (-)
4	X83 18YL/RD	LEFT INSTRUMENT PANEL SPEAKER (+)
5	X84 18OR/GY	RIGHT INSTRUMENT PANEL SPEAKER (-)
6	X93 18DG/WT	LEFT REAR DOOR SPEAKER (+)
7	X91 18WT/DG	LEFT REAR DOOR SPEAKER (-)
8	X87 18LG/RD	LEFT FRONT DOOR SPEAKER (+)
9	X80 18LB/BK	RIGHT FRONT DOOR SPEAKER (-)
10	X82 18LB/RD	RIGHT FRONT DOOR SPEAKER (+)
11	X81 18YL/BK	LEFT INSTRUMENT PANEL SPEAKER (-)
12	X86 18OR/RD	RIGHT INSTRUMENT PANEL SPEAKER (+)



POWER CONNECTOR

POWER CONNECTOR - WHITE 2 WAY

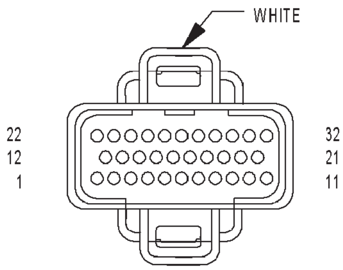
CAV	CIRCUIT	FUNCTION
1	F85 16VT/WT	FUSED B(+)
2	Z234 16BK	GROUND



POWERTRAIN CONTROL MODULE C1 (GAS)

POWERTRAIN CONTROL MODULE C1 (GAS) - BLACK 32 WAY

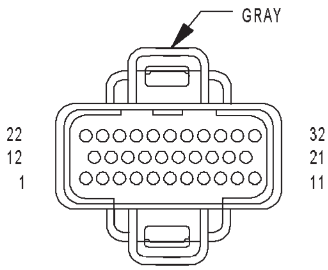
CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	K94 14TN/LG (4.7L)	COIL DRIVER NO. 4
4	K4 18BK/LB	SENSOR GROUND
5	K96 14TN/LB (4.7L)	COIL DRIVER NO. 6
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
7	K91 14TN/RD	COIL DRIVER NO. 1
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	K98 14LB/RD (4.7L)	COIL DRIVER NO. 8
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	-	-
13	-	-
14	K77 18LG/BK	TRANSFER CASE POSITION SENSOR INPUT
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5 VOLT SUPPLY
18	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/BK	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	K95 14TN/DG (4.7L)	COIL DRIVER NO. 5
22	A7 14RD/BK	FUSED B(+)
23	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SENSOR SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT BUILT-UP-EXPORT)	OXYGEN SENSOR 2/2 SIGNAL
29	K341 18PK/WT (4.7L)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z82 14BK/WT	GROUND
32	Z81 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE C2 (GAS)

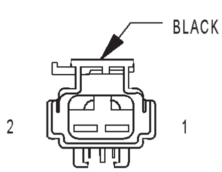
POWERTRAIN CONTROL MODULE C2 (GAS) - WHITE 32 WAY

CAV	CIRCUIT	FUNCTION
1	T54 18VT (4.0L)	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	K26 18VT (4.7L)	FUEL INJECTOR NO. 7 DRIVER
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
7	K97 14BR (4.7L)	COIL DRIVER NO. 7
8	K88 18PK (4.0L)	GOVERNOR PRESSURE SOLENOID CONTROL
9	K92 14TN/PK	COIL DRIVER NO. 2
10	K20 18DG	GENERATOR FIELD DRIVER
11	T20 18LB (4.0L)	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
12	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
13	K28 18GY/LB (4.7L)	FUEL INJECTOR NO. 8 DRIVER
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	K173 18LG	RADIATOR FAN RELAY CONTROL
18	-	-
19	C18 18DB	A/C PRESSURE SIGNAL
20	-	-
21	T60 18BR (4.0L)	3-4 SHIFT SOLENOID CONTROL
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
24	-	-
25	T13 18DB/BK (4.0L)	SPEED SENSOR GROUND
26	-	-
27	B22 18DG/YL	VEHICLE SPEED SENSOR SIGNAL
28	T14 18LG/WT (4.0L)	OUTPUT SPEED SENSOR SIGNAL
29	T25 18LG/RD (4.0L)	GOVERNOR PRESSURE SENSOR SIGNAL
30	K30 18PK/YL (4.0L)	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/BK	5 VOLT SUPPLY
32	-	-



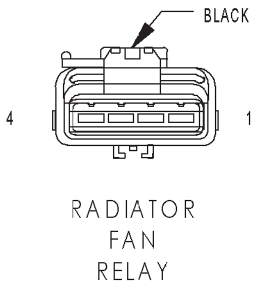
POWERTRAIN CONTROL MODULE C3 (GAS) - GRAY 32 WAY

CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	-	-
3	K51 18DB/YL	AUTO SHUT DOWN RELAY CONTROL
4	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	K42 18DB/LG (4.7L HIGH OUTPUT)	KNOCK SENSOR NO. 1 SIGNAL
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
10	K106 18WT/DG (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18OR/DG	SPEED CONTROL SUPPLY
12	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (4.7L RHD)	TORQUE MANAGEMENT REQUEST SENSE
13	T6 18OR/WT (4.0L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T10 18DG/LG (4.7L LHD)	TORQUE MANAGEMENT REQUEST SENSE
13	T6 18OR/BK (4.0L RHD)	OVERDRIVE OFF SWITCH SENSE
14	K107 18OR/PK (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SWITCH SENSE
15	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR 1/2 HEATER CONTROL
17	-	-
18	K142 18GY/BK (4.7L HIGH OUTPUT)	KNOCK SENSOR NO. 2 SIGNAL
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG (LHD)	SCI RECEIVE
29	D32 18LG/DG (RHD)	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL



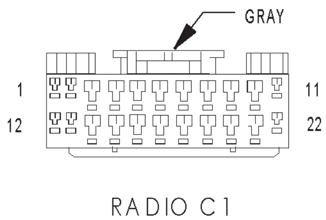
RADIATOR FAN MOTOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	C23 12DG	RADIATOR FAN RELAY OUTPUT
2	Z4 12BK/PK	GROUND



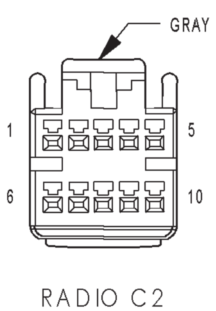
RADIATOR FAN RELAY - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	C24 20DB/PK	RADIATOR FAN RELAY CONTROL
3	C23 12DG	RADIATOR FAN RELAY OUTPUT
4	A16 12GY	FUSED B(+)



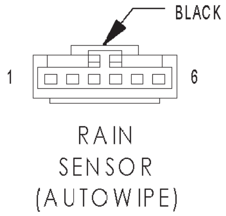
RADIO C1 - GRAY 22 WAY

CAV	CIRCUIT	FUNCTION
1	F60 16RD/WT	FUSED B(+)
2	X12 16WT/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	E2 20OR	PANEL LAMPS DRIVER
4	-	-
5	-	-
6	-	-
7	X54 18VT	RIGHT FRONT SPEAKER (+)
8	X56 18DB/PK	RIGHT FRONT SPEAKER (-)
9	X55 18BR/RD	LEFT FRONT SPEAKER (-)
10	X53 18DG/OR	LEFT FRONT SPEAKER (+)
11	Z9 16BK	GROUND
12	F60 16RD/WT	FUSED B(+)
13	X64 18BR/WT	ENABLE SIGNAL TO AMPLIFIER
14	D25 20YL/VT/DB	PCI BUS
15	-	-
16	-	-
17	-	-
18	X51 18WT/DG	LEFT REAR SPEAKER (+)
19	X57 18DG/WT	LEFT REAR SPEAKER (-)
20	X58 18DB/OR	RIGHT REAR SPEAKER (-)
21	X52 18DB/WT	RIGHT REAR SPEAKER (+)
22	Z9 16BK	GROUND



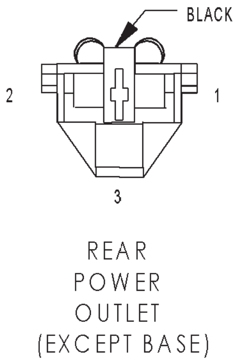
RADIO C2 - GRAY 10 WAY

CAV	CIRCUIT	FUNCTION
1	X40 20WT/RD	AUDIO OUT RIGHT
2	Z4 20WT/BK	GROUND
3	Z5 20BK/LB	SHIELD
4	-	-
5	X112 20RD	IGNITION SWITCH OUTPUT (RUN-ACC)
6	X41 20WT/DG	AUDIO OUT LEFT
7	Z17 20BK	GROUND
8	-	-
9	-	-
10	X160 20YL	FUSED B(+)



RAIN SENSOR (AUTOWIPE) - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20BK/PK	PCI BUS
3	-	-
4	Z155 20BK/OR	GROUND
5	Q30 20BK/LB	ACCESSORY DELAY RELAY OUTPUT
6	-	-

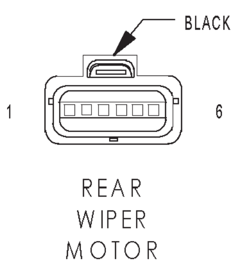


REAR POWER OUTLET - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	A148 16LG/RD	FUSED B(+)
2	-	-
3	Z151 16BK	GROUND

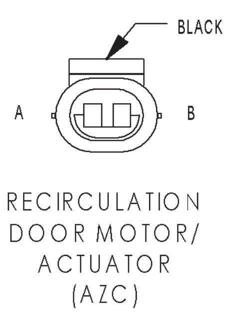
REAR WASHER PUMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z141 18BK	GROUND
2	V20 18BK/WT	REAR WASHER PUMP MOTOR CONTROL



REAR WIPER MOTOR - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V13 18BR/LG	REAR WIPER MOTOR CONTROL
3	G80 20VT/YL	LIFTGATE FLIP-UP AJAR SWITCH SENSE
4	V22 18BR/YL	REAR WIPER MOTOR DELAY CONTROL
5	F70 18BK	FUSED B(+)
6	-	-

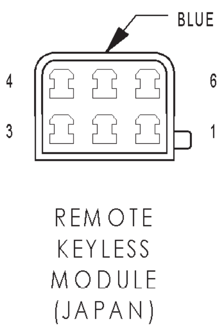


RECIRCULATION DOOR MOTOR/ACTUATOR (AZC) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
A	C32 20GY/DB (LHD)	RECIRCULATION DOOR DRIVER (A)
A	C100 20YL/DB (RHD)	RECIRCULATION DOOR DRIVER (B)
B	C100 20YL/DB (LHD)	RECIRCULATION DOOR DRIVER (B)
B	C32 20GY/DB (RHD)	RECIRCULATION DOOR DRIVER (A)

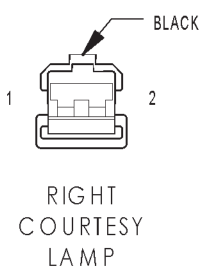
RED BRAKE WARNING INDICATOR SWITCH - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z231 18BK	GROUND
2	G9 18GY/BK	RED BRAKE WARNING INDICATOR DRIVER



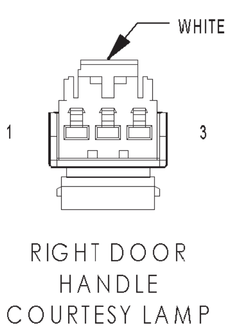
REMOTE KEYLESS MODULE (JAPAN) - BLUE 6 WAY

CAV	CIRCUIT	FUNCTION
1	K25 20RD/GY	ANTENNA SIGNAL
2	K25 20RD/GY	ANTENNA SIGNAL
3	M1 18PK	FUSED B(+)
4	Z1 18BK	GROUND
5	D30 20VT/YL	DIAGNOSTIC OUT
6	D30 20VT/YL	DIAGNOSTIC OUT



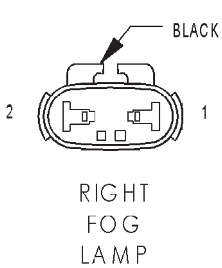
RIGHT COURTESY LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M2 20YL	COURTESY LAMP DRIVER



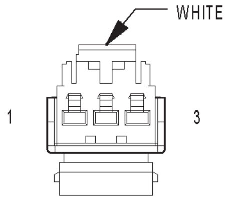
RIGHT DOOR HANDLE COURTESY LAMP - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED
3	M2 20YL/DG	COURTESY LAMP DRIVER



RIGHT FOG LAMP - BLACK 2 WAY

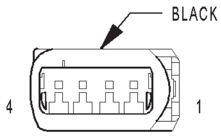
CAV	CIRCUIT	FUNCTION
1	L39 20LB	FOG LAMP RELAY OUTPUT
2	Z142 18BK	GROUND



RIGHT FRONT DOOR SPEAKER

RIGHT FRONT DOOR SPEAKER - WHITE 3 WAY

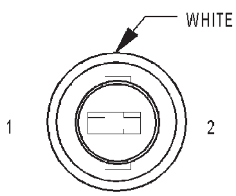
CAV	CIRCUIT	FUNCTION
1	X56 18LB/BK (BASE)	RIGHT FRONT DOOR SPEAKER (-)
1	X80 18LG/DG (RHD PREMIUM)	RIGHT FRONT DOOR SPEAKER (-)
1	X80 18LB/BK (LHD PREMIUM)	RIGHT FRONT DOOR SPEAKER (-)
2	-	-
3	X54 18LB/RD (BASE)	RIGHT FRONT DOOR SPEAKER (+)
3	X82 18LG/RD (RHD PREMIUM)	RIGHT FRONT DOOR SPEAKER (+)
3	X82 18LB/RD (LHD PREMIUM)	RIGHT FRONT DOOR SPEAKER (+)



RIGHT FRONT IMPACT SENSOR

RIGHT FRONT IMPACT SENSOR - BLACK 4 WAY

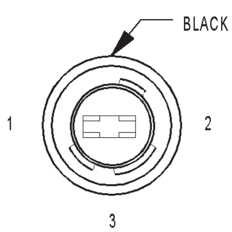
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R46 18BR/LB	RIGHT FRONT IMPACT SENSOR GROUND
4	R48 18TN	RIGHT FRONT IMPACT SENSOR SIGNAL



RIGHT FRONT PARK LAMP

RIGHT FRONT PARK LAMP - WHITE 2 WAY

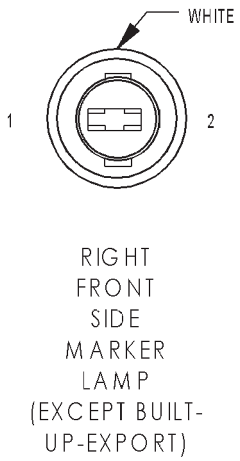
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 20BK/PK	PARK LAMP RELAY OUTPUT



RIGHT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)

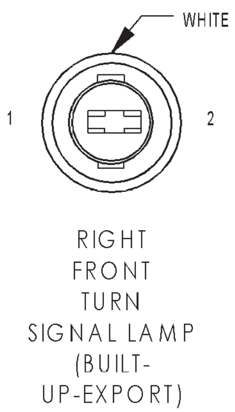
RIGHT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND
3	L60 20TN	RIGHT TURN SIGNAL



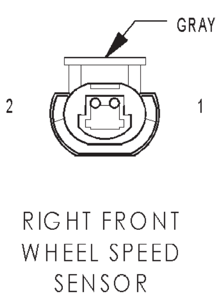
RIGHT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT) - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	L60 20TN	RIGHT TURN SIGNAL



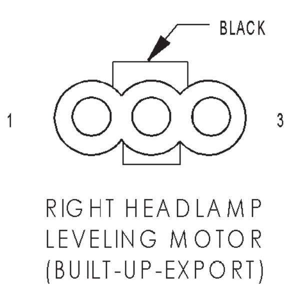
RIGHT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT) - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	L60 20TN	RIGHT TURN SIGNAL
2	Z1 18BK	GROUND



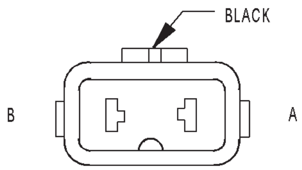
RIGHT FRONT WHEEL SPEED SENSOR - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL



RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT) - BLACK 3 WAY

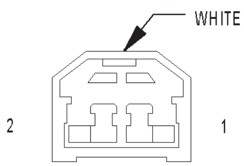
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L114 18VT/DB	HEADLAMP ADJUST SIGNAL
3	L7 20BK/PK	PARK LAMP RELAY OUTPUT



RIGHT HIGH BEAM HEADLAMP

RIGHT HIGH BEAM HEADLAMP - BLACK 2 WAY

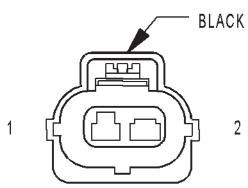
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT



RIGHT INSTRUMENT PANEL SPEAKER

RIGHT INSTRUMENT PANEL SPEAKER - WHITE 2 WAY

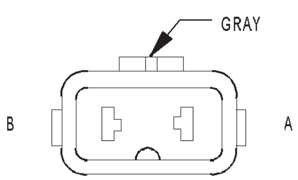
CAV	CIRCUIT	FUNCTION
1	X86 18OR/RD	RIGHT INSTRUMENT PANEL SPEAKER (+)
2	X84 18OR/BK	RIGHT INSTRUMENT PANEL SPEAKER (-)



RIGHT LIFTGATE AJAR SWITCH

RIGHT LIFTGATE AJAR SWITCH - BLACK 2 WAY

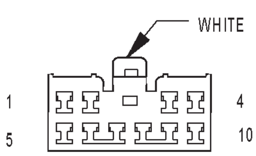
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE



RIGHT LOW BEAM HEADLAMP

RIGHT LOW BEAM HEADLAMP - GRAY 2 WAY

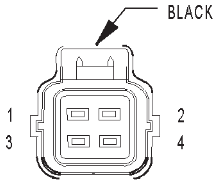
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT



RIGHT MULTI-FUNCTION SWITCH

RIGHT MULTI-FUNCTION SWITCH - WHITE 10 WAY

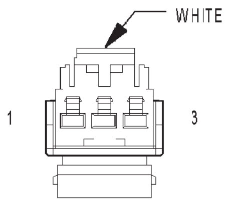
CAV	CIRCUIT	FUNCTION
1	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V20 18BK/WT	REAR WASHER PUMP MOTOR CONTROL
3	V10 20BR	WASHER PUMP SWITCH SENSE
4	-	-
5	V13 18BR/LG	REAR WIPER MOTOR CONTROL
6	V22 18BR/YL	REAR WIPER MOTOR DELAY CONTROL
7	V9 20WT/BK	WINDSHIELD WIPER SWITCH RETURN
8	V52 20DG/RD	WINDSHIELD WIPER SWITCH MUX
9	V48 20RD/GY	WIPER HIGH CONTROL
10	-	-



RIGHT REAR DOOR LOCK MOTOR/AJAR SWITCH

RIGHT REAR DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

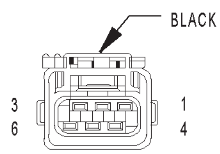
CAV	CIRCUIT	FUNCTION
1	G76 18TN/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



RIGHT REAR DOOR SPEAKER

RIGHT REAR DOOR SPEAKER - WHITE 3 WAY

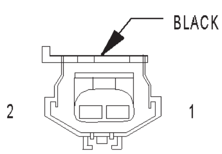
CAV	CIRCUIT	FUNCTION
1	X52 18WT/VT (BASE)	RIGHT REAR DOOR SPEAKER (+)
1	X90 18WT/VT (PREMIUM)	RIGHT REAR DOOR SPEAKER (+)
2	-	-
3	X58 18TN/DG (BASE)	RIGHT REAR DOOR SPEAKER (-)
3	X92 18TN/DG (PREMIUM)	RIGHT REAR DOOR SPEAKER (-)



RIGHT REAR LAMP ASSEMBLY

RIGHT REAR LAMP ASSEMBLY - BLACK 6 WAY

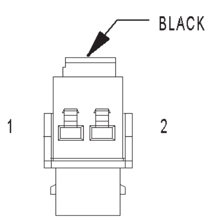
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L62 18BR/RD	RIGHT TURN SIGNAL
5	Z151 18BK	GROUND
6	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL



RIGHT REAR WHEEL SPEED SENSOR

RIGHT REAR WHEEL SPEED SENSOR - BLACK 2 WAY

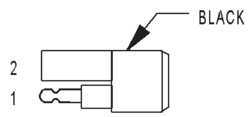
CAV	CIRCUIT	FUNCTION
1	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL



RIGHT REMOTE RADIO SWITCH

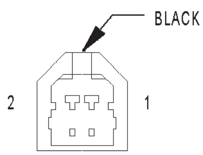
RIGHT REMOTE RADIO SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	X10 20RD/BK	RADIO CONTROL MUX RETURN
2	X20 20RD/YL	RADIO CONTROL MUX



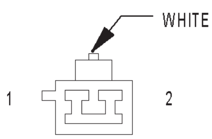
RIGHT SIDE REPEATER LAMP (BUILT-UP-EXPORT) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	Z142 18BK	GROUND



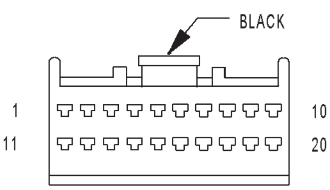
RIGHT VISOR/VANITY LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED



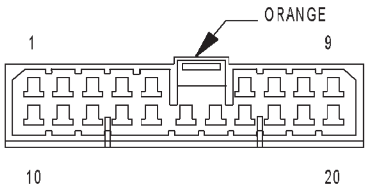
SEAT BELT SWITCH - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	G10 20LG/RD	SEAT BELT SWITCH SENSE
2	Z1 20BK	GROUND



SEAT MODULE C1 (PREMIUM) - BLACK 20 WAY

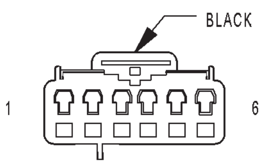
CAV	CIRCUIT	FUNCTION
1	P15 20YL/LB (PREMIUM II/III)	SEAT HORIZONTAL FORWARD SWITCH SENSE
2	-	-
3	P11 20YL/WT(PREMIUM II/III)	SEAT REAR UP SWITCH SENSE
4	P43 20GY/LB (PREMIUM II/III)	RECLINER UP SWITCH SENSE
5	P19 20YL/LG (PREMIUM II/III)	SEAT FRONT UP SWITCH SENSE
6	P86 20DG/YL (PREMIUM I/III)	PASSENGER SEAT TEMPERATURE SENSOR INPUT
7	P27 20LB/RD (PREMIUM II/III)	REAR RISER POSITION SIGNAL
8	P25 20VT/RD (PREMIUM II/III)	SEAT HORIZONTAL POSITION SIGNAL
9	P135 20LB/BK (PREMIUM I/III)	DRIVER SEAT TEMPERATURE SENSOR INPUT
10	P28 20BR/RD (PREMIUM II/III)	SEAT POSITION SENSOR GROUND
11	P41 20GY/WT (PREMIUM II/III)	RECLINER DOWN SWITCH SENSE
12	P17 20RD/YL (PREMIUM II/III)	SEAT HORIZONTAL REARWARD SWITCH SENSE
13	-	-
14	P21 20RD/LG (PREMIUM II/III)	SEAT FRONT DOWN SWITCH SENSE
15	P13 20RD/WT (PREMIUM II/III)	SEAT REAR DOWN SWITCH SENSE
16	P47 20LB (PREMIUM II/III)	RECLINER POSITION SIGNAL
17	P26 20BR (PREMIUM II/III)	FRONT RISER POSITION SIGNAL
18	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY
19	Z2 20BK/OR	GROUND
20	D25 20VT/YL	PCI BUS



SEAT
MODULE C2
(PREMIUM)

SEAT MODULE C2 (PREMIUM) - ORANGE 20 WAY

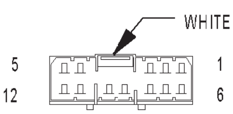
CAV	CIRCUIT	FUNCTION
1	F35 16RD	FUSED B(+)
2	P131 16BK/OR (PREMIUM I/III)	DRIVER SEAT HEATER B(+) DRIVER
3	Z1 16BK	GROUND
4	P119 16YL/RD (PREMIUM II/III)	SEAT FRONT UP DRIVER
5	P121 16RD/GY (PREMIUM II/III)	SEAT FRONT DOWN DRIVER
6	P111 16YL/DB (PREMIUM II/III)	SEAT REAR UP DRIVER
7	P113 16RD/BK (PREMIUM II/III)	SEAT REAR DOWN DRIVER
8	-	-
9	P115 16GY/LG (PREMIUM II/III)	SEAT HORIZONTAL FORWARD DRIVER
10	F35 16RD	FUSED B(+)
11	P130 16DG/WT (PREMIUM I/III)	PASSENGER SEAT HEATER B(+) DRIVER
12	Z1 16BK	GROUND
13	-	-
14	P9 20RD/LB (PREMIUM II/III)	SEAT SWITCH B(+) SUPPLY
15	Z6 16BK/YL (PREMIUM I/III)	GROUND
16	Z5 16BK/VT (PREMIUM I/III)	GROUND
17	-	-
18	P141 16GY/WT (PREMIUM II/III)	SEAT RECLINER DOWN DRIVER
19	P143 16GY/LB (PREMIUM II/III)	SEAT RECLINER UP DRIVER
20	P117 16RD/BR (PREMIUM II/III)	SEAT HORIZONTAL REARWARD DRIVER



SENTRY KEY
IMMOBILIZER
MODULE

SENTRY KEY IMMOBILIZER MODULE - BLACK 6 WAY

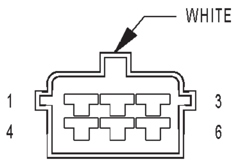
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	Z132 20BK/OR	GROUND
3	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	-	-
5	D25 20YL/VT/BK	PCI BUS
6	-	-



SHIFTER
ASSEMBLY
(C201 DIESEL)

SHIFTER ASSEMBLY (C201 DIESEL) - WHITE 12 WAY

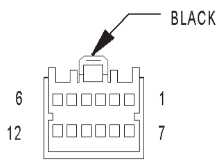
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	D25 20RD	PCI BUS
6	-	-
7	D21 20PK	SCI TRANSMIT
8	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
9	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
10	Z234 20WT	GROUND
11	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
12	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)



SHIFTER ASSEMBLY (GAS)

SHIFTER ASSEMBLY (GAS) - WHITE 6 WAY

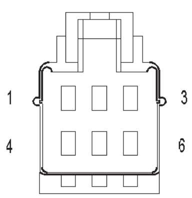
CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	Z234 18BK	GROUND
3	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
4	Z300 18BK	GROUND
5	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL



SHIFTER ASSEMBLY C1 (DIESEL)

SHIFTER ASSEMBLY C1 (DIESEL) - BLACK 12 WAY

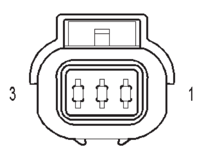
CAV	CIRCUIT	FUNCTION
1	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
5	D25 20OR	PCI BUS
6	W0 20DB/WT	SHIFTER C1 SENSE
7	W1 20VT/WT	SHIFTER C2 SENSE
8	W2 20VT	SHIFTER C3 SENSE
9	W3 20BK	SHIFTER C4 SENSE
10	W4 20PK/OR	SHIFTER C5 SENSE
11	Z234 20WT	GROUND
12	Z234 20WT	GROUND



SHIFTER ASSEMBLY C2 (DIESEL)

SHIFTER ASSEMBLY C2 (DIESEL) - 6 WAY

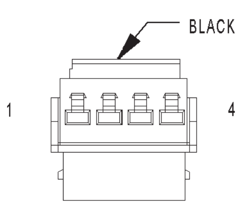
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL



SIREN (BUILT-UP-EXPORT)

SIREN (BUILT-UP-EXPORT) - 3 WAY

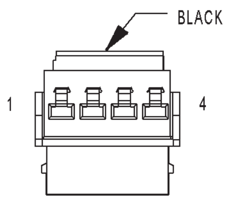
CAV	CIRCUIT	FUNCTION
1	Z141 18BK	GROUND
2	X75 18GY/LB (DIESEL)	SIREN SIGNAL CONTROL
2	X75 18GY/LG (GAS)	SIREN SIGNAL CONTROL
3	M1 18PK	FUSED B(+)



SPEED CONTROL SWITCH NO. 1

SPEED CONTROL SWITCH NO. 1 - BLACK 4 WAY

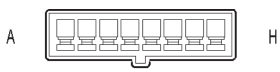
CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



SPEED CONTROL SWITCH NO.2

SPEED CONTROL SWITCH NO. 2 - BLACK 4 WAY

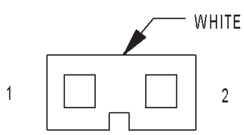
CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



SUNROOF CONTROL MODULE

SUNROOF CONTROL MODULE - 8 WAY

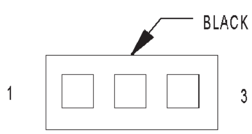
CAV	CIRCUIT	FUNCTION
A	Q46 20OR/WT	SUNROOF MOTOR POSITION SENSOR SIGNAL
B	Q41 20WT	SUNROOF OPEN
C	Q43 20VT	SUNROOF VENT
D	Z1 16BK	GROUND
E	-	-
F	Q30 16DB	ACCESSORY DELAY RELAY OUTPUT
G	Q5 16RD	SUNROOF MOTOR B(+)
H	Q6 16OR	SUNROOF MOTOR B(-)



SUNROOF MOTOR C1

SUNROOF MOTOR C1 - WHITE 2 WAY

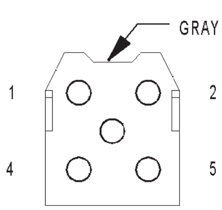
CAV	CIRCUIT	FUNCTION
1	Q5 16RD	SUNROOF MOTOR B(+)
2	Q6 16OR	SUNROOF MOTOR B(-)



SUNROOF MOTOR C2

SUNROOF MOTOR C2 - BLACK 3 WAY

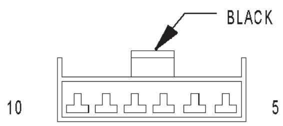
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	Q46 20OR/WT	SUNROOF MOTOR POSITION SENSOR SIGNAL
3	-	-



SUNROOF SWITCH

SUNROOF SWITCH - GRAY 5 WAY

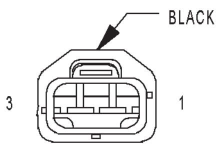
CAV	CIRCUIT	FUNCTION
1	Q43 20VT	SUNROOF VENT
2	-	-
3	Z150 20BK	GROUND
4	-	-
5	Q41 20WT	SUNROOF OPEN



TEMPERATURE VALVE ACTUATOR (MTC)

TEMPERATURE VALVE ACTUATOR (MTC) - BLACK 6 WAY

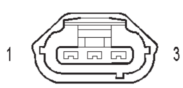
CAV	CIRCUIT	FUNCTION
5	-	-
6	-	-
7	Z132 20BK/OR	GROUND
8	C67 20RD/LB	BLEND AIR DOOR POSITION CONTROL
9	-	-
10	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)



THROTTLE POSITION SENSOR (4.0L)

THROTTLE POSITION SENSOR (4.0L) - BLACK 3 WAY

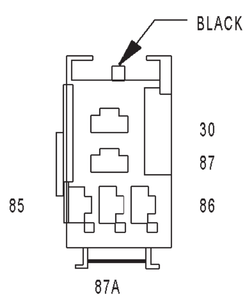
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL



THROTTLE POSITION SENSOR (4.7L)

THROTTLE POSITION SENSOR (4.7L) - 3 WAY

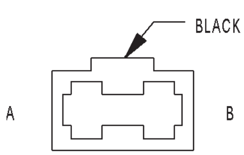
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



TRAILER TOW BRAKE LAMP RELAY

TRAILER TOW BRAKE LAMP RELAY - BLACK 5 WAY

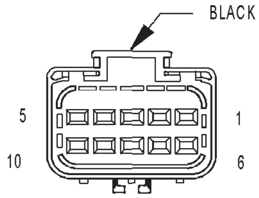
CAV	CIRCUIT	FUNCTION
30 (3)	F9 14RD/BK	FUSED B(+)
85 (2)	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
86 (1)	Z150 18BK	GROUND
87 (5)	L95 14DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L94 14OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT



TRAILER TOW CIRCUIT BREAKER

TRAILER TOW CIRCUIT BREAKER - BLACK 2 WAY

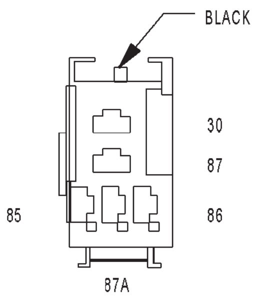
CAV	CIRCUIT	FUNCTION
A	F30 14RD/WT	FUSED CIGAR LIGHTER RELAY OUTPUT
B	F30 14RD/TN	CIGAR LIGHTER RELAY OUTPUT



TRAILER TOW CONNECTOR

TRAILER TOW CONNECTOR - BLACK 10 WAY

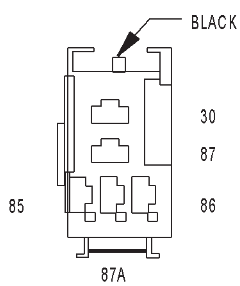
CAV	CIRCUIT	FUNCTION
1	-	-
2	L62 14BR/RD	RIGHT TURN SIGNAL
3	L1 18VT/BK	BACK-UP LAMP FEED
4	F30 14RD/WT	FUSED CIGAR LIGHTER RELAY OUTPUT
5	L7 18BK/YL	PARK LAMP RELAY OUTPUT
6	-	-
7	B40 14LB	TRAILER TOW BRAKE B(+)
8	Z150 14BK	GROUND
9	Z150 14BK	GROUND
10	L63 14DG/RD	LEFT TURN SIGNAL



TRAILER TOW LEFT TURN RELAY

TRAILER TOW LEFT TURN RELAY - BLACK 5 WAY

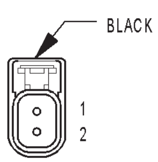
CAV	CIRCUIT	FUNCTION
30 (3)	L63 16DG/RD	LEFT TURN SIGNAL
85 (2)	L63 14DG/RD	LEFT TURN SIGNAL
86 (1)	Z150 18BK	GROUND
87 (5)	L94 14OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L95 14DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT



TRAILER TOW RIGHT TURN RELAY

TRAILER TOW RIGHT TURN RELAY - BLACK 5 WAY

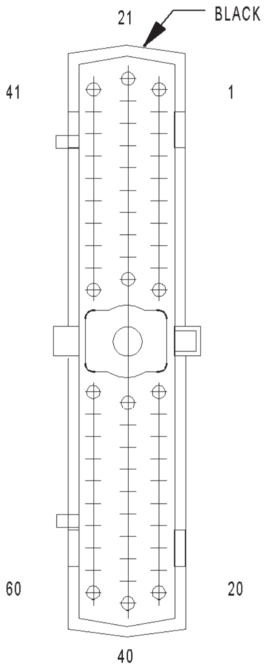
CAV	CIRCUIT	FUNCTION
30 (3)	L62 14BR/RD	RIGHT TURN SIGNAL
85 (2)	L62 20BR/RD	RIGHT TURN SIGNAL
86 (1)	Z150 18BK	GROUND
87 (5)	L94 14OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L95 14DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT



TRANSFER CASE POSITION SENSOR

TRANSFER CASE POSITION SENSOR - BLACK 2 WAY

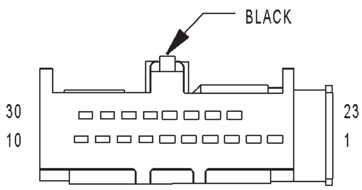
CAV	CIRCUIT	FUNCTION
1	K77 20BR/WT (DIESEL)	TRANSFER CASE POSITION SENSOR SIGNAL
1	K77 18LG/BK (GAS)	TRANSFER CASE POSITION SENSOR INPUT
2	K4 20BK/LB (DIESEL)	SENSOR GROUND
2	K4 18BK/LB (GAS)	SENSOR GROUND



TRANSMISSION CONTROL MODULE (4.7L)

TRANSMISSION CONTROL MODULE (4.7L) - BLACK 60 WAY

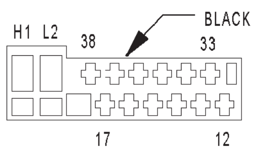
CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	T2 18TN/BK	TRS T2 SENSE
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	F45 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK/YL	TRANSMISSION CONTROL RELAY CONTROL
16	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
19	T119 18WT/DB	2C SOLENOID CONTROL
20	T120 18LG	LR SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
30	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
37	Z113 14BK/WT	GROUND
38	T138 14GY/LB	5 VOLT SUPPLY
39	Z112 14BK/YL	GROUND
40	T140 18VT/LG	MS SOLENOID CONTROL
41	T41 18WT	TRS T41 SENSE
42	T42 18VT/WT	TRS T42 SENSE
43	D25 18YL/VT	PCI BUS
44	-	-
45	-	-
46	D20 18LG	SCI RECEIVE
47	T147 18LB	2C PRESSURE SWITCH SENSE
48	T48 18DB	4C PRESSURE SWITCH SENSE
49	T6 18VT/WT	OVERDRIVE OFF SWITCH SENSE
50	T150 18BR/LB	LR PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z114 14BK/LG	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	T59 18PK	UNDERDRIVE SOLENOID CONTROL
56	A30 14RD/WT	FUSED B(+)
57	Z12 14BK/TN	GROUND
58	-	-
59	T159 18DG/WT	4C SOLENOID CONTROL
60	T60 18BR	OVERDRIVE SOLENOID CONTROL



TRANSMISSION CONTROL MODULE C1 (DIESEL)

TRANSMISSION CONTROL MODULE C1 (DIESEL) - BLACK 18 WAY

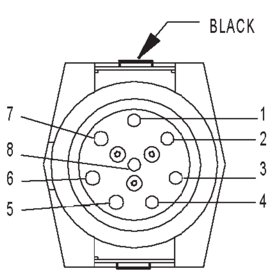
CAV	CIRCUIT	FUNCTION
1	D21 20PK	SCI TRANSMIT
2	-	-
3	W4 20PK/OR	SHIFTER C5 SENSE
4	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL
5	-	-
6	-	-
7	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
8	-	-
9	-	-
10	-	-
23	-	-
24	-	-
25	W0 20DB/WT	SHIFTER C1 SENSE
26	W1 20VT/WT	SHIFTER C2 SENSE
27	W2 20VT	SHIFTER C3 SENSE
28	W3 20BK	SHIFTER C4 SENSE
29	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
30	Z234 20WT	GROUND



TRANSMISSION CONTROL MODULE C2 (DIESEL)

TRANSMISSION CONTROL MODULE C2 (DIESEL) - BLACK 14 WAY

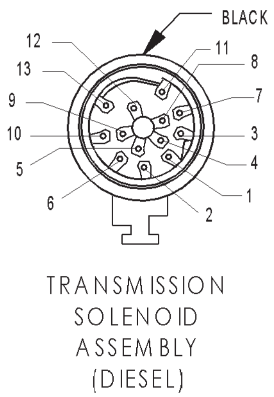
CAV	CIRCUIT	FUNCTION
12	T52 18RD/BK	N2 INPUT SPEED SENSOR
13	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
14	T60 18BR	1-2/4-5 SOLENOID CONTROL
15	T159 18DG/WT	3-4 SOLENOID CONTROL
16	T119 18WT/DB	2-3 SOLENOID CONTROL
17	T120 18LG	TCC SOLENOID CONTROL
33	T13 18DB/BK	SENSOR GROUND
34	T54 18VT	TEMP SENSOR - P/N SWITCH
35	T14 18LG/WT	N3 INPUT SPEED SENSOR
36	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
37	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
38	T16 18RD	SOLENOID SUPPLY VOLTAGE
H1	D52 18LG/WT	CAN C BUS(+)
L2	D51 18DG/WT	CAN C BUS(-)



TRANSMISSION SOLENOID (4.0L)

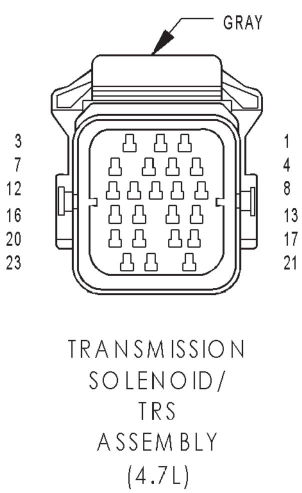
TRANSMISSION SOLENOID (4.0L) - BLACK 8 WAY

CAV	CIRCUIT	FUNCTION
1	T15 18LG	FUSED TRANSMISSION CONTROL RELAY OUTPUT
2	K6 18VT/BK	5 VOLT SUPPLY
3	K4 18BK/LB	SENSOR GROUND
4	T25 18LG/RD	GOVERNOR PRESSURE SENSOR SIGNAL
5	K88 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
6	T60 18BR	3-4 SHIFT SOLENOID CONTROL
7	T20 18LB	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
8	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL



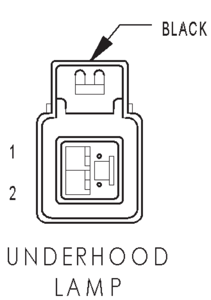
TRANSMISSION SOLENOID ASSEMBLY (DIESEL) - BLACK 13 WAY

CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	N3 INPUT SPED SENSOR
2	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
3	T52 18RD/BK	N2 INPUT SPEED SENSOR
4	T54 18VT	TEMP SENSOR - P/N SWITCH
5	-	-
6	T16 18RD	SOLENOID SUPPLY VOLTAGE
7	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
8	T119 18WT/DB	2-3 SOLENOID CONTROL
9	T159 18DG/WT	3-4 SOLENOID CONTROL
10	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
11	T120 18LG	TCC SOLENOID CONTROL
12	T13 18DB/BK	SENSOR GROUND
13	T60 18BR	1-2/4-5 SOLENOID CONTROL



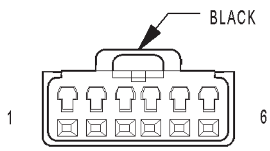
TRANSMISSION SOLENOID/TRS ASSEMBLY (4.7L) - GRAY 23 WAY

CAV	CIRCUIT	FUNCTION
1	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	T120 18LG	LR SOLENOID CONTROL
3	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
4	T141 18WT	TRS T41 SENSE
5	T42 18VT/WT	TRS T42 SENSE
6	L1 18VT/BK	BACK-UP LAMP FEED
7	T60 18BR	OVERDRIVE SOLENOID CONTROL
8	T3 18VT	TRS T3 SENSE
9	T1 18LG/BK	TRS T1 SENSE
10	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
11	T48 18DB	4C PRESSURE SWITCH SENSE
12	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
13	T2 18TN/BK	TRS T2 SENSE
14	T150 18BR/LB	LR PRESSURE SWITCH SENSE
15	T147 18LB	2C PRESSURE SWITCH SENSE
16	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
17	T59 18PK	UNDERDRIVE SOLENOID CONTROL
18	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
19	T159 18DG/WT	4C SOLENOID CONTROL
20	T119 18WT/DB	2C SOLENOID CONTROL
21	T140 18VT/LG	MS SOLENOID CONTROL
22	T13 18DB/BK	SPEED SENSOR GROUND
23	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL



UNDERHOOD LAMP - BLACK 2 WAY

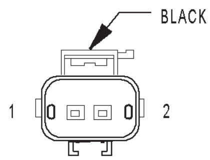
CAV	CIRCUIT	FUNCTION
1	Z141 20BK	GROUND
2	M1 20PK/RD	FUSED B(+)



VEHICLE INFORMATION CENTER

VEHICLE INFORMATION CENTER - BLACK 6 WAY

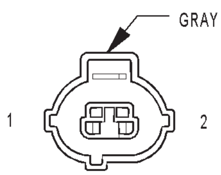
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	F70 20PK	FUSED B(+)
4	Z155 20BK/OR	GROUND
5	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	-	-



VISCOUS/CABIN HEATER (DIESEL)

VISCOUS/CABIN HEATER (DIESEL) - BLACK 2 WAY

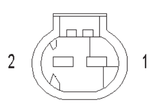
CAV	CIRCUIT	FUNCTION
1	A82 16PK/LG	VISCOUS/CABIN HEATER RELAY OUTPUT
2	Z18 16BK	GROUND



WASHER FLUID LEVEL SWITCH

WASHER FLUID LEVEL SWITCH - GRAY 2 WAY

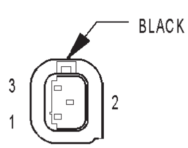
CAV	CIRCUIT	FUNCTION
1	V11 20BK/TN	WASHER FLUID SWITCH SENSE
2	Z141 20BK	GROUND



WASTEGATE SOLENOID (DIESEL)

WASTEGATE SOLENOID (DIESEL) - 2 WAY

CAV	CIRCUIT	FUNCTION
1	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	Y42 18OR/DB	WASTEGATE SOLENOID CONTROL



WATER IN FUEL SENSOR (DIESEL)

WATER IN FUEL SENSOR (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	G123 20DG/WT	WATER IN FUEL SENSOR SIGNAL
3	F15 20RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT

8W-91 CONNECTOR/GROUND/SPLICE LOCATION

TABLE OF CONTENTS

page

CONNECTOR/GROUND/SPLICE LOCATION

DESCRIPTION

This section provides illustrations identifying connector, ground, and splice locations in the vehicle. Connector, ground, and splice indexes are provided. Use the wiring diagrams in each section for connector, ground, and splice identification. Refer to the appropriate index for the proper figure number. For items that are not shown in this section N/S is placed in the Fig. column.

CONNECTORS

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
A/C Compressor Clutch	BK	At A/C Compressor	9, 13
A/C Pressure Transducer	BK	Right Front of Engine Compartment	3, 4, 5
Accelerator Pedal Position Sensor (Diesel)	BK	Rear of Engine Compartment Near Fuel/Water Seperator	7
Adjustable Pedals Module (Except Built-up Export)	GN	Above Drivers Control Pedals	N/S
Adjustable Pedals Motor/ Sensor Assembly (Except Built-up Export)		Above Drivers Control Pedals	N/S
Adjustable Pedals Switch	WT	Drivers Lower Kick Panel	21
Airbag Control Module (ORC) C1	YL	Below Center Floor Console, Near Park Brake	19, 20, 21, 22
Airbag Control Module (ORC) C2	YL	Below Center Floor Console, Near Park Brake	19, 20, 21, 22
Ambient Temperature Sensor	BK	On Radiator Center Support	5
Antenna Module (Built-up-export)	WT	Above Right Quarter Window	N/S
Ash Receiver Lamp	BK	Below Cigarette Lighter	19, 20
Automatic Day/Night Mirror	BK	In Front of Rear View Mirror	N/S
Automatic Headlamp Light Sensor/VTSS LED	BK	Near Left Instrument Panel Speaker	19, 20
Automatic Zone Control Module - C1 (AZC)	WT	Left Side of HVAC Housing	N/S
Automatic Zone Control Module - C2 (AZC)	WT	Left Side of HVAC Housing	N/S
Battery Temperature Sensor	BK	Below Battery Tray	4, 5
Blower Motor	BK	Behind Right Hand Side of Instrument Panel	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Blower Motor Controller (AZC)	BK	Behind Right Hand Side of Instrument Panel	N/S
Blower Motor Resistor Block (MTC)	BK	Behind Right Hand Side of Instrument Panel	N/S
Body Control Module - C1	GY	Lower Left Side of Instrument Panel	21, 22
Body Control Module-C2 -LHD	WT	Lower Left Side of Instrument Panel	21
Body Control Module-C2 - RHD	GY	Lower Left Side of Instrument Panel	22
Boost Pressure Sensor (Diesel)	BK	Top Front of Engine	N/S
Brake Lamp Switch	GY	Brake Pedal Arm	31
C100	BK	Right Front Engine Compartment	2, 5
C101 (4.0L RHD)	LTGY	Rear of Engine Compartment	15
C101 (4.7L RHD)	BK	Rear of Engine Compartment	N/S
C102 (Diesel)	BK	Left Rear Engine Compartment	4, 7
C102 (Gas)	BK	Right Rear Engine Compartment	5, 10, 11, 14, 15, 18
C103 (Diesel)	LTGY	Rear of Engine	4, 7
C103 (Gas)	GY	Right Rear Engine Compartment	5, 10 11, 14, 15
C104	LTGY	Right Rear Engine Compartment	14 18
C105 (Diesel)	GY	Right Rear Engine Compartment	4, 7, 8
C106 (Diesel)	GY	Lower Right Instrument Panel	N/S
C106 (Gas RHD)	GY	Lower Right Instrument Panel	N/S
C107 (Diesel)	GY	Left Rear Engine Compartment	4
C107 (LHD)	BK	Passenger Side Near Kick Panel	3, 30, 35
C107 (RHD)	GY	Passenger Side Near Kick Panel	3, 31
C108	BK	Left Cowl	3, 4
C109	BK	Near Transfer Case switch	12
C110 (Diesel)	GY	Top of Engine Near Glow Plugs	4, 7
C111	BK	Left Front Frame Near Windshield Washer Pump	1, 3, 4
C112	BK	Right Front Frame Near Horns	1, 5
C113 (Diesel)	LTGY	Rear of Engine	7, 8
C200 - LHD	GY	Passenger Side Near Kick Panel	19, 21, 35
C200 - RHD	BK	Passenger Side Near Kick Panel	20, 22
C201)	WT	Below Center Floor Console, Near Park Brake	19, 20, 21, 22
C202	WT	HVAC Unit, Right Side of Instrument Panel	19, 20, 21, 22
C203 (AZC)	WT	HVAC Unit, Right Side of Instrument Panel	19, 20, 21, 22
C300 (LHD)	GY	Near Junction Block	30, 33
C301 (RHD)	BK	Near Junction Block	31
C302	BK	At Driver Door	24, 25, 30, 31

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
C303	WT	Right Rear Door	29, 34, 36
C304	BK	Under Driver Seat	33, 36
C306	BK	Under Passenger Seat	34, 35
C307	WT	Left Rear Door	28, 33 35
C308	WT	Top of Liftgate	37, 38
C309	WT	Left Rear Quarter Pillar	37
C310 (Built-Up-Export)	LT GY	Above Left Quarter Wheel Housing	37, 39
C310 (Except Built-Up-Export)	LT GN	Above Left Quarter Wheel Housing	39
C311	WT	Top of Liftgate	38
C312		Center of Liftgate	38
C313	WT	In Driver Door	24, 25
C314	LT GY	At Passenger Door	26, 27, 31
C315		To Rear of Right Quarter Window	32
C318		At C Post	33, 36
Camshaft Position Sensor (Diesel)	BK	Top of Engine	N/S
Camshaft Position Sensor (Gas)	GY	Right Side of Engine	10, 11, 14, 15
Capacitor (4.0L)	BK	Right Rear of Engine	10
Capacitor NO. 1 (4.7L)	BK	Right Side of Engine	14, 15
Capacitor NO. 2 (4.7L)	BK	Left Side of Engine	13
Cargo Lamp	WT	In Headliner Near Liftgate	N/S
Center High Mounted Stop Lamp	BK	Top of Liftgate	N/S
Cigar Lighter	RD	Center of Instrument Panel	19, 20
Clockspring - C1	BK	At Steering Column	23
Clockspring - C2		At Steering Column	23
Clockspring - C3	GY	At Steering Column	23
Clockspring - C4	BK	At Steering Column	N/S
Coil On Plug NO. 1 (4.7L)	BK	Left Side of Engine Near Fuel Injector No.1	13
Coil On Plug NO. 2 (4.7L)	BK	Right Side of Engine Near Fuel Injector No.2	14, 15
Coil On Plug NO. 3 (4.7L)	BK	Left Side of Engine Near Fuel Injector No.3	13
Coil On Plug NO. 4 (4.7L)	BK	Right Side of Engine Near Fuel Injector No.4	14, 15
Coil On Plug NO. 5 (4.7L)	BK	Left Side of Engine Near Fuel Injector No.5	13
Coil On Plug NO. 6 (4.7L)	BK	Right Side of Engine Near Fuel Injector No.6	14, 15
Coil On Plug NO. 7 (4.7L)	BK	Left Side of Engine Near Fuel Injector No.7	13

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Coil On Plug NO. 8 (4.7L)	BK	Right Side of Engine Near Fuel Injector No.8	14, 15
Coil Rail (4.0L)	BK	Right Rear of Engine	10, 11
Compact Disc Changer	BK	Near Radio	N/S
Compact Disc Changer	BK	Right Rear Quarter Panel	37
Controller Antilock Brake	BK	Left Front Engine Compartment	3, 4
Coolant Level Sensor	LT GY	Right Rear of Engine	5
Crankcase Heater (Diesel)	BK	Near T/O for G105	8
Crankshaft Position Sensor (Diesel)	BK	Rear of Engine Near Transmission Bell Housing	N/S
Crankshaft Position Sensor (Gas)	BK	Rear of Engine Near Transmission Bell Housing	10, 11, 14, 15, 17
Data Link Connector	BK	Under Lower Driver's Side of Instrument Panel	20, 21, 22
Diagnostic Junction Port	BK	At Steering Column	23
Driver Airbag Squib 1	BK	In Steering Wheel	N/S
Driver Airbag Squib 2	BK	In Steering Wheel	N/S
Driver Blend Door Motor/ Actuator (AZC)	BK	On HVAC Housing	N/S
Driver Cylinder Lock Switch	GY	In Driver Door	24, 25
Driver Door Lock Motor/Ajar Switch	BK	In Driver Door	24, 25
Driver Door Module - C1	WT	In Driver Door	24, 25
Driver Door Module - C2	BK	In Driver Door	N/S
Driver Door Module - C3	BK	In Driver Door	N/S
Driver Front Door Courtesy Lamp	BK	In Driver Door	N/S
Driver Front Power Window Motor	BK	In Driver Door	24, 25
Driver Heated Seat Back (Premium I/III)	GN	At Driver Seat	N/S
Driver Heated Seat Cushion (Premium I/III)	BK	At Driver Seat	N/S
Driver Heated Seat Switch	WT	Center of Instrument Panel	19 20, 21
Driver Lumbar Motor (Midline/Premium)	BK	At Driver Seat	N/S
Driver Lumbar Switch (Midline/Premium)	WT	At Driver Seat	N/S
Driver Power Mirror	BK	At Driver Door	N/S
Driver Power Seat Front Riser Motor	RD	At Driver Seat	N/S
Driver Power Seat Front Riser Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Horizontal Motor	BK	At Driver Seat	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Driver Power Seat Horizontal Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Rear Riser Motor	RD	At Driver Seat	N/S
Driver Power Seat Rear Riser Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Recliner Motor	BK	At Driver Seat	N/S
Driver Power Seat Recliner Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Switch (Midline/Premium)	GN	At Driver Seat	N/S
Driver Rear Power Window Motor	BK	In Left Rear Door	28
Driver Rear Power Window Switch	BL	In Left Rear Door	28
Driver Seat Belt Switch		At Switch	N/S
EGR Solenoid (Diesel)	BK	Left Front Fender	7, 8
Electric Brake	BL	Near Junction Block	N/S
Electronic Speed Control Servo	BK	Right Front of Engine Compartment	5
Engine Control Module C1 (Diesel)	BK	Left Front of Engine	7, 8
Engine Control Module C2 (Diesel)	BK	Left Front of Engine	7, 8
Engine Coolant Temperature Sensor (Diesel)	BK	Top of Engine	N/S
Engine Coolant Temperature Sensor (GAS)	BK	Front of Engine	9, 13
Engine Oil Pressure Sensor	BK	Side of Engine	10, 11, 13
EVAP/Purge Solenoid	BK	Left Front Fender Near Controller Antilock Brake	3
Front Power Outlet	RD	Center of Instrument Panel	19, 20
Front Washer Pump	WT	Left Front of Engine Compartment	3, 4
Front Wiper Motor	BK	Left Side of Cowl	3, 4
Fuel Injector No.1	BK	At Injector	7, 9, 13
Fuel Injector No.2	BK	At Injector	7, 9, 14, 15
Fuel Injector No.3	BK	At Injector	7, 9, 13
Fuel Injector No.4	BK	At Injector	7, 9, 14, 15
Fuel Injector No.5	BK	At Injector	9, 13
Fuel Injector No.6	BK	At Injector	9, 14, 15
Fuel Injector No.7 (4.7L)	BK	At Injector	13
Fuel Injector No.8 (4.7L)	BK	At Injector	14, 15
Fuel Pressure Sensor (Diesel)	BK	Right Front of Engine	N/S
Fuel Pressure Solenoid (Diesel)	BK	Top of Engine	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Fuel Pump Module (Gas)	BK	Near Fuel Tank	33, 35
Fuel Tank Module Diesel)	BK	Near Fuel Tank	33, 35
Generator (Diesel)	LTGY	At Generator	8
Generator (Gas)	BK	At Generator	N/S
Glove Box Lamp	BK	Inside Glove Box	19, 20, 22
Headlamp Leveling Switch (Built-Up-Export)	WT	Driver Side of Instrument Panel	20
Hood Ajar Switch	BK	Left Side of Engine Compartment	3, 4
Horn No.1	BK	Right Front Fascia	5
Horn No.2	BK	Right Front Fascia	5
Hydraulic Cooling Module	BK	Right Front of Engine Compartment	5
Idle Air Control Motor	BK	Left Side of Engine Near Throttle Body	13
Ignition Switch - C1	WT	On Steering Column	23
Ignition Switch - C2	BK	On Steering Column	23
Input Speed Sensor (4.7L)	BK	Left Side of Transmission	16
Instrument Cluster	WT	At Instrument Cluster	19, 20
Intake Air Temperature Sensor (Gas)	GY	Left Side of Engine	9, 13
Intake Air Temperature Sensor (Diesel)	BK	Near T/O for Crankcase Heater	8
Intake Port Swirl Actuator (Diesel)	BK	Right Rear of Engine Compartment	N/S
Intrusion Transceiver Module (Built-up-Export)	BK	In The Overhead	N/S
Junction Block - C1	BK	At Junction Block	30, 31, 33
Junction Block - C2	BK	At Junction Block	30, 31
Junction Block - C3	BK	At Junction Block	21, 22, 30
Junction Block - C4	WT	At Junction Block	30, 31
Junction Block - C5	WT	At Junction Block	30, 31
Knock Sensor (4.7L High Output)	BK	Right Rear Side of Engine, Near Coil on Plug No.8	N/S
Leak Detection Pump (Except Built-Up-Export)		Left Front Wheel Opening	3
Left Courtesy Lamp	BK	Left Side of Instrument Panel	21 22, 23
Left Curtain Airbag	BK	Near Left C Pillar	37
Left Door Handle Courtesy Lamp	BK	At Lamp	N/S
Left Fog Lamp	BK	At Lamp	3, 4
Left Front Door Speaker	WT	In Left Front Door	24, 27
Left Front Impact Sensor	BK	Left Front Frame Near Windshield Washer Pump	3, 4
Left Front Park Lamp	WT	At Lamp	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Left Front Park/Turn Signal Lamp (Except Built-Up-Export)	BK	At Lamp	N/S
Left Front Side Marker Lamp (Except Built-Up-Export)	WT	At Lamp	N/S
Left Front Turn Signal Lamp (Built-Up-Export)	WT	At Lamp	N/S
Left Front Wheel Speed Sensor	GY	At Left Front Wheel Opening	4
Left Headlamp Leveling Motor (Built-Up-Export)	BK	At Motor	N/S
Left High Beam Headlamp	BK	At Lamp	N/S
Left Instrument Panel Speaker	WT	At Speaker	19, 20
Left Liftgate Ajar Switch	BK	In Liftgate	38
Left Low Beam Headlamp	GY	At Lamp	N/S
Left Multi-Function Switch	WT	On Steering Column	23
Left Rear Door Lock Motor/Ajar Switch	BK	In Left Rear Door	28
Left Rear Door Speaker	WT	In Left Rear Door	28
Left Rear Lamp Assembly	BK	At Lamp Assembly	37
Left Rear Wheel Speed Sensor	GY	Near Left Rear Wheel	33, 35
Left Remote Radio Switch	BK	At Switch in Steering Wheel	N/S
Left Side Impact Sensor	BK	Left Body	N/S
Left Side Repeater Lamp (Built-Up-Export)	BK	On Left Front Fender	3, 4
Left Visor/Vanity Lamp	BK	At Lamp	N/S
License Lamp No.1	BK	At Lamp	N/S
License Lamp No.2	BK	At Lamp	N/S
Liftgate Flip-Up Ajar Switch	GY	In Liftgate	38
Liftgate Flip-Up Push Button Switch	BK	In Liftgate	N/S
Liftgate Flip-Up Release Solenoid	BK	In Liftgate	38
Liftgate Lock Motor	BK	In Liftgate	38
Line Pressure Sensor (4.7L)	BK	Rear of Transmission	N/S
Manifold Absolute Pressure Sensor (4.0L)	BK	At Throttle Body	9
Manifold Absolute Pressure Sensor (4.7L)	BK	Right Side of Engine	13
Manual Temperature Control - C1 (MTC)	WT	Center of Instrument Panel	N/S
Manual Temperature Control - C2 (MTC)	WT	Center of Instrument Panel	N/S
Mass Air Flow sensor (Diesel)	BK	Near T/O for G105	8
Mode Door Motor/Actuator (AZC)	BK	Right Center of Instrument Panel	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Output Speed Sensor (4.0L)	GY	Left Side of Transmission	12
Output Speed Sensor (4.7L)	BK	Left Side of Transmission	16
Overhead Map/Courtesy Lamp	WT	At Overhead Console	N/S
Oxygen Sensor 1/1 Upstream (4.0L)	GY	Left Side of Engine at Exhaust	9, 12
Oxygen Sensor 1/1 Upstream (4.7L)	GY	Left Side of Engine at Exhaust	17
Oxygen Sensor 1/2 Downstream (4.0L)	BK	Rear of Transmission	9, 12
Oxygen Sensor 1/2 Downstream (4.7L)	BK	Rear of Transmission	17
Oxygen Sensor 2/1 Upstream		Rear of Transmission	N/S
Oxygen Sensor 2/2 Downstream		Rear of Transmission	N/S
Park Brake Switch		Center Console Area, Near Airbag Control Module	20, 21, 22
Park/Neutral Position Switch (4.0L)	BK	Left Side of Transmission	12
Park/Neutral Position Switch (Diesel)	BK	Left Side of Transmission	N/S
Passenger Airbag	YL	Passenger Side of Instrument Panel	19, 20
Passenger Blend Door Motor/Actuator (AZC)	BK	Passenger Side of Instrument Panel	N/S
Passenger Door Lock Motor/Ajar Switch	BK	In Passenger Door	26, 27
Passenger Door Module - C1	WT	In Passenger Door	26, 27
Passenger Door Module - C2	BK	In Passenger Door	N/S
Passenger Front Door Courtesy Lamp	BK	In Passenger Door	N/S
Passenger Front Power Window Motor	BK	In Passenger Door	26, 27
Passenger Heated Seat Back (Premium I/III)	GN	At Passenger Seat	N/S
Passenger Heated Seat Cushion (Premium I/III)	BK	At Passenger Seat	N/S
Passenger Heated Seat Switch	BK	Center of Instrument Panel	19, 20, 21
Passenger Lumbar Motor (Midline/Premium)	BK	At Passenger Seat	N/S
Passenger Lumbar Switch (Midline/Premium)	WT	At Passenger Seat	N/S
Passenger Power Mirror	BK	In Passenger Door	N/S
Passenger Power Seat Front Riser Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Horizontal Motor	RD	At Passenger Seat	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Passenger Power Seat Rear Riser Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Recliner Motor (Midline/ Premium)	BK	At Passenger Seat	N/S
Passenger Power Seat Switch (Midline/Premium)	GN	At Passenger Seat	N/S
Passenger Rear Power Window Motor	BK	In Right Rear Door	29
Passenger Rear Power Window Switch	BL	In Right Rear Door	29
Passenger Seat Belt Switch		t Switch	N/S
Power Amplifier - C1	WT	Under Rear Seat	34, 36
Power Amplifier - C2	WT	Under Rear Seat	34, 36
Power Connector	WT	Center of Instrument Panel	21, 22
Powertrain Control Module - C1 (Gas)	BK	Rear of Engine Compartment	5, 10, 11, 14, 15, 18
Powertrain Control Module - C2 (Gas)	WT	Rear of Engine Compartment	5, 10, 11, 14, 15, 18
Powertrain Control Module - C3 (Gas)	WT	Rear of Engine Compartment	N/S
Radiator Fan Motor	BK	At Radiator	5
Radiator Fan Relay	BK	Right Side of Engine Compartment	5
Radio - C1	GY	Center of Instrument Panel	19, 20
Radio - C2	BK	Center of Instrument Panel	19, 20
Rain Sensor	BK	Front Center Overhead	N/S
Rear Power Outlet	RD	Right Rear Quarter Panel	37
Rear Washer Pump	BK	Left Front of Engine Compartment	3, 4
Rear Window Defogger	BK	Right Upper Coner of Liftgate	38
Rear Wiper Motor	BK	In Liftgate	38
Recirculation Door Motor/ Actuator (AZC)	BK	Center of Instrument Panel	N/S
Red Brake Warning Indicator Switch	GY	At Master Cylinder	4
Remote Keyless Module (Japan)	BL	In Driver Door	25
Right Courtesy Lamp	BK	At Lamp	20 21, 22
Right Curtain Airbag	BK	Near Right C Pillar	37
Right Door Handle Courtesy Lamp	BK	At Lamp	N/S
Right Fog Lamp	BK	At Right Front Fascia	5
Right Front Door Speaker	WT	In Right Front Door	25, 26
Right Front Impact Sensor	BK	Near Right Verticle Radiator Support	N/S
Right Front Park Lamp	WT	At Lamp	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Right Front Park/Turn Signal Lamp (Except Built-Up-Export)	BK	At Lamp	N/S
Right Front Side Marker Lamp (Except Built-Up-Export)	WT	At Lamp	N/S
Right Front Turn Signal Lamp (Built-Up-Export)	WT	At Lamp	N/S
Right Front Wheel Speed Sensor	GY	In Right Front Wheel Opening	N/S
Right Headlamp Leveling Motor (Built-Up-Export)	BK	At Motor	N/S
Right High Beam Headlamp	BK	At Lamp	N/S
Right Instrument Panel Speaker	WT	At Speaker	19, 20
Right Liftgate Ajar Switch	BK	In Liftgate	38
Right Low Beam Headlamp	GY	At Lamp	N/S
Right Multi-Function Switch	WT	On Steering Column	23
Right Rear Door Lock Motor/Ajar Switch	BK	In Right Rear Door	29
Right Rear Door Speaker	WT	In Right Rear Door	29
Right Rear Lamp Assembly	BK	At Lamp Assembly	37
Right Rear Wheel Speed Sensor	BK	Near Right Rear Wheel	33, 35
Right Remote Radio Switch	BK	At Switch in Steering Wheel	N/S
Right Side Repeater Lamp (Built-Up-Export)	BK	On Right Front Fender	5
Right Visor/Vanity Lamp	BK	At Lamp	N/S
Seat Belt Switch	WT	At Driver Seat	N/S
Seat Module - C1 (Premium)	BK	Under Driver Seat	N/S
Seat Module - C2 (Premium)	OR	Under Driver Seat	N/S
Sentry Key Immobilizer Module	BK	On Steering Column	23
Shifter Assembly (Gas)	WT	Between Front Seats	23
Shifter Assembly C1 (Diesel)		Between Front Seats	N/S
Shifter Assembly C2 (Diesel)		Between Front Seats	N/S
Siren (Built-up-export)		Left Front Fender	3, 4
Speed Control Switch NO. 1	BK	On Steering Wheel	N/S
Speed Control Switch NO. 2	BK	On Steering Wheel	N/S
Sunroof Control Module		At Sunroof	32
Sunroof Motor C1	WT	At Sunroof	N/S
Sunroof Motor C2	BK	In Overhead	N/S
Sunroof Switch	GY	At Switch	N/S
Temperature Valve Actuator (MTC)	BK	On HVAC Housing	N/S
Throttle Position Sensor (4.0L)	BK	Left Side of Engine	9
Throttle Position Sensor (4.7L)	WT	Left Side of Engine	13

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Trailer Tow Brake Lamp Relay	BK	Left Quarter Panel	N/S
Trailer Tow Circuit Breaker	BK	Left Quarter Panel	N/S
Trailer Tow Connector	BK	In Rear Bumper	39
Trailer Tow Left Turn Relay	BK	Left Quarter Panel	N/S
Trailer Tow Right Turn Relay	BK	Left Quarter Panel	N/S
Transfer Case Position Sensor	BK	On Transfer Case	7
Transmission Control Module (4.7L)	BK	Rear of Engine Compartment	14, 15, 18
Transmission Control Module C1 (Diesel)	BK	Right Rear Side of Engine Compartment	N/S
Transmission Control Module C2 (Diesel)	BK	Right Rear Side of Engine Compartment	8
Transmission Solenoid (4.0L Gas)	BK	Left Side of Transmission	12
Transmission Solenoid Assembly (Diesel)	BK	On Transmission	8
Transmission Solenoid/TRS Assembly (4.7L)	GY	Left Side of Transmission	16
Underhood Lamp	BK	At Lamp	6
Vehicle Information Center	BK	In Overhead Console	N/S
Viscous/Cabin Heater (Diesel)	BK	Left Rear of Engine Compartment	N/S
Washer Fluid Level Switch	GY	Left Front of Engine Compartment	3, 4
Wastegate Solenoid (Diesel)		Near Power Distribution Center	N/S
Water In Fuel Sensor (Diesel)	BK	Left Rear of Engine Compartment	N/S

GROUNDS

GROUND NUMBER	LOCATION	FIG.
G100 (4.0L and Diesel)	Near Starter	N/S
G100 (4.7L)	Near Intake Plenum	N/S
G101	Near Battery	2
G102	Right Side of Engine	14, 15
G103	Right Side of Engine	7, 8, 10, 11, 14, 15
G104 (4.0L)	Right Rear of Engine	10, 11
G104 (4.7L)	Left Side of Engine	13
G105	Right Side of Engine	8
G106	Left Side of Engine Compartment	3, 4
G107	Left Side of Engine Compartment	3, 4
G108	Near Power Distribution Center	5
G200	Near Airbag Control Module	19, 20, 21, 22
G201	Near Airbag Control Module	19, 20, 21, 22
G300	Near Right Front Seat	34, 36
G301	Near Left Front Seat	33, 35

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICES

SPLICE NUMBER	LOCATION	FIG.
S100	Near T/O for Power Distribution Center Eyelet	2
S102 (4.0L)	Near T/O for G103	10, 11
102 (4.7L)	Near T/O for Fuel Injector No. 1	13
S102 (Diesel)	Near T/O for C110	7, 8
S103 (4.7L)	Near T/O for Engine Oil Pressure Sensor	13
S104 (4.0L)	Near T/O for A/C Compressor Clutch	N/S
S104 (4.7L)	Near T/O for Oxygen Sensor 2/2 Downstream	N/S
S105 (4.0L)	Near T/O for Capacitor	10 11
S105 (4.7L)	Near T/O for Fuel Injector NO. 7	13
S106 (4.0L)	In T/O for Oxygen Sensors	11, 12
S106 (4.7L)	Near T/O for C103	14
S106 (4.7L) RHD	Near T/O for Fuel Injector No.4	15
S107 (4.0L)	Near T/O for Fuel Injector No.5	9
S107 (4.7L)	Near T/O for Fuel Injector No.7	13
S109 (4.0L)	Near T/O for Fuel Injector No.2	9
S109 (4.7L)	Near T/O for Coil On Plug No. 6	14, 15
S110 (4.0L Except Built-Up-Export)	Near T/O for Oxygen Sensor	N/S
S111 (4.7L)	In T/O for Oxygen Sensor	N/S
S111 (4.0L Except Built-Up-Export)	Near T/O for Oxygen Sensor	N/S
S112 (4.0L)	Near T/O for C102, C103 and C104	10, 11
S112 (4.7L)	Near T/O for Coil On Plug No.8	15
S112 (Diesel)	Near T/O for Accelerator Pedal Position Sensor	N/S
S113 (4.7L)	Near T/O for Transmission Control Module	15, 18
S114 (4.0L)	Near T/O for Transmission Control Module	18
S114 (4.7L)	Near T/O for Transmission Control Module	15, 18
S115 (4.0L)	Near T/O for Transmission Control Module	18
S115 (4.7L)	Near T/O for Transmission Control Module	15, 18
S116 (4.0L)	Near Powertrain Control Module C1 and C2	18
S116 (4.7L) LHD	Near T/O for C102, C103 and C104	14
S116 (4.7L) RHD	In T/O for Powertrain Control Module	15
S117 (4.7L) LHD	Neat T/O for C102, C103 and C104	14
S118 (4.7L)	Near T/O for Coil On PlugNo.4	14, 15
S118 (Diesel)	Near T/O for Fuel Sender Unit	N/S
S119 (4.7L) LHD	In T/O for Crankshaft Position Sensor	18
S119 (4.7L) RHD	In T/O for Powertrain Control Module	15
S120 (4.7L)	Near T/O for Powertrain Control Module	15, 18
S121 (4.7L)	Near T/O for Idle Air Control Motor	13

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S122 (4.0L)	Near T/O for G103	10, 11
S122 (4.7L) LHD	Near T/O for Input Speed Sensor	15
S122 (4.7L) RHD	Near T/O for Powertrain Control Module	16
S122 (Diesel)	Near T/O for Generator	N/S
S123 (4.0L)	Near T/O for Capacitor	10, 11
S124 (4.7L)	In Trough Near T/O for Capacitor No.2	13
S125 (Diesel)	In T/O for C103 and C105 Left Rear of Engine Compartment	N/S
S125 (Gas)	Near T/O for Powertrain Control Module - C3	N/S
S126 (4.0L) LHD	Near T/O for Battery Temperature Sensor	N/S
S126 (4.0L) RHD	In Trough Near T/O for Powertrain Control Module - C3	N/S
S127 (LHD) Gas	In Trough Near T/O for Powertrain Control Module - C3	N/S
S127 (RHD) Gas	In T/O for Power Distribution Center	5
S127 (Diesel)	Near T/O for Power Distribution Center	4
S128 (Diesel)	In T/O for C102 Left Rear of Engine Compartment	N/S
S128 (LHD) Gas	In Trough Near T/O for Powertrain Control Module - C3	N/S
S128 (RHD) Gas	In T/O for C102	5
S130 (LHD) Gas	In T/O for C102	N/S
S130 (RHD) Gas	In T/O for Controller Antilock Brake	3
S130 (Diesel)	In T/O for Controller Anti-Lock Brake	4
S131	In Trough Near T/O for Power Distribution Center	5
S131 (Diesel)	Near T/O for Power Distribution Center	4
S132 (Diesel)	Near T/O for EGR Solenoid	N/S
S132 (Gas)	Near T/O for Battery Temperature Sensor	5
S133 (Diesel)	In Trough Near T/O for EGR Solenoid	N/S
S133 (Gas)	Near T/O for Battery Temperature Sensor	5
S134 (Diesel)	In Trough Near T/O for G106/G107	4
S134 (Gas)	In Trough Near T/O for Controller Anti-Lock Brake	3
S135 (Diesel)	Near T/O for Engine Control Module C1	7, 8
S136 (Diesel)	Near T/O for Engine Control Module C1	7, 8
S137 (Diesel)	In Trough Near T/O for Coolant Level Sensor	N/S
S139 (Diesel)	Near T/O for Engine Control Module C1	7, 8
S140 (Diesel)	Near T/O for Power Distribution Center	4
S140 (Gas)	Near T/O for Controller Antilock Brake	N/S
S141 (Gas)	Near T/O for Controller Antilock Brake	3
S142 (Diesel)	In Trough Near T/O for Coolant Level Sensor	N/S
S142 Gas	In T/O for C102	5
S143 (Diesel)	In Trough Near T/O for Hood Ajar Switch	4
S143 (Gas, Built-Up-Export) LHD	In Trough Near T/O for Controller Antilock Brake	3
S143 Gas RHD	Near T/O for Evap/Purge Solenoid	N/S
S145 (Diesel)	Near T/O for Engine Control Module C1	7, 8

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S147 (Diesel)	In T/O for Controller Anti-Lock Brake	4
S151	In Headlamp Assembly	N/S
S152	In Headlamp Assembly	N/S
S153	In Headlamp Assembly	N/S
S154	In Headlamp Assembly	N/S
S155	In Headlamp Assembly	N/S
S156	In Headlamp Assembly	N/S
S158 4.7L RHD	Near T/O for Fuel Injector No. 1	13
S159	In T/O for C101	N/S
S160 (4.7L High Output)	In T/O for C102	N/S
S162 (Diesel)	In T/O for Wastegate Solenoid	4, 8
S163	Near T/O for Leak Detection Pump	3
S165 (Diesel)	Near T/O for Left Front Wheel Speed Sensor	4
S168	Near T/O for Intake Air Temperature Sensor	7, 8
S169	Near T/O for Engine Control Module C1	7, 8
S170	Near T/O for Engine Control Module C2	7, 8
S171	Near T/O for C113	7
S172	Near T/O for C113	7
S174	Near Washer Fluid Level Switch Connector	3
S176	Near T/O for Intake Air Temperature Sensor	7
S200	In Trough Near T/O for Passenger Heated Seat Switch	21
S200 (RHD)	Upper Center Instrument Panel	22
S201	In Trough Near T/O for Front Power Outlet	21
S201 (RHD)	Near T/O for Power Connector	22
S202	In Trough Near T/O for Passenger Heated Seat Switch	21
S202 (RHD)	Upper Center Instrument Panel	22
S203	In Trough Near T/O for Cigar Lighter	21
S203 (RHD)	Lower Center Instrument Panel	22
S204	In Trough Near T/O for Power Connector	21
S204 (RHD)	Right Center Instrument Panel	22
S205	Near T/O for Adjustable Pedal Switch	21
S205 (RHD)	Upper Center Instrument Panel	22
S206	Near T/O for Adjustable Pedals Switch	N/S
S206 (RHD)	Upper Center Instrument Panel	22
S207	In Trough Near T/O for Radio Connectors	21
S207 (RHD)	Upper Center Instrument Panel	22
S208	In Trough Near T/O for Radio Connectors	21
S208 (RHD)	Upper Center Instrument Panel	22
S209	In Trough Near T/O for Left Courtesy Lamp	21
S209 (RHD)	Lower Center Instrument Panel	22
S210	In Trough Near T/O for Left Courtesy Lamp	21

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S210 (RHD)	Lower Center Instrument Panel	22
S211	In Trough Near T/O for Left Courtesy Lamp	N/S
S211 (RHD)	Right Side of Instrument Panel	22
S212	In Trough Near T/O for Left Courtesy Lamp	21
S212 (RHD)	Right Center Instrument Panel	22
S213	Near T/O for Cruise Switch No.1	N/S
S214	Near T/O for Cruise Switch No.1	N/S
S215	Near T/O for Horn Switch	N/S
S216	Near T/O for Remote Radio Switch No.2	N/S
S217	In Trough Near T/O for Power Connector	21
S217 (RHD)	Lower Center Instrument Panel	22
S221	Right Center of Instrument Panel	21
S221 (RHD)	Left Center of Instrument Panel	22
S222	Right Center of Instrument Panel	21
S222 (RHD)	Near T/O for Front Power Outlet	22
S223	Near T/O for Adjustable Pedals Switch	21
S223 (RHD)	Lower Left Side of Instrument Panel	22
S224	Right Center of Instrument Panel	21
S224 (RHD)	Upper Center of Instrument Panel	22
S300	Near T/O for G304	33
S301	In T/O for C304	33
S302	In Sill Trough Near T/O for C307	33, 35
S303	In Sill Trough Near T/O for C307	33, 35
S304	In Sill Trough Near T/O for C307	35
S305	In Sill Trough Near T/O for C307	N/S
S306	Near T/O for C310	37
S307	Near T/O for C310	37
S308	Between T/O's for C310 and Left Rear Lamp Assembly	36, 37
S309	Between T/O's for C310 and Left Rear Lamp Assembly	37
S310	Between T/O's for C310 and Left Rear Lamp Assembly	35, 37
S311	Near T/O for Left Rear Lamp Assembly	37
S312	Near T/O for C200	35
S313	Near T/O for G301	35
S314	Near T/O for C314	N/S
S315 (Gas)	In Center Spline Near T/O for G301	35
S316 (Gas)	Near T/O for Junction Block C2, C4, C5	N/S
S317	Between Troughs Near T/O for C314	N/S
S318	Between Troughs Near T/O for C314	N/S
S319	In Trough Near T/O for C304	33
S323	Near T/O for C314	N/S
S324	In T/O for C200	34

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S326	Near T/O for C200	34, 35
S327	Near T/O for c307	34, 35
S328	In Sill Trough Near T/O for G300	34
S329	In Sill Trough Near T/O for G300	34
S330	Near T/O for G300	34
S331	In Sill Trough Near T/O for C303	34, 36
S332	In Sill Trough Near T/O for C303	34, 36
S333	Near T/O for Power Amplifiers	36
S334	In T/O for Power Amplifier - C2	34
S335	Near T/O for C314	36
S336	Near T/O for Driver Power Window Motor	24, 25
S338	Near T/O for Passenger Power Window Motor	26, 27
S339	Near T/O for Passenger Power Window Motor	26 27
S340	In T/O for Passenger Door Module - C1	26, 27
S341	Near T/O for C306	N/S
S345	Near T/O for Sunroof Switch	32
S346	Near T/O for Left Visor/Vanity Lamp	32
S347	Near T/O for Left Visor/Vanity Lamp	32
S348	Near T/O for Automatic Day/Night Mirror	32
S349	Near T/O for Automatic Day/Night Mirror	32
S351	Near T/O for Seat Belt Switch	N/S
S352	Near T/O for Seat Belt Switch	N/S
S353	Near T/O for Driver Lumbar Switch	N/S
S355	Near T/O for C304 and C306	N/S
S356	In T/O for Left Rear Door Lock Motor/Ajar Switch	28
S357	In T/O for Right Rear Door Lock Motor/Ajar Switch	29
S358	Near Left B Pillar Sill Trough	35
S359	Near T/O for C302	34
S360	In T/O for C302	N/S
S362	In T/O for C200	34
S363	In T/O for C200	34
S364	Near B Pillar Sill Trough	36
S365 Japan	Near T/O for Remote Keyless Entry Module	24, 25
S366	Near T/O for Junction Block C1	N/S
S367 (RHD)	Near T/O for C310	N/S
S368	Near T/O for Power Amplifier - C1	34
S369	Near T/O for Left Visor Vanity Lamp	N/S
S370	Near T/O for Sunroof Module	32
S400	Near Rear Window Defogger Ground Connector	38
S401	Near Rear Window Defogger Ground Connector	38
S402	Near T/O for Liftgate Flip-Up Ajar Switch	38

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S403	Near T/O for Rear Wiper Motor	38
S404	Near T/O for Liftgate Lock Motor	38
S405	In T/O for Rear Wiper Motor	38
S406 (Except Built-Up-Export)	In T/O for Trailer Tow Right Turn Relay	N/S
S407 (Except Built-Up-Export)	Near T/O for Trailer Tow Left Turn Relay	N/S
S408	Near T/O for Trailer Tow Circuit Breaker	N/S
S410	In T/O for Trailer Tow Connector	39
S411	Near T/O for License Lamp No.1	N/S
S412	In T/O for C312	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

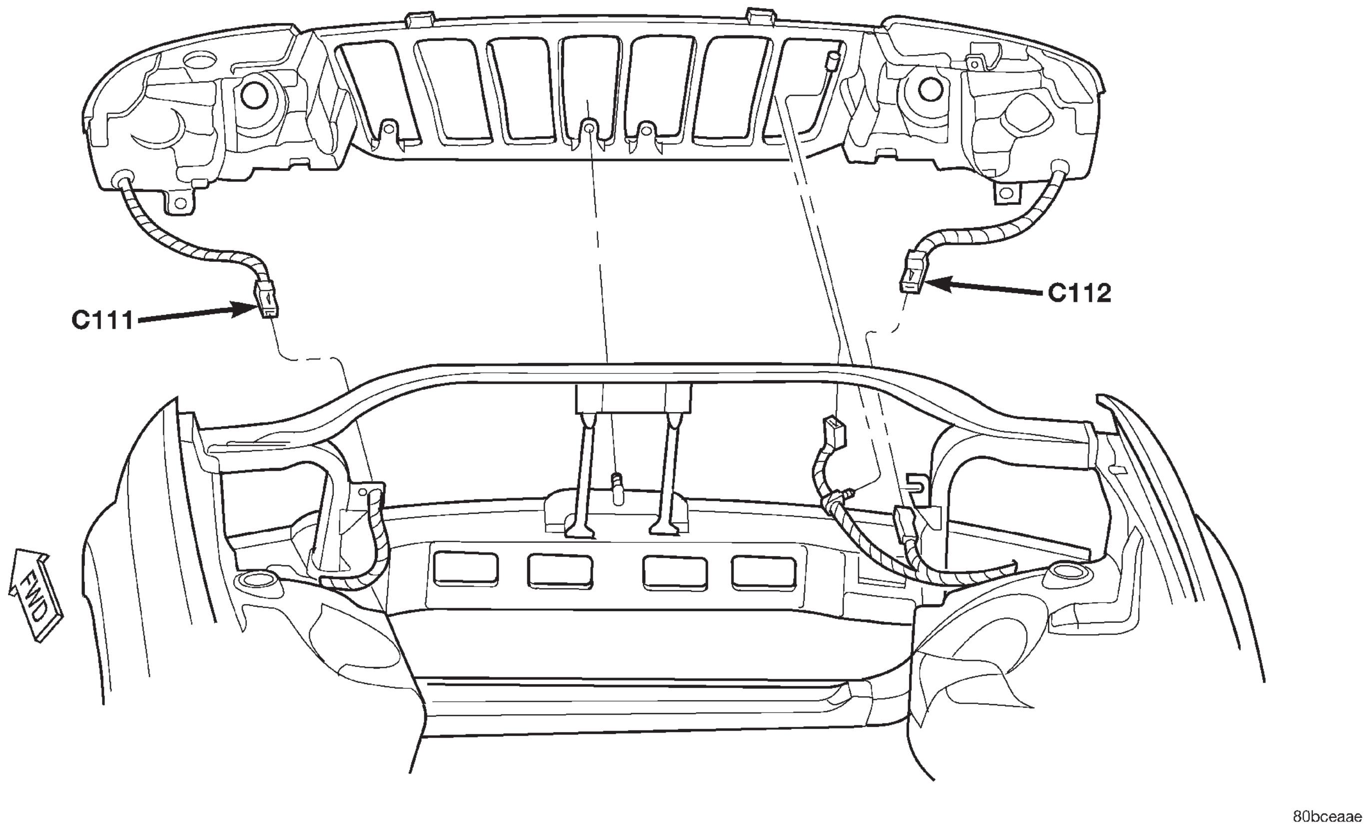


Fig. 1 ENGINE COMPARTMENT (FRONT CLIP)

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

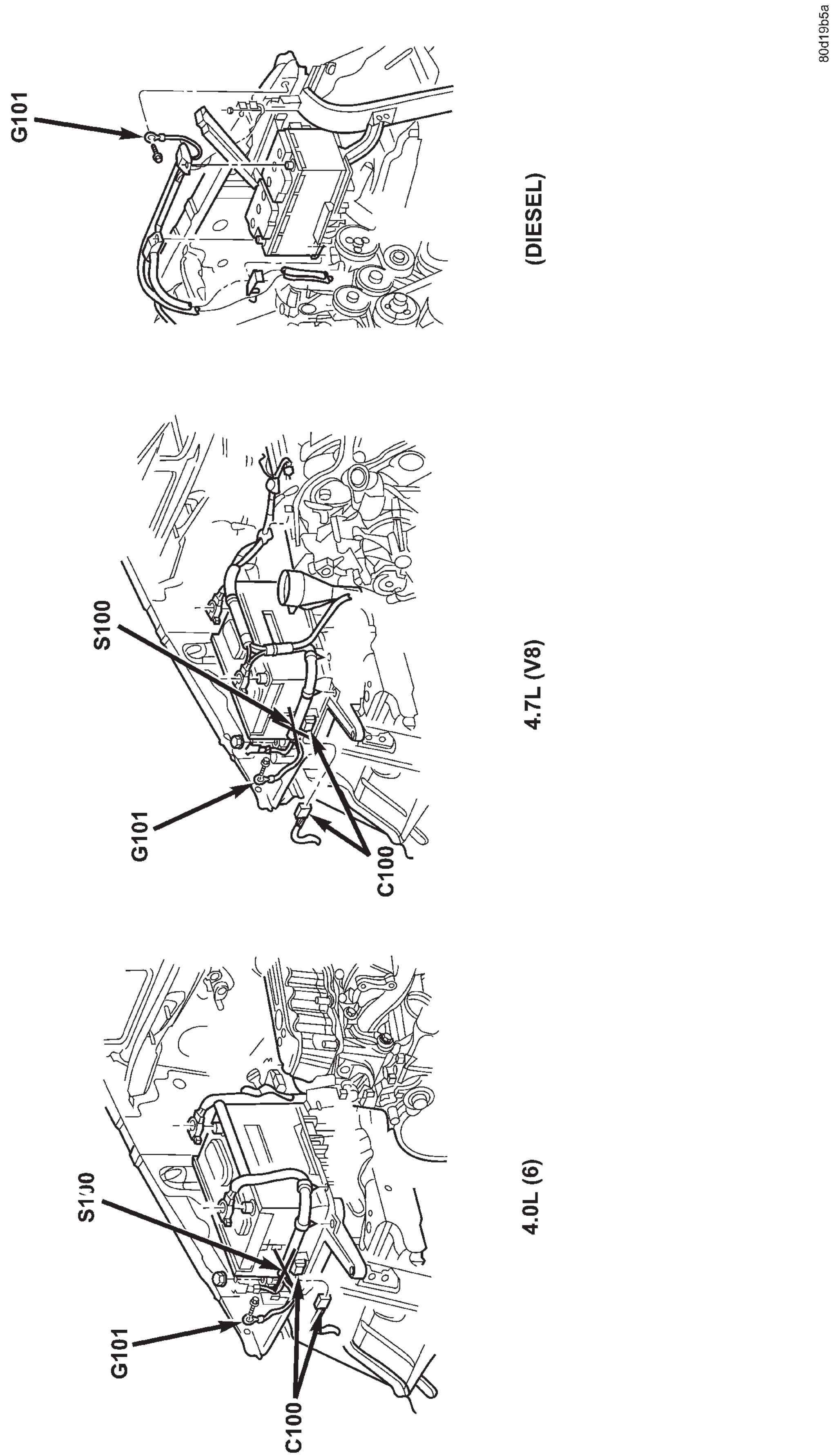


Fig. 2 ENGINE COMPARTMENT (BATTERY)

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

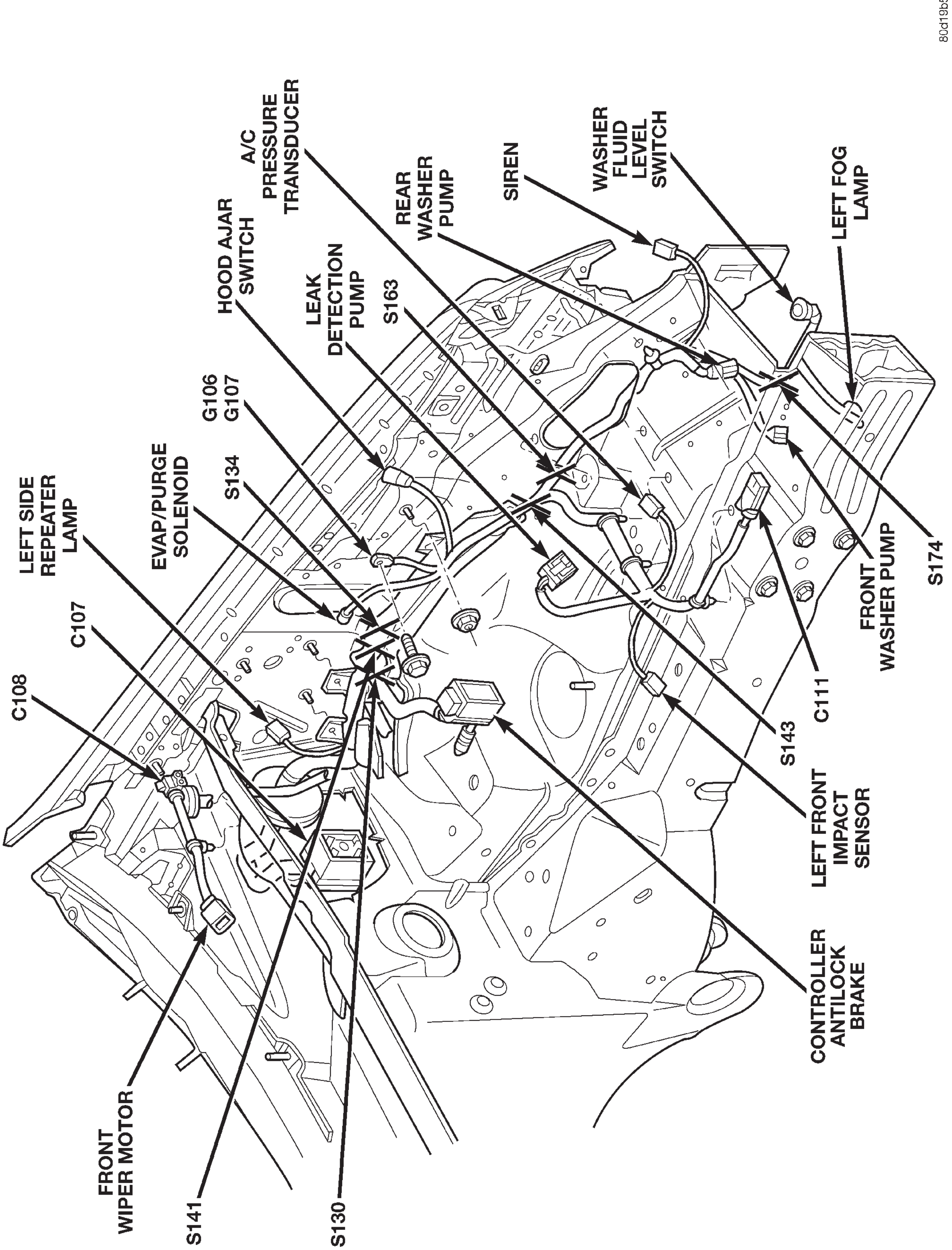


Fig. 3 ENGINE COMPARTMENT LEFT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

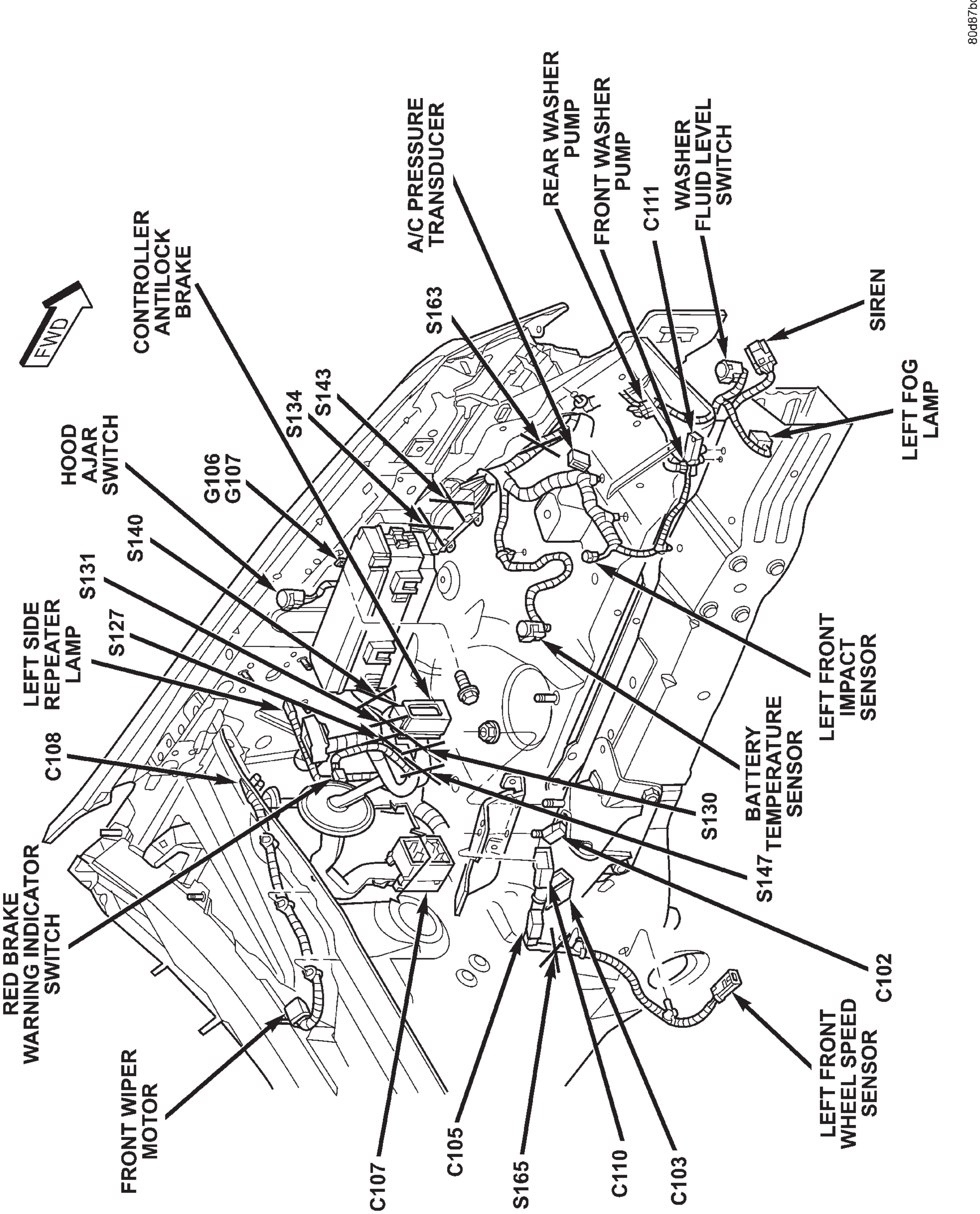


Fig. 4 ENGINE COMPARTMENT LEFT SIDE DIESEL

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

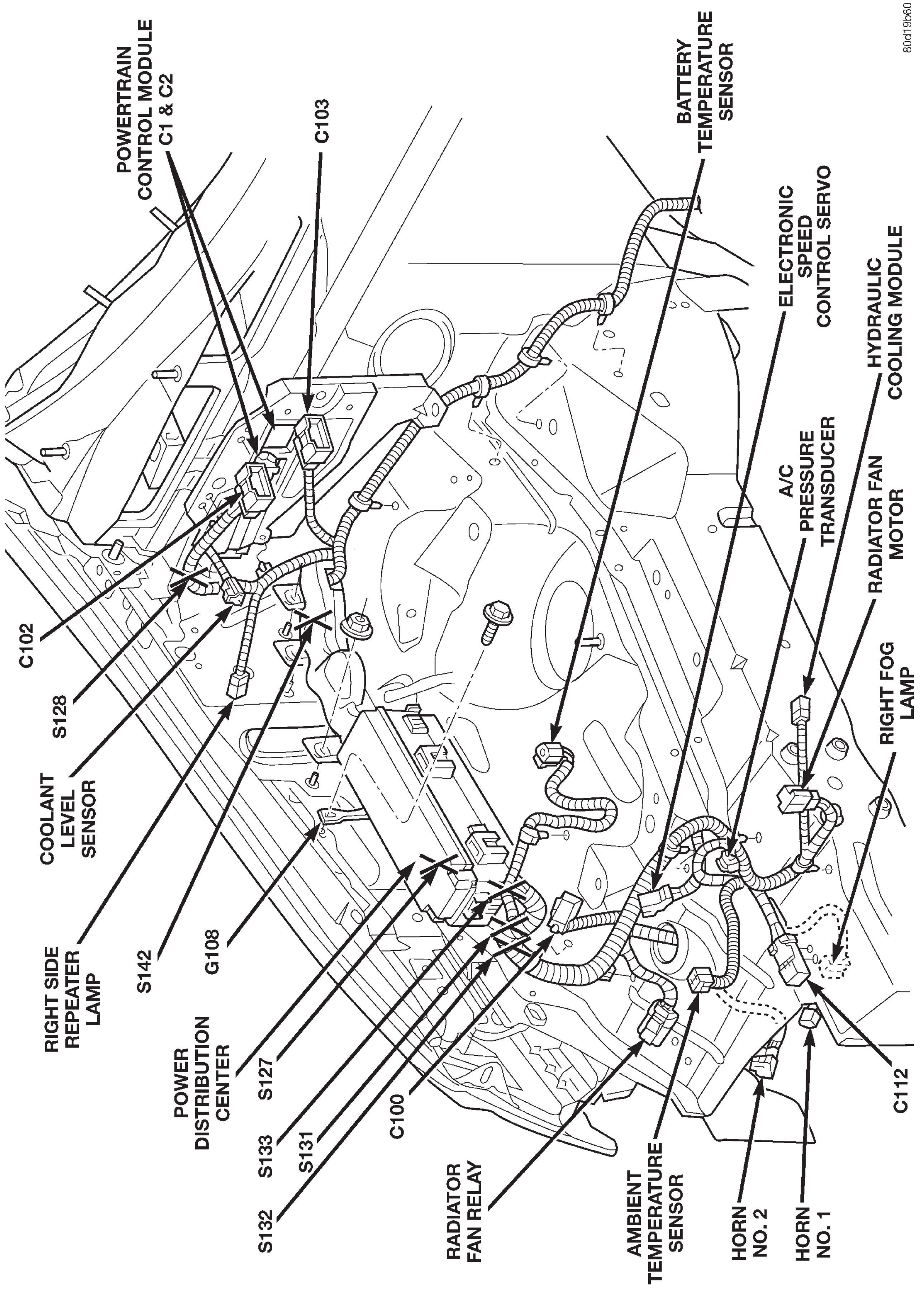


Fig. 5 ENGINE COMPARTMENT RIGHT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

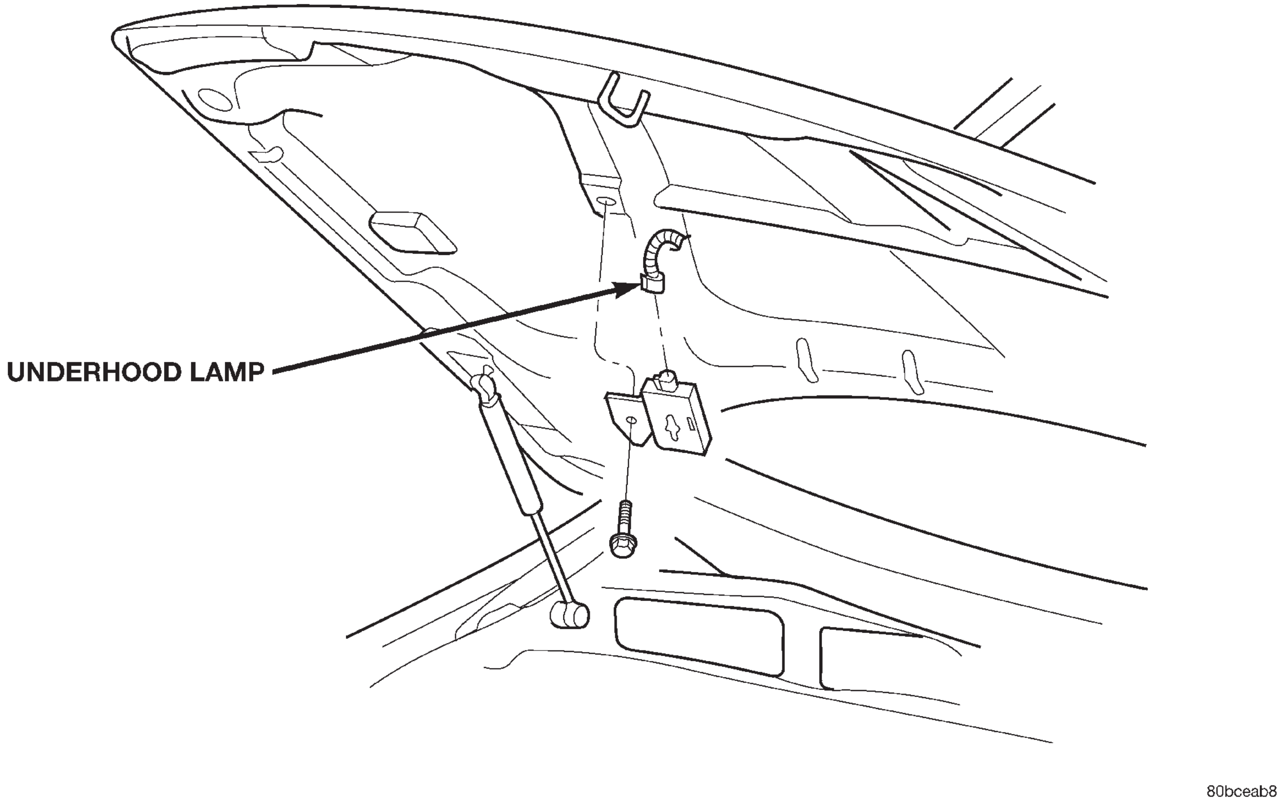


Fig. 6 UNDERHOOD LAMP

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

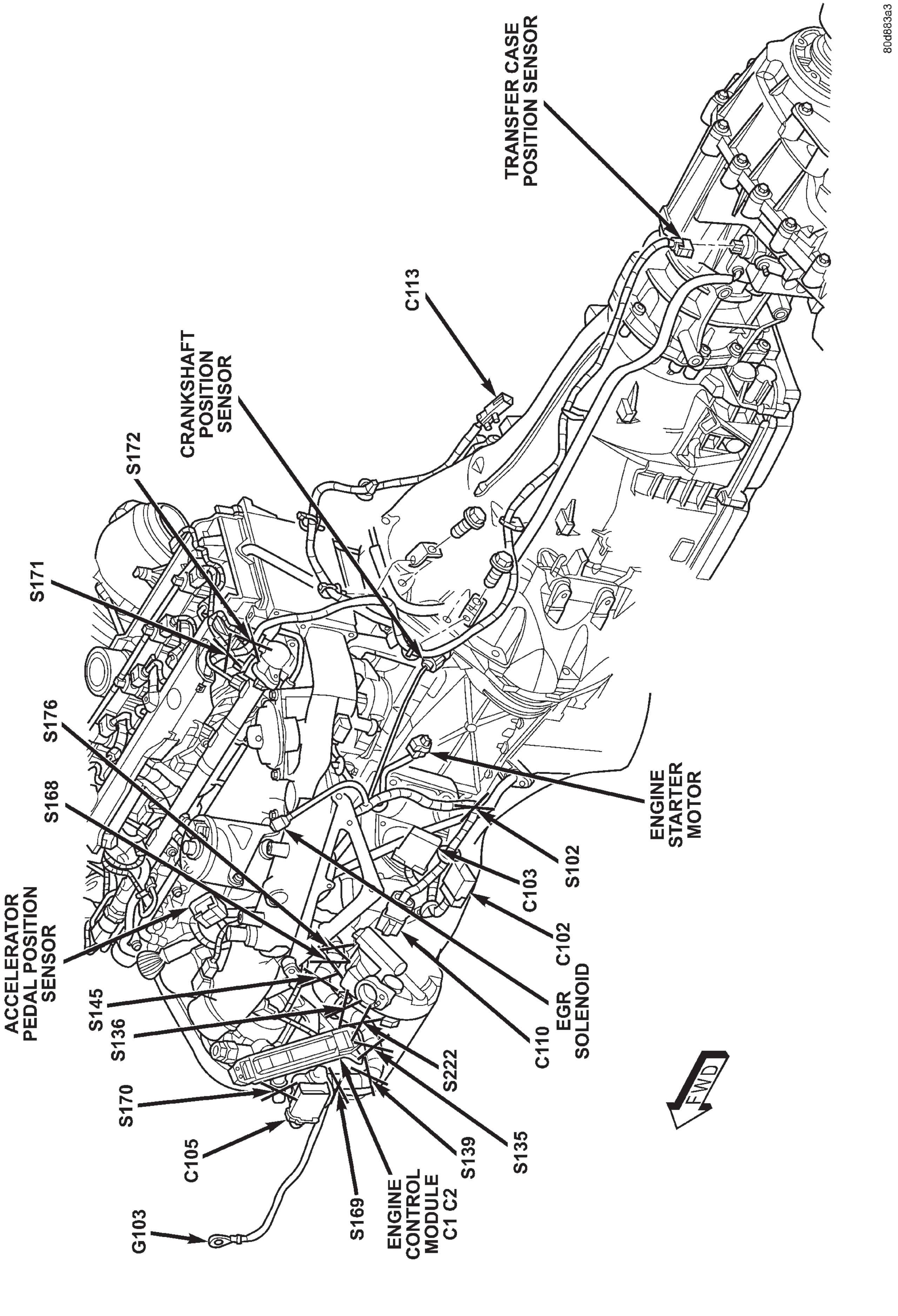


Fig. 7 2.7 LITER DIESEL ENGINE LEFT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

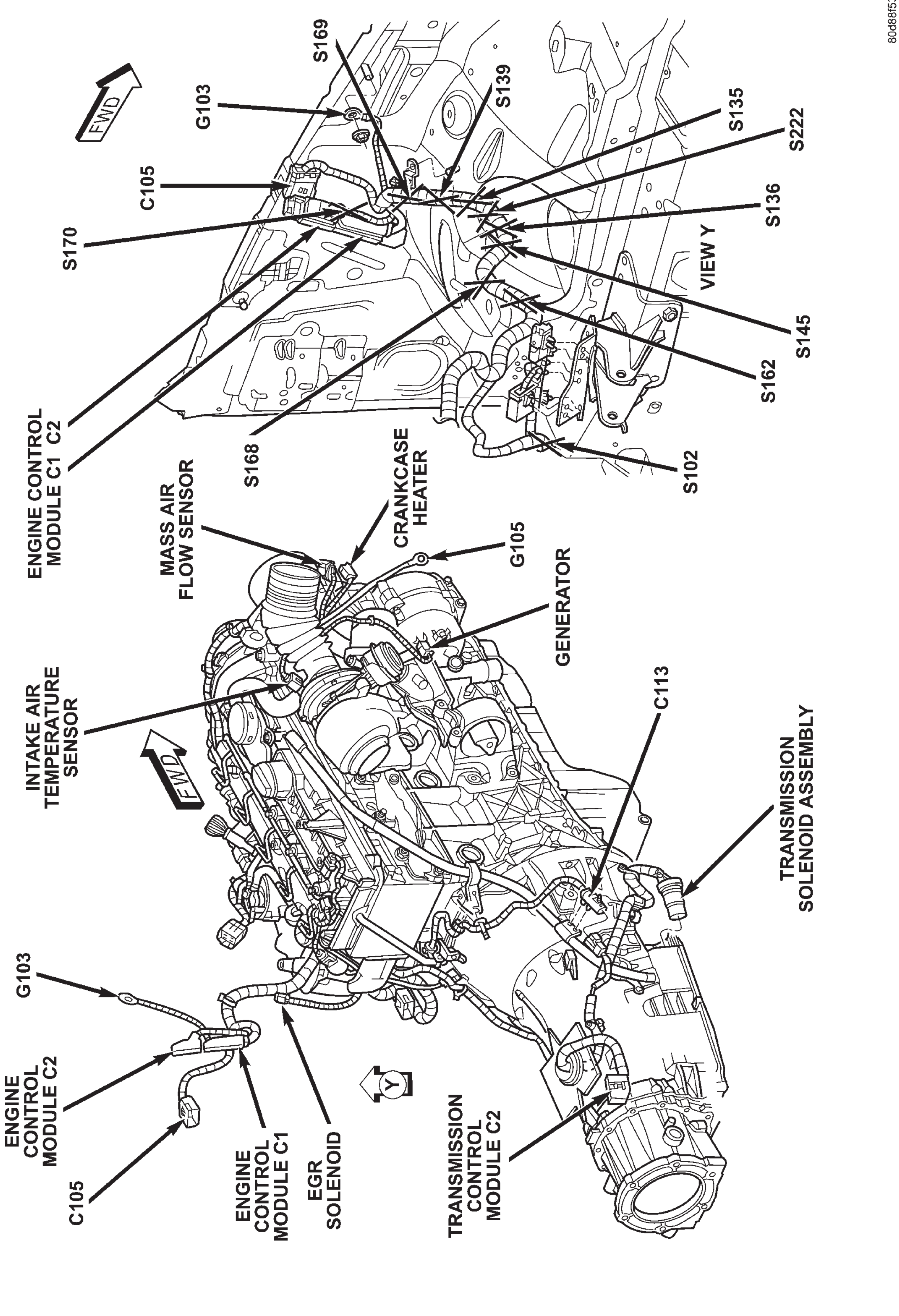


Fig. 8 2.7 LITER DIESEL ENGINE RIGHT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

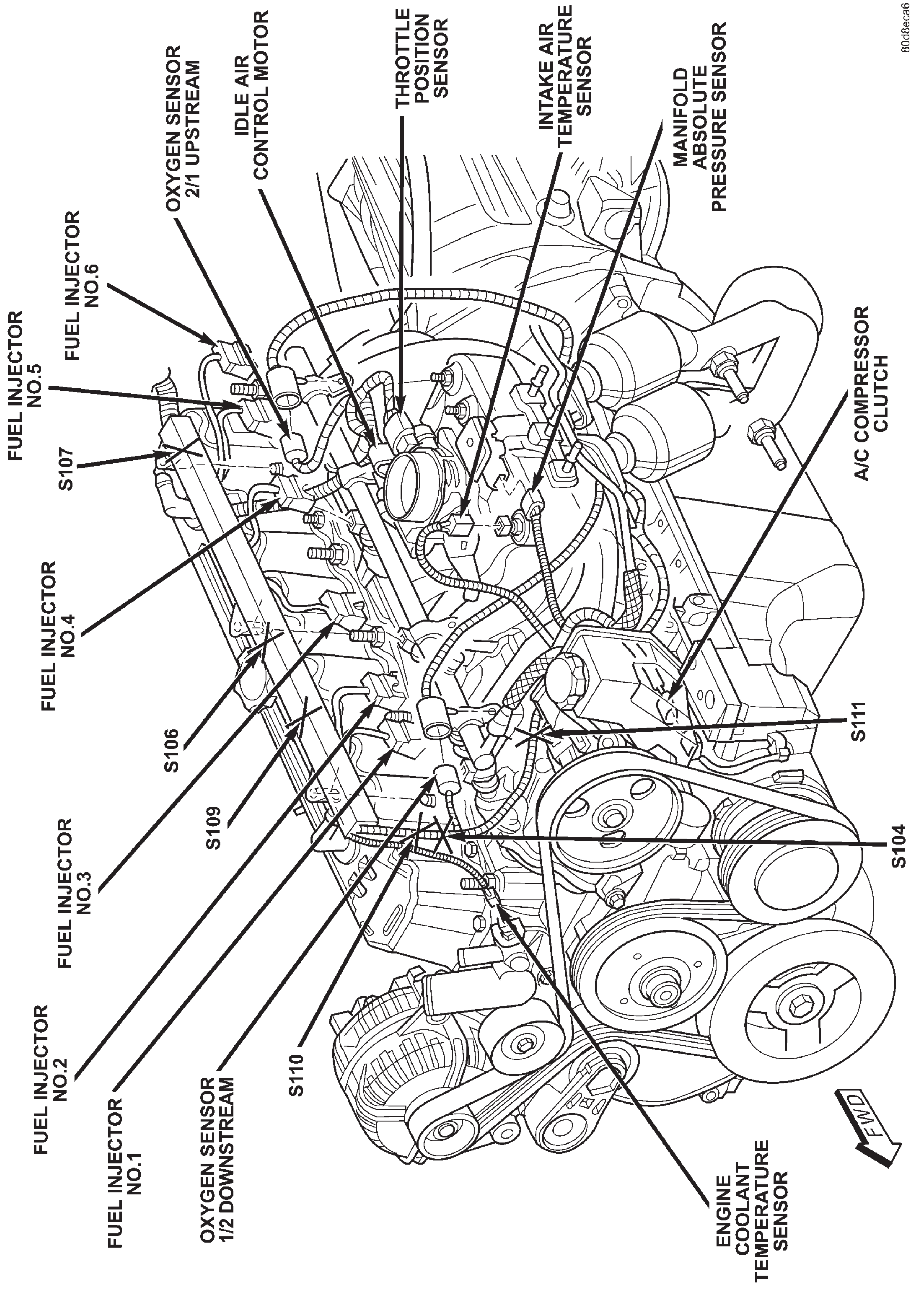


Fig. 9 4.0 LITER ENGINE LEFT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

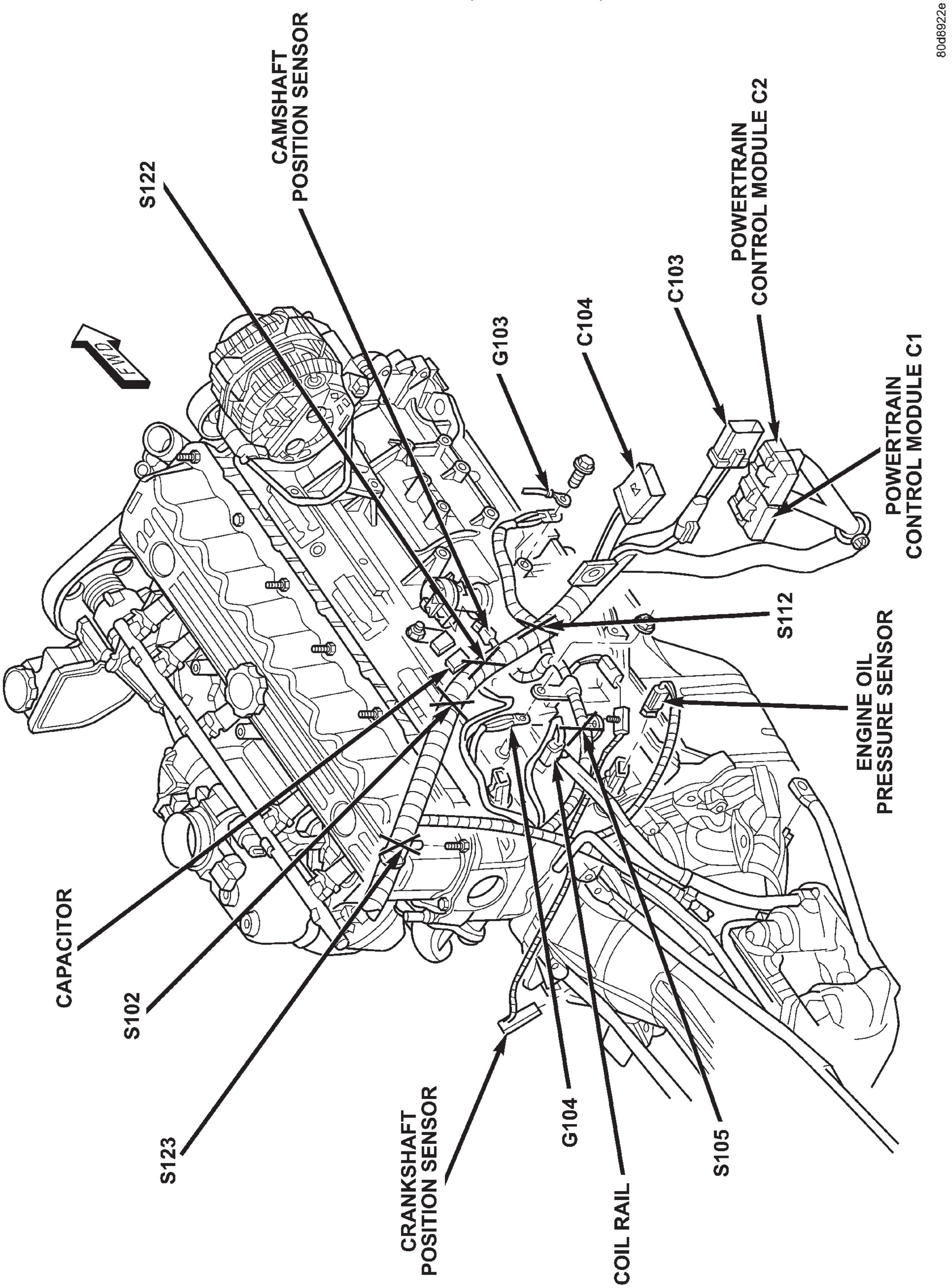


Fig. 10 4.0 LITER ENGINE RIGHT REAR LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

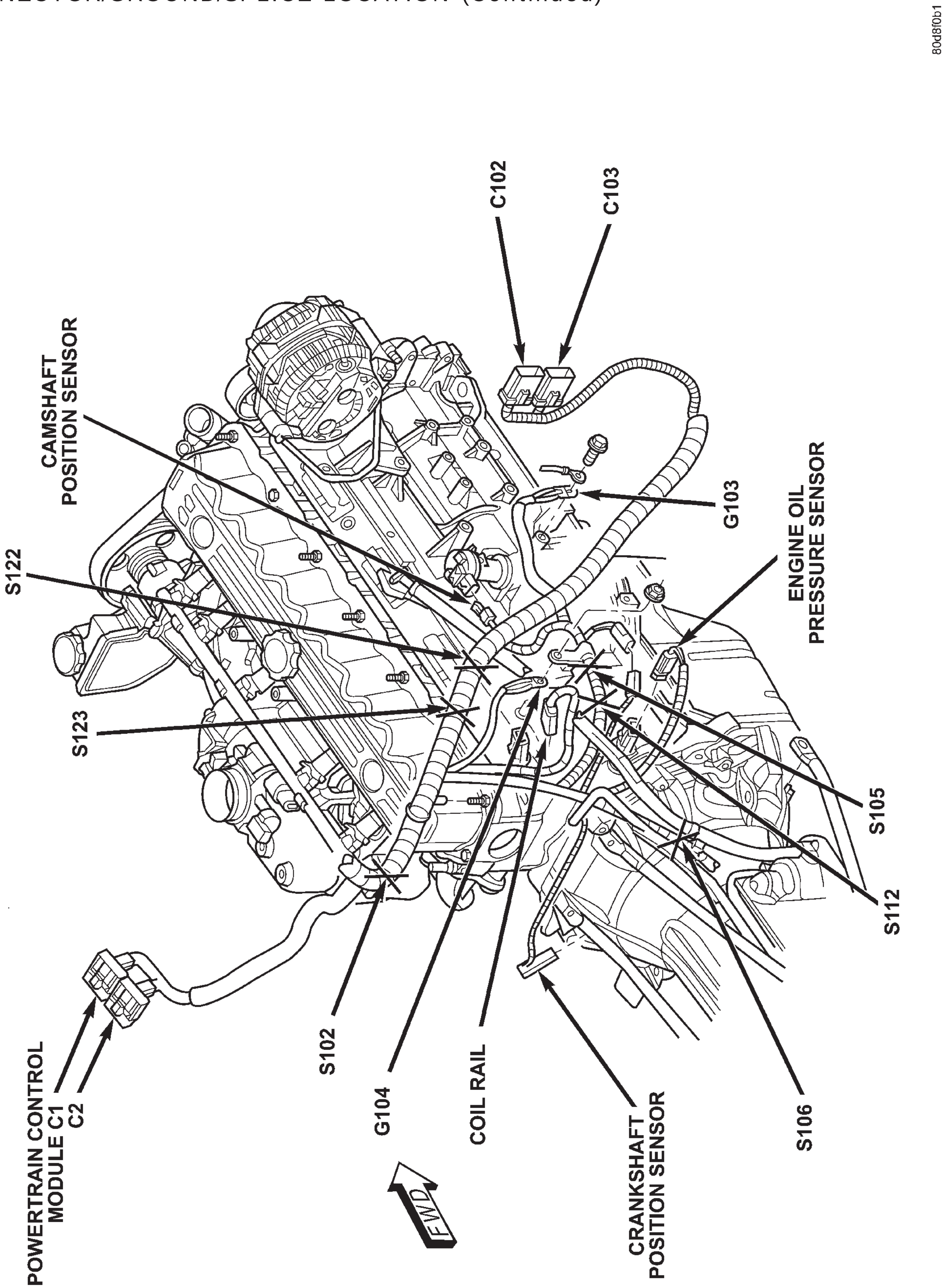


Fig. 11 4.0 LITER ENGINE RIGHT REAR RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

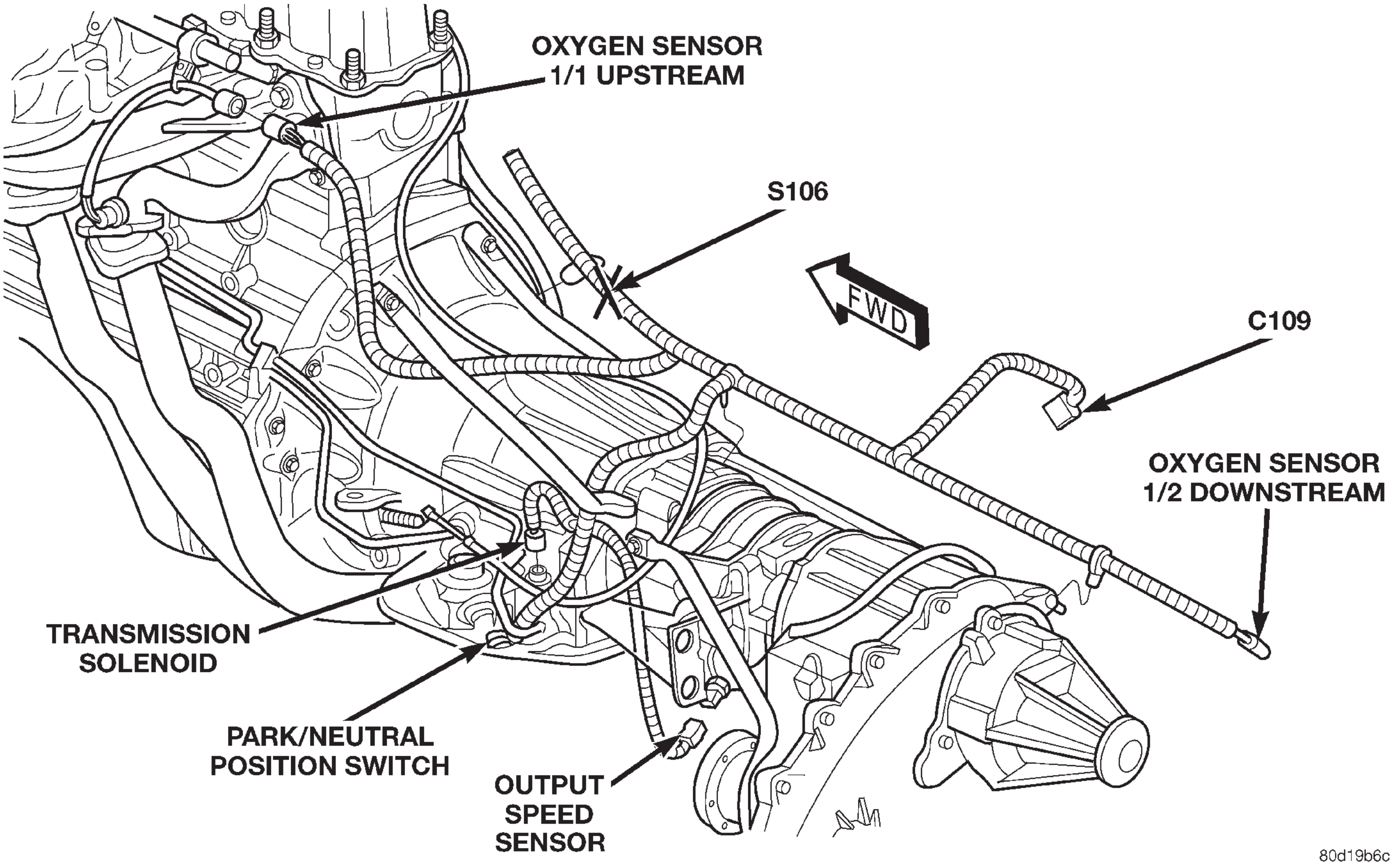


Fig. 12 TRANSMISSION 4.0 LITER ENGINE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

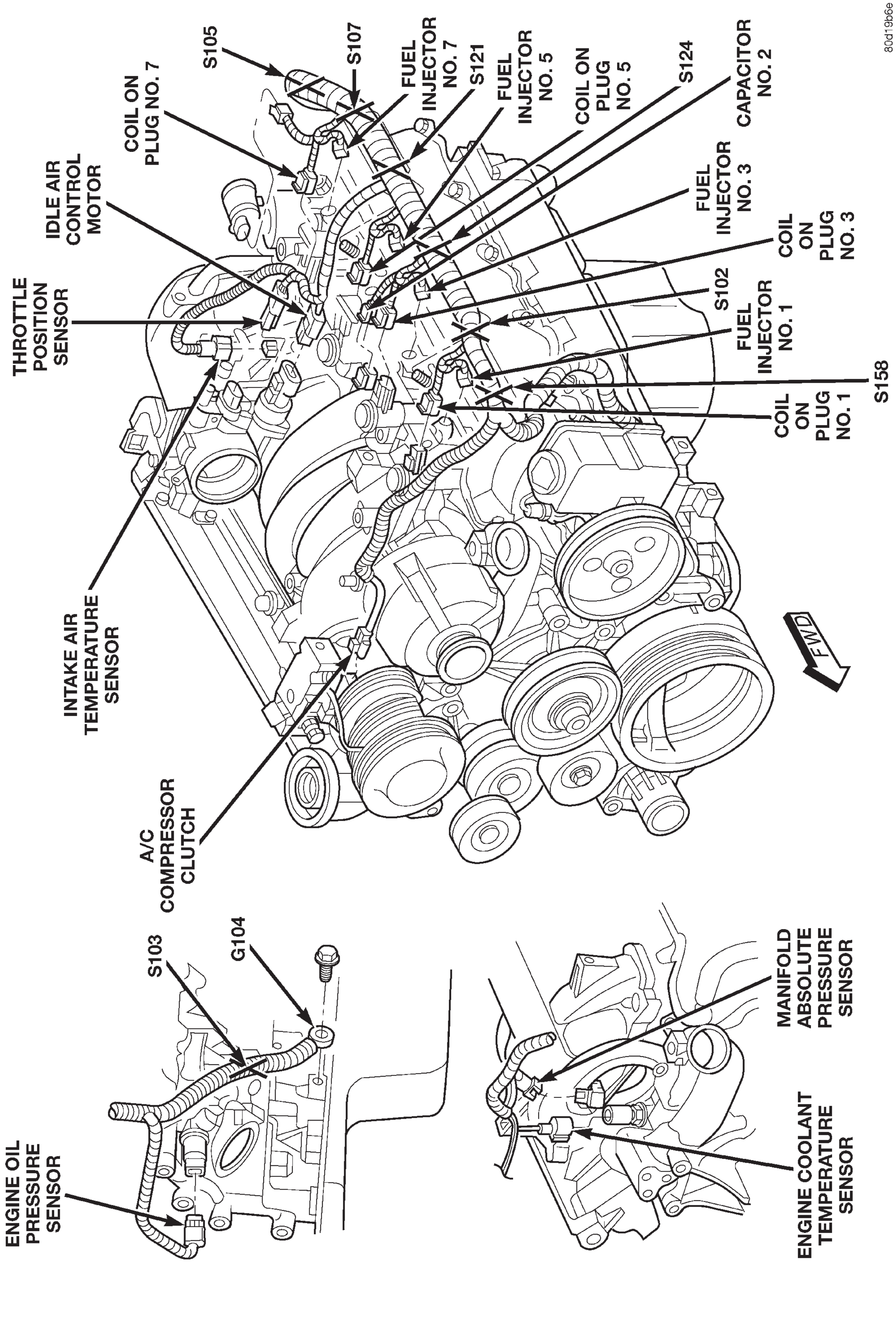


Fig. 13 4.7 LITER ENGINE LEFT FRONT

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

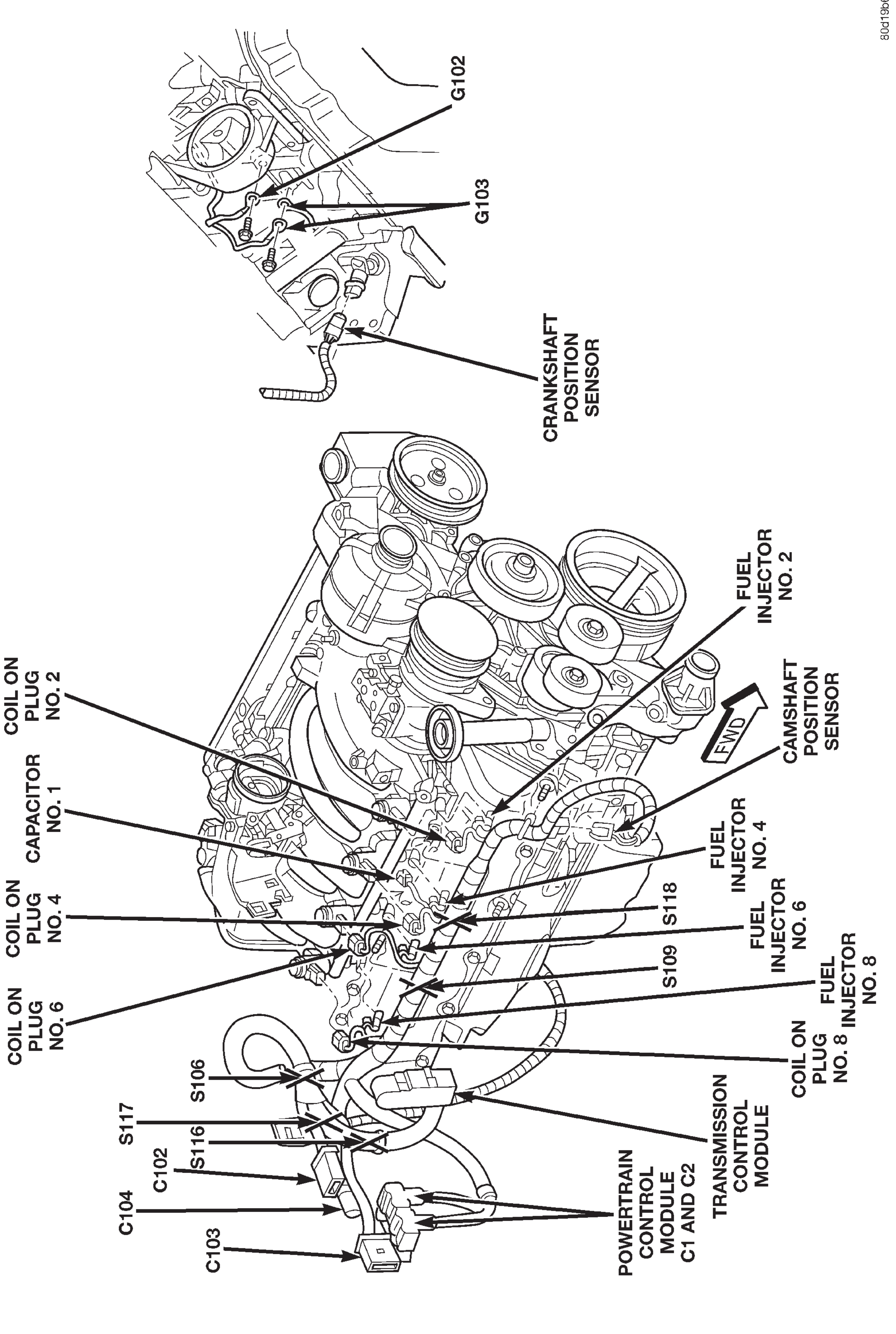


Fig. 14 4.7 LITER ENGINE RIGHT FRONT LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

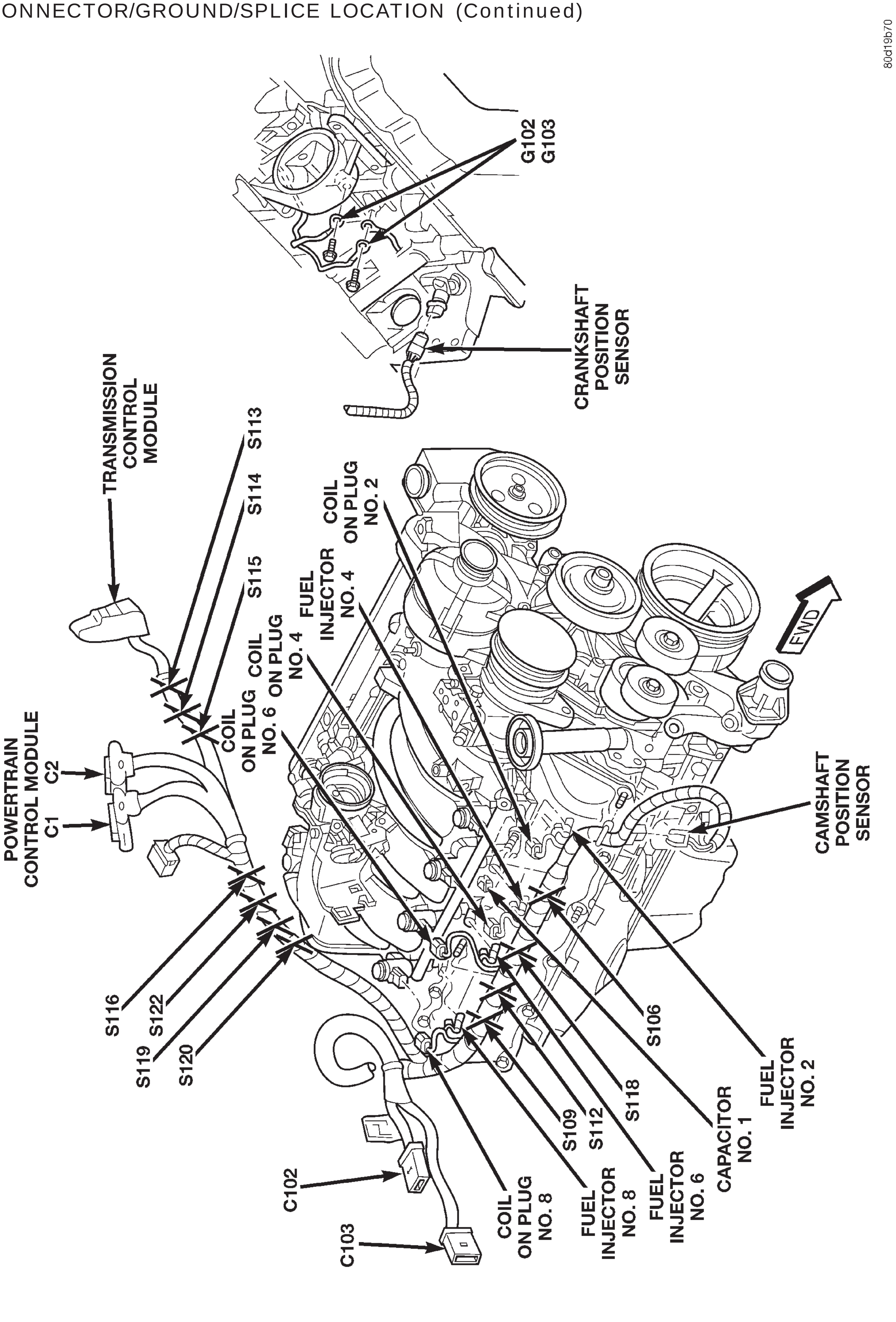


Fig. 15 4.7 LITER ENGINERIGHT FRONT RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

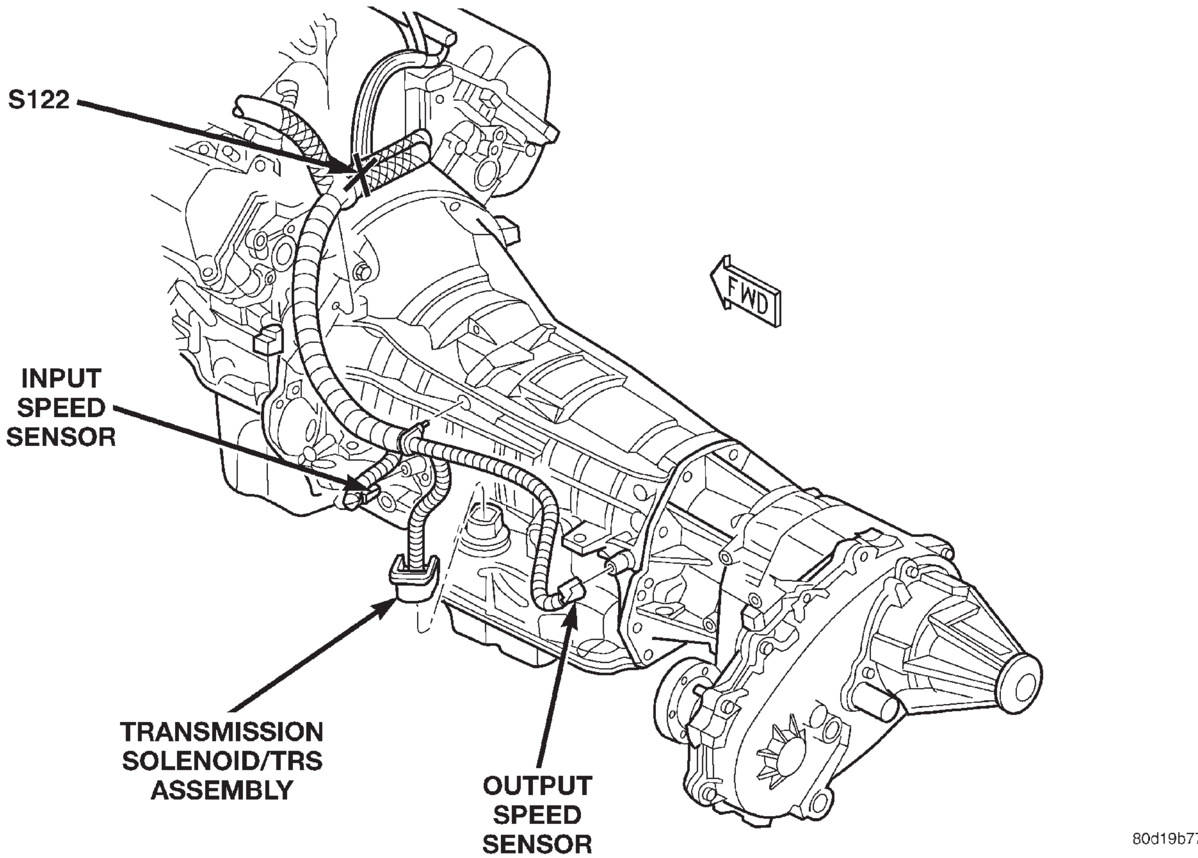


Fig. 16 TRANSMISSION 4.7 LITER ENGINE LEFT SIDE

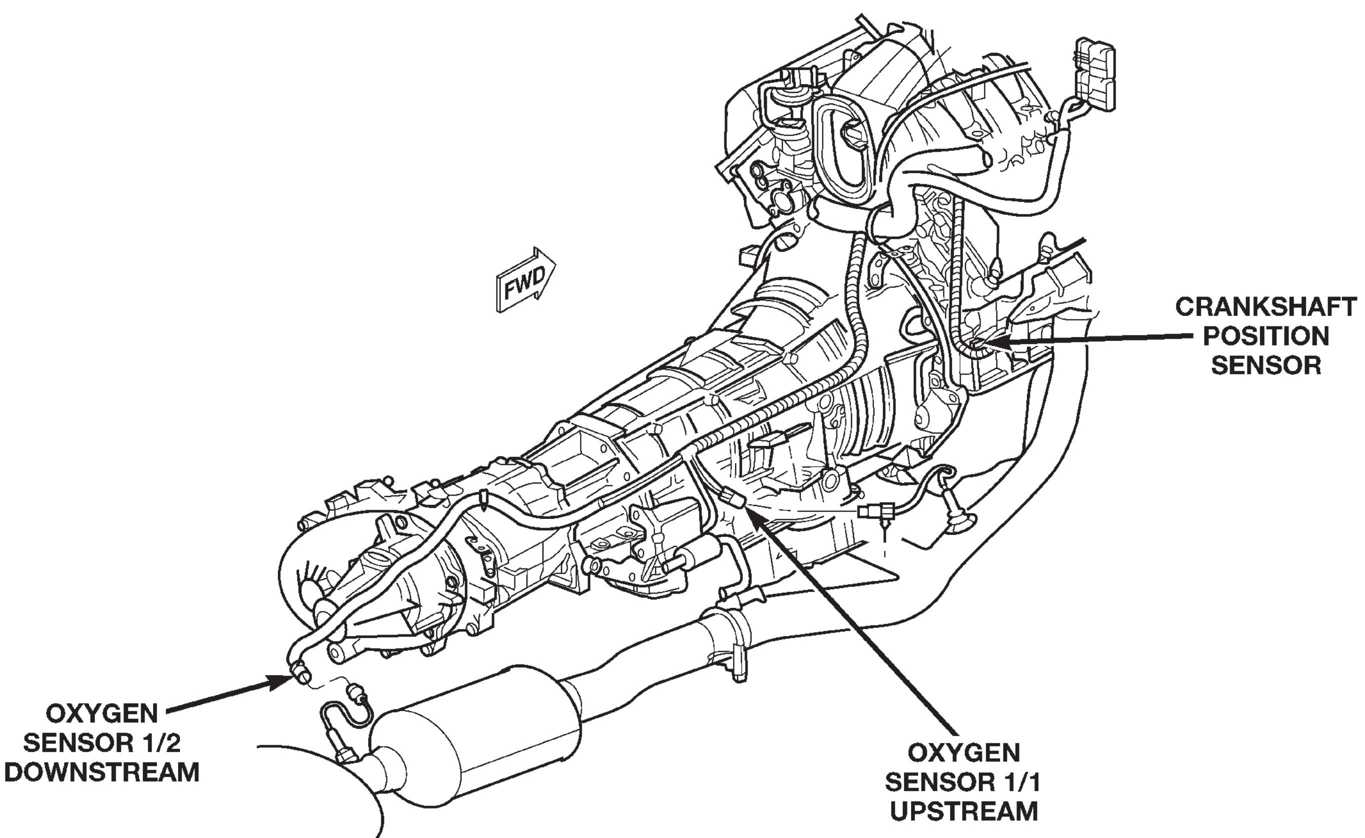


Fig. 17 TRANSMISSION 4.7 LITER ENGINE RIGHT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

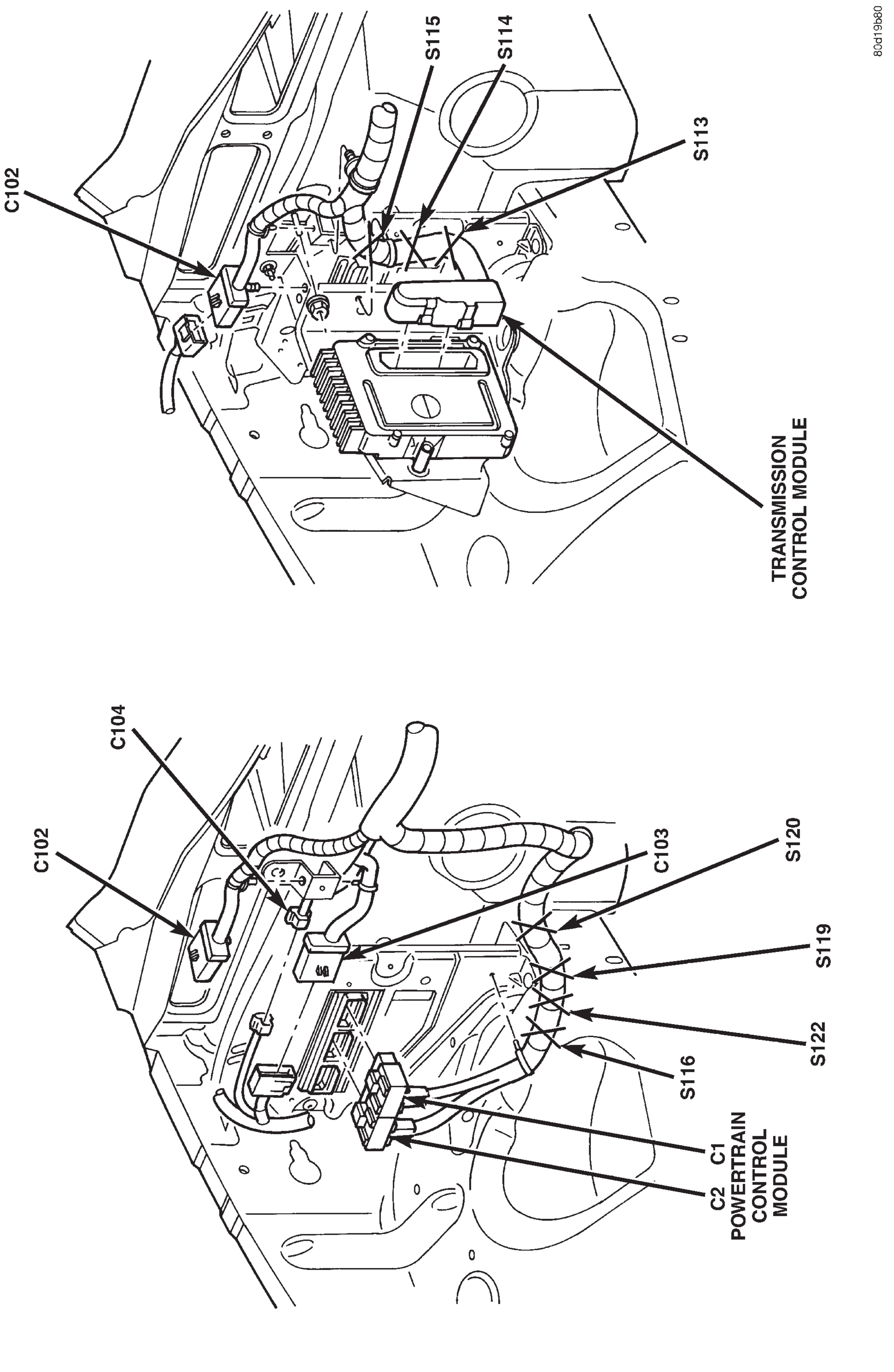


Fig. 18 REAR ENGINE COMPARTMENT LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

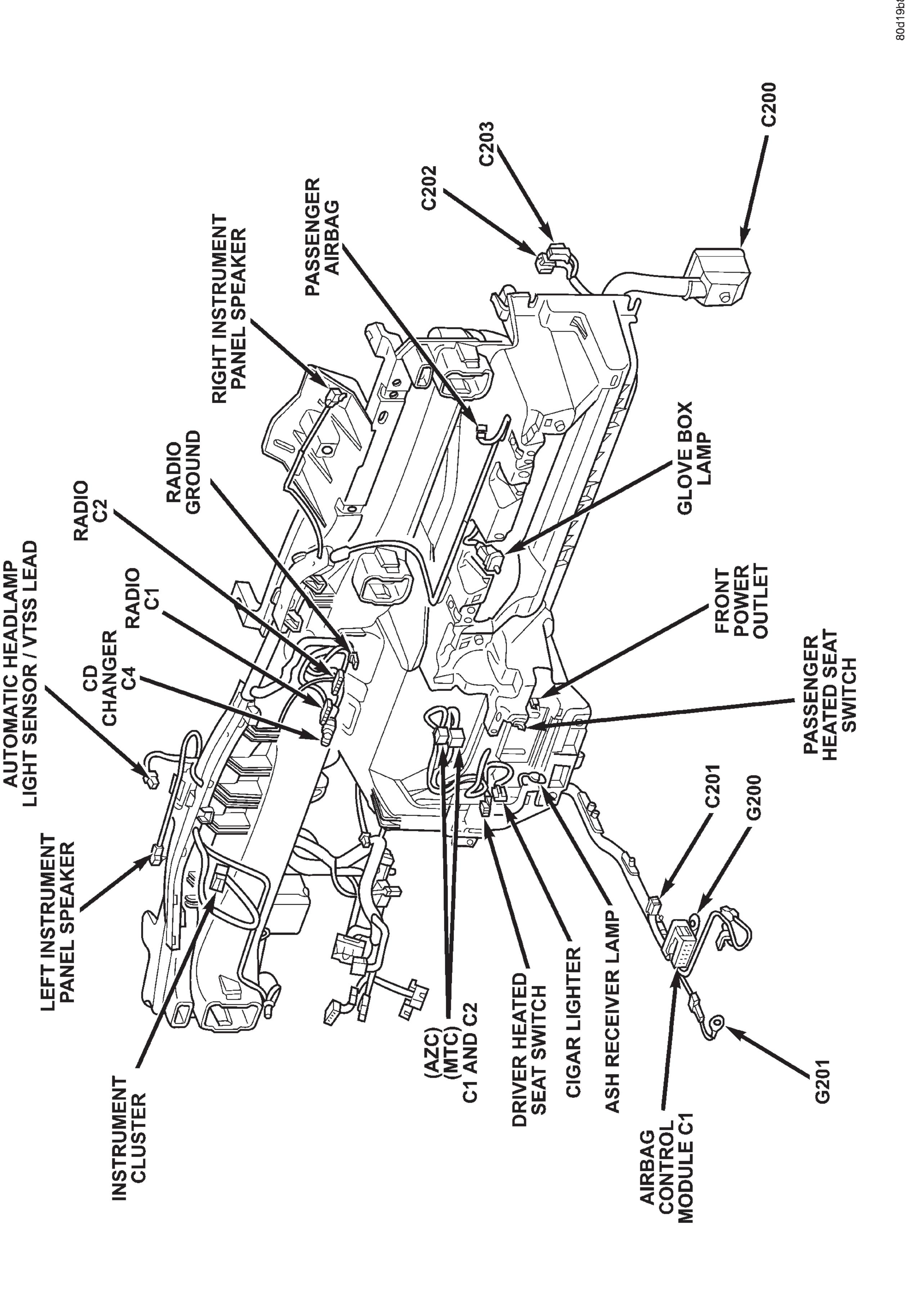


Fig. 19 INSTRUMENT PANEL FRONT LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

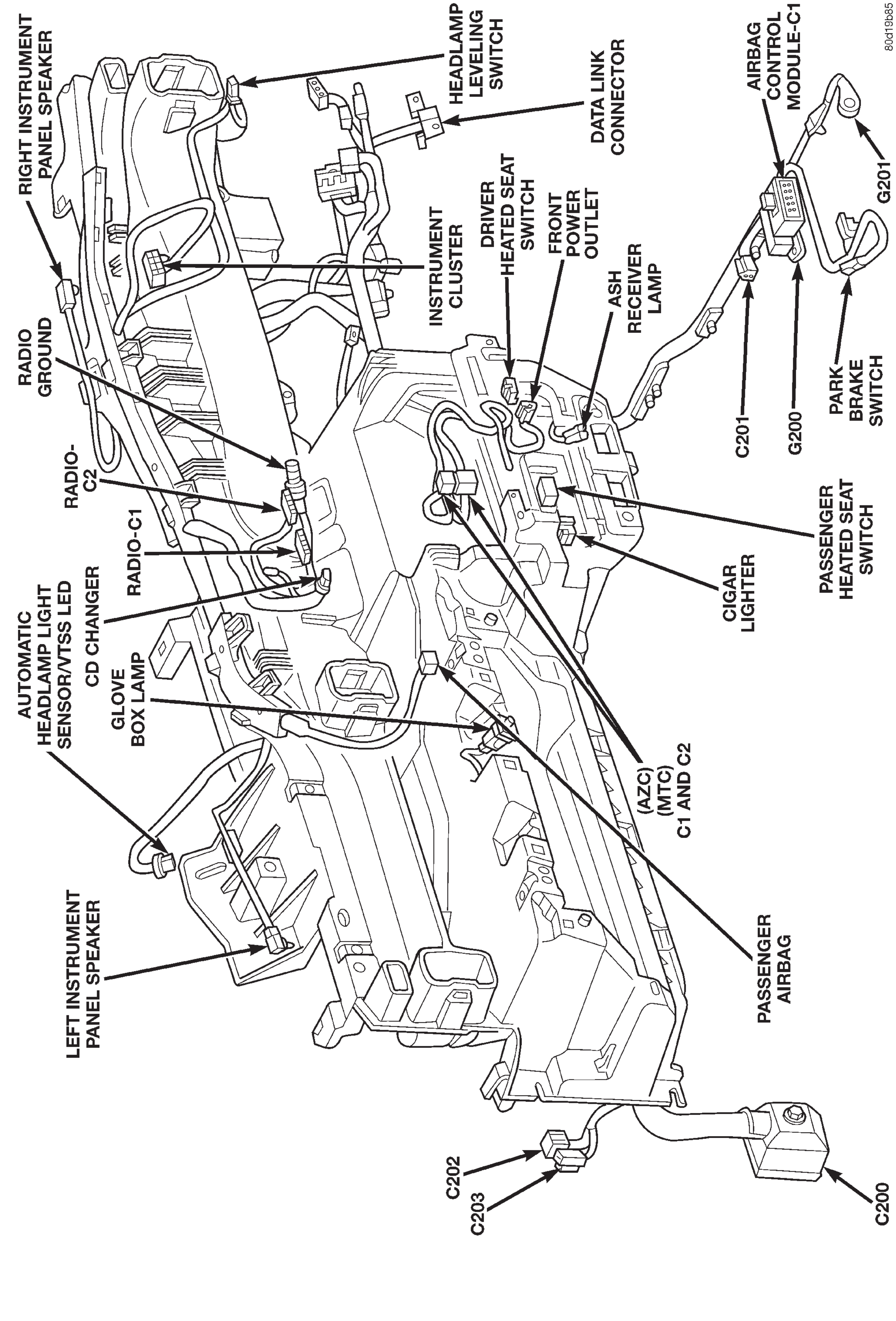


Fig. 20 INSTRUMENT PANEL FRONT RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

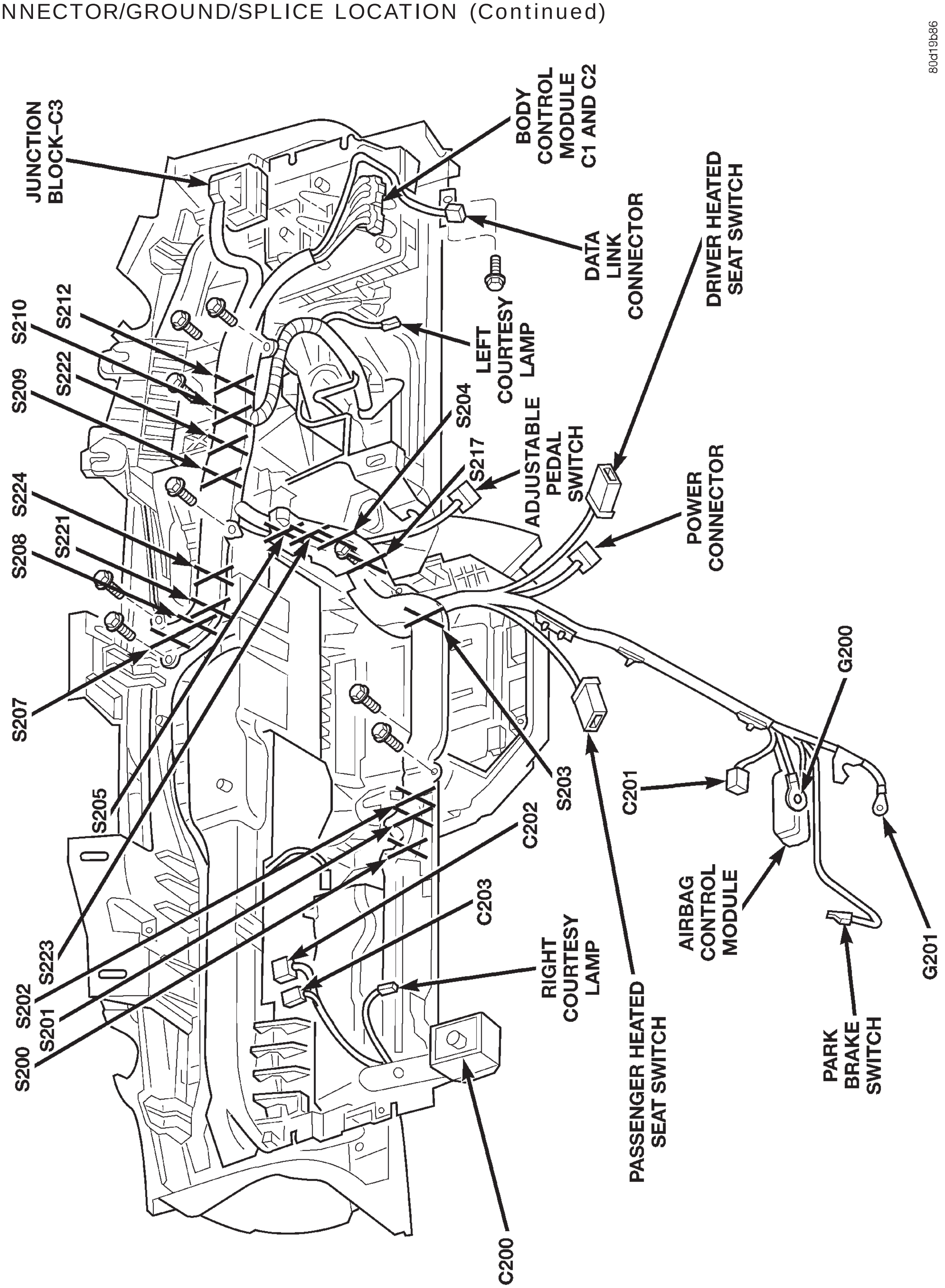


Fig. 21 INSTRUMENT PANEL REAR LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

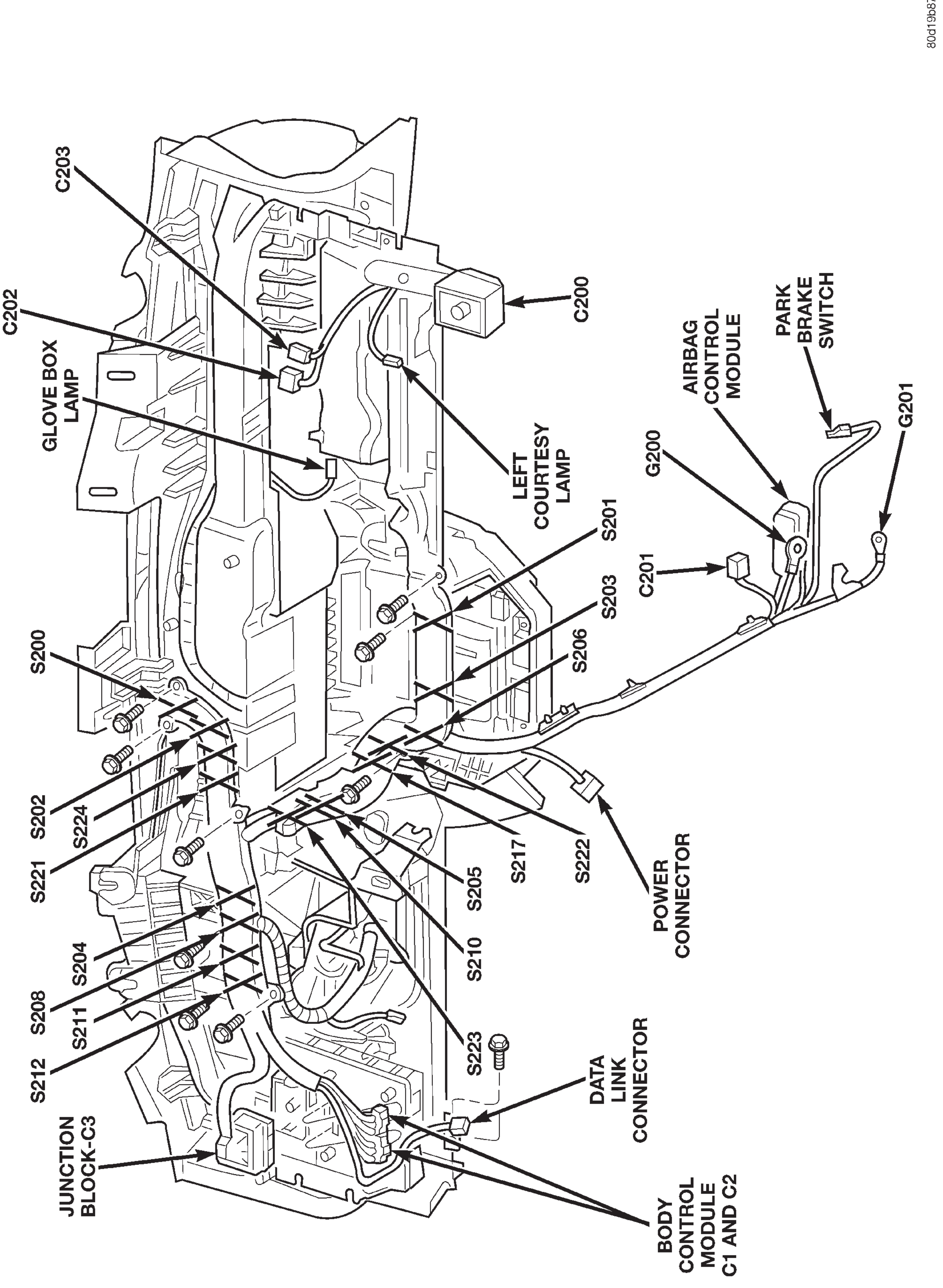


Fig. 22 INSTRUMENT PANEL REAR RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

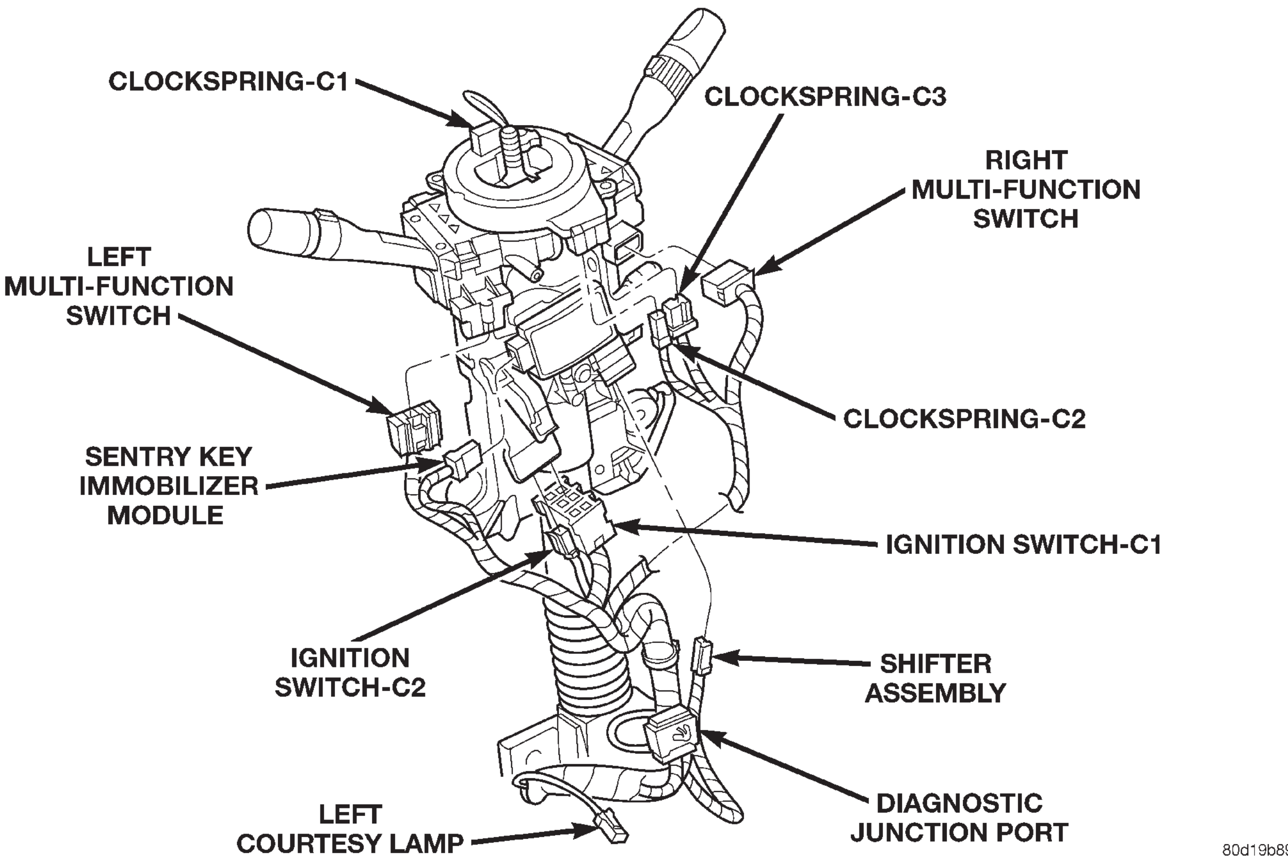


Fig. 23 STEERING COLUMN

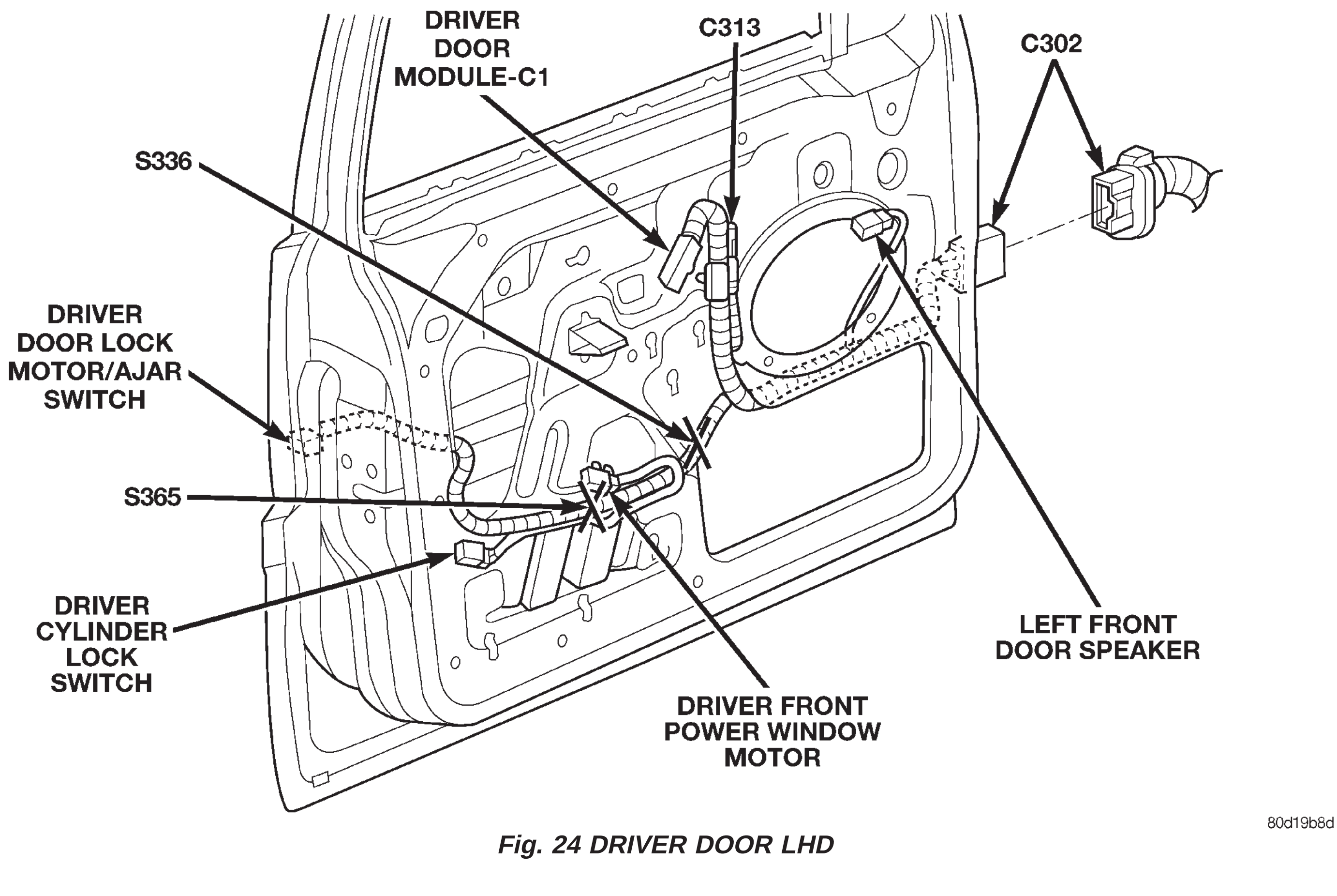


Fig. 24 DRIVER DOOR LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

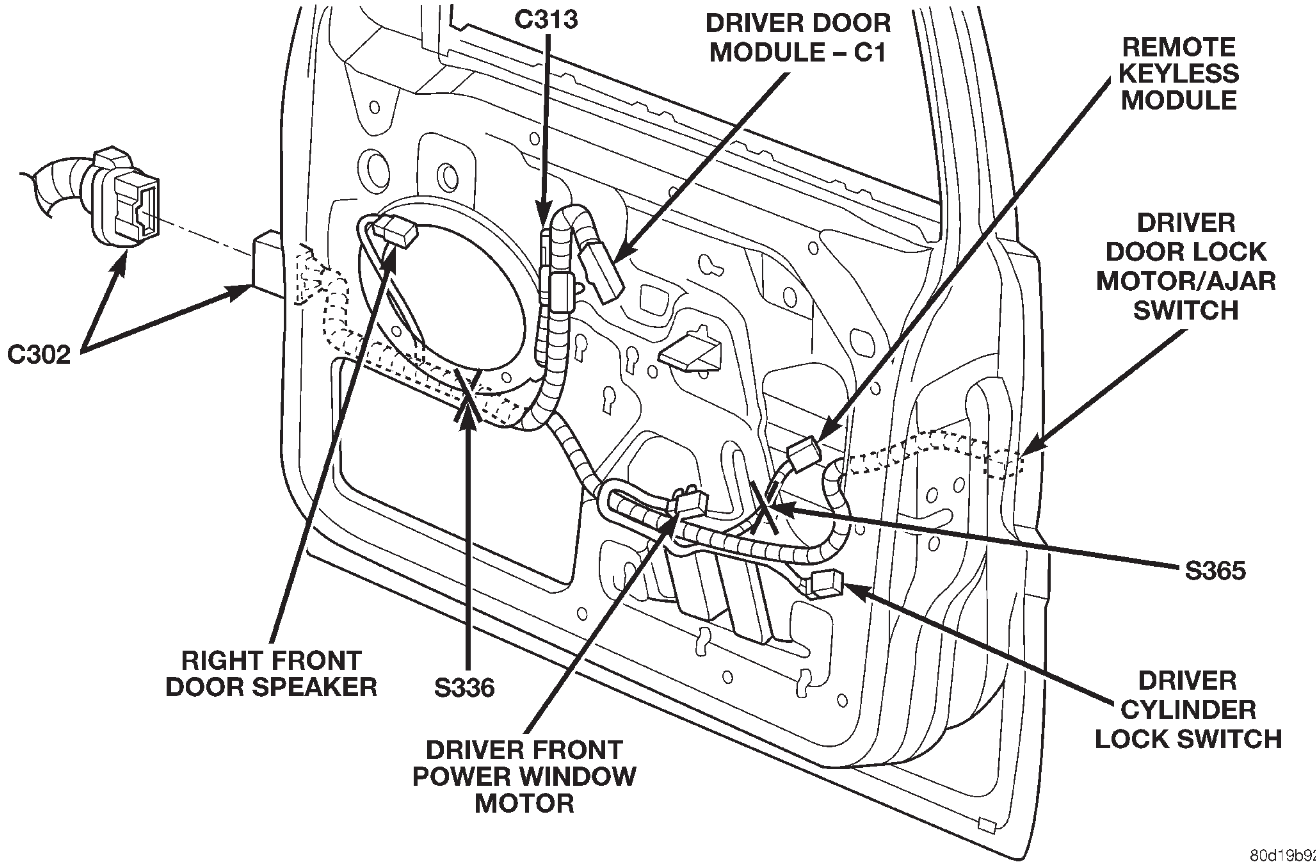


Fig. 25 DRIVER DOOR RHD

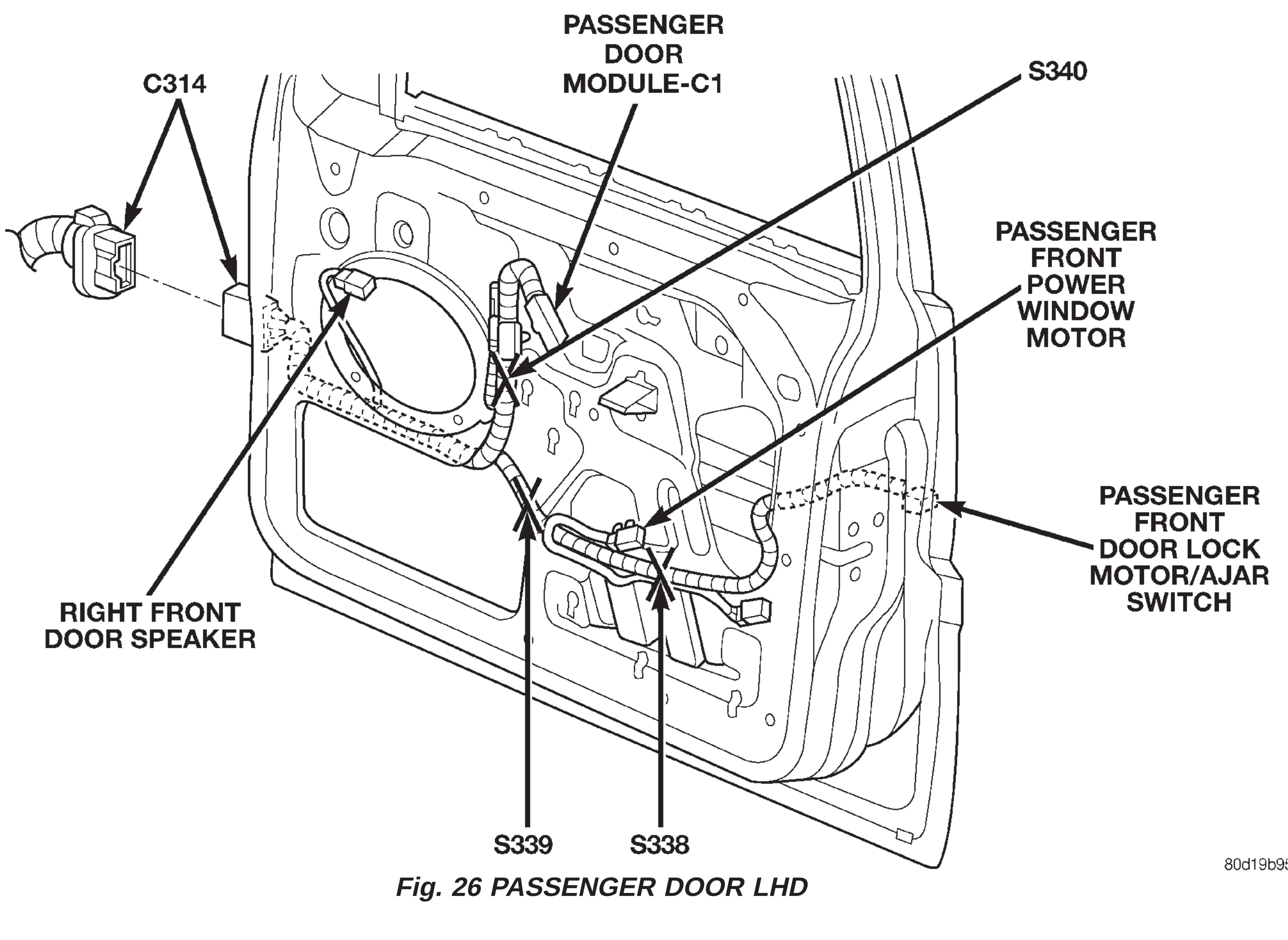


Fig. 26 PASSENGER DOOR LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

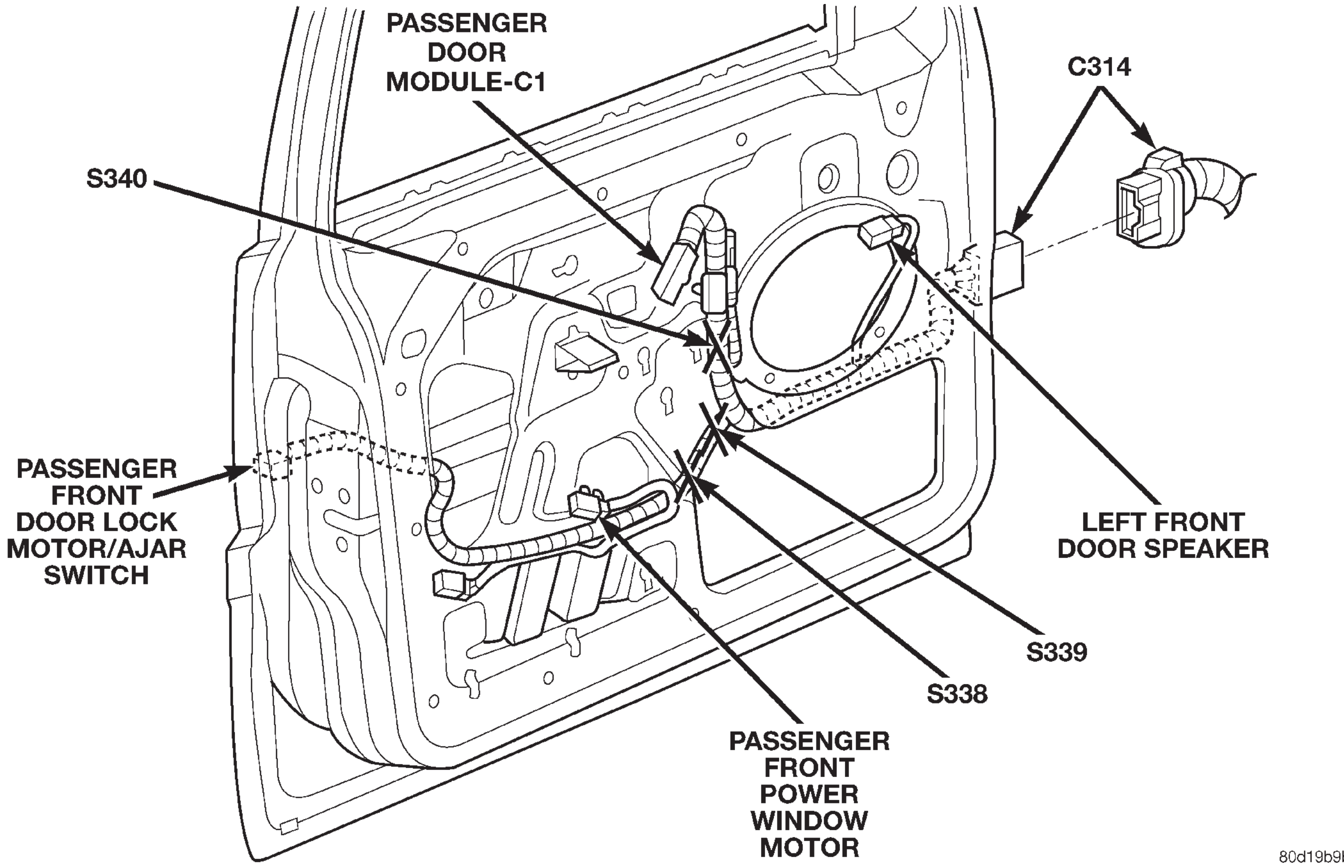


Fig. 27 PASSENGER DOOR RHD

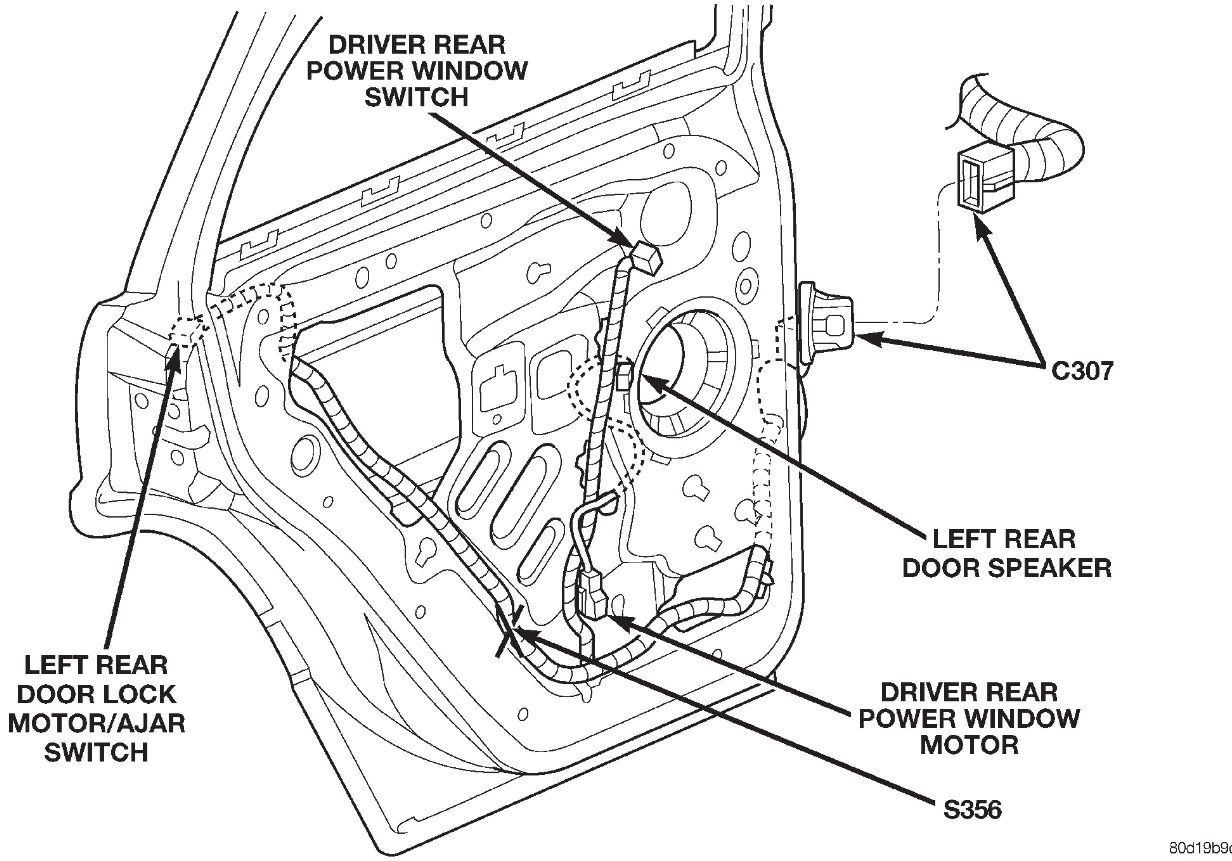


Fig. 28 LEFT REAR DOOR

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

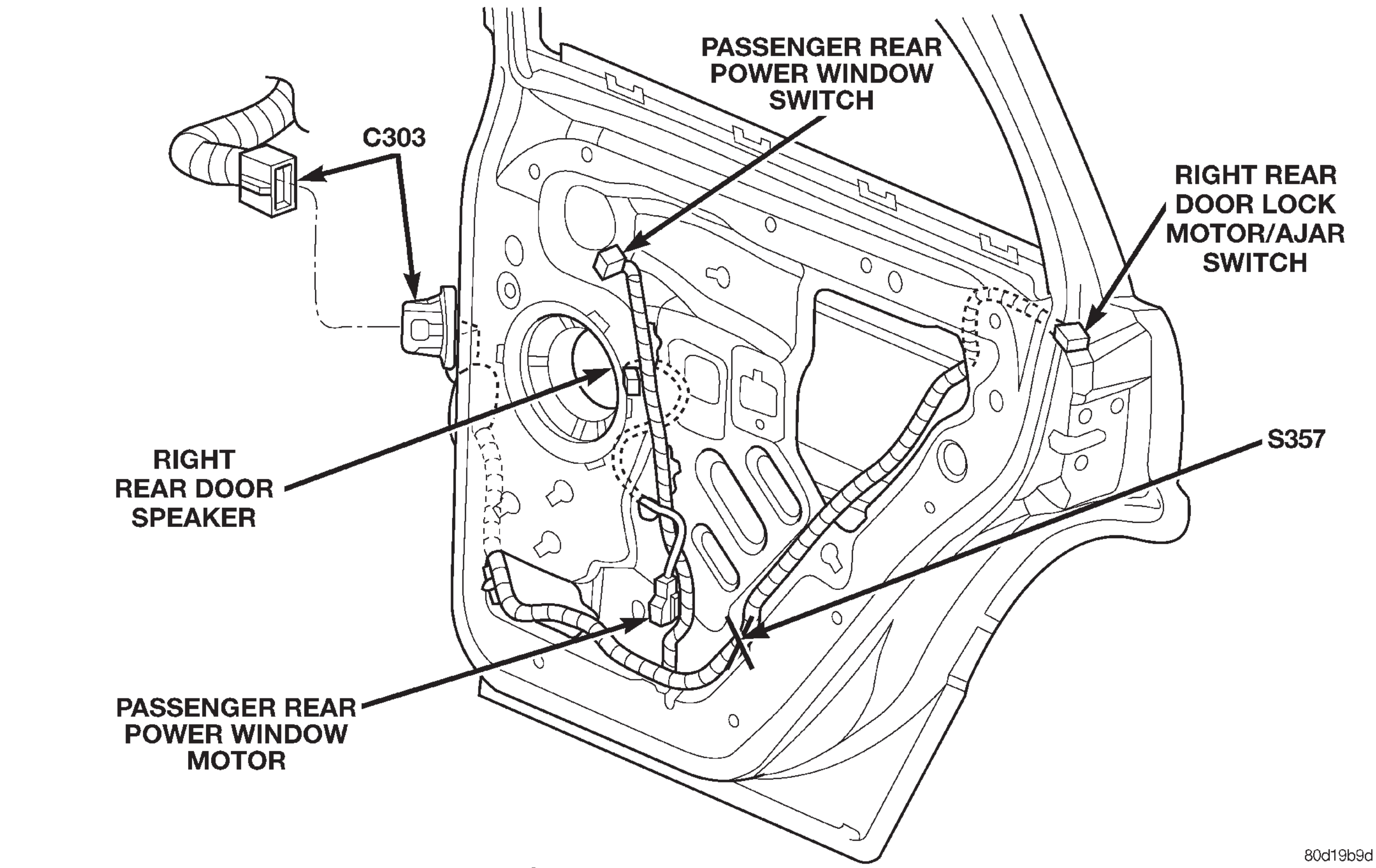


Fig. 29 RIGHT REAR DOOR

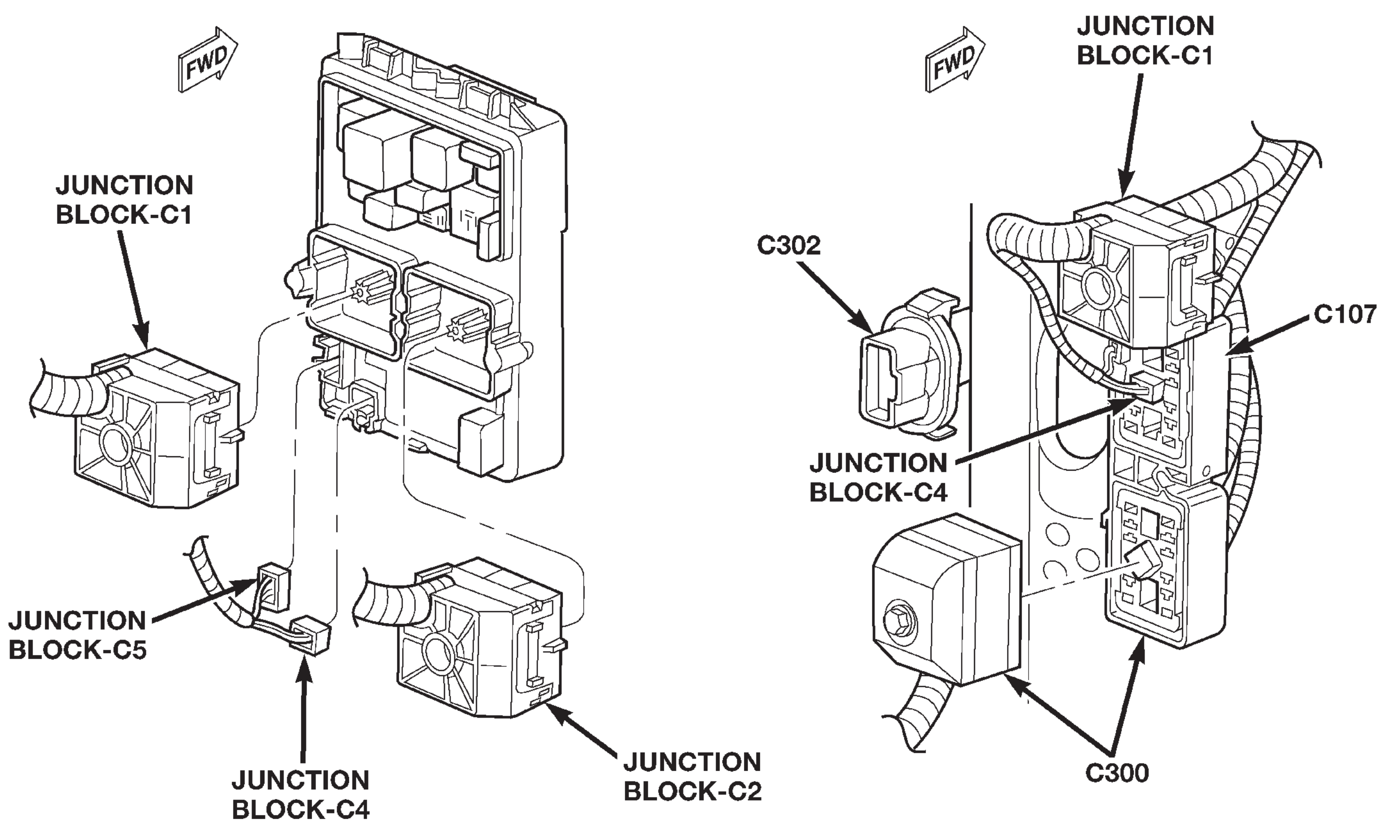


Fig. 30 KICK PANEL AREA LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

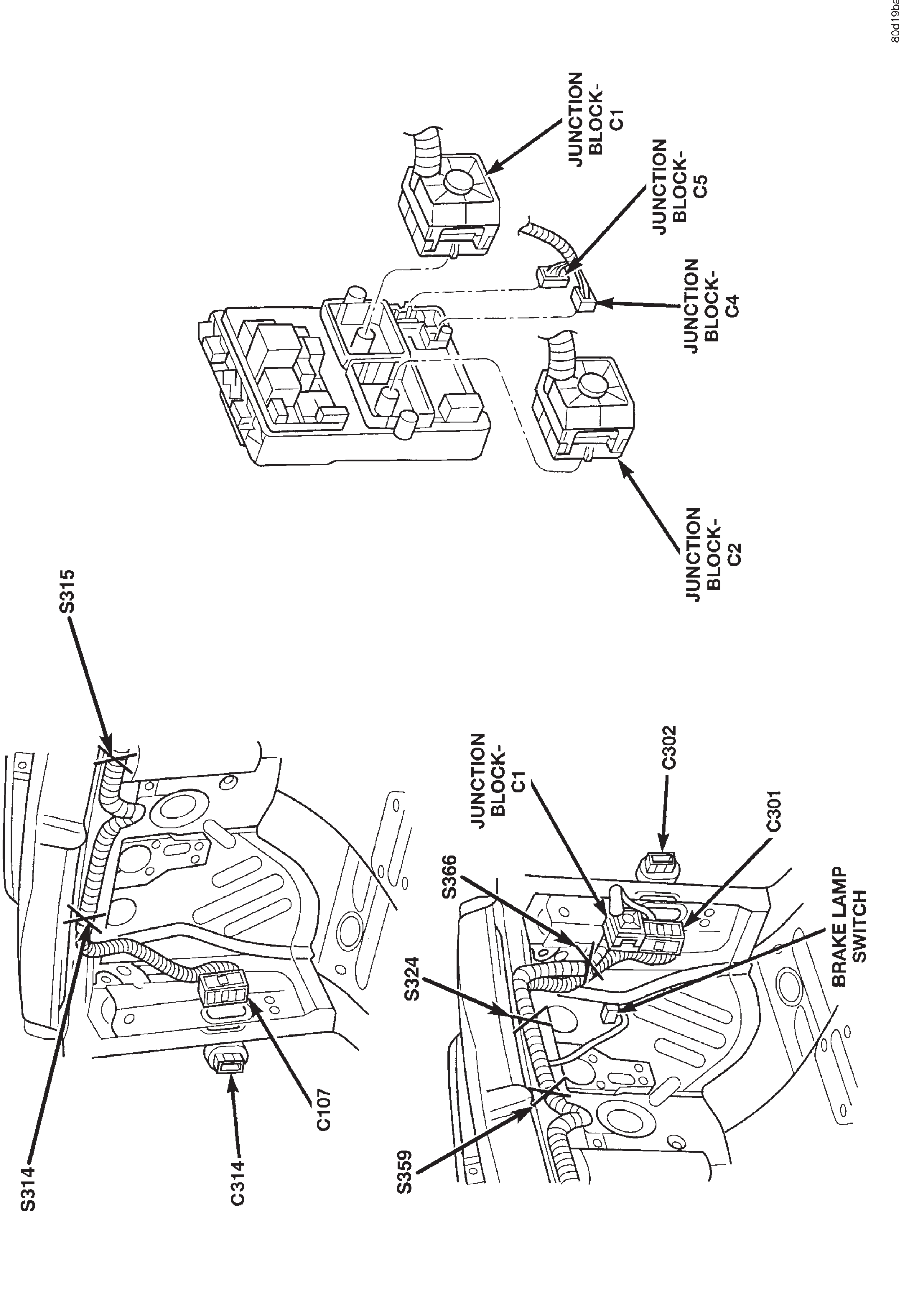


Fig. 31 KICK PANEL AREA RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

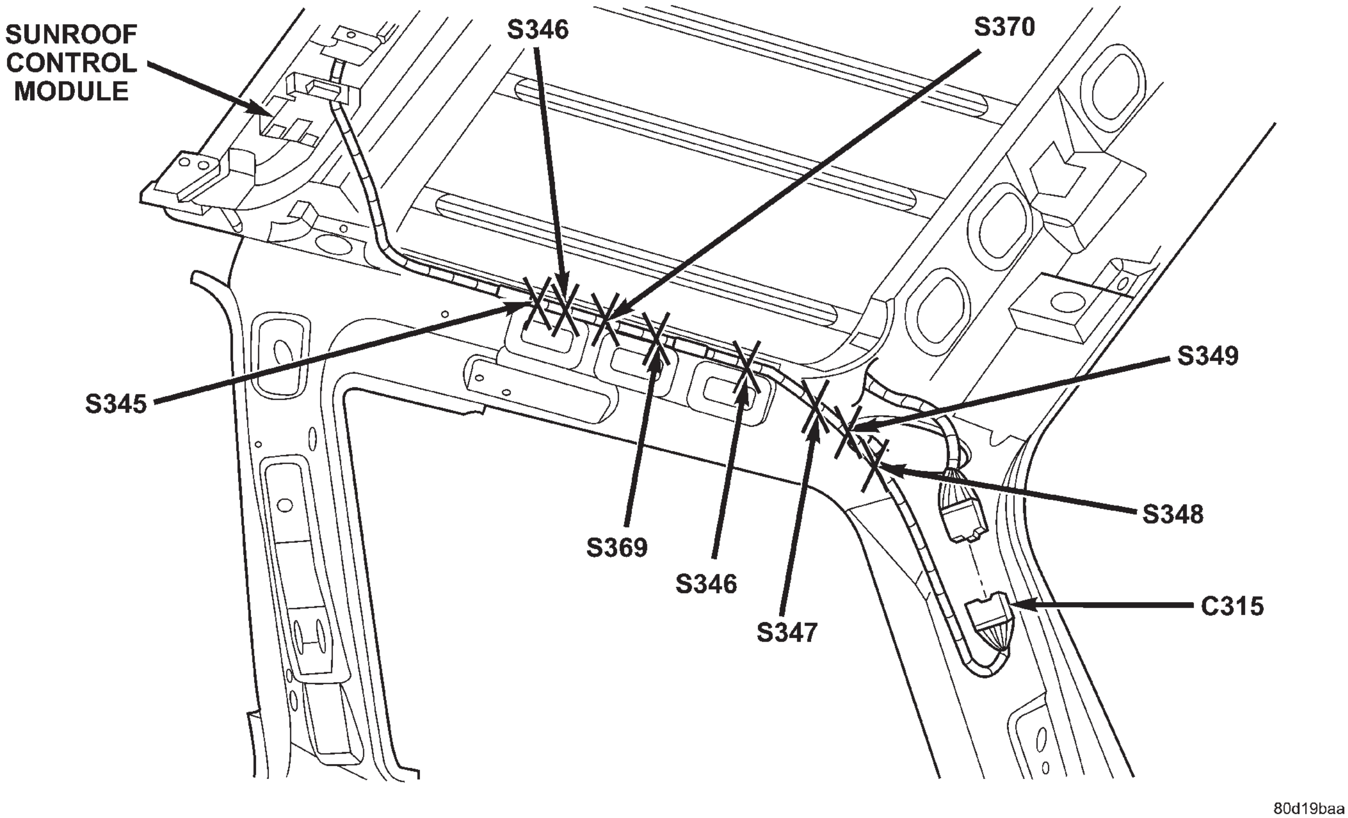


Fig. 32 ROOF AREA

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

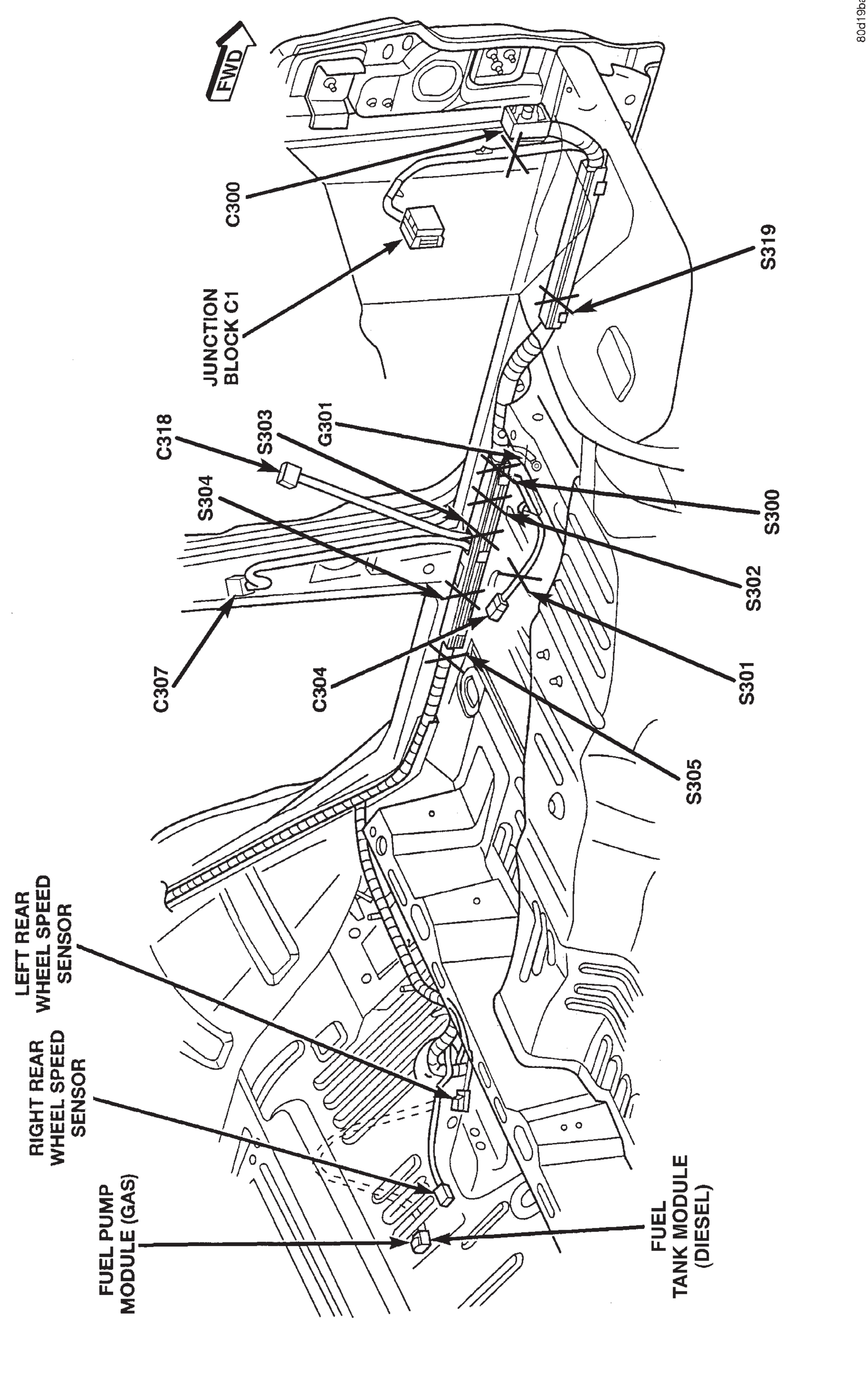


Fig. 33 BODY LEFT SIDE LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

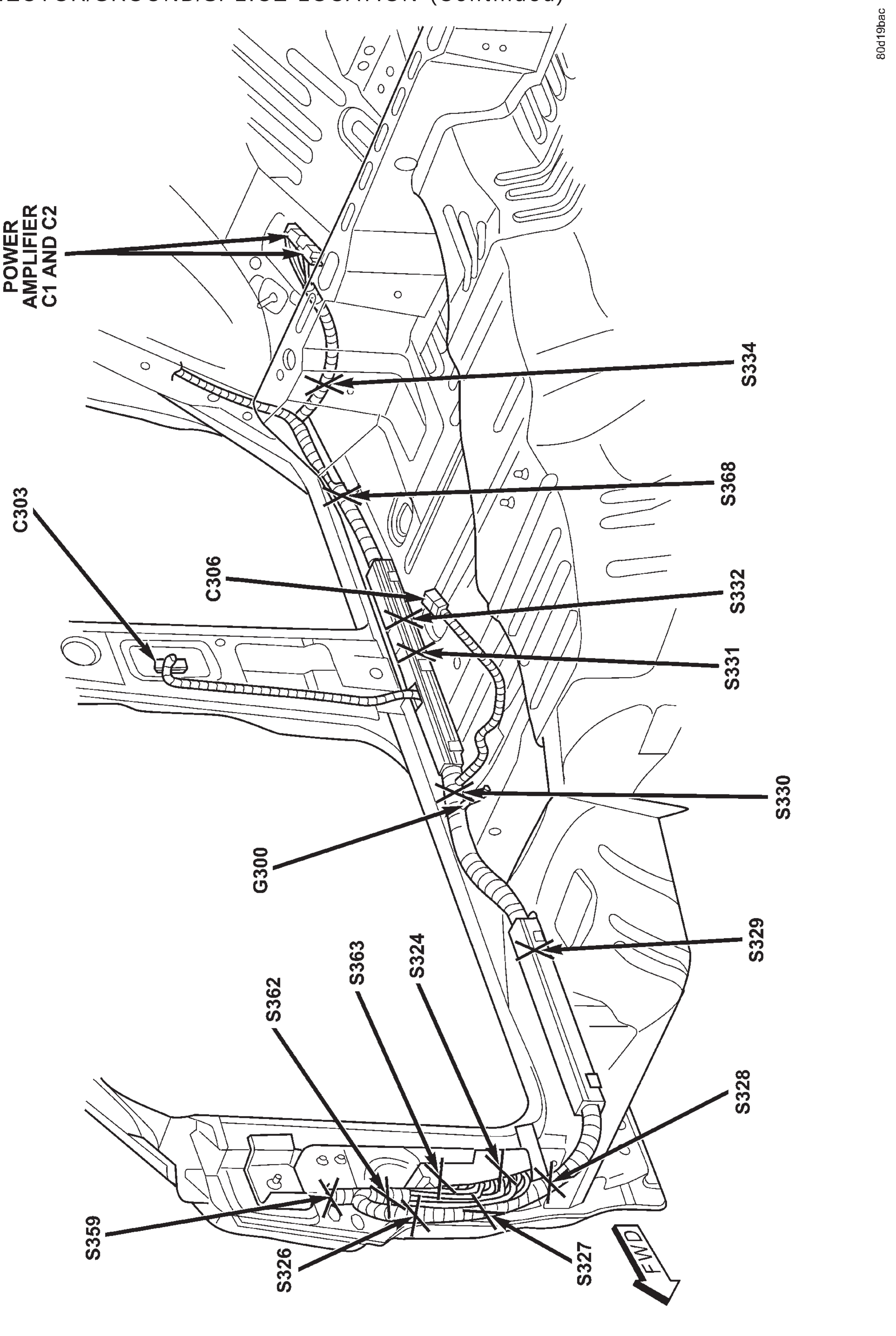


Fig. 34 BODY RIGHT SIDE LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

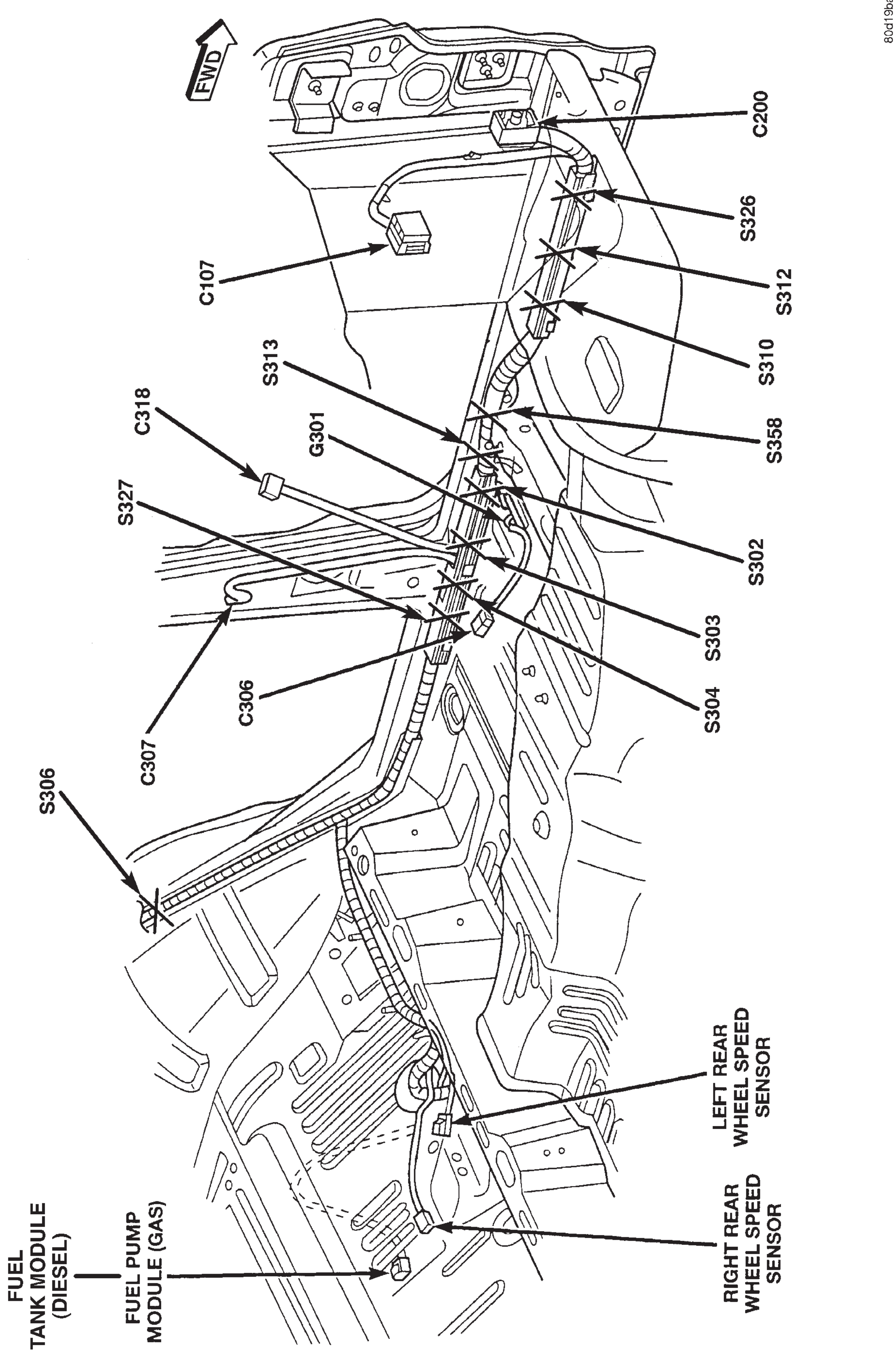


Fig. 35 BODY LEFT SIDE RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

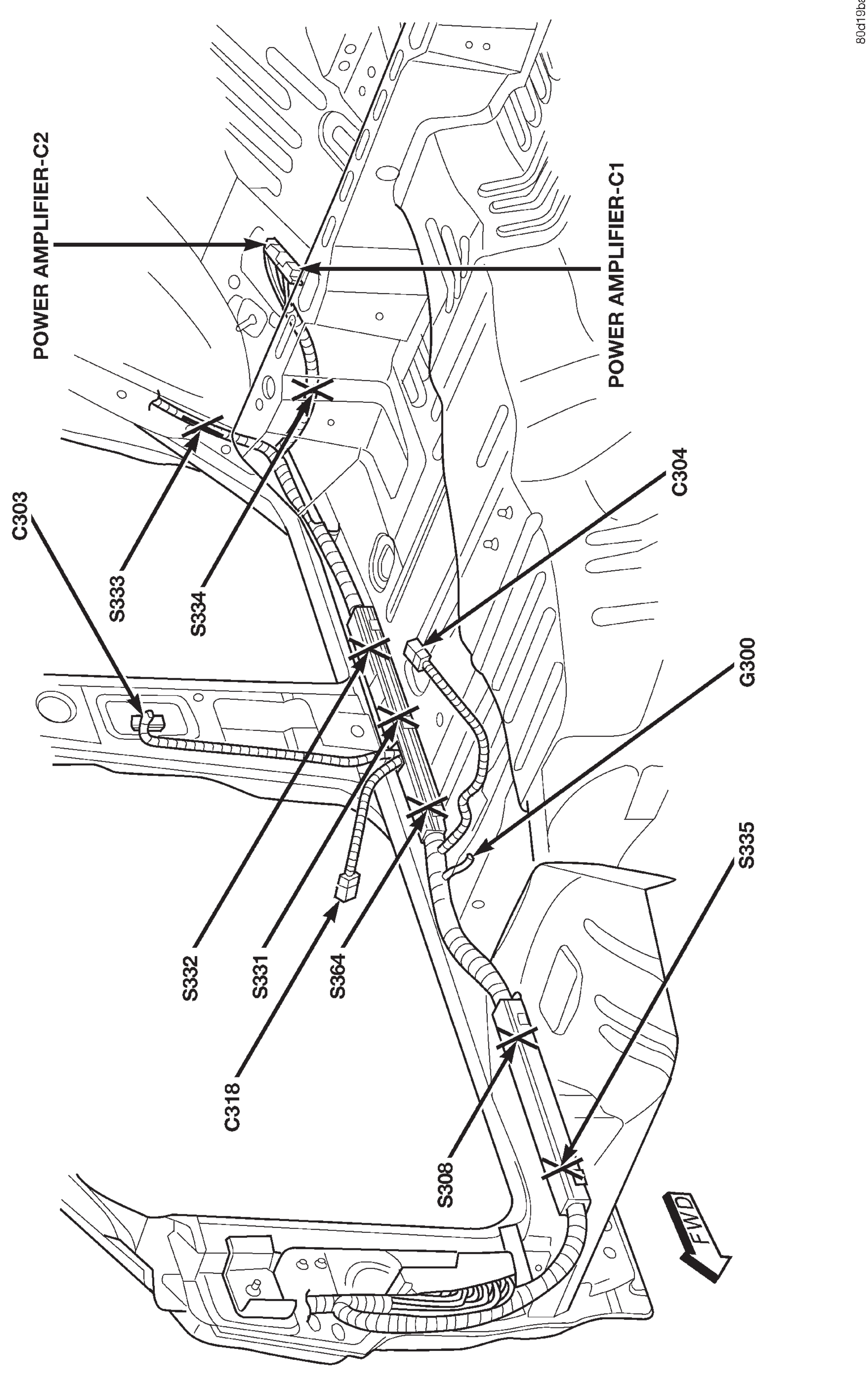


Fig. 36 BODY RIGHT SIDE RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

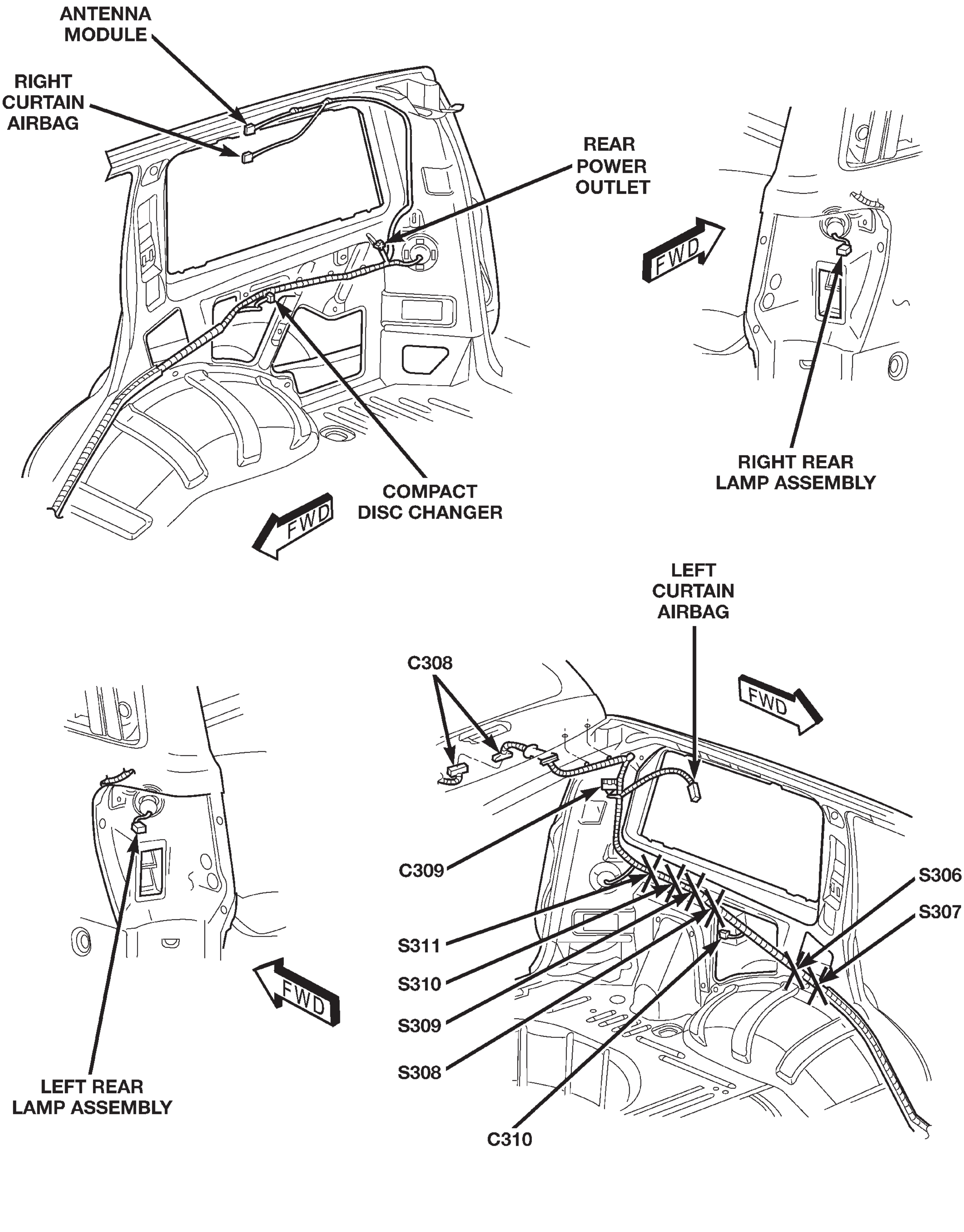


Fig. 37 BODY QUARTER PANELS

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

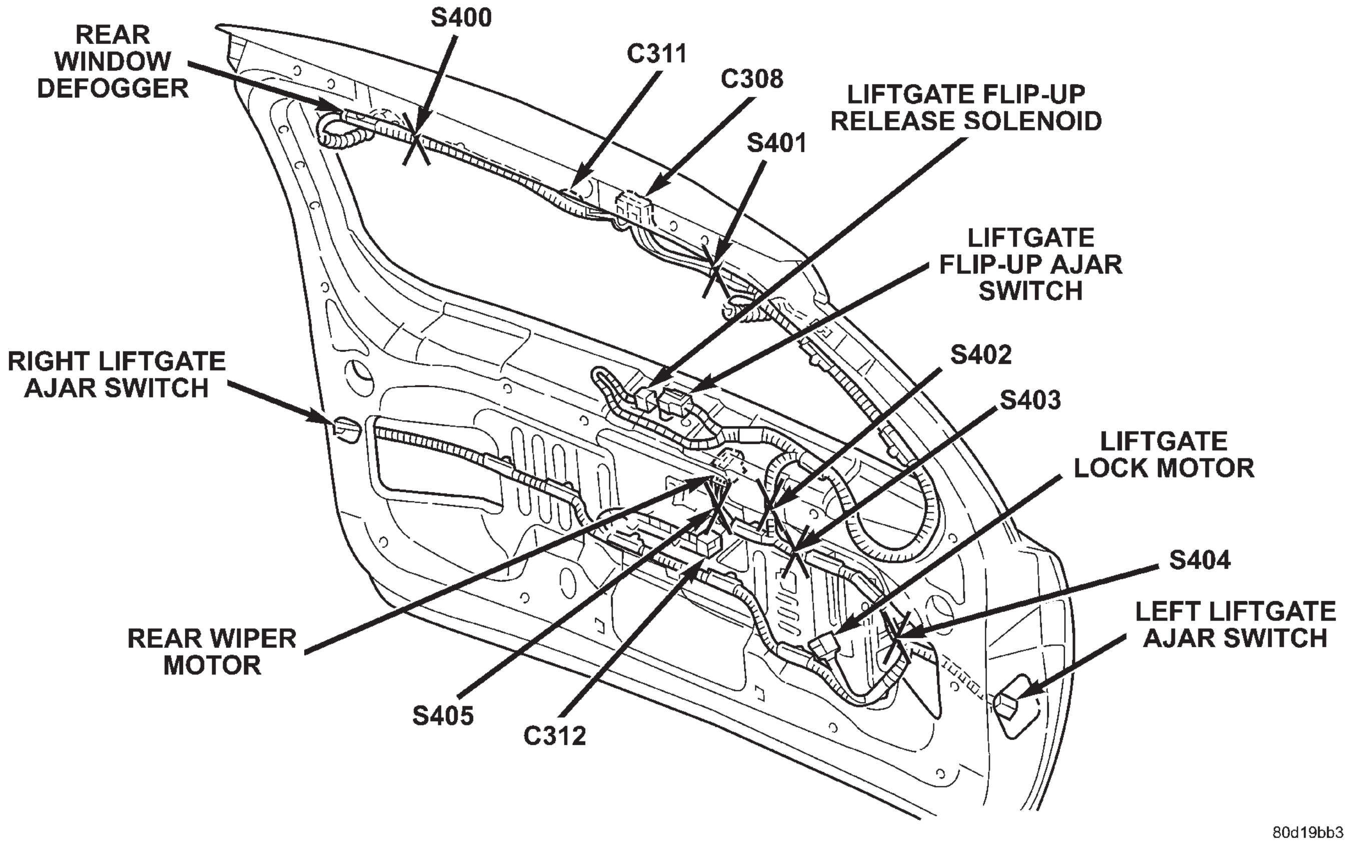


Fig. 38 LIFTGATE

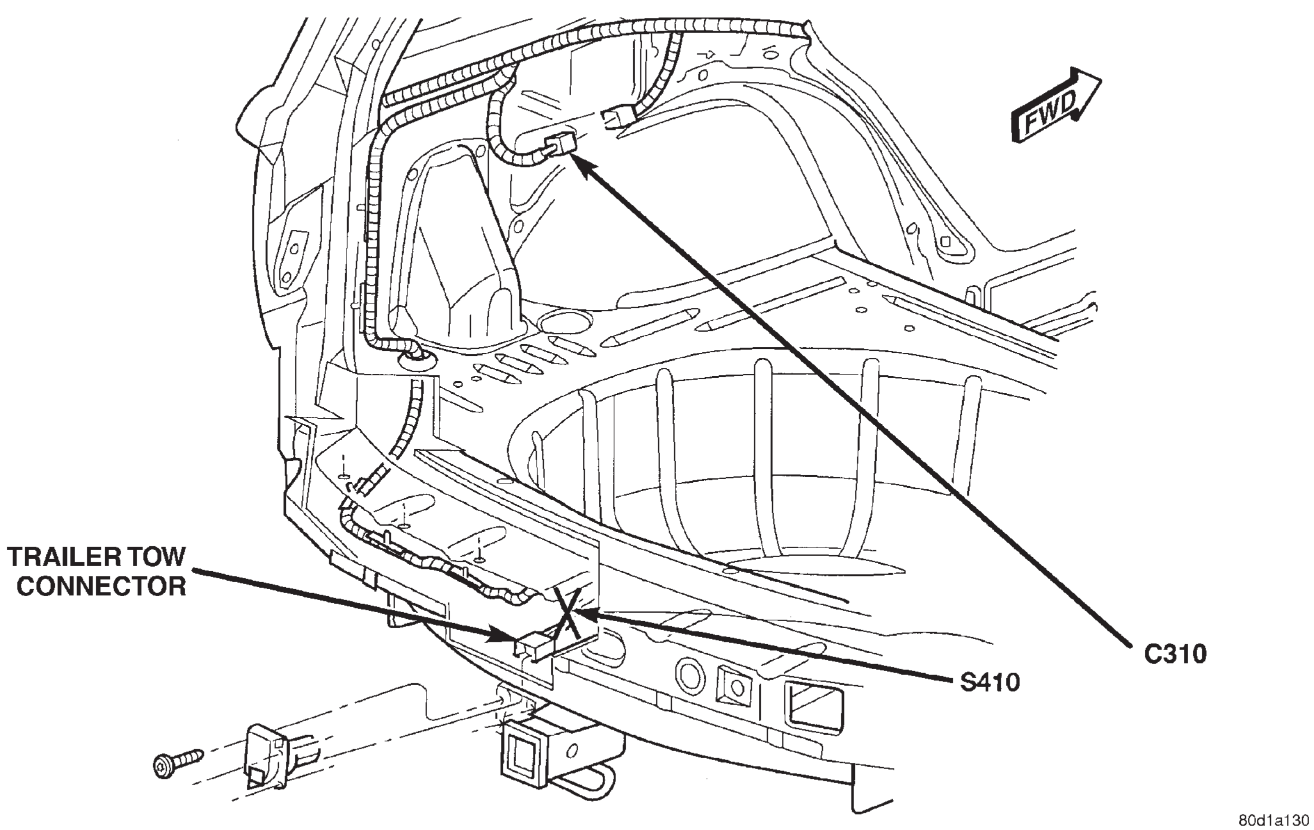


Fig. 39 TRAILER TOW

8W-97 POWER DISTRIBUTION

TABLE OF CONTENTS

POWER DISTRIBUTION

DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Junction Block (JB)
- Power Outlets

The power distribution system also incorporates various types of circuit control and protection features, including:

- Automatic resetting circuit breakers
- Blade-type fuses
- Bus bars
- Cartridge fuses
- Circuit splice blocks
- Flashers
- Fusible links
- Standard and Micro-Relays

Following are general descriptions of the major components in the power distribution system. See the owner's manual in the vehicle glove box for more information on the features and use of all of the power distribution system components. Refer to Wiring Diagrams for complete circuit diagrams.

OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the standard and optional factory-installed electrical and electronic powertrain, chassis, safety, security, comfort and convenience systems. At

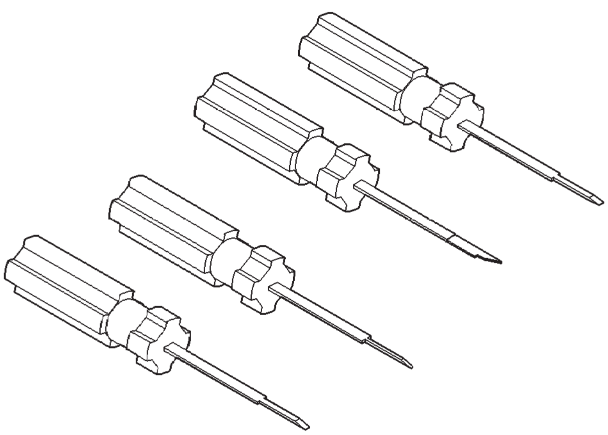
POWER DISTRIBUTION (Continued)

the same time, the power distribution system was designed to provide ready access to these electrical distribution points for the vehicle technician to use when conducting diagnosis and repair of faulty circuits. The power distribution system can also prove useful for the sourcing of additional electrical circuits that may be required to provide the electrical current needed to operate accessories that the vehicle owner may choose to have installed in the aftermarket.

NOTE: DO NOT ATTEMPT TO SWAP POWER DISTRIBUTION CENTERS FROM ONE VEHICLE TO ANOTHER. MOST OF THESE ASSEMBLIES ARE VEHICLE FEATURE SPECIFIC AND THEREFORE NOT INTERCHANGEABLE. ALWAYS USE THE CORRECT PART NUMBERED ASSEMBLY WHEN DIAGNOSING OR REPLACING A POWER DISTRIBUTION CENTER.

SPECIAL TOOLS

POWER DISTRIBUTION SYSTEMS



Terminal Pick Kit 6680

CIGAR LIGHTER OUTLET

DESCRIPTION

A cigar lighter outlet is standard equipment on this model. On models equipped with the optional Smoker's Package, the cigar lighter knob and heating element are included. On models without the Smoker's Package, the cigar lighter outlet is equipped with a snap fit plastic cap and is treated as an extra accessory power outlet. The cigar lighter outlet is installed in the instrument panel center lower bezel, which is located near the bottom of the instrument panel center stack area, below the heater and air conditioner controls. The cigar lighter outlet is secured by a snap fit within the center lower bezel.

The cigar lighter outlet, plastic cap and the knob and heating element unit are available for service replacement. These components cannot be repaired and, if faulty or damaged, they must be replaced.

OPERATION

The cigar lighter consists of two major components: a knob and heating element unit, and the cigar lighter base or outlet shell. The receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The cigar lighter receives battery voltage from a fuse in the junction block when the ignition switch is in the Accessory or On positions.

The cigar lighter knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the outlet shell, the heating element resistor coil is grounded through its housing to the outlet shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the outlet shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the outlet shell. These clips engage and hold the heating element against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the outlet shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

DIAGNOSIS AND TESTING - CIGAR LIGHTER OUTLET

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in Wiring Diagrams.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused B(+) fuse in

CIGAR LIGHTER OUTLET (Continued)

the junction block. If OK, go to Step 3. If not OK, repair the open or short as required.

(3) Remove the cigar lighter knob and element from the cigar lighter outlet shell. Check for continuity between the inside circumference of the cigar lighter outlet shell and a good ground. there should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Turn the ignition switch to the On position. Check for battery voltage at the insulated contact located at the back of the cigar lighter outlet shell. If OK, replace the faulty cigar lighter knob and element. If not OK, go to Step 5.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument panel center lower bezel. Check for continuity between the ground circuit cavity of the cigar lighter wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Turn the ignition switch to the Accessory or On positions. Check for battery voltage at the fused B(+) circuit cavity of the cigar lighter wire harness connector. If OK, replace the faulty cigar lighter outlet. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

CIGAR LIGHTER OUTLET DOOR SPRING

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the instrument panel center lower bezel from the I.P. Refer to Body for the procedure.

(3) Remove the cigar lighter outlet door spring from its locating holes (Fig. 1).

INSTALLATION

(1) Install the cigar outlet door spring in its locating holes.

(2) Install the instrument panel center lower bezel on the I.P. Refer to Body for the procedure.

(3) Connect the negative battery cable.

IOD FUSE

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse (Fig. 2) that is removed from its cavity in the Power Distribution Center (PDC) when the vehicle is shipped from the factory. Dealer personnel are to remove the IOD fuse from the storage location and install it into PDC fuse cavity 15 as part

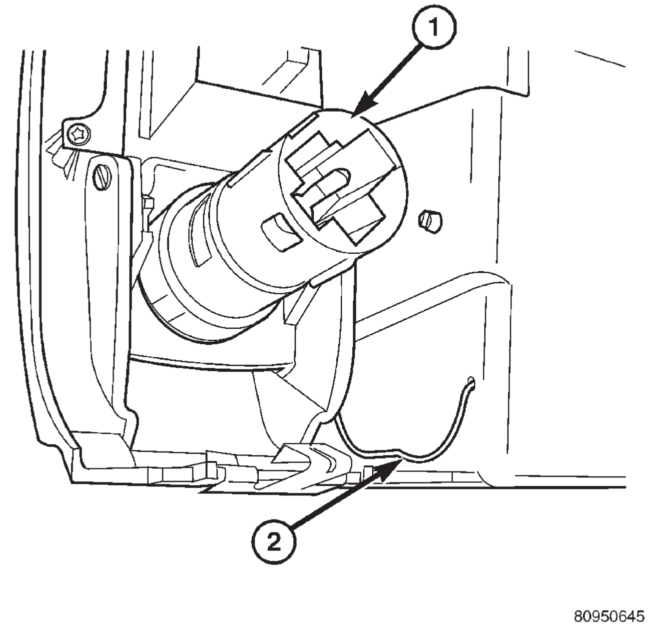


Fig. 1 Cigar Lighter Outlet Door Spring

1 - CIGAR LIGHTER OUTLET
2 - CIGAR LIGHTER OUTLET DOOR SPRING

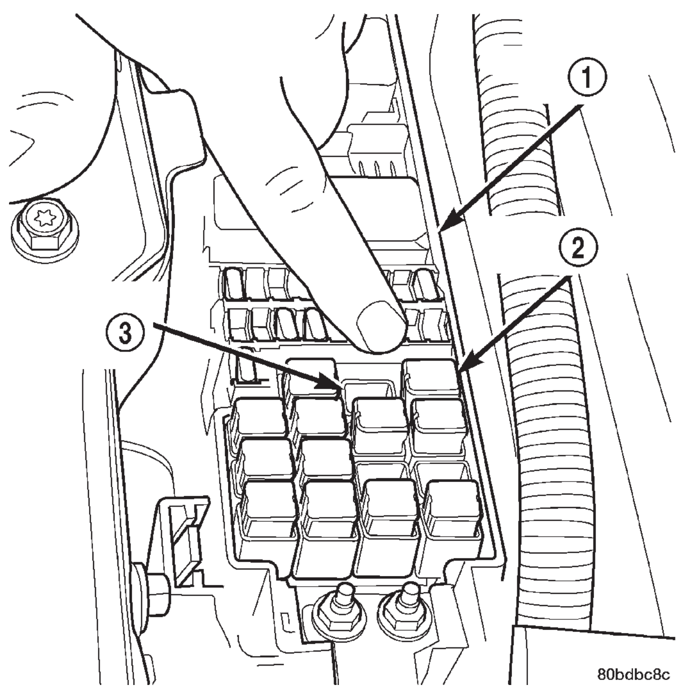


Fig. 2 Ignition-Off Draw Fuse

1 - POWER DISTRIBUTION CENTER
2 - IGNITION-OFF DRAW FUSE
3 - IOD FUSE STORAGE CAVITY

IOD FUSE (Continued)

of the preparation procedures performed just prior to new vehicle delivery.

The PDC has a molded plastic cover that can be removed to provide service access to all of the fuses and relays in the PDC. An integral latch and hinges are molded into the PDC cover for easy removal. A fuse layout map is integral to the underside of the PDC cover to ensure proper fuse and relay identification. The IOD fuse is a 50 ampere maxi-type cartridge fuse and, when removed, it is stored in a spare fuse cavity within the PDC.

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position, including the clock. The only reason the IOD fuse is removed is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed by both vehicle transportation company and dealer personnel.

The IOD fuse is removed from PDC fuse cavity 15 when the vehicle is shipped from the assembly plant. Dealer personnel must install the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse becomes transparent and the fuse that has been assigned the IOD designation becomes only another Fused B(+) circuit fuse. The IOD fuse serves no useful purpose to the dealer technician in the service or diagnosis of any vehicle system or condition, other than the same purpose as that of any other standard circuit protection device.

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that removing the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged. Refer to **Battery System** for additional service information.

REMOVAL

The Ignition-Off Draw (IOD) fuses normal installation location is cavity 15 in the power distribution center. When the vehicle is shipped from the assembly plant the fuse is removed to maintain proper battery voltage during vehicle storage (in some cases). Dealer personnel must install the IOD fuse when the vehicle is being prepared for customer delivery in order to restore full electrical system operation.

(1) Turn the ignition switch to the Off position.

(2) Unlatch and open the cover of the power distribution center.

(3) Remove the IOD fuse from fuse **cavity 15** of the power distribution center (Fig. 2).

(4) Store the removed IOD fuse by installing it in the unused fuse storage **cavity 11** of the PDC (Fig. 2).

(5) Close and latch the power distribution center cover.

INSTALLATION

(1) Be certain the ignition switch is in the Off position.

(2) Unlatch and open the cover of the power distribution center.

(3) Remove the stored IOD fuse from fuse storage **cavity 11** of the power distribution center.

(4) Use a thumb to press the IOD fuse firmly down into power distribution center fuse **cavity 15**.

(5) Close and latch the power distribution center cover.

JUNCTION BLOCK

DESCRIPTION

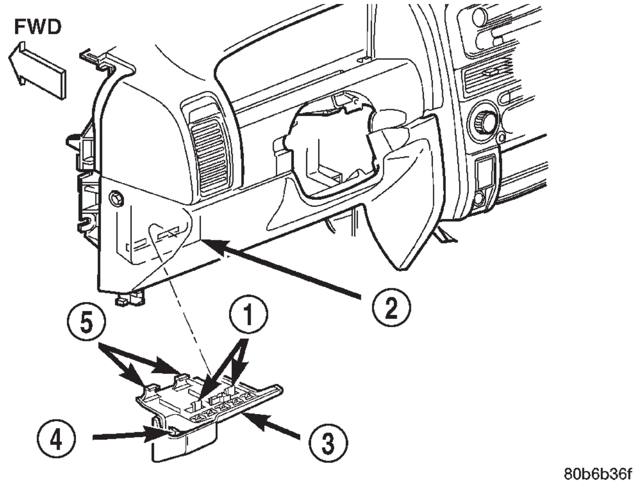


Fig. 3 Junction Block Location

1 - REAR LATCHES
2 - JUNCTION BLOCK AND BODY CONTROL MODULE UNIT
3 - INSTRUMENT PANEL FUSE COVER
4 - SIDE LATCH
5 - FRONT LATCHES

An electrical Junction Block (JB) is concealed beneath the driver side of the instrument panel in the passenger compartment of the vehicle (Fig. 3). The JB combines the functions previously provided by a separate fuseblock module and relay center. The JB serves to simplify and centralize numerous electrical components, as well as to distribute electrical current to many of the accessory systems in the vehicle. It also eliminates the need for numerous splice connections. The JB houses up to thirty-three blade-type mini fuses, up to two blade-type automatic resetting circuit breakers, the electronic combination flasher, the Daytime Running Lamp (DRL) module (Canada only) and up to twelve International Standards Organization (ISO) relays (three standard-type and nine micro-type). The JB also incorporates an integral connector and mounting for the Body Control Module (BCM). The BCM is secured with four screws directly to the dash panel side of the JB. Refer to **Body Control Module** in Electronic Control Modules for additional information covering the BCM.

The molded plastic JB housing has integral mounts that are secured with two screws and two snap retainers to the instrument panel steering column support bracket behind the instrument panel steering column opening cover. The JB is concealed above the molded plastic instrument panel fuse cover. Integral latches molded into the fuse cover secure it the JB, the BCM and the 16-way data link connector tab of the instrument panel steering column support bracket. The fuse cover can be pulled downward to disengage the latches and provide service access to all of the fuses, relays and wire harness connectors of the JB. The fuse cover has a fuse puller and spare fuses secured to its upper surface. Refer to **Instrument Panel Fuse Cover** in Body for additional service information.

The JB unit cannot be repaired and is only serviced as an assembly. If any internal circuit or the JB housing is faulty or damaged, the entire JB unit must be replaced. The BCM is available for separate service replacement.

OPERATION

All of the circuits entering and leaving the Junction Block (JB) do so through up to five wire harness connectors, which are connected to the JB through integral connector receptacles molded into the JB housing. Internal connection of all of the JB circuits is accomplished by a printed circuit board. There are also two separate wire harness connections to connector receptacles that are integral to the BCM. Refer to **Junction Block** in Wiring Diagrams for additional information and the location of complete JB circuit diagrams.

REMOVAL

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse cover from the bottom of the Junction Block (JB).

(3) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in Body for the location of steering column opening cover removal procedures.

JUNCTION BLOCK (Continued)

(4) Reach behind the JB to disconnect the two instrument panel wire harness connectors from the Body Control Module (BCM) connector receptacles located near the bottom of the JB (Fig. 4).

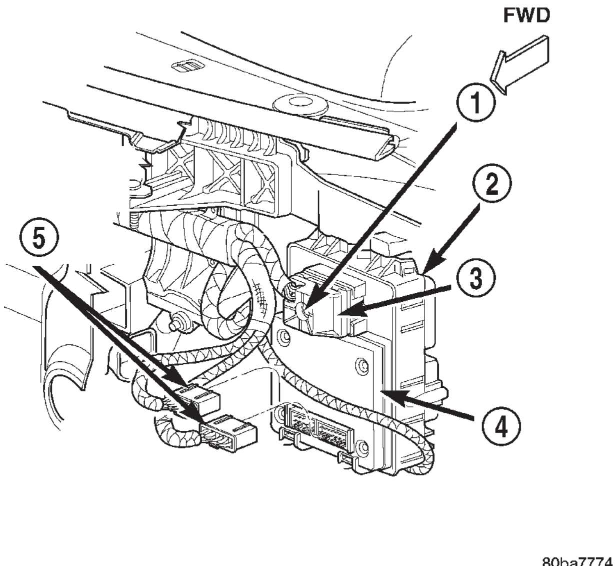


Fig. 4 Junction Block Connections

1 - SCREW
2 - JUNCTION BLOCK
3 - BULKHEAD CONNECTOR
4 - BODY CONTROL MODULE
5 - INSTRUMENT PANEL WIRE HARNESS CONNECTORS

(5) Reach behind the JB to remove the screw that secures the instrument panel wire harness bulkhead connector to the connector receptacle located near the top of the JB and disconnect the connector.

(6) Disconnect the fused B(+) and the IOD wire harness connectors from the connector receptacles located near the bottom of the JB (Fig. 5).

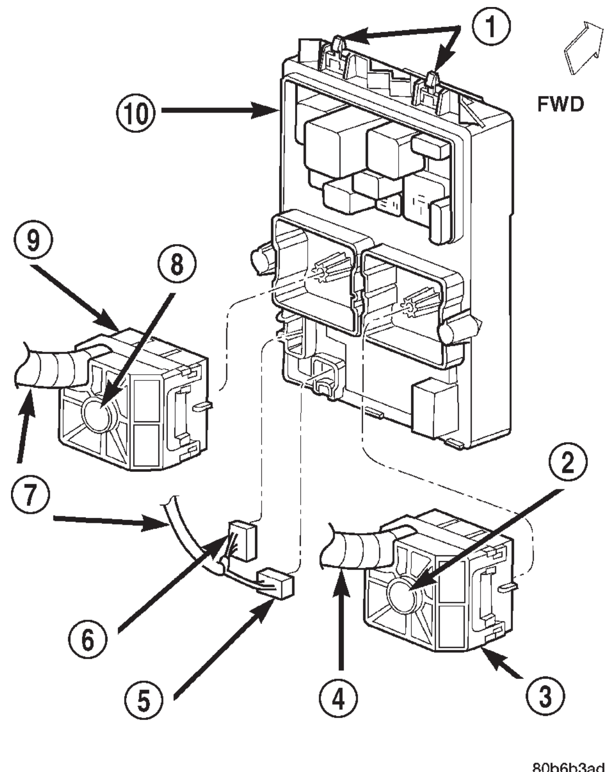


Fig. 5 Junction Block Connections

1 - SNAP CLIPS
2 - SCREW
3 - CONNECTOR
4 - LEFT BODY WIRE HARNESS
5 - IOD CONNECTOR
6 - FUSED B+ CONNECTOR
7 - RIGHT BODY WIRE HARNESS
8 - SCREW
9 - CONNECTOR
10 - JUNCTION BLOCK

(7) Remove the screws that secure the right and left body wire harness bulkhead connectors to the connector receptacles located near the center of the JB and disconnect the connectors.

(8) Remove the two screws that secure the JB to the instrument panel steering column support bracket (Fig. 6).

(9) To disengage the two snap clips that secure the top of the JB to the instrument panel steering column support bracket, grasp the bottom of the junction block firmly with both hands and pull it downward sharply.

(10) Remove the JB from the instrument panel steering column support bracket.

INSTALLATION

NOTE: If the Junction Block (JB) is being replaced with a new unit, be certain to transfer each of the optional fuses, circuit breakers and relays from the faulty JB to the proper cavities of the replacement JB. Refer to Junction Block in Wiring Diagrams for the location of complete circuit diagrams and cavity assignments for the JB. The Body Control Module (BCM) must also be transferred to the new JB. Refer to Body Control Module in Electronic Control Modules for the location of the BCM removal and installation procedures.

(1) Position the JB into its mounting location on the instrument panel steering column support bracket.

(2) Align the snap clips at the top of the JB with the mounting holes in the instrument panel steering column support bracket.

(3) Grasp the bottom of the JB firmly with both hands and push it upward sharply to engage the two snap clips that secure the top of the JB to the instrument panel steering column support bracket.

(4) Install and tighten the two screws that secure the JB to the instrument panel steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

JUNCTION BLOCK (Continued)

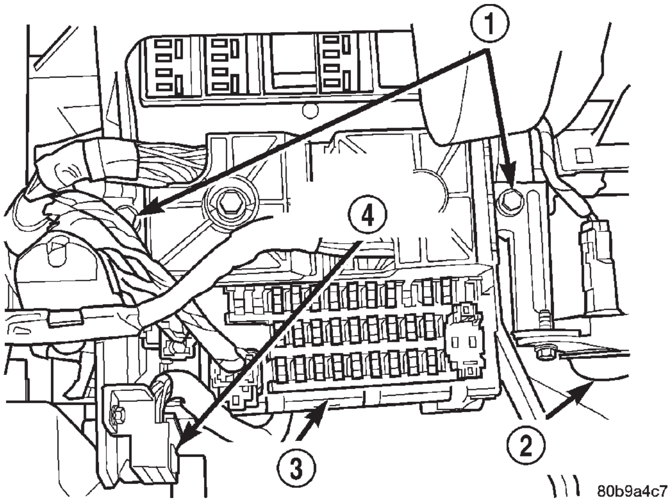


Fig. 6 Junction Block

1 - SCREW (2)
2 - DRIVER SIDE COURTESY LAMP
3 - JUNCTION BLOCK
4 - 16 WAY DATA LINK CONNECTOR

(5) Reconnect the right and left body wire harness bulkhead connectors to the connector receptacles located near the center of the JB.

(6) Install and tighten the screws that secure the right and left body wire harness bulkhead connectors to the connector receptacles located near the center of the JB. Tighten the screws to 2.2 N·m (20 in. lbs.).

(7) Reconnect the fused B(+) and the IOD wire harness connectors to the connector receptacles located near the bottom of the JB.

(8) Reach behind the JB to reconnect the instrument panel wire harness bulkhead connector to the connector receptacle located near the top of the JB.

(9) Install and tighten the screw that secures the instrument panel wire harness bulkhead connector to the connector receptacle located near the top of the JB. Tighten the screw to 2.2 N·m (20 in. lbs.).

(10) Reach behind the JB to reconnect the two instrument panel wire harness connectors to the BCM connector receptacles located near the bottom of the JB.

(11) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in Body for the location of the steering column opening cover installation procedures.

(12) Install the fuse cover onto the bottom of the JB.

(13) Reconnect the battery negative cable.

POWER DISTRIBUTION CENTER

DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC) (Fig. 7). The molded plastic PDC housing is located in the right front corner of the engine compartment, between the battery and the right front inner fender shield. The PDC houses up to fifteen maxi-type cartridge fuses, which replace all in-line fusible links. The PDC also houses up to thirteen blade-type mini fuses, and up to ten International Standards Organization (ISO) relays (two standard-type and eight micro-type).

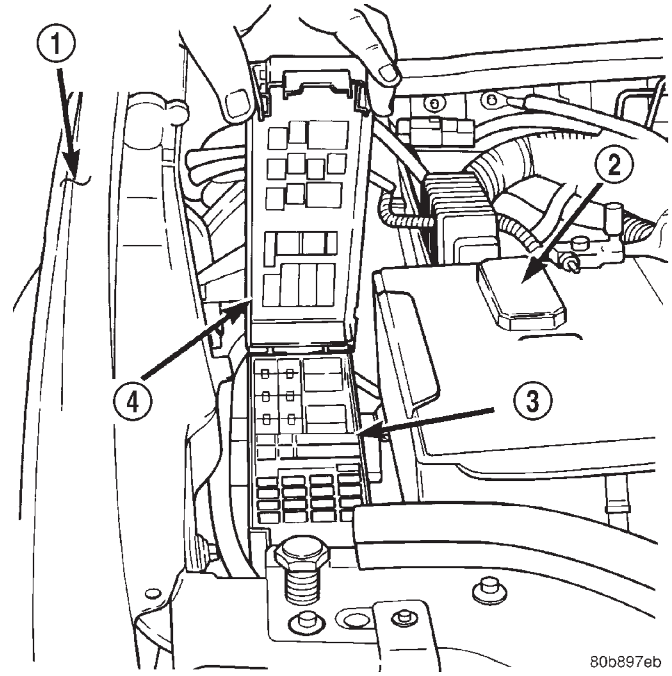


Fig. 7 Power Distribution Center Location

1 - RIGHT FENDER
2 - BATTERY
3 - POWER DISTRIBUTION CENTER
4 - COVER

The PDC housing is secured in the engine compartment at three points. Integral mounts on both sides of the PDC housing engage and latch to stanchions that are integral to the molded plastic battery support. The PDC is integral to the right headlamp and dash wire harness, which exits from the bottom of the PDC housing. The PDC housing has a molded plastic cover that includes two integral latches at the front and pivot hooks at the back that snap over a hinge pin on the rear of the PDC housing. The PDC cover is easily opened or removed for service access and has a convenient fuse and relay layout map integral to the inside surface of the cover to ensure proper component identification. A fuse puller is also stored on the inside of the PDC cover.

The PDC cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC main housing unit, the fuse wedges and the bus bars cannot be repaired and

POWER DISTRIBUTION CENTER (Continued)

are only serviced as a unit with the right headlamp and dash wire harness. If the PDC main housing unit, fuse wedges or the bus bars are faulty or damaged, the right headlamp and dash wire harness unit must be replaced.

OPERATION

All of the current from the battery and the generator output enters the PDC through two cables and a single two-holed eyelet that is secured with nuts to the two PDC B(+) terminal studs just inside the front end of the PDC housing. The PDC cover is unlatched and opened to access the battery and generator output connection B(+) terminal studs, the fuses or the relays. Internal connection of all of the PDC circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Power Distribution** in Wiring Diagrams for the location of complete PDC circuit diagrams.

REMOVAL

The Power Distribution Center (PDC) main housing unit, the PDC fuse wedges and the PDC bus bars cannot be repaired and are only serviced as a unit with the right headlamp and dash wire harness. If the PDC main housing unit, the fuse wedges or the bus bars are faulty or damaged, the entire PDC and right headlamp and dash wire harness unit must be replaced.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect each of the right headlamp and dash wire harness connectors. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the right headlamp and dash wire harness connector locations.

(3) Remove all of the fasteners that secure each of the right headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the ground eyelet locations.

(4) Disengage each of the retainers that secure the right headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the right headlamp and dash wire harness retainer locations.

(5) Unlatch and open the PDC cover.

(6) Remove the two nuts that secure the two-holed eyelet of the battery wire harness PDC take outs to the PDC B(+) terminal studs (Fig. 8).

(7) Remove the battery wire harness PDC take out eyelet from the B(+) terminal studs.

(8) Disengage the latches on the PDC housing mounts from the tabs on the PDC mounting stanchions of the battery support, and pull the PDC housing upward to disengage the mounts from the stanchions (Fig. 9).

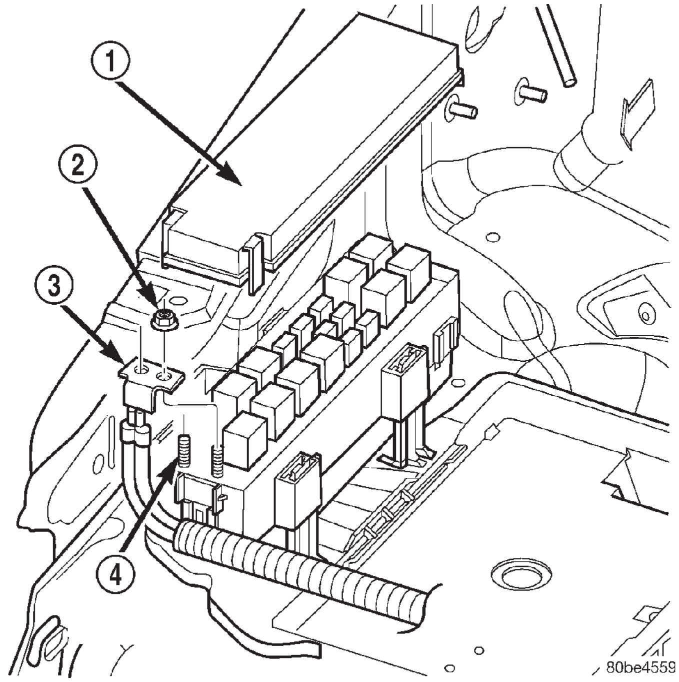


Fig. 8 Power Distribution Center Connections

1 - PDC COVER
2 - NUT (2)
3 - EYELET
4 - B(+) TERMINAL STUDS

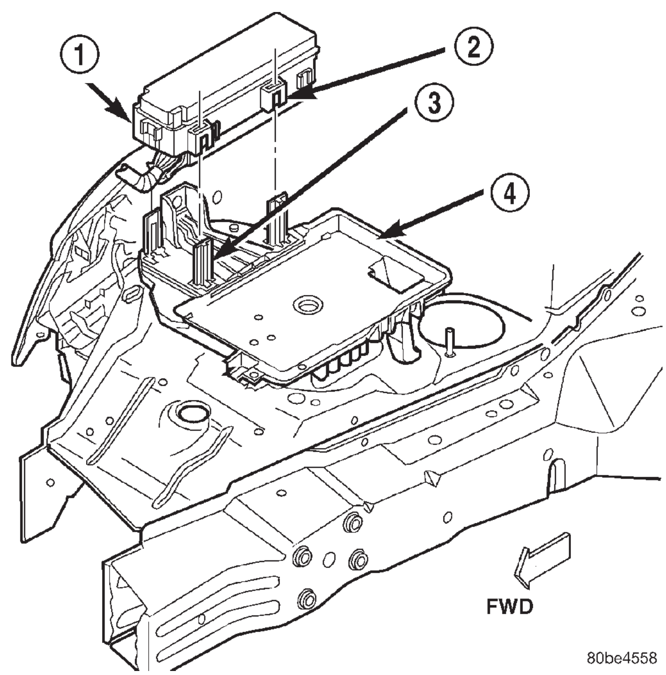


Fig. 9 Power Distribution Center Remove/Install

1 - POWER DISTRIBUTION CENTER
2 - MOUNTS
3 - STANCHIONS (3)
4 - BATTERY SUPPORT

POWER DISTRIBUTION CENTER (Continued)

(9) Remove the PDC and the right headlamp and dash wire harness from the engine compartment as a unit.

DISASSEMBLY

POWER DISTRIBUTION CENTER DISASSEMBLY

PDC HOUSING LOWER COVER REMOVAL

The Power Distribution Center (PDC) cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC cover can be simply unlatched and removed from the PDC housing without the PDC being removed or disassembled. Service of the remaining PDC components requires that the PDC be removed from its mounting and disassembled. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.

(1) Remove the battery from the battery support. Refer to **Battery System** for the location of the battery removal procedures.

(2) Unlatch and remove the cover from the PDC.

(3) Remove the two nuts that secure the two-holed eyelet of the battery wire harness PDC take out to the B(+) terminal studs near the front of the PDC.

(4) Remove the battery wire harness PDC take out eyelet from the two PDC B(+) terminal studs.

(5) Disengage the latches on the PDC housing mounts from the tabs on the PDC mounting stanchions on the battery support, and pull the PDC housing upward to disengage the mounts from the stanchions.

(6) Where the right headlamp and dash wire harness exits the PDC, remove the tape that secures the wire harness to the trough formation on the PDC housing lower cover.

(7) Using a trim stick or another suitable wide flat-bladed tool, gently pry the latches on each side and the front of the PDC housing that secure the housing lower cover to the PDC and remove the housing lower cover (Fig. 10).

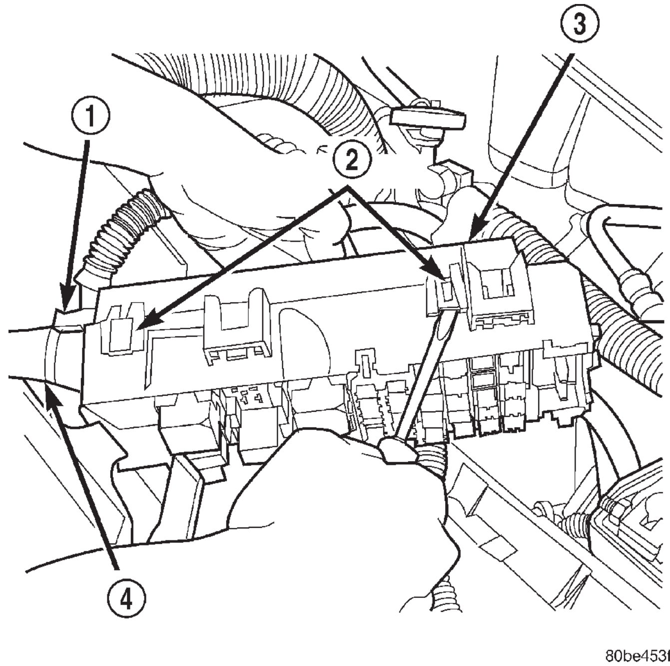


Fig. 10 PDC Housing Lower Cover Remove/Install - Typical

1 - TROUGH FORMATION
2 - LATCHES (5)
3 - PDC HOUSING LOWER COVER
4 - WIRE HARNESS

PDC B+ TERMINAL MODULE REMOVAL

The Power Distribution Center (PDC) cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC cover can be simply unlatched and removed from the PDC housing without the PDC being removed or disassembled. Service of the remaining PDC components requires that the PDC be removed from its mounting and disassembled. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.

(1) Remove the PDC housing lower cover.

(2) From the top of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches that secure the B(+) terminal module in the PDC.

(3) Gently and evenly press the two B(+) terminal studs down through the bus bar in the PDC.

(4) From the bottom of the PDC housing, remove the B(+) terminal module from the PDC.

PDC RELAY WEDGE REMOVAL

The Power Distribution Center (PDC) cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC cover can be simply unlatched and removed from the PDC housing without the PDC being removed or disassembled. Service of the remaining PDC components requires that the PDC be removed from its mounting and disassembled. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.

(1) Remove the PDC housing lower cover.

(2) Remove each of the relays from the PDC relay wedge to be removed.

(3) From the bottom of the PDC housing, use a small screwdriver or a terminal pick tool (Special

POWER DISTRIBUTION CENTER (Continued)

Tool Kit 6680) to release the two latches (yellow) that secure the relay wedge to the PDC relay cassette.

(4) From the top of the PDC housing, remove the relay wedge from the PDC relay cassette (Fig. 11).

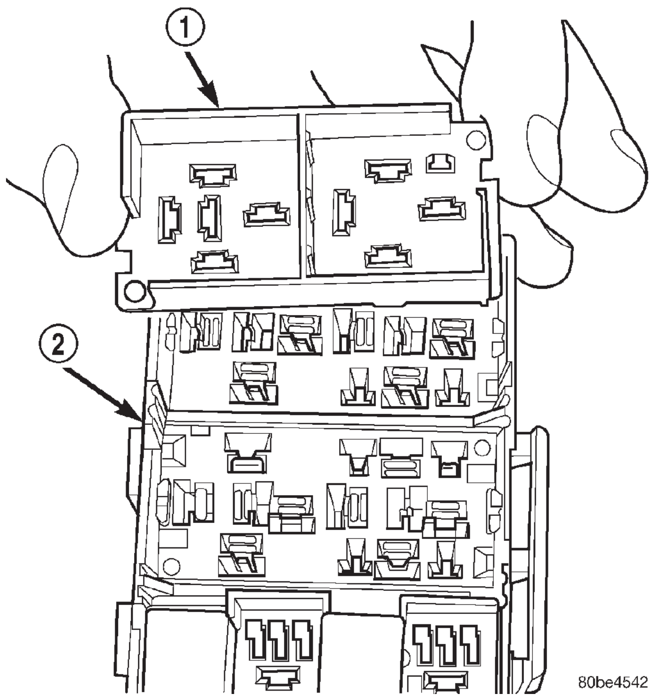


Fig. 11 PDC Relay Wedge Remove/Install - Typical

1 - RELAY WEDGE (TYPICAL)
2 - PDC HOUSING

PDC RELAY CASSETTE REMOVAL

The Power Distribution Center (PDC) cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC cover can be simply unlatched and removed from the PDC housing without the PDC being removed or disassembled. Service of the remaining PDC components requires that the PDC be removed from its mounting and disassembled. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.

(1) Remove the relay wedge from the PDC relay cassette to be removed.

NOTE: It may be necessary to remove relay cassettes that are not being serviced from the PDC housing in order to obtain sufficient clearance to access the faulty relay cassette. The same service procedure is repeated as necessary to remove each of the interfering relay wedges and relay cassettes from the PDC housing.

(2) From the top of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches that secure the relay cassette in the PDC (Fig. 12).

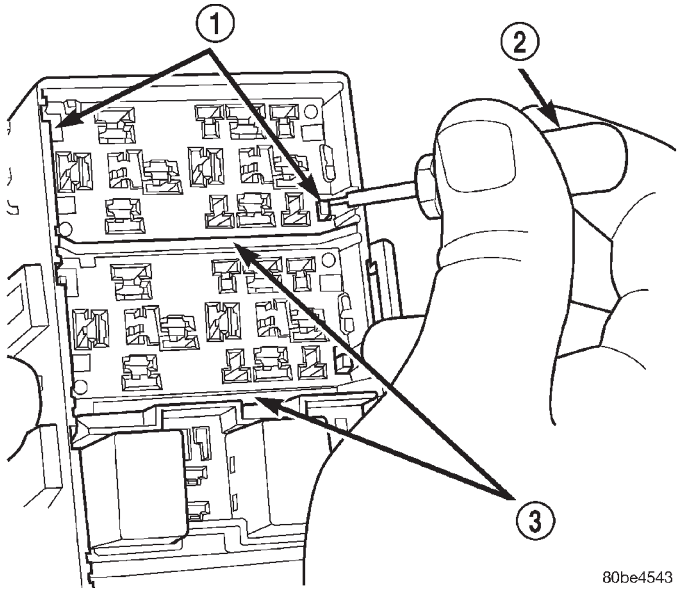


Fig. 12 PDC Relay Cassette Latches - Typical

1 - LATCHES
2 - FROM SPECIAL TOOL KIT 6680
3 - PDC RELAY CASSETTES (TYPICAL)

(3) Gently and evenly press the relay cassette down through the PDC housing.

(4) From the bottom of the PDC housing, remove the relay cassette from the PDC (Fig. 13).

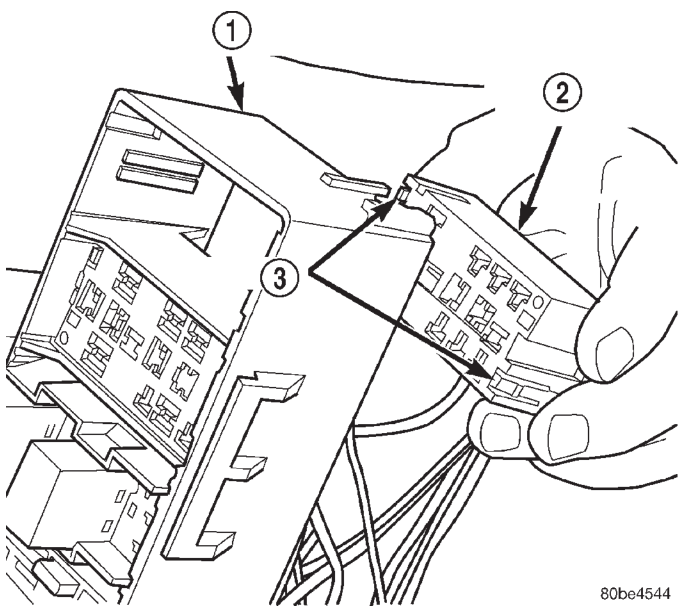


Fig. 13 PDC Relay - Typical

1 - PDC HOUSING
2 - PDC RELAY CASSETTE (TYPICAL)
3 - LATCHES

POWER DISTRIBUTION CENTER (Continued)

CAUTION: Do not remove the wiring and terminals from the terminal cavities of the faulty PDC relay cassette at this time. Refer to the Assembly procedure that follows for the proper procedures for transferring the wiring and terminals to the replacement PDC relay cassette.

ASSEMBLY

POWER DISTRIBUTION CENTER ASSEMBLY

PDC B(+) TERMINAL MODULE INSTALLATION

(1) From the bottom of the PDC housing, align and insert the B(+) terminal module into the PDC.

(2) From the bottom of the PDC housing, align and insert the two studs of the PDC B(+) terminal module through the bus bar in the PDC.

(3) From the bottom of the PDC housing, press the B(+) terminal module gently and evenly into the PDC until both of the latches are fully engaged.

(4) Install the PDC housing lower cover.

RELAY WEDGE INSTALLATION

(1) From the top of the PDC housing, align and insert the PDC relay wedge latch arms into the correct cavities in the relay cassette.

(2) Gently and evenly press the PDC relay wedge down into the relay cassette until both of the latches are fully engaged.

(3) Install each of the removed relays into the proper cavities of the PDC relay wedge.

(4) Install the PDC housing lower cover.

RELAY CASSETTE INSTALLATION

(1) Move the faulty PDC relay cassette with its wiring away from the bottom of the PDC housing far enough to allow the replacement relay cassette to be installed into the PDC.

(2) Using the faulty relay cassette as a guide, be certain that the replacement relay cassette is correctly oriented before installing it into the PDC housing.

(3) From the bottom of the PDC housing, align and insert the replacement relay cassette into the PDC. Press the relay cassette up into the PDC until both of the latches are fully engaged.

CAUTION: Proper care must be taken to be certain that the wiring and terminals from the faulty PDC relay cassette are installed in the correct terminal cavities of the replacement relay cassette. To prevent mistakes it is recommended that the wiring and terminals be removed from the faulty relay cassette one cavity at a time, repaired or spliced as necessary, then installed securely into the correct cavity of the replacement relay cassette. If you are not absolutely certain into which cavity a terminal should be installed, refer to Power Distribution in the index of this service manual for the location of complete circuit diagrams covering the PDC.

(4) While pulling gently on the wire from the bottom of the faulty PDC relay cassette, use a terminal pick tool (Special Tool Kit 6680) from the top of the relay cassette to release the latch that secures the terminal in the relay cassette terminal cavity (Fig. 14).

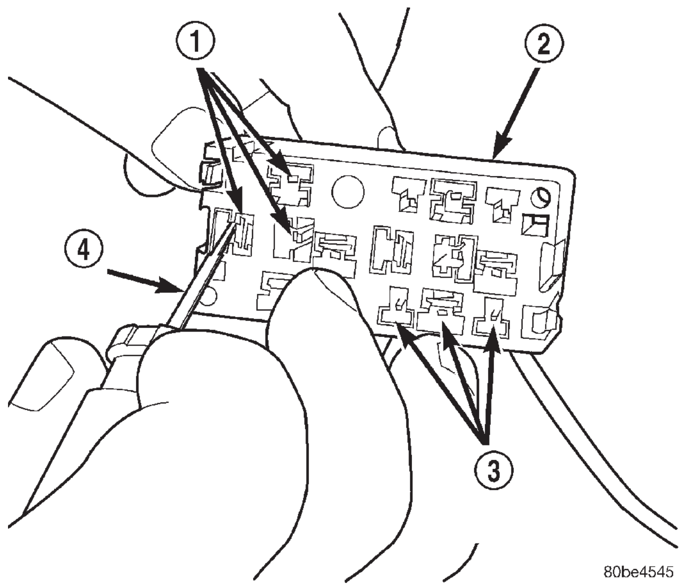


Fig. 14 PDC Relay Cassette Terminal Remove/Install - Typical

1 - TERMINAL CAVITIES (TYPICAL)
2 - PDC RELAY CASSETTE (TYPICAL)
3 - TERMINAL LATCHES (TYPICAL)
4 - FROM SPECIAL TOOL KIT 6680

(5) From the bottom of the faulty PDC relay cassette, remove the wire and terminal from the relay cassette terminal cavity.

(6) Make all necessary repairs and splices to the wire for the removed terminal. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.

(7) From the bottom of the PDC housing, align and insert the removed wire and terminal into the correct terminal cavity of the replacement relay cassette. Push the wire and terminal up into the relay cassette terminal cavity until it is fully engaged by the latch.

(8) Repeat Step 4, Step 5, Step 6 and Step 7 one wire and terminal at a time until each of the wires and terminals have been transferred from the faulty PDC relay cassette into the replacement relay cassette.

(9) Install the PDC relay wedge into the replacement PDC relay cassette.

POWER DISTRIBUTION CENTER (Continued)

PDC LOWER COVER INSTALLATION

(1) Align the PDC housing lower cover on the bottom of the PDC.

(2) Evenly press the lower cover into place until latches are fully engaged.

(3) Where the right headlamp and dash harness enters the PDC, tape the harness securely to the trough formation on the PDC lower cover.

(4) Install the PDC in its mounting location on the battery support.

(5) Install the battery wire harness over the two PDC B+ terminal studs. Torque the nuts to 11.3 N·m (100 in. lbs.).

(6) Install the battery. Refer to Battery System for the procedure.

(7) Install the PDC cover.

INSTALLATION

The Power Distribution Center (PDC) main housing unit, the PDC fuse wedges and the PDC bus bars cannot be repaired and are only serviced as a unit with the right headlamp and dash wire harness. If the PDC main housing unit, the fuse wedges or the bus bars are faulty or damaged, the entire PDC and right headlamp and dash wire harness unit must be replaced.

(1) Position the PDC and the right headlamp and dash wire harness unit in the engine compartment.

(2) Engage the PDC housing mounts with the stanchions of the battery support and push the unit downward until the mount latches fully engage the mounting tabs on the stanchions.

(3) Install the two-holed eyelet of the battery wire harness PDC take outs onto the two PDC B(+) terminal studs.

(4) Install and tighten the nuts that secure the eyelet of the battery wire harness PDC take outs to the B(+) terminal studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(5) Engage each of the retainers that secure the right headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the right headlamp and dash wire harness retainer locations.

(6) Install all of the fasteners that secure each of the right headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the ground eyelet locations.

(7) Reconnect each of the right headlamp and dash wire harness connectors. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the right headlamp and dash wire harness connector locations. For connectors secured with screws, tighten the screws to 4.3 N·m (38 in. lbs.).

(8) Reconnect the battery negative cable.

POWER OUTLET

DESCRIPTION - FRONT POWER OUTLET

An accessory power outlet is standard equipment on this model. The power outlet is installed in the instrument panel center lower bezel, which is located near the bottom of the instrument panel center stack area, below the heater and air conditioner controls. The power outlet base is secured by a snap fit within the center lower bezel. A hinged door with an over-center spring flips closed to conceal and protect the power outlet base when the power outlet is not being used, and flips open below the center lower bezel while the power outlet is in use.

The power outlet receptacle unit and the power outlet door are each available for service replacement.

OPERATION - FRONT POWER OUTLET

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the junction block at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

DIAGNOSIS AND TESTING - POWER OUTLET

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in Wiring Diagrams.

WARNING: REFER TO RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(3) Open the power outlet door. Check for continuity between the inside circumference of the power

POWER OUTLET (Continued)

outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the instrument panel center lower bezel. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the power outlet wire harness connector. If OK, replace the faulty power outlet receptacle. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in Body for the procedure.

(3) Pull the cigar lighter knob and element or the protective cap out of the cigar lighter receptacle base, or open the power outlet door in the instrument panel center lower bezel.

(4) Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the instrument panel center lower bezel (Fig. 15).

(5) Insert a pair of external snap ring pliers into the cigar lighter or power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(6) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(7) Remove the cigar lighter or power outlet mount from the instrument panel center lower bezel.

INSTALLATION

(1) Install the cigar lighter or power outlet mount into the instrument panel center lower bezel.

(2) Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

(3) Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

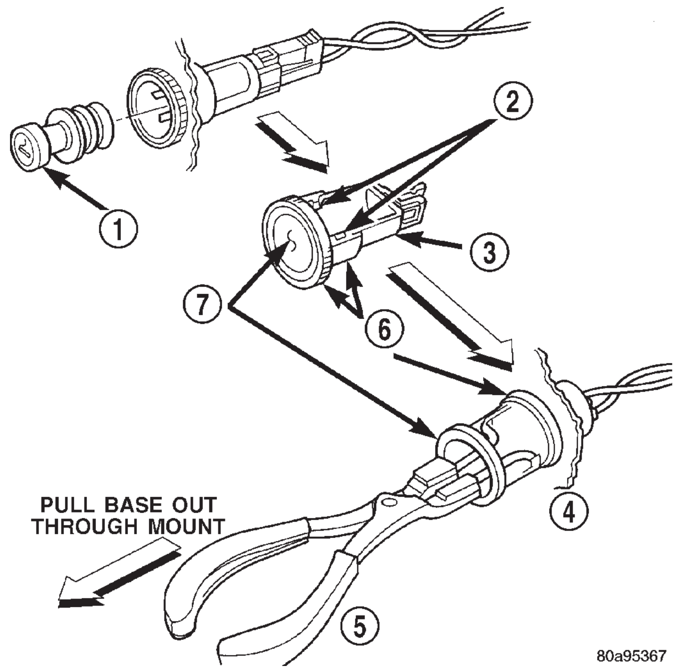


Fig. 15 Cigar Lighter and Power Outlet Remove/ Install - Typical

1 - KNOB AND ELEMENT
2 - RETAINING BOSSES-ENGAGE PLIERS HERE
3 - BASE
4 - PARTIALLY REMOVED
5 - EXTERNAL SNAP-RING PLIERS
6 - MOUNT
7 - BASE

(4) Install the cigar lighter knob and element or the protective cap into the cigar lighter receptacle base, or close the power outlet door in the instrument panel center lower bezel.

(5) Install the center lower bezel onto the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in Body for the procedure.

(6) Reconnect the battery negative cable.

POWER OUTLET RELAY

DESCRIPTION

The power outlet / cigar lighter relay is an electromechanical device that switches fused battery current to the cigar lighter or power outlet when the ignition switch is turned to the Accessory or On positions. The power outlet / cigar lighter relay is located in the junction block, below the driver side of the instrument panel in the passenger compartment.

The cigar lighter relay is a International Standards Organization (ISO) relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

POWER OUTLET RELAY (Continued)

The cigar lighter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING - POWER OUTLET RELAY

The power outlet / cigar lighter relay (Fig. 16) is located in the junction block, below the driver side end of the instrument panel in the passenger compartment. For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in Wiring Diagrams.

WARNING: REFER TO RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the power outlet / cigar lighter relay from the junction block. Refer to the procedure in this group.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

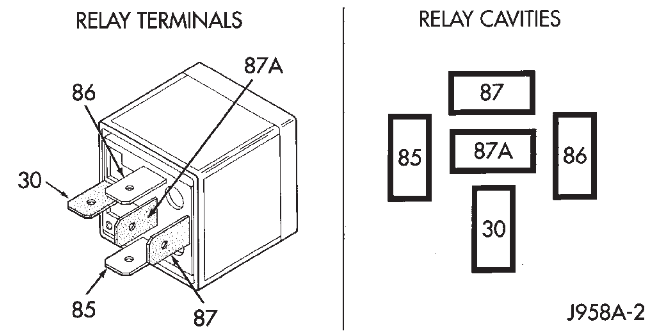


Fig. 16 Accessory Relay

TERMINAL LEGEND

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

DIAGNOSIS AND TESTING - RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) of the junction block is connected to battery voltage and should be hot at all times. Check for battery voltage at the fused B(+) circuit cavity in the junction block receptacle for the cigar lighter relay. If OK, go to Step 2. If not OK, repair the fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the fused B(+) fuse in the junction block that feeds the cigar lighter when the relay is energized by the ignition switch. There should be continuity between the junction block cavity for relay terminal 87 and the fused B(+) fuse in the junction block at all times. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(4) The coil ground terminal (85) is connected to the electromagnet in the relay. It receives battery feed to energize the cigar lighter relay when the ignition switch is in the Accessory or On positions. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity for relay terminal 85 in the junction block receptacle for the cigar lighter relay. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.

(5) The coil battery terminal (86) is connected to the electromagnet in the relay. The junction block cavity for this terminal should have continuity to

POWER OUTLET RELAY (Continued)

ground at all times. If not OK, repair the open ground circuit to ground as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in Body for the procedure.

(3) The power outlet / cigar lighter relay is located on the left side of the combination flasher in the junction block.

(4) Remove the power outlet / cigar lighter relay from the junction block.

INSTALLATION

(1) Position the power outlet / cigar lighter relay in the proper receptacle in the junction block.

(2) Align the power outlet / cigar lighter relay terminals with the terminal cavities in the junction block receptacle.

(3) Push in firmly on the power outlet / cigar lighter relay until the terminals are fully seated in the terminal cavities in the junction block receptacle.

(4) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in Body for the procedure.

(5) Reconnect the battery negative cable.

IOD WIRE HARNESS CONNECTOR

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) connector that is located in a molded connector receptacle on the lower rear surface of the Junction Block (JB) housing (Fig. 17). The JB is concealed above the molded plastic instrument panel fuse cover. Integral latches molded into the fuse cover secure it the JB, the Body Control Module (BCM) and the 16-way data link connector tab of the instrument panel steering column support bracket. The fuse cover can be pulled downward to disengage the latches and provide service access to all of the fuses, relays and wire harness connectors of the JB. Refer to **Instrument Panel Fuse Cover** in the index of this service manual for the location of additional service information covering the fuse cover.

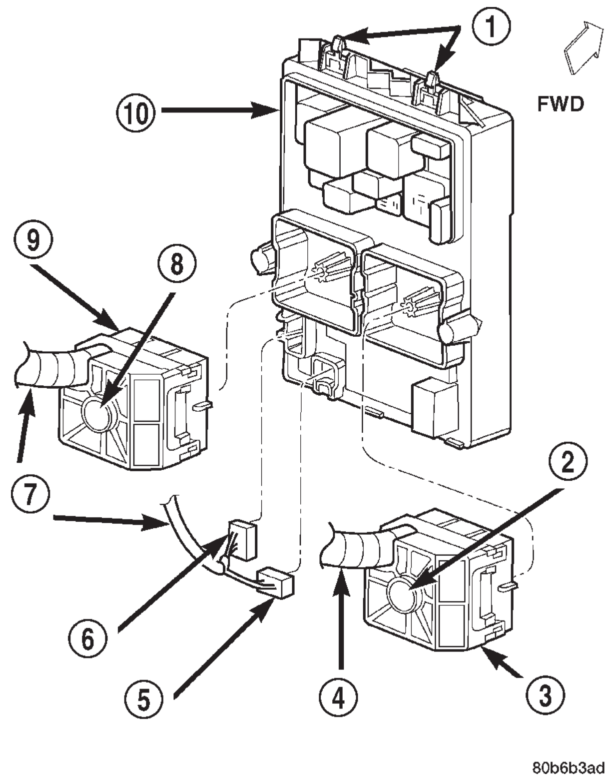


Fig. 17 Ignition-Off Draw Connector

1 - SNAP CLIPS
2 - SCREW
3 - CONNECTOR
4 - LEFT BODY WIRE HARNESS
5 - IOD CONNECTOR
6 - FUSED B+ CONNECTOR
7 - RIGHT BODY WIRE HARNESS
8 - SCREW
9 - CONNECTOR
10 - JUNCTION BLOCK

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD connector feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position, including the clock.

The IOD connector can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about twenty days (short-term storage). Simply disconnect the IOD connector from the JB receptacle. However, it must be remembered that disconnecting the IOD connector will not eliminate IOD, but only reduce this normal condition. When a vehicle will not be used for more than twenty days, but less than thirty days, remove the IOD fuse from the Power Distribution Center (PDC). If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged. Refer to **Ignition-Off Draw**

IOD WIRE HARNESS CONNECTOR (Continued)

Fuse and **Battery** in the index in this service manual for the location of additional service information covering the ignition-off draw fuse and the battery.

FUSE COVER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull down on the rear edge (nearest the rear of the vehicle) of the instrument panel fuse cover until the rear latches unsnap from the tabs on the lower junction block housing and the side latch unsnaps from the tab on the instrument panel steering column support bracket outboard of the 16-way data link connector (Fig. 18).

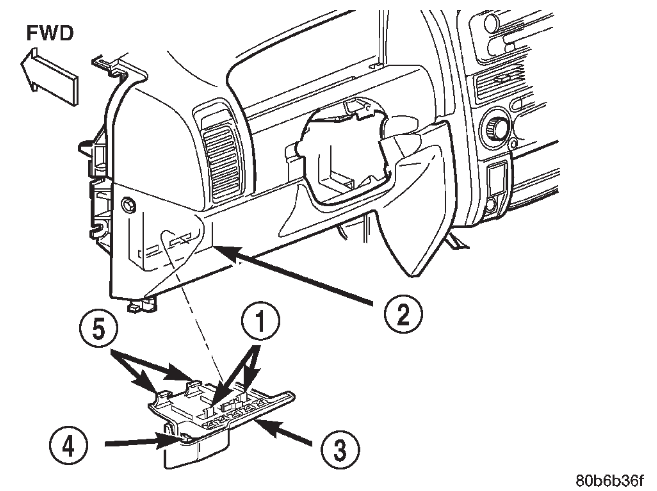


Fig. 18 Instrument Panel Fuse Cover Remove/Install

1 - REAR LATCHES
2 - JUNCTION BLOCK AND BODY CONTROL MODULE UNIT
3 - INSTRUMENT PANEL FUSE COVER
4 - SIDE LATCH
5 - FRONT LATCHES

(3) Move the instrument panel fuse cover towards the front of the vehicle to disengage the front latches from the mounting slots in the lower housing of the body control module.

(4) Remove the fuse cover from under the instrument panel.

INSTALLATION

(1) Position the two front latches of the instrument panel fuse cover within the two locator channel formations on the bottom of the body control module housing (Fig. 19).

(2) While applying a slight upward pressure to the instrument panel fuse cover over the front latches, slowly slide the front latches through the locator channels toward the front of the vehicle until the latches exit the front of the locator channels. This will locate the front latches at the mounting slots in the lower housing of the body control module.

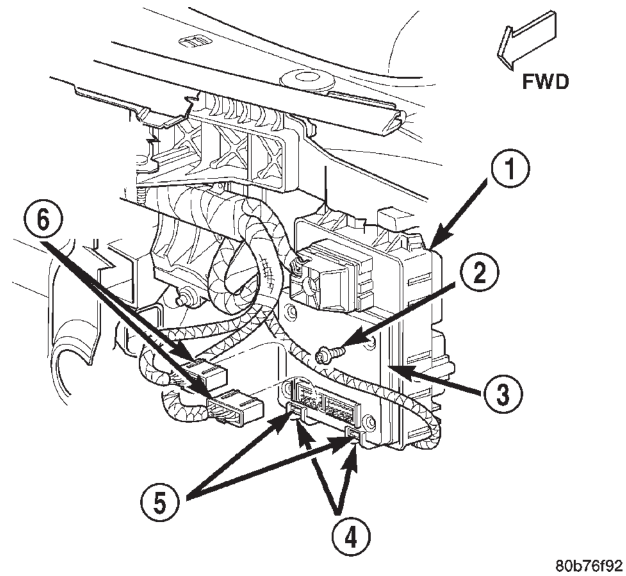


Fig. 19 Instrument Panel Fuse Cover Locator Channels

1 - JUNCTION BLOCK
2 - SCREWS (4)
3 - BODY CONTROL MODULE
4 - FUSE COVER LOCATOR CHANNELS
5 - FUSE COVER MOUNTING SLOTS
6 - INSTRUMENT PANEL WIRE HARNESS CONNECTORS

(3) Apply a slight rearward pressure on the instrument panel fuse cover to engage the front latches in the mounting slots in the lower housing of the body control module.

(4) Swing the rear edge (nearest the rear of the vehicle) of the instrument panel fuse cover up toward the junction block.

(5) Press firmly upward on the instrument panel fuse cover over the rear latches until the latches snap into place over the tabs on the lower edge of the junction block housing.

(6) Press firmly upward on the 16-way data link connector cover formation of the instrument panel fuse cover until the side latch snaps into place over the tab on the outboard side of the instrument panel steering column support bracket.

(7) Reconnect the battery negative cable.

REAR POWER OUTLET

DESCRIPTION - REAR POWER OUTLET

A rear accessory power outlet is optional equipment on this model. The rear power outlet is installed in the lower right quarter trim panel near the right liftgate opening pillar in the cargo area of

REAR POWER OUTLET (Continued)

the vehicle. The power outlet base and mount are secured by a snap fit within the quarter trim panel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use. While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

The power outlet receptacle unit and the accessory power outlet protective cap are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION - REAR POWER OUTLET

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the Power Distribution Center (PDC) through a fuse in the Junction Block (JB) at all times. Refer to **Horn/Cigar Lighter/Power Outlet** in Wiring Diagrams for the location of complete rear power outlet circuit diagrams.

DIAGNOSIS AND TESTING - REAR POWER OUTLET

Refer to **Horn/Cigar Lighter/Power Outlet** in Wiring Diagrams for the location of complete rear power outlet circuit diagrams.

(1) Check the fused B(+) fuse in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the JB. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) as required.

(3) Remove the plastic protective cap from the rear power outlet receptacle. Check for continuity between the inside circumference of the rear power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the rear power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the rear power outlet from the right quarter trim panel. Check for continuity between the ground circuit cavity of the rear power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the rear power outlet wire harness connector. If OK, replace the faulty rear power outlet receptacle base. If not OK, repair the open fused B(+) circuit to the JB fuse as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull the protective cap out of the rear power outlet receptacle base (Fig. 20).

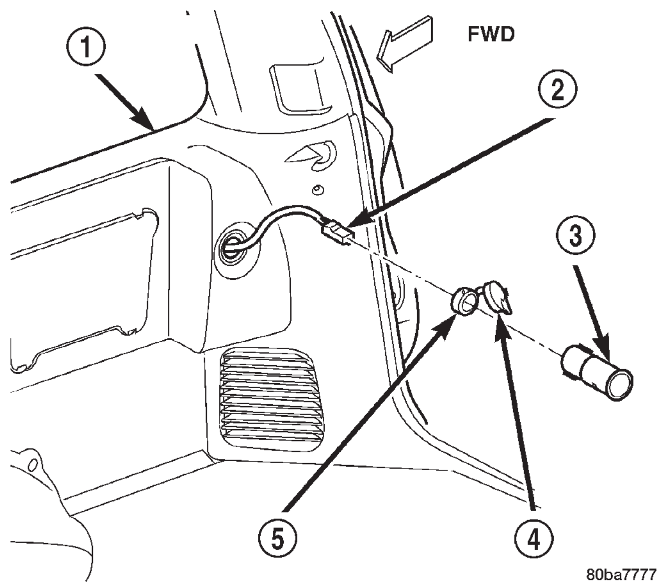


Fig. 20 Rear Power Outlet Remove/Install

1 - RIGHT QUARTER TRIM PANEL
2 - RIGHT BODY WIRE HARNESS CONNECTOR
3 - RECEPTACLE BASE
4 - PROTECTIVE CAP
5 - MOUNT

REAR POWER OUTLET (Continued)

(3) Look inside the rear power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the right quarter trim panel (Fig. 21).

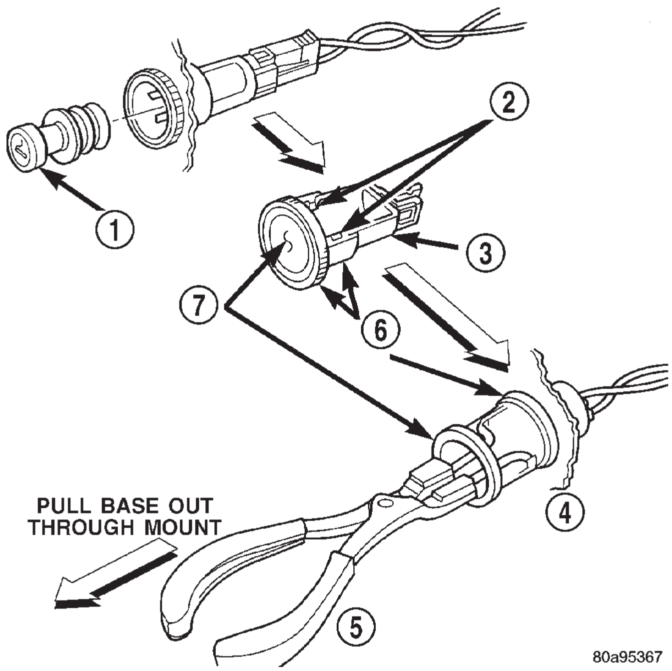


Fig. 21 Power Outlet Remove/Install - Typical

1 - KNOB AND ELEMENT
2 - RETAINING BOSSES-ENGAGE PLIERS HERE
3 - BASE
4 - PARTIALLY REMOVED
5 - EXTERNAL SNAP-RING PLIERS
6 - MOUNT
7 - BASE

(4) Insert a pair of external snap ring pliers into the rear power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(5) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(6) Pull the rear power outlet receptacle base away from the right quarter trim panel far enough to access the wire harness connector.

(7) Disconnect the right body wire harness connector from the rear power outlet receptacle base connector receptacle.

(8) Remove the rear power outlet mount from the right quarter trim panel.

INSTALLATION

(1) Align the splines on the outside of the rear power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

(2) Insert the rear power outlet receptacle base about half way through the mount.

(3) Reconnect the right body wire harness connector to the rear power outlet receptacle base connector receptacle.

(4) Insert the rear power outlet receptacle base and mount into the right quarter trim panel as a unit until the mount is seated flush against the trim panel.

(5) Press firmly on the rear power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

(6) Install the protective cap into the rear power outlet receptacle base.

(7) Reconnect the battery negative cable.

ENGINE

TABLE OF CONTENTS

ENGINE - 4.0L

TABLE OF CONTENTS

ENGINE - 4.0L

DESCRIPTION

The 4.0 Liter (242 CID) six-cylinder engine is an In-line, lightweight, overhead valve engine. This engine is designed for unleaded fuel.

The engine cylinder head has dual quench-type combustion chambers that create turbulence and fast burning of the air/fuel mixture. This results in better fuel economy.

The cylinders are numbered 1 through 6 from front to rear. The firing order is 1-5-3-6-2-4 (Fig. 1).

The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within seven main bearings. The camshaft rotates within four bearings.

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No.2 and No.3 cylinders (Fig. 2).

The digits of the code identify:

- 1st Digit—The year (8 = 1998).
- 2nd & 3rd Digits—The month (01 - 12).
- 4th & 5th Digits—The engine type/fuel system/compression ratio (MX = A 4.0 Liter (242 CID) 8.7:1 compression ratio engine with a multi-point fuel injection system).

ENGINE - 4.0L (Continued)

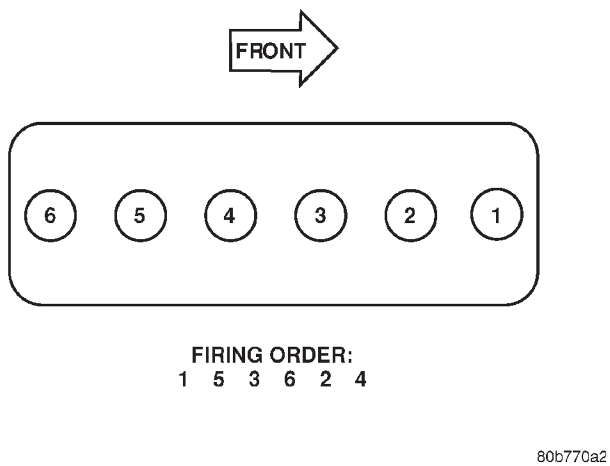


Fig. 1 Engine Firing Order

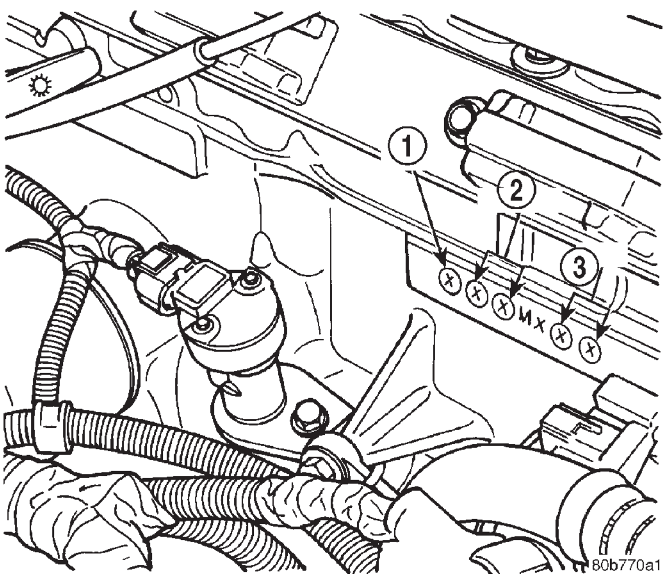


Fig. 2 Build Date Code Location

1 - YEAR
2 - MONTH
3 - DAY

- 6th & 7th Digits—The day of engine build (01 - 31).

(1) **FOR EXAMPLE:** Code * 801MX12 * identifies a 4.0 Liter (242 CID) engine with a multi-point fuel injection system, 8.7:1 compression ratio and built on January 12, 1998.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - Preformance) or (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - Mechanical). Refer to 14 - FUEL SYSTEM for fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING)
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING)
- Lash Adjuster (Tappet) Noise Diagnosis (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - DIAGNOSIS AND TESTING)
- Engine Oil Leak Inspection (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING)

ENGINE - 4.0L (Continued)

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

ENGINE PERFORMANCE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK	1. Weak or dead battery	1. Charge/Replace Battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE), for correct procedures. Check charging system. (Refer to 8 - ELECTRICAL/ CHARGING - DIAGNOSIS AND TESTING), for correct procedures.
	2. Corroded or loose battery connections	2. Clean/tighten suspect battery/ starter connections
	3. Faulty starter or related circuit(s)	3. Check starting system. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING), for correct diagnostics/procedures
	4. Siezed accessory drive component	4. Remove accessory drive belt and attempt to start engine. If engine starts, repair/replace siezed component.
	5. Engine internal mechanical failure or hydro-static lock	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), for correct diagnostics/procedures
ENGINE CRANKS BUT WILL NOT START	1. No spark	1. Check for spark. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS), for correct procedures.
	2. No fuel	2. Perform fuel pressure test (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP - DIAGNOSIS AND TESTING), and if necessary, inspect fuel injector(s) and driver circuits. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - DIAGNOSIS AND TESTING), for correct procedures.
	3. Low or no engine compression	3. Perform cylinder compression pressure test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
ENGINE LOSS OF POWER	1. Worn or burned distributor rotor	1. Install new distributor rotor
	2. Worn camshaft position sensor shaft	2. Remove and repair camshaft position sensor.(Refer to 8 - ELECTRICAL/IGNITION CONTROL/ CAMSHAFT POSITION SENSOR - REMOVAL).

ENGINE - 4.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	3. Worn or incorrect gapped spark plugs	3. Clean plugs and set gap. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - CLEANING).
	4. Dirt or water in fuel system	4. Clean system and replace fuel filter
	5. Faulty fuel pump	5. Install new fuel pump
	6. Incorrect valve timing	6. Correct valve timing
	7. Blown cylinder head gasket	7. Install new cylinder head gasket
	8. Low compression	8. Test cylinder compression. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
	9. Burned, warped, or pitted valves	9. Install/Reface valves as necessary
	10. Plugged or restricted exhaust system	10. Install new parts as necessary
	11. Faulty ignition coil rail	11. Test and replace, as necessary. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL).
ENGINE STALLS OR ROUGH IDLE	1. Carbon build-up on throttle plate	1. Remove throttle body and de-carbon. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ THROTTLE BODY - REMOVAL) for correct procedure.
	2. Engine idle speed too low	2. Check Idle Air Control circuit.
	3. Worn or incorrectly gapped spark plugs	3. Replace or clean and re-gap spark plugs. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING)
	4. Faulty coil rail	4. Test and replace, if necessary. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL)
	5. Intake manifold vacuum leak	5. Inspect intake manifold gasket and vacuum hoses. Replace if necessary. (Refer to 9 - ENGINE/MANIFOLDS/ INTAKE MANIFOLD - DIAGNOSIS AND TESTING).
ENGINE MISSES ON ACCELERATION	1. Worn or incorrectly gapped spark plugs	1. Replace spark plugs or clean and set gap.
	2. Spark plug cables defective or crossed	2. Replace spark plug cables.
	3. Dirt in fuel system	3. Clean fuel system
	4. Burned, warped or pitted valves	4. Install new valves
	5. Faulty coil rail	5. Test and replace as necessary. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL)

ENGINE - 4.0L (Continued)

DIAGNOSIS AND TESTING— ENGINE DIAGNOSIS - MECHANICAL

ENGINE MECHANICAL DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES/LIFTERS	1. High or low oil level in crankcase	1. Check for correct oil level. Adjust oil level by draining or adding as needed
	2. Thin or diluted oil	2. Change oil. (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE)
	3. Low oil pressure	3. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING) for engine oil pressure test/specifications
	4. Dirt in tappets/lash adjusters	4. Clean/replace hydraulic tappets/ lash adjusters
	5. Bent push rod(s)	5. Install new push rods
	6. Worn rocker arms	6. Inspect oil supply to rocker arms and replace worn arms as needed
	7. Worn tappets/lash adjusters	7. Install new hydraulic tappets/lash adjusters
	8. Worn valve guides	8. Inspect all valve guides and replace as necessary
	9. Excessive runout of valve seats or valve faces	9. Grind valves and seats
CONNECTING ROD NOISE	1. Insufficient oil supply	1. Check engine oil level.
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING) engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. (Refer to 9 - ENGINE/LUBRICATION/ OIL - STANDARD PROCEDURE) for correct procedure/engine oil specifications
	4. Excessive connecting rod bearing clearance	Measure bearings for correct clearance with plasti-gage. Repair as necessary
	5. Connecting rod journal out of round	5. Replace crankshaft or grind journals
	6. Misaligned connecting rods	6. Replace bent connecting rods
MAIN BEARING NOISE	1. Insufficient oil supply	1. Check engine oil level.
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING)

ENGINE - 4.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	3. Thin or diluted oil	3. Change oil to correct viscosity.
	4. Excessive main bearing clearance	4. Measure bearings for correct clearance. Repair as necessary
	5. Excessive end play	5. Check crankshaft thrust bearing for excessive wear on flanges
	6. Crankshaft main journal out of round or worn	6. Grind journals or replace crankshaft
	7. Loose flywheel or torque converter	7. Inspect crankshaft, flexplate/ flywheel and bolts for damage. Tighten to correct torque
LOW OIL PRESSURE	1. Low oil level	1. Check oil level and fill if necessary
	2. Faulty oil pressure sending unit	2. Install new sending unit
	3. Clogged oil filter	3. Install new oil filter
	4. Worn oil pump	4. Replace oil pump assembly.
	5. Thin or diluted oil	5. Change oil to correct viscosity.
	6. Excessive bearing clearance	6. Measure bearings for correct clearance
	7. Oil pump relief valve stuck	7. Remove valve to inspect, clean and reinstall
	8. Oil pump suction tube loose, broken, bent or clogged	8. Inspect suction tube and clean or replace if necessary
	9. Oil pump cover warped or cracked	9. Install new oil pump
OIL LEAKS	1. Misaligned or deteriorated gaskets	1. Replace gasket
	2. Loose fastener, broken or porous metal part	2. Tighten, repair or replace the part
	3. Front or rear crankshaft oil seal leaking	3. Replace seal
	4. Leaking oil gallery plug or cup plug	4. Remove and reseal threaded plug. Replace cup style plug
EXCESSIVE OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. CCV System malfunction	1. (Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS - DESCRIPTION) for correct operation
	2. Defective valve stem seal(s)	2. Repair or replace seal(s)
	3. Worn or broken piston rings	3. Hone cylinder bores. Install new rings
	4. Scuffed pistons/cylinder walls	4. Hone cylinder bores and replace pistons as required
	5. Carbon in oil control ring groove	5. Remove rings and de-carbon piston
	6. Worn valve guides	6. Inspect/replace valve guides as necessary
	7. Piston rings fitted too tightly in grooves	7. Remove rings and check ring end gap and side clearance. Replace if necessary

ENGINE - 4.0L (Continued)

DIAGNOSIS AND TESTING—CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise, the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(3) Secure the throttle in the wide-open position.

(4) Disconnect the ignition coil.

(5) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(6) Record the compression pressure on the third revolution. Continue the test for the remaining cylinders.

(Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating)
- Leaks between adjacent cylinders or into water jacket
- Any causes for combustion/compression pressure loss

WARNING: DO NOT REMOVE THE RADIATOR CAP WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM HOT COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn OFF the engine.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

Perform the test procedure on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe or oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

ENGINE - 4.0L (Continued)

DIAGNOSIS AND TESTING—REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

(4) If no leaks are detected, pressurized the crankcase as outlined in (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. Refer to the service Diagnosis—Mechanical, under the Oil Leak row, for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL), for proper replacement procedures.

STANDARD PROCEDURE

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

ENGINE - 4.0L (Continued)

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier then using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE—HYDROSTATIC LOCK

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(2) Disconnect the negative cable(s) from the battery.

(3) Inspect air cleaner, induction system, and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the spark plugs.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (coolant, fuel, oil, etc.).

(7) Be sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt a small amount of engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs. Tighten the spark plugs to 41 N·m (30 ft. lbs.) torque.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS).

(15) Connect the negative cable(s) to the battery.

(16) Start the engine and check for any leaks.

STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

ENGINE - 4.0L (Continued)

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 40° to 60° for proper seating of rings (Fig. 3).

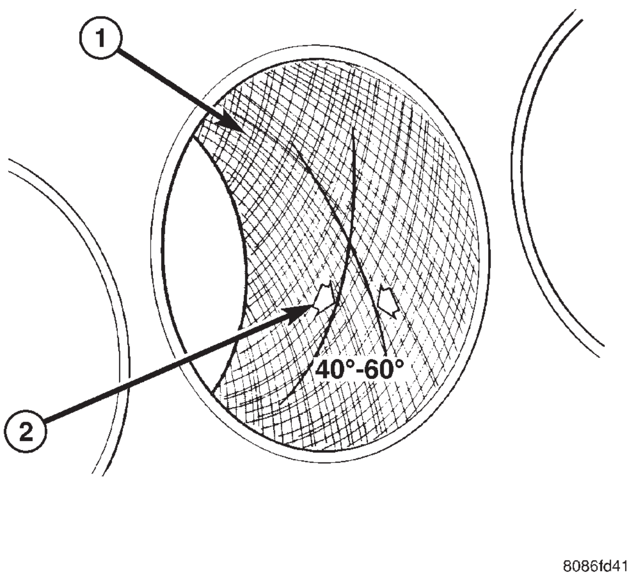


Fig. 3 Cylinder Bore Crosshatch Pattern

1 - CROSSHATCH PATTERN
2 - INTERSECT ANGLE

(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 40° to 60° angle. Faster up and down strokes increase the crosshatch angle.

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 4).

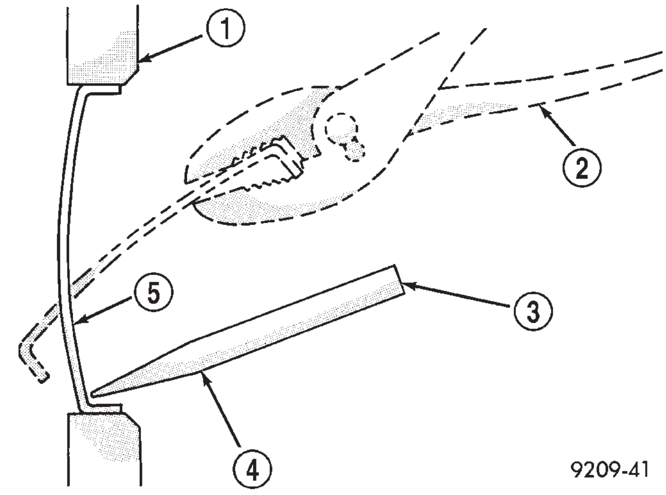


Fig. 4 Core Hole Plug Removal

1 - CYLINDER BLOCK
2 - REMOVE PLUG WITH PLIERS
3 - STRIKE HERE WITH HAMMER
4 - DRIFT PUNCH
5 - CUP PLUG

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

REMOVAL

(1) Disconnect the battery negative cable.

(2) Mark the hinge locations on the hood panel for alignment reference during installation. Remove the engine compartment lamp. Remove the hood.

(3) Remove the radiator drain cock and radiator cap to drain the coolant. DO NOT waste usable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(4) Remove the upper radiator hose and coolant recovery hose.

(5) Remove the lower radiator hose.

(6) Remove upper radiator support retaining bolts and remove radiator support.

ENGINE - 4.0L (Continued)

(7) Remove the fan assembly from the water pump (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(8) Remove the fan shroud.

(9) Disconnect the transmission fluid cooler lines (automatic transmission).

(10) Discharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(11) Remove the service valves and cap the compressor ports.

(12) Remove the radiator or radiator/condenser (if equipped with A/C).

(13) Disconnect the heater hoses at the engine thermostat housing and water pump.

(14) Disconnect the accelerator cable, transmission line pressure cable and speed control cable (if equipped) from the throttle body.

(15) Remove cables from the bracket and secure out of the way.

(16) Disconnect the body ground at the engine.

(17) Disconnect the following connectors and secure their harness out of the way.

- Power steering pressure switch
- Coolant temperature sensor
- Six (6) fuel injector connectors
- Intake air temperature sensor
- Throttle position sensor
- Map sensor
- Crankshaft position sensor
- Oxygen sensor
- Camshaft position sensor
- Generator connector and B+ terminal wire

(18) Disconnect the coil rail electrical connections and the oil pressure switch connector.

(19) Perform the fuel pressure release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(20) Disconnect the fuel supply line at the injector rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ QUICK CONNECT FITTING - STANDARD PROCEDURE).

(21) Remove the fuel line bracket from the intake manifold.

(22) Remove the air cleaner assembly (Fig. 5).

(23) Disconnect the hoses from the fittings at the steering gear.

(24) Drain the pump reservoir.

(25) Cap the fittings on the hoses and steering gear to prevent foreign objects from entering the system.

(26) Raise and support the vehicle.

(27) Disconnect the wires from the engine starter motor solenoid.

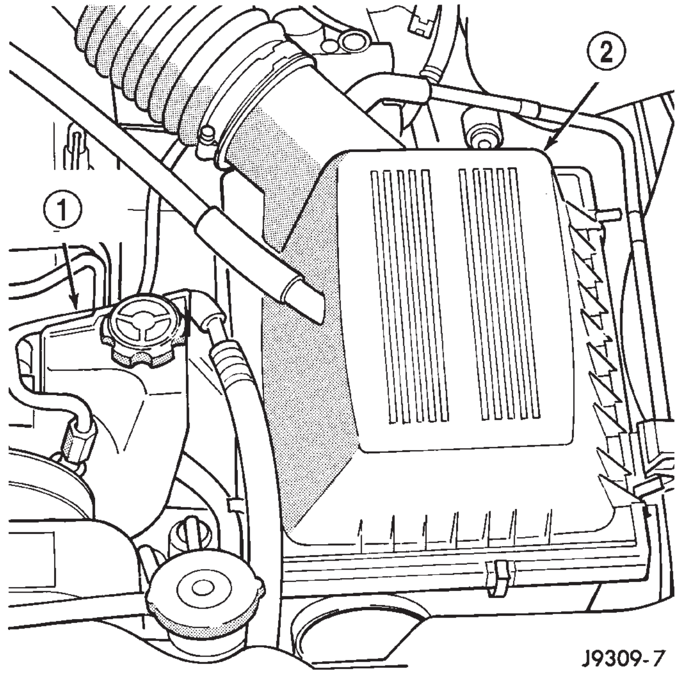


Fig. 5 Air Cleaner Assembly

1 - POWER STEERING PUMP
2 - AIR CLEANER ASSEMBLY

(28) Remove the engine starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

(29) Disconnect the oxygen sensor from the exhaust pipe.

(30) Disconnect the exhaust pipe from the manifold.

(31) Remove the exhaust pipe support.

(32) Remove the bending brace (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCT SUPPORT - REMOVAL).

(33) Remove the engine flywheel/converter housing access cover.

(34) Mark the converter and drive plate location.

(35) Remove the converter-to-drive plate bolts.

(36) Remove the upper engine flywheel/converter housing bolts and loosen the bottom bolts.

(37) Remove the engine mount cushion-to-engine compartment bracket bolts.

(38) Lower the vehicle.

(39) Attach a lifting device to the engine.

(40) Raise the engine off the front supports.

(41) Place a support or floor jack under the converter (or engine flywheel) housing.

(42) Remove the remaining converter (or engine flywheel) housing bolts.

(43) Lift the engine out of the engine compartment.

ENGINE - 4.0L (Continued)

INSTALLATION

CAUTION: When installing the engine into a vehicle equipped with an automatic transmission, be careful not to damage the trigger wheel on the engine flywheel.

(1) Attach a lifting device to the engine and lower the engine into the engine compartment. For easier installation, it may be necessary to remove the engine mount bracket as an aid in alignment of the engine to the transmission.

(2) Align the transmission torque converter housing with the engine.

(3) Loosely install the converter housing lower bolts and install the next higher bolt and nut on each side.

(4) Tighten all 4 bolts finger tight.

(5) Install the engine mount brackets (if removed).

(6) Lower the engine and engine mount brackets onto the engine compartment cushions. Install the bolts and finger tighten the nuts.

(7) Remove the engine lifting device.

(8) Raise and support the vehicle.

(9) Install the remaining engine flywheel/converter housing bolts. Tighten all bolts to 38 N·m (28 ft. lbs.) torque.

(10) Install the converter-to-drive plate bolts.

(11) Ensure the installation reference marks are aligned.

(12) Install the engine flywheel/converter housing access cover.

(13) Install the exhaust pipe support and tighten the screw.

(14) Install the engine bending brace (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCT SUPPORT - INSTALLATION).

(15) Tighten the engine mount-to-bracket bolts.

(16) Connect the vehicle speed sensor wire connections and tighten the screws.

(17) Connect the exhaust pipe to the manifold.

(18) Install the engine starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(19) Connect the wires to the engine starter motor solenoid.

(20) Lower the vehicle.

(21) Connect all the vacuum hoses and wire connectors identified during engine removal.

(22) Remove protective caps from the power steering hoses.

(23) Connect the hoses to the fittings at the steering gear. Tighten the nut to 52 N·m (38 ft. lbs.) torque.

(24) Fill the pump reservoir with fluid.

(25) Inspect the fuel supply line o-ring(s) and replace if necessary. Connect fuel supply line to injection rail and verify connection by pulling outward on the line.

(26) Install the fuel line bracket to the intake manifold.

(27) Connect the coil rail electrical connectors and oil pressure switch connector.

(28) Connect the following electrical connectors:

- Power steering pressure switch
- Coolant temperature sensor
- Six (6) fuel injector connectors
- Intake air temperature sensor
- Throttle position sensor
- Map sensor
- Crankshaft position sensor
- Oxygen sensor
- Camshaft position sensor
- Generator connector and B+ terminal wire

(29) Connect all previously removed vacuum hoses.

(30) Connect the body ground strap.

(31) Install the throttle, transmission line pressure, and speed control cables to their mounting bracket and connect them to the throttle body.

(32) Connect the heater hoses at the engine thermostat housing and water pump.

(33) Install the fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(34) Place the fan shroud in position over the fan.

(35) Install the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(36) Connect the service valves to the A/C compressor ports, if equipped with A/C.

(37) Charge the air conditioner system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(38) Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped.

(39) Install the fan shroud to the radiator or radiator/condenser (if equipped with A/C).

(40) Install upper radiator support.

(41) Connect the upper radiator hose and tighten the clamp.

(42) Connect the lower radiator hose and tighten the clamp.

(43) Fill crankcase with engine oil. (Refer to LUBRICATION & MAINTENANCE/FLUID CAPACITIES - SPECIFICATIONS) for correct capacities.

(44) Fill the cooling system with reusable coolant or new coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(45) Align the hood to the scribe marks. Install the hood.

(46) Install the air cleaner assembly.

(47) Install the battery and connect the battery cable.

ENGINE - 4.0L (Continued)

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(48) Start the engine, inspect for leaks and correct the fluid levels, as necessary.

SPECIFICATIONS

ENGINE - 4.0L

DESCRIPTION	SPECIFICATION
Engine Type	In-line 6 Cylinder
Bore and Stroke	98.4 x 86.69 mm (3.88 x 3.413 in.)
Displacement	4.0L (242 cu. in.)
Compression Ratio	8.8:1
Firing Order	1–5–3–6–2–4
Lubrication	Pressure Feed–Full Flow Filtration
Cooling System	Liquid Cooled–Forced Circulation
Cylinder Block	Cast Iron
Crankshaft	Cast Nodular Iron
Cylinder Head	Cast Iron
Camshaft	Cast Iron
Pistons	Aluminum Alloy
Combustion Chamber	Dual-Quench
Connecting Rods	Cast Malleable Iron
CAMSHAFT	
Hydraulic Tappet Clearance	Zero Lash
Bearing Clearance	0.025 to 0.076 mm (0.001 to 0.003 in.)
Bearing Journal Diameter	
No. 1	51.54 to 51.56 mm (2.029 to 2.030 in.)
No. 2	51.28 to 51.31 mm (2.019 to 2.020 in.)
No. 3	51.03 to 51.05 mm (2.009 to 2.010 in.)
No. 4	50.78 to 50.80 mm (1.999 to 2.000 in.)
Base Circle Runout (MAX)	0.03 mm (0.001 in.)
Valve Lift	
Intake	10.350 mm (0.4075 in.)
Exhaust	10.528 mm (0.4145 in.)
Valve Timing	
Intake	
Opens	12.4° BTDC
Closes	60.9° ABDC
Exhaust	
Opens	49.8 BBDC
Closes	29.2° ATDC
Valve Overlap	41.6°
Intake Duration	253.3°
Exhaust Duration	259.°
CRANKSHAFT	
End Play	0.038 to 0.165 mm (0.0015 to 0.0065 in.)
Main Bearing Journal Diameter	
No. 1-6	63.489 to 63.502 mm (2.4996 to 2.5001 in.)
No. 7	63.449 to 63.487 mm (2.4980 to 2.4995 in.)

ENGINE - 4.0L (Continued)

DESCRIPTION	SPECIFICATION
Main Bearing Journal Width	
No. 1	27.58 to 27.89 mm (1.086 to 1.098 in.)
No. 3	32.28 to 32.33 mm (1.271 to 1.273 in.)
No. 2-4-5-6-7	30.02 to 30.18 mm (1.182 to 1.188 in.)
Main Bearing Clearance	0.03 to 0.06 mm (0.001 to 0.0025 in.)
Preferred	0.051 mm (0.002 in.)
Connecting Rod Journal Diameter	53.17 to 53.23 mm (2.0934 to 2.0955 in.)
Connecting Rod Journal Width	27.18 to 27.33 mm (1.070 to 1.076 in.)
Out-of-Round (MAX)	0.013 mm (0.0005 in.)
Taper (MAX)	0.013 mm (0.0005 in.)
CYLINDER BLOCK	
Deck Height	240.03 to 240.18 mm (9.450 to 9.456 in.)
Deck Clearance (Below Block)	0.546 mm (0.0215 in.)
Cylinder Bore Diameter	
Standard	98.45 to 98.48 mm (3.8759 to 3.8775 in.)
Taper	0.025 mm (0.001 in.)
Out-ofRound	0.025 mm (0.001 in.)
Tappet Bore Diameter	23.000 to 23.025 mm (0.9055 to 0.9065 in.)
Flatness	0.03 mm per 25 mm (0.001 in. per 1 in.) 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness Max.	0.20 mm max. for total length

DESCRIPTION	SPECIFICATION
	(0.008 in. max. for total length)
Main Bearing Bore Diameter	68.3514 to 68.3768 mm (2.691 to 2.692 in.)
CONNECTING ROD	
Total Weight (Less Bearing)	663 to 671 grams (23.39 to 23.67 oz.)
Length (Center-to-Center)	155.52 to 155.62 mm (6.123 to 6.127 in.)
Piston Pin Bore Diameter	23.59 to 23.62 mm (0.9288 to 0.9298 in.)
Bore (Less Bearings)	56.08 to 56.09 mm (2.2080 to 2.2085 in.)
Bearing Clearance	0.025 to 0.076 mm (0.001 to 0.003 in.)
Preferred	0.044 to 0.050 mm (0.0015 to 0.0020 in.)
Side Clearance	0.25 to 0.48 mm (0.010 to 0.019 in.)
Twist (Max.)	0.002 mm per mm (0.002 in. per inch)
Bend (Max.)	0.002 mm per mm (0.002 in. per inch.)
CYLINDER COMPRESSION PRESSURE	
Pressure Range	827 to 1,034 kPa (120 to 150 psi)
Max. Variation Between Cylinders	206 kPa (30 psi)
CYLINDER HEAD	
Combustion Chamber	55.22 to 58.22 cc (3.37 to 3.55 cu. in.)
Valve Guide I.D. (Integral)	7.95 to 7.97 mm (0.313 to 0.314 in.)

ENGINE - 4.0L (Continued)

DESCRIPTION	SPECIFICATION
Valve Stem-to-Guide Clearance	0.025 to 0.076 mm (0.001 to 0.003 in.)
Valve Seat Angle	
Intake	44.5°
Exhaust	44.5°
Valve Seat Width	1.02 to 1.52 mm (0.040 to 0.060 in.)
Valve Seat Runout	0.064 mm (0.0025 in.)
Flatness	0.03 mm per 25 mm (0.001 in. per 1 in.) 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness Max.	0.20 mm - max. for total length (0.008 in. max. for total length)
ROCKER ARMS, PUSH RODS & TAPPETS	
Rocker Arm Ratio	1.6:1
Push Rod Length (Pink)	244.856 to 245.364 mm (9.640 to 9.660 in.)
Push Rod Diameter	7.92 to 8.00 mm (0.312 to 0.315 in.)
Hydraulic Tappet Diameter	22.962 to 22.974 mm (0.904 to 0.9045 in.)
Tappet-to-Bore Clearance	0.025 to 0.063 mm (0.001 to 0.0025 in.)
VALVES	
Valve Length (Overall)	
Intake	122.479 to 122.860 mm (4.822 to 4.837 in.)
Exhaust	122.860 to 123.241 mm (4.837 to 4.852 in.)
Valve Stem Diameter	7.899 to 7.925 mm (0.311 to 0.312 in.)
Stem-to-Guide Clearance	0.025 to 0.076 mm (0.001 to 0.003 in.)

DESCRIPTION	SPECIFICATION
Valve Head Diameter	
Intake	48.387 to 48.641 mm (1.905 to 1.915 in.)
Exhaust	37.973 to 38.227 mm (1.495 to 1.505 in.)
Valve Face Angle	
Intake	46.5°
Exhaust	46.5°
Tip Refinishing (Max. Allowable)	0.25 mm (0.010 in.)
VALVE SPRINGS	
Free Length (Approx.)	47.65 mm (1.876 in.)
Spring Load	
Valve Closed	316 to 351 N @ 41.656 mm (71 to 79 lbf. @ 1.64 in.)
Valve Open	898.6 to 969.7 N @ 30.89 mm (202 to 218 lbf @ 1.216 in.)
Inside Diameter	21.0 mm to 21.51 mm (0.827 to 0.847 in.)
Installed Height	41.656 mm (1.64 in.)
PISTONS	
Weight (Less Pin)	417 to 429 grams (14.7 to 15.1 oz.)
Piston Pin Bore (Centerline to Piston Top)	40.61 to 40.72 mm (1.599 to 1.603 in.)
Piston-to-Bore Clearance	0.018 to 0.038 mm (0.0008 to 0.0015 in.)
Ring Gap Clearance	
Top Compression Ring	0.229 to 0.610 mm (0.0090 to 0.0240 in.)
2nd Compression Ring	0.483 to 0.965 mm (0.0190 to 0.0380 in.)
Oil Control Steel Rails	0.254 to 1.500 mm (0.010 to 0.060 in.)

ENGINE - 4.0L (Continued)

DESCRIPTION	SPECIFICATION
Ring Side Clearance	
Compression Rings	0.042 to 0.084 mm (0.0017 to 0.0033 in.)
Oil Control Rings	0.06 to 0.21 mm (0.0024 to 0.0083 in.)
Piston Ring Groove Height	
Compression Rings	1.530 to 1.555 mm (0.0602 to 0.0612 in.)
Oil Control Ring	4.035 to 4.060 mm (0.1589 to 0.1598 in.)
Piston Ring Groove Diameter	
No.1 Compression Ring	88.39 to 88.65 mm (3.48 to 3.49 in.)
No.2 Compression Ring	87.63 to 87.88 mm (3.45 to 3.46 in.)
Oil Control Ring	89.66 to 89.92 mm (3.53 to 3.54 in.)
Piston Pin Bore Diameter	23.650 to 23.658 mm (0.9312 to 0.9315 in.)
Piston Pin Diameter	23.637 to 23.640 mm (0.9306 to 0.9307 in.)
Piston-to-Pin Clearance	0.0102 to 0.0208 mm (0.0005 to 0.0009 in.)
Piston-to-Pin Connecting Rod (Press Fit)	8.9 kN (2000 lbf.)
OIL PUMP	
Gear-to-Body Clearance (Radial)	0.051 to 0.102 mm (0.002 to 0.004 in.)
Gear-to-Body Clearance (Radial) Preferred	0.051 mm (0.002 in.)
Gear End Clearance Plastigage	0.051 to 0.152 mm (0.002 to 0.006 in.)
Gear End Clearance Plastigage (Preferred)	0.051 mm (0.002 in.)
Gear End Clearance Feeler Gauge	0.1016 to 0.2032 mm (0.004 to 0.008 in.)
Gear End Clearance Feeler Gauge (Preferred)	0.1778 mm (0.007 in.)
Oil Pressure	
At Idle Speed	89.6 kPa (13 psi)
At 1600 rpm & Higher	255 to 517 kPa (37 to 75 psi)
Oil Pressure Relief	517 kPa (75 psi)

TORQUE - 4.0L ENGINE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
A/C Compressor—Bolts	28	—	250
Block Heater—Nut	2	—	16
Camshaft Sprocket—Bolt	68	50	—
Camshaft Thrust Plate to Cylinder Block—Screws	24	18	—
Clutch Cover to Flywheel—Bolts	54	40	—
Coil Bracket to Block—Bolts	22	—	192
Connecting Rod—Nuts	45	33	—
Cylinder Block—Drain Plugs	34	25	—
Cylinder Head—Bolts	135	100	—
Cylinder Head Cover—Bolts	10	—	85
Distributor Clamp—Bolts	23	—	204
Engine Mounts—Front			
Support Bracket Bolts	61	45	—
Support Cushion Bolts/Nuts	41	30	—
Support Cushion Bracket Bolts	54	40	—
Support Cushion Bracket Stud Nuts	41	30	—
Support Cushion Thru-Bolt	65	48	—
Engine Mounts—Rear			
Crossmember to Sill Bolts—(Automatic)	41	30	—
Insulator Stud Assembly—Nut	41	30	—
Support Cushion/Crossmember—Nuts	22	—	192
Support Cushion/Bracket—Nuts (Manual)	75	55	—

ENGINE - 4.0L (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Transmission Support Bracket —Bolt (Manual)	46	34	—
Transmission Support Bracket/ Cushion—Bolt (4WD Auto)	75	55	—
Transmission Support Adaptor Bracket—Bolts (2WD Auto)	75	55	—
Exhaust Manifold/Pipe—Nuts	27	20	—
Intake/Exhaust Manifold			
Fasteners #1-5	33	24	—
Fasteners #6 and 7	14	—	126
Fasteners #8-11	33	24	—
Flywheel to Converter Housing—Bolts	38	28	—
Flywheel to Crankshaft—Bolts	143	105	—
Front Cover to Block—Bolts			
1/4-20	7	—	60
5/16-18	22	—	192
Fuel Rail—Bolts/Stud	12	—	108
Generator—Bolts	57	42	—
Generator Bracket to Engine—Bolts	47	35	—
Idler Pulley to Cylinder Head—Bolt	47	35	—
Main Bearing Cap—Bolts	108	80	—
Oil Filter	18	—	156
Oil Filter Connector to			
Adaptor	47	35	—
Block	68	50	—
Adaptor Bolts	102	50	—
Oil Galley—Plug	41	30	—
Oil Pan—Bolts			
1/4-20	9.5	—	84
5/16-18	15	—	132
Oil Pan—Drain Plug	34	25	—
Oil Pump			
Mounting Bolts	23	—	204
Cover Bolts	8	—	70
Rocker Arm Assembly to Cylinder Head—Capscrews	30	21	—
Spark Plugs	37	27	—
Starter Motor—Mounting Bolts	45	33	—
Thermostat Housing—Bolts	18	—	156
Throttle Body—Bolts	10	—	90
Vibration Damper—Bolt	108	80	—
Water Pump to Block—Bolts	23	17	—

AIR CLEANER ELEMENT

REMOVAL - 4.0L

(1) Unlatch four clips retaining air cleaner cover to air cleaner housing (Fig. 6).

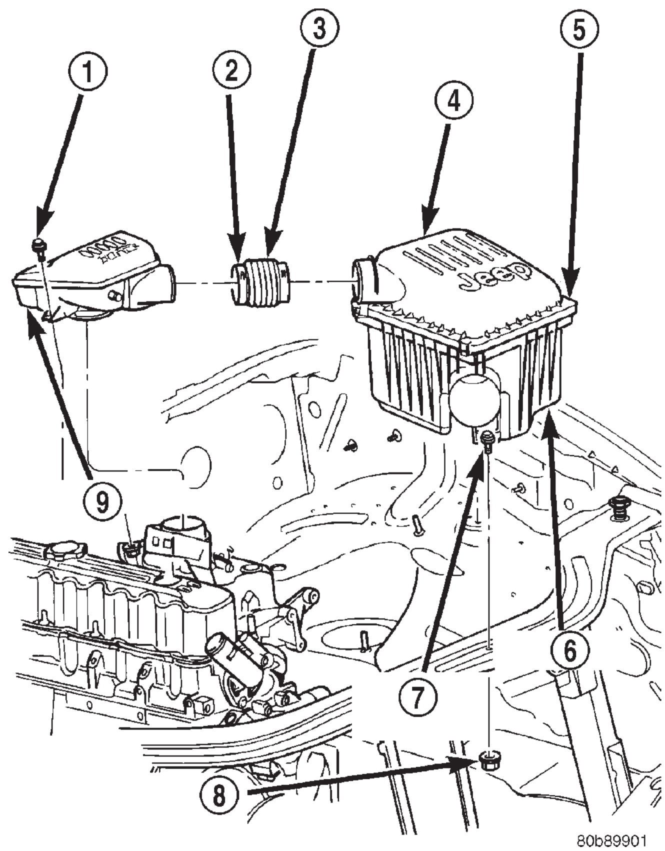


Fig. 6 Air Cleaner Assembly —4.0L Engine

1 - RESONATOR BOLTS
2 - CLAMPS
3 - AIR DUCT
4 - AIR CLEANER COVER
5 - CLIPS
6 - HOUSING
7 - HOUSING BOLTS (3)
8 - LOWER HOUSING NUTS (3)
9 - RESONATOR

AIR CLEANER ELEMENT (Continued)

(2) Lift cover up and position to the side.
(3) Remove air cleaner element.

INSTALLATION - 4.0L

(1) Clean inside of air cleaner housing before installing new element.
(2) Install air cleaner element into housing.
(3) Latch clips and clamp cover down to secure. Be sure air cleaner cover is properly seated to air cleaner housing.

AIR CLEANER HOUSING

REMOVAL - 4.0L

(1) Disconnect air cleaner cover-to-air duct clamp (Fig. 6).
(2) Disconnect air duct at housing.
(3) **Each of the 3 air cleaner housing mounting bolts is attached with 2 nuts (an upper nut and lower nut). DO NOT REMOVE BOLTS. To prevent stripping bolts, only remove lower nuts. The lower housing nuts are located under left front inner fender (Fig. 6).**
(a) To gain access to lower nuts, raise vehicle.
(b) Remove clips retaining rubber inner fender shield.
(c) Pry back shield enough to gain access to lower nuts.
(d) Remove 3 nuts.
(e) Remove air cleaner assembly from vehicle.
(4) If resonator is to be removed, disconnect breather tube at resonator, disconnect air duct clamp at resonator (Fig. 6)and remove 1 resonator mounting bolt. Remove resonator from throttle body by loosening clamp (Fig. 7).

INSTALLATION - 4.0L

(1) Position air cleaner assembly to body and install 3 nuts. Tighten nuts to 10 N·m (93 in. lbs.) torque. **To prevent excessive vibration transmitted through housing, the nuts must be properly torqued. Do not overtighten nuts.**
(2) If resonator was removed: Install resonator and bolts. Tighten bolts to 4 N·m (35 in. lbs.) torque. Tighten clamp at throttle body to 4 N·m (35 in. lbs.) torque.
(3) Position fender liner and install clips.
(4) Connect air duct at housing (Fig. 6).
(5) Tighten air duct clamp.

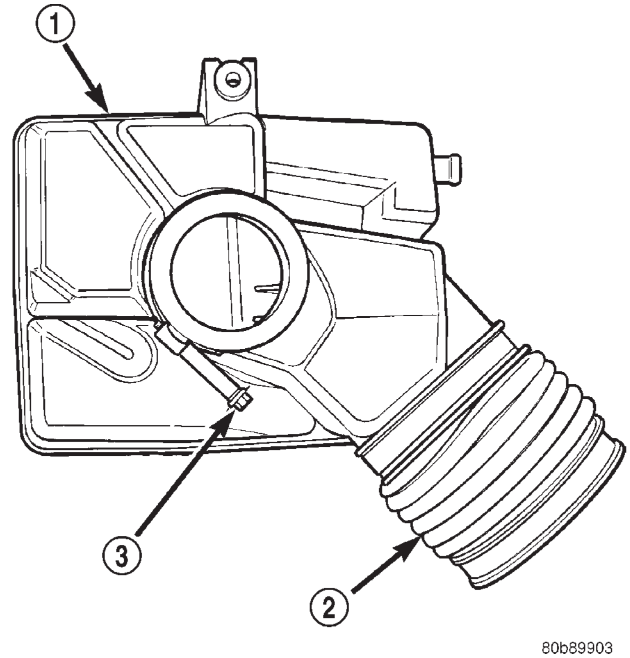


Fig. 7 RESONATOR CLAMP - 4.0L

1 - RESONATOR
2 - AIR DUCT
3 - CLAMP

CYLINDER HEAD

DESCRIPTION

The cylinder head is made of cast iron containing twelve valves made of chrome plated heat resistant steel, valve stem seals, springs, retainers and keepers. The cylinder head and valve seats can be resurfaced for service purposes.

The valve guides are integral to the cylinder head, They are not replaceable. However, they are serviceable.

The cylinder head uses dual quench-type design combustion chambers which cause turbulence in the cylinders allowing faster burning of the air/fuel mixture, resulting in better fuel economy (Fig. 8).

REMOVAL

NOTE: This procedure can be done with the engine in or out of the vehicle.

(1) Disconnect the battery negative cable.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAIN COCK WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

CYLINDER HEAD (Continued)

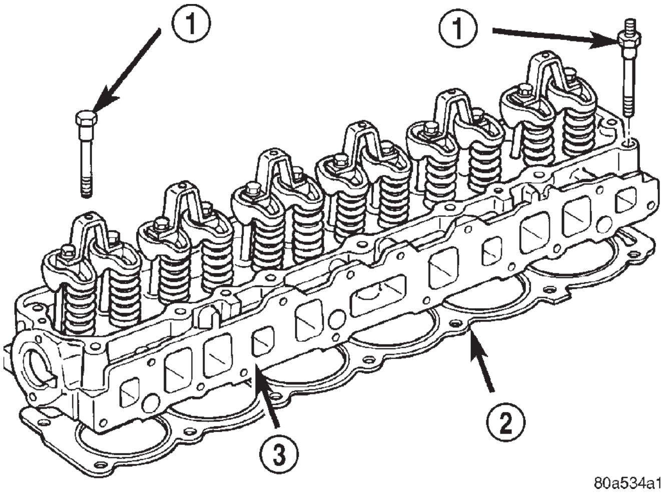


Fig. 8 Cylinder Head 4.0L Engine

1 - CYLINDER HEAD BOLTS
2 - CYLINDER HEAD GASKET
3 - CYLINDER HEAD

(2) Drain the coolant (Refer to 7 - COOLING - STANDARD PROCEDURE) and disconnect the hoses at the engine thermostat housing and the water pump inlet. DO NOT waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

(3) Remove the air cleaner assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(4) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(5) Remove the capscrews, bridge and pivot assemblies and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).

(6) Remove the push rods. **Retain the push rods, bridges, pivots and rocker arms in the same order as removed.**

(7) Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(8) Remove the A/C compressor mounting bolts and secure the compressor to the side.

(9) Remove the power steering pump and bracket from the intake manifold and water pump. Set the pump and bracket aside. DO NOT disconnect the hoses.

(10) Perform the Fuel System Pressure Release procedure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(11) Disconnect the fuel supply line at the fuel rail.

(12) Remove the intake and exhaust manifolds from the engine cylinder head (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

(13) Remove the coil rail (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL).

(14) Remove spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(15) Disconnect the temperature sending unit wire connector.

(16) Remove the engine cylinder head bolts. Bolt No.14 cannot be removed until the head is moved forward (Fig. 9). Pull bolt No.14 out as far as it will go and then suspend the bolt in this position (tape around the bolt).

(17) Remove the engine cylinder head and gasket (Fig. 9).

(18) If this was the first time the bolts were removed, put a paint dab on the top of the bolt. If the bolts have a paint dab on the top of the bolt or it isn’t known if they were used before, discard the bolts.

(19) Stuff clean lint free shop towels into the cylinder bores.

NOTE: If the valves, springs, or seals are to be inspected/replaced at this time, (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE) for proper inspection procedures.

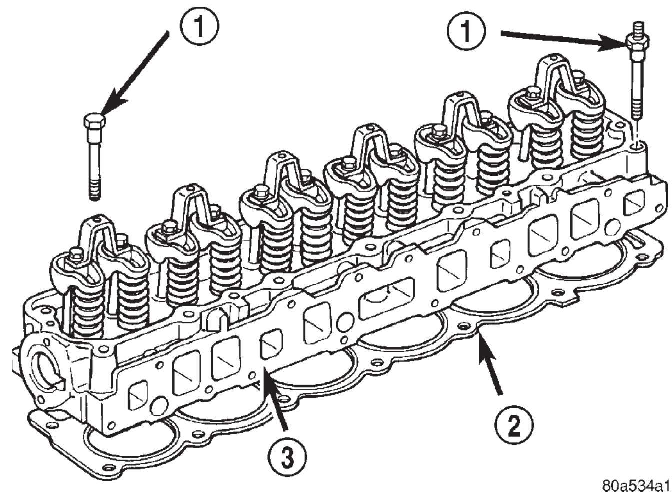


Fig. 9 Engine Cylinder

1 - CYLINDER HEAD BOLTS
2 - CYLINDER HEAD GASKET
3 - CYLINDER HEAD

CYLINDER HEAD (Continued)

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and engine exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

INSTALLATION

NOTE: This procedure can be done with the engine in or out of the vehicle.

The engine cylinder head gasket is a composition gasket. The gasket is to be installed DRY. **DO NOT use a gasket sealing compound on the gasket.**

If the engine cylinder head is to be replaced and the original valves used, measure the valve stem diameter. Only standard size valves can be used with a service replacement engine cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems. Remove all carbon buildup and reface the valves.

(1) Remove the shop towels from the cylinder bores. Coat the bores with clean engine oil.

(2) Position the engine cylinder head gasket (with the numbers facing up) using the alignment dowels in the cylinder block, to position the gasket.

CAUTION: Engine cylinder head bolts should be reused only once. Replace the head bolts if they were used before or if they have a paint dab on the top of the bolt.

(3) With bolt No.14 held in place (tape around bolt), install the engine cylinder head over the same dowels used to locate the gasket. Remove the tape from bolt No.14.

(4) Coat the threads of stud bolt No.11 with Loctite 592 sealant, or equivalent.

(5) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 10).

CAUTION: During the final tightening sequence, bolt No.11 will be tightened to a lower torque than the rest of the bolts. DO NOT overtighten bolt No.11.

(a) Tighten all bolts in sequence (1 through 14) to 30 N·m (22 ft. lbs.) torque.

(b) Tighten all bolts in sequence (1 through 14) to 61 N·m (45 ft. lbs.) torque.

(c) Check all bolts to verify they are set to 61 N·m (45 ft. lbs.) torque.

(d) Tighten bolts in sequence:

- Bolts 1 through 10 to 149 N·m (110 ft. lbs.) torque.
- Bolt 11 to 135 N·m (100 ft. lbs.) torque.
- Bolts 12 through 14 to 149 N·m (110 ft. lbs.) torque.

CYLINDER HEAD BOLTS

POSITION	DESCRIPTION
1,4,5,12,13	1/2 in.-13 BOLT
8,9	1/2 in.-13 BOLT WITH DOWEL POINT
2,3,6,7,10,11,14	1/2 in.-13 WITH 7/16 in.-14 STUD END
All bolts are 12 point drives for rocker cover clearance	

(e) Check all bolts in sequence to verify the correct torque.

(f) If not already done, clean and mark each bolt with a dab of paint after tightening. Should you encounter bolts which were painted in an earlier service operation, replace them.

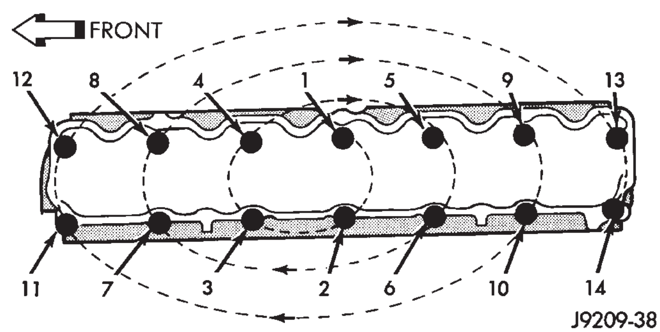


Fig. 10 Engine Cylinder Head Bolt Tightening Sequence

(6) Install the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - INSTALLATION).

(7) Connect the temperature sending unit wire connector.

(8) Install the ignition coil rail (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - INSTALLATION).

(9) Install the intake and exhaust manifolds (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

(10) Install the fuel line.

(11) Attach the power steering pump and bracket.

CYLINDER HEAD (Continued)

(12) Install the push rods, rocker arms, pivots and bridges in the order they were removed (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).

(13) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(14) Attach the air conditioner compressor mounting bracket to the engine cylinder head and block. Tighten the bolts to 40 N·m (30 ft. lbs.) torque.

(15) Attach the air conditioning compressor to the bracket. Tighten the bolts to 27 N·m (20 ft. lbs.) torque.

CAUTION: The serpentine drive belt must be routed correctly. Incorrect routing can cause the water pump to turn in the opposite direction causing the engine to overheat.

(16) Install the serpentine drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(17) Install the air cleaner and ducting.

(18) Connect the hoses to the engine thermostat housing and fill the cooling system to the specified level (Refer to 7 - COOLING - STANDARD PROCEDURE).

(19) The automatic transmission throttle linkage and cable must be adjusted after completing the engine cylinder head installation (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - AW4/ THROTTLE VALVE CABLE - ADJUSTMENTS).

(20) Install the temperature sending unit and connect the wire connector.

(21) If equipped with air conditioning, install A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION) and charge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(22) Connect negative cable to battery.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH THE FAN. DO NOT PUT HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(23) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the engine thermostat opens. Add coolant, if required.

CYLINDER HEAD COVER(S)

DESCRIPTION

The cylinder head cover (Fig. 11) is made of stamped steel and incorporates the Crankcase Ventilation (CCV) Hoses and the oil fill opening.

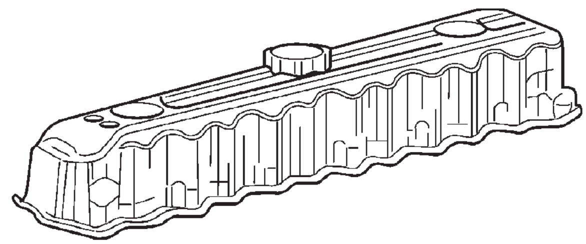


Fig. 11 Cylinder Head Cover

REMOVAL

The cylinder head cover is isolated from the cylinder head via grommets and a reusable molded rubber gasket. The grommet and limiter are retained in the cylinder head cover.

(1) Disconnect negative cable from battery.

(2) Disconnect the Crankcase Ventilation (CCV) vacuum hose from engine cylinder head cover.

(3) Disconnect the fresh air inlet hose from the engine cylinder head cover.

(4) Disconnect the accelerator, transmission, and speed (if equipped) control cables from the throttle body (Fig. 12).

(5) Remove the three bolts that fasten the control cable bracket to the intake manifold.

(6) Remove control cables from cylinder head cover clip.

(7) Position control cables and bracket away from cylinder head cover secure with tie straps.

(8) Remove the engine cylinder head cover mounting bolts.

(9) Remove the engine cylinder head cover and gasket.

CYLINDER HEAD COVER(S) (Continued)

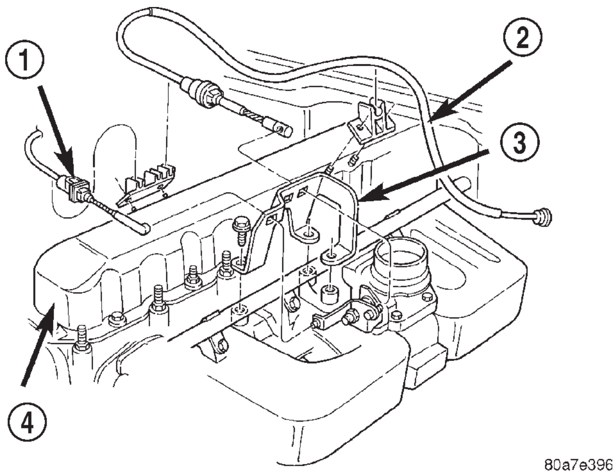


Fig. 12 Engine Cylinder Head Cover

1 - TRANS CONTROL CABLE
2 - ACCELERATOR CABLE
3 - CONTROL CABLE BRACKET
4 - CYLINDER HEAD COVER

CLEANING

Remove any original sealer from the cover sealing surface of the engine cylinder head and clean the surface using a fabric cleaner.

Remove all residue from the sealing surface using a clean, dry cloth.

INSPECTION

Inspect the engine cylinder head cover for cracks. Replace the cover, if cracked.

The original dark grey gasket material should NOT be removed. If sections of the gasket material are missing or are compressed, replace the engine cylinder head cover. However, sections with minor damage such as small cracks, cuts or chips may be repaired with a hand held applicator. The new material must be smoothed over to maintain gasket height. Allow the gasket material to cure prior to engine cylinder head cover installation.

INSTALLATION

The cylinder head cover is isolated from the cylinder head via grommets and a reusable molded rubber gasket. The grommet and limiter are retained in the cylinder head cover.

(1) If a replacement cover is installed, transfer the CCV valve grommet and oil filler cap from the original cover to the replacement cover.

(2) Install cylinder head cover and gasket (Fig. 13). Tighten the mounting bolts to 10 N·m (85 in. lbs.) torque.

(3) Connect the CCV hoses.

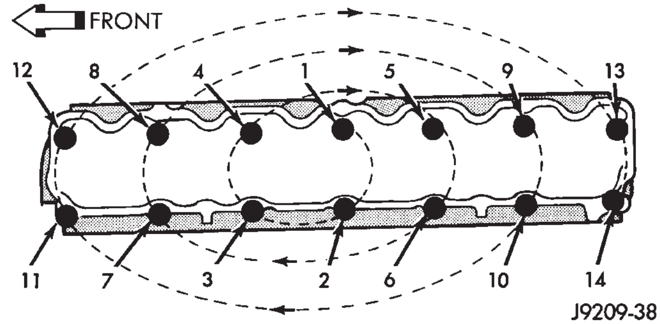


Fig. 13 Cylinder Head Cover Gasket Locator Pins at #8 & #9

(4) Install control cables and bracket on intake manifold and tighten bolts to 8.7 N·m (77 in. lbs.) torque.

(5) Connect control cables to throttle body linkage.

(6) Snap control cables into cylinder head cover clip.

(7) Connect negative cable to battery.

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. All valves use three bead locks to promote valve rotation (Fig. 14).

STANDARD PROCEDURE - VALVE SERVICE

VALVE REFACING

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 0.787 mm (0.031 inch) must remain (Fig. 15). If the margin is less than 0.787 mm (0.031 inch), the valve must be replaced.

VALVE SEAT REFACING

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

(2) Use tapered stones to obtain the specified seat width when required.

INTAKE/EXHAUST VALVES & SEATS (Continued)

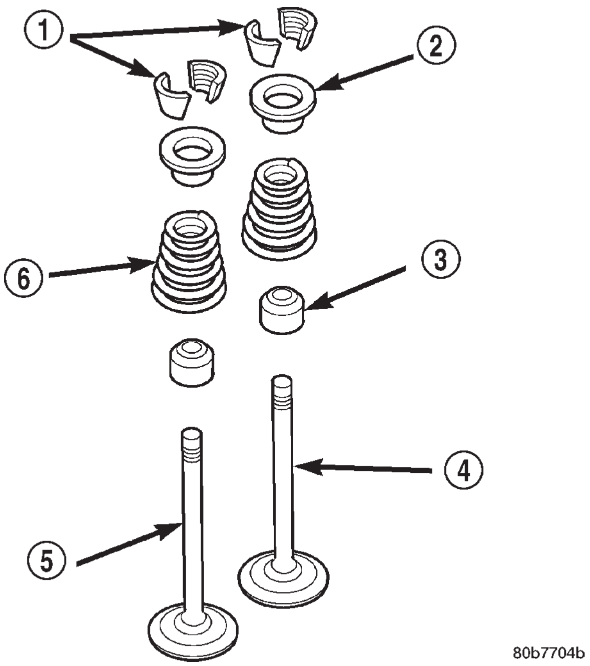


Fig. 14 VALVE AND KEEPER CONFIGURATION 4.0L

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

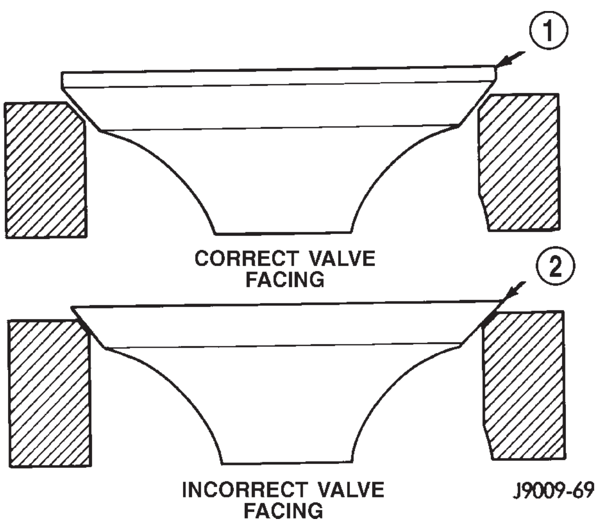


Fig. 15 Valve Facing

1 - VALVE MARGIN
2 - NO MARGIN

(3) Control valve seat runout to a maximum of 0.0635 mm (0.0025 in.) (Fig. 16).

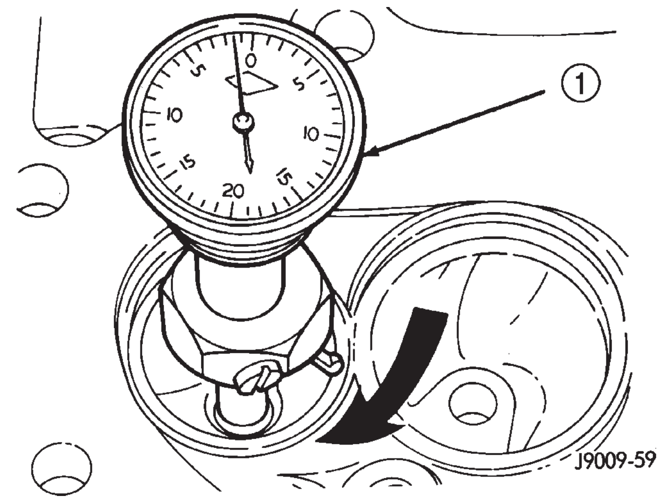


Fig. 16 Measurement of Valve Seat Runout

1 - DIAL INDICATOR

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

PREFERRED METHOD

(1) Remove the valve from the head.

(2) Clean the valve stem guide bore with solvent and a bristle brush.

(3) Insert a telescoping gauge into the valve stem guide bore approximately 9.525 mm (.375 inch) from the valve spring side of the head (Fig. 17).

(4) Remove and measure telescoping gauge with a micrometer.

(5) Repeat the measurement with contacts lengthwise to engine cylinder head.

(6) Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0635 mm (0.0025 in.), ream the guide bore to accommodate an oversize valve stem.

(7) Compare the measured valve guide bore diameter with specifications (7.95-7.97 mm or 0.313-0.314 inch). If the measurement differs from specification by more than 0.076 mm (0.003 inch), ream the guide bore to accommodate an oversize valve stem.

ALTERNATIVE METHOD

(1) Use a dial indicator to measure the lateral movement of the valve stem (stem-to-guide clearance). This must be done with the valve installed in its guide and just off the valve seat (Fig. 18).

(2) Correct clearance is 0.025-0.0762 mm (0.001-0.003 inch). If indicated movement exceeds the specification ream the valve guide to accommodate an oversize valve stem.

INTAKE/EXHAUST VALVES & SEATS (Continued)

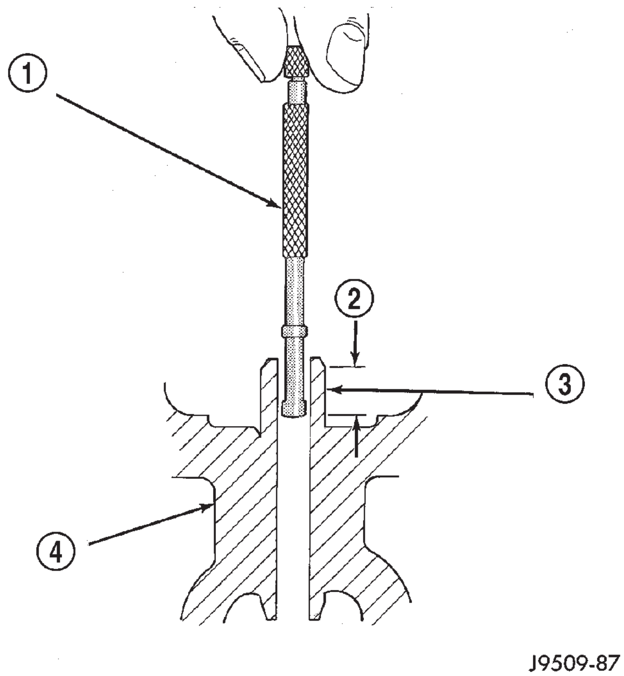


Fig. 17 Measurement of Valve Guide Bore Diameter

1 - GAUGE
2 - 9.525 MM (3/8 INCH)
3 - VALVE STEM GUIDE
4 - CYLINDER HEAD

NOTE: Valve seats must be ground after reaming the valve guides to ensure that the valve seat is concentric to the valve guide.

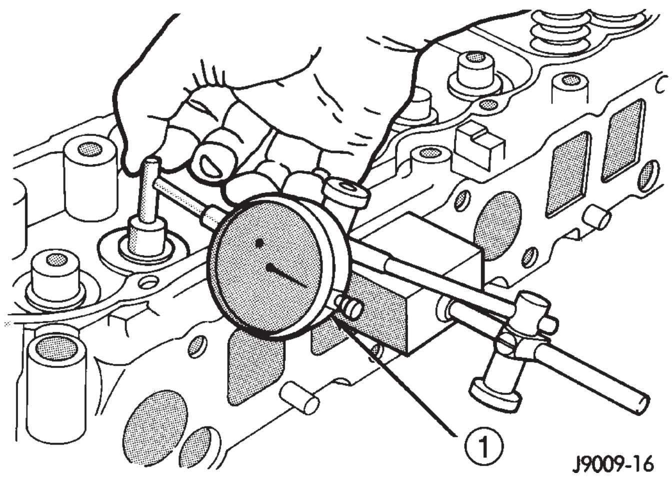


Fig. 18 Measurement of Lateral Movement Of Valve Stem

1 - DIAL INDICATOR

REMOVAL

NOTE: This procedure is done with the engine cylinder head removed from the block.

(1) Remove the engine cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) from the cylinder block.

(2) Use Valve Spring Compressor Tool MD-998772A and compress each valve spring.

(3) Remove the valve locks, retainers, springs and valve stem oil seals. Discard the oil seals (Fig. 19).

(4) Use a smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.

(5) Remove the valves, and place them in a rack in the same order as removed.

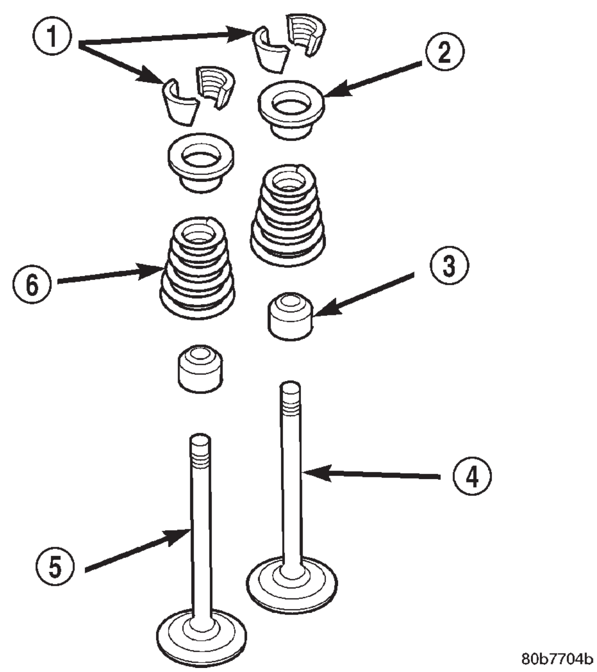


Fig. 19 Valve and Valve Components

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

INSTALLATION

NOTE: This procedure is done with the engine cylinder head removed from the block.

(1) Thoroughly clean the valve stems and the valve guide bores.

(2) Lightly lubricate the stem.

(3) Install the valve in the original valve guide bore.

(4) Install the replacement valve stem oil seals on the valve stems (Fig. 20). If the 0.381 mm (0.015 inch) oversize valve stems are used, oversize oil seals are required.

INTAKE/EXHAUST VALVES & SEATS (Continued)

(5) Position the valve spring and retainer on the engine cylinder head and compress the valve spring with Valve Spring Compressor Tool MD-998772A.

(6) Install the valve locks and release the tool.

(7) Tap the valve spring from side to side with a hammer to ensure that the spring is properly seated at the engine cylinder head. Also tap the top of the retainer to seat the valve locks.

(8) Install the engine cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

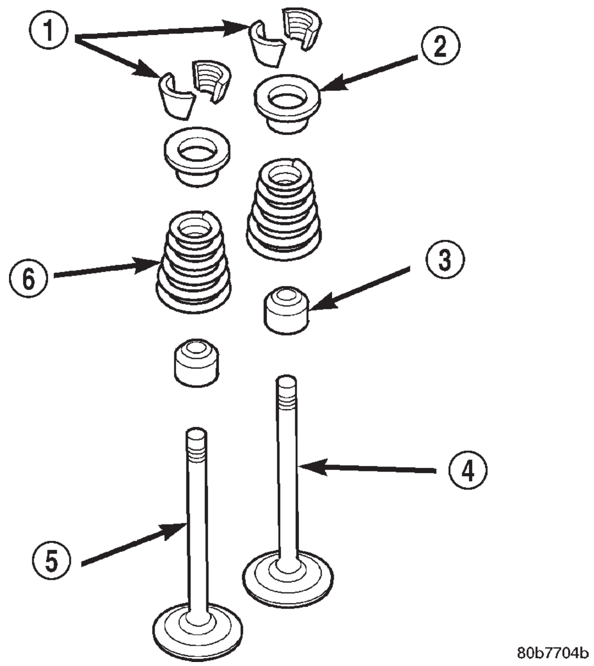


Fig. 20 Valve and Valve Components

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

ROCKER ARM / ADJUSTER ASSEMBLY

DESCRIPTION

The rocker arms are made of stamped steel and have a operational ratio of 1.6:1 (Fig. 21).

OPERATION

When the push rods are forced upward by the camshaft lobes the push rod presses upward on the rocker arms, the rocker arms pivot, forcing downward pressure on the valves forcing the valves to move downward and off from their seats.

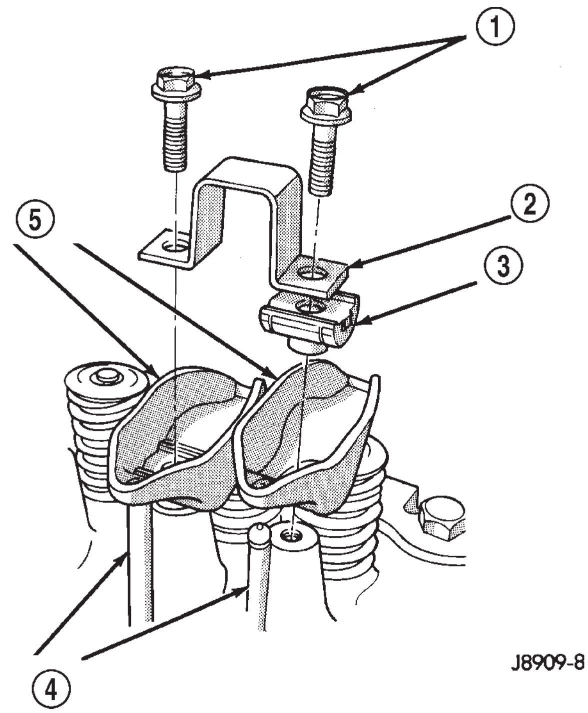


Fig. 21 Rocker Arms—Typical

1 - CAPSCREWS
2 - BRIDGE
3 - PIVOT ASSEMBLY
4 - PUSH RODS
5 - ROCKER ARMS

REMOVAL

NOTE: This procedure can be done with the engine in or out of the vehicle.

(1) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Check for rocker arm bridges which are causing misalignment of the rocker arm to valve tip area.

(3) Remove the capscrews at each bridge and pivot assembly (Fig. 22). Alternately loosen the capscrews one turn at a time to avoid damaging the bridges.

(4) Remove the bridges, pivots and corresponding pairs of rocker arms (Fig. 22). Place them on a bench in the same order as removed.

(5) Remove the push rods and place them on a bench in the same order as removed.

CLEANING

Clean all the components with cleaning solvent.

Use compressed air to blow out the oil passages in the rocker arms and push rods.

ROCKER ARM / ADJUSTER ASSEMBLY (Continued)

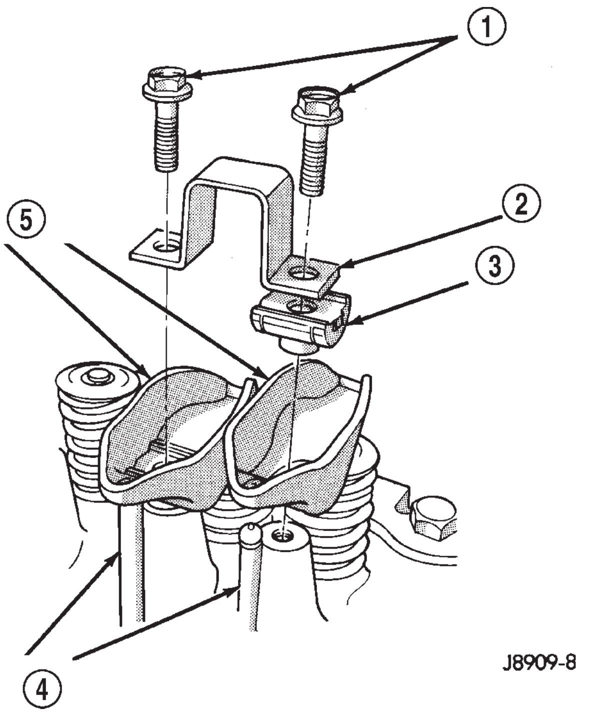


Fig. 22 Rocker Arm

1 - CAPSCREWS
2 - BRIDGE
3 - PIVOT ASSEMBLY
4 - PUSH RODS
5 - ROCKER ARMS

INSPECTION

Inspect the pivot surface area of each rocker arm. Replace any that are scuffed, pitted, cracked or excessively worn.

Inspect the valve stem tip contact surface of each rocker arm and replace any rocker arm that is deeply pitted.

Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn because of lack of oil, replace it and inspect the corresponding hydraulic tappet for excessive wear.

Inspect the push rods for straightness by rolling them on a flat surface or by shining a light between the push rod and the flat surface.

A wear pattern along the length of the push rod is not normal. Inspect the engine cylinder head for obstruction if this condition exists.

INSTALLATION

NOTE: This procedure can be done with the engine in or out of the vehicle.

(1) Lubricate the ball ends of the push rods with Mopar® Engine Oil Supplement, or equivalent and install push rods in their original locations. Ensure that the bottom end of each push rod is centered in the tappet plunger cap seat.

(2) Using Mopar® Engine Oil Supplement, or equivalent, lubricate the area of the rocker arm that the pivot contacts. Install rocker arms, pivots and bridge above each cylinder in their originally position (Fig. 23).

(3) Loosely install the capscrews through each bridge.

(4) At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(5) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

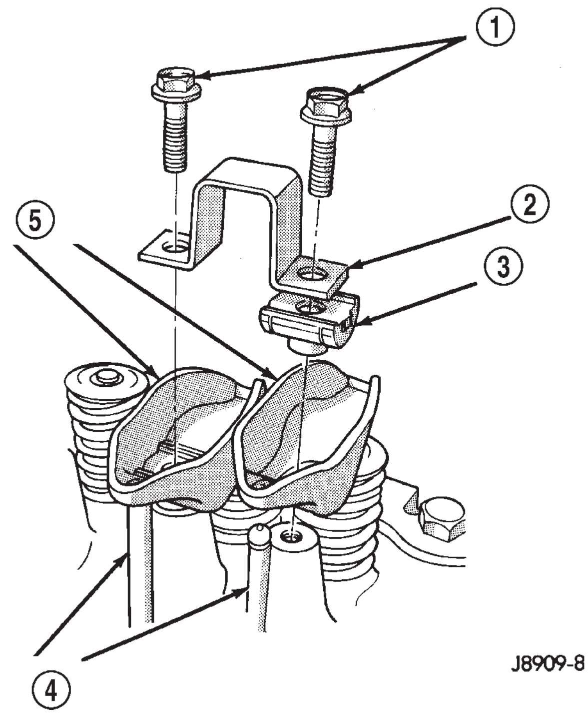


Fig. 23 Rocker Arm

1 - CAPSCREWS
2 - BRIDGE
3 - PIVOT ASSEMBLY
4 - PUSH RODS
5 - ROCKER ARMS

VALVE STEM SEALS

DESCRIPTION

The valve stem seals (Fig. 24) are made of rubber and incorporate a garter spring to maintain consistent lubrication control.

VALVE STEM SEALS (Continued)

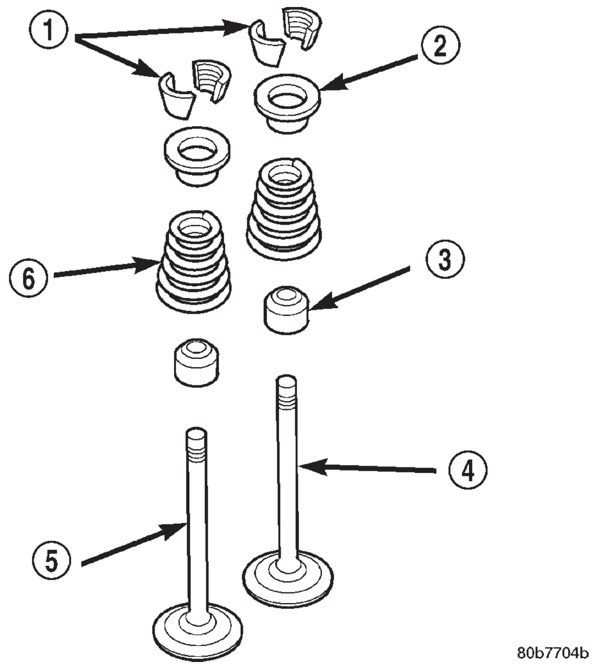


Fig. 24 Valve

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

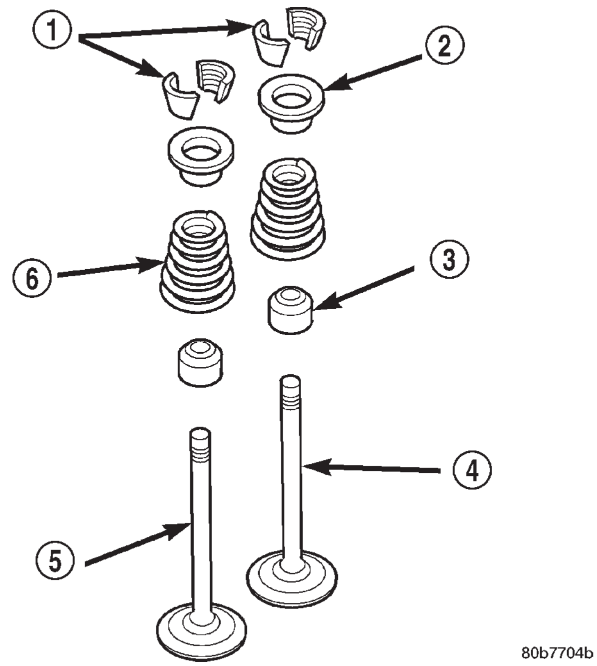


Fig. 25 VALVE AND KEEPER CONFIGURATION 4.0L

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

VALVE SPRINGS

DESCRIPTION

The valve springs (Fig. 25) are made of high strength silicon chrome spring steel. The springs are common for both intake and exhaust valves.

STANDARD PROCEDURE - VALVE SPRING TENSION TEST

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

Use a universal Valve Spring Tester and a torque wrench to test each valve spring for the specified tension value (Fig. 26).

Replace valve springs that are not within specifications.

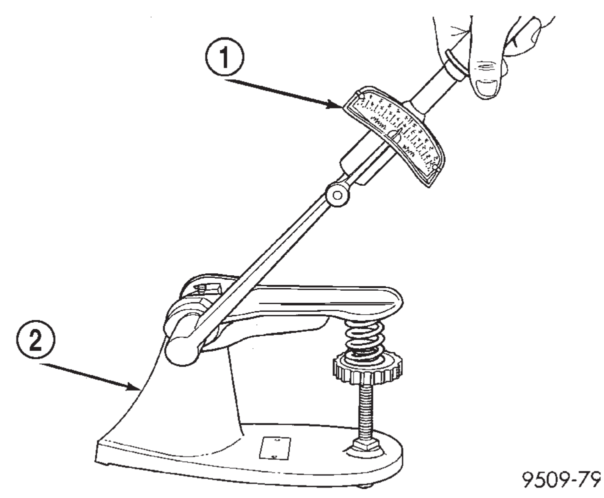


Fig. 26 Valve Spring Tester

1 - TORQUE WRENCH
2 - VALVE SPRING TESTER

REMOVAL

NOTE: This procedure can be done with the engine cylinder head installed on the block.

Inspect the valve stems, especially the grooves. An Arkansas smooth stone should be used to remove nicks and high spots.

Each valve spring is held in place by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.

(1) Remove the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

VALVE SPRINGS (Continued)

(2) Remove cap screws, bridge and pivot assemblies and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL) for access to each valve spring to be removed.

(3) Remove push rods. **Retain the push rods, bridges, pivots and rocker arms in the same order and position as removed.**

(4) Inspect the springs and retainer for cracks and possible signs of weakening.

(5) Remove the spark plug(s) adjacent to the cylinder(s) below the valve springs to be removed.

(6) Connect an air hose to the adapter and apply air pressure slowly. Maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats. For vehicles equipped with an air conditioner, use a flexible air adaptor when servicing the No.1 cylinder.

(7) Tap the retainer or tip with a rawhide hammer to loosen the lock from the retainer. Use Valve Spring Compressor Tool MD-998772A to compress the spring and remove the locks (Fig. 27).

(8) Remove valve spring and retainer (Fig. 27).

(9) Remove valve stem oil seals (Fig. 27). Note the valve seals are different for intake and exhaust valves. The top of each seal is marked either INT (intake/black in color) or EXH (exhaust/brown in color). DO NOT mix the seals.

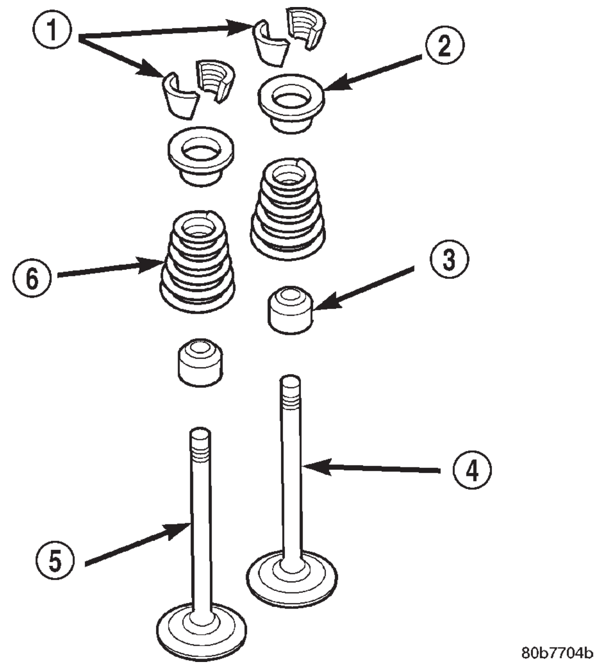


Fig. 27 Valve and Valve Components

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

INSTALLATION

NOTE: This procedure can be done with the engine cylinder head installed on the block.

CAUTION: Install oil seals carefully to prevent damage from the sharp edges of the valve spring lock grove.

(1) Lightly push the valve seal over the valve stem and valve guide boss. Be sure the seal is completely seated on the valve guide boss.

(2) Install valve spring and retainer (Fig. 28).

(3) Compress the valve spring with Valve Spring Compressor Tool MD-998772A and insert the valve locks. Release the spring tension and remove the tool. Tap the spring from side-to-side to ensure that the spring is seated properly on the engine cylinder head.

(4) Release air pressure and disconnect the air hose. Remove the adaptor from the spark plug hole and install the spark plug.

(5) Repeat the procedures for each remaining valve spring to be removed.

(6) Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

(7) Install the rocker arms, pivots and bridge (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION) at their original location.

(8) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

VALVE SPRINGS (Continued)

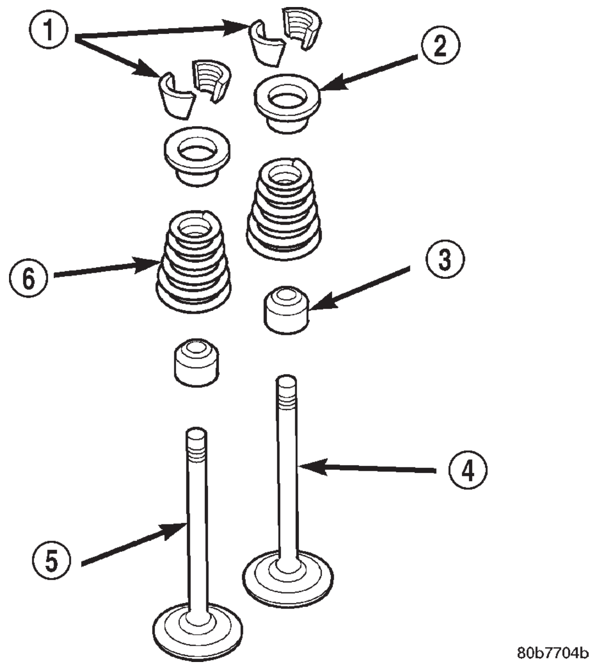


Fig. 28 Valve and Valve

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

ENGINE BLOCK

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:
- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N·m (25 ft. lbs.) torque.

INSPECTION

(1) It is mandatory to use a dial bore gauge to measure each cylinder bore diameter (Fig. 29). To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.

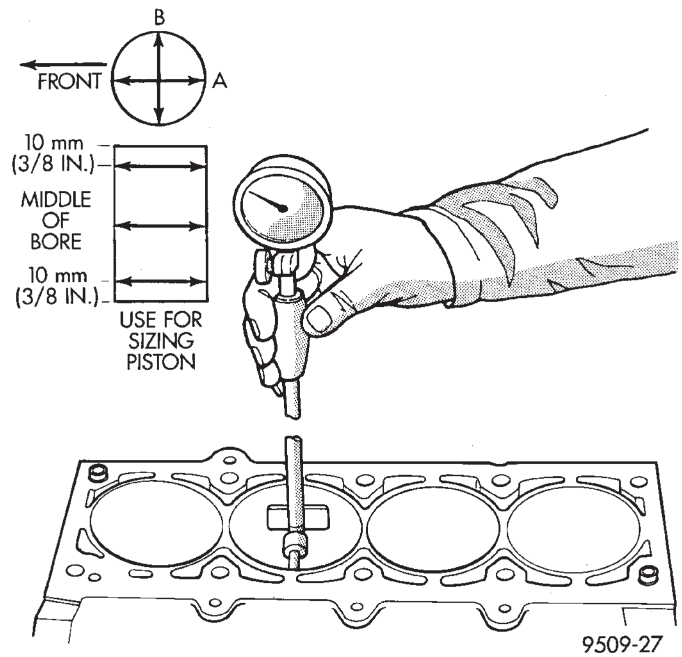


Fig. 29 Cylinder Bore Measurement

(3) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.

(4) Determine taper by subtracting the smaller diameter from the larger diameter.

(5) Rotate measuring device 90° and repeat steps above.

(6) Determine out-of-roundness by comparing the difference between each measurement.

(7) If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder must be bored and then honed to accept an oversize piston. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

CAMSHAFT & BEARINGS

DESCRIPTION

The camshaft is made of gray cast iron with twelve machined lobes and four bearing journals (Fig. 30). When the camshaft rotates the lobes actuate the tappets and push rods, forcing upward on the rocker arms which applies downward force on the valves.

CAMSHAFT & BEARINGS (Continued)

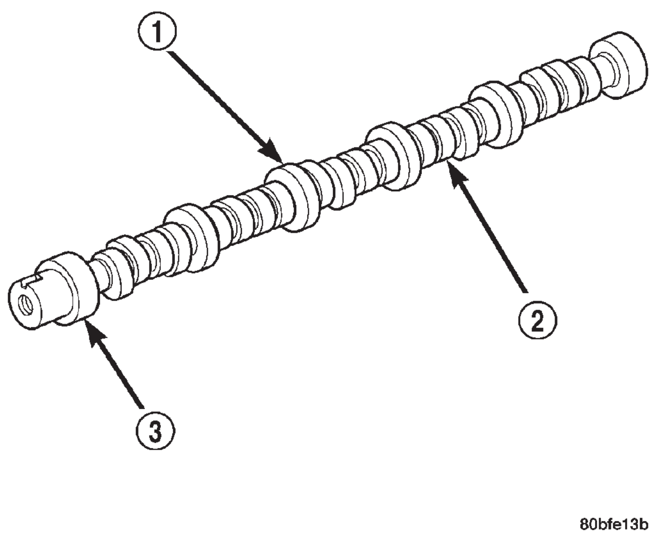


Fig. 30 Camshaft—Typical

1 - CAMSHAFT
2 - LOBES
3 - BEARING JOURNAL

REMOVAL

REMOVAL - CAMSHAFT BEARINGS

The camshaft rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed. The camshaft bearing bores and bearing diameters are not the same size. They are stepped down in 0.254 mm (0.010 inch) increments from the front bearing (largest) to the rear bearing (smallest). This permits easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated. Camshaft end play is maintained by the thrust plate.

(1) Remove the camshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).

NOTE: It is not advisable to attempt to replace camshaft bearings unless special removal and installation tools are available, such as recommended tool 8544 Camshaft Bushing Remover Installer.

(2) Using Special tool 8544 Camshaft Bushing Remover Installer, remove the camshaft bearings.

REMOVAL - CAMSHAFT

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. RELEASE THE PRESSURE BEFORE REMOVING THE DRAIN COCK, CAP AND DRAIN PLUGS.

(1) Disconnect negative cable from battery.

(2) Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL) and condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - REMOVAL), if equipped with A/C.

(4) Remove the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(5) Remove the rocker arms, bridges and pivots (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).

(6) Remove the push rods.

(7) Remove the engine cylinder head and gasket (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(8) Remove the hydraulic valve tappets from the engine cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - REMOVAL).

(9) Remove the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(10) Remove the timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(11) Rotate the crankshaft until the crankshaft sprocket timing mark is aligned on centerline with the camshaft sprocket timing mark (Fig. 32).

(12) Remove the timing chain and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(13) Remove the front bumper and/or grille, as required.

(14) Remove the two thrust plate retaining screws, thrust plate and camshaft (Fig. 31).

INSPECTION

INSPECTION - CAMSHAFT BEARINGS

(1) Inspect the bearing journals for uneven wear pattern or finish.

(2) Inspect the bearings for wear.

INSPECTION - CAMSHAFT

(1) Inspect the cam lobes for wear.

(2) Inspect the camshaft position sensor drive gear for wear.

(3) If the camshaft appears to have been rubbing against the thrust washer, examine the oil pressure

CAMSHAFT & BEARINGS (Continued)

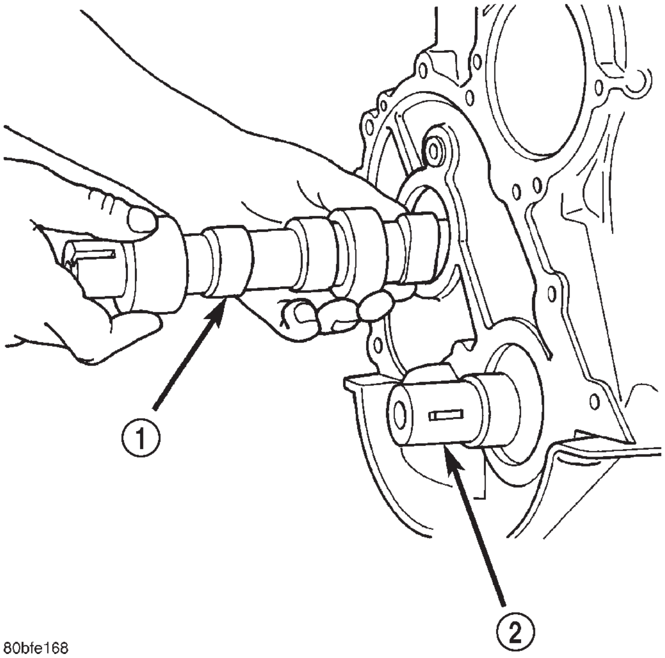


Fig. 31 Camshaft Removal

1 - CAMSHAFT
2 - CRANKSHAFT

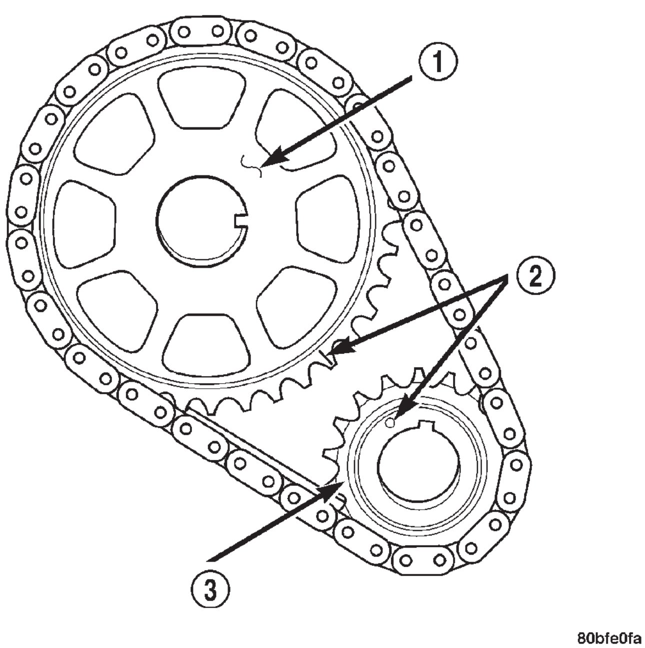


Fig. 32 Crankshaft / Camshaft Sprocket Timing Mark Alignment

1 - CAMSHAFT SPROCKET
2 - TIMING MARKS
3 - CRANKSHAFT SPROCKET

relief holes in the rear cam journal. The oil pressure relief holes must be free of debris.

INSTALLATION

INSTALLATION - CAMSHAFT BEARINGS

CAUTION: Make sure outside diameter of number 1 bearing is clean. Make sure that the bearing is properly installed in the engine block, align the oil hole in the bearing with the oil gallery in the bearing bore. Failure to do so will cause inadequate oil supply for the sprockets and timing chain.

(1) Using recommended special tool 8544 Camshaft Bearing Remover/Installer, install new camshaft bearings.

INSTALLATION - CAMSHAFT

(1) Lubricate the camshaft with Mopar® Engine Oil Supplement, or equivalent.

(2) Carefully install the camshaft to prevent damage to the camshaft bearings.

(3) Position thrust plate and install retaining screws. Tighten screws to 24 N·m (18 ft. lbs.).

(4) Lubricate the camshaft with Mopar® engine oil supplement, or equivalent.

(5) Install the camshaft sprocket, crankshaft sprocket and timing chain (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(6) Tighten the camshaft sprocket bolt and washer to 68 N·m (50 ft. lbs.).

(7) To verify correct installation of the timing chain, turn the crankshaft two full revolutions then position the camshaft sprocket timing mark as shown in (Fig. 33).

(8) Install the timing case cover with a replacement oil seal (Fig. 34). (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install the vibration damper (Fig. 34) (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(10) Install the hydraulic valve tappets (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - INSTALLATION).

(11) Install the cylinder head gasket with the numbers facing up.

(12) Install the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(13) Install the push rods.

(14) Install the rocker arms and pivot and bridge assemblies (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).

(15) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

CAMSHAFT & BEARINGS (Continued)

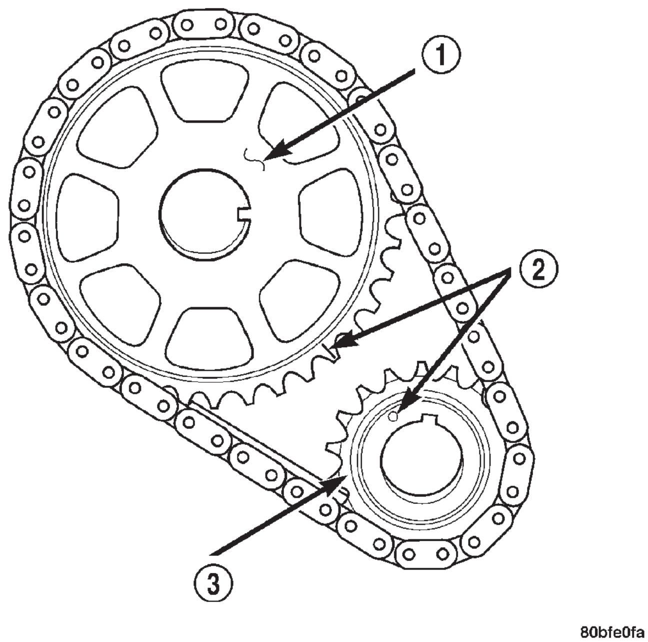


Fig. 33 Crankshaft / Camshaft Chain Drive Installation—Typical

1 - CAMSHAFT SPROCKET
2 - TIMING MARKS
3 - CRANKSHAFT SPROCKET

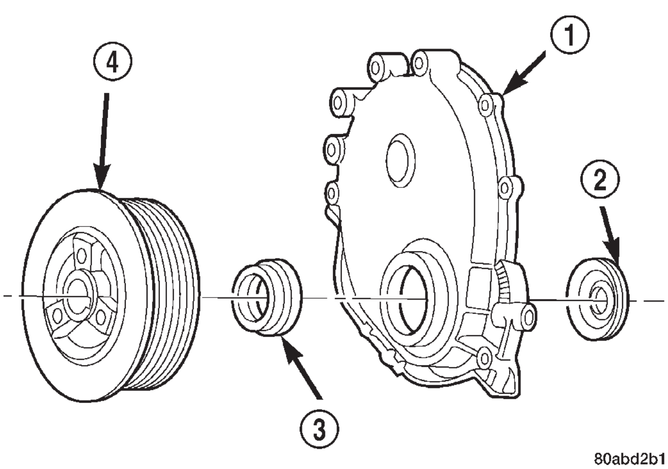


Fig. 34 Timing Case Cover Components

1 - TIMING CASE COVER
2 - OIL SLINGER
3 - CRANKSHAFT OIL SEAL
4 - VIBRATION DAMPER PULLEY

(16) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

NOTE: During installation, lubricate the hydraulic valve tappets and all valve components with Mopar® Engine Oil Supplement, or equivalent. The Mopar® Engine Oil Supplement, or equivalent must remain with the engine oil for at least 1609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

(17) Install the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(18) Check the ignition timing and adjust as necessary.

(19) Install the grille and bumper, if removed.

(20) Connect negative cable to battery.

CONNECTING ROD BEARINGS

STANDARD PROCEDURE - FITTING CONNECTING ROD BEARINGS

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 35) (Fig. 36). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 37). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

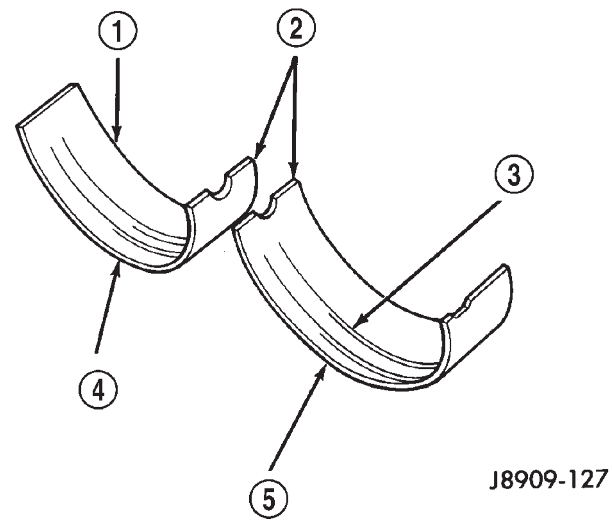


Fig. 35 Connecting Rod Bearing Inspection

1 - UPPER BEARING HALF
2 - MATING EDGES
3 - GROOVES CAUSED BY ROD BOLTS SCRATCHING JOURNAL DURING INSTALLATION
4 - WEAR PATTERN - ALWAYS GREATER ON UPPER BEARING
5 - LOWER BEARING HALF

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

CONNECTING ROD BEARINGS (Continued)

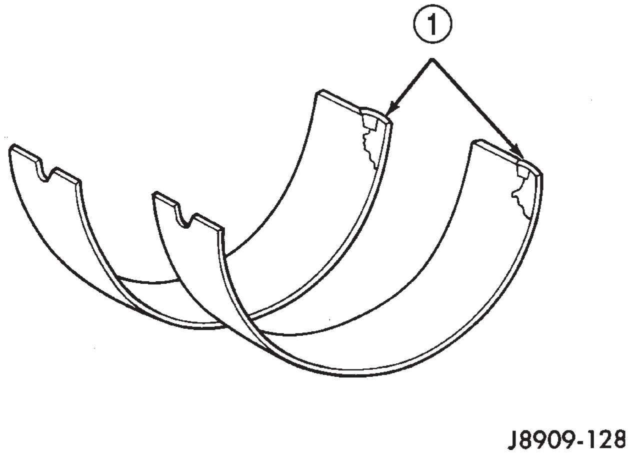


Fig. 36 Locking Tab Inspection

1 - ABNORMAL CONTACT AREA CAUSED BY LOCKING TABS NOT FULLY SEATED OR BEING BENT

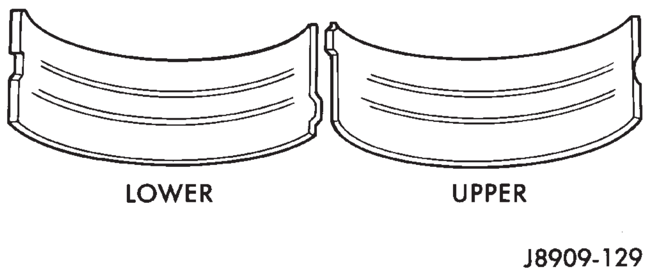


Fig. 37 Scoring Caused by Insufficient Lubrication or Damaged Crankshaft Journal

BEARING-TO-JOURNAL CLEARANCE

(1) Wipe the oil from the connecting rod journal.

(2) Use short rubber hose sections over rod bolts during installation.

(3) Lubricate the upper bearing insert and install in connecting rod.

(4) Use piston ring compressor to install the rod and piston assemblies. The oil squirt holes in the rods must face the camshaft. The arrow on the piston crown should point to the front of the engine (Fig. 38). Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

(5) Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

(6) Install bearing cap and connecting rod on the journal and tighten nuts to 45 N·m (33 ft. lbs.) torque. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

(7) Remove the bearing cap and determine amount of bearing-to- journal clearance by measuring the width of compressed Plastigage (Fig. 39). **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**

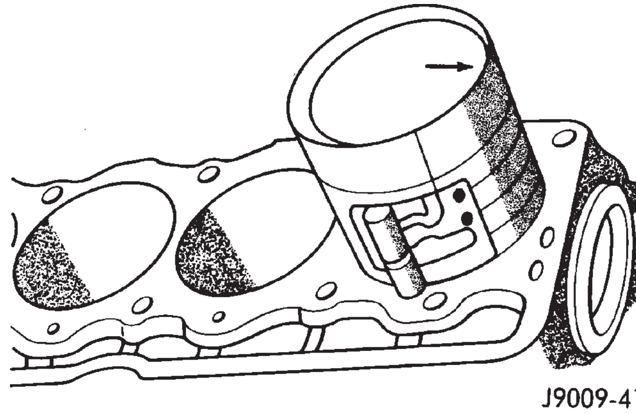


Fig. 38 Rod and Piston Assembly Installation

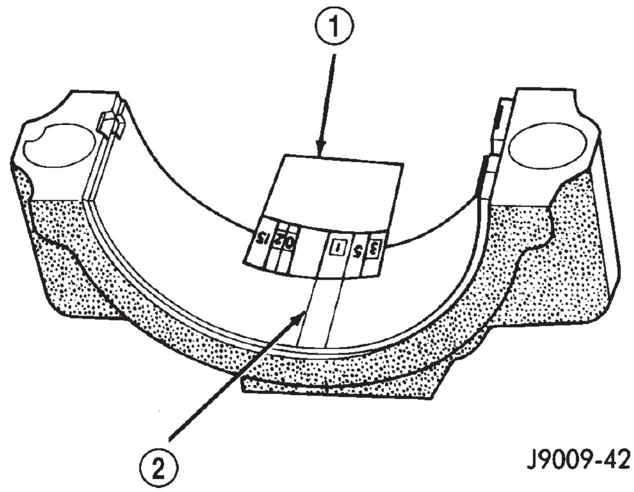


Fig. 39 Measuring Bearing Clearance with Plastigage

1 - PLASTIGAGE SCALE
2 - COMPRESSED PLASTIGAGE

(8) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

(9) If bearing-to-journal clearance exceeds the specification, install a pair of 0.0254 mm (0.001 inch) undersize bearing inserts. All the odd size inserts must be on the bottom. The sizes of the service replacement bearing inserts are stamped on the backs of the inserts. Measure the clearance as described in the previous steps.

(10) The clearance is measured with a pair of 0.0254 mm (0.001 inch) undersize bearing inserts installed. This will determine if two 0.0254 mm (0.001 inch) undersize inserts or another combination

CONNECTING ROD BEARINGS (Continued)

is needed to provide the correct clearance. Refer to CONNECTING ROD BEARING FITTING CHART .

CONNECTING ROD BEARING FITTING CHART

CRANKSHAFT JOURNAL		CORRESPONDING ROD BEARING INSERT	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	53.2257 - 53.2079 mm (2.0955 - 2.0948 in.)	Yellow - Standard	Yellow - Standard
Orange	53.2079 - 53.1901 mm (2.0948 - 2.0941 in.) 0.0178 mm (0.0007 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	53.1901 - 53.1724 mm (2.0941 - 2.0934 in.) 0.0356 mm (0.0014 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Red	52.9717 - 52.9539 mm (2.0855 - 2.0848 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

(11) **FOR EXAMPLE:** If the initial clearance was 0.0762 mm (0.003 inch), 0.025 mm (0.001 inch) undersize inserts would reduce the clearance by 0.025 mm (0.001 inch). The clearance would be 0.002 inch and within specification. A 0.051 mm (0.002 inch) undersize insert would reduce the initial clearance an additional 0.013 mm (0.0005 inch). The clearance would then be 0.038 mm (0.0015 inch).

(12) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(13) Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 45 N·m (33 ft. lbs.) torque.

SIDE CLEARANCE MEASUREMENT

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange (Fig. 40). (Refer to 9 - ENGINE - SPECIFICATIONS). Replace the connecting rod if the side clearance is not within specification.

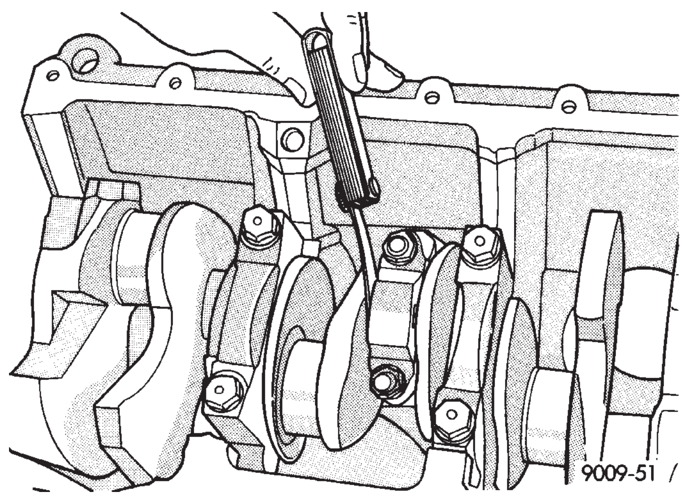


Fig. 40 Checking Connecting Rod Side Clearance - Typical

CRANKSHAFT

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by seven select main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The select fit main bearing markings are located on the crankshaft counter weights. The crankshaft rear oil seal is a two piece design. The front oil seal is a one piece design retained in the timing chain cover (Fig. 41).

CRANKSHAFT (Continued)

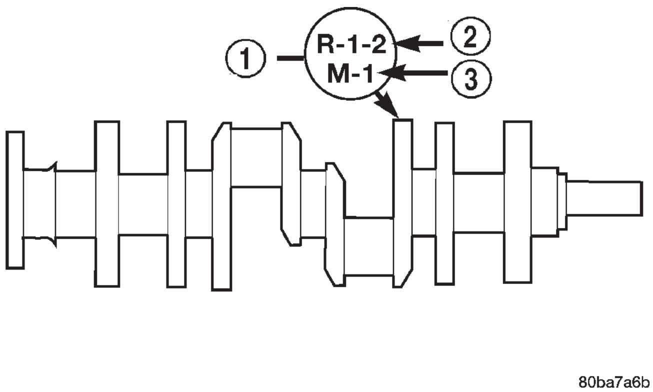


Fig. 41 Crankshaft with Select Fit Marking Location

1 - 1/4” LETTERS
2 - (ROD)
3 - (MAIN)

CRANKSHAFT MAIN BEARINGS

STANDARD PROCEDURE - FITTING CRANKSHAFT MAIN BEARINGS

FITTING BEARINGS (CRANKSHAFT INSTALLED)

The main bearing caps, numbered (front to rear) from 1 through 7 have an arrow to indicate the forward position. The upper main bearing inserts are grooved to provide oil channels while the lower inserts are smooth.

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance. In production, the select fit is obtained by using various-sized color-coded bearing insert pairs as listed in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert. **The size is not stamped on bearing inserts used for engine production.**

The main bearing journal size (diameter) is identified by a color-coded paint mark (Fig. 42)on the adjacent cheek or counterweight towards the rear of the crankshaft (flange end). The rear main journal, is identified by a color-coded paint mark on the crankshaft rear flange.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce the clearance by 0.013 mm (0.0005 inch). **Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 inch) difference in size. Refer to the Bearing Insert Pair Chart.**

NOTE: When replacing inserts, the odd size inserts must be either all on the top (in cylinder block) or all on the bottom (in main bearing cap).

Once the bearings have been properly fitted, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - INSTALLATION).

BEARING-TO-JOURNAL CLEARANCE (CRANKSHAFT INSTALLED)

When using Plastigage, check only one bearing clearance at a time.

Install the grooved main bearings into the cylinder block and the non-grooved bearings into the bearing caps.

Install the crankshaft into the upper bearings dry.

Place a strip of Plastigage across full width of the crankshaft journal to be checked.

Install the bearing cap and tighten the bolts to 108 N·m (80 ft. lbs.) torque.

NOTE: DO NOT rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate reading. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

Remove the bearing cap. Determine the amount of clearance by measuring the width of the compressed Plastigage with the scale on the Plastigage envelope (Fig. 43). (Refer to 9 - ENGINE - SPECIFICATIONS) for the proper clearance.

Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

If the specified clearance is indicated and there are no abnormal wear patterns, replacement of the bearing inserts is not necessary. Remove the Plastigage from the crankshaft journal and bearing insert. Proceed to (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT MAIN BEARINGS - INSTALLATION).

If the clearance exceeds specification, install a pair of 0.025 mm (0.001 inch) undersize bearing inserts and measure the clearance as described in the previous steps.

The clearance indicate with the 0.025 mm (0.001 inch) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance. **FOR EXAMPLE:** If the clearance was 0.0762 mm (0.003 inch) originally, a pair of 0.0254 mm (0.001 inch) undersize inserts would reduce the clearance by 0.0254 mm (0.001 inch). The clearance would then be 0.0508 mm (0.002 inch) and within the specification. A 0.051 mm (0.002 inch) undersize bearing insert and a 0.0254 mm (0.001 inch) undersize insert would reduce the origi-

CRANKSHAFT MAIN BEARINGS (Continued)

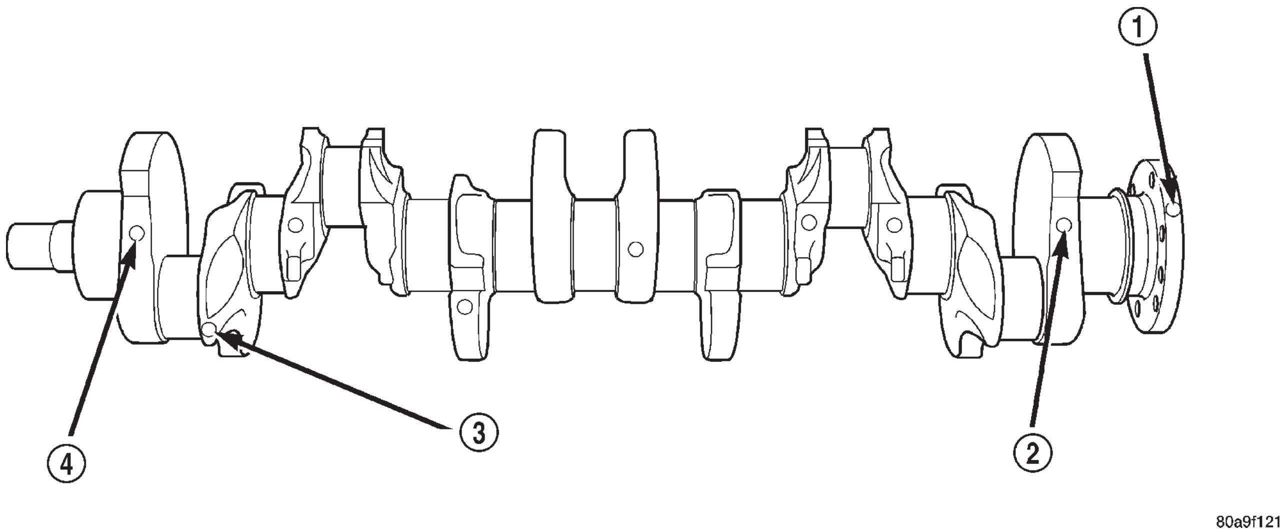


Fig. 42 Crankshaft Journal Size Paint I.D. Location

1 - NO. 7 MAIN JOURNAL SIZE PAINT MARK
2 - NO. 6 CONNECTING ROD JOURNAL SIZE PAINT MARK
3 - NO. 1 CONNECTING ROD JOURNAL SIZE PAINT MARK
4 - NO. 1 MAIN JOURNAL SIZE PAINT MARK

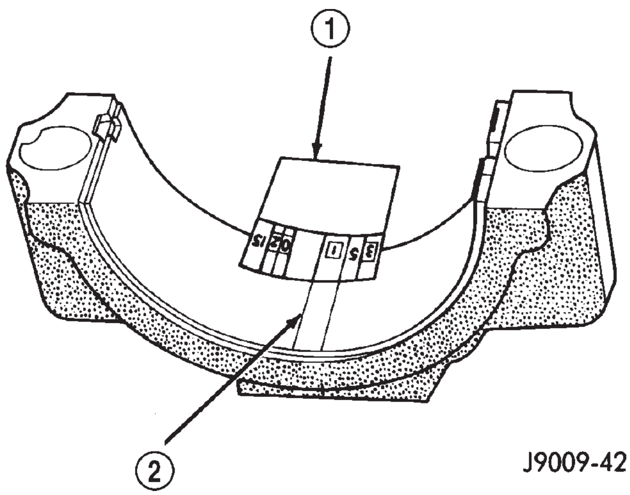


Fig. 43 Measuring Bearing Clearance with Plastigage

1 - PLASTIGAGE SCALE
2 - COMPRESSED PLASTIGAGE

nal clearance an additional 0.0127 mm (0.0005 inch). The clearance would then be 0.0381 mm (0.0015 inch).

CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair.

FOR EXAMPLE: DO NOT use a standard size upper insert and a 0.051 mm (0.002 inch) undersize lower insert.

If the clearance exceeds specification using a pair of 0.051 mm (0.002 inch) undersize bearing inserts, measure crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

Replace the crankshaft or grind to accept the appropriate undersize bearing inserts if:

- Journal diameters 1 through 6 are less than 63.4517 mm (2.4981 inches)
- Journal 7 diameter is less than 63.4365 mm (2.4975 inches).

Once the proper clearances have been obtained, proceed to (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - INSTALLATION).

JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper and out of round is 0.013 mm (0.0005 inch). Compare the measured diameter with the journal diameter specification MAIN BEARING FITTING CHART . Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block.

CRANKSHAFT MAIN BEARINGS (Continued)

MAIN BEARING FITTING CHART

Crankshaft Journals #1-6		Corresponding Crankshaft Bearing Insert	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	63.5025 -63.4898 mm (2.5001 - 2.4996 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4898 - 63.4771 mm (2.4996 - 2.4991 in.) 0.0127 mm (0.0005 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	63.4771 - 63.4644 mm (2.4991 - 2.4986 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4644 - 63.4517 mm (2.4986 - 2.4981 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2485 - 63.2358 mm (2.4901 - 2.4896 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

Crankshaft Journal #7 Only		Corresponding Bearing Insert	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	63.4873 - 63.4746 mm (2.4995 - 2.4990 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4746 - 63.4619 mm (2.4990 - 2.4985 in.) 0.0127 mm (0.0005 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	63.4619 - 63.4492 mm (2.4985 - 2.4980 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4492 - 63.4365 mm (2.4980 - 2.4975 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2333 - 63.2206 mm (2.4895 - 2.4890 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

CRANKSHAFT MAIN BEARINGS (Continued)

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(3) Raise the vehicle.

(4) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL) and oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

(5) Remove main bearing cap brace (Fig. 44).

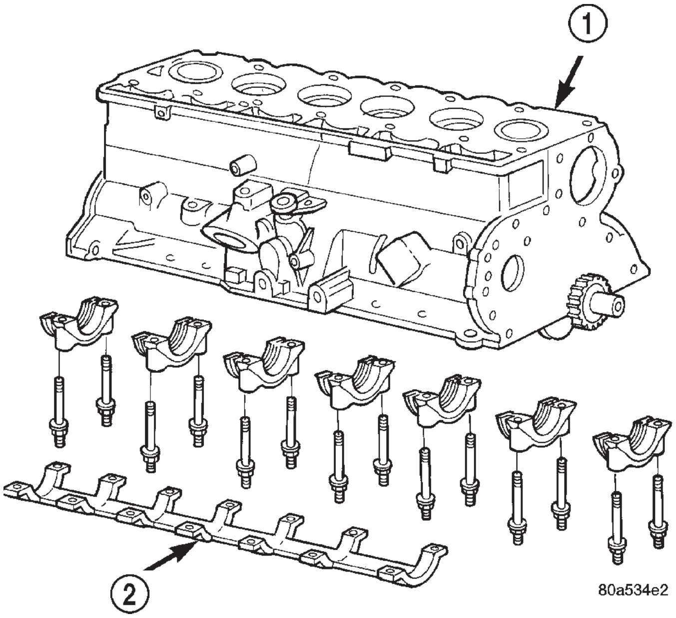


Fig. 44 Main Bearing Caps and Brace.

1 - BLOCK
2 - MAIN BEARING CAP BRACE

(6) Remove only one main bearing cap and lower insert at a time (Fig. 45).

(7) Remove the lower insert from the bearing cap.

(8) Remove the upper insert by LOOSENING (DO NOT REMOVE) all of the other bearing caps. Now insert a small cotter pin tool in the crankshaft journal oil hole. Bend the cotter pin as illustrated to fabricate the tool (Fig. 46). With the cotter pin tool in place, rotate the crankshaft so that the upper bearing insert will rotate in the direction of its locking tab. Because there is no hole in the No.3 main journal, use a tongue depressor or similar soft-faced tool to remove the bearing insert (Fig. 46). After moving the insert approximately 25 mm (1 inch), it can be removed by applying pressure under the tab.

(9) Using the same procedure described above, remove the remaining bearing inserts one at a time for inspection.

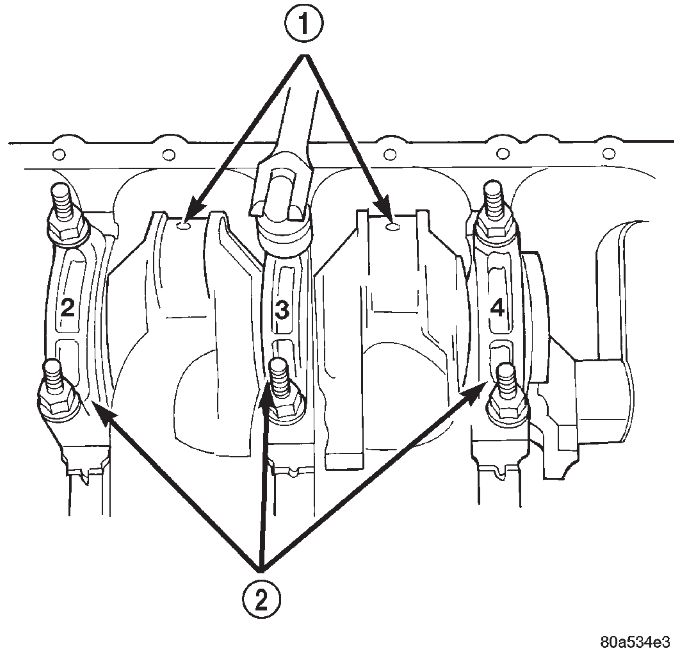


Fig. 45 Removing Main Bearing Caps and Lower Inserts

1 - CONNECTING ROD JOURNAL
2 - MAIN BEARING CAPS

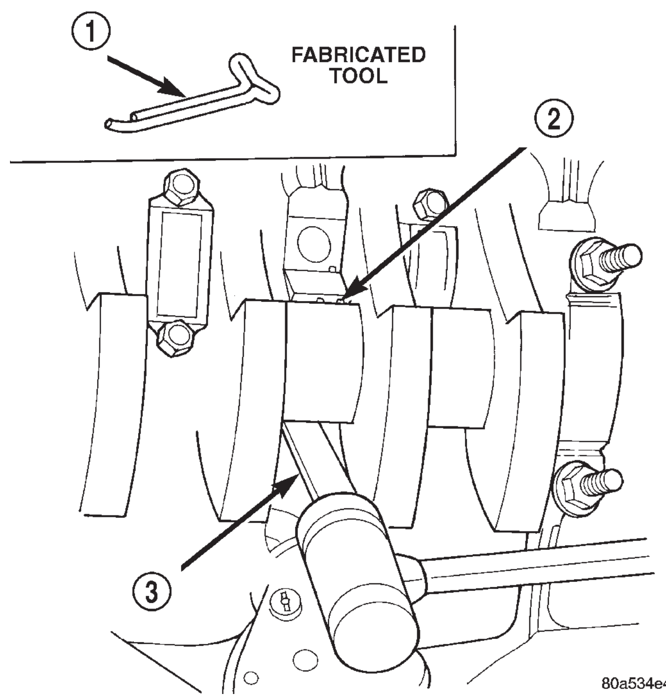


Fig. 46 Removing Upper Inserts

1 - COTTER PIN
2 - BEARING INSERT
3 - TONGUE DEPRESSOR

CRANKSHAFT MAIN BEARINGS (Continued)

INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated (Fig. 47). In general the lower bearing half will have a heaver wear pattern.

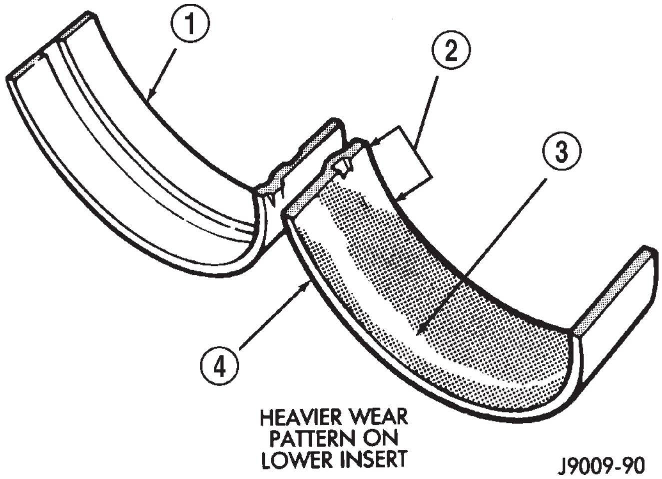


Fig. 47 Main Bearing Wear Patterns

1 - UPPER INSERT
2 - NO WEAR IN THIS AREA
3 - LOW AREA IN BEARING LINING
4 - LOWER INSERT

NOTE: If any of the crankshaft journals are scored, remove the engine for crankshaft repair.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

INSTALLATION

(1) Lubricate the bearing surface of each insert with engine oil.

(2) Loosen all the main bearing caps. Install the main bearing upper inserts.

(3) Install the lower bearing inserts into the main bearing caps.

(4) On the rear main cap, apply Mopar® Gasket Maker sealer on both sides of cylinder block as shown in (Fig. 48). The dab of sealer should be 3 mm (0.125 in.) in diameter.

(5) Apply Mopar® Gasket Maker on the rear bearing cap. The bead should be 2.3 mm (0.09 in.) in diameter. DO NOT apply sealer to the lip of the seal.

(6) Install the main bearing cap(s) and lower insert(s).

(7) Tighten the bolts of caps 1, 2, 4, 5, 6, and 7 to 54 N·m (40 ft. lbs.) torque. Now tighten these bolts to 95 N·m (70 ft. lbs.) torque. Finally, tighten these bolts to 108 N·m (80 ft. lbs.) torque.

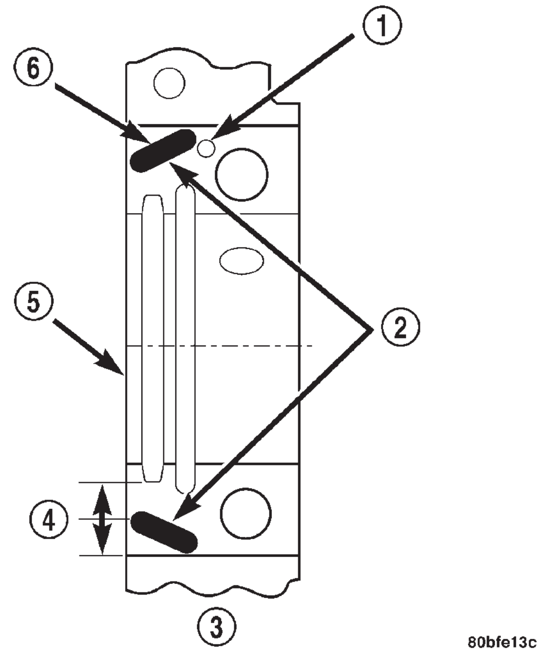


Fig. 48 Location of Sealer

1 - **DOWEL**
2 - **SEALER LOCATIONS**
3 - **CYLINDER BLOCK**
4 - **HALFWAY BETWEEN**
5 - **REAR FACE OF CYLINDER BLOCK**
6 - **3mm (0.125 in.)**

(8) Push the crankshaft forward and backward. Load the crankshaft front or rear and tighten cap bolt No.3 to 54 N·m (40 ft. lbs.) torque. Then tighten to 95 N·m (70 ft. lbs.) torque and finally tighten to 108 N·m (80 ft. lbs.) torque.

(9) Rotate the crankshaft after tightening each main bearing cap to ensure the crankshaft rotates freely.

(10) Check crankshaft end play. Crankshaft end play is controlled by the thrust bearing which is flange and installed at the No.2 main bearing position.

(a) Attach a magnetic base dial indicator to the cylinder block at either the front or rear of the engine.

(b) Position the dial indicator rod so that it is parallel to the center line of the crankshaft.

(c) Pry the crankshaft forward, position the dial indicator to zero.

(d) Pry the crankshaft forward and backward. Note the dial indicator readings. End play is the difference between the high and low measurements (Fig. 49). Correct end play is 0.038-0.165 mm (0.0015-0.0065 inch). The desired specifications are 0.051-0.064 mm (0.002-0.0025 inch).

CRANKSHAFT MAIN BEARINGS (Continued)

(e) If end play is not within specification, inspect crankshaft thrust faces for wear. If no wear is apparent, replace the thrust bearing and measure end play. If end play is still not within specification, replace the crankshaft.

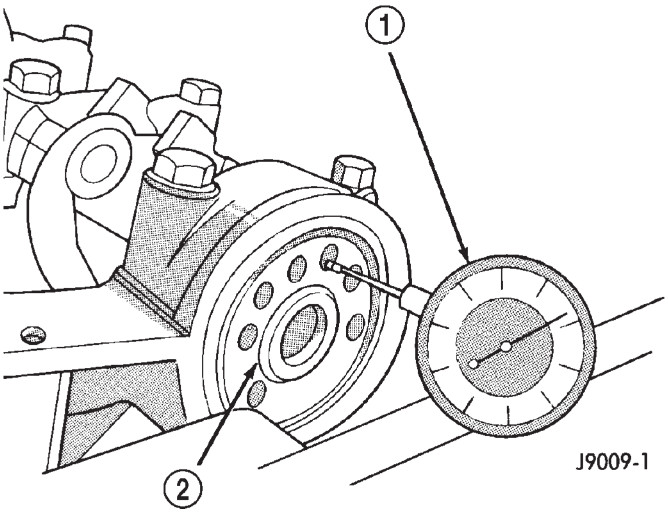


Fig. 49 Crankshaft End Play Measurement

1 - DIAL INDICATOR
2 - CRANKSHAFT

(11) If the crankshaft was removed, install the crankshaft into the cylinder block.

(12) Install main bearing cap brace tighten nuts to 47 N·m (35 ft. lbs.) torque.

(13) Install oil pump assy. and tighten attaching bolts to 23 N·m (17 ft. lbs.)

(14) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(15) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(16) Lower the vehicle.

(17) Install the spark plugs. Tighten the plugs to 37 N·m (27 ft. lbs.) torque.

(18) Fill the oil pan with engine oil to the full mark on the dipstick level.

(19) Connect negative cable to battery.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

This procedure is done with the timing case cover installed.

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(4) Remove the radiator shroud.

(5) Carefully remove the oil seal. Make sure seal bore is clean.

INSTALLATION

This procedure is done with the timing case cover installed.

(1) Position the replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool 6139 with seal open end facing inward. Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal. Lightly coat the crankshaft with engine oil.

(2) Position the tool and seal over the end of the crankshaft and insert a draw screw tool into Seal Installation Tool 6139 (Fig. 50). Tighten the nut against the tool until it contacts the cover.

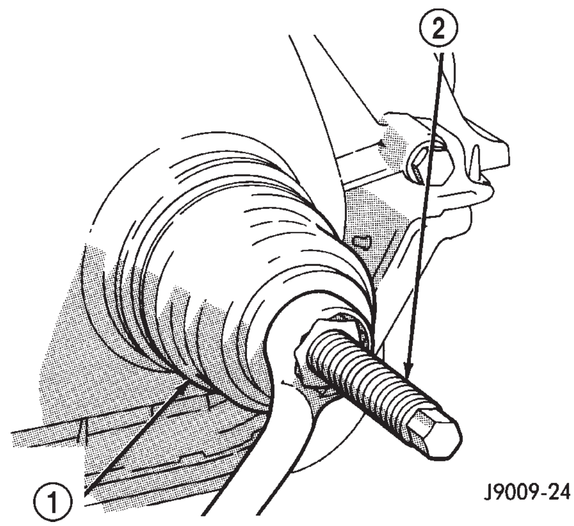


Fig. 50 Timing Case Cover Oil Seal Installation

1 - SEAL INSTALLATION TOOL
2 - DRAW SCREW TOOL

(3) Remove the tools. Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(4) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(5) Install the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Install the radiator shroud.

(7) Connect negative cable to battery.

CRANKSHAFT OIL SEAL - REAR

REMOVAL

The crankshaft rear main bearing oil seal consists of two half pieces of viton with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

(1) Remove transmission inspection cover.

(2) Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

(3) Remove main bearing cap brace.

(4) Remove rear main bearing cap (No.7).

(5) Push upper seal out of the groove. Ensure that the crankshaft and seal groove are not damaged.

(6) Remove lower half of the seal from the bearing cap.

INSTALLATION

The crankshaft rear main bearing oil seal consists of two half pieces of viton with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

(1) Wipe the seal surface area of the crankshaft until it is clean.

(2) Apply a thin coat of engine oil.

(3) Coat lip of the seal with engine oil.

(4) Carefully position the upper seal into the groove in the cylinder block. The lip of the seal faces toward the front of the engine.

(5) Apply Mopar® Gasket Maker sealer on both sides of cylinder block as shown in (Fig. 51). The dab of sealer should be 3 mm (0.125 in.) in diameter.

(6) Apply Mopar® Gasket Maker on the rear bearing cap (Fig. 51). The bead should be 2.3 mm (0.09 in.) in diameter. DO NOT apply sealer to the lip of the seal.

(7) Position the lower seal into the bearing cap recess and seat it firmly. Be sure the seal is flush with the cylinder block pan rail.

(8) Coat the outer curved surface of the lower seal with soap and the lip of the seal with engine oil.

(9) Install the rear main bearing cap. DO NOT strike the cap more than twice for proper engagement.

(10) Tighten all main bearing bolts to 108 N·m (80 ft. lbs.) torque.

(11) Install the main bearing cap brace. Tighten nuts to 47 N·m (35 ft. lbs.).

(12) Install the oil pan gasket and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

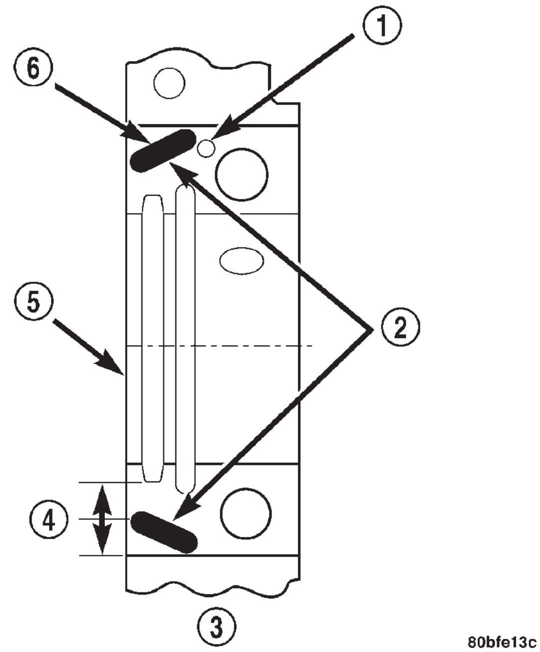


Fig. 51 Location of Sealer

1 - DOWEL
2 - SEALER LOCATIONS
3 - CYLINDER BLOCK
4 - HALFWAY BETWEEN
5 - REAR FACE OF CYLINDER BLOCK
6 - 3mm (0.125 in.)

(13) Apply Mopar® Silicone Rubber Adhesive Sealant on cylinder block to rear main bearing cap corners and cylinder block to front cover joints (four places) (Fig. 52)

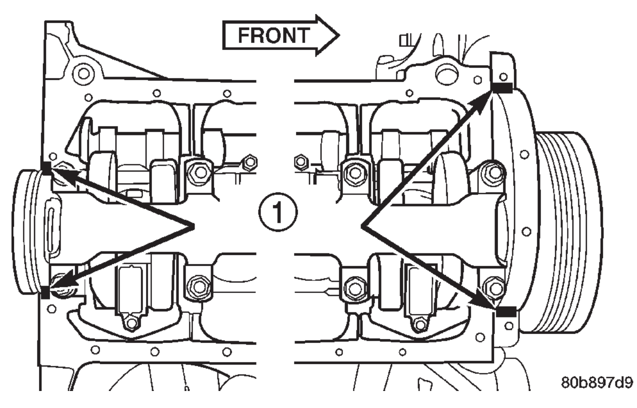


Fig. 52 Oil Pan

1 - SEALER LOCATIONS

(14) Install transmission inspection cover.

HYDRAULIC LIFTERS

DESCRIPTION

Valve lash is controlled by hydraulic tappets located inside the cylinder block, in tappet bores above the camshaft.

REMOVAL

NOTE: Retain all the components in the same order as removed.

(1) Remove the engine cylinder head(Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(2) Remove the push rods.

(3) Remove the tappets through the push rod openings in the cylinder block with a Hydraulic Valve Tappet Removal/Installation Tool (Fig. 53).

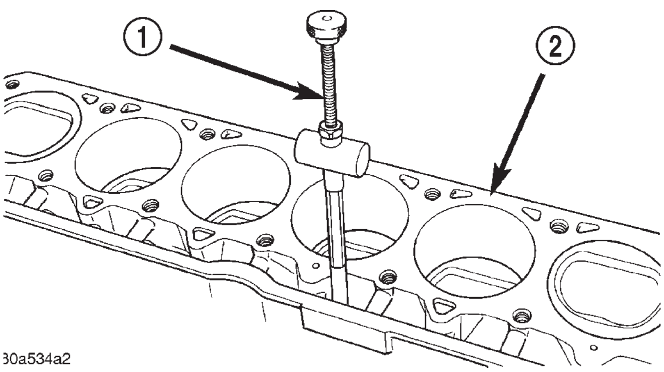


Fig. 53 HYDRAULIC VALVE TAPPET REMOVAL - 4.0L

1 - HYDRAULIC TAPPET REMOVAL TOOL
2 - CYLINDER BLOCK

CLEANING

Clean each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

INSPECTION

Inspect for indications of scuffing on the side and base of each tappet body.

Inspect each tappet base for concave wear with a straightedge positioned across the base. If the base is concave, the corresponding lobe on the camshaft is also worn. Replace the camshaft and tappets.

After cleaning and inspection, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation (Fig. 54).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Leak-Down Tester.

(1) Place a 7.925-7.950 mm (0.312-0.313 inch) diameter ball bearing on the plunger cap of the tappet.

(2) Lift the ram and position the tappet (with the ball bearing) inside the tester cup.

(3) Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. DO NOT tighten the hex nut on the ram.

(4) Fill the tester cup with hydraulic valve tappet test oil until the tappet is completely submerged.

(5) Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

(6) Adjust the nose of the ram to align the pointer with the SET mark on the scale of the tester and tighten the hex nut.

(7) Slowly swing the weighted arm onto the push rod.

(8) Rotate the cup by turning the handle at the base of the tester clockwise one revolution every 2 seconds.

(9) Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark. A normally functioning tappet will require 20-110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.

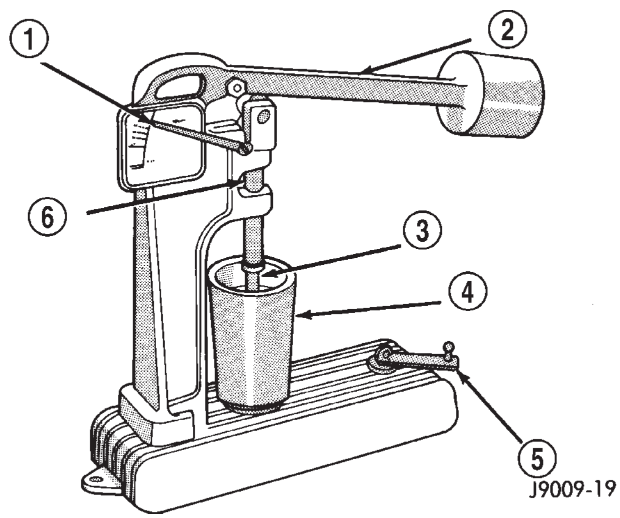


Fig. 54 Leak-Down Tester

1 - POINTER
2 - WEIGHTED ARM
3 - RAM
4 - CUP
5 - HANDLE
6 - PUSH ROD

INSTALLATION

Retain all the components in the same order as removed.

HYDRAULIC LIFTERS (Continued)

It is not necessary to charge the tappets with engine oil. They will charge themselves within a very short period of engine operation.

(1) Dip each tappet in Mopar® Engine Oil Supplement, or equivalent.

(2) Use Hydraulic Valve Tappet Removal/Installation Tool to install each tappet in the same bore from where it was originally removed.

(3) Install the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(4) Install the push rods in their original locations.

(5) Install the rocker arms and bridge and pivot assemblies at their original locations. Loosely install the capscrews at each bridge.

(6) Tighten the capscrews alternately, one turn at a time, to avoid damaging the bridges. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(7) Pour the remaining Mopar® Engine Oil Supplement, or equivalent over the entire valve actuating assembly. The Mopar® Engine Oil Supplement, or equivalent must remain with the engine oil for at least 1 609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

(8) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

PISTON & CONNECTING ROD

DESCRIPTION

The pistons (Fig. 55) are made of a high strength aluminum alloy, the piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of cast iron.

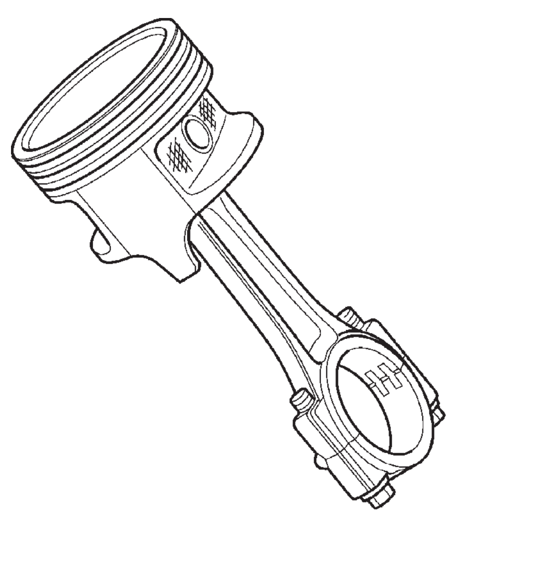


Fig. 55 Piston and Connecting Rod Assembly

STANDARD PROCEDURE - PISTON FITTING

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at a point 49.5 mm (1-15/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 57).

(3) The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. **The coated piston connecting rod assembly can be used to service previous built engines and MUST be replaced as complete sets.** Tin coated pistons should not be used as replacements for coated pistons.

(4) The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results (Fig. 56). Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.

(5) Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

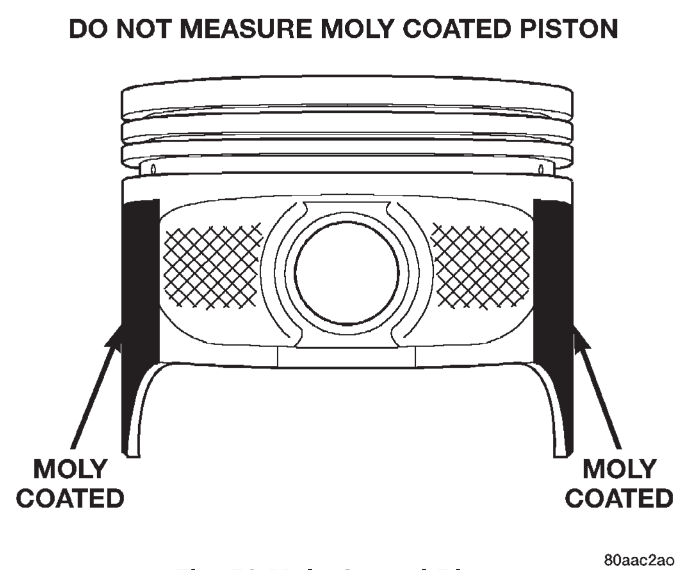


Fig. 56 Moly Coated Piston

1 - MOLY COATED
2 - MOLY COATED

PISTON & CONNECTING ROD (Continued)

PISTON SIZE CHART

CYLINDER BORE SIZE	PISTON LETTER SIZE
98.438 - 98.448 mm (3.8755 - 3.8759 in.)	A
98.448 - 98.458 mm (3.8759 - 3.8763 in.)	B
98.458 - 98.468 mm (3.8763 - 3.8767 in.)	C
98.468 - 98.478 mm (3.8767 - 3.8771 in.)	D
98.478 - 98.488 mm (3.8771 - 3.8775 in.)	E
98.488 - 98.498 mm (3.8775 - 3.8779 in.)	F

REMOVAL

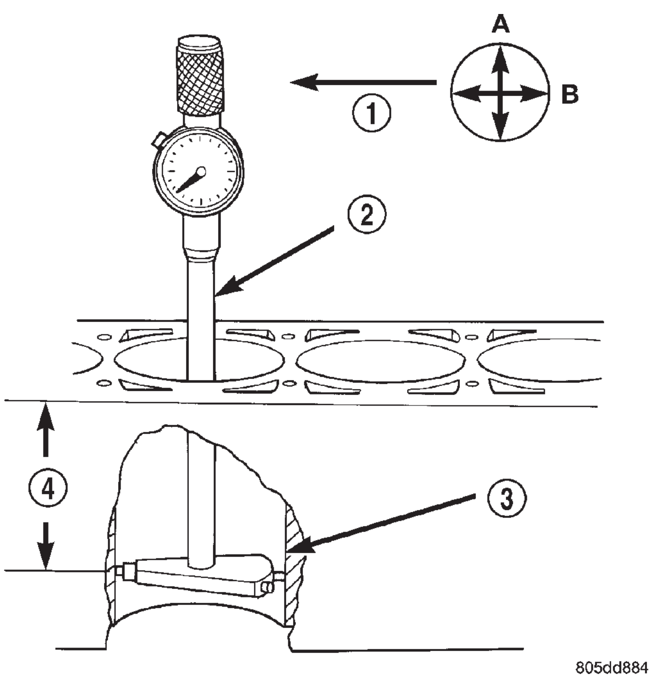


Fig. 57 Bore Gauge

1 - FRONT
2 - BORE GAUGE
3 - CYLINDER BORE
4 - 49.5 MM (1-15/16 in.)

(1) Remove the engine cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Remove the rocker arms, bridges and pivots.

(3) Remove the push rods.

(4) Remove the engine cylinder head. (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(5) Position the pistons one at a time near the bottom of the stroke. Use a ridge reamer to remove the ridge from the top end of the cylinder walls. Use a protective cloth to collect the cuttings.

(6) Raise the vehicle.

(7) Drain the engine oil.

(8) Remove the oil pan and gasket. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(9) Remove main bearing cap brace (Fig. 58).

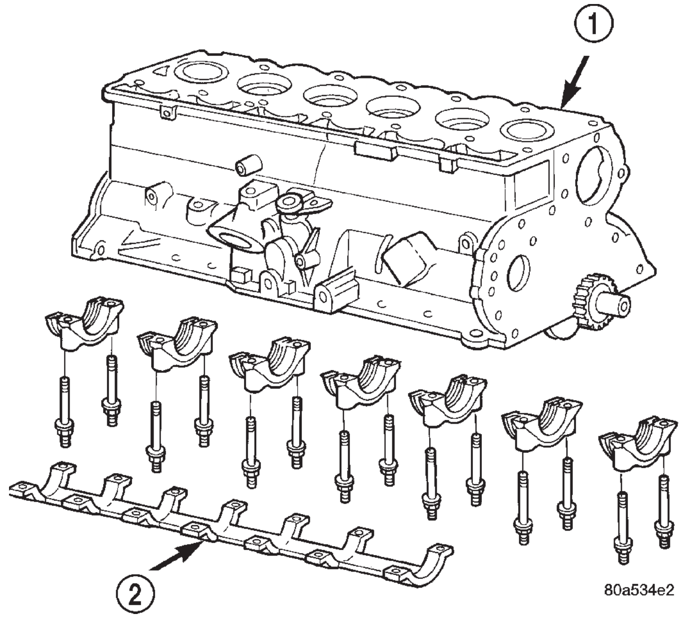


Fig. 58 Main Bearings Caps and Brace

1 - BLOCK
2 - MAIN BEARING CAP BRACE

(10) Remove the connecting rod bearing caps and inserts. Mark the caps and rods with the cylinder bore location. The connecting rods and caps are stamped with a two letter combination (Fig. 59).

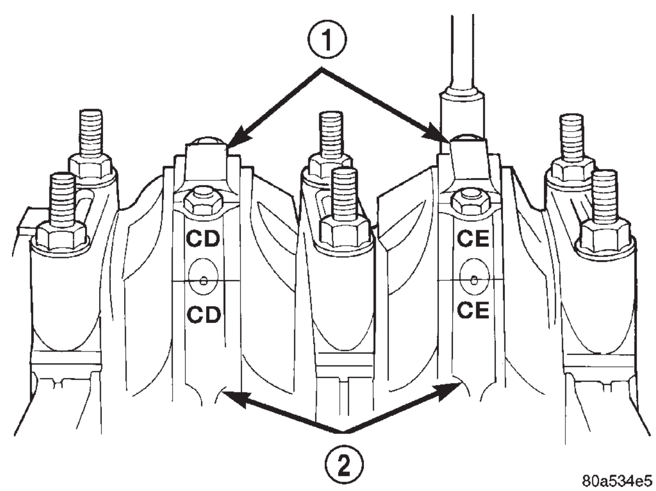


Fig. 59 Stamped Connecting Rods and Caps

1 - CONNECTING ROD CAP
2 - CONNECTING ROD

PISTON & CONNECTING ROD (Continued)

(11) Lower the vehicle until it is about 2 feet from the floor.

CAUTION: Ensure that the connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose, slipped over the rod bolts will provide protection during removal.

(12) Have an assistant push the piston and connecting rod assemblies up and through the top of the cylinder bores (Fig. 60).

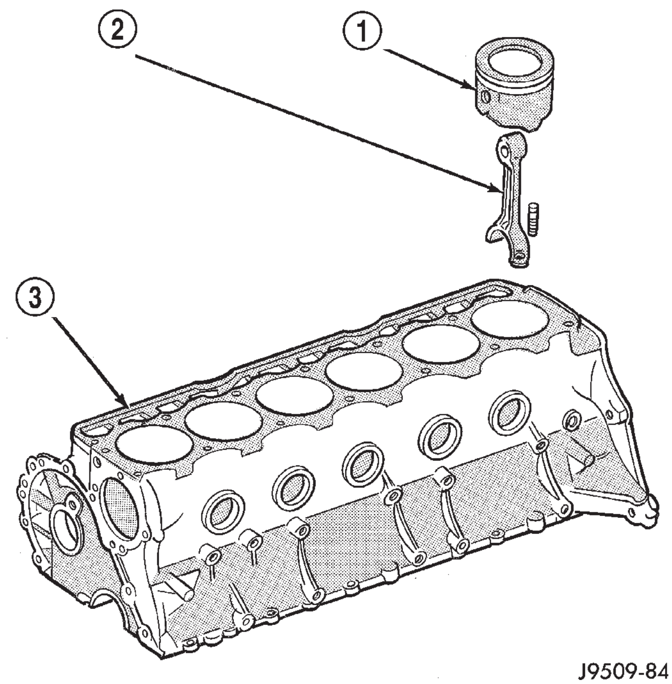


Fig. 60 Removal of Connecting Rod and Piston Assembly

1 - PISTON
2 - CONNECTING ROD
3 - BLOCK

INSTALLATION

(1) Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean lint-free cloth.

(2) Install the piston rings on the pistons if removed (Refer to 9 - ENGINE/ENGINE BLOCK/ PISTON RINGS - STANDARD PROCEDURE).

(3) Lubricate the piston and rings with clean engine oil.

CAUTION: Ensure that connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during installation.

(4) Use a piston ring compressor to install the connecting rod and piston assemblies through the top of the cylinder bores (Fig. 61).

(5) Ensure the arrow on the piston top points to the front of the engine (Fig. 61).

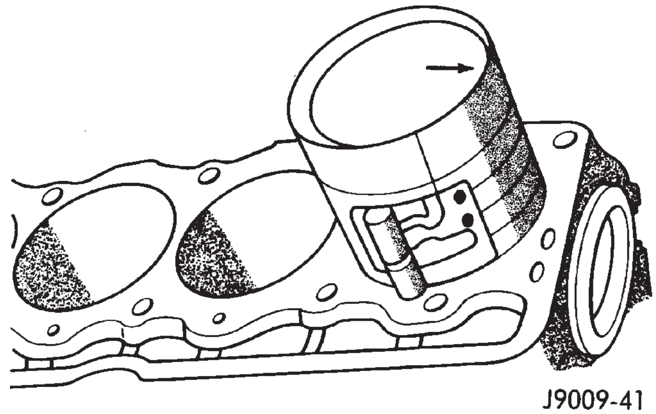


Fig. 61 Rod and Piston Assembly Installation

(6) Raise the vehicle.

(7) Each bearing insert is fitted to its respective journal to obtain the specified clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the Connecting Rod Bearing Fitting Chart. The color code appears on the edge of the bearing insert. The size is not stamped on inserts used for production of engines.

(8) The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flange (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the Connecting Rod Bearing Fitting Chart.

(9) When required, upper and lower bearing inserts of different sizes may be used as a pair (refer to Connecting Rod Bearing Fitting Chart). A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce clearance 0.013 mm (0.0005 inch).

CAUTION: DO NOT intermix bearing caps. Each connecting rod and bearing cap are stamped with the cylinder number. The stamp is located on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

(10) Install the connecting rod bearing caps and inserts in the same positions as removed.

CAUTION: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

(11) Install main bearing cap brace (Fig. 58). Tighten nuts to 47 N·m (35 ft. lbs.).

PISTON & CONNECTING ROD (Continued)

(12) Install the oil pan and gasket (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(13) Lower the vehicle.

(14) Install the engine cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION), push rods, rocker arms, bridges, pivots and engine cylinder head cover(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(15) Fill the crankcase with engine oil.

PISTON RINGS

STANDARD PROCEDURE - PISTON RING FITTING

(1) Carefully clean the carbon from all ring grooves. Oil drain openings in the oil ring groove and pin boss must be clear. DO NOT remove metal from the grooves or lands. This will change ring-to-groove clearances and will damage the ring-to-land seating.

(2) Be sure the piston ring grooves are free of nicks and burrs.

(3) Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring (Fig. 62) (Fig. 63). Rotate the ring in the groove. It must move freely around circumference of the groove.

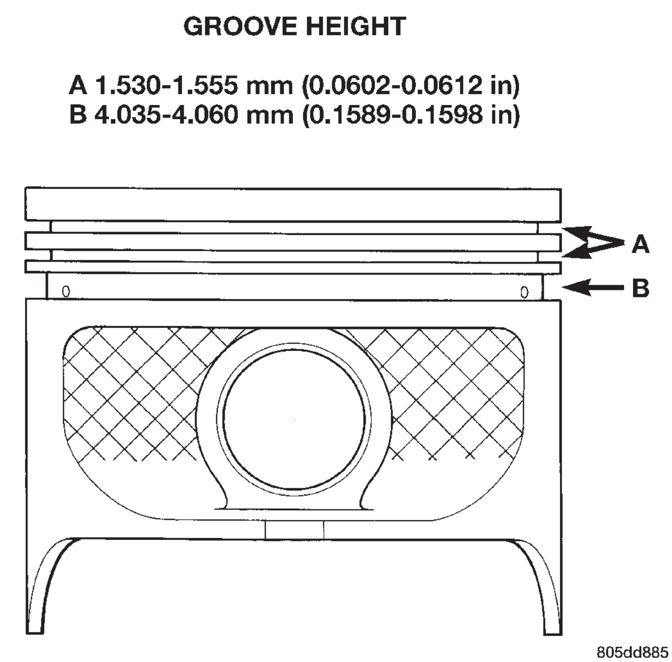


Fig. 62 Piston Dimensions

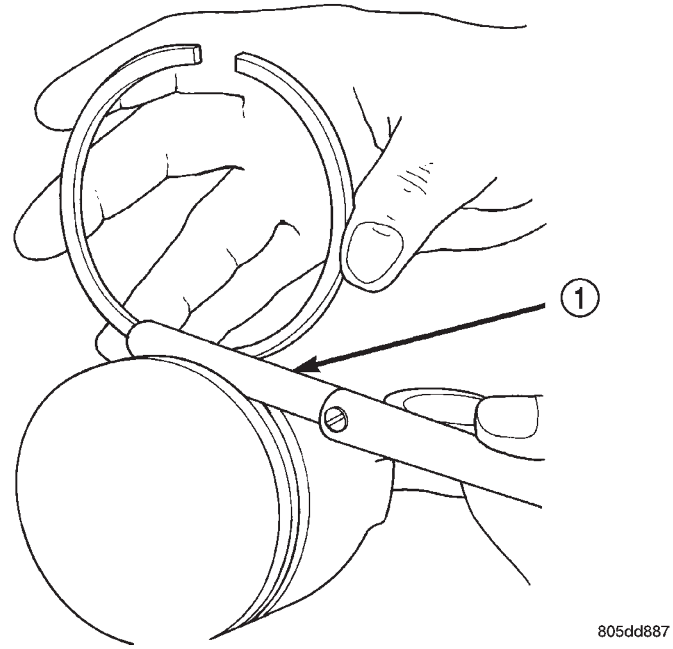


Fig. 63 Ring Side Clearance Measurement

1 - FEELER GAUGE

RING SIDE CLEARANCE CHART

ITEM	SPECIFICATION
Top Compression Ring	0.042 - 0.084 mm (0.0017 - 0.0033 in.)
Second Compression Ring	0.042 - 0.084 mm (0.0017 - 0.0033 in.)
Oil Control Ring	0.06 - 0.21 mm (0.0024 - 0.0083 in.)

(4) Place ring in the cylinder bore and push down with inverted piston to position near lower end of the ring travel. Measure ring gap with a feeler gauge fitting snugly between ring ends (Fig. 64).

RING GAP MEASUREMENT CHART

ITEM	SPECIFICATION
Top Compression Ring	0.229 - 0.610 mm (0.0090 - 0.0240 in.)
Second Compression Ring	0.483 - 0.965 mm (0.0190 - 0.080 in.)
Oil Control Ring	0.254 - 1.500 mm (0.010 - 0.060 in.)

PISTON RINGS (Continued)

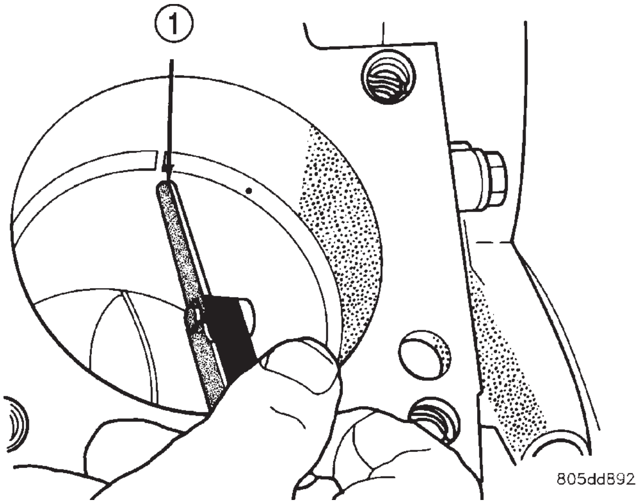


Fig. 64 Gap Measurement

1 - FEELER GAUGE

(5) The oil control rings are symmetrical, and can be installed with either side up. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

(6) The two compression rings are different and cannot be interchanged. The top compression ring can be identified by the shiny coating on the outer sealing surface and can be installed with either side up. (Fig. 65).

(7) The second compression ring has a slight chamfer on the bottom of the inside edge and a dot on the top for correct installation (Fig. 66) and (Fig. 67).

(8) Using a ring installer, install the second compression ring with the dot facing up (Fig. 66) (Fig. 68).

(9) Using a ring installer, install the top compression ring (either side up).

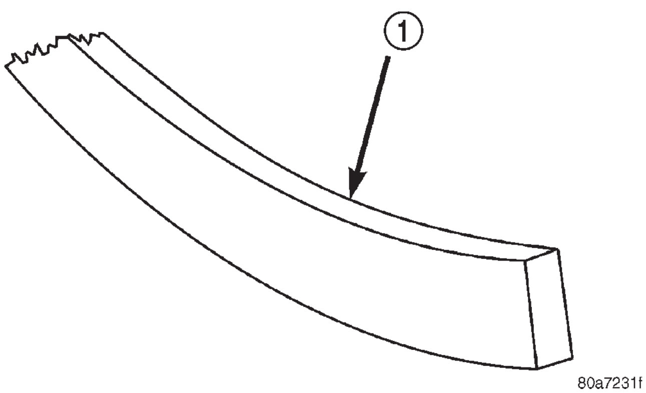


Fig. 65 Top Compression ring identification

1 - TOP COMPRESSION RING

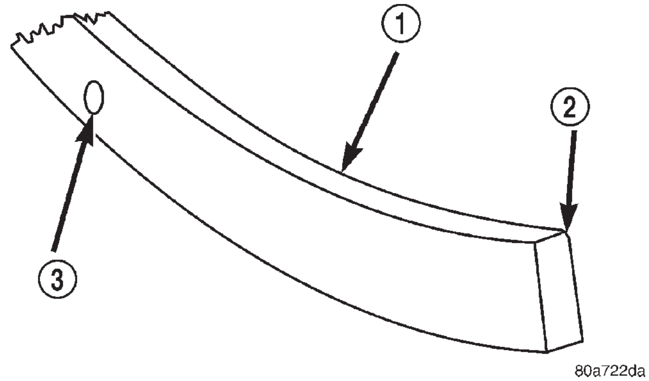


Fig. 66 Second Compression Ring Identification

1 - SECOND COMPRESSION RING
2 - CHAMFER
3 - ONE DOT

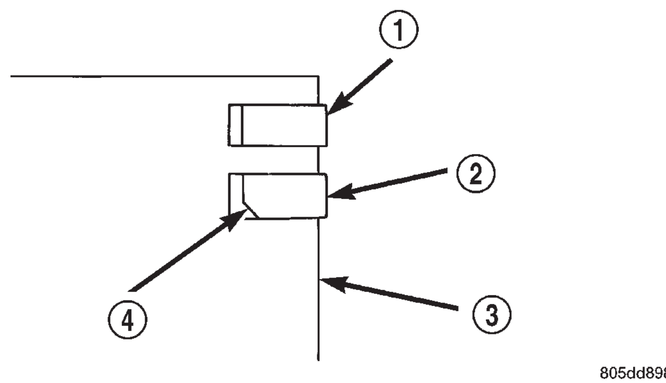


Fig. 67 Compression Ring Chamfer Location

1 - TOP COMPRESSION RING
2 - SECOND COMPRESSION RING
3 - PISTON
4 - CHAMFER

Ring Gap Orientation

- Position the gaps on the piston as shown (Fig. 69).
- Oil spacer - Gap on center line of piston skirt.
- Oil rails - gap 180° apart on centerline of piston pin bore.
- No. 2 Compression ring - Gap 180° from top oil rail gap.
- No. 1 Compression ring - Gap 180° from No. 2 compression ring gap.

PISTON RINGS (Continued)

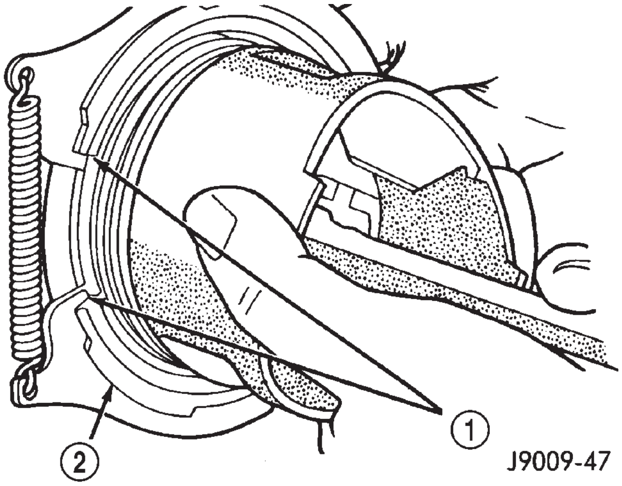


Fig. 68 Compression Ring Installation

1 - COMPRESSION RING
2 - RING EXPANDER RECOMMENDED

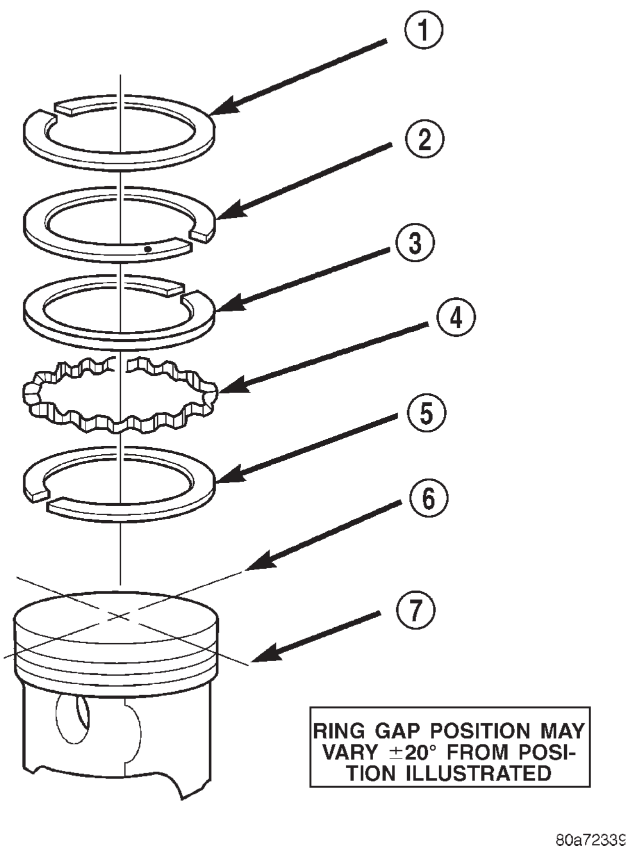


Fig. 69 Ring Gap Orientation

1 - TOP COMPRESSION RING
2 - BOTTOM COMPRESSION RING
3 - TOP OIL CONTROL RAIL
4 - OIL RAIL SPACER
5 - BOTTOM OIL CONTROL RAIL
6 - IMAGINARY LINE PARALLEL TO PISTON PIN
7 - IMAGINARY LINE THROUGH CENTER OF PISTON SKIRT

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) and fan shroud.

(3) Remove the vibration damper retaining bolt and washer.

(4) Use Vibration Damper Removal Tool 7697 to remove the damper from the crankshaft (Fig. 70).

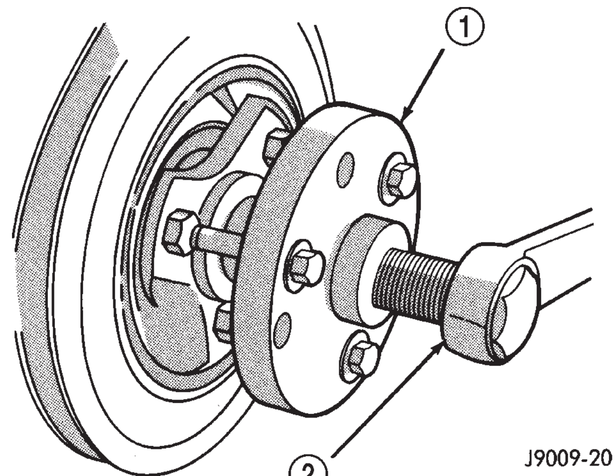


Fig. 70 Vibration Damper Removal Tool 7697

1 - VIBRATION DAMPER REMOVAL TOOL
2 - WRENCH

INSTALLATION

(1) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in position, align the keyway on the vibration damper hub with the crankshaft key and tap the damper onto the crankshaft.

(2) Install the vibration damper retaining bolt and washer.

(3) Tighten the damper retaining bolt to 108 N·m (80 ft. lbs.) torque.

(4) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) and fan shroud.

(5) Connect negative cable to battery.

STRUCTURAL SUPPORT

REMOVAL

The engine bending braces are used to add strength to the powertrain and to address some minor NVH concerns.

STRUCTURAL SUPPORT (Continued)

NOTE: Before the engine or the transmission can be removed the engine bending braces must be removed.

(1) Raise and support vehicle.

NOTE: Both left and right side bending braces are removed the sameway. Only the right side is shown.

NOTE: The exhaust does not require removal to preform this procedure.

(2) Remove the exhaust hanger bracket retaining bolt.

(3) Remove locknut and transmission bending brace bar.

(4) Remove engine-to-bending brace retaining bolt, bending brace bar and cross bar.

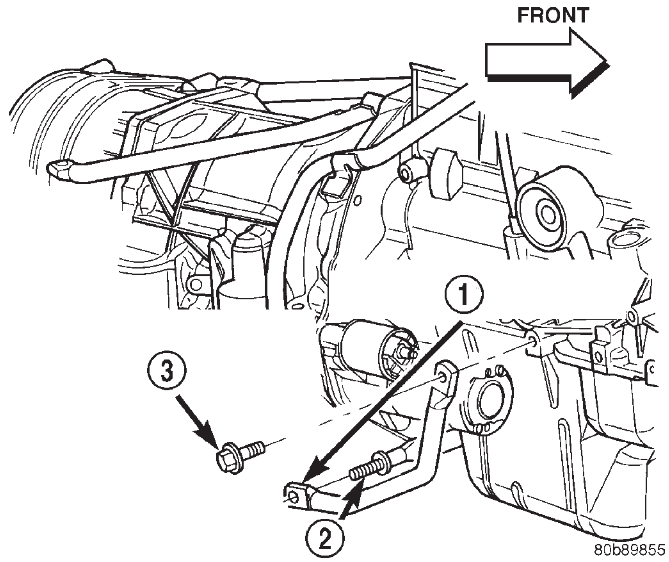


Fig. 71 Engine-to-Transmission Bending Braces

1 - ENGINE-TO-TRANSMISSION BENDING BRACE
2 - CROSS BRACE
3 - ENGINE-TO-TRANSMISSION BENDING BRACE RETAINING BOLT

INSTALLATION

NOTE: DO NOT tighten the retaining hardware until all bending braces are in place.

(1) Position the cross brace into the engine-to-transmission brace, then position the engine-to-transmission brace and install retaining bolt.

(2) Position the transmission bending brace onto through brace and install new locknut.

(3) Position exhaust hanger and transmission brace, install retaining bolt (Fig. 72).

(4) Tighten engine-to-transmission brace retaining bolt (Fig. 71)to 40 N·m (30 ft. lbs.).

(5) Tighten transmission brace retaining bolts (Fig. 72)to 40 N·m (30 ft. lbs.), then tighten transmission brace retaining lock nuts (Fig. 72) to 108 N·m (80 ft. lbs.).

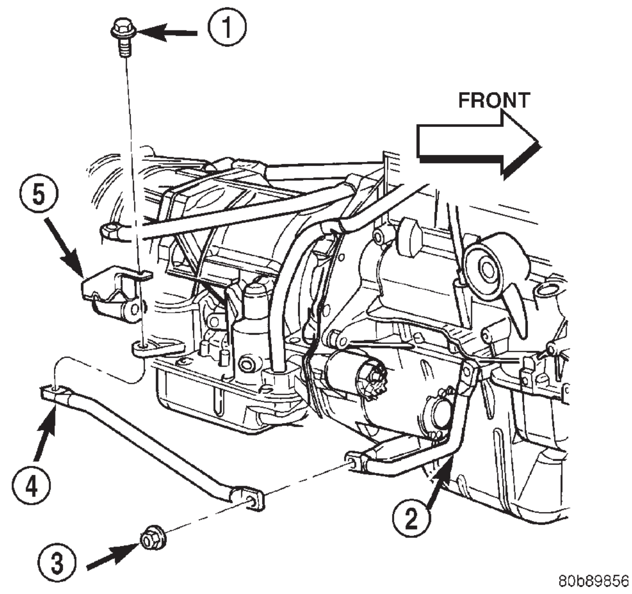


Fig. 72 Transmission Bending Braces and Exhaust Hanger

1 - TRANSMISSION BENDING BRACE RETAINING BOLT
2 - ENGINE-TO-TRANSMISSION BENDING BRACE
3 - LOCKNUT
4 - TRANSMISSION BRACE
5 - EXHAUST HANGER

LUBRICATION

DESCRIPTION

A gear—type positive displacement pump is mounted at the underside of the block opposite the No. 4 main bearing.

OPERATION

The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery which extends the entire length of the block.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The

LUBRICATION (Continued)

crankshaft is drilled internally to pass oil from the main bearing journals (except number 4 main bearing journal) to the connecting rod journals. Each connecting rod bearing cap has a small squirt hole, oil passes through the squirt hole and is thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

The hydraulic valve tappets receive oil directly from the main oil gallery. Oil is provided to the camshaft bearing through galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the number one main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components, then passes down through the push rod guide holes in the cylinder head past the valve tappet area, and returns to the oil pan (Fig. 73).

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE OIL PRESSURE

(1) Disconnect connector and remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292 or equivalent. Start engine and record pressure. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct pressures.

DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat inspection.**If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

(1) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(2) Remove the CCV valve from the cylinder head cover. Cap or plug the CCV valve grommet.

(3) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(4) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service information procedures.

(5) If the leakage occurs at the rear oil seal area, INSPECTION FOR REAR SEAL AREA LEAKS .

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the CCV valve and breather cap hose.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

(4) If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

LUBRICATION (Continued)

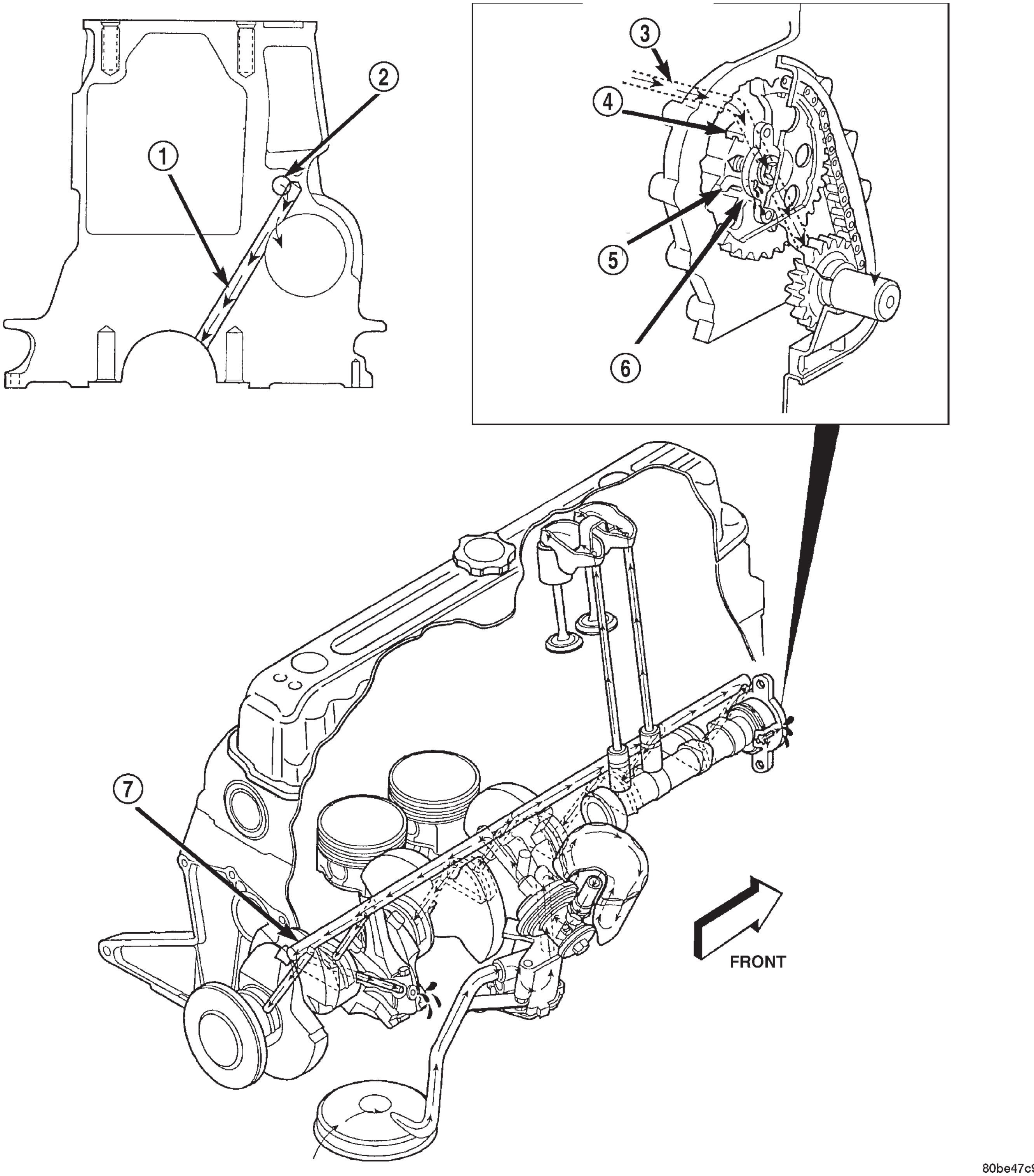


Fig. 73 Oil Lubrication System—4.0L Engine

1 - CAM/CRANK MAIN GALLERY (7)
2 - TAPPET GALLERY
3 - TAPPET GALLERY
4 - CAMSHAFT BEARING
5 - NUMBER 1 CAMSHFT BEARING JOURNAL
6 - CAMSHAFT SPROCKET
7 - TAPPET GALLERY

LUBRICATION (Continued)

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

OIL

STANDARD PROCEDURE - ENGINE OIL SERVICE

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.

(6) Install drain plug in crankcase.

(7) Replace engine oil filter. (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).

(8) Lower vehicle and fill crankcase with specified type of engine oil (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION) and amount of engine oil (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS).

(9) Install oil fill cap.

(10) Start engine and inspect for leaks.

(11) Stop engine and inspect oil level. Refer to CRANKCASE OIL LEVEL INSPECTION .

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine.

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.

The engine oil level indicator (Dipstick) is located at the right rear of the 4.0L engine. Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick (Fig. 74).

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading (Fig. 74).

(6) Add oil only if level is below the ADD mark on dipstick.

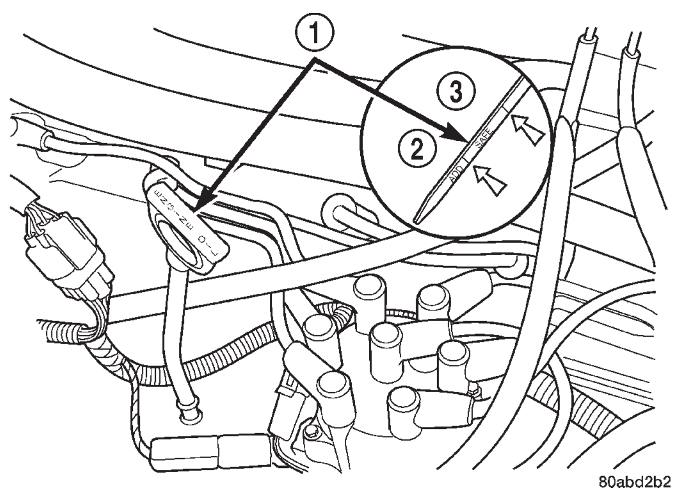


Fig. 74 Engine Oil Dipstick—4.0L Engine

1 - DIPSTICK
2 - ADD
3 - SAFE

OIL FILTER

REMOVAL

CAUTION: Do not use oil filter with metric threads. The proper oil filter has SAE type 3/4 X 16 threads. An oil filter with metric threads can result in oil leaks and engine failure.

OIL FILTER (Continued)

All Jeep engines are equipped with a high quality full-flow, throw-away type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss or filter adapter housing (Fig. 75).

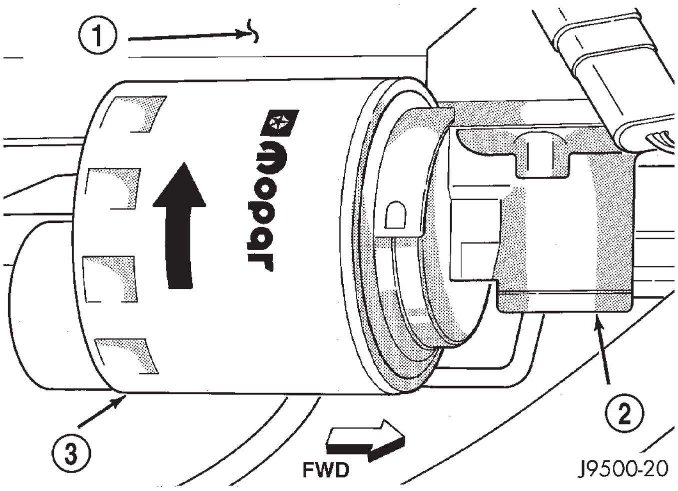


Fig. 75 Oil Filter—4.0L Engine

1 - CYLINDER BLOCK
2 - ADAPTER
3 - OIL FILTER

(4) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) Make sure old gasket comes off with oil filter. With a wiping cloth, clean the gasket sealing surface (Fig. 76) of oil and grime.

INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil or chassis grease.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 76) hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

OIL PAN

DESCRIPTION

The oil pan is made of stamped steel. The oil pan gasket is a one piece steel backbone silicone coated gasket (Fig. 77).

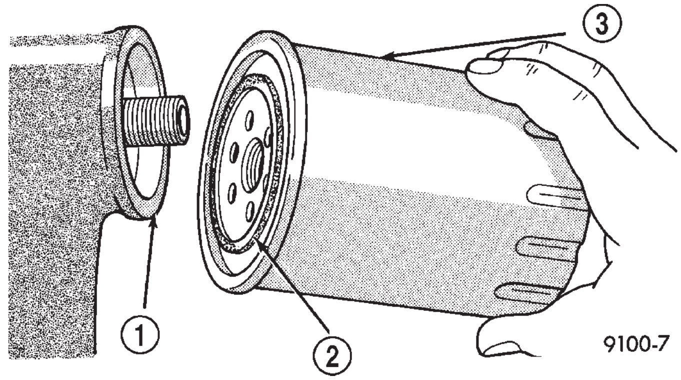


Fig. 76 Oil Filter Sealing Surface—Typical

1 - SEALING SURFACE
2 - RUBBER GASKET
3 - OIL FILTER

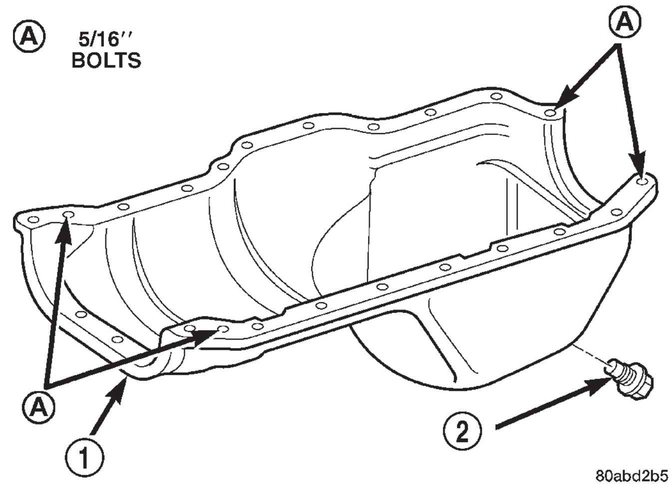


Fig. 77 Oil Pan

1 - OIL PAN
2 - OIL PAN DRAIN PLUG

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise the vehicle.

(3) Remove the oil pan drain plug and drain the engine oil.

(4) Disconnect the exhaust pipe at the exhaust manifold.

(5) Disconnect the exhaust hanger at the catalytic converter and lower the pipe.

(6) Remove the starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

(7) Remove the engine flywheel and transmission torque converter housing access cover.

(8) If equipped with an oil level sensor, disconnect the sensor.

(9) Position a jack stand directly under the engine vibration damper.

OIL PAN (Continued)

(10) Place a piece of wood (2 x 2) between the jack stand and the engine vibration damper.

(11) Remove the engine mount through bolts.

(12) Using the jack stand, raise the engine until adequate clearance is obtained to remove the oil pan.

(13) Remove transmission oil cooling lines (if equipped) and oxygen sensor wiring supports that are attached to the oil pan studs.

(14) Remove the oil pan bolts and studs. Carefully slide the oil pan and gasket to the rear. If equipped with an oil level sensor, take care not to damage the sensor.

INSTALLATION

(1) Clean the block and pan gasket surfaces.

(2) Fabricate 4 alignment dowels from 1 1/2 x 1/4 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 78).

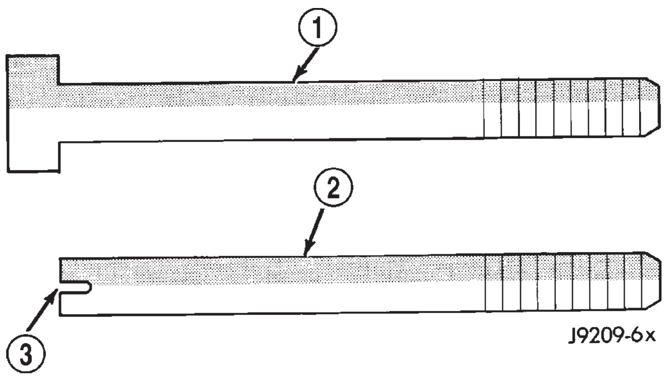


Fig. 78 Fabrication of Alignment Dowels

1 - 1/4′′ × 1 1/2′′ BOLT
2 - DOWEL
3 - SLOT

(3) Install two dowels in the timing case cover. Install the other two dowels in the cylinder block (Fig. 79).

(4) Apply Mopar® Silicone Rubber Adhesive Sealant on cylinder block to rear main bearing cap corners and cylinder block to front cover joints (four places) (Fig. 80).

(5) Slide the one-piece gasket over the dowels and onto the block and timing case cover.

(6) Position the oil pan over the dowels and onto the gasket. If equipped with an oil level sensor, take care not to damage the sensor.

(7) Install the 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque. Install the 5/16 inch oil pan bolts (Fig. 81). Tighten these bolts to 15 N·m (132 in. lbs.) torque.

(8) Remove the dowels. Install the remaining 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque.

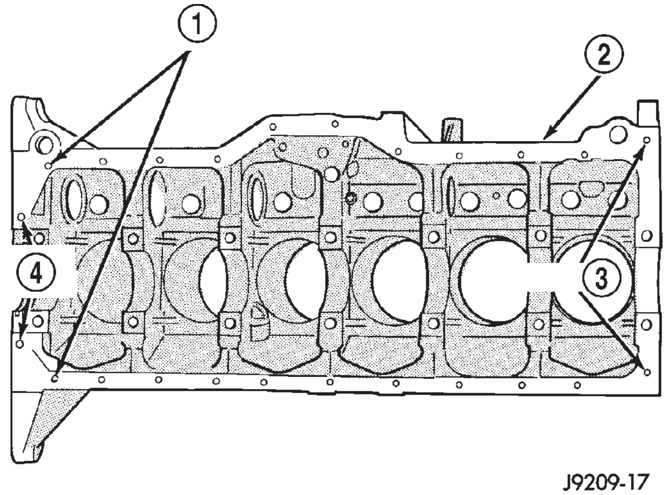


Fig. 79 Position of Dowels in Cylinder Block

1 - DOWEL HOLES
2 - CYLINDER BLOCK
3 - 5/16′′ HOLES
4 - 5/16′′ HOLES

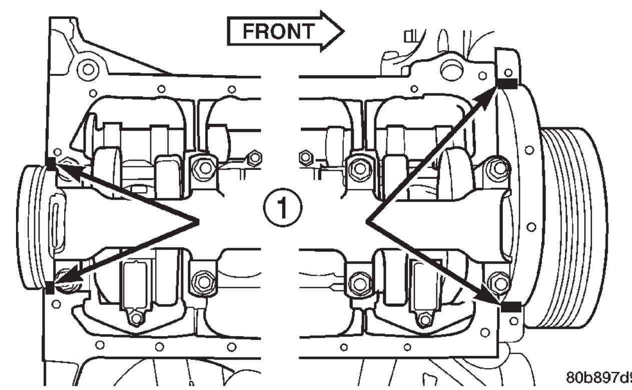


Fig. 80 Oil Pan Sealer Location

1 - SEALER LOCATIONS

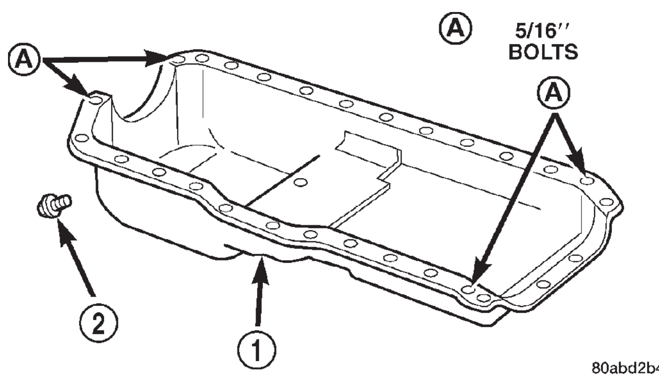


Fig. 81 Position of 5/16 inch Oil Pan Bolts

1 - OIL PAN
2 - OIL PAN DRAIN PLUG

OIL PAN (Continued)

(9) Lower the engine until it is properly located on the engine mounts.

(10) Install the through bolts and tighten the nuts.

(11) Lower the jack stand and remove the piece of wood.

(12) Install the engine flywheel and transmission torque converter housing access cover.

(13) Install the engine starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(14) Connect the exhaust pipe to the hanger and to the engine exhaust manifold.

(15) Install transmission oil cooling lines (if equipped) and oxygen sensor wiring supports that attach to the oil pan studs.

(16) Install the oil pan drain plug (Fig. 81). Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(17) Lower the vehicle.

(18) Connect negative cable to battery.

(19) Fill the oil pan with engine oil to the specified level.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(20) Start the engine and inspect for leaks.

ENGINE OIL PRESSURE SENSOR

DESCRIPTION

The 3–wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses three circuits. They are:

- A 5–volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3–wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5–volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

OIL PUMP

REMOVAL

A gear-type oil pump is mounted at the underside of the cylinder block opposite the No.4 main bearing.

(1) Drain the engine oil.

(2) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(3) Remove the pump-to-cylinder block attaching bolts. Remove the pump assembly with gasket (Fig. 82).

CAUTION: If the oil pump is not to be serviced, DO NOT disturb position of oil inlet tube and strainer assembly in pump body. If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

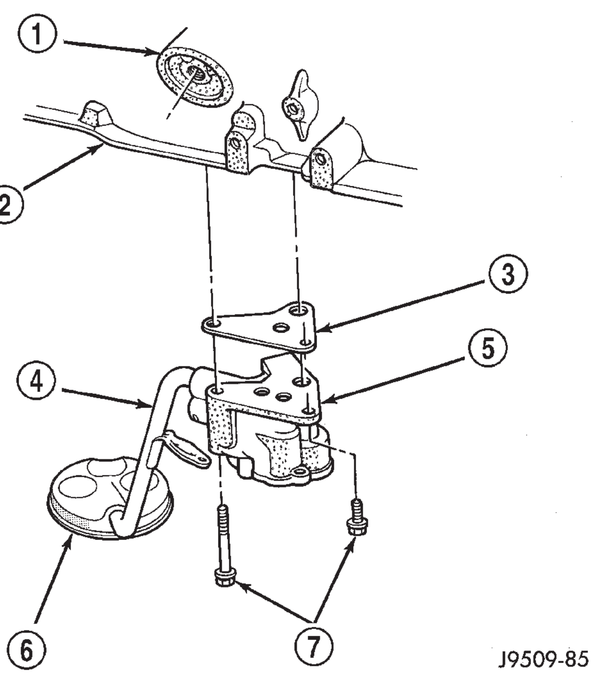


Fig. 82 Oil Pump Assembly

1 - OIL FILTER ADAPTOR
2 - BLOCK
3 - GASKET
4 - OIL INLET TUBE
5 - OIL PUMP
6 - STRAINER ASSEMBLY
7 - ATTACHING BOLTS

OIL PUMP (Continued)

INSTALLATION

A gear-type oil pump is mounted at the underside of the cylinder block opposite the No.4 main bearing.

(1) Install the oil pump on the cylinder block using a replacement gasket. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(2) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(3) Fill the oil pan with oil to the specified level.

INTAKE MANIFOLD

DESCRIPTION

The intake manifold (Fig. 83) is made of cast aluminum and uses eleven bolts to mount to the cylinder head. This mounting style improves sealing and reduces the chance of leaks.

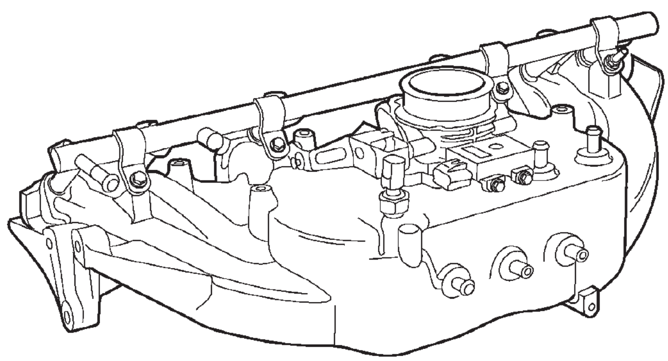


Fig. 83 Intake Manifold 4.0L Engine

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.

(2) Spray a small stream of water at the suspected leak area.

(3) If a change in RPM is observed the area of the suspected leak has been found.

(4) Repair as required.

REMOVAL

NOTE: THE ENGINE INTAKE AND EXHAUST MANIFOLD MUST BE REMOVED AND INSTALLED TOGETHER. THE MANIFOLDS USE A COMMON GASKET AT THE CYLINDER HEAD.

(1) Disconnect the battery negative cable.

(2) Remove air cleaner inlet hose from the resonator assembly.

(3) Remove the air cleaner assembly.

(4) Remove the throttle cable, vehicle speed control cable (if equipped) and the transmission line pressure cable (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - AW4/THROTTLE VALVE CABLE - REMOVAL).

(5) Disconnect the following electrical connections and secure their harness out of the way:

- Throttle Position Sensor
- Idle Air Control Motor
- Coolant Temperature Sensor (at thermostat housing)
- Intake Air Temperature Sensor
- Oxygen Sensor
- Crank Position Sensor
- Six (6) Fuel Injector Connectors
- Manifold Absolute Pressure (MAP) Sensor.

(6) Disconnect HVAC, and Brake Booster vacuum supply hoses at the intake manifold.

(7) Perform the fuel pressure release procedure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(8) Disconnect and remove the fuel system supply line from the fuel rail assembly.

(9) Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(10) Remove the power steering pump from the intake manifold and set aside.

(11) Raise the vehicle.

(12) Disconnect the exhaust pipes from the engine exhaust manifolds.

(13) Lower the vehicle.

(14) Remove the intake manifold and exhaust manifold bolts and manifolds (Fig. 84).

INSTALLATION

If the manifold is being replaced, ensure all the fitting, etc. are transferred to the replacement manifold.

(1) Install a new engine exhaust/intake manifold gasket over the alignment dowels on the cylinder head.

(2) Position the engine exhaust manifolds to the cylinder head. Install fastener Number 3 and finger tighten at this time (Fig. 84).

INTAKE MANIFOLD (Continued)

(3) Install intake manifold on the cylinder head dowels.

(4) Install washer and fastener Numbers 1, 2, 4, 5, 8, 9, 10 and 11 (Fig. 84).

(5) Install washer and fastener Numbers 6 and 7 (Fig. 84).

(6) Tighten the fasteners in sequence and to the specified torque (Fig. 84).

- Fastener Numbers 1 through 5—Tighten to 33 N·m (24 ft. lbs.) torque.
- Fastener Numbers 6 and 7—Tighten to 31 N·m (23 ft. lbs.) torque.
- Fastener Numbers 8 through 11—Tighten to 33 N·m (24 ft. lbs.) torque.

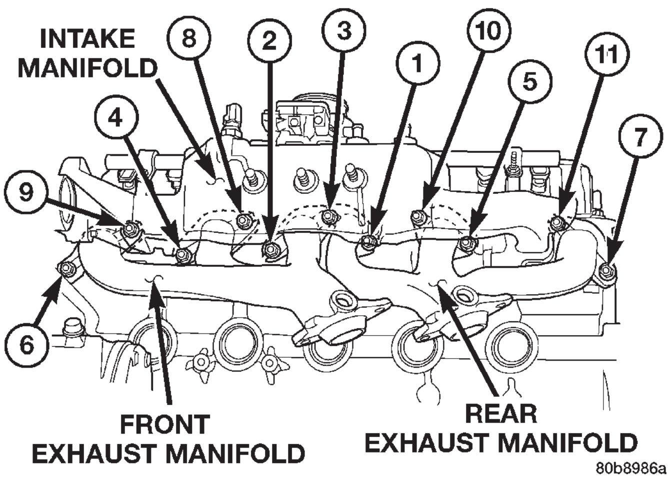


Fig. 84 Intake and Exhaust Manifolds Installation

(7) Install the power steering pump to the intake manifold.

(8) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(9) Install the fuel system supply line to the fuel rail assembly.

(10) Connect all electrical connections on the intake manifold.

(11) Connect the vacuum hoses previously removed.

(12) Install throttle cable, vehicle speed control cable (if equipped).

(13) Install the transmission line pressure cable (if equipped) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - AW4/THROTTLE VALVE CABLE - INSTALLATION).

(14) Install air cleaner assembly.

(15) Connect air inlet hose to the resonator assembly.

(16) Raise the vehicle.

(17) Connect the exhaust pipes to the engine exhaust manifolds. Tighten the bolts to 31 N·m (23 ft. lbs.)

(18) Lower the vehicle.

(19) Connect the battery negative cable.

(20) Start the engine and check for leaks.

EXHAUST MANIFOLD

DESCRIPTION

The two exhaust manifolds (Fig. 85) are log style and are made of high silicon molybdenum cast iron. The exhaust manifolds share a common gasket with the intake manifold. The exhaust manifolds also incorporate ball flange outlets for improved sealing and strain free connections.

REMOVAL

The intake and engine exhaust manifolds on the 4.0L engine must be removed together. The manifolds use a common gasket at the cylinder head.

(Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

INSTALLATION

(1) The exhaust manifold and the intake manifold must be installed together using a common gasket.

(2) (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

TIMING BELT / CHAIN COVER(S)

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(3) Remove the fan, hub assembly and fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(4) Remove the accessory drive brackets that are attached to the timing case cover.

(5) Remove the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL) (if equipped) and generator bracket assembly from the engine cylinder head and move to one side.

(6) Remove the oil pan-to-timing case cover bolts and timing case cover-to-cylinder block bolts.

(7) Remove the timing case cover and gasket from the engine.

(8) Pry the crankshaft oil seal from the front of the timing case cover (Fig. 86).

INSTALLATION

Clean the timing case cover, oil pan and cylinder block gasket surfaces.

TIMING BELT / CHAIN COVER(S) (Continued)

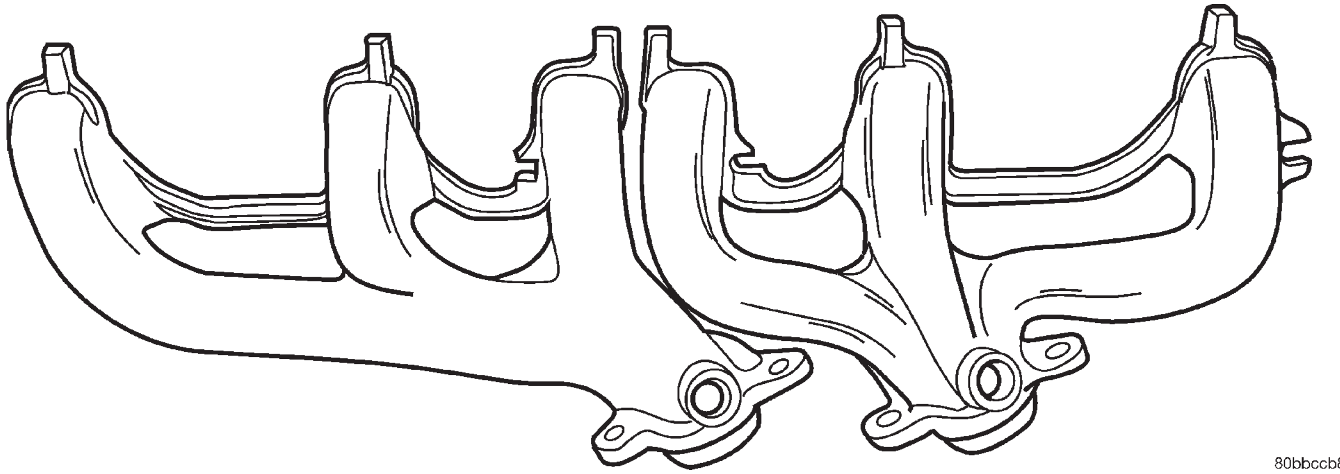


Fig. 85 EXHAUST MANIFOLDS 4.0L ENGINE

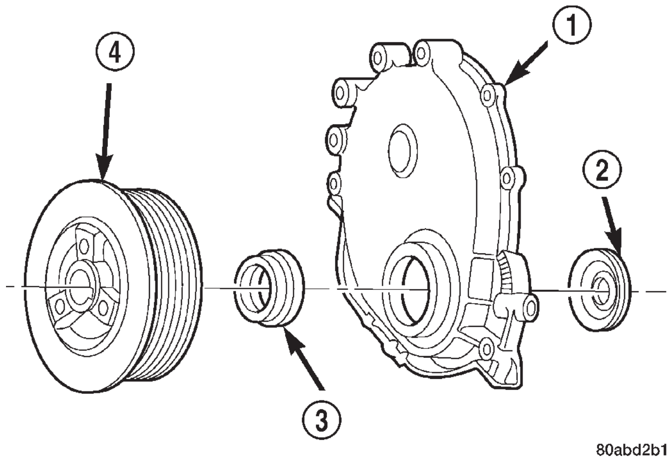


Fig. 86 Timing Case Cover Components

1 - TIMING CASE COVER
2 - OIL SLINGER
3 - CRANKSHAFT OIL SEAL
4 - VIBRATION DAMPER PULLEY

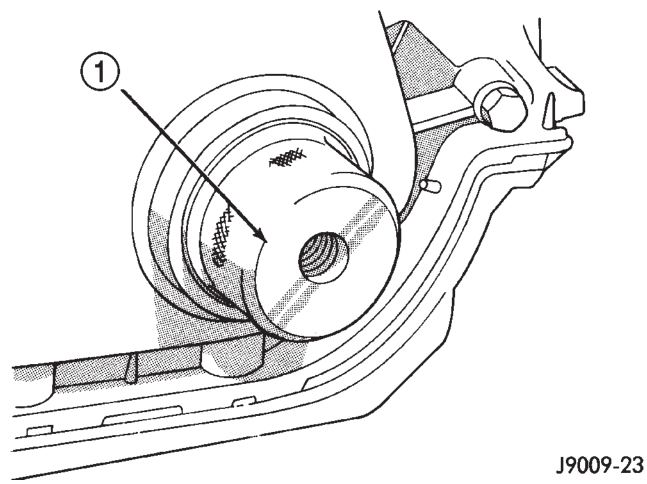


Fig. 87 Timing Case Cover Alignment

1 - TIMING CASE COVER ALIGNMENT AND SEAL INSTALLATION TOOL

(1) Install a new crankshaft oil seal in the timing case cover. The open end of the seal should be toward the inside of the cover. Support the cover at the seal area while installing the seal. Force it into position with Seal Installation Tool 6139.

(2) Position the gasket on the cylinder block.

(3) Position the timing case cover on the oil pan gasket and the cylinder block.

(4) Insert Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening in the cover (Fig. 87).

(5) Install the timing case cover-to-cylinder block and the oil pan-to-timing case cover bolts.

(6) Tighten the 1/4 inch cover-to-block bolts to 7 N·m (60 in. lbs.) torque. Tighten the 5/16 inch front cover-to-block bolts to 22 N·m (192 in. lbs.) torque. Tighten the oil pan-to-cover 1/4 inch bolts to 9.5 N·m (84 in. lbs.) torque.

(7) Remove the cover alignment tool.

(8) Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(9) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(10) Install the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION) (if equipped) and generator bracket assembly.

(11) Install the engine fan, hub assembly and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(12) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Connect negative cable to battery.

TIMING BELT/CHAIN AND SPROCKETS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(3) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(4) Remove the crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(5) Remove the timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(6) Rotate crankshaft until the "0" timing mark is closest to and on the center line with camshaft sprocket timing mark (Fig. 88).

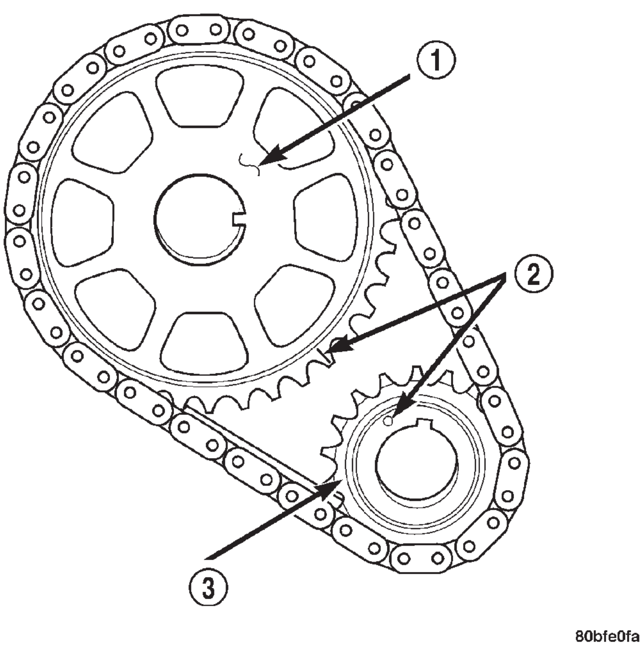


Fig. 88 Crankshaft—Camshaft Alignment

1 - CAMSHAFT SPROCKET
2 - TIMING MARKS
3 - CRANKSHAFT SPROCKET

(7) Remove the oil slinger from the crankshaft.

(8) Remove the camshaft sprocket bolt and washer (Fig. 89).

(9) Remove the crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

(10) Installation of the timing chain with the timing marks on the crankshaft and camshaft sprockets properly aligned ensures correct valve timing. A worn or stretched timing chain will adversely affect valve timing. If the timing chain deflects more than 12.7 mm (1/2 inch) replace it.

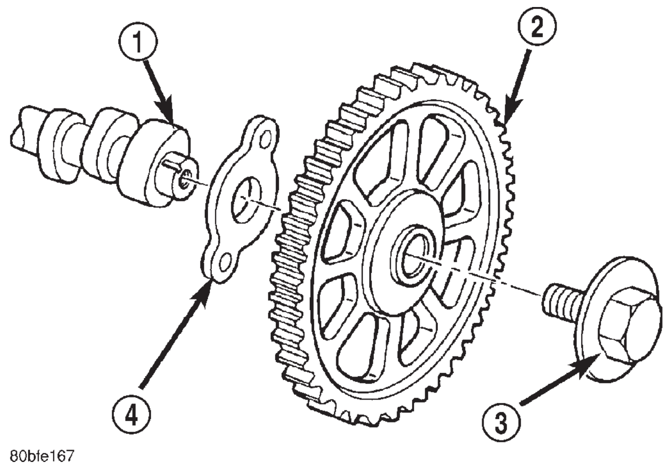


Fig. 89 Camshaft Sprocket and Thrust Plate

1 - CAMSHAFT
2 - CAMSHAFT SPROCKET W/INTEGRAL KEY
3 - BOLT AND WASHER
4 - THRUST PLATE

INSTALLATION

Assemble the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned (Fig. 88).

(1) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in the keyway on the crankshaft, install the assembly on the crankshaft and camshaft.

(2) Install the camshaft sprocket bolt and washer (Fig. 89). Tighten the bolt to 68 N·m (50 ft. lbs.) torque.

(3) To verify correct installation of the timing chain, rotate the crankshaft 2 revolutions. The camshaft and crankshaft sprocket timing mark should align (Fig. 88).

(4) Install the crankshaft oil slinger.

(5) Replace the oil seal in the timing case cover (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - REMOVAL).

(6) Install the timing case cover and gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) With the key installed in the crankshaft keyway, install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(8) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(9) Install the fan, hub assembly and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

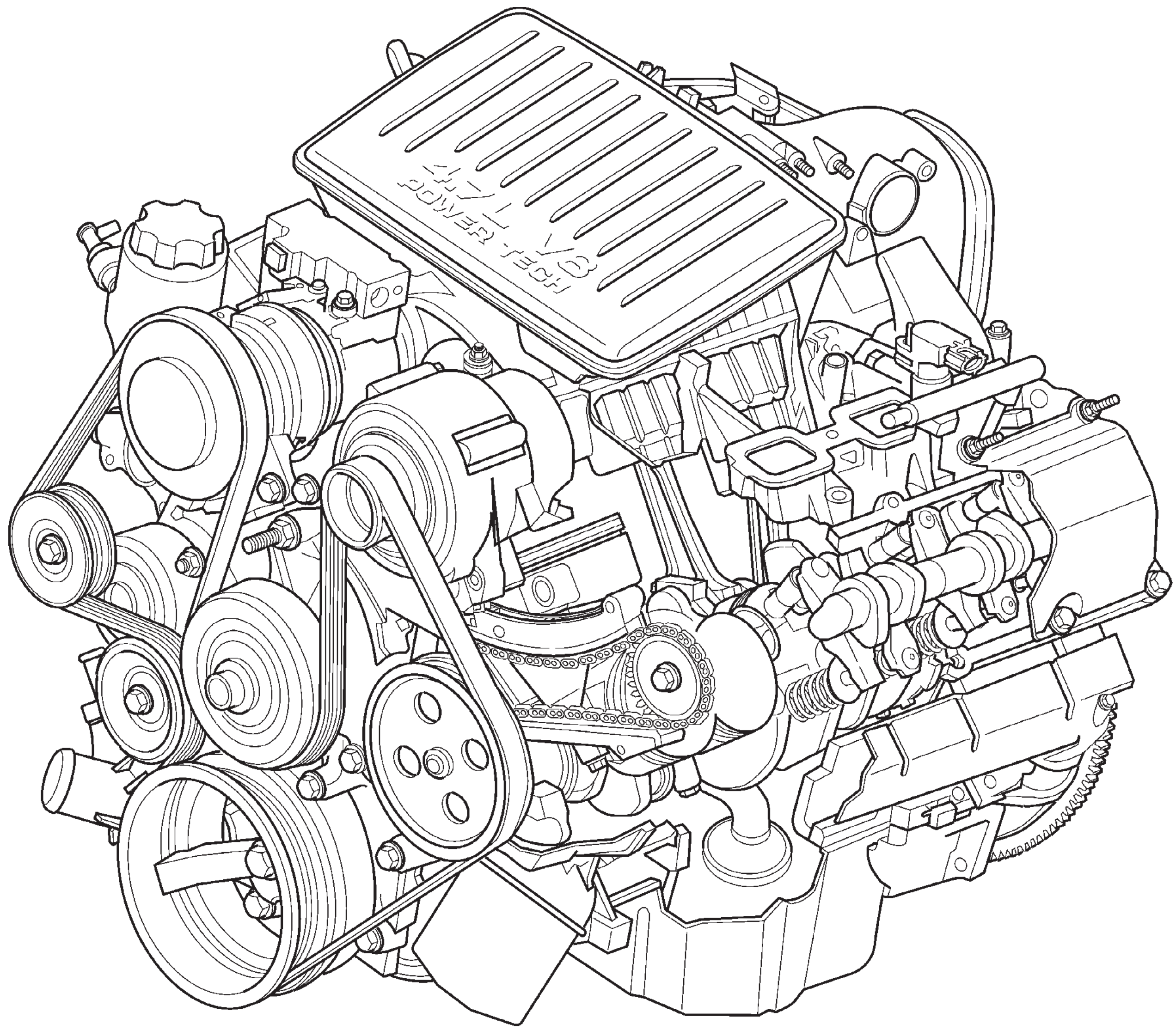
(10) Connect negative cable to battery.

ENGINE - 4.7L

TABLE OF CONTENTS

ENGINE - 4.7L

DESCRIPTION—4.7L ENGINE



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The 4.7 liter (287 CID) eight-cylinder engine is an 90° single overhead camshaft engine. The cast iron cylinder block is made up of two different components; the first component is the cylinder bore and upper block, the second component is the bedplate that comprises the lower portion of the cylinder block and houses the lower half of the crankshaft main bearings. The cylinders are numbered from front to rear with the left bank being numbered 1,3,5 and 7, and the right bank being numbered 2,4,6 and 8. The firing order is 1–8–4–3–6–5–7–2. The engine serial number is located at the right front side of the engine block (Fig. 1)

ENGINE - 4.7L (Continued)

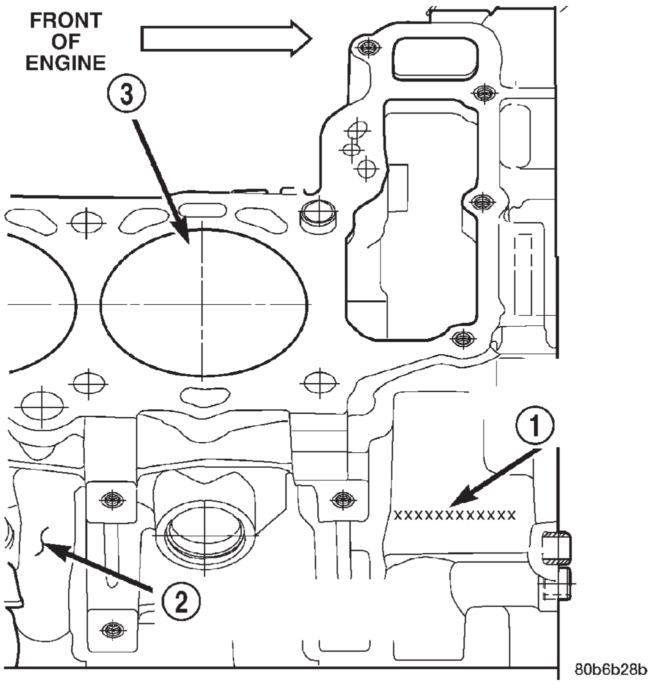


Fig. 1 Engine Identification Location

1 - VEHICLE VIN NUMBER LOCATION
2 - CYLINDER BLOCK RIGHT HAND SIDE
3 - CYLINDER BORE #2

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—MECHANICAL for possible causes and corrections of malfunctions. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING) and (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - DIAGNOSIS AND TESTING) for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

ENGINE - 4.7L (Continued)

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. (Refer to 8 - ELECTRICAL/ STARTING - DIAGNOSIS AND TESTING).
	4. Faulty coil or control unit.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect spark plug gap.	5. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump, relay or wiring.	7. Repair or replace as necessary.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set to low.	1. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/IDLE AIR CONTROL MOTOR - REMOVAL).
	2. Idle mixture to lean or to rich.	2. Refer to Powertrain Diagnosis Information.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect engine timing.	5. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
1. ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP - DIAGNOSIS AND TESTING).
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), repair as necessary.
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).

ENGINE - 4.7L (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
1. ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replcae as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
1. ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Faulty coil.	2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
	8. Excessive runout of valve seats on valve faces.	8. Service valves and valve seats. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.

ENGINE - 4.7L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTIONS
MAIN BEARING NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings.	1.
	(a) Misaligned or damaged.	(a) Replace as necessary.
	(b) Loose fasteners, broken or porous metal parts.	(b) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - REAR - REMOVAL).
	3. Crankshaft seal flange. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - FRONT - REMOVAL).
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.

ENGINE - 4.7L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL).
	3. Low oil pressure.	3. Check oil pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
	5. Worn oil pump.	5. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
	9. Oil pick up tube loose, damaged or clogged.	9. Replace as necessary.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
	3. Incorrect ring size installed.	3. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
	4. Worn valve guides.	4. Ream guides and replace valves (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
	5. Leaking valve guide seals.	5. Replace valve guide seals.

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs.

(3) Secure the throttle in the wide-open position.

(4) Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).

(5) Remove the ASD relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).

(6) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(7) Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

(8) (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

ENGINE - 4.7L (Continued)

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

(1) Check the coolant level and fill as required. DO NOT install the radiator cap.

(2) Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

(3) Remove the spark plugs.

(4) Remove the oil filler cap.

(5) Remove the air cleaner.

(6) Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

(7) Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

ENGINE - 4.7L (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier then using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper

ENGINE - 4.7L (Continued)

• Abrasive pad or paper to clean cylinder block and head
• High speed power tool with an abrasive pad or a wire brush (Fig. 2)

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Only use the following for cleaning gasket surfaces:
• Solvent or a commercially available gasket remover
• Plastic or wood scraper (Fig. 2)
• Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (Fig. 2)

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

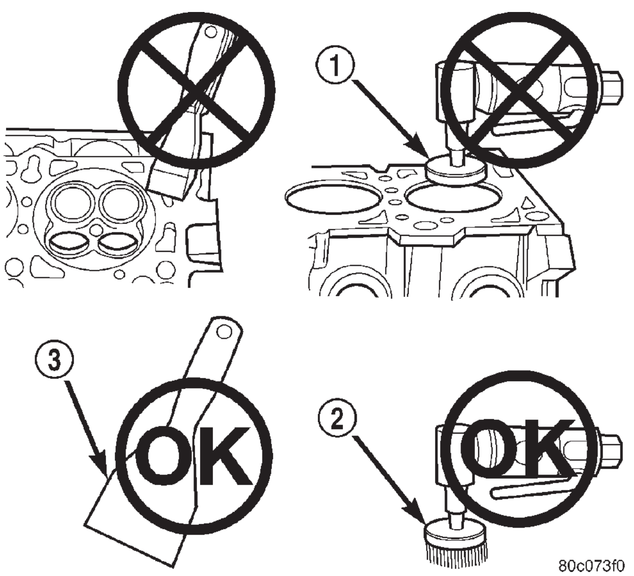


Fig. 2 Proper Tool Usage For Surface Preparation

1 - ABRASIVE PAD
2 - 3M ROLOC™ BRISTLE DISC
3 - PLASTIC/WOOD SCRAPER

STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 3).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

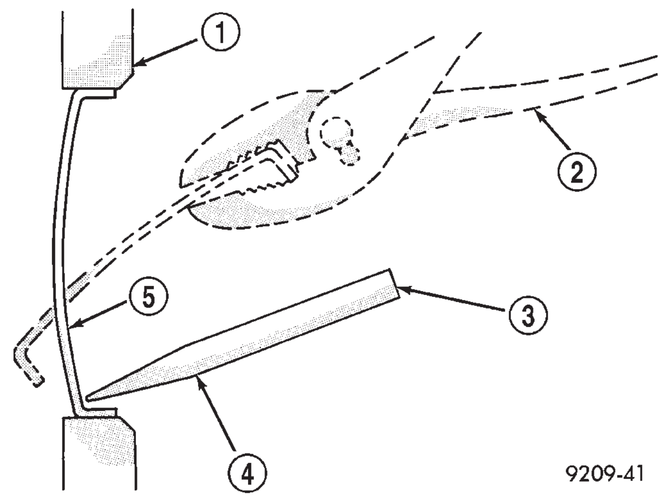


Fig. 3 Core Hole Plug Removal

1 - CYLINDER BLOCK
2 - REMOVE PLUG WITH PLIERS
3 - STRIKE HERE WITH HAMMER
4 - DRIFT PUNCH
5 - CUP PLUG

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

REMOVAL

(1) Disconnect the battery negative cable.
(2) Remove the front fascia.
(3) Raise vehicle on hoist.
(4) Remove exhaust crossover pipe from exhaust manifolds.
(5) Disconnect two ground straps from the lower left hand side and one ground strap from the lower right hand side of the engine.
(6) Disconnect crankshaft position sensor. (Fig. 4)
(7) Remove structural cover (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - REMOVAL).
(8) Remove starter. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).
(9) Remove rubber splash shield.
(10) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(11) Remove torque converter bolts.
(12) Remove transmission to engine mounting bolts.

ENGINE - 4.7L (Continued)

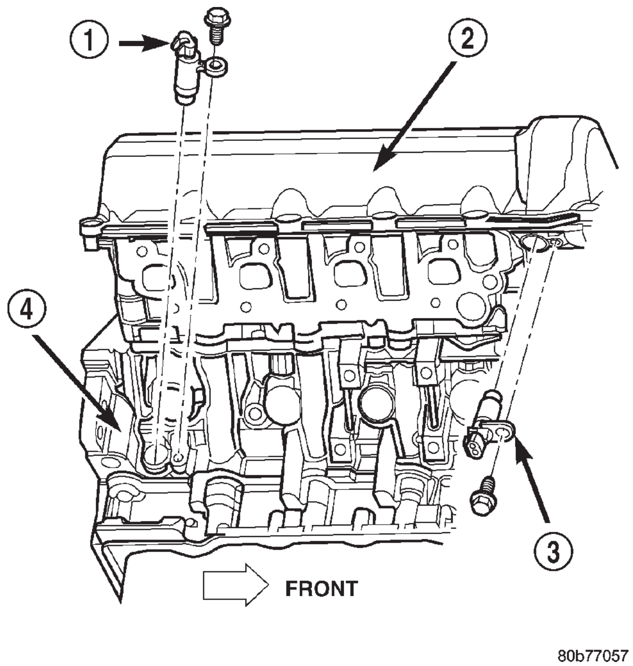


Fig. 4 Crankshaft Position Sensor

1 - CRANKSHAFT POSITION SENSOR
2 - CYLINDER HEAD COVER
3 - CAMSHAFT POSITION SENSOR
4 - RIGHT SIDE CYLINDER BLOCK

(13) Disconnect the engine block heater power cable from the block heater.

(14) Lower vehicle.

(15) Remove throttle body resonator assembly and inlet hose.

(16) Disconnect throttle and speed control cables.

(17) Disconnect tube from both the left and right side crankcase breathers, then remove the breathers (Fig. 5).

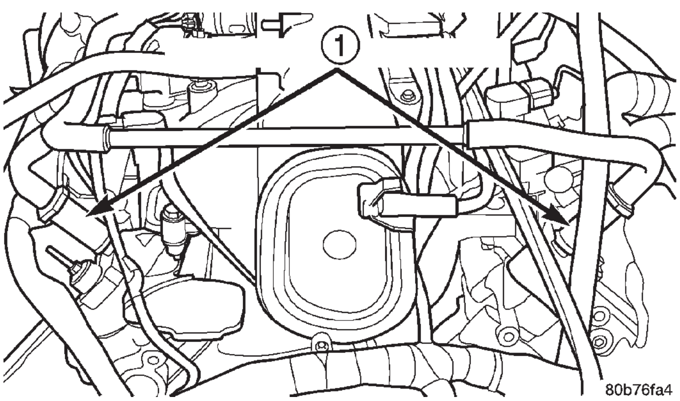


Fig. 5 Crankcase Breather Connection Points

1 - CRANKCASE BREATHERS

(18) Discharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(19) Remove radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL) and accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(20) Remove A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).

(21) Disconnect transmission oil cooler lines at the radiator.

(22) Disconnect radiator lower hose at the thermostat housing.

(23) Remove A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - REMOVAL).

(24) Remove radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).

(25) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(26) Disconnect the two heater hoses from the timing chain cover.

(27) Disconnect engine harness at the following points :

- Intake air temperature (IAT) sensor (Fig. 6)
- Fuel Injectors
- Throttle Position (TPS) Switch
- Idle Air Control (IAC) Motor
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold absolute pressure (MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs

(28) Release fuel rail pressure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE) then disconnect the fuel supply quick connect fitting at the fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

(29) Remove power steering pump and position out of the way.

(30) Disconnect ground straps from the left side of the engine.

(31) Install Engine Lifting Fixture Special Tool 8347 (Fig. 7)following these steps.

- Holding the lifting fixture at a slight angle, slide the large bore in the front plate over the hex portion of the lifting stud.
- Position the two remaining fixture arms onto the two lifting studs in the cylinder heads.
- Pull foward and upward on the lifting fixture so that the lifting stud rest in the slotted area below the large bore.
- Secure the lifting fixture to the three studs using three 7/16 – 14 N/C locknuts.
- Make sure the lifting loop in the lifting fixture is in the last hole (closest to the throttle body) to minimize the angle of engine during removal.

ENGINE - 4.7L (Continued)

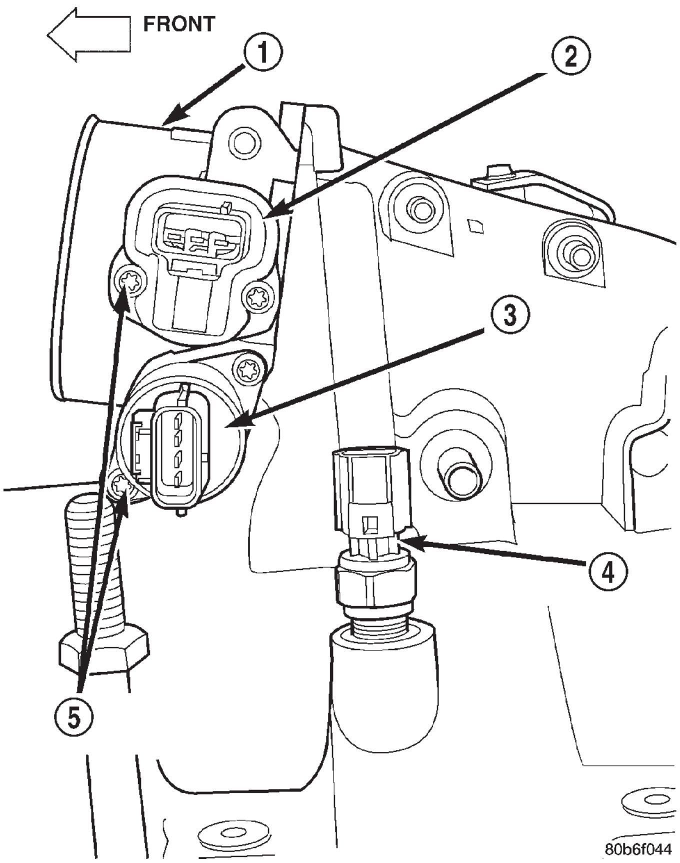


Fig. 6 Throttle Body Connection Points

1 - THROTTLE BODY
2 - TPS
3 - IAC MOTOR
4 - IAT SENSOR (THREADED TYPE)
5 - MOUNTING SCREWS

(32) Disconnect body ground strap at the right side cowl.

NOTE: It will be necessary to support the transmission in order to remove the engine.

(33) Position a suitable jack under the transmission.

(34) Remove the engine mount through bolts.

(35) Raise engine slightly, then remove both left and right side engine mounts from engine. (Refer to 9 - ENGINE/ENGINE MOUNTING/FRONT MOUNT - REMOVAL).

(36) Remove engine from the vehicle.

INSTALLATION

(1) Position engine in the vehicle.

(2) Install both left and right side engine mounts onto engine (Refer to 9 - ENGINE/ENGINE MOUNTING/FRONT MOUNT - INSTALLATION).

(3) Install transmission to engine mounting bolts. Tighten the bolts to 41 N·m (30 ft. lbs.).

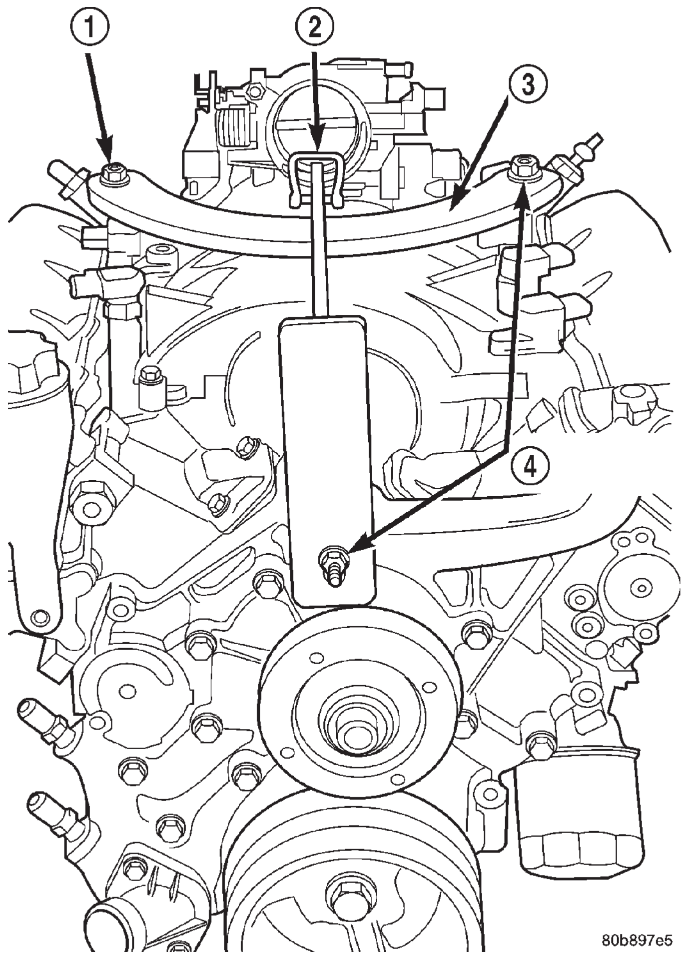


Fig. 7 Engine Lifting Fixture Attachment Locations

1 - ATTACHING LOCATION
2 - ADJUSTABLE HOOK
3 - SPECIAL TOOL 8347 ENGINE LIFT FIXTURE
4 - ATTACHING LOCATIONS

(4) Remove jack from under the transmission.

(5) Remove engine lifting fixture special tool 8347 (Fig. 7).

(6) Connect ground straps on the left side of the engine.

(7) Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).

(8) Connect fuel supply line quick connect fitting (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

(9) Connect engine harness at the following points (Fig. 6):

- Intake Air Temperature (IAT) Sensor
- Idle Air Control (IAC) Motor
- Fuel Injectors
- Throttle Position (TPS) Switch
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure (MAP) Sensor

ENGINE - 4.7L (Continued)

- Camshaft Position (CMP) Sensor
- Coil Over Plugs

(10) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(11) Install radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(12) Install A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - INSTALLATION).

(13) Connect radiator lower hose at the thermostat housing.

(14) Connect the transmission oil cooler lines to the radiator.

(15) Install A/C compressor. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).

(16) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) and radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(17) Install breathers, then connect tube to both crankcase breathers (Fig. 5).

(18) Connect throttle and speed control cables.

(19) Install throttle body resonator assembly and inlet hose.

(20) Raise vehicle.

(21) Connect two ground straps on the lower left hand side of the engine and one ground strap on the lower right side.

(22) Install torque converter bolts.

(23) Connect crankshaft position sensor (Fig. 4).

(24) Install starter.

(25) Install rubber splash shield.

CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

(26) Install structural cover (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).

(27) Install exhaust crossover pipe.

(28) Install engine block heater power cable, If equipped.

(29) Lower vehicle.

(30) Check and fill engine oil (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).

(31) Recharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(32) Refill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(33) Connect the battery negative cable.

(34) Start engine and check for leaks.

SPECIFICATIONS

4.7L ENGINE

DESCRIPTION	SPECIFICATION
GENERAL SPECIFICATIONS	
Engine Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters / 4701cc (287 Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.0:1
Horsepower	235 BHP @ 4800 RPM
Torque	295 LB-FT @ 3200 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2
CYLINDER BLOCK	
Cylinder Block	Cast Iron
Bore Diameter	93.010 ± .0075 mm (3.6619 ± 0.0003 in.)
Out of Round (MAX)	0.076 mm (0.003 in.)
Taper (MAX)	0.051 mm (0.002 in.)
PISTONS	
Material	Aluminum Alloy
Diameter	92.975 mm (3.6605 in.)
Weight	367.5 grams (12.96 oz)
Ring Groove Diameter	
No. 1	83.73 - 83.97 mm (3.296 - 3.269 in.)
No. 2	82.833 - 83.033 mm (3.261 - 3.310 in.)
No. 3	83.88 - 84.08 mm (3.302 - 3.310 in.)
PISTON PINS	
Type	Pressed Fit
Clearance In Piston	0.010 - 0.019 mm (0.0004 - 0.0008 in.)
Diameter	24.013 - 24.016 mm (0.9454 - 0.9456 in.)

ENGINE - 4.7L (Continued)

DESCRIPTION	SPECIFICATION
PISTON RINGS	
Ring Gap	
Top Compression Ring	0.37 - 0.63 mm
	(0.0146 - 0.0249 in.)
Second Compression Ring	0.37 - 0.63 mm
	(0.0146 - 0.0249 in.)
Oil Control (Steel Rails)	0.25 - 0.76 mm
	(0.0099 - 0.30 in.)
Side Clearance	
Top Compression Ring	.051 - .094 mm
	(0.0020 - 0.0037 in.)
Second Compression Ring	0.040 - 0.080 mm
	(0.0016 - 0.0031 in.)
Oil Ring (Steel Ring)	.019 - .229 mm
	(.0007 - .0091 in.)
Ring Width	
Top Compression Ring	1.472 - 1.490 mm
	(0.057 - 0.058 in.)
Second Compression Ring	1.472 - 1.490 mm
	(0.057 - 0.058 in.)
Oil Ring (Steel Rails)	0.445 - 0.470 mm
	(0.017 - 0.018 in.)
CONNECTING RODS	
Bearing Clearance	0.010 - 0.048 mm
	(0.0004 - 0.0019 in.)
Side Clearance	0.10 - 0.35 mm
	(0.004 - 0.0138 in.)
Piston Pin Bore Diameter	.022 - .045 mm
(Interference Fit)	(0.0009 - 0.0018 in.)
Bearing Bore Out of Round	0.004 mm
(MAX)	(0.0002 in.)
Total Weight (Less Bearing)	555 grams (19.5771 ounces)
CRANKSHAFT	
Main BearingJournal	
Diameter	63.488 - 63.512 mm
	(2.4996 - 2.5005 in.)

DESCRIPTION	SPECIFICATION
Bearing Clearance	0.018 - 0.052 mm
	(0.0008 - 0.0021 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
End Play	0.052 - 0.282 mm
	(0.0021 - 0.0112 in.)
End Play (MAX)	0.282 mm (0.0112 in)
Connecting Rod Journal	
Diameter	50.992 - 51.008 mm
	(2.0076 - 2.0082 in.)
Bearing Clearance	0.015 - 0.055 mm
	(0.0006 -0.0022 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
CAMSHAFT	
Bore Diameter	26.02 - 26.04 mm
	(1.0245 - 1.0252 in.)
Bearing Journal Diameter	25.975 - 25.995 mm
	(1.0227 - 1.0235 in.)
Bearing Clearance	0.025 - 0.065 mm
	(0.001 - 0.0026 in.)
Bearing Clearance (MAX)	0.065 mm (0.0026 in.)
End Play	.075 - .200 mm
	(0.003 - 0.0079 in.)
End Play (MAX)	.200 mm (0.0079 in.)
VALVE TIMING	
Intake	
Opens (ATDC)	3.6°
Closes (ATDC)	247.1°
Duration	243.5°
Exhaust	
Opens (BTDC)	232.5°
Closes (ATDC)	21.2°
Duration	253.70°
Valve Overlap	17.6°
VALVES	
Face Angle	45° - 45.5°
Head Diameter	
Intake	48.52 - 48.78 mm
	(1.9103 - 1.9205 in.)

ENGINE - 4.7L (Continued)

DESCRIPTION	SPECIFICATION
Exhaust	36.87 - 37.13 mm 1.4516 - 1.4618 in.)
Length (Overall)	
Intake	113.45 - 114.21 mm (4.4666 - 4.4965)
Exhaust	114.92 - 115.68 mm (4.5244 - 4.5543 in.)
Stem Diameter	
Intake	6.931 - 6.957 mm (0.2729 - 0.2739 in.)
Exhaust	6.902 - 6.928 mm (0.2717 - 0.2728 in.)
Stem - to - Guide Clearance	
Intake	.018 - .069 mm (0.0008 - 0.0028 in.)
Exhaust	.047 - .098 mm (0.0019 - 0.0039 in.)
Max. Allowable Stem - to - **Guide Clearance (Rocking** **Method)**	
Intake	0.069 mm (0.0028 in.)
Exhaust	0.098 mm (0.0039 in.)
Valve Lift (Zero Lash)	
Intake	11.25 mm (0.443 in.)
Exhaust	10.90 mm (0.4292 in.)
VALVE SPRING	
Free Length (Approx)	
Intake and Exhaust	48.6 mm (1.9134 in.)
Spring Force (Valve Closed)	
Intake and Exhaust	315.5 - 352.5 N @ 40.89 mm (70.92722 - 79.24515 lbs. @ 1.6099 in.)
Spring Force (Valve Open)	
Intake and Exhaust	786.0 - 860.0 N @ 29.64 mm 176.6998 - 193.3357 lbs. @ 1.167 in.)
Number of Coils	
Intake and Exhaust	6.69
Wire Diameter	
Intake and Exhaust	4.2799 - 4.3561 mm (0.1685 - 0.1715 in.)
Installed Height (Spring Seat to Bottom of Retainer)	
Nominal	
Intake	40.97 mm (1.613 in.)
Exhaust	40.81 mm (1.606 in.)
CYLINDER HEAD	
Gasket Thickness (Compressed)	.7 mm (0.0276 in.)
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.051 mm (0.002 in.)
Valve Seat Width	
Intake	1.75 - 2.36 mm (0.0698 - 0.0928 in.)
Exhaust	1.71 - 2.32 mm (0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm (0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)
OIL PUMP	
Clearance Over Rotors / End Face (MAX)	.035 - .095 mm (0.0014 - 0.0038 in.)
Cover Out - of -Flat (MAX)	.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.02 mm (0.4731 in.)

ENGINE - 4.7L (Continued)

DESCRIPTION	SPECIFICATION
Outer Rotor Clearance (MAX)	.235 mm (.0093 in.)
Outer Rotor Diameter (MIN)	85.925 mm (0.400 in.)
Tip Clearance Between Rotors (MAX)	.150 mm (0.006 in.)
OIL PRESSURE	
At Curb Idle Speed (MIN)*	25 kPa (4 psi)
@ 3000 rpm	170 - 758 kPa (25 - 110 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

SPECIFICATIONS - 4.7L H.O. ENGINE

DESCRIPTION	SPECIFICATION
GENERAL SPECIFICATIONS	
Engine Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters / 4701cc (287 Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.7:1
Horsepower	270 BHP @ 5100 RPM
Torque	330 LB-FT @ 3600 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2
CYLINDER BLOCK	
Cylinder Block	Cast Iron
Bore Diameter	93.010 ± .0075 mm (3.6619 ± 0.0003 in.)
Out of Round (MAX)	0.076 mm (0.003 in.)
Taper (MAX)	0.051 mm (0.002 in.)
PISTONS	
Material	Aluminum Alloy
Diameter	92.975 mm (3.6605 in.)
Weight	383.5 grams (13.52 oz)
Ring Groove Diameter	
No. 1	83.37 - 83.13 mm (3.296 - 3.269 in.)
No. 2	82.833 - 83.033 mm (3.261 - 3.310 in.)
No. 3	83.88 - 84.08 mm (3.302 - 3.310 in.)
PISTON PINS	
Type	Full Floating
Clearance In Piston	0.010 - 0.019 mm (0.0004 - 0.0008 in.)
Clearance in Rod	0.006 - 0.015 mm (0.0002 - 0.0005 in.)
Diameter	24.017 - 24.020 mm (0.9455 - 0.9456 in.)
PISTON RINGS	
Ring Gap	
Top Compression Ring	0.37 - 0.63 mm (0.0146 - 0.0249 in.)
Second Compression Ring	0.37 - 0.63 mm (0.0146 - 0.0249 in.)
Oil Control (Steel Rails)	0.25 - 0.76 mm (0.0099 - 0.30 in.)
Side Clearance	
Top Compression Ring	.051 - .094 mm (0.0020 - 0.0037 in.)
Second Compression Ring	0.040 - 0.080 mm (0.0016 - 0.0031 in.)
Oil Ring (Steel Ring)	.019 - .229 mm (.0007 - .0091 in.)
Ring Width	
Top Compression Ring	1.472 - 1.490 mm (0.057 - 0.058 in.)
Second Compression Ring	1.472 - 1.490 mm (0.057 - 0.058 in.)
Oil Ring (Steel Rails)	0.445 - 0.470 mm (0.017 - 0.018 in.)
CONNECTING RODS	
Bearing Clearance	0.010 - 0.048 mm (0.0004 - 0.0019 in.)

ENGINE - 4.7L (Continued)

DESCRIPTION	SPECIFICATION
Side Clearance	0.10 - 0.35 mm (0.004 - 0.0138 in.)
Piston Pin Bore Diameter	24.045 - 24.035 mm (0.94665 - 0.94625 in.)
Bearing Bore Out of Round (MAX)	0.004 mm (0.0002 in.)
Total Weight (Less Bearing)	555 grams (19.5771 ounces)
CRANKSHAFT	
Main BearingJournal	
Diameter	63.488 - 63.512 mm (2.4996 - 2.5005 in.)
Bearing Clearance	0.018 - 0.052 mm (0.0008 - 0.0021 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
End Play	0.052 - 0.282 mm (0.0021 - 0.0112 in.)
End Play (MAX)	0.282 mm (0.0112 in)
Connecting Rod Journal	
Diameter	50.992 - 51.008 mm (2.0076 - 2.0082 in.)
Bearing Clearance	0.015 - 0.055 mm (0.0006 -0.0022 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
CAMSHAFT	
Bore Diameter	26.02 - 26.04 mm
	(1.0245 - 1.0252 in.)
Bearing Journal Diameter	25.975 - 25.995 mm (1.0227 - 1.0235 in.)
Bearing Clearance	0.025 - 0.065 mm (0.001 - 0.0026 in.)
Bearing Clearance (MAX)	0.065 mm (0.0026 in.)
End Play	.075 - .200 mm (0.003 - 0.0079 in.)
End Play (MAX)	.200 mm (0.0079 in.)

DESCRIPTION	SPECIFICATION
VALVE TIMING	
Intake	
Opens (BTDC)	3.0°
Closes (ATDC)	233.0°
Duration	236.0°
Exhaust	
Opens (BTDC)	235.0°
Closes (ATDC)	15.0°
Duration	250.0°
Valve Overlap	18.0°
VALVES	
Face Angle	45° - 45.5°
Head Diameter	
Intake	48.52 - 48.78 mm (1.9103 - 1.9205 in.)
Exhaust	36.87 - 37.13 mm 1.4516 - 1.4618 in.)
Length (Overall)	
Intake	113.45 - 114.21 mm (4.4666 - 4.4965)
Exhaust	114.92 - 115.68 mm (4.5244 - 4.5543 in.)
Stem Diameter	
Intake	6.931 - 6.957 mm (0.2729 - 0.2739 in.)
Exhaust	6.902 - 6.928 mm (0.2717 - 0.2728 in.)
Stem - to - Guide Clearance	
Intake	.018 - .069 mm (0.0008 - 0.0028 in.)
Exhaust	.047 - .098 mm (0.0019 - 0.0039 in.)
Max. Allowable Stem - to - Guide Clearance (Rocking Method)	
Intake	0.069 mm (0.0028 in.)
Exhaust	0.098 mm (0.0039 in.)

ENGINE - 4.7L (Continued)

DESCRIPTION	SPECIFICATION
Valve Lift (Zero Lash)	
Intake	12.00 mm (0.4724 in.)
Exhaust	10.90 mm (0.4292 in.)
VALVE SPRING	
Free Length (Approx)	
Intake and Exhaust	48.92 mm (1.9259 in.)
Spring Force (Valve Closed)	
Intake and Exhaust	380.0 +/- 19.0 N @ 40.12 mm (85.4274 lbs. @ 1.5795 in.)
Spring Force (Valve Open)	
Intake and Exhaust	1030.0 +/- 46.0 N @ 28.12 mm 231.5532 lbs. @ 1.107 in.)
Number of Coils	
Intake and Exhaust	7.30
Wire Diameter	
Intake and Exhaust	4.77 +/- 0.03 mm x 3.80+/- .03mm
Installed Height (Spring Seat to Bottom of Retainer)	
Nominal	
Intake	40.97 mm (1.613 in.)
Exhaust	40.81 mm (1.606 in.)
CYLINDER HEAD	
Gasket Thickness (Compressed)	.7 mm (0.0276 in.)
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.051 mm (0.002 in.)
Valve Seat Width	
Intake	1.75 - 2.36 mm (0.0698 - 0.0928 in.)
Exhaust	1.71 - 2.32 mm (0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm (0.2747 - 0.2756 in.)

DESCRIPTION	SPECIFICATION
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)
OIL PUMP	
Clearance Over Rotors / End Face (MAX)	.035 - .095 mm (0.0014 - 0.0038 in.)
Cover Out - of -Flat (MAX)	.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.02 mm (0.4731 in.)
Outer Rotor Clearance (MAX)	.235 mm (.0093 in.)
Outer Rotor Diameter (MIN)	85.925 mm (0.400 in.)
Tip Clearance Between Rotors (MAX)	.150 mm (0.006 in.)
OIL PRESSURE	
At Curb Idle Speed (MIN)*	25 kPa (4 psi)
@ 3000 rpm	170 - 758 kPa (25 - 110 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

TORQUE

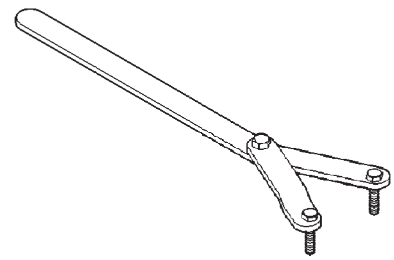
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft			
Non - Oiled Sprocket Bolt	122	90	—
Bearing Cap Bolts	11	—	100
Timing Chain Cover—Bolts	54	40	—
Connecting Rod Cap—Bolts	27	20	—
	PLUS 90° TURN		
Bed Plate—Bolts	Refer to Procedure		
Crankshaft Damper—Bolt	175	130	—
Cylinder Head—Bolts			
M11 Bolts	81	60	—
M8 Bolts	26	19	—
Cylinder Head Cover—Bolts	12	—	105
Exhaust Manifold—Bolts	25	18	—

ENGINE - 4.7L (Continued)

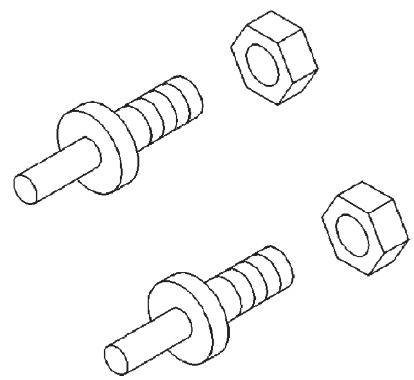
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Exhaust Manifold Heat Shield—Nuts	8	—	72
	Then loosen 45°		
Flexplate—Bolts	60	45	—
Engine Mount Bracket to Block—Bolts	61	45	—
Rear Mount to Transmission—Bolts	46	34	—
Generator Mounting—Bolts			
M10 Bolts	54	40	—
M8 Bolts	28	—	250
Intake Manifold—Bolts	12	—	105
	Refer to Procedure for Tightening Sequence		
Oil Pan—Bolts	15	—	130
Oil Pan—Drain Plug	34	25	—
Oil Pump—Bolts	28	—	250
Oil Pump Cover—Bolts	12	—	105
Oil Pickup Tube—Bolt and Nut	28	—	250
Oil Dipstick Tube to Engine Block—Bolt	15	—	130
Oil Fill Tube—Bolts	12	—	105
Timing Chain Guide—Bolts	28	—	250
Timing Chain Tensioner Arm—Special Pin Bolt	17	—	150
Hydraulic Tensioner—Bolts	28	—	250
Timing Chain Primary Tensioner—Bolts	28	—	250
Timing Drive Idler Sprocket—Bolt	34	25	—
Thermostat Housing—Bolts	13	—	115
Water Pump—Bolts	54	40	—

SPECIAL TOOLS

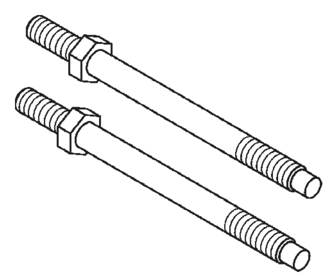
4.7L ENGINE



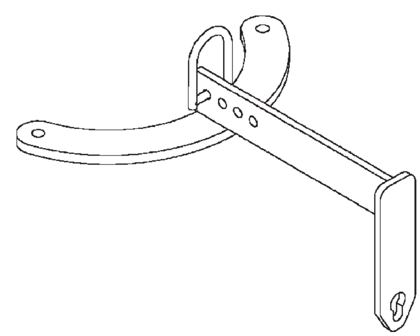
Spanner Wrench 6958



Adapter Pins 8346

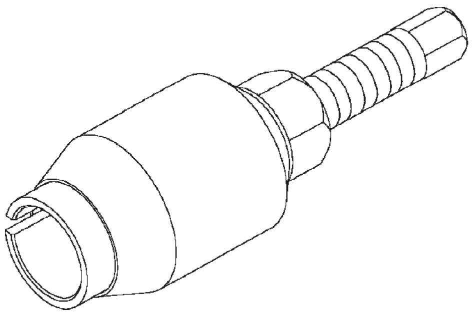


Engine Lifting Studs 8400

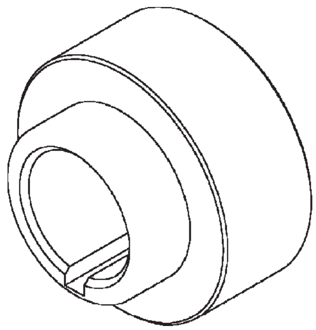


Engine Lift Fixture 8347

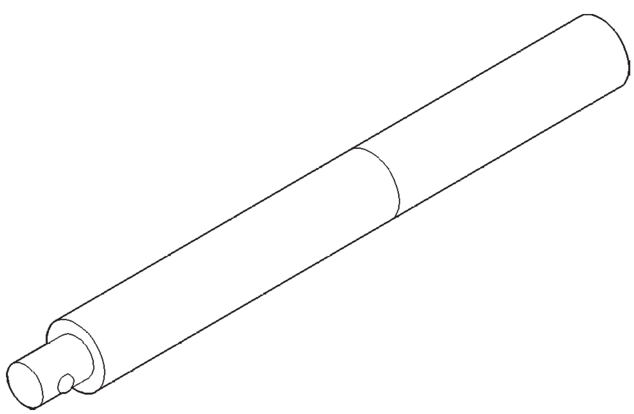
ENGINE - 4.7L (Continued)



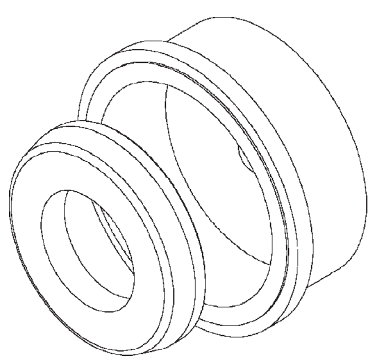
Front Crankshaft Seal Remover 8511



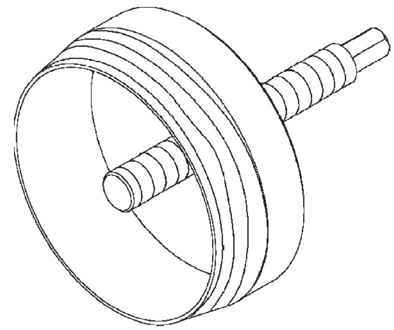
Front Crankshaft Seal Installer 8348



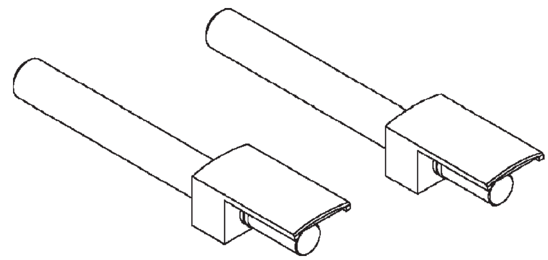
Handle C-4171



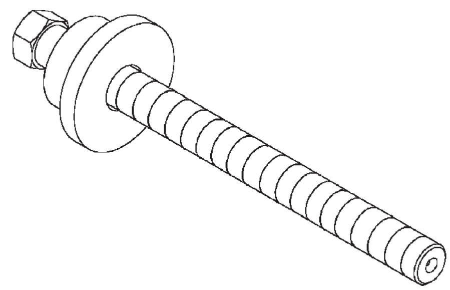
Rear Crankshaft Seal Installer 8349



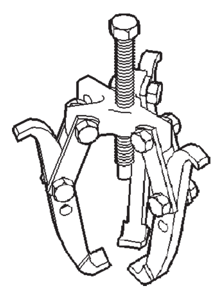
Rear Crankshaft Seal Remover 8506



Connecting Rod Guides 8507

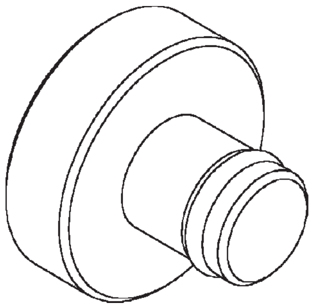


Crankshaft Damper Installer 8512

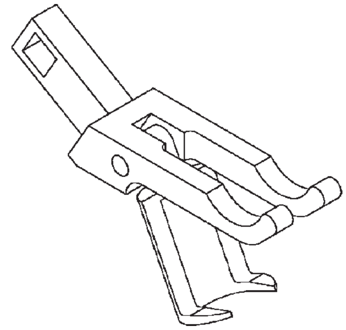


Puller 1026

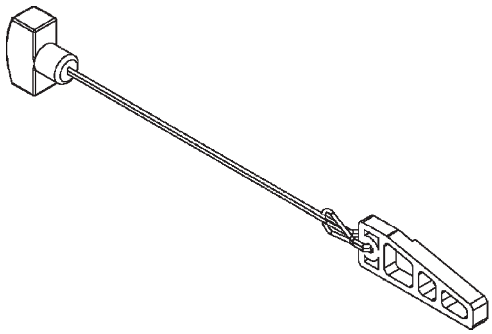
ENGINE - 4.7L (Continued)



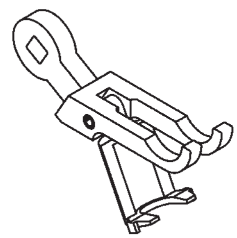
Crankshaft Damper Removal Insert 8513



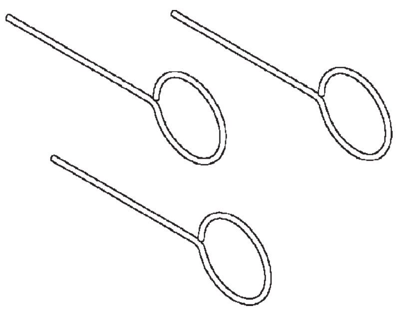
Remover, Rocker Arm 8516



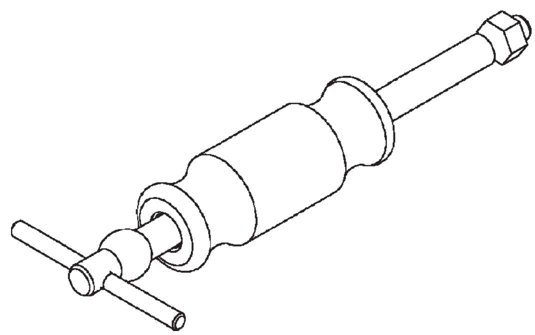
Chain Tensioner Wedge 8379



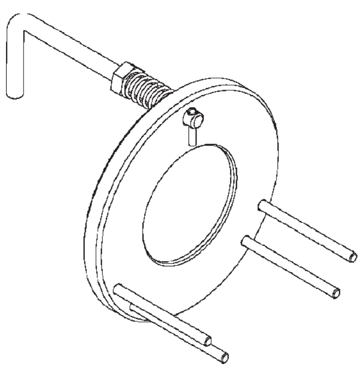
Valve Spring Compressor 8387



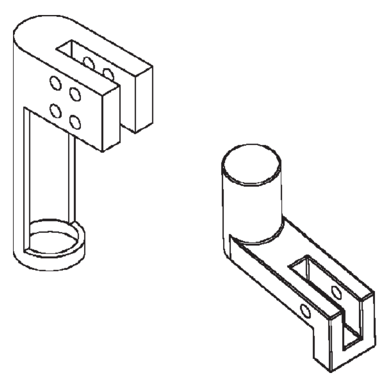
Chain Tensioner Pins 8514



Idler Shaft Remover 8517

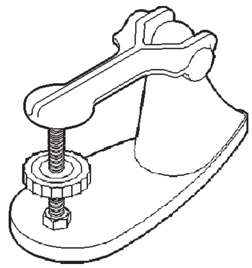


Secondary Chain Holder 8429

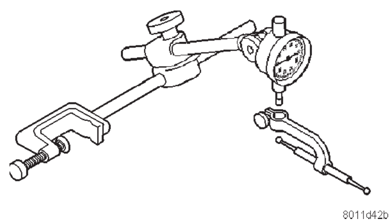


Valve Spring Compressor Adapters 8519

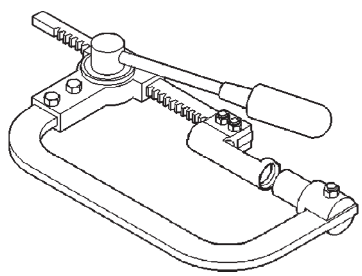
ENGINE - 4.7L (Continued)



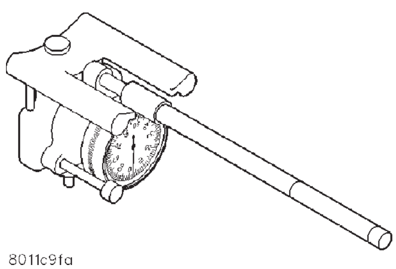
Valve Spring Tester C-647



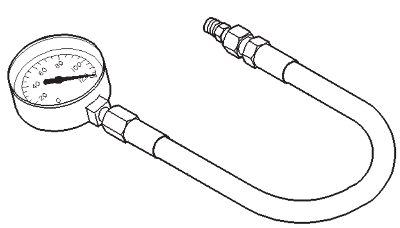
Dial Indicator C-3339



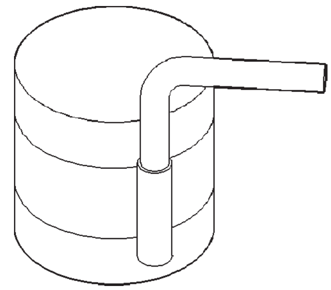
Valve Spring Compressor C-3422-B



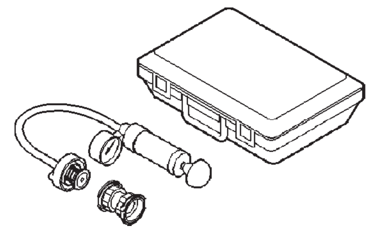
Bore Size Indicator C-119



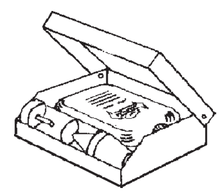
Oil Pressure Gauge C-3292



Piston Ring Compressor C-385



Pressure Tester Kit 7700



Bloc–Chek–Kit C-3685–A

AIR CLEANER ELEMENT

REMOVAL - 4.7L

(1) Unlatch four clips retaining air cleaner cover to air cleaner housing (Fig. 8).

(2) Lift cover up and position to the side.

(3) Remove air cleaner element.

INSTALLATION - 4.7L

(1) Clean inside of air cleaner housing before installing new element.

(2) Install air cleaner element into housing.

(3) Latch clips and clamp cover down to secure. Be sure air cleaner cover is properly seated to air cleaner housing.

AIR CLEANER ELEMENT (Continued)

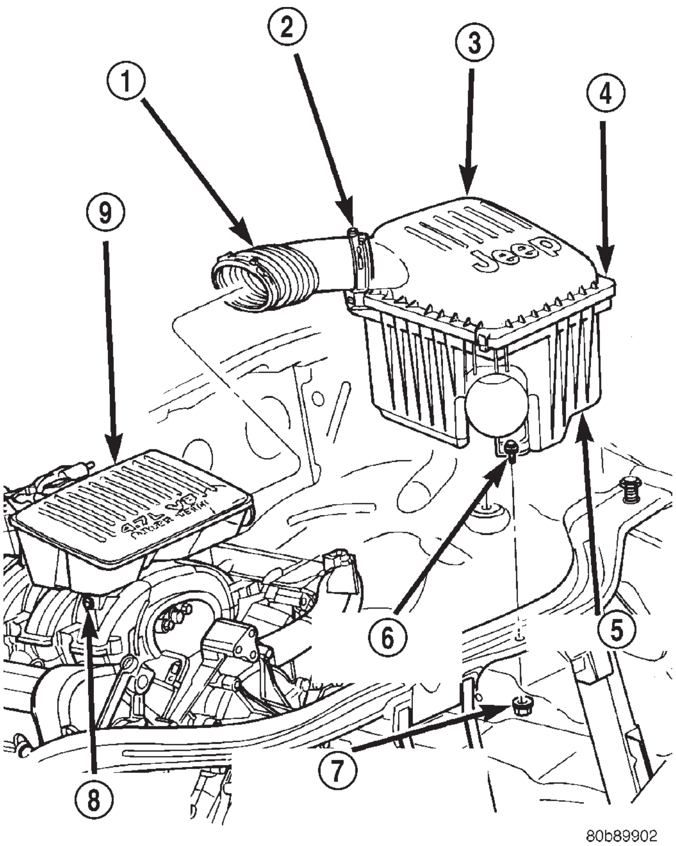


Fig. 8 Air Cleaner Assembly - 4.7L

1 - AIR DUCT
2 - CLAMPS
3 - AIR CLEANER COVER
4 - CLIPS
5 - HOUSING
6 - HOUSING BOLTS (3)
7 - LOWER HOUSING NUTS (3)
8 - RESONATOR BOLTS
9 - RESONATOR

AIR CLEANER HOUSING

REMOVAL - 4.7L

(1) Disconnect air cleaner cover-to-air duct clamp (Fig. 8).

(2) Disconnect air duct at housing.

(3) **Each of the 3 air cleaner housing mounting bolts is attached with 2 nuts (an upper nut and lower nut). DO NOT REMOVE BOLTS. To prevent stripping bolts, only remove lower nuts. The lower housing nuts are located under left front inner fender (Fig. 8).**

(a) To gain access to lower nuts, raise vehicle.

(b) Remove clips retaining rubber inner fender shield.

(c) Pry back shield enough to gain access to lower nuts.

(d) Remove 3 nuts.

(e) Remove air cleaner assembly from vehicle.

(4) If resonator is to be removed, disconnect breather tube at resonator, disconnect air duct clamp at resonator (Fig. 8)and remove 2 resonator mounting bolts (at sides of resonator). Remove resonator from throttle body by loosening clamp at throttle body.

INSTALLATION - 4.7L

(1) Position air cleaner assembly to body and install 3 nuts. Tighten nuts to 10 N·m (93 in. lbs.) torque. **To prevent excessive vibration transmitted through housing, the nuts must be properly torqued. Do not overtighten nuts.**

(2) If resonator was removed: Install resonator and bolts. Tighten bolts to 4 N·m (35 in. lbs.) torque. Tighten clamp at throttle body to 4 N·m (35 in. lbs.) torque.

(3) Position fender liner and install clips.

(4) Connect air duct at housing (Fig. 8).

(5) Tighten air duct clamp.

CYLINDER HEAD - LEFT

DESCRIPTION

DESCRIPTION - CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

CYLINDER HEAD - LEFT (Continued)

(3) Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Oil leak or excessive cam bore wear in cylinder head.

(11) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected lash adjusters, and replace.

c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

DIAGNOSIS AND TESTING—CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle on a hoist.

(3) Disconnect the exhaust pipe at the left side exhaust manifold.

(4) Drain the engine coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE).

(5) Lower the vehicle.

(6) Remove the intake manifold. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

(7) Remove the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(8) Remove accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(9) Remove the power steering pump and set aside.

(10) Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (Fig. 9).

CYLINDER HEAD - LEFT (Continued)

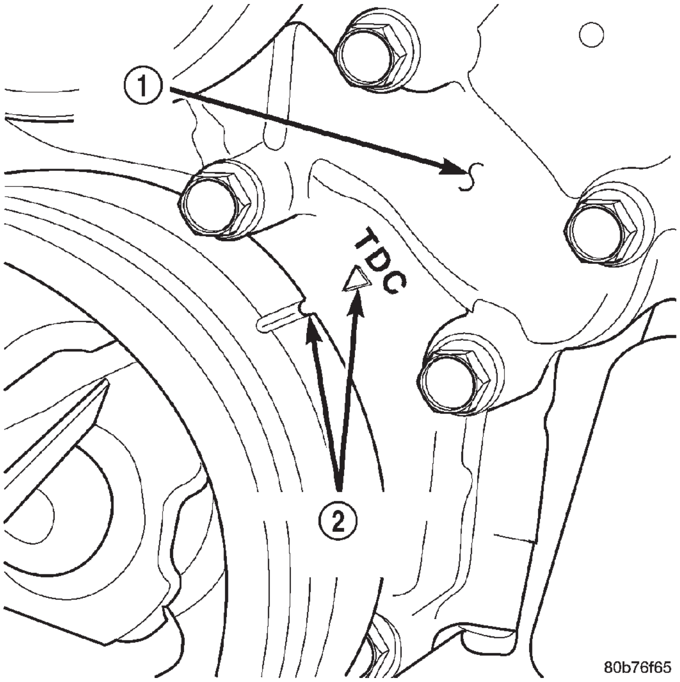


Fig. 9 Engine Top Dead Center

1 - TIMING CHAIN COVER
2 - CRANKSHAFT TIMING MARKS

(11) Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (Fig. 11). Rotate the crankshaft one turn if necessary.

(12) Remove the crankshaft damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(13) Remove the timing chain cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(14) Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (Fig. 10).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

(15) Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear (Fig. 11).

(16) Remove the left side secondary chain tensioner. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(17) Remove the cylinder head access plug (Fig. 12).

(18) Remove the left side secondary chain guide. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(19) Remove the retaining bolt and the camshaft drive gear.

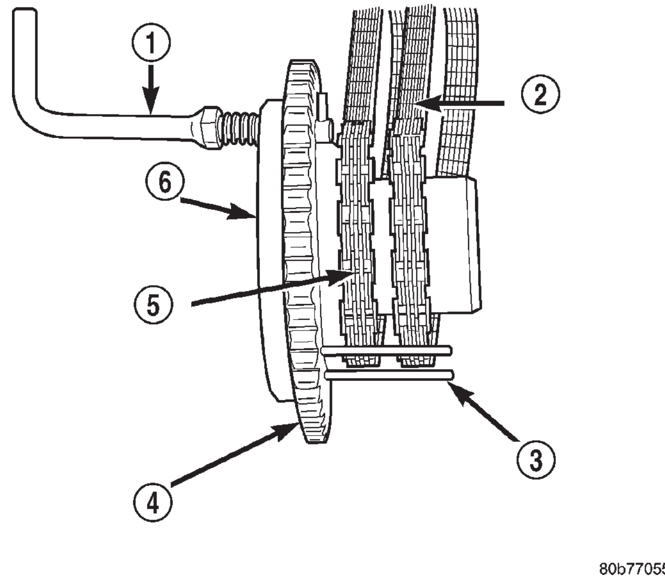


Fig. 10 Using Special Tool 8515 to Hold Chains to Idler Sprocket.

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8515

CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

(20) Remove the cylinder head retaining bolts.

(21) Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

CYLINDER HEAD - LEFT (Continued)

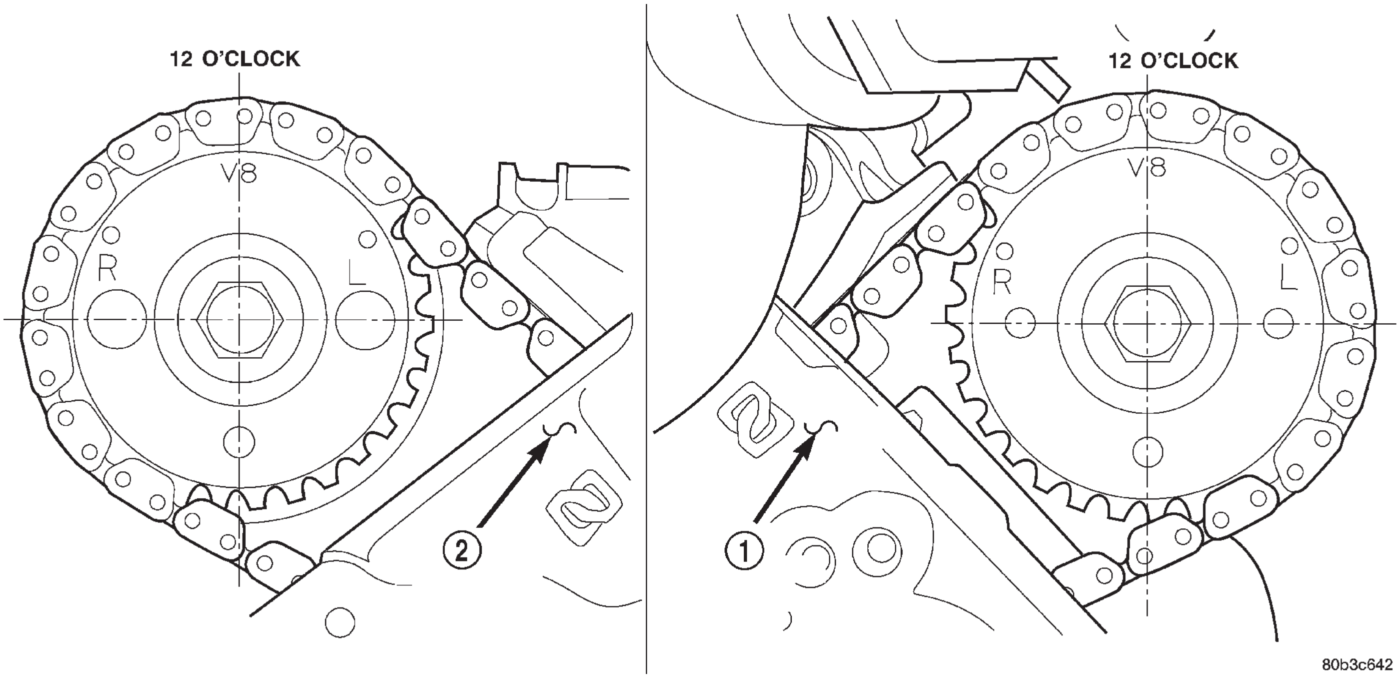


Fig. 11 Camshaft Sprocket V8 Marks

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

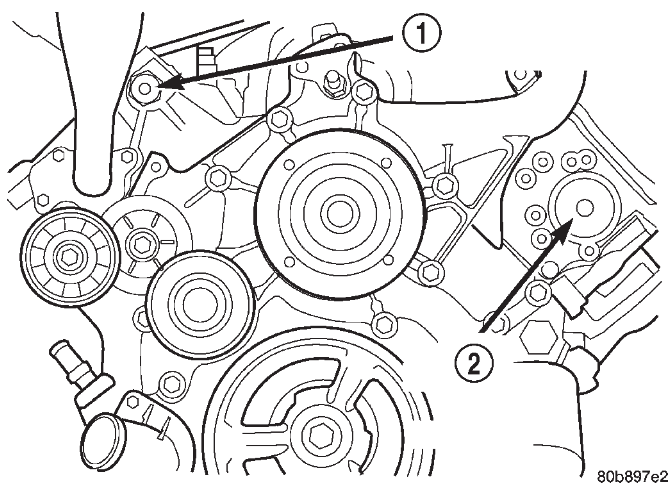


Fig. 12 Cylinder Head Access Plugs

1 - RIGHT CYLINDER HEAD ACCESS PLUG
2 - LEFT CYLINDER HEAD ACCESS PLUG

INSPECTION

(1) Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.

(2) Inspect the valve seats for damage. Service the valve seats as necessary.

(3) Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced (Fig. 13).

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

(1) Clean the cylinder head and cylinder block mating surfaces (Refer to 9 - ENGINE - STANDARD PROCEDURE).

(2) Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

CYLINDER HEAD - LEFT (Continued)

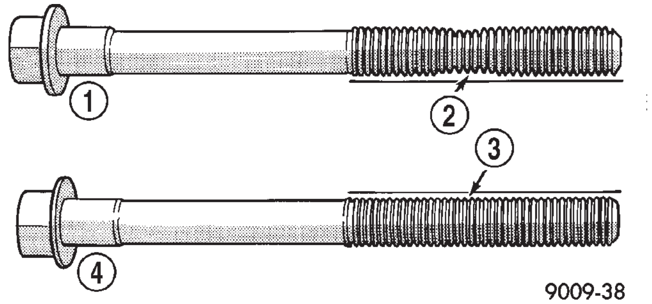


Fig. 13 Checking Cylinder Head Bolts for Stretching (Necking)

1 - STRETCHED BOLT
2 - THREADS ARE NOT STRAIGHT ON LINE
3 - THREADS ARE STRAIGHT ON LINE
4 - UNSTRETCHED BOLT

(3) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

(4) Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.

(5) Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

(6) Tighten the bolts in sequence (Fig. 14) using the following steps and torque values:

- Step 1: Tighten bolts 1–10, 27 N·m (20 ft. lbs.).
- Step 2: Verify that bolts 1–10, all reached 27 N·m (20 ft. lbs.), by repeating step-1 without loosening the bolts. Tighten bolts 11 thru 14 to 14 N·m (10 ft. lbs.).
- Step 3: Tighten bolts 1–10, 90 degrees.
- Step 4: Tighten bolts 1–10, 90 degrees, again. Tighten bolts 11–14, 26 N·m (19 ft. lbs.)

(7) Install the secondary chain and secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install the cylinder head access plug.

(9) Re-set and Install the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(10) Remove Special Tool 8515.

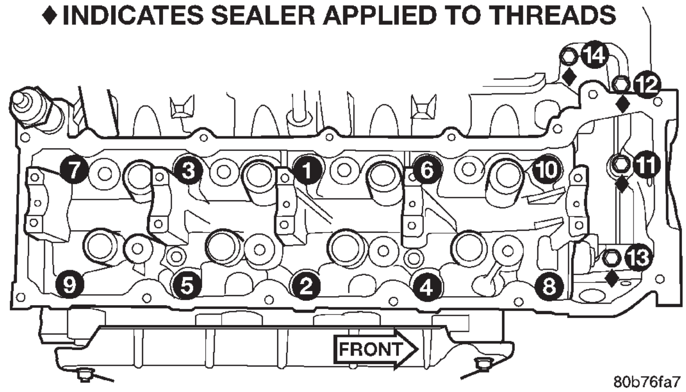


Fig. 14 Cylinder Head Tightening Sequence

(11) Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(12) Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(13) Install the power steering pump.

(14) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(15) Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

(16) Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(17) Raise the vehicle.

(18) Install the exhaust pipe onto the left exhaust manifold.

(19) Lower the vehicle.

(20) Connect the negative cable to the battery.

(21) Start the engine and check for leaks.

CAMSHAFT(S) - LEFT

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

CAMSHAFT(S) - LEFT (Continued)

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8350 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

(1) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.

(3) Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

(4) Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

(5) Position Special Tool 8350 timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide (Fig. 15).

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

(6) Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket (Fig. 16).

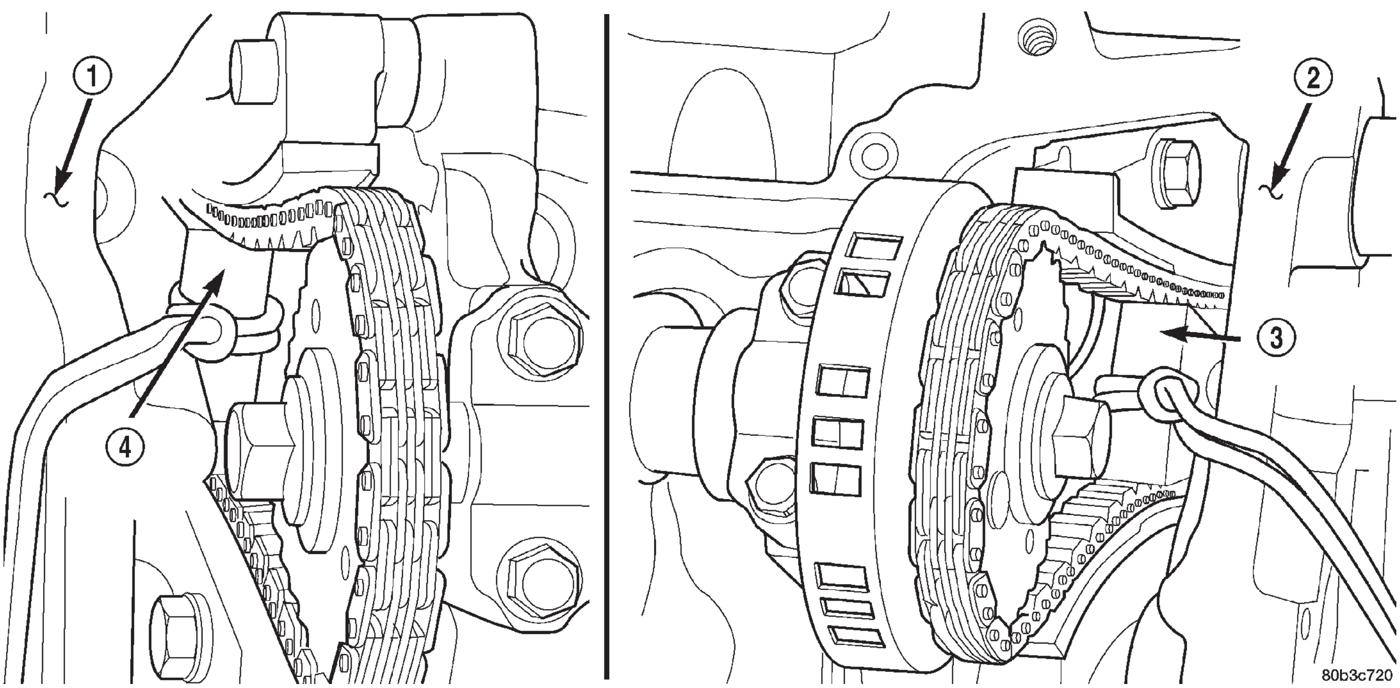


Fig. 15 Securing Timing Chain Tensioners Using Timing Chain Wedge

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD
3 - SPECIAL TOOL 8350 WEDGE
4 - SPECIAL TOOL 8350 WEDGE

CAMSHAFT(S) - LEFT (Continued)

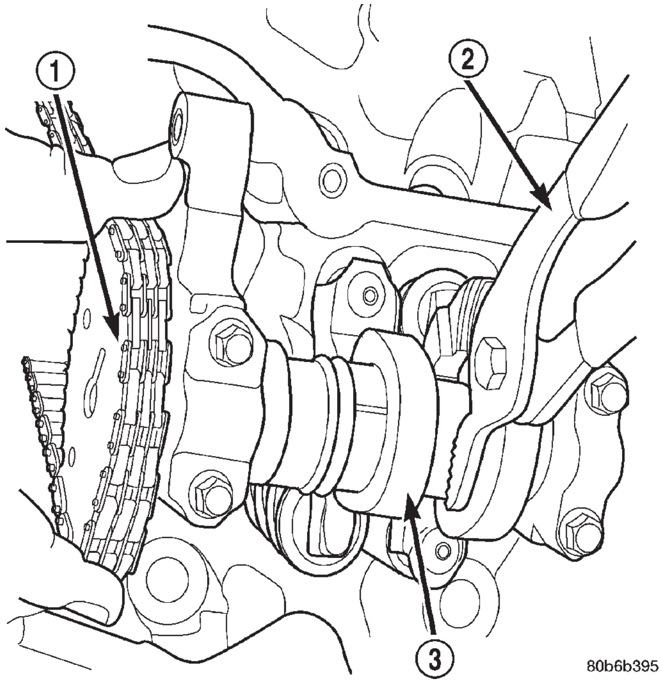


Fig. 16 Camshaft Sprocket and Chain

1 - CAMSHAFT SPROCKET AND CHAIN
2 - ADJUSTABLE PLIERS
3 - CAMSHAFT

(7) Using the pliers, gently allow the camshaft to rotate 15° clockwise until the camshaft is in the neutral position (no valve load).

(8) Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

(9) Remove the camshaft bearing caps and the camshaft.

INSTALLATION

(1) Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

(2) Position the camshaft into the cylinder head.

(3) Install the camshaft bearing caps, hand tighten the retaining bolts.

(4) Working in ½ turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward (Fig. 17).

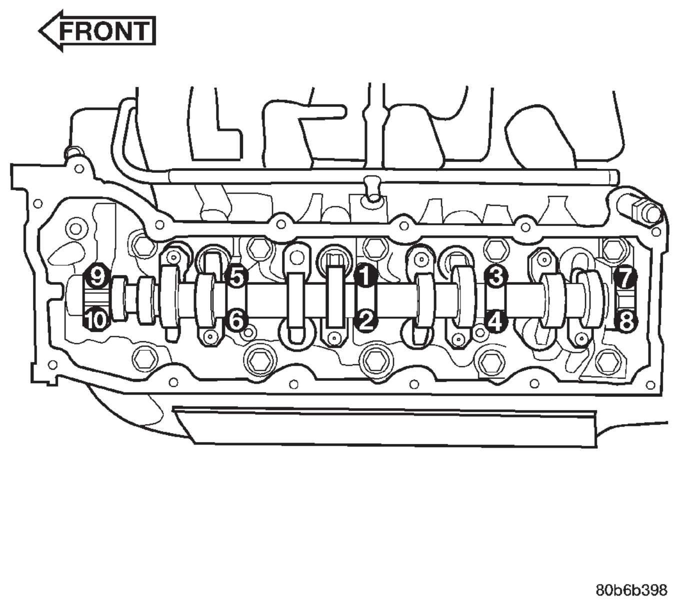


Fig. 17 Camshaft Bearing Caps Tightening Sequence

(5) Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).

(6) Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (Fig. 18).

CAMSHAFT(S) - LEFT (Continued)

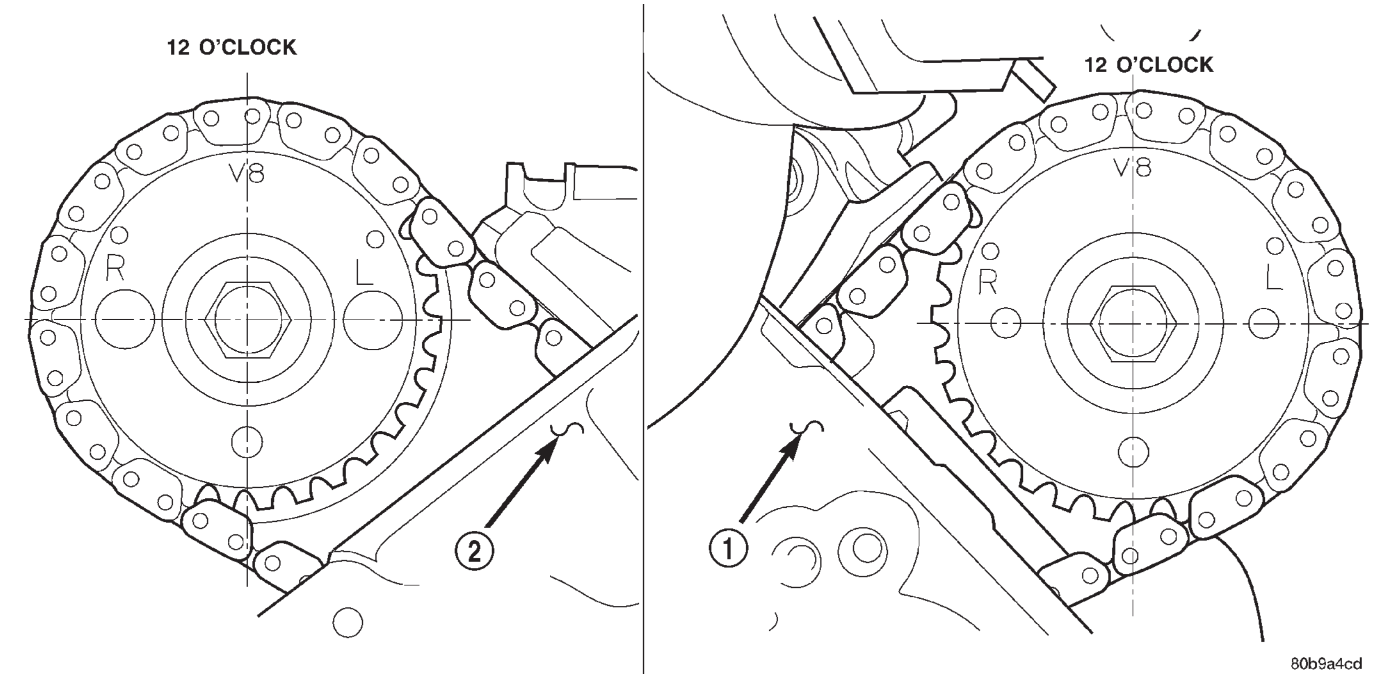


Fig. 18 Timing Chain to Sprocket Alignment

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

(7) Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft (Fig. 19).

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

(8) Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.

(9) Remove Special Tool 8350 timing chain wedge (Fig. 20).

(10) Using Special Tool 6958 spanner wrench with adapter pins 8346 (Fig. 21), torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).

(11) Install the cylinder head cover.

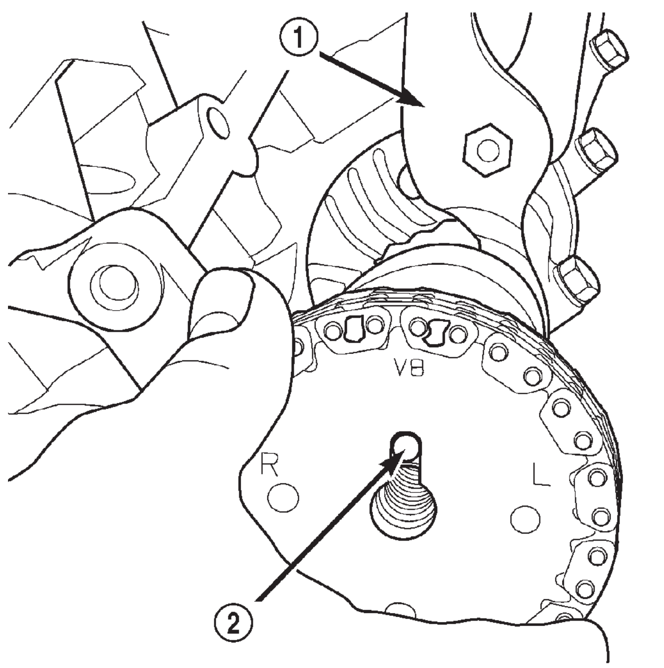


Fig. 19 Camshaft Sprocket Installation

1 - ADJUSTABLE PLIERS
2 - CAMSHAFT DOWEL

CAMSHAFT(S) - LEFT (Continued)

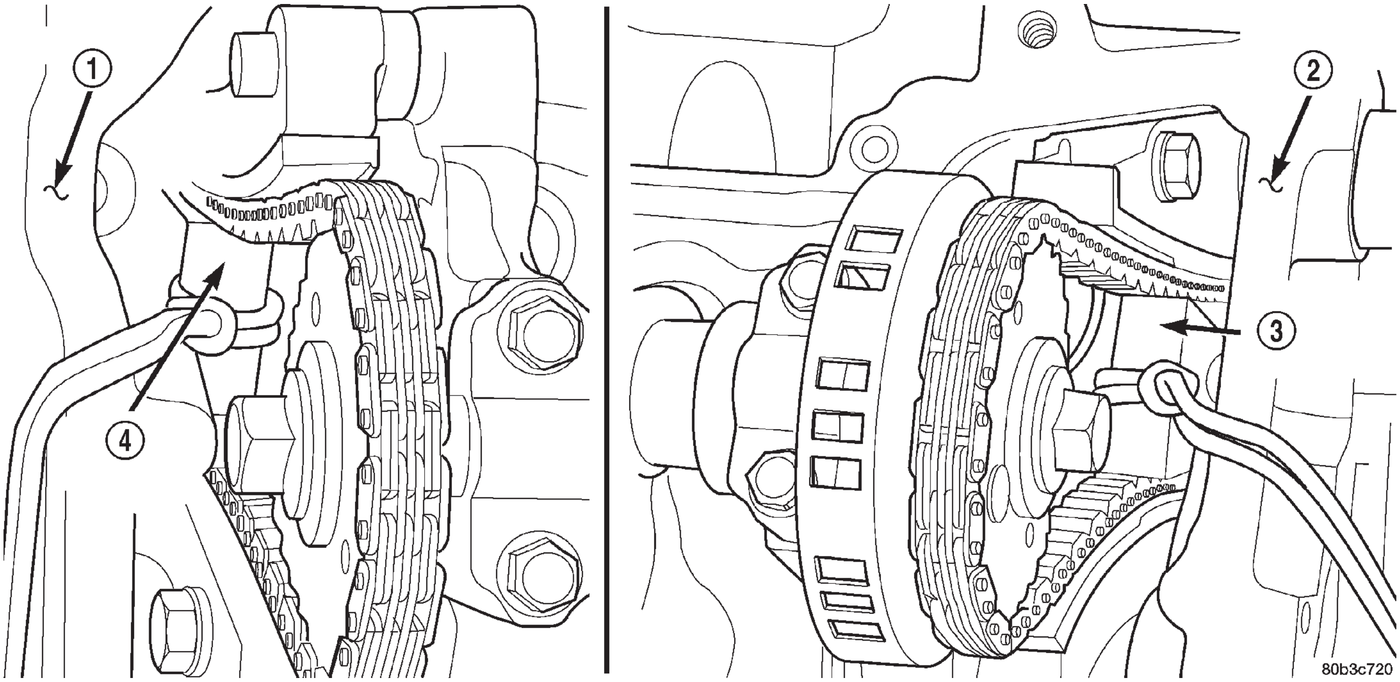


Fig. 20 SPECIAL TOOL 8350

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD
3 - SPECIAL TOOL 8350 WEDGE
4 - SPECIAL TOOL 8350 WEDGE

CAMSHAFT(S) - LEFT (Continued)

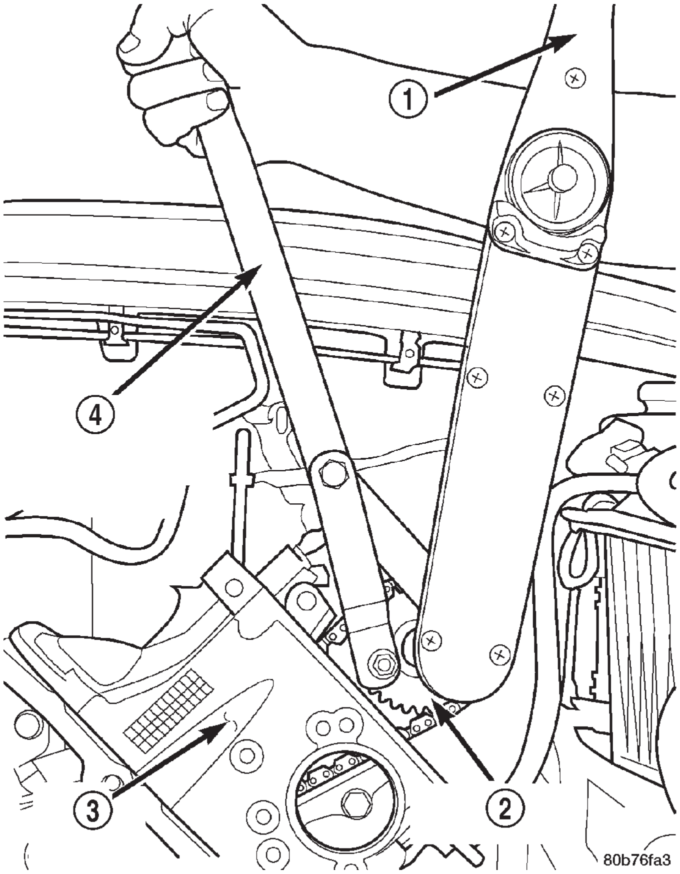


Fig. 21 Tightening Left Side Cam Sprocket Retaining Bolt

1 - TORQUE WRENCH
2 - CAMSHAFT SPROCKET
3 - LEFT CYLINDER HEAD
4 - SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

CYLINDER HEAD COVER(S) - LEFT

DESCRIPTION

The cylinder head covers are made of die cast magnesium, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

REMOVAL - LEFT SIDE

(1) Disconnect negative cable from battery.

(2) Remove the resonator assemble and air inlet hose.

(3) Disconnect injector connectors and un-clip the injector harness.

(4) Route injector harness in front of cylinder head cover.

(5) Disconnect the left side breather tube and remove the breather tube.

(6) Remove the cylinder head cover mounting bolts.

(7) Remove cylinder head cover and gasket.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

CLEANING

Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

INSTALLATION—LEFT SIDE

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the cylinder head cover. Prolonged contact with other objects may wear a hole in the engine cylinder head cover.

(1) Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.

(2) Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location shown in (Fig. 22).

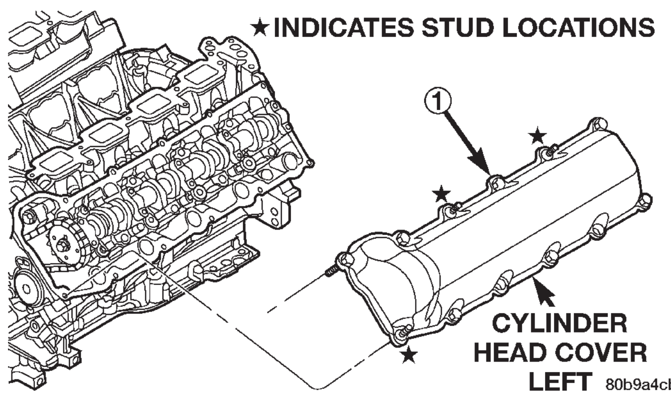


Fig. 22 Cylinder Head Cover—Left

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N·m (105 in. lbs.)

(3) Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs.).

(4) Install left side breather and connect breather tube.

(5) Connect injector electrical connectors and injector harness retaining clips.

(6) Install the resonator and air inlet hose.

(7) Connect negative cable to battery.

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

STANDARD PROCEDURE—REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(1) Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).

(2) Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.

(3) When the seat is properly positioned the width of the intake seat must be 1.75 – 2.36 mm (0.0689 – 0.0928 in.) and the exhaust seat must be 1.71 – 2.32 mm (0.0673 – 0.0911 in.).

(4) Check the valve spring installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 41.44 mm (1.6315 in.).

(5) The valve seat and valve face must maintain a face angle of 44.5 – 45 degrees angle (Fig. 23).

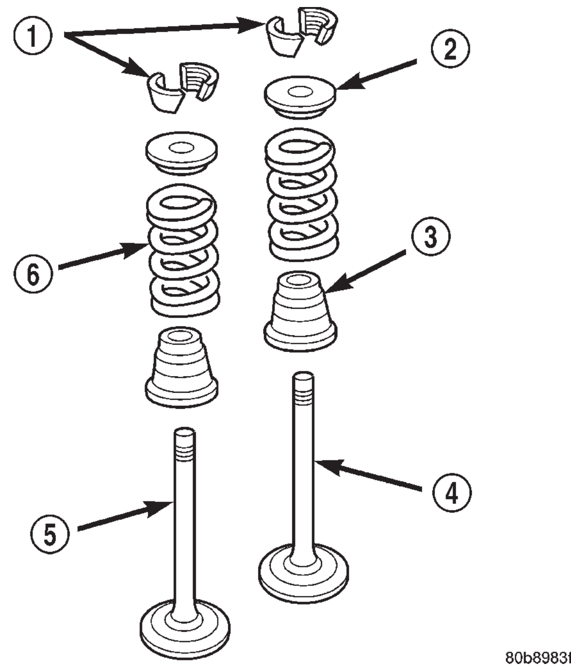


Fig. 23 Valve Assembly Configuration

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

REMOVAL

NOTE: The cylinder heads must be removed in order to preform this procedure.

(1) Remove rocker arms and lash adjusters. Refer to procedures in this section (Fig. 24).

(2) Remove the camshaft bearing caps and the camshaft.

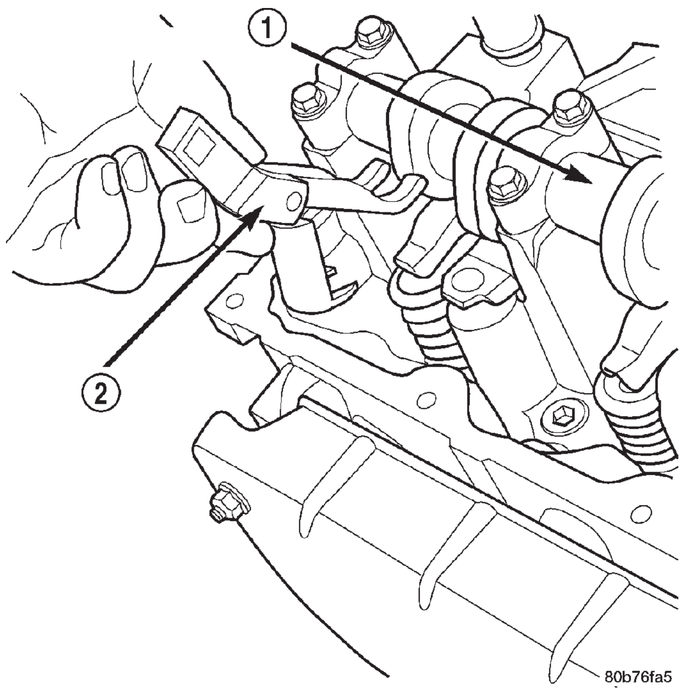


Fig. 24 Rocker Arm Removal

1 - CAMSHAFT
2 - SPECIAL TOOL 8516

INTAKE/EXHAUST VALVES & SEATS (Continued)

NOTE: All eight valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.

(3) Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

(4) Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

(5) Remove the valve spring compressor.
(6) Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

(7) Remove the valve from the cylinder head.

NOTE: The valve stem seals are common between intake and exhaust.

(8) Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 until surface is in line with the 40.69 mm (1.602 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications. (Fig. 25)

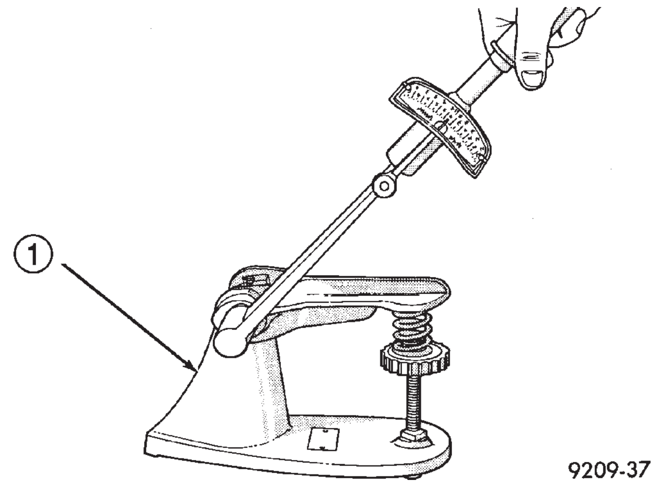


Fig. 25 Testing Valve Springs

1 - SPECIAL TOOL C-647

INSTALLATION

(1) coat the valve stem with clean engine oil and insert it into the cylinder head.
(2) Install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
(3) Install the spring and the spring retainer (Fig. 26).
(4) Using the valve spring compressor, compress the spring and install the two valve spring retainer halves.
(5) Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.
(6) lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.
(7) Install the camshaft bearing cap retaining bolts. Tighten the bolts 9–13 N·m (100 in. lbs.) in ½ turn increments in the sequence shown (Fig. 27).
(8) Position the hydraulic lash adjusters and rocker arms (Fig. 24).

INTAKE/EXHAUST VALVES & SEATS (Continued)

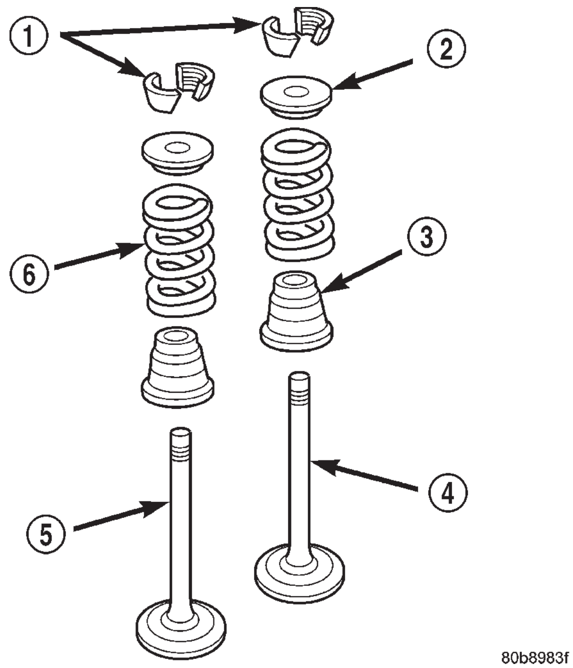


Fig. 26 Valve Assembly Configuration

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

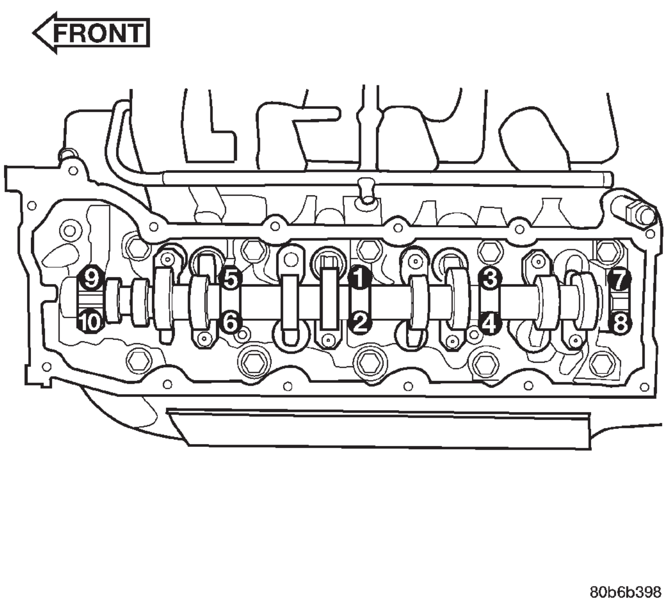


Fig. 27 Camshaft Bearing Caps Tightening Sequence

ROCKER ARM / ADJUSTER ASSEMBLY

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

(1) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(3) For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(4) For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(5) For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(6) Using special tool 8516 Rocker Arm Remover, press downward on the valve spring, remove rocker arm (Fig. 28).

INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

(1) For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(2) For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(3) For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(4) For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

ROCKER ARM / ADJUSTER ASSEMBLY (Continued)

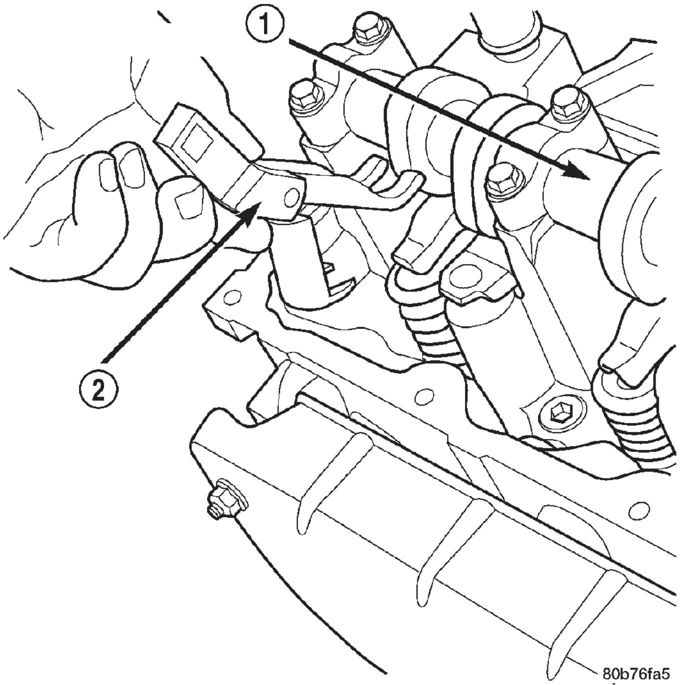


Fig. 28 Rocker Arm—Removal

1 - CAMSHAFT
2 - SPECIAL TOOL 8516

(5) Using special tool 8516 press downward on the valve spring, install rocker arm (Fig. 28).

(6) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

VALVE SPRINGS

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

VALVE STEM SEALS

DESCRIPTION

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

CYLINDER HEAD - RIGHT

DESCRIPTION

DESCRIPTION - CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING—CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

(3) Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Oil leak or excessive cam bore wear in cylinder head.

(11) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected lash adjusters, and replace.

c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

REMOVAL

(1) Disconnect battery negitive cable.

(2) Raise the vehicle on a hoist.

(3) Disconnect the exhaust pipe at the right side exhaust manifold.

(4) Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(5) Lower the vehicle.

(6) Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

(7) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(8) Remove oil fill housing from cylinder head.

(9) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(10) Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (Fig. 9).

(11) Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (Fig. 11). Rotate the crankshaft one turn if necessary.

(12) Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(13) Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(14) Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (Fig. 10).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

(15) Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear (Fig. 11).

(16) Remove the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(17) Remove the cylinder head access plug (Fig. 29).

(18) Remove the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

CYLINDER HEAD - RIGHT (Continued)

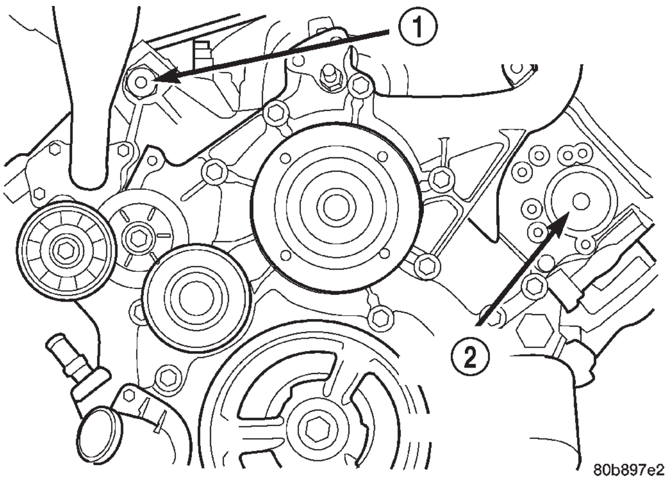


Fig. 29 Cylinder Head Access Plugs

1 - RIGHT CYLINDER HEAD ACCESS PLUG
2 - LEFT CYLINDER HEAD ACCESS PLUG

(19) Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

(20) Remove the cylinder head retaining bolts.
(21) Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

INSPECTION

(1) Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.
(2) Inspect the valve seats for damage. Service the valve seats as necessary.
(3) Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced (Fig. 13).

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

(1) Clean the cylinder head and cylinder block mating surfaces (Refer to 9 - ENGINE - STANDARD PROCEDURE).
(2) Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

(3) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

(4) Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.
(5) Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive**then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

(6) Tighten the bolts in sequence (Fig. 30) using the following steps and torque values:
- Step 1: Tighten bolts 1–10, 27 N·m (20 ft. lbs.).

CYLINDER HEAD - RIGHT (Continued)

• Step 2: Verify that bolts 1–10, all reached 27 N·m (20 ft. lbs.), by repeating step-1 without loosening the bolts. Tighten bolts 11 thru 14 to 14 N·m (10 ft. lbs.).

• Step 3: Tighten bolts 1–10, 90 degrees.

• Step 4: Tighten bolts 1–10, 90 degrees, again. Tighten bolts 11–14, 26 N·m (19 ft. lbs.)

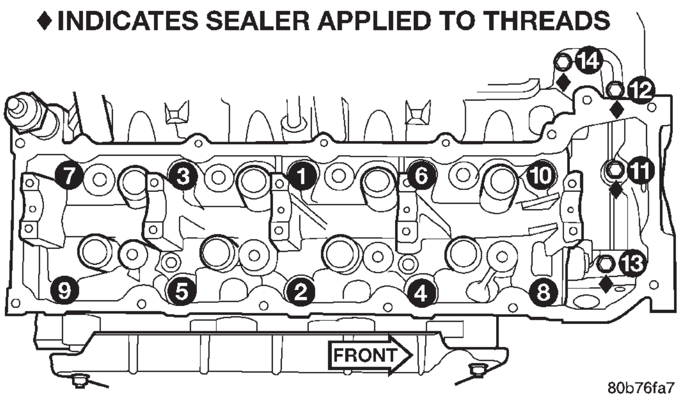


Fig. 30 Cylinder Head Tightening Sequence

(7) Install the secondary chain and secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install the cylinder head access plug.

(9) Re-set and install the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(10) Remove Special Tool 8515.

(11) Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(12) Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(13) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(14) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(15) Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

(16) Install oil fill housing onto cylinder head.

(17) Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(18) Raise the vehicle.

(19) Install the exhaust pipe onto the right exhaust manifold.

(20) Lower the vehicle.

(21) Reconnect battery negitive cable.

(22) Start the engine and check for leaks.

CAMSHAFT(S) - RIGHT

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8350 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

(1) Remove the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.

(3) Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

(4) Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

CAMSHAFT(S) - RIGHT (Continued)

(5) Position Special Tool 8350 timing chain wedge between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide (Fig. 31).

(6) Remove the camshaft position sensor (Fig. 32).

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

(7) Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket (Fig. 33).

(8) Using the pliers, gently allow the camshaft to rotate 45° counter-clockwise until the camshaft is in the neutral position (no valve load).

(9) Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

(10) Remove the camshaft bearing caps and the camshaft.

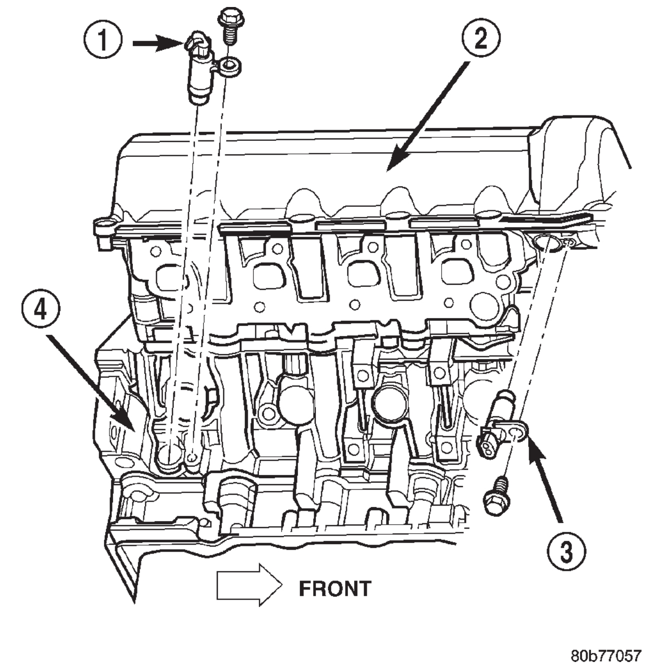


Fig. 32 Camshaft Position Sensor

1 - CRANKSHAFT POSITION SENSOR
2 - CYLINDER HEAD COVER
3 - CAMSHAFT POSITION SENSOR
4 - RIGHT SIDE CYLINDER BLOCK

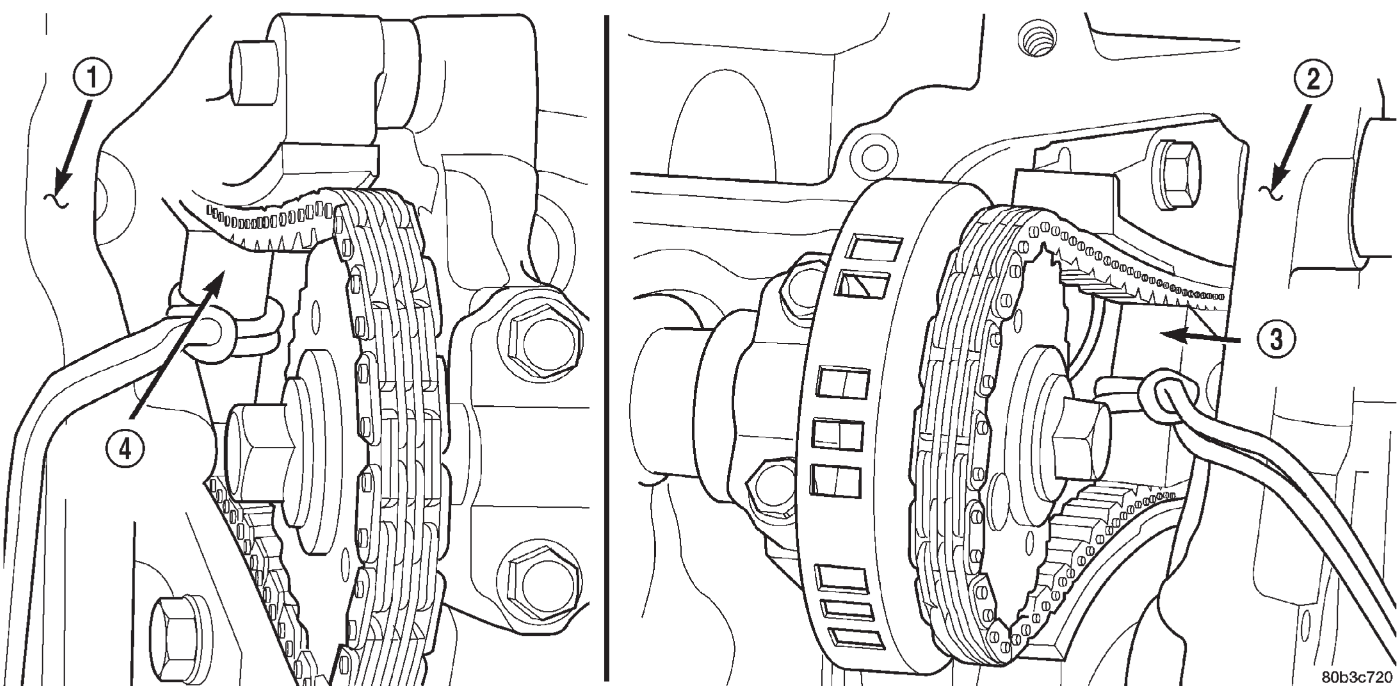


Fig. 31 Securing Timing Chain Tensioners Using Timing Chain Wedge

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD
3 - SPECIAL TOOL 8350 WEDGE
4 - SPECIAL TOOL 8350 WEDGE

CAMSHAFT(S) - RIGHT (Continued)

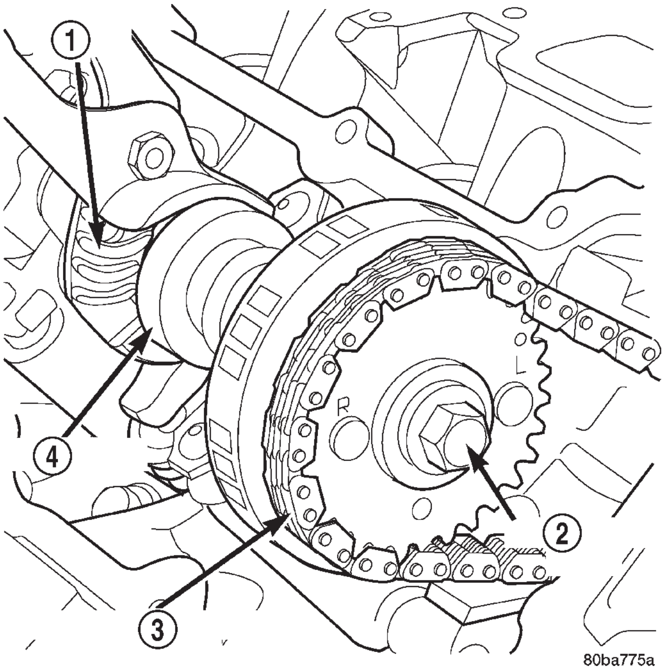


Fig. 33 Camshaft Sprocket and Chain

1 - ADJUSTABLE PLIERS
2 - SPROCKET BOLT
3 - CAMSHAFT SPROCKET AND CHAIN
4 - CAMSHAFT

INSTALLATION

(1) Lubricate camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

(2) Position the camshaft into the cylinder head.

(3) Install the camshaft bearing caps, hand tighten the retaining bolts.

(4) Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward (Fig. 34).

(5) Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).

(6) Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (Fig. 35).

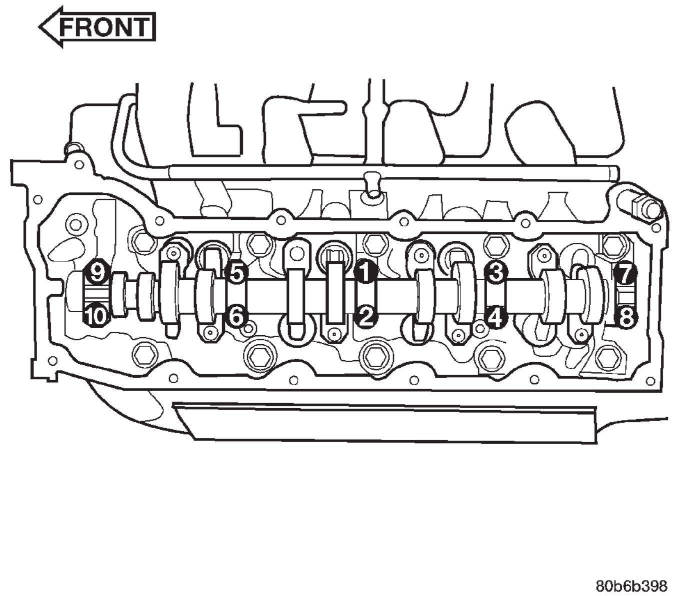


Fig. 34 Camshaft Bearing Caps Tightening Sequence

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

(7) Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft (Fig. 36).

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

(8) Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.

(9) Remove timing chain wedge special tool 8350 (Fig. 31).

(10) Using Special Tool 6958 spanner wrench with adapter pins 8346 (Fig. 37), torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).

(11) Install the camshaft position sensor (Fig. 32).

(12) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

CAMSHAFT(S) - RIGHT (Continued)

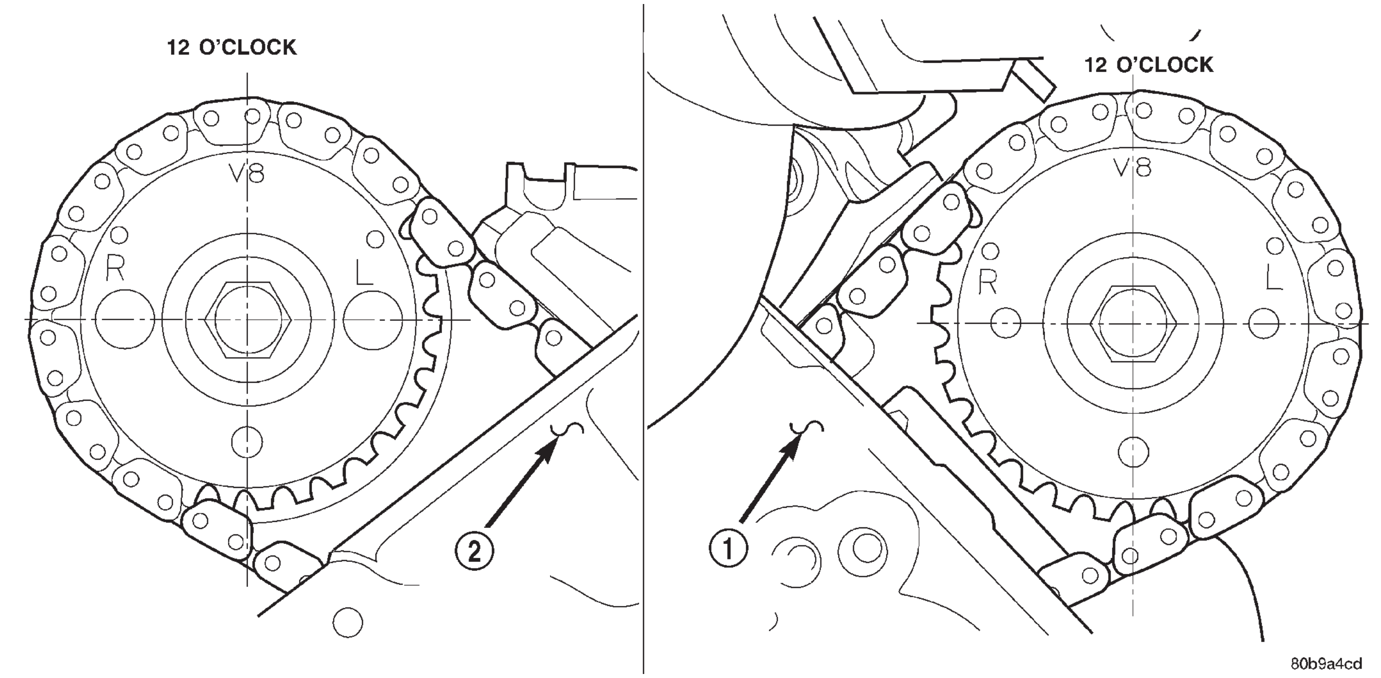


Fig. 35 Timing Chain to Sprocket Alignment

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

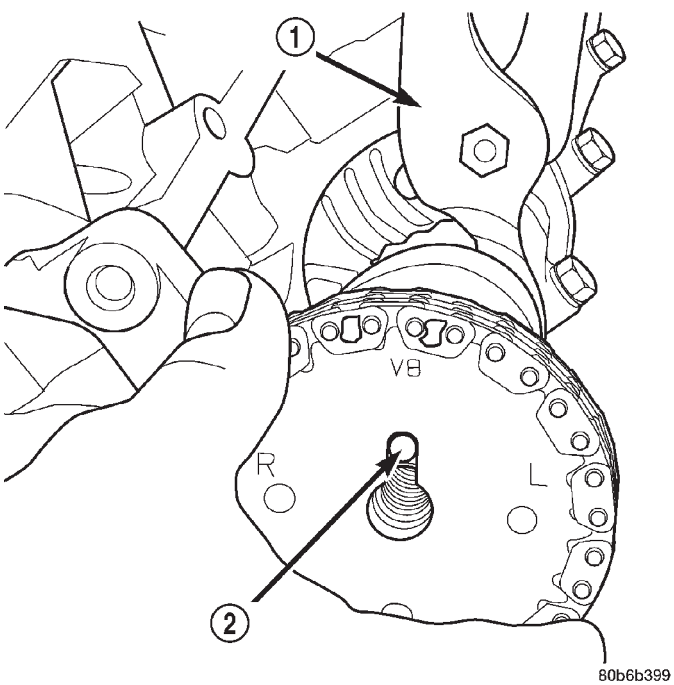


Fig. 36 Camshaft Sprocket Installation

1 - ADJUSTABLE PLIERS
2 - CAMSHAFT DOWEL

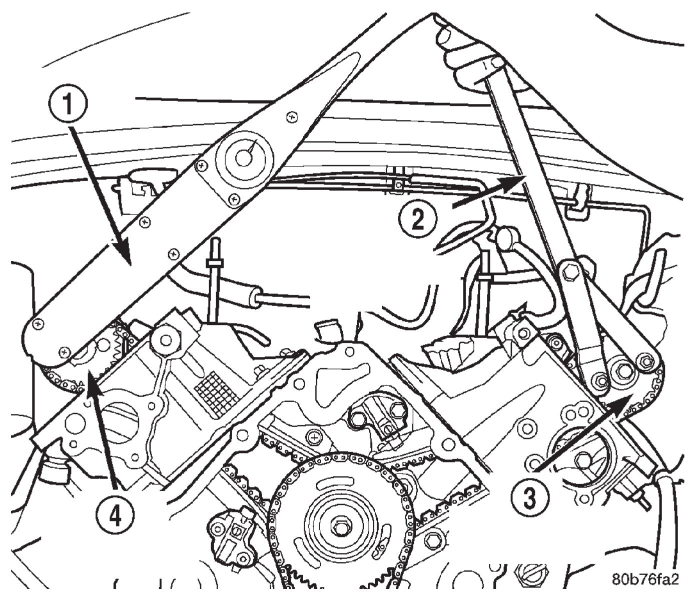


Fig. 37 Tightening Right Side Cam Sprocket Retaining Bolt

1 - TORQUE WRENCH
2 - SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 - LEFT CAMSHAFT SPROCKET
4 - RIGHT CAMSHAFT SPROCKET

CYLINDER HEAD COVER(S) - RIGHT

DESCRIPTION

The cylinder head covers are made of die cast magnesium, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

REMOVAL - RIGHT SIDE

(1) Disconnect battery negative cable.
(2) Remove air cleaner assembly, resonator assembly and air inlet hose.
(3) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(4) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(5) Remove air conditioning compressor retaining bolts and move compressor to the left.
(6) Remove heater hoses.
(7) Disconnect injector and ignition coil connectors.
(8) Disconnect and remove positive crankcase ventilation (PCV) hose.
(9) Remove oil fill tube.
(10) Un-clip injector and ignition coil harness and move away from cylinder head cover.
(11) Remove right rear breather tube and filter assembly.
(12) Remove cylinder head cover retaining bolts.
(13) Remove cylinder head cover.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

CLEANING

Clean cylinder head cover gasket surface.
Clean head rail, if necessary.

INSTALLATION - RIGHT SIDE

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the engine cylinder head cover. Prolonged contact with other objects may wear a hole in the cylinder head cover.

(1) Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
(2) Install cylinder head cover and hand start all fasteners. Verify that all double ended studs are in the correct location shown in (Fig. 38).

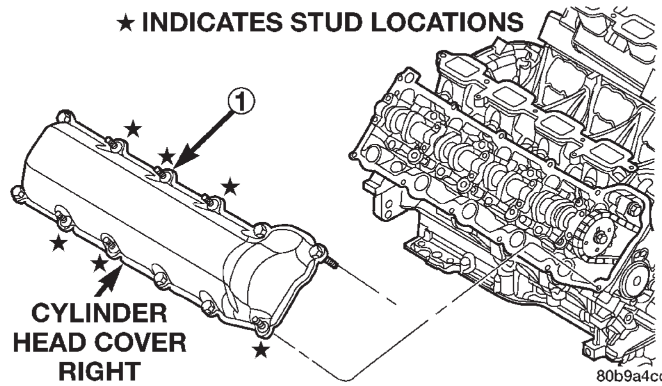


Fig. 38 Cylinder Head Cover—Right

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N·m (105 in. lbs.)

(3) Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).
(4) Install right rear breather tube and filter assembly.
(5) Connect injector, ignition coil electrical connectors and harness retaining clips.
(6) Install the oil fill tube.
(7) Install PCV hose.
(8) Install heater hoses.
(9) Install air conditioning compressor retaining bolts.
(10) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(11) Fill Cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(12) Install air cleaner assembly, resonator assembly and air inlet hose.
(13) Connect battery negative cable.

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

INTAKE/EXHAUST VALVES & SEATS (Continued)

STANDARD PROCEDURE—REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(1) Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).

(2) Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.

(3) When the seat is properly positioned the width of the intake seat must be 1.75 – 2.36 mm (0.0689 – 0.0928 in.) and the exhaust seat must be 1.71 – 2.32 mm (0.0673 – 0.0911 in.).

(4) Check the valve spring installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 41.44 mm (1.6315 in.).

(5) The valve seat and valve face must maintain a face angle of 44.5 – 45 degrees angle (Fig. 39).

REMOVAL

NOTE: The cylinder heads must be removed in order to preform this procedure.

(1) Remove rocker arms and lash adjusters. Refer to procedures in this section (Fig. 40).

(2) Remove the camshaft bearing caps and the camshaft.

NOTE: All eight valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.

(3) Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

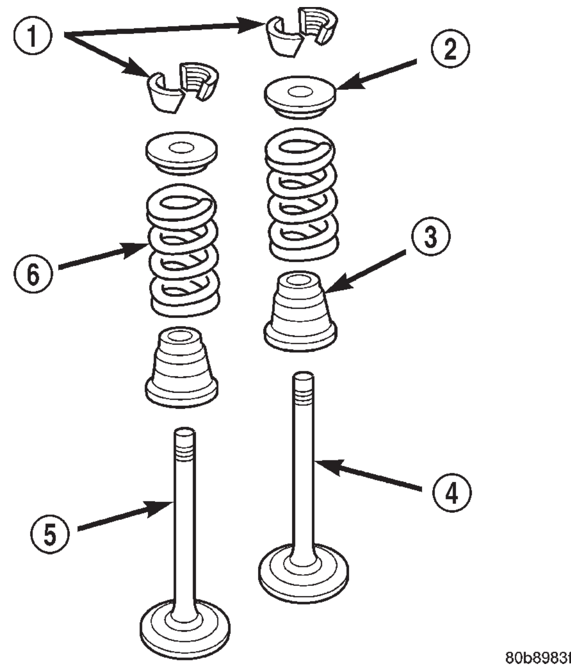


Fig. 39 Valve Assembly Configuration

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

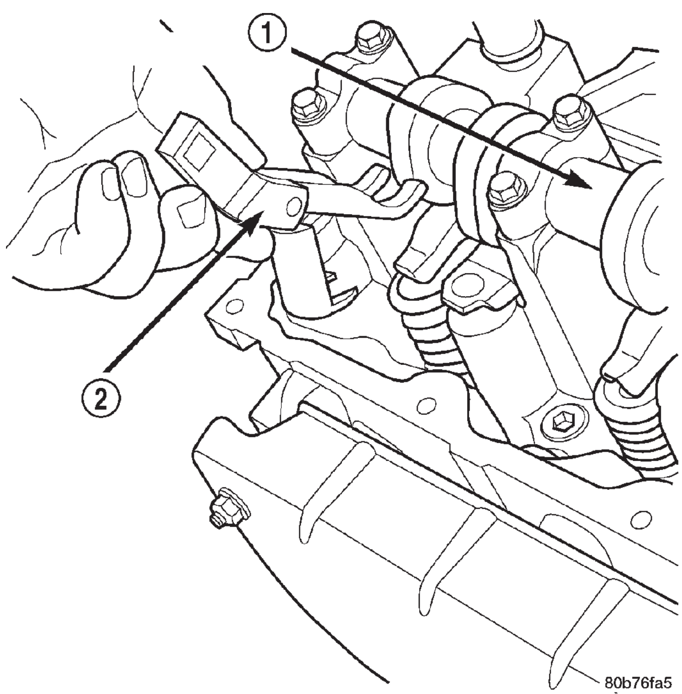


Fig. 40 Rocker Arm Removal

1 - CAMSHAFT
2 - SPECIAL TOOL 8516

INTAKE/EXHAUST VALVES & SEATS (Continued)

(4) Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

(5) Remove the valve spring compressor.
(6) Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

(7) Remove the valve from the cylinder head.

NOTE: The valve stem seals are common between intake and exhaust.

(8) Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 until surface is in line with the 40.69 mm (1.602 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications. (Fig. 41)

INSTALLATION

(1) coat the valve stem with clean engine oil and insert it into the cylinder head.
(2) Install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
(3) Install the spring and the spring retainer (Fig. 42).
(4) Using the valve spring compressor, compress the spring and install the two valve spring retainer halves.
(5) Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.

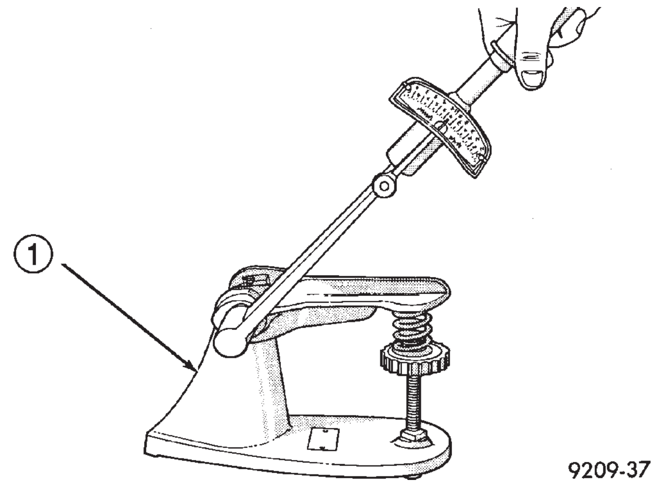


Fig. 41 Testing Valve Springs

1 - SPECIAL TOOL C-647

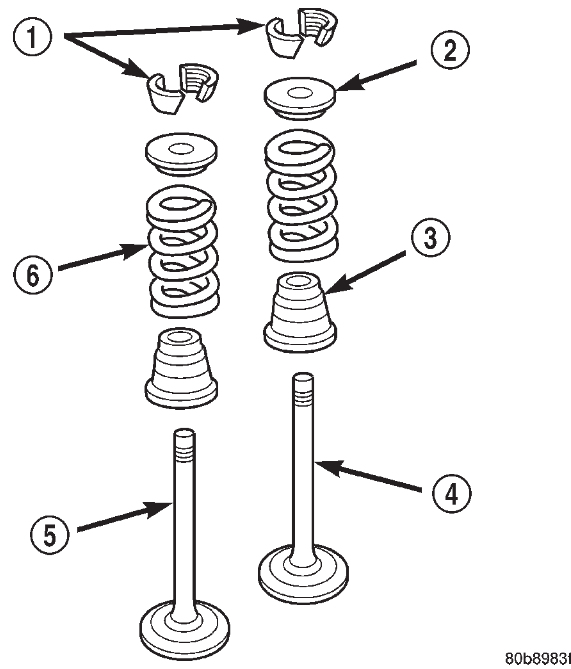


Fig. 42 Valve Assembly Configuration

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

(6) lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.

INTAKE/EXHAUST VALVES & SEATS (Continued)

(7) Install the camshaft bearing cap retaining bolts. Tighten the bolts 9–13 N·m (100 in. lbs.) in ½ turn increments in the sequence shown (Fig. 43).

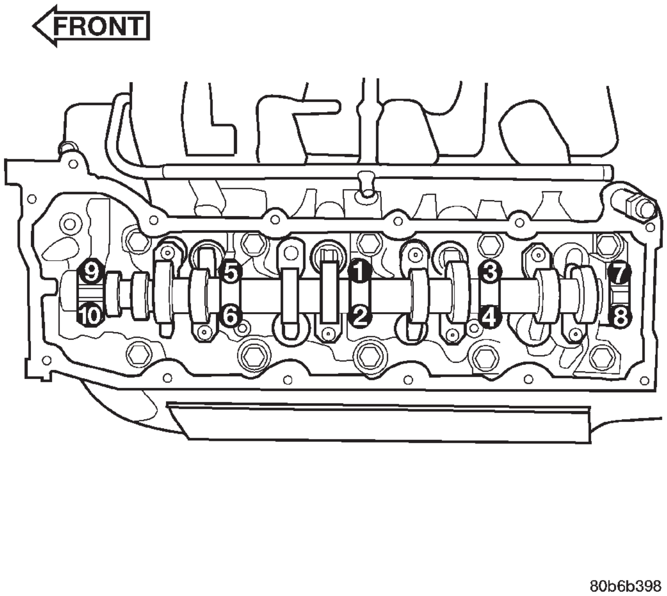


Fig. 43 Camshaft Bearing Caps Tightening Sequence

(8) Position the hydraulic lash adjusters and rocker arms (Fig. 40).

ROCKER ARM / ADJUSTER ASSEMBLY

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

(1) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(3) For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(4) For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(5) For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(6) Using special tool 8516 Rocker Arm Remover, press downward on the valve spring, remove rocker arm (Fig. 44).

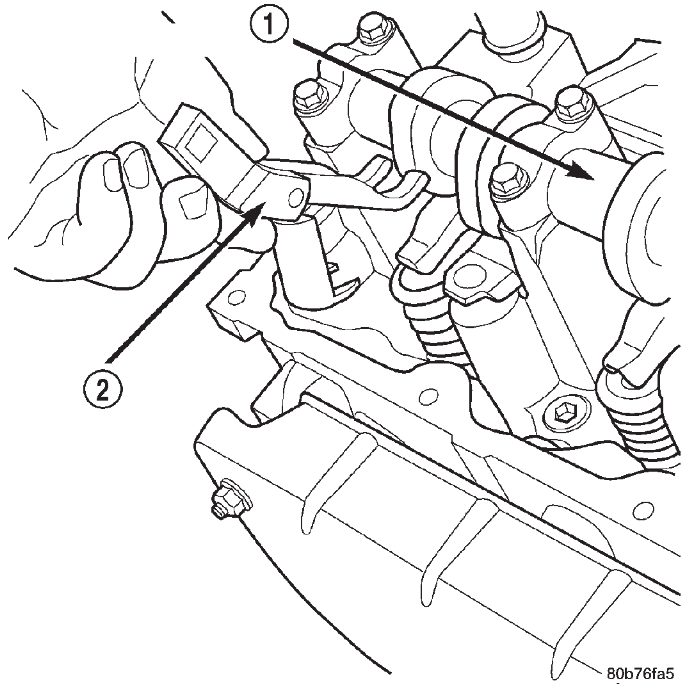


Fig. 44 Rocker Arm—Removal

1 - CAMSHAFT
2 - SPECIAL TOOL 8516

INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

(1) For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(2) For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(3) For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

ROCKER ARM / ADJUSTER ASSEMBLY (Continued)

(4) For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(5) Using special tool 8516 press downward on the valve spring, install rocker arm (Fig. 44).

(6) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

VALVE SPRINGS

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

VALVE STEM SEALS

DESCRIPTION

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

ENGINE BLOCK

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

STANDARD PROCEDURE—CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings (Fig. 45).

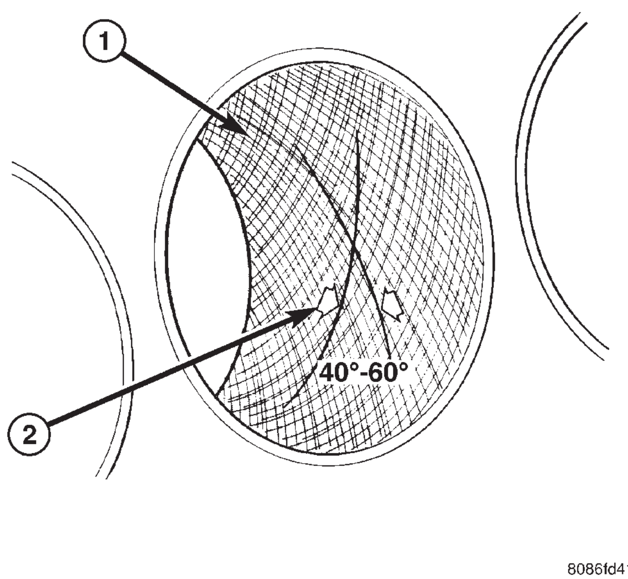


Fig. 45 Cylinder Bore Crosshatch Pattern

1 - CROSSHATCH PATTERN
2 - INTERSECT ANGLE

(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-

ENGINE BLOCK (Continued)

free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N·m (25 ft. lbs.) torque.

INSPECTION

(1) It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer (Fig. 46).

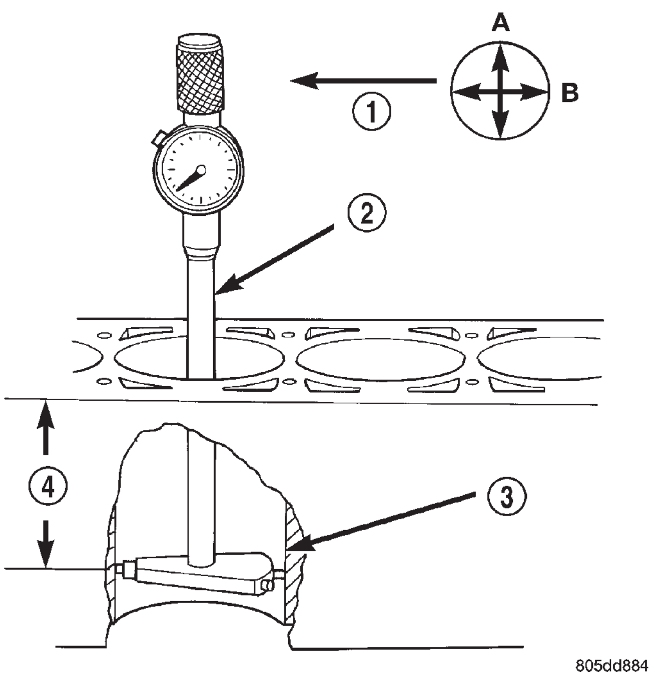


Fig. 46 Bore Gauge—Typical

1 - FRONT
2 - BORE GAUGE
3 - CYLINDER BORE
4 - 38 MM (1.5 in)

(2) Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.

(3) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.

(4) Determine taper by subtracting the smaller diameter from the larger diameter.

(5) Rotate measuring device 90° and repeat steps above.

(6) Determine out-of-roundness by comparing the difference between each measurement.

(7) If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

CONNECTING ROD BEARINGS

STANDARD PROCEDURE - CONNECTING ROD BEARING FITTING

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 47) (Fig. 48). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 49). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

(1) Wipe the oil from the connecting rod journal.

(2) Lubricate the upper bearing insert and install in connecting rod.

(3) Use piston ring compressor and Guide Pins Special Tool 8507 (Fig. 50) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The "F"'s near the piston wrist pin bore should point to the front of the engine.

(4) Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

(5) Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

CONNECTING ROD BEARINGS (Continued)

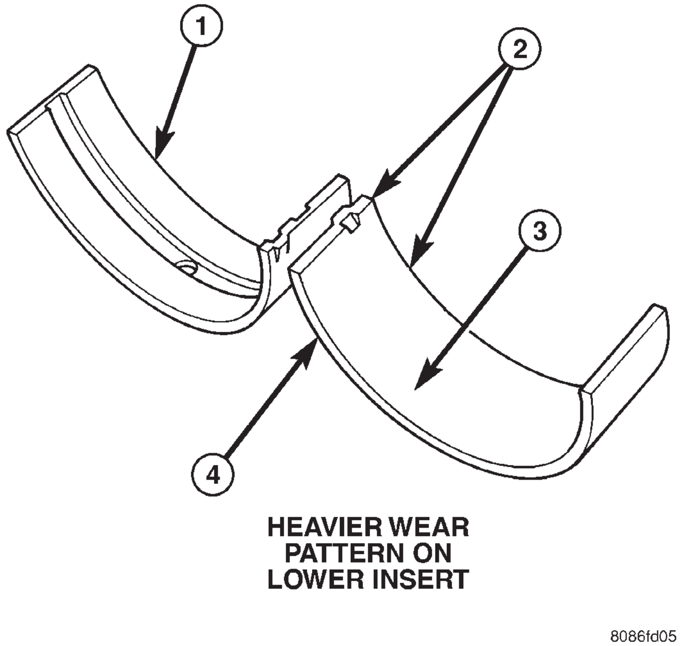


Fig. 47 Connecting Rod Bearing Inspection

1 - UPPER BEARING HALF
2 - MATING EDGES
3 - GROOVES CAUSED BY ROD BOLTS SCRATCHING JOURNAL DURING INSTALLATION
4 - WEAR PATTERN — ALWAYS GREATER ON UPPER BEARING

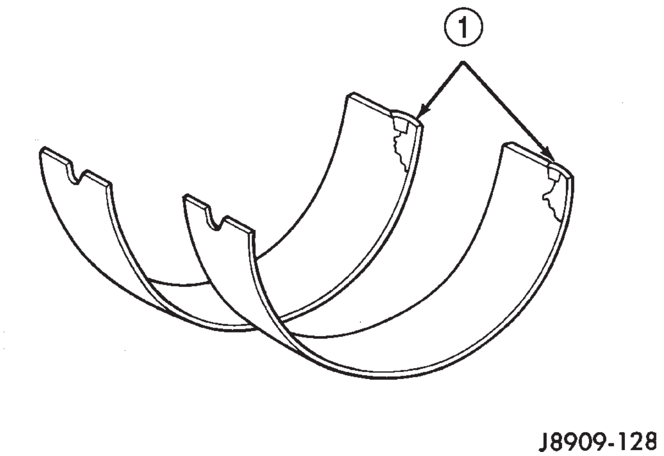


Fig. 48 Locking Tab Inspection

1 - ABNORMAL CONTACT AREA CAUSED BY LOCKING TABS NOT FULLY SEATED OR BEING BENT

(6) Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (Fig. 51). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**

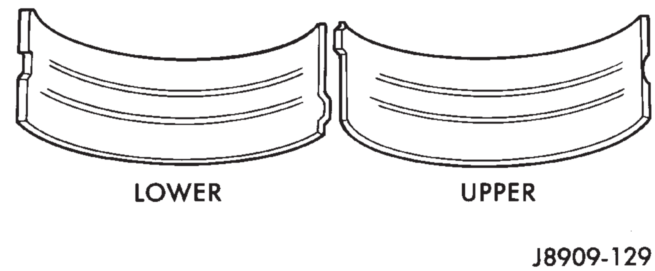


Fig. 49 Scoring Caused by Insufficient Lubrication or Damaged Crankshaft Journal

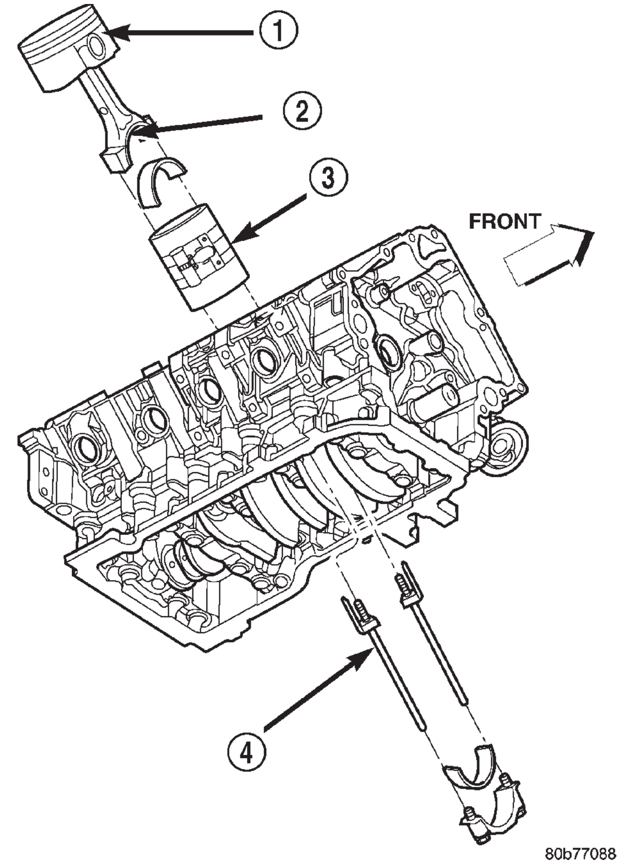


Fig. 50 Piston and Connecting Rod - Installation

1 - “F” TOWARD FRONT OF ENGINE
2 - OIL SLINGER SLOT
3 - RING COMPRESSOR
4 - SPECIAL TOOL 8507

(7) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

(8) If bearing-to-journal clearance exceeds the specification, determin which services bearing set to use the bearing sizes are as follows:

CONNECTING ROD BEARINGS (Continued)

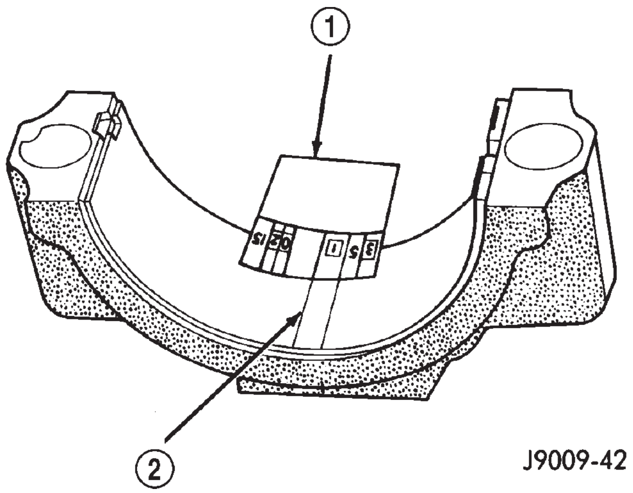


Fig. 51 Measuring Bearing Clearance with Plastigage

1 - PLASTIGAGE SCALE
2 - COMPRESSED PLASTIGAGE

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	50.983-50.967 mm (2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
.250 US	.250 mm (.010 in.)	50.758-50.742 mm (1.9984-1.9978 in.)

(9) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(10) Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange (Fig. 52). Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

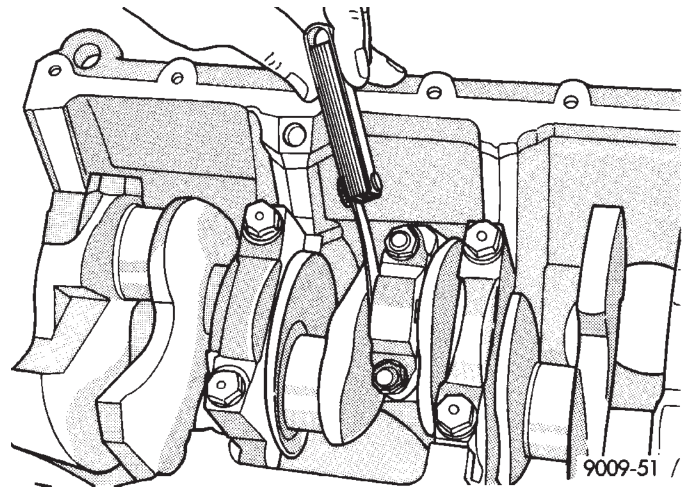


Fig. 52 Checking Connecting Rod Side Clearance - Typical

CRANKSHAFT

DESCRIPTION

The 4.7L crankshaft is constructed of nodular cast iron. The crankshaft for the 4.7L H.O. is constructed of **forged steel.** The crankshaft is a cross shaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select fit main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

STANDARD PROCEDURE - MEASURING CRANKSHAFT END PLAY

(1) Mount a dial indicator to front of engine with the locating probe on nose of crankshaft (Fig. 53).

(2) Move crankshaft all the way to the rear of its travel.

(3) Zero the dial indicator.

(4) Move crankshaft all the way to the front and read the dial indicator. (Refer to 9 - ENGINE - SPECIFICATIONS) for end play specification.

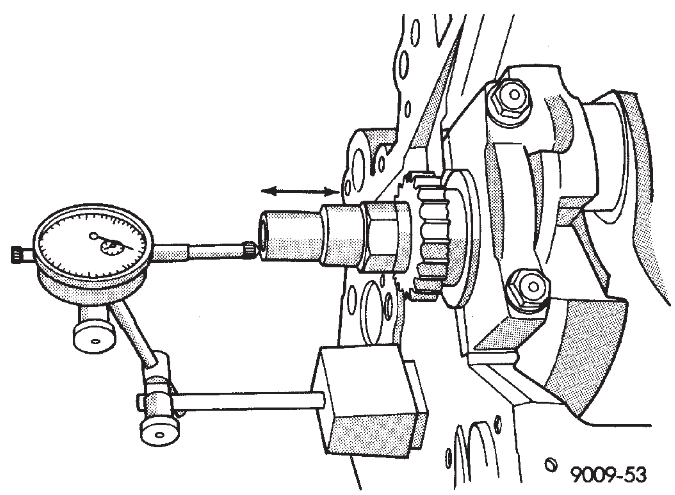


Fig. 53 Checking Crankshaft End Play—Typical

CRANKSHAFT (Continued)

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

(1) Remove the engine. (Refer to 9 - ENGINE - REMOVAL).

(2) Remove the engine oil pump.(Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

(3) Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(4) Remove the oil pump pickup tube and oil pan gasket /windage tray.

(5) Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.

(6) Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause sever damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are on both the left and right sides, only the left side is shown.

(7) Carefully pry on the pry points (Fig. 54) to loosen the bedplate then remove the bedplate.

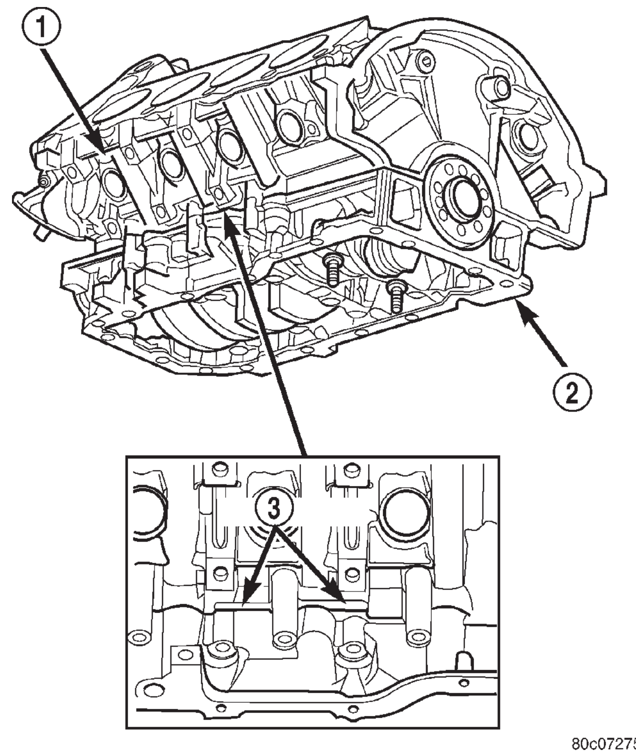


Fig. 54 Bedplate Pry Point Location

1 - CYLINDER BLOCK
2 - BEDPLATE
3 - PRY POINT

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

(8) Remove the crankshaft.

(9) Remove the crankshaft target wheel.

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

(1) If required, remove the main bearing halves from the cylinder block and bedplate.

(2) Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.

(3) Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.

(4) Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washer.

(5) Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

INSTALLATION

CAUTION: Main bearings are select fit. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE) for proper bearing selections.

CRANKSHAFT (Continued)

(1) Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the target wheel retaining screws prior to installation.

(2) Install the crankshaft target wheel. Torque the mounting screws to 22 N·m (21 ft. lbs.).
(3) Position crankshaft in cylinder block.
(4) Install the thrust washers (Fig. 55).

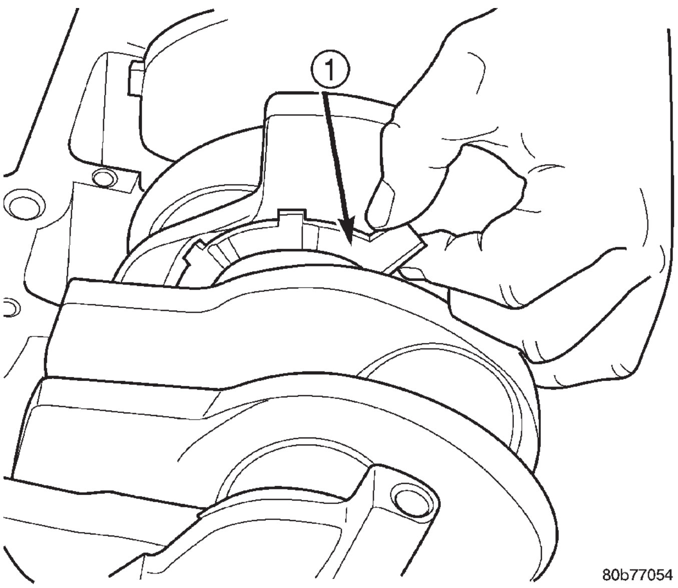


Fig. 55 Crankshaft Thrust Washer Installation

1 - CRANKSHAFT THRUST WASHER

CAUTION: The bedplate to cylinder block mateing surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: The installation time to install the bedplate after the sealant has been applied is critical.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

(5) Apply a 2.5mm (0.100 inch) (Fig. 56) bead of Mopar® Gen II Silicone Rubber Adhesive sealant to the cylinder block-to-bedplate mating surface as shown (Fig. 57).

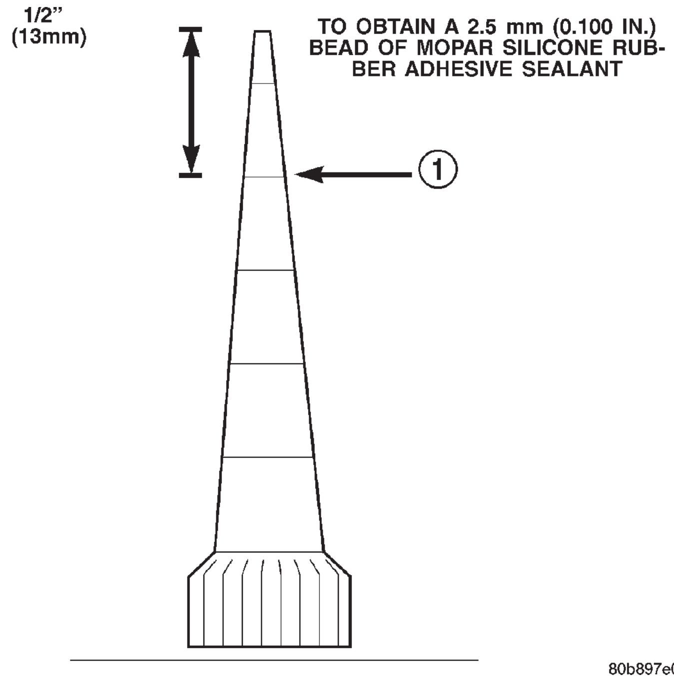


Fig. 56 Cutting Aplicator to Achieve 2.5mm (0.100 in.) Bead

1 - CUT HERE

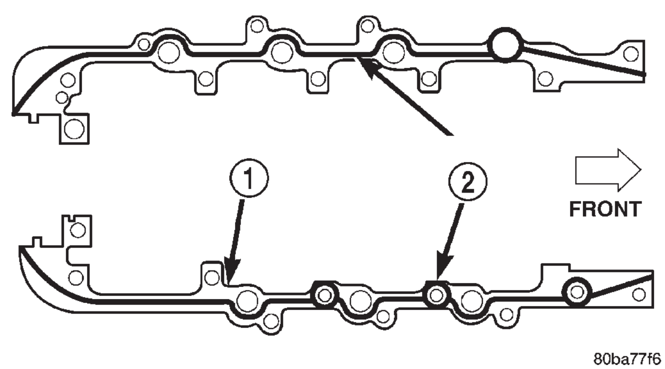


Fig. 57 Cylinder Block-to-Bedplate Sealent Bead Location

1 - CYLINDER BLOCK
2 - SEALANT BEAD LOCATION

(6) Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

(7) Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown (Fig. 58).

- Tighten bolts **A – L** to 54 N·m (40 ft. lbs.)
- Tighten bolts **1–10** to 2.8 N·m (25 in. lbs.)
- Turn bolts **1–10** an additional 90°.

CRANKSHAFT (Continued)

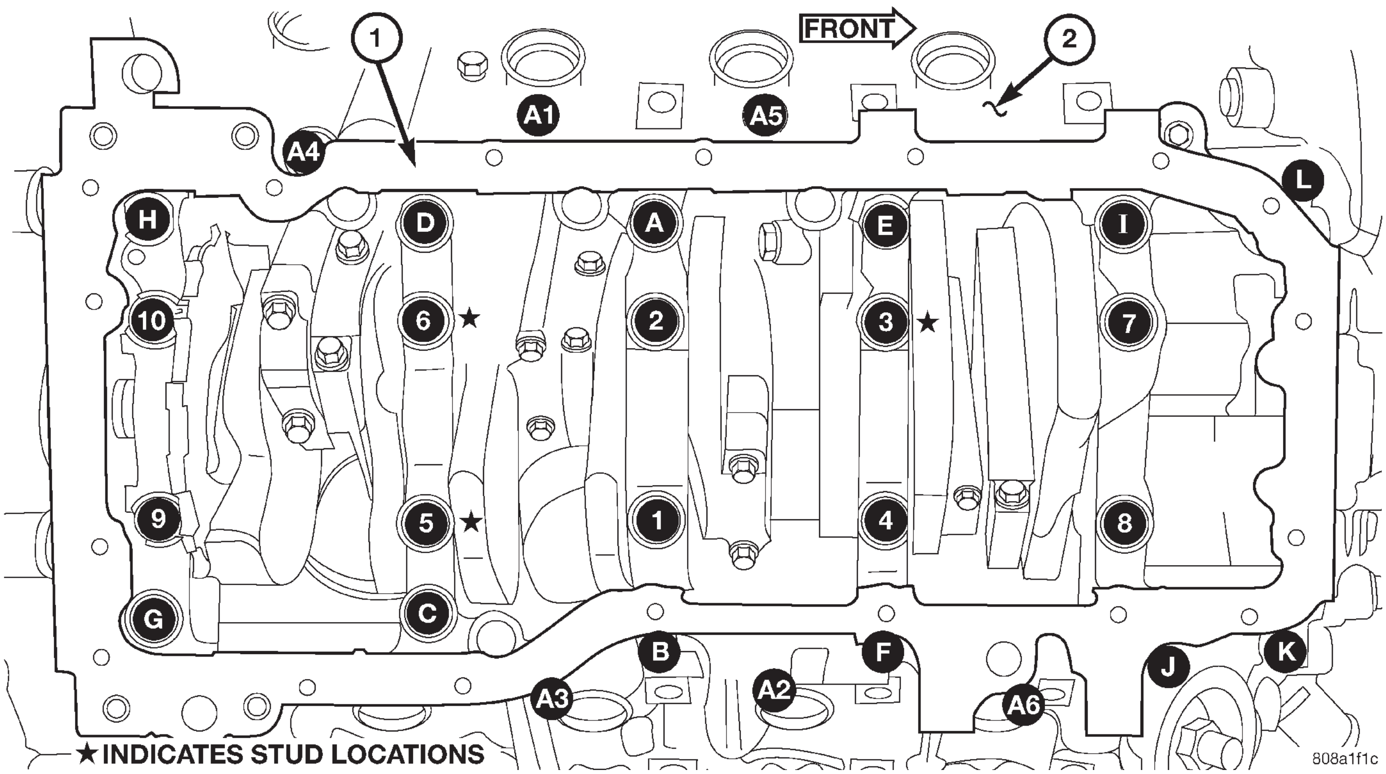


Fig. 58 Bedplate Tightening Sequence

1 - BEDPLATE
2 - CYLINDER BLOCK

- Tighten bolts **A1– A6** to 27 N·m (20 ft. lbs.)

(8) Measure crankshaft end play. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - STANDARD PROCEDURE).

(9) Install the connecting rods and measure side clearance. (Refer to 9 - ENGINE/ENGINE BLOCK/ CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

(10) Position the oil pan gasket/windage tray, using a new o-ring, install the oil pickup tube. Torque the bolt to 28N·n (20 ft. lbs.) torque the nuts to 28N·m (20 ft. lbs.).

(11) Install the oil pan. Torque the retaining bolts to 15 N·m (11 ft. lbs.) in the sequence shown (Fig. 59).

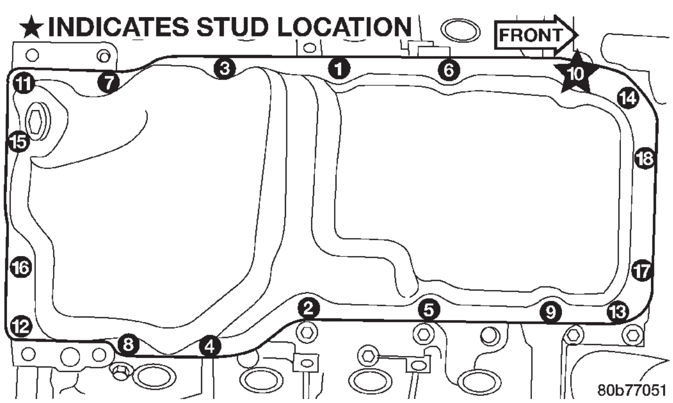


Fig. 59 Oil Pan Tightening Sequence

(12) Install the engine (Refer to 9 - ENGINE - INSTALLATION).

CRANKSHAFT MAIN BEARINGS

STANDARD PROCEDURE—CRANKSHAFT MAIN BEARING - FITTING

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Crankshaft removed from the cylinder block.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

CRANKSHAFT MAIN BEARINGS (Continued)

CRANKSHAFT MAIN BEARING SELECTION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (Fig. 60). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel is mounted to the number 8 counter weight on the crankshaft.

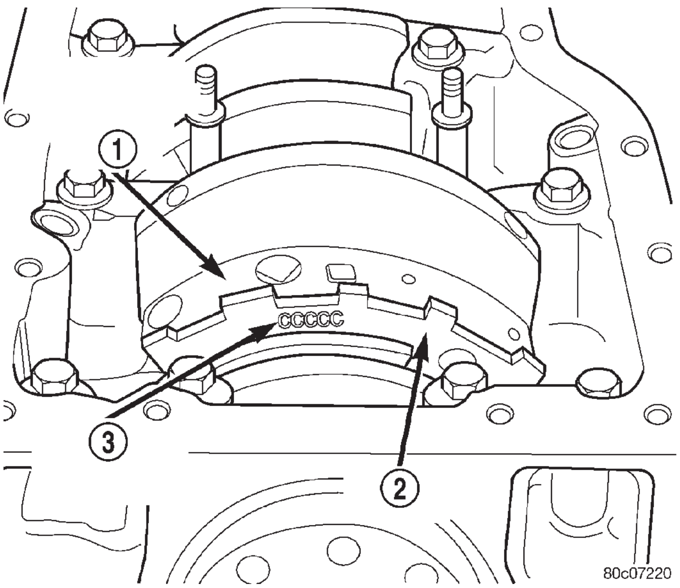


Fig. 60 Main Bearing Markings on Target Wheel

1 - REARMOST CRANKSHAFT COUNTER WEIGHT
2 - TARGET WHEEL
3 - MAIN BEARING SELECT FIT MARKINGS

NOTE: Service main bearings are coded. These codes identify what size (grade) the bearing is.

MAIN BEARING SELECTION CHART—4.7L

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	0.008 mm U/S (0.0004 in.) U/S	63.488–63.496 mm (2.4996–2.4999 in.)
B	NOMINAL	63.496–63.504 mm (2.4999–2.5002 in.)
C	0.008 mm O/S (0.0004 in.) O/S	63.504–63.512 mm (2.5002–2.5005 in.)

INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated (Fig. 61).

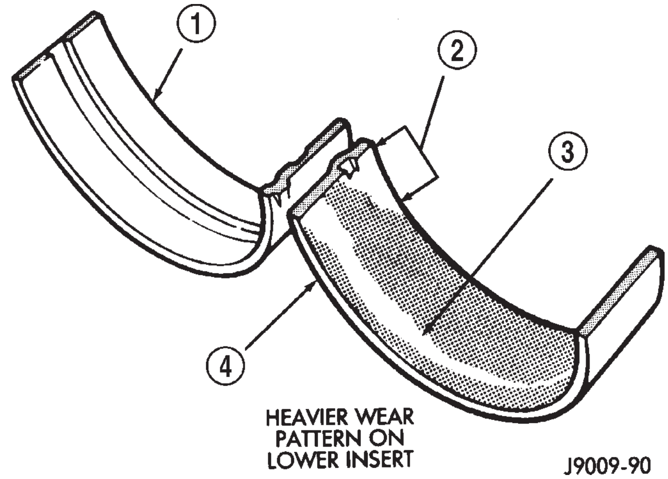


Fig. 61 Main Bearing Wear Patterns

1 - UPPER INSERT
2 - NO WEAR IN THIS AREA
3 - LOW AREA IN BEARING LINING
4 - LOWER INSERT

NOTE: If any of the crankshaft journals are scored, the crankshaft must be repaired or replaced.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove A/C compressor mouning fasteners and set aside.

(4) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(5) Remove upper radiator hose.

(6) Disconnect electrical connector for fan mounted inside radiator shroud.

(7) Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

CRANKSHAFT OIL SEAL - FRONT (Continued)

(8) Remove radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(9) Remove crankshaft damper bolt.

(10) Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (Fig. 62).

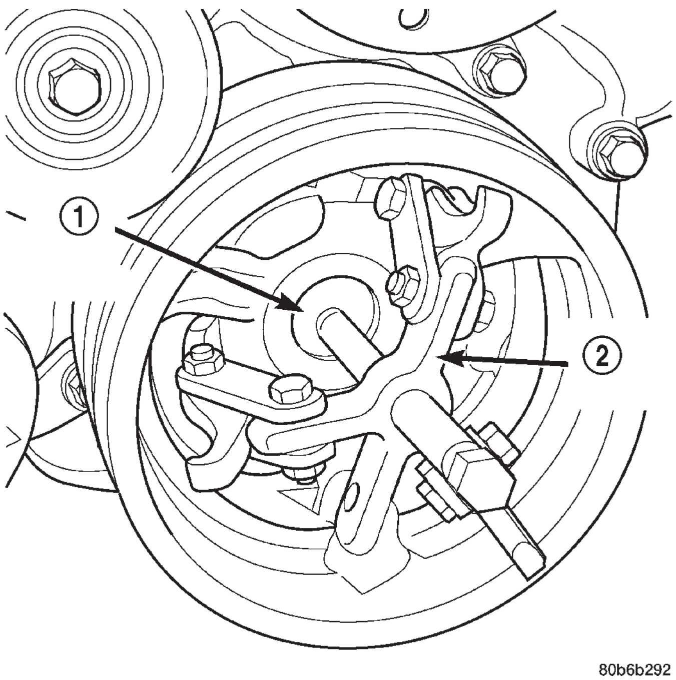


Fig. 62 Crankshaft Damper—Removal

1 - SPECIAL TOOL 8513 INSERT
2 - SPECIAL TOOL 1026

(11) Using Special Tool 8511, remove crankshaft front seal (Fig. 63).

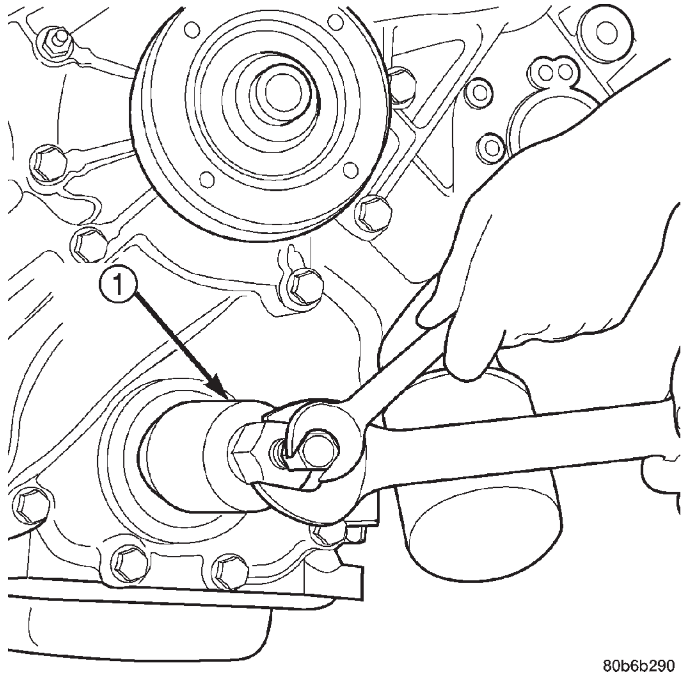


Fig. 63 Crankshaft Front Seal—Removal

1 - SPECIAL TOOL 8511

INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

(1) Using Special Tool 8348 and 8512, install crankshaft front seal (Fig. 64).

(2) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(3) Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(4) Install upper radiator hose.

(5) Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).

(6) Install accessory drive belt refer (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

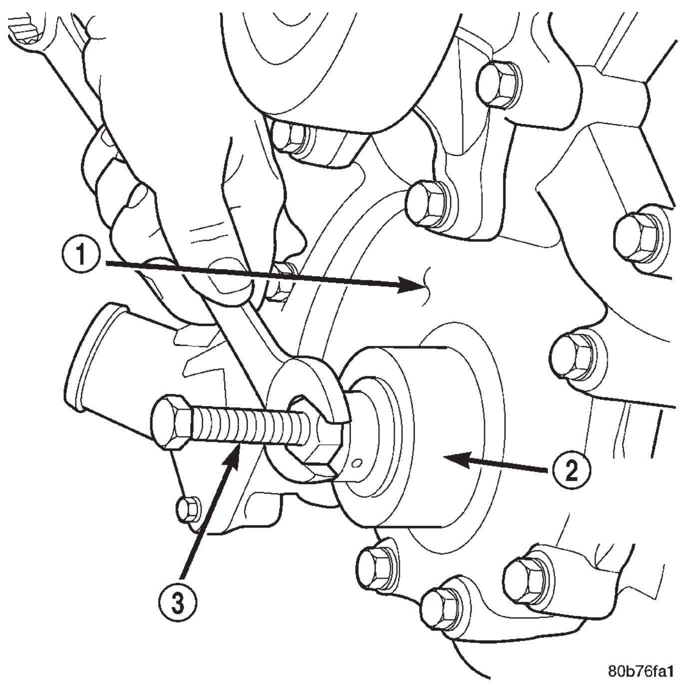


Fig. 64 Crankshaft Front Seal—Installation

1 - TIMING CHAIN COVER
2 - SPECIAL TOOL 8348
3 - SPECIAL TOOL 8512

(7) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(8) Connect negative cable to battery.

CRANKSHAFT OIL SEAL - REAR

REMOVAL

NOTE: This procedure can be performed in vehicle.

(1) If being preformed in vehicle, remove the transmission.

(2) Remove the flexplate (Refer to 9 - ENGINE/ ENGINE BLOCK/FLEX PLATE - REMOVAL).

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.

(3) Using Special Tool 8506 (Fig. 65), remove the crankshaft rear oil seal.

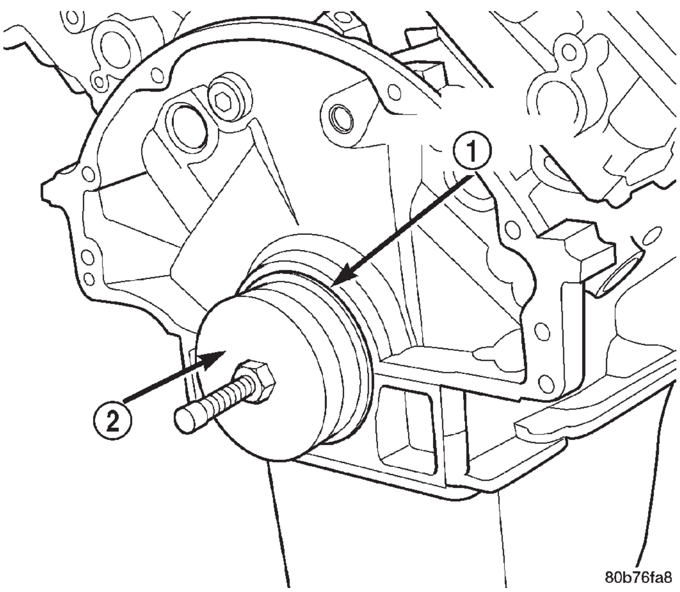


Fig. 65 Crankshaft Rear Oil Seal Removal

1 - REAR CRANKSHAFT SEAL
2 - SPECIAL TOOL 8506

INSTALLATION

(1) Position the magnetic seal guide Special Tool 8349–2 (Fig. 66) onto the crankshaft rear face. Then position the crankshaft rear oil seal onto the guide.

(2) Using Special Tools 8349 Crankshaft Rear Oil Seal Installer and C-4171 Driver Handle (Fig. 67), with a hammer, tap the seal into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.

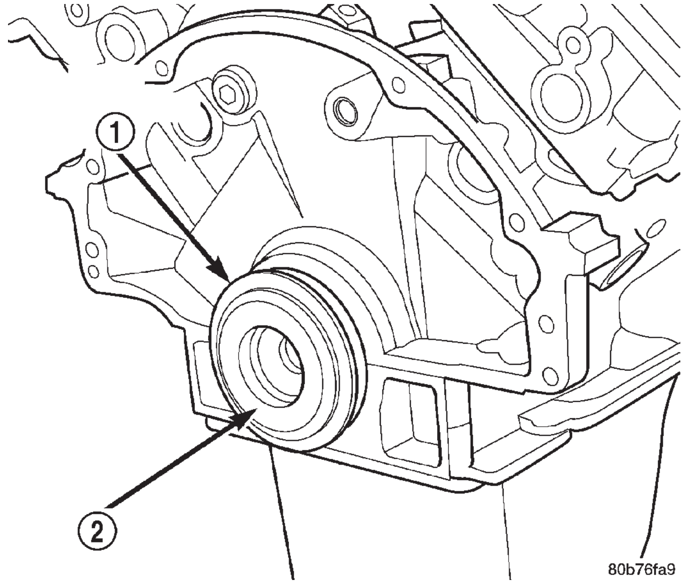


Fig. 66 Crankshaft Rear Oil Seal Guide Special Tool 8349–2 and Oil

1 - REAR CRANKSHAFT SEAL
2 - SPECIAL TOOL 8349–2 GUIDE

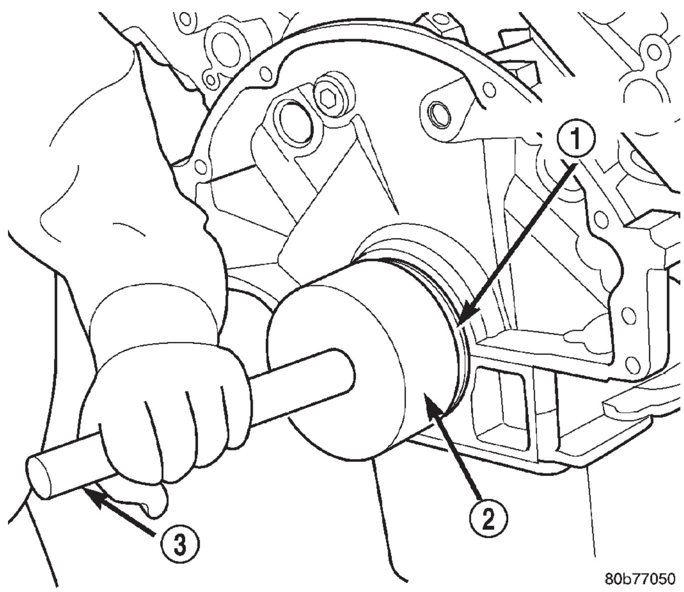


Fig. 67 Crankshaft Rear Oil Seal Installation

1 - REAR CRANKSHAFT SEAL
2 - SPECIAL TOOL 8349–1 INSTALLER
3 - SPECIAL TOOL C-4171 HANDLE

(3) Install the flexplate.

(4) Install the transmission.

FLEX PLATE

REMOVAL

(1) Remove the transmission.
(2) Remove the bolts and flexplate.

INSTALLATION

(1) Position the flexplate onto the crankshaft and install the bolts hand tight.
(2) Tighten the flexplate retaining bolts to 60 N·m (45 ft. lbs.) in the sequence shown (Fig. 68).
(3) Install the transmission.

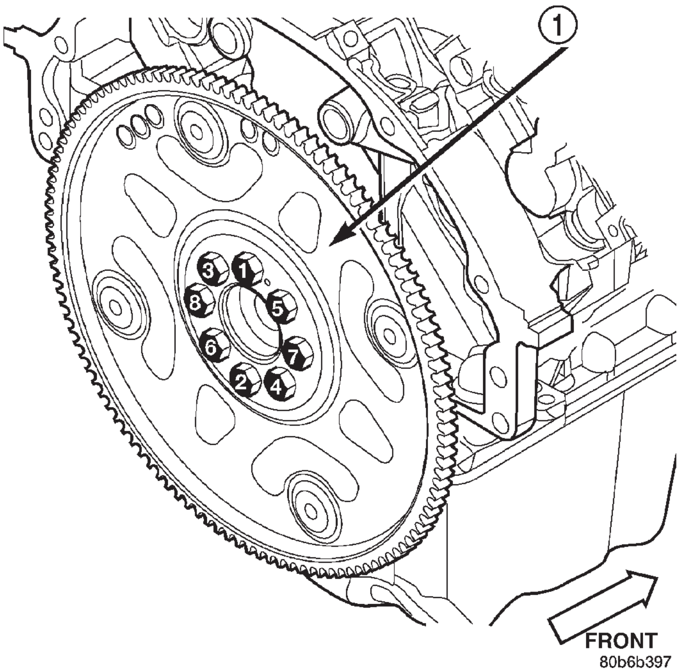


Fig. 68 Flexplate Tightening Sequence

1 - FLEXPLATE

PISTON & CONNECTING ROD

DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons are made of a high strength aluminum alloy. The anodized top ring groove and crown has been replaced with a coated top ring that is blue in color on the bottom surface. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a "fractured cap" design. A pressed fit piston pin is used to attach the piston and connecting rod on the 4.7L. The 4.7L HO uses a full floating piston pin.

STANDARD PROCEDURE—PISTON FITTING

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
(2) Measure the inside diameter of the cylinder bore at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 70).
(3) The coated pistons will be serviced with the piston pin and connecting rod pre-assembled.
(4) The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results (Fig. 69). Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
(5) Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

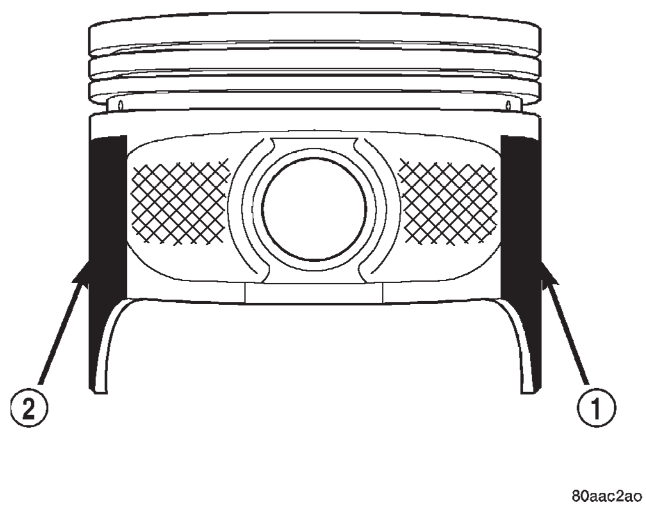


Fig. 69 Moly Coated Piston—Typical

1 - MOLY COATED
2 - MOLY COATED

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove the following components:
• Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
• Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) -

PISTON & CONNECTING ROD (Continued)

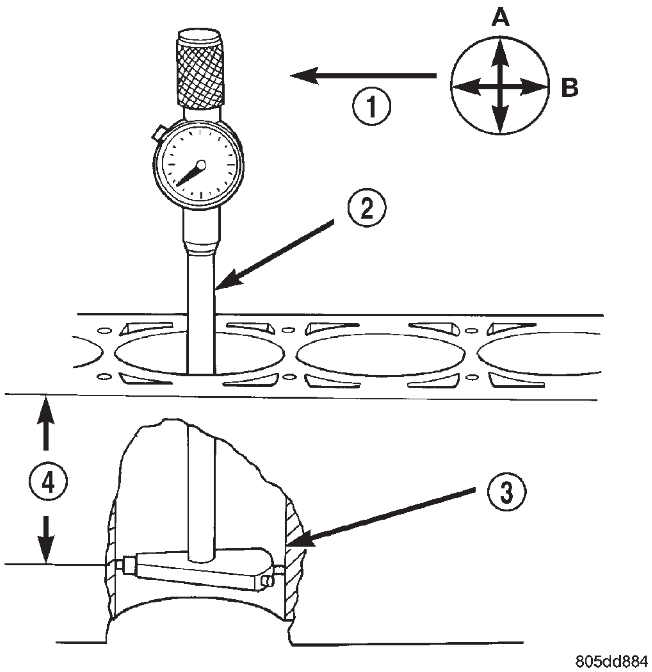


Fig. 70 Bore Gauge—Typical

1 - FRONT
2 - BORE GAUGE
3 - CYLINDER BORE
4 - 38 MM (1.5 in)

REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

• Timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

• Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(3) If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

(4) Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool (Fig. 71).

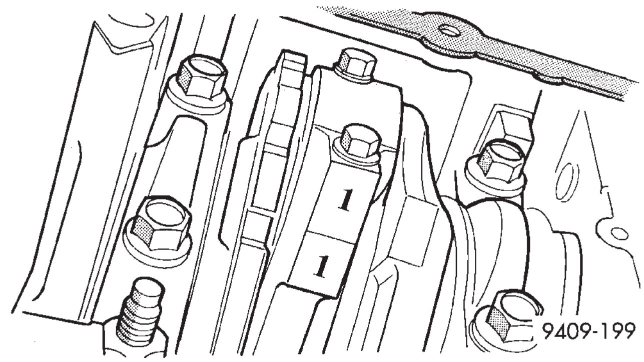


Fig. 71 Identify Connecting Rod to Cylinder Position—Typical

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

(5) Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

(6) Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.

(7) Carefully remove piston rings from piston(s), starting from the top ring down.

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

(1) Using a suitable cleaning solvent clean the pistons in warm water and towel dry.

(2) Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

PISTON & CONNECTING ROD (Continued)

Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION

(1) Before installing piston and connecting rod assemblies into the bore, install the piston rings.

(2) Immerse the piston head and rings in clean engine oil. Position a ring compressor over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**

(3) Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.

(4) Install Special Tool 8507 Connecting Rod Guides into connecting rod bolt threads (Fig. 72).

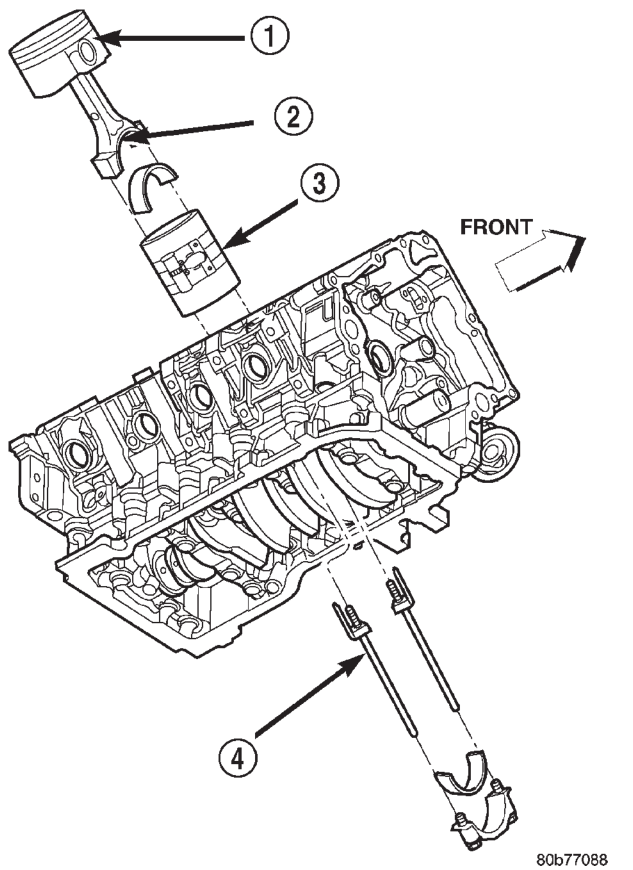


Fig. 72 Piston and Connecting Rod—Installation

1 - "F" TOWARD FRONT OF ENGINE
2 - OIL SLINGER SLOT
3 - RING COMPRESSOR
4 - SPECIAL TOOL 8507

(5) The pistons are marked on the piston pin bore surface with an raised "F" indicating installation position. This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine (Fig. 73).

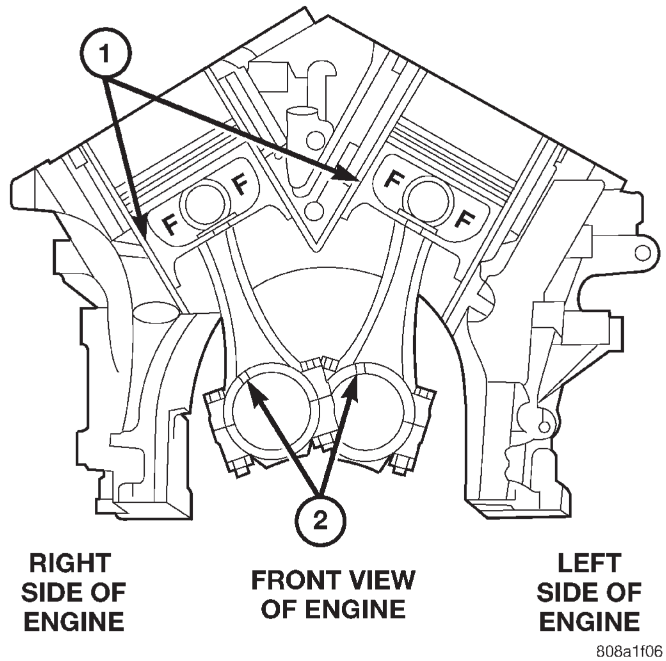


Fig. 73 Piston and Connecting Rod Orientation

1 - MAJOR THRUST SIDE OF PISTON
2 - OIL SLINGER SLOT

(6) Wipe cylinder bore clean and lubricate with engine oil.

(7) Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.

(8) Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

(9) Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.

(10) Install the following components:

- Cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
- Timing chain and cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

PISTON & CONNECTING ROD (Continued)

• Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

• Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(11) Fill crankcase with proper engine oil to correct level.

(12) Connect negative cable to battery.

PISTON RINGS

STANDARD PROCEDURE - PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

(1) Wipe the cylinder bore clean.

(2) Insert the ring in the cylinder bore.

NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

(3) Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.

(4) Using a feeler gauge check the ring end gap (Fig. 74). Replace any rings not within specification.

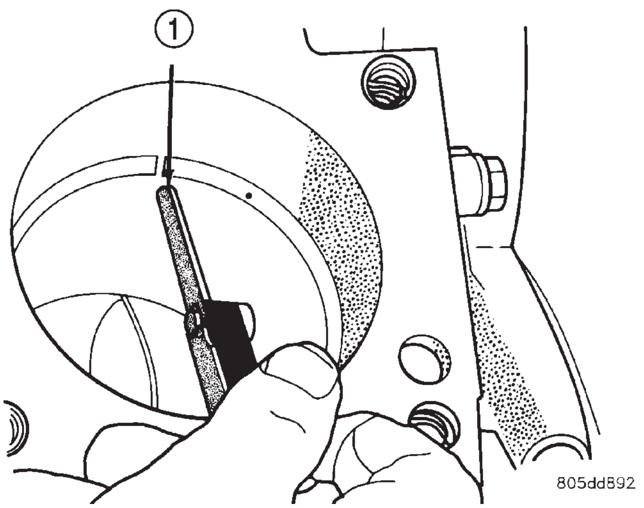


Fig. 74 Ring End Gap Measurement - Typical

1 - FEELER GAUGE

PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

(5) Measure the ring side clearance as shown (Fig. 75)make sure the feeler gauge fits snugly between the ring land and the ring. Replace any ring not within specification.

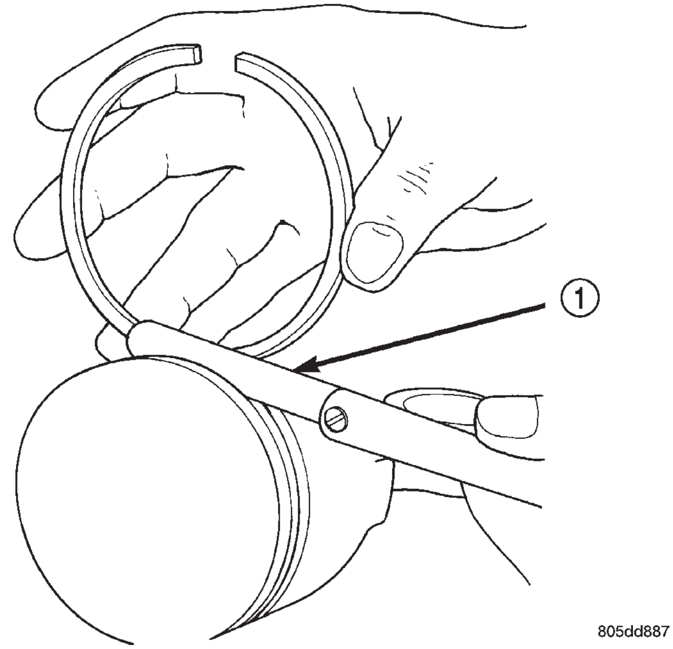


Fig. 75 Measuring Piston Ring Side Clearance

1 - FEELER GAUGE

(6) Rotate the ring around the piston, the ring must rotate in the groove with out binding.

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094mm (0.0020- .0037 in.)	0.11mm (0.004 in.)
Intermediate Ring	0.04-0.08mm (0.0016-0.0031 in.)	0.10mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229mm (.0007-.0090 in.)	.25mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.23-0.39mm (0.009-0.015 in.)	0.43mm (0.0017 in.)
Intermediate Ring	0.40-0.66mm (0.015-0.026 in.)	0.74mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.028-0.79mm (0.011- 0.031 in.)	1.55mm (0.061 in.)

PISTON RINGS (Continued)

(7) The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

(8) Install the oil ring expander.

(9) Install upper side rail (Fig. 76) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

(10) Install No. 2 intermediate piston ring using a piston ring installer (Fig. 77).

(11) Install No. 1 upper piston ring using a piston ring installer (Fig. 77).

(12) Position piston ring end gaps as shown in (Fig. 78). It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

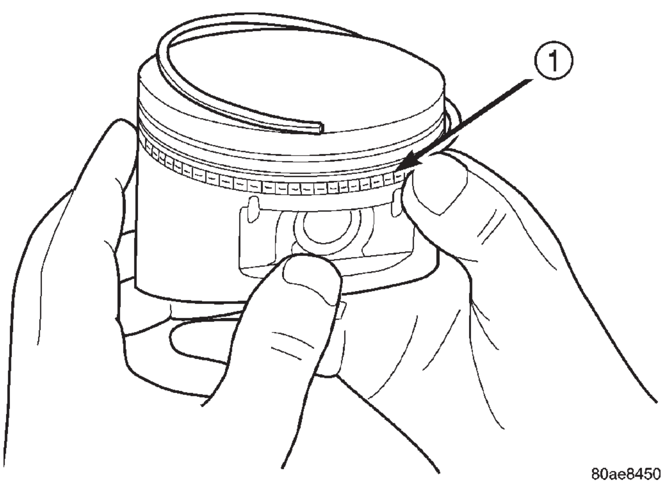


Fig. 76 Side Rail—Installation

1 - SIDE RAIL END

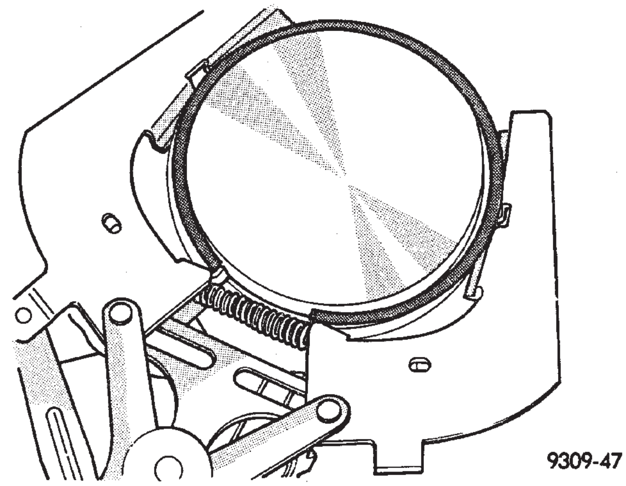


Fig. 77 Upper and Intermediate Rings—Installation

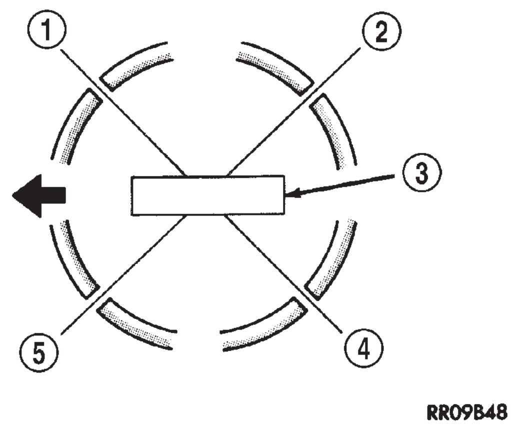


Fig. 78 Piston Ring End Gap Position

1 - SIDE RAIL UPPER
2 - NO. 1 RING GAP
3 - PISTON PIN
4 - SIDE RAIL LOWER
5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

VIBRATION DAMPER (Continued)

(3) Remove crankshaft damper bolt.

(4) Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (Fig. 79).

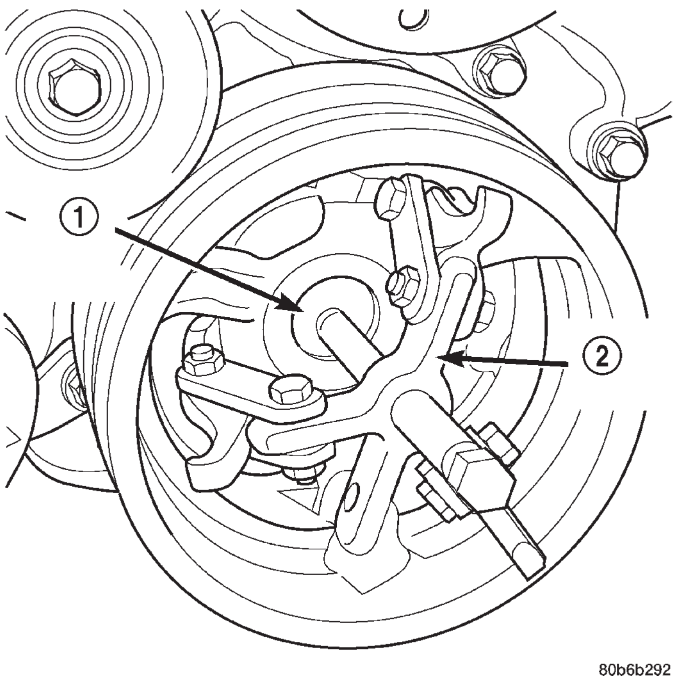


Fig. 79 Crankshaft Damper—Removal

1 - SPECIAL TOOL 8513 INSERT
2 - SPECIAL TOOL 1026

INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

(1) Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

CAUTION: Special Tool 8512A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.

(2) Assemble Special Tool 8512–A as follows, The nut is threaded onto the shaft first. Then the roller bearing is placed onto the threaded rod (The hardened bearing surface of the bearing **MUST**face the nut). Then the hardened washer slides onto the threaded rod (Fig. 80). Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or (Loctite No. 771).

(3) Using Special Tool 8512A, press damper onto crankshaft (Fig. 81).

(4) Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).

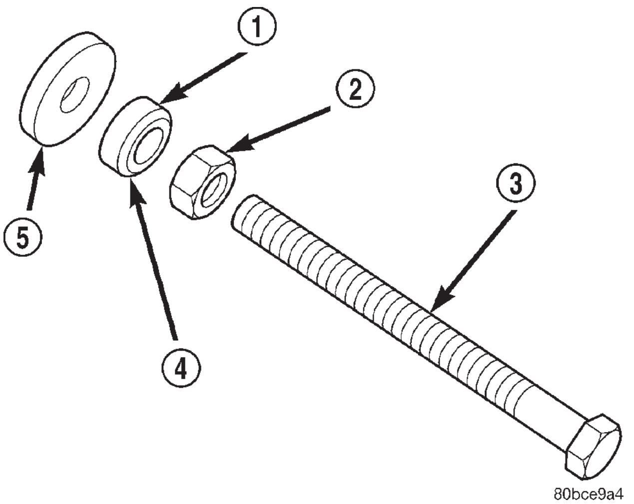


Fig. 80 Proper Assembly Method for Special Tool 8512–A

1 - BEARING
2 - NUT
3 - THREADED ROD
4 - BEARING HARDENED SURFACE (FACING NUT)
5 - HARDENED WASHER

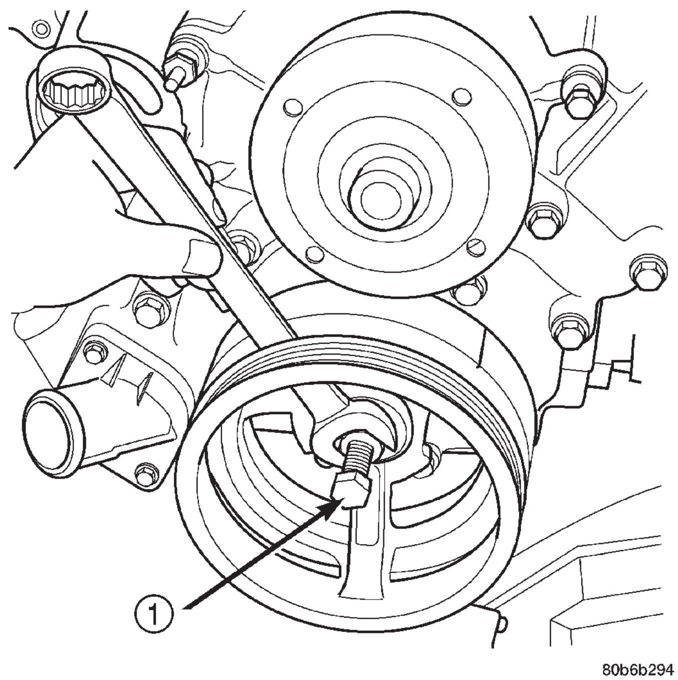


Fig. 81 Crankshaft Damper Installation

1 - SPECIAL TOOL 8512A

(5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Connect negative cable to battery.

STRUCTURAL COVER

DESCRIPTION

The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

REMOVAL

(1) Raise vehicle on hoist.
(2) Remove the left hand exhaust pipe from exhaust manifold.
(3) Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
(4) Remove the eight bolts retaining structural cover (Fig. 82) in the sequence shown.
(5) Pivot the exhaust pipe downward and remove the structural cover.

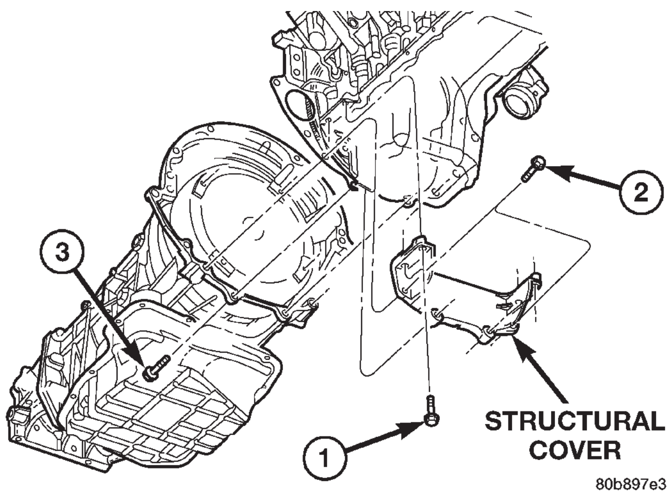


Fig. 82 Structural Cover

INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

(1) Position the structural cover in the vehicle.
(2) Install all four bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.
(3) Install the four cover-to-transmission bolts. Do NOT tighten at this time.

CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

(4) Starting with the two rear cover-to-engine bolts, tighten bolts (1) (Fig. 83) to 54 N·m (40 ft. lbs.), then tighten bolts (2) (Fig. 83) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.

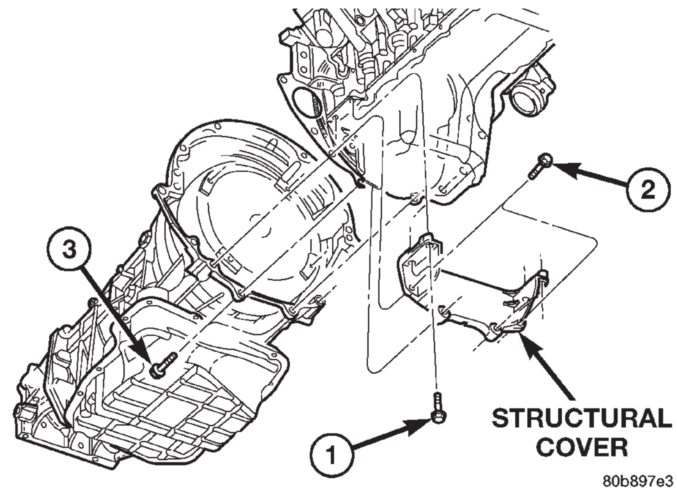


Fig. 83 Structural Cover

(5) Install the exhaust pipe on left hand exhaust manifold.
(6) Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

FRONT MOUNT

REMOVAL

(1) Disconnect the negative cable from the battery.

CAUTION: Remove the fan blade, fan clutch and fan shroud before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

(2) Remove the engine oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
(3) Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.

FRONT MOUNT (Continued)

(4) Remove the four cylinder block-to-insulator mount bolts and the nut form the engine insulator mount through bolt (Fig. 84) (Fig. 85)

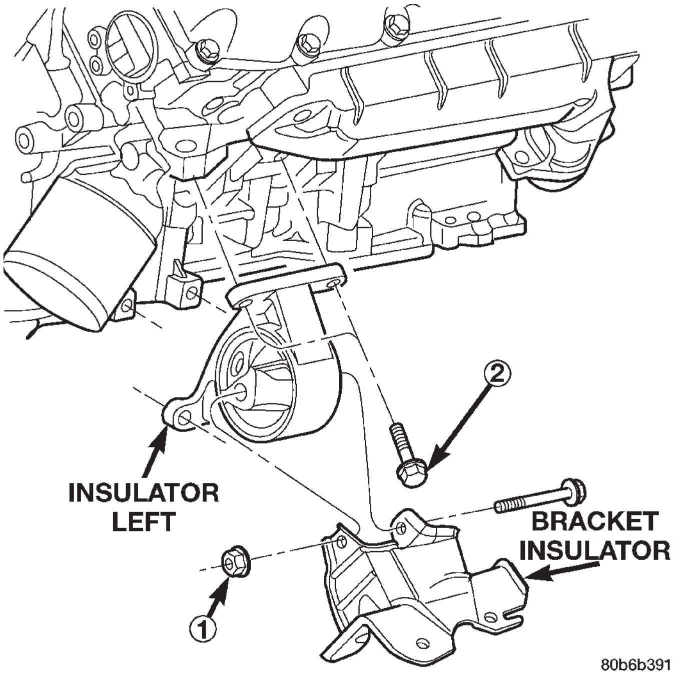


Fig. 84 Engine Insulator Mount 4.7 LEFT

1 - NUT
2 - BOLT

(5) Using the jack, raise the engine high enough to remove the engine insulator mount through bolt and the insulator mount.

INSTALLATION

(1) Position the insulator mount and install the insulator mount through bolt.

(2) Lower the engine until the four cylinder block-to-insulator mount bolts can be installed.

(3) Remove the jack and block of wood.

(4) Torque the cylinder block-to-insulator mount bolts to 61N·m (45 ft. lbs.).

(5) Install and torque the through bolt retaining nut to 61N·m (45 ft. lbs.).

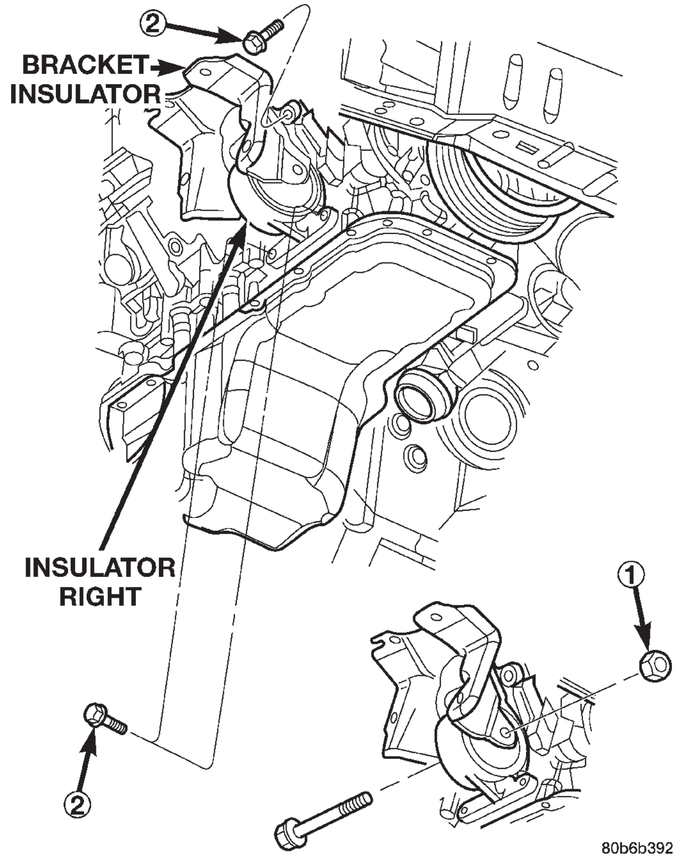


Fig. 85 Engine Insulator Mount 4.7 Right

1 - NUT
2 - BOLT

REAR MOUNT

REMOVAL

(1) Raise vehicle on hoist.

(2) Using a suitable jack, support transmission.

(3) Remove the lock nut from the insulator mount through bolt and the four insulator-to-transmission mounting bolts.

(4) Raise the transmission enough to remove the through bolt and insulator mount (Fig. 86) (Fig. 87).

REAR MOUNT (Continued)

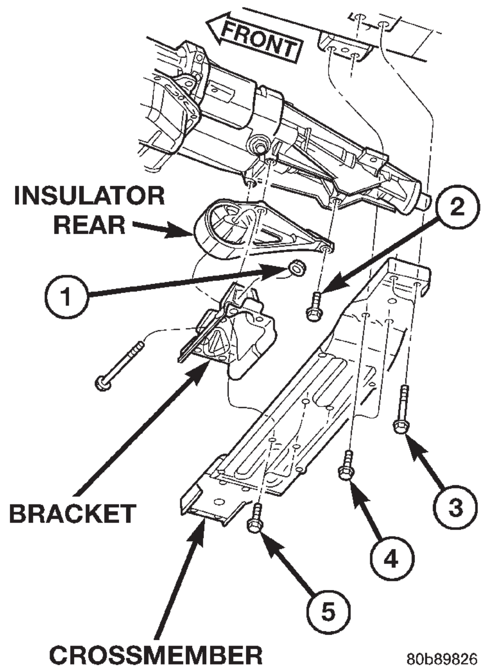


Fig. 86 Engine Rear Mount—4X2

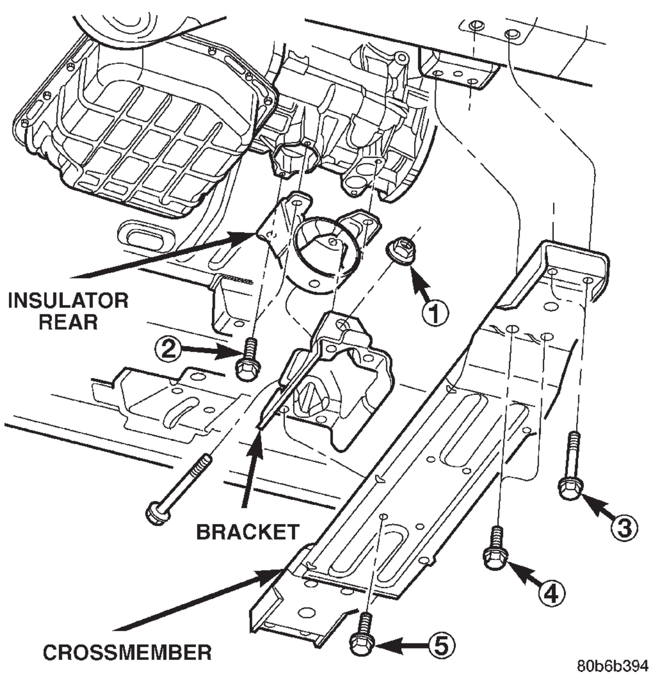


Fig. 87 Engine Rear Mount—4X4

ITEM	DESCRIPTION	TORQUE
1	NUT (Qty 1)	45 N·m (33 ft. lbs)
2	BOLT (Qty 4)	46 N·m (34 ft. lbs.)
3	BOLT (Qty 2 Per Side)	68 N·m (50 ft. lbs.)
4	BOLT (Qty 2 Per Side)	46 N·m (34 ft. lbs.)
5	BOLT (Qty 4)	46 N·m (34 ft. lbs.)

INSTALLATION

(1) Position the insulator mount and install the through bolt.

(2) Lower the transmission enough to install the four insulator-to-transmission mounting bolts. Torque the bolts to 46N·m (34 ft. lbs.).

(3) Install the through bolt lock nut. Torque nut to 68N·m (50 ft. lbs.).

(4) Remove jack, lower vehicle.

LUBRICATION

DESCRIPTION

The lubrication system (Fig. 88) is a full flow filtration pressure feed type.

OPERATION

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing. For lubrication flow refer to (Fig. 88).

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orentation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

LUBRICATION (Continued)

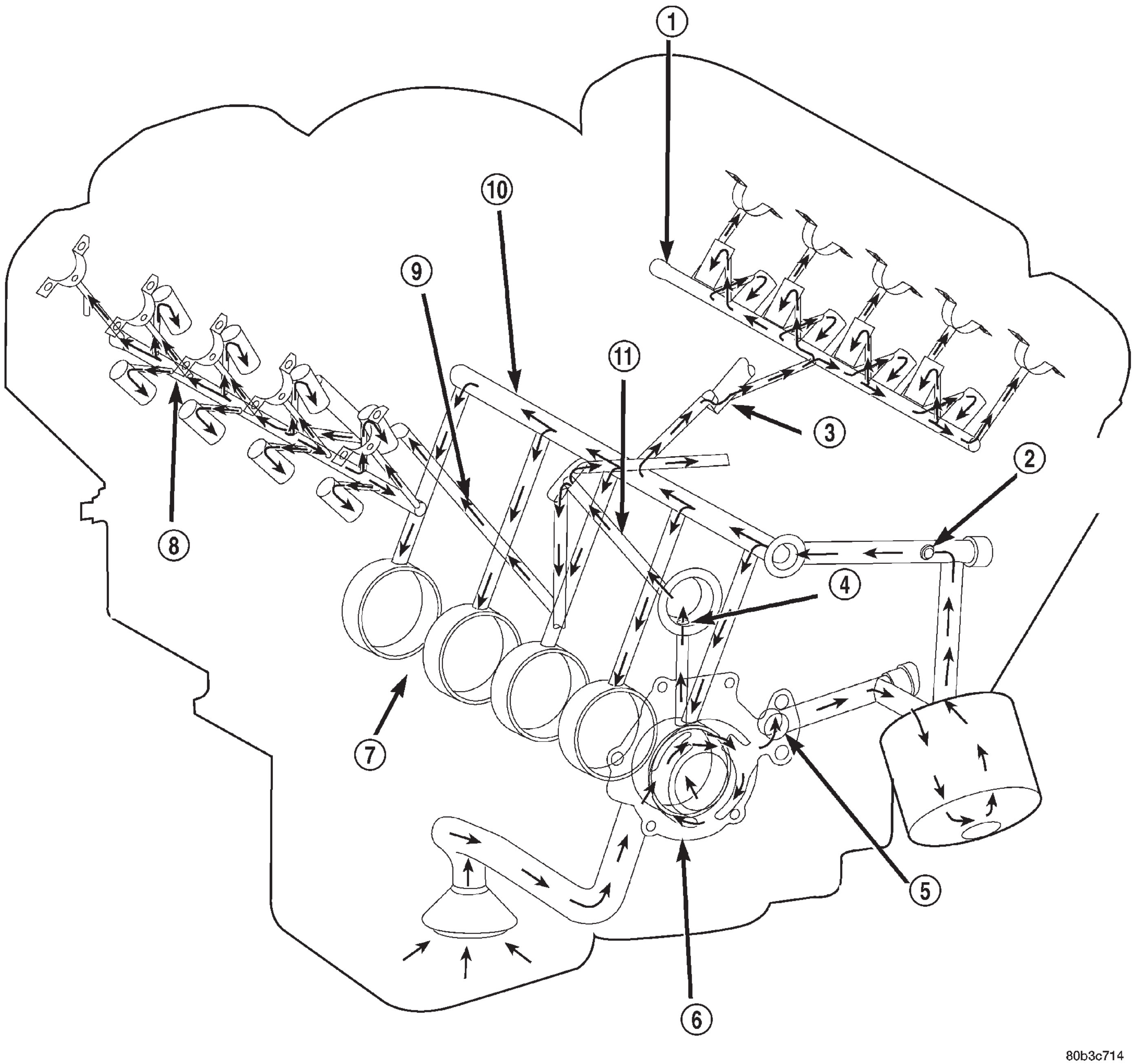


Fig. 88 Engine Oil Lubrication System

1 - LEFT CYLINDER HEAD OIL GALLERY
2 - OIL PRESSURE SENSOR LOCATION
3 - TO LEFT CYLINDER HEAD
4 - OIL FEED TO IDLER SHAFT
5 - OIL PUMP OUTLET TO BLOCK
6 - OIL PUMP
7 - TO CRANKSHAFT MAIN JOURNALS
8 - RIGHT CYLINDER HEAD OIL GALLERY
9 - TO RIGHT CYLINDER HEAD
10 - CYLINDER BLOCK MAIN GALLERY
11 - OIL FEED TO BOTH SECONDARY TENSIONERS

LUBRICATION (Continued)

ENGINE LUBRICATION FLOW CHART—BLOCK: TABLE 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1.Front Timing Chain Idler Shaft 2.Both Secondary Chain Tensioners
Left Cylinder Head	See Table 2
Right Cylinder Head	See Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads.	

ENGINE LUBRICATION FLOW CHART—CYLINDER HEADS: TABLE 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING—ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit (Fig. 89)and install gauge assembly C-3292.

(2) Run engine until thermostat opens.

(3) Oil Pressure:

- Curb Idle—25 Kpa (4 psi) minimum
- 3000 rpm—170 - 550 KPa (25 - 80 psi)

(4) If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

DIAGNOSIS AND TESTING—REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

LUBRICATION (Continued)

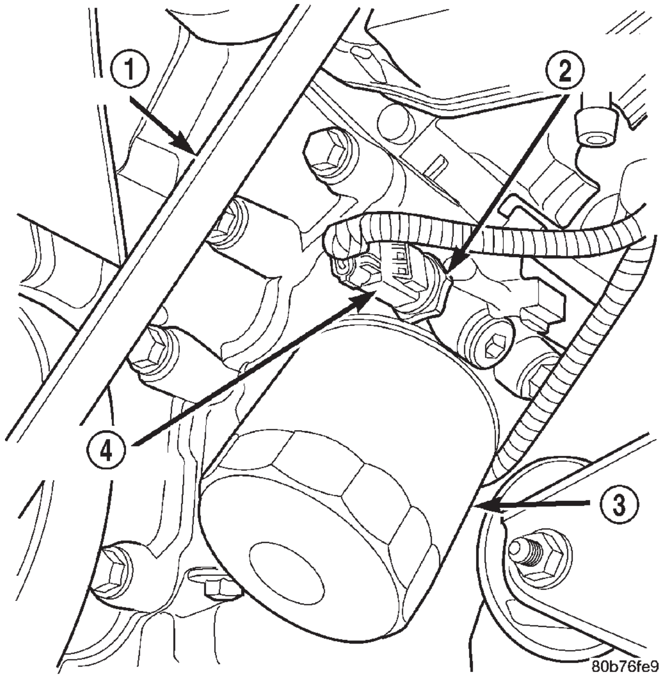


Fig. 89 Oil Pressure Sending Unit

1 - BELT
2 - OIL PRESSURE SENSOR
3 - OIL FILTER
4 - ELEC. CONNECTOR

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

DIAGNOSIS AND TESTING—ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat inspection.**If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

(1) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(2) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(3) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(4) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

(5) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

LUBRICATION (Continued)

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

(4) If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

OIL

STANDARD PROCEDURE - ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY.

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30 in the 4.7L engines. **The 4.7L H.O. uses 10W-30 oil only.**These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 90).

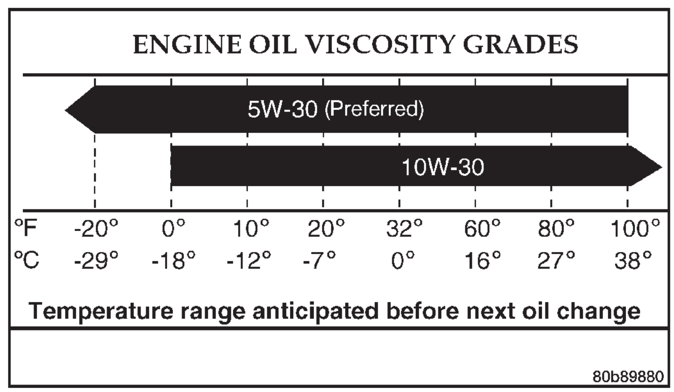


Fig. 90 Temperature/Engine Oil Viscosity - 4.7L Engine

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 91).

OIL LEVEL INDICATOR (DIPSTICK)

The engine oil level indicator is located on the right side of the the 4.7L engine. (Fig. 92).

OIL (Continued)

9400-9

Fig. 91 Engine Oil Container Standard Notations

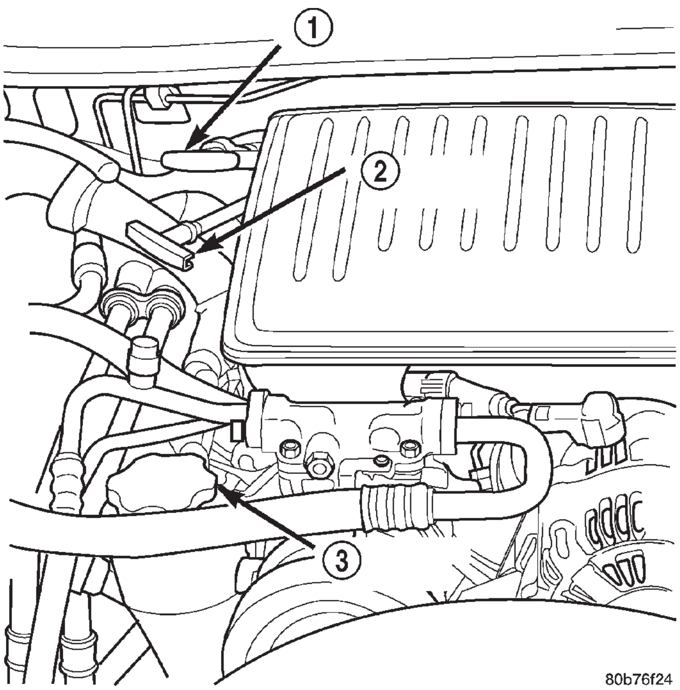


Fig. 92 Engine Oil Dipstick 4.7L Engine

1 - TRANSMISSION DIPSTICK
2 - ENGINE OIL DIPSTICK
3 - ENGINE OIL FILL CAP

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil if level is below the SAFE ZONE on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Remove oil fill cap.

(3) Hoist and support vehicle on safety stands.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.

(6) Install drain plug in crankcase.

(7) Remove oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).

(8) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(9) Install oil fill cap.

(10) Start engine and inspect for leaks.

(11) Stop engine and inspect oil level.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

OIL FILTER

REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise (Fig. 93)to remove it from the cylinder block oil filter boss.

(4) When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

NOTE: Make sure filter gasket was removed with filter.

OIL FILTER (Continued)

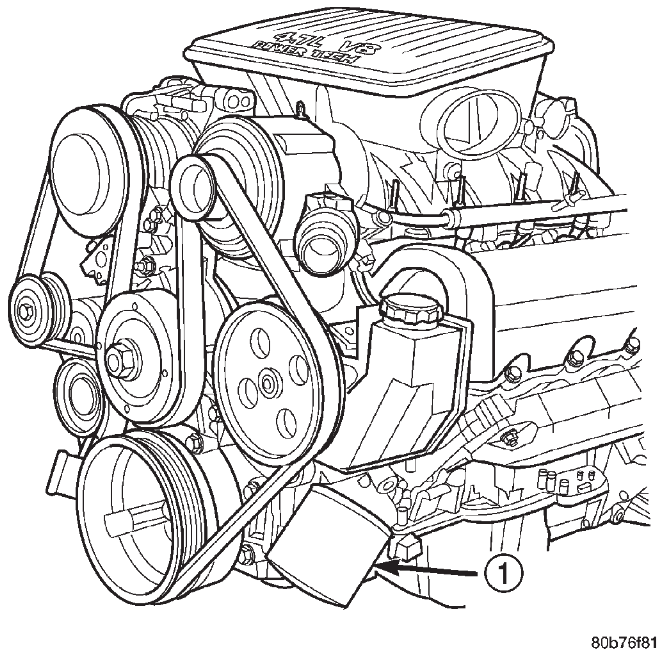


Fig. 93 Oil Filter - 4.7L Engine

1 - ENGINE OIL FILTER

(5) With a wiping cloth, clean the gasket sealing surface of oil and grime.

INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 94)hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

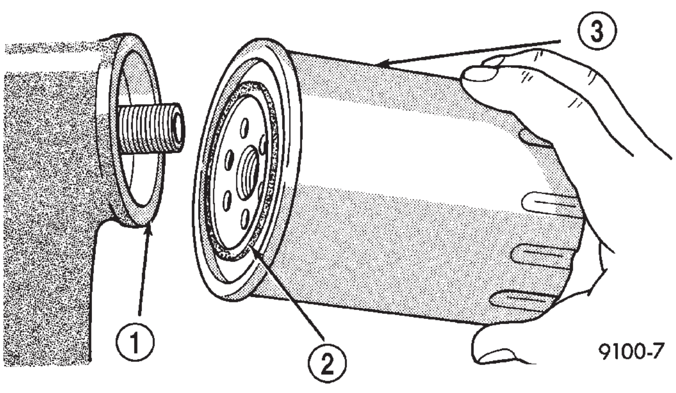


Fig. 94 Oil Filter Sealing Surface—Typical

1 - SEALING SURFACE
2 - RUBBER GASKET
3 - OIL FILTER

OIL PAN

DESCRIPTION

The engine oil pan is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on hoist.

(3) Remove structural cover (Refer to 9 - ENGINE/ ENGINE BLOCK/STRUCTURAL COVER - REMOVAL).

(4) Remove exhaust system Y-pipe.

(5) Remove starter (Refer to 8 - ELECTRICAL/ STARTING/STARTER MOTOR - REMOVAL).

(6) Drain engine oil.

(7) Un-clip transmission lines from support on oil pan stud. Move lines for oil pan clearance.

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when lowering oil pan. Gasket can not be removed with oil pan.

(8) Remove oil pan bolts and oil pan.

(9) Remove oil pump pickup tube.

(10) Remove oil pan gasket.

CLEANING

(1) Clean oil pan in solvent and wipe dry with a clean cloth.

(2) Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.

(3) Clean oil screen and tube thoroughly in clean solvent.

INSPECTION

(1) Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.

(2) Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

INSTALLATION

(1) Clean oil pan and all sealing surfaces. Inspect oil pan gasket and replace as necessary.

(2) Install oil pan gasket.

OIL PAN (Continued)

NOTE: When installing oil pan gasket/windage tray, start four pan bolts at each corner before tightening oil pickup tube. This will keep pan gasket in alignment.

(3) Install oil pump pick-up tube using a new O-ring. First tighten bolt at O-ring end of tube to 28 N·m (20 ft. lbs.). Tighten remain tube support fasteners to 28 N·m (20 ft. lbs.).

(4) Install oil pan and tighten fasteners to 15 N·m (11 ft. lbs.) (Fig. 95).

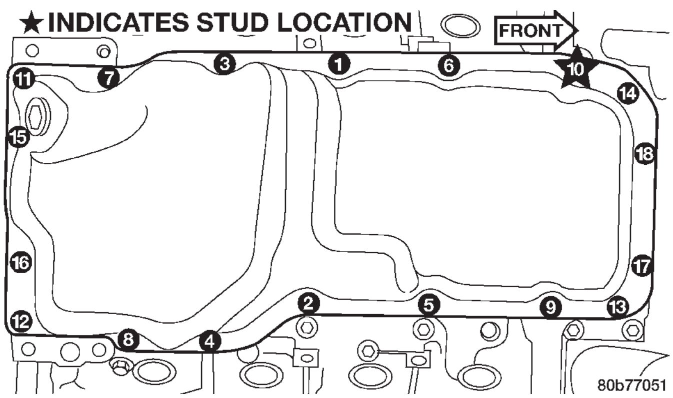


Fig. 95 Oil Pan Tightening Sequence

(5) Reconnect transmission oil cooler lines to oil pan stud bolt.

(6) Install starter (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(7) Install exhaust system Y-pipe.

(8) Install structural cover (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).

(9) Lower vehicle.

(10) Fill engine with proper amount of oil (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).

(11) Connect negative cable to battery.

OIL PRESSURE SENSOR/ SWITCH

DESCRIPTION

The 3–wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses three circuits. They are:

- A 5–volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3–wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5–volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Raise vehicle on hoist.
(3) Remove front splash shield.
(4) Disconnect oil pressure sender wire (Fig. 96).
(5) Remove the pressure sender (Fig. 96).

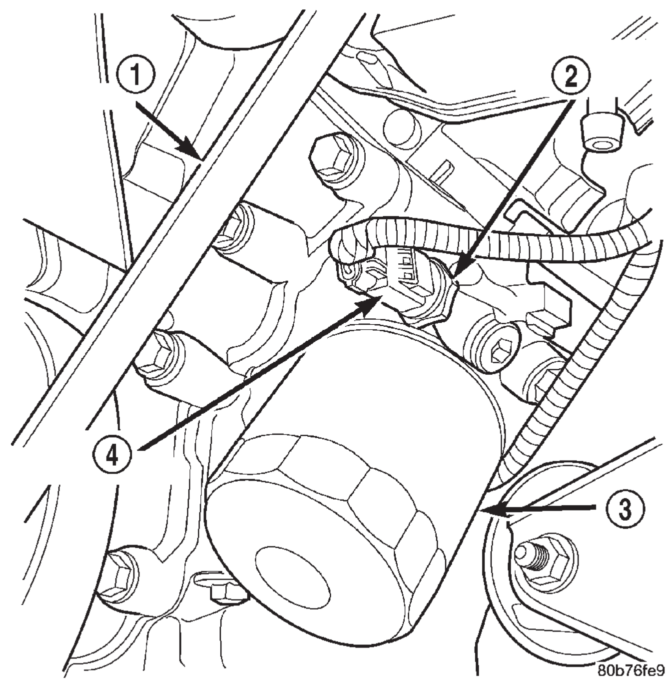


Fig. 96 Oil Pressure Sending Unit

1 - BELT
2 - OIL PRESSURE SENSOR
3 - OIL FILTER
4 - ELEC. CONNECTOR

INSTALLATION

(1) Install oil pressure sender.
(2) Connect oil pressure sender wire.
(3) Install front splash shield.
(4) Lower vehicle.
(5) Connect the negative battery cable.

OIL PUMP

REMOVAL

(1) Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(2) Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(3) Remove the timing chains and tensioners (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(4) Remove the four bolts, primary timing chain tensioner and the oil pump.

DISASSEMBLY

(1) Remove oil pump cover screws and lift off cover plate.

(2) Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

(3) If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

CLEANING

(1) Wash all parts in a suitable solvent.

INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

(1) Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.

(2) Lay a straight edge across the pump cover surface (Fig. 97). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between the cover and the straight edge the oil pump assembly should be replaced.

(3) Measure the thickness of the outer rotor (Fig. 98). If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.

(4) Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.

(5) Measure the thickness of the inner rotor (Fig. 99). If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.

(6) Slide outer rotor into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body (Fig. 100). If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.

(7) Install the inner rotor in the into the oil pump body. Measure the clearance between the inner and outer rotors (Fig. 101). If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.

(8) Place a straight edge across the body of the oil pump (between the bolt holes), if a feeler gauge of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced (Fig. 102).

NOTE: The 4.7 Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

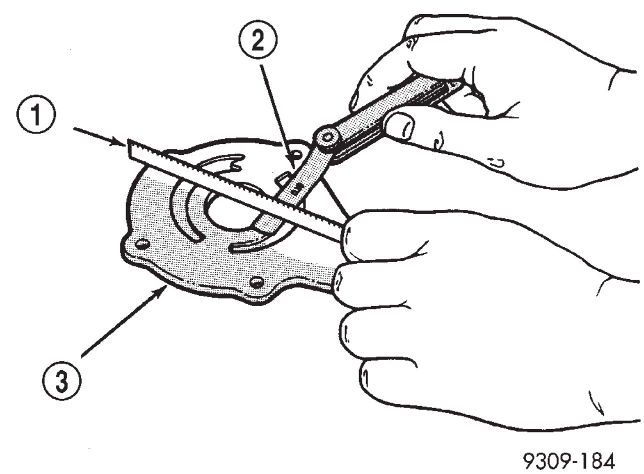


Fig. 97 Checking Oil Pump Cover Flatness

1 - STRAIGHT EDGE
2 - FEELER GAUGE
3 - OIL PUMP COVER

OIL PUMP (Continued)

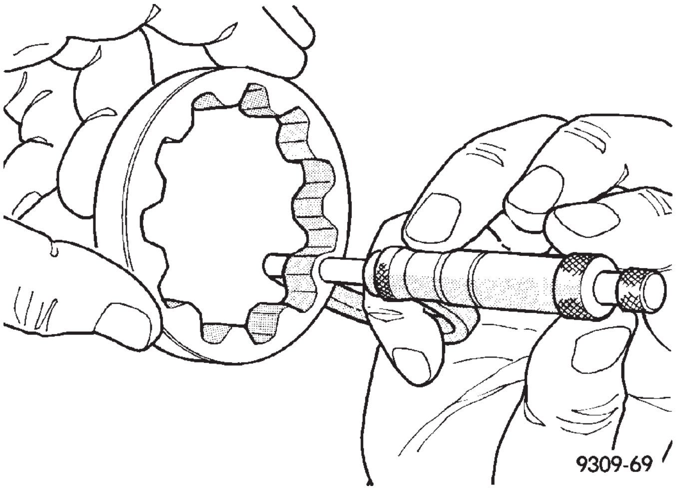


Fig. 98 Measuring Outer Rotor Thickness

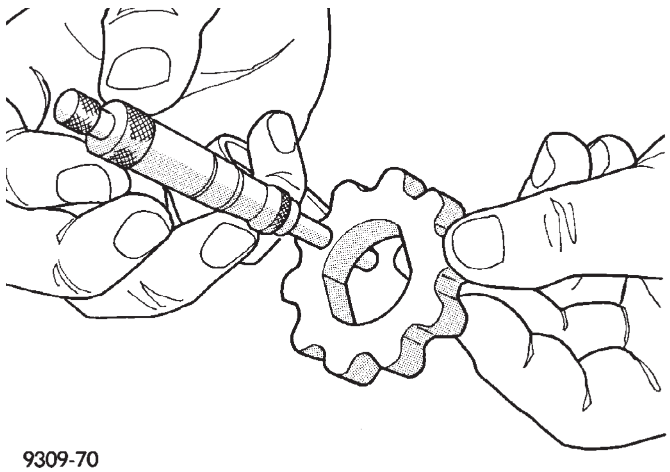


Fig. 99 Measuring Inner Rotor Thickness

ASSEMBLY

(1) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

(2) Install inner and outer rotors

(3) Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).

(4) Prime oil pump before installation by filling rotor cavity with engine oil.

(5) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

INSTALLATION

(1) Position the oil pump onto the crankshaft and install two oil pump retaining bolts.

(2) Position the primary timing chain tensioner and install the two retaining bolts.

(3) Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown (Fig. 103).

(4) Install the secondary timing chain tensioners and timing chains (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(5) Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(6) Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

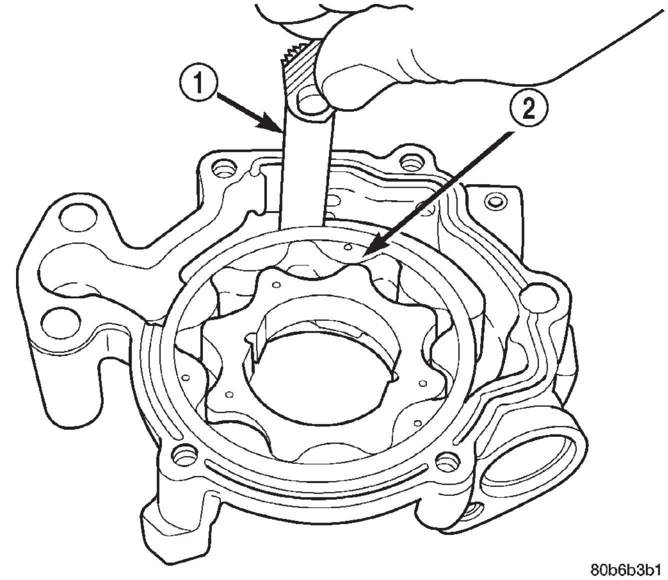


Fig. 100 Measuring Outer Rotor Clearance in

1 - FEELER GAUGE
2 - OUTER ROTOR

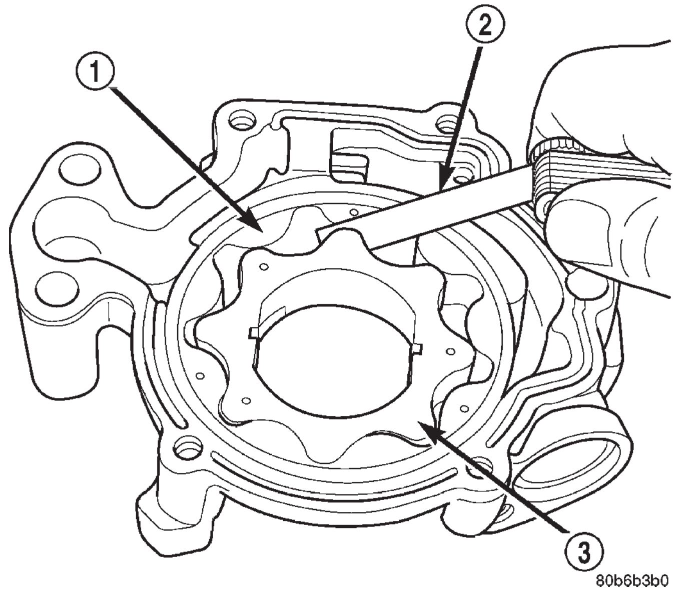


Fig. 101 Measuring Clearance Between Rotors

1 - OUTER ROTOR
2 - FEELER GAUGE
3 - INNER ROTOR

OIL PUMP (Continued)

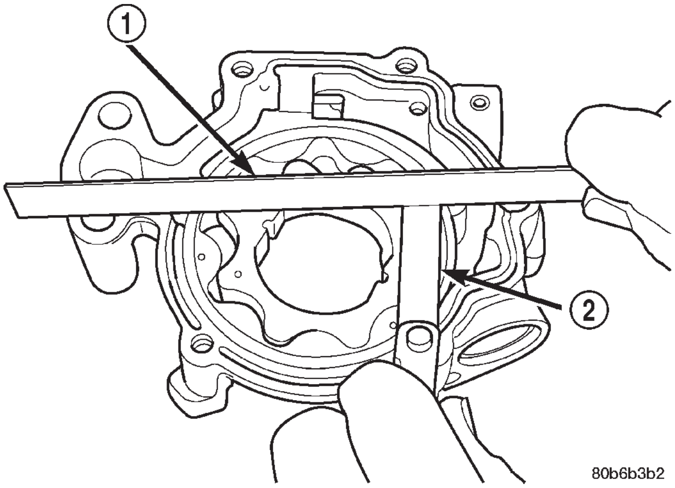


Fig. 102 Measuring Clearance Over Rotors

1 - STRAIGHT EDGE
2 - FEELER GAUGE

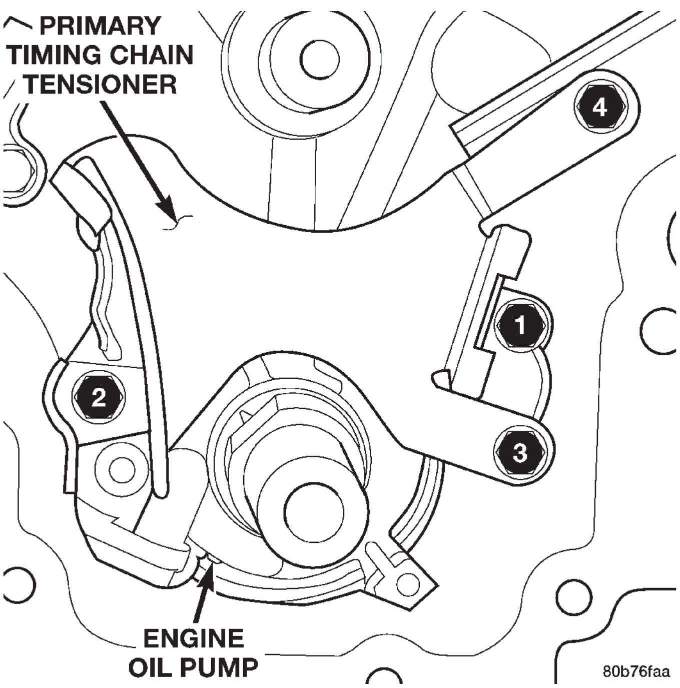


Fig. 103 Oil Pump and Primary Timing Chain Tensioner Tightening Sequence

INTAKE MANIFOLD

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks. Eight studs and two bolts are used to fasten the intake to the head.

DIAGNOSIS AND TESTING—INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.
(2) Spray a small stream of water at the suspected leak area.
(3) If a change in RPM is observed the area of the suspected leak has been found.
(4) Repair as required.

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove air cleaner housing and throttle body resonator (Fig. 104).

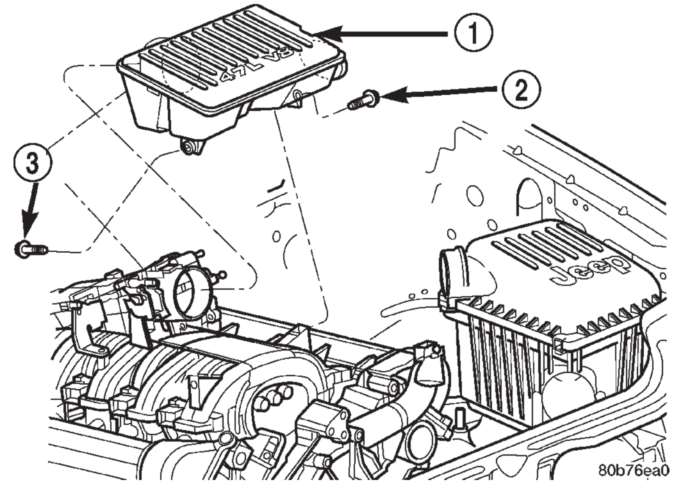


Fig. 104 Throttle Body Resonator

1 - THROTTLE BODY RESONATOR
2 - BOLT
3 - BOLT

(3) Disconnect throttle and speed control cables.
(4) Disconnect electrical connectors for the following components:
- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Coolant Temperature (CTS) Sensor
- Idle Air Control (IAC) Motor

(5) Disconnect vapor purge hose, brake booster hose, speed control servo hose, positive crankcase ventilation (PCV) hose.

INTAKE MANIFOLD (Continued)

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Disconnect generator electrical connections.

(8) Unbolt the generator and move it away from the intake manifold for clearance.

(9) Disconnect air conditioning compressor electrical connections.

(10) Unbolt the air conditioning compressor and move it away from the intake manifold for clearance.

(11) Disconnect left and right radio suppressor straps.

(12) Disconnect and remove ignition coil towers (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).

(13) Remove top oil dipstick tube retaining bolt and ground strap.

(14) Bleed pressure from fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(15) Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).

(16) Remove throttle body assembly and mounting bracket.

(17) Drain cooling system below coolant temperature level (Refer to 7 - COOLING - STANDARD PROCEDURE).

(18) Remove coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMP SENSOR - REMOVAL).

(19) Remove cowl to hood seal. (Refer to 23 - BODY/WEATHERSTRIP/SEALS/COWL WEATHERSTRIP - REMOVAL).

(20) Remove right side engine lifting stud.

(21) Remove intake manifold retaining fasteners, in reverse order of tightening sequence (Fig. 105).

NOTE: Intake must be lifted upward and level in the front and rear to clear the cowl. Interference with the cowl will occur during removal.

(22) Remove intake manifold.

CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

(1) Inspect the intake sealing surface for cracks, nicks and distortion.

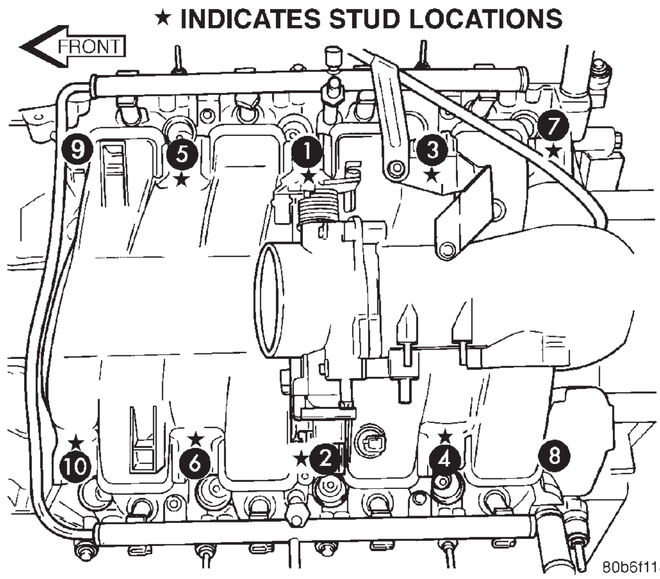


Fig. 105 Intake Manifold Tightening Sequence

(2) Inspect the intake manifold vacuum hose fittings for looseness or blockage.

(3) Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

INSTALLATION

(1) Install intake manifold gaskets.

(2) Install intake manifold.

(3) Install intake manifold retaining bolts and tighten in sequence shown in (Fig. 106) to 12 N·m (105 in. lbs.).

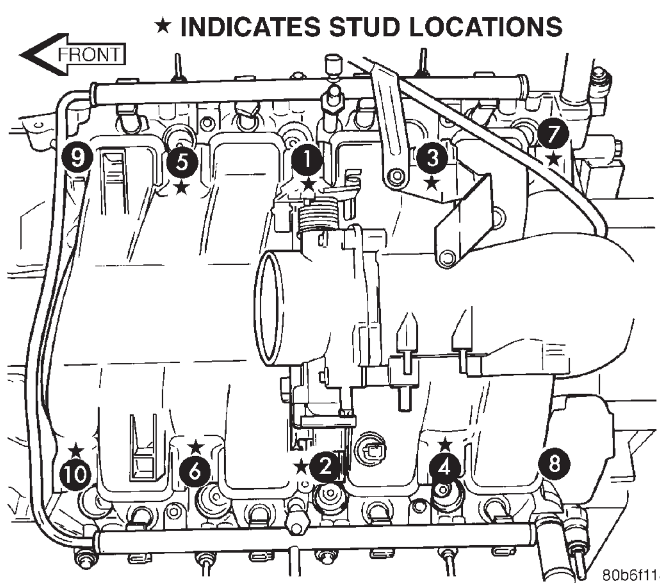


Fig. 106 Intake Manifold Tightening Sequence

(4) Install left and right radio suppressor straps.

(5) Install throttle body assembly.

(6) Install throttle cable bracket.

INTAKE MANIFOLD (Continued)

(7) Connect throttle cable and speed control cable to throttle body.

(8) Install fuel rail (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL RAIL - INSTALLATION).

(9) Install ignition coil towers (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - INSTALLATION).

(10) Install coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMP SENSOR - INSTALLATION).

(11) Connect electrical connectors for the following components:

- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Coolant Temperature (CTS) Sensor
- Idle Air Control (IAC) Motor
- Ignition coil towers
- Fuel injectors

(12) Install top oil dipstick tube retaining bolt and ground strap.

(13) Install right side engine lifting stud.

(14) Install generator including electrical connections (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(15) Connect Vapor purge hose, Brake booster hose, Speed control servo hose, Positive crankcase ventilation (PCV) hose.

(16) Install air conditioning compressor including electrical connections.

(17) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(18) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(19) Install cowl to hood seal (Refer to 23 - BODY/ WEATHERSTRIP/SEALS/COWL WEATHERSTRIP - INSTALLATION).

(20) Install air cleaner housing and throttle body resonator. Tighten resonator bolts 4.5 N·m (40 in. lbs.).

(21) Connect negative cable to battery.

EXHAUST MANIFOLD - LEFT

DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

REMOVAL

(1) Disconnect negative cable for battery.

(2) Hoist vehicle.

(3) Disconnect exhaust pipe at manifold.

(4) Lower vehicle.

(5) Remove air cleaner housing and tube.

(6) Remove the front two exhaust heat shield retaining fasteners. Raise vehicle and remove the fasteners at rear of heat shield.

(7) Remove heat shield (Fig. 107).

(8) Lower vehicle and remove the upper exhaust manifold retaining bolts (Fig. 107).

(9) Raise vehicle and remove the lower exhaust manifold retaining bolts (Fig. 107).

(10) Remove exhaust manifold and gasket (Fig. 107). Manifold is removed from below the engine compartment.

CLEANING

(1) Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.

(2) Clean all gasket residue from the manifold mating surface.

INSPECTION

(1) Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.

(2) Using a straight edge and a feeler gauge, check the mating surface for warp and twist.

(3) Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

INSTALLATION

(1) Install exhaust manifold and gasket from below engine compartment.

(2) Install lower exhaust manifold fasteners (Fig. 107). DO NOT tighten until all fasteners are in place.

(3) Lower vehicle and install upper exhaust manifold fasteners (Fig. 107). Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

(4) Install exhaust manifold heat shield (Fig. 107). Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.

(5) Install air cleaner housing and tube.

(6) Connect exhaust pipe to manifold.

(7) Connect negative cable to battery.

EXHAUST MANIFOLD - LEFT (Continued)

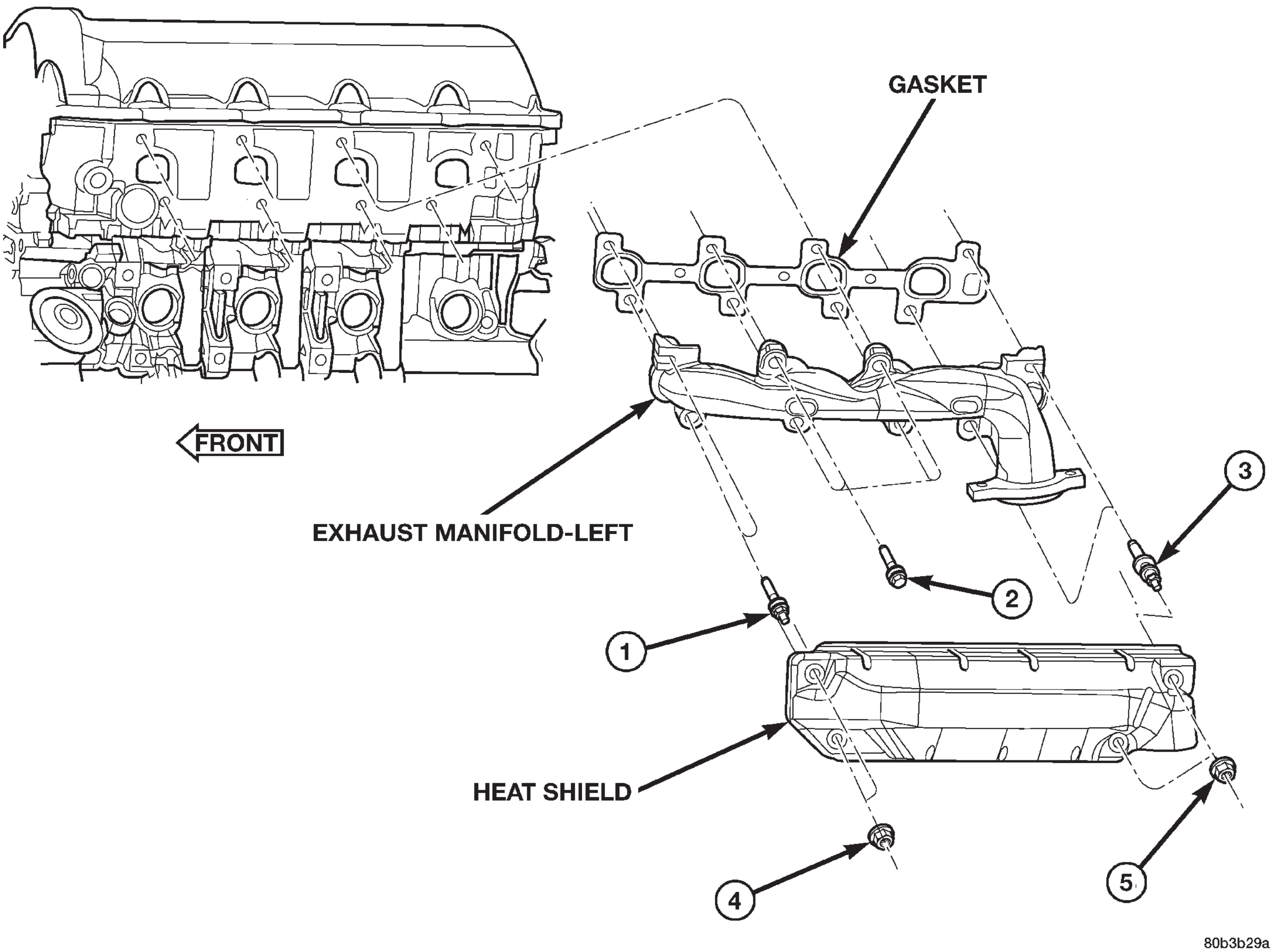


Fig. 107 Exhaust Manifold—Left

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)		4	Nut (Qty 2)	8 N·m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)	25 N·m (18 ft. lbs.)	5	Nut (Qty 2)	
3	Stud (Qty 2)				

EXHAUST MANIFOLD - RIGHT

DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

REMOVAL

(1) Disconnect negative cable for battery.

(2) Remove battery from vehicle.

(3) Remove Power Distribution Center (PDC) fasteners and set aside.

(4) Remove battery tray assembly.

(5) Remove washer bottle assembly

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

EXHAUST MANIFOLD - RIGHT (Continued)

(7) Remove A/C compressor from mounting and set aside.

(8) Remove A/C accumulator support bracket fastener.

(9) Drain coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(10) Remove heater hoses at engine.

(11) Remove fasteners attaching exhaust manifold heat shield (Fig. 108).

(12) Remove heat shield (Fig. 108).

(13) Remove upper exhaust manifold attaching fasteners (Fig. 108).

(14) Raise vehicle on hoist.

(15) Disconnect exhaust pipe from manifold.

(16) Remove fasteners attaching starter. Move starter aside.

(17) Remove lower exhaust manifold attaching fasteners.

(18) Remove exhaust manifold and gasket (Fig. 108). Manifold is removed from below the engine compartment.

CLEANING

(1) Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.

(2) Clean all gasket residue from the manifold mating surface.

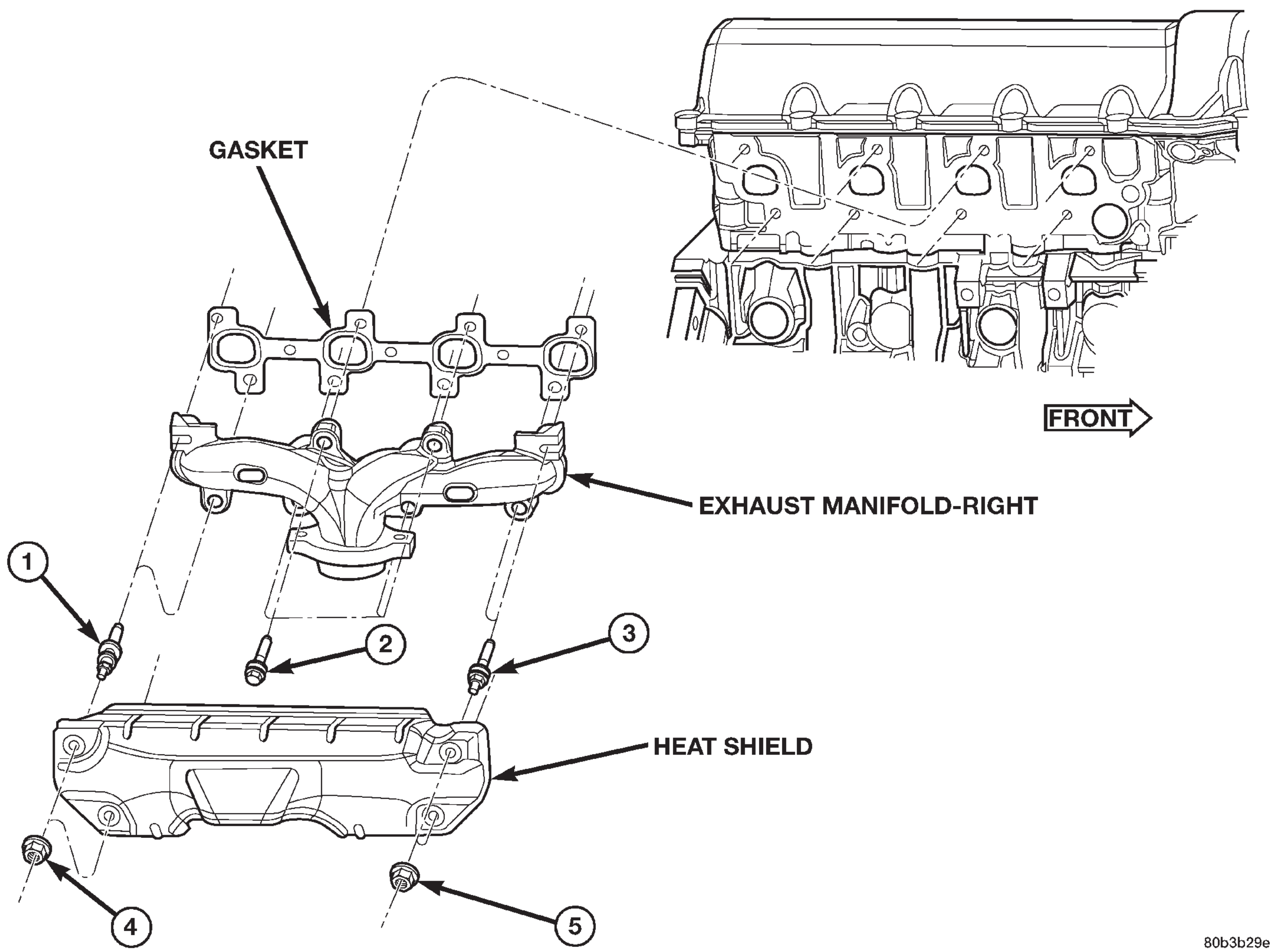


Fig. 108 Exhaust Manifold—Right

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)		4	Nut (Qty 2)	8 N·m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)	25 N·m (18 ft. lbs.)	5	Nut (Qty 2)	
3	Stud (Qty 2)				

EXHAUST MANIFOLD - RIGHT (Continued)

INSPECTION

(1) Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.

(2) Using a straight edge and a feeler gauge, check the mating surface for warp and twist.

(3) Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

INSTALLATION

(1) Install exhaust manifold and gasket from below engine compartment.

(2) Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.

(3) Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

(4) Install exhaust manifold heat shield. Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.

(5) Install starter and fasteners.

(6) Connect exhaust pipe to manifold.

(7) Connect heater hoses at engine.

(8) Install fastener attaching A/C accumulator.

(9) Install A/C compressor and fasteners.

(10) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(11) Install washer bottle and battery tray assembly.

(12) Install PDC.

(13) Install battery and connect cables.

(14) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

VALVE TIMING

DESCRIPTION - TIMING DRIVE SYSTEM

The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain and two secondary timing chain drives (Fig. 109).

OPERATION - TIMING DRIVE SYSTEM

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral thirty tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a non – serviceable press fit anti rattle type. A spiral ring is installed on the outboard side of the fifty tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, both are inverted tooth type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a thirty tooth cam sprocket directly from the thirty tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

STANDARD PROCEDURE

STANDARD PROCEDURE - ENGINE TIMING - VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

VALVE TIMING (Continued)

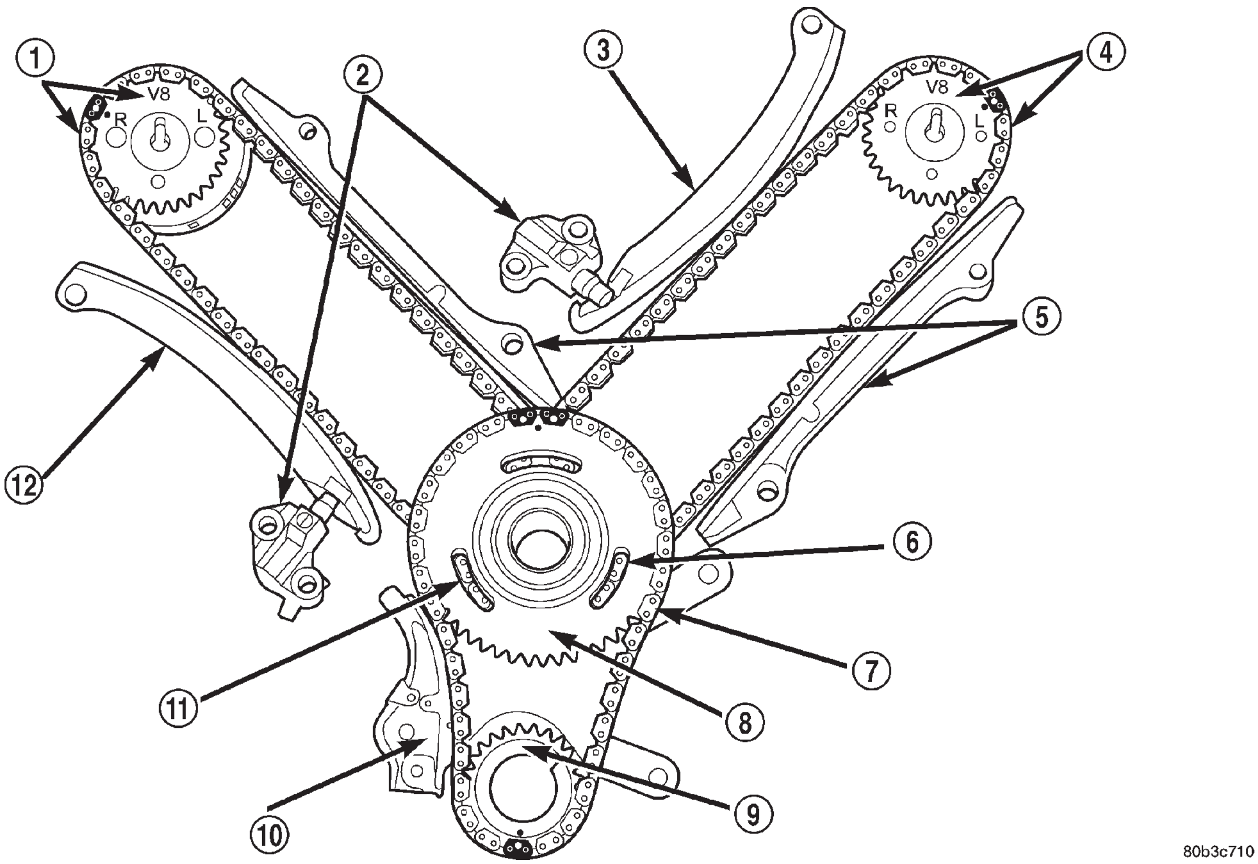


Fig. 109 Timing Drive System

1 - RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN
2 - SECONDARY TIMING CHAIN TENSIONER (LEFT AND RIGHT SIDE NOT COMMON)
3 - SECONDARY TENSIONER ARM
4 - LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN
5 - CHAIN GUIDE
6 - TWO PLATED LINKS ON RIGHT CAMSHAFT CHAIN
7 - PRIMARY CHAIN
8 - IDLER SPROCKET
9 - CRANKSHAFT SPROCKET
10 - PRIMARY CHAIN TENSIONER
11 - TWO PLATED LINKS ON LEFT CAMSHAFT CHAIN
12 - SECONDARY TENSIONER ARM

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

(1) Remove the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Using a mirror, locate the TDC arrow on the front cover (Fig. 110). Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

(3) Note the location of the V8 mark stamped into the camshaft drive gears (Fig. 111). If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC (cylinder #1) on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC (cylinder #1) on the compression stroke.

(4) If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.

(5) If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.

(6) If both camshaft drive gear V8 marks are at the twelve o'clock or the six o' clock position the engine base timing is correct. Reinstall the cylinder head covers.

VALVE TIMING (Continued)

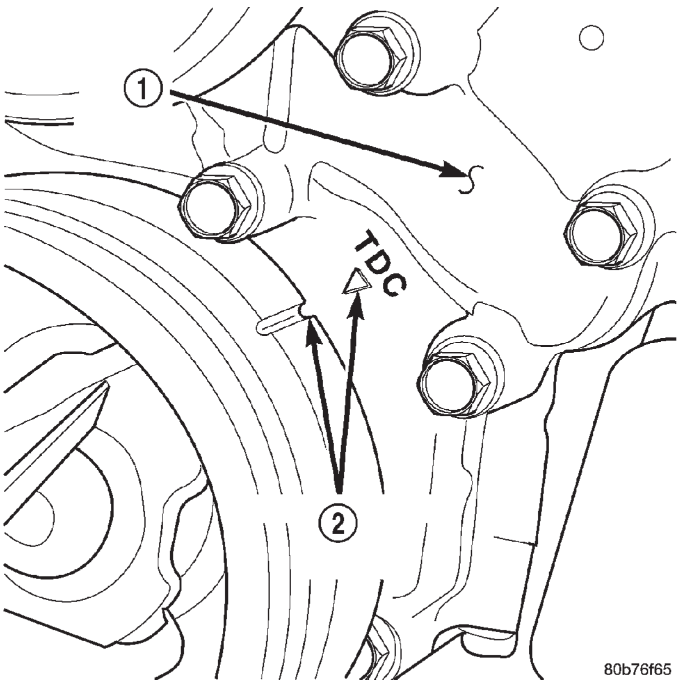


Fig. 110 Engine Top Dead Center (TDC) Indicator Mark

1 - TIMING CHAIN COVER
2 - CRANKSHAFT TIMING MARKS

SINGLE CAMSHAFT TIMING

NOTE: to adjust the timing on one camshaft, preform the following procedure.

(1) Using Chain Tensioner Wedge, special tool 8350, stabilize the secondary chain drive (Fig. 112). For reference purposes, mark the chain-to-sprocket position (Fig. 112).

(2) Remove the camshaft drive gear retaining bolt.

(3) Carefully remove the camshaft drive gear from the camshaft.

(4) Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

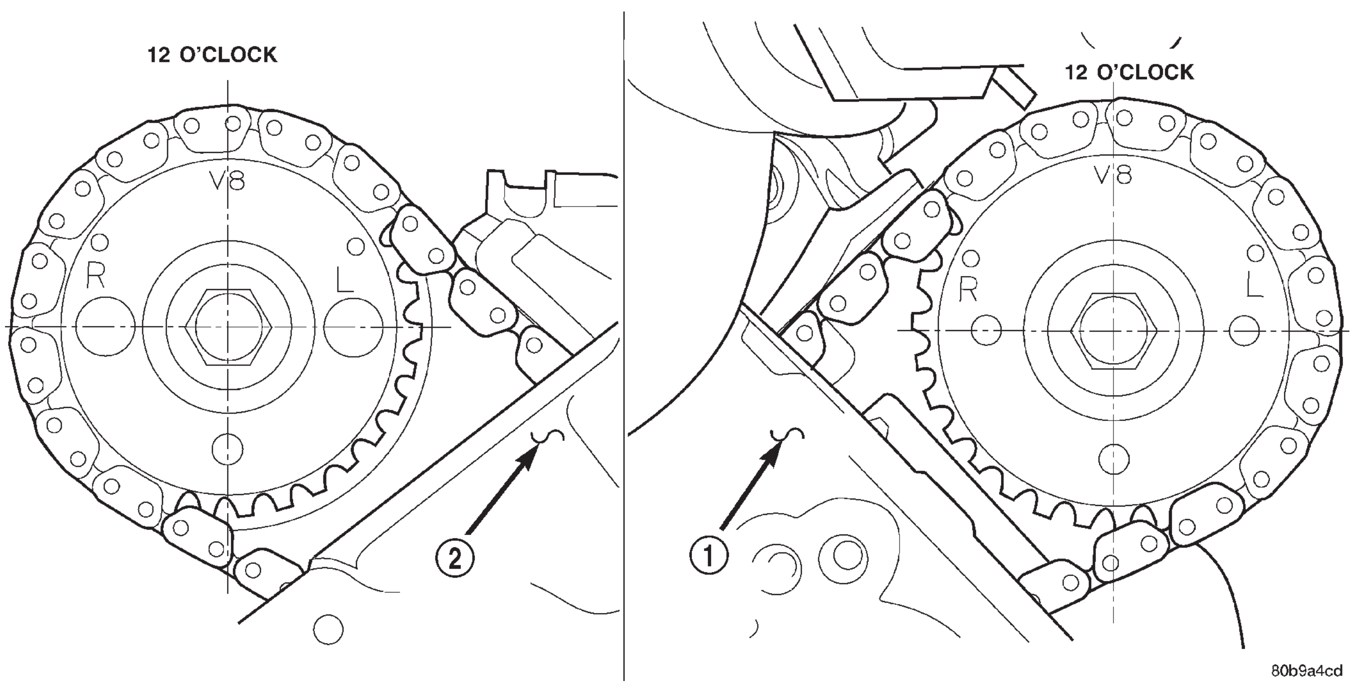


Fig. 111 Camshaft Sprocket V8 Marks

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

VALVE TIMING (Continued)

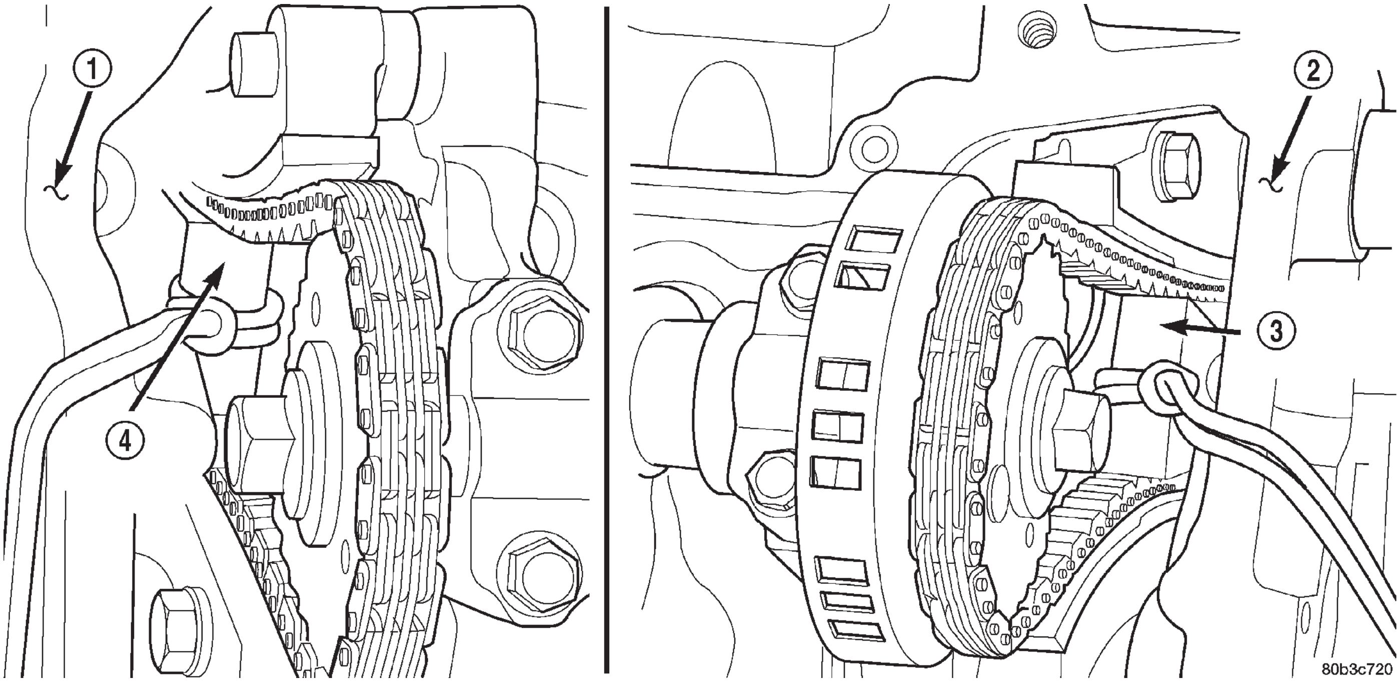


Fig. 112 Securing Timing Chain Tensioners Using Timing Chain Wedge

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD
3 - SPECIAL TOOL 8350 WEDGE
4 - SPECIAL TOOL 8350 WEDGE

(5) Using a suitable pair of adjustable pliers, rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear (Fig. 113).

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

(6) Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench, Tighten retaining bolt to 122N·m (90 ft. Lbs.) (Fig. 114) (Fig. 115).

(7) Remove special tool 8350.

(8) Rotate the crankshaft two full revolutions, then reverify that the camshaft drive gear V8 marks are in fact aligned.

(9) Install the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

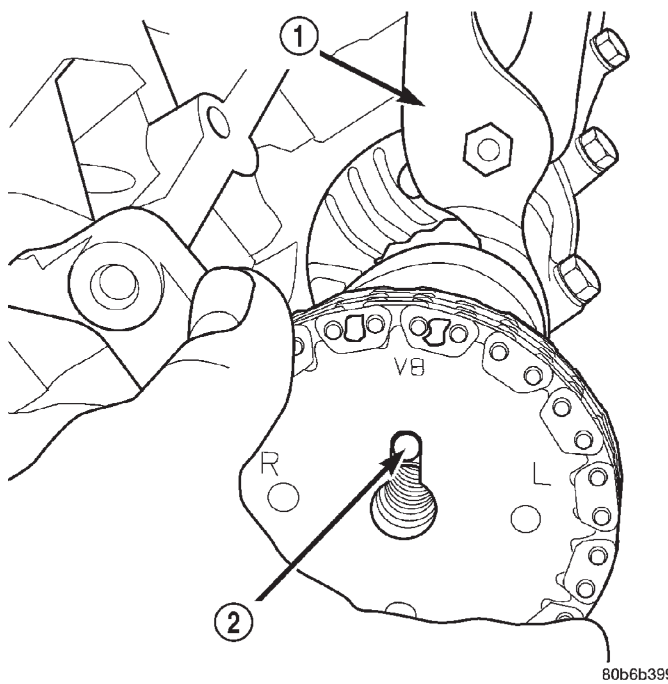


Fig. 113 Camshaft Dowel

1 - ADJUSTABLE PLIERS
2 - CAMSHAFT DOWEL

VALVE TIMING (Continued)

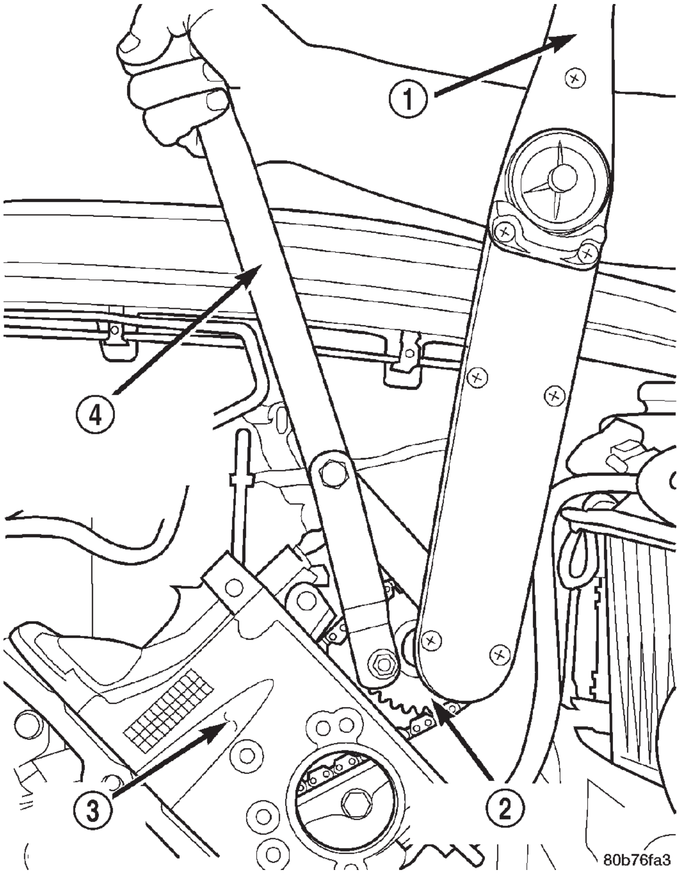


Fig. 114 Camshaft Sprocket Left Cylinder Head

1 - TORQUE WRENCH
2 - CAMSHAFT SPROCKET
3 - LEFT CYLINDER HEAD
4 - SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

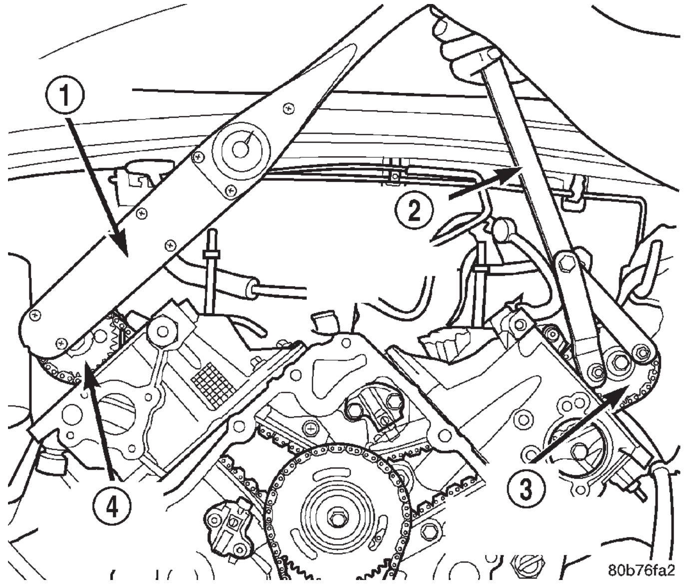


Fig. 115 Camshaft Sprocket Installation—Right Cylinder Head

1 - TORQUE WRENCH
2 - SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 - LEFT CAMSHAFT SPROCKET
4 - RIGHT CAMSHAFT SPROCKET

STANDARD PROCEDURE—MEASURING TIMING CHAIN WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

(1) Remove the timing chain cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(2) To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston (Fig. 116). The measurement at point (A) must be less than 15mm (0.5906 inches).

(3) If the measurement exceeds the specification the secondary timing chains are worn and require replacement. (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

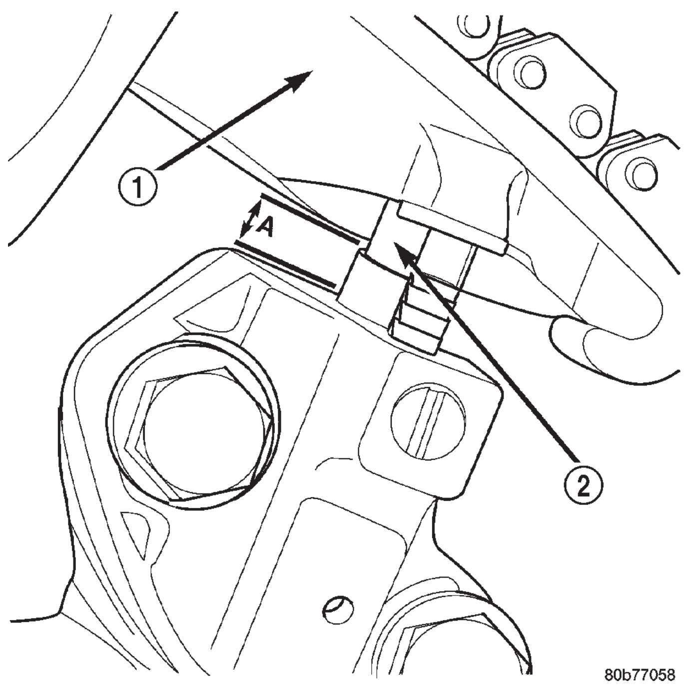


Fig. 116 Measuring Secondary Timing Chains For Wear

1 - SECONDARY TENSIONER ARM
2 - SECONDARY CHAIN TENSIONER PISTON

NOTE: If the secondary chains are to be replaced the primary chain must also be replaced.

TIMING BELT / CHAIN COVER(S)

REMOVAL

(1) Disconnect the battery negative cable.

(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Disconnect both heater hoses at timing cover.

(4) Disconnect lower radiator hose at engine.

(5) Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(6) Remove accessory drive belt tensioner assembly (Fig. 117).

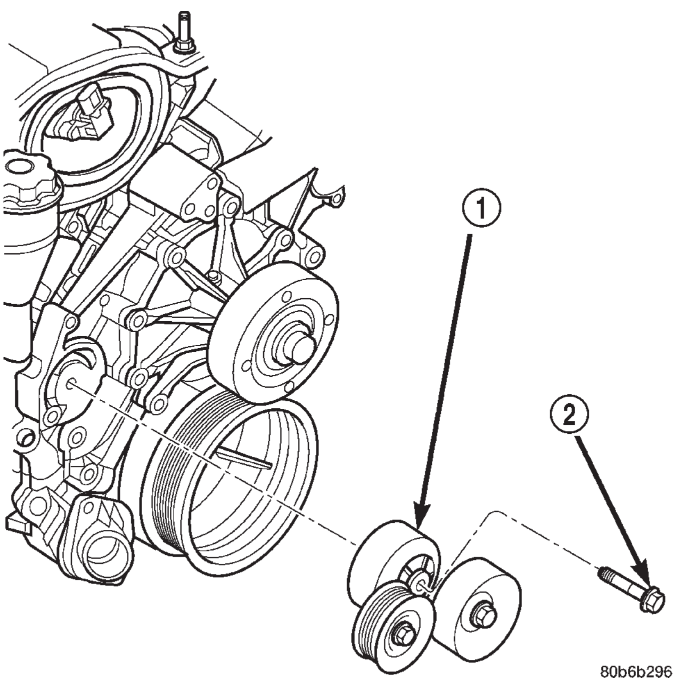


Fig. 117 Accessory Drive Belt Tensioner

1 - TENSIONER ASSEMBLY
2 - FASTENER TENSIONER TO FRONT COVER

(7) Remove the generator and A/C compressor.

(8) Remove cover and gasket (Fig. 118).

INSTALLATION

(1) Clean timing chain cover and block surface. Inspect cover gasket and replace as necessary.

(2) Install cover and gasket. Tighten fasteners in sequence as shown in (Fig. 119) to 54 N·m (40 ft. lbs.).

(3) Install the A/C compressor and generator.

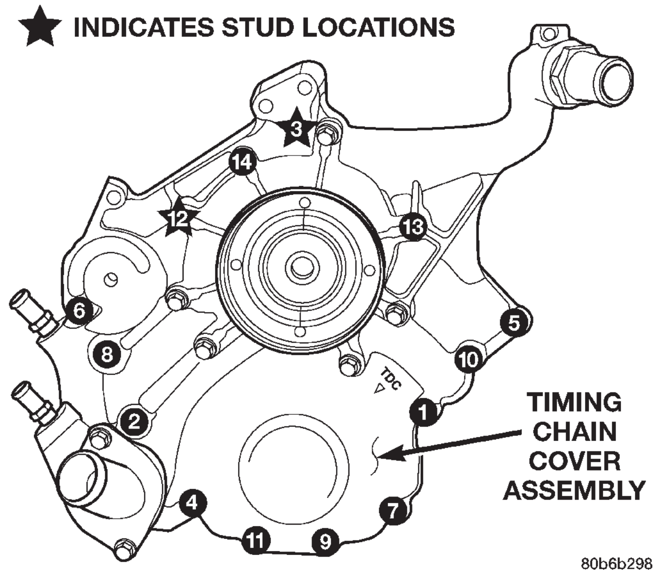


Fig. 118 Timing Chain Cover Fasteners

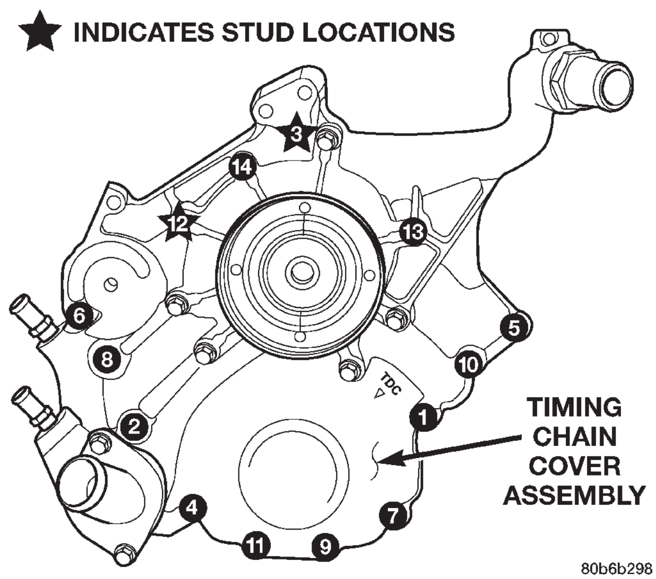


Fig. 119 Timing Chain Cover Fasteners

(4) Install crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(5) Install accessory drive belt tensioner assembly. Tighten fastener to 54 N·m (40 ft. lbs.).

(6) Install lower radiator hose.

(7) Install both heater hoses.

(8) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(9) Connect the battery negative cable.

TIMING BELT/CHAIN AND SPROCKETS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove right and left cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(4) Remove radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(5) Rotate engine until timing mark on crankshaft damper aligns with TDC mark on timing chain cover (Fig. 120) (#1 cylinder exhaust stroke) and the camshaft sprocket “V8” marks are at the 12 o’clock position (Fig. 121).

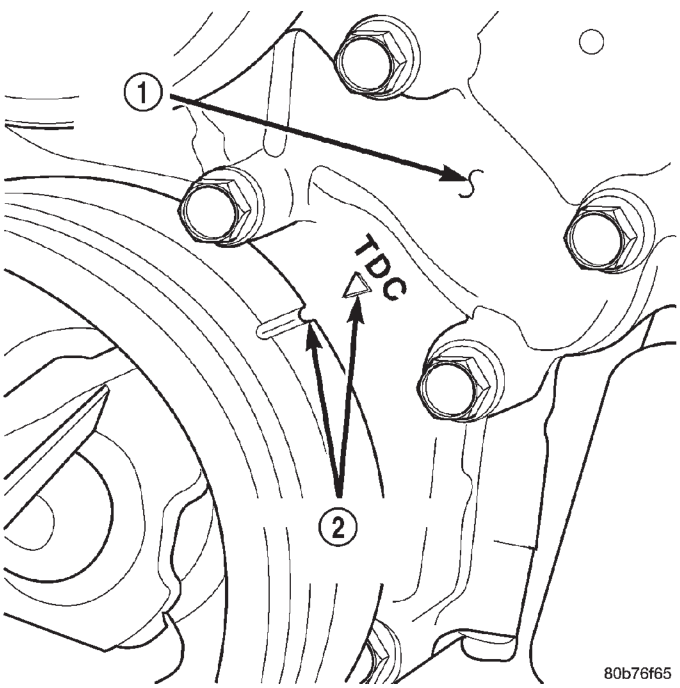


Fig. 120 Engine Top Dead Center (TDC) Indicator Mark

1 - TIMING CHAIN COVER
2 - CRANKSHAFT TIMING MARKS

(6) Remove power steering pump.

(7) Remove access plugs (2) from left and right cylinder heads for access to chain guide fasteners (Fig. 122).

(8) Remove the oil fill housing to gain access to the right side tensioner arm fastener.

(9) Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(10) Collapse and pin primary chain tensioner (Fig. 123).

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

(11) Remove secondary chain tensioners.

(12) Remove camshaft position sensor from right cylinder head (Fig. 124).

CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.

(13) Remove left and right camshaft sprocket bolts.

(14) While holding the left camshaft steel tube with adjustable pliers, (Fig. 125) remove the left camshaft sprocket. Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.

(15) While holding the right camshaft steel tube with adjustable pliers, (Fig. 126) remove the right camshaft sprocket. Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.

TIMING BELT/CHAIN AND SPROCKETS (Continued)

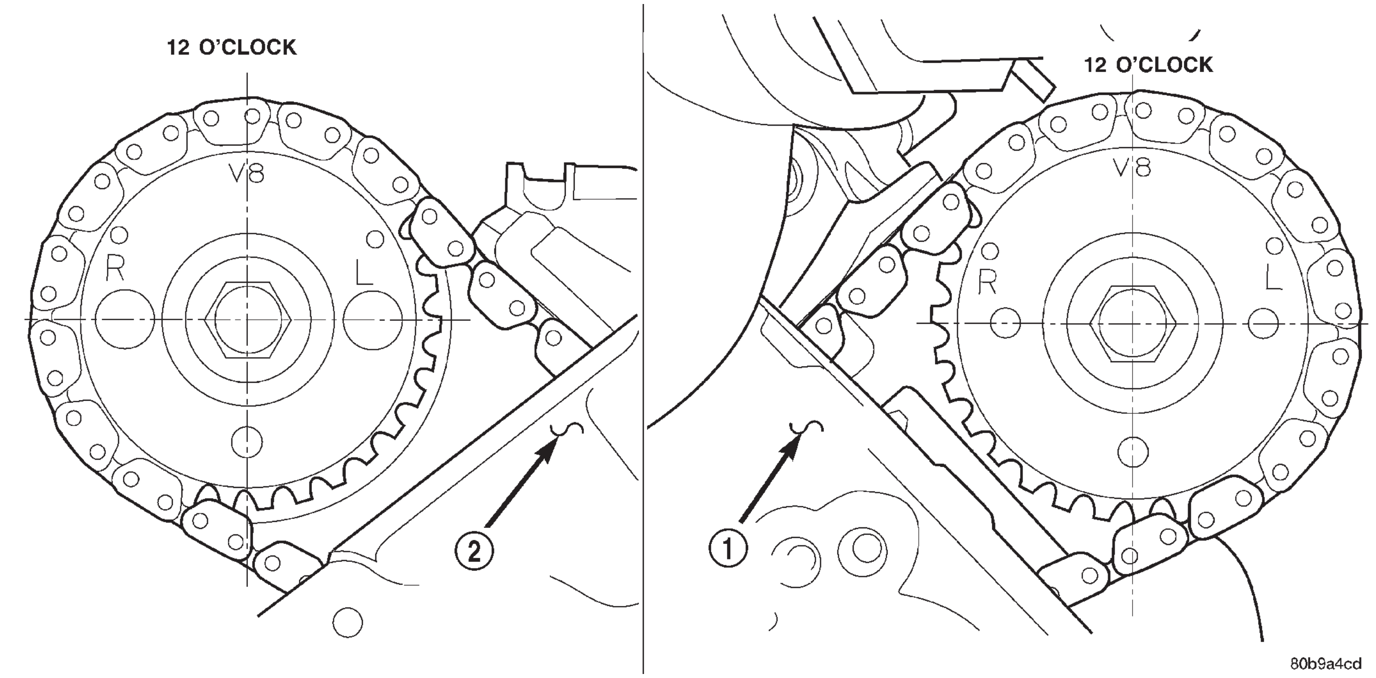


Fig. 121 Camshaft Sprocket V8 Marks

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

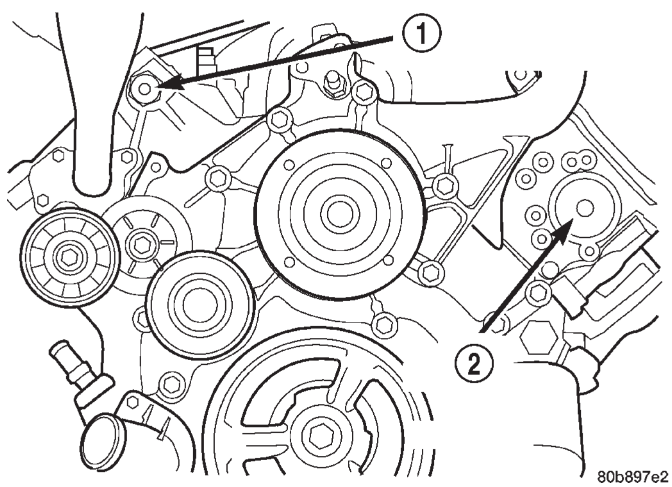


Fig. 122 Cylinder Head Access Plug Location

1 - RIGHT CYLINDER HEAD ACCESS PLUG
2 - LEFT CYLINDER HEAD ACCESS PLUG

(16) Remove idler sprocket assembly bolt.

(17) Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.

(18) Remove both pivoting tensioner arms and chain guides.

(19) Remove chain tensioner.

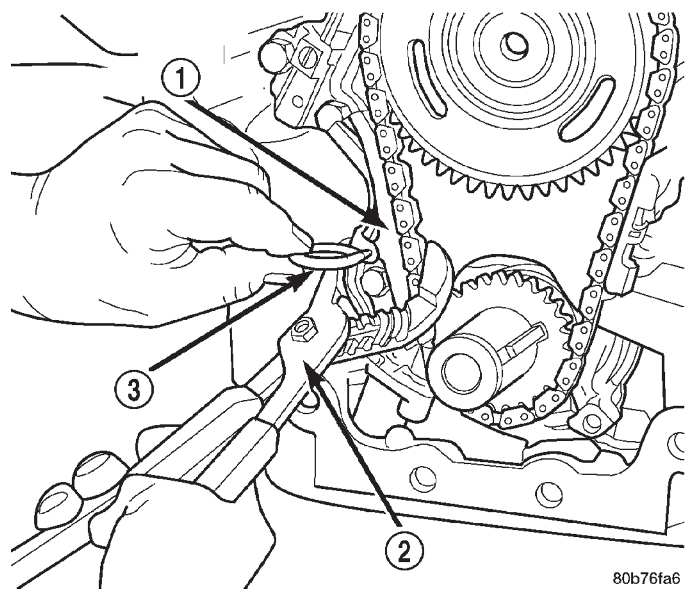


Fig. 123 Collapsing And Pinning Primary Chain Tensioner

1 - PRIMARY CHAIN TENSIONER
2 - ADJUSTABLE PLIERS
3 - SPECIAL TOOL 8514

TIMING BELT/CHAIN AND SPROCKETS (Continued)

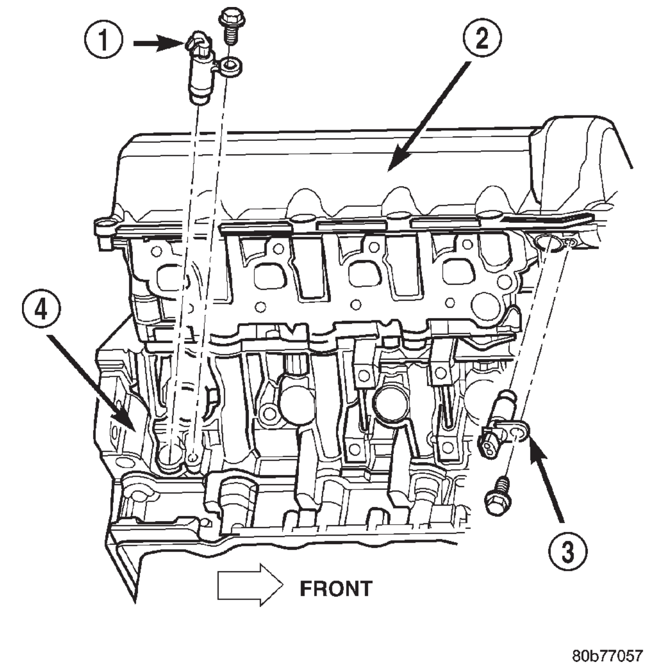


Fig. 124 Camshaft Position Sensor—Removal

1 - CRANKSHAFT POSITION SENSOR
2 - CYLINDER HEAD COVER
3 - CAMSHAFT POSITION SENSOR
4 - RIGHT SIDE CYLINDER BLOCK

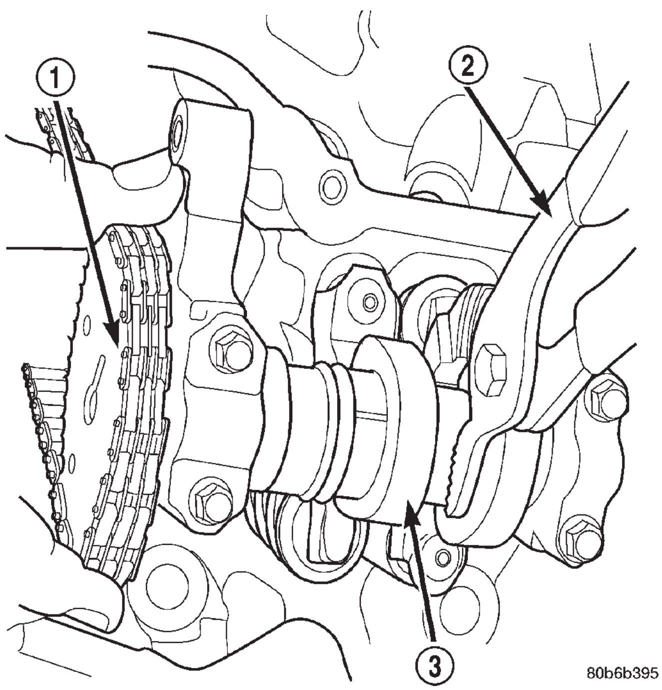


Fig. 125 Camshaft Rotation—Left Side

1 - CAMSHAFT SPROCKET AND CHAIN
2 - ADJUSTABLE PLIERS
3 - CAMSHAFT

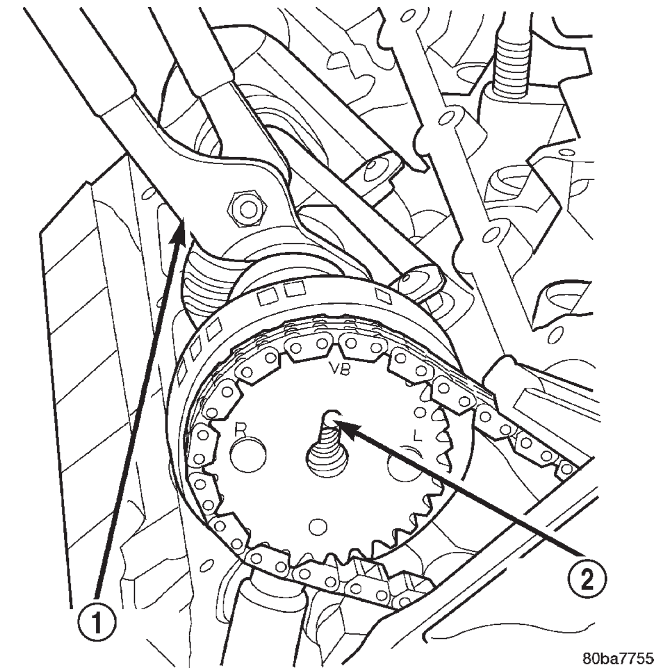


Fig. 126 Camshaft Rotation—Right Side

1 - ADJUSTABLE PLIERS
2 - CAMSHAFT DOWEL

INSPECTION

Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner and tensioner arm should be replaced.
- Primary chain tensioner plastic faces. Replace as required (Fig. 127).

INSTALLATION

(1) Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner

TIMING BELT/CHAIN AND SPROCKETS (Continued)

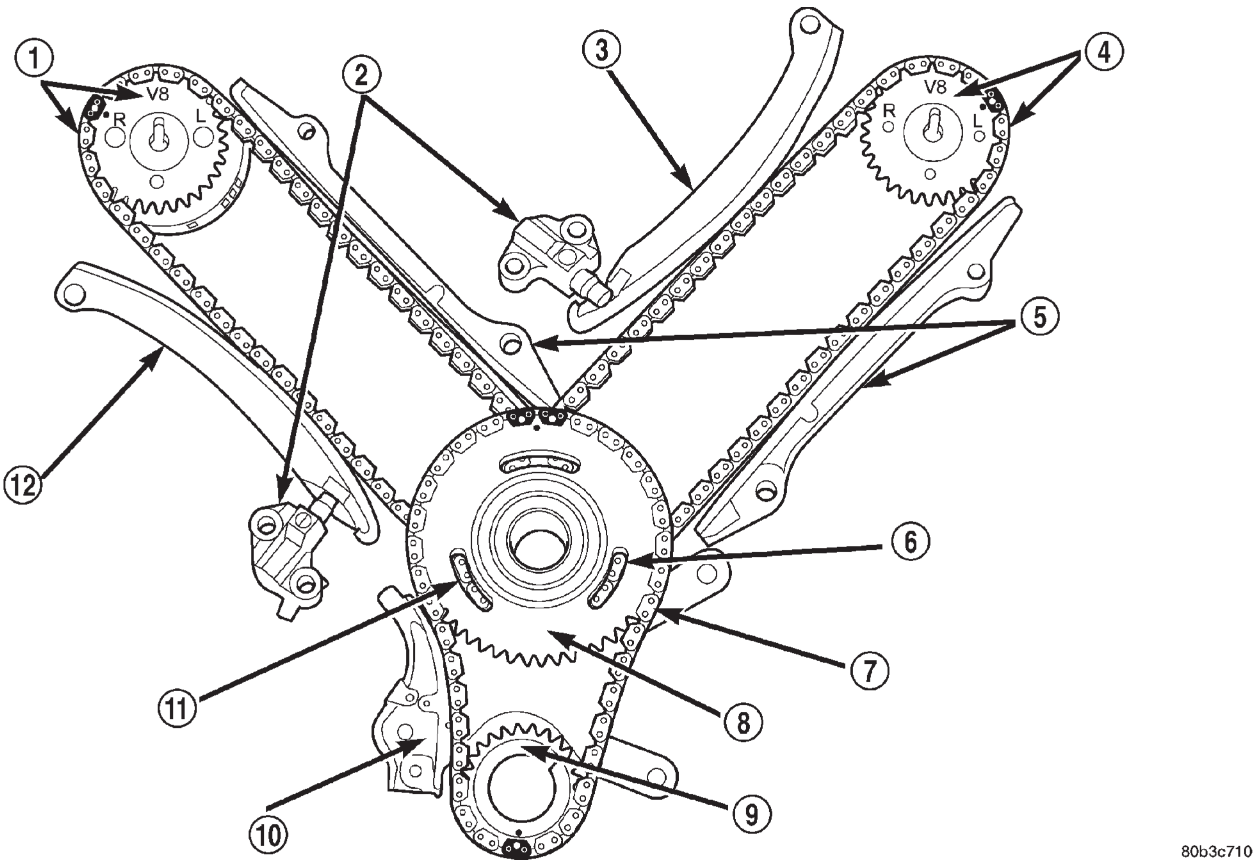


Fig. 127 Timing Chain System

1 - RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN
2 - SECONDARY TIMING CHAIN TENSIONER (LEFT AND RIGHT SIDE NOT COMMON)
3 - SECONDARY TENSIONER ARM
4 - LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN
5 - CHAIN GUIDE
6 - TWO PLATED LINKS ON RIGHT CAMSHAFT CHAIN
7 - PRIMARY CHAIN
8 - IDLER SPROCKET
9 - CRANKSHAFT SPROCKET
10 - PRIMARY CHAIN TENSIONER
11 - TWO PLATED LINKS ON LEFT CAMSHAFT CHAIN
12 - SECONDARY TENSIONER ARM

body. Install Special Tool 8514 lock pin into hole on front of tensioner. Slowly open vise to transfer piston spring force to lock pin (Fig. 128).

(2) Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

(3) Install right side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).

NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

(4) Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

(5) Install left side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).

(6) Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

(7) Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8515 to hold chains in place for installation (Fig. 129).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

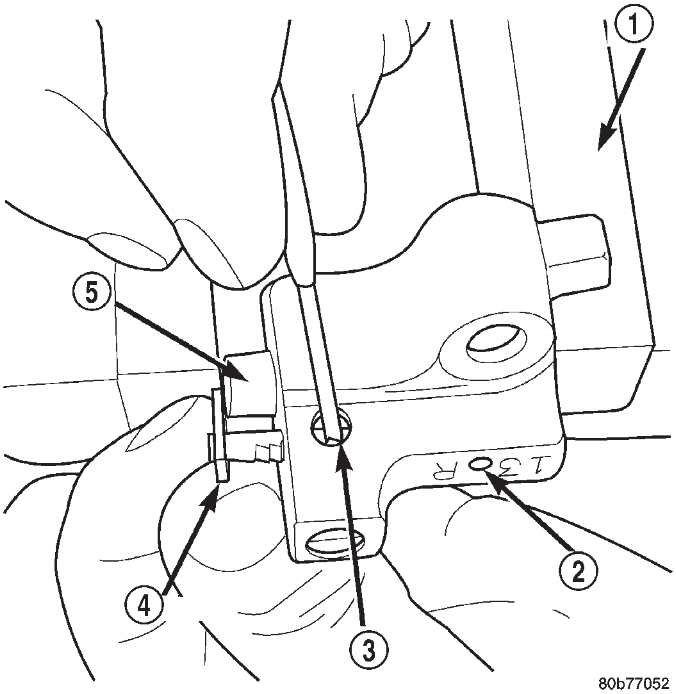


Fig. 128 Resetting Secondary Chain Tensioners

1 - VISE
2 - INSERT LOCK PIN
3 - RATCHET PAWL
4 - RATCHET
5 - PISTON

(8) Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (Fig. 127).

(9) Lubricate idler shaft and bushings with clean engine oil.

(10) Install all chains, crankshaft sprocket, and idler sprocket as an assembly (Fig. 130). After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

(11) Align left camshaft sprocket "L" dot to plated link on chain.

(12) Align right camshaft sprocket "R" dot to plated link on chain.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

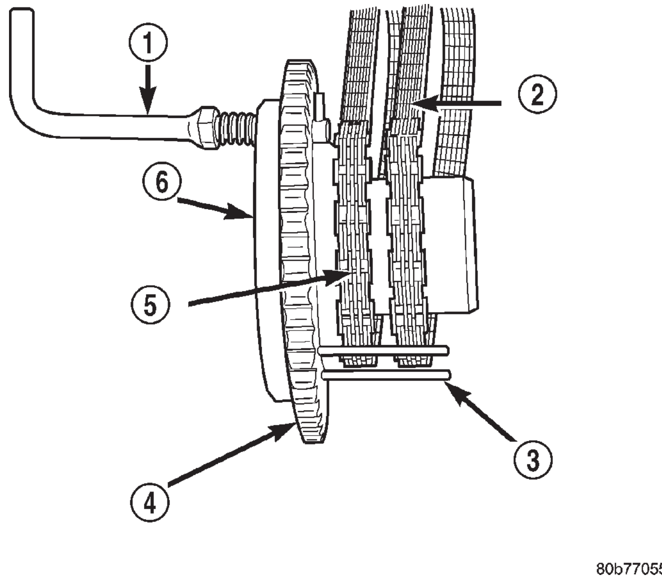


Fig. 129 Installing Secondary Timing Chains on Idler Sprocket

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8515

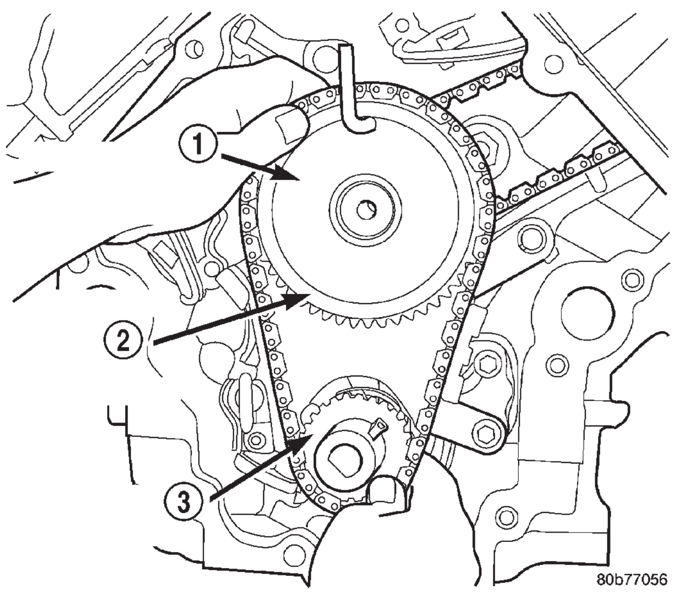


Fig. 130 Installing Idler Gear, Primary and Secondary Timing Chains

1 - SPECIAL TOOL 8515
2 - PRIMARY CHAIN IDLER SPROCKET
3 - CRANKSHAFT SPROCKET

TIMING BELT/CHAIN AND SPROCKETS (Continued)

(13) Remove Special Tool 8515, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.

(14) Verify that all plated links are aligned with the marks on all sprockets and the “V8” marks on camshaft sprockets are at the 12 o’clock position (Fig. 127).

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

(15) Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

(16) Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).

(17) Remove all locking pins (3) from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

(18) Using Special Tool 6958, Spanner with Adaptor Pins 8346, tighten left (Fig. 131) and right (Fig. 132). camshaft sprocket bolts to 122 N·m (90 ft. lbs.).

(19) Rotate engine two full revolutions. Verify timing marks are at the follow locations:

• primary chain idler sprocket dot is at 12 o’clock (Fig. 127)

• primary chain crankshaft sprocket dot is at 6 o’clock (Fig. 127)

• secondary chain camshaft sprockets “V8” marks are at 12 o’clock (Fig. 127)

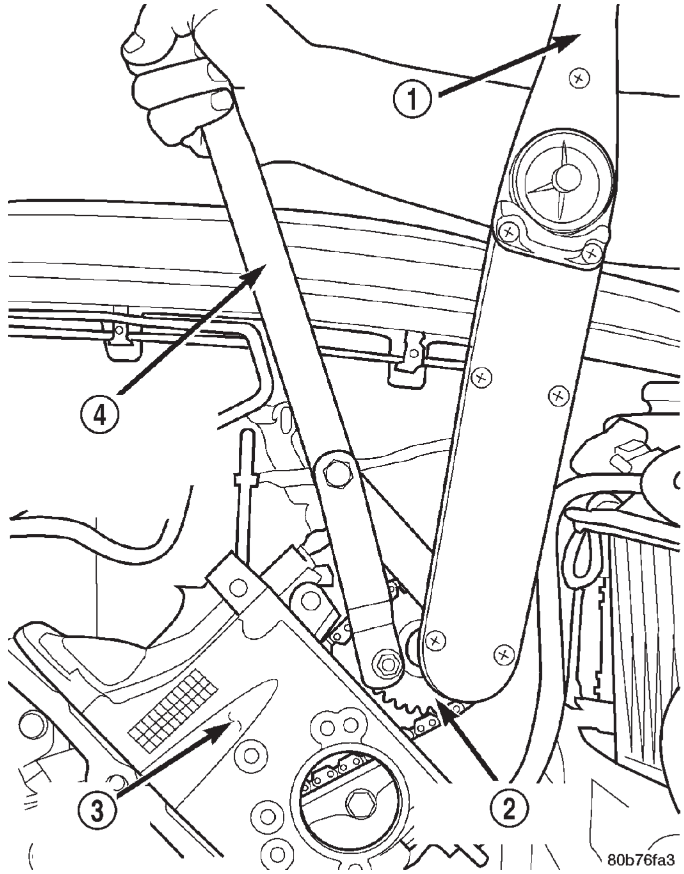


Fig. 131 Tightening Left Side Camshaft Sprocket Bolt

1 - TORQUE WRENCH
2 - CAMSHAFT SPROCKET
3 - LEFT CYLINDER HEAD
4 - SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

(20) Lubricate all three chains with engine oil.

(21) After installing all chains, it is recommended that the idler gear end play be checked (Fig. 133). The end play must be within 0.10–0.25 mm (0.004–0.010 in.). If not within specification, the idler gear must be replaced.

TIMING BELT/CHAIN AND SPROCKETS (Continued)

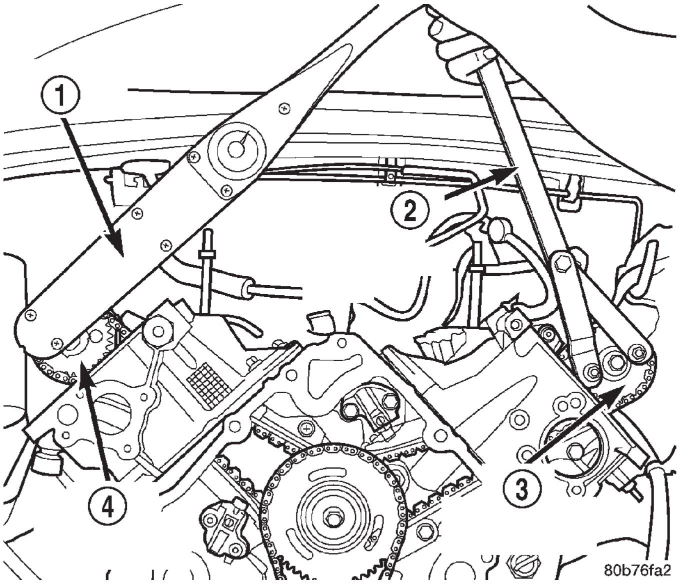


Fig. 132 Tightening Right Side Camshaft Sprocket Bolt

1 - TORQUE WRENCH
2 - SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 - LEFT CAMSHAFT SPROCKET
4 - RIGHT CAMSHAFT SPROCKET

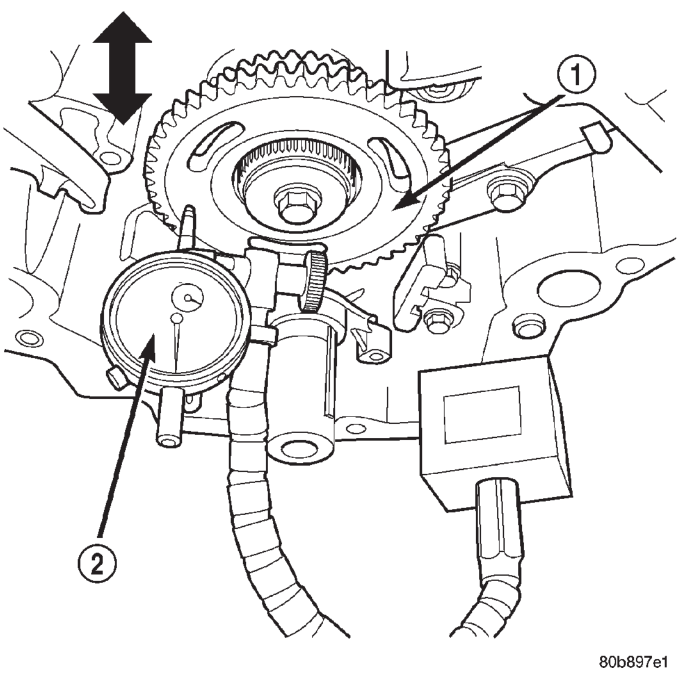


Fig. 133 Measuring Idler Gear End Play

1 - IDLER SPROCKET ASSEMBLY
2 - DIAL INDICATOR

(22) Install timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION) and crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(23) Install cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

(24) Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head and tighten to 81 N·m (60 ft. lbs.) (Fig. 122).

(25) Install the oil fill housing.

(26) Install access plug in left cylinder head (Fig. 122).

(27) Install power steering pump.

(28) Install radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(29) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(30) Connect negative cable to battery.

EXHAUST SYSTEM

TABLE OF CONTENTS

EXHAUST SYSTEM

DESCRIPTION - EXHAUST SYSTEM

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The exhaust system uses a single muffler with a welded tailpipe.

The 50 State Emissions vehicles use two mini catalytic converters inline with the exhaust pipe below the exhaust manifolds.

The exhaust manifolds are equipped with ball flange outlets to assure a tight seal and strain free connections.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it may amplify objectionable noises originating from the engine or body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or their equivalent). This will assure proper alignment and provide acceptable exhaust noise levels.

The basic exhaust system consists of exhaust manifold(s), exhaust pipe with oxygen sensors, catalytic converter(s), heat shield(s), muffler and tailpipe (Fig. 1) and (Fig. 2).

EXHAUST SYSTEM (Continued)

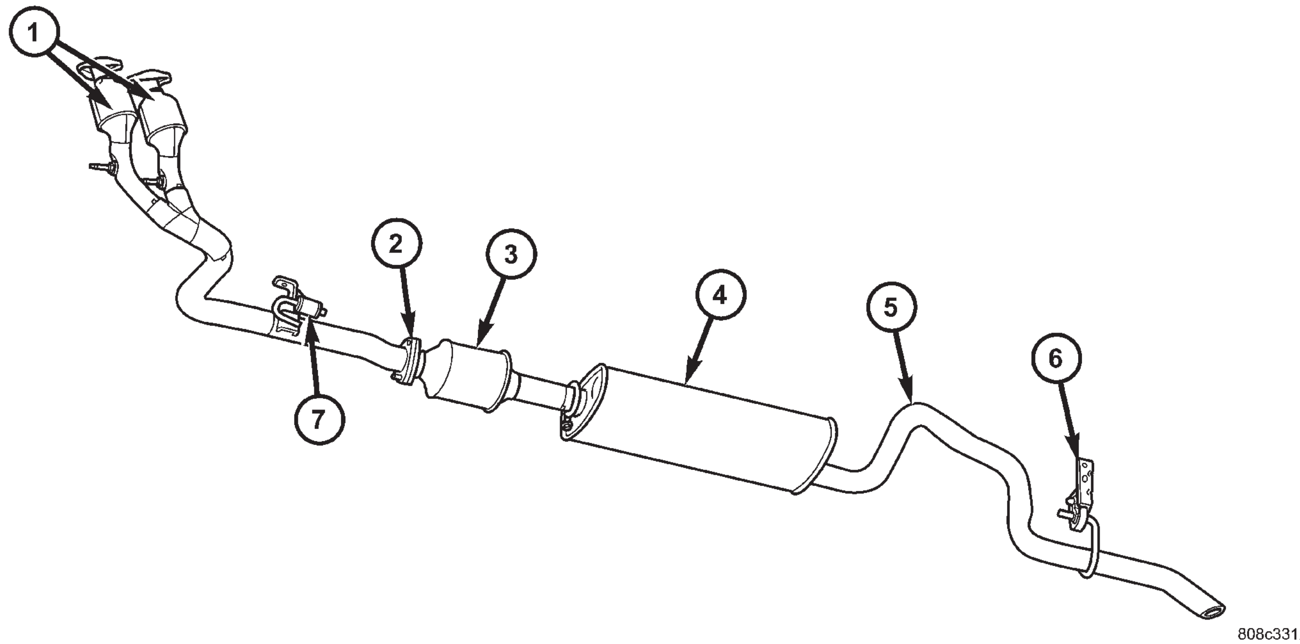


Fig. 1 Exhaust System—4.0L

1 - MINI CONVERTERS (2)
2 - CATALYTIC CONVERTER TO EXHAUST PIPE FLANGE JOINT
3 - CATALYTIC CONVERTER
4 - MUFFLER
5 - TAILPIPE
6 - TAILPIPE HANGER REAR MOUNT INSULATOR
7 - EXHAUST PIPE HANGER AND MOUNT INSULATOR

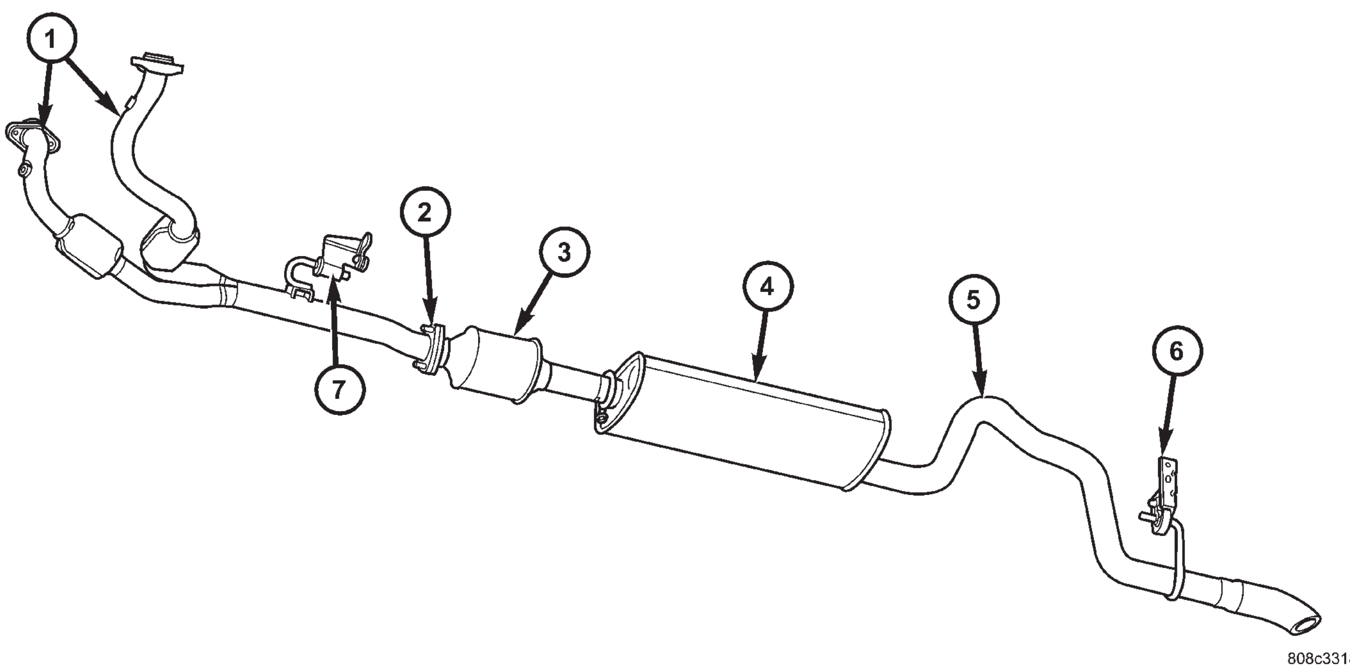


Fig. 2 Exhaust System—4.7L

1 - EXHAUST PIPE WITH CATALYTIC CONVERTERS
2 - EXHAUST PIPE TO CATALYTIC CONVERTER FLANGE JOINT
3 - CATALYTIC CONVERTER
4 - MUFFLER
5 - TAILPIPE
6 - TAILPIPE HANGER REAR MOUNT INSULATOR
7 - EXHAUST PIPE HANGER AND MOUNT INSULATOR

EXHAUST SYSTEM (Continued)

DIAGNOSIS AND TESTING - EXHAUST SYSTEM

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE	1. Leaks at pipe joints.	1. Tighten clamps to specified torque at leaking joints (Refer to 11 - EXHAUST SYSTEM - SPECIFICATIONS).
	2. Burned or blown out muffler.	2. Replace muffler assembly (Refer to 11 - EXHAUST SYSTEM/ MUFFLER - REMOVAL). Check exhaust system.
	3. Burned or rusted-out exhaust pipe.	3. Replace exhaust pipe (Refer to 11 - EXHAUST SYSTEM/EXHAUST PIPE - REMOVAL).
	4. Exhaust pipe leaking at manifold flange.	4. Tighten connection attaching nuts (Refer to 11 - EXHAUST SYSTEM - SPECIFICATIONS).
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold (Refer to 9 - ENGINE/MANIFOLDS/ EXHAUST MANIFOLD - REMOVAL).
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head stud nuts or bolts (Refer to 9 - ENGINE - SPECIFICATIONS).
	7. Restriction in muffler or tailpipe.	7. Remove restriction, if possible. Replace muffler or tailpipe, as necessary.
	8. Exhaust system contacting body or chassis.	8. Re-align exhaust system to clear surrounding components.
LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten/replace clamps at leaking joints (Refer to 11 - EXHAUST SYSTEM - SPECIFICATIONS).

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Catalytic Converter-to-Exhaust Pipe—Nuts	28	—	250
Exhaust Pipe-to-Manifold—Nuts	31	23	—
Heat Shield Retaining—Nuts	2.0	—	20

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Muffler-to-Catalytic Converter U-bolt clamp	47	35	—
Rear Tailpipe Hanger—Bolts	22	—	192

CATALYTIC CONVERTER - 4.0L

DESCRIPTION - CATALYTIC CONVERTER 4.0L ENGINE

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

CAUTION: DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

Unleaded gasoline must be used to avoid contaminating the catalyst core.

50 State emission vehicles incorporate two mini catalytic converters located after the exhaust manifolds and before the inline catalytic converter (Fig. 3).

REMOVAL

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

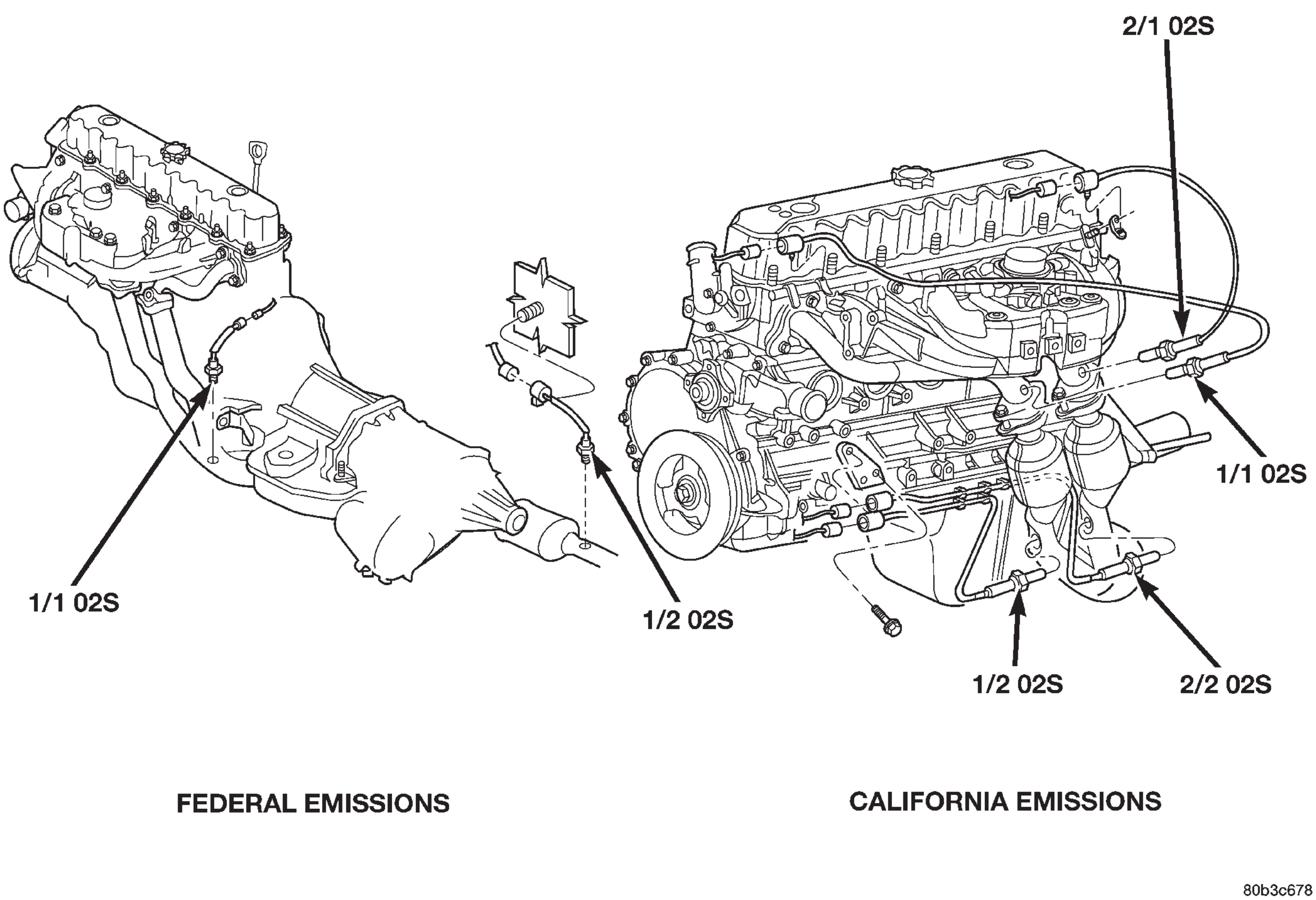


Fig. 3 4.0L Catalytic Converter and O2 Sensor Configuration - 50 State Emissions

CATALYTIC CONVERTER - 4.0L (Continued)

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove nuts from the catalytic converter and exhaust pipe flange connection (Fig. 4).

(4) Loosen exhaust clamp from the catalytic converter and muffler connection (Fig. 4).

(5) Disconnect oxygen sensor wiring (Fig. 4).

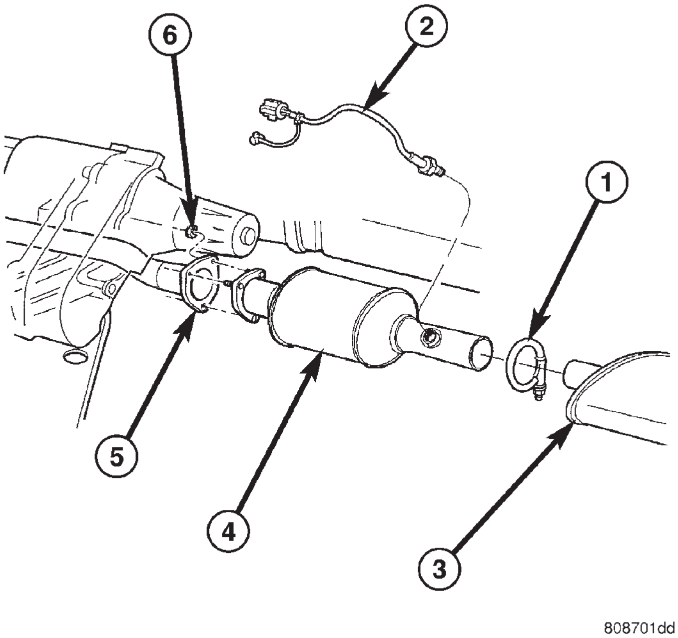


Fig. 4 Exhaust Pipe-to-Catalytic Converter-to-Muffler Connection

1 - EXHAUST CLAMP ASSEMBLY
2 - OXYGEN SENSOR
3 - MUFFLER
4 - CATALYTIC CONVERTER
5 - EXHAUST PIPE WITH FLANGE JOINT
6 - NUTS (3)

(6) Heat the catalytic converter to muffler connection with a torch until the metal becomes cherry red.

(7) While the metal is still cherry red, twist the catalytic converter back and forth to separate it from the exhaust pipe and the muffler (Fig. 5).

INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

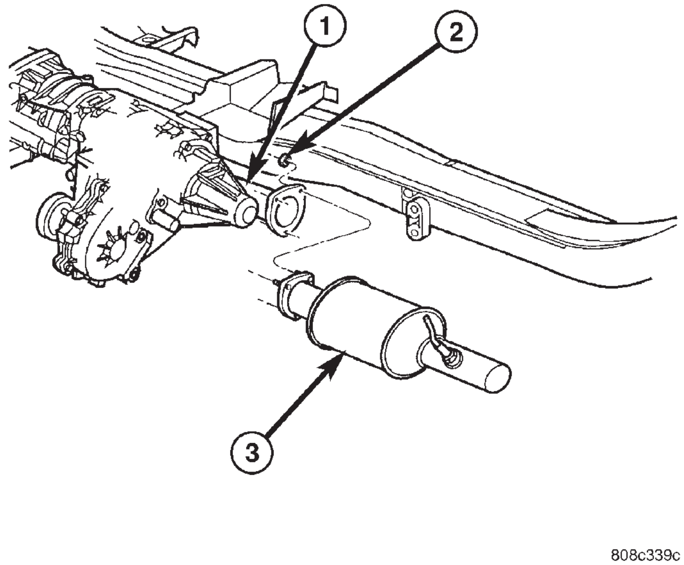


Fig. 5 Catalytic Converter—Removal

1 - EXHAUST PIPE WITH FLANGE
2 - NUTS (3)
3 - CATALYTIC CONVERTER

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

INSTALLATION

(1) Position the catalytic converter onto the exhaust pipe flange connection (Fig. 4). Tighten the nuts to 28 N·m (250 in. lbs.) torque.

(2) Install the muffler onto the catalytic converter until the alignment tab is inserted into the alignment slot.

(3) Install the exhaust clamp at the muffler and catalytic converter connection (Fig. 4). Tighten the clamp nuts to 47 N·m (35 ft. lbs.) torque.

(4) Connect oxygen sensor wiring (Fig. 4).

(5) Lower the vehicle.

(6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

CATALYTIC CONVERTER - 4.7L

DESCRIPTION - CATALYTIC CONVERTER

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

CAUTION: DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

Unleaded gasoline must be used to avoid contaminating the catalyst core.

50 State emission vehicles incorporate two mini catalytic converters located after the exhaust manifolds and before the inline catalytic converter (Fig. 6).

REMOVAL

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

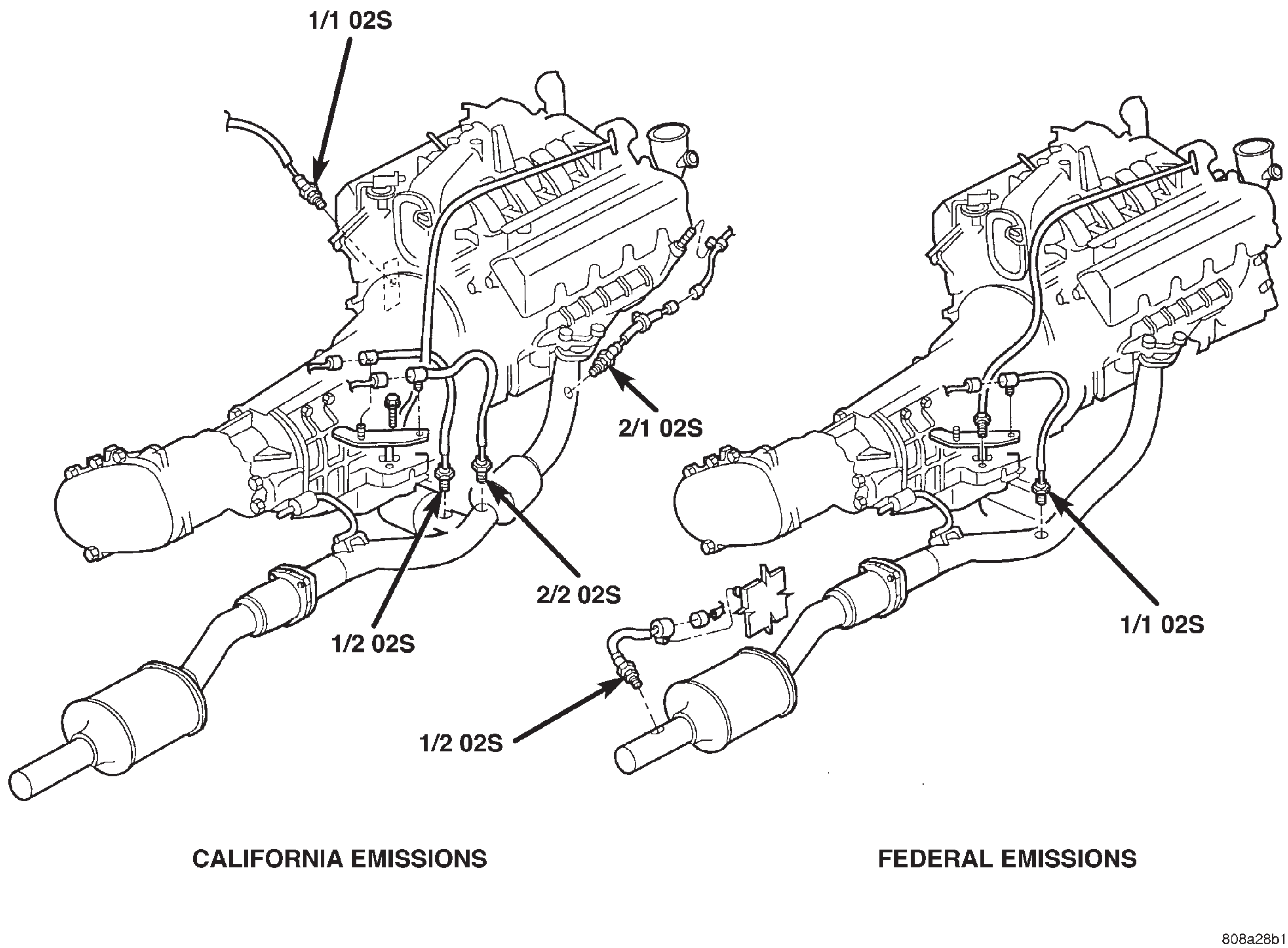


Fig. 6 4.7L Catalytic Converter and O2 Sensor Configuration - 50 State Emissions

CATALYTIC CONVERTER - 4.7L (Continued)

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove nuts from the catalytic converter and exhaust pipe flange connection (Fig. 7).

(4) Loosen exhaust clamp from the catalytic converter and muffler connection (Fig. 7).

(5) Disconnect oxygen sensor wiring (Fig. 7).

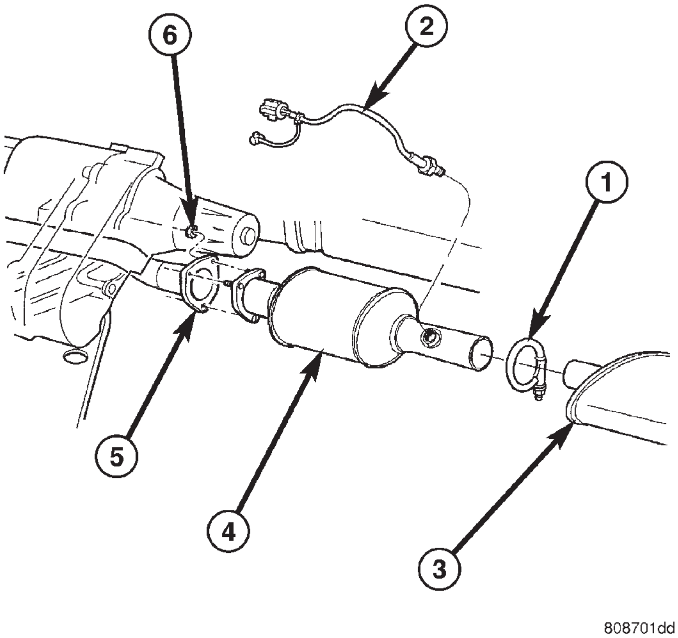


Fig. 7 Exhaust Pipe-to-Catalytic Converter-to-Muffler Connection

1 - EXHAUST CLAMP ASSEMBLY
2 - OXYGEN SENSOR
3 - MUFFLER
4 - CATALYTIC CONVERTER
5 - EXHAUST PIPE WITH FLANGE JOINT
6 - NUTS (3)

(6) Heat the catalytic converter to muffler connection with a torch until the metal becomes cherry red.

(7) While the metal is still cherry red, twist the catalytic converter back and forth to separate it from the muffler (Fig. 8).

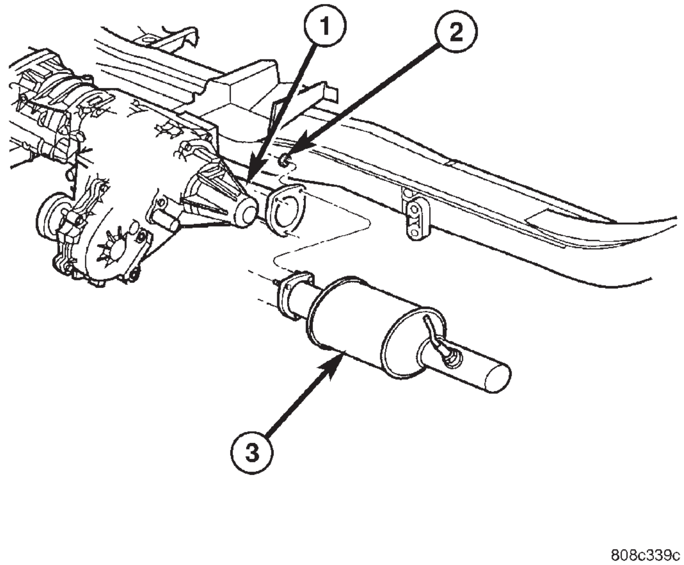


Fig. 8 Catalytic Converter—Removal

1 - EXHAUST PIPE WITH FLANGE
2 - NUTS (3)
3 - CATALYTIC CONVERTER

INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

INSTALLATION

(1) Position the catalytic converter onto the exhaust pipe flange connection (Fig. 7). Tighten the nuts to 28 N·m (250 in. lbs.) torque.

(2) Install the muffler onto the catalytic converter until the alignment tab is inserted into the alignment slot.

(3) Install the exhaust clamp at the muffler and catalytic converter connection (Fig. 7). Tighten the clamp nuts to 47 N·m (35 ft. lbs.) torque.

(4) Connect oxygen sensor wiring (Fig. 7).

(5) Lower the vehicle.

(6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

EXHAUST PIPE - 4.0L

REMOVAL

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the oxygen sensor from the exhaust pipe (Fig. 9).

(4) Remove the nuts from the exhaust pipe to catalytic converter flange connection (Fig. 10).

(5) Disconnect the exhaust pipe from the exhaust manifold (Fig. 11).

INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

INSTALLATION

(1) Connect the exhaust pipe to the engine exhaust manifold. Tighten the nuts to 31 N·m (23 ft. lbs.) (Fig. 11).

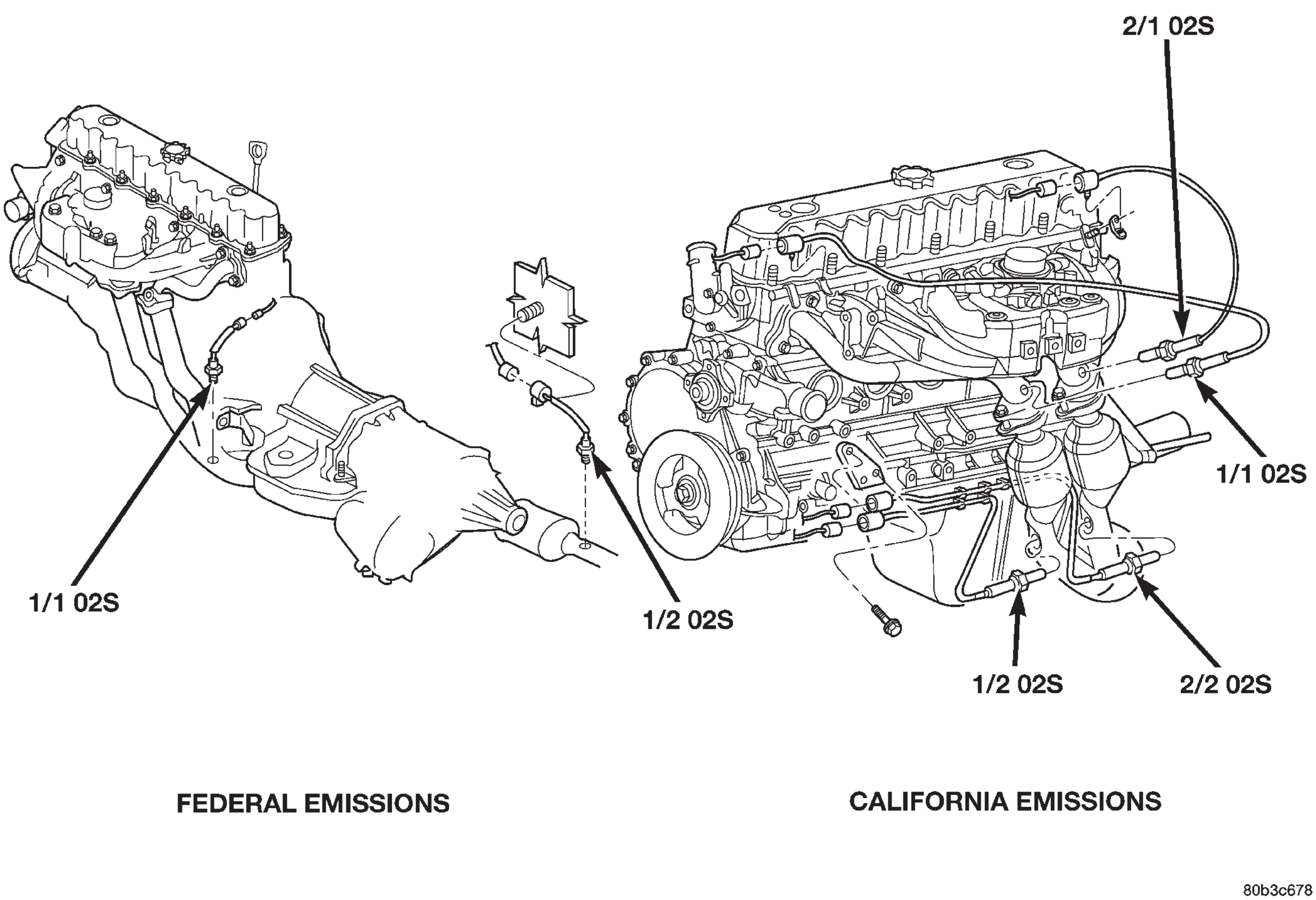


Fig. 9 O2 Sensor Location 4.0L

EXHAUST PIPE - 4.0L (Continued)

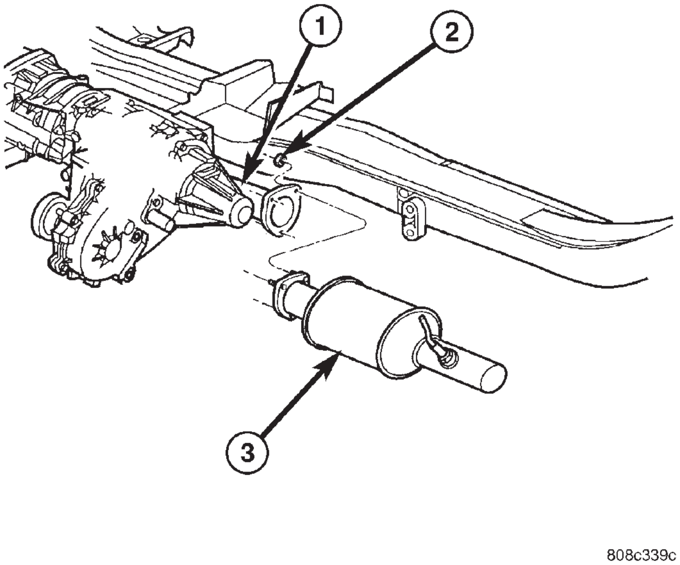


Fig. 10 Catalytic Converter—Removal

1 - EXHAUST PIPE WITH FLANGE
2 - NUTS (3)
3 - CATALYTIC CONVERTER

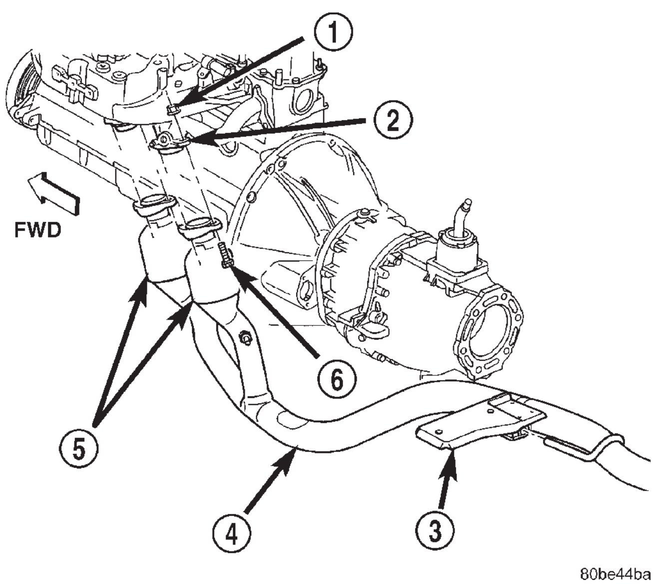


Fig. 11 Exhaust Pipe 4.0L

1 - NUT
2 - EXHAUST MANIFOLD
3 - TRANSMISSION SUPPORT
4 - EXHAUST PIPE
5 - MINI CATALYTIC CONVERTER
6 - BOLT

NOTE: When servicing the exhaust system, replace the factory installed uni-clamp with standard u-bolt clamps.

(2) Position the catalytic converter onto the exhaust pipe flange connection. Tighten retaining nuts to 28 N·m (250 in. lbs.) (Fig. 12).

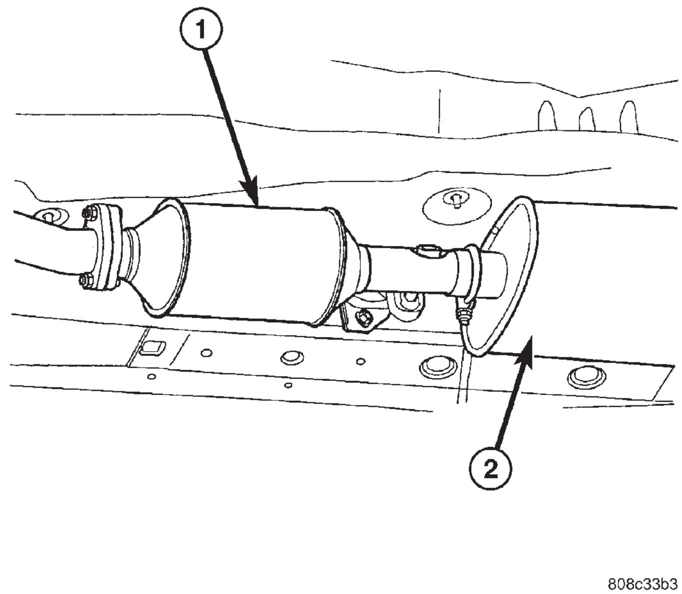


Fig. 12 Installing Exhaust Clamps

1 - CATALYTIC CONVERTER
2 - MUFFLER

(3) Coat the oxygen sensor with anti-seize compound. Install the sensor and tighten the nut to 48 N·m (35 ft. lbs.) torque (Fig. 9).

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

(6) After initial start-up, check the engine exhaust manifold to exhaust pipe nuts for proper torque.

EXHAUST PIPE - 4.7L

REMOVAL

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the oxygen sensor from the exhaust pipe (Fig. 13).

(4) Remove the retaining nuts holding catalytic converter to exhaust pipe (Fig. 14).

(5) Disconnect the exhaust pipe from the exhaust manifold. (Fig. 15)

INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

INSTALLATION

(1) Connect the exhaust pipe to the engine exhaust manifold. Tighten the nuts (A) to 31 N·m (23 ft. lbs.) (Fig. 15).

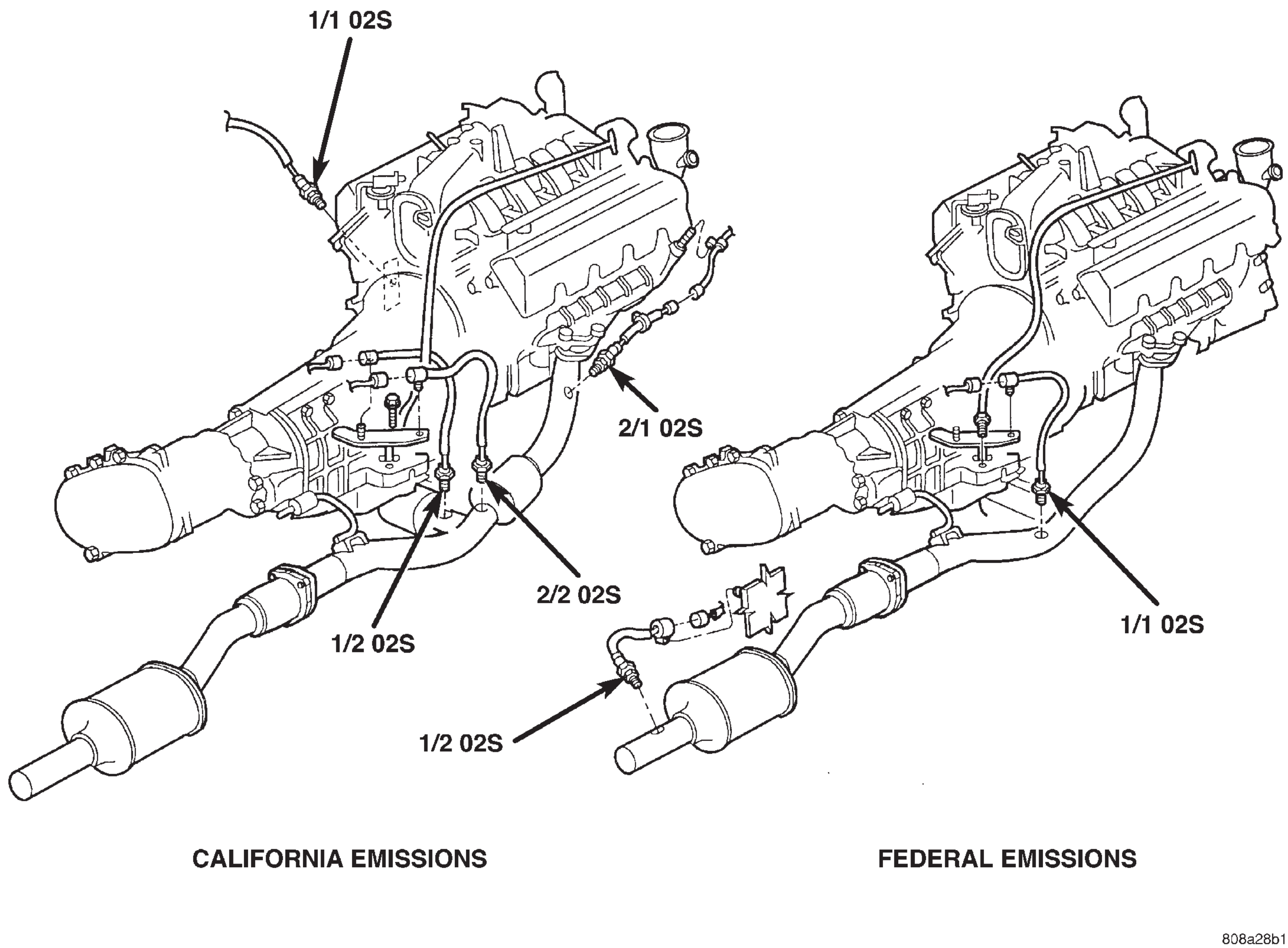


Fig. 13 4.7L Catalytic Converter and O2 Sensor Configuration - 50 State Emissions

EXHAUST PIPE - 4.7L (Continued)

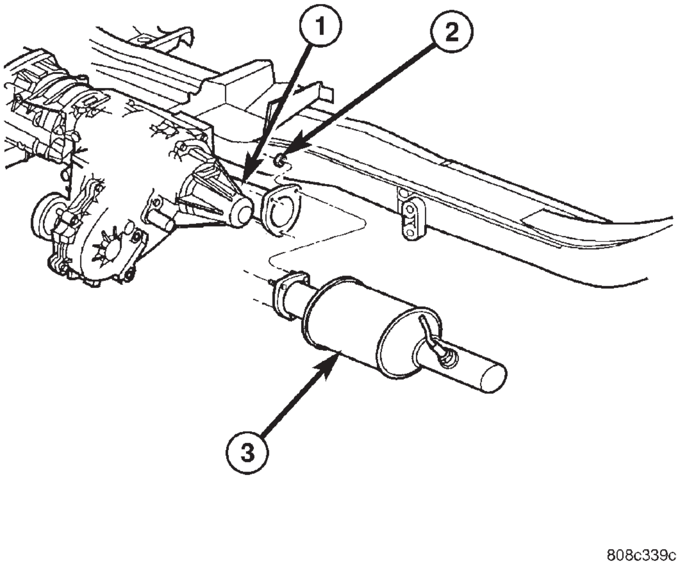


Fig. 14 Catalytic Converter—Removal

1 - EXHAUST PIPE WITH FLANGE
2 - NUTS (3)
3 - CATALYTIC CONVERTER

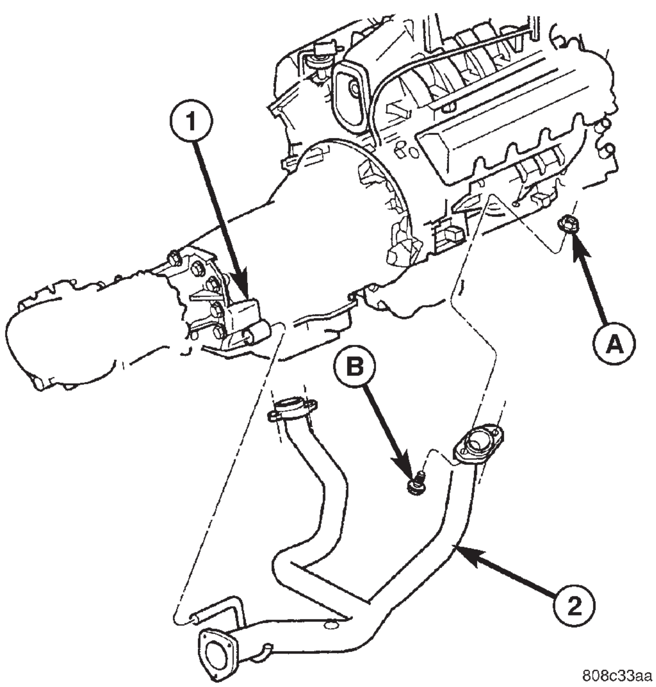


Fig. 15 Exhaust Pipe 4.7L

1 - EXHAUST PIPE HANGER
A - NUTS (4)
3 - EXHAUST PIPE
B - BOLTS (4)

NOTE: When servicing the exhaust system, replace the factory installed uni-clamp with standard u-bolt clamps.

(2) Position the catalytic converter onto the exhaust pipe flange connection. Tighten retaining nuts to 28 N·m (250 in. lbs.). (Fig. 16)

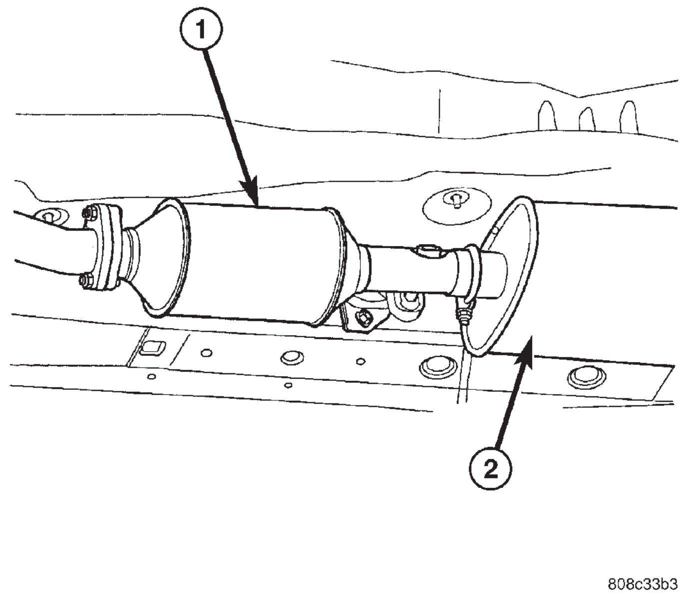


Fig. 16 Installing Exhaust Clamps

1 - CATALYTIC CONVERTER
2 - MUFFLER

(3) Coat the oxygen sensor with anti-seize compound. Install the sensor and tighten the nut to 48 N·m (35 ft. lbs.) torque (Fig. 13).

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

(6) After initial start-up, check the engine exhaust manifold to exhaust pipe nuts for proper torque.

HEAT SHIELDS

DESCRIPTION

Heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter. The catalytic converter releases additional heat into the exhaust system. Under severe operating conditions, the temperature increases in the area of the converter. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency (Fig. 17).

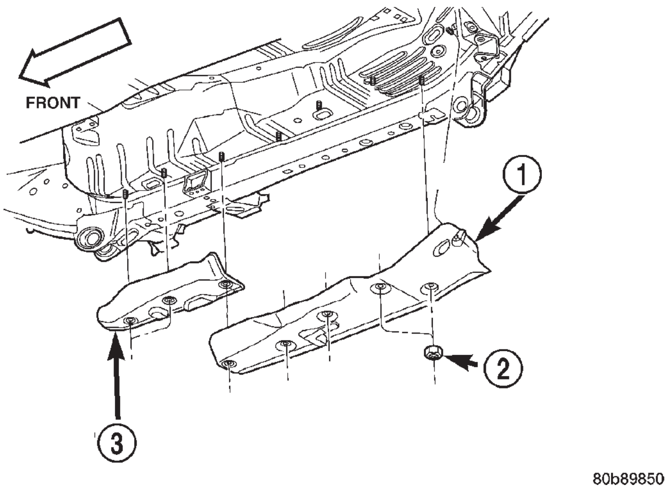


Fig. 17 Front and Rear Floor Pan Heat Shields Typical

1 - REAR FLOOR PAN HEAT SHIELD
2 - HEAT SHIELD RETAINING NUTS (QTY 8)
3 - FRONT FLOOR PAN HEAT SHIELD

MUFFLER

DESCRIPTION

Both the 4.0L and 4.7L engines use a stainless steel muffler to control exhaust noise levels and exhaust back pressure. The muffler and tailpipe are a one piece assembly (Fig. 18).

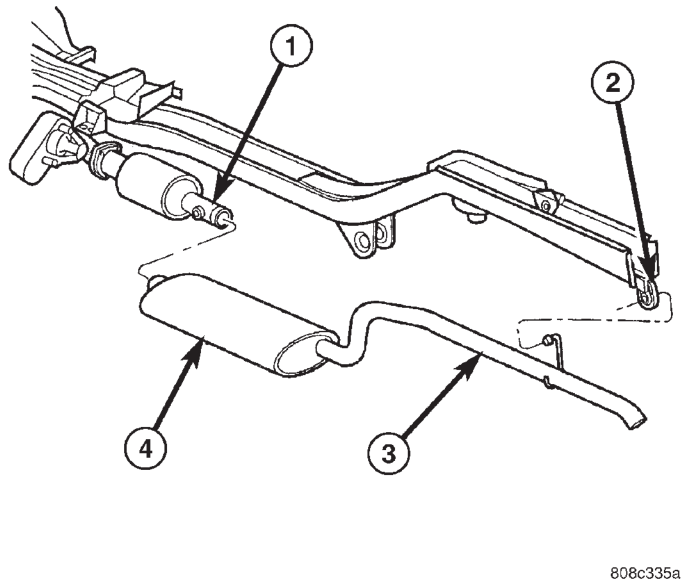


Fig. 18 Muffler and Tailpipe

1 - CATALYTIC CONVERTER
2 - TAILPIPE HANGER
3 - TAILPIPE
4 - MUFFLER

REMOVAL

All original equipment exhaust systems are manufactured with the tailpipe welded to the muffler. Service replacement mufflers and tailpipes are either clamped together or welded together.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

(1) Raise and support the vehicle.
(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
(3) Loosen the exhaust clamp on the catalytic converter to muffler connection (Fig. 19).
(4) Heat the catalytic converter-to-muffler connection with a torch until the metal becomes cherry red.
(5) While the metal is still cherry red, remove the tailpipe/muffler assembly from the catalytic converter.
(6) Remove the tailpipe from the tailpipe hanger (Fig. 20).
(7) Remove the tailpipe/muffler assembly (Fig. 20).

INSTALLATION

(1) If the tailpipe hanger assembly was removed, install the hanger to the frame. Tighten the bolts to 22 N·m (192 in. lbs.) torque.
(2) Position the tailpipe and muffler onto the tailpipe hanger (Fig. 20) .
(3) Install the muffler onto the catalytic converter. Make sure that the tailpipe has sufficient clearance from the floor pan. Install exhaust clamp and tighten the nuts to 47 N·m (35 ft. lbs.) torque (Fig. 19) .
(4) Lower the vehicle.
(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

MUFFLER (Continued)

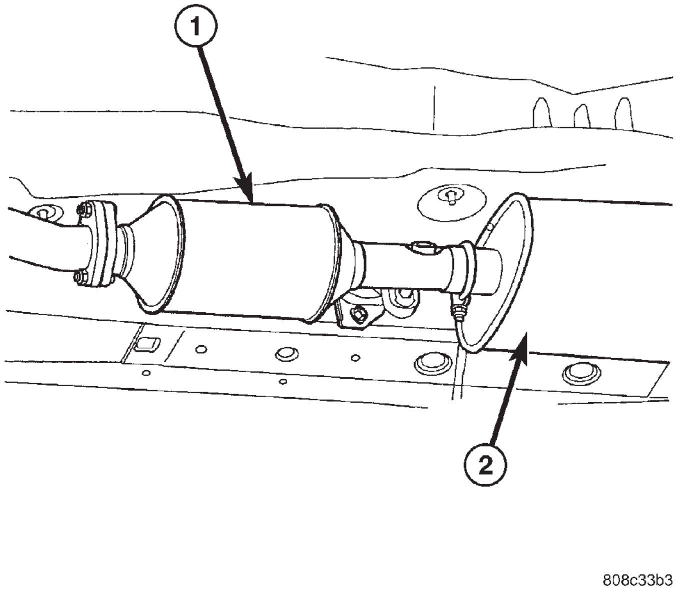


Fig. 19 Installing Exhaust Clamps

1 - CATALYTIC CONVERTER
2 - MUFFLER

TAILPIPE

DESCRIPTION

The tailpipe is also made of stainless steel. (Fig. 18) .

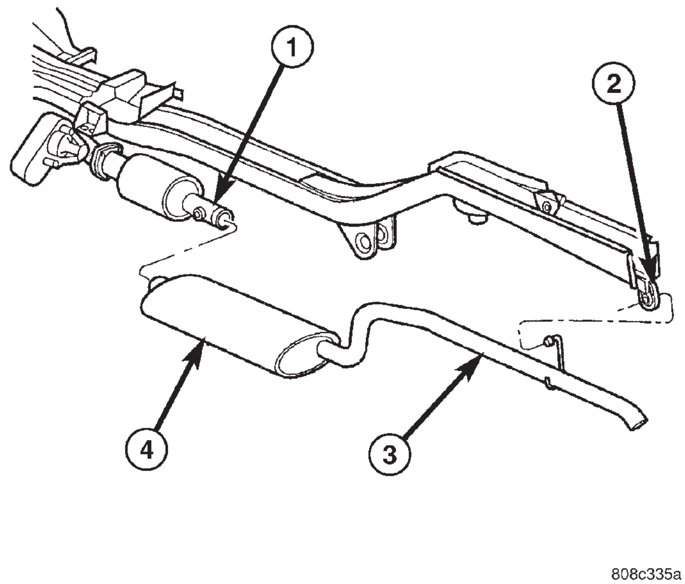


Fig. 20 Muffler and Tailpipe

1 - CATALYTIC CONVERTER
2 - TAILPIPE HANGER
3 - TAILPIPE
4 - MUFFLER

OPERATION

The Tailpipe channels the exhaust out of the muffler and out from under the vehicle to control noise and prevent exhaust gas fumes from entering the passenger compartment

FRAME & BUMPERS

TABLE OF CONTENTS

FRONT ABSORBER

REMOVAL

(1) Remove front fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(2) Remove the retainer attaching the absorber to the fascia.

(3) Separate the absorber from the fascia.

INSTALLATION

(1) Position the absorber on the fascia.

(2) Install the retainer attaching the absorber to the fascia.

(3) Install front fascia. Refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

FRONT FASCIA

REMOVAL

(1) Raise and support vehicle.

(2) Turn front wheels to access rivets and remove plastic rivets attaching fascia to wheel liner.

(3) Remove bolts attaching fascia to fender (Fig. 1).

(4) Remove plastic push pin fasteners attaching front fascia to lower radiator crossmember splash shield (Fig. 2).

(5) Disengage fog lamp connectors, if equipped.

(6) Remove screws attaching fascia/grille to upper radiator crossmember (Fig. 3).

(7) Slide fascia forward to separate from vehicle.

INSTALLATION

(1) Slide fascia onto vehicle engaging fascia with tabs on bottom of front fenders.

(2) Install screws attaching fascia/grille to upper radiator crossmember (Fig. 3).

(3) Install bolts attaching fascia to fender (Fig. 1).

(4) Engage fog lamp connectors, if equipped.

(5) Install plastic rivets attaching fascia to wheel liner.

(6) Install plastic push pin fasteners attaching front fascia to lower radiator crossmember splash shield (Fig. 2).

(7) Remove supports and lower vehicle.

FRONT FASCIA (Continued)

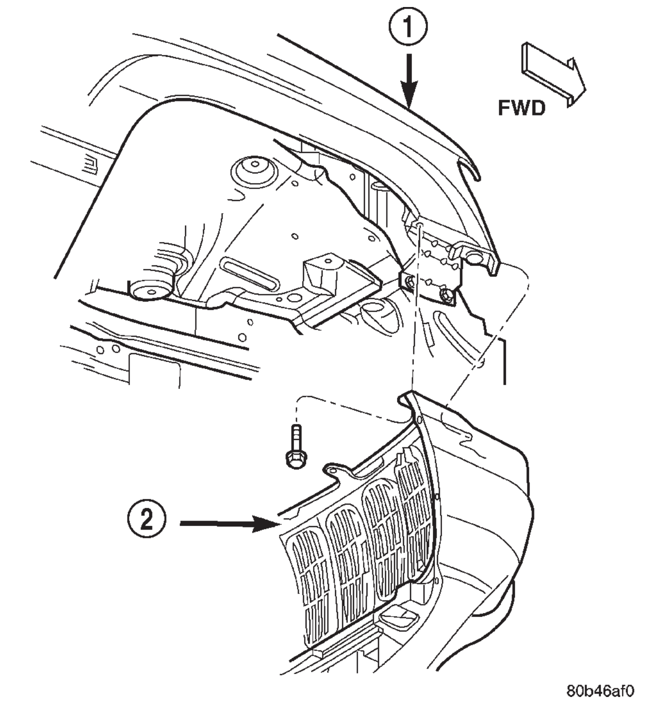


Fig. 1 Front Fascia

1 - BODY
2 - FASCIA

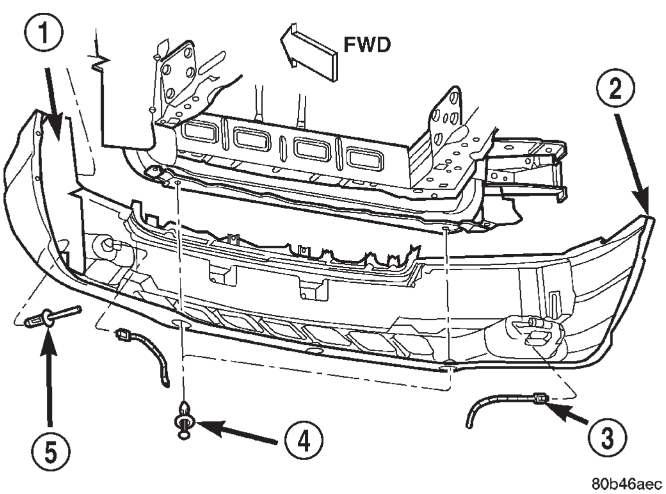


Fig. 2 Front Fascia

1 - WHEEL LINER
2 - FASCIA
3 - FOG LAMP CONNECTOR
4 - PLASTIC PUSH PIN
5 - PLASTIC RIVET

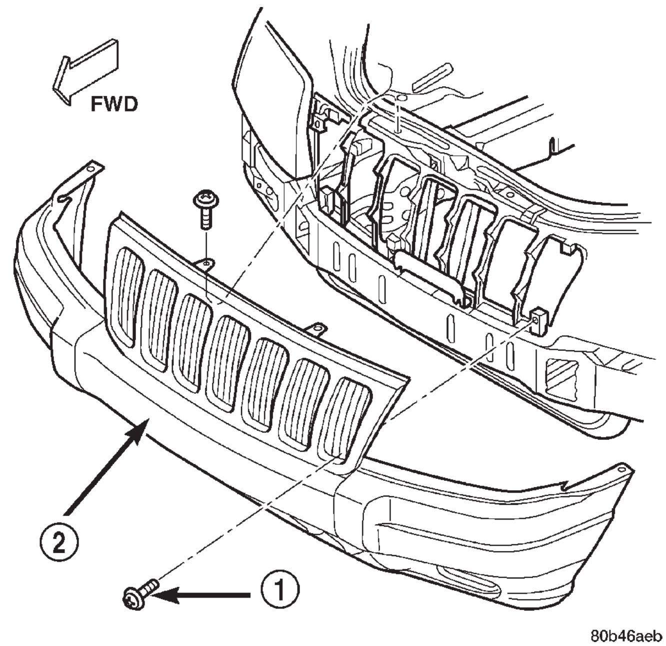


Fig. 3 Front Fascia

1 - SCREW
2 - FASCIA

REAR ABSORBER

REMOVAL

(1) Remove rear fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/REAR FASCIA - REMOVAL).

(2) Remove rivets attaching absorber to rear cross-member (Fig. 5).

(3) Separate absorber from vehicle.

INSTALLATION

(1) Position absorber on vehicle.

(2) Install rivets attaching absorber to rear cross-member (Fig. 2).

(3) Install rear fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/REAR FASCIA - INSTALLATION).

REAR FASCIA

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheels.

(3) Remove plastic push pins attaching fascia to fuel tank skid plate.

(4) Remove plastic rivets attaching fascia to wheel liner.

REAR FASCIA (Continued)

(5) Remove nuts attaching upper edge of fascia to quarter panel and wheel liner (Fig. 4).

(6) Remove plastic push pins attaching fascia to liftgate opening (Fig. 5).

(7) Remove screws attaching fascia to liftgate opening.

(8) Remove D pillar trim and scuff plate outboard screws.

(9) Remove the rearward tie down screws and the aperture trim panel.

(10) Carefully peel back the rubber body sealer patch to access the retainer clips.

(11) Release the forward and rearward retainer clips on both sides of the fascia.

(12) Grasp forward edges of fascia and pull outward to disengage retainers attaching fascia to quarter panel (Fig. 6).

(13) Separate fascia from vehicle.

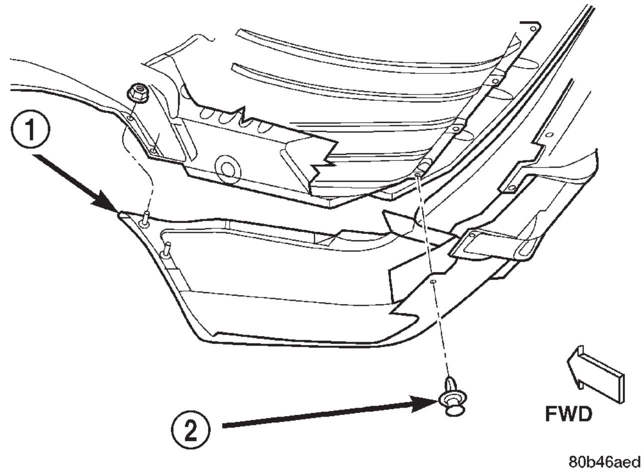


Fig. 4 Rear Fascia Attachment

1 - FASCIA
2 - PLASTIC PUSH PIN

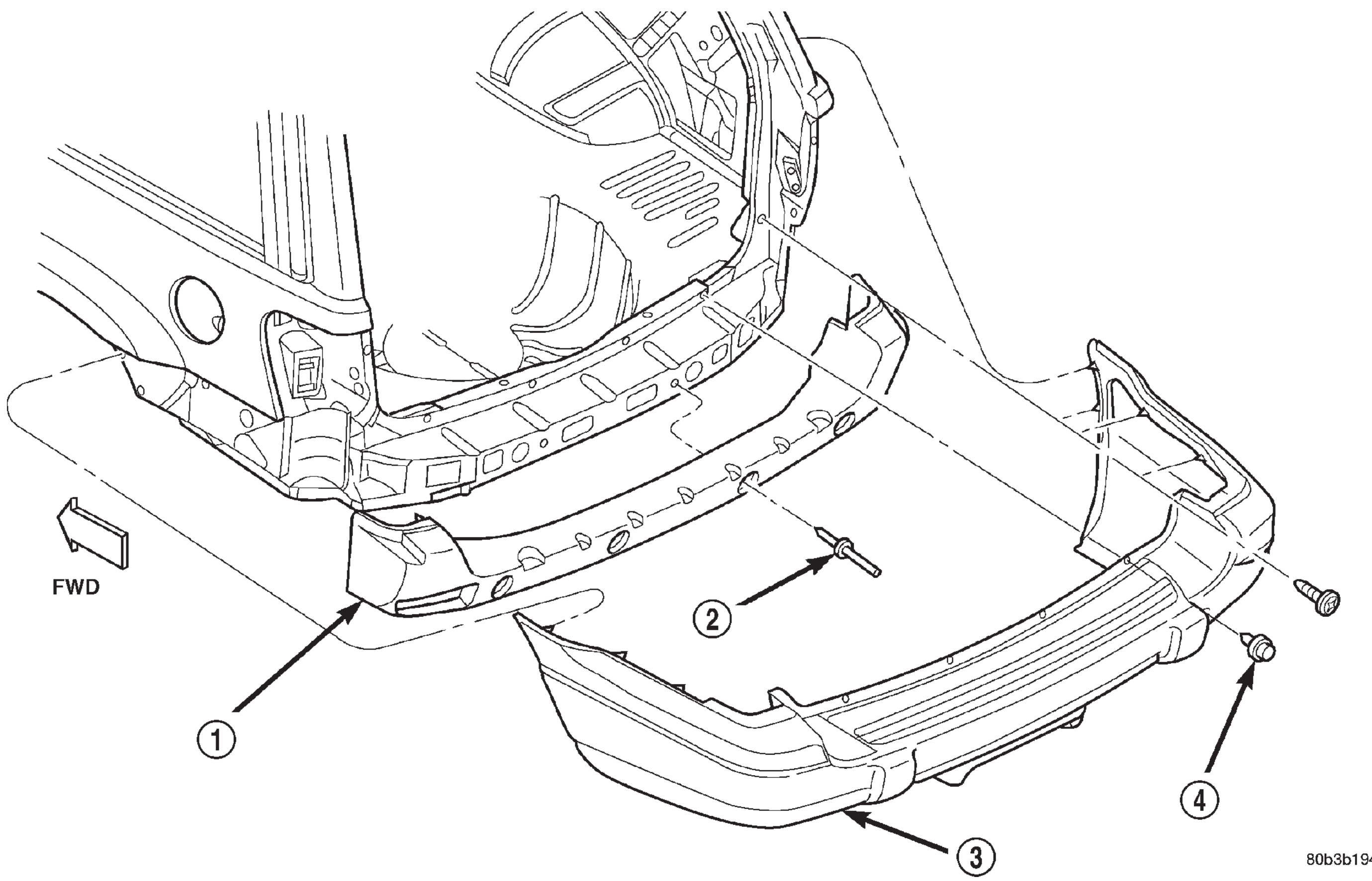


Fig. 5 Rear Fascia

1 - ABSORBER
2 - RIVET
3 - FASCIA
4 - PLASTIC PUSH PIN

REAR FASCIA (Continued)

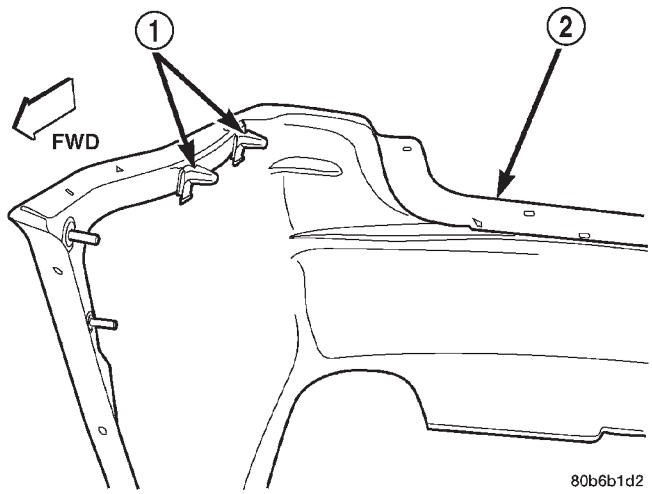


Fig. 6 Rear Fascia Retainers

1 - RETAINER
2 - FASCIA

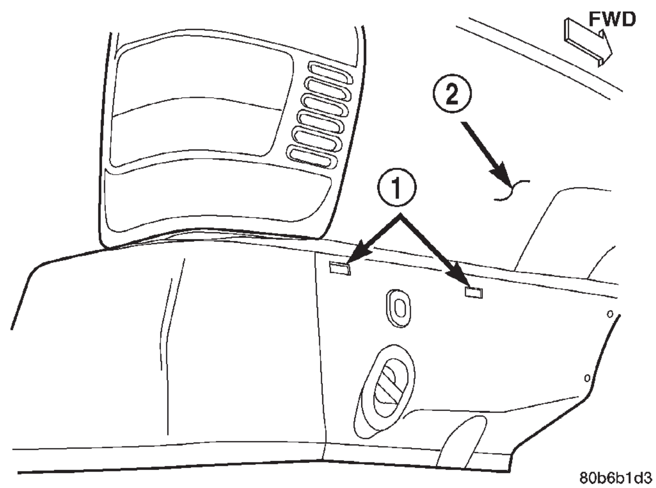


Fig. 7 Fascia Attachment

1 - SLOT
2 - QUARTER PANEL

INSTALLATION

(1) Position fascia on vehicle aligning retainers with slots in quarter panel (Fig. 7).
(2) Press forward edges of fascia inward to engage retainers.
(3) Install screws attaching fascia to liftgate opening.
(4) Install plastic push pins attaching fascia to liftgate opening.
(5) Install nuts attaching upper edge of fascia to quarter panel and wheel liner.
(6) Install plastic rivets attaching fascia to wheel liner.
(7) Install support lower vehicle.
(8) Install plastic push pins attaching fascia to fuel tank skid plate.
(9) Install the interior trim panels removed to access fascia retainers.
(10) Install tie down loop screws.
(11) Install the wheels, refer to section 22 for tightening sequence and torque specifications.

FRAME

SPECIFICATIONS

SPECIFICATIONS - TORQUE

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Front Tow Hook Bolt	54	40	—
Front Skid Plate Bolt	54	40	—
Rear Tow Hook Bolt	68	50	—
Trailer Hitch Bolts	68	50	—
Transfer Case Skid Plate Bolts	34	25	—

FRAME DIMENSIONS

INDEX

DESCRIPTION	FIGURE
SIDE VIEW	8
BOTTOM VIEW	9

FRAME (Continued)

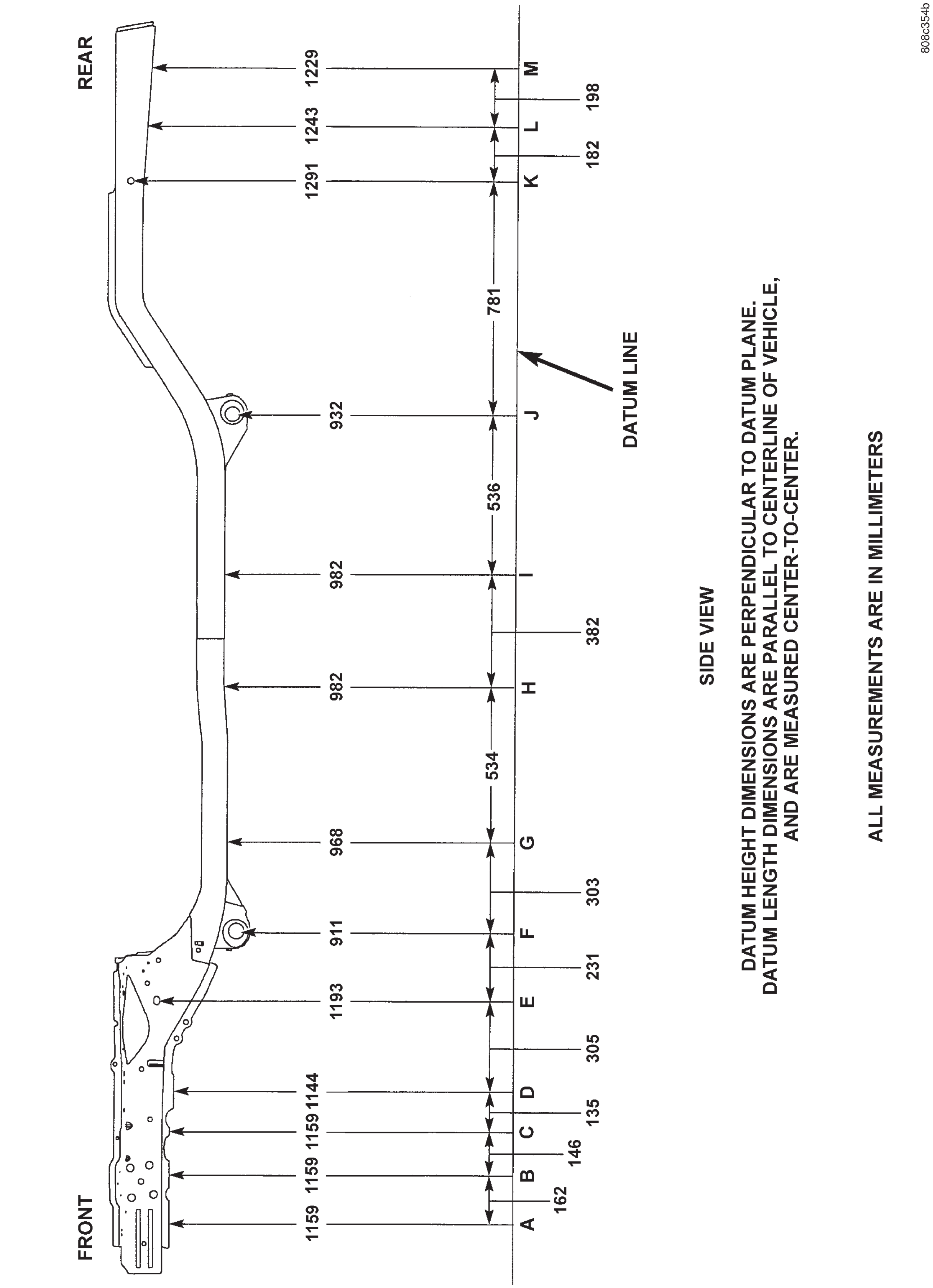


Fig. 8 SIDE VIEW

FRAME (Continued)

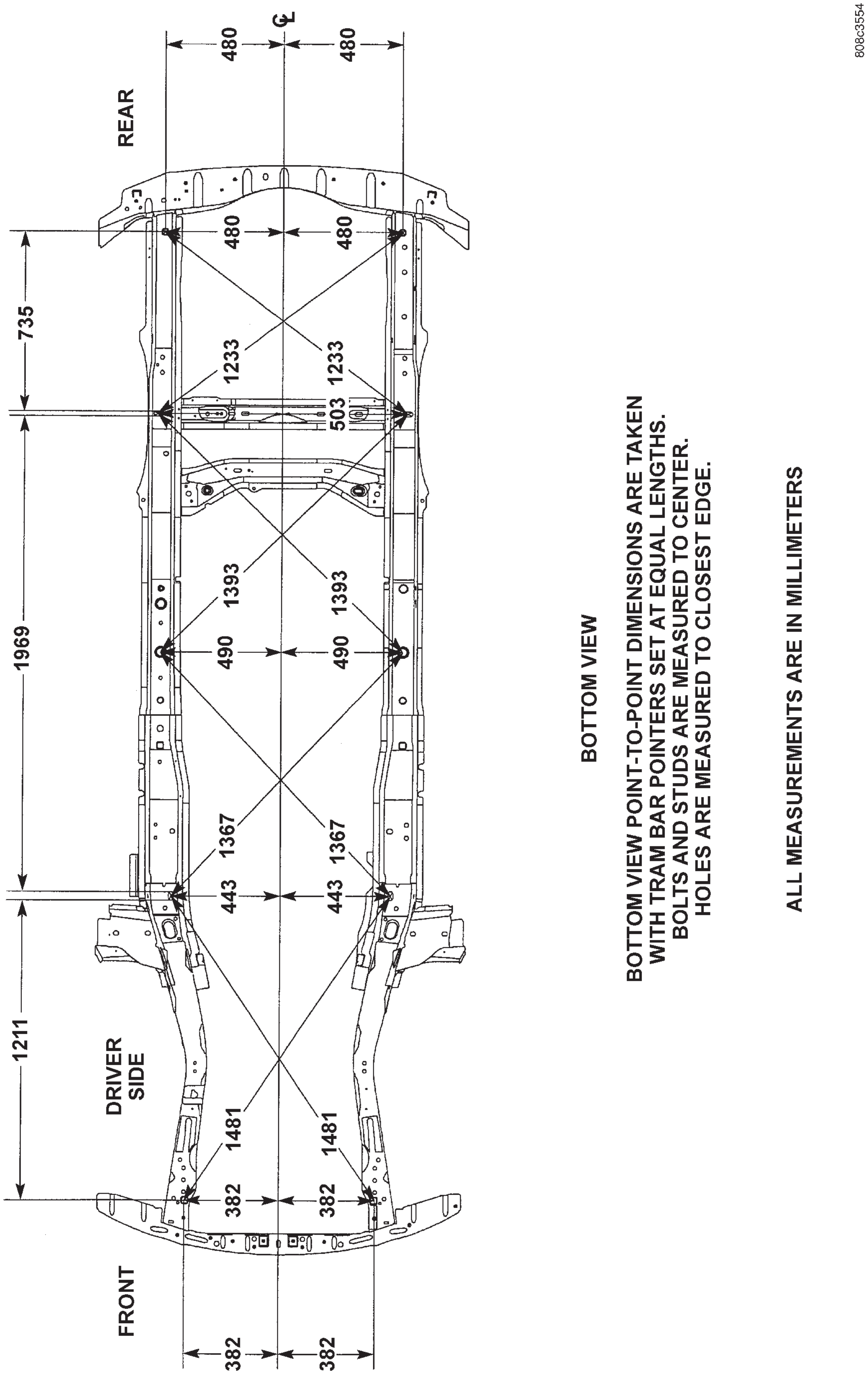


Fig. 9 BOTTOM VIEW

FRONT SKID PLATE

REMOVAL

(1) Position a support under skid plate.
(2) Remove bolts attaching skid plate to frame (Fig. 10).
(3) Separate skid plate from frame.

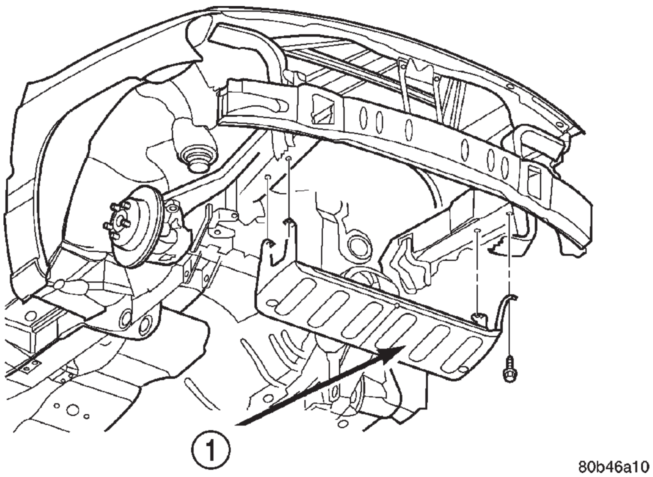


Fig. 10 Front Skid Plate

1 - SKID PLATE

INSTALLATION

(1) Position skid plate on a support.
(2) Raise it into position
(3) Install bolts attaching skid plate to frame. Tighten bolts to 54 N·m (40 ft. lbs.) torque.

FRONT TOW HOOK

REMOVAL

(1) Remove bolts that attach tow hook bracket to the lower crossmember (Fig. 11).
(2) Separate tow hook bracket from lower cross-member.

INSTALLATION

(1) Position tow hook bracket at the lower cross-member.
(2) Install bolts attaching tow hook bracket to crossmember. Tighten bolts to 54 N·m (40 ft. lbs.) torque.

FUEL TANK SKID PLATE

DESCRIPTION

The fuel tank skid plate is integrated with the fuel tank. Refer to Fuel Tank for service procedures

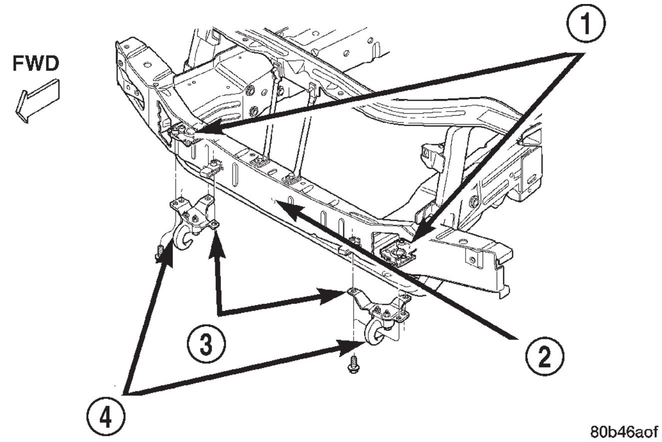


Fig. 11 Front Tow Hook

1 - TAPPING PLATE
2 - CROSSMEMBER
3 - BRACKET
4 - TOW HOOK

REAR TOW HOOK

REMOVAL

(1) Remove rear tow hook to frame brace.
(2) Remove bolts attaching the tow hook bracket to frame (Fig. 12).
(3) Separate tow hook bracket from frame.

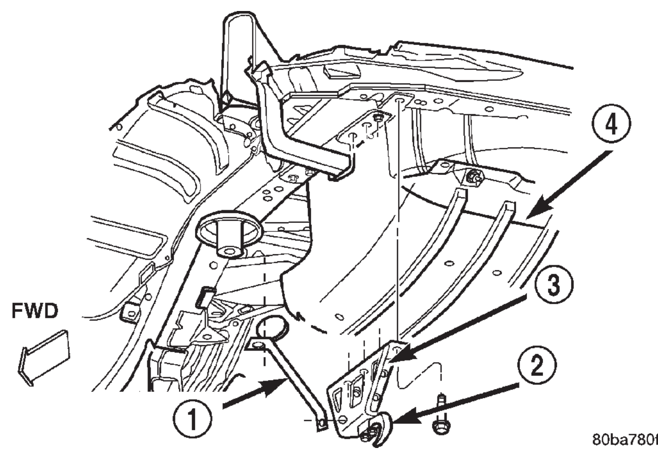


Fig. 12 Rear Tow Hook

1 - TOW HOOK BRACE
2 - TOW HOOK
3 - BRACKET
4 - FUEL TANK

INSTALLATION

(1) position tow hook bracket on frame.
(2) Install bolts attaching tow hook bracket to frame. Tighten bolts to 68 N·m (50 ft. lbs.) torque.
(3) Install rear tow hook to frame brace.

TRAILER HITCH

REMOVAL

(1) Remove rear fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/REAR FASCIA - REMOVAL).

(2) Remove screws attaching trailer harness plug to trailer hitch.

(3) Disconnect harness connector from harness plug.

(4) Position support stands under trailer hitch.

(5) Remove bolts attaching trailer hitch to frame rails (Fig. 13).

(6) Separate trailer hitch from vehicle.

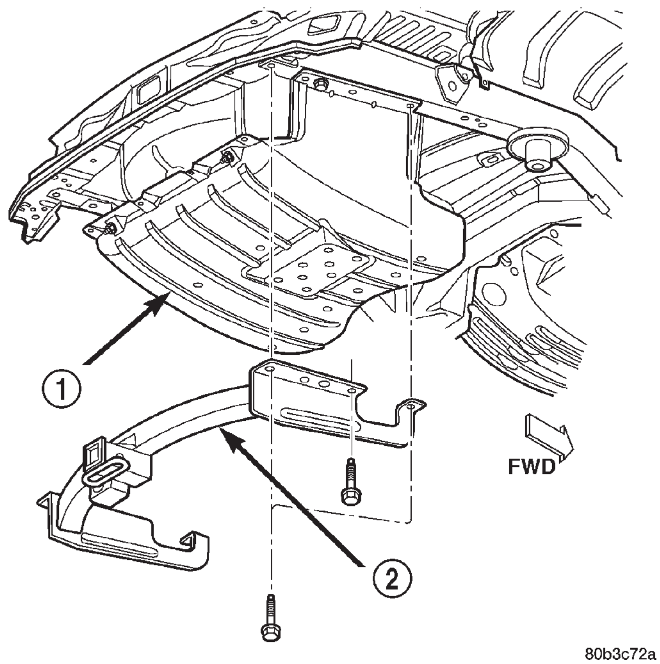


Fig. 13 Trailer Hitch

1 - FUEL TANK
2 - TRAILER HITCH

INSTALLATION

(1) Position trailer hitch on support stands.

(2) Position trailer hitch on vehicle.

(3) Install bolts attaching trailer hitch to frame rails. Tighten bolts to 68 N·m (50 lbs.) torque.

(4) Connect harness connector to harness plug.

(5) Position harness plug in trailer hitch and install screws.

(6) Install rear fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/REAR FASCIA - INSTALLATION).

TRANSFER CASE SKID PLATE

REMOVAL

(1) Support skid plate.

(2) Remove bolts that attach skid plate to transmission support crossmember and frame sill (Fig. 14).

(3) Remove support and skid plate from vehicle.

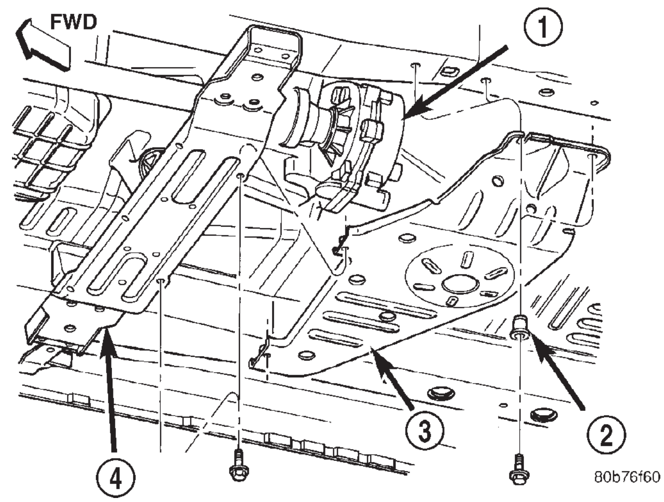


Fig. 14 Transfer Case Skid Plate

1 - TRANSFER CASE
2 - NUTSERT
3 - SKID PLATE
4 - CROSSMEMBER

INSTALLATION

(1) Install nutserts, if removed.

(2) Position and support skid plate at the frame sill and transmission support crossmember.

(3) Attach skid plate to frame sill and crossmember with the bolts. Tighten bolts to 34 N·m (25 ft. lbs) torque.

FUEL SYSTEM

TABLE OF CONTENTS

FUEL DELIVERY

TABLE OF CONTENTS

FUEL DELIVERY

DESCRIPTION

The fuel delivery system consists of:

- the fuel pump module containing the electric fuel pump, fuel gauge sending unit (fuel level sensor) and a separate fuel filter located at bottom of pump module
- a separate combination fuel filter/fuel pressure regulator
- fuel tubes/lines/hoses
- quick-connect fittings
- fuel injector rail
- fuel injectors
- fuel tank
- fuel tank filler/vent tube assembly
- fuel tank filler tube cap
- accelerator pedal
- throttle cable

OPERATION

The fuel tank assembly consists of: the fuel tank, fuel tank shield, fuel tank straps, fuel pump module assembly, fuel pump module locknut/gasket, and fuel tank check valve (refer to Emission Control System for fuel tank check valve information).

A fuel filler/vent tube assembly using a pressure/ vacuum, 1/4 turn fuel filler cap is used. The fuel filler tube contains a flap door located below the fuel fill cap.

Also to be considered part of the fuel system is the evaporation control system. This is designed to reduce the emission of fuel vapors into the atmosphere. The description and function of the Evaporative Control System is found in Emission Control Systems.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

DIAGNOSIS AND TESTING

FUEL PRESSURE LEAK DOWN TEST

Use this test in conjunction with the Fuel Pump Pressure Test and Fuel Pump Capacity Test.

Check Valve Operation: The electric fuel pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** When the electric fuel pump is activated, fuel pressure should **immediately** (1–2 seconds) rise to specification.

Abnormally long periods of cranking to restart a **hot** engine that has been shut down for a short period of time may be caused by:

- Fuel pressure bleeding past a fuel injector(s).
- Fuel pressure bleeding past the check valve in the fuel pump module.
- A defective fuel filter/pressure regulator.

Two #6539, 5/16”, Fuel Line Pressure Test Adapter Hose Tools are required for the following tests.

(1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure.

(2) Raise vehicle.

Fuel Line Identification: The fuel filter/pressure regulator is located in front of the fuel tank and above the rear axle. It is transversely mounted to a chassis crossmember (left-to-right). The filter/regulator is equipped with 3 fuel line fittings (2 at one end and 1 at the other end). The single fitting facing the left side of the vehicle is the supply line to the fuel rail (Fig. 1) . The 2 fittings facing the right side of the vehicle are connected to the fuel tank. Of these 2 fittings, the fitting towards the **front** is used for fuel return to the fuel tank. The fitting towards the **rear** is a pressure line. This **rear** fitting must be disconnected for the following step.

(3) See previous step. Disconnect fuel pressure line at **rear** of filter/regulator. This is a 5/16″ quick-connect fitting (Fig. 1) . Refer to Quick-Connect Fittings for procedures.

(4) Obtain correct Fuel Line Pressure Test Adapter Hose Tool # 6539 for 5/16” fuel lines. Connect one end of this Special Tool into the disconnected fuel pressure line. Connect the other end of the Tool into fitting on filter/regulator.

(5) Lower vehicle.

(6) Disconnect the fuel inlet line at fuel rail. Refer to Quick-Connect Fittings for procedures. On some engines, air cleaner housing removal may be necessary before fuel line disconnection.

(7) Obtain a second Fuel Line Pressure Test Adapter Hose Tool # 6539 for 5/16” fuel lines. Connect this tool between disconnected fuel line and fuel rail (Fig. 2) .

(8) Connect the 0-414 kPa (0-60 psi) fuel pressure test gauge (from Gauge Set 5069) to the test port on the appropriate Adaptor Tool. **NOTE: The DRB III Scan Tool along with the PEP module, the 500 psi pressure transducer, and the transducer-to-test port adapter may also be used in place of the fuel pressure gauge.**

FUEL DELIVERY (Continued)

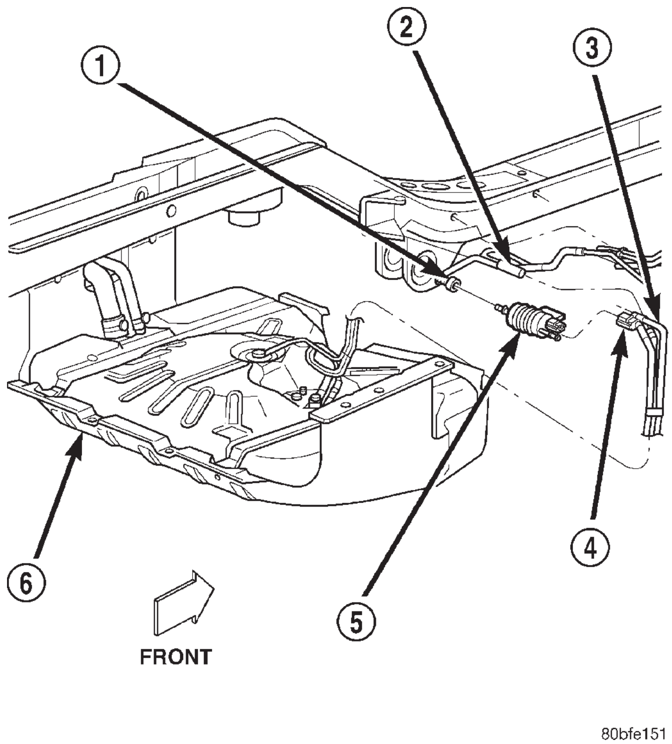


Fig. 1 Disconnect Fuel Pressure Line at Filter/ Regulator

1 - FUEL SUPPLY LINE (TO FUEL RAIL)
2 - EVAP LINE
3 - FUEL RETURN LINE (MALE)
4 - FUEL PRESSURE LINE (FEMALE)
5 - FUEL FILTER/PRESSURE REGULATOR
6 - FUEL TANK

CAUTION: The fittings on both tools must be in good condition and free from any small leaks before performing the proceeding test.

(9) Start engine and bring to normal operating temperature.

(10) Observe fuel pressure test gauge (or DRB screen). Normal operating pressure should be 339 kPa ± 34 kPa (49.2 psi ± 5 psi).

(11) Shut engine off.

(12) Pressure should not fall below **30 psi for five minutes.**

(13) If pressure falls below 30 psi, it must be determined if a fuel injector, the supply check valve within the fuel pump module, the fuel filter/pressure regulator, or a fuel tube/line is leaking.

(14) Again, start engine and bring to normal operating temperature.

(15) Shut engine off.

(16) **Testing for fuel injector or fuel rail leakage:** Clamp off the rubber hose portion of the 6539 Adaptor Tool between the fuel rail and the test port “T” on Adapter Tool (be sure clamping pressure is sufficient). If pressure now holds at or above 30 psi, a fuel injector or the fuel rail is leaking.

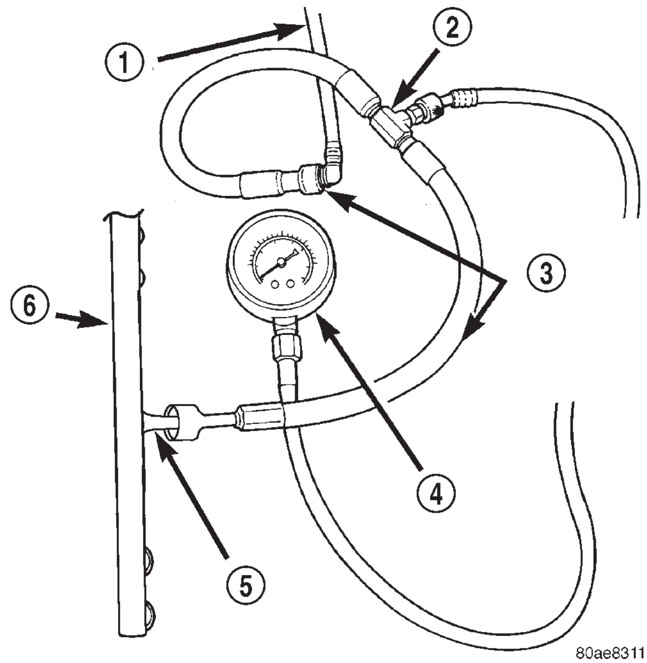


Fig. 2 Connecting Adapter Tool—Typical

1 - VEHICLE FUEL LINE
2 - TEST PORT “T”
3 - SPECIAL TOOL 6923, 6631, 6541 OR 6539
4 - FUEL PRESSURE TEST GAUGE
5 - FUEL LINE CONNECTION AT RAIL
6 - FUEL RAIL

(17) Again, start engine and bring to normal operating temperature.

(18) Shut engine off.

(19) Raise vehicle.

(20) **Testing for fuel filter/pressure regulator leakage:** While continuing to securely clamp between the fuel rail and the test port ″T″ on Adaptor Tool 6539, securely clamp off **any** rubber hose portion of the Adaptor Tool 6539 that was installed between the fuel pressure line and the filter/regulator fitting (by restricting the pump module supply line’s backflow, you isolate any leakdown originating from the filter/regulator via the tank return line.) If the pressure falls below 30 psi within 5 minutes, the filter/regulator is leaking. If it now holds at or above 30 psi, the electric fuel pump check valve is leaking or a fuel tube/line is leaking. A fuel odor presence would indicate the latter.

The electric fuel pump is not serviced separately. If replacement is necessary, replace the fuel pump module assembly. The filter/regulator may be replaced separately. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for additional information.

FUEL DELIVERY (Continued)

STANDARD PROCEDURE - FUEL SYSTEM PRESSURE RELEASE

Use following procedure if the fuel injector rail is, or is not equipped with a fuel pressure test port.

(1) Remove fuel fill cap.

(2) Remove fuel pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.

(3) Start and run engine until it stalls.

(4) Attempt restarting engine until it will no longer run.

(5) Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

(6) Unplug connector from any fuel injector.

(7) Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.

(8) Connect other end of jumper wire to positive side of battery.

(9) Connect one end of a second jumper wire to remaining injector terminal.

CAUTION: Powering an injector for more than a few seconds will permanently damage the injector.

(10) Momentarily touch other end of jumper wire to negative terminal of battery for no more than a few seconds.

(11) Place a rag or towel below fuel line quick-connect fitting at fuel rail.

(12) Disconnect quick-connect fitting at fuel rail. Refer to Quick-Connect Fittings.

(13) Return fuel pump relay to PDC.

(14) One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB® scan tool must be used to erase a DTC.

SPECIFICATIONS

FUEL SYSTEM PRESSURE
339 kPa ± 34 kPa (49.2 psi ± 5 psi).

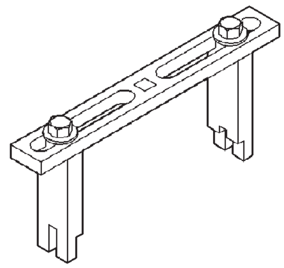
TORQUE - FUEL DELIVERY

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Accelerator Pedal Bracket Mounting Nuts (without adjustable pedals)	12 ±2	-	105 ±20
Fuel Filter/Fuel Press. Reg. Bolts	3	-	26
Fuel Hose Clamps	3	-	26
Fuel Injector Rail Mounting Bolts -4.0L Engine	11	-	100
Fuel Injector Rail Mounting Bolts -4.7L V-8 Engine	11	-	100
Fuel Pump Module Locknut	74	55	-
Fuel Tank Filler Tube-to-Body Mounting Bolts	2	-	15
Fuel Tank-to-Body Mounting Bolts	88	65	-
Fuel Tank Support Bracket Bolts (large brackets)	88	65	-
Fuel Tank Support Bracket Bolts (small bracket)	5	-	45
Fuel Tank Support Bracket Nuts (large brackets)	61	45	-
Fuel Tank Heat Shield Nuts (shield-to-tank)	9	-	85
Fuel Tank Heat Shield Nuts (shield-to-body)	3	-	25

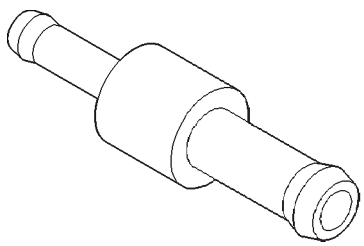
FUEL DELIVERY (Continued)

SPECIAL TOOLS

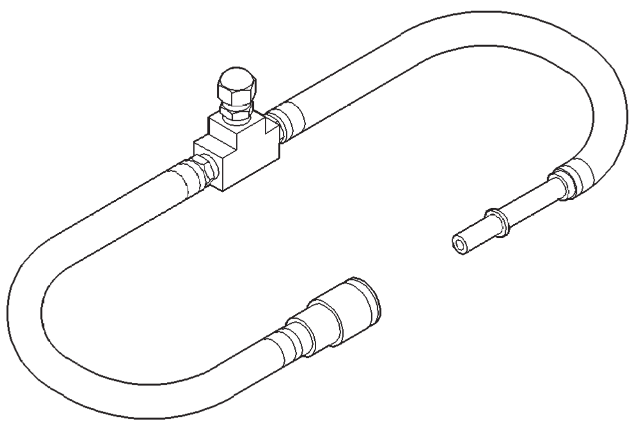
FUEL SYSTEM



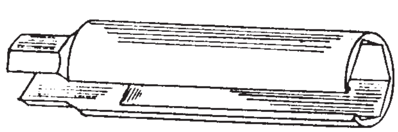
Spanner Wrench—6856



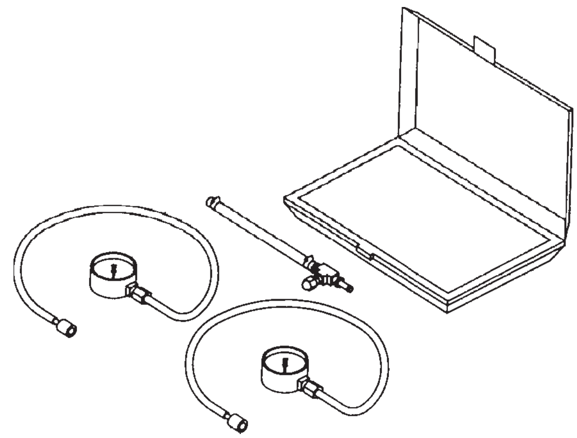
FITTING, AIR METERING - 6714



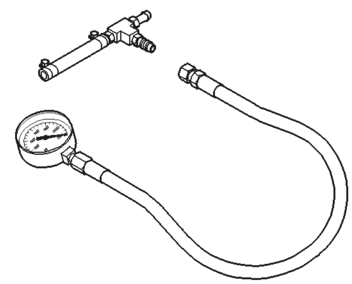
Adapters, Fuel Pressure Test—6539 and/or 6631



O2S (Oxygen Sensor) Remover/Installer—C-4907



Test Kit, Fuel Pressure—5069



Test Kit, Fuel Pressure—C-4799-B

Fuel Line Removal Tool—6782

FUEL FILTER/PRESSURE REGULATOR

DESCRIPTION

The combination fuel filter/pressure regulator is located in front of the fuel tank and above the rear axle (Fig. 3). It is transversely mounted to a chassis crossmember (left-to-right). **Fuel Line Identification:** The filter/regulator is equipped with 3 fuel line fittings (2 at one end and 1 at the other end). The single fitting facing the left side of the vehicle is the supply line to the fuel rail (Fig. 3). The 2 fittings facing the right side of the vehicle are connected to the fuel tank. Of these 2 fittings, the fitting towards the **front** is used for fuel return to the fuel tank. The fitting towards the **rear** is a pressure line.

OPERATION

Fuel Pressure Regulator Operation: The pressure regulator is a mechanical device that is not controlled by engine vacuum or the Powertrain Control Module (PCM).

FUEL FILTER/PRESSURE REGULATOR (Continued)

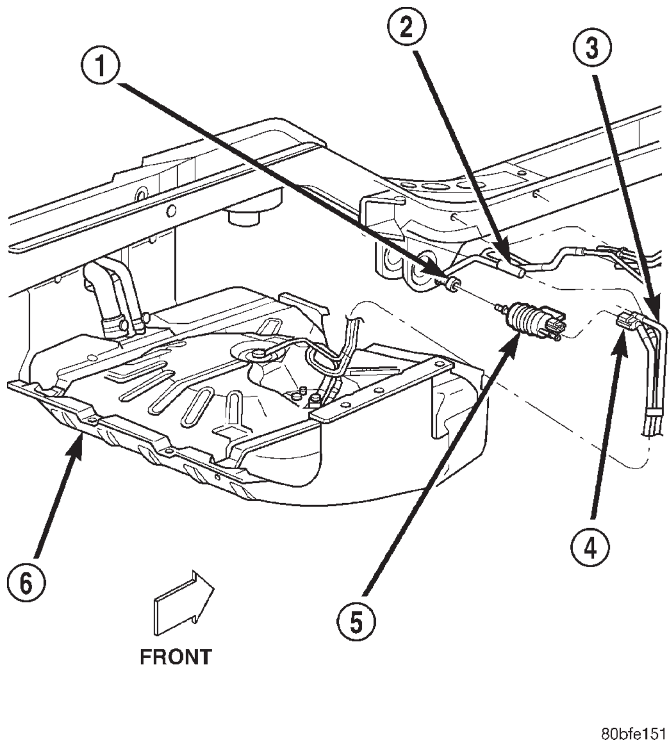


Fig. 3 Fuel Filter/Fuel Pressure Regulator Location

1 - FUEL SUPPLY LINE (TO FUEL RAIL)
2 - EVAP LINE
3 - FUEL RETURN LINE (MALE)
4 - FUEL PRESSURE LINE (FEMALE)
5 - FUEL FILTER/PRESSURE REGULATOR
6 - FUEL TANK

The regulator is calibrated to maintain fuel system operating pressure of approximately 339 kPa ± 34 kPa (49.2 psi ± 5 psi) at the fuel injectors. It contains a diaphragm, calibrated springs and a fuel return valve. The internal fuel filter is also part of the assembly.

Fuel is supplied to the filter/regulator by the electric fuel pump. The regulator acts as a check valve to maintain some fuel pressure when the engine is not operating. This will help to start the engine. A second check valve is located at the outlet end of the electric fuel pump.

If fuel pressure at the pressure regulator exceeds approximately 49 psi, an internal diaphragm closes. Excess fuel is then routed into a separate fuel return line and returned to the fuel tank through the top of the fuel pump module.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

REMOVAL

The combination Fuel Filter/Fuel Pressure Regulator is remotely mounted to the vehicle body, above the rear axle and near the front of the fuel tank (Fig. 4) or (Fig. 5).

(1) Perform Fuel System Pressure Release Procedure.

(2) Disconnect negative battery cable at battery.

(3) Raise vehicle.

(4) Clean area around 3 filter/regulator fittings.

(5) Disconnect fuel supply, fuel return and fuel pressure lines at filter/regulator (Fig. 4) . Refer to Quick-Connect Fittings.

(6) Remove 2 mounting bolts (Fig. 5) and remove filter/regulator.

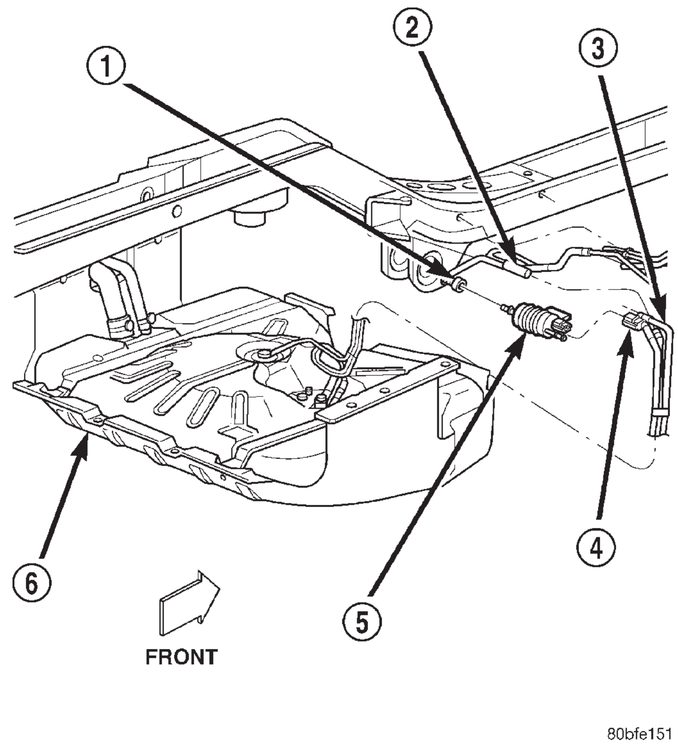


Fig. 4 Fuel Filter/Fuel Pressure Regulator Location

1 - FUEL SUPPLY LINE (TO FUEL RAIL)
2 - EVAP LINE
3 - FUEL RETURN LINE (MALE)
4 - FUEL PRESSURE LINE (FEMALE)
5 - FUEL FILTER/PRESSURE REGULATOR
6 - FUEL TANK

INSTALLATION

The combination Fuel Filter/Fuel Pressure Regulator is remotely mounted to the vehicle body, above the rear axle and near the front of the fuel tank (Fig. 4) or (Fig. 5).

(1) Before installing filter/regulator, be sure all fittings are cleaned of all dirt and contaminants.

(2) Be sure o-ring is positioned into fuel return fitting in filter/regulator.

FUEL FILTER/PRESSURE REGULATOR (Continued)

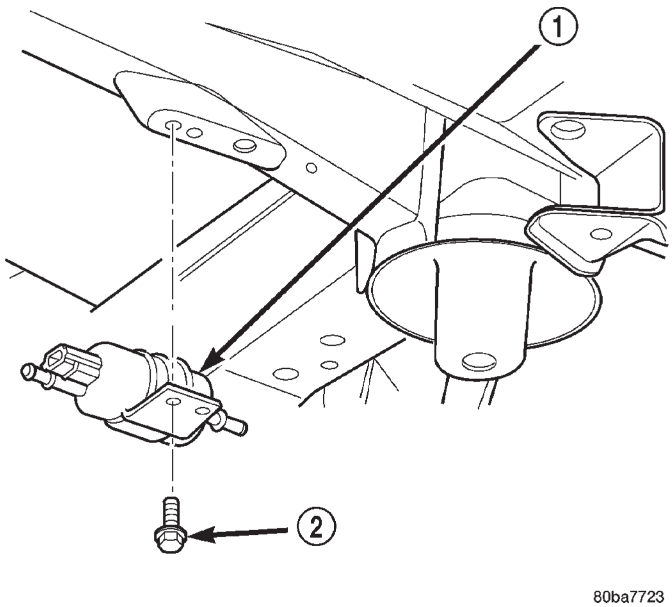


Fig. 5 Fuel Filter/Fuel Pressure Regulator Removal/ Installation

1 - FUEL FILTER/FUEL PRESSURE REGULATOR
2 - MOUNTING BOLTS (2)

(3) Apply a small amount of clean engine oil to o-rings.

(4) Position filter/regulator to body and install 2 bolts. Tighten bolts to 3 N·m (30 in. lbs.) torque.

(5) Connect 3 fittings. Refer to Quick-Connect Fittings.

(6) Connect negative battery cable to battery.

(7) Start engine and check for leaks.

FUEL LEVEL SENDING UNIT / SENSOR

DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor track (card).

OPERATION

The fuel pump module has 4 different circuits (wires). Two of these circuits are used for the fuel gauge sending unit for fuel gauge operation, and for certain OBD II emission requirements. The other 2 wires are used for electric fuel pump operation.

For Fuel Gauge Operation: A constant input voltage source of about 12 volts (battery voltage) is supplied to the resistor track on the fuel gauge sending unit. This is fed directly from the Powertrain Control Module (PCM). **NOTE: For diagnostic purposes, this 12V power source can only be verified with the circuit opened (fuel pump module electrical connector unplugged). With the connectors plugged, output voltages will vary from about 0.6 volts at FULL, to about 8.6 volts at EMPTY (about 8.6 volts at EMPTY for Jeep models, and about 7.0 volts at EMPTY for Dodge Truck models).** The resistor track is used to vary the voltage (resistance) depending on fuel tank float level. As fuel level increases, the float and arm move up, which decreases voltage. As fuel level decreases, the float and arm move down, which increases voltage. The varied voltage signal is returned back to the PCM through the sensor return circuit.

Both of the electrical circuits between the fuel gauge sending unit and the PCM are hard-wired (not multi-plexed). After the voltage signal is sent from the resistor track, and back to the PCM, the PCM will interpret the resistance (voltage) data and send a message across the multi-plex bus circuits to the instrument panel cluster. Here it is translated into the appropriate fuel gauge level reading. Refer to Instrument Panel for additional information.

For OBD II Emission Monitor Requirements: The PCM will monitor the voltage output sent from the resistor track on the sending unit to indicate fuel level. The purpose of this feature is to prevent the OBD II system from recording/setting false misfire and fuel system monitor diagnostic trouble codes. The feature is activated if the fuel level in the tank is less than approximately 15 percent of its rated capacity. If equipped with a Leak Detection Pump (EVAP system monitor), this feature will also be activated if the fuel level in the tank is more than approximately 85 percent of its rated capacity.

DIAGNOSIS AND TESTING - FUEL LEVEL SENDING UNIT

The fuel level sending unit contains a variable resistor (track). As the float moves up or down, electrical resistance will change. Refer to Instrument Panel and Gauges for Fuel Gauge testing. To test the gauge sending unit only, it must be removed from vehicle. The unit is part of the fuel pump module. Refer to Fuel Pump Module Removal/Installation for procedures. Measure the resistance across the sending unit terminals. With float in up position, resistance should be 20 ohms (+/- 5%). With float in down position, resistance should be 270 ohms (+/- 5%).

REMOVAL

The fuel gauge sending unit (fuel level sensor) and float assembly is located on the side of fuel pump module (Fig. 6). The fuel pump module is located within the fuel tank.

FUEL LEVEL SENDING UNIT / SENSOR (Continued)

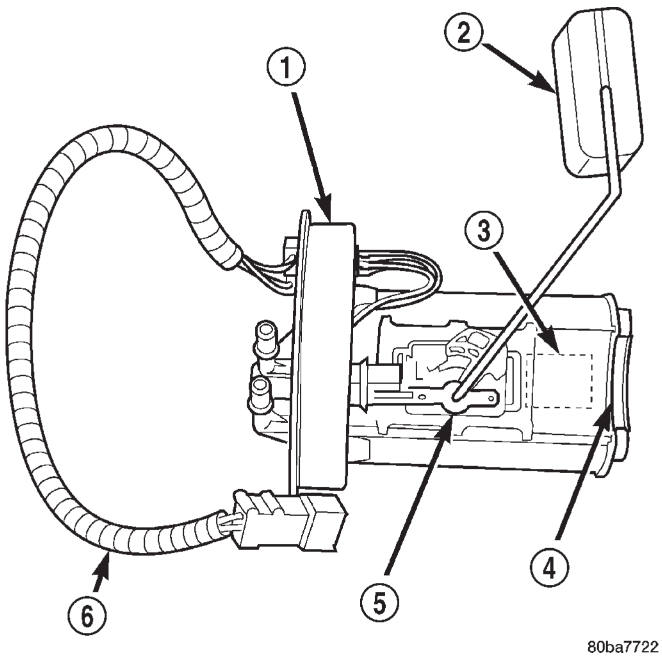


Fig. 6 Fuel Gauge Sending Unit Location

1 - FUEL PUMP MODULE
2 - FUEL GAUGE FLOAT
3 - ELECTRIC FUEL PUMP
4 - INLET FILTER
5 - FUEL GAUGE SENDING UNIT
6 - PIGTAIL HARNESS

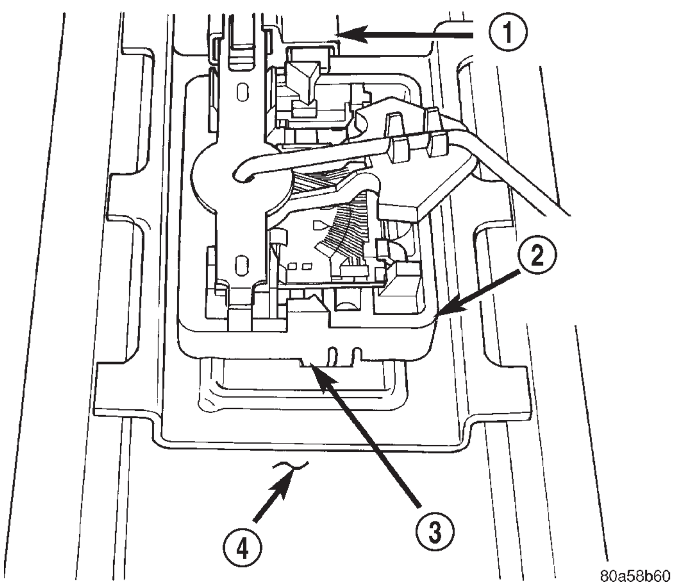


Fig. 7 Fuel Gauge Sending Unit Release Tab

1 - ELECTRICAL CONNECTOR
2 - FUEL GAUGE SENDING UNIT
3 - RELEASE TAB
4 - FUEL PUMP MODULE

(1) Remove fuel tank. Refer to Fuel Tank Removal/ Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Remove electrical wire connector at sending unit terminals.

(4) Press upward on release tab (Fig. 7) to remove sending unit from pump module.

INSTALLATION

The fuel gauge sending unit (fuel level sensor) and float assembly is located on the side of fuel pump module (Fig. 6). The fuel pump module is located within the fuel tank.

(1) Position sending unit to pump module and snap into place.

(2) Connect electrical connector to terminals.

(3) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(4) Install fuel tank. Refer to Fuel Tank Removal/ Installation.

FUEL LINES

DESCRIPTION

Also refer to Quick-Connect Fittings.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

FUEL PUMP

DESCRIPTION

The electric fuel pump is located inside of the fuel pump module. A 12 volt, permanent magnet, electric motor powers the fuel pump. The electric fuel pump is not a separate, serviceable component.

FUEL PUMP (Continued)

OPERATION

Voltage to operate the electric pump is supplied through the fuel pump relay.

Fuel is drawn in through a filter at the bottom of the module and pushed through the electric motor gearset to the pump outlet.

Check Valve Operation: The pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** Refer to the Fuel Pressure Leak Down Test for more information.

The electric fuel pump is not a separate, serviceable component.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - FUEL PUMP CAPACITY TEST

Before performing this test, verify fuel pump pressure. Refer to Fuel Pump Pressure Test. Use this test in conjunction with the Fuel Pressure Leak Down Test.

(1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure.

(2) Disconnect fuel supply line at fuel rail. Refer to Quick-Connect Fittings. Some engines may require air cleaner housing removal before line disconnection.

(3) Obtain correct Fuel Line Pressure Test Adapter Tool Hose. Tool number 6539 is used for 5/16" fuel lines and tool number 6631 is used for 3/8" fuel lines.

(4) Connect correct Fuel Line Pressure Test Adapter Tool Hose into disconnected fuel supply line. Insert other end of Adaptor Tool Hose into a graduated container.

(5) Remove fuel fill cap.

(6) To activate fuel pump and pressurize system, obtain DRB® scan tool and actuate ASD Fuel System Test.

(7) A good fuel pump will deliver at least 1/4 liter of fuel in 7 seconds. Do not operate fuel pump for longer than 7 seconds with fuel line disconnected as fuel pump module reservoir may run empty.

(a) If capacity is lower than specification, but fuel pump can be heard operating through fuel fill cap opening, check for a kinked/damaged fuel supply line somewhere between fuel rail and fuel pump module.

(b) If line is not kinked/damaged, and fuel pressure is OK, but capacity is low, replace fuel filter/fuel pressure regulator. The filter/regulator may be serviced separately on certain applications. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for additional information.

(c) If both fuel pressure and capacity are low, replace fuel pump module assembly. Refer to Fuel Pump Module Removal/Installation.

DIAGNOSIS AND TESTING - FUEL PUMP AMPERAGE TEST

This amperage (current draw) test is to be done in conjunction with the Fuel Pump Pressure Test, Fuel Pump Capacity Test and Fuel Pressure Leak Down Test. Before performing the amperage test, be sure the temperature of the fuel tank is above 50° F (10° C).

The DRB® Scan Tool along with the DRB Low Current Shunt (LCS) adapter (Fig. 8) and its test leads will be used to check fuel pump amperage specifications.

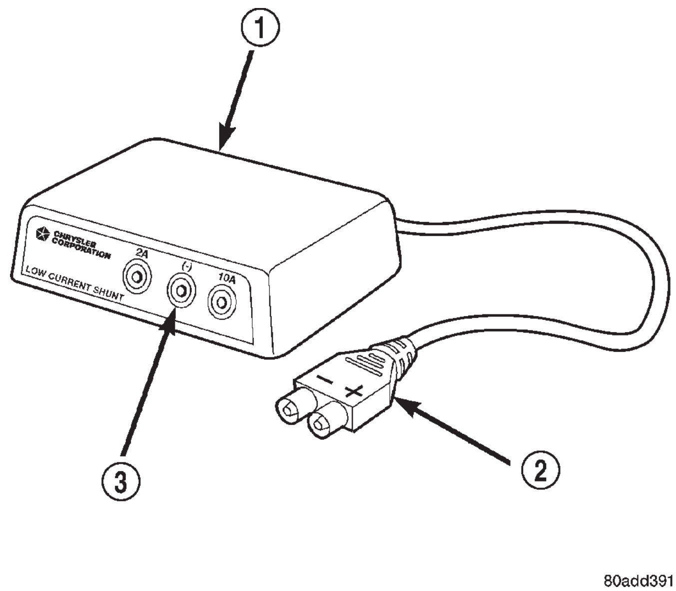


Fig. 8 LOW CURRENT SHUNT

1 - LOW CURRENT SHUNT ADAPTER
2 - PLUG TO DRB
3 - TEST LEAD RECEPTACLES

(1) Be sure fuel tank contains fuel before starting test. If tank is empty or near empty, amperage readings will be incorrect.

(2) Obtain LCS adapter.

(3) Plug cable from LCS adapter into DRB scan tool at SET 1 receptacle.

(4) Plug DRB into vehicle 16–way connector (data link connector).

FUEL PUMP (Continued)

(5) Connect (-) and (+) test cable leads into LCS adapter receptacles. Use **10 amp (10A +)** receptacle and common (-) receptacles.

(6) Gain access to MAIN MENU on DRB screen.

(7) Press DVOM button on DRB.

(8) Using left/right arrow keys, highlight CHANNEL 1 function on DRB screen.

(9) Press ENTER three times.

(10) Using up/down arrow keys, highlight RANGE on DRB screen (screen will default to 2 amp scale).

(11) Press ENTER to change 2 amp scale to 10 amp scale. **This step must be done to prevent damage to DRB scan tool or LCS adapter (blown fuse).**

(12) Remove cover from Power Distribution Center (PDC).

(13) Remove fuel pump relay from PDC. Refer to label on PDC cover for relay location.

WARNING: BEFORE PROCEEDING TO NEXT STEP, NOTE THE FUEL PUMP WILL BE ACTIVATED AND SYSTEM PRESSURE WILL BE PRESENT. THIS WILL OCCUR AFTER CONNECTING TEST LEADS FROM LCS ADAPTER INTO FUEL PUMP RELAY CAVITIES. THE FUEL PUMP WILL OPERATE EVEN WITH IGNITION KEY IN OFF POSITION. BEFORE ATTACHING TEST LEADS, BE SURE ALL FUEL LINES AND FUEL SYSTEM COMPONENTS ARE CONNECTED.

CAUTION: To prevent possible damage to the vehicle electrical system and LCS adapter, the test leads must be connected into relay cavities exactly as shown in following steps.

Depending upon vehicle model, year or engine configuration, three different types of relays may be used: Type-1, type-2 and type–3.

(14) If equipped with **type–1 relay** (Fig. 9), attach test leads from LCS adapter into PDC relay cavities number 30 and 87. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 9).

(15) If equipped with **type–2 relay** (Fig. 10), attach test leads from LCS adapter into PDC relay cavities number 30 and 87. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 10).

(16) If equipped with **type–3 relay** (Fig. 11), attach test leads from LCS adapter into PDC relay cavities number 3 and 5. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 11).

(17) When LCS adapter test leads are attached into relay cavities, fuel pump **will be activated.** Determine fuel pump amperage on DRB screen. Amperage should be below 10.0 amps. If amperage is below 10.0 amps, and specifications for the Fuel Pump Pressure, Fuel Pump Capacity and Fuel Pressure Leak Down tests were met, the fuel pump module is OK.

(18) If amperage is more than 10.0 amps, replace fuel pump module assembly. The electric fuel pump is not serviced separately.

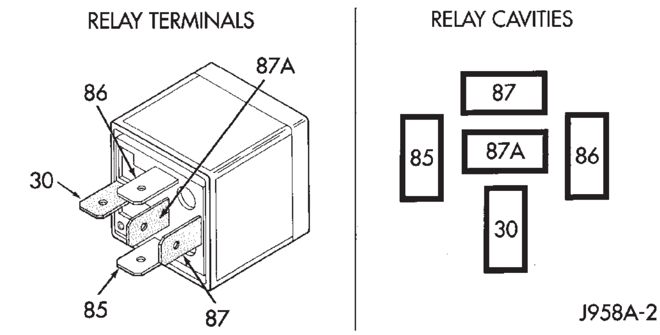


Fig. 9 FUEL PUMP RELAY - TYPE 1

TERMINAL LEGEND

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

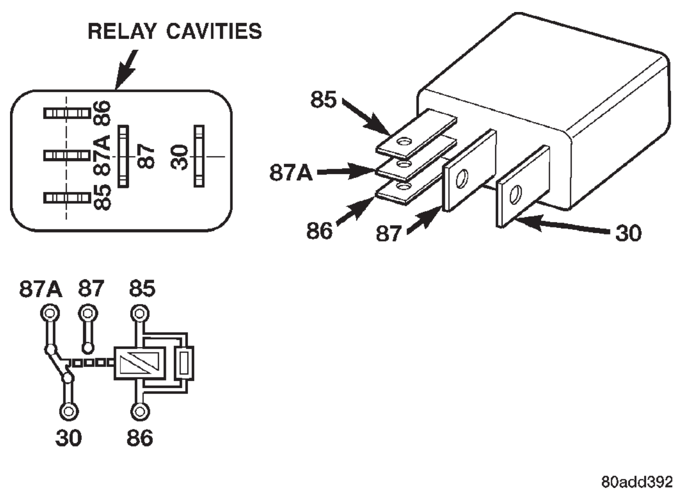


Fig. 10 FUEL PUMP RELAY - TYPE 2

TERMINAL LEGEND

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

FUEL PUMP (Continued)

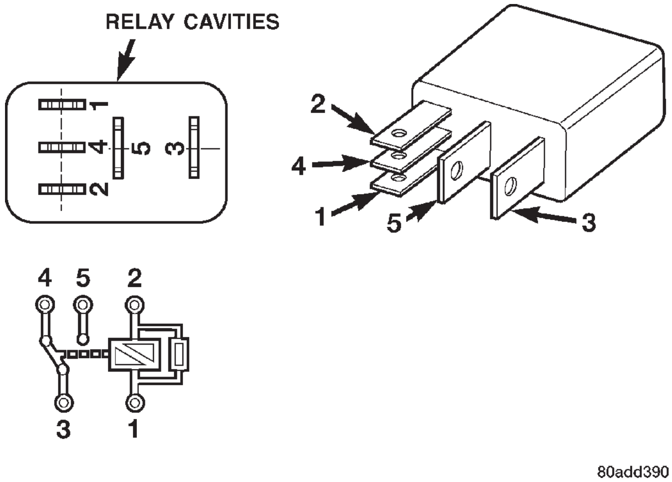


Fig. 11 FUEL PUMP RELAY - TYPE 3

TERMINAL LEGEND

NUMBER	IDENTIFICATION
1	COIL BATTERY
2	COIL GROUND
3	COMMON FEED
4	NORMALLY CLOSED
5	NORMALLY OPEN

(19) Disconnect test leads from relay cavities immediately after testing.

FUEL PUMP PRESSURE TEST

Use this test in conjunction with other fuel system tests. Refer to the Fuel Pump Capacity Test, Fuel Pressure Leak Down Test and Fuel Pump Amperage Test.

Check Valve Operation: The electric fuel pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** When the electric fuel pump is activated, fuel pressure should **immediately** (1–2 seconds) rise to specification.

The fuel system is equipped with a combination fuel filter/fuel pressure regulator. The fuel pressure regulator is not controlled by engine vacuum.

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. BEFORE DISCONNECTING FUEL LINE AT FUEL RAIL, THIS PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

(1) Remove pressure test port cap at fuel rail test port (Fig. 12) or (Fig. 13) . Connect 0–414 kPa (0-60 psi) fuel pressure gauge (from gauge set 5069) to test port pressure fitting on fuel rail (Fig. 14) . **The DRB III Scan Tool along with the PEP module, the 500 psi pressure transducer, and the transducer-to-test port adapter may also be used in place of the fuel pressure gauge.**

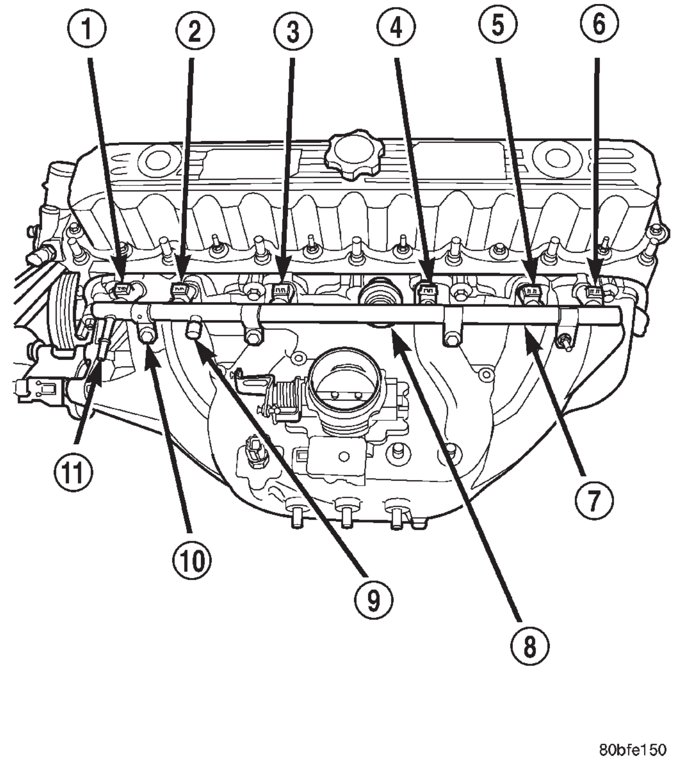


Fig. 12 Test Port Cap Location—4.0L Engine

1 - INJ. #1
2 - INJ. #2
3 - INJ. #3
4 - INJ. #4
5 - INJ. #5
6 - INJ. #6
7 - FUEL INJECTOR RAIL
8 - FUEL DAMPER
9 - PRESSURE TEST PORT CAP
10 - MOUNTING BOLTS (4)
11 - QUICK-CONNECT FITTING

(2) Start and warm engine and note pressure gauge reading. The DRB scan tool may also be used to power fuel pump. Fuel pressure should be 339 kPa ± 34 kPa (49.2 psi ± 5 psi) at idle.

(3) If engine runs, but pressure is below 44.2 psi, determine if fuel pump or filter/regulator is defective. Proceed to next step:

(a) Check for a kinked fuel supply line somewhere between fuel rail and fuel pump module.

FUEL PUMP (Continued)

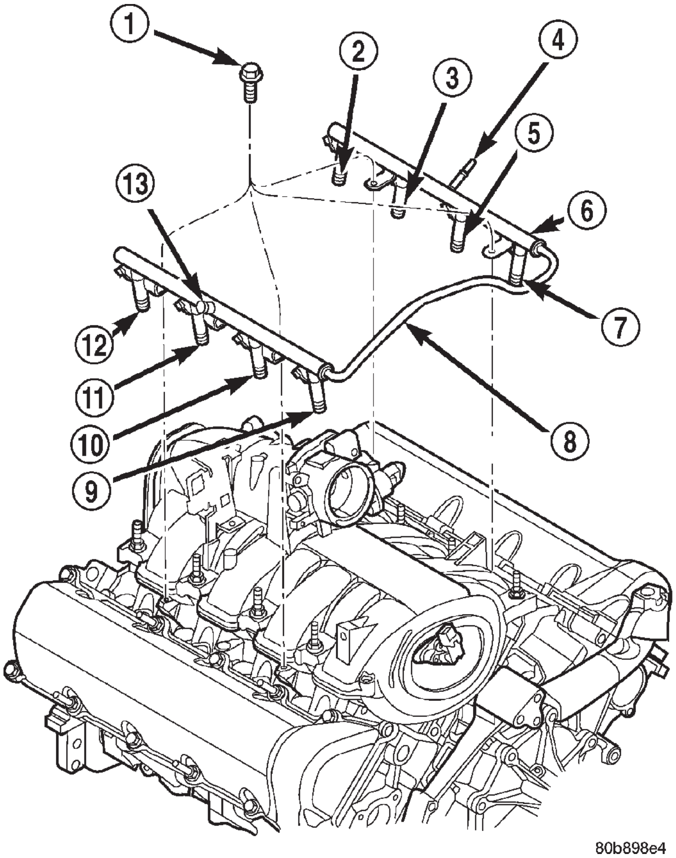


Fig. 13 Test Port Cap Location—4.7L V-8 Engine

1 - MOUNTING BOLTS (4)
2 - INJ.#7
3 - INJ.#5
4 - QUICK-CONNECT FITTING
5 - INJ.#3
6 - FUEL INJECTOR RAIL
7 - INJ.#1
8 - CONNECTOR TUBE
9 - INJ.#2
10 - INJ.#4
11 - INJ.#6
12 - INJ.#8
13 - PRESSURE TEST PORT CAP

(b) If line is not kinked and pressure is low, raise vehicle and disconnect fuel pressure line at fuel filter/fuel pressure regulator (Fig. 15) . Three fuel lines are attached to filter/regulator. The **fuel pressure line** is attached to the right side of filter/regulator. It is also the most rearward of the two (Fig. 15) .

(c) Install Special 5/16” Fuel Line Adapter Tool # 6539 between disconnected fuel line and filter/regulator fitting

(d) Attach 0–60 psi fuel pressure test gauge to “T” fitting on tool 6539.

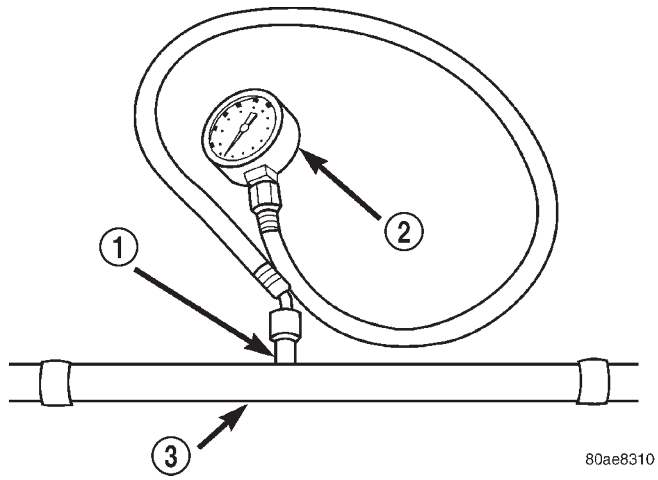


Fig. 14 Fuel Pressure Test Gauge (Typical Gauge Installation at Test Port)

1 - SERVICE (TEST) PORT
2 - FUEL PRESSURE TEST GAUGE
3 - FUEL RAIL

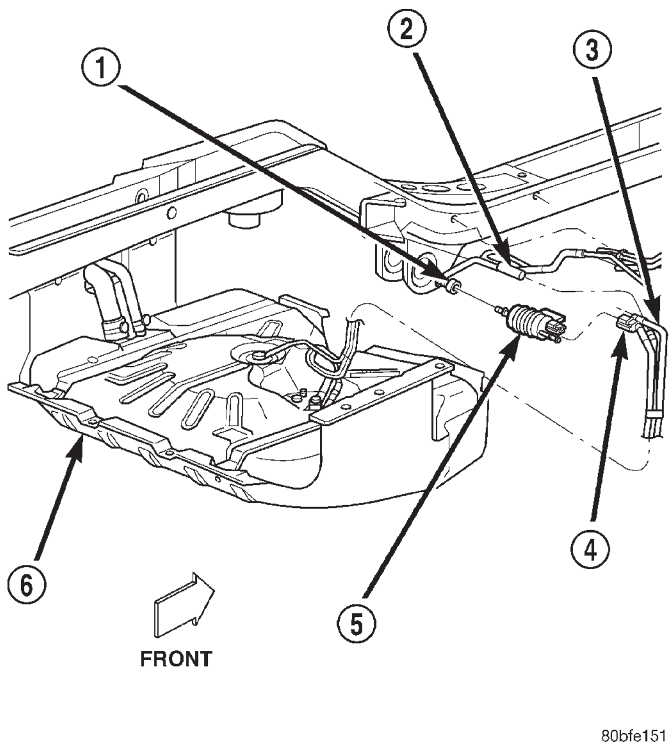


Fig. 15 Fuel Filter/Fuel Pressure Regulator Location

1 - FUEL SUPPLY LINE (TO FUEL RAIL)
2 - EVAP LINE
3 - FUEL RETURN LINE (MALE)
4 - FUEL PRESSURE LINE (FEMALE)
5 - FUEL FILTER/PRESSURE REGULATOR
6 - FUEL TANK

FUEL PUMP (Continued)

(e) Use DRB scan tool to power fuel pump. If pressure is now within specifications, replace fuel filter/fuel pressure regulator.

(f) If pressure is still low, replace fuel pump module.

(4) If operating pressure is above 54.2 psi, electric fuel pump is OK, but fuel pressure regulator is defective. Replace fuel filter/fuel pressure regulator.

(5) Install test port cap to fuel rail test port.

FUEL PUMP MODULE

DESCRIPTION

The fuel pump module is installed in the top of the fuel tank (Fig. 16). The fuel pump module (Fig. 17) contains the following components:

- A separate fuel pick-up filter (strainer)
- An electric fuel pump
- A threaded locknut to retain module to tank
- A gasket between tank flange and module
- Fuel gauge sending unit (fuel level sensor)
- Fuel supply tube (line) connection
- Fuel return tube (line) connection

The fuel gauge sending unit and pick-up filter may be serviced separately. If the electrical fuel pump requires service, the entire fuel pump module must be replaced.

OPERATION

Refer to Fuel Pump, Fuel Filter/Fuel Pressure Regulator and Fuel Gauge Sending Unit.

REMOVAL

Fuel tank removal will be necessary for fuel pump module removal.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING FUEL PUMP MODULE, FUEL SYSTEM PRESSURE MUST BE RELEASED.

(1) Perform Fuel System Pressure Release Procedure.

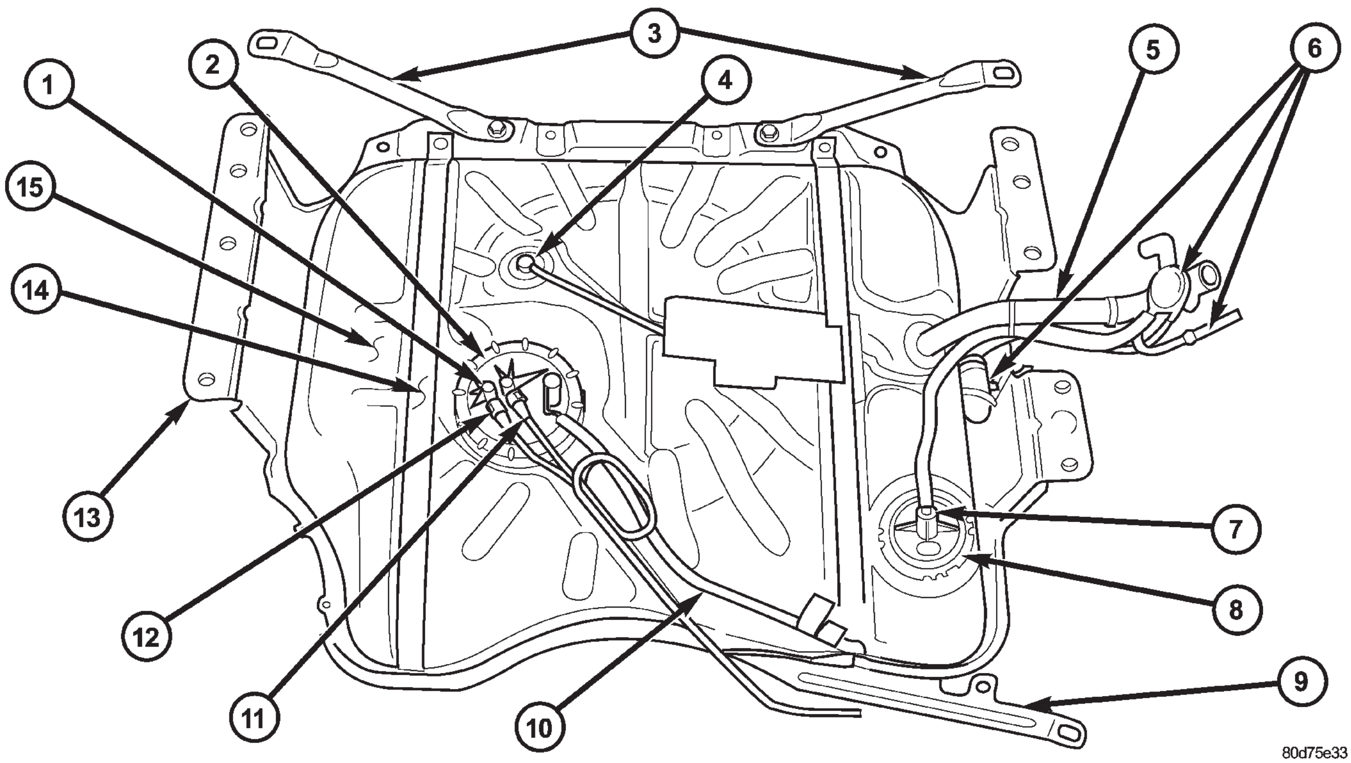


Fig. 16 FUEL TANK AND COMPONENTS

1 - FUEL PUMP MODULE
2 - MODULE LOCK RING
3 - TANK SUPPORT BRACKETS (REAR)
4 - CHECK VALVE
5 - FUEL FILL HOSE
6 - ORVR COMPONENTS
7 - ORVR CONTROL VALVE
8 - CONTROL VALVE LOCK RING
9 - TANK SUPPORT BRACKET (SMALL/FRONT)
10 - MODULE PIGTAIL HARNESS
11 - FUEL SUPPLY (PRESSURE) LINE
12 - FUEL RETURN LINE
13 - SKID PLATE
14 - TANK STRAPS (2)
15 - FUEL TANK

FUEL PUMP MODULE (Continued)

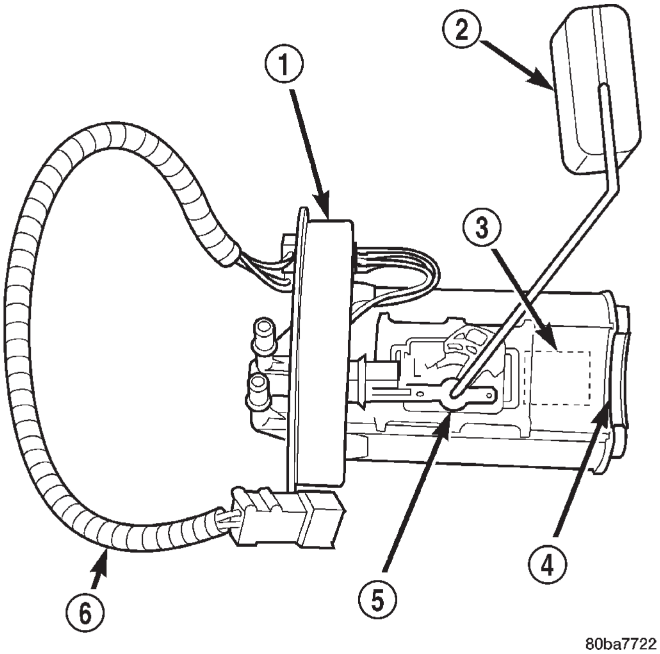


Fig. 17 FUEL PUMP MODULE

1 - FUEL PUMP MODULE
2 - FUEL GAUGE FLOAT
3 - ELECTRIC FUEL PUMP
4 - INLET FILTER
5 - FUEL GAUGE SENDING UNIT
6 - PIGTAIL HARNESS

(2) Drain fuel tank and remove tank. Refer to Fuel Tank Removal/Installation.

(3) Thoroughly wash and clean area around pump module to prevent contaminants from entering tank.

(4) Disconnect fuel return and pressure lines from fuel pump module fittings (Fig. 16). Refer to Quick-Connect Fittings for procedures.

(5) The plastic fuel pump module locknut is threaded onto fuel tank (Fig. 16). Install Special Tool 6856 to fuel pump module locknut and remove locknut (Fig. 18). The fuel pump module will spring up slightly after locknut is removed.

(6) Remove module from fuel tank.

INSTALLATION

Fuel tank removal will be necessary for fuel pump module removal.

CAUTION: Whenever fuel pump module is serviced, module gasket must be replaced.

(1) Thoroughly clean locknut threads and mating fuel tank threads. Use a soap/water solution. Do not use carburetor cleaner to clean threads.

(2) Using new gasket, position fuel pump module into opening in fuel tank.

(3) Apply clean water to locknut threads.

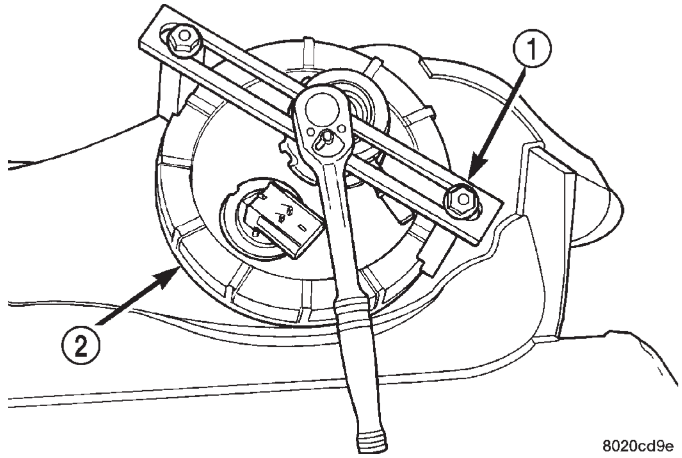


Fig. 18 LOCKNUT REMOVAL/INSTALLATION - TYPICAL

1 - SPECIAL TOOL 6856
2 - LOCKNUT

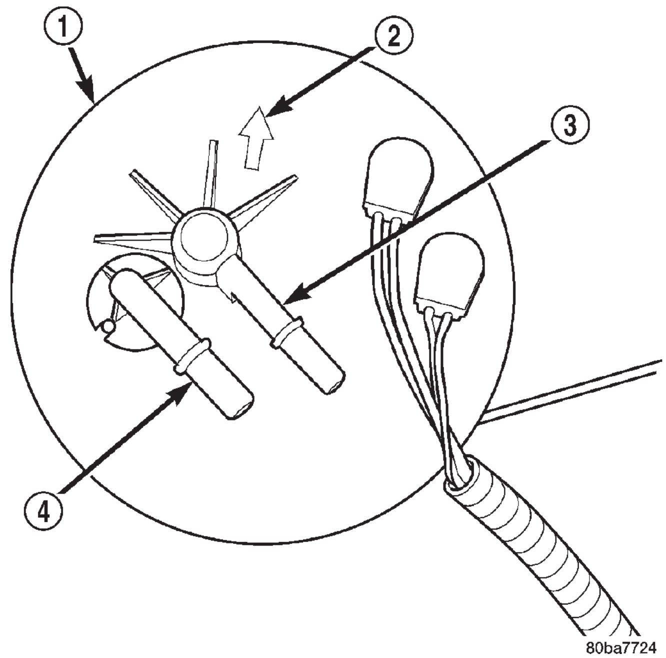


Fig. 19 FUEL PUMP MODULE INDEXING ARROW

1 - FUEL PUMP MODULE
2 - INDEXING ARROW
3 - FUEL SUPPLY (PRESSURE) FITTING
4 - FUEL RETURN FITTING

(4) Position locknut over top of fuel pump module.

(5) Rotate module until indexing arrow at top of module (Fig. 19)is pointed toward rear of vehicle. Align arrow to tick mark on top of fuel tank. **This step must be done to prevent float/float rod assembly from contacting sides of fuel tank.**

(6) Install Special Tool 6856 to locknut.

(7) Tighten locknut to 74 N·m (55 ft. lbs.) torque.

FUEL PUMP MODULE (Continued)

(8) Connect fuel return and pressure lines to fuel pump module fittings (Fig. 16). Refer to Quick-Connect Fittings.

(9) Install fuel tank. Refer to Fuel Tank Installation.

FUEL RAIL

DESCRIPTION

DESCRIPTION - 4.7L

The fuel injector rail is used to mount the fuel injectors to the engine. It is mounted to the intake manifold (Fig. 20).

DESCRIPTION - 4.0L

The fuel injector rail is used to mount the fuel injectors to the engine (Fig. 21). On the 4.0L 6–cylinder engine, a **fuel damper** is located near the center of the fuel rail (Fig. 21).

OPERATION

OPERATION - 4.7L

High pressure fuel from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

A fuel pressure test port is located on the fuel rail (Fig. 20). A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

OPERATION - 4.0L

The fuel injector rail supplies the necessary fuel to each individual fuel injector.

High pressure fuel from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

The fuel damper is used only to help control fuel pressure pulsations. These pulsations are the result of the firing of the fuel injectors. It is **not used** as a fuel pressure regulator. The fuel pressure regulator is **not mounted** to the fuel rail on any engine. It is located near the front of the fuel tank above the rear axle. Refer to Fuel Filter/Fuel Pressure Regulator in this group for information.

A fuel pressure test port is located on the fuel rail (Fig. 21). A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

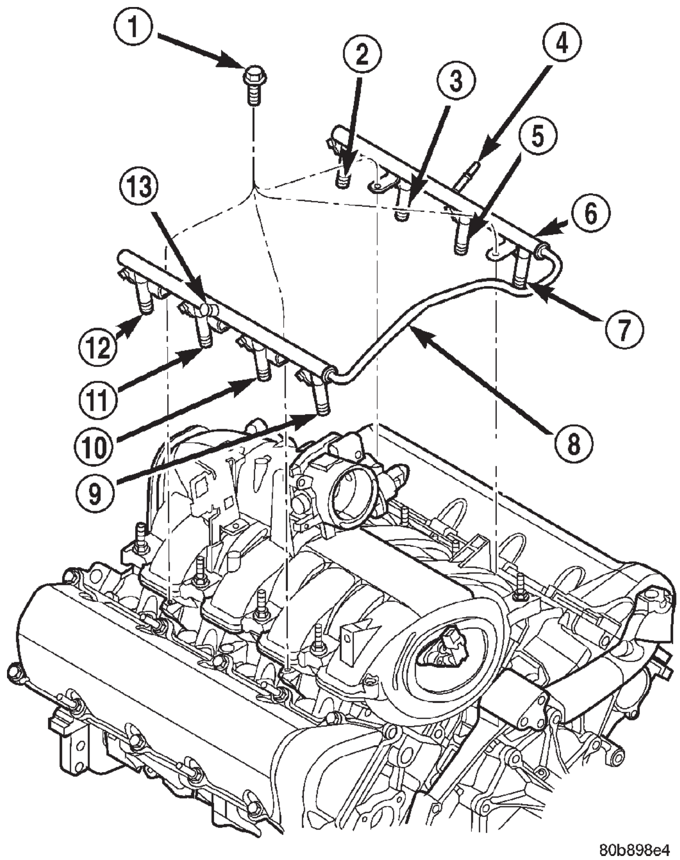


Fig. 20 Fuel Injector Rail—4.7L V-8 Engine

1 - MOUNTING BOLTS (4)
2 - INJ.#7
3 - INJ.#5
4 - QUICK-CONNECT FITTING
5 - INJ.#3
6 - FUEL INJECTOR RAIL
7 - INJ.#1
8 - CONNECTOR TUBE
9 - INJ.#2
10 - INJ.#4
11 - INJ.#6
12 - INJ.#8
13 - PRESSURE TEST PORT CAP

REMOVAL

REMOVAL - 4.7L

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL RAIL, FUEL SYSTEM PRESSURE MUST BE RELEASED.

FUEL RAIL (Continued)

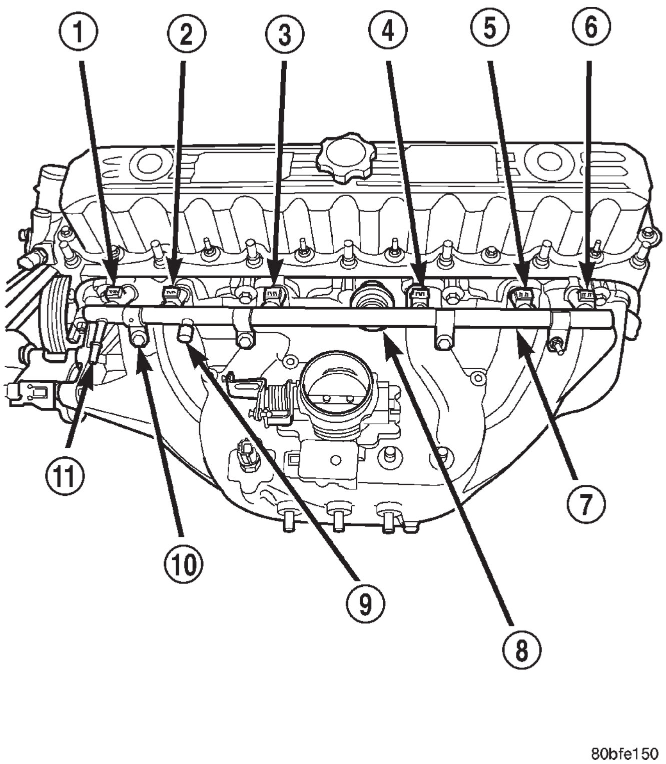


Fig. 21 Fuel Injector Rail/Fuel Damper—4.0L Engine

1 - INJ. #1
2 - INJ. #2
3 - INJ. #3
4 - INJ. #4
5 - INJ. #5
6 - INJ. #6
7 - FUEL INJECTOR RAIL
8 - FUEL DAMPER
9 - PRESSURE TEST PORT CAP
10 - MOUNTING BOLTS (4)
11 - QUICK-CONNECT FITTING

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connector tube (Fig. 22). Due to design of tube, it does not use any clamps. Never attempt to install a clamping device of any kind to tube. When removing fuel rail assembly for any reason, be careful not to bend or kink tube.

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Remove negative battery cable at battery.

(4) Remove air duct at throttle body air box.

(5) Remove air box at throttle body.

(6) Remove wiring at rear of generator.

(7) Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. Refer to Quick-Connect Fittings.

(8) Remove vacuum lines at throttle body.

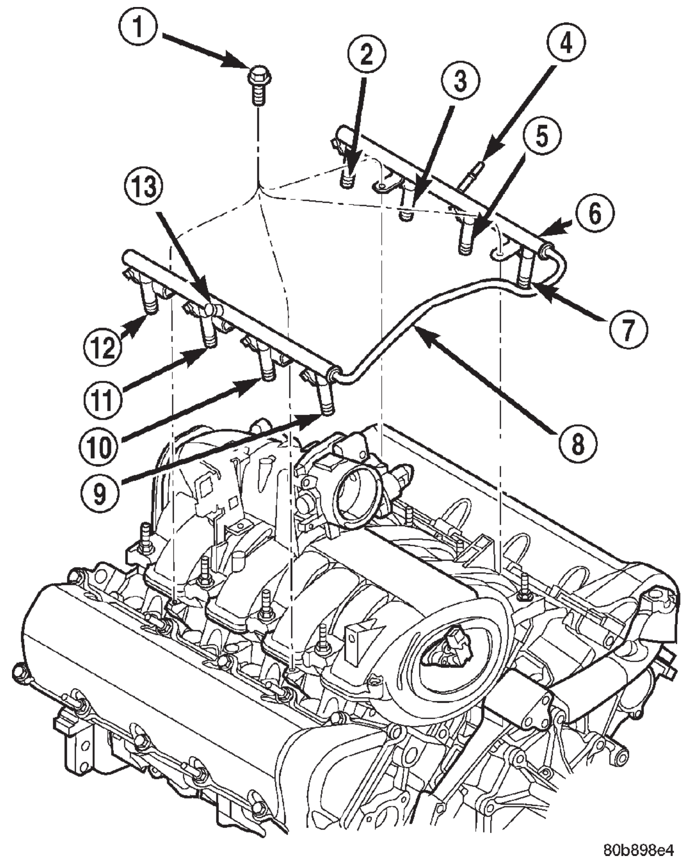


Fig. 22 FUEL INJECTOR RAIL - 4.7L V-8 EN

1 - MOUNTING BOLTS (4)
2 - INJ.#7
3 - INJ.#5
4 - QUICK-CONNECT FITTING
5 - INJ.#3
6 - FUEL INJECTOR RAIL
7 - INJ.#1
8 - CONNECTOR TUBE
9 - INJ.#2
10 - INJ.#4
11 - INJ.#6
12 - INJ.#8
13 - PRESSURE TEST PORT CAP

(9) Disconnect electrical connectors at all 8 fuel injectors. To remove connector refer to (Fig. 23). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

(10) Disconnect electrical connectors at throttle body.

(11) Disconnect electrical connectors at MAP and IAT sensors.

FUEL RAIL (Continued)

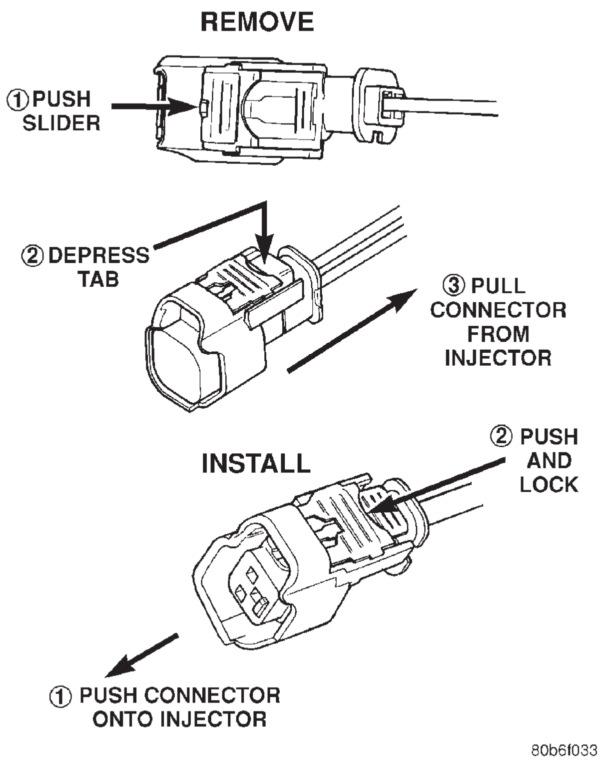


Fig. 23 Remove/Install Injector Connector—4.7L V-8 Engine

(12) Remove first three ignition coils on each bank (cylinders #1, 3, 5, 2, 4 and 6). Refer to Ignition Coil Removal/Installation.

(13) Remove 4 fuel rail mounting bolts (Fig. 22).

(14) Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.

(15) Remove fuel rail (with injectors attached) from engine.

(16) If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

REMOVAL - 4.0L

The fuel damper is not serviced separately.

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL RAIL.

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Disconnect negative battery cable from battery.

(4) Remove air tube at top of throttle body. Note: Some engine/vehicles may require removal of air cleaner ducts at throttle body.

(5) Disconnect electrical connectors at all 6 fuel injectors. To remove connector refer to (Fig. 25). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

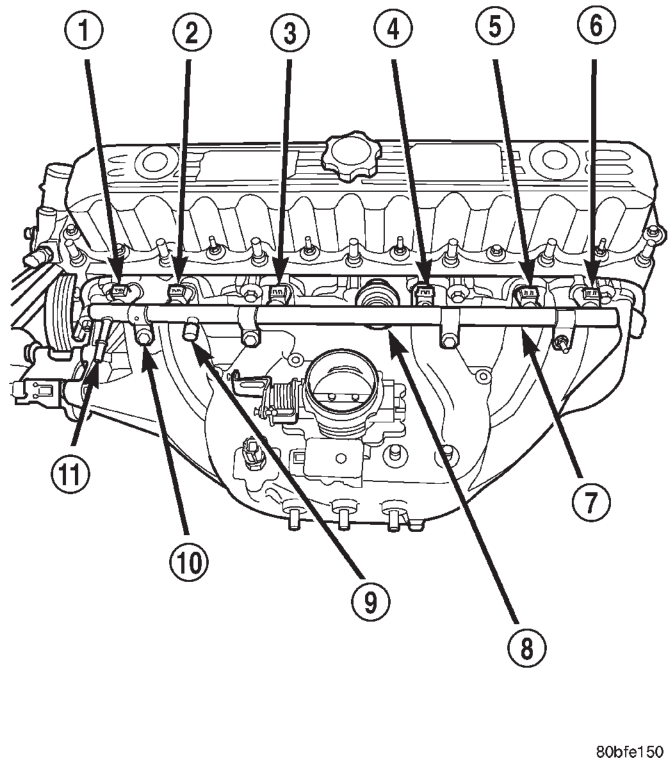


Fig. 24 Fuel Rail Mounting—4.0L Engine

1 - INJ. #1
2 - INJ. #2
3 - INJ. #3
4 - INJ. #4
5 - INJ. #5
6 - INJ. #6
7 - FUEL INJECTOR RAIL
8 - FUEL DAMPER
9 - PRESSURE TEST PORT CAP
10 - MOUNTING BOLTS (4)
11 - QUICK-CONNECT FITTING

(6) Remove oxygen sensor wiring clip nuts at fuel rail mounting studs (certain emissions packages only).

(7) Disconnect fuel supply line latch clip and fuel line at fuel rail. Refer to Quick-Connect Fittings.

(8) Disconnect throttle cable at throttle body. Refer to Throttle Cable Removal/Installation.

FUEL RAIL (Continued)

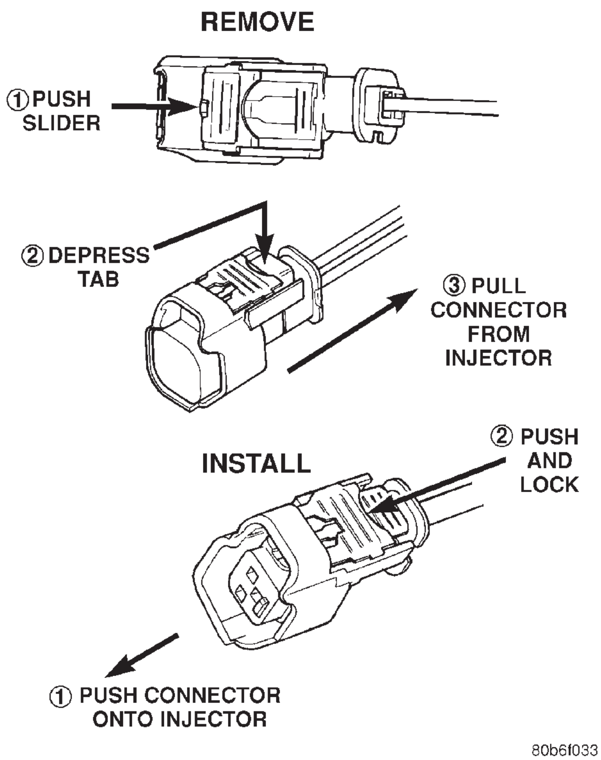


Fig. 25 Remove/Install Injector Connector—4.0L Engine

(9) Disconnect speed control cable at throttle body (if equipped). Refer to Speed Control Cable.

(10) Disconnect automatic transmission cable at throttle body (if equipped).

(11) Remove cable routing bracket at intake manifold.

(12) Clean dirt/debris from each fuel injector at intake manifold.

(13) Remove fuel rail mounting nuts/bolts (Fig. 24).

(14) Remove fuel rail by gently rocking until all fuel injectors have cleared machined holes at intake manifold.

(15) If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

INSTALLATION

INSTALLATION - 4.7L

(1) If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.

(2) Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.

(3) Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.

(4) Guide each injector into cylinder head. Be careful not to tear injector o-rings.

(5) Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.

(6) Install 4 fuel rail mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(7) Install ignition coils. Refer to Ignition Coil Removal/Installation.

(8) Connect electrical connectors to throttle body.

(9) Connect electrical connectors to MAP and IAT sensors.

(10) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 23). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(11) Connect vacuum lines to throttle body.

(12) Connect fuel line latch clip and fuel line to fuel rail. Refer to Quick-Connect Fittings.

(13) Connect wiring to rear of generator.

(14) Install air box to throttle body.

(15) Install air duct to air box.

(16) Connect battery cable to battery.

(17) Start engine and check for leaks.

INSTALLATION - 4.0L

(1) If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.

(2) Clean each injector bore at intake manifold.

(3) Apply a small amount of clean engine oil to each injector o-ring. This will aid in installation.

(4) Position tips of all fuel injectors into the corresponding injector bore in intake manifold. Seat injectors into manifold.

(5) Install and tighten fuel rail mounting bolts to 11 ±3 N·m (100 ±25 in. lbs.) torque.

(6) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 25). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(7) Connect fuel line and fuel line latch clip to fuel rail. Refer Quick-Connect Fittings.

(8) Install protective cap to pressure test port fitting (if equipped).

(9) Install cable routing bracket to intake manifold.

(10) Connect throttle cable at throttle body.

(11) Connect speed control cable at throttle body (if equipped).

(12) Connect automatic transmission cable at throttle body (if equipped).

(13) Install oxygen sensor wiring clip nuts to fuel rail mounting studs (certain emissions packages only).

FUEL RAIL (Continued)

(14) Install air tube (or duct) at top of throttle body.

(15) Install fuel tank cap.

(16) Connect negative battery cable to battery.

(17) Start engine and check for fuel leaks.

FUEL TANK

DESCRIPTION

The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module and certain ORVR components.

OPERATION

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

A fuel tank check valve(s) is mounted into the top of the fuel tank (or pump module). Refer to Fuel Tank Check Valve for additional information.

An evaporation control system is connected to the check valve(s) to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using a Leak Detection Pump (LDP). Refer to Emission Control System for additional information.

Refer to ORVR for On-Board Refueling Vapor Recovery system information.

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH ENGINE OFF. PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL TANK.

Two different procedures may be used to drain fuel tank (through ORVR control valve opening at top of fuel tank, or using DRB scan tool). The quickest is draining through ORVR control valve opening at top of fuel tank (Fig. 26).

As an alternative procedure, the electric fuel pump may be activated allowing tank to be drained at fuel rail connection. Refer to DRB scan tool for fuel pump activation procedures. Before disconnecting fuel line at fuel rail, release fuel pressure. Refer to the Fuel System Pressure Release Procedure for procedures. Attach end of Special Adapter Hose Tool number 6539 at fuel rail disconnection. Position opposite end of 6539 to an approved gasoline draining station. Activate fuel pump with DRB and drain tank until empty.

If electric fuel pump is not operating, tank **MUST** be drained through ORVR control valve opening at top of fuel tank (Fig. 26).

(1) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure.

(2) Disconnect negative battery cable at battery.

(3) Raise and support vehicle.

(4) Remove left rear wheel/tire.

CAUTION: HANDLE EVAP, LDP AND ORVR VAPOR / VACUUM LINES VERY CAREFULLY. THESE LINES AND HOSES MUST BE FIRMLY CONNECTED. CHECK THE VAPOR/VACUUM LINES AT THE LDP, LDP FILTER, EVAP CANISTER, EVAP CANISTER PURGE SOLENOID AND ORVR COMPONENTS FOR DAMAGE OR LEAKS. IF A LEAK IS PRESENT, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

(5) Clean top of fuel tank at ORVR control valve (Fig. 26) or (Fig. 27).

(6) Press release tab in direction of arrow in (Fig. 27) and remove ORVR control valve lock ring (counter-clockwise). Lift up ORVR control slightly. Using an approved gasoline draining station, drain tank until empty through this opening.

(7) Remove stone shield behind left/rear wheel (Fig. 28). Drill out plastic rivets for removal.

(8) Remove 3 LDP mounting bolts (Fig. 29).

(9) Remove support bracket brace bolt (Fig. 30).

(10) Loosen, but do not remove 2 support bracket nuts at frame rail (Fig. 29).

(11) To separate and lower front section of two-piece support bracket, remove 3 attaching bolts on bottom of support bracket (Fig. 30). While lowering support bracket, disconnect LDP wiring clip (Fig. 31).

(12) Remove hose clamp (Fig. 32) and remove fuel fill hose from fuel fill tube.

(13) Cut and discard tie wrap from axle vent hose (Fig. 32).

(14) Disconnect fuel vent hose from fuel vent tube (Fig. 32).

(15) Disconnect ORVR hose elbow (Fig. 33) at top of EVAP canister.

(16) Place hydraulic jack to bottom of fuel tank.

(17) Remove fuel tank-to-rear bumper fascia clips (Fig. 34).

(18) Remove fuel tank heat shield mounting bolts (Fig. 35).

CAUTION: To protect fuel tank from exhaust heat, shield must re-installed after tank installation.

WARNING: PLACE SHOP TOWEL AROUND FUEL LINES TO CATCH ANY EXCESS FUEL.

FUEL TANK (Continued)

(19) Disconnect fuel return line at fuel filter/fuel pressure regulator (Fig. 36). Refer to Quick-Connect Fittings for procedures.

(20) Disconnect fuel pressure line at fuel filter/fuel pressure regulator (Fig. 36). Refer to Quick-Connect Fittings for procedures.

(21) Disconnect EVAP canister vent line near front of tank (Fig. 36).

(22) Disconnect fuel pump module electrical connector (pigtail harness) near front of tank (Fig. 36). Harness connector is clipped to body.

(23) Remove left / front tank support bracket bolt at frame (Fig. 37).

(24) **WITHOUT TRAILER HITCH:** Remove tank-to-frame mounting bolts (Fig. 39). Remove rear tank support bracket bolts at frame (Fig. 38). Carefully lower tank until clear of vehicle. Place tank on floor.

(25) **WITH TRAILER HITCH:** Remove tank / hitch mounting bolts (Fig. 40). Carefully lower tank until clear of vehicle. Place tank on floor.

(26) If necessary, separate skid plate from fuel tank by removing 2 fuel tank strap nuts (Fig. 39) and remove 2 tank straps.

(27) If fuel pump module removal is necessary, refer to Fuel Pump Module Removal/Installation.

(28) If hoses are to be removed at fuel tank end, note painted alignment (indexing) markings on hoses, and molded indexing tangs on tank before removal. Remove hoses.

(29) If necessary, remove 3 fuel filler tube assembly mounting bolts (Fig. 41) and remove fuel filler tube.

INSTALLATION

CAUTION: HANDLE EVAP, LDP AND ORVR VAPOR / VACUUM LINES VERY CAREFULLY. THESE LINES AND HOSES MUST BE FIRMLY CONNECTED. CHECK THE VAPOR/VACUUM LINES AT THE LDP, LDP FILTER, EVAP CANISTER, EVAP CANISTER PURGE SOLENOID AND ORVR COMPONENTS FOR DAMAGE OR LEAKS. IF A LEAK IS PRESENT, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

(1) If necessary, position fuel filler tube assembly to body. Install 3 bolts and tighten to 2 N·m (15 in. lbs.) torque.

(2) If necessary, connect quick-connect fittings to fuel pump module.

(3) If fuel pump module is being installed, refer to Fuel Pump Module Removal/Installation.

(4) Install fuel fill/vent hoses to tank fittings. To prevent hoses from kinking, rotate each hose until painted indexing mark on hose is aligned to molded indexing tang on tank.

(5) Install hose clamps to hoses. Refer to Torque Specifications.

(6) If necessary, position fuel tank into skid plate. Install 2 tank straps and 2 strap nuts (Fig. 39). Refer to Torque Specifications.

(7) Position fuel tank / skid plate assembly to hydraulic jack.

(8) Raise tank into position to frame.

(9) **WITH TRAILER HITCH:** Position trailer hitch and tow hooks (Fig. 40) to bottom of fuel tank. Install bolts and nuts loosely.

(10) **WITHOUT TRAILER HITCH:** Install 2 rear tank support brackets and bolts (Fig. 38). Install tank-to-frame bolts. Do not tighten bolts / nuts at this time.

(11) Install 1 left / front tank support bracket and bolts / nuts (Fig. 37). Do not tighten bolts / nuts at this time.

(12) Be sure fuel tank is properly aligned to frame and body. Tighten all tank, tow hook and trailer hitch bolts / nuts except for 3 support brackets. Tighten all 3 (2 rear and 1 left / front) support bracket bolts / nuts last. Refer to Torque Specifications.

(13)

(14) Connect fuel pump module pigtail harness electrical connector near front of tank.

(15) Connect both fuel lines to fuel filter/fuel pressure regulator. Refer to Quick-Connect Fittings for procedures.

(16) Connect EVAP hose near front of tank.

(17) Position rear axle vent hose and install new tie strap (Fig. 32).

(18) Install heat shield nuts / bolts (Fig. 35). Refer to Torque Specifications.

(19) Connect ORVR hose elbow (Fig. 33) to top of EVAP canister.

(20) Connect fuel vent hose to fuel vent tube (Fig. 32).

(21) Install fuel fill hose and clamp to fuel fill tube (Fig. 32).

(22) Install 3 LDP mounting bolts (Fig. 29).

(23) While raising support bracket, connect LDP wiring clip (Fig. 31). Install front section of two-piece support bracket to rear section with 3 attaching bolts located on bottom of support bracket (Fig. 30).

(24) Install support bracket brace bolt (Fig. 30).

(25) Tighten 2 support bracket nuts at frame rail (Fig. 29).

(26) Install fuel tank-to-rear bumper fascia clips (Fig. 34).

(27) Using new plastic rivets, install stone shield behind left/rear wheel (Fig. 28).

(28) Install left rear wheel/tire.

(29) Lower vehicle and connect negative battery cable to battery.

(30) Fill tank with fuel and check for leaks.

FUEL TANK (Continued)

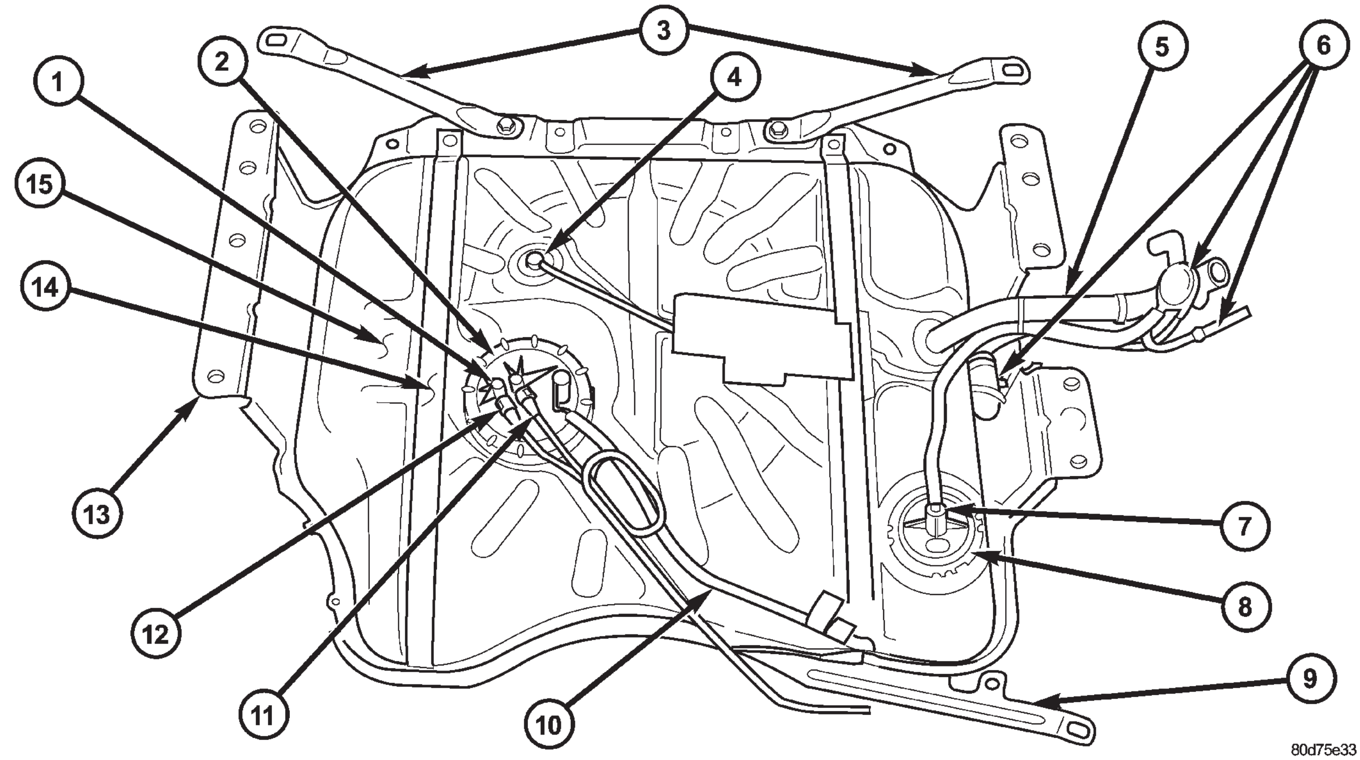


Fig. 26 FUEL TANK AND COMPONENTS

1 - FUEL PUMP MODULE
2 - MODULE LOCK RING
3 - TANK SUPPORT BRACKETS (REAR)
4 - CHECK VALVE
5 - FUEL FILL HOSE
6 - ORVR COMPONENTS
7 - ORVR CONTROL VALVE
8 - CONTROL VALVE LOCK RING
9 - TANK SUPPORT BRACKET (SMALL/FRONT)
10 - MODULE PIGTAIL HARNESS
11 - FUEL SUPPLY (PRESSURE) LINE
12 - FUEL RETURN LINE
13 - SKID PLATE
14 - TANK STRAPS (2)
15 - FUEL TANK

FUEL TANK (Continued)

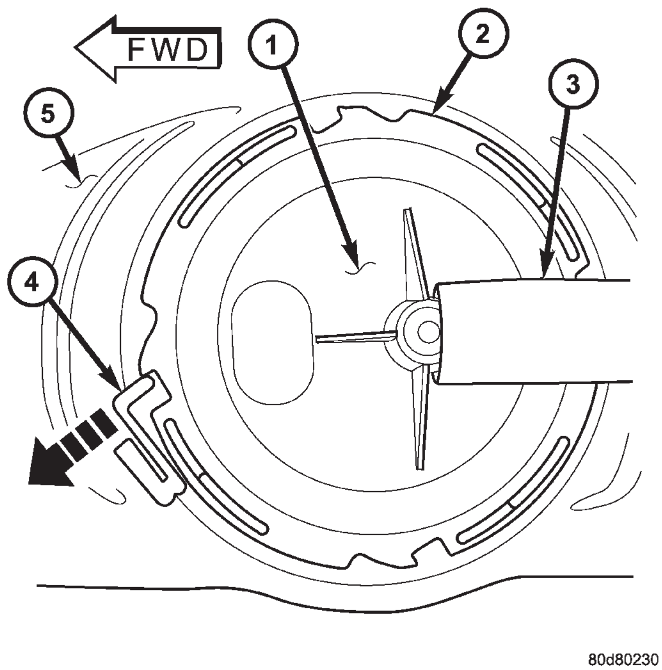


Fig. 27 ORVR CONTROL VALVE / LOCK RING

1 - ORVR CONTROL VALVE
2 - LOCK RING
3 - ORVR HOSE
4 - RELEASE TAB
5 - TOP OF FUEL TANK

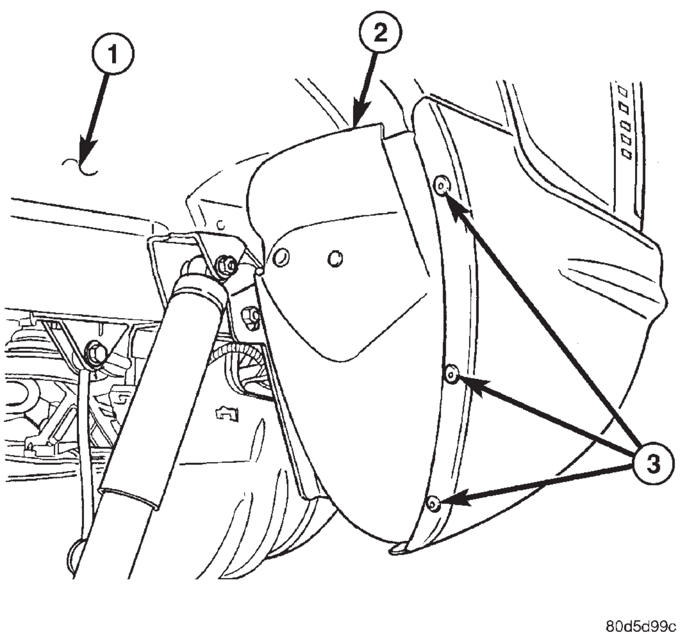


Fig. 28 STONE SHIELD

1 - LEFT-REAR WHEELHOUSE
2 - STONE SHIELD
3 - PLASTIC RIVETS

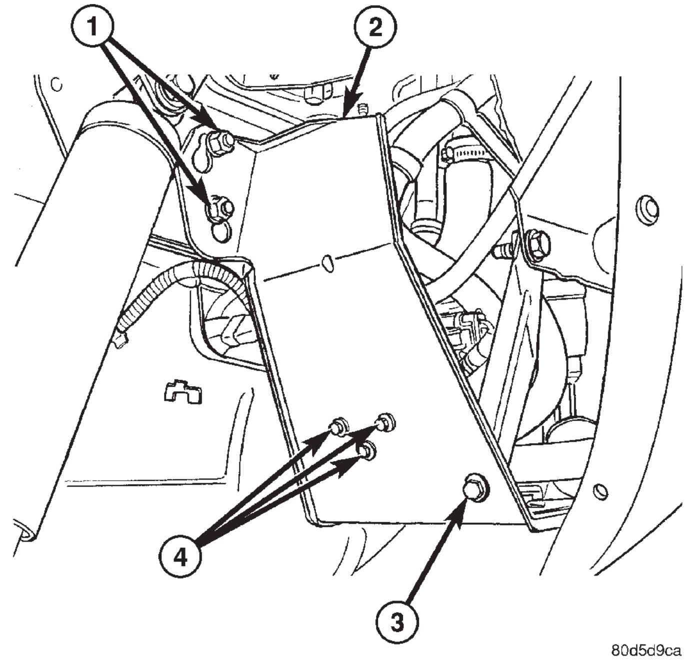


Fig. 29 LDP MOUNTING BOLTS

1 - SUPPORT BRACKET NUTS (2)
2 - SUPPORT BRACKET (FRONT)
3 - SUPPORT BRACKET BRACE BOLT
4 - LDP MOUNTING BOLTS (3)

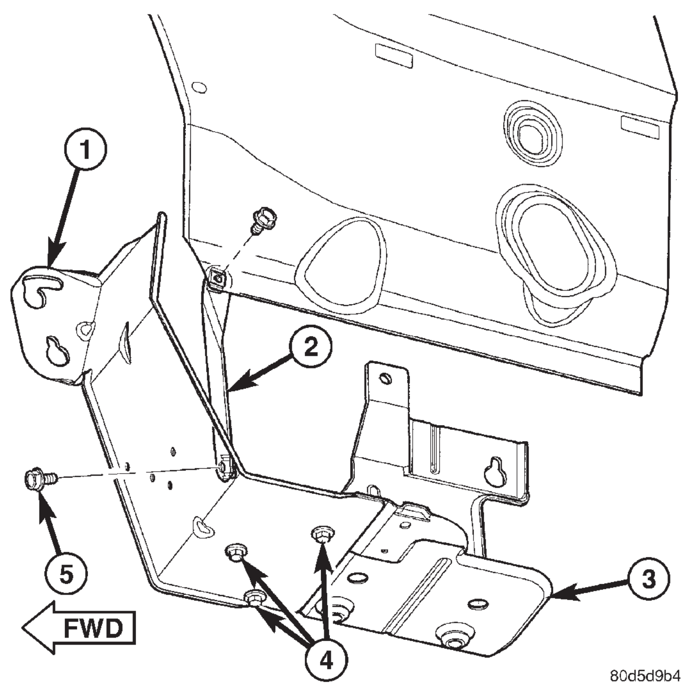


Fig. 30 TWO-PIECE SUPPORT BRACKET

1 - TWO-PIECE SUPPORT BRACKET (FRONT)
2 - SUPPORT BRACKET BRACE
3 - TWO-PIECE SUPPORT BRACKET (REAR)
4 - SUPPORT BRACKET ATTACHING BOLTS (3)
5 - SUPPORT BRACKET BRACE BOLT

FUEL TANK (Continued)

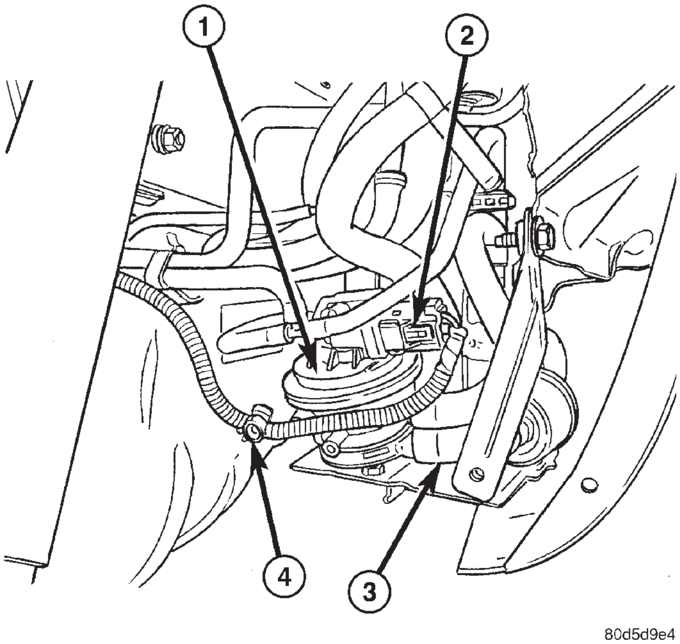


Fig. 31 LDP REMOVAL / INSTALLATION

1 - LDP
2 - ELEC. CONNECT.
3 - VAPOR / VACUUM LINES
4 - WIRING CLIP

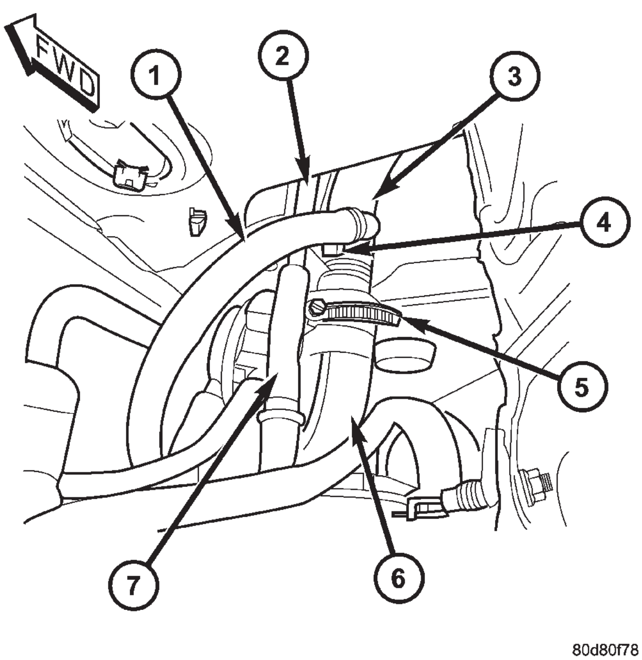


Fig. 32 FUEL FILL TUBE/HOSE/CLAMP

1 - AXLE VENT HOSE
2 - FUEL VENT TUBE
3 - FUEL FILL TUBE
4 - PLASTIC TIE WRAP
5 - HOSE CLAMP
6 - FUEL FILL HOSE
7 - FUEL VENT HOSE

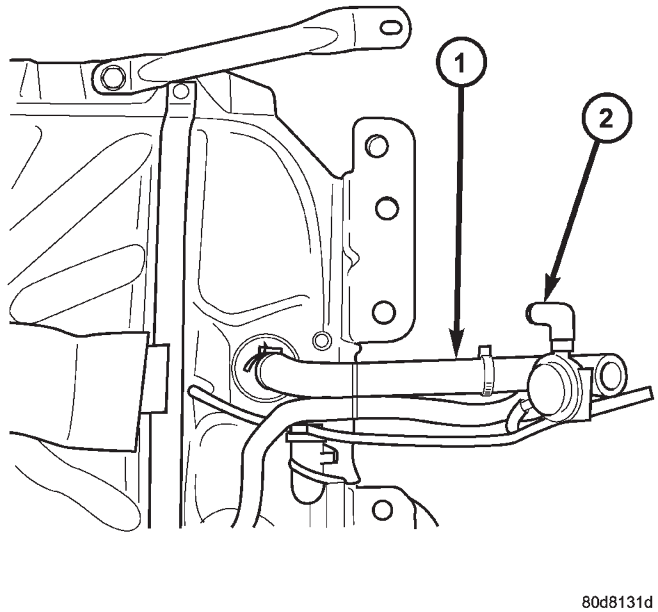


Fig. 33 ORVR HOSE ELBOW

1 - FUEL FILL HOSE
2 - ELBOW (TO TOP OF EVAP CANISTER)

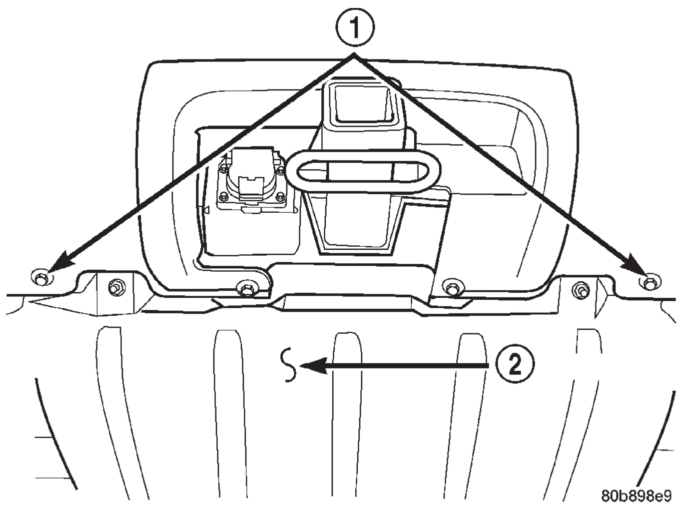


Fig. 34 BUMPER FASCIA CLIPS

1 - CLIPS
2 - FUEL TANK

FUEL TANK (Continued)

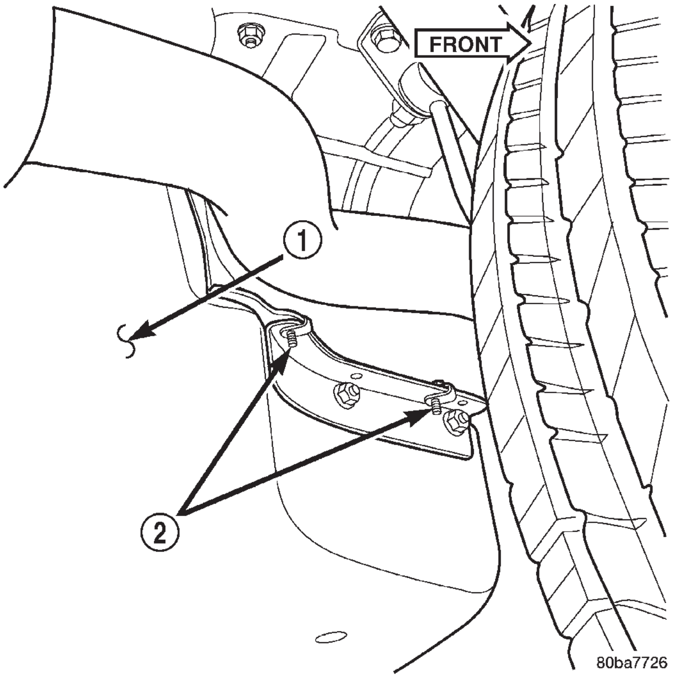


Fig. 35 FUEL TANK HEAT SHIELD BOLTS

1 - FUEL TANK
2 - HEAT SHIELD BOLTS

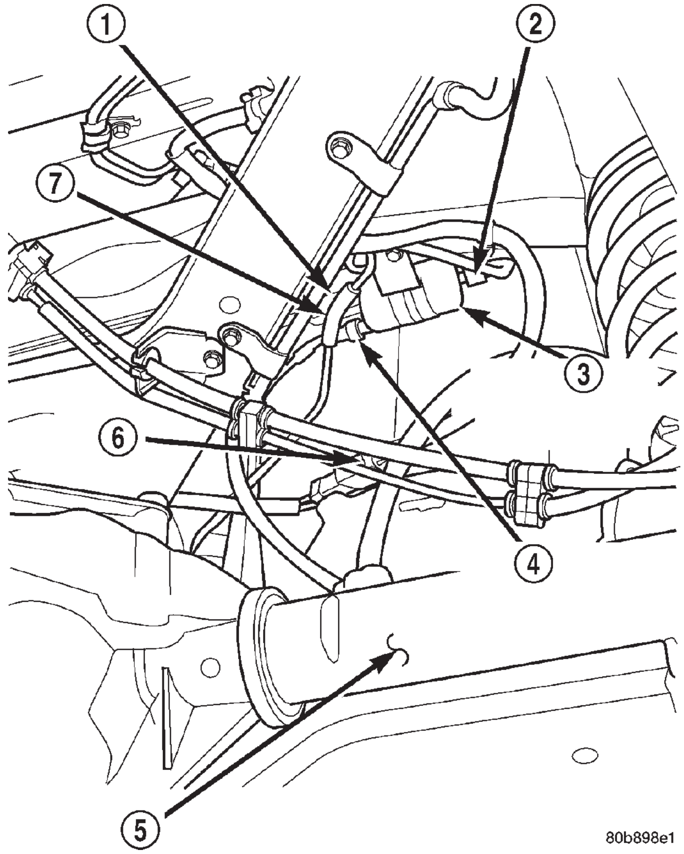


Fig. 36 FUEL FILTER/FUEL PRESSURE REGULATOR

1 - FUEL RETURN LINE
2 - FUEL SUPPLY LINE (TO FUEL RAIL)
3 - FUEL FILTER/FUEL PRESSURE REGULATOR
4 - FUEL PRESSURE LINE
5 - REAR AXLE
6 - ELEC. CONNECTOR
7 - EVAP LINE

FUEL TANK (Continued)

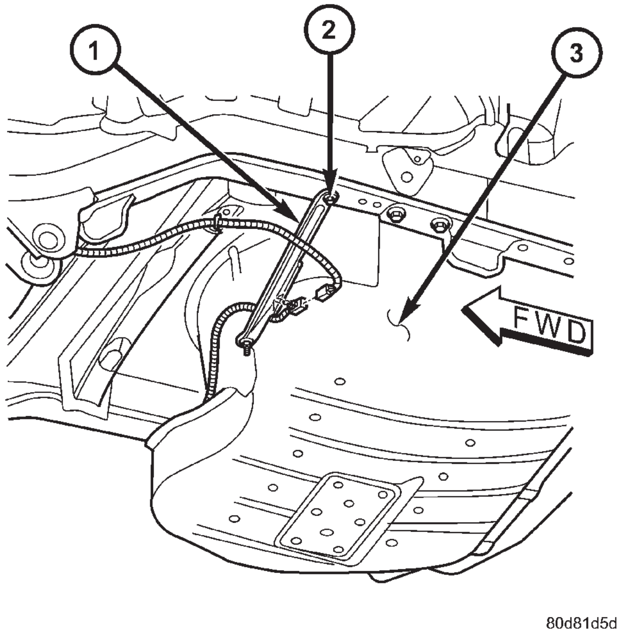


Fig. 37 BRACKET, TANK SUPPORT - FRONT

1 - FUEL TANK SUPPORT BRACKET (LEFT FRONT)
2 - BRACKET BOLT
3 - LEFT SIDE OF TANK

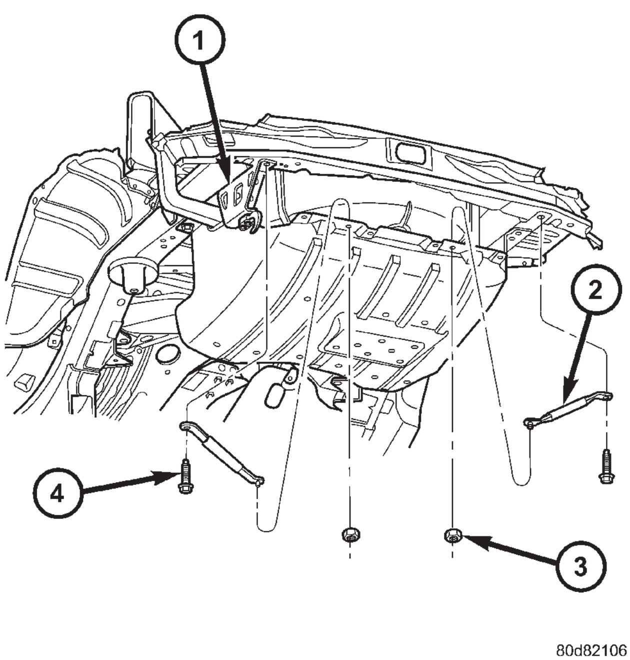


Fig. 38 BRACKETS, TANK SUPPORT - REAR

1 - TOW HOOKS
2 - REAR SUPPORT BRACKETS (2)
3 - TANK SUPPORT BRACKET NUTS
4 - TANK SUPPORT BRACKET BOLTS

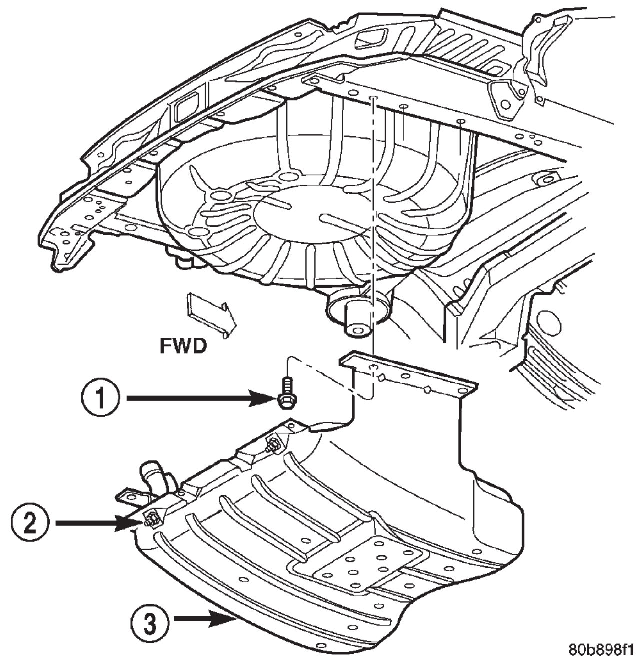


Fig. 39 FUEL TANK MOUNTING - NO TRAILER HITCH

1 - TANK MOUNTING BOLTS
2 - STRAP NUTS
3 - FUEL TANK/SHIELD ASSEMBLY

FUEL TANK (Continued)

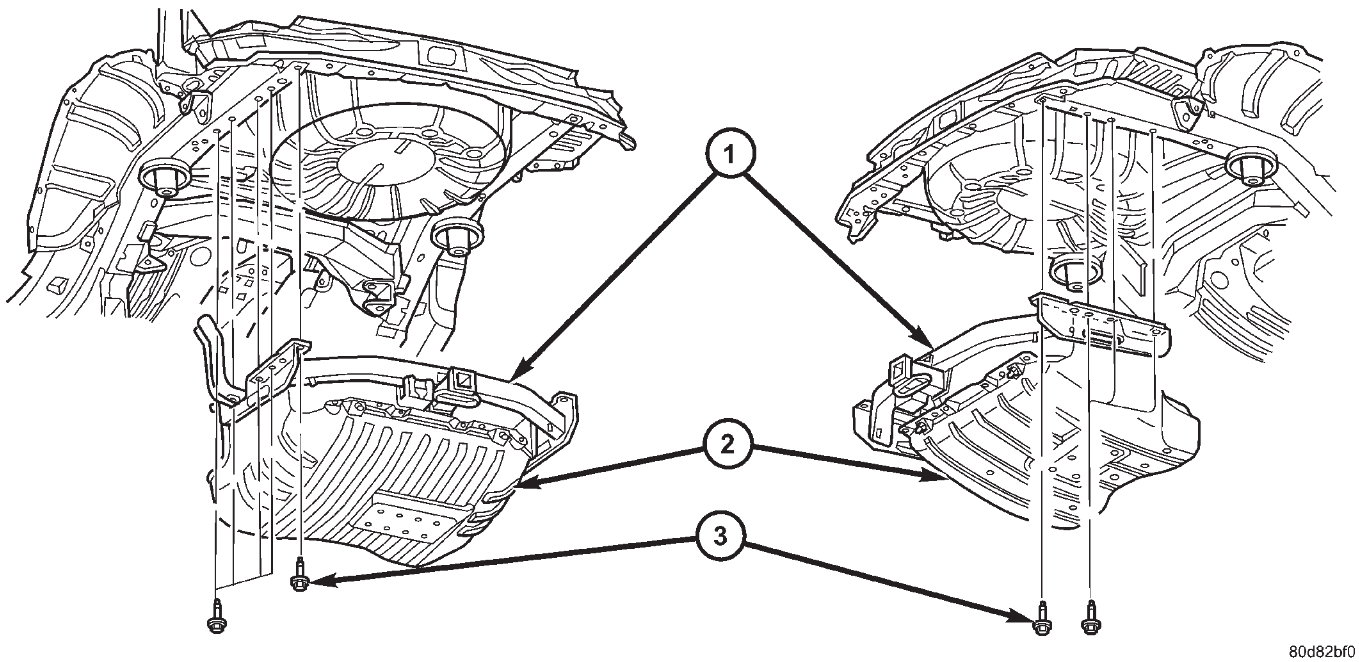


Fig. 40 FUEL TANK MOUNTING - WITH TRAILER HITCH

1 - TRAILER HITCH
2 - FUEL TANK
3 - FUEL TANK / HITCH MOUNTING BOLTS

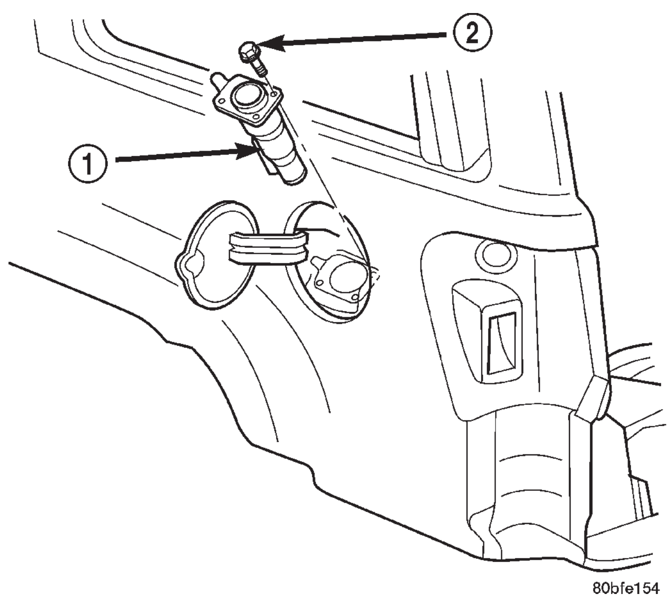


Fig. 41 FUEL FILLER TUBE

1 - FUEL FILLER TUBE
2 - MOUNTING BOLTS (3)

INLET FILTER

REMOVAL

The fuel pump inlet filter (strainer) is located on the bottom of fuel pump module (Fig. 42). The fuel pump module is located on top of fuel tank.

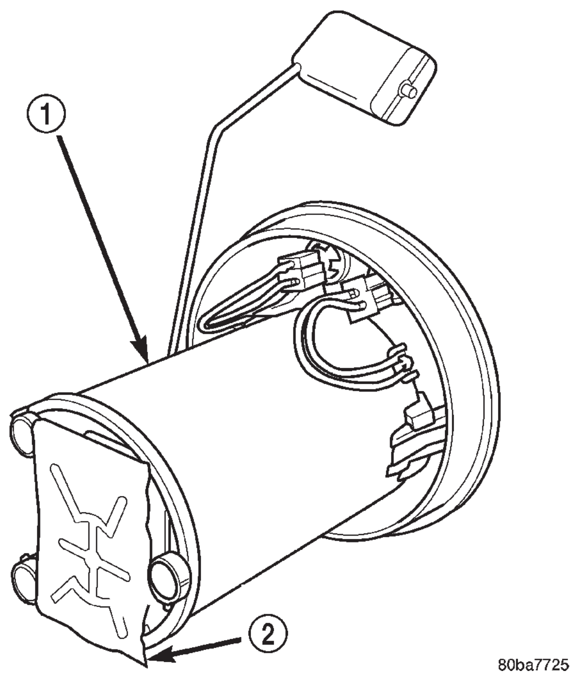


Fig. 42 Fuel Pump Inlet Filter

1 - FUEL PUMP MODULE
2 - FUEL PUMP INLET FILTER

The fuel pump inlet filter (strainer) is located on the bottom of fuel pump module (Fig. 42). The fuel pump module is located on top of fuel tank.

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Remove filter by prying from bottom of module with 2 screwdrivers. Filter is snapped to module.

(4) Clean bottom of pump module.

INSTALLATION

The fuel pump inlet filter (strainer) is located on the bottom of fuel pump module (Fig. 42). The fuel pump module is located on top of fuel tank.

(1) Snap new filter to bottom of module.

(2) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Install fuel tank. Refer to Fuel Tank Removal/Installation.

QUICK CONNECT FITTING

DESCRIPTION

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. Refer to Quick-Connect Fittings Removal/Installation for more information.

CAUTION: The interior components (o-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

STANDARD PROCEDURE - QUICK-CONNECT FITTINGS

Also refer to Fuel Tubes/Lines/Hoses and Clamps.

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Safety latch clips are used on certain components/lines. Certain fittings may require use of a special tool for disconnection.

DISCONNECTING

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSE, FITTING OR LINE, FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

CAUTION: The interior components (o-rings, spacers) of some types of quick-connect fitting are not serviced separately. If service parts are not available, do not attempt to repair a damaged fitting or fuel line. If repair is necessary, replace complete fuel line assembly.

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure.

(2) Disconnect negative battery cable from battery.

(3) Clean fitting of any foreign material before disassembly.

(4) **2–Button Type Fitting:** This type of fitting is equipped with a push-button located on each side of quick-connect fitting (Fig. 43). Press on both buttons simultaneously for removal. Special tools are not required for disconnection.

QUICK CONNECT FITTING (Continued)

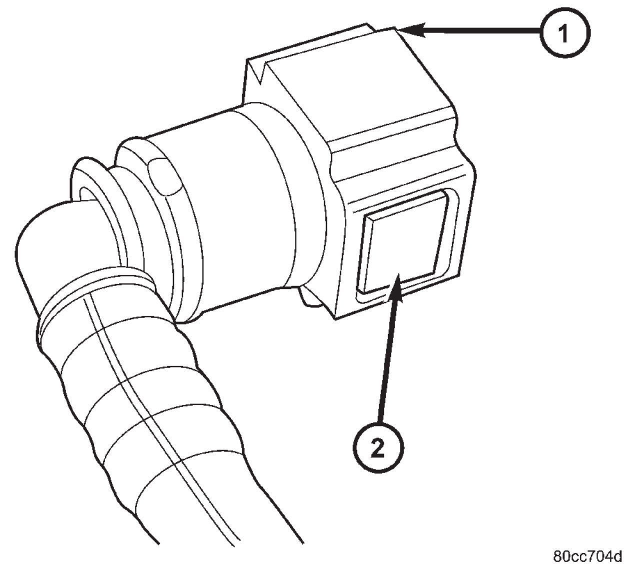


Fig. 43 2-BUTTON TYPE FITTING

1 - QUICK-CONNECT FITTING
2 - PUSH-BUTTONS (2)

(5) **Pinch-Type Fitting:** This fitting is equipped with two finger tabs. Pinch both tabs together while removing fitting (Fig. 44). Special tools are not required for disconnection.

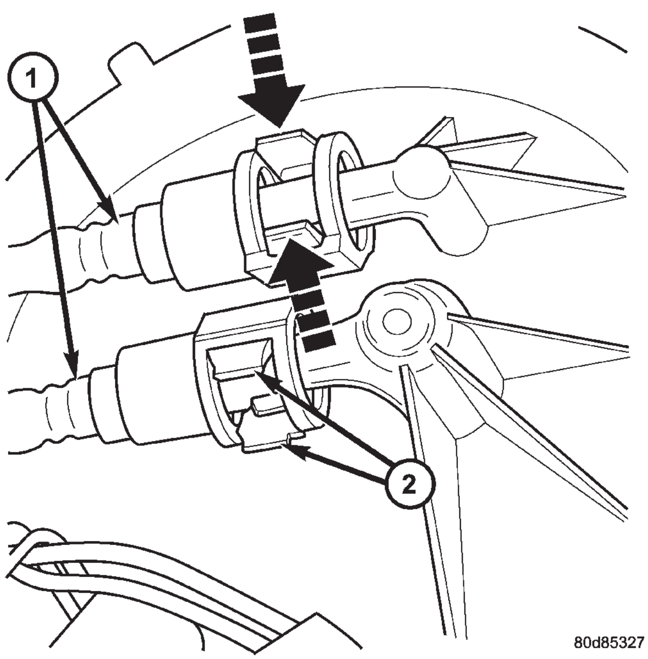


Fig. 44 PINCH TYPE QUICK-CONNECT FITTING

1 - QUICK-CONNECT FITTINGS
2 - PINCH TABS

(6) **Single-Tab Type Fitting:** This type of fitting is equipped with a single pull tab (Fig. 45). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component. Special tools are not required for disconnection.

(a) Press release tab on side of fitting to release pull tab (Fig. 46). **If release tab is not pressed prior to releasing pull tab, pull tab will be damaged.**

(b) While pressing release tab on side of fitting, use screwdriver to pry up pull tab (Fig. 46).

(c) Raise pull tab until it separates from quick-connect fitting (Fig. 47).

(7) **Two-Tab Type Fitting:** This type of fitting is equipped with tabs located on both sides of fitting (Fig. 48). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.

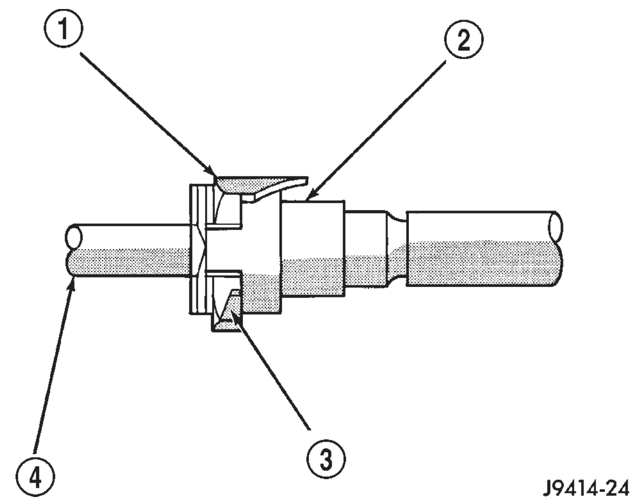


Fig. 45 SINGLE-TAB TYPE FITTING

1 - PULL TAB
2 - QUICK-CONNECT FITTING
3 - PRESS HERE TO REMOVE PULL TAB
4 - INSERTED TUBE END

(a) To disconnect quick-connect fitting, squeeze plastic retainer tabs (Fig. 48) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.

(b) Pull fitting from fuel system component being serviced.

(c) The plastic retainer will remain on component being serviced after fitting is disconnected. The o-rings and spacer will remain in quick-connect fitting connector body.

(8) **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 49) usually black in color.

(a) To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (Fig. 49). With plastic ring

QUICK CONNECT FITTING (Continued)

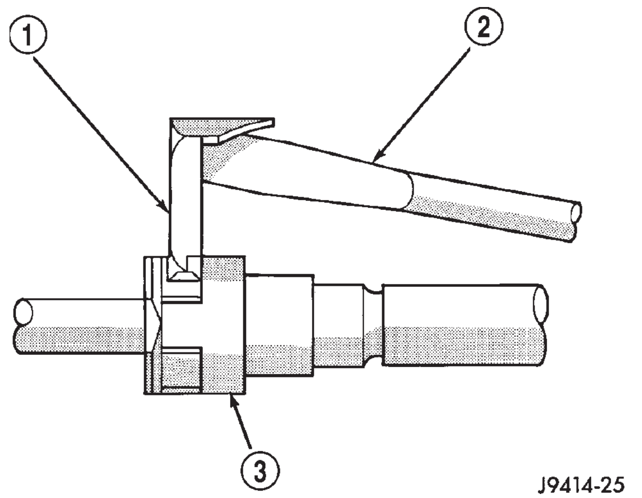


Fig. 46 DISCONNECTING SINGLE-TAB TYPE FITTING

1 - PULL TAB
2 - SCREWDRIVER
3 - QUICK-CONNECT FITTING

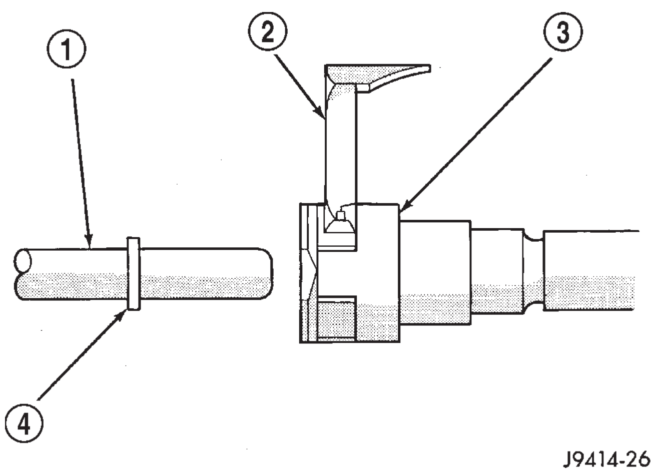


Fig. 47 REMOVING PULL TAB

1 - FUEL TUBE OR FUEL SYSTEM COMPONENT
2 - PULL TAB
3 - QUICK-CONNECT FITTING
4 - FUEL TUBE STOP

depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

(b) After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

(c) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

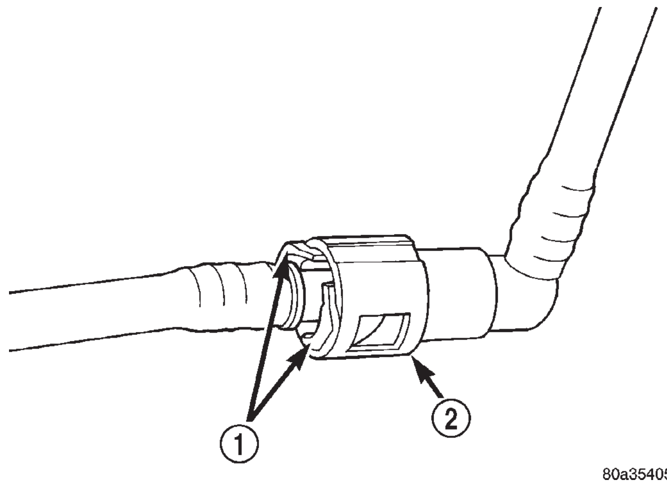


Fig. 48 TYPICAL 2–TAB TYPE FITTING

1 - TAB(S)
2 - QUICK-CONNECT FITTING

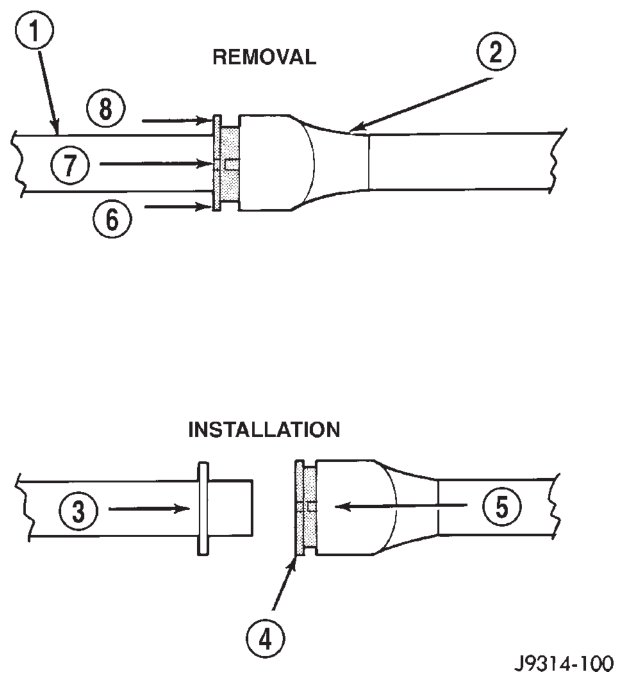


Fig. 49 PLASTIC RETAINER RING TYPE FITTING

1 - FUEL TUBE
2 - QUICK CONNECT FITTING
3 - PUSH
4 - PLASTIC RETAINER
5 - PUSH
6 - PUSH
7 - PUSH
8 - PUSH

(9) **Latch Clips:** Depending on vehicle model and engine, 2 different types of safety latch clips are used (Fig. 50) or (Fig. 51). Type-1 is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.

QUICK CONNECT FITTING (Continued)

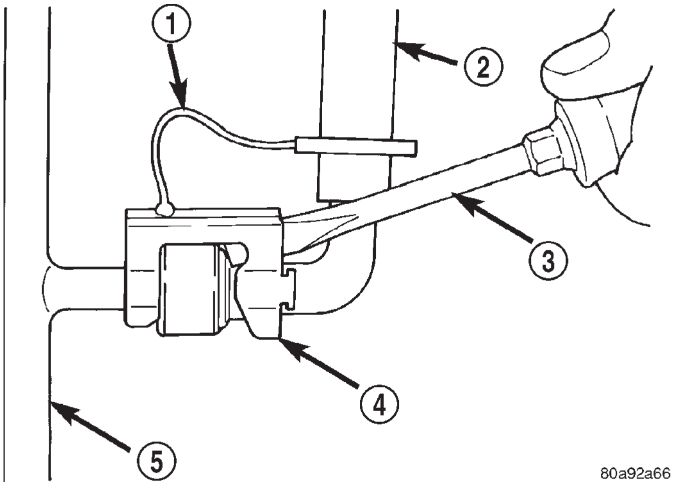


Fig. 50 LATCH CLIP-TYPE 1

1 - TETHER STRAP
2 - FUEL LINE
3 - SCREWDRIVER
4 - LATCH CLIP
5 - FUEL RAIL

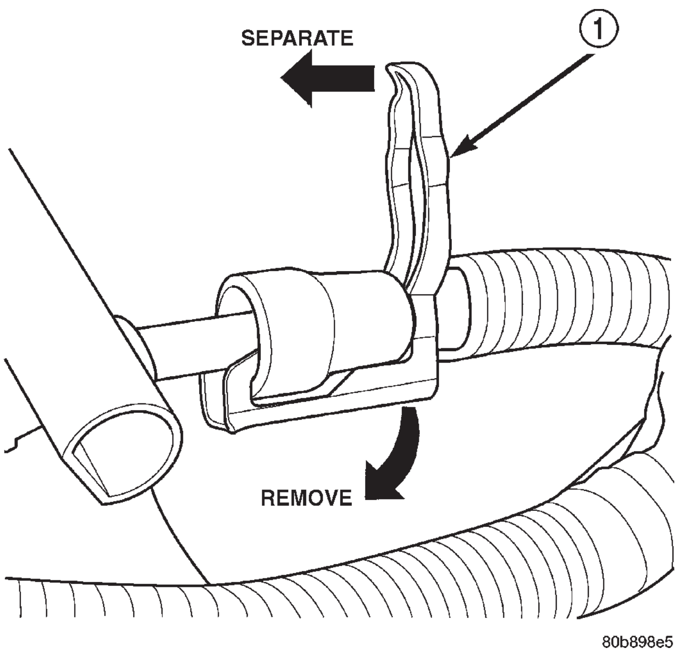


Fig. 51 LATCH CLIP-TYPE 2

1 - LATCH CLIP

(a) Type 1: Pry up on latch clip with a screwdriver (Fig. 50).

(b) Type 2: Separate and unlatch 2 small arms on end of clip (Fig. 51) and swing away from fuel line.

(c) Slide latch clip toward fuel rail while lifting with screwdriver.

(d) Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (Fig. 52). Use tool to release locking fingers in end of line.

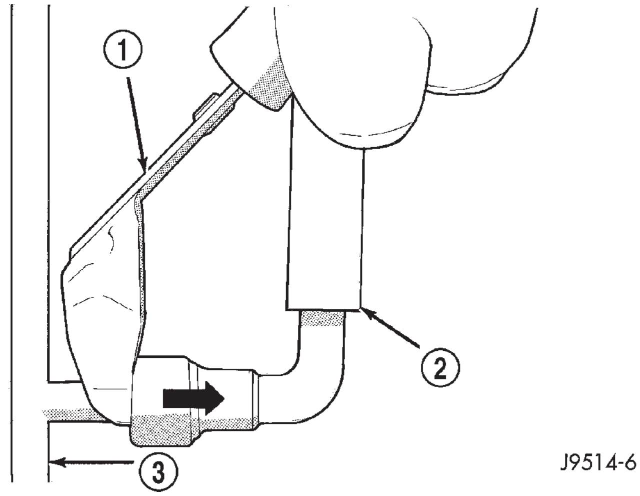


Fig. 52 FUEL LINE DISCONNECTION USING SPECIAL TOOL

1 - SPECIAL FUEL LINE TOOL
2 - FUEL LINE
3 - FUEL RAIL

(e) With special tool still inserted, pull fuel line from fuel rail.

(f) After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.

(10) Disconnect quick-connect fitting from fuel system component being serviced.

CONNECTING

(1) Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.

(2) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(3) Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.

(4) Continue pushing until a click is felt.

(5) Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.

(6) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(7) Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**

(8) Connect negative cable to battery.

(9) Start engine and check for leaks.

FUEL INJECTION

TABLE OF CONTENTS

FUEL INJECTION

DIAGNOSIS AND TESTING

VISUAL INSPECTION

A visual inspection for loose, disconnected or incorrectly routed wires, vacuum lines and hoses should be made. This should be done before attempting to diagnose or service the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Verify three 32–way electrical connectors are fully inserted into connector of Powertrain Control Module (PCM) (Fig. 1).

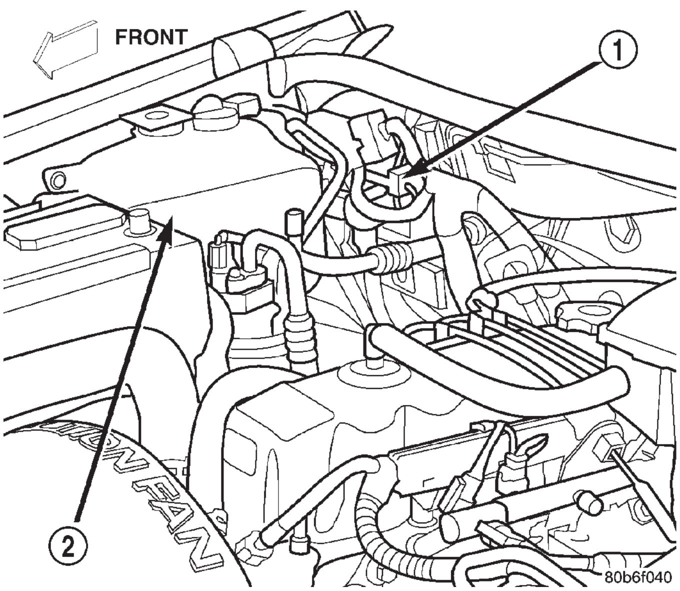


Fig. 1 Powertrain Control Module (PCM) Location

1 - PCM
2 - COOLANT TANK

(2) Inspect battery cable connections. Be sure they are clean and tight.

(3) Inspect fuel pump relay and air conditioning compressor clutch relay (if equipped). Inspect ASD and oxygen sensor heater relay connections. Inspect starter motor relay connections. Inspect relays for signs of physical damage and corrosion. The relays are located in the Power Distribution Center (PDC) (Fig. 2). Refer to label on PDC cover for relay location.

(4) Inspect ignition coil connections (Fig. 3)or (Fig. 4).

(5) Verify camshaft position sensor wire connector is firmly connected (Fig. 5) or (Fig. 6).

(6) Verify crankshaft position sensor wire connector is firmly connected (Fig. 7) or (Fig. 8).

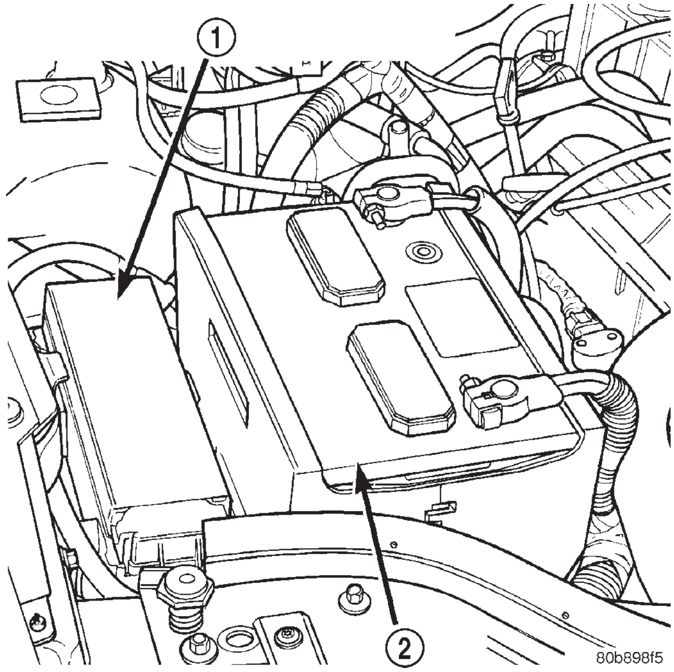


Fig. 2 Power Distribution Center (PDC) Location

1 - POWER DISTRIBUTION CENTER (PDC)
2 - BATTERY

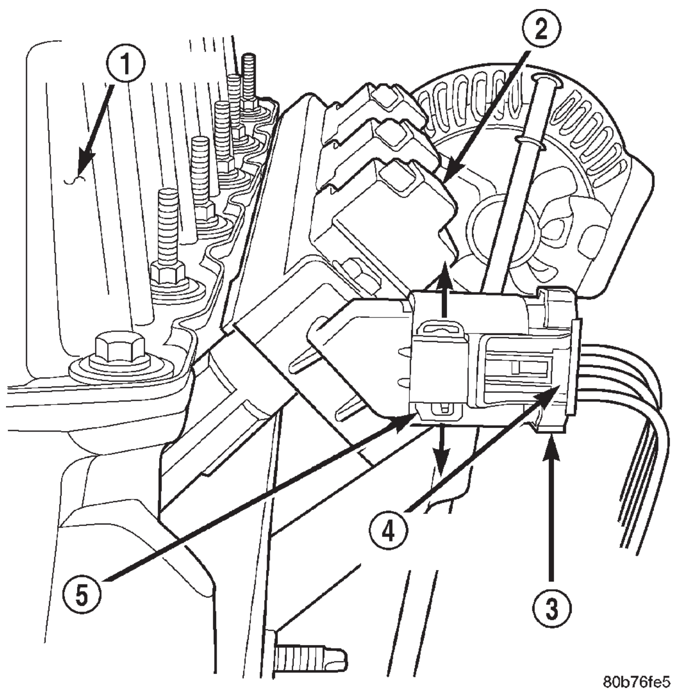


Fig. 3 Ignition Coil Connector—4.0L Engine

1 - REAR OF VALVE COVER
2 - COIL RAIL
3 - COIL CONNECTOR
4 - RELEASE LOCK
5 - SLIDE TAB

FUEL INJECTION (Continued)

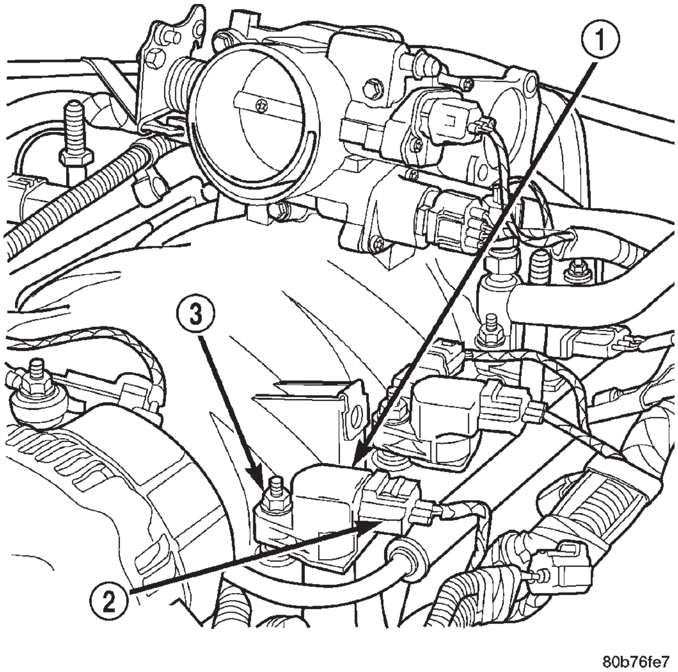


Fig. 4 Ignition Coil Connector—4.7L V-8 Engine

1 - IGNITION COIL
2 - COIL ELECTRICAL CONNECTOR
3 - COIL MOUNTING STUD/NUT

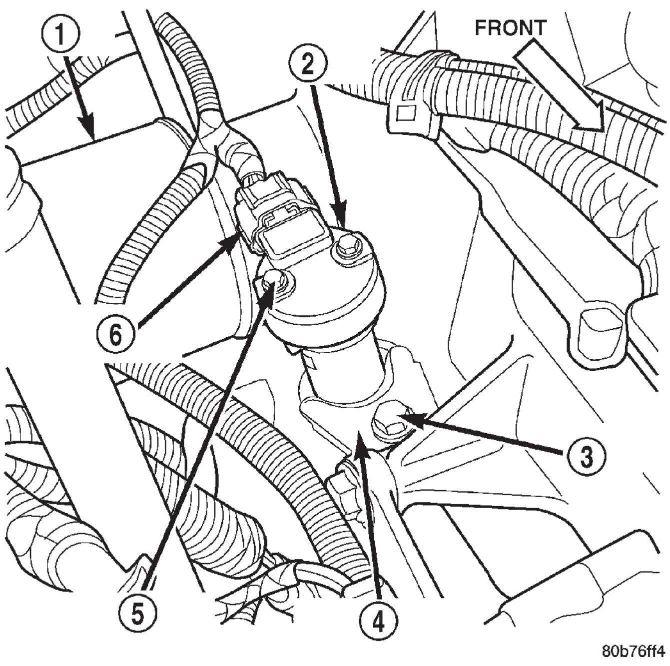


Fig. 5 Camshaft Position Sensor—4.0L Engine

1 - OIL FILTER
2 - CAMSHAFT POSITION SENSOR
3 - CLAMP BOLT
4 - HOLD-DOWN CLAMP
5 - MOUNTING BOLTS (2)
6 - ELEC. CONNECTOR

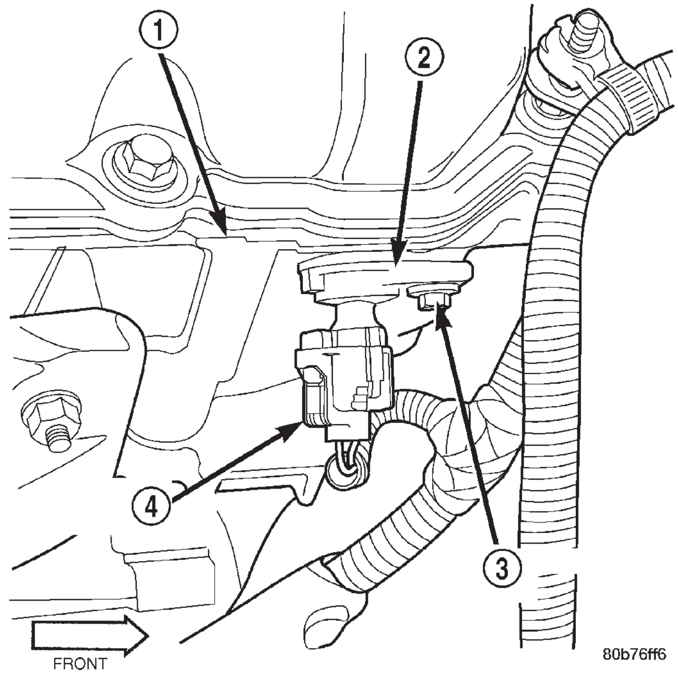


Fig. 6 Camshaft Position Sensor—4.7L V-8 Engine

1 - RIGHT CYLINDER HEAD
2 - CAMSHAFT POSITION SENSOR
3 - MOUNTING BOLT
4 - ELEC. CONNECTOR

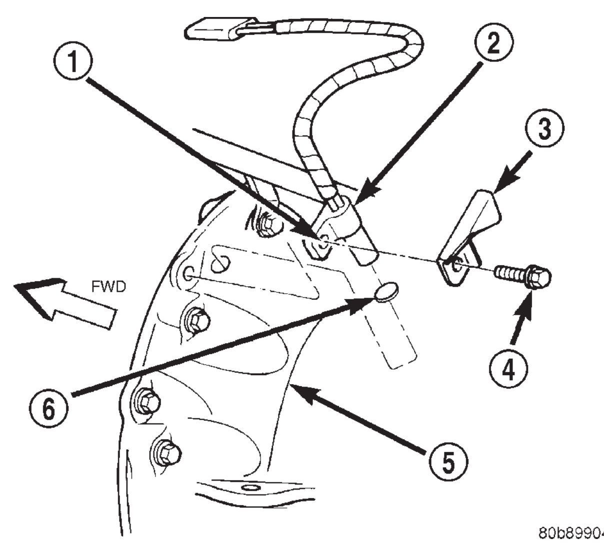


Fig. 7 Crankshaft Position Sensor—4.0L Engine

1 - SLOTTED HOLE
2 - CRANKSHAFT POSITION SENSOR
3 - WIRE SHIELD
4 - MOUNTING BOLT
5 - TRANSMISSION HOUSING
6 - PAPER SPACER

(7) Verify generator output wire (B+ wire) and generator field connector are firmly connected to generator.

FUEL INJECTION (Continued)

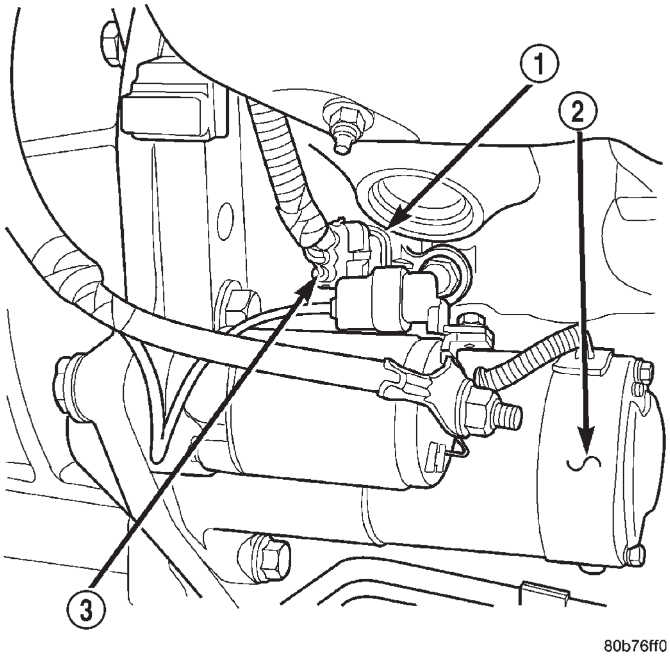


Fig. 8 Crankshaft Position Sensor—4.7L V-8 Engine

1 - CRANKSHAFT POSITION SENSOR
2 - STARTER
3 - ELEC. CONNECTOR

(8) Inspect system body grounds for loose or dirty connections. Refer to Group 8, Wiring for ground locations.

(9) Verify crankcase ventilation (CCV) operation. Refer to Emission Control System for additional information.

(10) Inspect all fuel line quick-connect fittings for damage or leaks.

(11) Verify hose connections to all ports of vacuum fittings on intake manifold, and for emission system are tight and not leaking.

(12) Inspect accelerator cable, transmission throttle cable (if equipped) and speed control cable connections (if equipped). Check their connections to throttle body linkage for any binding or restrictions.

(13) Verify vacuum booster hose is firmly connected to fitting on intake manifold. Also check connection to brake vacuum booster.

(14) Inspect air cleaner inlet and air cleaner element for dirt or restrictions.

(15) Inspect radiator grille area, radiator fins and air conditioning condenser for restrictions.

(16) 4.0L Engine: Verify MAP, Intake Manifold Air Temperature (IAT) sensor, TPS and Idle Air Control (IAC) motor connectors are firmly connected (Fig. 9). Be sure throttle body mounting bolts (Fig. 9)are tight.

(17) 4.7L Engine: Verify Intake Manifold Air Temperature (IAT) sensor, TPS and Idle Air Control (IAC) motor connectors are firmly connected (Fig. 10). Be sure throttle body mounting bolts (Fig. 10)are tight.

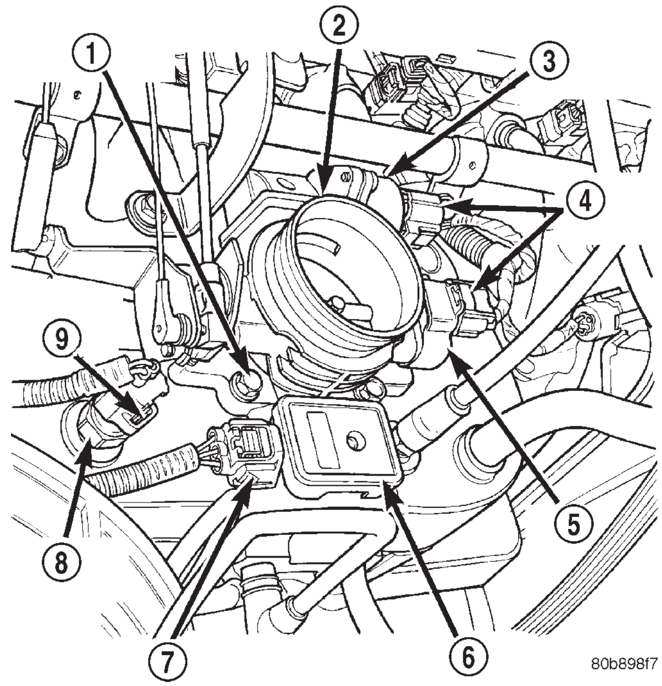


Fig. 9 IAT, MAP, IAC, TPS Sensor Locations—4.0L Engine

1 - MOUNTING BOLTS (4)
2 - THROTTLE BODY
3 - IAC MOTOR
4 - ELEC. CONN.
5 - TPS
6 - MAP SENSOR
7 - ELEC. CONN.
8 - IAT SENSOR
9 - ELEC. CONN.

FUEL INJECTION (Continued)

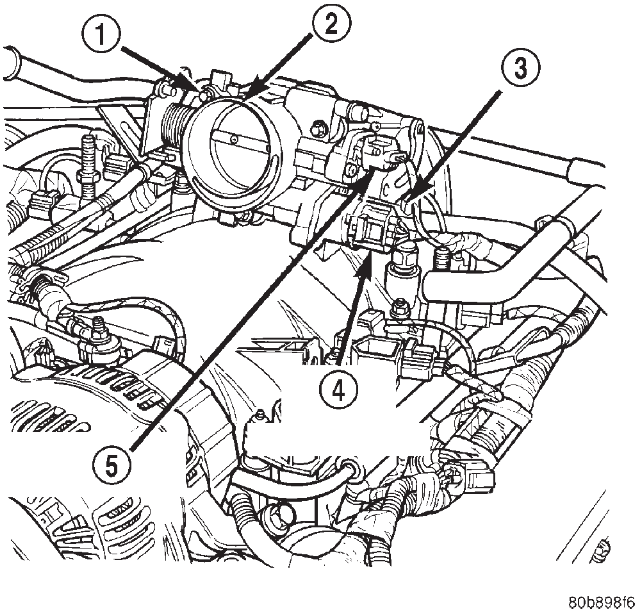


Fig. 10 IAT, IAC, TPS Sensor Locations—4.7L V-8 Engine

1 - MOUNTING BOLTS (3)
2 - THROTTLE BODY
3 - IAT SENSOR CONNECTOR
4 - IAC MOTOR CONNECTOR
5 - TPS CONNECTOR

(18) 4.0L Engine: Verify wire harness connector is firmly connected to Engine Coolant Temperature (ECT) sensor (Fig. 11).

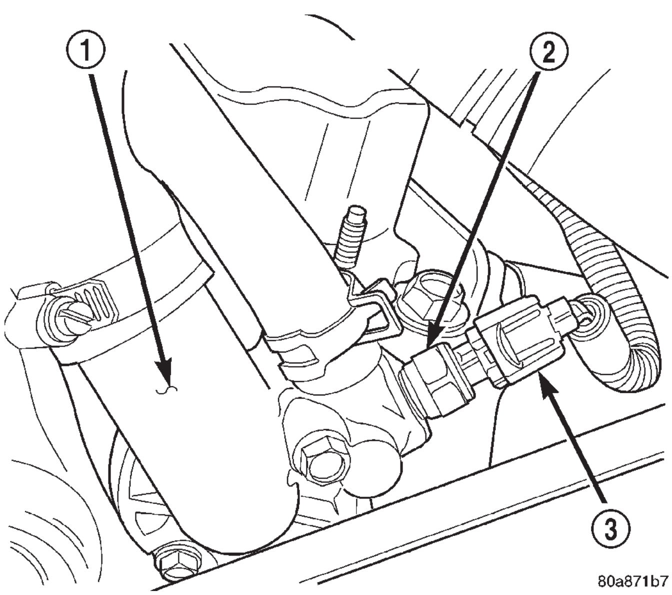


Fig. 11 ECT Sensor Location—4.0L Engine

1 - THERMOSTAT HOUSING
2 - ENGINE COOLANT TEMPERATURE SENSOR
3 - ELECTRICAL CONNECTOR

(19) 4.7L Engine: Verify MAP and Engine Coolant Temperature (ECT) sensor electrical connectors are firmly connected to sensors (Fig. 12).

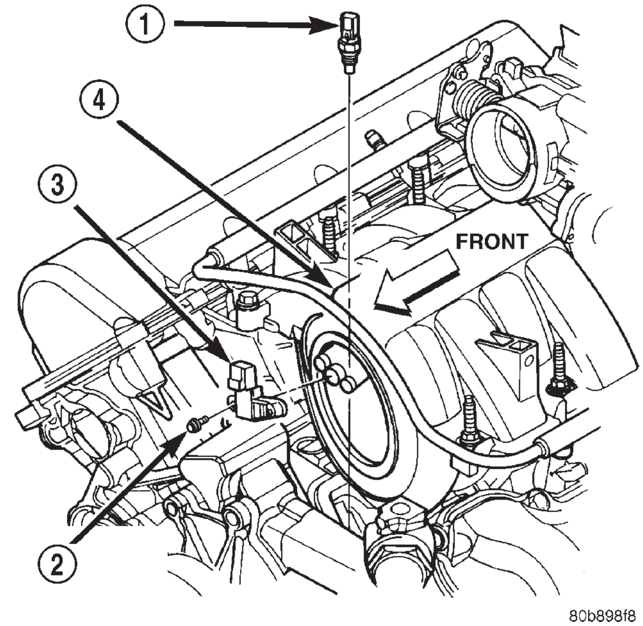


Fig. 12 MAP and ECT Sensor Locations—4.7L V-8 Engine

1 - ECT SENSOR
2 - MOUNTING BOLTS (2)
3 - MAP SENSOR
4 - INTAKE MANIFOLD

(20) Verify fuel injector wire harness connectors are firmly connected to injectors in correct order. Each harness connector is numerically tagged with injector number (INJ 1, INJ 2 etc.) of its corresponding fuel injector and cylinder number.

(21) Raise and support vehicle.

(22) Verify all oxygen sensor wire connectors are firmly connected to sensors. Inspect sensors and connectors for damage (Fig. 13)or (Fig. 14).

FUEL INJECTION (Continued)

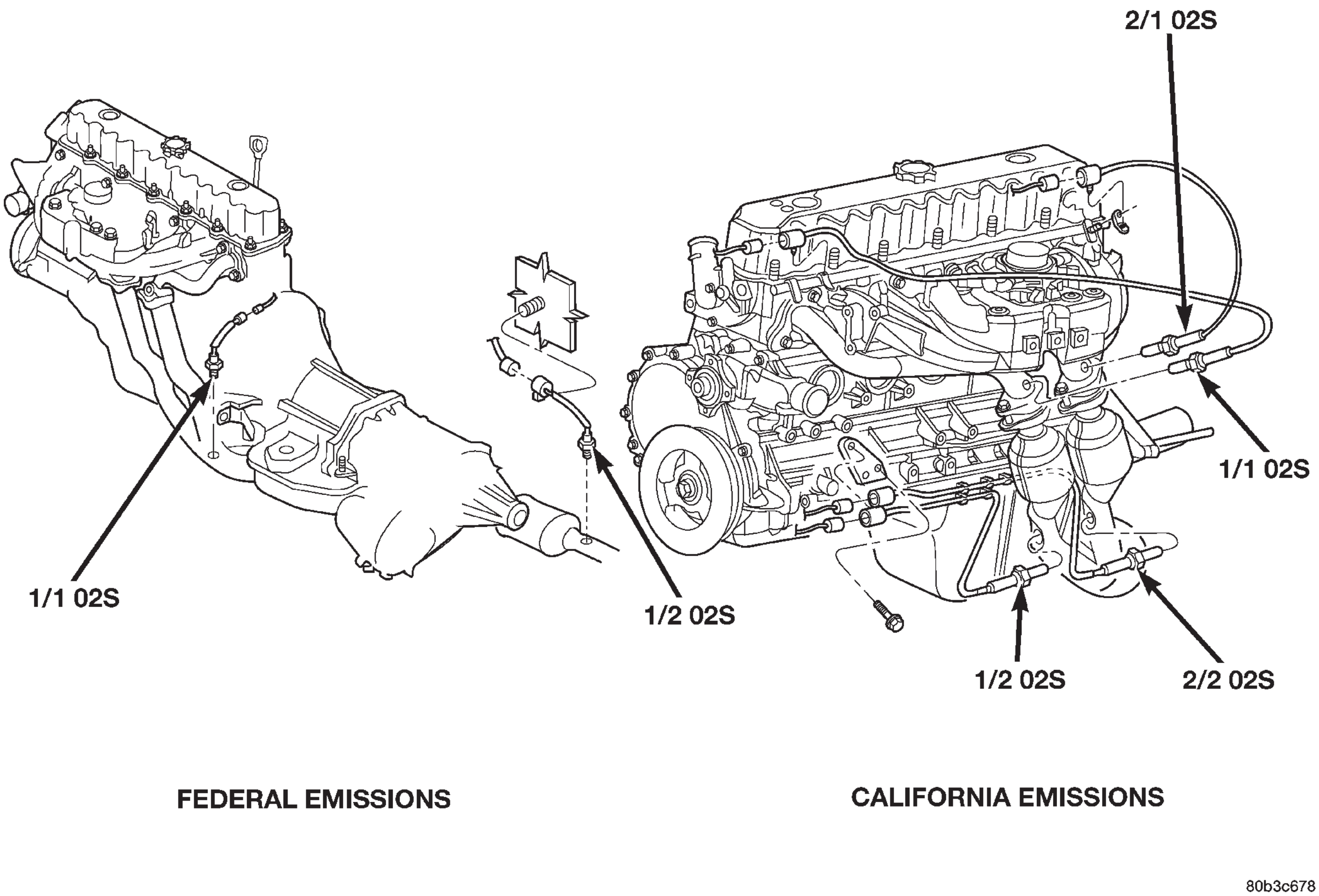


Fig. 13 Oxygen Sensor Locations—4.0L Engine

FUEL INJECTION (Continued)

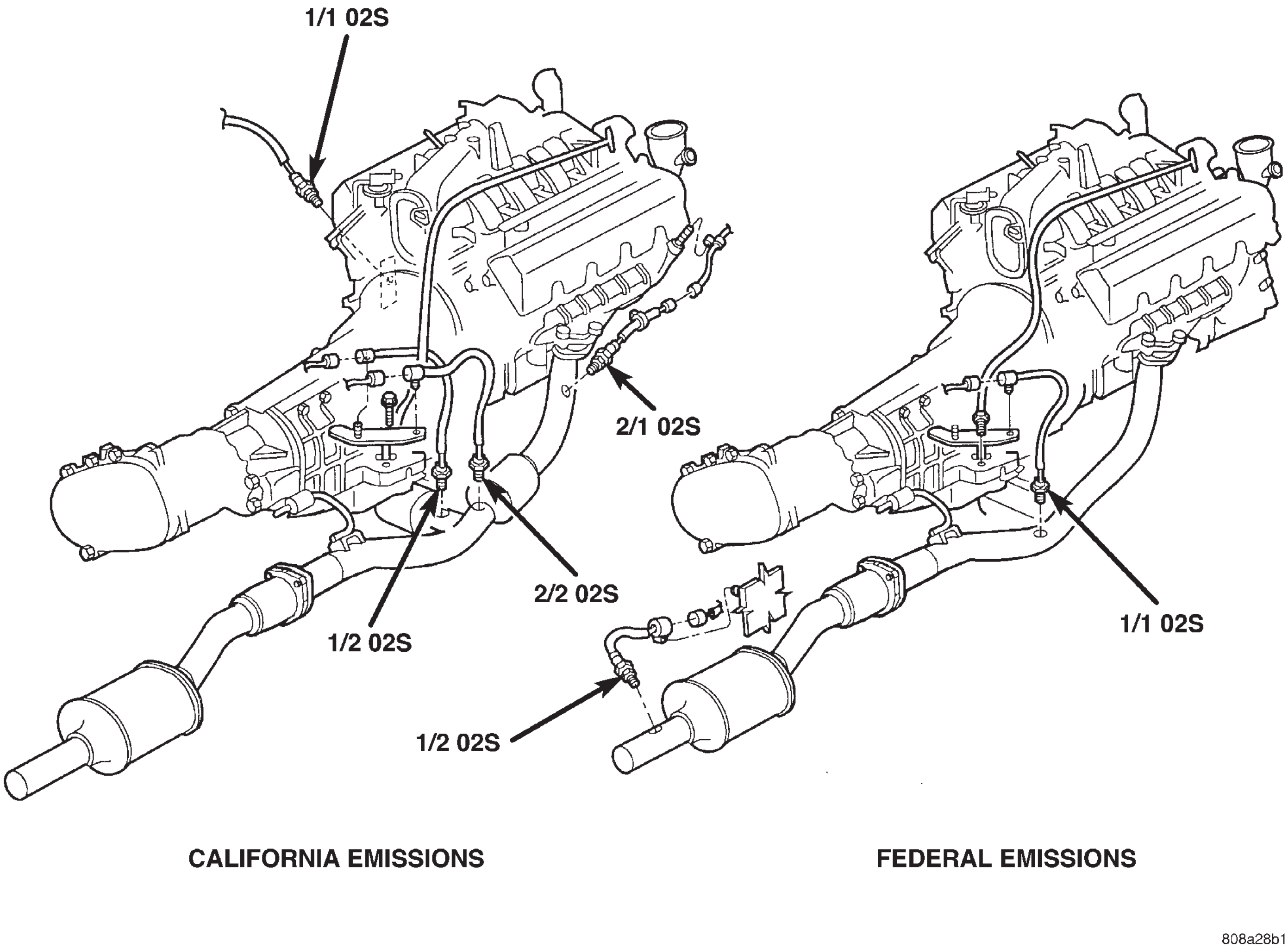


Fig. 14 Oxygen Sensor Locations—4.7L V-8 Engine

FUEL INJECTION (Continued)

(23) Inspect for pinched or leaking fuel tubes/lines. Inspect for pinched, cracked or leaking fuel hoses.

(24) Inspect for exhaust system restrictions such as pinched exhaust pipes, collapsed muffler or plugged catalytic convertor.

(25) If equipped with automatic transmission, verify electrical harness is firmly connected to park/neutral switch and to transmission components.

(26) Verify fuel pump module pigtail harness electrical connector (Fig. 15) is firmly connected to body harness connector.

(27) Inspect fuel line harness (from fuel pump module) at fuel filter/fuel pressure regulator (Fig. 15) for chaffing, cracks or leaks.

(28) Verify battery cable and solenoid feed wire connections to starter solenoid are tight and clean.

(29) Inspect for chaffed wires or wires rubbing up against other components.

(30) Inspect for chaffed vacuum lines or lines rubbing up against other components.

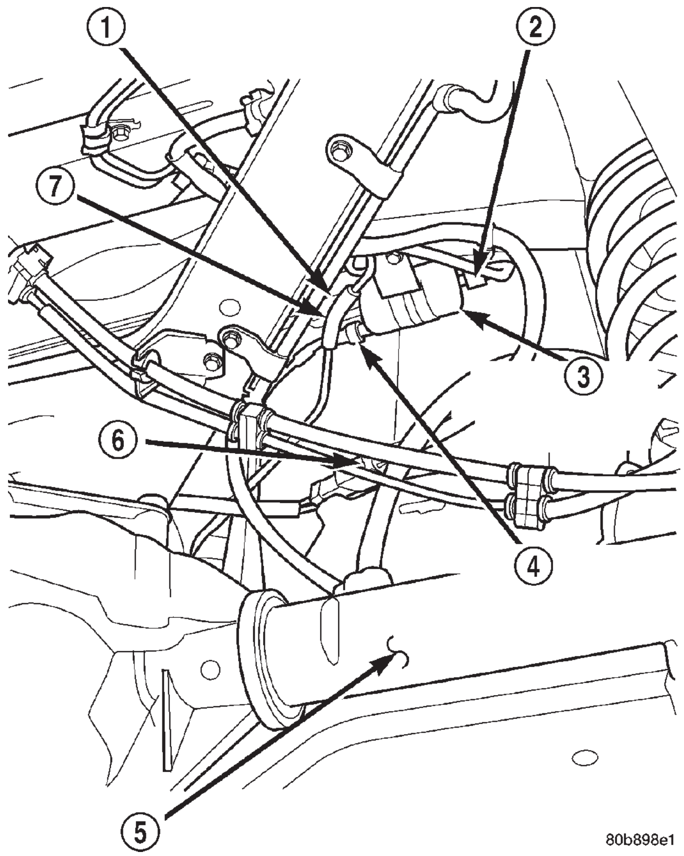


Fig. 15 Fuel Filter/Fuel Pressure Regulator Location

1 - FUEL RETURN LINE
2 - FUEL SUPPLY LINE (TO FUEL RAIL)
3 - FUEL FILTER/FUEL PRESSURE REGULATOR
4 - FUEL PRESSURE LINE
5 - REAR AXLE
6 - ELEC. CONNECTOR
7 - EVAP LINE

SPECIFICATIONS

TORQUE - FUEL INJECTION

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Air Cleaner Housing Mount. Nuts	10		93
Air Cleaner Air Duct Clamps	4		35
Air Cleaner Resonator Bolts	4		35
Engine Coolant Temperature Sensor—4.0L Engine	11		96
Engine Coolant Temperature Sensor—4.7L Engine	11		96
Fuel Hose Clamps	1		10
IAC Motor-To-Throttle Body Bolts—4.0L Engine	7		′60
IAC Motor-To-Throttle Body Bolts—4.7L Engine	7		60
Intake Manifold Air Temp. Sensor—4.0L Engine	28	20	
Intake Manifold Air Temp. Sensor—4.7L Engine	28	20	
MAP Sensor Mounting Screws—4.0L Engine	3		25
MAP Sensor Mounting Screws—4.7L Engine	3		25
Oxygen Sensor—All Engines	30	22	
PCM-to-Mounting Bracket Screws	3		25
PCM-to-Mounting Bracket Screws	9		80
Radiator Cooling Fan Relay Bolts	3		25
Throttle Body Mounting Bolts—4.0L Engine	11		100
Throttle Body Mounting Bolts—4.7L Engine	12		105
TPS Mounting Screws—4.0L Engine	7		60
TPS Mounting Screws—4.7L Engine	7		60

ACCELERATOR PEDAL

REMOVAL

The accelerator pedal is connected to the throttle body linkage by the throttle cable. The cable is protected by a plastic sheathing and is connected to the throttle body linkage by a ball socket. It is connected to the accelerator pedal arm by a plastic retainer (clip) (Fig. 16). This retainer (clip) snaps into the top of the accelerator pedal arm. A retainer clip (Fig. 16) is also used to fasten cable to dash panel.

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm. Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove accelerator pedal bracket nuts. Remove accelerator pedal assembly.

INSTALLATION

The accelerator pedal is connected to the throttle body linkage by the throttle cable. The cable is protected by a plastic sheathing and is connected to the throttle body linkage by a ball socket. It is connected to the accelerator pedal arm by a plastic retainer (clip) (Fig. 16) . This retainer (clip) snaps into the top of the accelerator pedal arm. A retainer clip (Fig. 16) is also used to fasten cable to dash panel.

(1) Place accelerator pedal assembly over studs protruding from floor pan. Tighten mounting nuts to 12 N·m ± 2 N·m (105 in. lbs. ± 20 in. lbs.) torque.

(2) Slide throttle cable into opening in top of pedal arm. Push plastic cable retainer (clip) into pedal arm opening until it snaps into place.

(3) Before starting engine, operate accelerator pedal to check for any binding.

ACCELERATOR PEDAL (Continued)

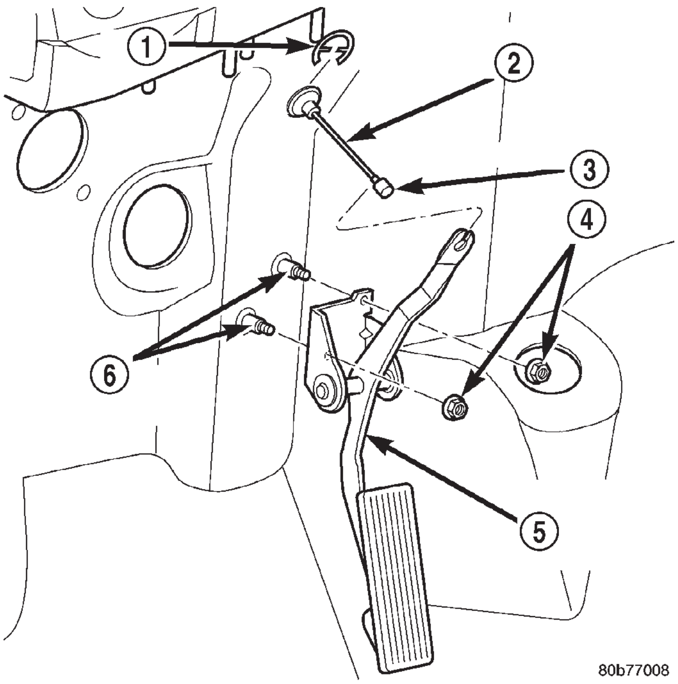


Fig. 16 Accelerator Pedal Mounting

1 - CLIP
2 - ACCELERATOR CABLE
3 - CABLE CONNECTOR
4 - MOUNTING NUTS (2)
5 - PEDAL/BRACKET ASSEMBLY
6 - MOUNTING STUDS (2)

CRANKSHAFT POSITION SENSOR

DESCRIPTION

DESCRIPTION - 4.0L

The Crankshaft Position Sensor (CKP) is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 17).

DESCRIPTION - 4.7L

The Crankshaft Position Sensor (CKP) is mounted into the engine block above the starter motor (Fig. 18).

OPERATION

OPERATION - 4.0L

Engine speed and crankshaft position are provided through the crankshaft position sensor. The sensor generates pulses that are the input sent to the powertrain control module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

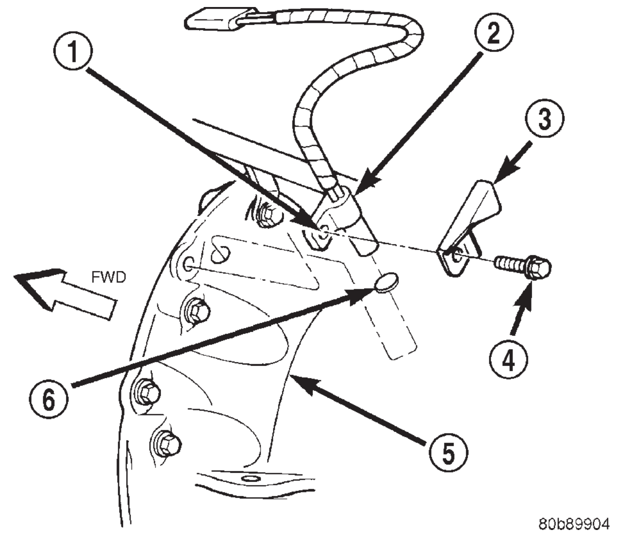


Fig. 17 CKP Sensor Location—4.0L 6-Cyl. Engine

1 - SLOTTED HOLE
2 - CRANKSHAFT POSITION SENSOR
3 - WIRE SHIELD
4 - MOUNTING BOLT
5 - TRANSMISSION HOUSING
6 - PAPER SPACER

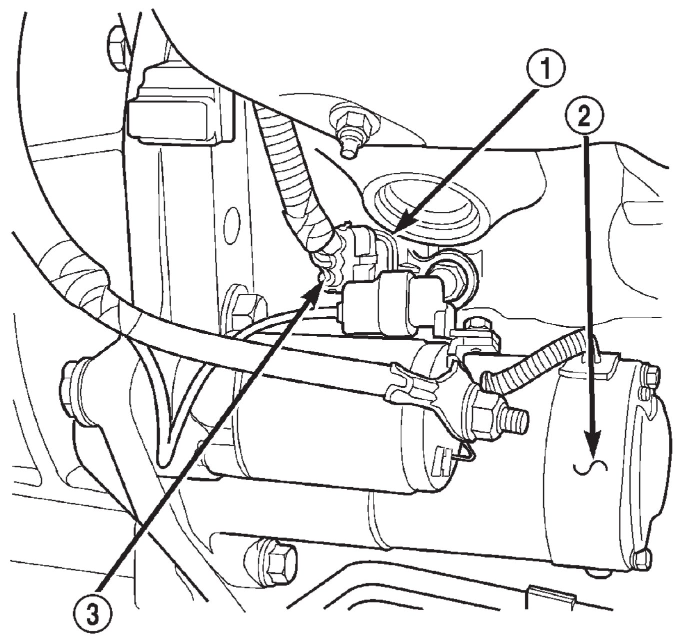


Fig. 18 CKP Sensor Location—4.7L V–8 Engine

1 - CRANKSHAFT POSITION SENSOR
2 - STARTER
3 - ELEC. CONNECTOR

CRANKSHAFT POSITION SENSOR (Continued)

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

On 4.0L 6-cylinder engines, the flywheel/drive plate has 3 sets of four notches at its outer edge (Fig. 19).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution there are 3 sets of four pulses generated.

The trailing edge of the fourth notch, which causes the pulse, is four degrees before top dead center (TDC) of the corresponding piston.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

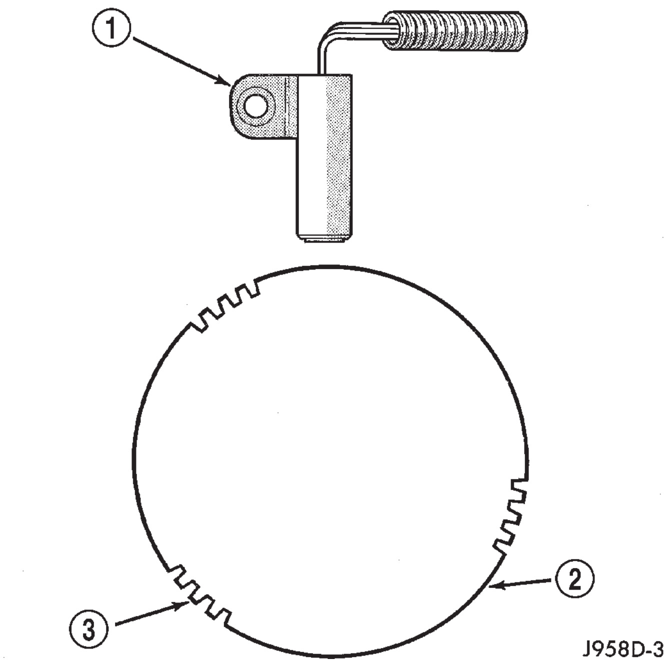


Fig. 19 CKP Sensor Operation—4.0L 6-Cyl. Engine

1 - CRANKSHAFT POSITION SENSOR
2 - FLYWHEEL
3 - FLYWHEEL NOTCHES

OPERATION - 4.7L

Engine speed and crankshaft position are provided through the crankshaft position sensor. The sensor generates pulses that are the input sent to the powertrain control module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

On the 4.7L V–8 engine, a tonewheel is bolted to the engine crankshaft (Fig. 20). This tonewheel has sets of notches at its outer edge (Fig. 20).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.

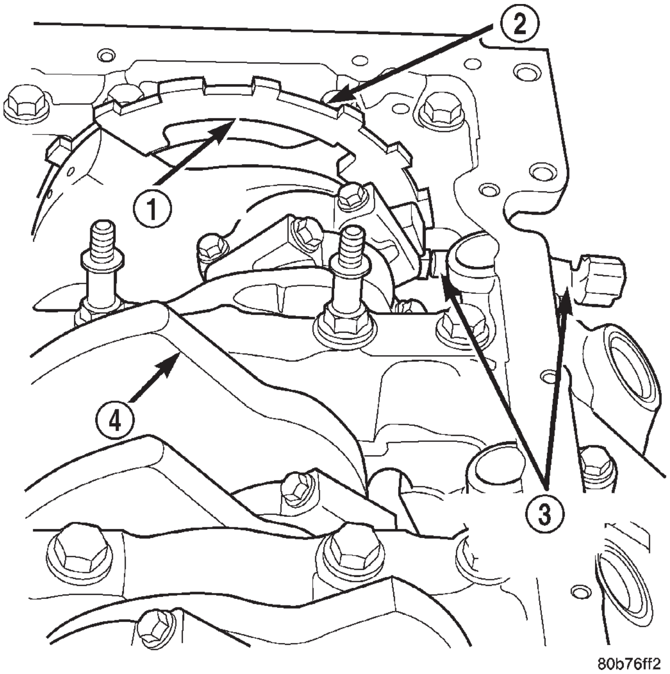


Fig. 20 CKP Sensor Operation and Tonewheel—4.7L V–8 Engine

1 - TONEWHEEL
2 - NOTCHES
3 - CRANKSHAFT POSITION SENSOR
4 - CRANKSHAFT

REMOVAL

REMOVAL - 4.0L

The Crankshaft Position (CKP) sensor is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 21). The sensor **is adjustable** and is attached with one bolt. A wire shield/router is attached to the sensor (Fig. 21).

(1) Disconnect sensor pigtail harness (3–way connector) from main engine wiring harness.

(2) Remove sensor mounting bolt.

(3) Remove wire shield and sensor.

REMOVAL - 4.7L

The Crankshaft Position (CKP) sensor is bolted to the side of the engine cylinder block above the starter motor (Fig. 22). It is positioned into a machined hole at the side of the engine block.

(1) Remove starter motor. Refer to Starter Removal/Installation.

CRANKSHAFT POSITION SENSOR (Continued)

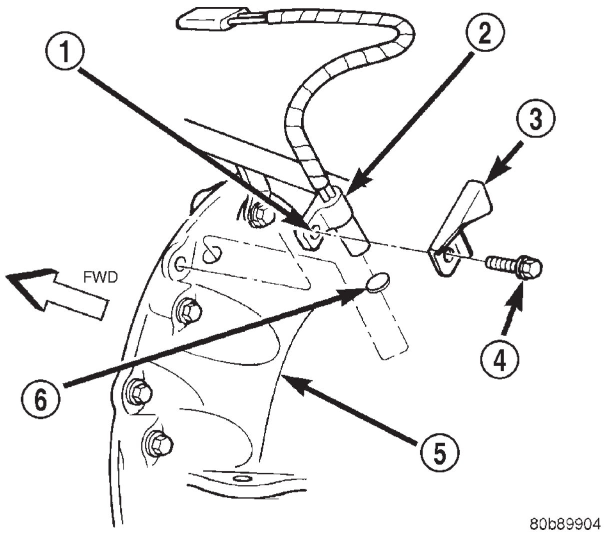


Fig. 21 CKP Sensor—4.0L 6-Cylinder Engine

1 - SLOTTED HOLE
2 - CRANKSHAFT POSITION SENSOR
3 - WIRE SHIELD
4 - MOUNTING BOLT
5 - TRANSMISSION HOUSING
6 - PAPER SPACER

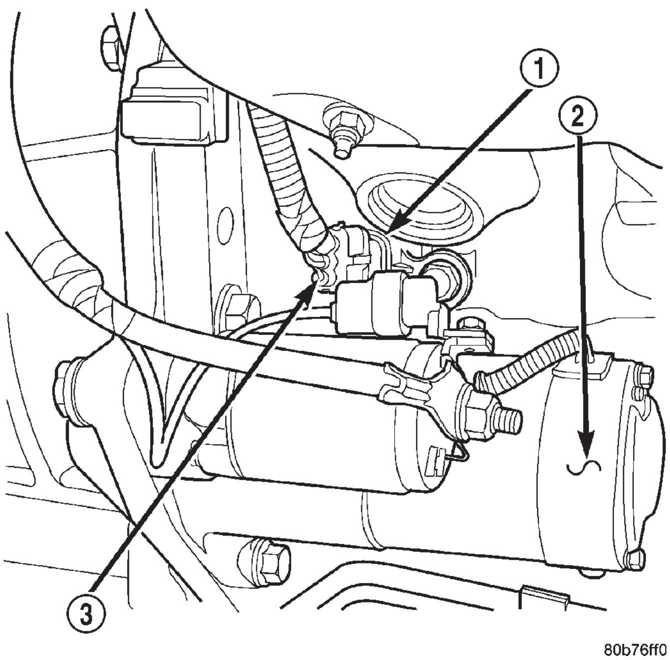


Fig. 22 CKP Sensor Location—4.7L V–8 Engine

1 - CRANKSHAFT POSITION SENSOR
2 - STARTER
3 - ELEC. CONNECTOR

(2) Disconnect CKP electrical connector at sensor (Fig. 22).

(3) Remove CKP mounting bolt (Fig. 23).

(4) Carefully twist sensor from cylinder block.

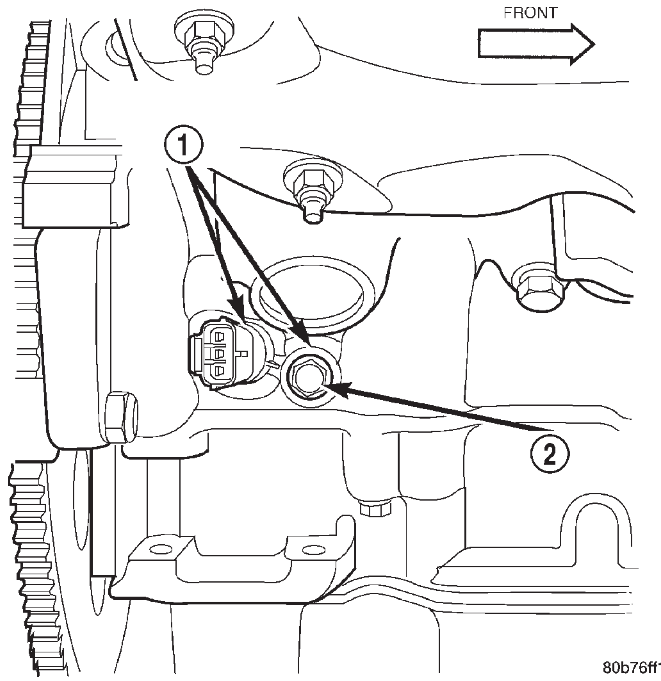


Fig. 23 CKP Sensor Removal/Installation—4.7L V–8 Engine

1 - CRANKSHAFT POSITION SENSOR
2 - MOUNTING BOLT

(5) Remove sensor from vehicle.

(6) Check condition of sensor o-ring.

INSTALLATION

INSTALLATION - 4.0L

The Crankshaft Position (CKP) sensor is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 21). The sensor **is adjustable** and is attached with one bolt. A wire shield/ router is attached to the sensor (Fig. 21).

New replacement sensors will be equipped with a paper spacer glued to bottom of sensor. If installing (returning) a **used** sensor to vehicle, a new paper spacer must be installed to bottom of sensor. This spacer will be ground off the first time engine is started. If spacer is not used, sensor will be broken the first time engine is started.

(1) New Sensors: Be sure paper spacer is installed to bottom of sensor. If not, obtain spacer PN05252229.

(2) Used Sensors: Clean bottom of sensor and install spacer PN05252229.

(3) Install sensor into transmission bellhousing hole.

(4) Position sensor wire shield to sensor (Fig. 21).

CRANKSHAFT POSITION SENSOR (Continued)

(5) Push sensor against flywheel/drive plate. With sensor pushed against flywheel/drive plate, tighten mounting bolt to 7 N·m (60 in. lbs.) torque.

(6) Route sensor wiring harness into wire shield.

(7) Connect sensor pigtail harness electrical connector to main wiring harness.

INSTALLATION - 4.7L

(1) Clean out machined hole in engine block.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into engine block with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 28 N·m (21 ft. lbs.) torque.

(5) Connect electrical connector to sensor.

(6) Install starter motor. Refer to Starter Removal/Installation.

FUEL INJECTOR

DESCRIPTION

A separate fuel injector (Fig. 24) is used for each individual cylinder.

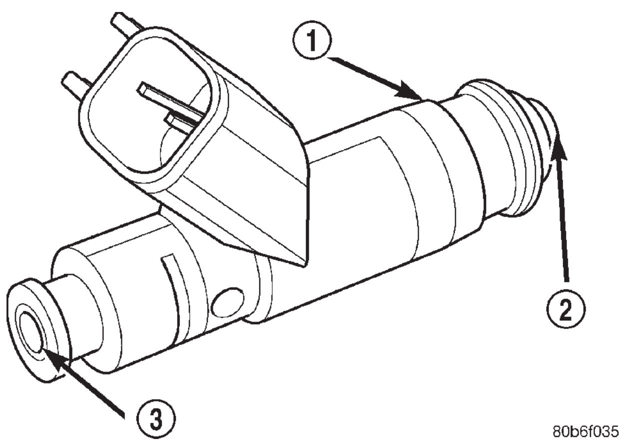


Fig. 24 Fuel Injector—4.0L/4.7L Engines

1 - FUEL INJECTOR
2 - NOZZLE
3 - TOP (FUEL ENTRY)

OPERATION

OPERATION

The fuel injectors are electrical solenoids. The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a pencil stream. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.

The top (fuel entry) end of the injector (Fig. 24) is attached into an opening on the fuel rail.

The nozzle (outlet) ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

The injectors are electrically energized, individually and in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage is supplied to the injectors through the ASD relay.

The PCM determines injector pulse width based on various inputs.

OPERATION - PCM OUTPUT

The nozzle ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector with its respective cylinder number.

The injectors are energized individually in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage (12 volts +) is supplied to the injectors through the ASD relay. The ASD relay will shutdown the 12 volt power source to the fuel injectors if the PCM senses the ignition is on, but the engine is not running. This occurs after the engine has not been running for approximately 1.8 seconds.

FUEL INJECTOR (Continued)

The PCM determines injector on-time (pulse width) based on various inputs.

DIAGNOSIS AND TESTING - FUEL INJECTOR

To perform a complete test of the fuel injectors and their circuitry, use the DRB scan tool and refer to the appropriate Powertrain Diagnostics Procedures manual. To test the injector only, refer to the following:

Disconnect the fuel injector wire harness connector from the injector. The injector is equipped with 2 electrical terminals (pins). Place an ohmmeter across the terminals. Resistance reading should be approximately 12 ohms ±1.2 ohms at 20°C (68°F).

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL INJECTOR(S), FUEL SYSTEM PRESSURE MUST BE RELEASED.

To remove one or more fuel injectors, the fuel rail assembly must be removed from engine.

(1) Perform Fuel System Pressure Release Procedure.

(2) Remove fuel injector rail. Refer to Fuel Injector Rail Removal/Installation.

(3) Remove clip(s) retaining injector(s) to fuel rail (Fig. 25).

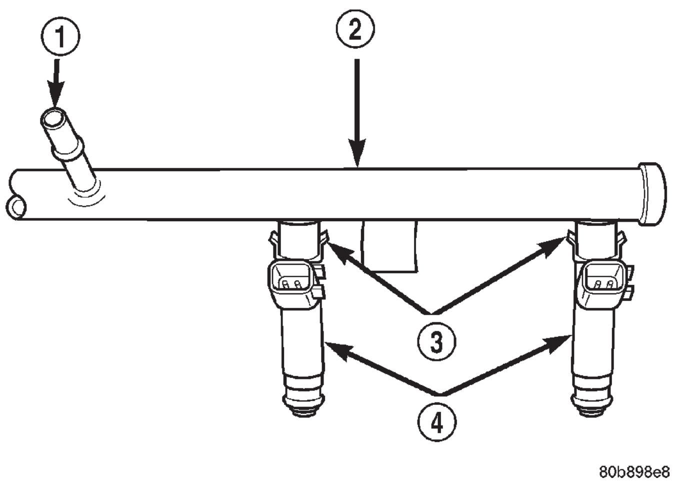


Fig. 25 Fuel Injector Mounting—Typical (4.7L V-8 Engine Shown)

1 - INLET FITTING
2 - FUEL INJECTOR RAIL
3 - CLIP
4 - FUEL INJECTOR

(4) Remove injector(s) from fuel rail.

INSTALLATION

(1) Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.

(2) Install injector(s) and injector clip(s) to fuel rail.

(3) Install fuel rail assembly. Refer to Fuel Injector Rail Removal/Installation.

(4) Start engine and check for leaks.

FUEL PUMP RELAY

DESCRIPTION

The 5–pin, 12–volt, fuel pump relay is located in the Power Distribution Center (PDC). Refer to the label on the PDC cover for relay location.

OPERATION

The Powertrain Control Module (PCM) energizes the electric fuel pump through the fuel pump relay. The fuel pump relay is energized by first applying battery voltage to it when the ignition key is turned ON, and then applying a ground signal to the relay from the PCM.

Whenever the ignition key is turned ON, the electric fuel pump will operate. But, the PCM will shutdown the ground circuit to the fuel pump relay in approximately 1–3 seconds unless the engine is operating or the starter motor is engaged.

IDLE AIR CONTROL MOTOR

DESCRIPTION

The IAC stepper motor is mounted to the throttle body, and regulates the amount of air bypassing the control of the throttle plate. As engine loads and ambient temperatures change, engine rpm changes. A pintle on the IAC stepper motor protrudes into a passage in the throttle body, controlling air flow through the passage. The IAC is controlled by the Powertrain Control Module (PCM) to maintain the target engine idle speed.

OPERATION

At idle, engine speed can be increased by retracting the IAC motor pintle and allowing more air to pass through the port, or it can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle plate.

The IAC is called a stepper motor because it is moved (rotated) in steps, or increments. Opening the IAC opens an air passage around the throttle blade which increases RPM.

IDLE AIR CONTROL MOTOR (Continued)

The PCM uses the IAC motor to control idle speed (along with timing) and to reach a desired MAP during decel (keep engine from stalling).

The IAC motor has 4 wires with 4 circuits. Two of the wires are for 12 volts and ground to supply electrical current to the motor windings to operate the stepper motor in one direction. The other 2 wires are also for 12 volts and ground to supply electrical current to operate the stepper motor in the opposite direction.

To make the IAC go in the opposite direction, the PCM just reverses polarity on both windings. If only 1 wire is open, the IAC can only be moved 1 step (increment) in either direction. To keep the IAC motor in position when no movement is needed, the PCM will energize both windings at the same time. This locks the IAC motor in place.

In the IAC motor system, the PCM will count every step that the motor is moved. This allows the PCM to determine the motor pintle position. If the memory is cleared, the PCM no longer knows the position of the pintle. So at the first key ON, the PCM drives the IAC motor closed, regardless of where it was before. This zeros the counter. From this point the PCM will back out the IAC motor and keep track of its position again.

When engine rpm is above idle speed, the IAC is used for the following:

- Off-idle dashpot (throttle blade will close quickly but idle speed will not stop quickly)
- Deceleration air flow control
- A/C compressor load control (also opens the passage slightly before the compressor is engaged so that the engine rpm does not dip down when the compressor engages)
- Power steering load control

The PCM can control polarity of the circuit to control direction of the stepper motor.

IAC Stepper Motor Program: The PCM is also equipped with a memory program that records the number of steps the IAC stepper motor most recently advanced to during a certain set of parameters. For example: The PCM was attempting to maintain a 1000 rpm target during a cold start-up cycle. The last recorded number of steps for that may have been 125. That value would be recorded in the memory cell so that the next time the PCM recognizes the identical conditions, the PCM recalls that 125 steps were required to maintain the target. This program allows for greater customer satisfaction due to greater control of engine idle.

Another function of the memory program, which occurs when the power steering switch (if equipped), or the A/C request circuit, requires that the IAC stepper motor control engine rpm, is the recording of the last targeted steps into the memory cell. The PCM can anticipate A/C compressor loads. This is accomplished by delaying compressor operation for approximately 0.5 seconds until the PCM moves the IAC stepper motor to the recorded steps that were loaded into the memory cell. Using this program helps eliminate idle-quality changes as loads change. Finally, the PCM incorporates a ″No-Load″ engine speed limiter of approximately 1800 - 2000 rpm, when it recognizes that the TPS is indicating an idle signal and IAC motor cannot maintain engine idle.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the IAC motor through the PCM.

REMOVAL

REMOVAL - 4.0L

The IAC motor is located on the throttle body.

(1) Remove air duct and air resonator box at throttle body.

(2) Disconnect electrical connector from IAC motor (Fig. 40).

(3) Remove two mounting bolts (screws) (Fig. 26).

(4) Remove IAC motor from throttle body.

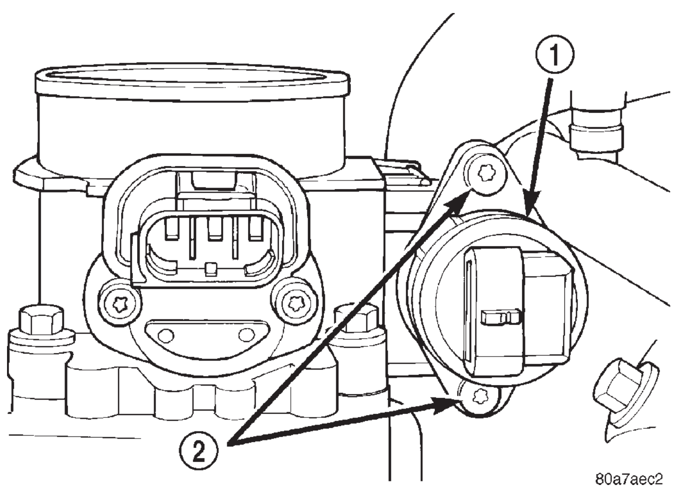


Fig. 26 Mounting Bolts (Screws)—IAC

1 - IDLE AIR CONTROL MOTOR
2 - MOUNTING SCREWS

REMOVAL - 4.7L

(1) Remove air duct and air resonator box at throttle body.

(2) Disconnect electrical connector from IAC motor (Fig. 36).

(3) Remove two mounting bolts (screws) (Fig. 42).

(4) Remove IAC motor from throttle body.

IDLE AIR CONTROL MOTOR (Continued)

INSTALLATION

INSTALLATION - 4.0L

The IAC motor is located on the throttle body.

(1) Install IAC motor to throttle body.

(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.

(3) Install electrical connector.

(4) Install air cleaner duct/air box to throttle body.

INSTALLATION - 4.7L

(1) Install IAC motor to throttle body.

(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.

(3) Install electrical connector.

(4) Install air duct/air box to throttle body.

INTAKE AIR TEMPERATURE SENSOR

DESCRIPTION

The 2–wire Intake Manifold Air Temperature (IAT) sensor is installed in the intake manifold with the sensor element extending into the air stream.

The IAT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as intake manifold temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

The IAT sensor provides an input voltage to the Powertrain Control Module (PCM) indicating the density of the air entering the intake manifold based upon intake manifold temperature. At key-on, a 5–volt power circuit is supplied to the sensor from the PCM. The sensor is grounded at the PCM through a low-noise, sensor-return circuit.

The PCM uses this input to calculate the following:

• Injector pulse-width

• Adjustment of spark timing (to help prevent spark knock with high intake manifold air-charge temperatures)

The resistance values of the IAT sensor is the same as for the Engine Coolant Temperature (ECT) sensor.

REMOVAL

REMOVAL - 4.0L

The Intake Manifold Air Temperature (IAT) sensor is installed into the intake manifold plenum near the front of the throttle body (Fig. 27).

(1) Disconnect electrical connector from sensor.

(2) Remove sensor from intake manifold.

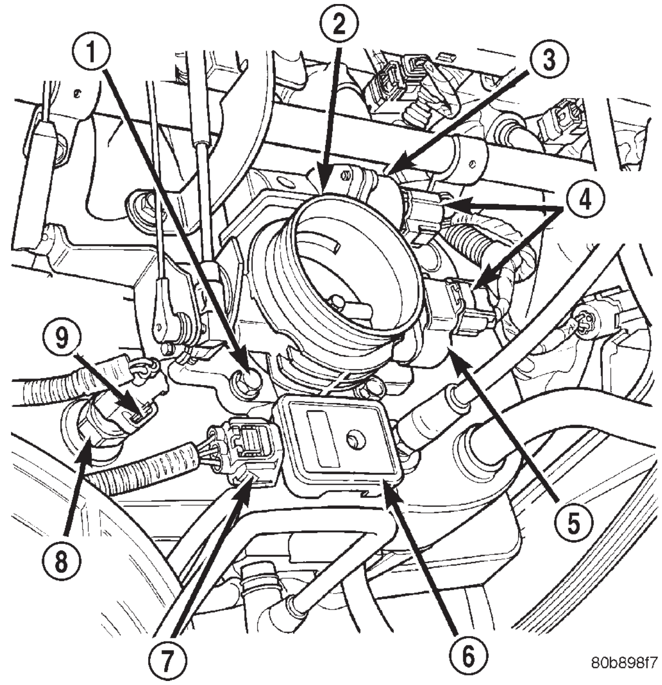


Fig. 27 Intake Manifold Air Sensor Location—4.0L Engine

1 - MOUNTING BOLTS (4)
2 - THROTTLE BODY
3 - IAC MOTOR
4 - ELEC. CONN.
5 - TPS
6 - MAP SENSOR
7 - ELEC. CONN.
8 - IAT SENSOR
9 - ELEC. CONN.

REMOVAL - 4.7L

The Intake Manifold Air Temperature (IAT) sensor is located on the left side of the intake manifold.

Threaded Type Sensor

(1) Disconnect electrical connector from sensor.

(2) Remove sensor from intake manifold (Fig. 28).

Snap-In Type Sensor

(1) Disconnect electrical connector from IAT sensor.

(2) Clean dirt from intake manifold at sensor base.

(3) Gently lift on small plastic release tab (Fig. 30) or (Fig. 29) and rotate sensor about 1/4 turn counterclockwise for removal.

(4) Check condition of sensor o-ring.

INTAKE AIR TEMPERATURE SENSOR (Continued)

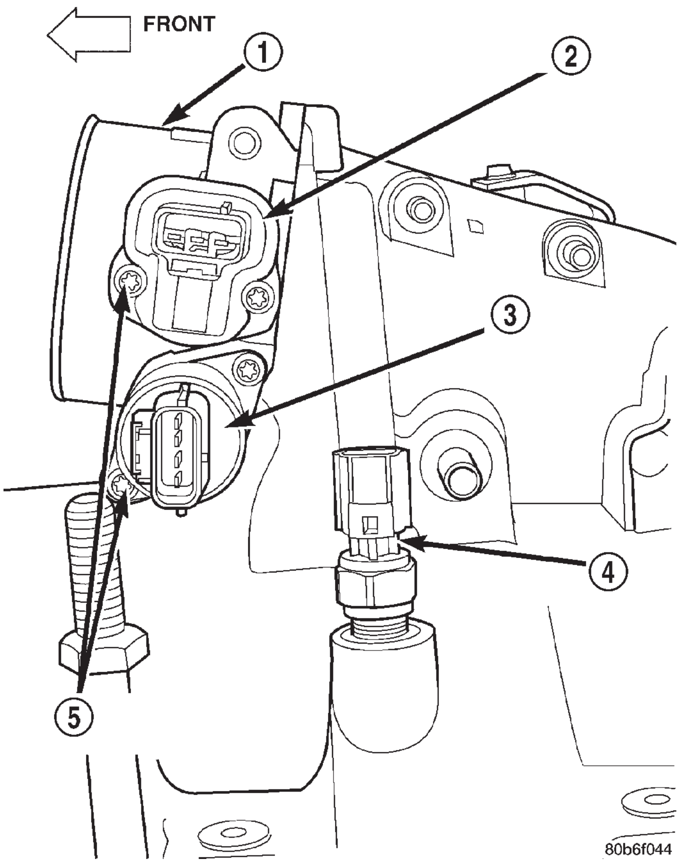


Fig. 28 IAT - 4.7L (THREADED TYPE)

1 - THROTTLE BODY
2 - TPS
3 - IAC MOTOR
4 - IAT SENSOR (THREADED TYPE)
5 - MOUNTING SCREWS

INSTALLATION

INSTALLATION - 4.0L

The Intake Manifold Air Temperature (IAT) sensor is installed into the intake manifold plenum near the front of the throttle body (Fig. 27).

(1) Install sensor into intake manifold. Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect electrical connector to sensor.

INSTALLATION - 4.7L

Threaded Type Sensor

(1) Install sensor (Fig. 28) into intake manifold. Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect electrical connector to sensor.

Snap-In Type Sensor

(1) Check condition of sensor o-ring (Fig. 30).

(2) Clean sensor mounting hole in intake manifold.

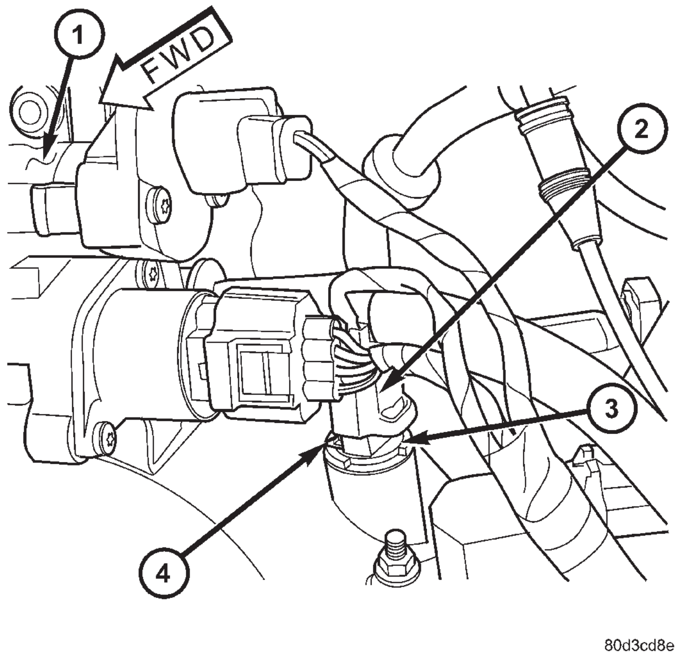


Fig. 29 IAT SENSOR - 4.7L (SNAP-IN TYPE)

1 - LEFT SIDE OF THROTTLE BODY
2 - ELEC. CONNECT.
3 - IAT SENSOR
4 - RELEASE TAB

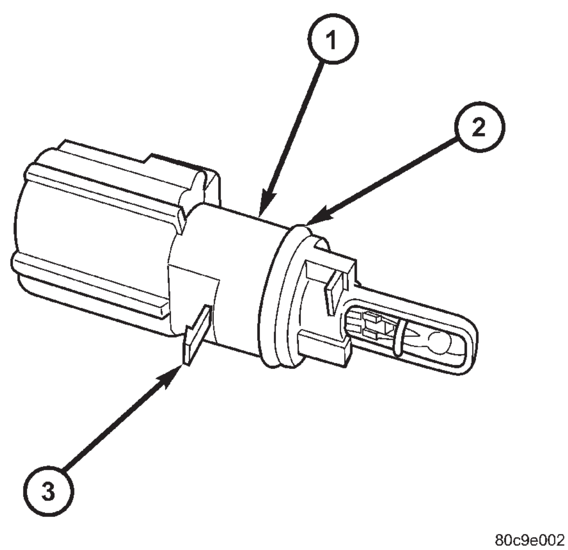


Fig. 30 IAT SENSOR TAB / O-RING - 4.7L (SNAP-IN TYPE)

1 - IAT SENSOR
2 - SENSOR O-RING
3 - RELEASE TAB

(3) Position sensor (Fig. 29) into intake manifold and rotate clockwise until past release tab.

(4) Install electrical connector.

MAP SENSOR

DESCRIPTION

DESCRIPTION

On the 4.0L six-cylinder engine the MAP sensor is mounted to the engine throttle body. On the 4.7L V-8 engine the MAP sensor is mounted to front of the intake manifold.

DESCRIPTION - 4.7L

The MAP sensor is located on the front of the intake manifold. An o-ring seals the sensor to the intake manifold.

OPERATION

The MAP sensor is used as an input to the Powertrain Control Module (PCM). It contains a silicon based sensing unit to provide data on the manifold vacuum that draws the air/fuel mixture into the combustion chamber. The PCM requires this information to determine injector pulse width and spark advance. When manifold absolute pressure (MAP) equals Barometric pressure, the pulse width will be at maximum.

A 5 volt reference is supplied from the PCM and returns a voltage signal to the PCM that reflects manifold pressure. The zero pressure reading is 0.5V and full scale is 4.5V. For a pressure swing of 0–15 psi, the voltage changes 4.0V. To operate the sensor, it is supplied a regulated 4.8 to 5.1 volts. Ground is provided through the low-noise, sensor return circuit at the PCM.

The MAP sensor input is the number one contributor to fuel injector pulse width. The most important function of the MAP sensor is to determine barometric pressure. The PCM needs to know if the vehicle is at sea level or at a higher altitude, because the air density changes with altitude. It will also help to correct for varying barometric pressure. Barometric pressure and altitude have a direct inverse correlation; as altitude goes up, barometric goes down. At key-on, the PCM powers up and looks at MAP voltage, and based upon the voltage it sees, it knows the current barometric pressure (relative to altitude). Once the engine starts, the PCM looks at the voltage again, continuously every 12 milliseconds, and compares the current voltage to what it was at key-on. The difference between current voltage and what it was at key-on, is manifold vacuum.

During key-on (engine not running) the sensor reads (updates) barometric pressure. A normal range can be obtained by monitoring a known good sensor.

As the altitude increases, the air becomes thinner (less oxygen). If a vehicle is started and driven to a very different altitude than where it was at key-on, the barometric pressure needs to be updated. Any time the PCM sees Wide Open Throttle (WOT), based upon Throttle Position Sensor (TPS) angle and RPM, it will update barometric pressure in the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively.

The PCM uses the MAP sensor input to aid in calculating the following:

- Manifold pressure
- Barometric pressure
- Engine load
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (certain automatic transmissions only)
- Idle speed
- Decel fuel shutoff

The MAP sensor signal is provided from a single piezoresistive element located in the center of a diaphragm. The element and diaphragm are both made of silicone. As manifold pressure changes, the diaphragm moves causing the element to deflect, which stresses the silicone. When silicone is exposed to stress, its resistance changes. As manifold vacuum increases, the MAP sensor input voltage decreases proportionally. The sensor also contains electronics that condition the signal and provide temperature compensation.

The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; meaning as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3 volts at 26 in. of Hg. Barometric pressure is the pressure exerted by the atmosphere upon an object. At sea level on a standard day, no storm, barometric pressure is approximately 29.92 in Hg. For every 100 feet of altitude, barometric pressure drops .10 in. Hg. If a storm goes through it can change barometric pressure from what should be present for that altitude. You should know what the average pressure and corresponding barometric pressure is for your area.

REMOVAL

REMOVAL - 4.0L

The MAP sensor is mounted to the side of the throttle body (Fig. 40). An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 31).

(1) Remove air cleaner duct and air resonator box at throttle body.

MAP SENSOR (Continued)

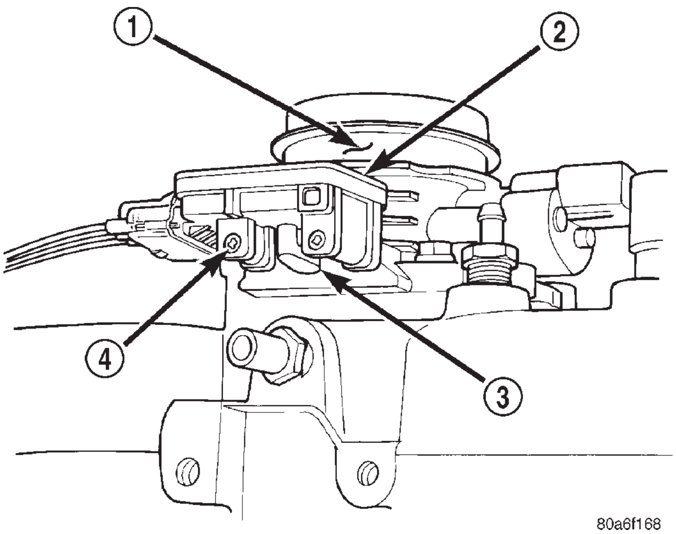


Fig. 31 Rubber L-Shaped Fitting—MAP Sensor-to-Throttle Body—4.0L Engine

1 - THROTTLE BODY
2 - MAP SENSOR
3 - RUBBER FITTING
4 - MOUNTING SCREWS (2)

(2) Remove two MAP sensor mounting bolts (screws) (Fig. 31).

(3) While removing MAP sensor, slide the rubber L-shaped fitting (Fig. 31) from the throttle body.

(4) Remove rubber L-shaped fitting from MAP sensor.

REMOVAL - 4.7L

The MAP sensor is located on the front of the intake manifold (Fig. 32). An o-ring seals the sensor to the intake manifold.

(1) Disconnect electrical connector at sensor.

(2) Clean area around MAP sensor.

(3) Remove 2 sensor mounting bolts (Fig. 32).

(4) Remove MAP sensor from intake manifold.

INSTALLATION

INSTALLATION - 4.0L

The MAP sensor is mounted to the side of the throttle body (Fig. 40). An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 31).

(1) Install rubber L-shaped fitting to MAP sensor.

(2) Position sensor to throttle body while guiding rubber fitting over throttle body vacuum nipple.

(3) Install MAP sensor mounting bolts (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.

(4) Install air cleanerduct/air box.

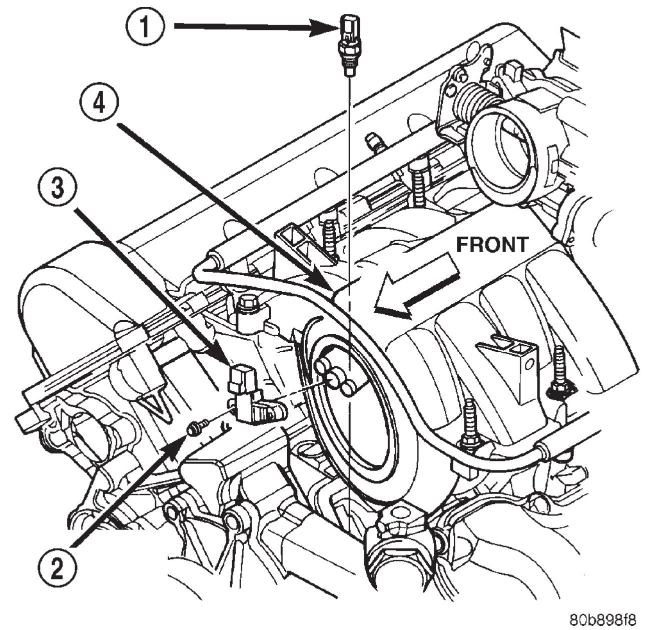


Fig. 32 MAP and ECT Sensor Locations—4.7L V–8 Engine

1 - ECT SENSOR
2 - MOUNTING BOLTS (2)
3 - MAP SENSOR
4 - INTAKE MANIFOLD

INSTALLATION - 4.7L

The MAP sensor is located on the front of the intake manifold (Fig. 32). An o-ring seals the sensor to the intake manifold.

(1) Clean MAP sensor mounting hole at intake manifold.

(2) Check MAP sensor o-ring seal for cuts or tears.

(3) Position sensor into manifold.

(4) Install MAP sensor mounting bolts (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.

(5) Connect electrical connector.

O2S HEATER RELAY

DESCRIPTION

The 2 oxygen (O2) sensor heater relays (upstream and downstream) are located in the Powertrain Distribution Center (PDC).

OPERATION

Engines equipped with the California (NAE) Emissions Package use **four O2 sensors.**

Two of the four sensor heater elements (upstream sensors 1/1 and 2/1) are controlled by the upstream heater relay through output signals from the Powertrain Control Module (PCM).

O2S HEATER RELAY (Continued)

The other two heater elements (downstream sensors 1/2 and 2/2) are controlled by the downstream heater relay through output signals from the PCM.

To avoid a large simultaneous current surge, power is delayed to the 2 downstream heater elements by the PCM for approximately 2 seconds.

REMOVAL

(1) Remove PDC cover.

(2) Remove relay from PDC.

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.

(2) Install cover to PDC.

O2S SENSOR

DESCRIPTION

The Oxygen Sensors (O2S) are attached to, and protrude into the vehicle exhaust system. Depending on the emission package, the vehicle may use a total of either 2 or 4 sensors.

Federal Emissions Package: Two sensors are used: upstream (referred to as 1/1) and downstream (referred to as 1/2). With this emission package, the upstream sensor (1/1) is located just before the main catalytic convertor. The downstream sensor (1/2) is located just after the main catalytic convertor.

4.7L V-8 With California Emissions Package: On this emissions package, 4 sensors are used: 2 upstream (referred to as 1/1 and 2/1) and 2 downstream (referred to as 1/2 and 2/2). With this emission package, the right upstream sensor (2/1) is located in the right exhaust downpipe just before the mini-catalytic convertor. The left upstream sensor (1/1) is located in the left exhaust downpipe just before the mini-catalytic convertor. The right downstream sensor (2/2) is located in the right exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor. The left downstream sensor (1/2) is located in the left exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor.

4.0L 6–Cylinder With California Emissions Package: On this emissions package, 4 sensors are used: 2 upstream (referred to as 1/1 and 2/1) and 2 downstream (referred to as 1/2 and 2/2). With this emission package, the rear/upper upstream sensor (2/1) is located in the exhaust downpipe just before the rear mini-catalytic convertor. The front/upper upstream sensor (1/1) is located in the exhaust downpipe just before the front mini-catalytic convertor. The rear/lower downstream sensor (2/2) is located in the exhaust downpipe just after the rear mini-catalytic convertor, and before the main catalytic convertor. The front/lower downstream sensor (1/2) is located in the exhaust downpipe just after the front mini-catalytic convertor, and before the main catalytic convertor.

OPERATION

An O2 sensor is a galvanic battery that provides the PCM with a voltage signal (0-1 volt) inversely proportional to the amount of oxygen in the exhaust. In other words, if the oxygen content is low, the voltage output is high; if the oxygen content is high the output voltage is low. The PCM uses this information to adjust injector pulse-width to achieve the 14.7–to–1 air/fuel ratio necessary for proper engine operation and to control emissions.

The O2 sensor must have a source of oxygen from outside of the exhaust stream for comparison. Current O2 sensors receive their fresh oxygen (outside air) supply through the O2 sensor case housing.

Four wires (circuits) are used on each O2 sensor: a 12–volt feed circuit for the sensor heating element; a ground circuit for the heater element; a low-noise sensor return circuit to the PCM, and an input circuit from the sensor back to the PCM to detect sensor operation.

Oxygen Sensor Heaters/Heater Relays: Depending on the emissions package, the heating elements within the sensors will be supplied voltage from either the ASD relay, or 2 separate oxygen sensor relays. Refer to Wiring Diagrams to determine which relays are used.

The O2 sensor uses a Positive Thermal Co-efficient (PTC) heater element. As temperature increases, resistance increases. At ambient temperatures around 70°F, the resistance of the heating element is approximately 4.5 ohms on 4.0L engines. It is approximately 13.5 ohms on the 4.7L engine. As the sensor's temperature increases, resistance in the heater element increases. This allows the heater to maintain the optimum operating temperature of approximately 930°-1100°F (500°-600° C). Although the sensors operate the same, there are physical differences, due to the environment that they operate in, that keep them from being interchangeable.

Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

O2S SENSOR (Continued)

In Closed Loop operation, the PCM monitors certain O2 sensor input(s) along with other inputs, and adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

Upstream Sensor (Non-California Emissions): The upstream sensor (1/1) provides an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensor. The PCM will change the air/fuel ratio until the upstream sensor inputs a voltage that the PCM has determined will make the downstream sensor output (oxygen content) correct.

The upstream oxygen sensor also provides an input to determine catalytic convertor efficiency.

Downstream Sensor (Non-California Emissions): The downstream oxygen sensor (1/2) is also used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensor also provides an input to determine catalytic convertor efficiency.

Upstream Sensors (California Engines): Two upstream sensors are used (1/1 and 2/1). The 1/1 sensor is the first sensor to receive exhaust gases from the #1 cylinder. They provide an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensors. The PCM will change the air/fuel ratio until the upstream sensors input a voltage that the PCM has determined will make the downstream sensors output (oxygen content) correct.

The upstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

Downstream Sensors (California Engines): Two downstream sensors are used (1/2 and 2/2). The downstream sensors are used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage, and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

Engines equipped with either a downstream sensor(s), or a post-catalytic sensor, will monitor catalytic convertor efficiency. If efficiency is below emission standards, the Malfunction Indicator Lamp (MIL) will be illuminated and a Diagnostic Trouble Code (DTC) will be set. Refer to Monitored Systems in Emission Control Systems for additional information.

REMOVAL

Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness.

Oxygen sensor (O2S) locations are shown in (Fig. 33) and (Fig. 34).

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER(S) BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support vehicle.

(2) Disconnect O2S pigtail harness from main wiring harness.

(3) If equipped, disconnect sensor wire harness mounting clips from engine or body.

CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.

(4) Remove O2S sensor with an oxygen sensor removal and installation tool.

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to threads of a new oxygen sensor.**

(1) Install O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.

(2) Connect O2S sensor wire connector to main wiring harness.

(3) If equipped, connect sensor wire harness mounting clips to engine or body. **When Equipped: The O2S pigtail harness must be clipped and/or bolted back to their original positions on engine or body to prevent mechanical damage to wiring.**.

(4) Lower vehicle.

O2S SENSOR (Continued)

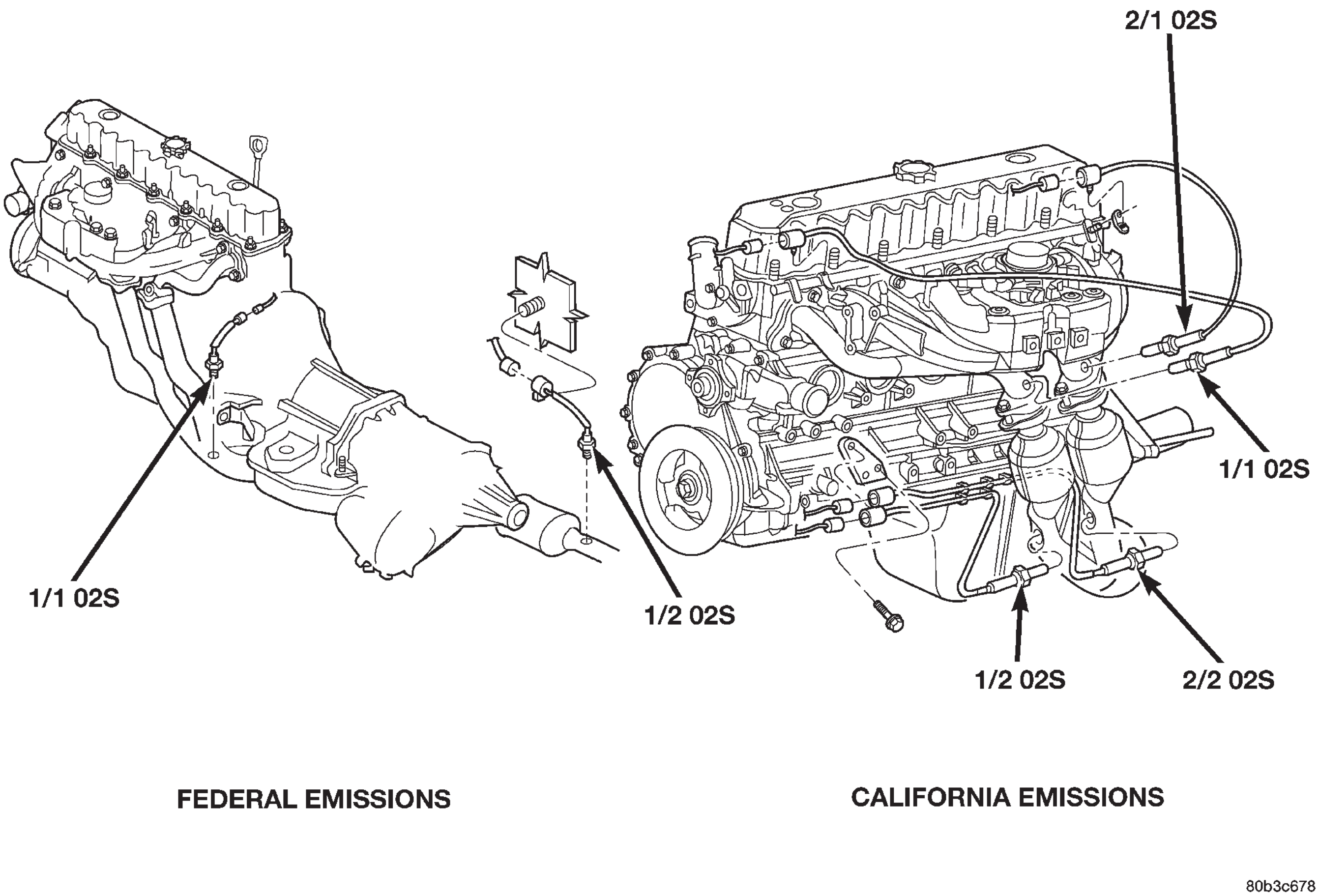


Fig. 33 Oxygen Sensor Locations—4.0L Engine

THROTTLE BODY

DESCRIPTION

The throttle body is located on the intake manifold. Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors.

OPERATION

Filtered air from the air cleaner enters the intake manifold through the throttle body. The throttle body contains an air control passage controlled by an Idle Air Control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

Certain sensors are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle body linkage arm.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

REMOVAL

REMOVAL - 4.0L

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

(1) Remove air cleaner duct and air resonator box at throttle body.

(2) Disconnect throttle body electrical connectors at MAP sensor, IAC motor and TPS (Fig. 35).

THROTTLE BODY (Continued)

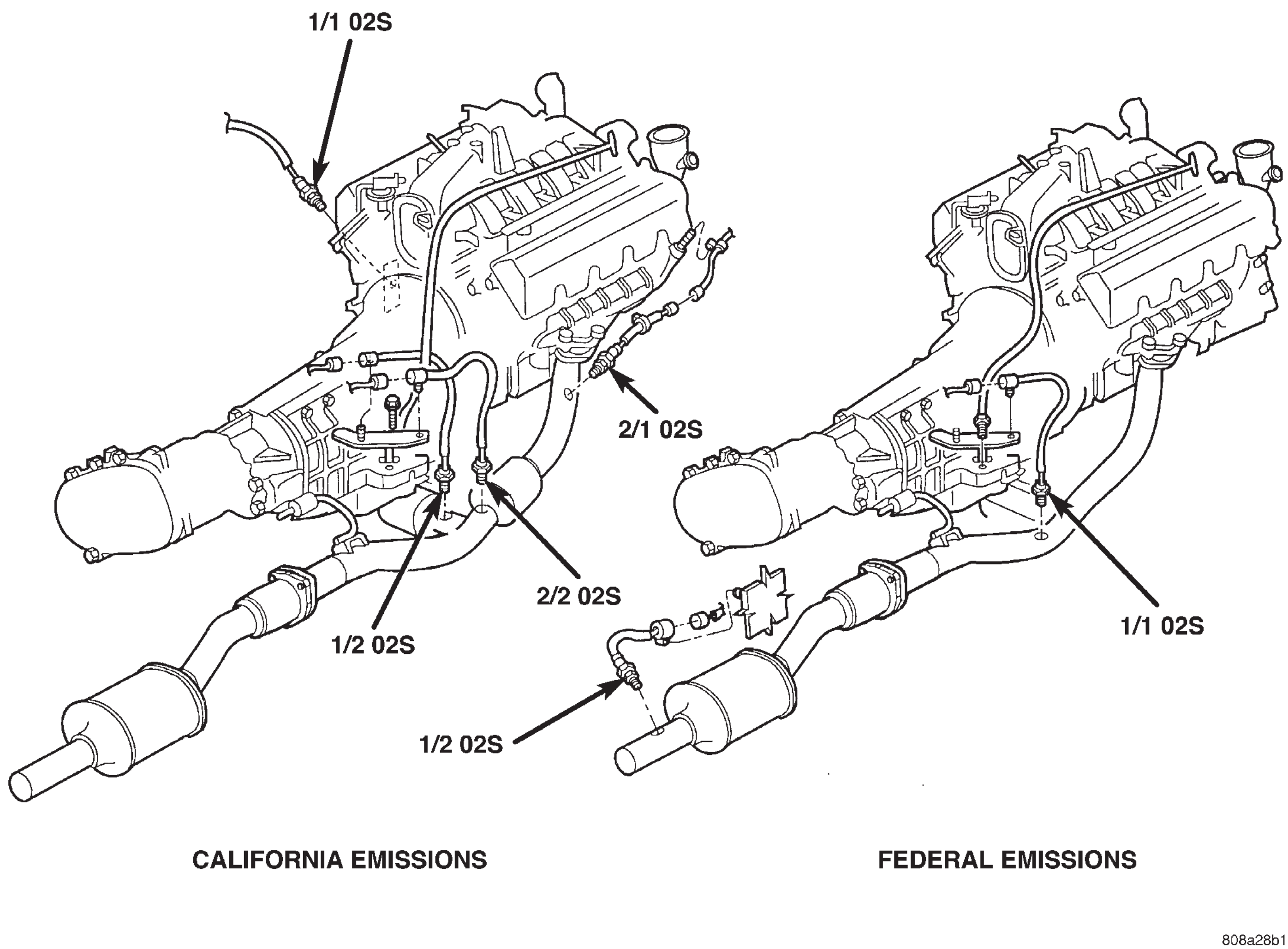


Fig. 34 Oxygen Sensor Locations—4.7L V-8 Engine

(3) Remove all control cables from throttle body (lever) arm. Refer to Accelerator Pedal and Throttle Cable.

(4) Remove four throttle body mounting bolts.

(5) Remove throttle body from intake manifold.

(6) Discard old throttle body-to-intake manifold gasket.

REMOVAL - 4.7L

(1) Remove the air duct and air resonator box at throttle body.

(2) Disconnect throttle body electrical connectors at IAC motor and TPS (Fig. 36).

(3) Remove vacuum line at throttle body.

(4) Remove all control cables from throttle body (lever) arm. Refer to Accelerator Pedal and Throttle Cable.

(5) Remove three throttle body mounting bolts (Fig. 36).

(6) Remove throttle body from intake manifold.

INSTALLATION

INSTALLATION - 4.0L

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

(1) Clean the mating surfaces of the throttle body and the intake manifold.

(2) Install new throttle body-to-intake manifold gasket.

(3) Install throttle body to intake manifold.

(4) Install four mounting bolts. Tighten bolts to 11 N·m (100 in. lbs.) torque.

(5) Install control cables.

(6) Install electrical connectors.

(7) Install air duct and air box at throttle body.

THROTTLE BODY (Continued)

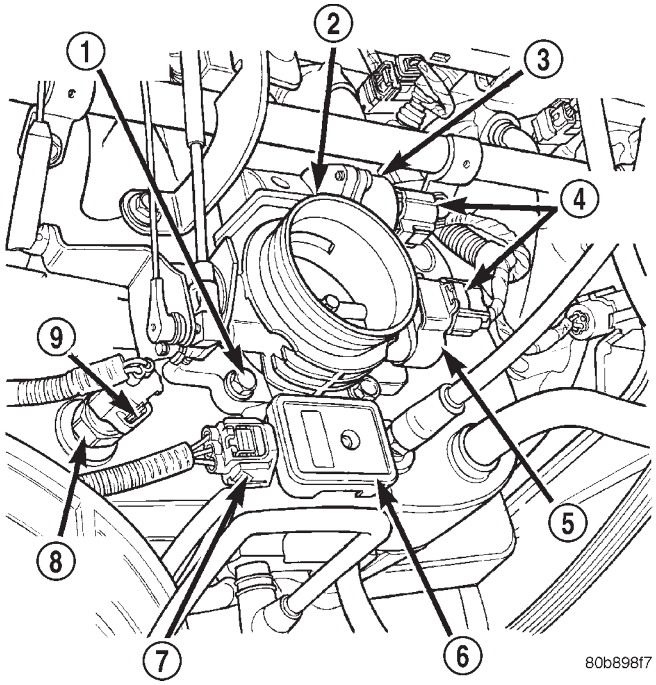


Fig. 35 Throttle Body and Sensor Locations—4.0L Engine

1 - MOUNTING BOLTS (4)
2 - THROTTLE BODY
3 - IAC MOTOR
4 - ELEC. CONN.
5 - TPS
6 - MAP SENSOR
7 - ELEC. CONN.
8 - IAT SENSOR
9 - ELEC. CONN.

INSTALLATION - 4.7L

(1) Clean throttle body-to-intake manifold o-ring.

(2) Clean mating surfaces of throttle body and intake manifold.

(3) Install throttle body to intake manifold by positioning throttle body to manifold alignment pins.

(4) Install three mounting bolts. Tighten bolts to 12 N·m (105 in. lbs.) torque.

(5) Install control cables.

(6) Install vacuum line to throttle body.

(7) Install electrical connectors.

(8) Install air duct/air box at throttle body.

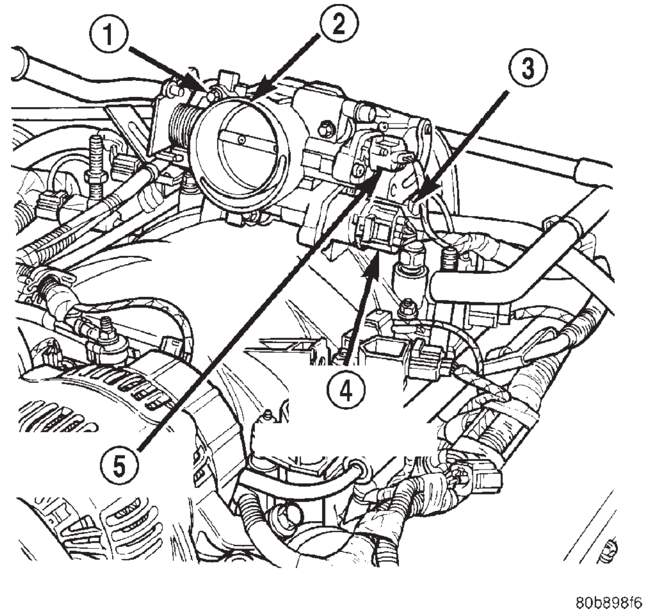


Fig. 36 Throttle Body, Sensors and Electrical Connectors—4.7L V-8 Engine

1 - MOUNTING BOLTS (3)
2 - THROTTLE BODY
3 - IAT SENSOR CONNECTOR
4 - IAC MOTOR CONNECTOR
5 - TPS CONNECTOR

THROTTLE CONTROL CABLE

REMOVAL

REMOVAL - 4.0L

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 16). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, remove clip holding cable to dashpanel (Fig. 16).

(4) Remove cable housing from dash panel and pull into engine compartment.

(5) Remove (unsnap) cable from routing clips on engine valve cover.

(6) Remove cable connector at throttle body bellcrank ball by unsnapping rearward (Fig. 37).

(7) Remove throttle cable from bracket by compressing release tabs (Fig. 37) and pushing cable through hole in bracket.

(8) Remove throttle cable from vehicle.

THROTTLE CONTROL CABLE (Continued)

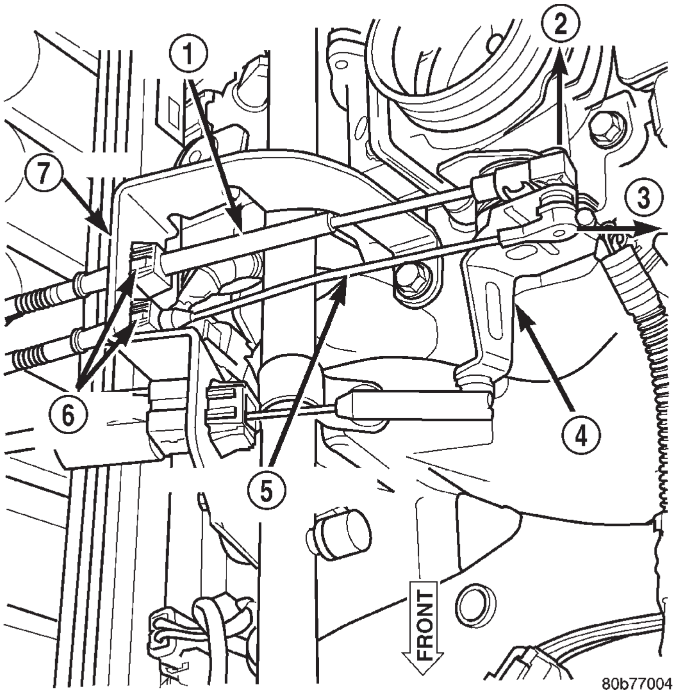


Fig. 37 Throttle (Accelerator) Cable at Throttle Body—4.0L Engine

1 - ACCELERATOR CABLE
2 - OFF
3 - OFF
4 - THROTTLE BODY BELLCRANK
5 - SPEED CONTROL CABLE
6 - RELEASE TABS
7 - BRACKET

REMOVAL - 4.7L

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 16). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, remove clip holding cable to dashpanel (Fig. 16).

(4) Remove air box at throttle body.

(5) Unsnap cable from plenum routing clip.

(6) Remove cable housing from dash panel and pull into engine compartment.

(7) Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 38). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(8) Lift accelerator cable from top of cable cam (Fig. 38).

(9) Press tab (Fig. 39) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (Fig. 39) towards passenger side of vehicle to remove cable from bracket.

(10) Remove throttle cable from vehicle.

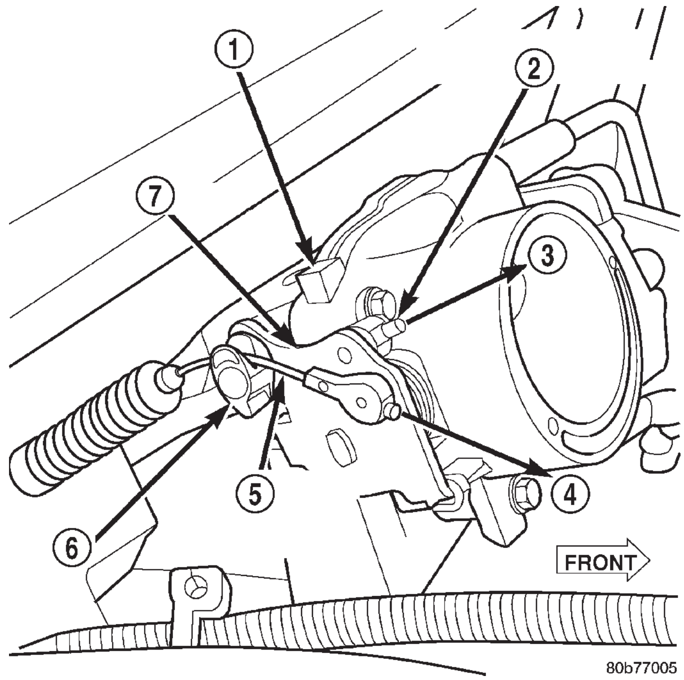


Fig. 38 Accelerator Cable at Bell Crank—4.7L V-8 Engine

1 - THROTTLE BODY
2 - SPEED CONTROL CABLE CONNECTOR
3 - OFF
4 - OFF
5 - ACCELERATOR CABLE CONNECTOR
6 - CABLE CAM
7 - BELLCRANK

INSTALLATION

INSTALLATION – 4.0L

(1) Slide throttle cable through hole in bracket until release tabs lock into bracket.

(2) Connect cable ball end to throttle body bellcrank ball (snaps on).

(3) Snap cable into routing clips on engine valve cover.

(4) Slide rubber grommet away from plastic cable housing.

(5) Install rubber grommet into dash panel until seated.

(6) Push cable housing into rubber grommet and through opening in dash panel.

THROTTLE CONTROL CABLE (Continued)

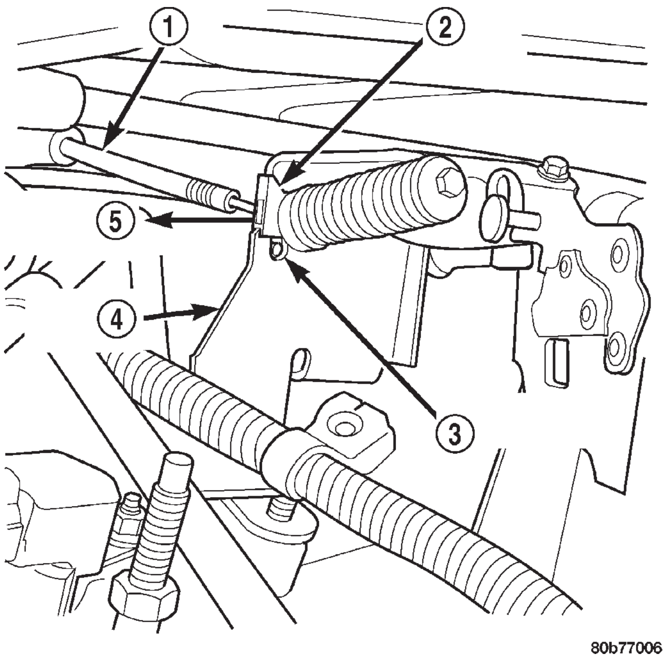


Fig. 39 Accelerator Cable Release Tab—4.7L V-8 Engine

1 - ACCELERATOR CABLE
2 - PLASTIC CABLE MOUNT
3 - PRESS TAB FOR REMOVAL
4 - CABLE BRACKET
5 - SLIDE FOR REMOVAL

(7) From inside vehicle, install clip holding cable to dashpanel (Fig. 16).

(8) From inside vehicle, slide throttle cable core wire into opening in top of pedal arm.

(9) Push cable retainer (clip) into pedal arm opening until it snaps in place.

(10) Before starting engine, operate accelerator pedal to check for any binding.

INSTALLATION - 4.7L

(1) Slide accelerator cable plastic mount into bracket. Continue sliding until tab (Fig. 39) is aligned to hole in mounting bracket.

(2) Route accelerator cable over top of cable cam.

(3) Connect cable end to throttle body bellcrank pin (snaps on rearward).

(4) Slide rubber grommet away from plastic cable housing.

(5) Install rubber grommet into dash panel until seated.

(6) Push cable housing into rubber grommet and through opening in dash panel.

(7) From inside vehicle, install clip holding cable to dashpanel (Fig. 16).

(8) From inside vehicle, slide throttle cable core wire into opening in top of pedal arm.

(9) Push cable retainer (clip) into pedal arm opening until it snaps in place.

(10) Snap cable into plenum routing clip.

(11) Install air box to throttle body.

(12) Before starting engine, operate accelerator pedal to check for any binding.

THROTTLE POSITION SENSOR

DESCRIPTION

The 3–wire Throttle Position Sensor (TPS) is mounted on the throttle body and is connected to the throttle blade.

OPERATION

The TPS is a 3–wire variable resistor that provides the Powertrain Control Module (PCM) with an input signal (voltage) that represents the throttle blade position of the throttle body. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the resistance (output voltage) of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from .26 volts at minimum throttle opening (idle), to 4.49 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

The PCM needs to identify the actions and position of the throttle blade at all times. This information is needed to assist in performing the following calculations:

- Ignition timing advance
- Fuel injection pulse-width
- Idle (learned value or minimum TPS)
- Off-idle (0.06 volt)
- Wide Open Throttle (WOT) open loop (2.608 volts above learned idle voltage)
- Deceleration fuel lean out
- Fuel cutoff during cranking at WOT (2.608 volts above learned idle voltage)
- A/C WOT cutoff (certain automatic transmissions only)

THROTTLE POSITION SENSOR (Continued)

REMOVAL

REMOVAL - 4.0L

The TPS is mounted to the throttle body.

(1) Disconnect TPS electrical connector (Fig. 40).

(2) Remove TPS mounting screws (Fig. 41).

(3) Remove TPS.

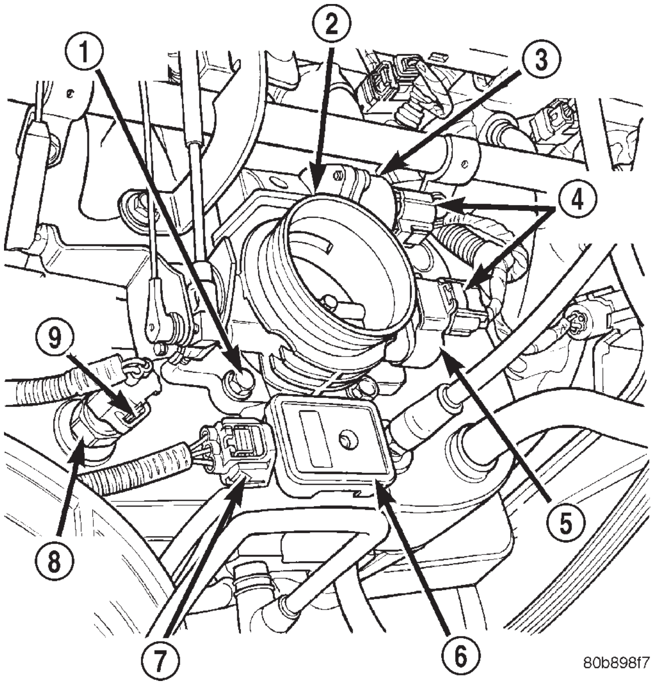


Fig. 40 TPS Electrical Connector—4.0L Engine

1 - MOUNTING BOLTS (4)
2 - THROTTLE BODY
3 - IAC MOTOR
4 - ELEC. CONN.
5 - TPS
6 - MAP SENSOR
7 - ELEC. CONN.
8 - IAT SENSOR
9 - ELEC. CONN.

REMOVAL - 4.7L

The TPS is located on the throttle body.

(1) Remove air duct and air resonator box at throttle body.

(2) Disconnect TPS electrical connector (Fig. 36).

(3) Remove two TPS mounting bolts (screws) (Fig. 42).

(4) Remove TPS from throttle body.

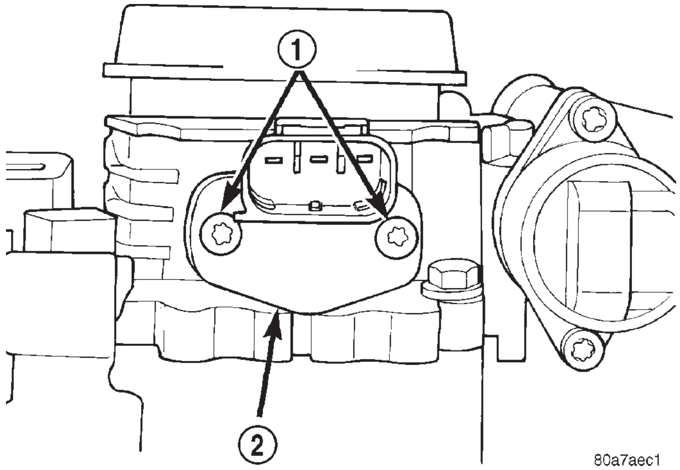


Fig. 41 TPS Mounting Screws—4.0L Engine

1 - MOUNTING SCREWS
2 - TPS

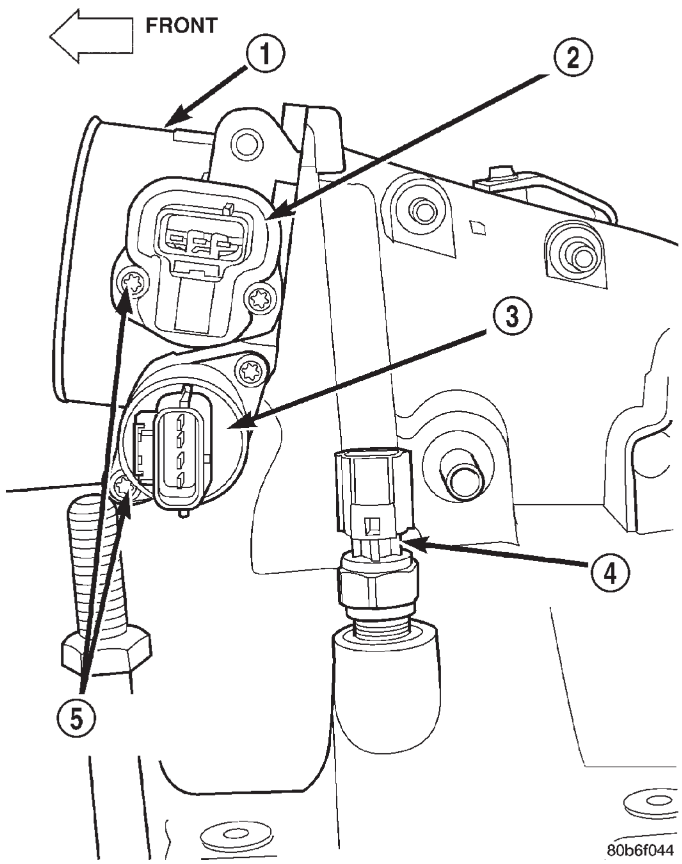


Fig. 42 TPS Mounting Bolts—4.7L V–8

1 - THROTTLE BODY
2 - TPS
3 - IAC MOTOR
4 - IAT SENSOR (THREADED TYPE)
5 - MOUNTING SCREWS

THROTTLE POSITION SENSOR (Continued)

INSTALLATION

INSTALLATION - 4.0L

The TPS is mounted to the throttle body.

The throttle shaft end of throttle body slides into a socket in the TPS (Fig. 43). The TPS must be installed so that it can be rotated a few degrees. (If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs). The TPS will be under slight tension when rotated.

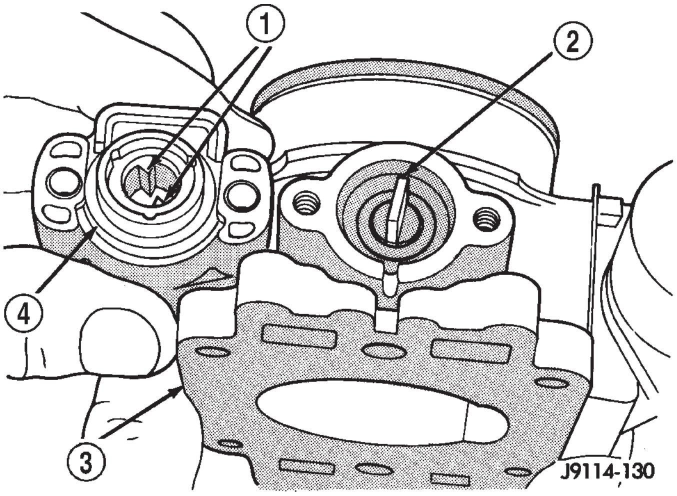


Fig. 43 Throttle Position Sensor Installation—4.0L Engine

1 - TANGS
2 - THROTTLE SHAFT
3 - THROTTLE BODY
4 - TPS

(1) Install TPS and retaining screws.
(2) Tighten screws to 7 N·m (60 in. lbs.) torque.
(3) Connect TPS electrical connector to TPS.
(4) Manually operate throttle (by hand) to check for any TPS binding before starting engine.

INSTALLATION - 4.7L

The throttle shaft end of throttle body slides into a socket in TPS (Fig. 44). The TPS must be installed so that it can be rotated a few degrees. If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs. The TPS will be under slight tension when rotated.

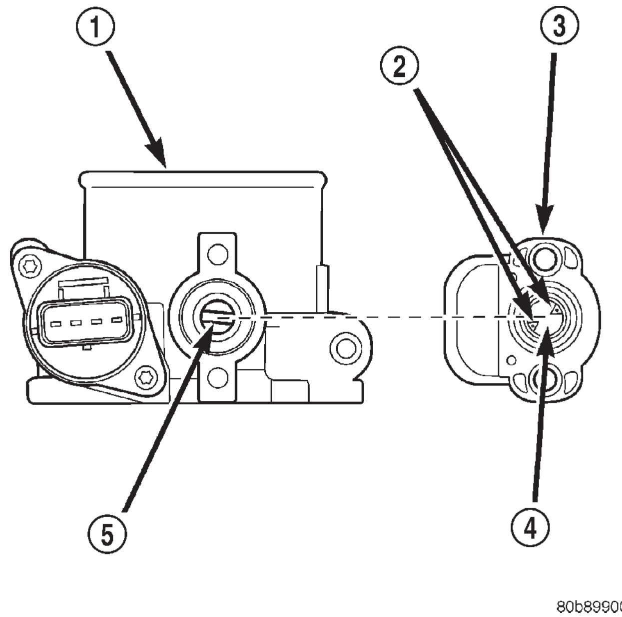


Fig. 44 TPS Installation—4.7L

1 - THROTTLE BODY
2 - LOCATING TANGS
3 - THROTTLE POSITION SENSOR
4 - SOCKET
5 - THROTTLE SHAFT

(1) Install TPS and two retaining bolts.
(2) Tighten bolts to 7 N·m (60 in. lbs.) torque.
(3) Manually operate throttle control lever by hand to check for any binding of TPS.
(4) Connect TPS electrical connector to TPS.
(5) Install air duct/air box to throttle body.

STEERING

TABLE OF CONTENTS

STEERING

DESCRIPTION - POWER STEERING SYSTEM

The power steering pump (Fig. 1) is a constant flow rate and displacement vane type pump. The pump reservoir is attached to the pump body. The pump is connected to the steering by the pressure and return hoses. The steering gear (Fig. 1) used is a recirculating ball type gear. A tilt and non-tilt column provide steering input.

The power steering system consists of:

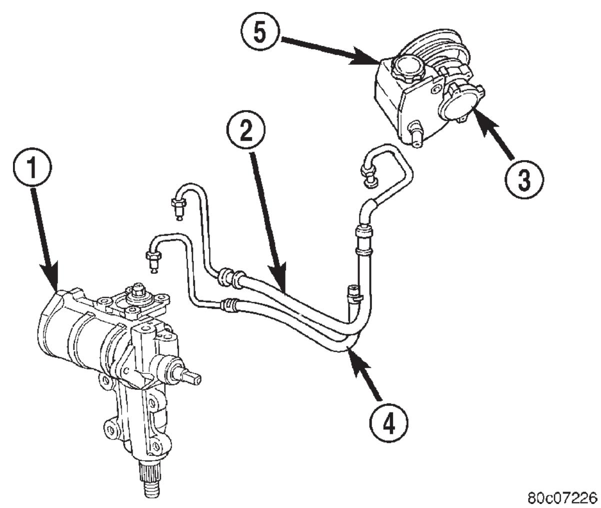


Fig. 1 POWER STEERING GEAR & PUMP 4.0L

1 - STEERING GEAR
2 - PRESSURE HOSE
3 - PUMP
4 - RETURN HOSE
5 - RESERVOIR

OPERATION - POWER STEERING SYSTEM

The rack piston balls act as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the lower end and a bearing assembly at the upper end. When the worm shaft is turned from input from the steering column the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which moves the steering linkage.

STEERING (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - POWER STEERING SYSTEM

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill parking. Or when the steering wheel is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Steering intermediate shaft to dash panel seal. 2. Noisy valve in power steering gear.	1. Check and repair seal at dash panel. 2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose. 2. Loose or damaged suspension components/track bar. 3. Loose or damaged steering linkage. 4. Internal gear noise. 5. Pressure hose in contact with other components.	1. Tighten bolts to specification. 2. Inspect and repair suspension. 3. Inspect and repair steering linkage. 4. Replace gear. 5. Reposition hose.
CHIRP OR SQUEAL	1. Loose belt. 2. Belt routing.	1. Adjust or replace. 2. Verify belt routing is correct.
WHINE OR GROWL	1. Low fluid level. 2. Pressure hose in contact with other components. 3. Internal pump noise. 4. Air in the system.	1. Fill to proper level. 2. Reposition hose. 3. Replace pump. 4. Perform pump initial operation.
SUCKING AIR SOUND	1. Loose return line clamp. 2. O-ring missing or damaged on hose fitting. 3. Low fluid level. 4. Air leak between pump and reservoir.	1. Replace clamp. 2. Replace o-ring. 3. Fill to proper level. 4. Repair as necessary.
SCRUBBING OR KNOCKING	1. Wrong tire size. 2. Wrong gear.	1. Verify tire size. 2. Verify gear.

STEERING (Continued)

BINDING AND STICKING

CONDITION	POSSIBLE CAUSE	CORRECTION
DIFFICULT TO TURN WHEEL STICKS OR BINDS	1. Low fluid level.	1. Fill to proper level.
	2. Tire pressure.	2. Adjust tire pressure.
	3. Steering component.	3. Inspect and lube.
	4. Loose belt.	4. Adjust or replace.
	5. Low pump pressure.	5. Pressure test and replace if necessary.
	6. Column shaft coupler binding.	6. Replace coupler.
	7. Steering gear worn or out of adjustment.	7. Repair or replace gear.
	8. Ball joints binding.	8. Inspect and repair as necessary.
	9. Belt routing.	9. Verify belt routing is correct.
4.7L	Hydraulic fan motor steering output low	Pressure / Flow test fans steering output flow

INSUFFICIENT ASST. OR POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSE	CORRECTION
HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT	1. Tire pressure.	1. Adjust tire pressure.
	2. Low fluid level.	2. Fill to proper level.
	3. Loose belt.	3. Adjust or replace.
	4. Lack of lubrication.	4. Inspect and lubricate steering and suspension compnents.
	5. Low pump pressure or flow.	5. Pressure and flow test and repair as necessary.
	6. Internal gear leak.	6. Pressure and flow test, and repair as necessary.
	7. Belt routing.	7. Verify belt routing is correct.
4.7L	8. Low flow / pressure from fan motor	8. Pressure and flow test and repair as necessary.
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tire pressure.	1. Adjust tire pressure.
	2. Wheel alignment.	2. Align front end.
	3. Lack of lubrication.	3. Inspect and lubricate steering and suspension compnents.
	4. High friction in steering gear.	4. Test and adjust as necessary.
	5. Ball joints binding.	5. Inspect and repair as necessary.

NOTE:
Some roads will cause a vehicle to drift, due to the crown in the road.

STEERING (Continued)

LOOSE STEERING AND VEHICLE LEADS/DRIFTS

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	1. Worn or loose suspension or steering components.	1. Repair as necessary.
	2. Worn or loose wheel bearings.	2. Repair as necessary.
	3. Steering gear mounting.	3. Tighten gear mounting bolts to specification.
	4. Gear out of adjustment.	4. Adjust gear to specification.
	5. Worn or loose steering coupler.	5. Repair as necessary.
VEHICLE PULLS TO ONE SIDE DURING BRAKING	1. Tire Pressure.	1. Adjust tire pressure.
	2. Air in brake hydrauliics system.	2. Bleed brake system.
	3. Worn brake components.	3. Repair as necessary.
VEHICLE LEADS OR DRIFTS FROM STRAIGHT AHEAD DIRECTION ON UNCROWNED ROAD.	1. Tire pressure.	1. Adjust tire pressure.
	2. Radial tire lead.	2. Cross front tires.
	3. Brakes dragging.	3. Repair as necessary.
	4. Wheel alignment.	4. Align vehicle.
	5. Weak or broken spring.	5. Replace spring.
	6. Loose or worn steering/ suspension components.	6. Repair as necessary.
	7. Cross caster out of spec.	7. Adjust or replace axle as necessary.

DIAGNOSIS AND TESTING - STEERING FLOW AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool kit 6815 (Fig. 2) and Adapter Kit 6893.

FLOW AND PRESSURE TEST

(1) Check the power steering belt to ensure it is in good condition and adjusted properly.

(2) Connect pressure gauge hose from the Power Steering Analyzer to Tube 6865.

(3) Connect Adapter 6826 to Power Steering Analyzer test valve end.

(4) Disconnect the high pressure hose from the power steering pump.

(5) Connect Tube 6865 to the pump hose fitting.

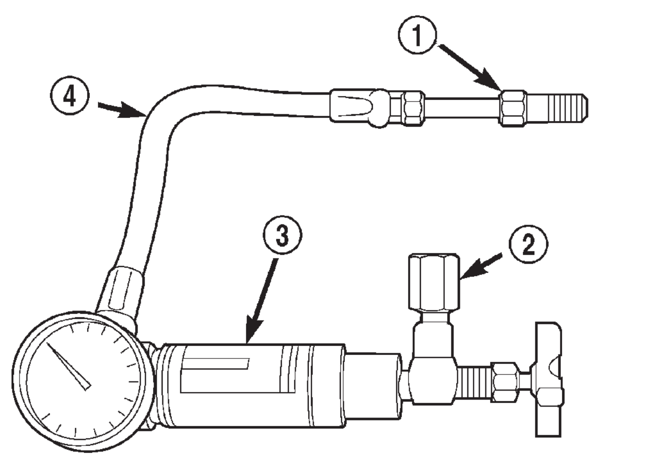


Fig. 2 Power Steering Analyzer

1 - TUBE
2 - ADAPTER FITTINGS
3 - ANALYZER
4 - GAUGE HOSE

(6) Connect the power steering hose from the steering gear to Adapter 6826.

(7) Open the test valve completely.

STEERING (Continued)

(8) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge.

(9) Shut off the engine and check the fluid level, add fluid as necessary. Start engine again and let idle.

(10) The initial pressure reading should be 345-552 kPa (50-80 psi). If pressure is higher inspect the hoses for restrictions and repair as necessary.

(11) Increase the engine speed to 1500 RPM and read the flow meter. The reading should be 2.4 - 2.8 GPM, if the reading is below this specification the pump should be replaced.

CAUTION: This next step involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than three seconds as the pump could be damaged.

(12) Close valve fully three times for three seconds and record highest pressure indicated each time. **All three readings must be at pump relief pressure specifications and within 345 kPa (50 psi) of each other.**

• Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.

• Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 4 seconds at a time because, pump damage will result.

(13) Open the test valve and turn the steering wheel to the extreme left and right positions against the stops. Record the highest pressure reading at each position. Compare readings to the pump specifications chart. If pressures readings are not within 50 psi. of each other, the gear is leaking internally and must be repaired.

GEAR INLET SPECIFICATIONS 4.0L & 4.7L

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM)
4.0L	9653 kPa (1400 psi)	1500 RPM 2.4 - 2.8 GPM
4.7L	9653 kPa (1450 psi)	

PUMP MOTOR SPECIFICATIONS 4.7L

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM)
4.7L	9653 kPa (1900 psi)	1100 RPM 2.4-2.8 GPM Minium @ 200 psi

DIAGNOSIS AND TESTING - 4.7L - HYDRAULIC

The following procedures are used to test the operation of the power steering and hydraulic fan systems on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with any maximum relief pressure. Perform test anytime a power steering system problem is present. This test will determine if the power steering pump, hydraulic fan, and power steering gear are not functioning properly. It will also determine if the flow coming out of the hydraulic fan motor is sufficient for the power steering gear. The following pressure and flow test is performed using the Power Steering Analyzer Tool kit 6815 (Fig. 2) and Adapter kit 8630 (Fig. 3).

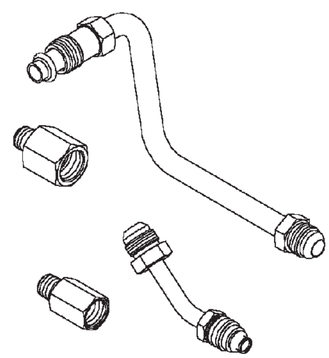


Fig. 3 4.7L HYDRAULIC POWER STEERING TEST ADAPTERS

FLOW TEST - FLOW FROM POWER STEERING PUMP

(1) Check the power steering belt to ensure it is in good condition and adjusted properly.

(2) Connect the pressure gauge hose from the Power Steering Analyzer to Tube 8630-2.

(3) Connect Adapter 8630-3 to Power Steering Analyzer test valve end.

(4) Disconnect the high pressure hose from the power steering pump.

(5) Connect Tube 8630-2 to the pump hose fitting.

(6) Connect the power steering hose from the fan motor to Adapter 8630-3.

(7) Open the test valve completely.

(8) Start engine and let idle long enough to circulate power steering fluid through the flow/pressure test gauge.

(9) Shut off the engine and check the fluid level, add fluid ass necessary. Start engine again and let idle.

(10) The initial pressure reading should be 483 - 690 kPa (70 - 100 psi). If pressure is higher inspect the hoses for restrictions and repair as necessary.

STEERING (Continued)

(11) Increase the engine speed to 1100 rpm and read the flow meter. The reading should be 2.6 GPM minimum, if the reading is below this specification, the pump should be replaced.

FLOW AND PRESSURE TEST - FLOW FROM HYDRAULIC FAN MOTOR TO STEERING GEAR (should be done if necessary after the Pump flow test)

(1) Connect the pressure gauge hose from the Power Steering Analyzer to Fitting 8630-1.

(2) Connect Adapter 8630-4 to Power Steering Analyzer test valve end.

(3) Disconnect the high pressure hose from the power steering gear.

(4) Connect Fitting 8630-1 to the high pressure hose.

(5) Connect Adapter 8630-4 to the power steering gear.

(6) Open the test valve completely.

(7) Start engine and let idle long enough to circulate power steering fluid through the flow/pressure test gauge.

(8) Shut off the engine and check the fluid level, add fluid ass necessary. Start engine again and let idle.

(9) The initial pressure reading should be 345-552 kPa (50-80 psi). If pressure is higher inspect the hoses for restrictions and repair as necessary.

(10) Increase the engine speed to 1500 RPM and read the flow meter. The reading should be 2.4 - 2.8 GPM if the reading is below this specification the fan should be replaced.

CAUTION: This next step involves testing maximum fan motor steering relief pressure. Do not leave the valve closed for more than three seconds.

(11) Close the valve fully three times for three seconds and record highest pressures indicated each time. All three readings must be at fan motor steering relief pressures.

(12) Open the test valve and turn the steering wheel to the extreme left and right positions against the stops. Record the highest pressure readings at each position. If pressure readings are not within 50 psi from each other, the gear is leaking internally and must be repaired.

PUMP MOTOR SPECIFICATIONS 4.7L

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM)
4.7L	9653 kPa (1900 psi)	1100 RPM 2.4-2.8 GPM Minium @ 200 psi

COLUMN

TABLE OF CONTENTS

COLUMN

DESCRIPTION

SERVICE WARNINGS AND CAUTIONS

DESCRIPTION

The tilt column (Fig. 1) has been designed to be serviced as an assembly, less the wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

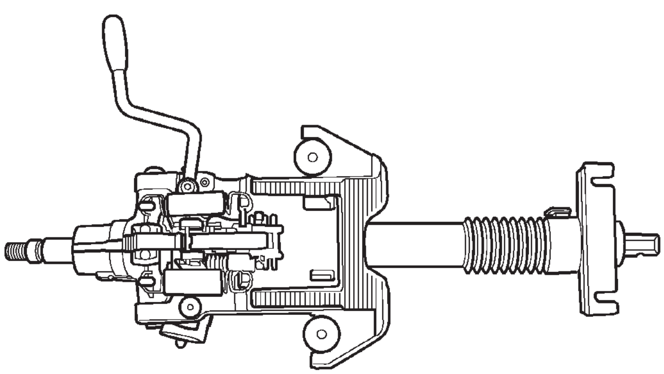


Fig. 1 Steering Column

To service the steering wheel, switches or airbag,(Refer to 8 - ELECTRICAL/RESTRAINTS - WARNING).

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

CAUTION: Safety goggles should be worn at all times when working on steering columns.

COLUMN (Continued)

REMOVAL

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY.(Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(1) Position front wheels straight ahead.

(2) Disconnect and isolate the negative (ground) cable from the battery.

(3) Remove the airbag,(Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(4) Remove the steering wheel nut and remove wheel with Puller C-3894-A (Fig. 2).

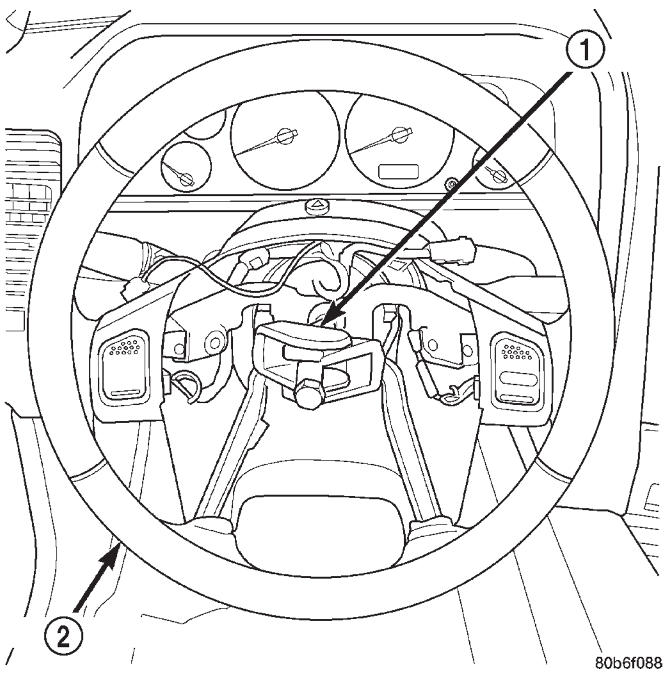


Fig. 2 Steering Wheel Puller

1 - PULLER
2 - STEERING WHEEL

NOTE: Ensure the puller jaws are seated in the pockets (Fig. 3) of the steering wheel armature.

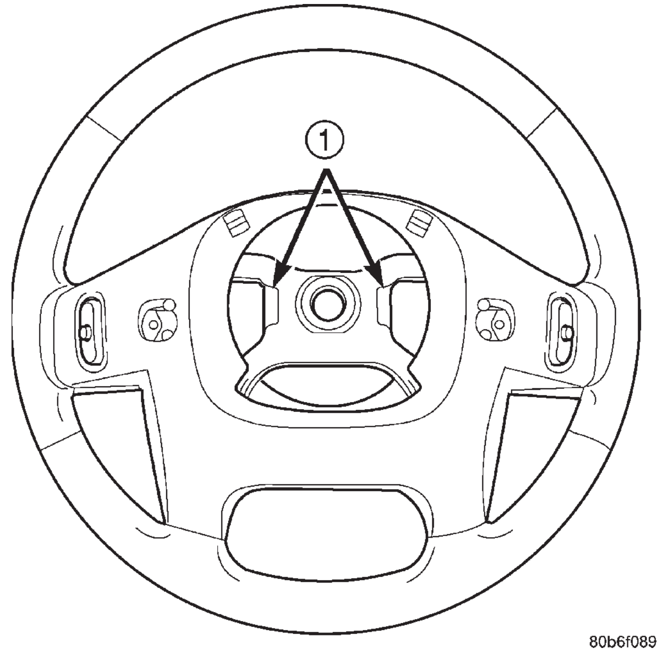


Fig. 3 Steering Wheel Pockets

1 - STEERING WHEEL POCKETS

(5) Remove the cluster bezel by pulling it from the instrument panel (Fig. 4).

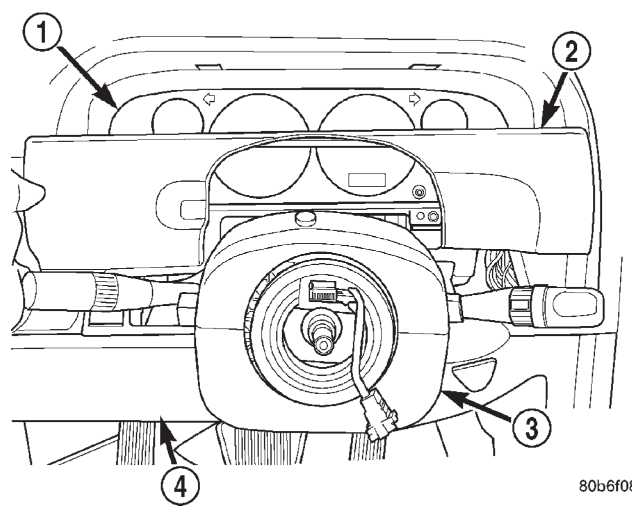


Fig. 4 Cluster Bezel

1 - CLUSTER
2 - CLUSTER BEZEL
3 - STEERING COLUMN
4 - KNEE BLOCKER COVER

COLUMN (Continued)

(6) Remove the knee blocker cover (Fig. 5),(Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

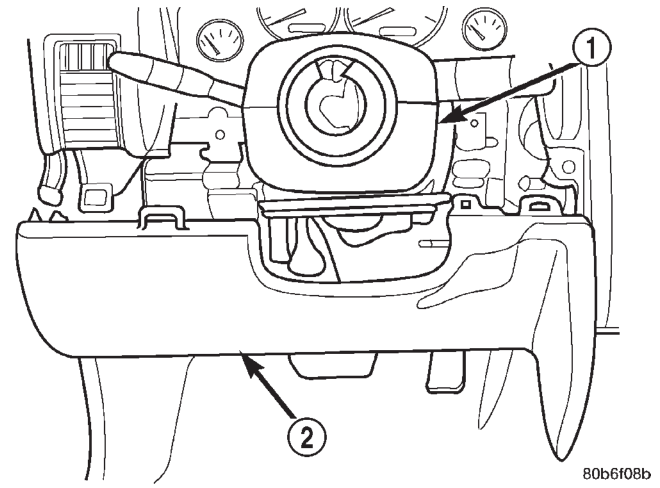


Fig. 5 Knee Blocker Cover

1 - STEERING COLUMN
2 - KNEE BLOCKER COVER

(7) Remove the lower steering column shroud mounting screw (Fig. 6).

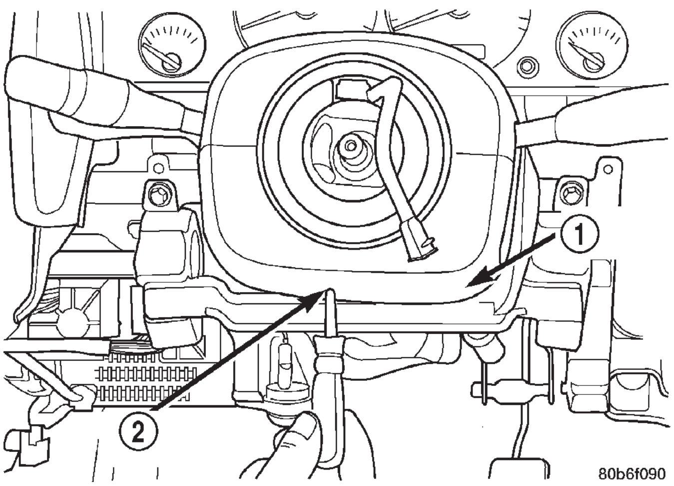


Fig. 6 Column Shroud Mounting Screw

1 - LOWER SHROUD
2 - ACCESS HOLE

(8) Unsnap the two halves of the column shrouds by pressing on the sides of the upper shroud and tilting the rear of the upper shroud up. Remove the shrouds from the steering column (Fig. 7).

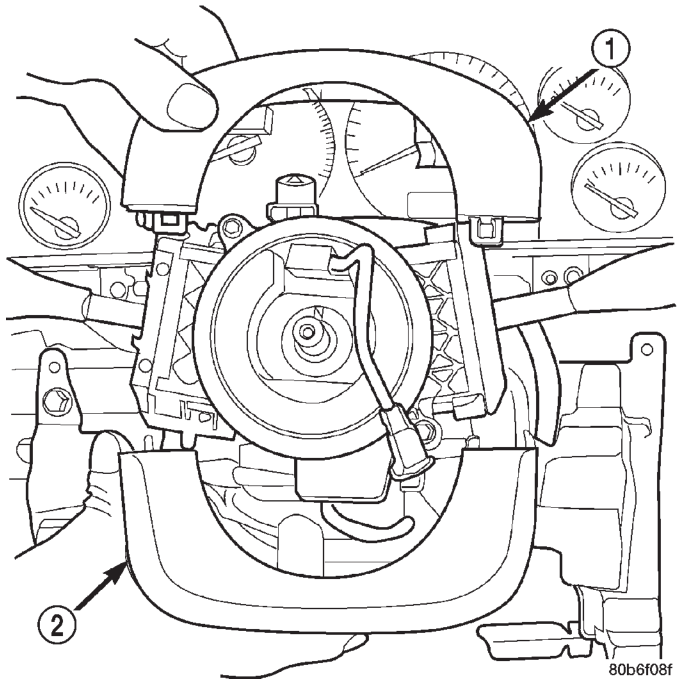


Fig. 7 Column Shrouds

1 - UPPER SHROUD
2 - LOWER SHROUD

(9) Remove the upper fixed shroud mounting screws and remove the shroud (Fig. 8).

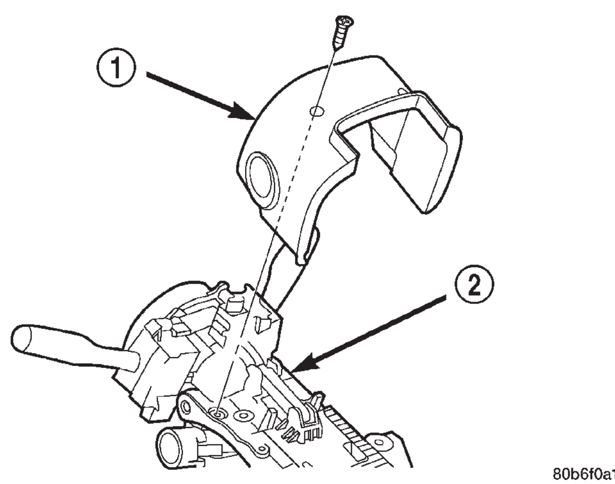


Fig. 8 Upper Fixed Shroud

1 - UPPER FIXED SHROUD
2 - COLUMN

COLUMN (Continued)

(10) Disconnect the multifuction switch (Fig. 9) and ignition switch harness.

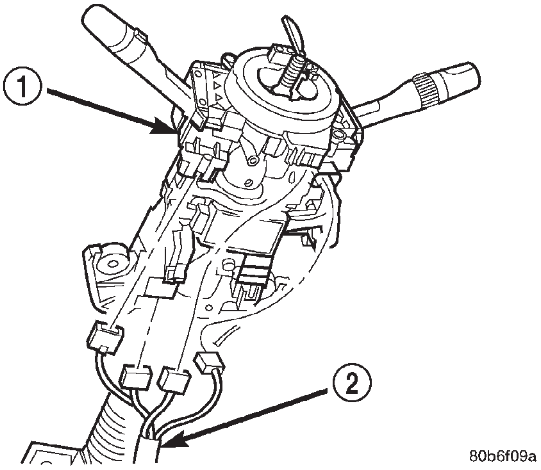


Fig. 9 Multifuction Switch Harness

1 - MULTIFUNCTION SWITCH
2 - MULTIFUNCTION SWITCH HARNESS

(11) Remove the multifuction switch screw from underneath the switch (Fig. 10). Slide the multifuction switch and clock spring off the column as an assembly (Fig. 11).

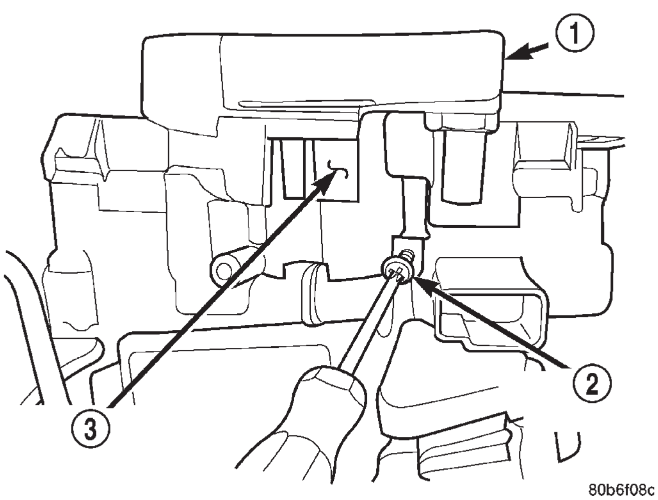


Fig. 10 Multifuction

1 - CLOCK SPRING
2 - SCREW
3 - MULTI-FUNCTION SWITCH MOUNTING HOUSING

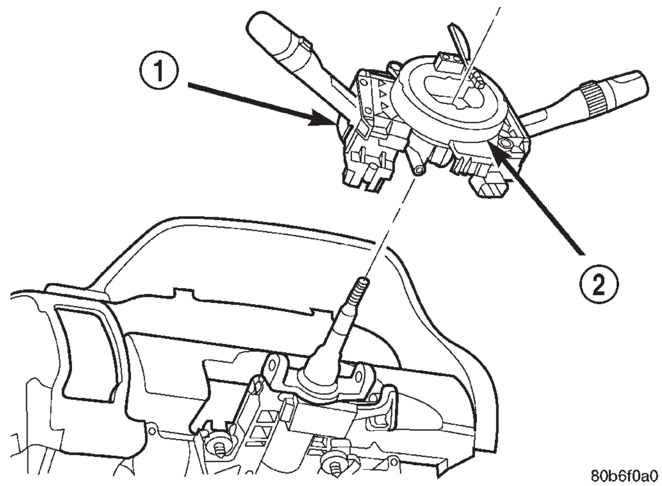


Fig. 11 Multifuction Switch And Clock Spring

1 - MULTI-FUNCTION SWITCH ASSEMBLY
2 - CLOCKSPRING

(12) Turn the ignition key to the on position then release and remove the shifter interlock cable (Fig. 12) from the ignition lock cylinder housing.

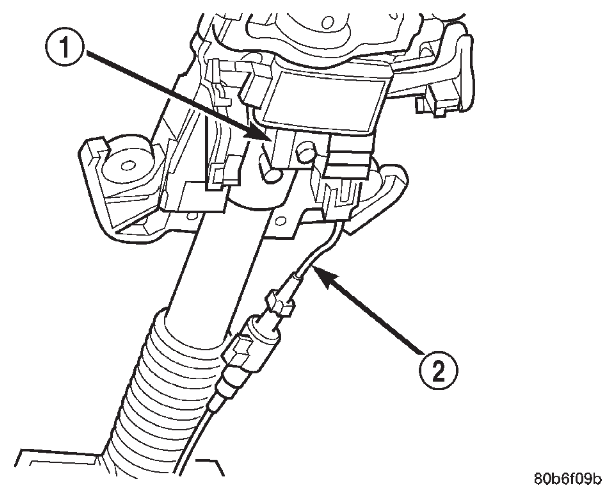


Fig. 12 Shifter Interlock Cable

1 - LOCK CYLINDER HOUSING
2 - INTERLOCK CABLE

COLUMN (Continued)

(13) Remove the column coupler bolt (Fig. 13) and slide the coupler off the column shaft.

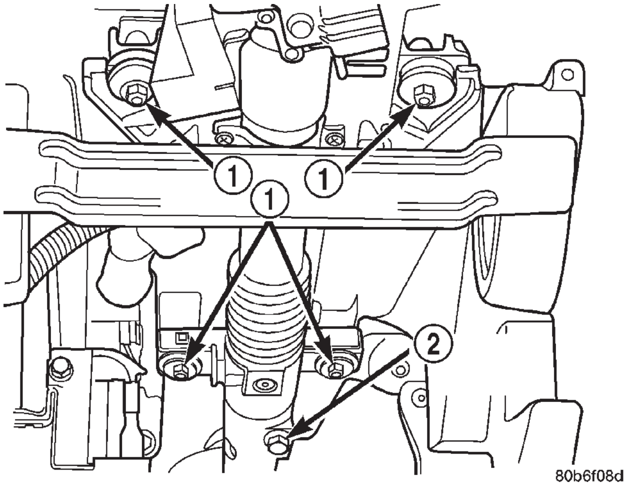


Fig. 13 Column Coupler Bolt And Mounting Nuts

1 - COLUMN MOUNTING NUTS
2 - COUPLER BOLT

(14) Remove the column mounting nuts (Fig. 13) and lower column off mounting studs. Remove the column from the vehicle.

(15) Remove the ignition switch, cylinder and SKIM, (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL). (Fig. 14).

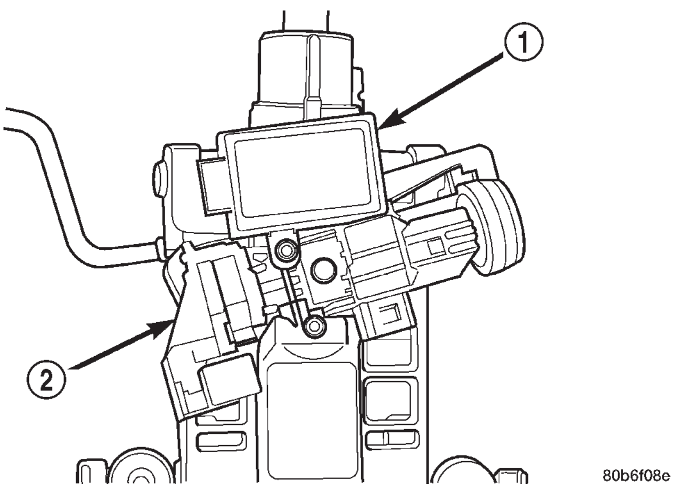


Fig. 14 Ignition Switch And SKIM

1 - SKIM
2 - IGNITION SWITCH

INSTALLATION

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

(1) Install the ignition switch, cylinder and SKIM-,(Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - INSTALLATION).

(2) Install the column into the vehicle and lift the column up onto the mounting studs. Install the mounting nuts and tighten to 12 N·m (105 in. lbs.).

(3) Slid the coupler onto the column shaft and install the coupler bolt. Tighten the coupler bolt to 49 N·m (36 ft. lbs.).

(4) Turn the ignition key to the on position then release and install the shifter interlock cable (Fig. 12) into ignition lock cylinder housing.

(5) Verify ignition switch and shifter interlock operation.,(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RE/GEAR SHIFT CABLE - ADJUSTMENTS).

(6) Slide the multifuction switch and clock spring onto the column as an assembly (Fig. 11).

(7) Install the multifuction switch mounting screw (Fig. 10).

(8) Connect the multifuction switch (Fig. 9) and ignition switch harness.

(9) Install the upper fixed shroud and mounting screws (Fig. 8).

(10) Install the lower steering column shroud to the steering column. Install and tighten the mounting screw.

(11) Install the upper column shroud. Align the upper shroud to the lower shroud and snap the two shroud halves together.

(12) Install the knee blocker cover (Fig. 5),(Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

(13) Install the cluster bezel by inserting it into the instrument panel (Fig. 4).

(14) Align the steering wheel with the column index spline and install the wheel on the column shaft. Pull the clockspring wire harness through the steering wheel armature spokes.

(15) Install and tighten the steering wheel mounting nut to 61 N·m (45 ft. lbs.).

(16) Connect the steering wheel wire harness connector to the clock spring connector.

(17) Install the airbag,(Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

(18) Connect the negative (ground) cable to the battery.

COLUMN (Continued)

SPECIFICATIONS

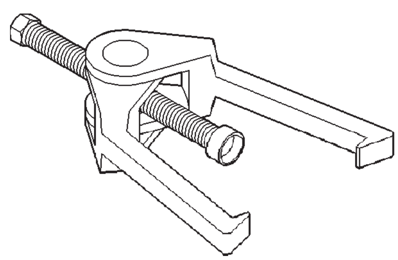
TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Steering Column Steering Wheel Nut	61	45	—
Steering Column Column Bracket Nuts	12	—	105
Steering Column Shaft Coupler Bolts	49	36	—

SPECIAL TOOLS

STEERING COLUMN



Puller C-3894-A

IGNITION SWITCH

DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key lock cylinder is used to engage/disengage the electrical ignition switch.

DIAGNOSIS AND TESTING - IGNITION SWITCH

ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, refer to Ignition Switch in Wiring Diagrams.

MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

Vehicles equipped with an automatic transmission and a floor mounted shifter: a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is rotated to the LOCKED or ACCESSORY position. The interlock device within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced,(Refer to 19 - STEERING/COLUMN - REMOVAL).

If the ignition key is difficult to rotate to or from the LOCK or ACCESSORY position, it may not be the fault of the key cylinder or the steering column components. The brake transmission shift interlock cable may be out of adjustment,(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 44RE/SHIFT INTERLOCK MECHANISM - ADJUSTMENTS) .

Vehicles equipped with an automatic transmission and a steering column mounted shifter: an interlock device is located within the steering column. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is in the LOCKED or ACCESSORY position. If it is difficult to rotate the key to or from the LOCK or ACCESSORY position, the interlock device within the steering column may be defective. This device is not serviceable. If repair is necessary, the steering column assembly must be replaced,(Refer to 19 - STEERING/COLUMN - REMOVAL).

Vehicles equipped with a manual transmission and a floor mounted shifter: on certain models, a lever is located on the steering column behind the ignition key lock cylinder. The lever must be manually operated to allow rotation of the ignition key lock cylinder to the LOCK or ACCESSORY position. If it is difficult to rotate the key to the LOCK or ACCESSORY position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced,(Refer to 19 - STEERING/COLUMN - REMOVAL).

On other models, the ignition key cylinder must be depressed to allow it to be rotated into the LOCK or ACCESSORY position. If it is difficult to rotate the key to the LOCK or ACCESSORY position, the lock mechanism within the steering column may be defective. This mechanism is not serviceable. If repair is

IGNITION SWITCH (Continued)

necessary, the steering column assembly must be replaced,(Refer to 19 - STEERING/COLUMN - REMOVAL).

REMOVAL

IGNITION SWITCH REMOVAL

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

(1) Remove key cylinder. Refer to previous steps.

(2) Remove lower steering column cover screws and remove cover (Fig. 19).

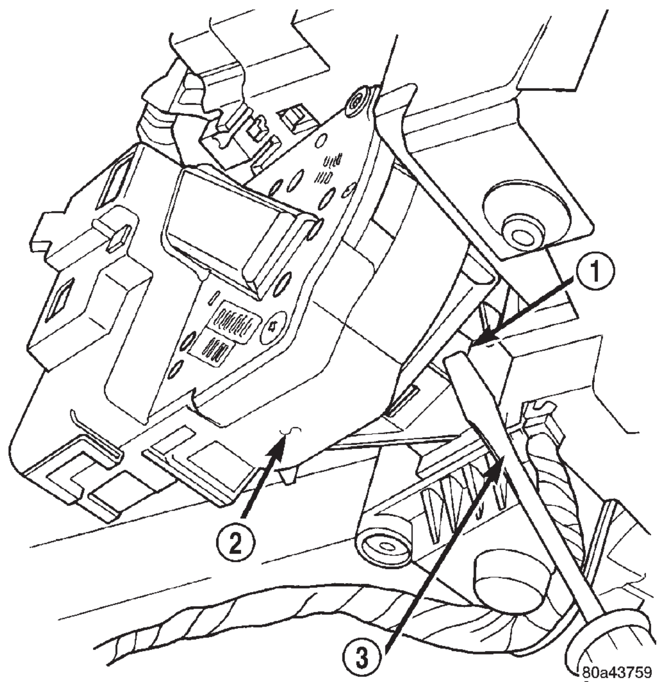


Fig. 15 Ignition Switch Lock Tab

1 - LOCK TAB
2 - IGNITION SWITCH
3 - SCREWDRIVER

(3) Remove ignition switch mounting screw (Fig. 17). Use tamper proof torx bit to remove the screw.

(4) Using a small screwdriver, push on locking tab (Fig. 15) and remove switch from steering column.

(5) Disconnect two electrical connectors at rear of ignition switch (Fig. 17).

INSTALLATION

IGNITION SWITCH INSTALLATION

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

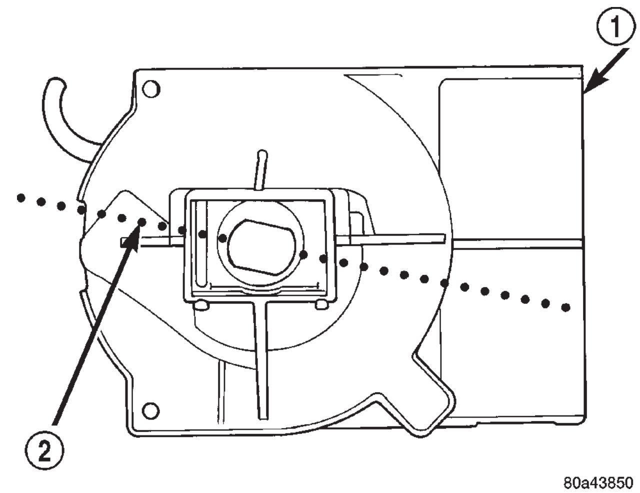


Fig. 16 Switch In ON Position

1 - IGNITION SWITCH
2 - ROTATE TO ON POSITION

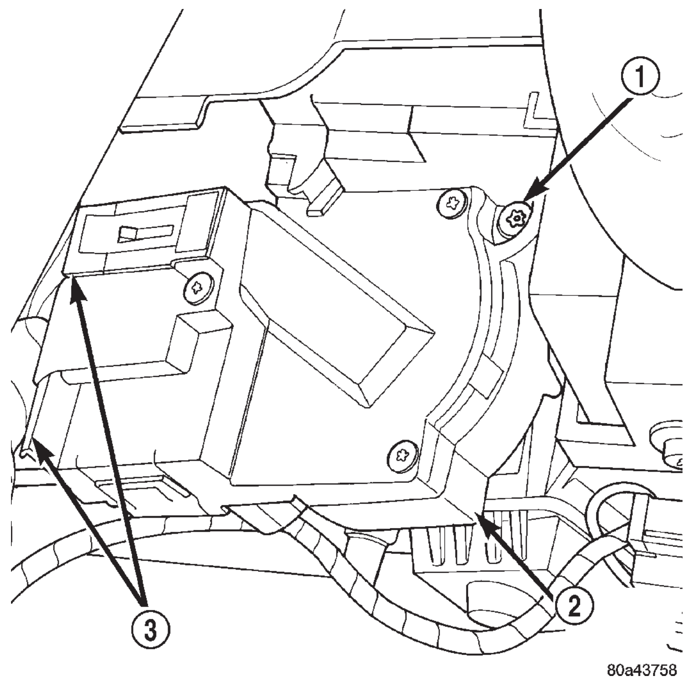


Fig. 17 Ignition Switch Removal/Installation

1 - TAMPER PROOF SCREW
2 - IGNITION SWITCH
3 - ELECTRICAL CONNECTORS

(1) Before installing ignition switch, rotate the slot in the switch to the ON position (Fig. 16).

(2) Connect two electrical connectors to rear of ignition switch. Make sure that locking tabs are fully seated into wiring connectors.

(3) Position switch to column and install tamper proof screw. Tighten screw to 3 N·m (26 in. lbs.).

(4) Install steering column lower cover.

KEY-IN IGNITION SWITCH

DESCRIPTION

The key-in ignition switch is concealed within and integral to the ignition switch, which is mounted on the steering column. The key-in ignition switch is actuated by the ignition lock cylinder mechanism, and is hard wired between a body ground and the Body Control Module (BCM) through the instrument panel wire harness.

The key-in ignition switch cannot be adjusted or repaired and, if faulty or damaged, the entire ignition switch unit must be replaced,(Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL). For complete circuit diagrams, refer to **Body Control Module** in the Contents of Wiring Diagrams.

OPERATION

The key-in ignition switch closes a path to ground for the BCM when the ignition key is inserted in the ignition lock cylinder, and opens the ground path when the key is removed from the ignition lock cylinder. The BCM monitors the key-in ignition switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The key-in ignition switch status is also used by the BCM as an input for chime warning system operation.

DIAGNOSIS AND TESTING

KEY-IN IGNITION SWITCH

For complete circuit diagrams, refer to **Body Control Module** in the Contents of Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the key-in ignition switch connector receptacle on the ignition switch. Check for continuity between the key-in ignition switch sense and ground terminals of the key-in ignition switch connector receptacle. There should be continuity with the key inserted in the ignition lock cylinder, and no continuity with the key removed from the ignition lock cylinder. If OK, go to Step 2. If not OK, replace the faulty ignition switch unit.

(2) Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the key-in ignition switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Disconnect the gray 26-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the key-in ignition switch sense circuit cavity of the instrument panel wire harness connector for the key-in ignition switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted key-in ignition switch sense circuit as required.

(4) Check for continuity between the key-in ignition switch sense circuit cavities of the instrument panel wire harness connector for the key-in ignition switch and the gray 26-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open key-in ignition switch sense circuit as required.

LOCK CYLINDER

REMOVAL

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

(1) Disconnect negative battery cable at battery.

(2) If equipped with an automatic transmission, place shifter in PARK position.

(3) Rotate key to ON position.

LOCK CYLINDER (Continued)

(4) A release tang is located on bottom of key cylinder (Fig. 18).

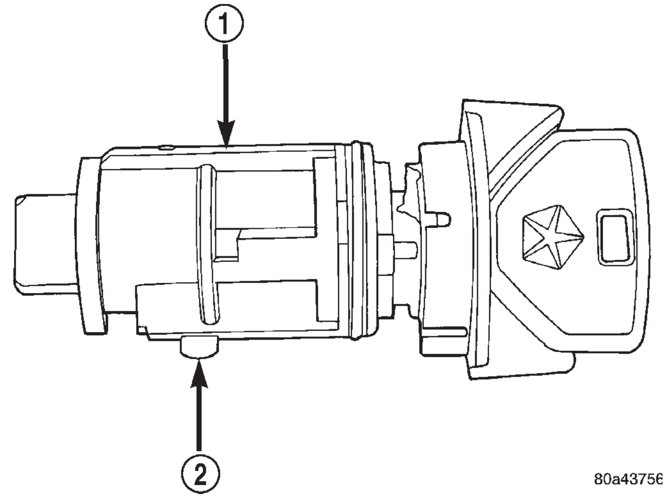


Fig. 18 Key Cylinder Release Tang

1 - KEY CYLINDER
2 - RELEASE TANG

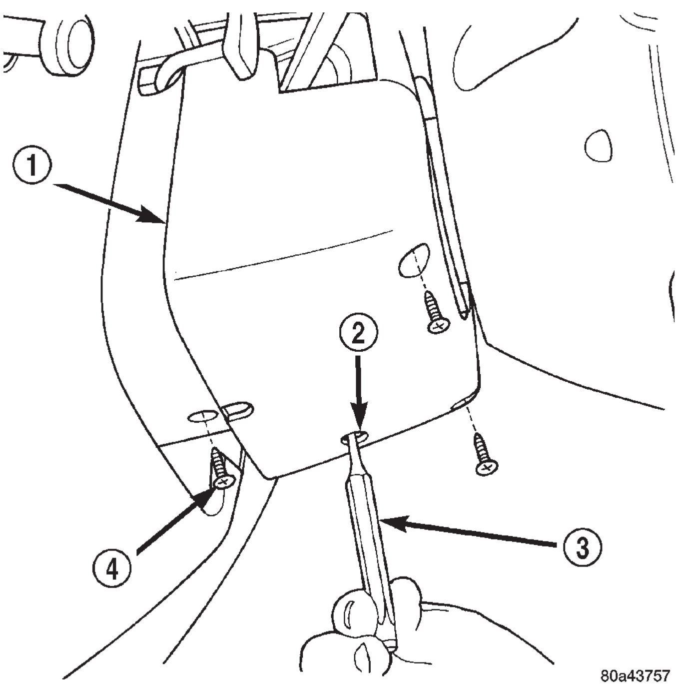


Fig. 19 Key Cylinder and Cover Removal

1 - LOWER COVER
2 - ACCESS HOLE
3 - PIN PUNCH
4 - COVER SCREWS (3)

(5) Position a small screwdriver or pin punch into tang access hole on bottom of steering column lower cover (Fig. 19).

(6) Push the pin punch up while pulling key cylinder from steering column.

INSTALLATION

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

(1) If equipped with an automatic transmission, place shifter in PARK position.

(2) Position key cylinder into steering column as it would normally be in the ON position.

(3) Press key cylinder into column until it snaps into position.

(4) Check mechanical operation of switch. **Automatic Transmission:** Be sure transmission lever is locked in PARK position after key removal. If key is difficult to rotate or is difficult to remove, the shift lever-to-steering column cable may be out of adjustment or defective. Refer to Transmission for procedures. **Manual Transmission:** Be sure key cannot be removed until release lever is operated. If key can be removed, release lever mechanism may be defective. Release lever mechanism is not serviced separately. If repair is necessary, the steering column must be replaced,(Refer to 19 - STEERING/COLUMN - REMOVAL).

(5) Connect negative cable to battery.

(6) Check electrical operation of switch.

STEERING WHEEL

REMOVAL

For steering wheel removal procedure,(Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

INSTALLATION

For steering wheel installation procedure,(Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

GEAR

TABLE OF CONTENTS

GEAR

DESCRIPTION

The power steering gear is a recirculating ball type gear (Fig. 1) .

The following gear components can be serviced:
- Pitman Shaft and Cover
- Pitman Shaft Bearings
- Pitman Shaft Oil Seal/Dust Seal
- Stud Shaft Housing with Seal
- O-Rings and Teflon Rings

NOTE: If rack piston assembly is damaged the gear must be replaced.

OPERATION

The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the lower end and a bearing assembly at the upper end. When the worm shaft is turned the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.

REMOVAL

(1) Place the front wheels in the straight ahead position with the steering wheel centered and locked.

(2) Remove the air cleaner housing,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(3) Drain or siphon the power steering system.

(4) Remove the pressure and return lines (Fig. 2)from the steering gear. Refer to hose removal in this section.

(5) Remove the column coupler shaft bolt (Fig. 2)and remove the shaft from the gear.

(6) Raise and support the vehicle.

(7) Remove the left front wheel and tire assembly.

(8) Remove the pitman arm from gear with Puller C-4150A.

(9) Remove the windshield washer reservoir,(Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WASHER RESERVOIR - REMOVAL).

(10) Remove the steering gear mounting bolts. Remove the steering gear out of the engine compartment (Fig. 3).

INSTALLATION

(1) Position the steering gear on the frame rail and install the bolts. Tighten the bolts to 108 N·m (80 ft. lbs.) torque.

(2) Install the pitman arm and tighten nut to 251 N·m (185 ft. lbs.).

(3) Install windshield washer reservoir,(Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WASHER RESERVOIR - INSTALLATION).

(4) Install the wheel and tire assembly.

(5) Remove the support and lower the vehicle.

(6) Install the pressure and return hoses to the steering gear and tighten to 20-38 N·m (14-28 ft. lbs.).

(7) Install the column coupler shaft.

(8) Install the air cleaner housing,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

GEAR (Continued)

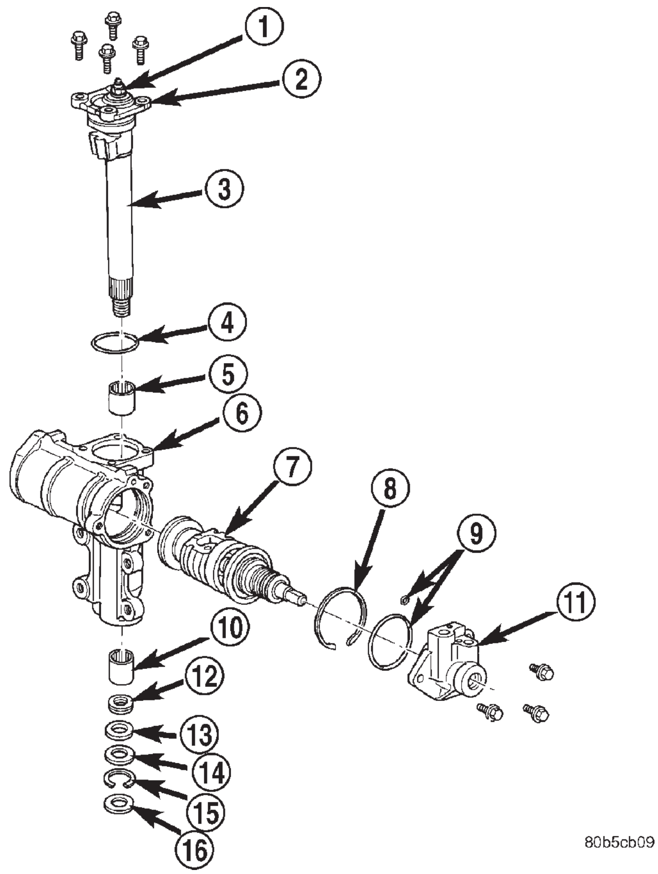


Fig. 1 Recirculating Ball Type Gear

1 - ADJUSTER NUT
2 - COVER
3 - PITMAN SHAFT
4 - O-RING
5 - BEARING
6 - GEAR HOUSING
7 - RACK PISTON
8 - RETAINING RING
9 - O-RING
10 - BEARING
11 - STUB SHAFT HOUSING
12 - PITMAN SHAFT SEAL
13 - PLASTIC BACKUP WASHER
14 - METAL BACKUP WASHER
15 - RETAINING RING
16 - DUST SEAL

(9) Fill the power steering pump (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

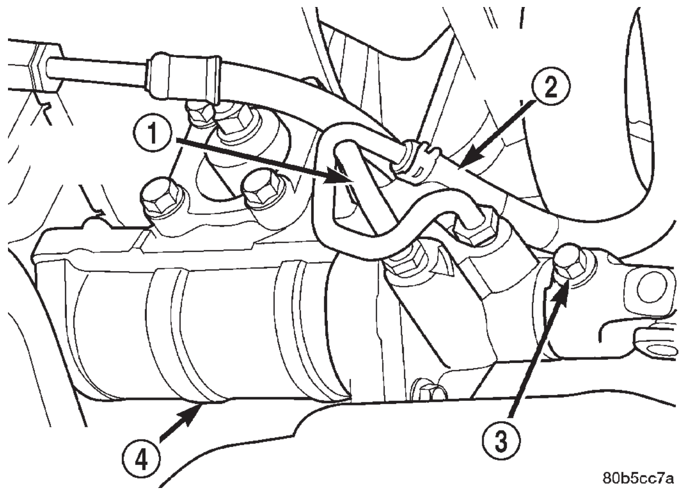


Fig. 2 Pressure And Return Lines

1 - PRESSURE LINE
2 - RETURN LINE
3 - COUPLER BOLT
4 - STEERING GEAR

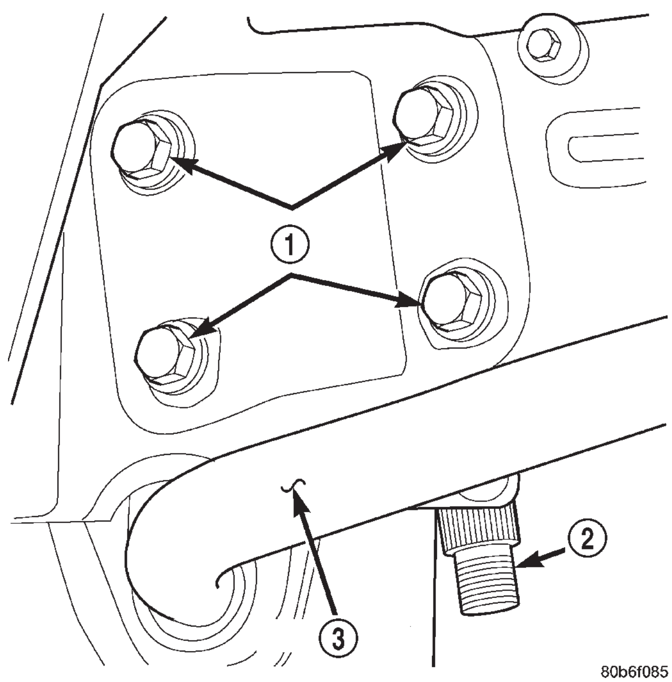


Fig. 3 Steering Gear Mounting

1 - MOUNTING BOLTS
2 - PITMAN SHAFT
3 - STABILIZER BAR

GEAR (Continued)

ADJUSTMENTS

STEERING GEAR

NOTE: Adjusting the steering gear in the vehicle is not recommended. Remove gear from the vehicle and drain the fluid. Then mount gear in a vise to perform adjustments.

OVER-CENTER

(1) Rotate the stub shaft with Socket 8343 from stop to stop and count the number of turns.

(2) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

(3) Place torque wrench and Socket 8343 in a vertical position on the stub shaft. Rotate the wrench 45 degrees each side of the center and record the highest rotational torque in this range (Fig. 4) . This is the Over-Center Rotating Torque.

NOTE: The stub shaft must rotate smoothly without sticking or binding.

(4) Rotate the stub shaft between 90° and 180° to the left of center and record the left off-center preload. Repeat this to the right of center and record the right off-center preload. The average of these two recorded readings is the Preload Rotating Torque.

(5) The Over-Center Rotating Torque should be 0.45-0.80 N·m (4-7 in. lbs.) **higher** than the Preload Rotating Torque.

(6) If an adjustment to the Over-Center Rotating Torque is necessary, first loosen the adjuster lock nut. Then turn the pitman shaft adjuster screw back (COUNTERCLOCKWISE) until fully extended, then turn back in (CLOCKWISE) one full turn.

(7) Remeasure Over-Center Rotating Torque. If necessary turn the adjuster screw and repeat measurement until correct Over-Center Rotating Torque is reached.

NOTE: To increase the Over-Center Rotating Torque turn the screw CLOCKWISE.

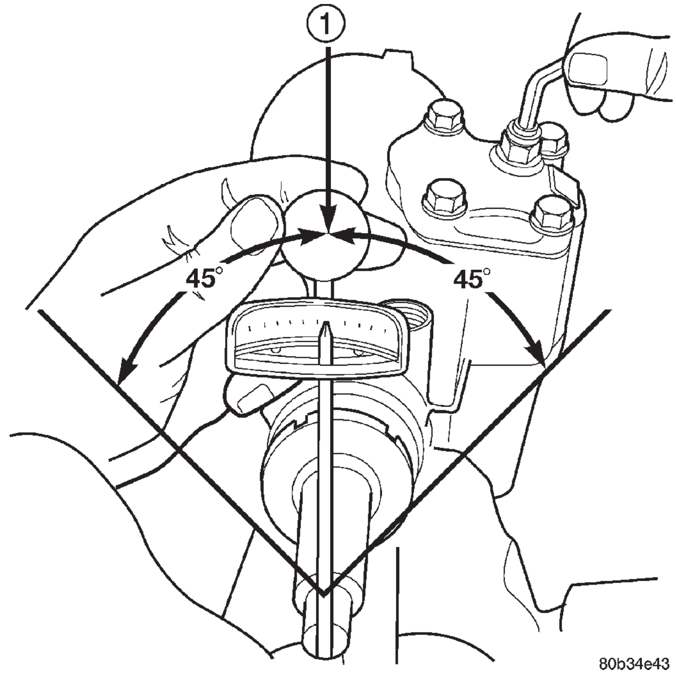


Fig. 4 Checking Over-center Rotation Torque

1 - CENTER

(8) Prevent the adjuster screw from turning while tightening adjuster lock nut. Tighten the adjuster lock nut to 37-52 N·m (27-38 ft. lbs.).

SPECIFICATIONS

POWER STEERING GEAR

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Steering Gear Type	Recirculating Ball
Steering Gear Overall Ratio	12.7:1

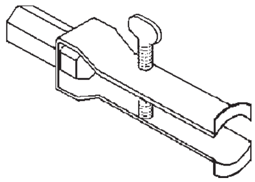
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pitman Shaft Overcenter Drag New Gear (under 400 miles)	0.45-0.80 + Worm Shaft Preload	—	4-7 + Worm Shaft Preload
Pitman Shaft Overcenter Drag Used Gear (over 400 miles)	0.5-0.6 + Worm Shaft Preload	—	4-5 + Worm Shaft Preload

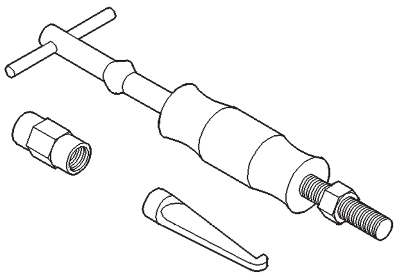
GEAR (Continued)

SPECIAL TOOLS

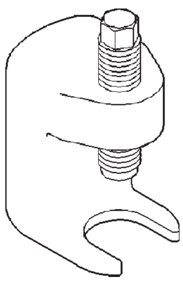
POWER STEERING GEAR



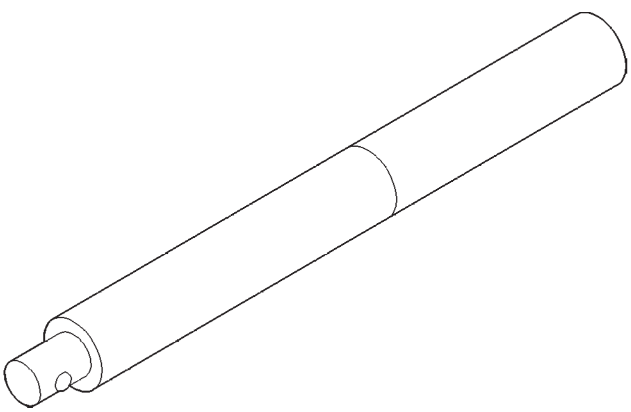
Puller Seal 7794-A



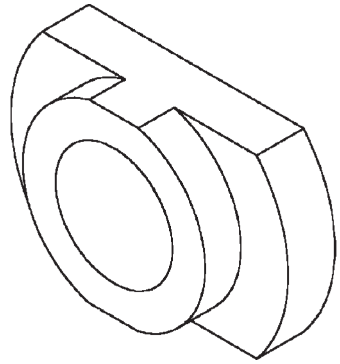
Slide Hammer C-637



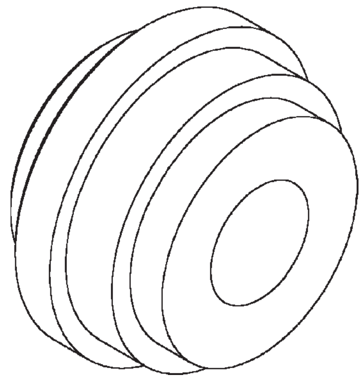
Remover, Pitman Arm C-4150A



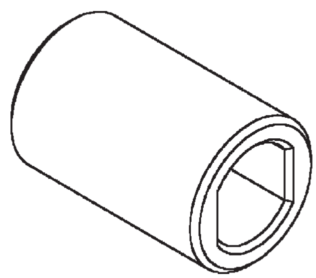
Handle C-4171



Driver 8277



Driver 8294



Scoket 8343

PITMAN SHAFT

REMOVAL

(1) Clean exposed end of pitman shaft and housing with a wire brush.

(2) Rotate the stub shaft with a wrench (Fig. 5)from stop to stop and count the number of turns.

(3) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

NOTE: The pitman shaft will not clear the housing if it is not centered.

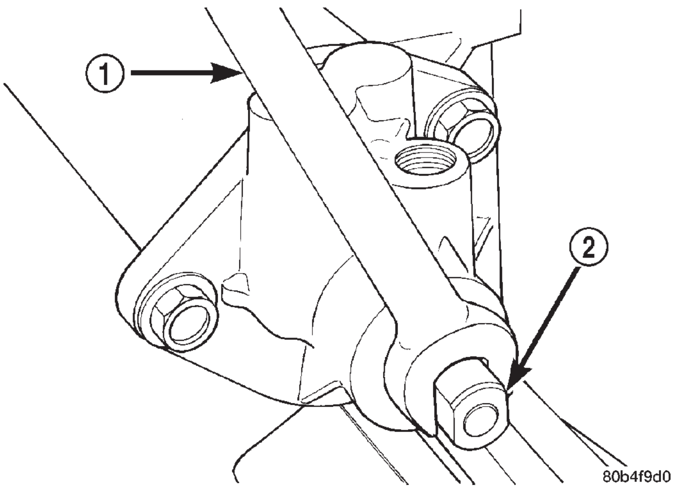


Fig. 5 Center Stub

1 - WRENCH
2 - STUB SHAFT

(4) Remove pitman shaft cover bolts and remove the shaft assembly (Fig. 6).

(5) Remove pitman shaft cover o-ring.

(6) Remove pitman shaft dust seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 7).

(7) Remove the pitman shaft oil seal retaining ring with snap ring pliers (Fig. 8).

(8) Remove oil seal metal backup washer then plastic backup washer from the housing.

(9) Remove pitman shaft oil seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 7).

(10) Drop Driver 8277 through the top bearing and align the driver up with the lower bearing. (Fig. 9). Install Handle C-4171 into the driver and remove the lower bearing.

(11) Turn the gear over and remover the upper bearing with Driver 8277 and Handle C-4171.

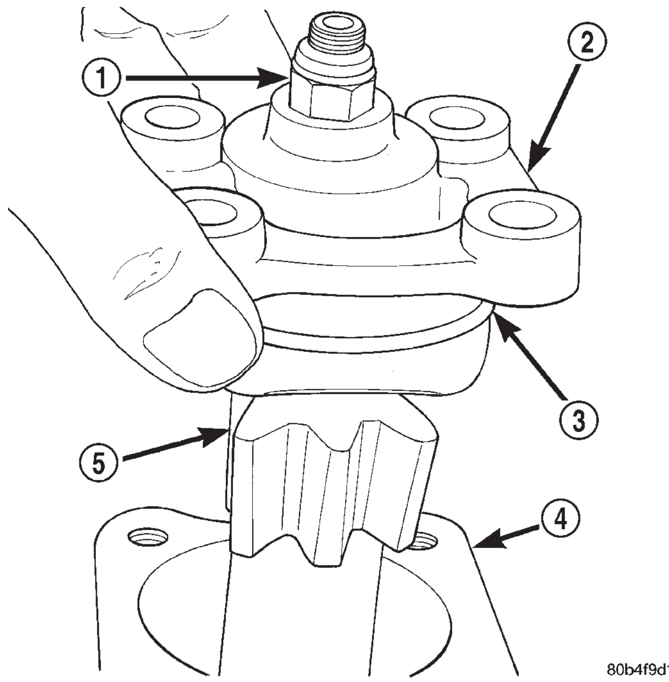


Fig. 6 Cover and Pitman Shaft

1 - ADJUSTER NUT
2 - PITMAN SHAFT COVER
3 - O-RING
4 - GEAR HOUSING
5 - PITMAN SHAFT

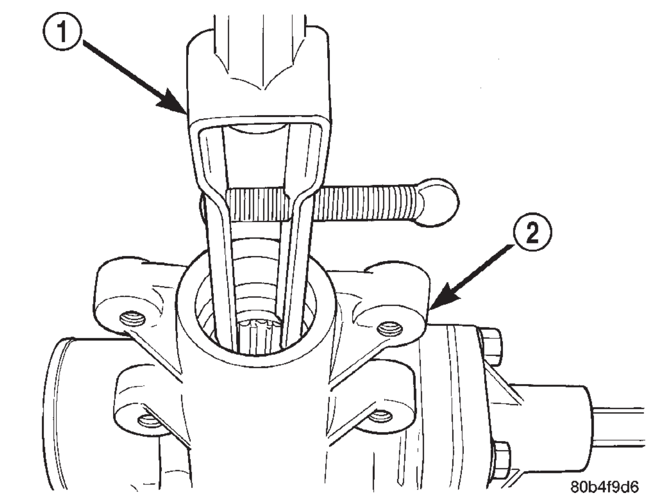


Fig. 7 Oil Seal Removal

1 - PULLER
2 - STEERING GEAR

INSTALLATION

(1) Install upper pitman shaft bearing, with Driver 8294 and Handle C-4171 (Fig. 10). Drive bearing into housing until the driver bottoms out.

NOTE: Install upper pitman shaft bearing with the part number/letters facing the driver.

PITMAN SHAFT (Continued)

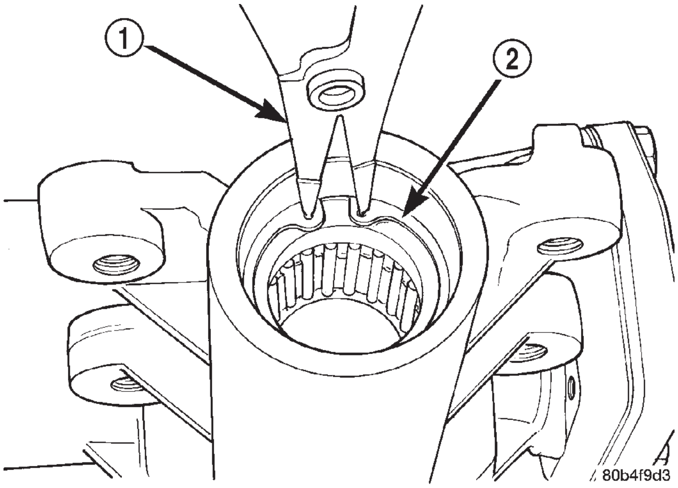


Fig. 8 Oil Seal Retaining Ring

1 - SNAP RING PLIERS
2 - RETAINING RING

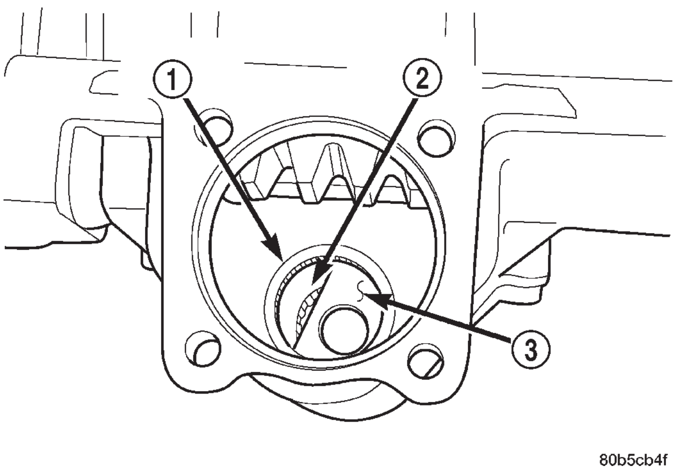


Fig. 9 Bearing Driver

1 - UPPER BEARING
2 - LOWER BEARING
3 - DRIVER

(2) Install lower pitman shaft bearing with the other side Driver 8294 and Handle C-4171 (Fig. 11). Drive bearing into housing until the bearing shoulder is seated against the housing.

(3) Coat the oil seal and backup washers with **special grease**supplied with the new seal.

(4) Install the oil seal with Driver 8294 and Handle C-4171.

(5) Install plastic backup washer.

NOTE: The plastic backup washer has a lip on the inside diameter that faces down towards the oil seal.

(6) Install metal backup washer.

(7) Install the retainer ring with snap ring pliers.

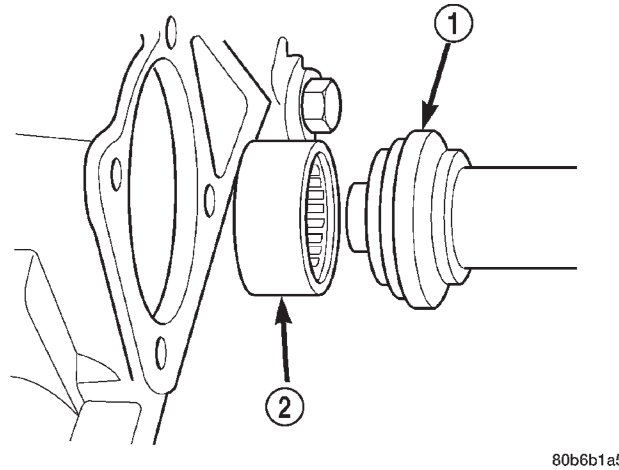


Fig. 10 Upper Pitman Shaft Bearing

1 - DRIVER
2 - UPPER BEARING

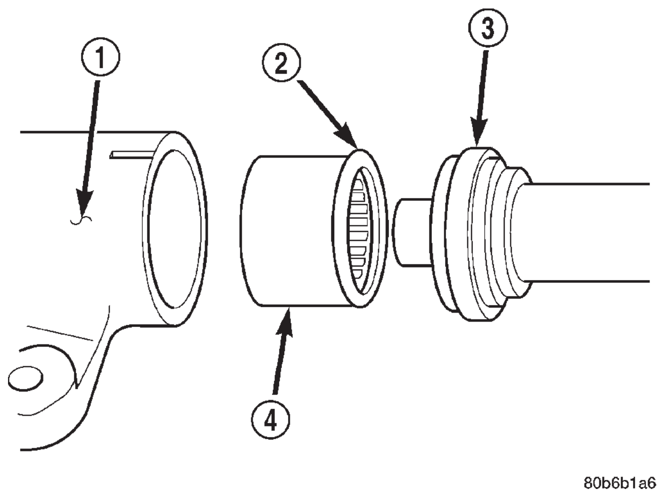


Fig. 11 Lower Pitman Shaft Bearing

1 - STEERING GEAR
2 - BEARING SHOULDER
3 - DRIVER
4 - LOWER BEARING

(8) Coat the dust seal with **special grease** supplied with the new seal.

(9) Install dust seal with Driver 8294 and Handle C-4171.

(10) Install new pitman shaft cover o-ring.

(11) Install pitman shaft assembly into the housing.

(12) Install cover bolts and tighten to 62 N·m (46 ft. lbs.).

(13) Perform over-center rotation torque adjustment.

PITMAN SHAFT BEARING

REMOVAL

(1) Clean exposed end of pitman shaft and housing with a wire brush.

(2) Rotate the stub shaft with a wrench (Fig. 5)from stop to stop and count the number of turns.

(3) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

NOTE: The pitman shaft will not clear the housing if it is not centered.

(4) Remove pitman shaft cover bolts and remove the shaft assembly (Fig. 6).

(5) Remove pitman shaft cover o-ring.

(6) Remove pitman shaft dust seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 7).

(7) Remove the pitman shaft oil seal retaining ring with snap ring pliers (Fig. 8).

(8) Remove oil seal metal backup washer then plastic backup washer from the housing (Fig. 12).

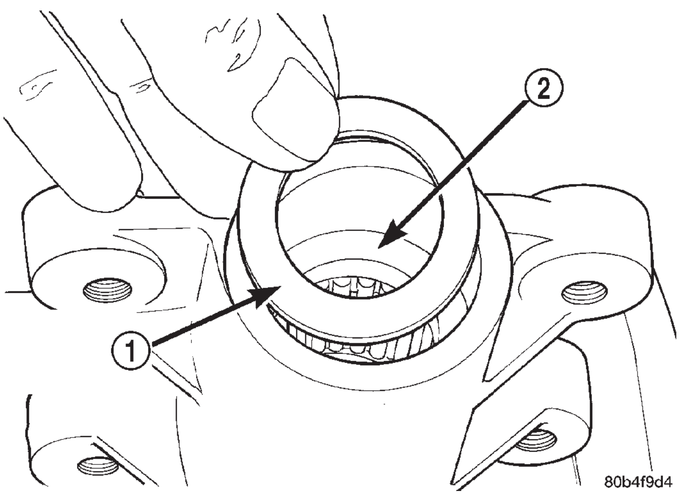


Fig. 12 Backup Washers

1 - METAL BACK UP WASHER
2 - PLASTIC BACK UP WASHER

(9) Remove pitman shaft oil seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 7).

(10) Drop Driver 8277 through the top bearing and align the driver up with the lower bearing. (Fig. 9). Install Handle C-4171 into the driver and remove the lower bearing.

(11) Turn the gear over and remover the upper bearing with Driver 8277 and Handle C-4171.

INSTALLATION

(1) Install upper pitman shaft bearing, with Driver 8294 and Handle C-4171 (Fig. 10). Drive bearing into housing until the driver bottoms out.

NOTE: Install upper pitman shaft bearing with the part number/letters facing the driver.

(2) Install lower pitman shaft bearing with the other side Driver 8294 and Handle C-4171 (Fig. 11). Drive bearing into housing until the bearing shoulder is seated against the housing.

(3) Coat the oil seal and backup washers with **special grease**supplied with the new seal.

(4) Install the oil seal with Driver 8294 and Handle C-4171.

(5) Install plastic backup washer.

NOTE: The plastic backup washer has a lip on the inside diameter that faces down towards the oil seal.

(6) Install metal backup washer.

(7) Install the retainer ring with snap ring pliers.

(8) Coat the dust seal with **special grease** supplied with the new seal.

(9) Install dust seal with Driver 8294 and Handle C-4171.

(10) Install new pitman shaft cover o-ring.

(11) Install pitman shaft assembly into the housing.

(12) Install cover bolts and tighten to 62 N·m (46 ft. lbs.).

(13) Perform over-center rotation torque adjustment.

PITMAN SHAFT SEAL

REMOVAL

(1) Clean exposed end of pitman shaft and housing with a wire brush.

(2) Rotate the stub shaft with a wrench (Fig. 5)from stop to stop and count the number of turns.

(3) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

NOTE: The pitman shaft will not clear the housing if it is not centered.

(4) Remove pitman shaft cover bolts and remove the shaft assembly (Fig. 6).

(5) Remove pitman shaft cover o-ring.

(6) Remove pitman shaft dust seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 7).

(7) Remove the pitman shaft oil seal retaining ring with snap ring pliers (Fig. 8).

(8) Remove oil seal metal backup washer then plastic backup washer from the housing (Fig. 12).

PITMAN SHAFT SEAL (Continued)

(9) Remove pitman shaft oil seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 7).

(10) Drop Driver 8277 through the top bearing and align the driver up with the lower bearing. (Fig. 9). Install Handle C-4171 into the driver and remove the lower bearing.

(11) Turn the gear over and remover the upper bearing with Driver 8277 and Handle C-4171.

INSTALLATION

(1) Install upper pitman shaft bearing, with Driver 8294 and Handle C-4171 (Fig. 10). Drive bearing into housing until the driver bottoms out.

NOTE: Install upper pitman shaft bearing with the part number/letters facing the driver.

(2) Install lower pitman shaft bearing with the other side Driver 8294 and Handle C-4171 (Fig. 11). Drive bearing into housing until the bearing shoulder is seated against the housing.

(3) Coat the oil seal and backup washers with **special grease**supplied with the new seal.

(4) Install the oil seal with Driver 8294 and Handle C-4171.

(5) Install plastic backup washer.

NOTE: The plastic backup washer has a lip on the inside diameter that faces down towards the oil seal.

(6) Install metal backup washer.

(7) Install the retainer ring with snap ring pliers.

(8) Coat the dust seal with **special grease** supplied with the new seal.

(9) Install dust seal with Driver 8294 and Handle C-4171.

(10) Install new pitman shaft cover o-ring.

(11) Install pitman shaft assembly into the housing.

(12) Install cover bolts and tighten to 62 N·m (46 ft. lbs.).

(13) Perform over-center rotation torque adjustment.

RACK PISTON/VALVE ASSEMBLY

REMOVAL

(1) Remove the steering gear (Refer to 19 - STEERING/GEAR - REMOVAL).

(2) Clean exposed end of pitman shaft and housing with a wire brush.

(3) Rotate the stub shaft with a wrench (Fig. 5)from stop to stop and count the number of turns.

(4) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

NOTE: The pitman shaft will not clear the housing if it is not centered.

(5) Remove pitman shaft cover bolts and remove the shaft assembly (Fig. 6).

(6) Remove the pitman shaft cover o-ring.

(7) Remove stub shaft housing bolts (Fig. 13).

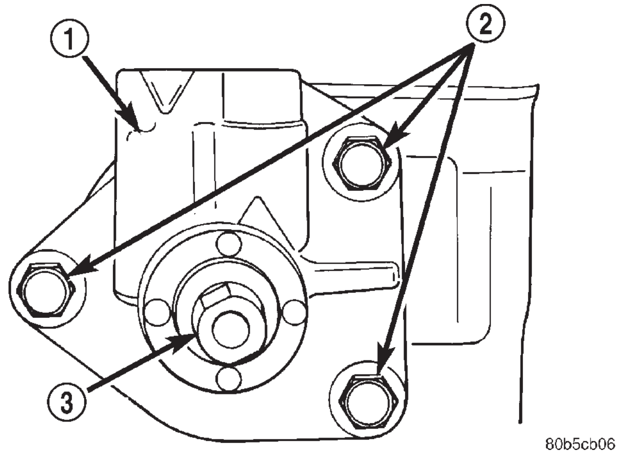


Fig. 13 Stub Shaft Housing

1 - STUB SHAFT HOUSING
2 - BOLTS
3 - STUB SHAFT

(8) Remove the housing from the stub shaft (Fig. 14).

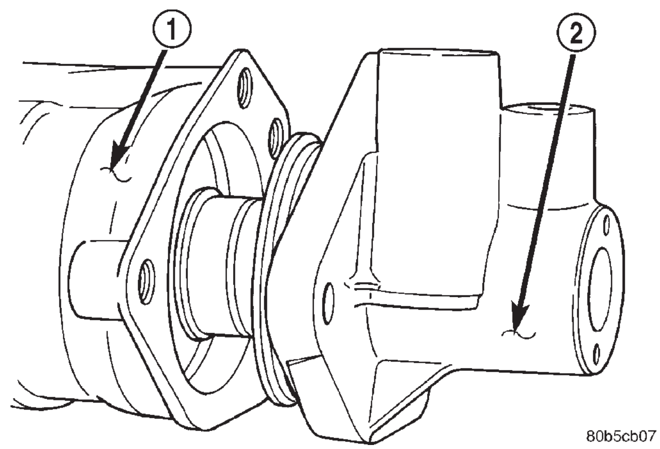


Fig. 14 Housing Removal

1 - STEERING GEAR
2 - STUB SHAFT HOUSING

RACK PISTON/VALVE ASSEMBLY (Continued)

(9) Remove stub shaft housing o-rings (Fig. 15).

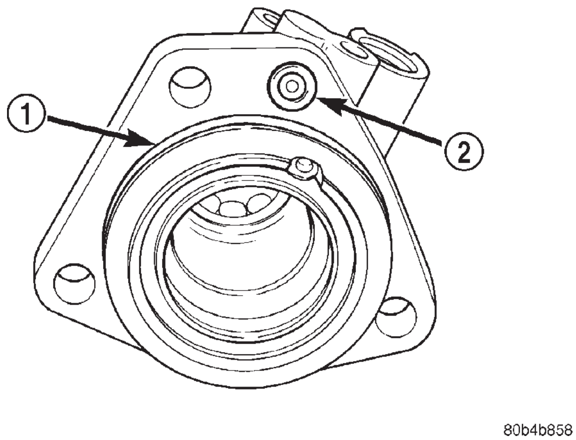


Fig. 15 O-Rings

1 - LARGE O-RING
2 - SMALL O-RING

(10) Remove the rack piston/valve assembly retaining ring with snap ring pliers (Fig. 16).

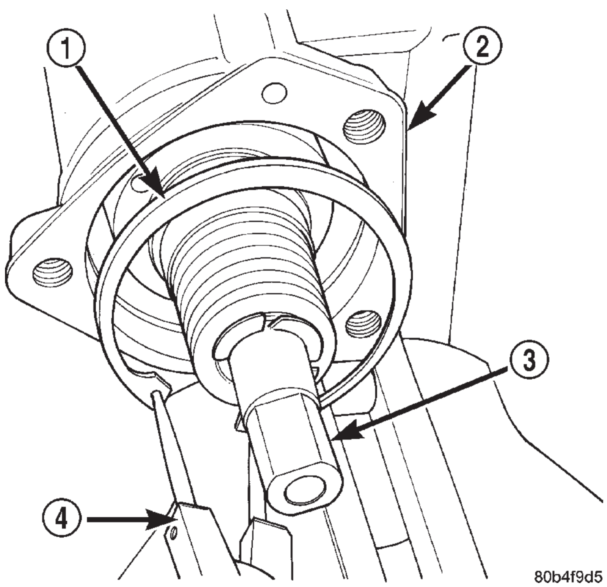


Fig. 16 Retaining Ring

1 - SNAP RING
2 - STUB SHAFT HOUSING
3 - STUB SHAFT
4 - SNAP RING PLIERS

(11) Pull the rack piston/valve assembly out of the gear housing (Fig. 17).

NOTE: If the rack piston is damage the gear assembly must be replaced.

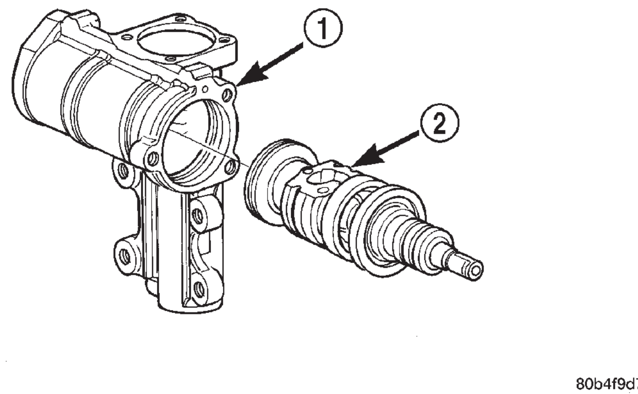


Fig. 17 Rack Piston/Valve Assembly

1 - STEERING GEAR
2 - RACK PISTON/VALVE ASSEMBLY

(12) Remove teflon rings and o-ring (Fig. 18) from the rack piston/valve assembly.

CAUTION: The rack piston teflon ring and o-ring must be replaced whenever the assembly is removed from the housing.

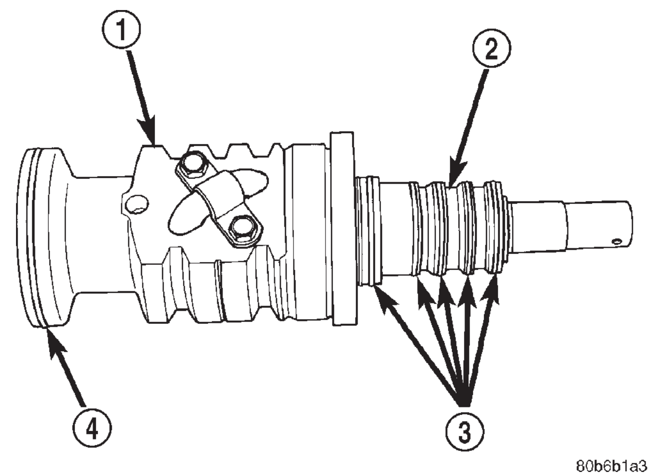


Fig. 18 Teflon Rings And O-Ring

1 - RACK PISTON
2 - VALVE
3 - TEFLON RINGS
4 - TEFLON AND O-RING

RACK PISTON/VALVE ASSEMBLY (Continued)

INSTALLATION

(1) Lubricate new o-ring and teflon rings with power steering fluid and install on the rack piston/valve assembly.
(2) Lubricate the rack piston/valve assembly with power steering fluid.
(3) Slide the assembly into the gear housing.
(4) Install new stub shaft housing o-rings and install the housing. Tighten the housing bolts to 62 N·m (46 ft. lbs.).
(5) Install new o-ring on the pitman shaft cover.
(6) Install the pitman shaft into the gear housing.
(7) Install the pitman shaft cover bolts and tighten to 62 N·m (46 ft. lbs.).
(8) Perform over-center rotation torque adjustment (Refer to 19 - STEERING/GEAR - ADJUSTMENTS)..
(9) Install the steering gear (Refer to 19 - STEERING/GEAR - INSTALLATION).
(10) Fill the power steering pump (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

STUB SHAFT HOUSING

REMOVAL

NOTE: If stub shaft housing, seal or bearing is damaged the housing must be replaced.

(1) Remove the steering gear (Refer to 19 - STEERING/GEAR - REMOVAL).
(2) Remove stub shaft housing bolts (Fig. 19).
(3) Remove housing from the steering gear (Fig. 20).
(4) Remove stub shaft housing o-rings (Fig. 15).

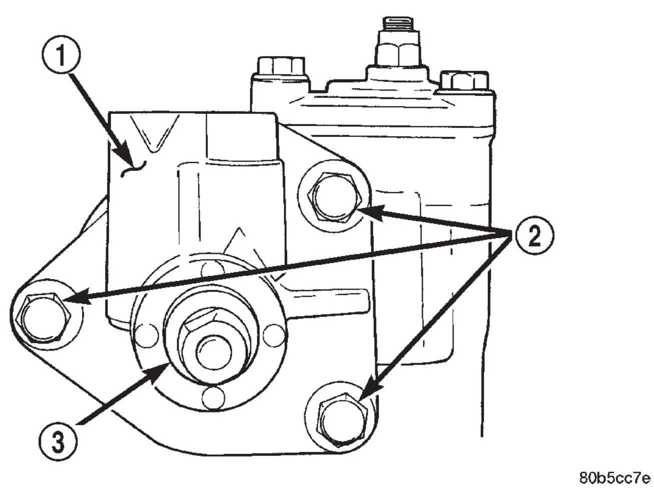


Fig. 19 Stub Shaft Housing

1 - STUB SHAFT HOUSING
2 - BOLTS
3 - STUB SHAFT

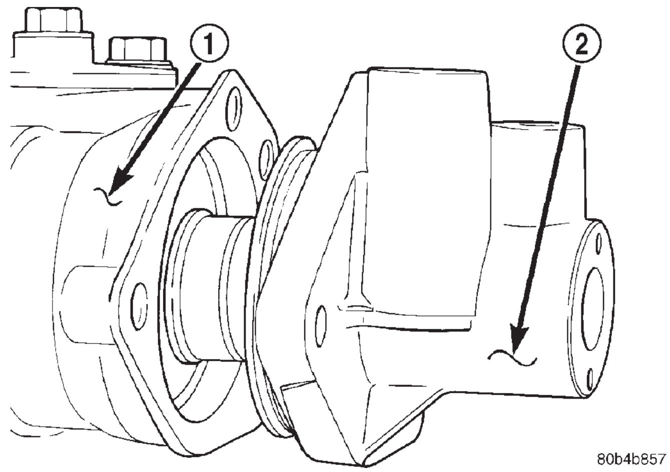


Fig. 20 Housing Removal

1 - STEERING GEAR
2 - HOUSING

INSTALLATION

NOTE: If stub shaft housing, seal or bearing is damaged the housing must be replaced.

(1) Grease stub shaft seal with **special grease**-supplied with new stub shaft housing.
(2) Install new stub shaft housing o-rings.
(3) Install housing on the steering gear.
(4) Install the housing bolts and tighten to 62 N·m (46 ft. lbs.).
(5) Install the steering gear (Refer to 19 - STEERING/GEAR - INSTALLATION).
(6) Fill the power steering pump (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

LINKAGE

TABLE OF CONTENTS

LINKAGE

DESCRIPTION

STEERING LINKAGE – RIGHT HAND DRIVE (RHD) VEHICLES

Vehicles equipped with right hand drive (RHD) steering utilize the same components of left hand drive vehicles. The RHD Steering linkage is designed as a mirror image of left hand drive linkage with the exception of the steering damper (Fig. 1), which is mounted on the same side of the vehicle weather RHD or LHD. See figure below for reference. All specifications are the same as LHD. Refer to Group 19, Steering of the gasoline engine service manual for additional information.

DESCRIPTION

The steering linkage consists of a pitman arm, drag link, tie rod, and steering dampener (Fig. 2) . An adjustment sleeve on the tie rod is used to set wheel toe position. The sleeve on the drag link is used for steering wheel centering.

CAUTION: If any steering components are replaced or serviced an alignment must be performed, to ensure the vehicle meets all alignment specifications.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

LINKAGE (Continued)

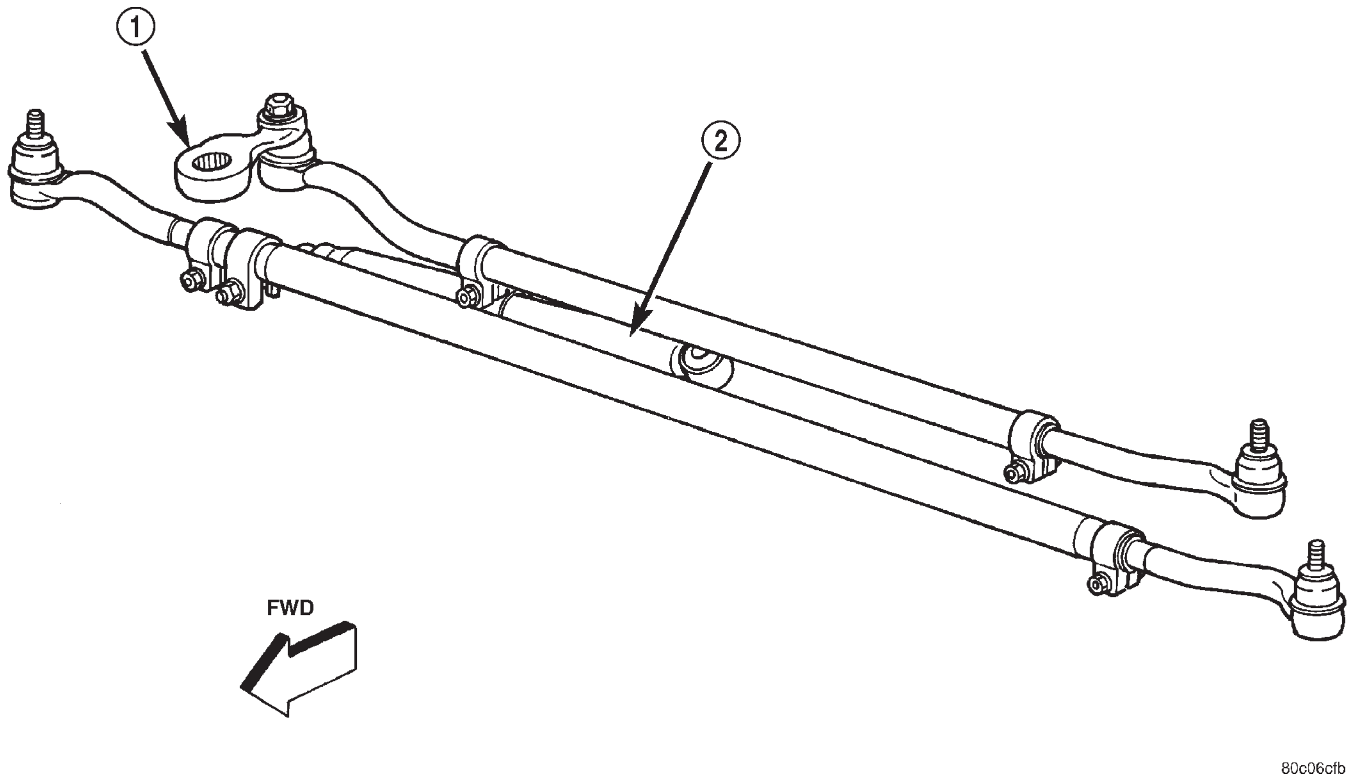


Fig. 1 Right Hand Drive Steering Linkage

1 - PITMAN ARM
2 - STEERING DAMPENER

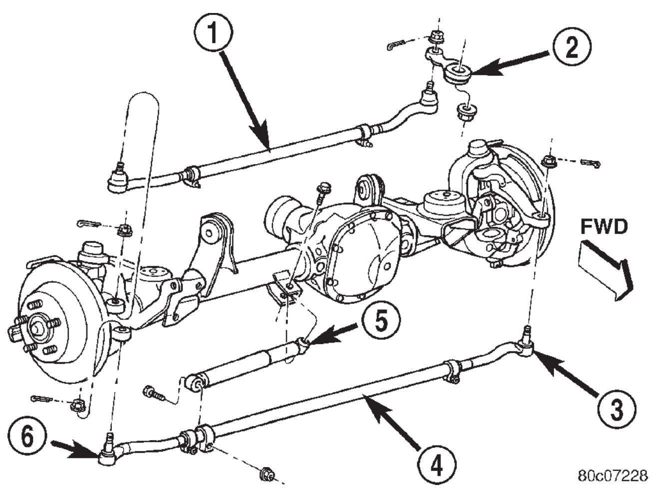


Fig. 2 Steering Linkage

1 - DRAG LINK
2 - PITMAN ARM
3 - TIE ROD END
4 - TIE ROD
5 - DAMPER
6 - TIE ROD END

LINKAGE (Continued)

SPECIFICATIONS

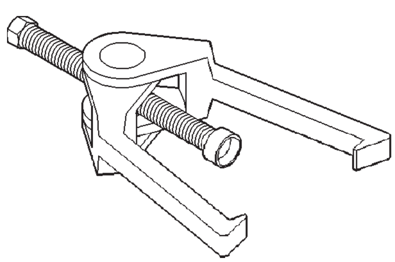
TORQUE CHART

TORQUE SPECIFICATIONS

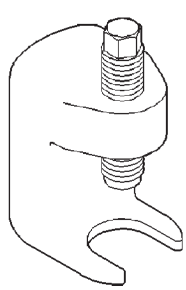
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pitman Arm Shaft Nut	251	185	—
Drag Link Pitman Arm Nut	88	65	—
Drag Link Knuckle Nut	47	35	—
Drag Link Clamp Nuts	41	30	—
Tie Rod Knuckle Nut	47	35	—
Tie Rod Clamp Nuts	41	30	—
Steering Damper Axle Bolt	88	65	—
Steering Damper Tie Rod Nut	41	30	—

SPECIAL TOOLS

STEERING LINKAGE



Puller C-3894–A



Remover Pitman C-4150A

DAMPER

DESCRIPTION

The damper is mounted to the axle housing and the tie rod end. The damper consists of steel tube shock absorber with a permanent bushed end.

OPERATION

The steering damper provides steering system damping.

REMOVAL

(1) Remove the nut from the ball stud at the tie rod.

(2) Remove the steering damper from the tie rod.

(3) Remove the steering damper nut and bolt from the axle bracket (Fig. 3) .

DAMPER (Continued)

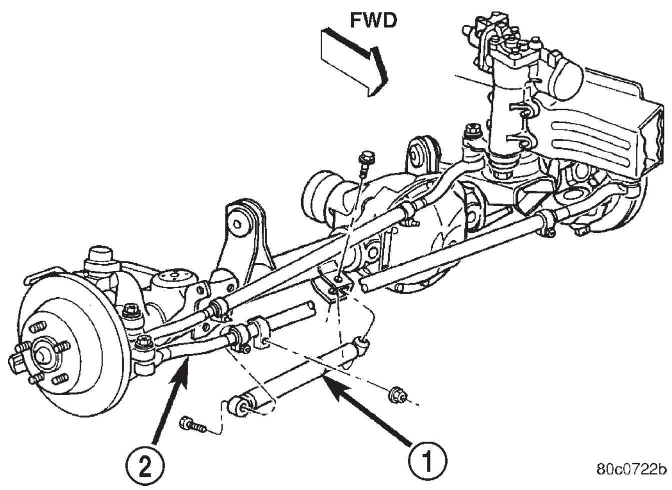


Fig. 3 Steering Damper

1 - DAMPER
2 - TIE ROD

INSTALLATION

(1) Install the steering damper to the axle bracket and tie rod.

(2) Install the steering damper bolt in the axle bracket and tighten bolt to 88 N·m (65 ft. lbs.).

(3) Install the nut at the tie rod and tighten to 41 N·m (30 ft. lbs.).

DRAG LINK

DESCRIPTION

The drag link and ends are comprised of two forged ends connected by a steel adjusting tube. The drag link connects the steering gear pitman arm to the steering knuckle. The larger offset end is attached to the pitman arm.

OPERATION

The sleeve is used for steering wheel centering.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove right wheel and tire assembly.

(3) Remove the cotter pins and nuts at the right steering knuckle and pitman arm (Fig. 4) .

(4) Remove the drag link from the steering knuckle and pitman arm Puller C-3894-A.

(5) Loosen adjustment sleeve clamp bolts and unscrew the tie rod ends from the adjustment sleeve.

INSTALLATION

(1) Screw the tie rod ends into the adjustment sleeve.

(2) Install the drag link onto the right steering knuckle and pitman arm.

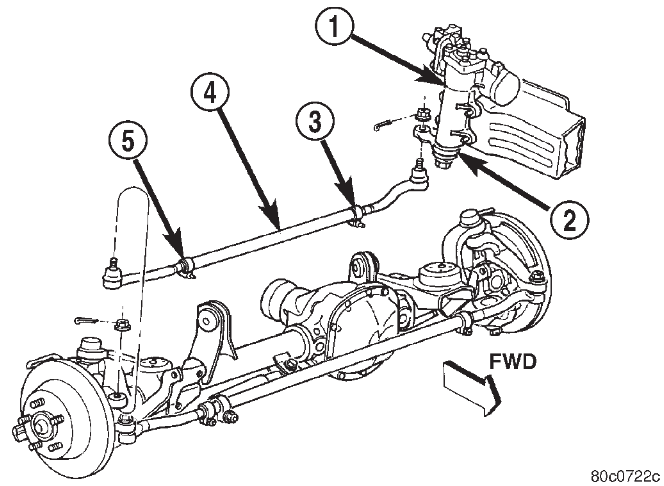


Fig. 4 Drag Link

1 - STEERING GEAR
2 - PITMAN ARM
3 - CLAMP
4 - DRAG LINK
5 - CLAMP

(3) Tighten the nut at the steering knuckle to 47 N·m (35 ft. lbs.). Tighten the pitman nut to 88 N·m (65 ft. lbs.). Install new cotter pins.

(4) Position clamp bolts to their original position and tighten to 41 N·m (30 ft. lbs.).

(5) Install right wheel and tire assembly.

(6) Remove support and lower the vehicle.

(7) Center the steering wheel.

PITMAN ARM

DESCRIPTION

The pitman arm is attached at one end of the steering gear's sector shaft. The other end is connected to the drag link.

OPERATION

The pitman arm transfers rotary motion into side to side motion.

REMOVAL

(1) Remove the cotter pin and nut from the drag link at the pitman arm (Fig. 5) .

(2) Remove the drag link ball stud from the pitman arm with a puller.

(3) Remove the nut and washer from the steering gear shaft. Mark the pitman shaft and pitman arm for installation reference. Remove the pitman arm from steering gear with Puller C-4150A.

PITMAN ARM (Continued)

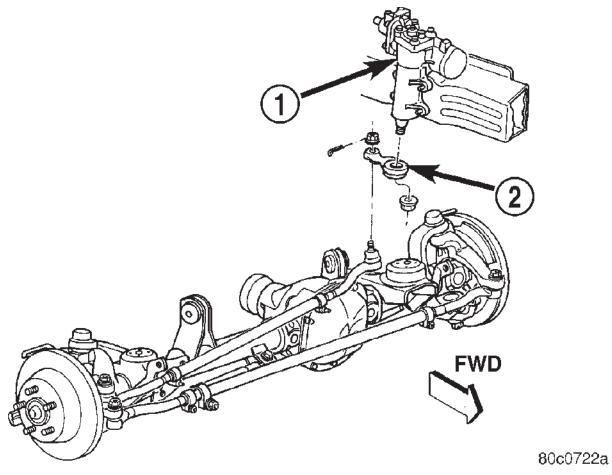


Fig. 5 Pitman Arm

1 - STEERING GEAR
2 - PITMAN ARM

INSTALLATION

(1) Align and install the pitman arm on steering gear shaft.

(2) Install the washer and nut on the shaft and tighten the nut to 251 N·m (185 ft. lbs.).

(3) Install drag link ball stud to pitman arm. Install nut and tighten to 88 N·m (65 ft. lbs.). Install a new cotter pin.

TIE ROD END

DESCRIPTION

The ends are forged, with a lubed for life ball socket.

OPERATION

The tie rod ends connect the drag link to the wheel assembly. The tie rod provides toe alignment and transfers steering input from the drag link to the wheels.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove the damper nut from the tie rod clamp (Fig. 6).

(4) Remove the damper from the tie rod.

(5) Remove the cotter pins and nuts from the tie rod ends at the steering knuckles (Fig. 6).

(6) Remove the tie rod ends from the steering knuckles with Puller C-3894-A..

(7) Loosen the adjustment sleeve clamp bolts and unscrew the tie rod ends from the sleeve.

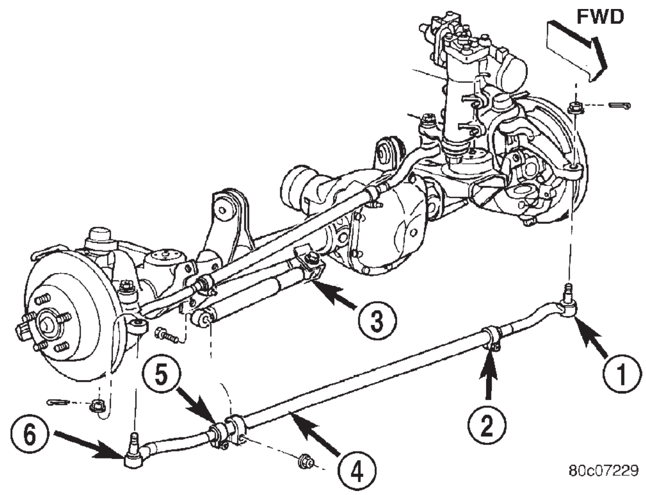


Fig. 6 Tie Rod Assembly

1 - TIE ROD END
2 - CLAMP
3 - DAMPER
4 - TIE ROD
5 - CLAMP
6 - TIE ROD END

INSTALLATION

(1) Screw the tie rod ends into the adjustment sleeve.

(2) Install the tie rod on the steering knuckles and install the nuts.

(3) Tighten the nuts to 47 N·m (35 ft. lbs.). Install new cotter pins and bend end 60°.

(4) Position the adjustment sleeve clamp bolts to their original location and tighten to 41 N·m (30 ft. lbs.).

(5) Install the damper on the tie rod and install the nut.

(6) Tighten the nut to 41 N·m (30 ft. lbs.). Install new cotter pins and bend end 60°.

(7) Install wheel and tire assemblies.

(8) Remove support and lower the vehicle.

(9) Perform toe position adjustment.

PUMP

TABLE OF CONTENTS

PUMP

DESCRIPTION - 4.0L, 4.7L

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump (Fig. 1) and (Fig. 2). The pump shaft has a pressed-on drive pulley that is belt driven by the crankshaft pulley.

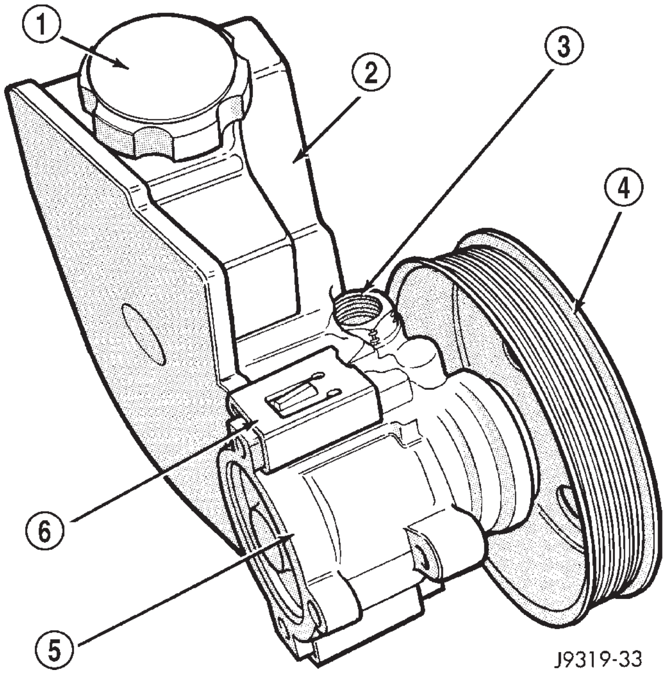


Fig. 1 Pump With Integral Reservoir

1 - CAP
2 - FLUID RESERVOIR (TYPICAL)
3 - HIGH-PRESSURE FITTING
4 - DRIVE PULLEY
5 - PUMP BODY
6 - RESERVOIR CLIP

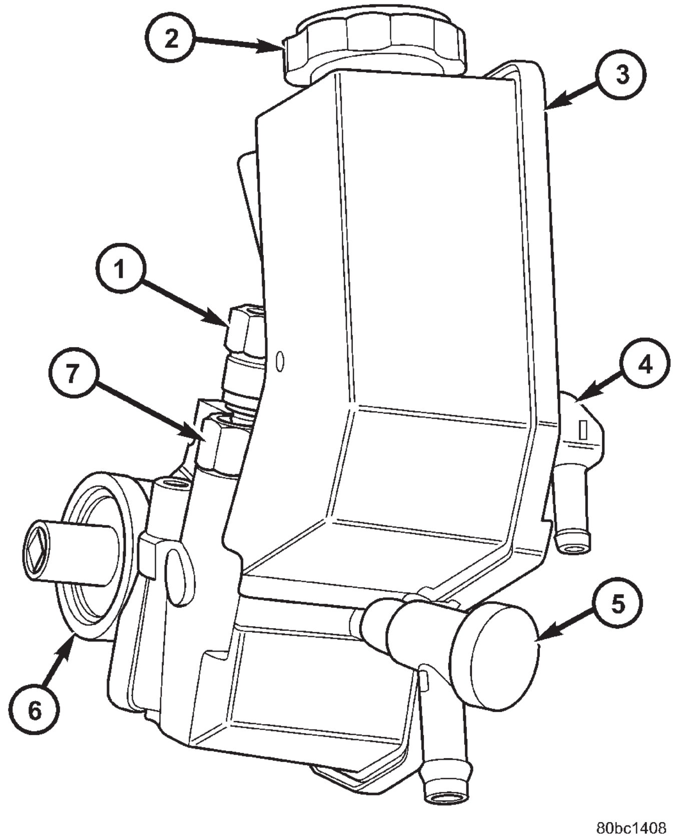


Fig. 2 4.7L POWER STEERING PUMP

1 - PRESSURE HOSE QUICK CONNECT NUT
2 - CAP
3 - FLUID RESERVOIR
4 - LOW-PRESSURE RETURN FROM THE COOLER
5 - LOW-PRESSURE RETURN FROM THE HYDRAULIC FAN DRIVE
6 - PUMP BODY
7 - HIGH PRESSURE FITTING

NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.

OPERATION

OPERATION - 4.7L

The power steering pump is a constant flow rate and displacement, vane-type pump. The pump has internal parts that operate submerged in fluid. The flow control orifice and the pressure relief valve, which limits the pump pressure, are internal to the pump. The reservoir is attached to the pump body with spring clips. The power steering pump is used to drive the hydraulic engine cooling fan, which separates the flow to the fan gerotors and the power steering gear. The power steering pump is connected to the engine cooling fan by pressure and return hoses and the pump is connected to the steering gear via a return hose from the steering cooler (Fig. 2).

OPERATION - 4.0L

The power steering pump is a constant flow rate and displacement, vane-type pump. The pump internal parts operate submerged in fluid. The flow control orifice is part of the high pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure. The reservoir is attached to the pump body with spring clips. The power steering pump is connected to the steering gear by the pressure and return hoses (Fig. 1).

NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.

PUMP (Continued)

DIAGNOSIS AND TESTING - PUMP LEAKAGE

(1) Possible areas of pump leakage (Fig. 3).

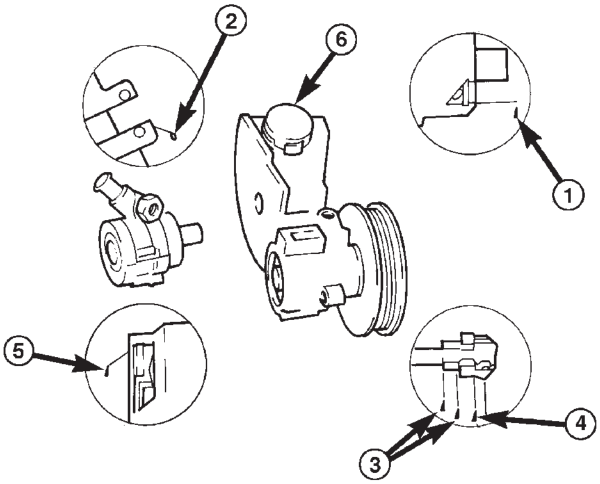


Fig. 3 4.0L Power Steering Pump

STANDARD PROCEDURE

STANDARD PROCEDURE - INITIAL OPERATION - 4.0L

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.

(2) Start the engine and let run for a few seconds then turn engine off.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.

(6) Check the fluid level add if necessary.

(7) Lower the vehicle, start the engine and turn the steering wheel slowly from lock to lock.

(8) Stop the engine and check the fluid level and refill as required.

(9) If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

STANDARD PROCEDURE - INITIAL OPERATION - 4.7L

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

NOTE: Remove as much of the old fluid out of the system as possible with a suction tool or by removing a hose, When a component has failed. Then refill it with fresh fluid until it is clean. This may have to be done more than once.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.

(2) Start the engine and let run for a few seconds then turn engine off.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.

(6) Check the fluid level add if necessary.

(7) Lower the vehicle, start the engine, and use the DRB III to activate the hydraulic fan on full fan operation.

(8) Turn the steering wheel slowly from lock to lock.

(9) Stop the engine, check the fluid level and refill as required and repeat the process

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

(10) If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

PUMP (Continued)

(11) While the vehicle is in park, use the DRB III to activate the hydraulic fan to full fan operation and briefly rev the engine up to 3000 rpm to fully engage the hydraulic fan.

(12) Check the fluid level add if necessary.

REMOVAL

REMOVAL - 4.0L ENGINE

(1) Remove serpentine drive belt,(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove pressure and return hoses from pump and drain the pump.

(3) Loosen the pump bracket bolt at the engine block.

(4) Remove 3 pump mounting bolts (Fig. 4) through pulley access holes.

(5) Tilt pump downward and remove from engine.

(6) Remove pulley from pump.

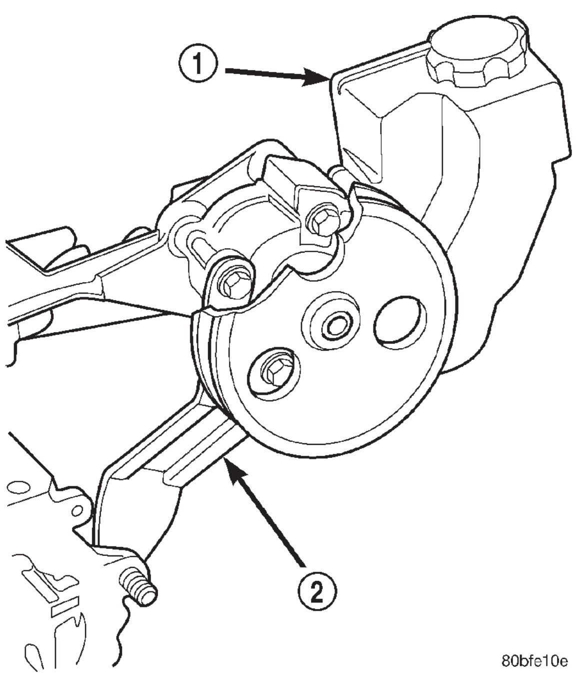


Fig. 4 PUMP MOUNTING – 4.0L

1 - PUMP ASSEMBLY
2 - PUMP BRACKET

REMOVAL - 4.7L ENGINE

(1) Remove the serpentine drive belt,(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove the pressure and return hoses from pump and drain pump.

(3) Remove 3 pump mounting bolts through pulley access holes (Fig. 5).

(4) Remove the pump from the vehicle.

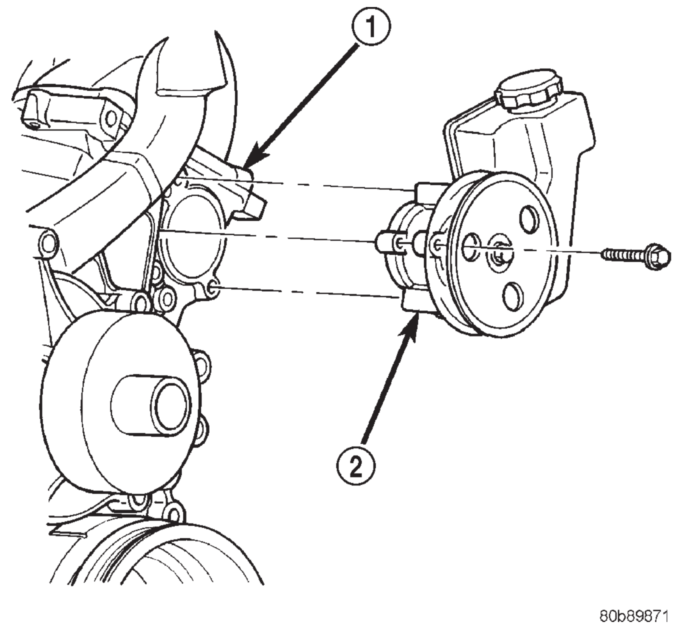


Fig. 5 Pump Mounting

1 - LEFT CYLINDER HEAD
2 - PUMP

INSTALLATION

INSTALLATION - 4.0L ENGINE

(1) Install pulley on pump.

(2) Install pump on the engine mounting bracket.

(3) Install 3 pump mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(4) Tighten pump bracket bolt to 57 N·m (42 ft. lbs.).

(5) Install the pressure line on the pump and tighten to 28 N·m (21 ft. lbs.).

(6) Install the return hoses on pump.

(7) Install the drive belt,(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(8) Add power steering fluid,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 4.7L ENGINE

(1) Position the pump on the left cylinder head and install bolts through pulley access holes. Tighten bolts to 28 N·m (21 ft. lbs.).

(2) Install the pressure and return hoses to pump.

(3) Install serpentine drive belt,(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(4) Add power steering fluid,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

PUMP (Continued)

SPECIFICATIONS

TORQUE CHART

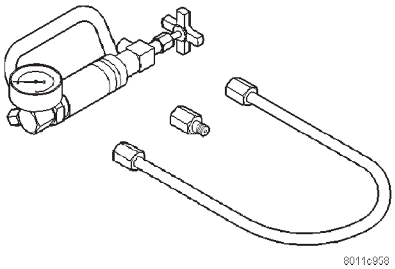
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Pump Bracket Bolt-4.0L	57	42	—
Power Steering Pump Pump Bolts-4.0L	28	21	250
Power Steering Pump Pump Bolts-4.7L	28	21	250
Power Steering Pump Flow Control Valve	75	55	—
Power Steering Pump Pressure Line 4.0L	20-38	14-28	—
Power Steering Pump Pressure Line 4.7L	47	35	416
Power Steering Pump Return Line 4.0L & 4.7L	20-38	14-28	—
High Pressure Inlet Hose to Hydraulic Fan Drive—1/2 inch Fitting	49	36	—
High Pressure Outlet Hose to Steering Gear—3/8 inch Fitting	29	21.5	—
Power Steering Cooler Lines at the Cooler	22.5	17	200

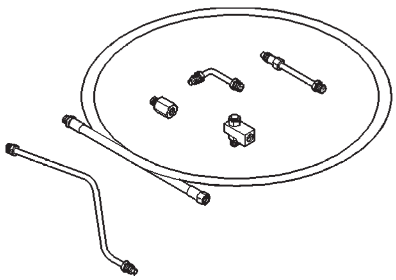
PUMP (Continued)

SPECIAL TOOLS

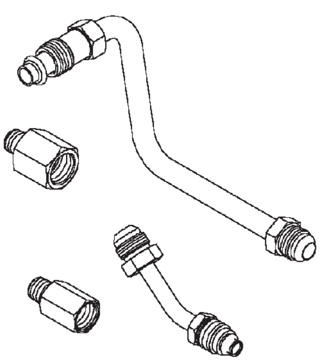
POWER STEERING PUMP



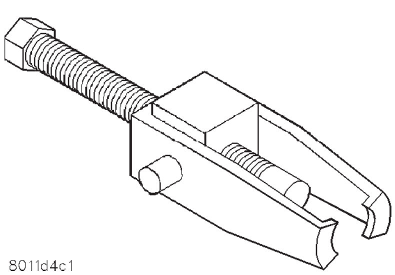
Analyzer Set, Power Steering Flow/Pressure 6815



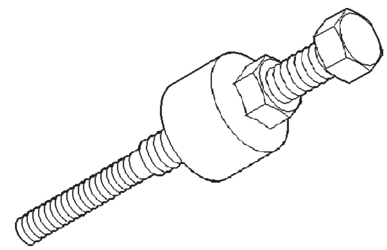
Adapters, Power Steering Flow/Pressure Tester 6893



4.7L HYDRAULIC POWER STEERING TEST ADAPTER KIT - 8630



Puller C-4333



Installer, Power Steering Pulley C-4063B

FLUID COOLER

DESCRIPTION

4.7L models of this vehicle are equipped with a cooler for the power steering system fluid. The power steering fluid cooler is located at the front of the vehicle. It is mounted to the radiator support just forward of the air-conditioning condenser and just rearward of the front fascia (Fig. 6). The cooler is positioned so it is in the air flow through the front fascia of the vehicle.

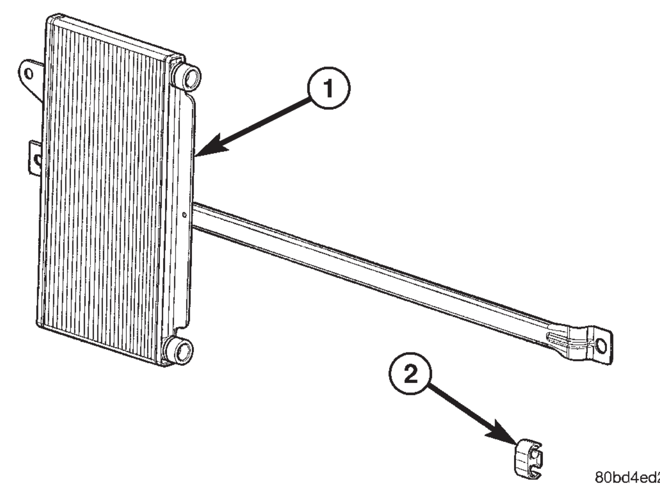


Fig. 6 POWER STEERING FLUID COOLER

1 - POWER STEERING COOLER
2 - POWER STEERING COOLER LINES CLIP

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Drain the power steering fluid out of the reservoir.

(3) Remove the front fascia grille assembly,(Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(4) Remove the grille opening reinforcement panel

(5) Place a drain pan under the cooler.

(6) Disconnect the lower hose at cooler (Fig. 6).

(7) Disconnect the upper hose at cooler (Fig. 6).

(8) Remove the three cooler mounting bolts (Fig. 6).

(9) Remove the cooler from the vehicle.

FLUID COOLER (Continued)

INSTALLATION

(1) Position and install the power steering cooler to the vehicle.

(2) Install the three mounting bracket bolts (Fig. 6).

(3) Reconnect the upper hose at cooler (Fig. 6).

(4) Reconnect the lower hose at cooler (Fig. 6).

(5) Connect negative battery cable to battery.

(6) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

(7) Start engine and check for leaks.

(8) Install the grille opening reinforcement panel

(9) Install the front fascia grille,(Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

HOSES - 4.0L

DESCRIPTION

DESCRIPTION - PRESSURE LINE

The hose consists of two metal ends and rubber center section that contains a tuning cable. The pump end uses a quick connect fitting. Lubircation must be used on the quick connect nut and o-ring when installing.

DESCRIPTION - RETURN LINE

Power steering return line is a hose which is clamped at the pump and the gear.

OPERATION

OPERATION - PRESSURE LINE

Power steering pressure line, is used to transfer high pressure power steering fluid, from the power steering pump to the power steering gear on the 4.0L. The 4.7L power steering pressure line, is used to transfer high pressure power steering fluid, from the power steering pump to the engine cooling fan and the steering gear.

OPERATION - RETURN LINE

Power steering return line, is used to transfer low pressure power steering fluid, from the power steering gear to the power steering pump.

REMOVAL

(1) Drain the power steering fluid from the reservoir.

(2) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(3) Disconnect the power steering pressure hose from the power steering pump and then the power steering gear (Fig. 7).

(4) Disconnect the power steering return hose from the power steering cooler and the reservoir.

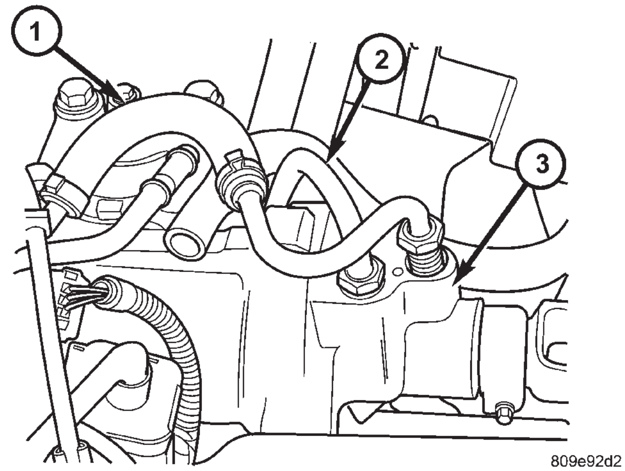


Fig. 7 POWER STEERING HOSES

1 - RETURN HOSE
2 - HIGH PRESSURE HOSE
3 - STEERING GEAR

(5) Remove the hoses from the vehicle.

INSTALLATION

(1) Install the hoses to the vehicle.

(2) Reconnect the power steering return hose to the power steering cooler and the reservoir.

(3) Reconnect the power steering pressure hose to the power steering pump and then the power steering gear.

(4) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(5) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

HOSES - 4.7L

DESCRIPTION

DESCRIPTION - 1/2” PRESSURE HOSE

The hose consists of two metal ends and a rubber center with quick connect nuts at both ends. The hose connects the power steering pump to the hydraulic fan motor and is clipped to the fan shroud (Fig. 8). Lubrication must be used on the quick connect nuts and o-rings when installing.

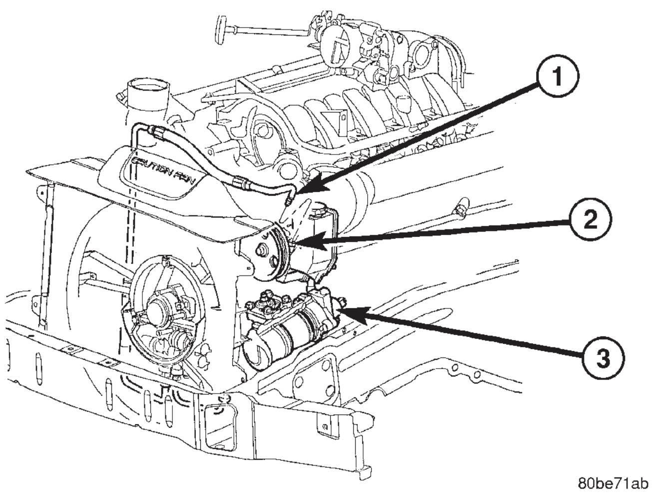


Fig. 8 1/2″ PRESSURE HOSE

1 - 1/2″ PRESSURE HOSE
2 - POWER STEERING PUMP
3 - STEERING GEAR

DESCRIPTION - 1/2” RETURN HOSE

The fan motor return line is a molded rubber hose that is clamped at the hydraulic motor and the power steering reservoir (Fig. 9).

DESCRIPTION - 3/8” PRESSURE HOSE

The hose consists of two metal ends and two rubber sections one of which contains a tuning cable (Fig. 10). The hose is clipped in two places to the fan shroud. Lubrication must be used on the o-rings when installing.

DESCRIPTION - 3/8” GEAR OUTLET HOSE

The gear outlet line consists of a metal section that connects to the gear and a rubber section that clamps to the steering cooler inlet tube (Fig. 11).

DESCRIPTION - 3/8” RETURN HOSE

The return hose is a formed rubber hose that connects the steering cooler outlet tube to the power steering reservoir (Fig. 12). It is clamped at both ends.

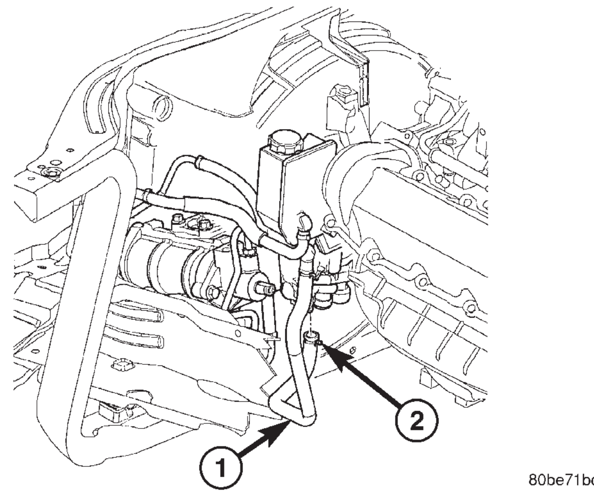


Fig. 9 1/2″ RETURN HOSE

1 - 1/2″ RETURN HOSE
2 - HOSE CLAMP

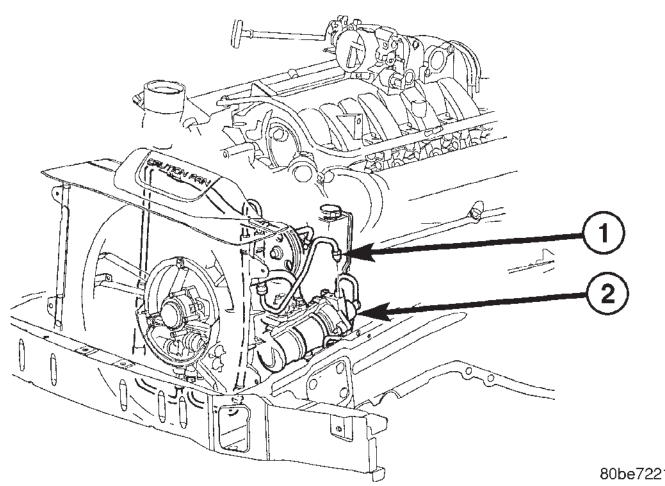


Fig. 10 3/8″ PRESSURE HOSE

1 - 3/8″ PRESSURE HOSE
2 - STEERING GEAR

OPERATION

OPERATION - 1/2” PRESSURE HOSE

The 1/2” pressure hose is used to transfer high pressure power steering fluid from the power steering pump to the engine cooling fan motor (Fig. 8).

OPERATION - 1/2” RETURN HOSE

The power steering return line returns low pressure excess flow from the hydraulic fan motor back to the power steering pump (Fig. 9).

HOSES - 4.7L (Continued)

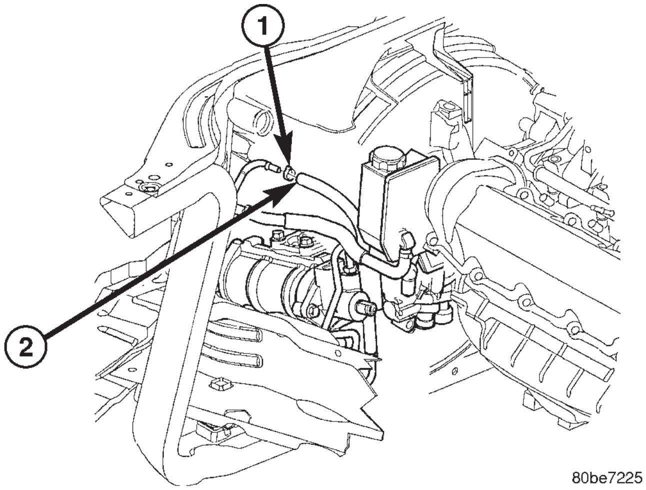


Fig. 11 3/8″ GEAR OUTLET HOSE

1 - HOSE CLAMP
2 - 3/8″ GEARR OUTLET HOSE

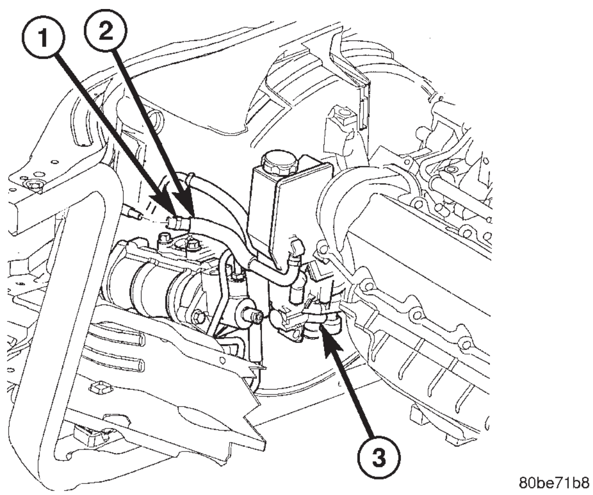


Fig. 12 3/8″ RETURN HOSE

1 - HOSE CLAMP
2 - 3/8″ RETURN HOSE
3 - HYDRAULIC COOLING FAN MOTOR

OPERATION - 3/8” PRESSURE HOSE

High pressure power steering fluid is transmitted from the hydraulic fan motor to the steering gear by the 3/8” steering line.

OPERATION - 3/8” GEAR OUTLET HOSE

The gear outlet hose transmits power steering fluid under moderate low pressure to the power steering cooler inlet tube.

OPERATION - 3/8”RETURN HOSE

Low pressure power steering fluid is transmitted from the steering cooler back to the power steering pump by the 3/8” return hose.

REMOVAL

REMOVAL - 1/2″ PRESSURE HOSE

(1) Drain the power steering fluid from the reservoir.
(2) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
(3) Raise and support the vehicle.
(4) Remove the metal skid plate.
(5) Disconnect the high pressure hose from the hydraulic fan motor (Fig. 8).
(6) Disconnect the high pressure hose from the power steering pump (Fig. 8).
(7) Remove the hose from the clipped position on the fan shroud.
(8) Remove the hose from the vehicle.

REMOVAL - 1/2″ RETURN HOSE

(1) Drain the power steering fluid from the reservoir.
(2) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
(3) Raise and support the vehicle.
(4) Remove the metal skid plate.
(5) Disconnect the rubber return hose from the hydraulic fan motor (Fig. 9).
(6) Disconnect the rubber return hose from the power steering reservoir .
(7) Remove the hose from the vehicle.

REMOVAL - 3/8″ PRESSURE HOSE

(1) Drain the power steering fluid from the reservoir.
(2) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
(3) Raise and support the vehicle.
(4) Remove the metal skid plate.
(5) Disconnect the high pressure hose from the hydraulic fan motor (Fig. 10).
(6) Disconnect the high pressure hose from the power steering gear (Fig. 10).
(7) Remove the hose from the clipped position on the fan shroud.
(8) Remove the hose from the vehicle.

REMOVAL - 3/8″ RETURN HOSE

(1) Drain the power steering fluid from the reservoir.
(2) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
(3) Raise and support the vehicle.
(4) Disconnect the rubber hose from the steering cooler outlet tube (Fig. 12).

HOSES - 4.7L (Continued)

(5) Disconnect the rubber hose from the power steering reservoir (Fig. 12).

(6) Remove the hose from the vehicle.

REMOVAL - 3/8″ GEAR OUTLET HOSE

(1) Drain the power steering fluid from the reservoir.

(2) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(3) Raise and support the vehicle.

(4) Disconnect the rubber hose from the steering cooler inlet tube (Fig. 11).

(5) Disconnect the metal tube from the power steering gear (Fig. 11).

(6) Remove the hose from the vehicle.

REMOVAL - INLET COOLER HOSE

(1) Disconnect negative battery cable at battery.

(2) Drain the power steering fluid out of the reservoir.

(3) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(4) Remove the front fascia grille assembly,(Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(5) Remove the grille opening reinforcement panel

(6) Place a drain pan under the cooler.

(7) Disconnect the lower hose at cooler (Fig. 6).

(8) Disconnect the cooler hose at the gear.

(9) Remove the bracket holding the cooler hoses (Fig. 13).

(10) Remove the cooler hose from the vehicle.

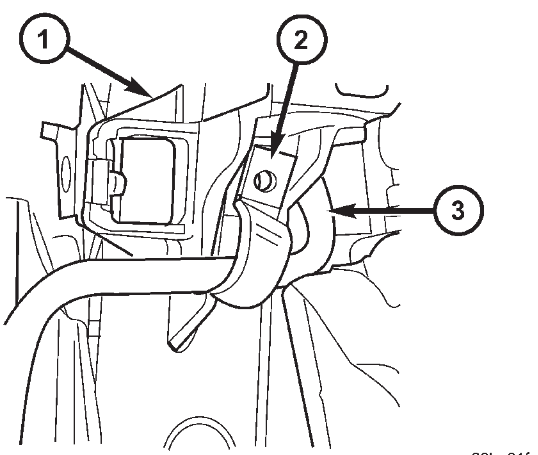


Fig. 13 COOLER HOSES MOUNTING BRACKET

1 - RADIATOR
2 - COOLER HOSES MOUNTING BRACKET
2 - COOLER HOSE

REMOVAL - OUTLET COOLER HOSE

(1) Disconnect negative battery cable at battery.

(2) Drain the power steering fluid out of the reservoir.

(3) Remove the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(4) Remove the front fascia grille assembly,(Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(5) Remove the grille opening reinforcement panel

(6) Place a drain pan under the cooler.

(7) Disconnect the upper hose at cooler (Fig. 6).

(8) Disconnect the cooler hose at the reservoir.

(9) Remove the bracket holding the cooler hoses (Fig. 13).

(10) Remove the cooler hose from the vehicle.

INSTALLATION

INSTALLATION - 1/2″ PRESSURE HOSE

NOTE: Lubrication and a new o-ring must be used when reinstalling.

(1) Install the hoses to the vehicle.

(2) Reconnect the high pressure hose to the power steering pump (Fig. 8) Tighten the hose to 22.5 N·m (17 ft.lbs.).

(3) Reconnect the high pressure hose to the hydraulic fan motor (Fig. 8) Tighten the hose to 22.5 N·m (17 ft.lbs.).

(4) Install the hose to the clipped position on the fan shroud.

(5) Install the metal skid plate.

(6) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(7) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 1/2″ RETURN HOSE

(1) Install the hoses to the vehicle.

(2) Reconnect the rubber return hose to the power steering reservoir (Fig. 9) Tighten the hose clamp.

(3) Reconnect the rubber return hose to the hydraulic fan motor (Fig. 9) Tighten the hose.

(4) Install the metal skid plate.

(5) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(6) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

HOSES - 4.7L (Continued)

INSTALLATION - 3/8″ PRESSURE HOSE

NOTE: Lubrication and a new o-ring must be used when reinstalling.

(1) Install the hoses to the vehicle.

(2) Reconnect the high pressure hose to the hydraulic fan motor (Fig. 10) Tighten the hose to 22.5 N·m (17 ft.lbs.).

(3) Reconnect the high pressure hose to the power steering gear (Fig. 10) Tighten the hose to 22.5 N·m (17 ft.lbs.).

(4) Install the hose to the clipped position on the fan shroud.

(5) Install the metal skid plate.

(6) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(7) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 3/8″ RETURN HOSE

(1) Install the hoses to the vehicle.

(2) Reconnect the rubber hose to the steering cooler outlet tube (Fig. 12) Tighten the hose clamp.

(3) Reconnect the rubber hose to the power steering reservoir (Fig. 12) Tighten the hose clamp.

(4) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(5) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 3/8″ GEAR OUTLET HOSE

NOTE: Lubrication and a new o-ring must be used when reinstalling.

(1) Install the hoses to the vehicle.

(2) Reconnect the rubber hose to the steering cooler inlet tube (Fig. 11) Tighten the hose clamp.

(3) Reconnect the metal tube to the power steering gear (Fig. 11) Tighten the hose to 22.5 N·m (17 ft.lbs.).

(4) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(5) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - INLET COOLER HOSE

(1) Install the cooler hose to the vehicle.

(2) Reconnect the cooler hose at the gear.

(3) Reconnect the lower hose at cooler (Fig. 6). Tighten the hose to 22.5 N·m (17 ft.lbs.)

(4) Install the bracket holding the cooler hoses (Fig. 13).

(5) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(6) Install the grille opening reinforcement panel

(7) Install the front fascia grille assembly, (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

(8) Reconnect negative battery cable at battery.

(9) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - OUTLET COOLER HOSE

(1) Install the cooler hose to the vehicle.

(2) Reconnect the cooler hose at the reservoir.

(3) Reconnect the upper hose at the cooler (Fig. 6). Tighten the hose to 22.5 N·m (17 ft. lbs.)

(4) Install the bracket holding the cooler hoses (Fig. 13). Tighten the bracket to 22.5 N·m (17 ft. lbs.)

(5) Install the air box,(Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(6) Install the grille opening reinforcement panel

(7) Install the front fascia grille assembly, (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

(8) Reconnect negative battery cable at battery.

(9) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

PULLEY

DESCRIPTION

POWER STEERING PUMP PULLEY - 3.1L DIESEL

To service the power steering pump pulley on the 3.1L turbo diesel engine. Refer to the power steering pump removal and installation procedure in this group. The pulley must be removed to service the pump assembly. Detailed instructions are provided in the pump procedure.

REMOVAL

CAUTION: On vehicles equipped with the 4.0L or 4.7L, Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

(1) Remove pump assembly.

(2) Remove pulley from pump with Puller C-4333 or equivalent puller (Fig. 14).

PULLEY (Continued)

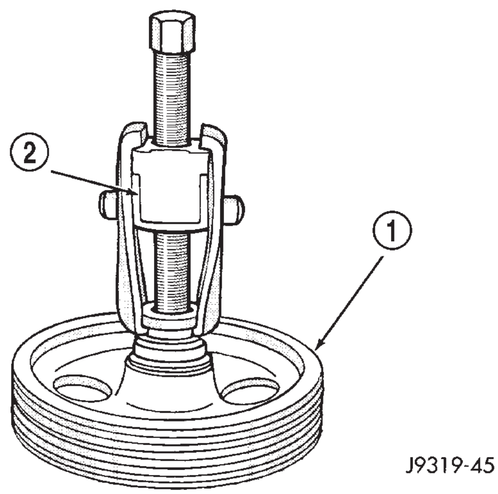


Fig. 14 Pulley Removal

1 - POWER STEERING PUMP DRIVE PULLEY
2 - SPECIAL TOOL C-4333

INSTALLATION

NOTE: The pulley is marked front for installation.

CAUTION: On vehicles equipped with the 4.0L or 4.7L, Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

(1) Replace pulley if bent, cracked, or loose.
(2) Install pulley on pump with Installer C-4063-B or equivalent installer (Fig. 15). The front edge of the pulley hub must be flush with the end of the shaft. Ensure the tool and pulley are aligned with the pump shaft.

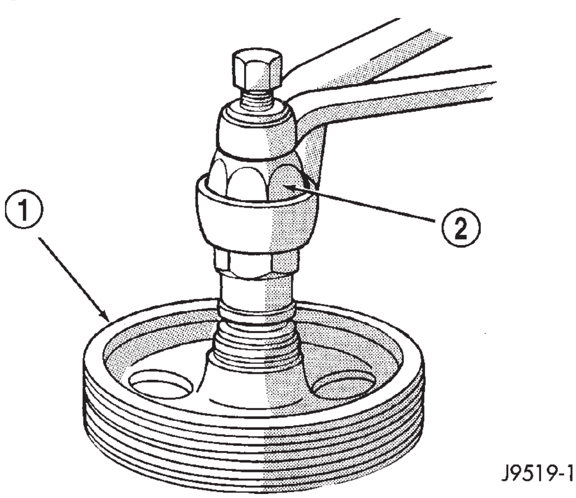


Fig. 15 Pulley Installation

1 - POWER STEERING PUMP DRIVE PULLEY
2 - SPECIAL TOOL C-4063–B

(3) Install pump assembly.
(4) With Serpentine Belt, run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**

RESERVOIR

REMOVAL

(1) Remove power steering pump.
(2) Clean exterior of pump.
(3) Clamp the pump body in a soft jaw vice.

NOTE: Use new retaining clips for installation.

(4) Pry up tab and slide the retaining clips off (Fig. 16).

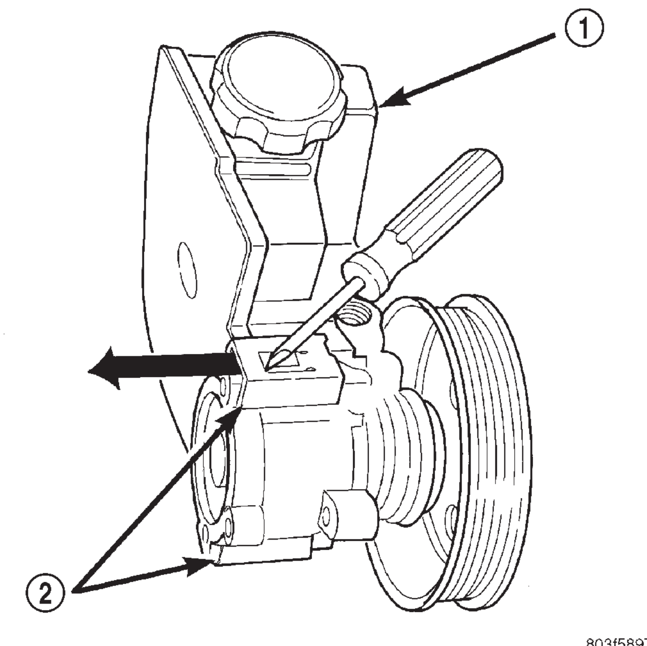


Fig. 16 Pump Reservoir Clips

1 - RESERVOIR
2 - RETAINING CLIPS

(5) Remove fluid reservoir from pump body. Remove and discard O-ring seal.

INSTALLATION

(1) Lubricate new O-ring Seal with Mopar Power Steering Fluid or equivalent.
(2) Install O-ring seal in housing.
(3) Install reservoir onto housing.
(4) Slide and tap in **new** reservoir retainer clips until tab locks to housing.
(5) Install power steering pump.
(6) Add power steering fluid,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

TRANSMISSION AND TRANSFER CASE

TABLE OF CONTENTS

AUTOMATIC TRANSMISSION - 42RE

TABLE OF CONTENTS

AUTOMATIC TRANSMISSION - 42RE

DESCRIPTION

The 42RE is a four speed fully automatic transmission (Fig. 1) with an electronic governor. The 42RE is equipped with a lock-up clutch in the torque converter. First through third gear ranges are provided by the clutches, bands, overrunning clutch, and planetary gear sets in the transmission. Fourth gear range is provided by the overdrive unit that contains an overdrive clutch, direct clutch, planetary gear set, and overrunning clutch.

The transmission contains a front, rear, and direct clutch which function as the input driving components. It also contains the kickdown (front) and the low/reverse (rear) bands which, along with the overrunning clutch and overdrive clutch, serve as the holding components. The driving and holding components combine to select the necessary planetary gear components, in the front, rear, or overdrive planetary gear set, transfer the engine power from the input shaft through to the output shaft.

The valve body is mounted to the lower side of the transmission and contains the valves to control pressure regulation, fluid flow control, and clutch/band application. The oil pump is mounted at the front of the transmission and is driven by the torque converter hub. The pump supplies the oil pressure necessary for clutch/band actuation and transmission lubrication.

AUTOMATIC TRANSMISSION - 42RE (Continued)

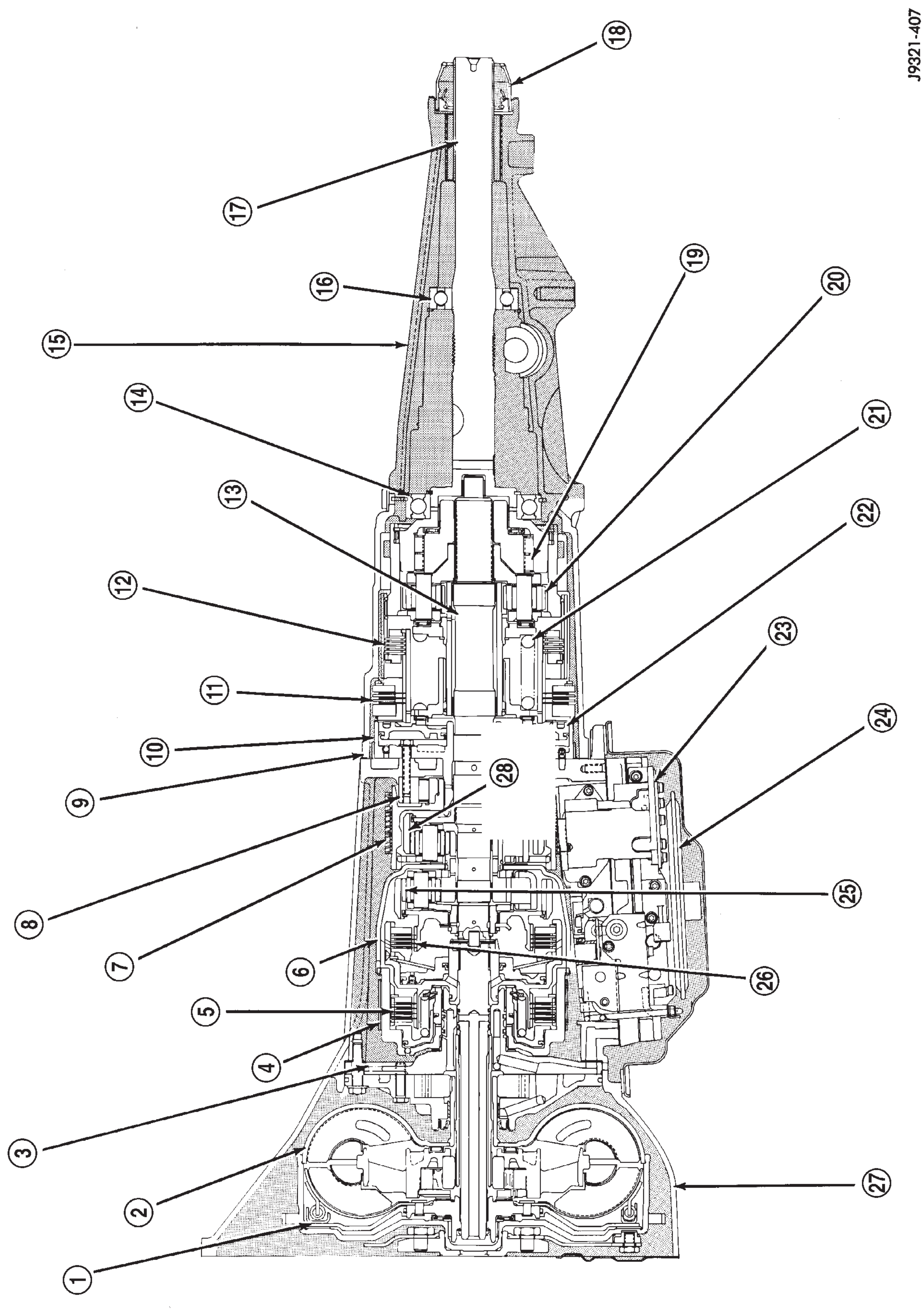


Fig. 1 42RE Transmission

AUTOMATIC TRANSMISSION - 42RE (Continued)

1 - CONVERTER CLUTCH
2 - TORQUE CONVERTER
3 - OIL PUMP AND REACTION SHAFT SUPPORT ASSEMBLY
4 - FRONT BAND
5 - FRONT CLUTCH
6 - DRIVING SHELL
7 - REAR BAND
8 - TRANSMISSION OVERRUNNING CLUTCH
9 - OVERDRIVE UNIT
10 - PISTON RETAINER
11 - OVERDRIVE CLUTCH
12 - DIRECT CLUTCH
13 - INTERMEDIATE SHAFT
14 - FRONT BEARING
15 - HOUSING
16 - REAR BEARING
17 - OUTPUT SHAFT
18 - SEAL
19 - OVERDRIVE OVERRUNNING CLUTCH
20 - OVERDRIVE PLANETARY GEAR
21 - DIRECT CLUTCH SPRING
22 - OVERDRIVE CLUTCH PISTON
23 - VALVE BODY ASSEMBLY
24 - FILTER
25 - FRONT PLANETARY GEAR
26 - REAR CLUTCH
27 - TRANSMISSION
28 - REAR PLANETARY GEAR

IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2). Refer to this information when ordering replacement parts.

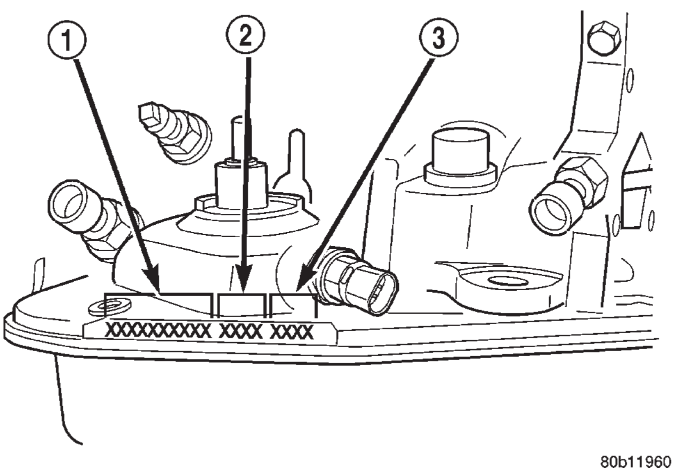


Fig. 2 Transmission Part And Serial Number Location

1 - PART NUMBER
2 - BUILD DATE
3 - SERIAL NUMBER

GEAR RATIOS The 42RE gear ratios are:

1st	2.74:1
2nd	1.54:1
3rd	1.00:1
4th	0.69:1
Rev.	2.21:1

OPERATION

The application of each driving or holding component is controlled by the valve body based upon the manual lever position, throttle pressure, and governor pressure. The governor pressure is a variable pressure input to the valve body and is one of the signals that a shift is necessary. First through fourth gear are obtained by selectively applying and releasing the different clutches and bands. Engine power is thereby routed to the various planetary gear assemblies which combine with the overrunning clutch assemblies to generate the different gear ratios. The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear under various conditions, such as when the O/D switch is OFF, when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased. The torque converter clutch feature increases fuel economy and reduces the transmission fluid temperature.

Since the overdrive clutch is applied in fourth gear only and the direct clutch is applied in all ranges except fourth gear, the transmission operation for park, neutral, and first through third gear will be described first. Once these powerflows are described, the third to fourth shift sequence will be described.

AUTOMATIC TRANSMISSION - 42RE (Continued)

PARK POWERFLOW

As the engine is running and the crankshaft is rotating, the flexplate and torque converter, which are also bolted to it, are all rotating in a clockwise direction as viewed from the front of the engine. The notched hub of the torque converter is connected to the oil pump's internal gear, supplying the transmission with oil pressure. As the converter turns, it turns the input shaft in a clockwise direction. As the input shaft is rotating, the front clutch hub-rear clutch retainer and all their associated parts are also rotating, all being directly connected to the input shaft. The power flow from the engine through the front clutch hub and rear clutch retainer stops at the rear clutch retainer. Therefore, no power flow to the output shaft occurs because no clutches are applied. The only mechanism in use at this time is the parking sprag (Fig. 3), which locks the parking gear on the output shaft to the transmission case.

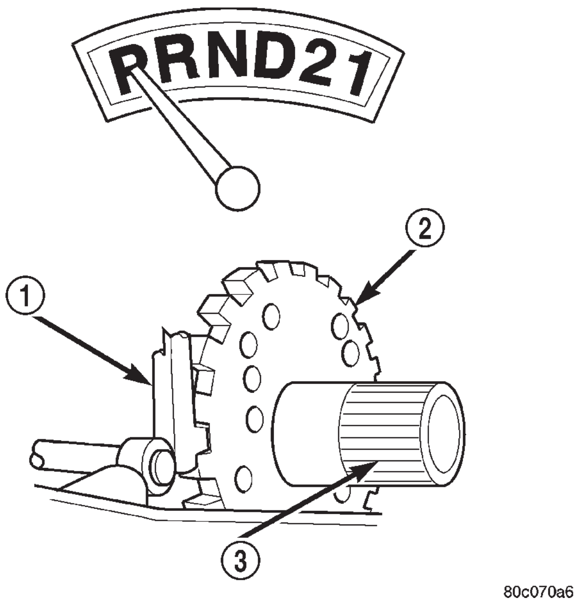


Fig. 3 Park Powerflow

1 - LEVER ENGAGED FOR PARK
2 - PARK SPRAG
3 - OUTPUT SHAFT

NEUTRAL POWERFLOW

With the gear selector in the NEUTRAL position (Fig. 4), the power flow of the transmission is essentially the same as in the park position. The only operational difference is that the parking sprag has been disengaged, unlocking the output shaft from the transmission case and allowing it to move freely.

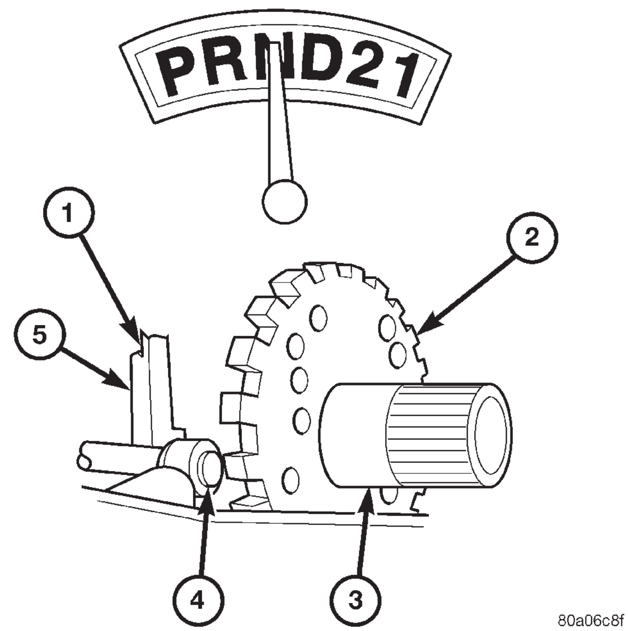


Fig. 4 Neutral Powerflow

1 - PAWL DISENGAGED FOR NEUTRAL
2 - PARK SPRAG
3 - OUTPUT SHAFT
4 - CAM
5 - PAWL

AUTOMATIC TRANSMISSION - 42RE (Continued)

REVERSE POWERFLOW

When the gear selector is moved into the REVERSE position (Fig. 5), the front clutch and the rear band are applied. With the application of the front clutch, engine torque is applied to the sun gear, turning it in a clockwise direction. The clockwise rotation of the sun gear causes the rear planet pinions to rotate against engine rotation in a counterclockwise direction. The rear band is holding the low reverse drum, which is splined to the rear carrier. Since the rear carrier is being held, the torque from the planet pinions is transferred to the rear annulus gear, which is splined to the output shaft. The output shaft in turn rotates with the annulus gear in a counterclockwise direction giving a reverse gear output. The entire transmission of torque is applied to the rear planetary gearset only. Although there is torque input to the front gearset through the sun gear, no other member of the gearset is being held. During the entire reverse stage of operation, the front planetary gears are in an idling condition.

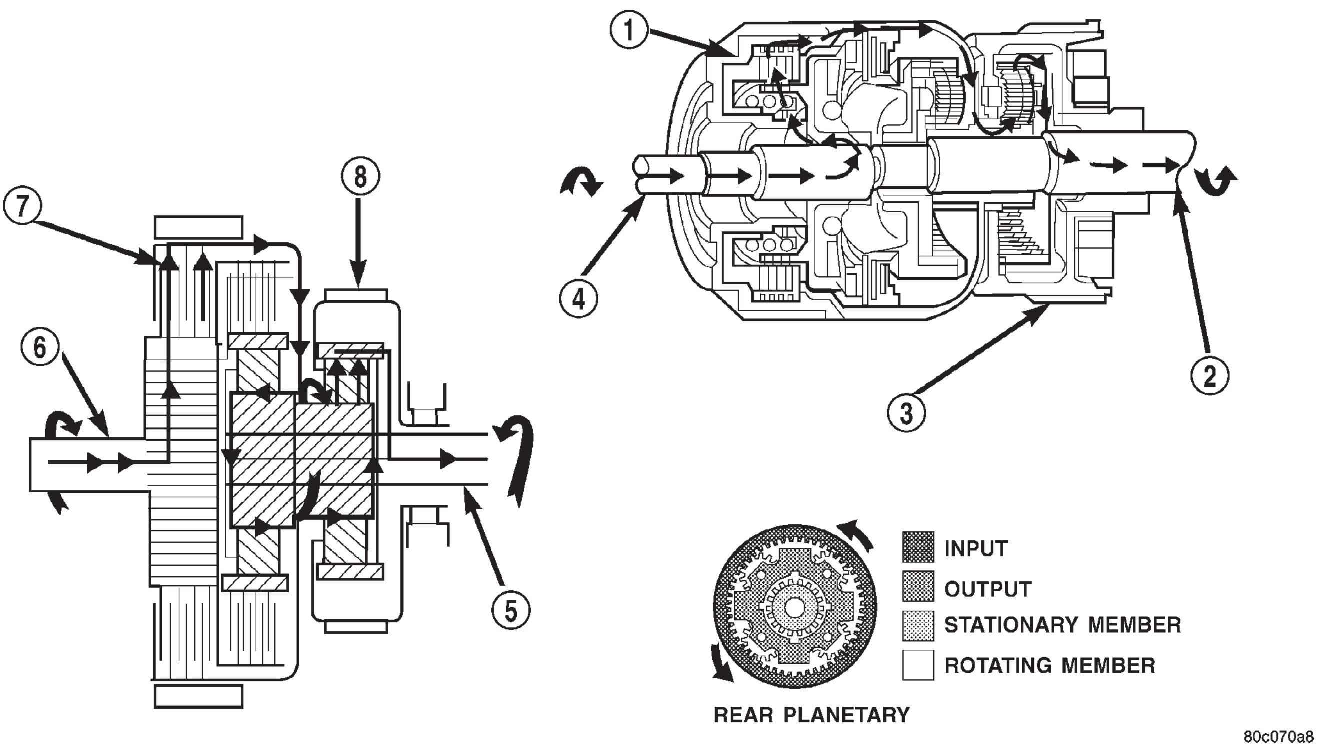


Fig. 5 Reverse Powerflow

1 - FRONT CLUTCH ENGAGED
2 - OUTPUT SHAFT
3 - LOW/REVERSE BAND APPLIED
4 - INPUT SHAFT
5 - OUTPUT SHAFT
6 - INPUT SHAFT
7 - FRONT CLUTCH ENGAGED
8 - LOW/REVERSE BAND APPLIED

AUTOMATIC TRANSMISSION - 42RE (Continued)

FIRST GEAR POWERFLOW

When the gearshift lever is moved into the DRIVE position the transmission goes into first gear (Fig. 6). As soon as the transmission is shifted from PARK or NEUTRAL to DRIVE, the rear clutch applies, applying the rear clutch pack to the front annulus gear. Engine torque is now applied to the front annulus gear turning it in a clockwise direction. With the front annulus gear turning in a clockwise direction, it causes the front planets to turn in a clockwise direction. The rotation of the front planets cause the sun to revolve in a counterclockwise direction. The sun gear now transfers its counterclockwise rotation to the rear planets which rotate back in a clockwise direction. With the rear annulus gear stationary, the rear planet rotation on the annulus gear causes the rear planet carrier to revolve in a counterclockwise direction. The rear planet carrier is splined into the low-reverse drum, and the low reverse drum is splined to the inner race of the over-running clutch. With the over-running clutch locked, the planet carrier is held, and the resulting torque provided by the planet pinions is transferred to the rear annulus gear. The rear annulus gear is splined to the output shaft and rotated along with it (clockwise) in an underdrive gear reduction mode.

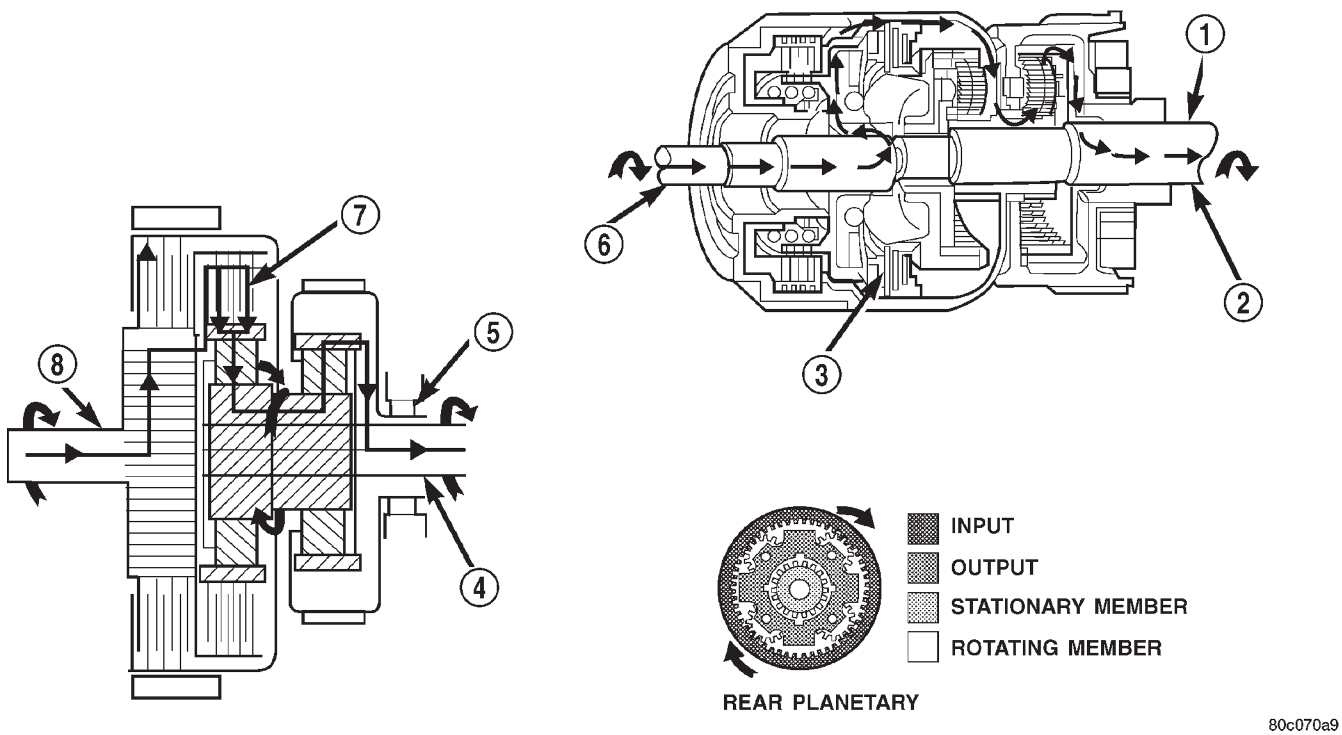


Fig. 6 First Gear Powerflow

1 - OUTPUT SHAFT
2 - OVER-RUNNING CLUTCH HOLDING
3 - REAR CLUTCH APPLIED
4 - OUTPUT SHAFT
5 - OVER-RUNNING CLUTCH HOLDING
6 - INPUT SHAFT
7 - REAR CLUTCH APPLIED
8 - INPUT SHAFT

AUTOMATIC TRANSMISSION - 42RE (Continued)

SECOND GEAR POWERFLOW

In DRIVE-SECOND (Fig. 7), the same elements are applied as in MANUAL-SECOND. Therefore, the power flow will be the same, and both gears will be discussed as one in the same. In DRIVE-SECOND, the transmission has proceeded from first gear to its shift point, and is shifting from first gear to second. The second gear shift is obtained by keeping the rear clutch applied and applying the front (kickdown) band. The front band holds the front clutch retainer that is locked to the sun gear driving shell. With the rear clutch still applied, the input is still on the front annulus gear turning it clockwise at engine speed. Now that the front band is holding the sun gear stationary, the annulus rotation causes the front planets to rotate in a clockwise direction. The front carrier is then also made to rotate in a clockwise direction but at a reduced speed. This will transmit the torque to the output shaft, which is directly connected to the front planet carrier. The rear planetary annulus gear will also be turning because it is directly splined to the output shaft. All power flow has occurred in the front planetary gear set during the drive-second stage of operation, and now the over-running clutch, in the rear of the transmission, is disengaged and freewheeling on its hub.

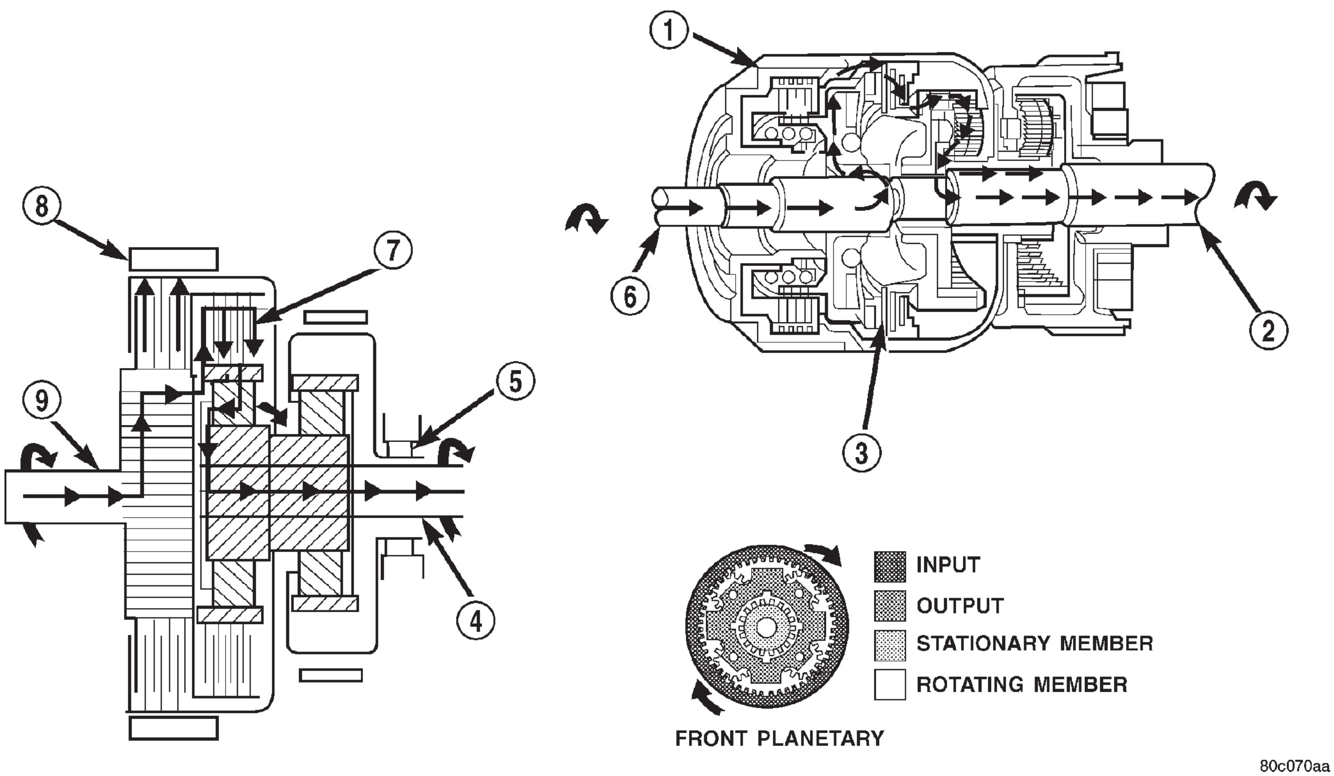


Fig. 7 Second Gear Powerflow

1 - KICKDOWN BAND APPLIED
2 - OUTPUT SHAFT
3 - REAR CLUTCH ENGAGED
4 - OUTPUT SHAFT
5 - OVER-RUNNING CLUTCH FREE-WHEELING
6 - INPUT SHAFT
7 - REAR CLUTCH APPLIED
8 - KICKDOWN BAND APPLIED
9 - INPUT SHAFT

AUTOMATIC TRANSMISSION - 42RE (Continued)

DIRECT DRIVE POWERFLOW

The vehicle has accelerated and reached the shift point for the 2-3 upshift into direct drive (Fig. 8). When the shift takes place, the front band is released, and the front clutch is applied. The rear clutch stays applied as it has been in all the forward gears. With the front clutch now applied, engine torque is now on the front clutch retainer, which is locked to the sun gear driving shell. This means that the sun gear is now turning in engine rotation (clockwise) and at engine speed. The rear clutch is still applied so engine torque is also still on the front annulus gear. If two members of the same planetary set are driven, direct drive results. Therefore, when two members are rotating at the same speed and in the same direction, it is the same as being locked up. The rear planetary set is also locked up, given the sun gear is still the input, and the rear annulus gear must turn with the output shaft. Both gears are turning in the same direction and at the same speed. The front and rear planet pinions do not turn at all in direct drive. The only rotation is the input from the engine to the connected parts, which are acting as one common unit, to the output shaft.

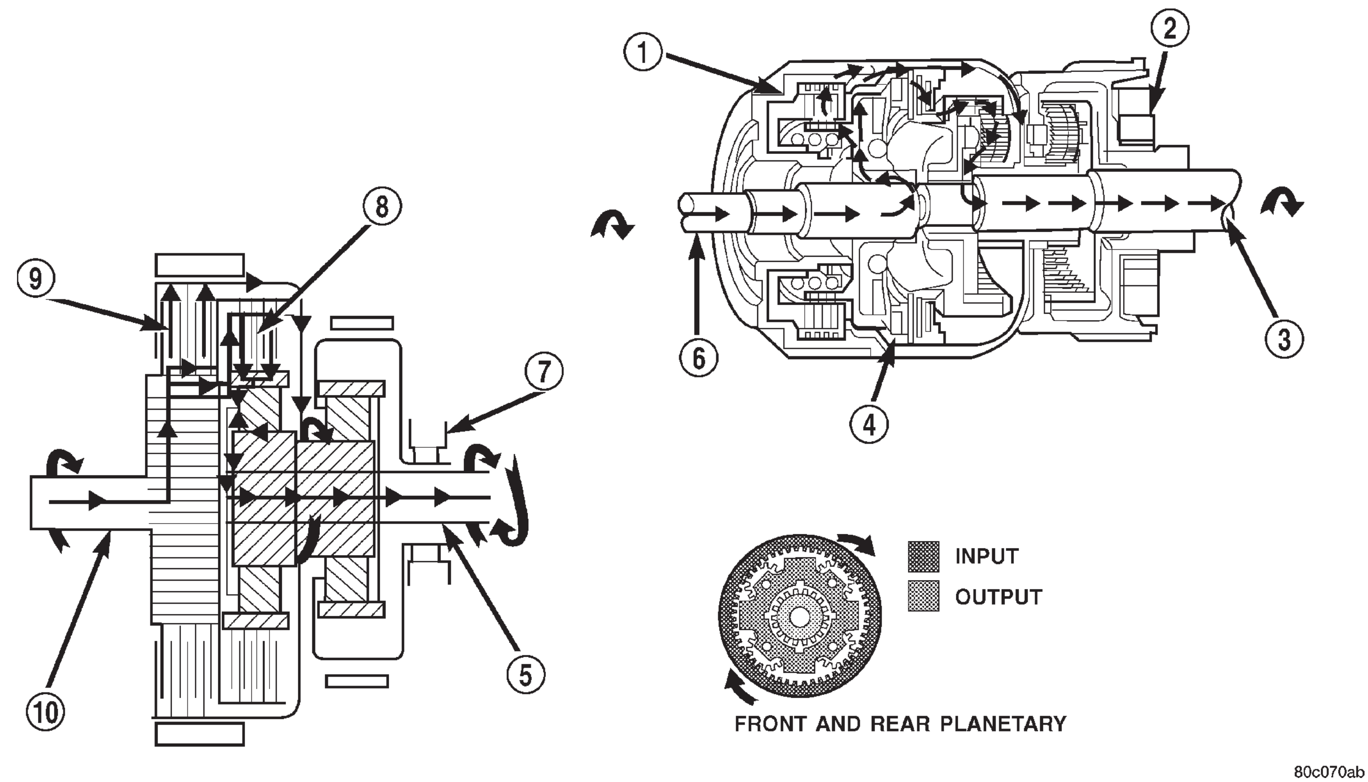


Fig. 8 Direct Drive Powerflow

1 - FRONT CLUTCH APPLIED
2 - OVER-RUNNING CLUTCH FREE-WHEELING
3 - OUTPUT SHAFT
4 - REAR CLUTCH APPLIED
5 - OUTPUT SHAFT
6 - INPUT SHAFT
7 - OVER-RUNNING CLUTCH FREE-WHEELING
8 - REAR CLUTCH APPLIED
9 - FRONT CLUTCH APPLIED
10 - INPUT SHAFT

AUTOMATIC TRANSMISSION - 42RE (Continued)

FOURTH GEAR POWERFLOW

Fourth gear overdrive range is electronically controlled and hydraulically activated. Various sensor inputs are supplied to the powertrain control module to operate the overdrive solenoid on the valve body. The solenoid contains a check ball that opens and closes a vent port in the 3-4 shift valve feed passage. The overdrive solenoid (and check ball) are not energized in first, second, third, or reverse gear. The vent port remains open, diverting line pressure from the 2-3 shift valve away from the 3-4 shift valve. The overdrive control switch must be in the ON position to transmit overdrive status to the PCM. A 3-4 upshift occurs only when the overdrive solenoid is energized by the PCM. The PCM energizes the overdrive solenoid during the 3-4 upshift. This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position. This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston. Line pressure through the timing valve moves the overdrive piston into contact with the overdrive clutch. The direct clutch is disengaged before the overdrive clutch is engaged. The boost valve provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts, and when accelerating in fourth gear. The 3-4 accumulator cushions overdrive clutch engagement to smooth 3-4 upshifts. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

Automatic transmission problems can be a result of poor engine performance, incorrect fluid level, incorrect linkage or cable adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or electrical/mechanical component malfunctions. Begin diagnosis by checking the easily accessible items such as: fluid level and condition, linkage adjustments and electrical connections. A road test will determine if further diagnosis is necessary.

DIAGNOSIS AND TESTING - PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVEABLE

(1) Check for transmission fault codes using DRB® scan tool.

(2) Check fluid level and condition.

(3) Adjust throttle and gearshift linkage if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts, and engages.

(5) Perform hydraulic pressure test if shift problems were noted during road test.

(6) Perform air-pressure test to check clutch-band operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift or throttle linkage.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged drive plate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

DIAGNOSIS AND TESTING - ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul will be necessary to restore normal operation.

A slipping clutch or band can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch and Band Application chart provides a basis for analyzing road test results.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CLUTCH AND BAND APPLICATION CHART

SHIFT LEVER POSITION	TRANSMISSION CLUTCHES AND BANDS					OVERDRIVE CLUTCHES		
	FRONT CLUTCH	FRONT BAND	REAR CLUTCH	REAR BAND	OVER-RUNNING CLUTCH	OVER-DRIVE CLUTCH	DIRECT CLUTCH	OVER-RUNNING CLUTCH
Reverse	X			X			X	
Drive - First			X		X		X	X
Drive - Second		X	X				X	X
Drive - Third	X		X				X	X
Drive - Fourth	X		X			X		
Manual Second		X	X		X		X	X
Manual First			X	X	X		X	X

Note that the rear clutch is applied in all forward ranges (D, 2, 1). The transmission overrunning clutch is applied in first gear (D, 2 and 1 ranges) only. The rear band is applied in 1 and R range only.

Note that the overdrive clutch is applied only in fourth gear and the overdrive direct clutch and overrunning clutch are applied in all ranges except fourth gear.

For example: If slippage occurs in first gear in D and 2 range but not in 1 range, the transmission overrunning clutch is faulty. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that the front and rear clutches are applied simultaneously only in D range third and fourth gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping.

If the transmission slips in fourth gear but not in third gear, the overdrive clutch is slipping. By selecting another gear which does not use these clutches, the slipping unit can be determined. For example, if the transmission also slips in Reverse, the front clutch is slipping. If the transmission does not slip in Reverse, the rear clutch is slipping.

If slippage occurs during the 3-4 shift or only in fourth gear, the overdrive clutch is slipping. Similarly, if the direct clutch were to fail, the transmission would lose both reverse gear and overrun braking in 2 position (manual second gear).

If the transmission will not shift to fourth gear, the control switch, overdrive solenoid or related wiring may also be the problem cause.

This process of elimination can be used to identify a slipping unit and check operation. Proper use of the Clutch and Band Application Chart is the key.

Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless a malfunction is obvious, such as no drive in D range first gear, do not disassemble the transmission. Perform the hydraulic and air pressure tests to help determine the probable cause.

DIAGNOSIS AND TESTING - HYDRAULIC PRESSURE TEST

Hydraulic test pressures range from a low of one psi (6.895 kPa) governor pressure, to 300 psi (2068 kPa) at the rear servo pressure port in reverse.

An accurate tachometer and pressure test gauges are required. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, and front servo ports. Test Gauge C-3293-SP has a 300 psi range and is used at the rear servo and overdrive ports where pressures exceed 100 psi.

Pressure Test Port Locations

Test ports are located at both sides of the transmission case (Fig. 9).

Line pressure is checked at the accumulator port on the right side of the case. The front servo pressure port is at the right side of the case just behind the filler tube opening.

AUTOMATIC TRANSMISSION - 42RE (Continued)

The rear servo and governor pressure ports are at the right rear of the transmission case. The overdrive clutch pressure port is at the left rear of the case.

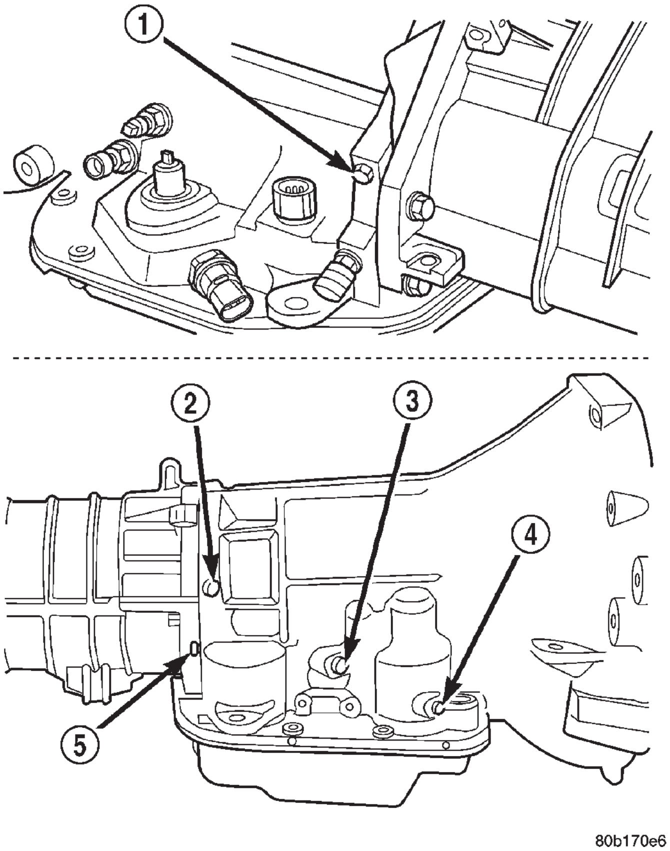


Fig. 9 Pressure Test Port Locations

1 - OVERDRIVE CLUTCH TEST PORT
2 - GOVERNOR TEST PORT
3 - ACCUMULATOR TEST PORT
4 - FRONT SERVO TEST PORT
5 - REAR SERVO TEST PORT

Test One - Transmission In Manual Low

NOTE: This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Both test gauges are required for this test.

(1) Connect tachometer to engine. Position tachometer so it can be observed from driver seat if helper will be operating engine. Raise vehicle on hoist that will allow rear wheels to rotate freely.

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port.

(3) Disconnect throttle and gearshift cables from levers on transmission valve body manual shaft.

(4) Have helper start and run engine at 1000 rpm.

(5) Move transmission shift lever fully forward into 1 range.

(6) Gradually move transmission throttle lever from full forward to full rearward position and note pressures on both gauges:

- Line pressure at accumulator port should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as throttle lever is moved rearward.
- Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two - Transmission In 2 Range

NOTE: This test checks pump output, line pressure and pressure regulation. Use 100 psi Test Gauge C-3292 for this test.

(1) Leave vehicle in place on hoist and leave Test Gauge C-3292 connected to accumulator port.

(2) Have helper start and run engine at 1000 rpm.

(3) Move transmission shift lever one detent rearward from full forward position. This is 2 range.

(4) Move transmission throttle lever from full forward to full rearward position and read pressure on gauge.

(5) Line pressure should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as lever is moved rearward.

Test Three - Transmission In D Range Third Gear

NOTE: This test checks pressure regulation and condition of the clutch circuits. Both test gauges are required for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and leave Gauge C-3292 in place at accumulator port.

(3) Move Gauge C-3293-SP over to front servo port for this test.

(4) Have helper start and run engine at 1600 rpm for this test.

(5) Move transmission shift lever two detents rearward from full forward position. This is D range.

(6) Read pressures on both gauges as transmission throttle lever is gradually moved from full forward to full rearward position:

- Line pressure at accumulator in D range third gear, should be 54-60 psi (372-414 kPa) with throttle lever forward and increase as lever is moved rearward.
- Front servo pressure in D range third gear, should be within 3 psi (21 kPa) of line pressure up to kickdown point.

AUTOMATIC TRANSMISSION - 42RE (Continued)

Test Four - Transmission In Reverse

NOTE: This test checks pump output, pressure regulation and the front clutch and rear servo circuits. Use 300 psi Test Gauge C-3293-SP for this test.

(1) Leave vehicle on hoist and leave gauge C-3292 in place at accumulator port.
(2) Move 300 psi Gauge C-3293-SP back to rear servo port.
(3) Have helper start and run engine at 1600 rpm for test.
(4) Move transmission shift lever four detents rearward from full forward position. This is Reverse range.
(5) Move transmission throttle lever fully forward then fully rearward and note reading at Gauge C-3293-SP.
(6) Pressure should be 145 - 175 psi (1000-1207 kPa) with throttle lever forward and increase to 230 - 280 psi (1586-1931 kPa) as lever is gradually moved rearward.

Test Five - Governor Pressure

NOTE: This test checks governor operation by measuring governor pressure response to changes in vehicle speed. It is usually not necessary to check governor operation unless shift speeds are incorrect or if the transmission will not downshift. The test should be performed on the road or on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port.
(2) Move transmission shift lever two detents rearward from full forward position. This is D range.
(3) Have helper start and run engine at curb idle speed. Then firmly apply service brakes so wheels will not rotate.
(4) Note governor pressure:
- Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.
- If pressure exceeds 20.6 kPa (3 psi), a fault exists in governor pressure control system.

(5) Release brakes, slowly increase engine speed, and observe speedometer and pressure test gauge (do not exceed 30 mph on speedometer). Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.
(6) Governor pressure rise should be smooth and drop back to no more than 20.6 kPa (3 psi), after engine returns to curb idle and brakes are applied to prevent wheels from rotating.
(7) Compare results of pressure test with analysis chart.

Test Six - Transmission In Overdrive Fourth Gear

NOTE: This test checks line pressure at the overdrive clutch in fourth gear range. Use 300 psi Test Gauge C-3293-SP for this test. The test should be performed on the road or on a chassis dyno.

(1) Remove tachometer; it is not needed for this test.
(2) Move 300 psi Gauge to overdrive clutch pressure test port. Then remove other gauge and reinstall test port plug.
(3) Lower vehicle.
(4) Turn OD switch on.
(5) Secure test gauge so it can be viewed from drivers seat.
(6) Start engine and shift into D range.
(7) Increase vehicle speed gradually until 3-4 shift occurs and note gauge pressure.
(8) Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-827 kPa (90-120 psi) at 1/2 to 3/4 throttle. Note that pressure can increase to around 896 kPa (130 psi) at full throttle.
(9) Return to shop or move vehicle off chassis dyno.

PRESSURE TEST ANALYSIS CHART

TEST CONDITION	INDICATION
Line pressure OK during any one test	Pump and regulator valve OK
Line pressure OK in R but low in D, 2, 1	Leakage in rear clutch area (seal rings, clutch seals)
Pressure low in D Fourth Gear Range	Overdrive clutch piston seal, or check ball problem
Pressure OK in 1, 2 but low in D3 and R	Leakage in front clutch area
Pressure OK in 2 but low in R and 1	Leakage in rear servo
Front servo pressure in 2	Leakage in servo; broken servo ring or cracked servo piston
Pressure low in all positions	Clogged filter, stuck regulator valve, worn or faulty pump, low oil level
Governor pressure too high at idle speed	Governor pressure solenoid valve system fault. Refer to diagnostic book.

AUTOMATIC TRANSMISSION - 42RE (Continued)

TEST CONDITION	INDICATION
Governor pressure low at all mph figures	Faulty governor pressure solenoid, transmission control module, or governor pressure sensor
Lubrication pressure low at all throttle positions	Clogged fluid cooler or lines, seal rings leaking, worn pump bushings, pump, clutch retainer, or clogged filter.
Line pressure high	Output shaft plugged, sticky regulator valve
Line pressure low	Sticky regulator valve, clogged filter, worn pump

DIAGNOSIS AND TESTING - AIR CHECKING TRANSMISSION CLUTCH AND BAND OPERATION

Air-pressure testing can be used to check transmission front/rear clutch and band operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check, after overhaul.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The servo and clutch apply passages are shown (Fig. 10).

Front Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

Rear Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through rear clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

Front Servo Apply Air Test

Apply air pressure to the front servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

Rear Servo Air Test

Apply air pressure to the rear servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

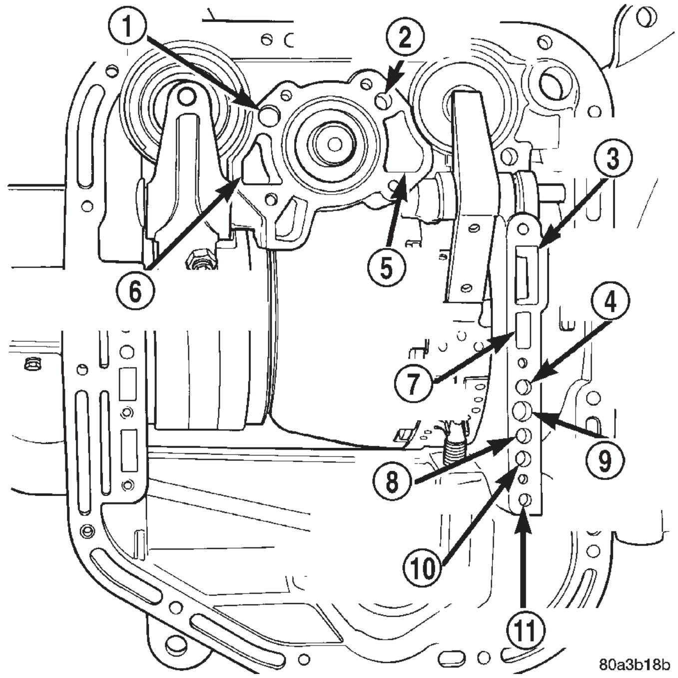


Fig. 10 Air Pressure Test Passages

1 - REAR SERVO APPLY
2 - FRONT SERVO APPLY
3 - PUMP SUCTION
4 - FRONT CLUTCH APPLY
5 - FRONT SERVO RELEASE
6 - LINE PRESSURE TO ACCUMULATOR
7 - PUMP PRESSURE
8 - TO CONVERTER
9 - REAR CLUTCH APPLY
10 - FROM CONVERTER
11 - TO COOLER

DIAGNOSIS AND TESTING - CONVERTER HOUSING FLUID LEAK

When diagnosing converter housing fluid leaks, two items must be established before repair.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump body leaks follow the same path as a seal leak (Fig. 11). Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 11). Pump o-ring or gasket leaks usually travel down the inside of the converter housing. Front band lever pin plug

AUTOMATIC TRANSMISSION - 42RE (Continued)

leaks are generally deposited on the housing and not on the converter.

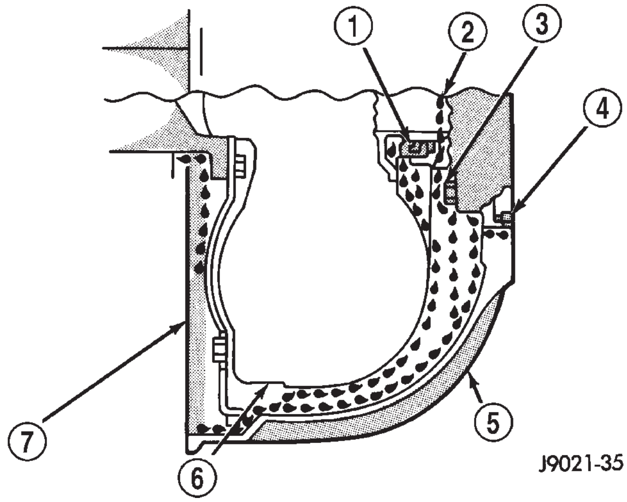


Fig. 11 Converter Housing Leak Paths

1 - PUMP SEAL
2 - PUMP VENT
3 - PUMP BOLT
4 - PUMP GASKET
5 - CONVERTER HOUSING
6 - CONVERTER
7 - REAR MAIN SEAL LEAK

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 12).

(2) Leaks at the converter hub weld (Fig. 12).

CONVERTER HOUSING AREA LEAK CORRECTION

(1) Remove converter.

(2) Tighten front band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out when oil pump is removed.

(3) Remove oil pump and remove pump seal. Inspect pump housing drainback and vent holes for obstructions. Clear holes with solvent and wire.

(4) Inspect pump bushing and converter hub. If bushing is scored, replace it. If converter hub is scored, either polish it with crocus cloth or replace converter.

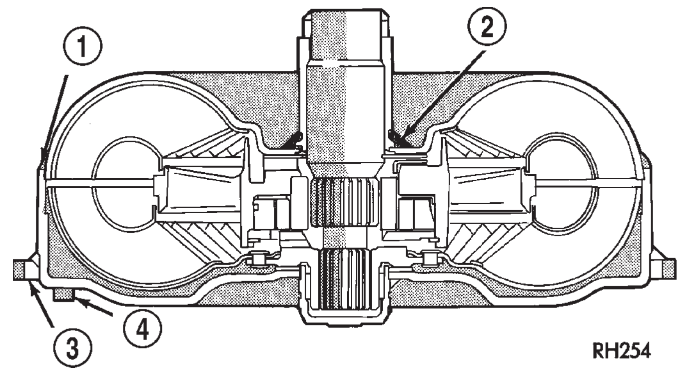


Fig. 12 Converter Leak Points - Typical

1 - OUTSIDE DIAMETER WELD
2 - TORQUE CONVERTER HUB WELD
3 - STARTER RING GEAR
4 - LUG

(5) Install new pump seal, O-ring, and gasket. Replace oil pump if cracked, porous or damaged in any way. Be sure to loosen the front band before installing the oil pump, damage to the oil pump seal may occur if the band is still tightened to the front clutch retainer.

(6) Loosen kickdown lever pin access plug three turns. Apply Loctite™ 592, or Permatex® No. 2 to plug threads and tighten plug to 17 N·m (150 in. lbs.) torque.

(7) Adjust front band.

(8) Lubricate pump seal and converter hub with transmission fluid or petroleum jelly and install converter.

(9) Install transmission and converter housing dust shield.

(10) Lower vehicle.

DIAGNOSIS AND TESTING - DIAGNOSIS CHARTS

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive unit and converter clutch fault conditions.

The hydraulic flow charts in the Schematics and Diagrams section of this group, outline fluid flow and hydraulic circuitry. Circuit operation is provided for PARK, NEUTRAL, FIRST, SECOND, THIRD, FOURTH, MANUAL FIRST, MANUAL SECOND, and REVERSE gear ranges. Normal working pressures are also supplied for each of the gear ranges.

AUTOMATIC TRANSMISSION - 42RE (Continued)

DIAGNOSIS CHARTS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low.	1. Add Fluid
	2. Throttle Linkage Mis-adjusted.	2. Adjust linkage - setting may be too long.
	3. Mount and Driveline Bolts Loose.	3. Check engine mount, transmission mount, propeller shaft, rear spring to body bolts, rear control arms, crossmember and axle bolt torque. Tighten loose bolts and replace missing bolts.
	4. U-Joint Worn/Broken.	4. Remove propeller shaft and replace U-Joint.
	5. Axle Backlash Incorrect.	5. Check per Service Manual. Correct as needed.
	6. Hydraulic Pressure Incorrect.	6. Check pressure. Remove, overhaul or adjust valve body as needed.
	7. Band Mis-adjusted.	7. Adjust rear band.
	8. Valve Body Check Balls Missing.	8. Inspect valve body for proper check ball installation.
	9. Axle Pinion Flange Loose.	9. Replace nut and check pinion threads before installing new nut. Replace pinion gear if threads are damaged.
	10. Clutch, band or planetary component damaged.	10. Remove, disassemble and repair transmission as necessary.
	11. Converter Clutch Faulty.	11. Replace converter and flush cooler and line before installing new converter.
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low.	1. Correct level and check for leaks.
	2. Filter Clogged.	2. Change filter.
	3. Gearshift Linkage Mis-adjusted.	3. Adjust linkage and repair linkage if worn or damaged.
	4. Torque Converter Drain Back (Oil drains from torque converter into transmission sump).	4. If vehicle moves normally after 5 seconds after shifting into gear, no repair is necessary. If longer, inspect pump bushing for wear. Replace pump house.
	5. Rear Band Mis-adjusted.	5. Adjust band.
	6. Valve Body Filter Plugged.	6. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	7. Oil Pump Gears Worn/Damaged.	7. Remove transmission and replace oil pump.
	8. Governor Circuit and Solenoid Valve Electrical Fault.	8. Test with DRB® scan tool and repair as required.
	9. Hydraulic Pressure Incorrect.	9. Perform pressure test, remove transmission and repair as needed.
	10. Reaction Shaft Seal Rings Worn/Broken.	10. Remove transmission, remove oil pump and replace seal rings.
	11. Rear Clutch/Input Shaft, Rear Clutch Seal Rings Damaged.	11. Remove and disassemble transmission and repair as necessary.
	12. Regulator Valve Stuck.	12. Clean.
	13. Cooler Plugged.	13. Transfer case failure can plug cooler.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE RANGE (REVERSE OK)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Repair or replace linkage components.
	3. Rear Clutch Burnt.	3. Remove and disassemble transmission and rear clutch and seals. Repair/replace worn or damaged parts as needed.
	4. Valve Body Malfunction.	4. Remove and disassemble valve body. Replace assembly if any valves or bores are damaged.
	5. Transmission Overrunning Clutch Broken.	5. Remove and disassemble transmission. Replace overrunning clutch.
	6. Input Shaft Seal Rings Worn/Damaged.	6. Remove and disassemble transmission. Replace seal rings and any other worn or damaged parts.
	7. Front Planetary Failed Broken.	7. Remove and repair.
NO DRIVE OR REVERSE (VEHICLE WILL NOT MOVE)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Inspect, adjust and reassemble linkage as needed. Replace worn/damaged parts.
	3. U-Joint/Axle/Transfer Case Broken.	3. Perform preliminary inspection procedure for vehicle that will not move. Refer to procedure in diagnosis section.
	4. Filter Plugged.	4. Remove and disassemble transmission. Repair or replace failed components as needed. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test. Flush oil. Replace cooler as necessary.
	5. Oil Pump Damaged.	5. Perform pressure test to confirm low pressure. Replace pump body assembly if necessary.
	6. Valve Body Malfunctioned.	6. Check and inspect valve body. Replace valve body (as assembly) if any valve or bore is damaged. Clean and reassemble correctly if all parts are in good condition.
	7. Transmission Internal Component Damaged.	7. Remove and disassemble transmission. Repair or replace failed components as needed.
	8. Park Sprag not Releasing - Check Stall Speed, Worn/ Damaged/Stuck.	8. Remove, disassemble, repair.
	9. Torque Converter Damage.	9. Inspect and replace as required.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Fluid Level Low/High.	1. Correct fluid level and check for leaks if low.
	2. Fluid Filter Clogged.	2. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test.
	3. Throttle Linkage Mis-adjusted.	3. Adjust linkage as described in service section.
	4. Throttle Linkage Binding.	4. Check cable for binding. Check for return to closed throttle at transmission.
	5. Gearshift Linkage/Cable Mis-adjusted.	5. Adjust linkage/cable as described in service section.
	6. Clutch or Servo Failure.	6. Remove valve body and air test clutch, and band servo operation. Disassemble and repair transmission as needed.
	7. Governor Circuit Electrical Fault.	7. Test using DRB® scan tool and repair as required.
	8. Front Band Mis-adjusted.	8. Adjust band.
	9. Pump Suction Passage Leak.	9. Check for excessive foam on dipstick after normal driving. Check for loose pump bolts, defective gasket. Replace pump assembly if needed.
NO REVERSE (D RANGES OK)	1. Gearshift Linkage/Cable Mis-adjusted/Damaged.	1. Repair or replace linkage parts as needed.
	2. Park Sprag Sticking.	2. Replace overdrive annulus gear.
	3. Rear Band Mis-adjusted/Worn.	3. Adjust band; replace.
	4. Valve Body Malfunction.	4. Remove and service valve body. Replace valve body if any valves or valve bores are worn or damaged.
	5. Rear Servo Malfunction.	5. Remove and disassemble transmission. Replace worn/damaged servo parts as necessary.
	6. Direct Clutch in Overdrive Worn.	6. Disassemble overdrive. Replace worn or damaged parts.
	7. Front Clutch Burnt.	7. Remove and disassemble transmission. Replace worn, damaged clutch parts as required.
HAS FIRST/REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor Circuit Electrical Fault.	1. Test using DRB® scan tool and repair as required.
	2. Valve Body Malfunction.	2. Repair stuck 1-2 shift valve or governor plug.
	3. Front Servo/Kickdown Band Damaged/Burned.	3. Repair/replace.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Valve Body Malfunction.	1. Remove, clean and inspect. Look for stuck 1-2 valve or governor plug.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor Circuit Electrical Fault.	1. Test with DRB® scan tool and repair as required.
	2. Valve Body Malfunction.	2. Remove, clean and inspect. Look for sticking 1-2 shift valve, 2-3 shift valve, governor plug or broken springs.
	3. Front Servo Piston Cocked in Bore.	3. Inspect servo and repair as required.
	4. Front Band Linkage Malfunction	4. Inspect linkage and look for bind in linkage.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Throttle Linkage Mis-adjusted.	1. Adjust linkage.
	2. Accelerator Pedal Travel Restricted.	2. Verify floor mat is not under pedal, repair worn accelerator cable or bent brackets.
	3. Valve Body Hydraulic Pressures Too High or Too Low Due to Valve Body Malfunction or Incorrect Hydraulic Control Pressure Adjustments.	3. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	4. Governor Circuit Electrical Fault.	4. Test with DRB® scan tool and repair as required.
	5. Valve Body Malfunction.	5. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	6. TPS Malfunction.	6. Replace sensor, check with DRB® scan tool.
	7. PCM Malfunction.	7. Check with DRB® scan tool and replace if required.
	8. Valve Body Malfunction.	8. Repair sticking 1-2, 2-3 shift valves, governor plugs, 3-4 solenoid, 3-4 shift valve, 3-4 timing valve.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Throttle Linkage Mis-adjusted/ Stuck.	1. Adjust linkage and repair linkage if worn or damaged. Check for binding cable or missing return spring.
	2. Gearshift Linkage Mis-adjusted.	2. Adjust linkage and repair linkage if worn or damaged.
	3. Governor Component Electrical Fault.	3. Check operating pressures and test with DRB® scan tool, repair faulty component.
	4. Front Band Out of Adjustment.	4. Adjust Band.
	5. Clutch or Servo Malfunction.	5. Air pressure check operation of clutches and bands. Repair faulty component.
CREEPS IN NEUTRAL	1. Gearshift Linkage Mis-adjusted.	1. Adjust linkage.
	2. Rear Clutch Dragging/Warped.	2. Disassemble and repair.
	3. Valve Body Malfunction.	3. Perform hydraulic pressure test to determine cause and repair as required.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BUZZING NOISE	1. Fluid Level Low	1. Add fluid and check for leaks.
	2. Shift Cable Mis-assembled.	2. Route cable away from engine and bell housing.
	3. Valve Body Mis-assembled.	3. Remove, disassemble, inspect valve body. Reassemble correctly if necessary. Replace assembly if valves or springs are damaged. Check for loose bolts or screws.
	4. Pump Passages Leaking.	4. Check pump for porous casting, scores on mating surfaces and excess rotor clearance. Repair as required. Loose pump bolts.
	5. Cooling System Cooler Plugged.	5. Flow check cooler circuit. Repair as needed.
	6. Overrunning Clutch Damaged.	6. Replace clutch.
SLIPS IN REVERSE ONLY	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Gearshift Linkage Mis-adjusted.	2. Adjust linkage.
	3. Rear Band Mis-adjusted.	3. Adjust band.
	4. Rear Band Worn.	4. Replace as required.
	5. Overdrive Direct Clutch Worn.	5. Disassemble overdrive. Repair as needed.
	6. Hydraulic Pressure Too Low.	6. Perform hydraulic pressure tests to determine cause.
	7. Rear Servo Leaking.	7. Air pressure check clutch-servo operation and repair as required.
	8. Band Linkage Binding.	8. Inspect and repair as required.
SLIPS IN FORWARD DRIVE RANGES	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Fluid Foaming.	2. Check for high oil level, bad pump gasket or seals, dirt between pump halves and loose pump bolts. Replace pump if necessary.
	3. Throttle Linkage Mis-adjusted.	3. Adjust linkage.
	4. Gearshift Linkage Mis-adjusted.	4. Adjust linkage.
	5. Rear Clutch Worn.	5. Inspect and replace as needed.
	6. Low Hydraulic Pressure Due to Worn Pump, Incorrect Control Pressure Adjustments, Valve Body Warpage or Malfunction, Sticking, Leaking Seal Rings, Clutch Seals Leaking, Servo Leaks, Clogged Filter or Cooler Lines.	6. Perform hydraulic and air pressure tests to determine cause.
	7. Rear Clutch Malfunction, Leaking Seals or Worn Plates.	7. Air pressure check clutch-servo operation and repair as required.
	8. Overrunning Clutch Worn, Not Holding (Slips in 1 Only).	8. Replace Clutch.
SLIPS IN LOW GEAR ″D″ ONLY, BUT NOT IN MANUAL 1 POSITION	Overrunning Clutch Faulty.	Replace overrunning clutch.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GROWLING, GRATING OR SCRAPING NOISES	1. Drive Plate Broken.	1. Replace.
	2. Torque Converter Bolts Hitting Dust Shield.	2. Dust shield bent. Replace or repair.
	3. Planetary Gear Set Broken/ Seized.	3. Check for debris in oil pan and repair as required.
	4. Overrunning Clutch Worn/ Broken.	4. Inspect and check for debris in oil pan. Repair as required.
	5. Oil Pump Components Scored/Binding.	5. Remove, inspect and repair as required.
	6. Output Shaft Bearing or Bushing Damaged.	6. Remove, inspect and repair as required.
	7. Clutch Operation Faulty.	7. Perform air pressure check and repair as required.
	8. Front and Rear Bands Mis-adjusted.	8. Adjust bands.
DRAGS OR LOCKS UP	1. Fluid Level Low.	1. Check and adjust level.
	2. Clutch Dragging/Failed	2. Air pressure check clutch operation and repair as required.
	3. Front or Rear Band Mis-adjusted.	3. Adjust bands.
	4. Case Leaks Internally.	4. Check for leakage between passages in case.
	5. Servo Band or Linkage Malfunction.	5. Air pressure check servo operation and repair as required.
	6. Overrunning Clutch Worn.	6. Remove and inspect clutch. Repair as required.
	7. Planetary Gears Broken.	7. Remove, inspect and repair as required (look for debris in oil pan).
	8. Converter Clutch Dragging.	8. Check for plugged cooler. Perform flow check. Inspect pump for excessive side clearance. Replace pump as required.
NO 4-3 DOWNSHIFT	1. Circuit Wiring and/or Connectors Shorted.	1. Test wiring and connectors with test lamp and volt/ohmmeter. Repair wiring as necessary. Replace connectors and/or harnesses as required.
	2. PCM Malfunction.	2. Check PCM operation with DRB® scan tool. Replace PCM only if faulty.
	3. TPS Malfunction	3. Check TPS with DRB® scan tool at PCM.
	4. Lockup Solenoid Not Venting.	4. Remove valve body and replace solenoid assembly if plugged or shorted.
	5. Overdrive Solenoid Not Venting.	5. Remove valve body and replace solenoid if plugged or shorted.
	6. Valve Body Valve Sticking.	6. Repair stuck 3-4 shift valve or lockup timing valve.
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control Switch Open/Shorted.	1. Test and replace switch if faulty.
	2. Overdrive Solenoid Connector Shorted.	2. Test solenoids and replace if seized or shorted.
	3. PCM Malfunction.	3. Test with DRB® scan tool. Replace PCM if faulty.
	4. Valve Body Stuck Valves.	4. Repair stuck 3-4, lockup or lockup timing valve.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUNK NOISE FROM DRIVELINE ON CLOSED THROTTLE 4-3 DOWNSHIFT	1. Transmission Fluid Low.	1. Add Fluid.
	2. Throttle Cable Mis-adjusted.	2. Adjust cable.
	3. Overdrive Clutch Select Spacer Wrong Spacer.	3. Replace overdrive piston thrust plate spacer.
3-4 UPSHIFT OCCURS IMMEDIATELY AFTER 2-3 SHIFT	1. Overdrive Solenoid Connector or Wiring Shorted.	1. Test connector and wiring for loose connections, shorts or ground and repair as needed.
	2. TPS Malfunction.	2. Test TPS and replace as necessary. Check with DRB® scan tool.
	3. PCM Malfunction.	3. Test PCM with DRB® scan tool and replace controller if faulty.
	4. Overdrive Solenoid Malfunction.	4. Replace solenoid.
	5. Valve Body Malfunction.	5. Remove, disassemble, clean and inspect valve body components. Make sure all valves and plugs slide freely in bores. Polish valves with crocus cloth if needed.
WHINE/NOISE RELATED TO ENGINE SPEED	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Shift Cable Incorrect Routing.	2. Check shift cable for correct routing. Should not touch engine or bell housing.
NO 3-4 UPSHIFT	1. O/D Switch In OFF Position.	1. Turn control switch to ON position.
	2. Overdrive Circuit Fuse Blown.	2. Replace fuse. Determine why fuse failed and repair as necessary (i.e., shorts or grounds in circuit).
	3. O/D Switch Wire Shorted/Open Cut.	3. Check wires/connections with 12V test lamp and voltmeter. Repair damaged or loose wire/connection as necessary.
	4. Distance or Coolant Sensor Malfunction.	4. Check with DRB® scan tool and repair or replace as necessary.
	5. TPS Malfunction.	5. Check with DRB® scan tool and replace if necessary.
	6. Neutral Sense to PCM Wire Shorted/Cut.	6. Test switch/sensor as described in service section and replace if necessary. Engine no start.
	7. PCM Malfunction.	7. Check with DRB® scan tool and replace if necessary.
	8. Overdrive Solenoid Shorted/ Open.	8. Replace solenoid if shorted or open and repair loose or damaged wires (DRB® scan tool).
	9. Solenoid Feed Orifice in Valve Body Blocked.	9. Remove, disassemble, and clean valve body thoroughly. Check feed orifice.
	10. Overdrive Clutch Failed.	10. Disassemble overdrive and repair as needed.
	11. Hydraulic Pressure Low.	11. Pressure test transmission to determine cause.
	12. Valve Body Valve Stuck.	12. Repair stuck 3-4 shift valve, 3-4 timing valve.
	13. O/D Piston Incorrect Spacer.	13. Remove unit, check end play and install correct spacer.
	14. Overdrive Piston Seal Failure.	14. Replace both seals.
	15. O/D Check Valve/Orifice Failed.	15. Check for free movement and secure assembly (in piston retainer). Check ball bleed orifice.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN OVERDRIVE FOURTH GEAR	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Overdrive Clutch Pack Worn.	2. Remove overdrive unit and rebuild clutch pack.
	3. Overdrive Piston Retainer Bleed Orifice Blown Out.	3. Disassemble transmission, remove retainer and replace orifice.
	4. Overdrive Piston or Seal Malfunction.	4. Remove overdrive unit. Replace seals if worn. Replace piston if damaged. If piston retainer is damaged, remove and disassemble the transmission.
	5. 3-4 Shift Valve, Timing Valve or Accumulator Malfunction.	5. Remove and overhaul valve body. Replace accumulator seals. Make sure all valves operate freely in bores and do not bind or stick. Make sure valve body screws are correctly tightened and separator plates are properly positioned.
	6. Overdrive Unit Thrust Bearing Failure.	6. Disassemble overdrive unit and replace thrust bearing (NO. 1 thrust bearing is between overdrive piston and clutch hub; NO. 2 thrust bearing is between the planetary gear and the direct clutch spring plate; NO. 3 thrust bearing is between overrunning clutch hub and output shaft).
	7. O/D Check Valve/Bleed Orifice Failure.	7. Check for function/secure orifice insert in O/D piston retainer.
DELAYED 3-4 UPSHIFT (SLOW TO ENGAGE)	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Throttle Valve Cable Mis-adjusted.	2. Adjust throttle valve cable.
	3. Overdrive Clutch Pack Worn/Burnt.	3. Remove unit and rebuild clutch pack.
	4. TPS Faulty.	4. Test with DRB® scan tool and replace as necessary
	5. Overdrive Clutch Bleed Orifice Plugged.	5. Disassemble transmission and replace orifice.
	6. Overdrive Solenoid or Wiring Shorted/Open.	6. Test solenoid and check wiring for loose/corroded connections or shorts/grounds. Replace solenoid if faulty and repair wiring if necessary.
	7. Overdrive Excess Clearance.	7. Remove unit. Measure end play and select proper spacer.
	8. O/D Check Valve Missing or Stuck.	8. Check for presence of check valve. Repair or replace as required.
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR	Lockup Solenoid, Relay or Wiring Shorted/Open.	Test solenoid, relay and wiring for continuity, shorts or grounds. Replace solenoid and relay if faulty. Repair wiring and connectors as necessary.
HARSH 1-2, 2-3, 3-4 OR 3-2 SHIFTS	Lockup Solenoid Malfunction.	Remove valve body and replace solenoid assembly.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO START IN PARK OR NEUTRAL	1. Gearshift Linkage/Cable Mis-adjusted.	1. Adjust linkage/cable.
	2. Neutral Sense Wire Open/Cut.	2. Check continuity with test lamp. Repair as required.
	3. Park/Neutral Switch, or Transmission Range Sensor Faulty.	3. Refer to service section for test and replacement procedure.
	4. Park/Neutral Switch, or Transmission Range Sensor Connection Faulty.	4. Connectors spread open. Repair.
	5. Valve Body Manual Lever Assembly Bent/Worn/Broken.	5. Inspect lever assembly and replace if damaged.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct Clutch Pack (front clutch) Worn.	1. Disassemble unit and rebuild clutch pack.
	2. Rear Band Mis-adjusted.	2. Adjust band.
	3. Front Clutch Malfunctioned/ Burned.	3. Air-pressure test clutch operation. Remove and rebuild if necessary.
	4. Overdrive Thrust Bearing Failure.	4. Disassemble geartrain and replace bearings.
	5. Direct Clutch Spring Collapsed/ Broken.	5. Remove and disassemble unit. Check clutch position and replace spring.

AUTOMATIC TRANSMISSION - 42RE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS.	1. Fluid Lines and Fittings Loose/Leaks/Damaged.	1. Tighten fittings. If leaks persist, replace fittings and lines if necessary.
	2. Fill Tube (where tube enters case) Leaks/Damaged.	2. Replace tube seal. Inspect tube for cracks in fill tube.
	3. Pressure Port Plug Loose Loose/Damaged.	3. Tighten to correct torque. Replace plug or reseal if leak persists.
	4. Pan Gasket Leaks.	4. Tighten pan screws (150 in. lbs.). If leaks persist, replace gasket.
	5. Valve Body Manual Lever Shaft Seal Leaks/Worn.	5. Replace shaft seal.
	6. Rear Bearing Access Plate Leaks.	6. Replace gasket. Tighten screws.
	7. Gasket Damaged or Bolts are Loose.	7. Replace bolts or gasket or tighten both.
	8. Adapter/Extension Gasket Damaged Leaks/Damaged.	8. Replace gasket.
	9. Park/Neutral Switch, or Transmission Range Sensor Leaks/Damaged.	9. Replace switch and gasket.
	10. Converter Housing Area Leaks.	10. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return, oil in front pump housing or hole plugged. Check for leaks past O-ring seal on pump or past pump-to-case bolts; pump housing porous, oil coming out vent due to overfill or leak past front band shaft access plug.
	11. Pump Seal Leaks/Worn/ Damaged.	11. Replace seal.
	12. Torque Converter Weld Leak/Cracked Hub.	12. Replace converter.
	13. Case Porosity Leaks.	13. Replace case.
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive Clutch Discs, Plates or Snap Rings Damaged.	1. Remove unit and rebuild clutch pack.
	2. Overdrive Piston or Planetary Thrust Bearing Damaged.	2. Remove and disassemble unit. Replace either thrust bearing if damaged.
	3. Output Shaft Bearings Scored/Damaged.	3. Remove and disassemble unit. Replace either bearing if damaged.
	4. Planetary Gears Worn/Chipped.	4. Remove and overhaul overdrive unit.
	5. Overdrive Unit Overrunning Clutch Rollers Worn/Scored.	5. Remove and overhaul overdrive unit.

STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

AUTOMATIC TRANSMISSION - 42RE (Continued)

REMOVAL

The overdrive unit can be removed and serviced separately. It is not necessary to remove the entire transmission assembly to perform overdrive unit repairs.

If only the overdrive unit requires service, refer to Overdrive Removal for proper procedures.

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

(1) Disconnect battery negative cable.

(2) Disconnect and lower or remove necessary exhaust components.

(3) Disconnect fluid cooler lines at transmission.

(4) Remove starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL)

(5) Disconnect and remove crankshaft position sensor. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/CRANKSHAFT POSITION SENSOR - REMOVAL) Retain sensor attaching bolts.

CAUTION: The crankshaft position sensor will be damaged if the transmission is removed, or installed, while the sensor is still bolted to the engine block, or transmission (4.0L only). To avoid damage, be sure to remove the sensor before removing the transmission.

(6) Remove the bolts holding the bell housing brace to the transmission.

(7) Remove nut holding the bell housing brace to the engine to transmission bending brace.

(8) Remove the bell housing brace from the transmission (Fig. 13).

(9) Remove the bolt holding the torque converter cover to the transmission.

(10) Remove the torque converter cover from the transmission.

(11) If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan.

(12) Remove fill tube bracket bolts and pull tube out of transmission. Retain fill tube seal. On 4 x 4 models, it will also be necessary to remove bolt attaching transfer case vent tube to converter housing.

(13) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

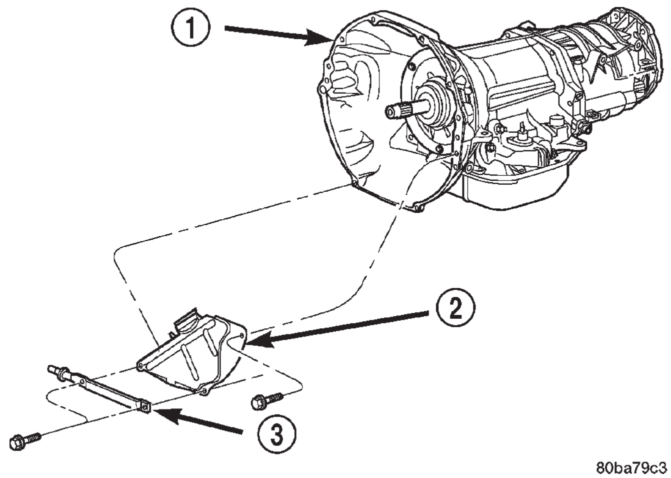


Fig. 13 Bell Housing Brace and Converter Cover

1 - Transmission
2 - Torque Converter Cover
3 - Bellhousing Brace

(14) Mark propeller shaft and axle yokes for assembly alignment. Then disconnect and remove propeller shaft. On 4 x 4 models, remove both propeller shafts.

(15) Disconnect wires from park/neutral position switch and transmission solenoid.

(16) Disconnect gearshift cable from transmission manual valve lever (Fig. 14).

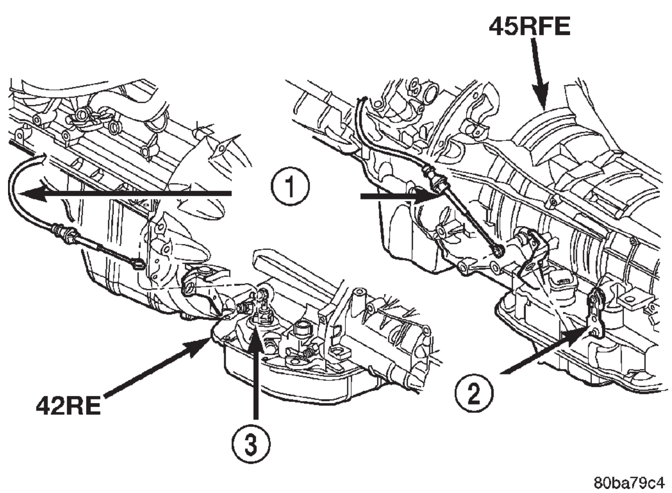


Fig. 14 Transmission Shift Cable

1 - SHIFT CABLE
2 - MANUAL LEVER
3 - MANUAL LEVER

AUTOMATIC TRANSMISSION - 42RE (Continued)

(17) Disconnect throttle valve cable from transmission bracket and throttle valve lever (Fig. 15).

(18) Disconnect transfer case shift cable from the transfer case shift lever (Fig. 16).

(19) Remove the clip securing the transfer case shift cable into the cable support bracket.

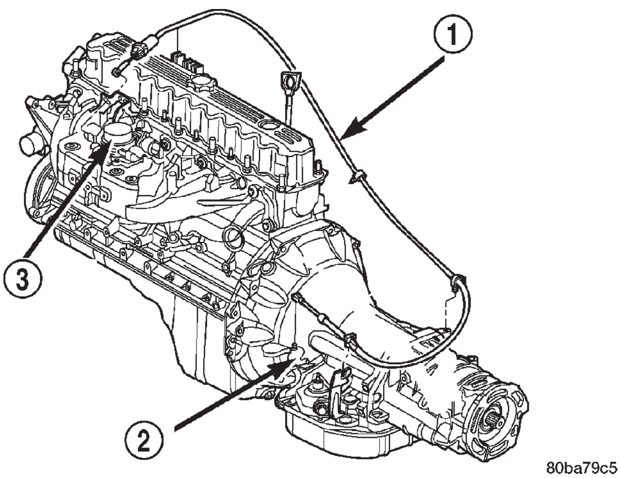


Fig. 15 Throttle Valve Cable

1 - THROTTLE VALVE CABLE
2 - THROTTLE VALVE LEVER
3 - THROTTLE BODY

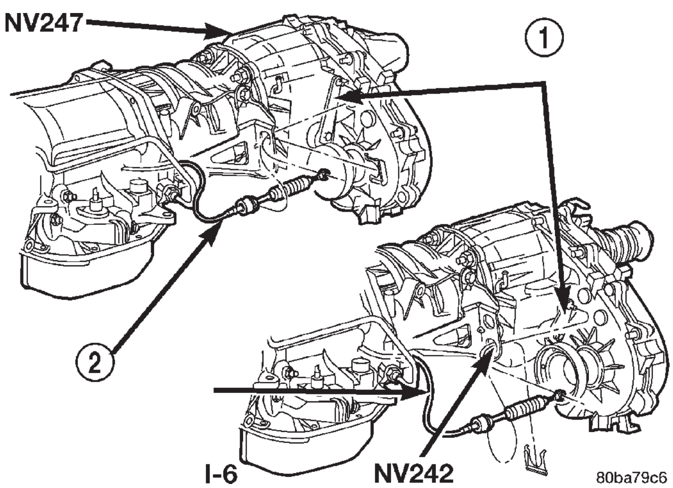


Fig. 16 Transfer Case Shift Cable

1 - TRANSFER CASE SHIFT LEVER
2 - TRANSFER CASE SHIFT CABLE

(20) Disconnect transmission fluid cooler lines at transmission fittings and clips.

(21) Support rear of engine with safety stand or jack.

(22) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(23) Remove bolts securing rear support and cushion to transmission and crossmember (Fig. 17).

(24) Remove bolts attaching crossmember to frame and remove crossmember.

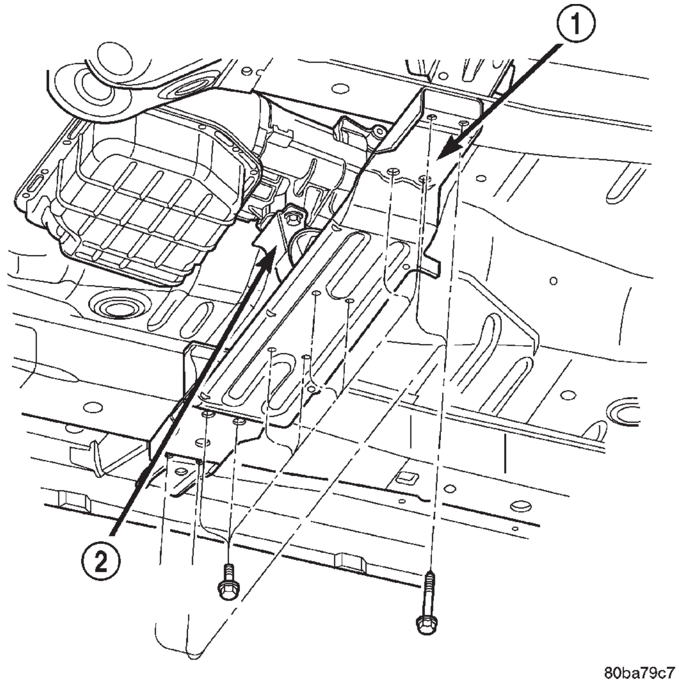


Fig. 17 Rear Transmission Crossmember

1 - CROSSMEMBER
2 - REAR TRANSMISSION MOUNT

(25) Remove transfer case (Fig. 18) and (Fig. 19).

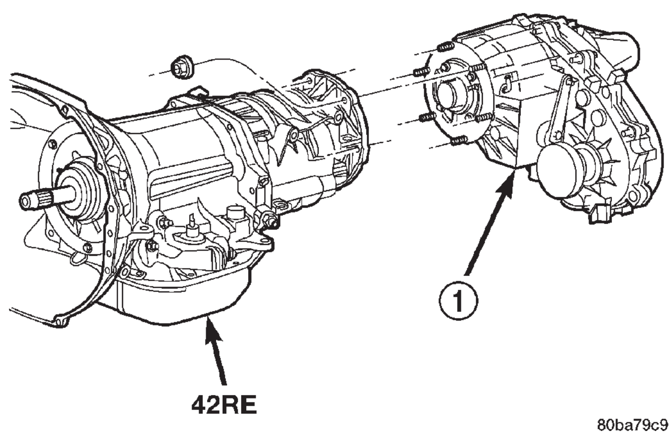


Fig. 18 Remove NV247 Transfer Case

1 - NV247 TRANSFER CASE

AUTOMATIC TRANSMISSION - 42RE (Continued)

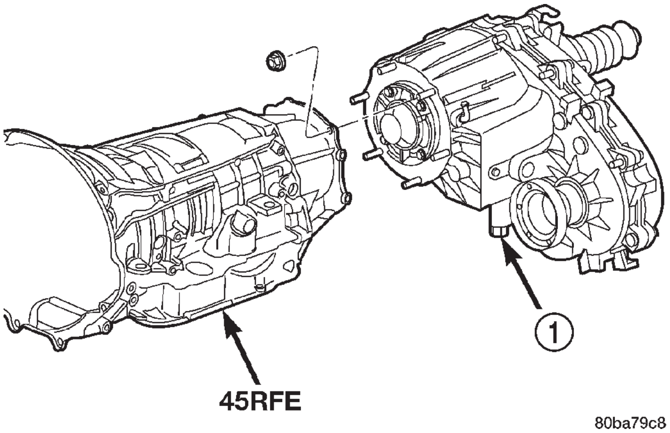


Fig. 19 Remove NV242 Transfer Case

1 - NV242 TRANSFER CASE

(26) Remove bolts holding the upper transmission bending braces to the torque converter housing and the overdrive unit (Fig. 20).

(27) Remove all remaining converter housing bolts.

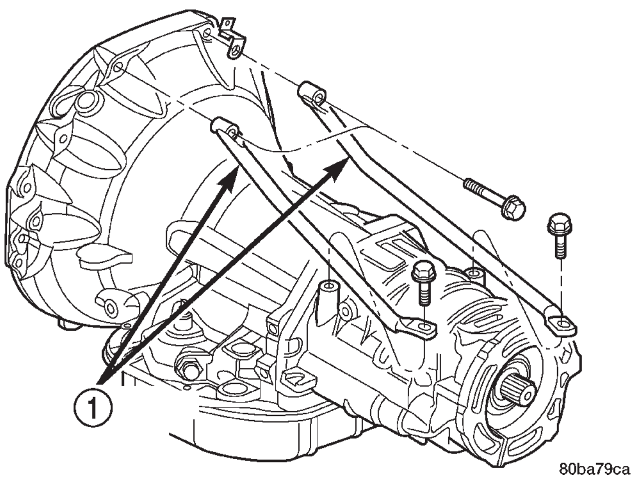


Fig. 20 Remove Upper Transmission Bending Braces

1 - TRANSMISSION BENDING BRACES

(28) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(29) Hold torque converter in place during transmission removal.

(30) Lower transmission and remove assembly from under the vehicle.

(31) To remove torque converter, carefully slide torque converter out of the transmission.

DISASSEMBLY

(1) Clean transmission exterior with steam gun or with solvent. Wear eye protection during cleaning operations.

(2) Place transmission in a vertical position.

(3) Measure input shaft end play as follows (Fig. 21).

(a) Attach Adapter 8266-6 to Handle 8266-8.

(b) Attach dial indicator C-3339 to Handle 8266-8.

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266-6 to secure it to the input shaft.

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

(e) Move the input shaft in and out. Record the maximum travel for assembly reference.

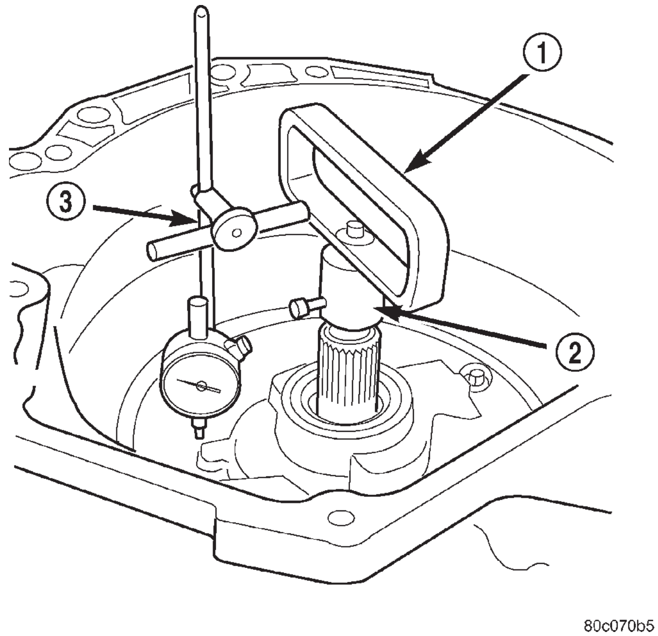


Fig. 21 Checking Input Shaft End Play

1 - TOOL 8266-8
2 - TOOL 8266-6
3 - TOOL C-3339

(4) Remove shift and throttle levers from valve body manual lever shaft.

(5) Place transmission in horizontal position.

(6) Remove transmission oil pan and gasket.

(7) Remove filter from valve body (Fig. 22). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.

(8) Remove park/neutral position switch.

(9) Remove hex head bolts attaching valve body to transmission case (Fig. 23). A total of 10 bolts are used. Note different bolt lengths for assembly reference.

AUTOMATIC TRANSMISSION - 42RE (Continued)

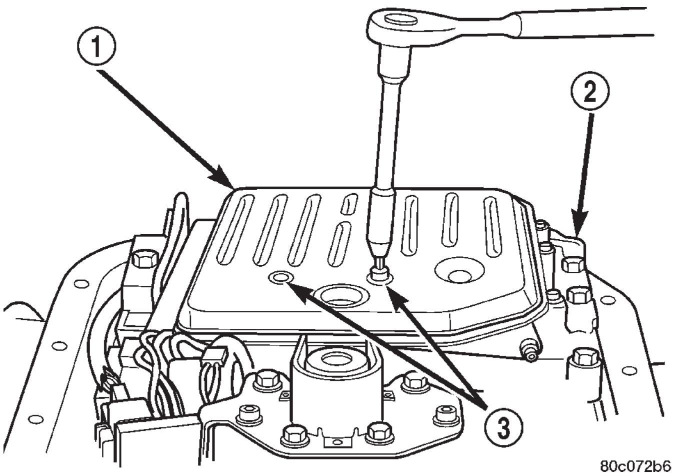


Fig. 22 Oil Filter Removal

1 - OIL FILTER
2 - VALVE BODY
3 - FILTER SCREWS (2)

(10) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 24).

(11) Remove accumulator piston and inner and outer springs (Fig. 25).

(12) Remove pump oil seal with suitable pry tool or slide-hammer mounted screw.

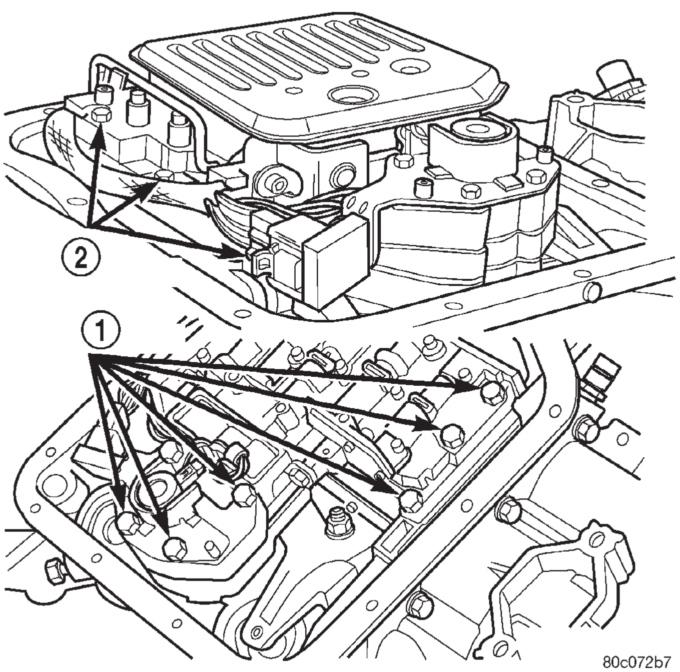


Fig. 23 Valve Body Bolt Locations

1 - VALVE BODY BOLTS
2 - VALVE BODY BOLTS

(13) Loosen front band adjusting screw locknut 4-5 turns. Then tighten band adjusting screw until band

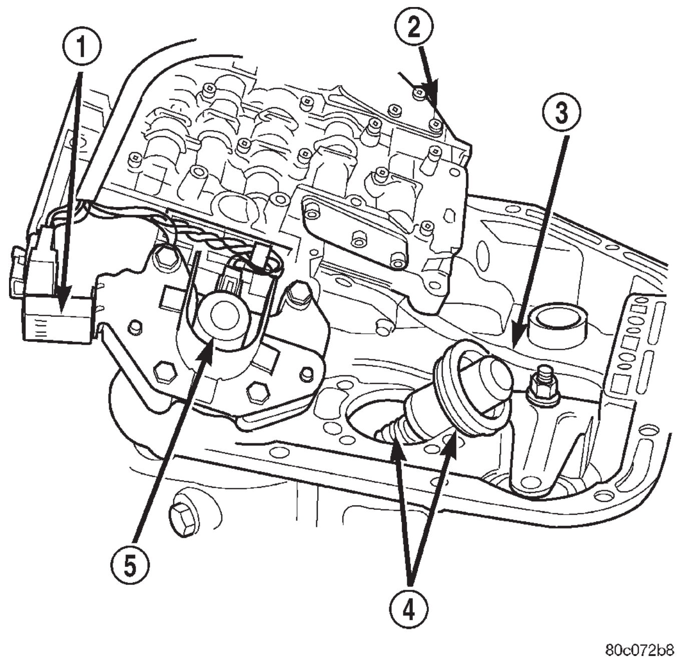


Fig. 24 Valve Body Removal

1 - GOVERNOR PRESSURE SENSOR
2 - VALVE BODY
3 - PARK ROD
4 - ACCUMULATOR PISTON
5 - GOVERNOR PRESSURE SOLENOID

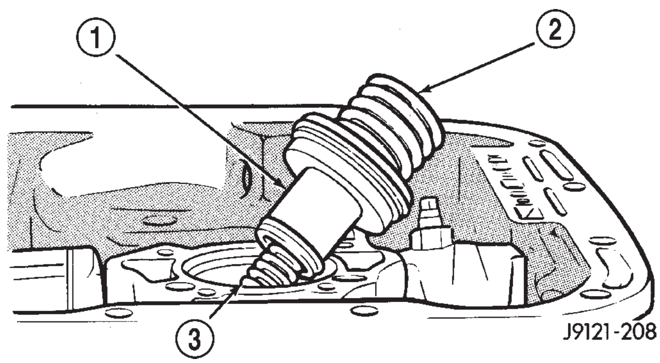


Fig. 25 Accumulator Piston And Springs

1 - ACCUMULATOR PISTON
2 - OUTER SPRING
3 - INNER SPRING

is tight around front clutch retainer. This prevents front/rear clutches from coming out with pump and possibly damaging clutch or pump components.

(14) Remove oil pump bolts.

(15) Thread bolts of Slide Hammer Tools C-3752 into threaded holes in pump body flange (Fig. 26).

(16) Bump slide hammer weights outward to remove pump and reaction shaft support assembly from case (Fig. 26).

(17) Loosen front band adjusting screw until band is completely loose.

AUTOMATIC TRANSMISSION - 42RE (Continued)

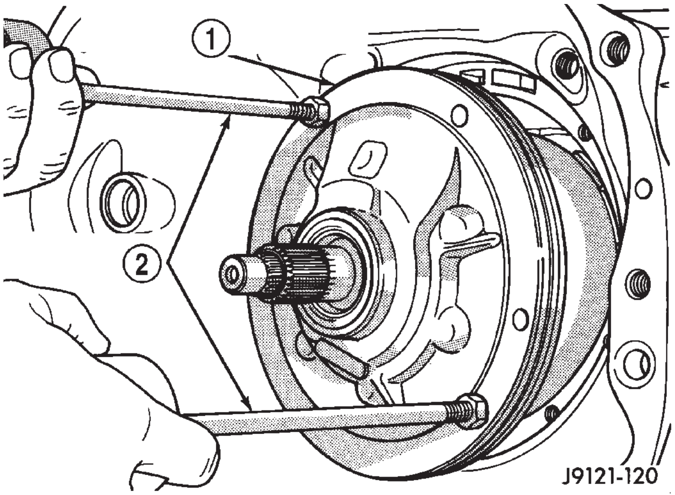


Fig. 26 Removing Oil Pump And Reaction Shaft Support Assembly

1 - OIL PUMP AND REACTION SHAFT SUPPORT ASSEMBLY
2 - SLIDE HAMMER TOOLS C-3752

(18) Squeeze front band together and remove band strut (Fig. 27).

(19) Remove front band lever (Fig. 28).

(20) Remove front band lever shaft plug, if necessary, from converter housing.

(21) Remove front band lever shaft.

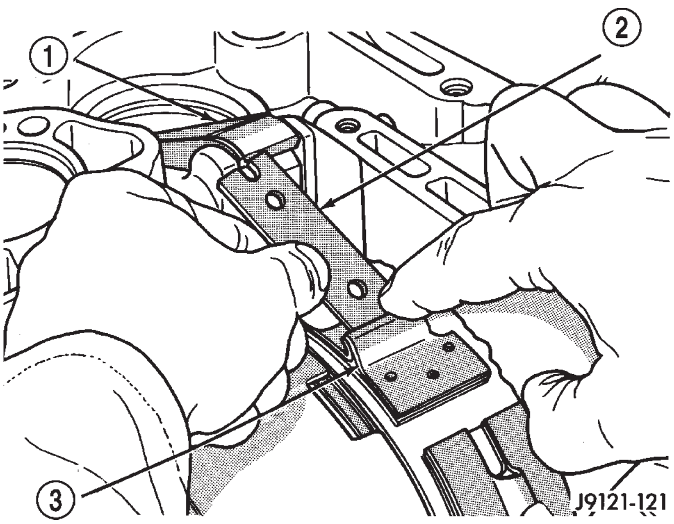


Fig. 27 Removing Front Band Strut

1 - BAND LEVER
2 - BAND STRUT
3 - FRONT BAND

(22) Remove front and rear clutch units as assembly. Grasp input shaft, hold clutch units together and remove them from case (Fig. 29).

(23) Lift front clutch off rear clutch (Fig. 30). Set clutch units aside for overhaul.

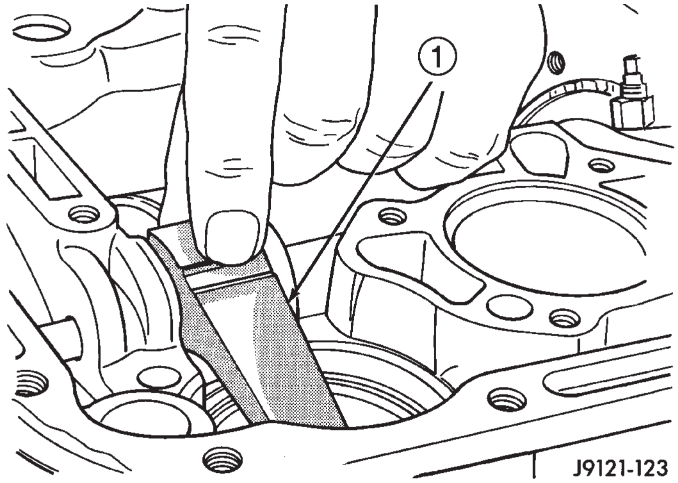


Fig. 28 Removing Front Band Lever

1 - FRONT BAND LEVER

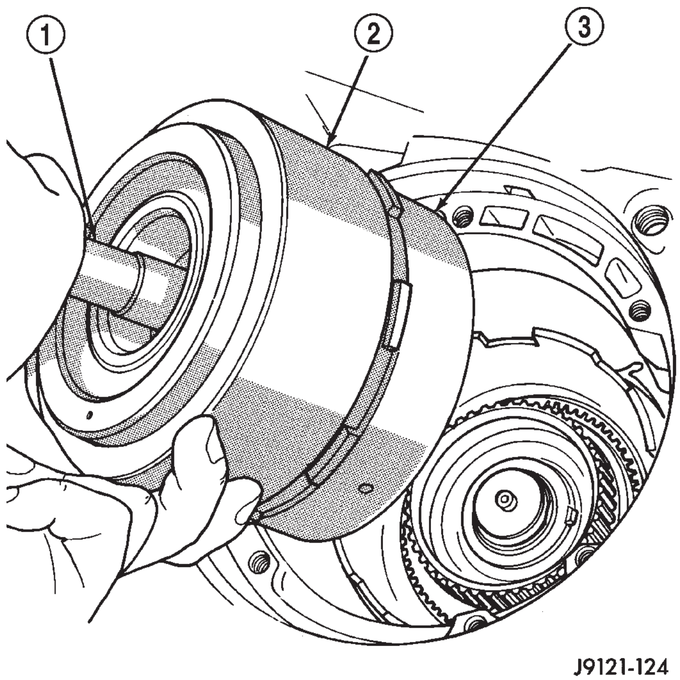


Fig. 29 Removing Front/Rear Clutch Assemblies

1 - INPUT SHAFT
2 - FRONT CLUTCH
3 - REAR CLUTCH

(24) Remove intermediate shaft thrust washer from front end of shaft or from rear clutch hub (Fig. 31).

(25) Remove output shaft thrust plate from intermediate shaft hub (Fig. 32).

(26) Slide front band off driving shell (Fig. 33) and remove band from case.

AUTOMATIC TRANSMISSION - 42RE (Continued)

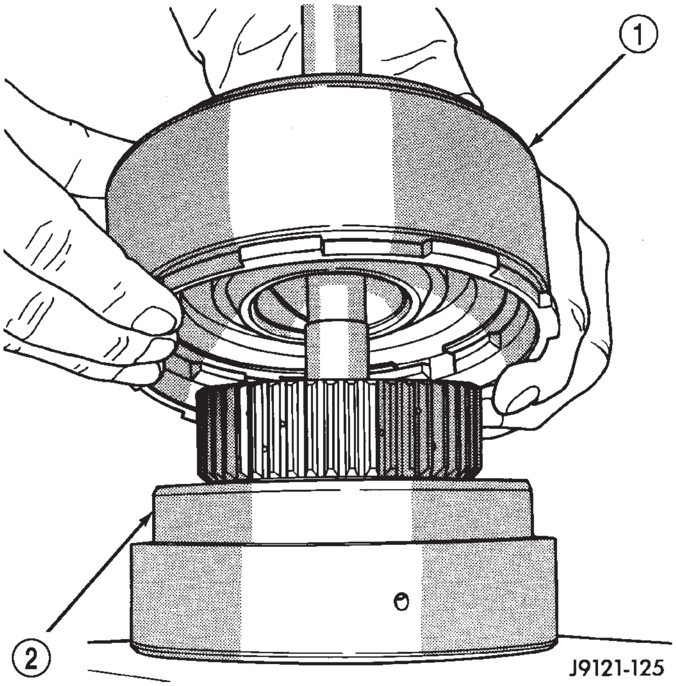


Fig. 30 Separating Front/Rear Clutch Assemblies

1 - FRONT CLUTCH
2 - REAR CLUTCH

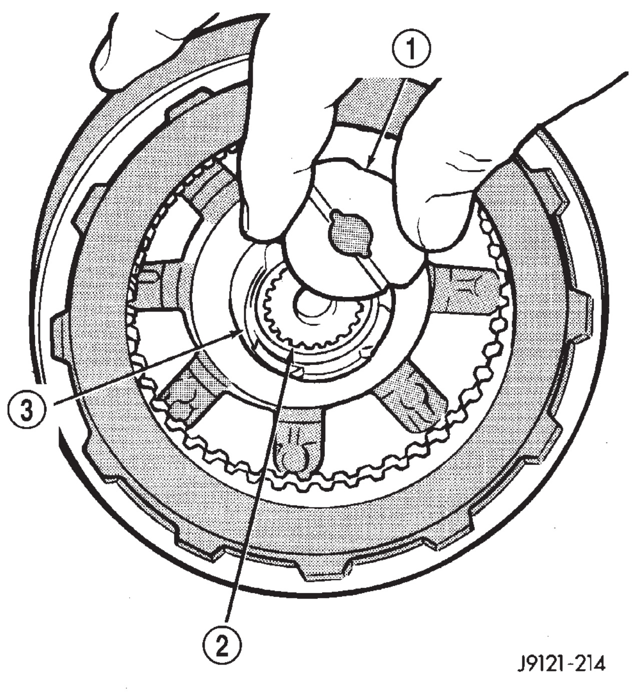


Fig. 31 Removing Intermediate Shaft Thrust Washer

1 - INTERMEDIATE SHAFT THRUST WASHER
2 - INPUT SHAFT
3 - REAR CLUTCH RETAINER HUB

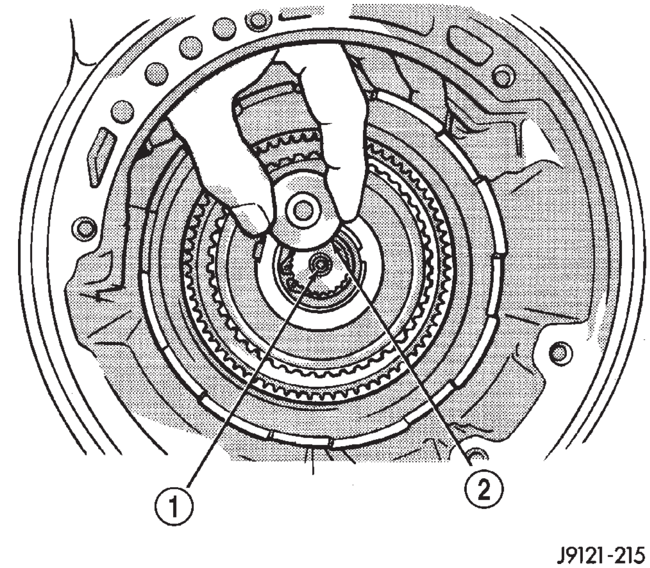


Fig. 32 Removing Intermediate Shaft Thrust Plate

1 - INTERMEDIATE SHAFT HUB
2 - INTERMEDIATE SHAFT THRUST PLATE

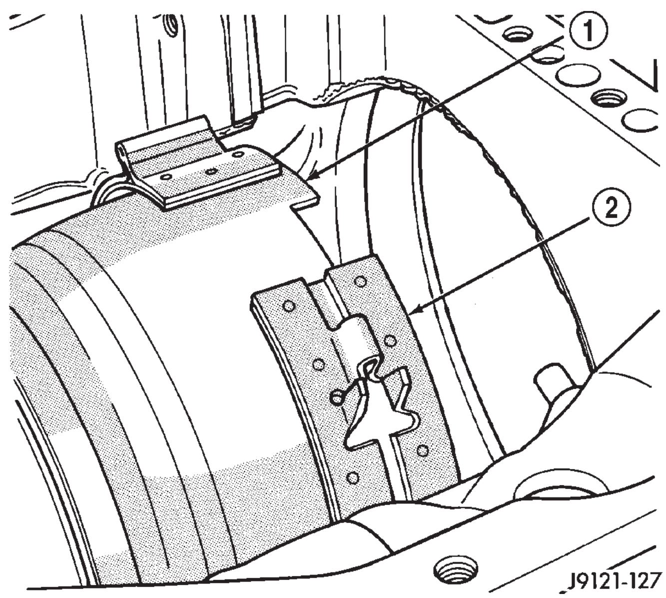


Fig. 33 Front Band Removal

1 - DRIVING SHELL
2 - FRONT BAND

(27) Remove planetary geartrain as assembly (Fig. 34). Support geartrain with both hands during removal. Do not allow machined surfaces on intermediate shaft or overdrive piston retainer to become nicked or scratched.

(28) If overdrive unit is not to be serviced, install Alignment Shaft 6227-2 into the overdrive unit to prevent misalignment of the overdrive clutches during service of main transmission components.

AUTOMATIC TRANSMISSION - 42RE (Continued)

(29) Loosen rear band adjusting screw 4-5 turns.

(30) Remove low-reverse drum snap-ring (Fig. 35).

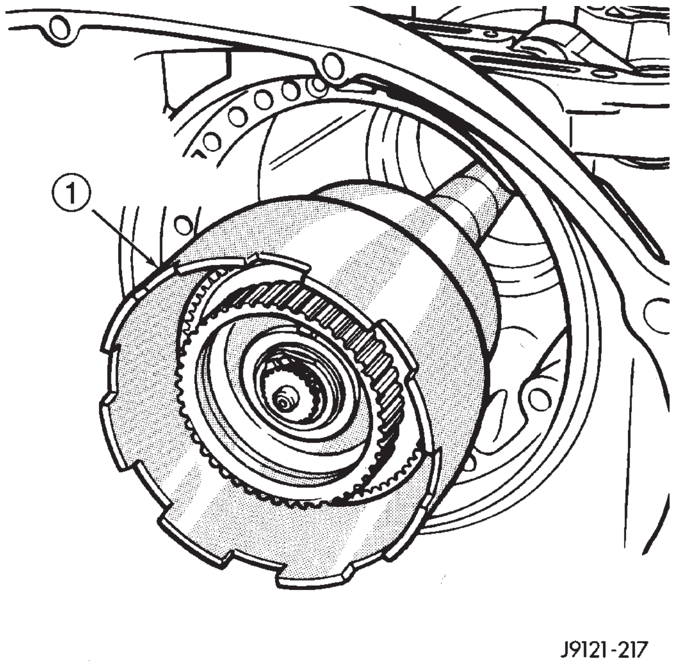


Fig. 34 Removing Planetary Geartrain And Intermediate Shaft Assembly

1 - PLANETARY GEARTRAIN AND INTERMEDIATE SHAFT ASSEMBLY

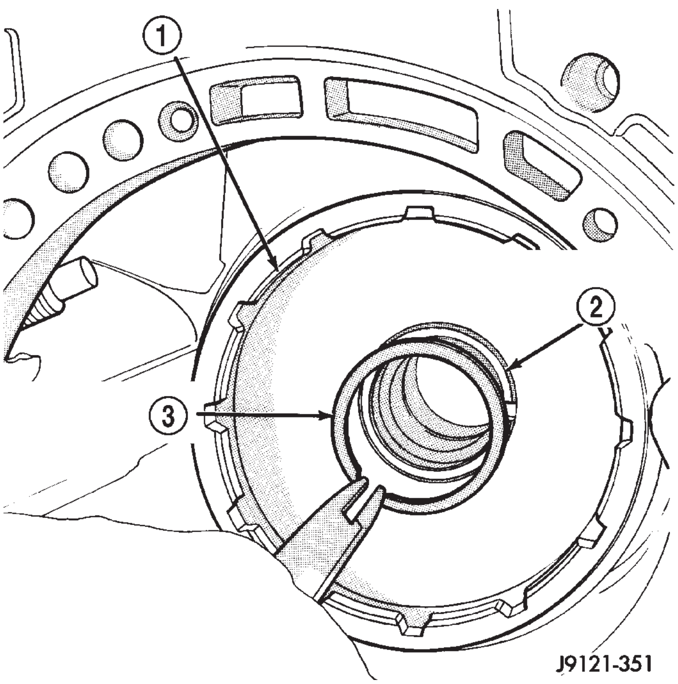


Fig. 35 Removing Low-Reverse Drum Snap-Ring

1 - LOW-REVERSE DRUM
2 - HUB OF OVERDRIVE PISTON RETAINER
3 - LOW-REVERSE DRUM SNAP-RING

(31) Remove low-reverse drum and reverse band.

(32) Remove overrunning clutch roller and spring assembly as a unit (Fig. 36).

(33) Compress front servo rod guide about 1/8 inch with Valve Spring Compressor C-3422-B (Fig. 37).

(34) Remove front servo rod guide snap-ring. Exercise caution when removing snap-ring. Servo bore can be scratched or nicked if care is not exercised.

(35) Remove compressor tools and remove front servo rod guide, spring and servo piston.

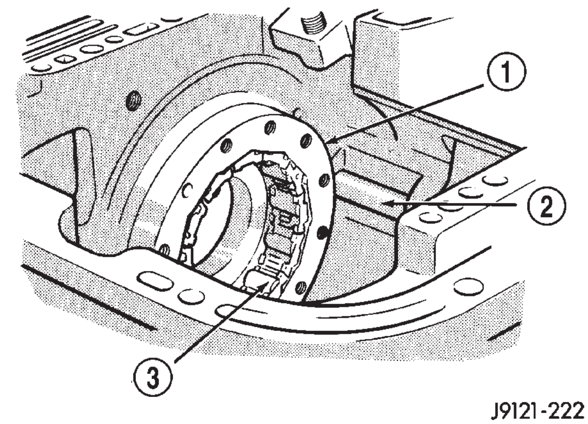


Fig. 36 Overrunning Clutch Assembly Removal

1 - OVERRUNNING CLUTCH CAM
2 - REAR BAND REACTION PIN
3 - OVERRUNNING CLUTCH ASSEMBLY

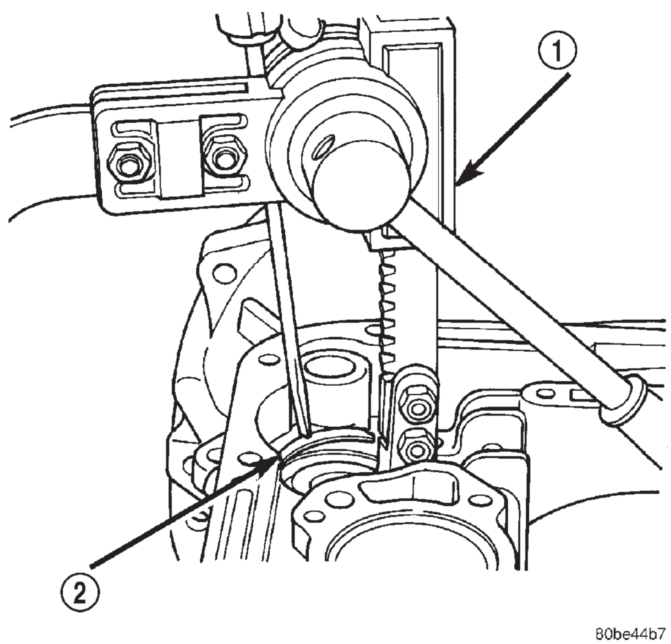


Fig. 37 Compressing Front Servo Rod Guide

1 - SPRING COMPRESSOR TOOL C-3422-B
2 - ROD GUIDE SNAP-RING

AUTOMATIC TRANSMISSION - 42RE (Continued)

(36) Compress rear servo spring retainer about 1/16 inch with Valve Spring Compressor C-3422-B (Fig. 38).

(37) Remove rear servo spring retainer snap-ring. Then remove compressor tools and remove rear servo spring and piston.

(38) Inspect transmission components.

NOTE: To Service the overrunning clutch cam or overdrive piston retainer, refer to the Overrunning Clutch Cam service procedure in this section.

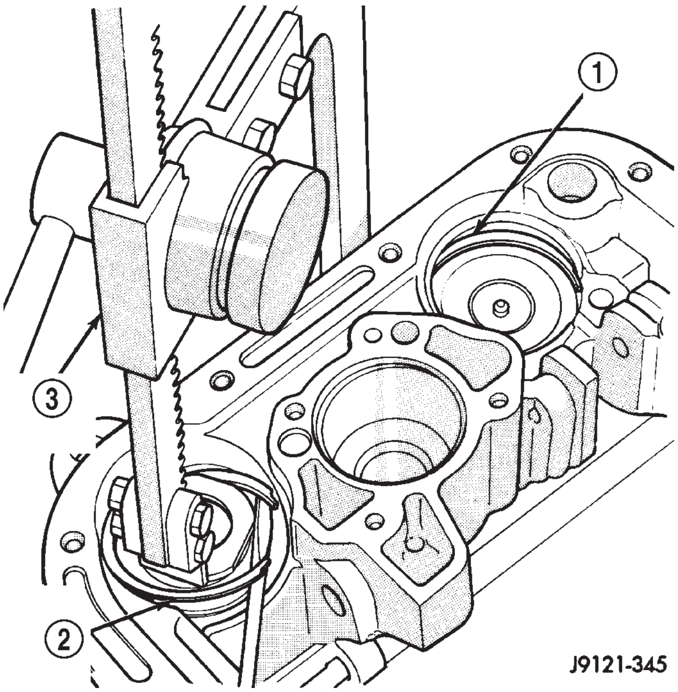


Fig. 38 Compressing Rear Servo Spring

1 - FRONT SERVO SNAP-RING
2 - REAR SERVO SNAP-RING
3 - SPECIAL TOOL

CLEANING

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Lubricate transmission parts with Mopar® ATF +4, type 9602, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde™ to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

INSPECTION

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

Lubricate the front band adjusting screw threads with petroleum jelly and thread the screw part-way into the case. Be sure the screw turns freely.

Inspect the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and accelerated wear of other components. However, do not replace bushings as a matter of course. Replace bushings only when they are actually worn, or scored.

Use recommended tools to replace bushings. The tools are sized and designed to remove, install, and seat bushings correctly. The bushing replacement tools are included in Bushing Tool Set C-3887-B.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

ASSEMBLY

Do not allow dirt, grease, or foreign material to enter the case or transmission components during assembly. Keep the transmission case and components clean. Also make sure the tools and workbench area used for assembly operations are equally clean.

Shop towels used for wiping off tools and hands must be made from **lint free** material. Lint will stick to transmission parts and could interfere with valve operation, or even restrict fluid passages.

Lubricate the transmission components with Mopar® transmission fluid during reassembly. Use Mopar® Door Ease, or Ru-Glyde™ on seals and O-rings to ease installation.

AUTOMATIC TRANSMISSION - 42RE (Continued)

Petroleum jelly can also be used to hold thrust washers, thrust plates and gaskets in position during assembly. However, **do not** use chassis grease, bearing grease, white grease, or similar lubricants on any transmission part. These types of lubricants can eventually block or restrict fluid passages and interfere with valve operation. Use petroleum jelly only.

Do not force parts into place. The transmission components and subassemblies are easily installed by hand when properly aligned.

If a part seems extremely difficult to install, it is either misaligned or incorrectly assembled. Also verify that thrust washers, thrust plates and seal rings are correctly positioned before assembly. These parts can interfere with proper assembly if mis-positioned.

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright.

(1) Install rear servo piston, spring and retainer (Fig. 39). Install spring on top of servo piston and install retainer on top of spring.

(2) Install front servo piston assembly, servo spring and rod guide (Fig. 40).

(3) Compress front/rear servo springs with Valve Spring Compressor C-3422-B and install each servo snap-ring (Fig. 41).

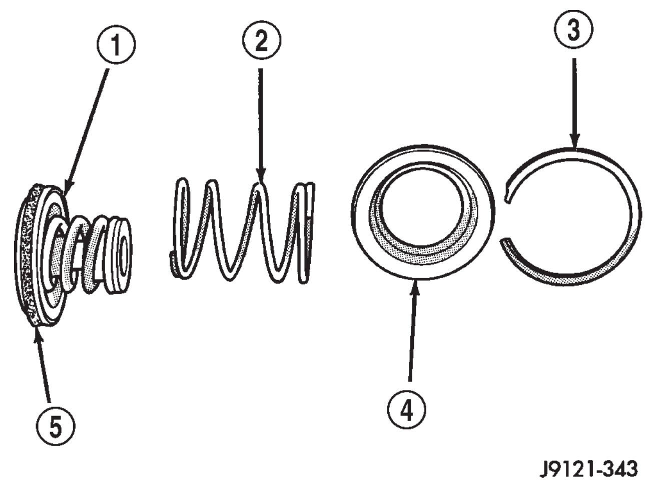


Fig. 39 Rear Servo Components

1 - SERVO PISTON
2 - PISTON SPRING
3 - SNAP-RING
4 - RETAINER
5 - PISTON SEAL

(4) Lubricate clutch cam rollers with transmission fluid.

(5) Install rear band in case (Fig. 42). Be sure twin lugs on band are seated against reaction pin.

(6) Install low-reverse drum and check overrunning clutch operation as follows:

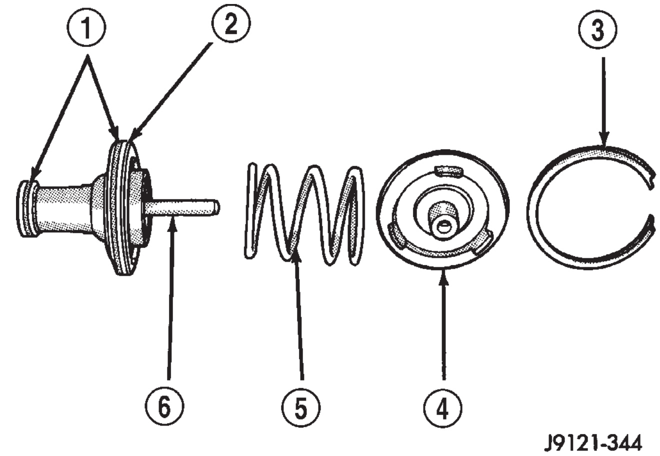


Fig. 40 Front Servo Components

1 - PISTON SEAL RINGS
2 - SERVO PISTON
3 - SNAP-RING
4 - ROD GUIDE
5 - SPRING
6 - ROD

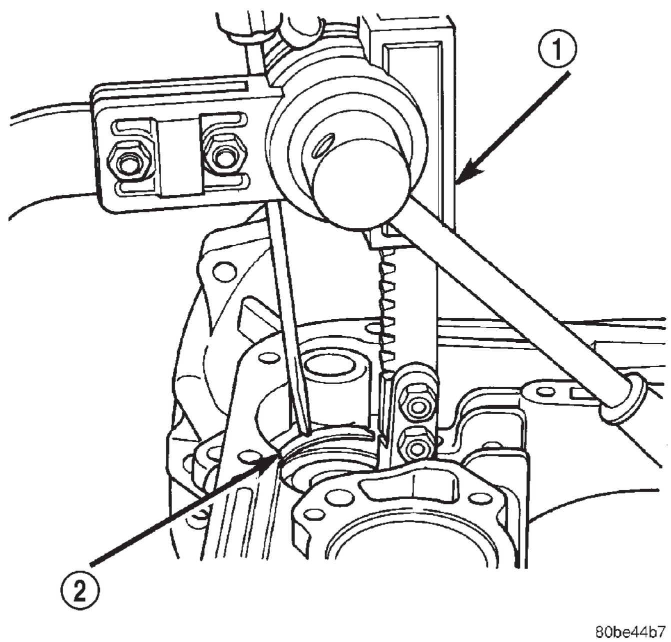


Fig. 41 Compressing Front/Rear Servo Springs

1 - SPRING COMPRESSOR TOOL C-3422-B
2 - ROD GUIDE SNAP-RING

(a) Lubricate overrunning clutch race (on drum hub) with transmission fluid.

(b) Guide drum through rear band.

(c) Tilt drum slightly and start race (on drum hub) into overrunning clutch rollers.

(d) Press drum rearward and turn it in clockwise direction until drum seats in overrunning clutch (Fig. 43).

AUTOMATIC TRANSMISSION - 42RE (Continued)

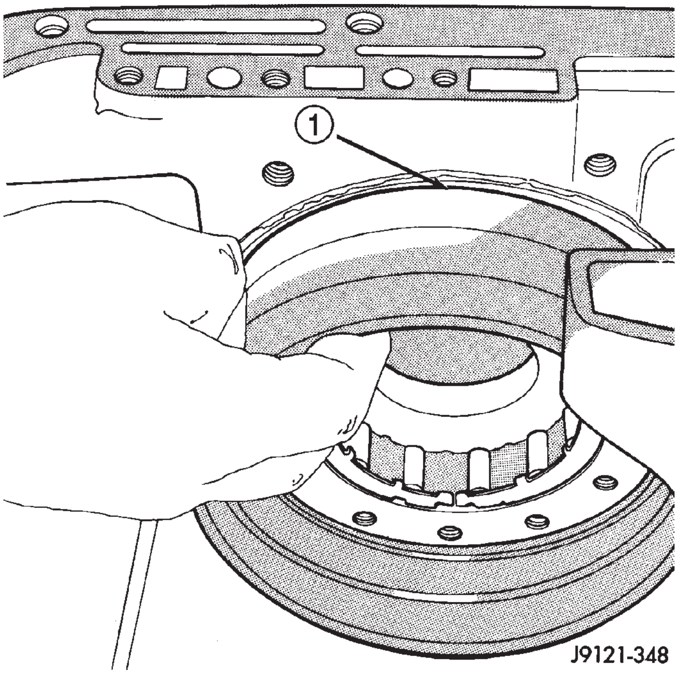


Fig. 42 Rear Band Installation

1 - REAR BAND

(e) Turn drum back and forth. Drum should rotate freely in clockwise direction and lock in counterclockwise direction (as viewed from front of case).

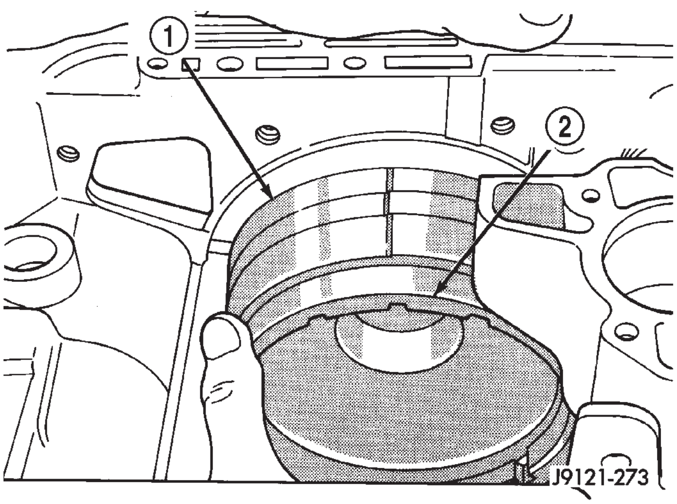


Fig. 43 Installing Low-Reverse Drum

1 - REAR BAND
2 - LOW-REVERSE DRUM

(7) Install snap-ring that secures low-reverse drum to hub of overdrive piston retainer (Fig. 44).

(8) Install rear band lever and pivot pin (Fig. 45). Align lever with pin bores in case and push pivot pin into place.

(9) Install planetary geartrain assembly (Fig. 46).

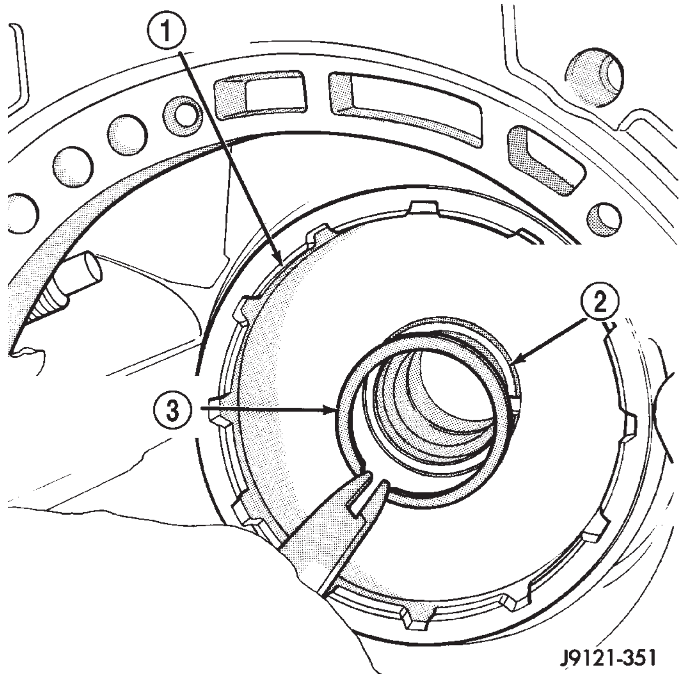


Fig. 44 Installing Low-Reverse Drum Retaining Snap-Ring

1 - LOW-REVERSE DRUM
2 - HUB OF OVERDRIVE PISTON RETAINER
3 - LOW-REVERSE DRUM SNAP-RING

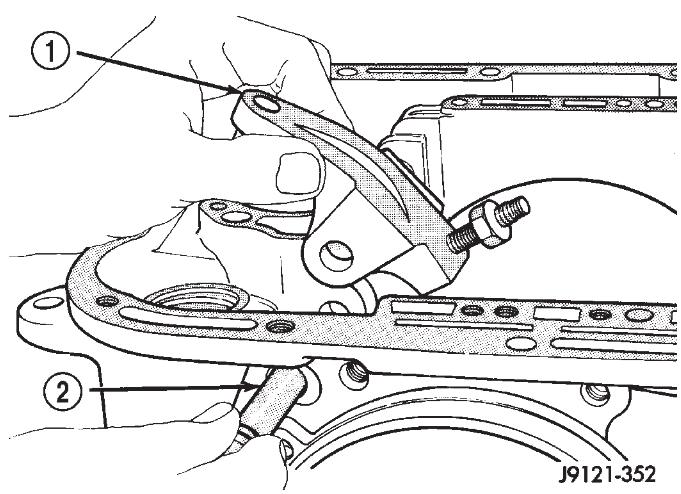


Fig. 45 Rear Band Lever And Pivot Pin Installation

1 - REAR BAND LEVER
2 - LEVER PIVOT PIN

AUTOMATIC TRANSMISSION - 42RE (Continued)

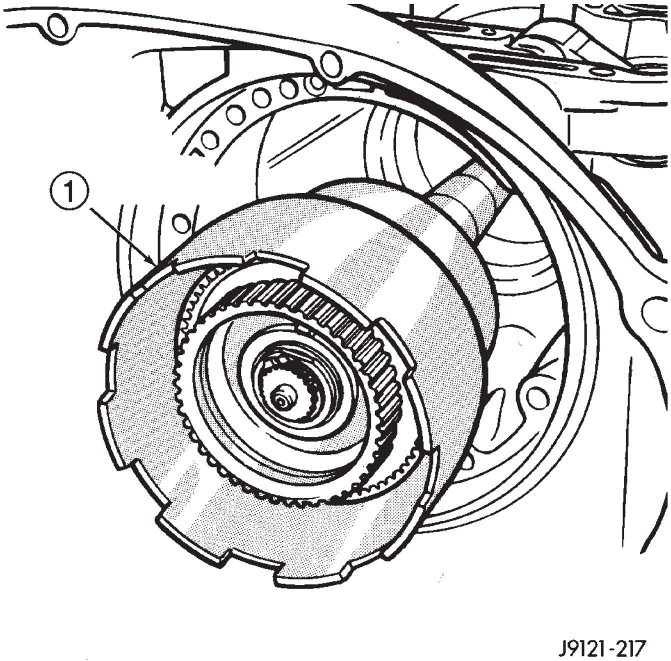


Fig. 46 Installing Planetary Geartrain

1 - PLANETARY GEARTRAIN AND INTERMEDIATE SHAFT ASSEMBLY

(10) Install thrust plate on intermediate shaft hub (Fig. 47). Use petroleum jelly to hold thrust plate in place.

(11) Check seal ring on rear clutch retainer hub and seal rings on input shaft (Fig. 48). Also verify that shaft seal rings are installed in sequence shown.

(12) Install rear clutch thrust washer (Fig. 49). Use additional petroleum jelly to hold washer in place if necessary.

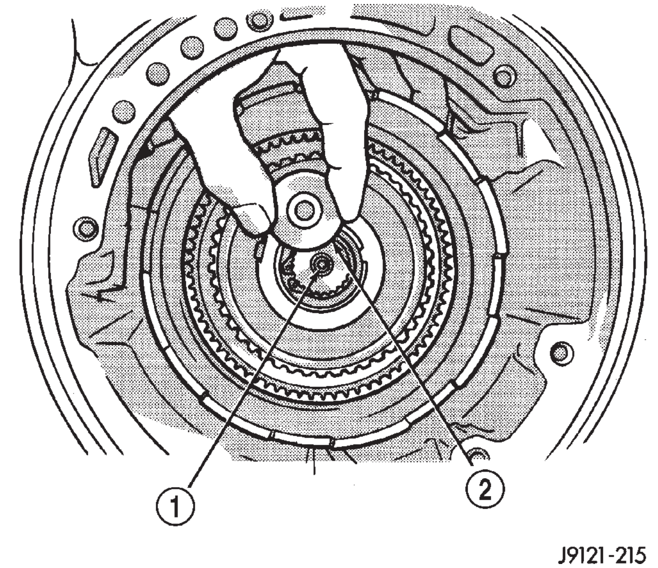


Fig. 47 Installing Intermediate Shaft Thrust Plate

1 - INTERMEDIATE SHAFT HUB
2 - INTERMEDIATE SHAFT THRUST PLATE

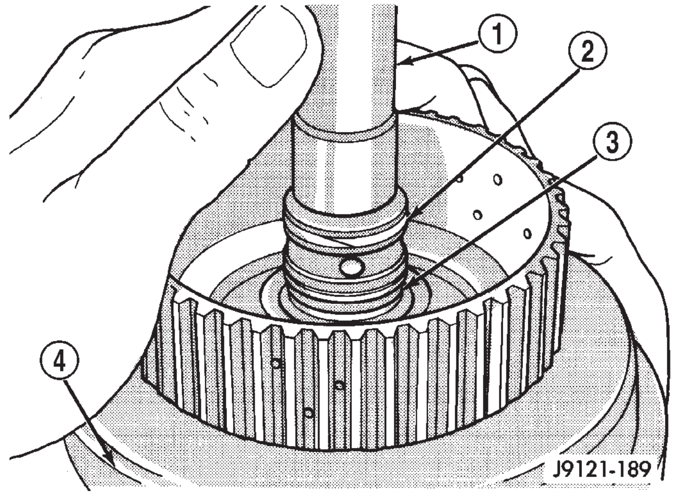


Fig. 48 Input Shaft Seal Ring Location

1 - INPUT SHAFT
2 - TEFLON SEAL RING
3 - PLASTIC SEAL RING
4 - REAR CLUTCH RETAINER

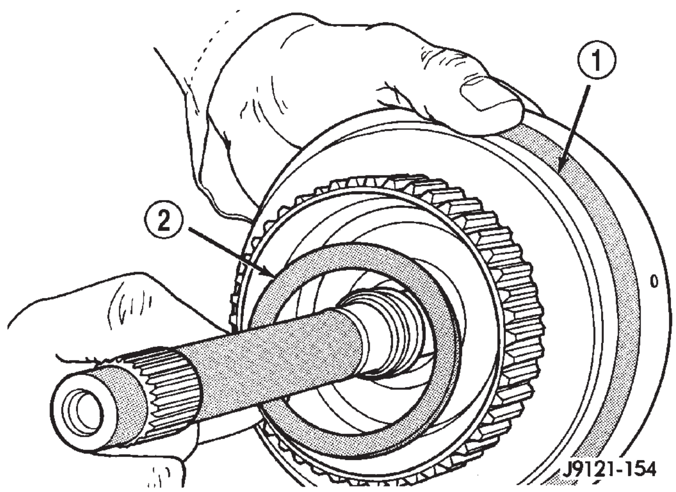


Fig. 49 Installing Rear Clutch Thrust Washer

1 - REAR CLUTCH RETAINER
2 - REAR CLUTCH THRUST WASHER (FIBER)

(13) Align clutch discs in front clutch and install front clutch on rear clutch (Fig. 50). Rotate front clutch retainer back and forth until completely seated on rear clutch retainer.

(14) Coat intermediate shaft thrust washer with petroleum jelly. Then install washer in rear clutch hub (Fig. 51). Use enough petroleum jelly to hold washer in place. Be sure grooved side of washer faces rearward (toward output shaft) as shown. Also note that washer only fits one way in clutch hub. Note thickness of this washer. It is a select fit part and is used to control transmission end play.

AUTOMATIC TRANSMISSION - 42RE (Continued)

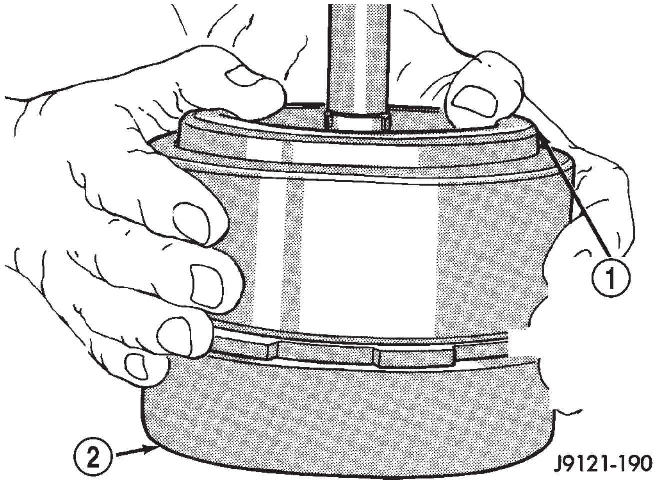


Fig. 50 Assembling Front And Rear Clutch Units

1 - TURN FRONT CLUTCH BACK & FORTH UNTIL SEATED
2 - REAR CLUTCH ASSEMBLY

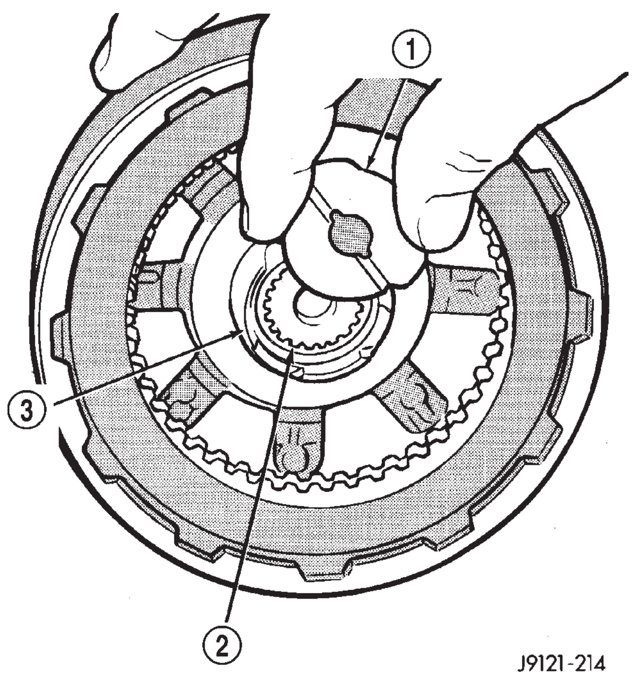


Fig. 51 Installing Intermediate Shaft Thrust Washer

1 - INTERMEDIATE SHAFT THRUST WASHER
2 - INPUT SHAFT
3 - REAR CLUTCH RETAINER HUB

(15) Align drive teeth on rear clutch discs with small screwdriver (Fig. 52). This makes installation on front planetary easier.

(16) Raise front end of transmission upward as far as possible and support case with wood blocks. Front/rear clutch and oil pump assemblies are easier to install if transmission is as close to upright position as possible.

(17) Slide front band into case.

(18) Install front and rear clutch units as assembly (Fig. 53). Align rear clutch with front annulus gear and install assembly in driving shell. Be sure output shaft thrust washer and thrust plate are not displaced during installation.

(19) Carefully work assembled clutches back and forth to engage and seat rear clutch discs on front annulus gear. Also be sure front clutch drive lugs are fully engaged in slots of driving shell after installation.

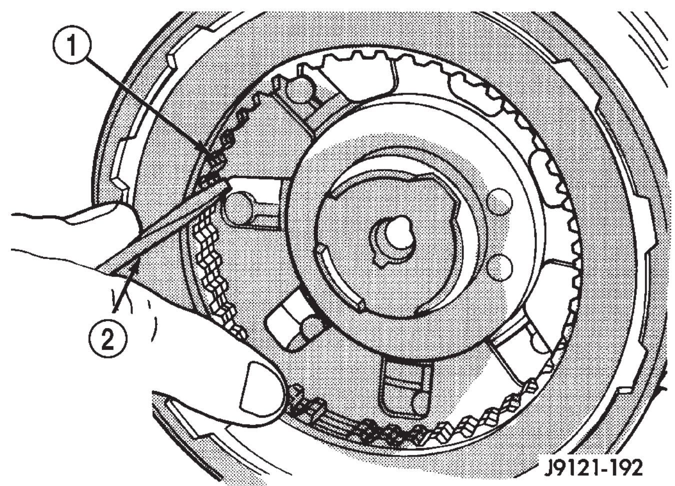


Fig. 52 Aligning Rear Clutch Disc Lugs

1 - REAR CLUTCH DISCS
2 - USE SMALL SCREWDRIVER TO ALIGN CLUTCH DISC TEETH

(20) Assemble front band strut.

(21) Install front band adjuster, strut and adjusting screw (Fig. 54).

(22) Tighten band adjusting screw until band just grips clutch retainer. Verify that front/rear clutches are still seated before continuing.

AUTOMATIC TRANSMISSION - 42RE (Continued)

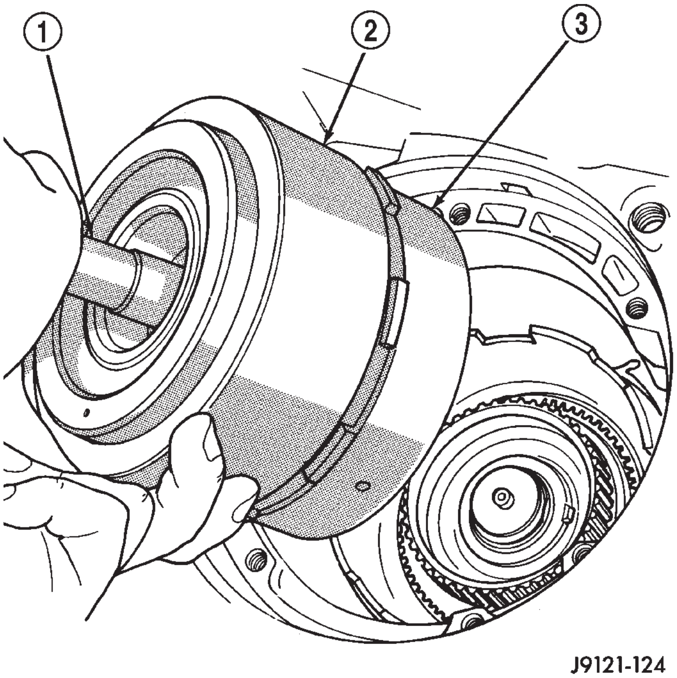


Fig. 53 Installing Front/Rear Clutch Assemblies

1 - INPUT SHAFT
2 - FRONT CLUTCH
3 - REAR CLUTCH

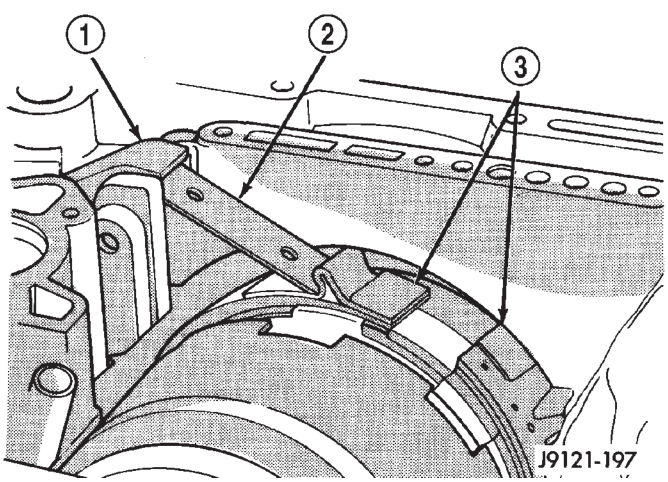


Fig. 54 Front Band Linkage Installation

1 - BAND LEVER
2 - BAND STRUT
3 - FRONT BAND

(23) Check seal rings on reaction shaft support hub. Verify that seal rings are hooked together and that the thrust washer is properly positioned (Fig. 55). Use petroleum jelly to hold thrust washer in place if necessary.

(24) Lubricate oil pump body seal with petroleum jelly. Lubricate pump shaft seal lip with petroleum jelly.

(25) Thread two Pilot Stud Tools C-3288-B into bolt holes in oil pump bore flange (Fig. 56).

(26) Align and install oil pump gasket (Fig. 56).

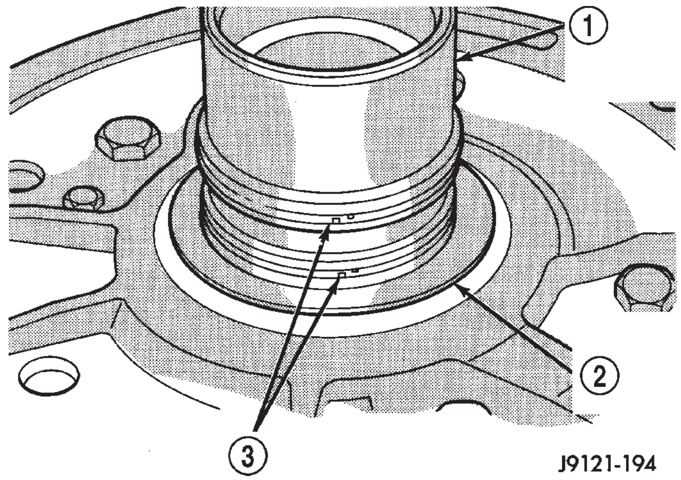


Fig. 55 Reaction Shaft Support Seal Rings And Thrust Washer

1 - REACTION SHAFT SUPPORT HUB
2 - THRUST WASHER
3 - SEAL RINGS

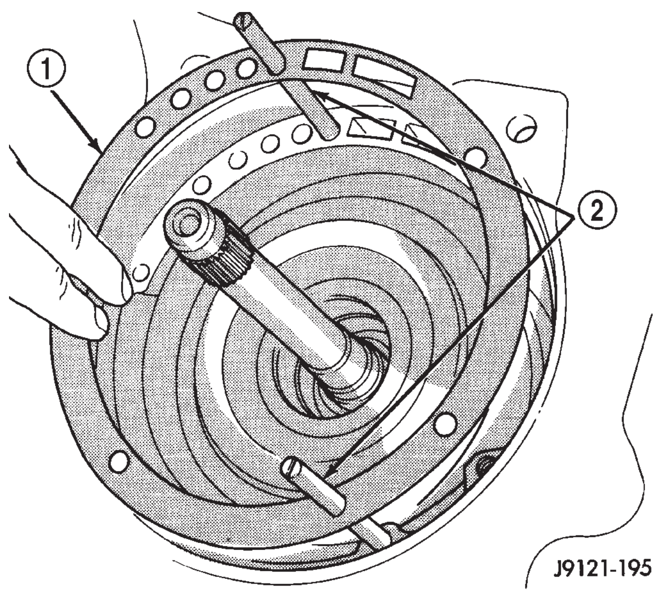


Fig. 56 Installing Pilot Studs And Oil Pump Gasket

1 - OIL PUMP GASKET
2 - PILOT STUD TOOLS C-3288-B

AUTOMATIC TRANSMISSION - 42RE (Continued)

(27) Install oil pump (Fig. 57). Align and position pump on pilot studs. Slide pump down studs and work it into front clutch hub and case by hand. Then install 2 or 3 pump bolts to hold pump in place.

(28) Remove pilot stud tools and install remaining oil pump bolts. Tighten bolts alternately in diagonal pattern to 20 N·m (15 ft. lbs.).

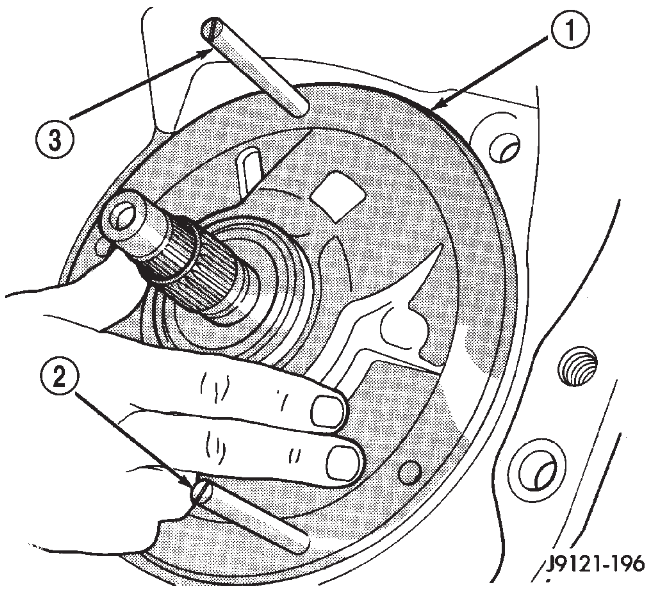


Fig. 57 Installing Oil Pump

1 - OIL PUMP
2 - PILOT STUD TOOL
3 - PILOT STUD TOOL

(29) Measure input shaft end play (Fig. 58).

NOTE: If end play is incorrect, transmission is incorrectly assembled, or the intermediate shaft thrust washer is incorrect. The intermediate shaft thrust washer is selective.

(a) Attach Adapter 8266-6 to Handle 8266-8.

(b) Attach dial indicator C-3339 to Handle 8266-8.

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266-6 to secure it to the input shaft.

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

(e) Move input shaft in and out and record reading. End play should be 0.56-2.31 mm (0.022-0.091 in.). Adjust as necessary.

(30) Install accumulator piston and inner and outer springs (Fig. 59).

(31) Verify that valve body solenoid harness is secured in 3-4 accumulator housing cover plate.

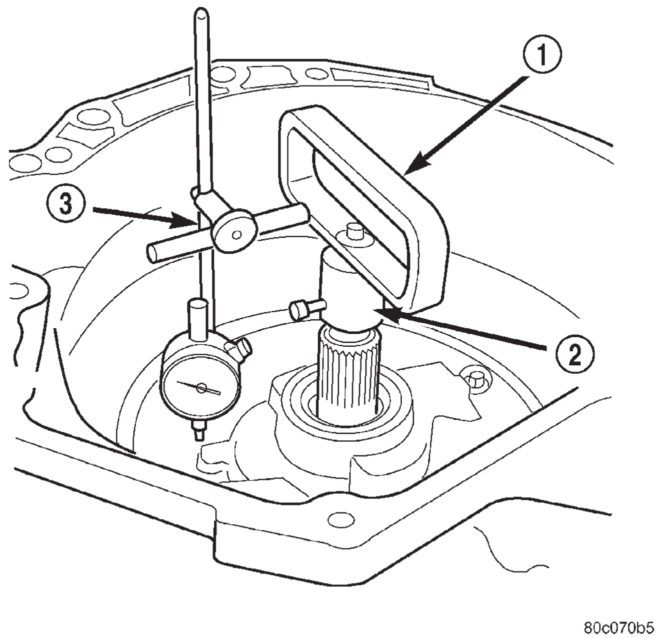


Fig. 58 Checking Input Shaft End Play

1 - TOOL 8266-8
2 - TOOL 8266-6
3 - TOOL C-3339

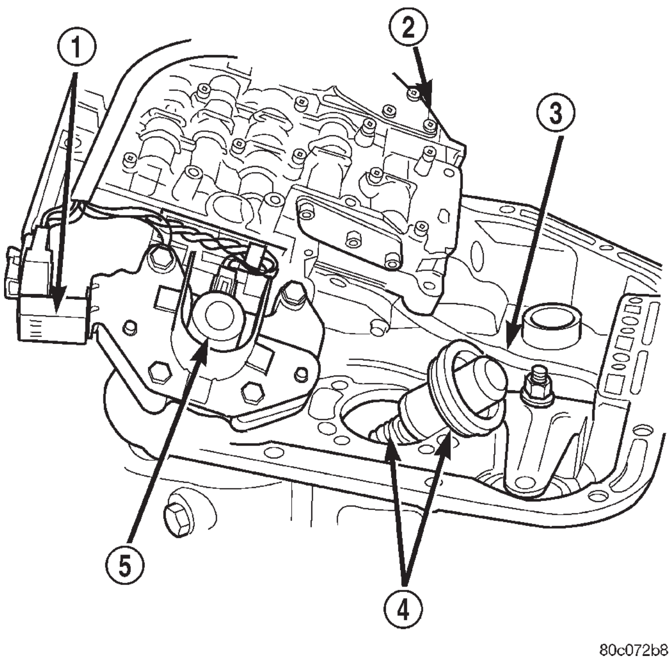


Fig. 59 Accumulator Piston And Springs

1 - GOVERNOR PRESSURE SENSOR
2 - VALVE BODY
3 - PARK ROD
4 - ACCUMULATOR PISTON
5 - GOVERNOR PRESSURE SOLENOID

AUTOMATIC TRANSMISSION - 42RE (Continued)

(32) Install valve body as follows:

(a) Align and carefully insert park rod into pawl. Rod will make click noise as it enters pawl. Move rod slightly to check engagement.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are fully seated in case. Also be sure valve body wiring is not pinched or kinked.

(c) Install and start all valve body attaching bolts by hand. Then tighten bolts evenly, in a diagonal pattern to 12 N·m (105 in. lbs.) torque. Do not overtighten valve body bolts. This could result in distortion and cross leakage after installation.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into the cavity.

(33) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(34) Adjust front and rear bands.

(35) Install seal on park/neutral position switch. Then install and tighten switch to 34 N·m (25 ft. lbs.).

(36) Install magnet in oil pan. Magnet goes on small protrusion at corner of pan.

(37) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(38) Install new valve body manual shaft seal in case (Fig. 60). Lubricate seal lip and manual shaft with petroleum jelly. Start seal over shaft and into case. Seat seal with 15/16 inch, deep well socket.

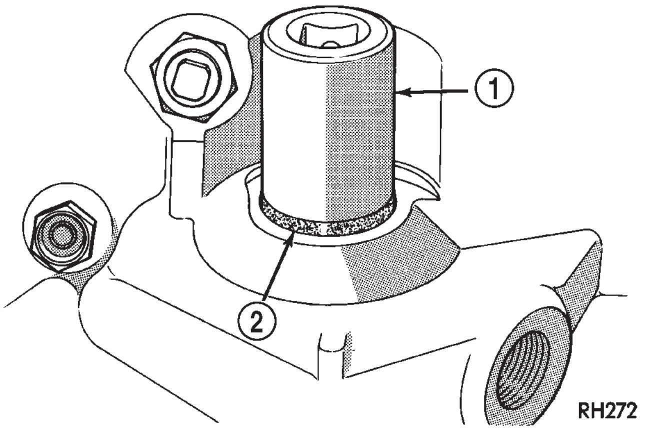


Fig. 60 Installing Manual Lever Shaft Seal

1 - 15/16'' SOCKET
2 - SEAL

(39) Install throttle valve and shift selector levers on valve body manual lever shaft.

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal during installation.

(2) Lubricate oil pump seal lip with transmission fluid.

(3) Align converter and oil pump.

(4) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(5) Check converter seating with steel scale and straightedge (Fig. 61). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(6) Temporarily secure converter with C-clamp.

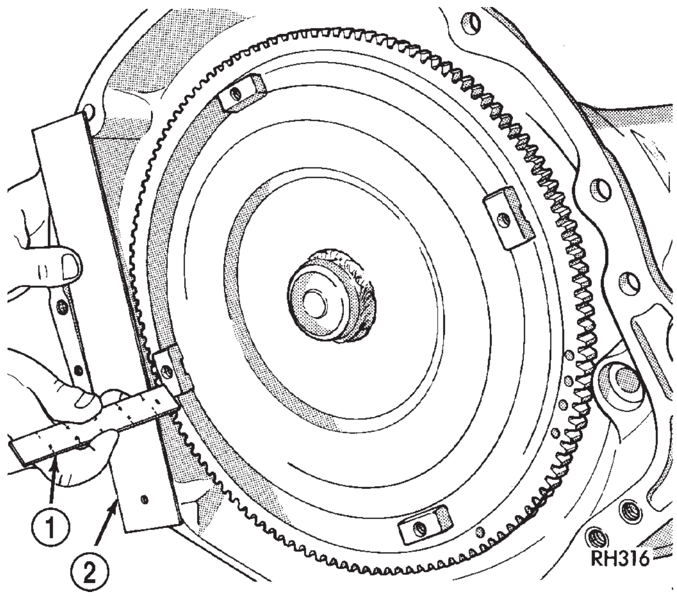


Fig. 61 Checking Torque Converter Seating - Typical

1 - SCALE
2 - STRAIGHTEDGE

(7) Position transmission on jack and secure it with chains.

(8) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.

(9) Apply a light coating of Mopar® High Temp grease to the torque converter hub pocket in the rear of the crankshaft

(10) Raise transmission and align converter with drive plate and converter housing with engine block.

AUTOMATIC TRANSMISSION - 42RE (Continued)

(11) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

(12) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(13) Install two bolts to attach converter housing to engine.

(14) Install the upper transmission bending braces to the torque converter housing and the overdrive unit. Tighten the bolts to 41 N·m (30 ft.lbs.).

(15) Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).

(16) Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).

(17) Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).

(18) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).

(19) Remove engine support fixture.

(20) Install crankshaft position sensor. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/CRANKSHAFT POSITION SENSOR - INSTALLATION)

(21) Install new plastic retainer grommet on any shift cable that was disconnected. Grommets should not be reused. Use pry tool to remove rod from grommet and cut away old grommet. Use pliers to snap new grommet into cable and to snap grommet onto lever.

(22) Connect gearshift and throttle valve cable to transmission.

(23) Connect wires to park/neutral position switch and transmission solenoid connector. Be sure transmission harnesses are properly routed.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(24) Install all torque converter-to-driveplate bolts by hand.

(25) Verify that the torque converter is pulled flush to the driveplate. Tighten bolts to 31 N·m (270 in. lbs.).

(26) Install converter housing access cover. Tighten bolt to 23 N·m (200 in.lbs.).

(27) Install the bell housing brace to the torque converter cover and the engine to transmission bending brace. Tighten the bolts and nut to 41 N·m (30 ft.lbs.).

(28) Install starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION) and cooler line bracket.

(29) Connect cooler lines to transmission.

(30) Install transmission fill tube. Install new seal on tube before installation.

(31) Install exhaust components.

(32) Install transfer case. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).

(33) Install the transfer case shift cable to the cable support bracket and the transfer case shift lever.

(34) Align and connect propeller shaft(s).

(35) Adjust gearshift linkage and throttle valve cable if necessary.

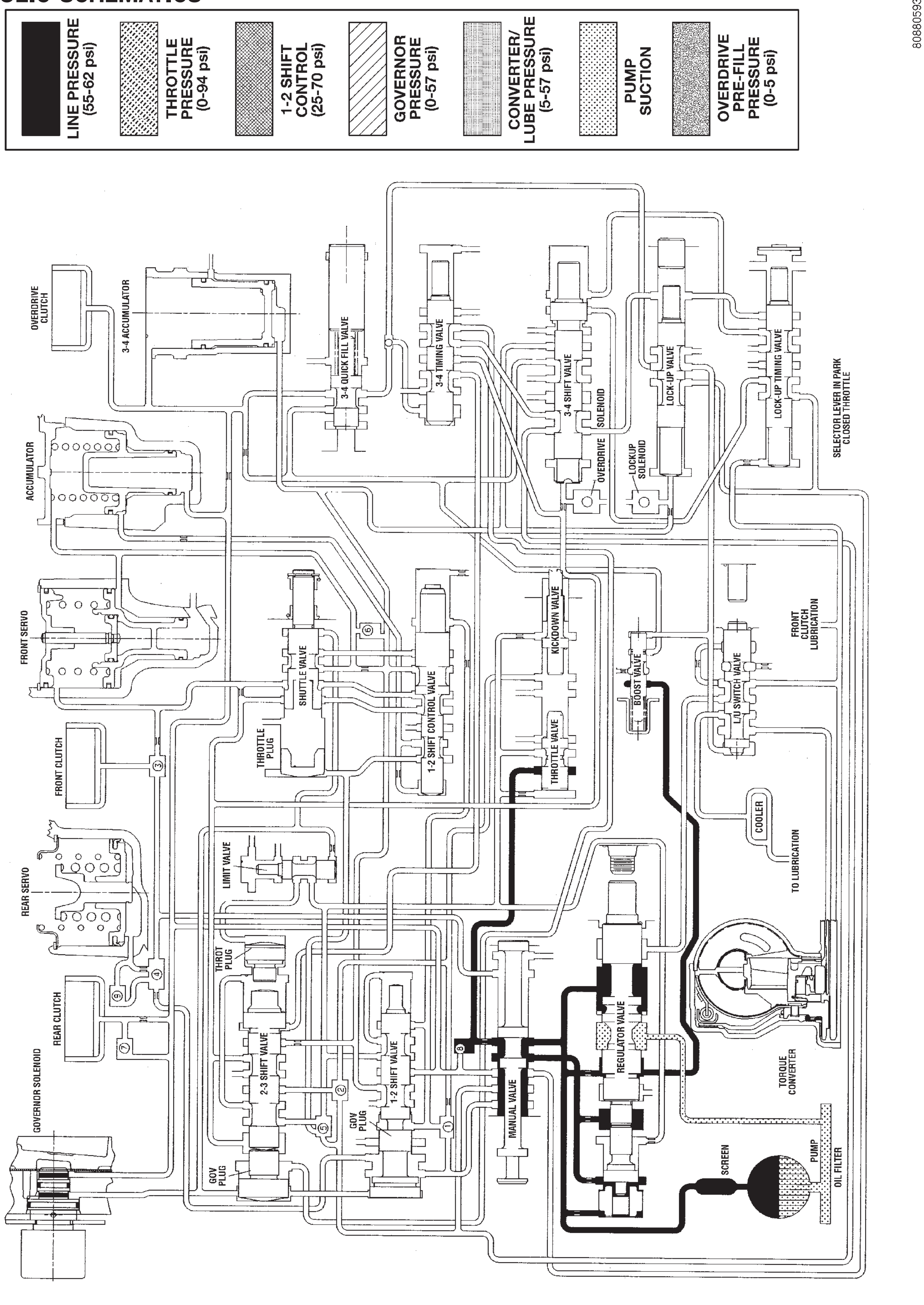
(36) Lower vehicle.

(37) Fill transmission with Mopar® ATF +4, type 9602, fluid.

AUTOMATIC TRANSMISSION - 42RE (Continued)

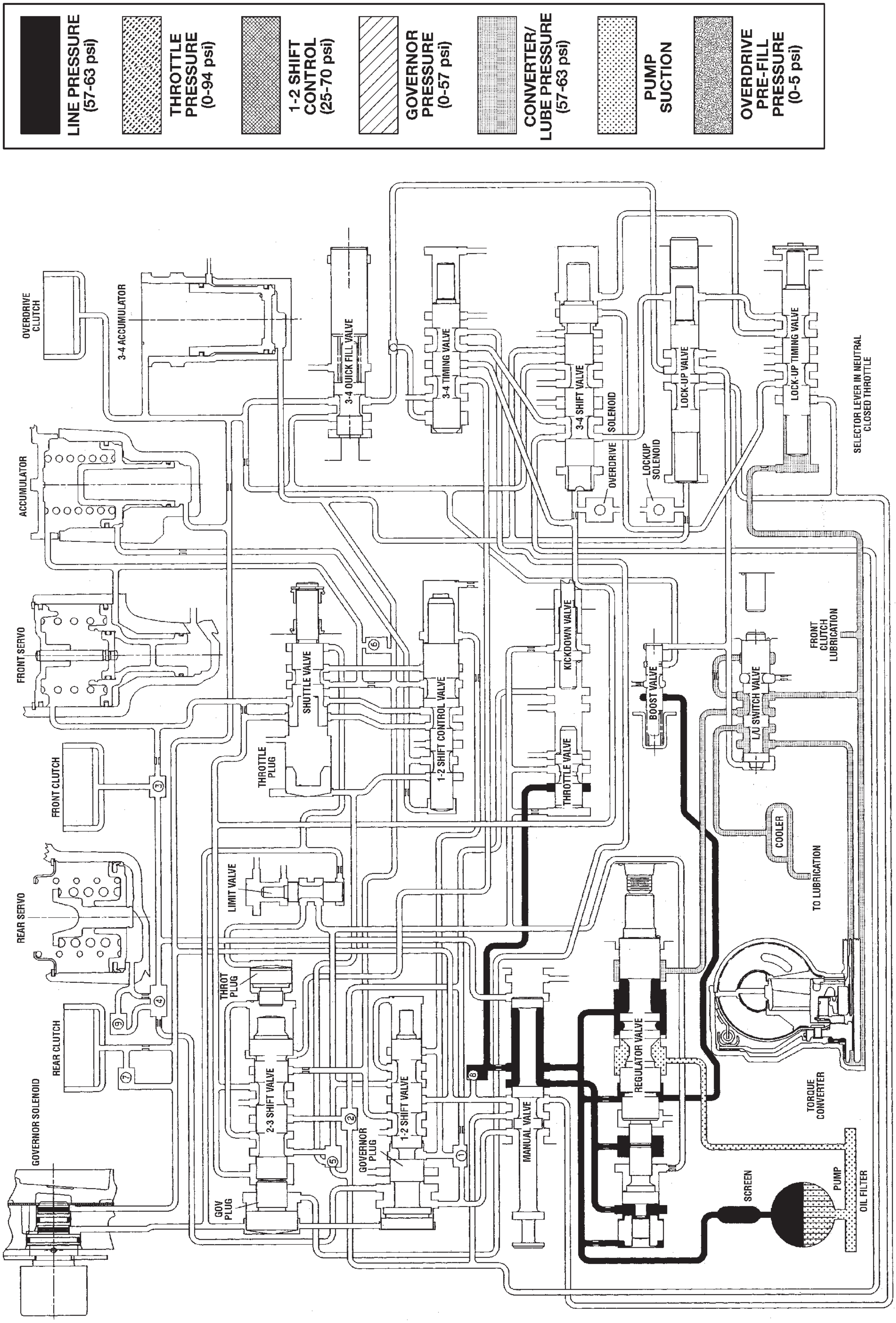
SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS



HYDRAULIC FLOW IN PARK

AUTOMATIC TRANSMISSION - 42RE (Continued)



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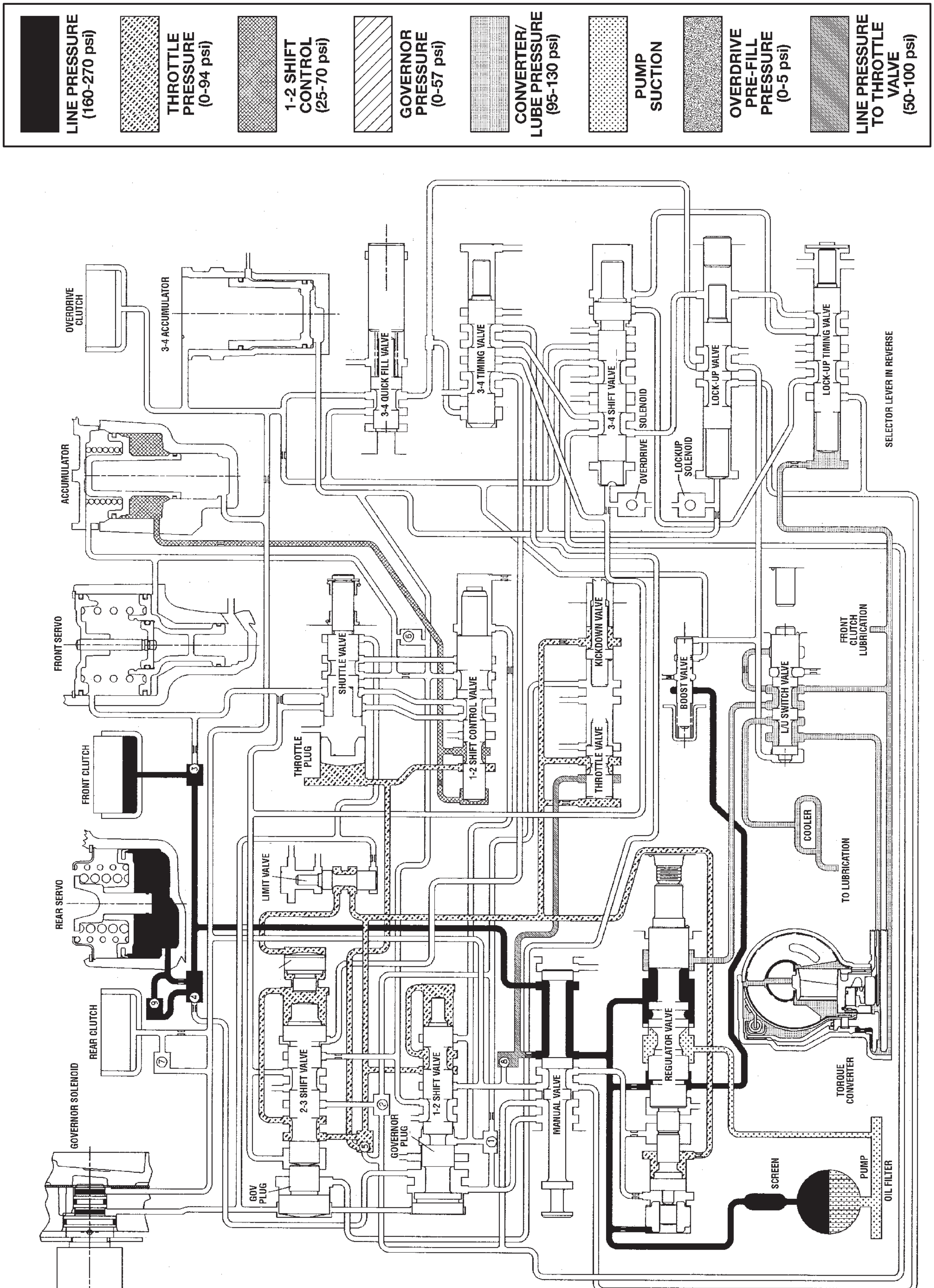
HYDRAULIC FLOW IN NEUTRAL

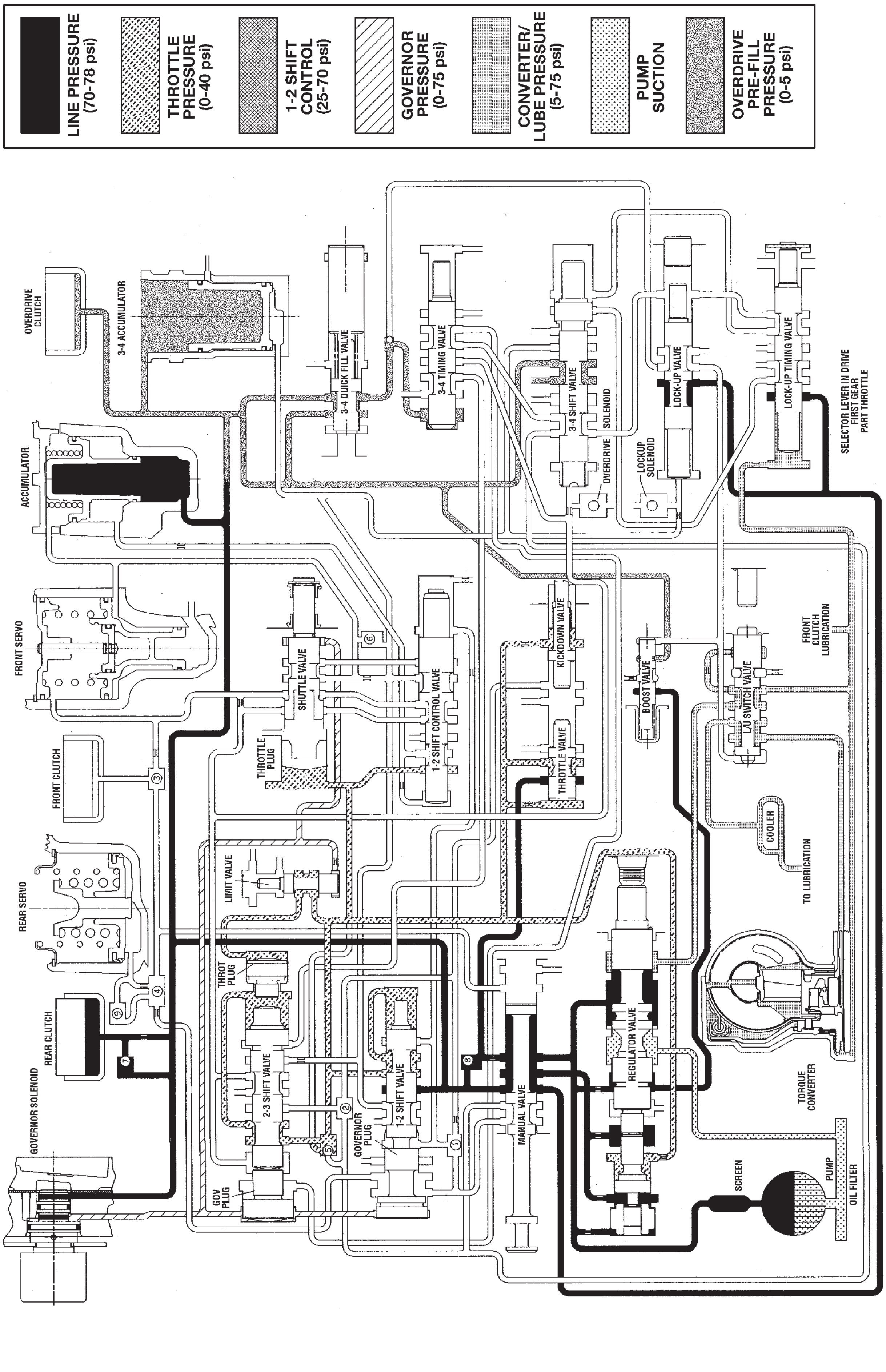
AUTOMATIC TRANSMISSION - 42RE (Continued)



80880595

HYDRAULIC FLOW IN REVERSE

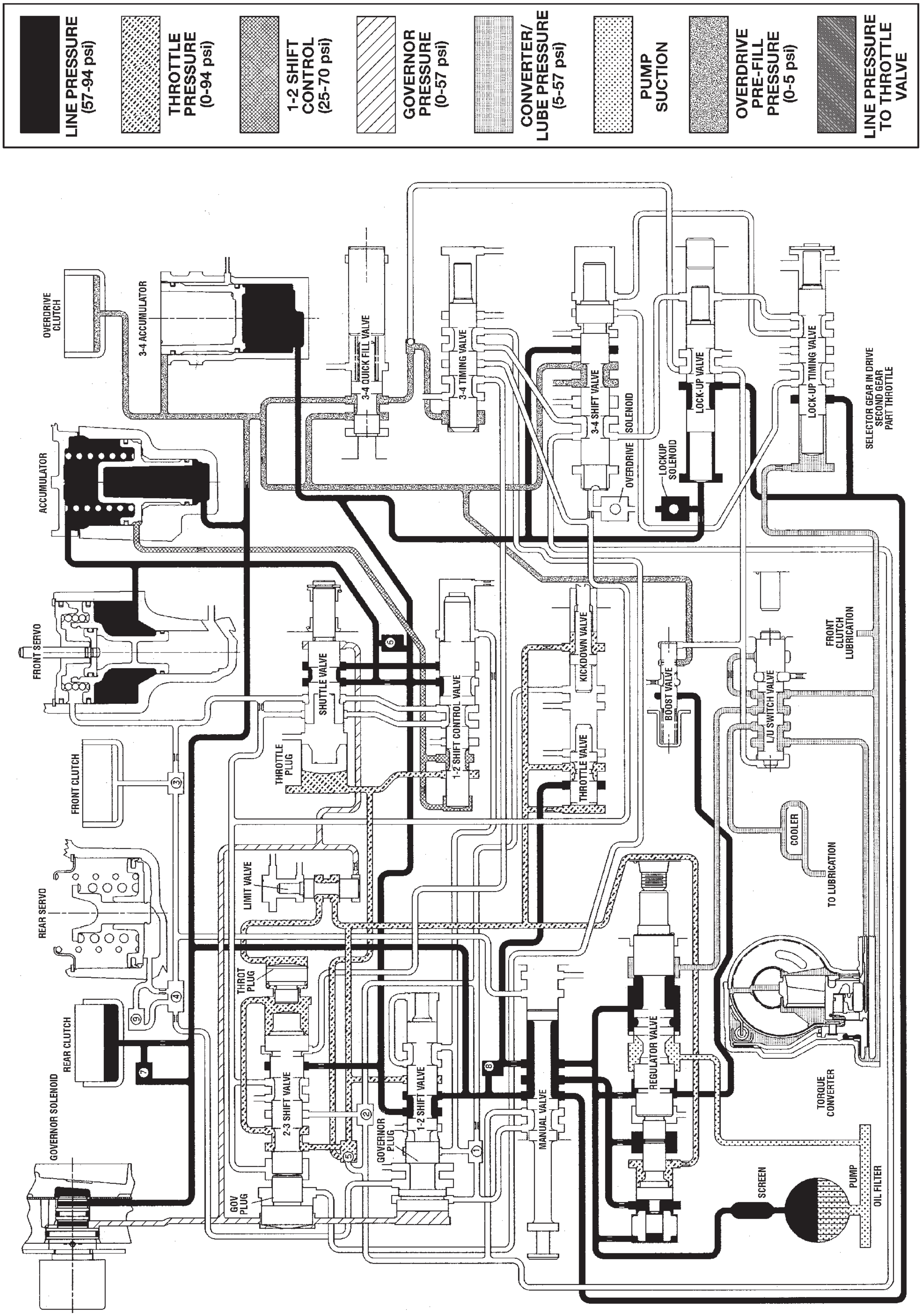
AUTOMATIC TRANSMISSION - 42RE (Continued)



80880596

HYDRAULIC FLOW IN DRIVE FIRST GEAR

AUTOMATIC TRANSMISSION - 42RE (Continued)



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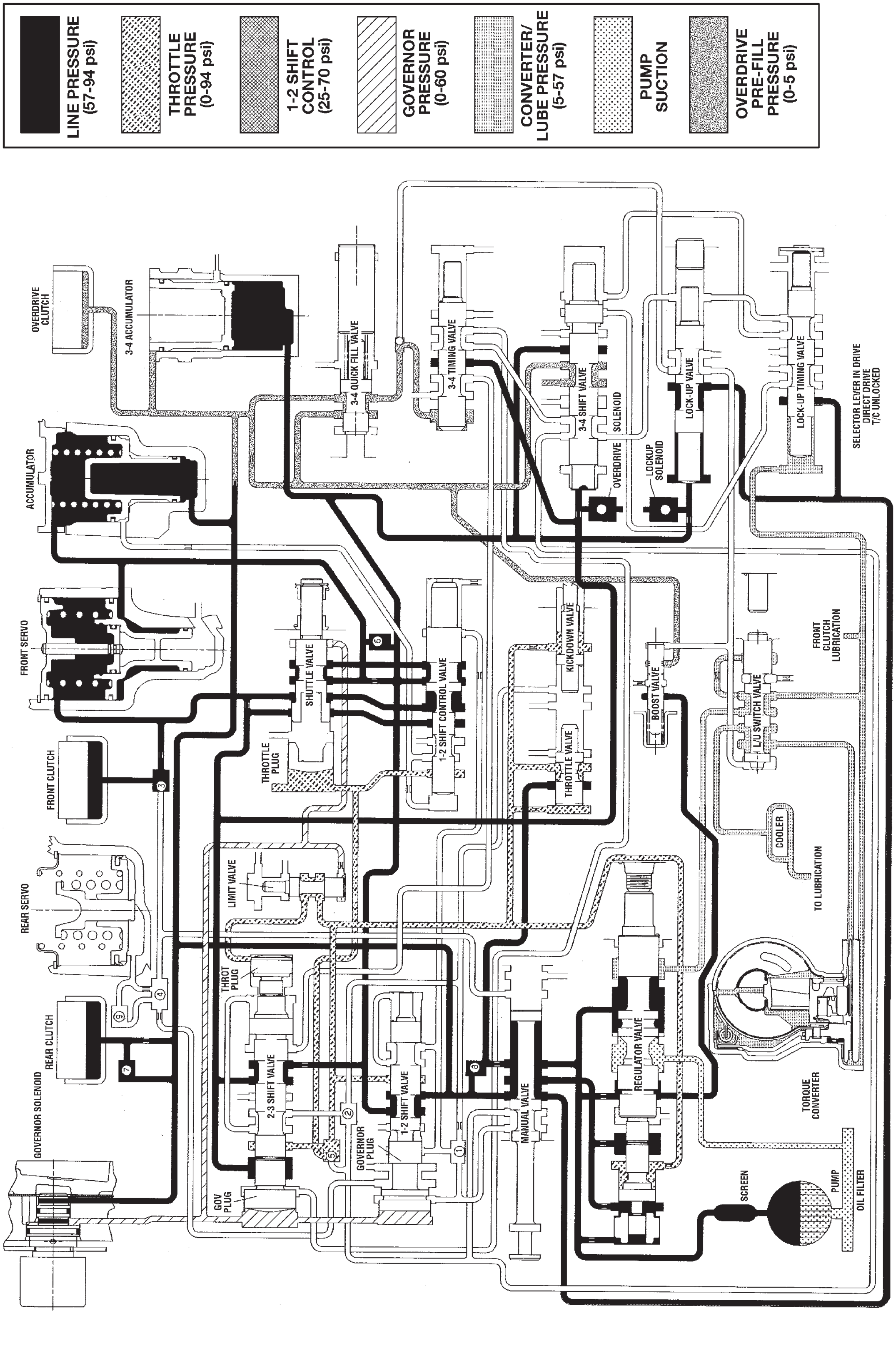
HYDRAULIC FLOW IN DRIVE SECOND GEAR

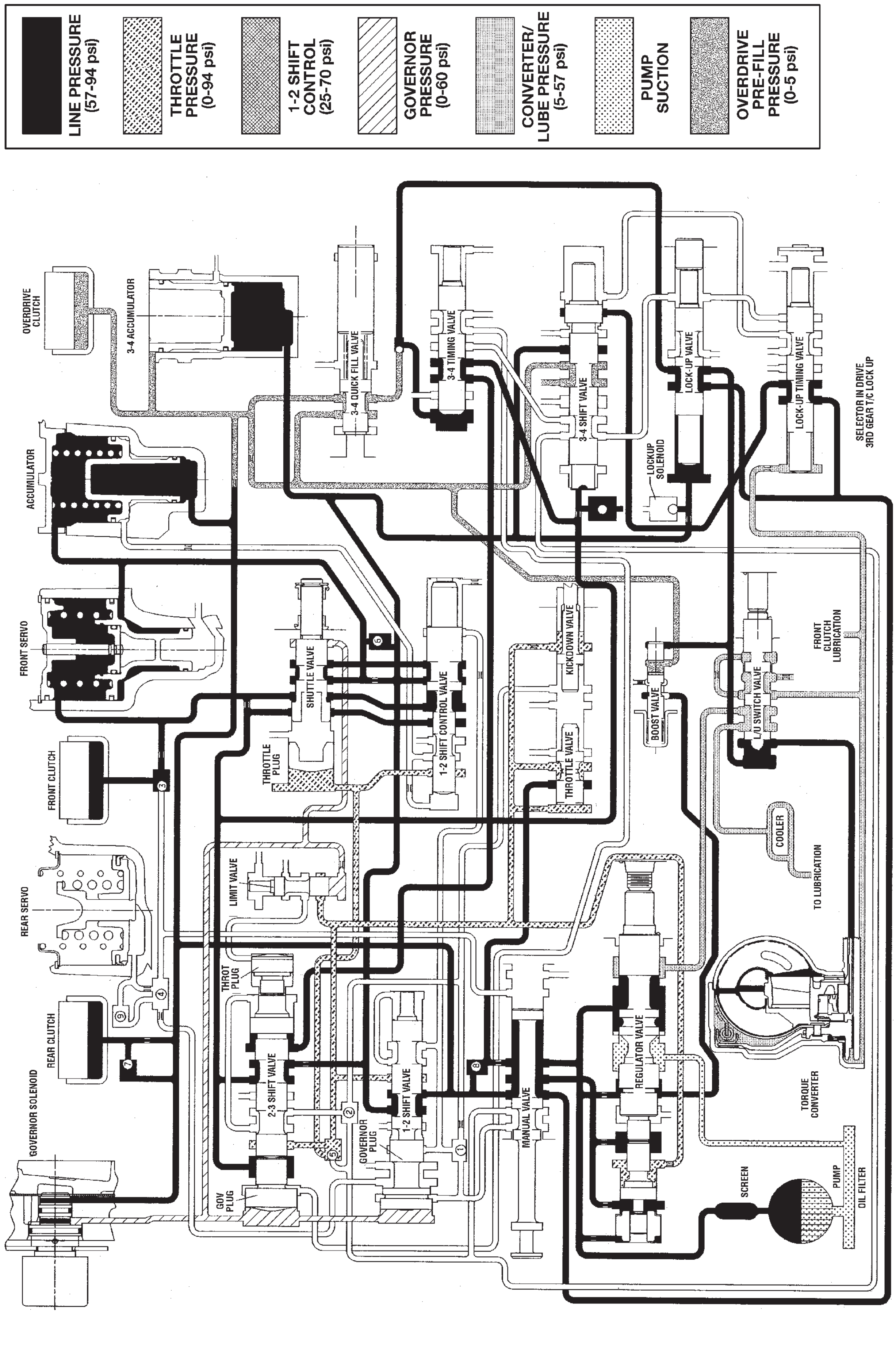
AUTOMATIC TRANSMISSION - 42RE (Continued)



80880598

HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH NOT APPLIED)

AUTOMATIC TRANSMISSION - 42RE (Continued)



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HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH APPLIED)

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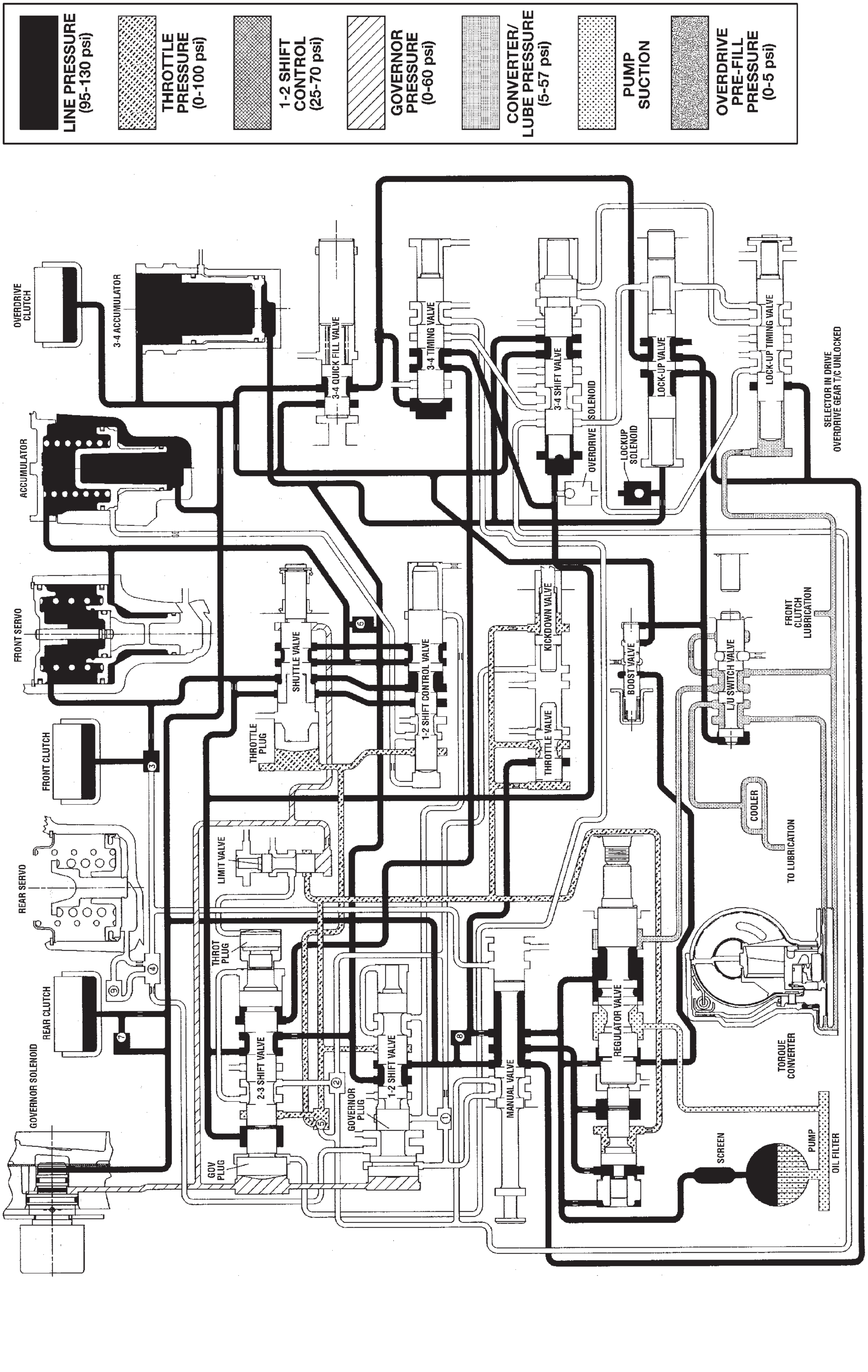

HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)

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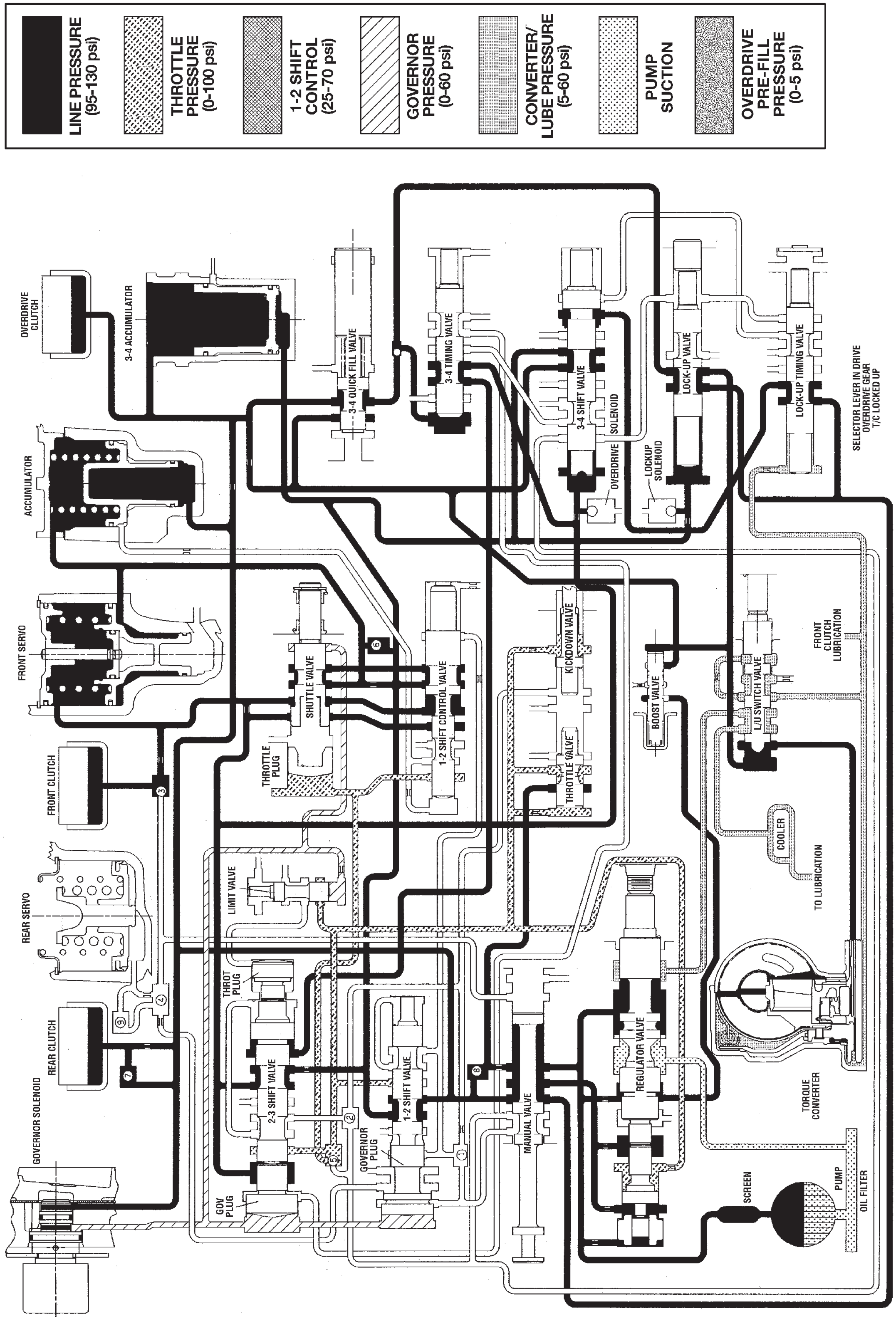
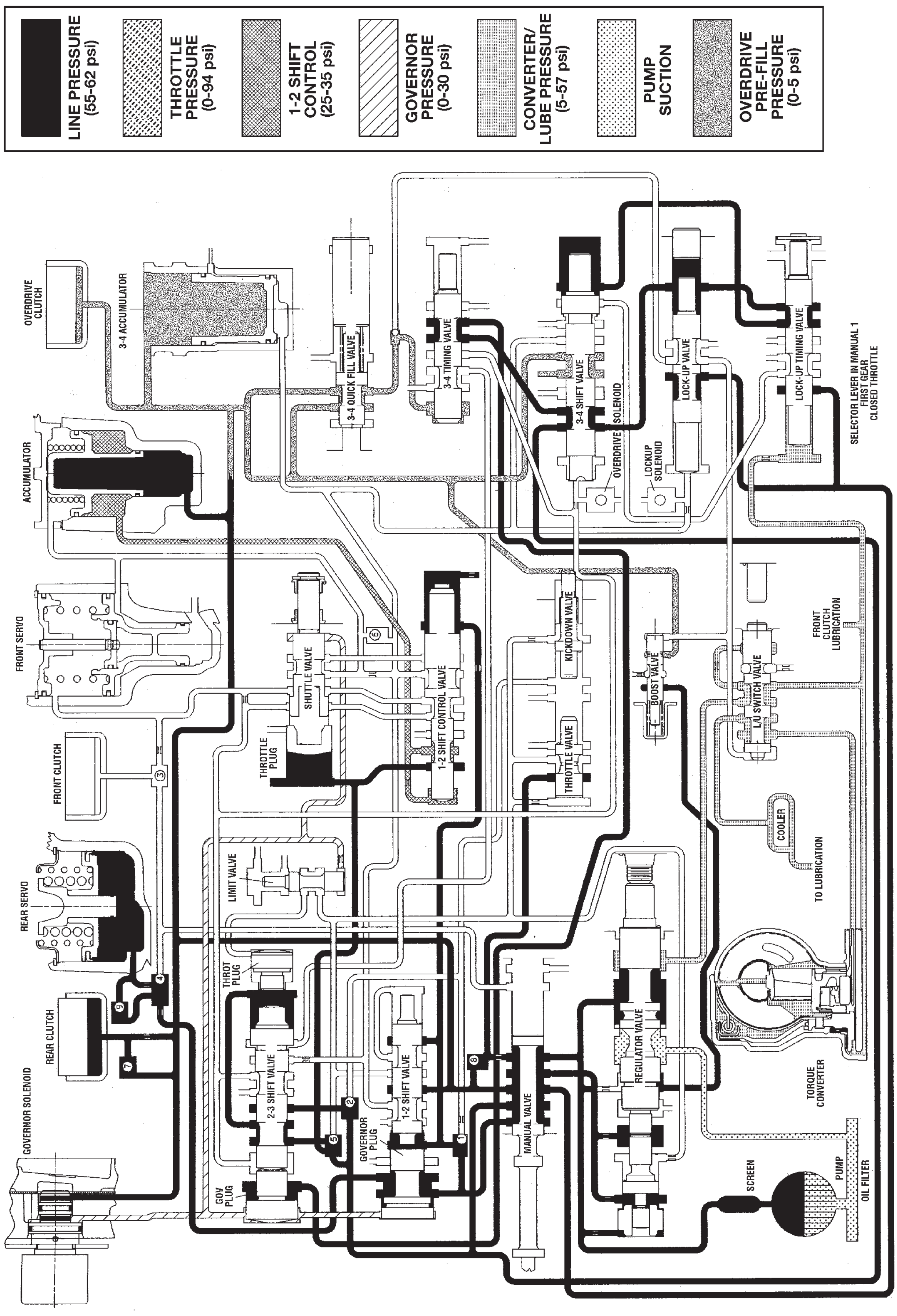


8088059c

HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH APPLIED)

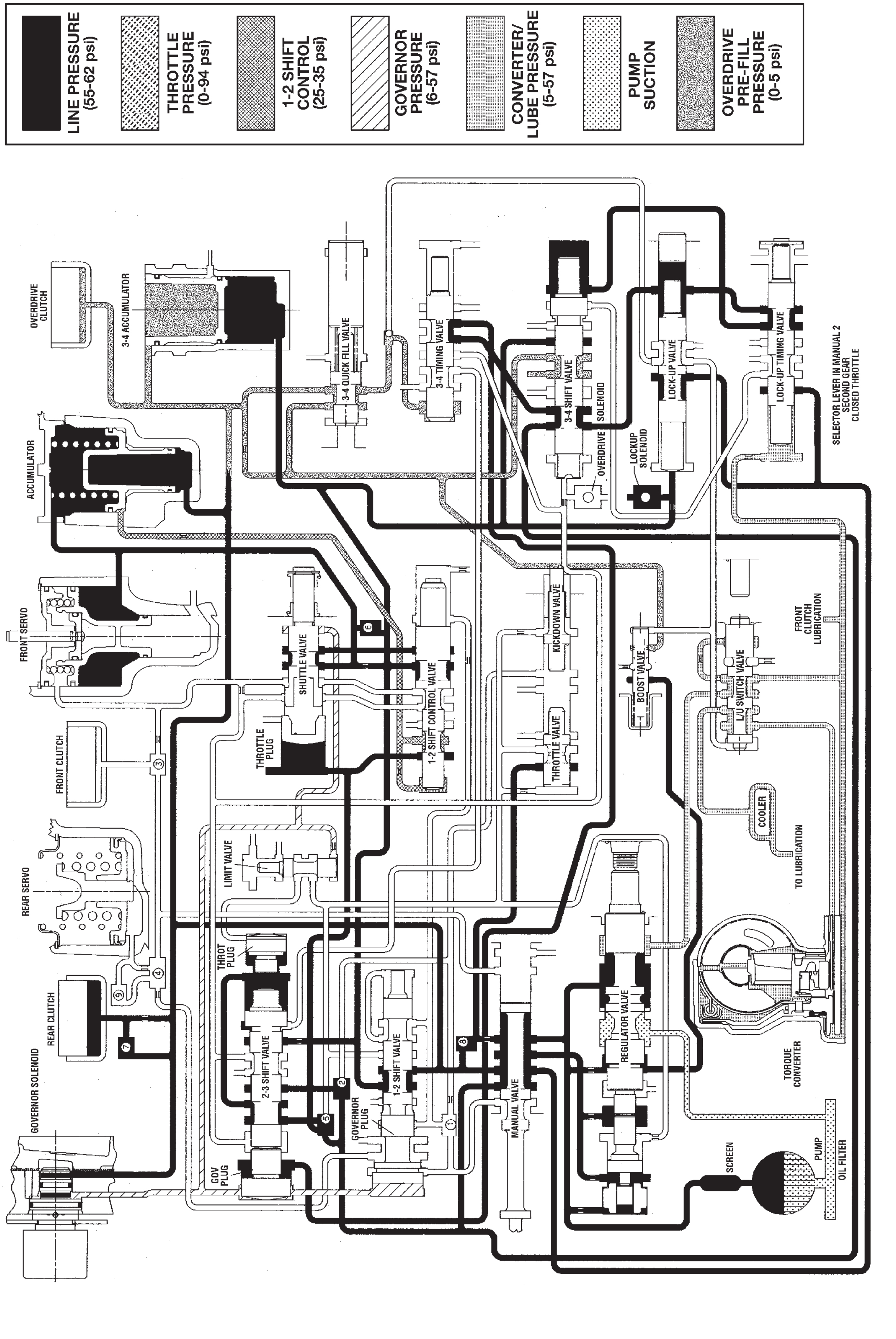
AUTOMATIC TRANSMISSION - 42RE (Continued)



8088059e

HYDRAULIC FLOW IN MANUAL LOW (1)

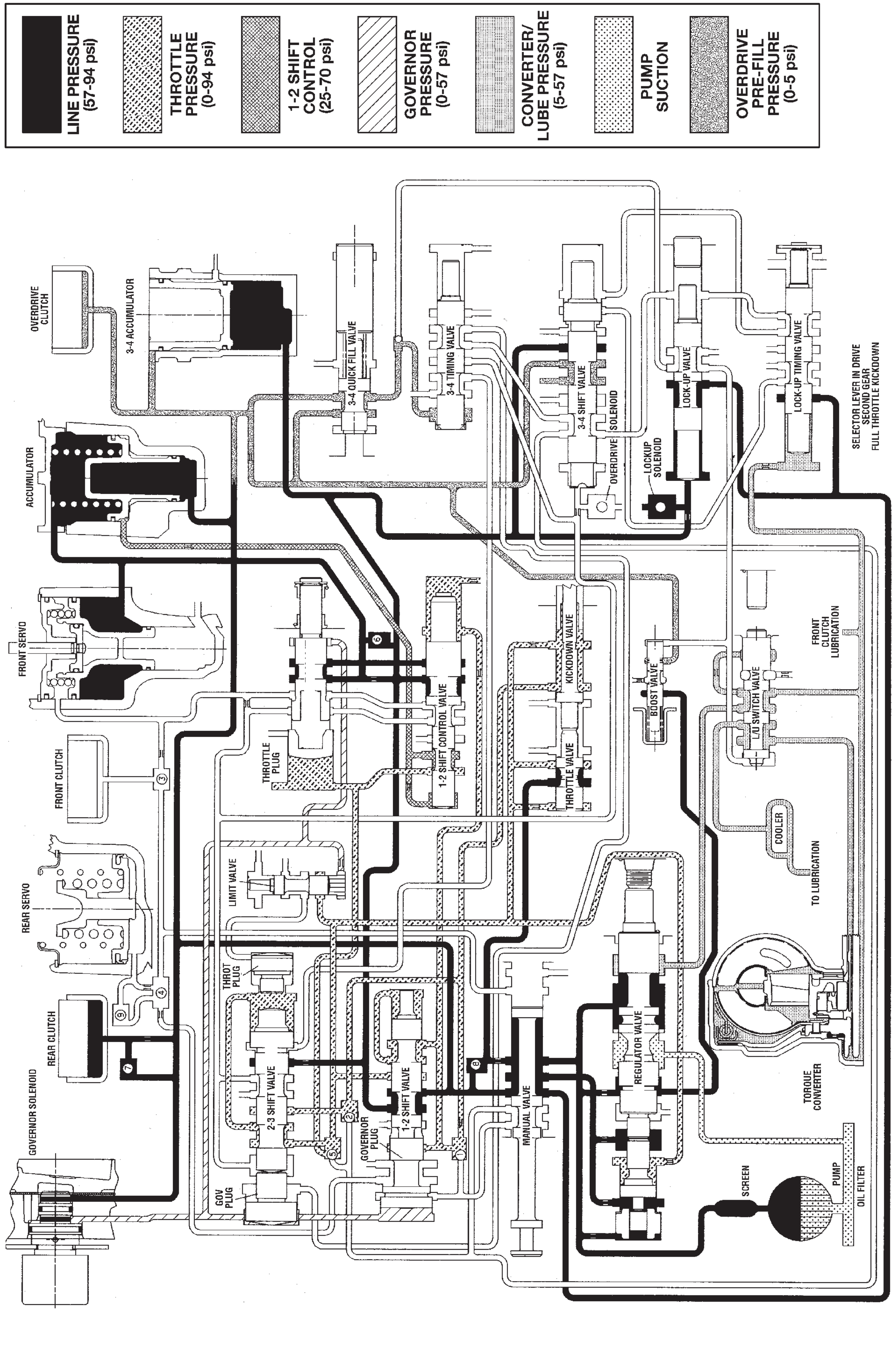
AUTOMATIC TRANSMISSION - 42RE (Continued)



808805a1

HYDRAULIC FLOW IN MANUAL SECOND (2)

AUTOMATIC TRANSMISSION - 42RE (Continued)



808805a2

HYDRAULIC FLOW DURING FULL THROTTLE 3-2 DOWNSHIFT (PASSING)

AUTOMATIC TRANSMISSION - 42RE (Continued)

SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
Planetary end play	0.127-1.22 mm	0.005-0.048 in.
Input shaft end play	0.56-2.31 mm	0.022-0.091 in.
Clutch pack clearance/ Front.	1.70-3.40mm	0.067-0.134 in.
Clutch pack clearance/ Rear.	0.559-0.914 mm	0.022-0.036 in.
Front clutch	4 discs	
Rear clutch	4 discs	
Overdrive clutch	3 discs	
Direct clutch	6 discs	
42RE Band adjustment from 72 in. lbs.		
Front band	Back off 3 turns	
Rear band	Back off 4 turns	
Recommended fluid	Mopar® ATF +4, type 9602	

GEAR RATIOS

1ST GEAR	2.74:1
2ND GEAR	1.54:1
3RD GEAR	1.0:1
4TH GEAR	0.69:1
REVERSE	2.21:1

THRUST WASHER/SPACER/SNAP-RING DIMENSIONS

Component	Metric	Inch
Front clutch thrust washer (reaction shaft support hub)	1.55 mm	0.061 in.
Rear clutch thrust washer (clutch retainer)	1.55 mm	0.061 in.
Intermediate shaft thrust plate (shaft hub pilot)	Select fit to set end play	
Output shaft thrust washer (rear clutch hub)	1.5-1.6 mm	0.060-0.063 in.
Rear clutch pack snap-ring	1.5 mm	0.060 in.
	1.95 mm	0.076 in.
	2.45 mm	0.098 in.
Planetary geartrain snap-ring (at front of output shaft)	Select fit (three thicknesses avalible)	
Overdrive piston thrust plate	Thrust plate and spacer are select fit. Refer to size charts and selection procedures in Overdrive Unit D&A procedures	
Intermiediate shaft spacer		

AUTOMATIC TRANSMISSION - 42RE (Continued)

PRESSURE TEST

Overdrive clutch	Fourth gear only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line pressure (at accumulator)	Closed throttle	372-414 kPa (54-60 psi).
Front servo	Third or Fourth gear only	No more than 21 kPa (3 psi) lower than line pressure.
Rear servo	1 range R range	No more than 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm.
Governor	D range closed throttle	Pressure should respond smoothly to changes in mph and return to 0-7 kPa (0-1.5 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1.5 psi) at stand still will prevent transmission from downshifting.

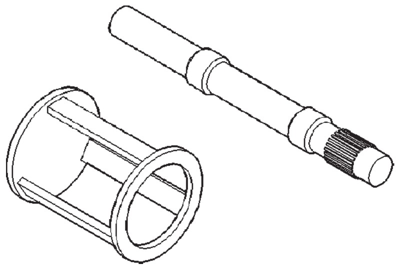
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fitting, cooler line at trans	18	13	-
Bolt, torque convertor	31	-	270
Bolt, clevis bracket to crossmember	47	35	-
Bolt, clevis bracket to rear support	68	50	-
Bolt, driveplate to crankshaft	75	55	-
Plug, front band reaction	17	13	-
Locknut, front band adj.	34	25	-
Switch, park/neutral	34	25	-
Bolt, fluid pan	17	13	-
Screws, fluid filter	4	-	35
Bolt, oil pump	20	15	-
Bolt, overrunning clutch cam	17	13	-
Bolt, O/D to trans.	34	25	-
Bolt, O/D piston retainer	17	13	-
Plug, pressure test port	14	10	-
Bolt, reaction shaft support	20	15	-
Locknut, rear band	41	30	-
Bolt, speedometer adapter	11	-	100
Screw, vehicle speed sensor	2.5	-	21
Bolt, valve body to case	12	-	100
Sensor, trans speed	27	20	-
Screw, solenoid wiring connector	4	-	35
Screw, solenoid to transfer plate	4	-	35

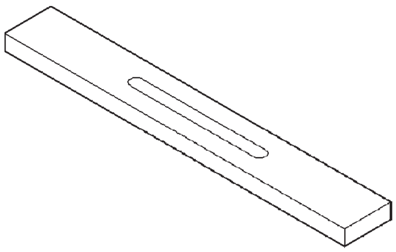
AUTOMATIC TRANSMISSION - 42RE (Continued)

SPECIAL TOOLS

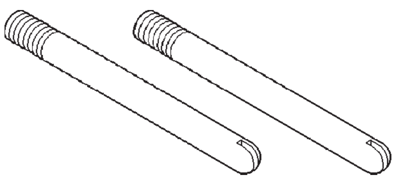
RE TRANSMISSIONS



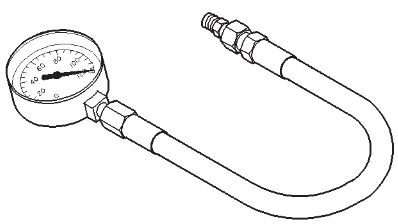
Shaft, Spring Compressor and Alignment - 6227



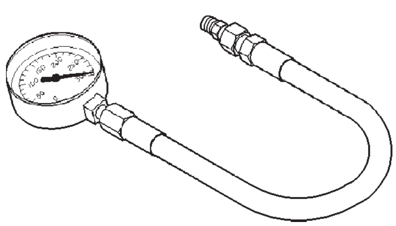
Bar, Gauge - 6311



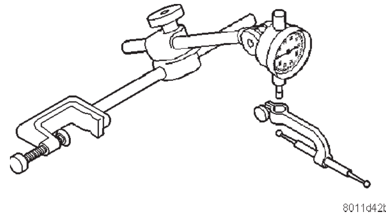
Pilot, Extension Housing - C-3288-B



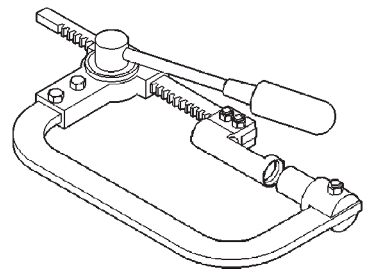
Gauge, Oil Pressure - C-3292



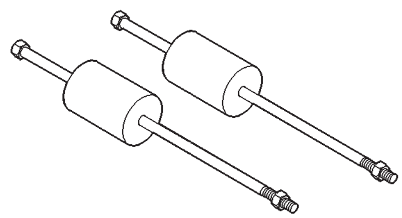
Gauge, Oil Pressure - C-3293SP



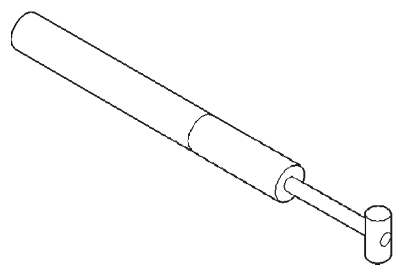
Dial Indicator - C-3339



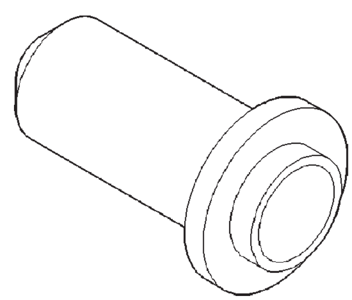
Compressor, Spring - C-3422-C



Puller, Slide Hammer - C-3752

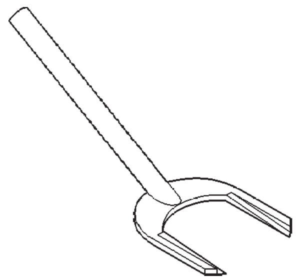


Gauge, Throttle Setting - C-3763

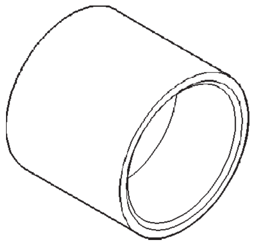


Installer, Seal - C-3860-A

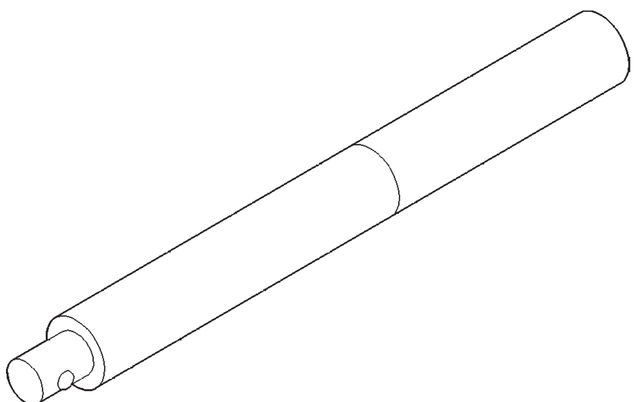
AUTOMATIC TRANSMISSION - 42RE (Continued)



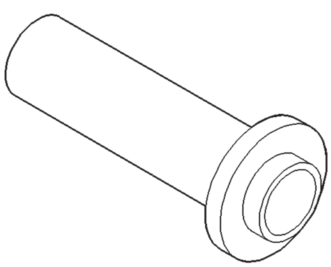
Remover, Seal - C-3985-B



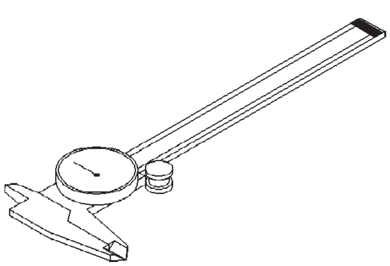
Installer, Seal - C-3995-A



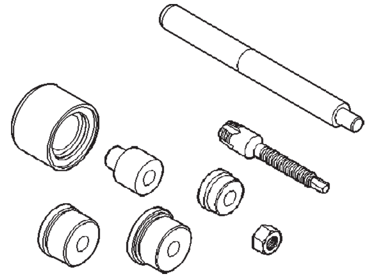
Handle, Universal - C-4171



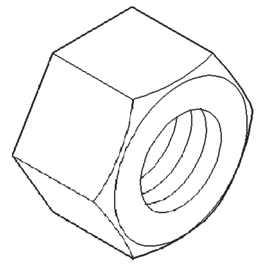
Installer, Seal - C-4193-A



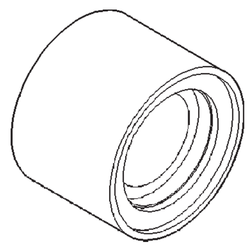
Dial Caliper - C-4962



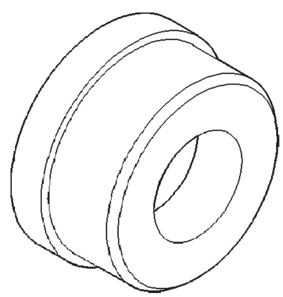
Kit, Bushing Remover/Installer - C-3887-J



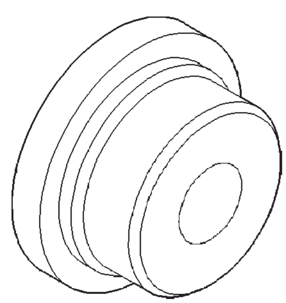
Nut, Bushing Remover - SP-1191, From kit C-3887-J



Cup, Bushing Remover - SP-3633, From kit C-3887-J

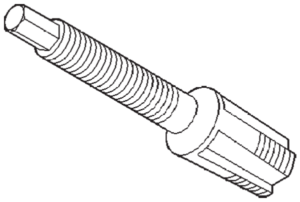


Remover, Bushing - SP-3551

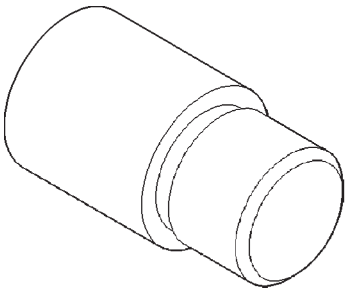


Installer, Bushing - SP-5117

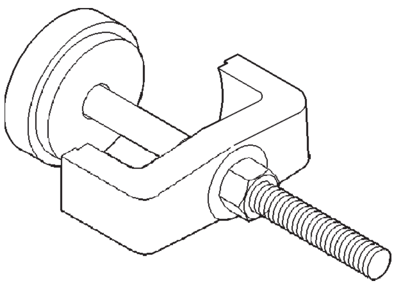
AUTOMATIC TRANSMISSION - 42RE (Continued)



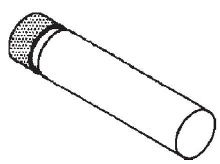
Remover, Bushing - SP-5324



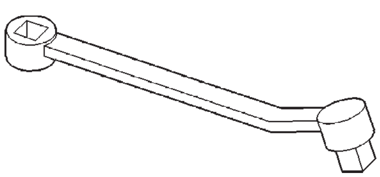
Installer, Bushing - SP-5325



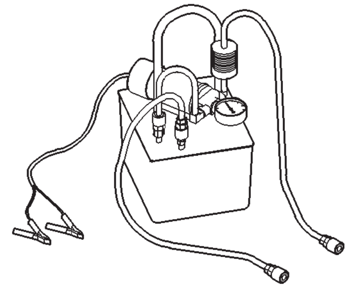
Compressor, Spring - C-3575-A



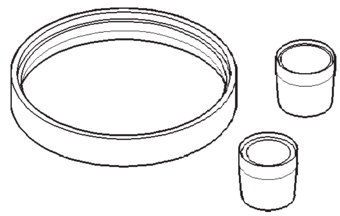
Gauge - 6312



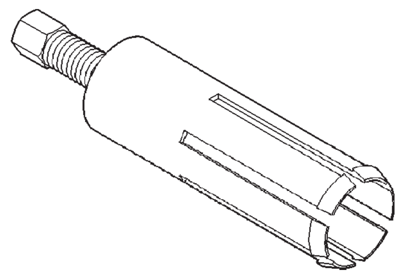
Adapter, Band Adjuster - C-3705



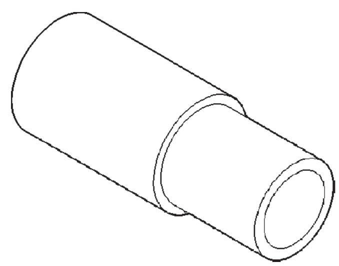
Flusher, Oil Cooler - 6906-B



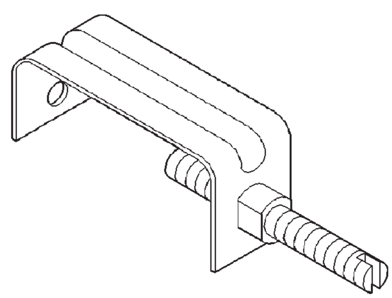
Installer, Piston - 8114



Remover, Bushing - 6957



Installer, Bushing - 6951



Retainer, Detent Ball and Spring - 6583

ACCUMULATOR

DESCRIPTION

The accumulator (Fig. 62) is a hydraulic device that has the sole purpose of cushioning the application of a band or clutch. The accumulator consists of a dual-land piston and a spring located in a bore in the transmission case. The 3-4 accumulator is located in a housing attached to the side of the valve body (Fig. 63).

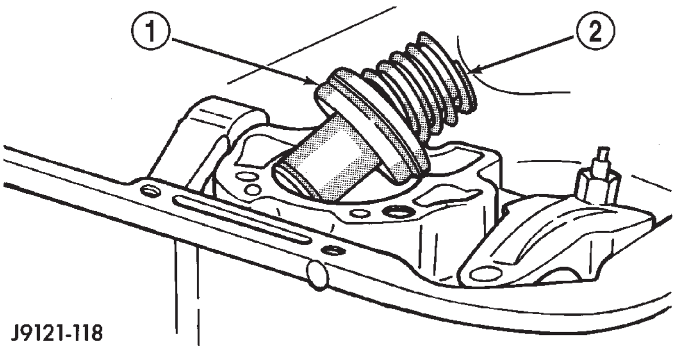


Fig. 62 Accumulator

1 - ACCUMULATOR PISTON
2 - PISTON SPRING

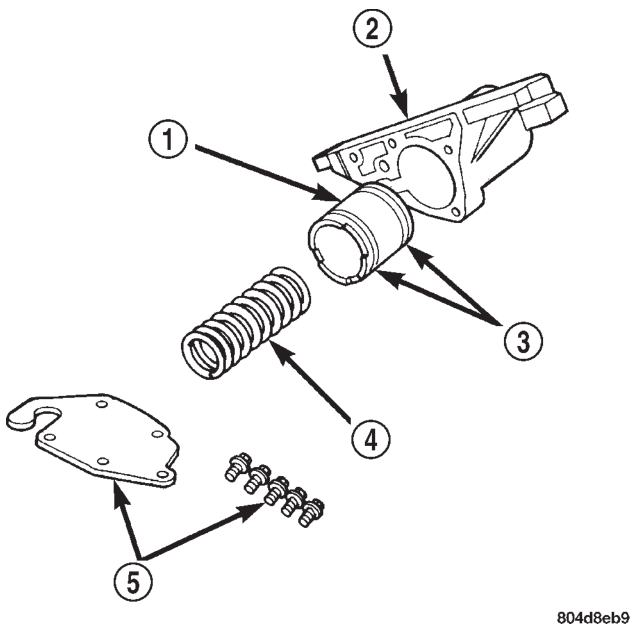


Fig. 63 3-4 Accumulator and Housing

1 - ACCUMULATOR PISTON
2 - 3-4 ACCUMULATOR HOUSING
3 - TEFLON SEALS
4 - PISTON SPRING
5 - COVER PLATE AND SCREWS

OPERATION

Both the accumulator and the 3-4 accumulator function the same. Line pressure is directed to the small end of the piston when the transmission is placed into a DRIVE position (Fig. 64), bottoming it against the accumulator plate. When the 1-2 upshift occurs (Fig. 65), line pressure is directed to the large end of the piston and then to the kickdown servo. As the line pressure reaches the accumulator, the combination of spring pressure and line pressure forces the piston away from the accumulator plate. This causes a balanced pressure situation, which results in a cushioned band application. After the kickdown servo has become immovable, line pressure will finish pushing the accumulator up into its bore. When the large end of the accumulator piston is seated in its bore, the band or clutch is fully applied.

NOTE: The accumulator is shown in the inverted position for illustrative purposes.

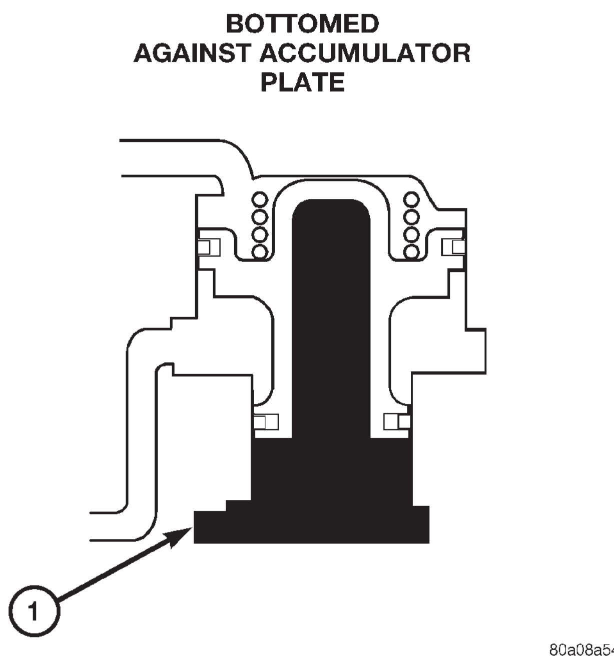


Fig. 64 Accumulator in DRIVE - FIRST Gear Position

1 - LINE PRESSURE

INSPECTION

Inspect the accumulator piston and seal rings (Fig. 66). Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.

Check condition of the accumulator inner and outer springs (Fig. 66). Replace the springs if the coils are cracked, distorted or collapsed.

BANDS (Continued)

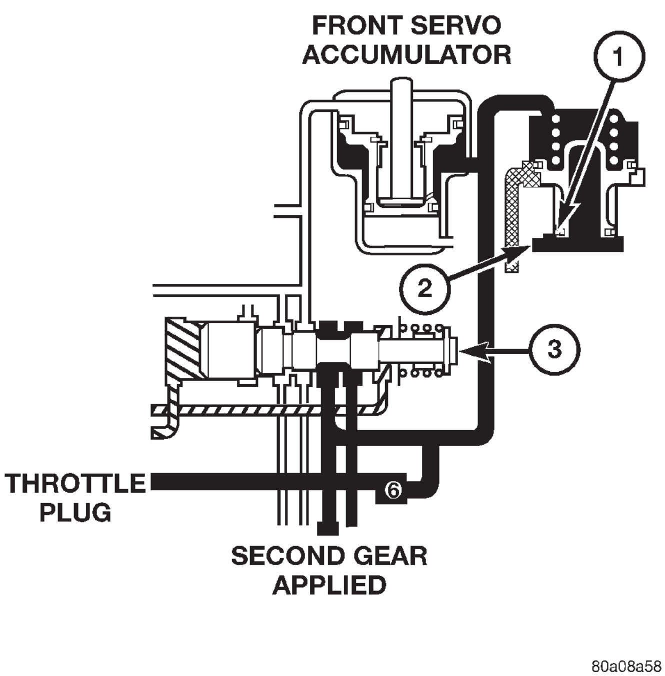


Fig. 65 Accumulator in SECOND Gear Position

1 - BOTTOM OF BORE
2 - LINE PRESSURE
3 - SHUTTLE VALVE

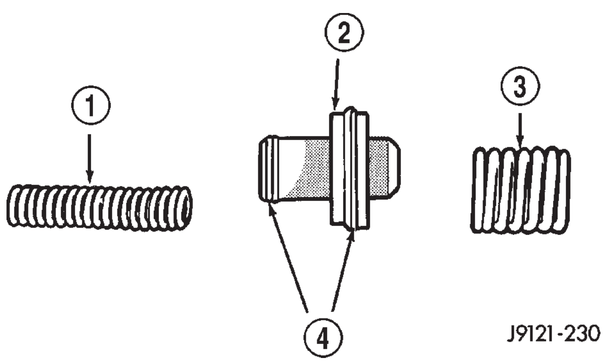


Fig. 66 Accumulator Components

1 - INNER SPRING
2 - ACCUMULATOR PISTON
3 - OUTER SPRING
4 - SEAL RINGS

BANDS

DESCRIPTION

KICKDOWN (FRONT) BAND

The kickdown, or "front", band (Fig. 67) holds the common sun gear of the planetary gear sets. The front (kickdown) band is made of steel, and faced on its inner circumference with a friction-type lining. One end of the band is anchored to the transmission case, and the other is acted on with a pushing force by a servo piston. The front band is a single-wrap design (the band does not completely encompass/wrap the drum that it holds).

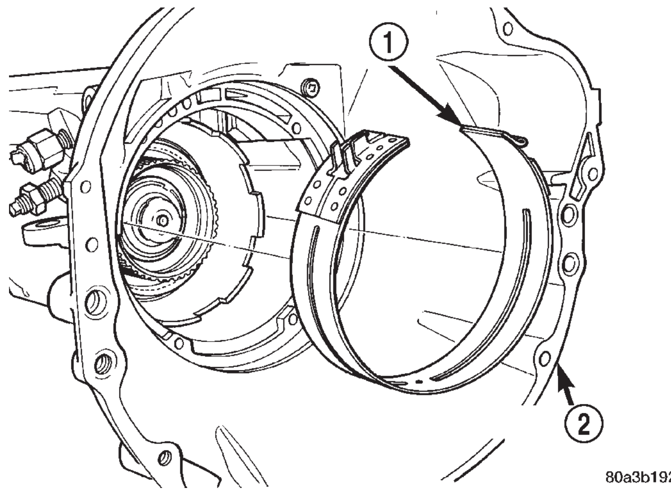


Fig. 67 Front Band

1 - FRONT BAND
2 - TRANSMISSION HOUSING

LOW/REVERSE (REAR) BAND

The low/reverse band, or "rear", band (Fig. 68) is similar in appearance and operation to the front band. The rear band is slightly different in that it does not use a link bar, but is acted directly on by the apply lever. This is referred to as a double-wrap band design (the drum is completely encompassed/wrapped by the band). The double-wrap band provides a greater holding power in comparison to the single-wrap design.

OPERATION

KICKDOWN (FRONT) BAND

The kickdown band holds the common sun gear of the planetary gear sets by applying and holding the front clutch retainer, which is splined to the sun gear driving shell, and in turn splined directly to the sun gear. The application of the band by the servo is typically done by an apply lever and link bar.

LOW/REVERSE (REAR) BAND

The rear band holds the rear planet carrier stationary by being mounted around and applied to the low/reverse drum.

BANDS (Continued)

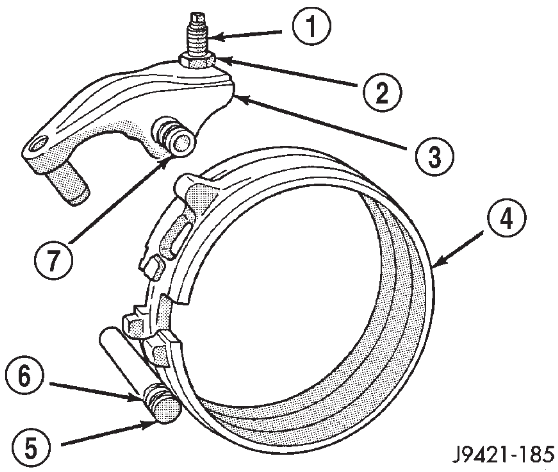


Fig. 68 Rear Band

1 - ADJUSTING SCREW
2 - LOCKNUT
3 - LEVER
4 - REAR BAND
5 - REACTION PIN
6 - O-RINGS
7 - PIVOT PIN

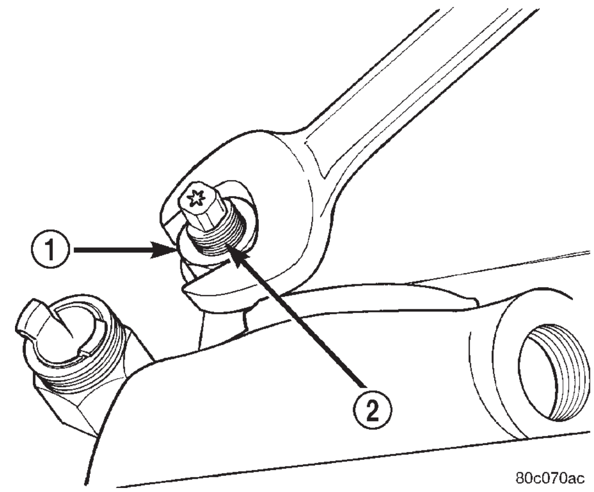


Fig. 69 Front Band Adjustment Screw Location

1 - LOCK-NUT
2 - FRONT BAND ADJUSTER

ADJUSTMENTS

ADJUSTMENT - BANDS

FRONT BAND

The front (kickdown) band adjusting screw is located on the left side of the transmission case above the manual valve and throttle valve levers.

(1) Raise vehicle.

(2) Loosen band adjusting screw locknut (Fig. 69). Then back locknut off 3-5 turns. Be sure adjusting screw turns freely in case. Apply lubricant to screw threads if necessary.

(3) Tighten band adjusting screw to 8 N·m (72 in. lbs.) torque with Inch Pound Torque Wrench C-3380-A, a 3-in. extension and appropriate Torx™ socket.

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw, tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

(4) Back off front band adjusting screw 3 turns.

(5) Hold adjuster screw in position and tighten locknut to 41 N·m (30 ft. lbs.) torque.

(6) Lower vehicle.

REAR BAND

The transmission oil pan must be removed for access to the rear band adjusting screw.

(1) Raise vehicle.

(2) Remove transmission oil pan and drain fluid.

(3) Loosen band adjusting screw locknut 5-6 turns (Fig. 70). Be sure adjusting screw turns freely in lever.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque.

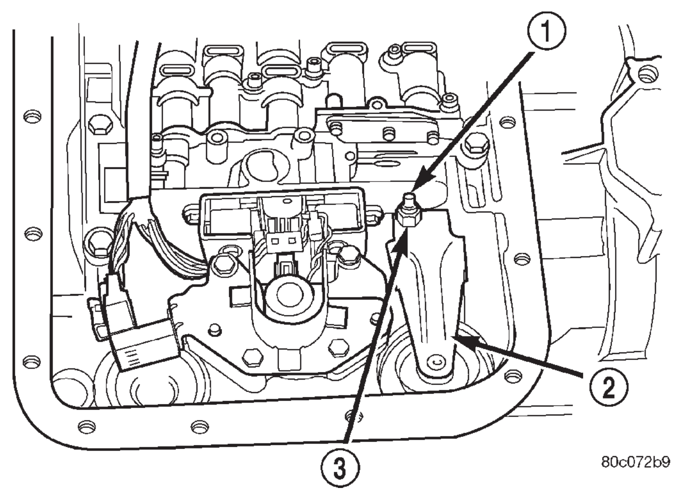


Fig. 70 Rear Band Adjusting Screw Location

1 - ADJUSTING SCREW
2 - REAR BAND LEVER
3 - LOCKNUT

(5) Back off adjusting screw 4 turns.

(6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(7) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(8) Lower vehicle and refill transmission with Mopar® ATF +4, type 9602, fluid.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

DESCRIPTION

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 71).

OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shifter assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK

(1) Verify that the key can only be removed in the PARK position

(2) When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.

(3) Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.

(4) Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.

(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

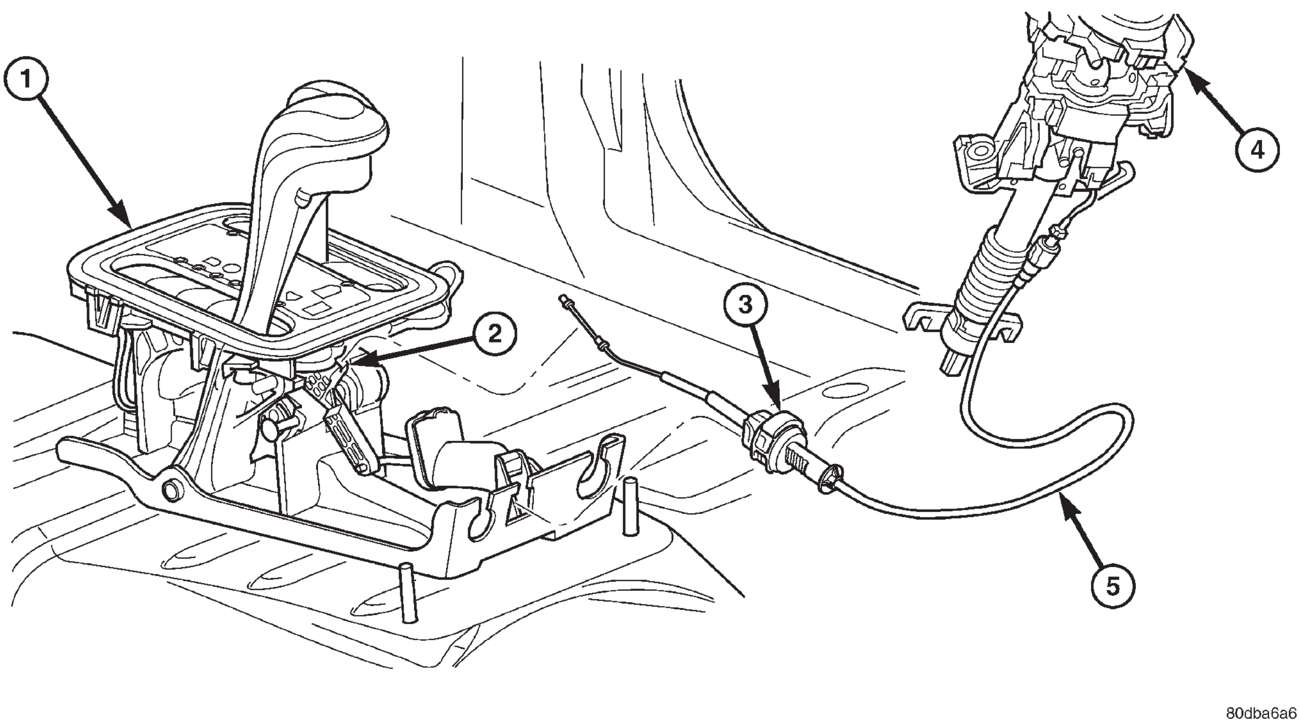


Fig. 71 Ignition Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

ADJUSTMENTS - BRAKE TRANSMISSION SHIFT INTERLOCK

The park interlock cable is part of the brake/shift lever interlock system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of PARK.

ADJUSTMENT PROCEDURE

(1) Remove floor console as necessary for access to the brake transmission shift interlock cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(2) Shift the transmission into the PARK position.

(3) Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**

(4) Pull cable lock button up to release cable (Fig. 72).

(5) Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.

(6) Push lock button down until it snaps in place.

BTSI FUNCTION CHECK

(1) Verify removal of ignition key allowed in PARK position only.

(2) When the shift lever is in PARK, and the shift handle push-button is in the out position, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the off position.

(4) Shifting out of PARK should not be possible while applying normal push-button force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gear and NEUTRAL, or PARK, may be done without depressing foot brake with ignition switch in run or start positions.

(7) The floor shifter lever and gate positions should be in alignment with all transmission detent positions.

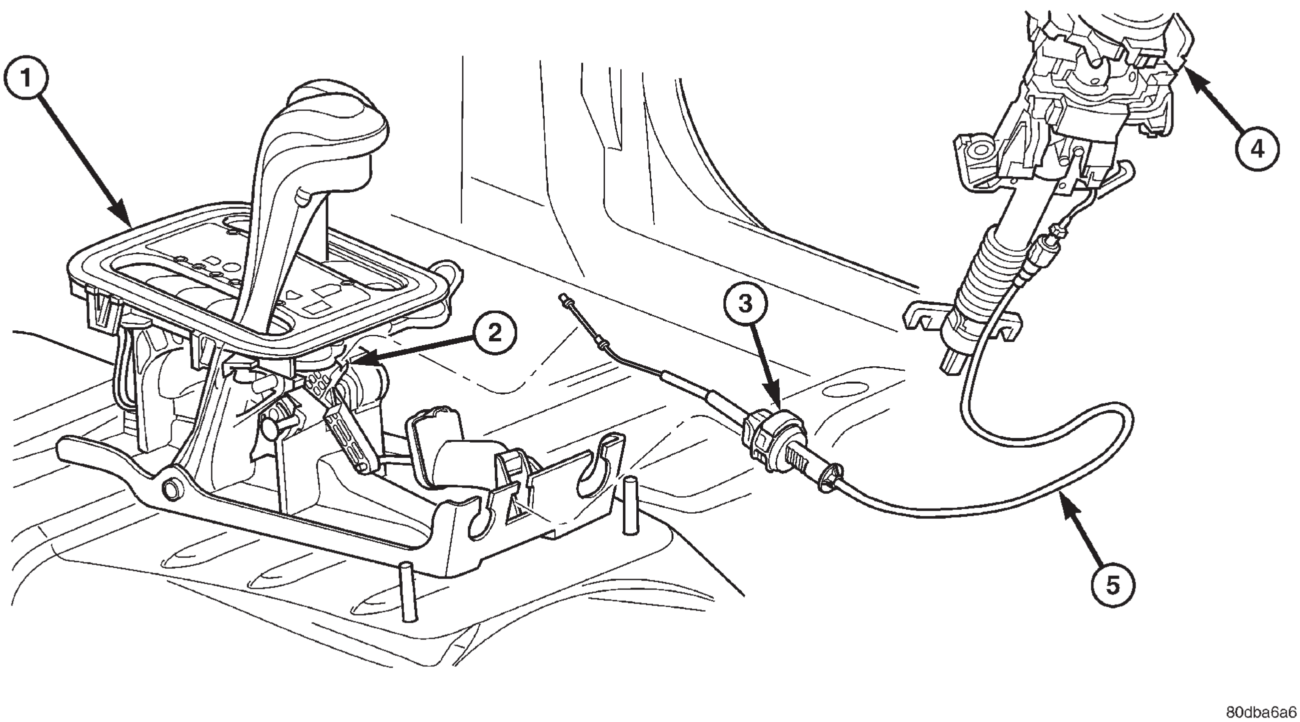


Fig. 72 Brake Transmission Shift Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

(8) Engine starts must be possible with shifter lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gate positions other than PARK or NEUTRAL.

(9) With shifter lever handle push-button not depressed and lever detent in:

- PARK position- apply forward force on center of handle and remove pressure. Engine start must be possible.
- PARK position- apply rearward force on center of handle and remove pressure. Engine start must be possible.
- NEUTRAL position- engine start must be possible.
- NEUTRAL position, engine running and brakes applied- Apply forward force on center of shift handle. Transmission should not be able to shift into REVERSE detent.

ELECTRONIC GOVERNOR

DESCRIPTION

Governor pressure is controlled electronically. Components used for governor pressure control include:

- Governor body
- Valve body transfer plate
- Governor pressure solenoid valve
- Governor pressure sensor
- Fluid temperature thermistor
- Throttle position sensor (TPS)
- Transmission speed sensor
- Powertrain control module (PCM)

GOVERNOR PRESSURE SOLENOID VALVE

The solenoid valve is a duty-cycle solenoid which regulates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device located in the governor body on the valve body transfer plate (Fig. 73).

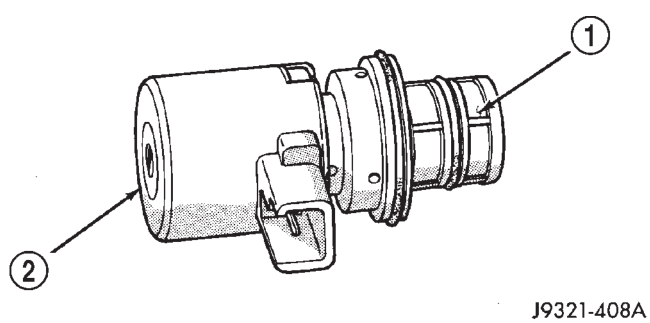


Fig. 73 Governor Pressure Solenoid Valve

1 - SOLENOID FILTER
2 - GOVERNOR PRESSURE SOLENOID

GOVERNOR PRESSURE SENSOR

The governor pressure sensor measures output pressure of the governor pressure solenoid valve (Fig. 74).

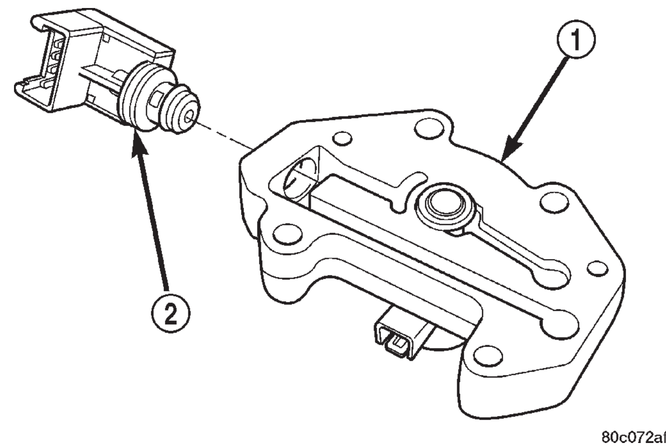


Fig. 74 Governor Pressure Sensor

1 - GOVERNOR BODY
2 - GOVERNOR PRESSURE SENSOR/TRANSMISSION FLUID TEMPERATURE THERMISTOR

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate is designed to supply transmission line pressure to the governor pressure solenoid valve and to return governor pressure.

The governor pressure solenoid valve is mounted in the governor body. The body is bolted to the lower side of the transfer plate (Fig. 74).

GOVERNOR PRESSURE CURVES

There are four governor pressure curves programmed into the transmission control module. The different curves allow the control module to adjust governor pressure for varying conditions. One curve is used for operation when fluid temperature is at, or below, –1°C (30°F). A second curve is used when fluid temperature is at, or above, 10°C (50°F) during normal city or highway driving. A third curve is used during wide-open throttle operation. The fourth curve is used when driving with the transfer case in low range.

OPERATION

Compensation is required for performance variations of two of the input devices. Though the slope of the transfer functions is tightly controlled, offset may vary due to various environmental factors or manufacturing tolerances.

The pressure transducer is affected by barometric pressure as well as temperature. Calibration of the zero pressure offset is required to compensate for shifting output due to these factors.

ELECTRONIC GOVERNOR (Continued)

Normal calibration will be performed when sump temperature is above 50 degrees F, or in the absence of sump temperature data, after the first 10 minutes of vehicle operation. Calibration of the pressure transducer offset occurs each time the output shaft speed falls below 200 RPM. Calibration shall be repeated each 3 seconds the output shaft speed is below 200 RPM. A 0.5 second pulse of 95% duty cycle is applied to the governor pressure solenoid valve and the transducer output is read during this pulse. Averaging of the transducer signal is necessary to reject electrical noise.

Under cold conditions (below 50 degrees F sump), the governor pressure solenoid valve response may be too slow to guarantee 0 psi during the 0.5 second calibration pulse. Calibration pulses are continued during this period, however the transducer output valves are discarded. Transducer offset must be read at key-on, under conditions which promote a stable reading. This value is retained and becomes the offset during the ″cold″ period of operation.

GOVERNOR PRESSURE SOLENOID VALVE

The inlet side of the solenoid valve is exposed to normal transmission line pressure. The outlet side of the valve leads to the valve body governor circuit.

The solenoid valve regulates line pressure to produce governor pressure. The average current supplied to the solenoid controls governor pressure. One amp current produces zero kPa/psi governor pressure. Zero amps sets the maximum governor pressure.

The powertrain control module (PCM) turns on the trans control relay which supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC). The PCM controls the ground side of the solenoid using the governor pressure solenoid control circuit.

GOVERNOR PRESSURE SENSOR

The sensor output signal provides the necessary feedback to the PCM. This feedback is needed to adequately control governor pressure.

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate channels line pressure to the solenoid valve through the governor body. It also channels governor pressure from the solenoid valve to the governor circuit. It is the solenoid valve that develops the necessary governor pressure.

GOVERNOR PRESSURE CURVES

LOW TRANSMISSION FLUID TEMPERATURE

When the transmission fluid is cold the conventional governor can delay shifts, resulting in higher than normal shift speeds and harsh shifts. The electronically controlled low temperature governor pressure curve is higher than normal to make the transmission shift at normal speeds and sooner. The PCM uses a temperature sensor in the transmission oil sump to determine when low temperature governor pressure is needed.

NORMAL OPERATION

Normal operation is refined through the increased computing power of the PCM and through access to data on engine operating conditions provided by the PCM that were not available with the previous stand-alone electronic module. This facilitated the development of a load adaptive shift strategy - the ability to alter the shift schedule in response to vehicle load condition. One manifestation of this capability is grade ″hunting″ prevention - the ability of the transmission logic to delay an upshift on a grade if the engine does not have sufficient power to maintain speed in the higher gear. The 3-2 downshift and the potential for hunting between gears occurs with a heavily loaded vehicle or on steep grades. When hunting occurs, it is very objectionable because shifts are frequent and accompanied by large changes in noise and acceleration.

WIDE OPEN THROTTLE OPERATION

In wide-open throttle (WOT) mode, adaptive memory in the PCM assures that up-shifts occur at the preprogrammed optimum speed. WOT operation is determined from the throttle position sensor, which is also a part of the emission control system. The initial setting for the WOT upshift is below the optimum engine speed. As WOT shifts are repeated, the PCM learns the time required to complete the shifts by comparing the engine speed when the shifts occur to the optimum speed. After each shift, the PCM adjusts the shift point until the optimum speed is reached. The PCM also considers vehicle loading, grade and engine performance changes due to high altitude in determining when to make WOT shifts. It does this by measuring vehicle and engine acceleration and then factoring in the shift time.

TRANSFER CASE LOW RANGE OPERATION

On four-wheel drive vehicles operating in low range, the engine can accelerate to its peak more rapidly than in Normal range, resulting in delayed shifts and undesirable engine ″flare.″ The low range governor pressure curve is also higher than normal to initiate upshifts sooner. The PCM compares electronic vehicle speed signal used by the speedometer to the transmission output shaft speed signal to determine when the transfer case is in low range.

ELECTRONIC GOVERNOR (Continued)

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove transmission fluid pan and filter.

(3) Disengage wire connectors from pressure sensor and solenoid (Fig. 75).

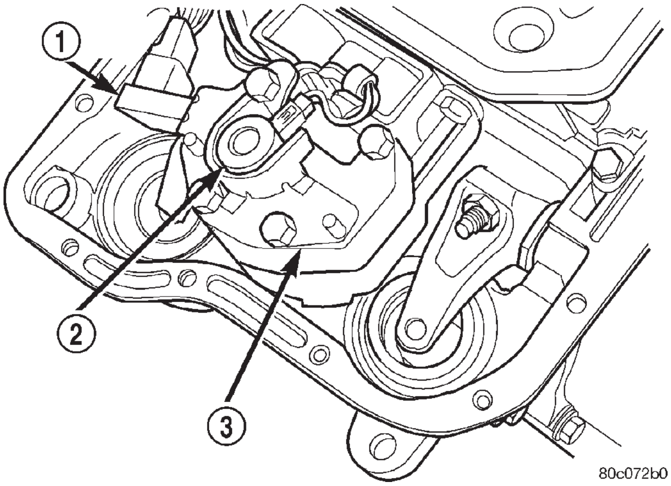


Fig. 75 Governor Solenoid And Pressure Sensor

1 - PRESSURE SENSOR
2 - PRESSURE SOLENOID
3 - GOVERNOR

(4) Remove screws holding pressure solenoid retainer to governor body.

(5) Separate solenoid retainer from governor (Fig. 76).

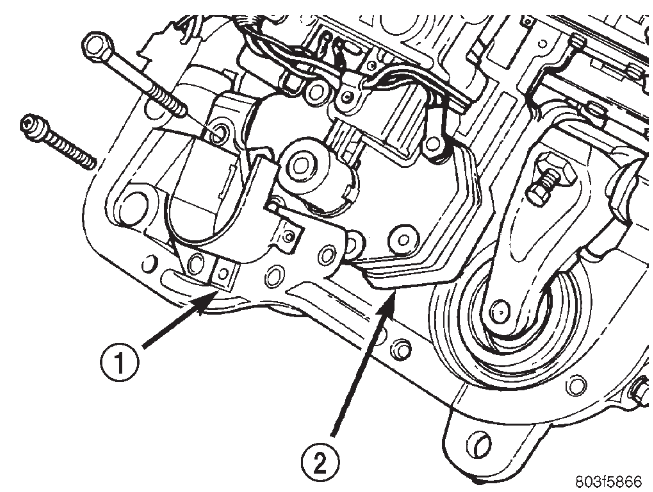


Fig. 76 Pressure Solenoid Retainer

1 - PRESSURE SOLENOID RETAINER
2 - GOVERNOR

(6) Pull solenoid from governor body (Fig. 77).

(7) Pull pressure sensor from governor body.

(8) Remove bolts holding governor body to valve body.

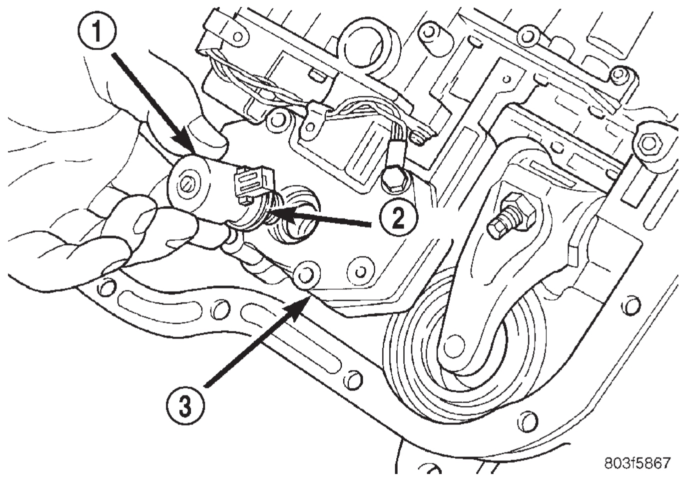


Fig. 77 Pressure Solenoid and O-ring

1 - PRESSURE SOLENOID
2 - O-RING
3 - GOVERNOR

(9) Separate governor body from valve body (Fig. 78).

(10) Remove governor body gasket.

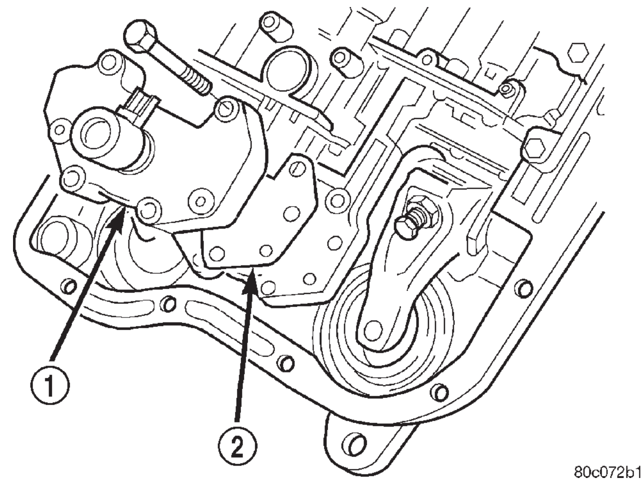


Fig. 78 Governor Body and Gasket

1 - GOVERNOR BODY
2 - GASKET

INSTALLATION

Before installing the pressure sensor and solenoid in the governor body, replace o-ring seals, clean the gasket surfaces and replace gasket.

(1) Place gasket in position on back of governor body (Fig. 79).

(2) Place governor body in position on valve body.

(3) Install bolts to hold governor body to valve body.

(4) Lubricate o-ring on pressure sensor with transmission fluid.

(5) Align pressure sensor to bore in governor body.

ELECTRONIC GOVERNOR (Continued)

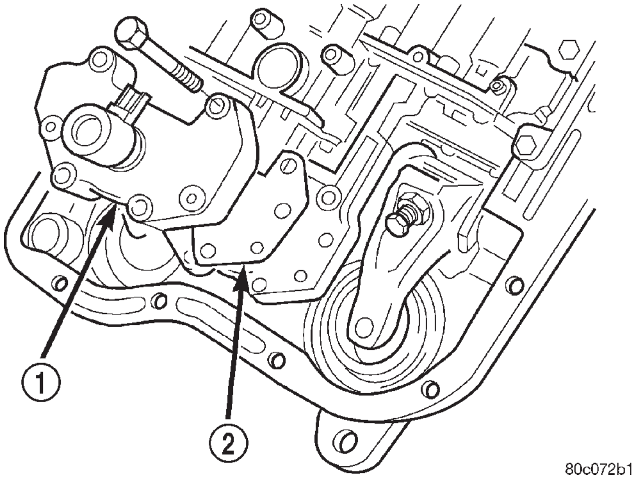


Fig. 79 Governor Body and Gasket

1 - GOVERNOR BODY
2 - GASKET

(6) Push pressure sensor into governor body.

(7) Lubricate o-ring, on pressure solenoid, with transmission fluid.

(8) Align pressure solenoid to bore in governor body (Fig. 80).

(9) Push solenoid into governor body.

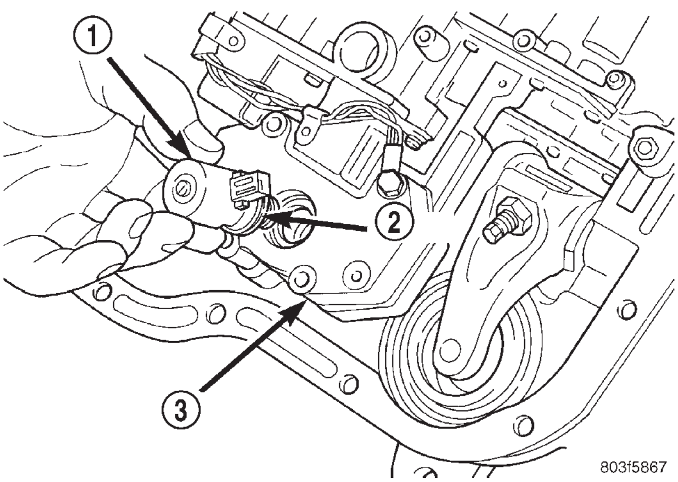


Fig. 80 Pressure Solenoid and O-ring

1 - PRESSURE SOLENOID
2 - O-RING
3 - GOVERNOR

(10) Place solenoid retainer in position on governor (Fig. 81).

(11) Install screws to hold pressure solenoid retainer to governor body.

(12) Engage wire connectors into pressure sensor and solenoid (Fig. 82).

(13) Install transmission fluid pan and (new) filter.

(14) Lower vehicle and road test to verify repair.

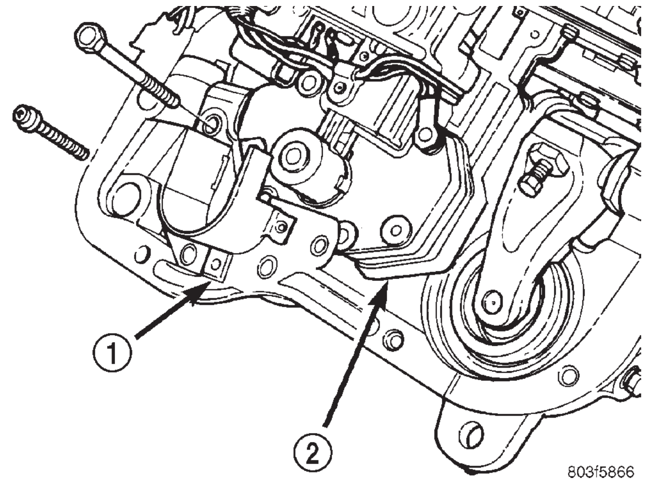


Fig. 81 Pressure Solenoid Retainer

1 - PRESSURE SOLENOID RETAINER
2 - GOVERNOR

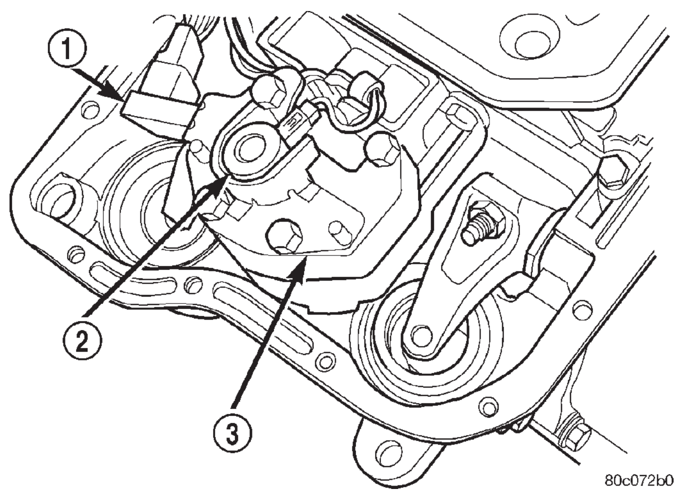


Fig. 82 Governor Solenoid And Pressure Sensor

1 - PRESSURE SENSOR
2 - PRESSURE SOLENOID
3 - GOVERNOR

EXTENSION HOUSING BUSHING

REMOVAL

(1) Remove extension housing yoke seal.

(2) Insert Remover 6957 into the extension housing. Tighten tool to bushing and remove bushing (Fig. 83).

INSTALLATION

(1) Align bushing oil hole with oil slot in extension housing.

(2) Tap bushing into place with Installer 6951 and Handle C-4171.

EXTENSION HOUSING BUSHING (Continued)

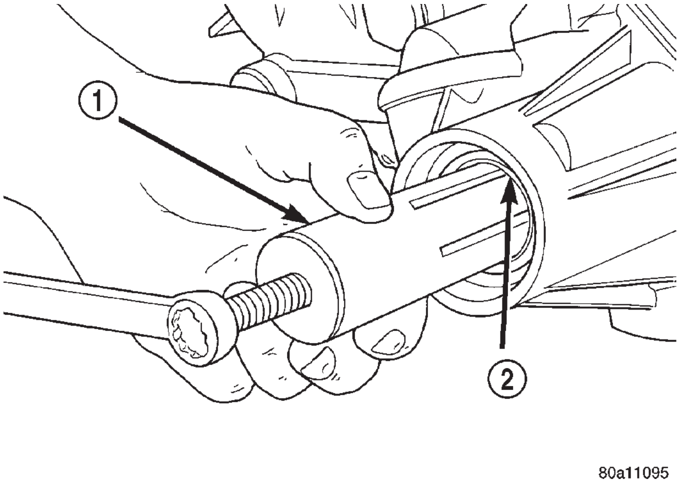


Fig. 83 Bushing Removal - Typical

1 - REMOVER 6957
2 - EXTENSION HOUSING BUSHING

(3) Install new oil seal in housing using Seal Installer C-3995-A (Fig. 84).

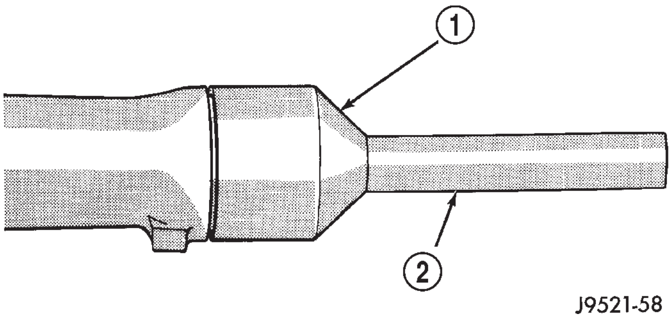


Fig. 84 Extension Housing Seal Installation

1 - SPECIAL TOOL C-3995-A OR C-3972-A
2 - SPECIAL TOOL C-4471

EXTENSION HOUSING SEAL

REMOVAL

(1) Raise vehicle.
(2) Mark propeller shaft and axle yoke for alignment reference.
(3) Disconnect and remove propeller shaft.
(4) Remove old seal with Seal Remover C-3985-B (Fig. 85) from overdrive housing.

INSTALLATION

(1) Place seal in position on overdrive housing.
(2) Drive seal into overdrive housing with Seal Installer C-3995-A (Fig. 86).
(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.

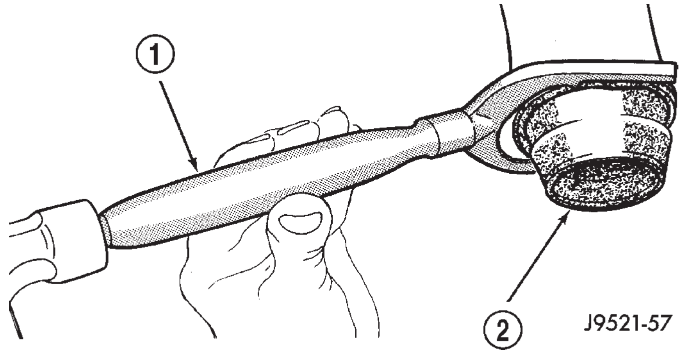


Fig. 85 Removing Overdrive Housing Yoke Seal

1 - SPECIAL TOOL C-3985-B
2 - SEAL

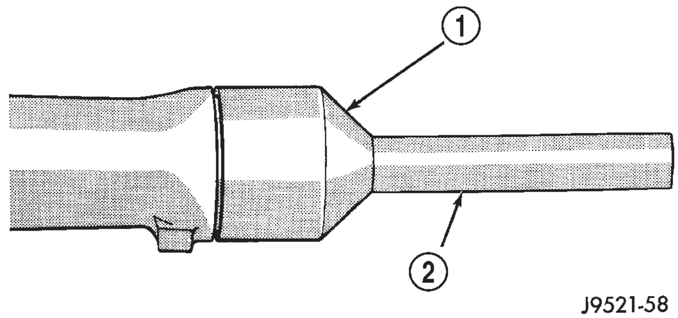


Fig. 86 Installing Overdrive Housing Seal

1 - SPECIAL TOOL C-3995-A OR C-3972-A
2 - SPECIAL TOOL C-4471

FLUID AND FILTER

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

FLUID AND FILTER (Continued)

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(2) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

DIAGNOSIS AND TESTING - FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmssion has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

Fluid level is checked with the engine running at curb idle speed, the transmission in NEUTRAL and the transmission fluid at normal operating temperature. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.**

The transmission fluid level can be checked two ways.

PROCEDURE ONE

(1) Transmission fluid must be at normal operating temperature for accurate fluid level check. Drive vehicle if necessary to bring fluid temperature up to normal hot operating temperature of 82°C (180°F).

(2) Position vehicle on level surface.

(3) Start and run engine at curb idle speed.

(4) Apply parking brakes.

(5) Shift transmission momentarily into all gear ranges. Then shift transmission back to NEUTRAL.

(6) Clean top of filler tube and dipstick to keep dirt from entering tube.

(7) Remove dipstick (Fig. 87) and check fluid level as follows:

(a) Correct acceptable level is in crosshatch area.

(b) Correct maximum level is to MAX arrow mark.

(c) Incorrect level is at or below MIN line.

(d) If fluid is low, add only enough Mopar® ATF +4, type 9602, to restore correct level. Do not overfill.

FLUID AND FILTER (Continued)

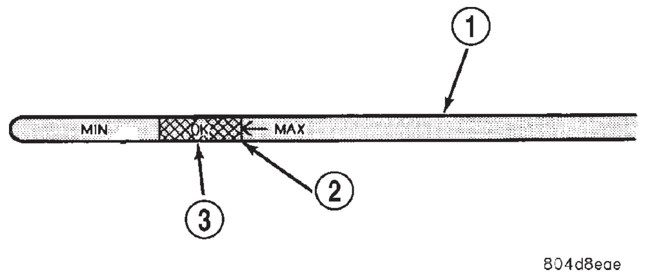


Fig. 87 Dipstick Fluid Level Marks - Typical

1 - DIPSTICK
2 - MAXIMUM CORRECT FLUID LEVEL
3 - ACCEPTABLE FLUID LEVEL

PROCEDURE TWO

(1) Start engine and apply parking brake.

(2) Shift the transmission into DRIVE for approximately 2 seconds.

(3) Shift the transmission into REVERSE for approximately 2 seconds.

(4) Shift the transmission into PARK.

(5) Hook up DRB® scan tool and select engine.

(6) Select sensors.

(7) Read the transmission temperature value.

(8) Compare the fluid temperature value with the figure. (Fig. 88)

(9) Adjust transmission fluid level shown on the dipstick according to the figure.

NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.

(10) Check transmission for leaks.

STANDARD PROCEDURE - FLUID AND FILTER REPLACEMENT

For proper service intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION). The service fluid fill after a filter change is approximately 3.8 liters (4.0 quarts).

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission (Fig. 89).

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan and gasket away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolt holding pan to transmission.

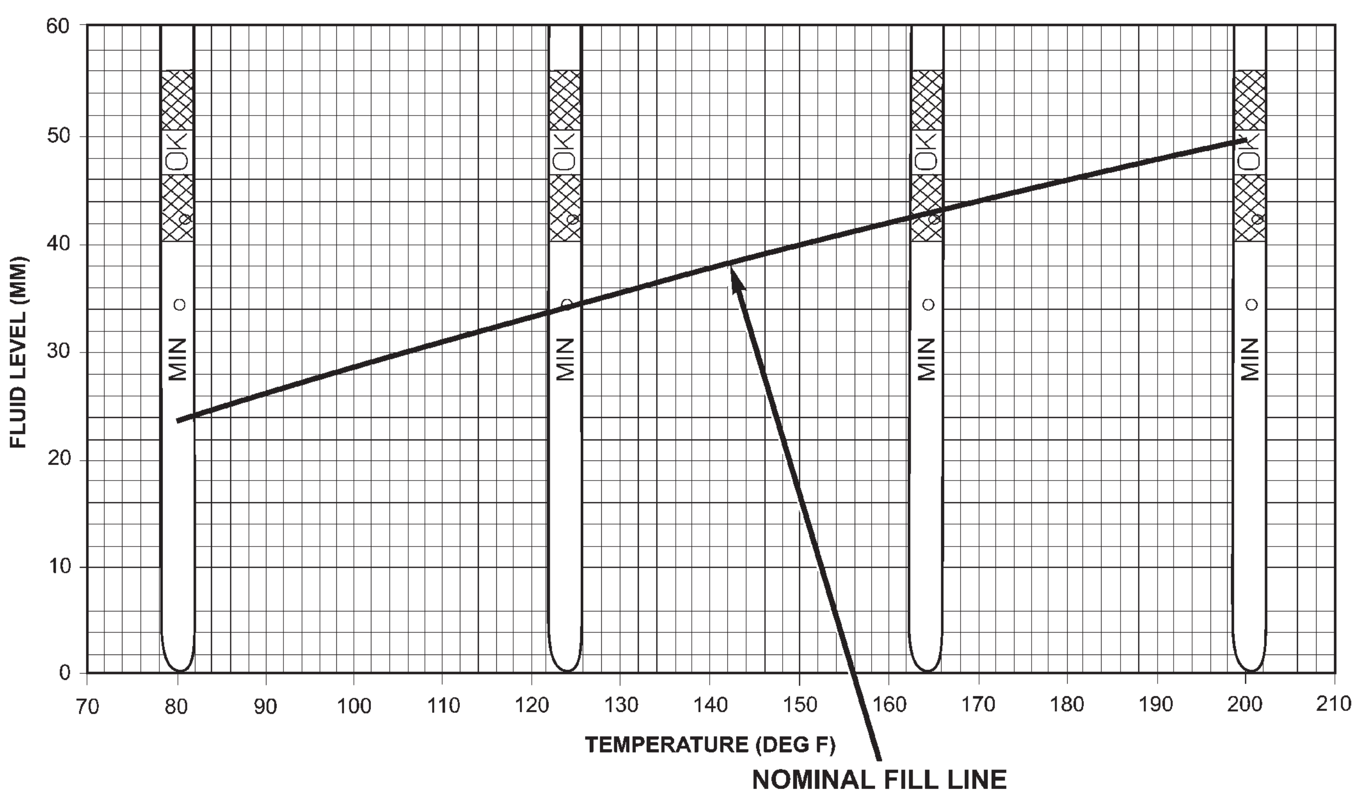


Fig. 88 42/44RE Fluid Fill Graph

FLUID AND FILTER (Continued)

(7) While holding pan level, lower pan and gasket away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screws holding filter to valve body (Fig. 90).

(10) Separate filter from valve body and pour fluid in filter into drain pan.

(11) Dispose of used trans fluid and filter properly.

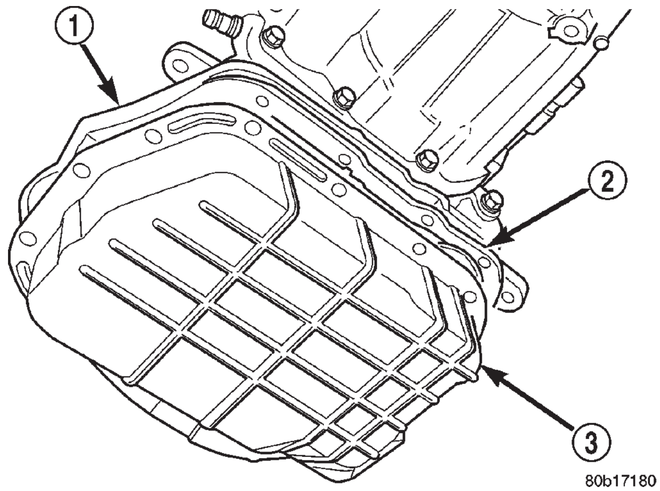


Fig. 89 Transmission Pan

1 - TRANSMISSION
2 - GASKET
3 - PAN

INSTALLATION

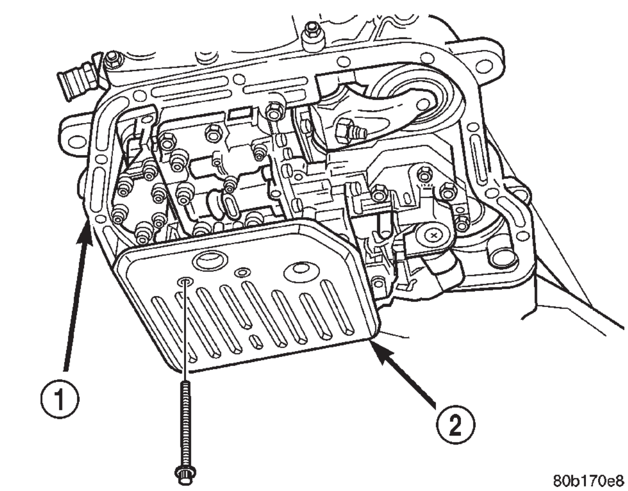


Fig. 90 Transmission Filter

1 - TRANSMISSION
2 - FILTER

(1) Position a new transmission oil filter onto the valve body.

(2) Install the screws to hold the filter to the valve body. Tighten the screws to 4 N·m (35 in.lbs.).

(3) Clean the gasket surfaces of the transmission oil pan and transmission pan rail.

NOTE: The transmission pan oil gasket is reusable. Inspect the sealing surfaces of the gasket. If the sealing ribs on both surfaces appear to be in good condition, clean the gasket of any foreign material and reinstall.

(4) Position the oil pan gasket onto the oil pan.

(5) Position the oil pan and gasket onto the transmission and install several bolts to hold the pan and gasket to the transmission.

(6) Install the remainder of the oil pan bolts. Tighten the bolts to 13.6 N·m (125 in.lbs.).

(7) Lower vehicle and fill transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/ FLUID - STANDARD PROCEDURE)

STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF +4, type 9602, to transmission:

(a) If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF +4 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **12 pints (6 quarts)** of ATF +4 to transmission.

(3) Apply parking brakes.

(4) Start and run engine at normal curb idle speed.

(5) Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

FRONT CLUTCH

DESCRIPTION

The front clutch assembly (Fig. 91) is composed of the front clutch retainer, pressure plate, clutch plates, driving discs, piston, piston return spring, return spring retainer, and snap-rings. The front clutch is the forward-most component in the transmission geartrain and is directly behind the oil pump and is considered a driving component.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

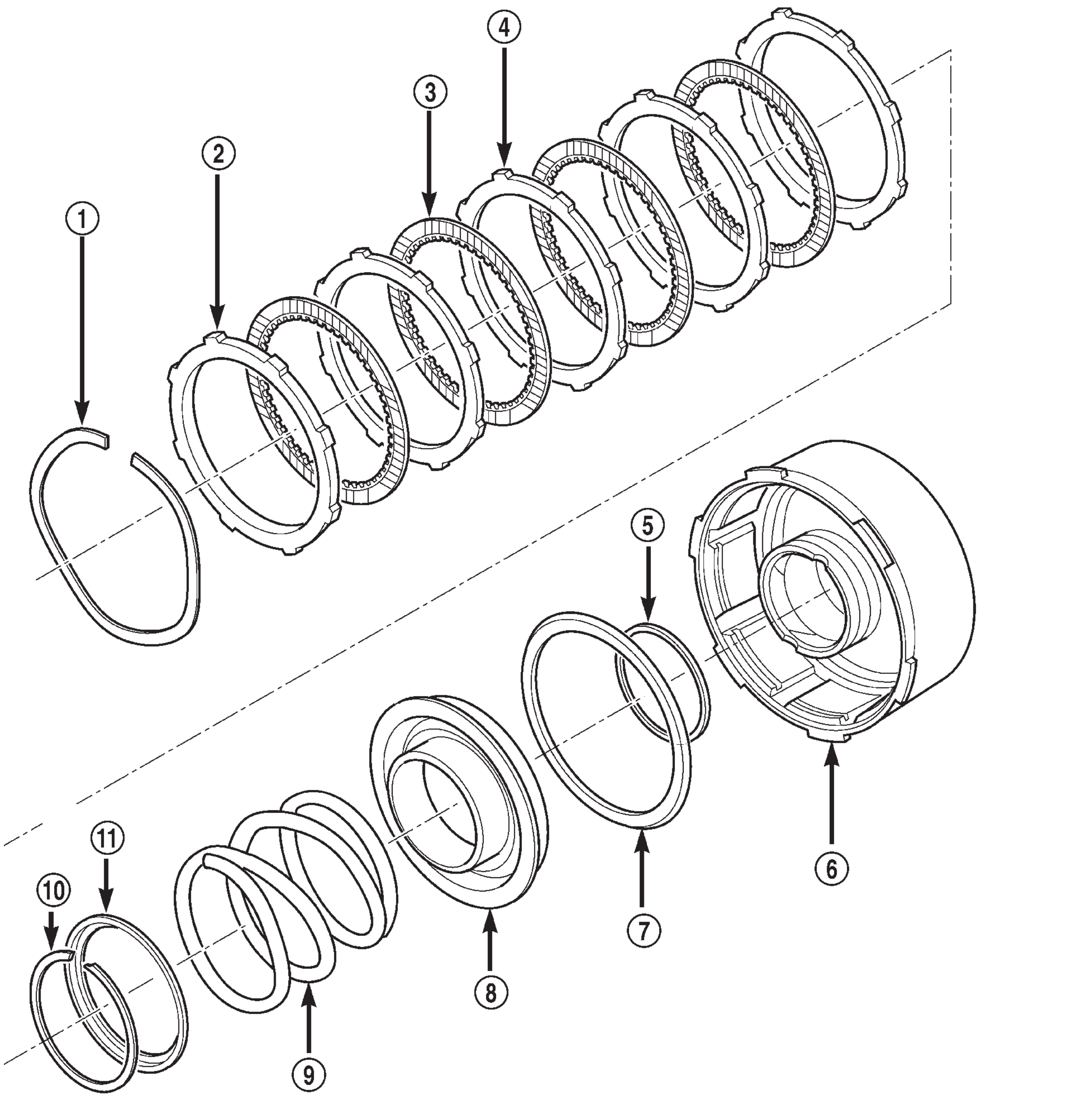


Fig. 91 Front Clutch Components

1 - SNAP-RING (WAVE)
2 - REACTION PLATE
3 - CLUTCH DISC
4 - CLUTCH PLATE
5 - SEAL
6 - CLUTCH RETAINER
7 - SEAL
8 - PISTON
9 - SPRING
10 - SNAP-RING
11 - SPRING RETAINER

FRONT CLUTCH (Continued)

OPERATION

To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved snap-ring is used to cushion the application of the clutch pack.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one-way ball-check-valve located in the clutch retainer. The check-valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

DISASSEMBLY

(1) Remove waved snap-ring and remove pressure plate, clutch plates and clutch discs (Fig. 92).

(2) Compress clutch piston spring with Compressor Tool C-3575-A (Fig. 93). Be sure legs of tool are seated squarely on spring retainer before compressing spring.

(3) Remove retainer snap-ring and remove compressor tool.

(4) Remove spring retainer and clutch spring. Note position of retainer on spring for assembly reference.

(5) Remove clutch piston from clutch retainer. Remove piston by rotating it up and out of retainer.

(6) Remove seals from clutch retainer piston bore and clutch retainer hub. Discard both seals as they are not reusable.

INSPECTION

Inspect the front clutch components. Replace the clutch discs if warped, worn, scored, burned or charred, or if the facing is flaking off. Replace the steel plates if heavily scored, warped, or broken. Be sure the driving lugs on the plates are in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the clutch spring and spring retainer if either is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The steel plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged.

Check action of the check ball in the retainer (Fig. 94). The ball must move freely and not stick.

NOTE: Inspect the clutch retainer bushings carefully (Fig. 95). The retainer bushings are NOT serviceable. It will be necessary to replace the retainer if either bushing is scored, or worn.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

ASSEMBLY

NOTE: The 42RE transmission uses four plates and discs for the front clutch.

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seals in the clutch retainer lower groove and on outer diameter of the retainer hub. Be sure lip of each seal faces interior of clutch retainer.

(3) Lubricate lips of the retainer seals with liberal quantity of Mopar® Door Ease. Then lubricate retainer hub, bore and piston with light coat of transmission fluid.

(4) Install clutch piston in retainer (Fig. 96). Use twisting motion to seat piston in bottom of retainer.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip.

(5) Position spring in clutch piston (Fig. 97).

(6) Position spring retainer on top of piston spring. Make sure retainer is properly installed (Fig. 92).

(7) Compress piston spring and retainer with Compressor Tool C-3575-A (Fig. 93). Then install new snap-ring to secure spring retainer and spring.

(8) Install clutch plates and discs (Fig. 92). Install steel plate then disc until all plates and discs are installed. The front clutch uses 4 clutch discs and plates in a 42RE transmission.

(9) Install pressure plate and waved snap-ring (Fig. 92).

Clearance should be 1.70 to 3.40 mm (0.067 to 0.134 in.). If clearance is incorrect, clutch discs, plates, pressure plates and snap-ring may have to be changed.

FRONT CLUTCH (Continued)

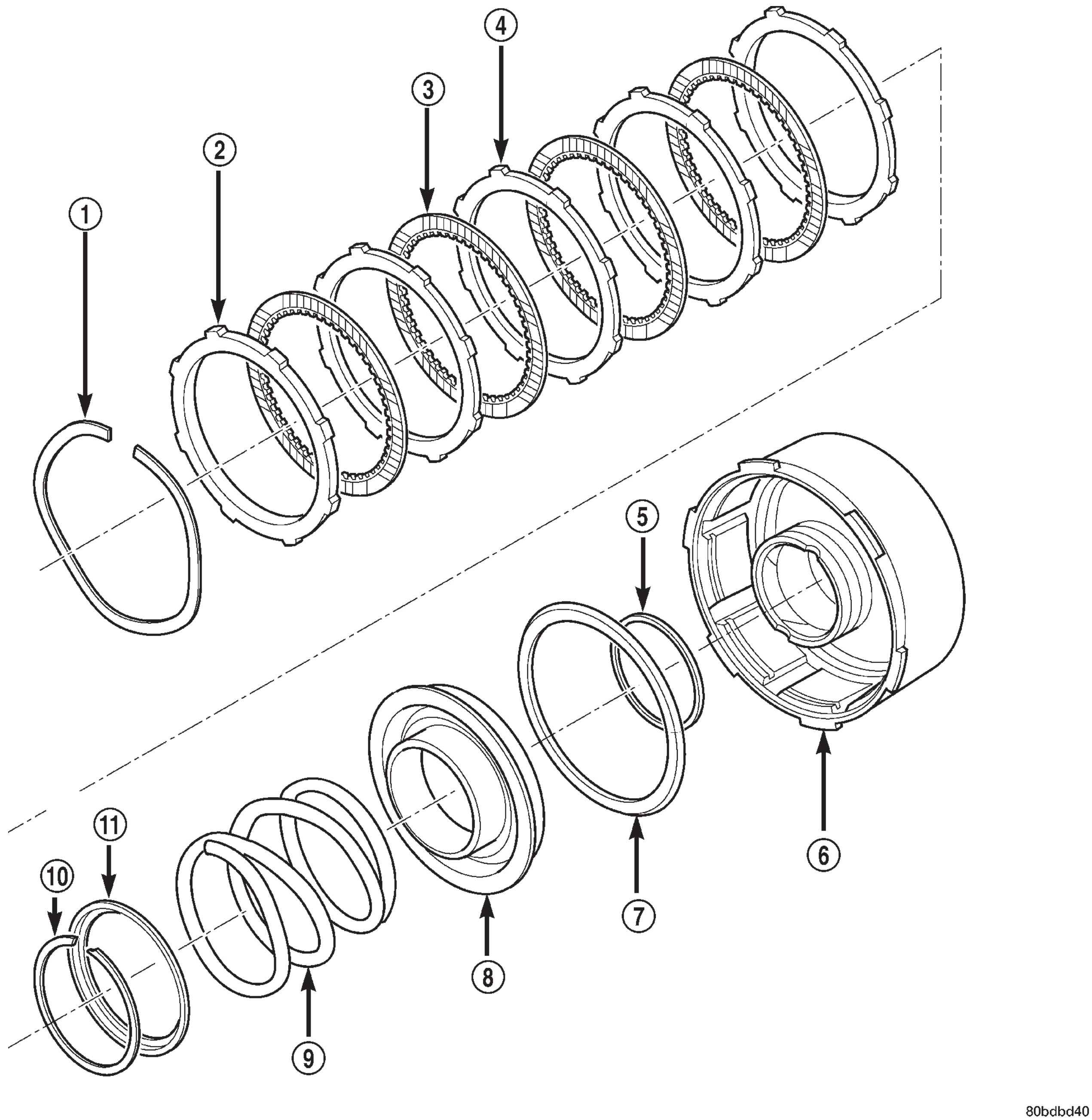


Fig. 92 42RE Front Clutch Components

1 - SNAP-RING (WAVE)
2 - REACTION PLATE
3 - CLUTCH DISC
4 - CLUTCH PLATE
5 - SEAL
6 - CLUTCH RETAINER
7 - SEAL
8 - PISTON
9 - SPRING
10 - SNAP-RING
11 - SPRING RETAINER

FRONT CLUTCH (Continued)

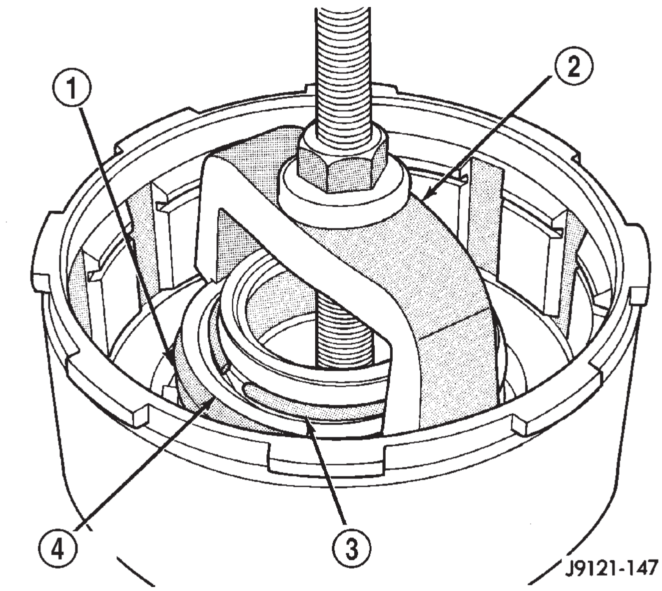


Fig. 93 Compressing Front Clutch Piston Spring

1 - FRONT CLUTCH SPRING
2 - COMPRESSOR TOOL C-3575-A
3 - RETAINER SNAP-RING
4 - SPRING RETAINER

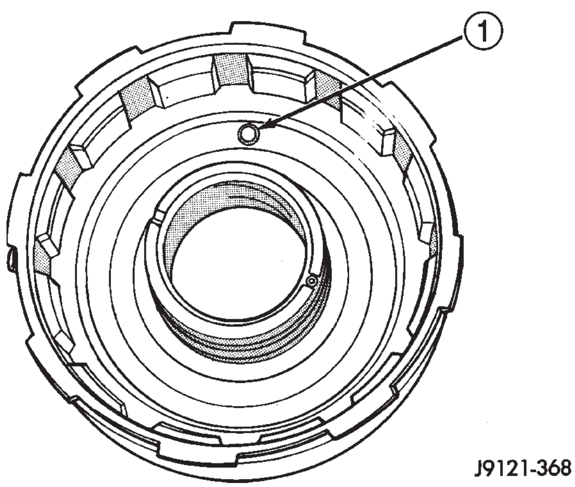


Fig. 94 Front Clutch Piston Retainer Check Ball Location

1 - RETAINER CHECK BALL

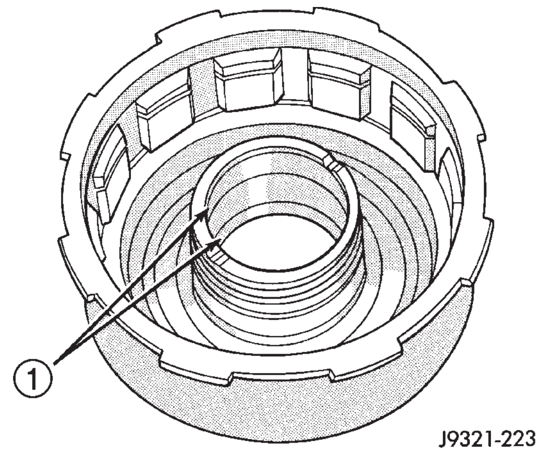


Fig. 95 Retainer Bushing Location/Inspection

1 - FRONT CLUTCH RETAINER BUSHINGS (NON-SERVICEABLE)

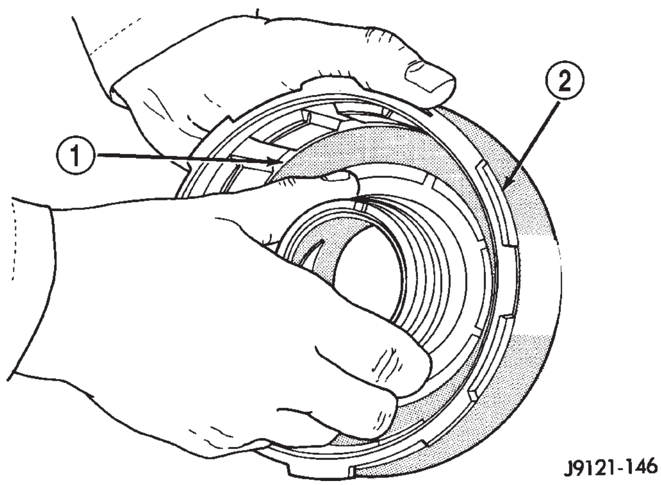


Fig. 96 Front Clutch Piston Installation

1 - CLUTCH PISTON
2 - FRONT CLUTCH RETAINER

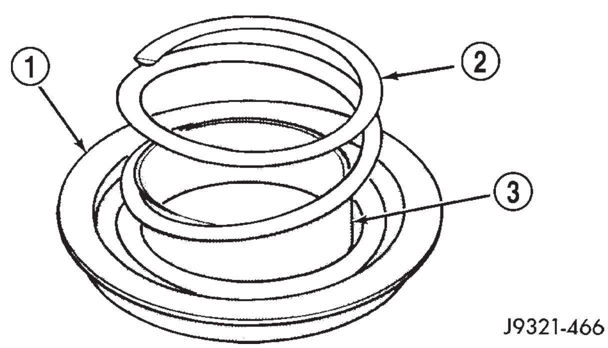


Fig. 97 Clutch Piston Spring Installation

1 - RETAINER
2 - CLUTCH SPRING
3 - PISTON

FRONT SERVO

DESCRIPTION

The kickdown servo (Fig. 98) consists of a two-land piston with an inner piston, a piston rod and guide, and a return spring. The dual-land piston uses seal rings on its outer diameters and an O-ring for the inner piston.

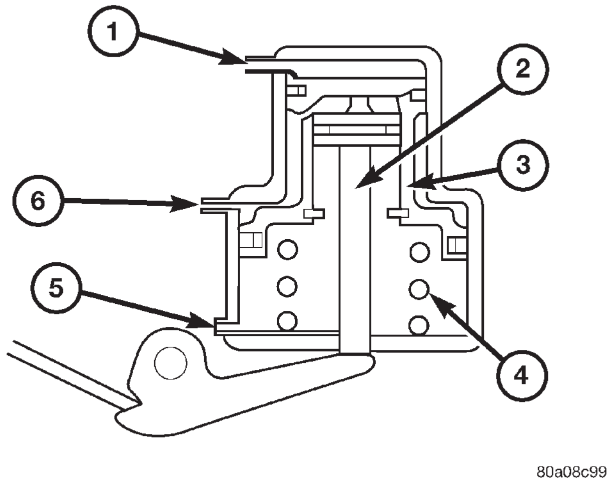


Fig. 98 Front Servo

1 - VENT
2 -PISTON ROD
3 - PISTON
4 - SPRING
5 - RELEASE PRESSURE
6 - APPLY PRESSURE

OPERATION

The application of the piston is accomplished by applying pressure between the two lands of the piston. The pressure acts against the larger lower land to push the piston downward, allowing the piston rod to extend though its guide against the apply lever. Release of the servo at the 2-3 upshift is accomplished by a combination of spring and line pressure, acting on the bottom of the larger land of the piston. The small piston is used to cushion the application of the band by bleeding oil through a small orifice in the larger piston. The release timing of the kickdown servo is very important to obtain a smooth but firm shift. The release has to be very quick, just as the front clutch application is taking place. Otherwise, engine runaway or a shift hesitation will occur. To accomplish this, the band retains its holding capacity until the front clutch is applied, giving a small amount of overlap between them.

DISASSEMBLY

(1) Remove seal ring from rod guide (Fig. 99).

(2) Remove small snap-ring from servo piston rod. Then remove piston rod, spring and washer from piston.

(3) Remove and discard servo component o-ring and seal rings.

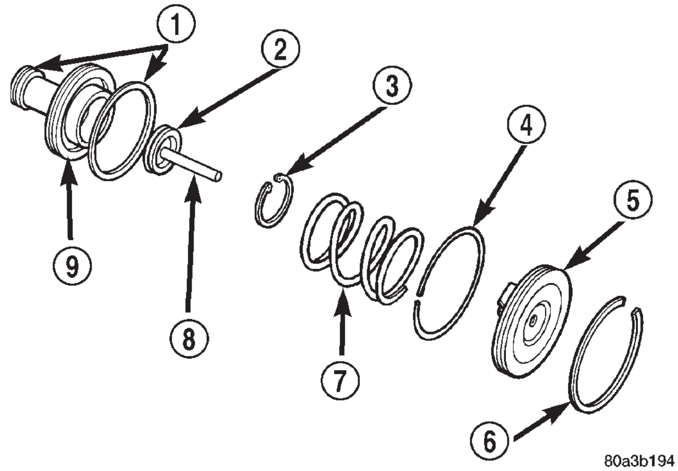


Fig. 99 Front Servo

1 - PISTON RINGS
2 - O-RING
3 - SNAP-RING
4 - SEAL RING
5 - PISTON ROD GUIDE
6 - SNAP-RING
7 - SERVO SPRING
8 - PISTON ROD
9 - SERVO PISTON

CLEANING

Clean the servo piston components (Fig. 100) with solvent and dry them with compressed air.

INSPECTION

Inspect the servo components (Fig. 101). Replace the springs if collapsed, distorted or broken. Replace the guide, rod and piston if cracked, bent, or worn. Discard the servo snap-ring if distorted or warped.

Check the servo piston bore for wear. If the bore is severely scored, or damaged, it will be necessary to replace the case.

Replace any servo component if doubt exists about condition. Do not reuse suspect parts.

ASSEMBLY

Clean and inspect front servo components.

(1) Lubricate new o-ring and seal rings with petroleum jelly and install them on piston, guide and rod.

(2) Install rod in piston. Install spring and washer on rod. Compress spring and install snap-ring (Fig. 102).

FRONT SERVO (Continued)

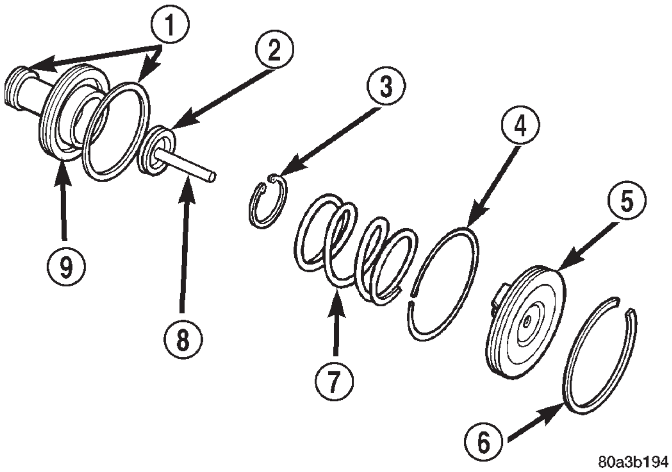


Fig. 100 Front Servo Piston

1 - PISTON RINGS
2 - O-RING
3 - SNAP-RING
4 - SEAL RING
5 - PISTON ROD GUIDE
6 - SNAP-RING
7 - SERVO SPRING
8 - PISTON ROD
9 - SERVO PISTON

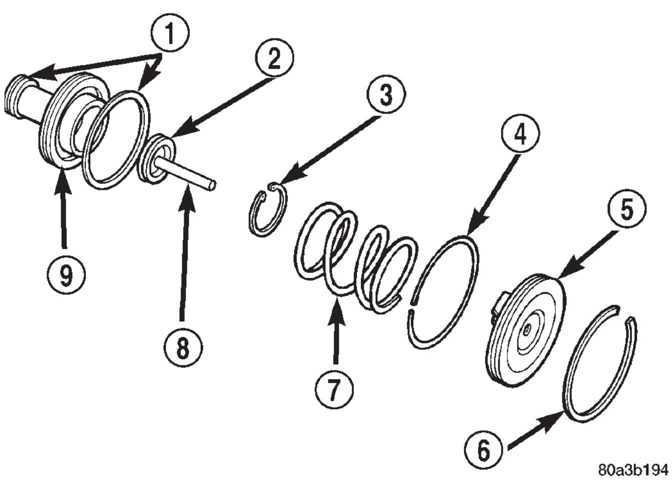


Fig. 101 Front Servo Piston

1 - PISTON RINGS
2 - O-RING
3 - SNAP-RING
4 - SEAL RING
5 - PISTON ROD GUIDE
6 - SNAP-RING
7 - SERVO SPRING
8 - PISTON ROD
9 - SERVO PISTON

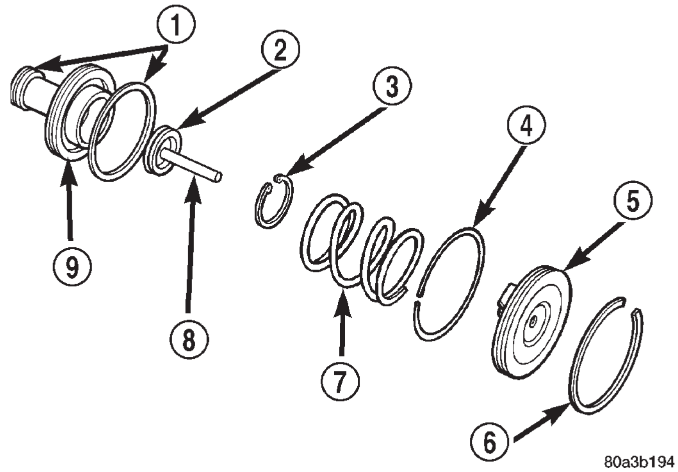


Fig. 102 Front Servo

1 - PISTON RINGS
2 - O-RING
3 - SNAP-RING
4 - SEAL RING
5 - PISTON ROD GUIDE
6 - SNAP-RING
7 - SERVO SPRING
8 - PISTON ROD
9 - SERVO PISTON

GEARSHIFT CABLE

DIAGNOSIS AND TESTING - GEARSHIFT CABLE

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

(a) PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.

(b) PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.

(c) NEUTRAL position - Normal position. Engine starts must be possible.

(d) NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

REMOVAL

(1) Shift transmission into PARK.

(2) Raise vehicle.

GEARSHIFT CABLE (Continued)

(3) Remove the shift cable eyelet from the transmission manual shift lever (Fig. 103).

(4) Remove shift cable from the cable support bracket.

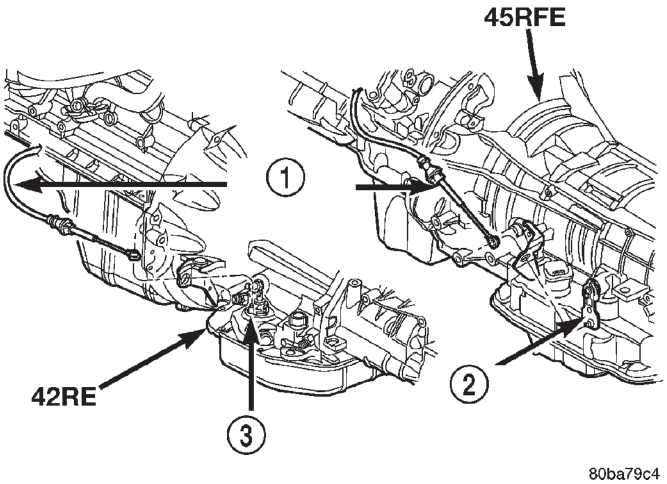


Fig. 103 Remove Shift Cable From Transmission

1 - SHIFT CABLE
2 - MANUAL LEVER
3 - MANUAL LEVER

(5) Lower vehicle.

(6) Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 104).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 105).

(9) Pull cable through floor panel opening.

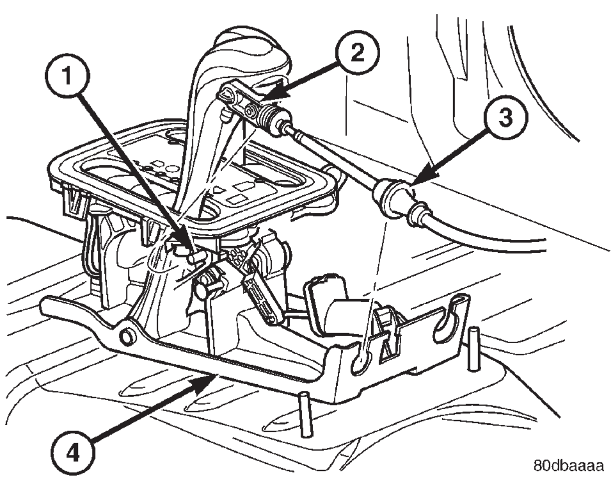


Fig. 104 Transmission Shift Cable at Shifter

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

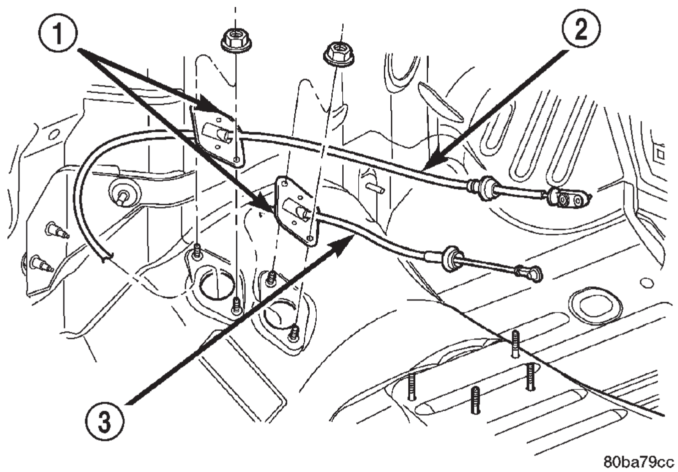


Fig. 105 Shift Cables at Floor Pan

1 - SEAL PLATES
2 - TRANSMISSION SHIFT CABLE
3 - TRANSFER CASE SHIFT CABLE

(10) Remove shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).

(4) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(5) Place the floor shifter lever in PARK position.

(6) Loosen the adjustment screw on the shift cable.

(7) Snap the shift cable onto the shift lever pin.

(8) Raise the vehicle.

(9) Install the shift cable to the shift cable support bracket.

(10) Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.

(11) Snap the shift cable onto the transmission manual shift lever.

(12) Lower vehicle.

(13) Verify that the shift lever is in the PARK position.

(14) Tighten the adjustment screw to 7 N·m (65 in.lbs.).

(15) Verify correct shifter operation.

(16) Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

ADJUSTMENTS - GEARSHIFT CABLE

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is

GEARSHIFT CABLE (Continued)

INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the park/neutral position switch or TRS may be faulty.

(1) Shift transmission into PARK.

(2) Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(3) Loosen the shift cable adjustment screw (Fig. 106).

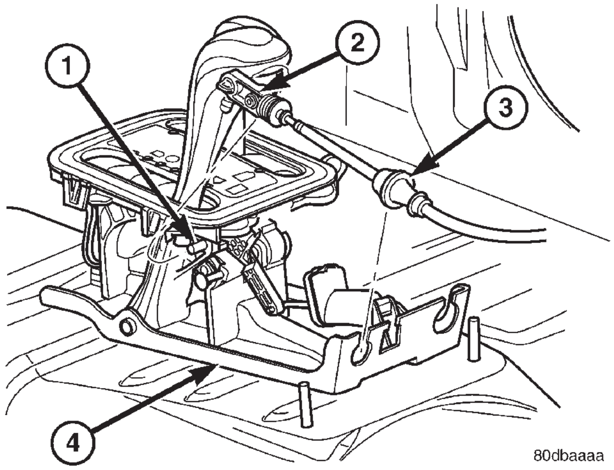


Fig. 106 Shift Cable at the Shifter

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

(4) Raise vehicle.

(5) Unsnap cable eyelet from transmission shift lever (Fig. 107).

(6) Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(8) Snap cable eyelet onto transmission shift lever.

(9) Lower vehicle

(10) Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).

(11) Verify correct operation.

(12) Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

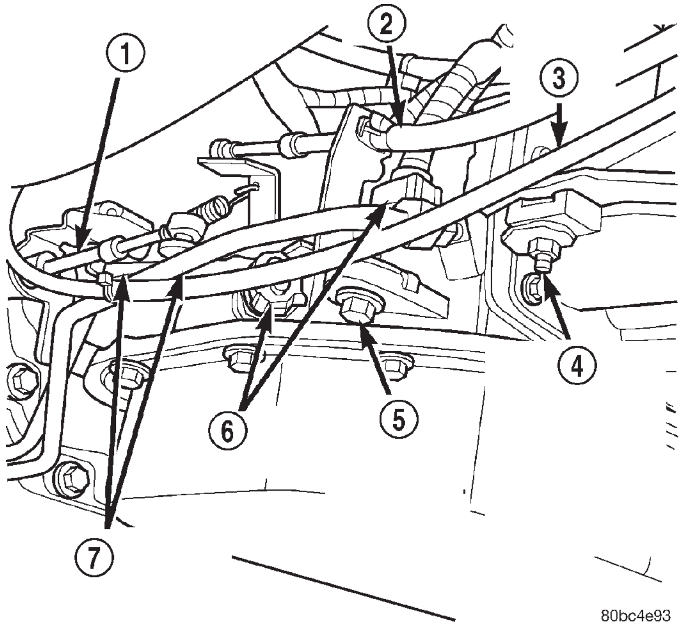


Fig. 107 Shift Cable at Transmission

1 - TRANSMISSION SHIFTER CABLE
2 - THROTTLE VALVE CABLE
3 - TRANSFER CASE SHIFTER CABLE
4 - TRANSFER CASE SHIFTER CABLE BRACKET RETAINING BOLT(S)
5 - THROTTLE VALVE CABLE BRACKET RETAINING BOLT
6 - ELECTRICAL CONNECTORS
7 - TRANSMISSION FLUID LINES

OIL PUMP

DESCRIPTION

The oil pump (Fig. 108) is located in the pump housing inside the bell housing of the transmission case. The oil pump consists of an inner and outer gear (Fig. 109), a housing, and a cover that also serves as the reaction shaft support.

OPERATION

As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

OIL PUMP (Continued)

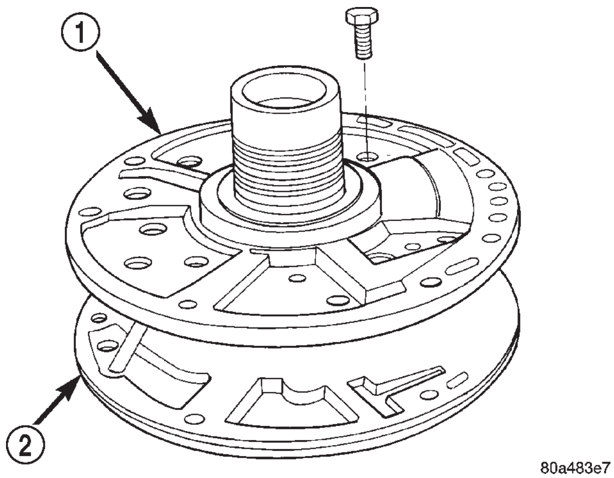


Fig. 108 Oil Pump and Reaction Shaft Support

1 - REACTION SHAFT SUPPORT
2 - PUMP

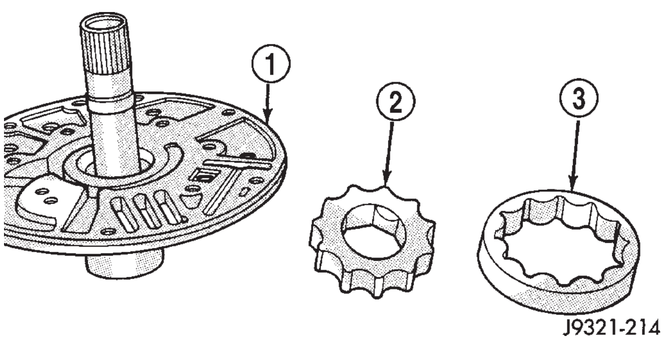


Fig. 109 Pump Gear Removal

1 - REACTION SHAFT SUPPORT
2 - INNER GEAR
3 - OUTER GEAR

STANDARD PROCEDURE - OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

(1) Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If one quart of transmission fluid is collected in the container in 20 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 20 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.

(4) Re-connect the **To cooler** line to the transmission cooler inlet.

(5) Refill the transmission to proper level.

DISASSEMBLY

(1) Remove seal ring from housing and reaction shaft support (Fig. 110).

(2) Mark pump housing and support assembly for alignment reference.

(3) Remove bolts attaching pump body to support (Fig. 111).

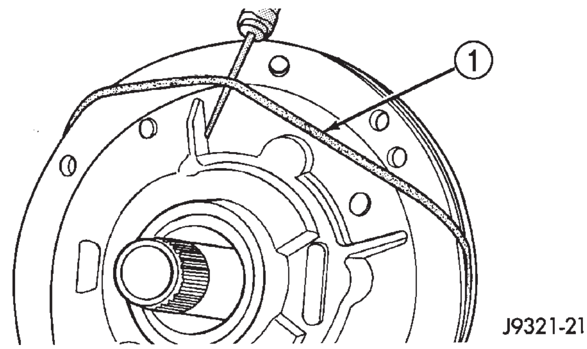


Fig. 110 Removing Pump Seal Ring

1 - PUMP HOUSING SEAL RING

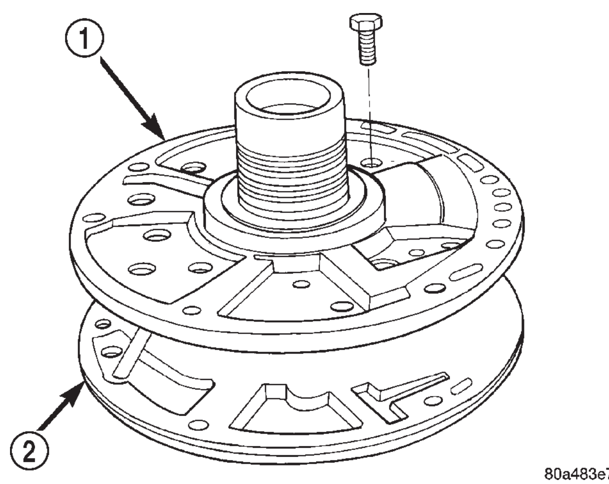


Fig. 111 Pump Support Bolts

1 - REACTION SHAFT SUPPORT
2 - PUMP

(4) Separate support from pump housing (Fig. 112).

(5) Remove inner and outer gears from reaction shaft support (Fig. 113).

OIL PUMP (Continued)

(6) If pump seal was not removed during transmission disassembly, remove seal with punch and hammer.

(7) Remove front clutch thrust washer from support hub (Fig. 114).

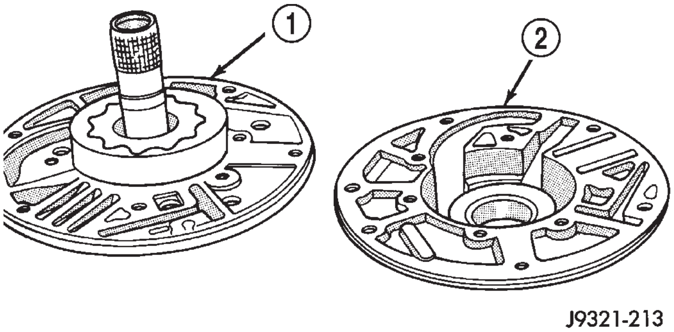


Fig. 112 Separating Pump Housing From Reaction Shaft Support

1 - REACTION SHAFT SUPPORT
2 - PUMP HOUSING

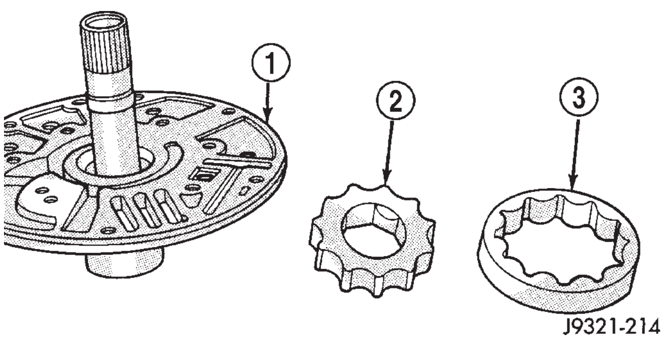


Fig. 113 Pump Gear Removal

1 - REACTION SHAFT SUPPORT
2 - INNER GEAR
3 - OUTER GEAR

OIL PUMP BUSHING REPLACEMENT

(1) Remove pump bushing with Tool Handle C-4171 and Bushing Remover SP-3551 from Tool Set C-3887-J (Fig. 115).

(2) Install new pump bushing with Tool Handle C-4171 and Bushing Installer SP-5117 (Fig. 115). Bushing should be flush with pump housing bore.

(3) Stake new pump bushing in two places with blunt punch (Fig. 116). Remove burrs from stake points with knife blade afterward.

REACTION SHAFT SUPPORT BUSHING REMOVAL

(1) Assemble Bushing Remover Tools SP-1191, 3633 and 5324 (Fig. 117). Do not clamp any part of reaction shaft or support in vise.

(2) Hold Cup Tool SP-3633 firmly against reaction shaft and thread remover SP-5324 into bushing as far as possible by hand. Then thread remover tool 3-4 additional turns into bushing with a wrench.

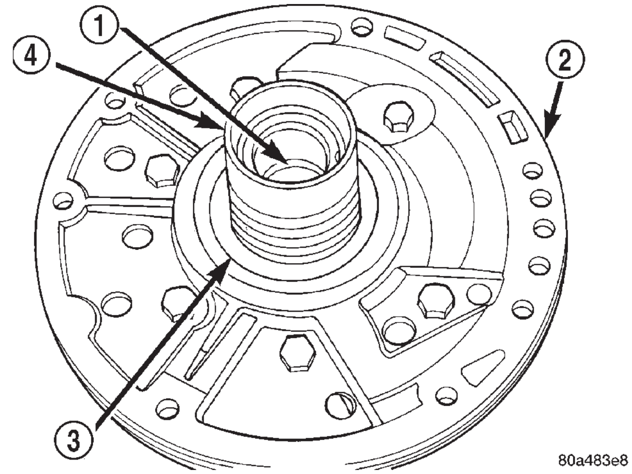


Fig. 114 Support Hub Thrust Washer

1 - BUSHING
2 - REACTION SHAFT SUPPORT
3 - THRUST WASHER
4 - HUB

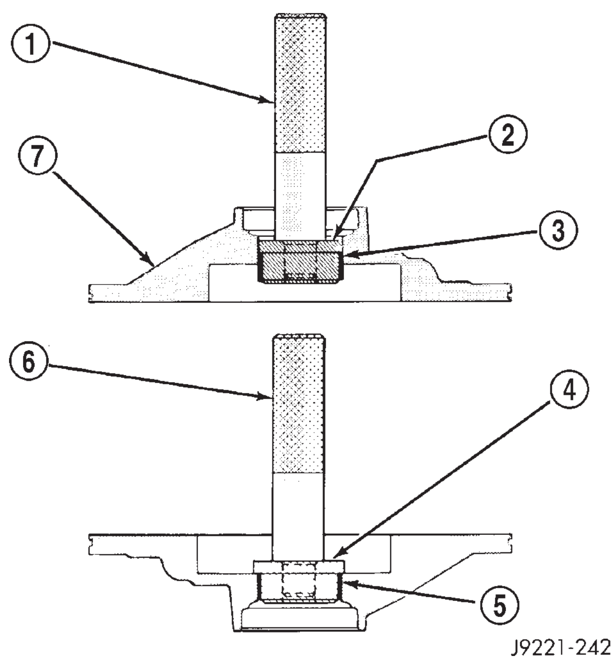


Fig. 115 Removing Oil Pump Bushing

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL SP-3551
3 - BUSHING
4 - SPECIAL TOOL SP-5117
5 - BUSHING
6 - SPECIAL TOOL C-4171
7 - PUMP HOUSING

(3) Turn remover tool hex nut down against remover cup to pull bushing from shaft. Clean all chips from shaft after bushing removal.

OIL PUMP (Continued)

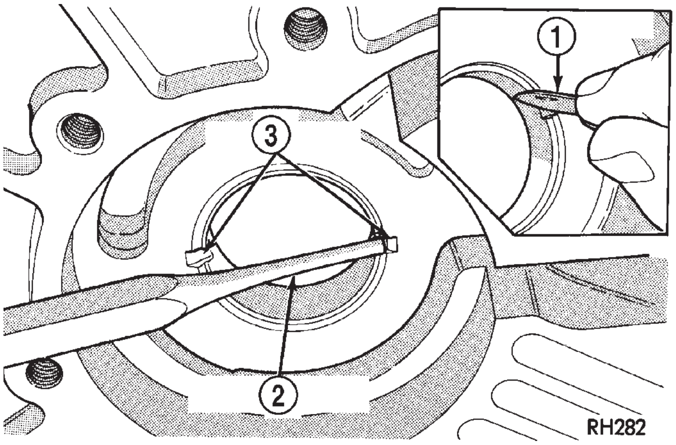


Fig. 116 Staking Oil Pump Bushing

1 - NARROW BLADE
2 - BLUNT PUNCH
3 - TWO STAKES

(4) Lightly grip old bushing in vise or with pliers and back remover tool out of bushing.

(5) Assemble Bushing Installer Tools C-4171 and SP-5325 (Fig. 117).

(6) Slide new bushing onto Installer Tool SP-5325.

(7) Position reaction shaft support upright on a clean smooth surface.

(8) Align bushing in bore. Then tap bushing into place until Bushing Installer SP-5325 bottoms.

(9) Clean reaction shaft support thoroughly after installing bushing.

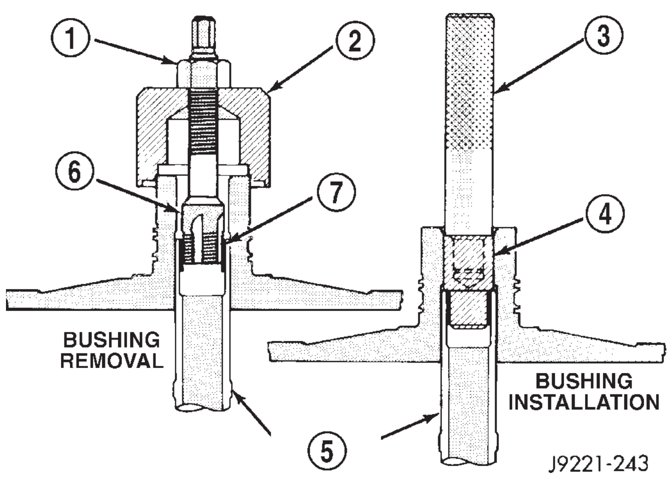


Fig. 117 Replacing Reaction Shaft Support Bushing

1 - SPECIAL TOOL SP-1191
2 - SPECIAL TOOL SP-3633
3 - SPECIAL TOOL C-4171
4 - SPECIAL TOOL SP-5325
5 - REACTION SHAFT
6 - SPECIAL TOOL SP-5324
7 - BUSHING

CLEANING

Clean pump and support components with solvent and dry them with compressed air.

INSPECTION

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump bushing. Then check the reaction shaft support bushing. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Clearance between outer gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Clearance between inner gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Both clearances can be measured at the same time by installing the gears in the pump body and measure pump component clearances as follows:

(1) Position an appropriate piece of Plastigage™ across both gears.

(2) Align the plastigage to a flat area on the reaction shaft housing.

(3) Install the reaction shaft to the pump housing.

(4) Separate the reaction shaft housing from the pump housing and measure the Plastigage™ following the instructions supplied with it.

Clearance between inner gear tooth and outer gear should be 0.08 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

Clearance between outer gear and pump housing should be 0.10 to 0.19 mm (0.004 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

ASSEMBLY

(1) Lubricate gear bore in pump housing with transmission fluid.

(2) Lubricate pump gears with transmission fluid.

(3) Support pump housing on wood blocks (Fig. 118).

(4) Install outer gear in pump housing (Fig. 118). Gear can be installed either way (it is not a one-way fit).

(5) Install pump inner gear (Fig. 119).

OIL PUMP (Continued)

CAUTION: The pump inner gear is a one way fit. The bore on one side of the gear inside diameter (I.D.) is chamfered. Be sure the chamfered side faces forward (to front of pump).

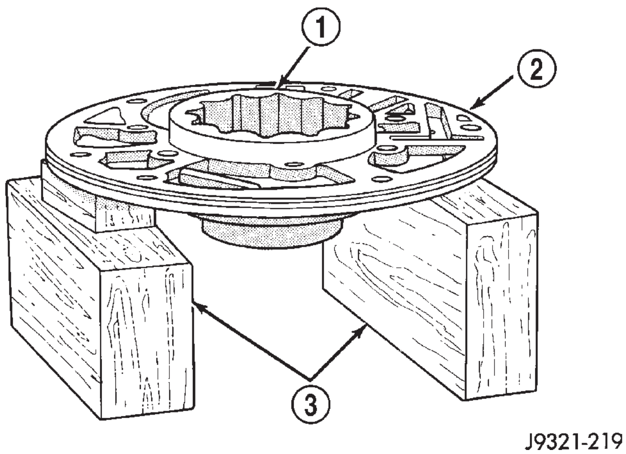


Fig. 118 Supporting Pump And Installing Outer Gear

1 - OUTER GEAR
2 - PUMP HOUSING
3 - WOOD BLOCKS

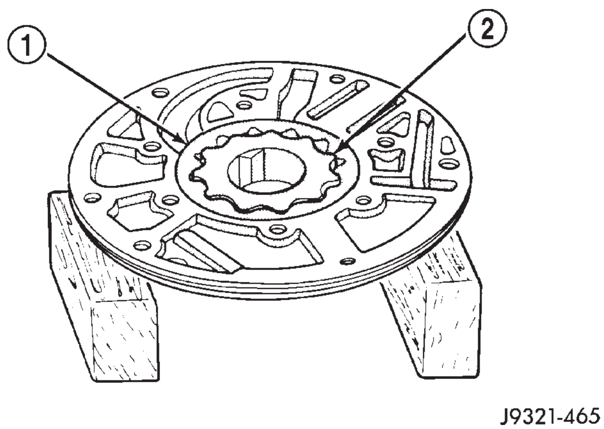


Fig. 119 Pump Inner Gear Installation

1 - OUTER GEAR
2 - INNER GEAR

(6) Install new thrust washer on hub of reaction shaft support. Lubricate washer with transmission fluid or petroleum jelly.

(7) If reaction shaft seal rings are being replaced, install new seal rings on support hub (Fig. 120). Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.

CAUTION: The reaction shaft support seal rings will break if overspread, or twisted. If new rings are being installed, spread them only enough for installation. Also be very sure the ring ends are securely hooked together after installation. Otherwise, the rings will either prevent pump installation, or break during installation.

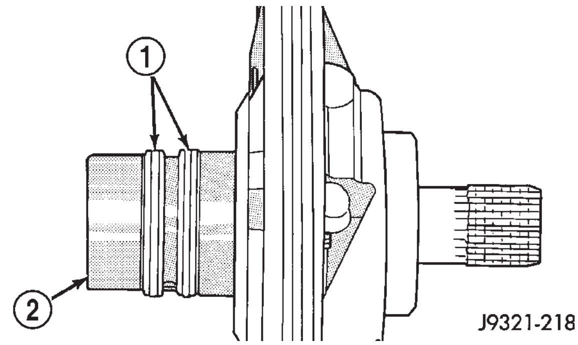


Fig. 120 Hub Seal Ring Position

1 - SEAL RINGS
2 - SUPPORT HUB

(8) Install reaction shaft support on pump housing (Fig. 121).

(9) Align reaction support on pump housing. Use alignment marks made at disassembly. Or, rotate support until bolt holes in support and pump housing are all aligned (holes are offset for one-way fit).

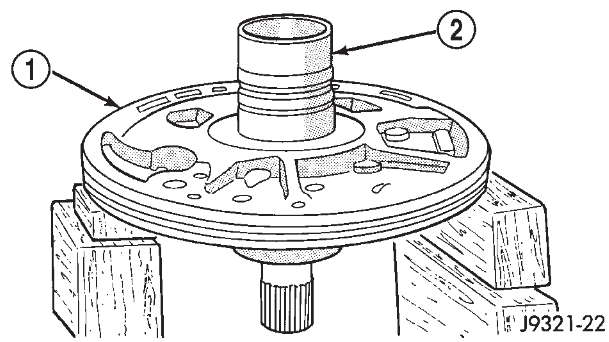


Fig. 121 Assembling Reaction Shaft Support And Pump Housing

1 - PUMP HOUSING
2 - REACTION SHAFT SUPPORT

(10) Install all bolts that attach support to pump housing. Then tighten bolts finger tight.

(11) Tighten support-to-pump bolts to required torque as follows:

(a) Reverse pump assembly and install it in transmission case. Position pump so bolts are facing out and are accessible.

(b) Secure pump assembly in case with 2 or 3 bolts, or with pilot studs.

(c) Tighten support-to-pump bolts to 20 N·m (15 ft. lbs.).

(d) Remove pump assembly from transmission case.

OIL PUMP (Continued)

(12) Install new oil seal in pump with Special Tool C-4193 and Tool Handle C-4171 (Fig. 122). Be sure seal lip faces inward.

(13) Install new seal ring around pump housing. Be sure seal is properly seated in groove.

(14) Lubricate lip of pump oil seal and O-ring seal with transmission fluid.

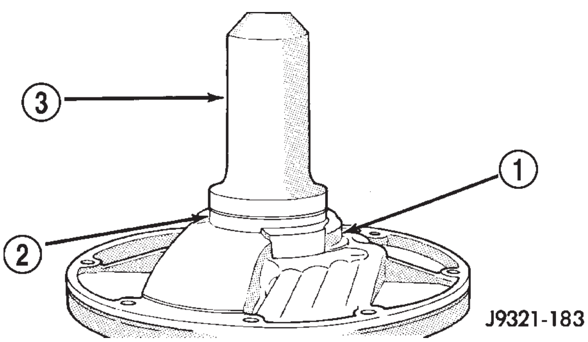


Fig. 122 Pump Oil Seal Installation

1 - PUMP BODY
2 - PUMP SEAL
3 - SPECIAL TOOL C-4193

OUTPUT SHAFT FRONT BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap-ring holding output shaft front bearing to overdrive geartrain. (Fig. 123).

(4) Pull bearing from output shaft.

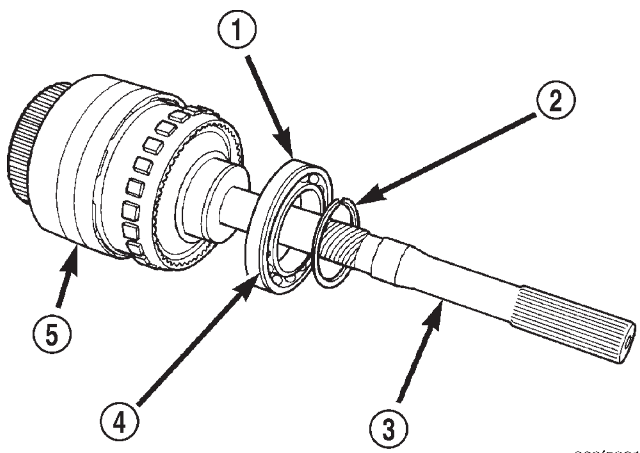


Fig. 123 Output Shaft Front Bearing

1 - OUTPUT SHAFT FRONT BEARING
2 - SNAP-RING
3 - OUTPUT SHAFT
4 - GROOVE TO REAR
5 - OVERDRIVE GEARTRAIN

INSTALLATION

(1) Place replacement bearing in position on geartrain with locating retainer groove toward the rear.

(2) Push bearing onto shaft until the snap-ring groove is visible.

(3) Install snap-ring to hold bearing onto output shaft.

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

OUTPUT SHAFT REAR BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/OVERDRIVE - REMOVAL)

(2) Remove overdrive geartrain from housing.

(3) Remove snap-ring holding output shaft rear bearing into overdrive housing (Fig. 124).

(4) Using a suitable driver inserted through the rear end of housing, drive bearing from housing.

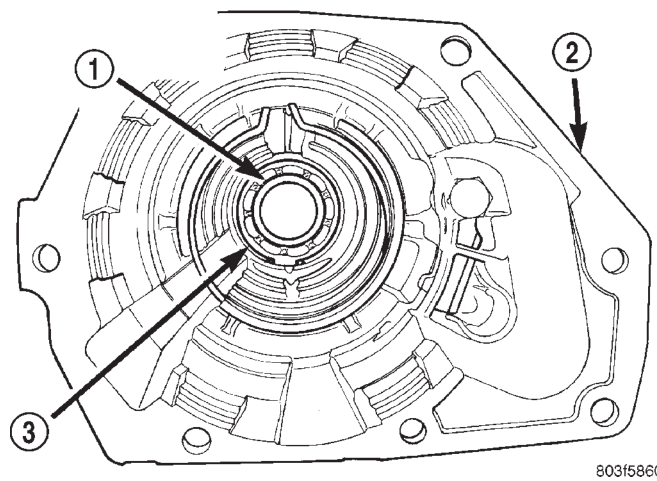


Fig. 124 Output Shaft Rear Bearing

1 - OUTPUT SHAFT REAR BEARING
2 - OVERDRIVE HOUSING
3 - SNAP-RING

INSTALLATION

(1) Place replacement bearing in position in housing.

(2) Using a suitable driver, drive bearing into housing until the snap-ring groove is visible.

(3) Install snap-ring to hold bearing into housing (Fig. 124).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

OVERDRIVE CLUTCH

DESCRIPTION

The overdrive clutch (Fig. 125) is composed of the pressure plate, clutch plates, holding discs, overdrive piston retainer, piston, piston spacer, and snap-rings. The overdrive clutch is the forwardmost component in the transmission overdrive unit and is considered a holding component. The overdrive piston retainer, piston, and piston spacer are located on the rear of the main transmission case.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the piston retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through passages at the lower rear portion of the valve body area. With pressure applied between the piston retainer and piston, the piston moves away from the piston retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the intermediate shaft into the overdrive planetary gear set. The overdrive clutch discs are attached to the overdrive clutch hub while the overdrive clutch plates, reaction plate, and pressure plate are lugged to the overdrive housing. This allows the intermediate shaft to transfer the engine torque to the planetary gear and overrunning clutch. This drives the planetary gear inside the annulus, which is attached to the overdrive clutch drum and output shaft, creating the desired gear ratio. The waved snap-ring is used to cushion the application of the clutch pack.

OVERDRIVE OFF SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

OPERATION

At key-on, fourth gear operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow upshifts to fourth gear. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the powertrain control module.

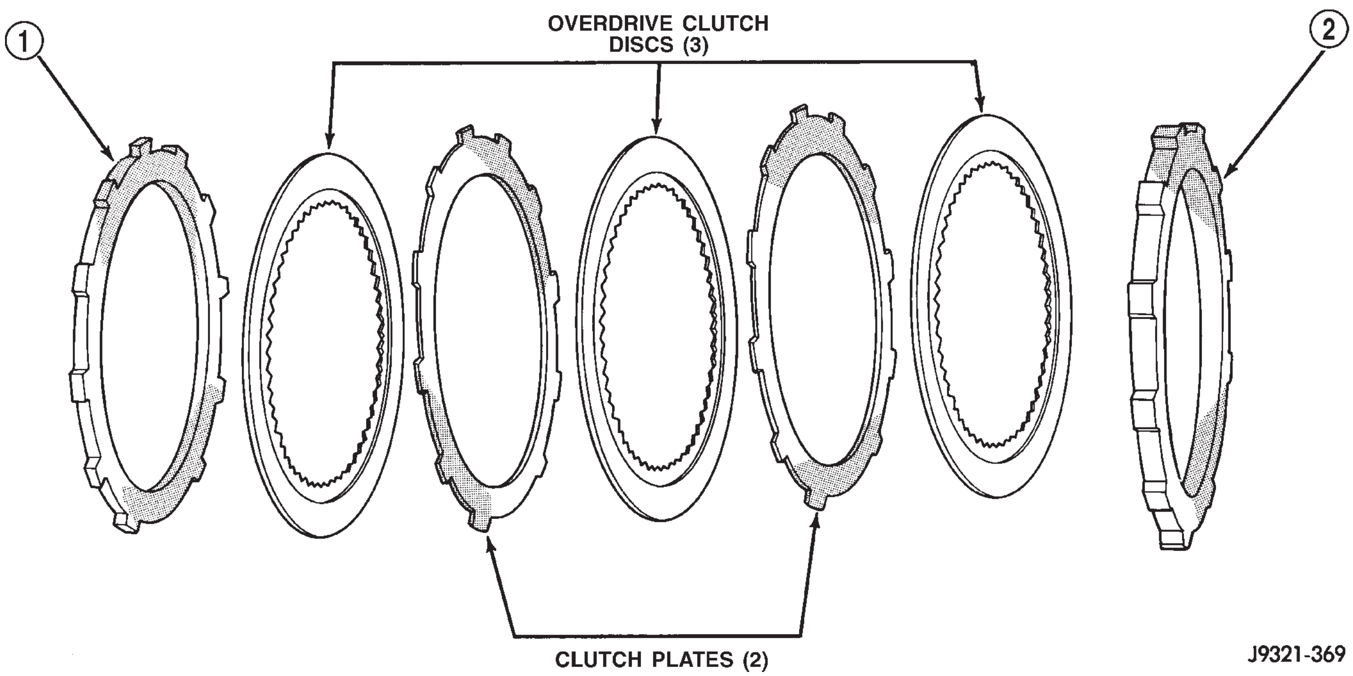


Fig. 125 Overdrive Clutch

1 - REACTION PLATE
2 - PRESSURE PLATE

OVERDRIVE OFF SWITCH (Continued)

DIAGNOSIS AND TESTING - OVERDRIVE ELECTRICAL CONTROLS

The overdrive off switch, valve body solenoid, case connectors and related wiring can all be tested with a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

OVERDRIVE UNIT

REMOVAL

(1) Shift transmission into PARK.

(2) Raise vehicle.

(3) Remove transfer case, if equipped.

(4) Mark propeller shaft universal joint(s) and axle pinion yoke, or the companion flange and flange yoke, for alignment reference at installation, if neccesary.

(5) Disconnect and remove the rear propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(6) Remove transmission oil pan, remove gasket, drain oil and reinstall pan.

(7) If overdrive unit had malfunctioned, or if fluid is contaminated, remove entire transmission. If diagnosis indicated overdrive problems only, remove just the overdrive unit.

(8) Support transmission with transmission jack.

(9) Remove bolts attaching overdrive unit to transmission (Fig. 126).

CAUTION: Support the overdrive unit with a jack before moving it rearward. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

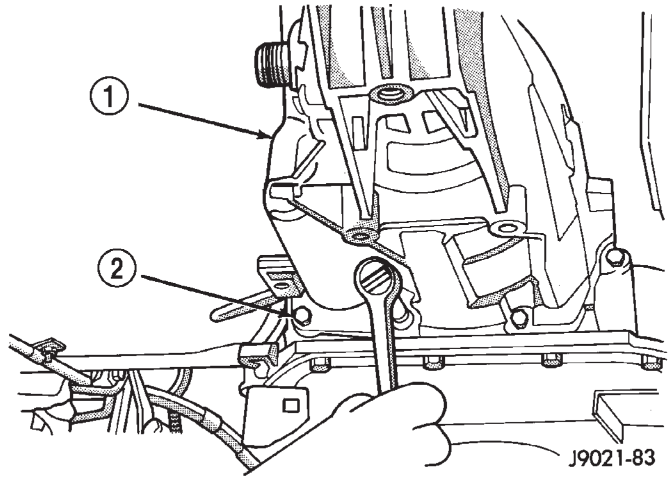


Fig. 126 Overdrive Unit Bolts

1 - OVERDRIVE UNIT
2 - ATTACHING BOLTS (7)

(10) Carefully work overdrive unit off intermediate shaft. Do not tilt unit during removal. Keep it as level as possible.

(11) If overdrive unit does not require service, immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch to prevent splines from rotating out of alignment. If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.

(12) Remove and retain overdrive piston thrust bearing. Bearing may remain on piston or in clutch hub during removal.

(13) Position drain pan on workbench.

(14) Place overdrive unit over drain pan. Tilt unit to drain residual fluid from case.

(15) Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

(16) If overdrive unit does not require any service, leave alignment tool in position. Tool will prevent accidental misalignment of planetary gear and overrunning clutch splines.

DISASSEMBLY

(1) Remove transmission speed sensor and O-ring seal from overdrive case (Fig. 127).

(2) Remove overdrive piston thrust bearing (Fig. 128).

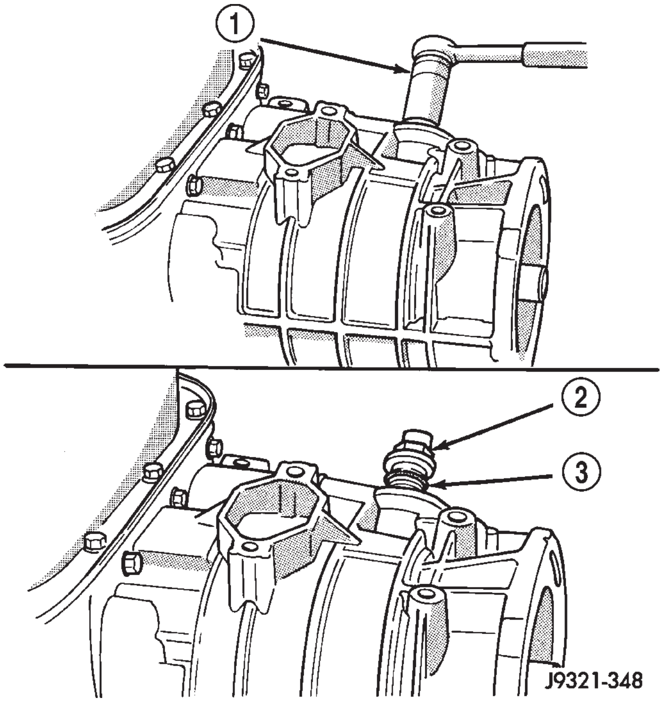


Fig. 127 Transmission Speed Sensor Removal

1 - SOCKET AND WRENCH
2 - SPEED SENSOR
3 - O-RING

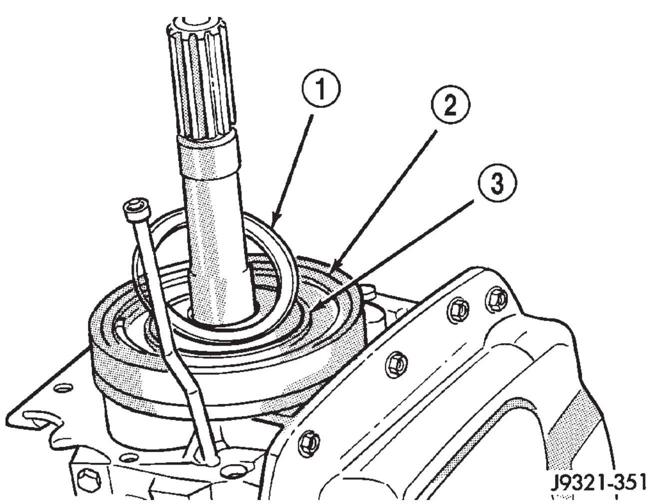


Fig. 128 Overdrive Piston Thrust Bearing Removal

1 - THRUST BEARING
2 - OVERDRIVE PISTON
3 - THRUST PLATE

OVERDRIVE PISTON

(1) Remove overdrive piston thrust plate (Fig. 129). Retain thrust plate. It is a select fit part and may possibly be reused.

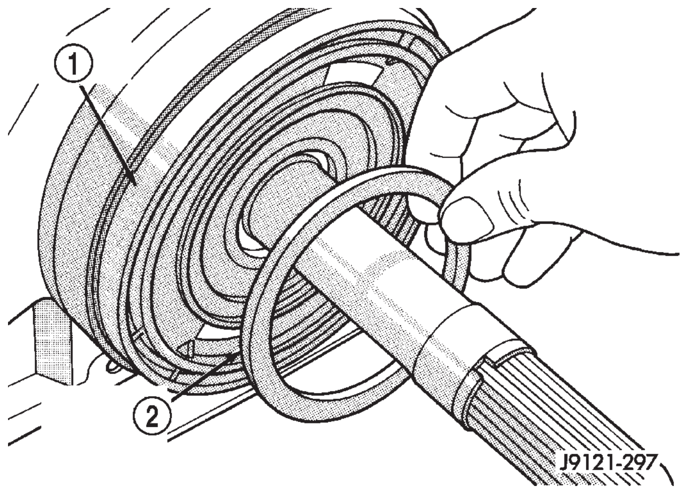


Fig. 129 Overdrive Piston Thrust Plate Removal

1 - OVERDRIVE PISTON
2 - OVERDRIVE PISTON SPACER (SELECT FIT)

(2) Remove intermediate shaft spacer (Fig. 130). Retain spacer. It is a select fit part and may possibly be reused.

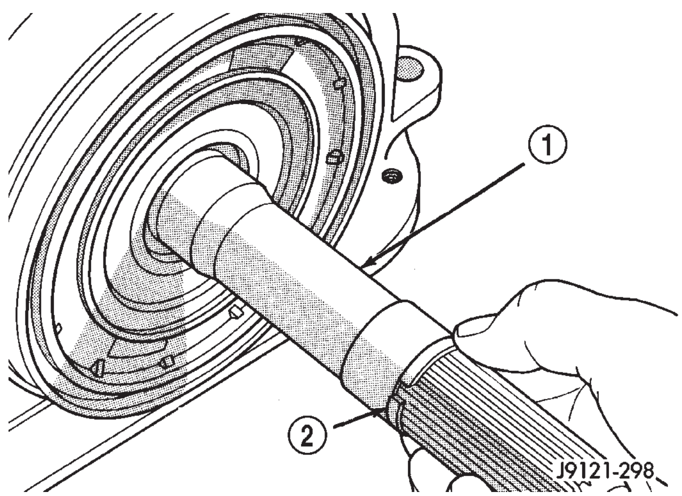


Fig. 130 Intermediate Shaft Spacer Location

1 - INTERMEDIATE SHAFT
2 - INTERMEDIATE SHAFT SPACER (SELECT FIT)

(3) Remove overdrive piston from retainer (Fig. 131).

OVERDRIVE UNIT (Continued)

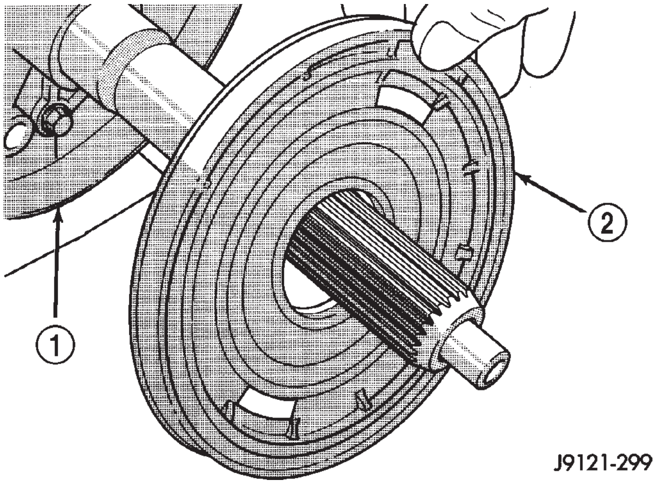


Fig. 131 Overdrive Piston Removal

1 - PISTON RETAINER
2 - OVERDRIVE PISTON

OVERDRIVE CLUTCH PACK

(1) Remove overdrive clutch pack wire retaining ring (Fig. 132).

(2) Remove overdrive clutch pack (Fig. 133).

NOTE: The 42RE transmission has three clutch discs and two clutch plates.

(3) Note position of clutch pack components for assembly reference (Fig. 134).

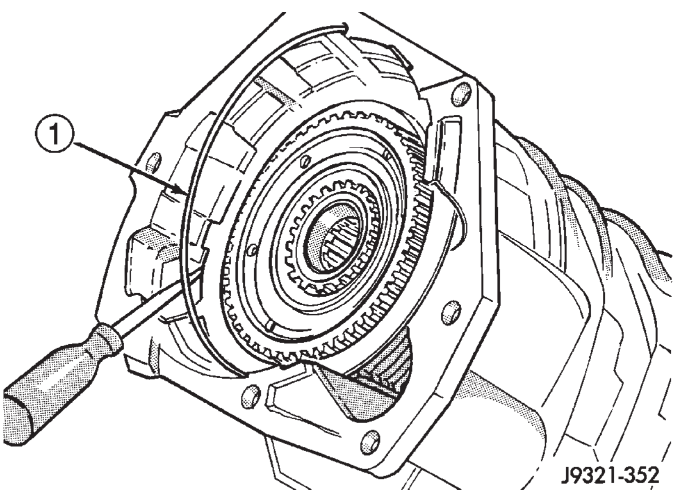


Fig. 132 Removing Overdrive Clutch Pack Retaining Ring

1 - OVERDRIVE CLUTCH PACK RETAINING RING

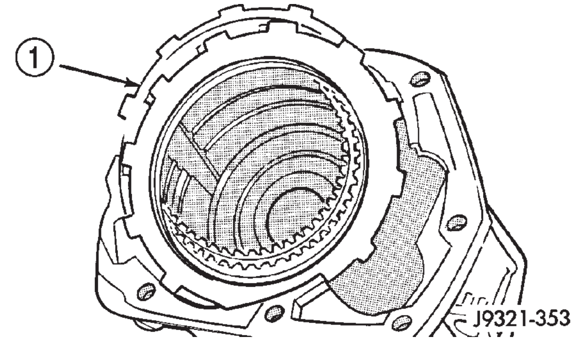


Fig. 133 Overdrive Clutch Pack Removal

1 - OVERDRIVE CLUTCH PACK

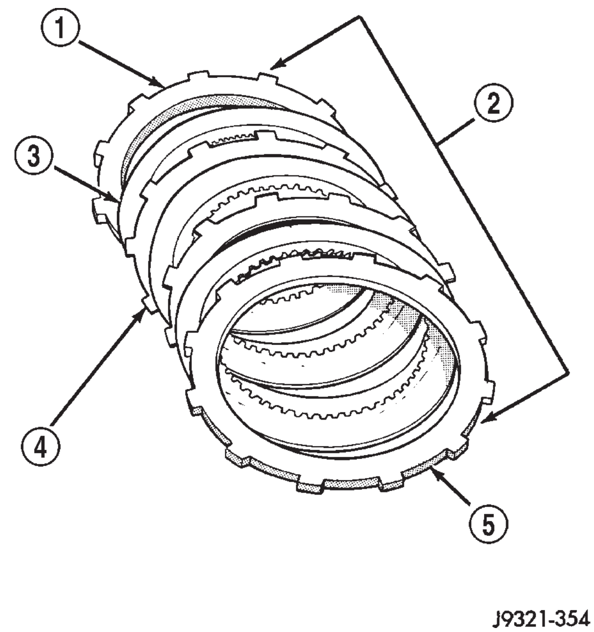


Fig. 134 42RE Overdrive Clutch Component Position

1 - PRESSURE PLATE (TO FRONT)
2 - OVERDRIVE CLUTCH PACK
3 - CLUTCH DISC (3)
4 - CLUTCH PLATE (2)
5 - REACTION PLATE (TO REAR)

OVERDRIVE UNIT (Continued)

OVERDRIVE GEARTRAIN

(1) Remove overdrive clutch wave spring (Fig. 135).

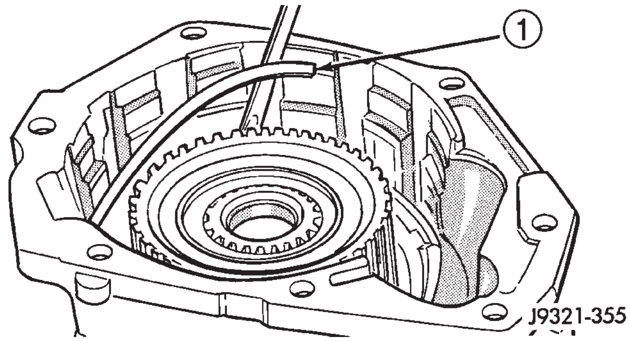


Fig. 135 Overdrive Clutch Wave

1 - WAVE SPRING

(2) Remove overdrive clutch reaction snap-ring (Fig. 136). Note that snap-ring is located in same groove as wave spring.

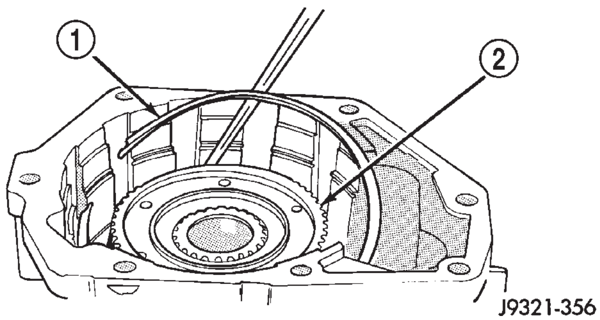


Fig. 136 Overdrive Clutch Reaction Snap-Ring Removal

1 - REACTION RING
2 - CLUTCH HUB

(3) Remove Torx™ head screws that attach access cover and gasket to overdrive case (Fig. 137).

(4) Remove access cover and gasket (Fig. 138).

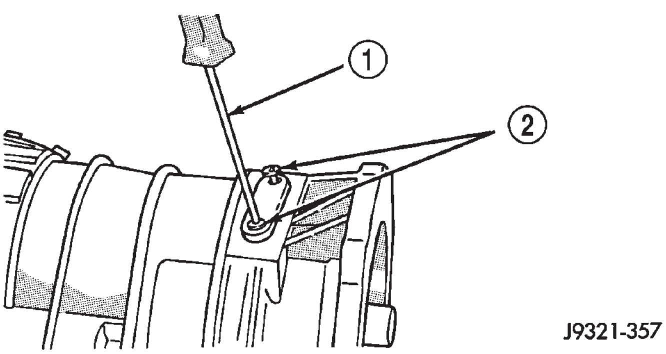


Fig. 137 Access Cover Screw Removal

1 - TORX SCREWDRIVER (T25)
2 - ACCESS COVER SCREWS

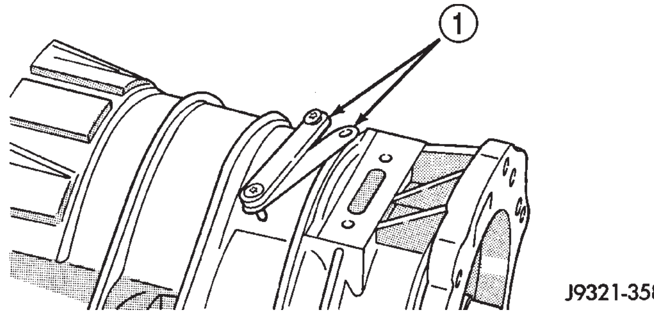


Fig. 138 Access Cover And Gasket Removal

1 - ACCESS COVER AND GASKET

(5) Expand output shaft bearing snap-ring with expanding-type snap-ring pliers. Then push output shaft forward to release shaft bearing from locating ring (Fig. 139).

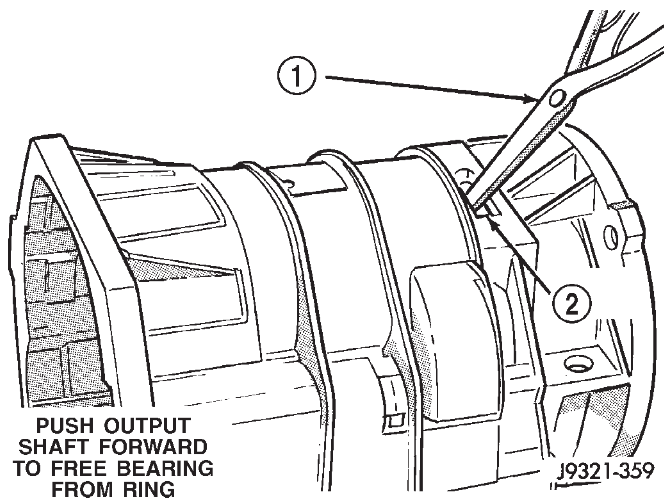


Fig. 139 Releasing Bearing From Locating Ring

1 - EXPAND BEARING LOCATING RING WITH SNAP-RING PLIERS
2 - ACCESS HOLE

(6) Lift gear case up and off geartrain assembly (Fig. 140).

(7) Remove snap-ring that retains rear bearing on output shaft.

(8) Remove rear bearing from output shaft (Fig. 141).

OVERDRIVE UNIT (Continued)

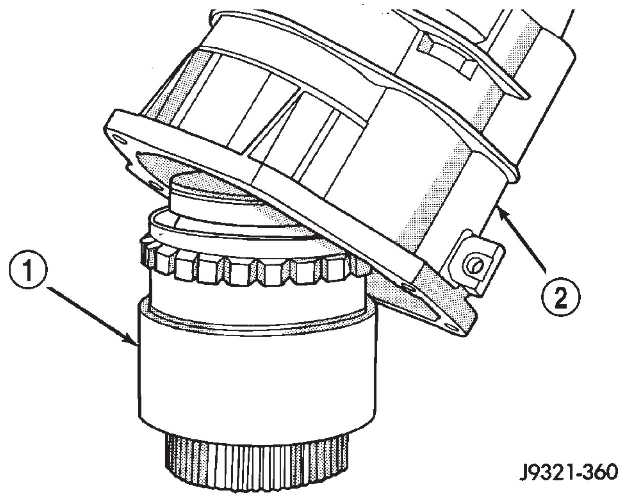


Fig. 140 Removing Gear Case From Geartrain Assembly

1 - GEARTRAIN ASSEMBLY
2 - GEAR CASE

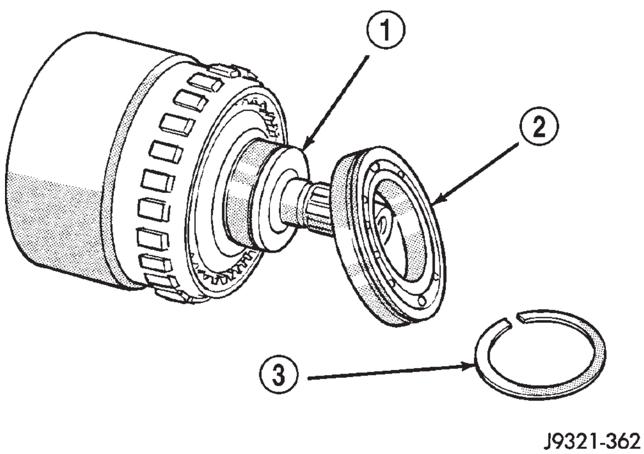


Fig. 141 Rear Bearing Removal

1 - OUTPUT SHAFT
2 - REAR BEARING
3 - SNAP-RING

DIRECT CLUTCH, HUB AND SPRING

WARNING: THE NEXT STEP IN DISASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE SPRING COMPRESSOR TOOL 6227-1 AND A HYDRAULIC SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(1) Mount geartrain assembly in shop press (Fig. 142).

(2) Position Compressor Tool 6227-1 on clutch hub (Fig. 142). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(3) Apply press pressure slowly. Compress hub and spring far enough to expose clutch hub retaining ring and relieve spring pressure on clutch pack snap-ring (Fig. 142).

(4) Remove direct clutch pack snap-ring (Fig. 143).

(5) Remove direct clutch hub retaining ring (Fig. 144).

(6) Release press load slowly and completely (Fig. 145).

(7) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 145).

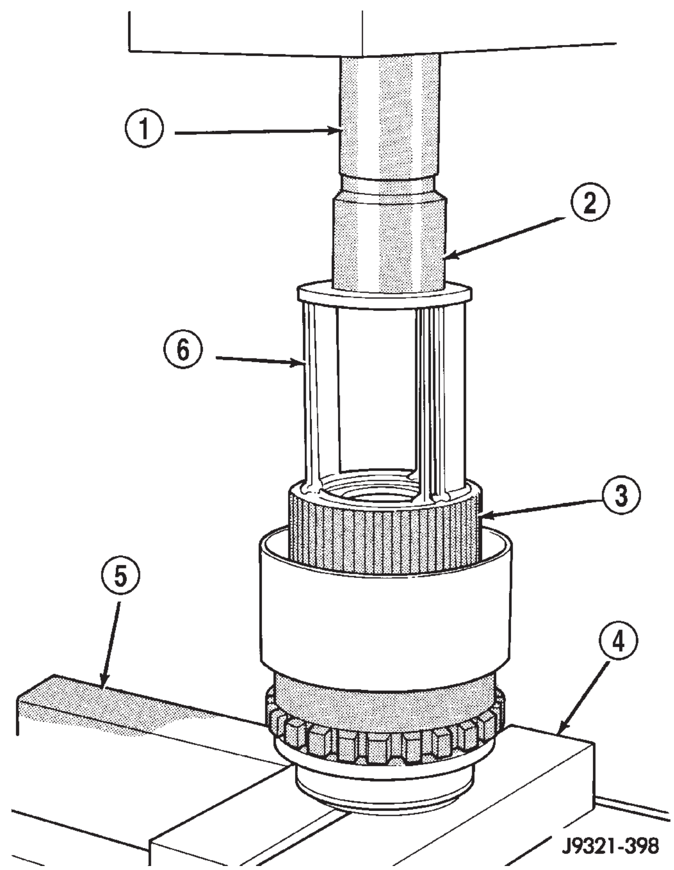


Fig. 142 Geartrain Mounted In Shop Press

1 - PRESS RAM
2 - SPECIAL TOOL C-3995-A (OR SIMILAR TOOL)
3 - CLUTCH HUB
4 - PLATES
5 - PRESS BED
6 - SPECIAL TOOL 6227-1

GEARTRAIN

(1) Remove direct clutch hub and spring (Fig. 146).

OVERDRIVE UNIT (Continued)

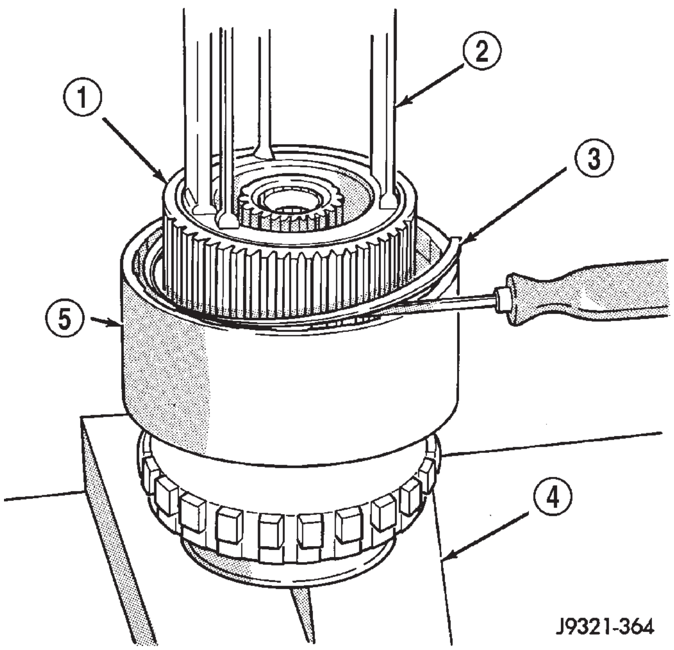


Fig. 143 Direct Clutch Pack Snap-Ring Removal

1 - CLUTCH HUB
2 - SPECIAL TOOL 6227-1
3 - DIRECT CLUTCH PACK SNAP-RING
4 - PRESS PLATES
5 - CLUTCH DRUM

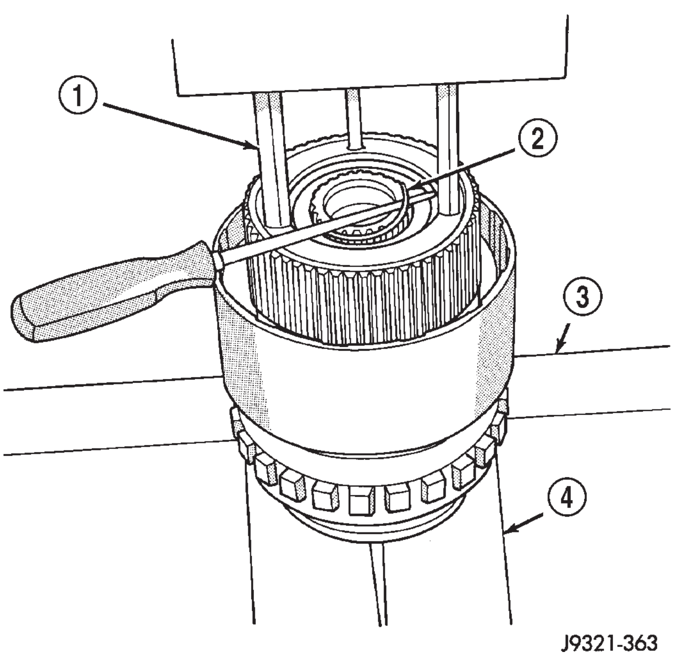


Fig. 144 Direct Clutch Hub Retaining Ring Removal

1 - SPECIAL TOOL 6227-1
2 - CLUTCH HUB RETAINING RING
3 - PRESS BED
4 - PRESS PLATES

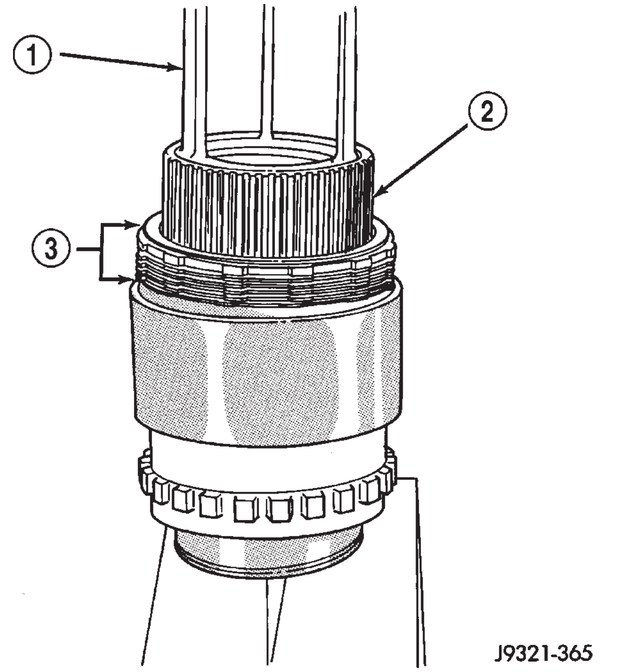


Fig. 145 Direct Clutch Pack Removal

1 - SPECIAL TOOL 6227-1
2 - DIRECT CLUTCH HUB
3 - DIRECT CLUTCH PACK

(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 147).

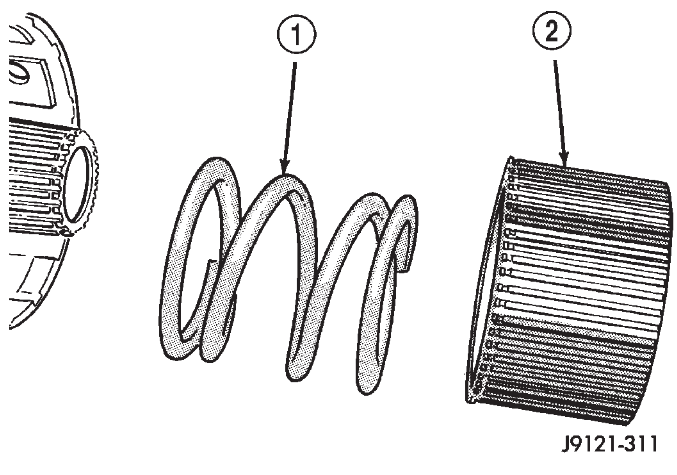


Fig. 146 Direct Clutch Hub And Spring Removal

1 - DIRECT CLUTCH SPRING
2 - DIRECT CLUTCH HUB

(3) Remove overrunning clutch assembly with expanding type snap-ring pliers (Fig. 148). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

(4) Remove thrust bearing from overrunning clutch hub.

OVERDRIVE UNIT (Continued)

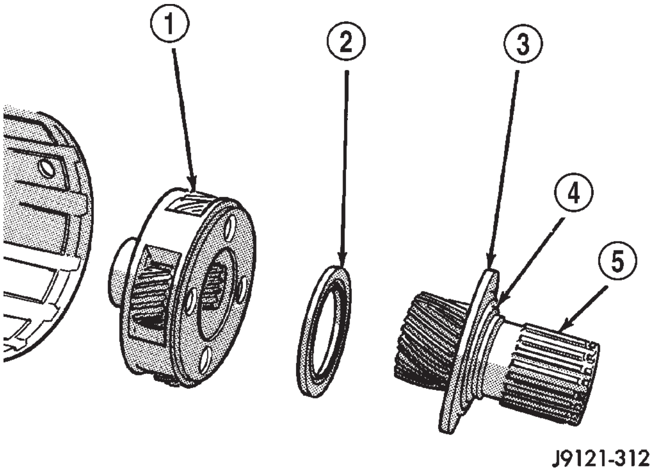


Fig. 147 Removing Sun Gear, Thrust Bearing And Planetary Gear

1 - PLANETARY GEAR
2 - PLANETARY THRUST BEARING
3 - CLUTCH SPRING PLATE
4 - SPRING PLATE SNAP-RING
5 - SUN GEAR

(5) Remove overrunning clutch from hub.

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 149). Use small center punch or scriber to make alignment marks.

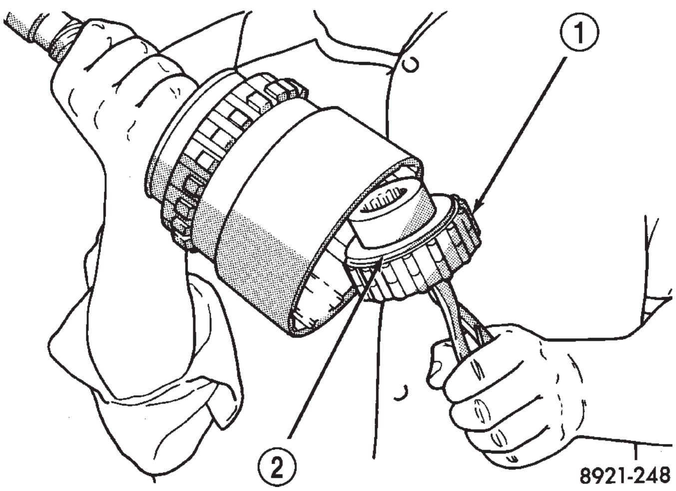


Fig. 148 Overrunning Clutch

1 - OVERRUNNING CLUTCH
2 - NEEDLE BEARING

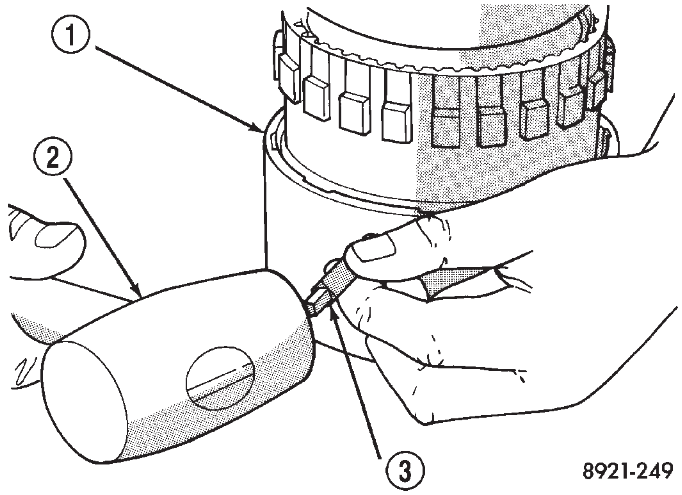


Fig. 149 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

1 - DIRECT CLUTCH DRUM
2 - HAMMER
3 - PUNCH

(7) Remove direct clutch drum rear retaining ring (Fig. 150).

(8) Remove direct clutch drum outer retaining ring (Fig. 151).

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 152). Use punch or scriber to mark gear and shaft.

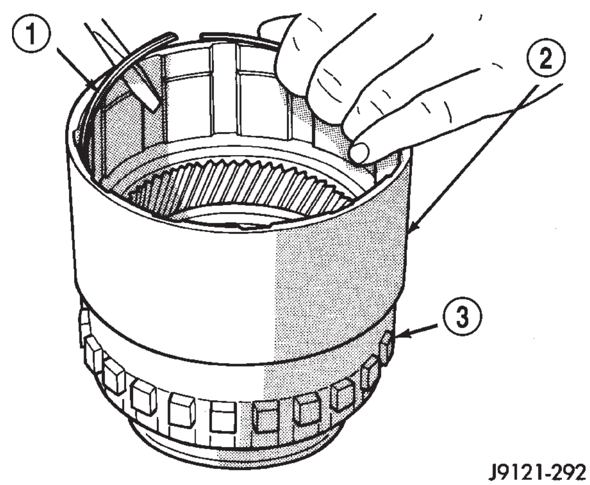


Fig. 150 Clutch Drum Inner Retaining Ring Removal

1 - INNER RETAINING RING
2 - DIRECT CLUTCH DRUM
3 - ANNULUS GEAR

OVERDRIVE UNIT (Continued)

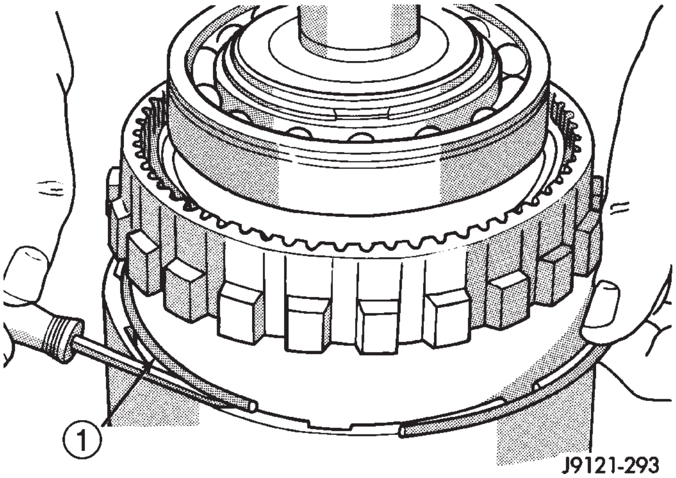


Fig. 151 Clutch Drum Outer Retaining Ring Removal

1 - OUTER RETAINING RING

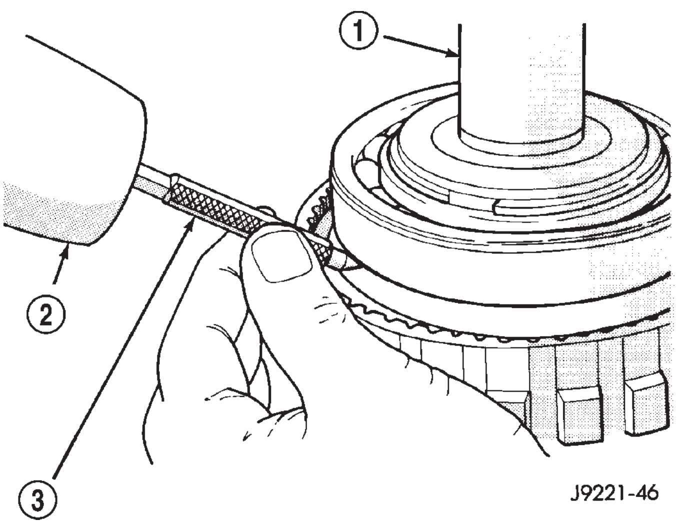


Fig. 152 Marking Annulus Gear And Output Shaft For Assembly Alignment

1 - OUTPUT SHAFT
2 - HAMMER
3 - PUNCH

(10) Remove snap-ring that secures annulus gear on output shaft (Fig. 153). Use two screwdrivers to unseat and work snap-ring out of groove as shown.

(11) Remove annulus gear from output shaft (Fig. 154). Use rawhide or plastic mallet to tap gear off shaft.

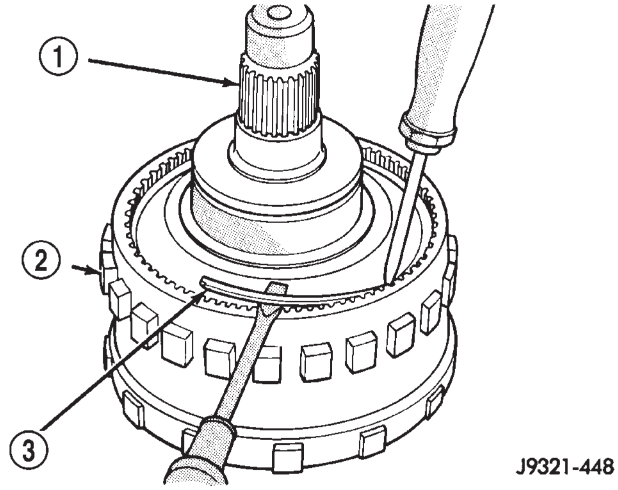


Fig. 153 Annulus Gear Snap-Ring Removal

1 - OUTPUT SHAFT
2 - ANNULUS GEAR
3 - SNAP-RING

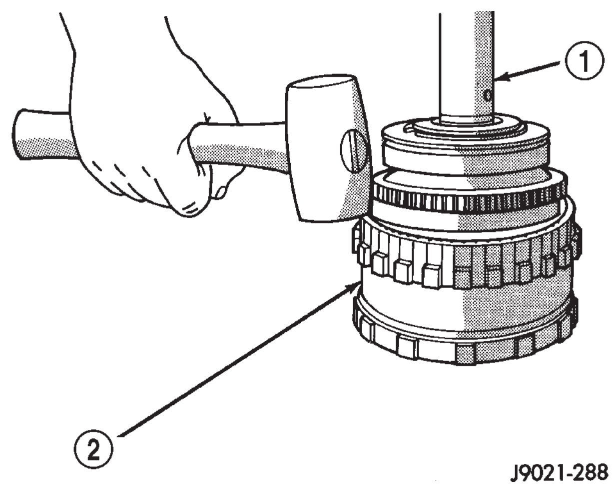


Fig. 154 Annulus Gear Removal

1 - OUTPUT SHAFT
2 - ANNULUS GEAR

OVERDRIVE UNIT (Continued)

GEAR CASE AND PARK LOCK

(1) Remove locating ring from gear case.

(2) Remove park pawl shaft retaining bolt and remove shaft, pawl and spring.

(3) Remove reaction plug snap-ring and remove reaction plug.

(4) Remove output shaft seal.

CLEANING

Clean the geartrain and case components with solvent. Dry all parts except the bearings with compressed air. Allow bearings to air dry.

Do not use shop towels for wiping parts dry unless the towels are made from a lint-free material. A sufficient quantity of lint (from shop towels, cloths, rags, etc.) could plug the transmission filter and fluid passages.

Discard the old case gasket and seals. Do not attempt to salvage these parts. They are not reusable. Replace any of the overdrive unit snap-rings if distorted or damaged.

Minor nicks or scratches on components can be smoothed with crocus cloth. However, do not attempt to reduce severe scoring on any components with abrasive materials. Replace severely scored components; do not try to salvage them.

INSPECTION

Check condition of the park lock components and the overdrive case.

Check the bushings in the overdrive case. Replace the bushings if severely scored or worn. Also replace the case seal if loose, distorted, or damaged.

Examine the overdrive and direct clutch discs and plates. Replace the discs if the facing is worn, severely scored, or burned and flaking off. Replace the clutch plates if worn, heavily scored, or cracked. Check the lugs on the clutch plates for wear. The plates should slide freely in the drum. Replace the plates or drum if binding occurs.

Check condition of the annulus gear, direct clutch hub, clutch drum and clutch spring. Replace the gear, hub and drum if worn or damaged. Replace the spring if collapsed, distorted, or cracked.

Be sure the splines and lugs on the gear, drum and hub are in good condition. The clutch plates and discs should slide freely in these components.

Inspect the thrust bearings and spring plate. Replace the plate if worn or scored. Replace the bearings if rough, noisy, brinnelled, or worn.

Inspect the planetary gear assembly and the sun gear and bushings. If either the sun gear or the bushings are damaged, replace the gear and bushings as an assembly. The gear and bushings are not serviced separately.

The planetary carrier and pinions must be in good condition. Also be sure the pinion pins are secure and in good condition. Replace the carrier if worn or damaged.

Inspect the overrunning clutch and race. The race surface should be smooth and free of scores. Replace the overrunning clutch assembly or the race if either assembly is worn or damaged in any way.

Replace the shaft pilot bushing and inner bushing if damaged. Replace either shaft bearing if rough or noisy. Replace the bearing snap-rings if distorted or cracked.

Check the machined surfaces on the output shaft. These surfaces should clean and smooth. Very minor nicks or scratches can be smoothed with crocus cloth. Replace the shaft if worn, scored or damaged in any way.

Inspect the output shaft bushings. The small bushing is the intermediate shaft pilot bushing. The large bushing is the overrunning clutch hub bushing. Replace either bushing if scored, pitted, cracked, or worn.

ASSEMBLY

GEARTRAIN AND DIRECT CLUTCH

(1) Soak direct clutch and overdrive clutch discs in Mopar® ATF +4, type 9602, transmission fluid. Allow discs to soak for 10-20 minutes.

(2) Install new pilot bushing and clutch hub bushing in output shaft if necessary (Fig. 155). Lubricate bushings with petroleum jelly, or transmission fluid.

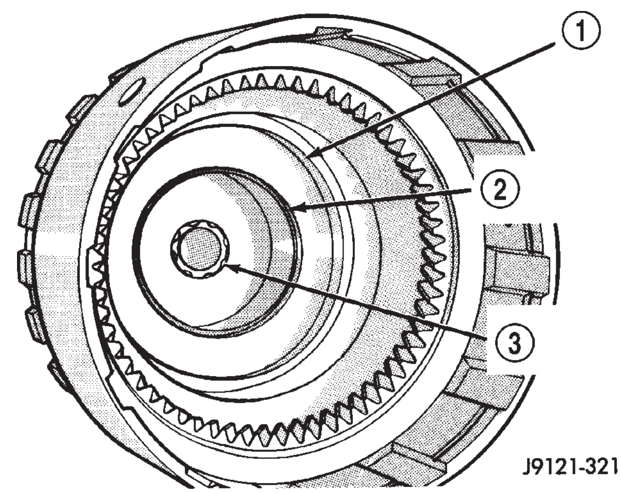


Fig. 155 Output Shaft Pilot Bushing

1 - OUTPUT SHAFT HUB
2 - OVERRUNNING CLUTCH HUB BUSHING
3 - INTERMEDIATE SHAFT PILOT BUSHING

(3) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap-ring (Fig. 156).

OVERDRIVE UNIT (Continued)

(4) Align and install clutch drum on annulus gear (Fig. 157). Be sure drum is engaged in annulus gear lugs.

(5) Install clutch drum outer retaining ring (Fig. 157).

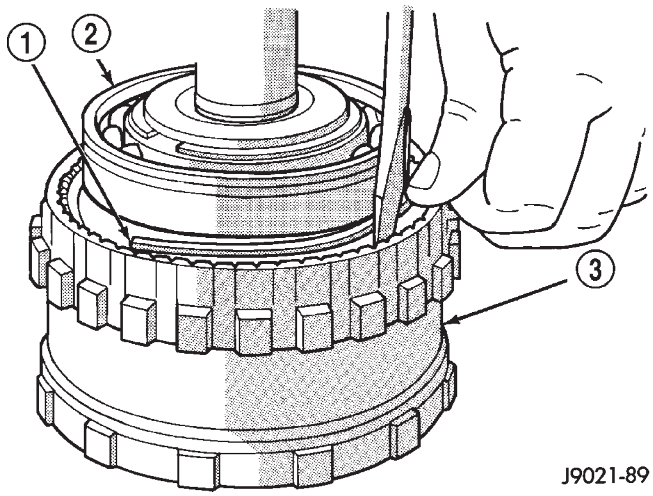


Fig. 156 Annulus Gear Installation

1 - SNAP-RING
2 - OUTPUT SHAFT FRONT BEARING
3 - ANNULUS GEAR

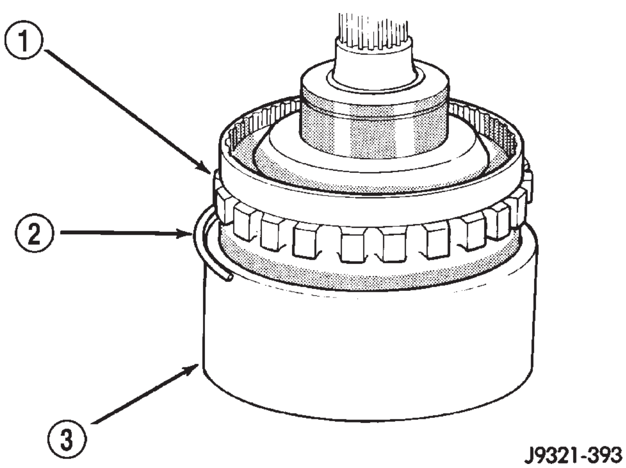


Fig. 157 Clutch Drum And Outer Retaining Ring Installation

1 - ANNULUS GEAR
2 - OUTER SNAP-RING
3 - CLUTCH DRUM

(6) Slide clutch drum forward and install inner retaining ring (Fig. 158).

(7) Install rear bearing and snap-ring on output shaft (Fig. 159). Be sure locating ring groove in bearing is toward rear.

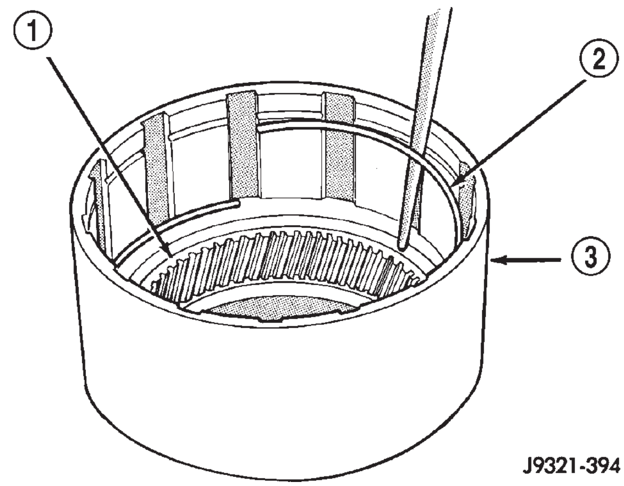


Fig. 158 Clutch Drum Inner Retaining Ring Installation

1 - ANNULUS GEAR
2 - INNER SNAP-RING
3 - CLUTCH DRUM

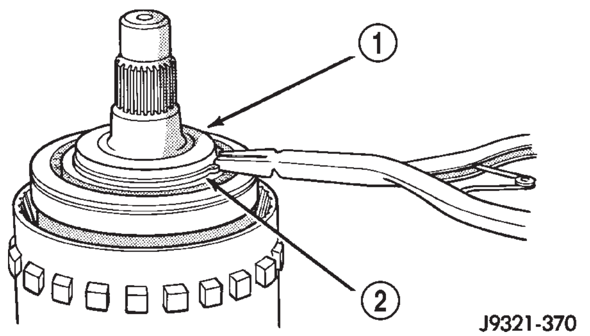


Fig. 159 Rear Bearing And Snap-Ring Installation

1 - REAR BEARING
2 - SNAP-RING

(8) Install overrunning clutch on hub (Fig. 160). Note that clutch only fits one-way. Shoulder on clutch should seat in small recess at edge of hub.

(9) Install thrust bearing on overrunning clutch hub. Use generous amount of petroleum jelly to hold bearing in place for installation. Bearing fits one-way only. Be sure bearing is seated squarely against hub. Reinstall bearing if it does not seat squarely.

(10) Install overrunning clutch in output shaft (Fig. 161). Insert snap-ring pliers in hub splines. Expand pliers to grip hub. Then install assembly with counterclockwise, twisting motion.

(11) Install planetary gear in annulus gear (Fig. 162). Be sure planetary pinions are fully seated in annulus gear before proceeding.

(12) Coat planetary thrust bearing and bearing contact surface of spring plate with generous amount of petroleum jelly. This will help hold bearing in place during installation.

OVERDRIVE UNIT (Continued)

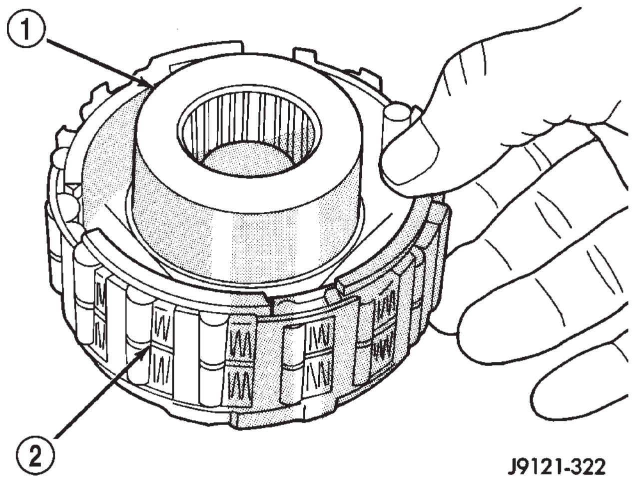


Fig. 160 Assembling Overrunning Clutch And Hub

1 - CLUTCH HUB
2 - OVERRUNNING CLUTCH

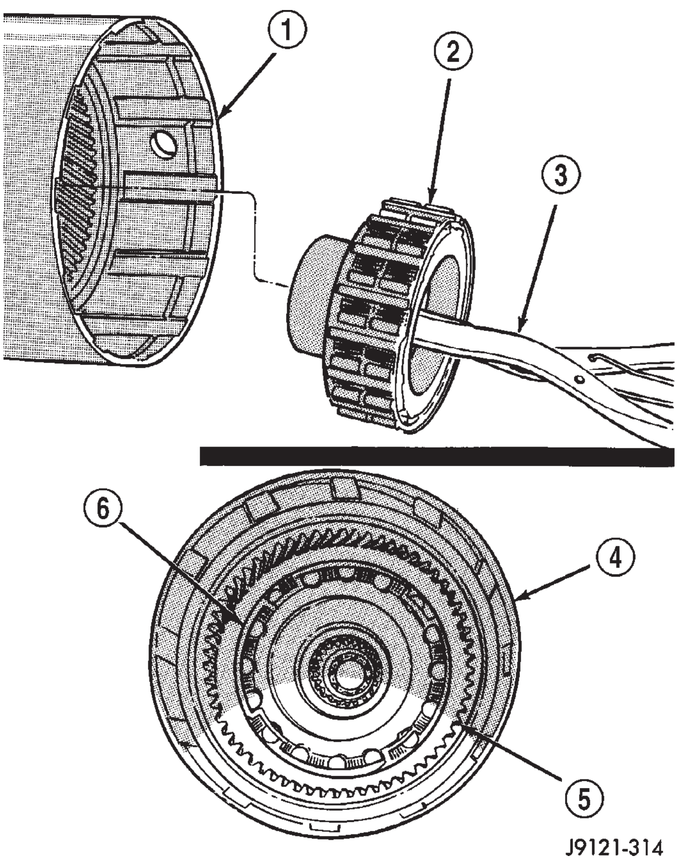


Fig. 161 Overrunning Clutch Installation

1 - CLUTCH DRUM
2 - OVERRUNNING CLUTCH ASSEMBLY
3 - EXPANDING-TYPE SNAP-RING PLIERS
4 - CLUTCH DRUM
5 - ANNULUS GEAR
6 - OVERRUNNING CLUTCH ASSEMBLY SEATED IN OUTPUT SHAFT

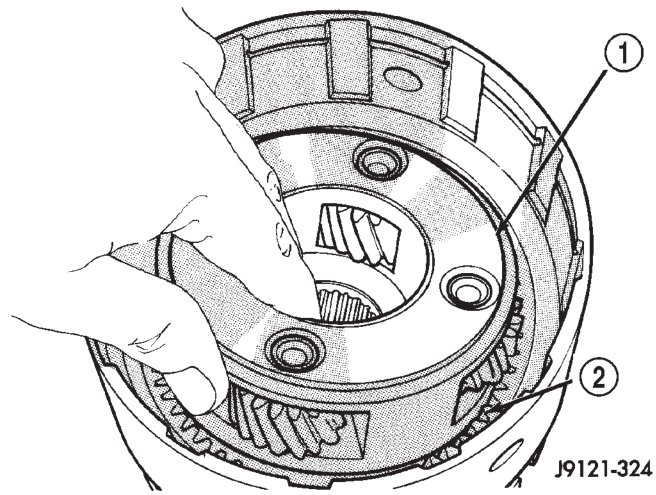


Fig. 162 Planetary Gear Installation

1 - PLANETARY GEAR
2 - ANNULUS GEAR

(13) Install planetary thrust bearing on sun gear (Fig. 163). Slide bearing onto gear and seat it against spring plate as shown. Bearing fits one-way only. If it does not seat squarely against spring plate, remove and reposition bearing.

(14) Install assembled sun gear, spring plate and thrust bearing (Fig. 164). Be sure sun gear and thrust bearing are fully seated before proceeding.

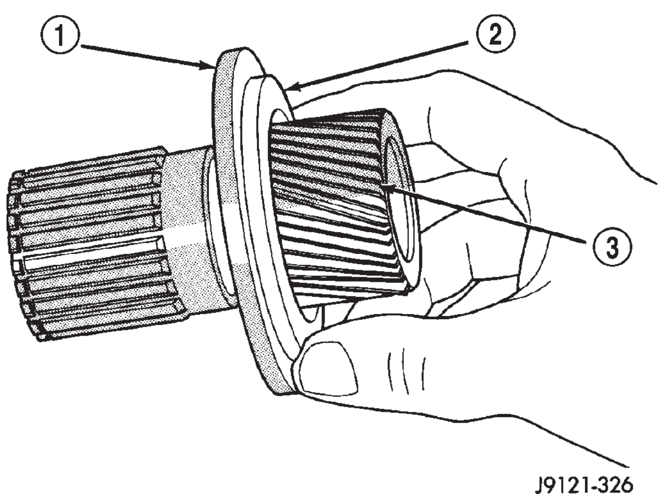


Fig. 163 Planetary Thrust Bearing Installation

1 - SPRING PLATE
2 - PLANETARY THRUST BEARING
3 - SUN GEAR

OVERDRIVE UNIT (Continued)

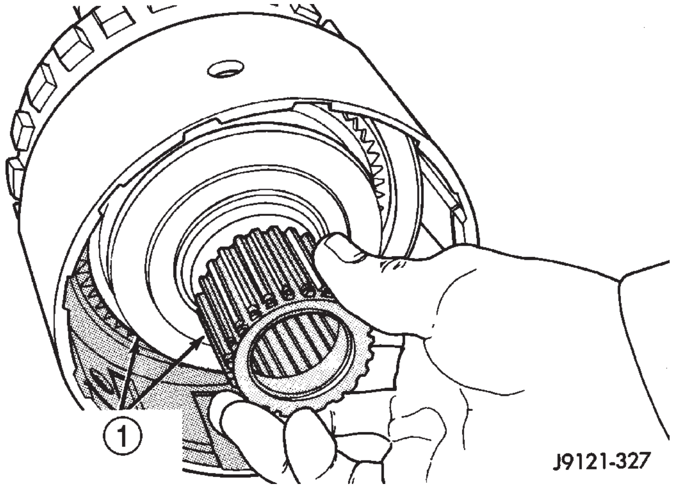


Fig. 164 Sun Gear Installation

1 - SUN GEAR AND SPRING PLATE ASSEMBLY

(15) Mount assembled output shaft, annulus gear, and clutch drum in shop press. Direct clutch spring, hub and clutch pack are easier to install with assembly mounted in press.

(16) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 165). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

(17) Install direct clutch spring (Fig. 166). Be sure spring is properly seated on spring plate.

NOTE: The 42RE transmission has 6 direct clutch discs and 5 clutch plates.

(18) Assemble and install direct clutch pack on hub as follows:

(a) Assemble clutch pack components (Fig. 167).

(b) Install direct clutch reaction plate on clutch hub first. Note that one side of reaction plate is counterbored. Be sure this side faces rearward. Splines at rear of hub are raised slightly. Counterbore in plate fits over raised splines. Plate should be flush with this end of hub (Fig. 168).

(c) Install first clutch disc followed by a steel plate until all discs and plates have been installed.

(d) Install pressure plate. This is last clutch pack item to be installed. Be sure plate is installed with shoulder side facing upward (Fig. 169).

(19) Install clutch hub and clutch pack on direct clutch spring (Fig. 170). Be sure hub is started on sun gear splines before proceeding.

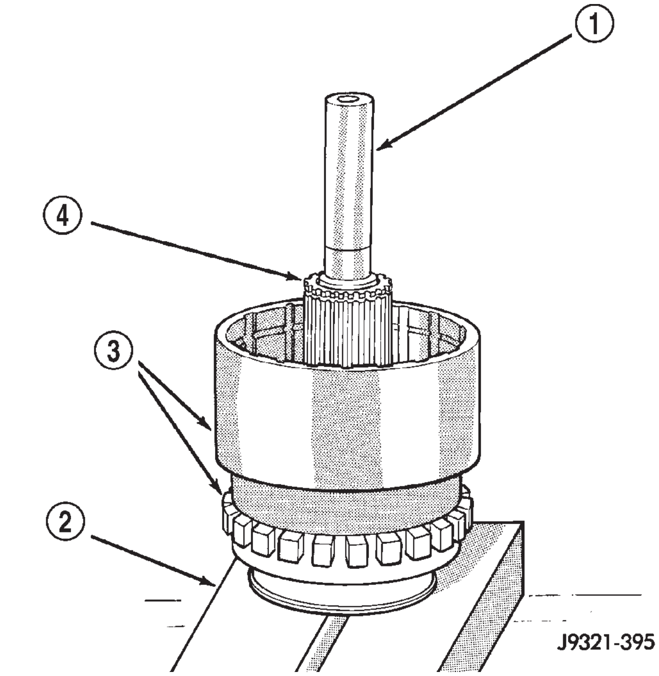


Fig. 165 Alignment Tool Installation

1 - SPECIAL TOOL 6227-2
2 - PRESS PLATES
3 - ASSEMBLED DRUM AND ANNULUS GEAR
4 - SUN GEAR

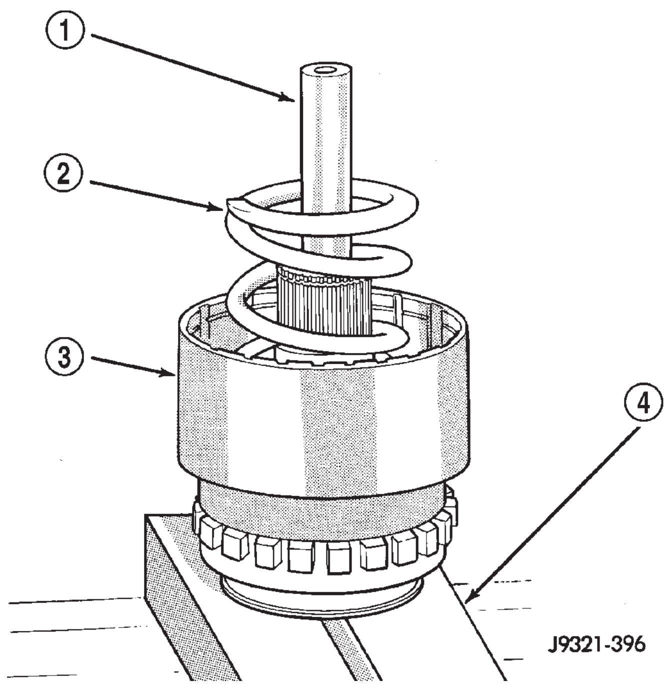


Fig. 166 Direct Clutch Spring Installation

1 - SPECIAL TOOL 6227-2
2 - DIRECT CLUTCH SPRING
3 - CLUTCH HUB
4 - PRESS PLATES

OVERDRIVE UNIT (Continued)

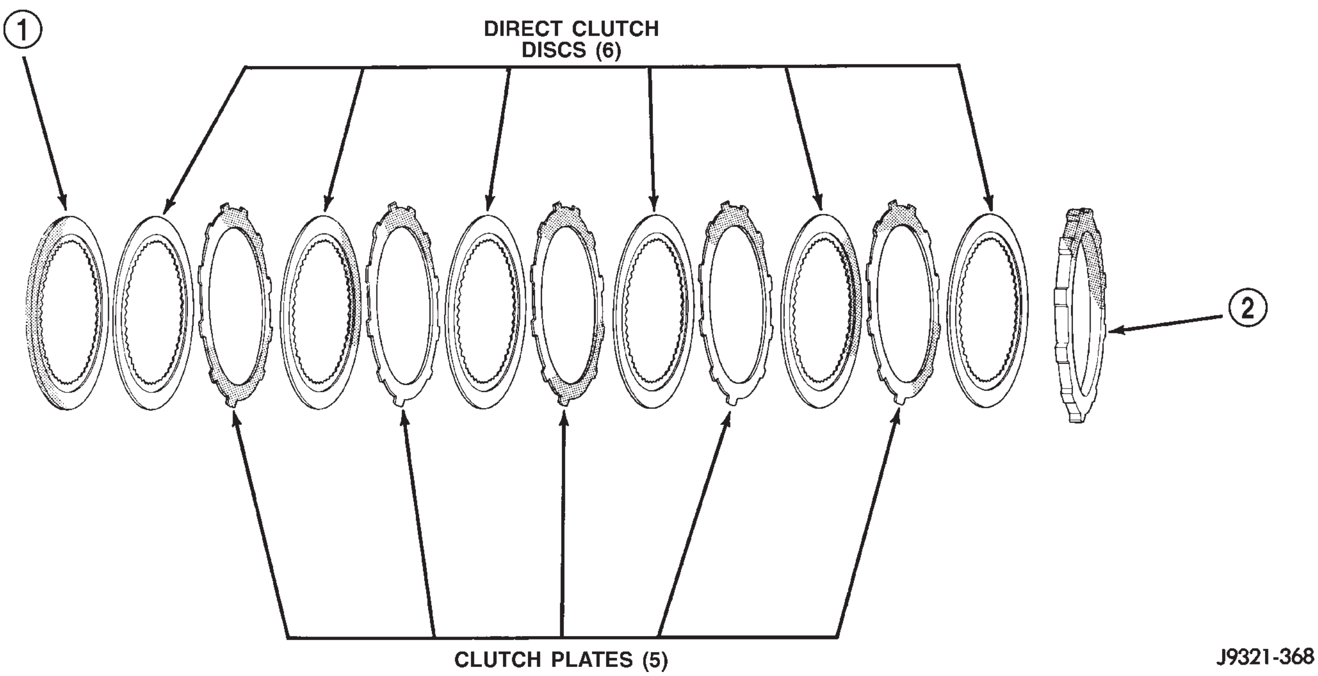


Fig. 167 42RE Direct Clutch Pack Components

1 - REACTION PLATE
2 - PRESSURE PLATE

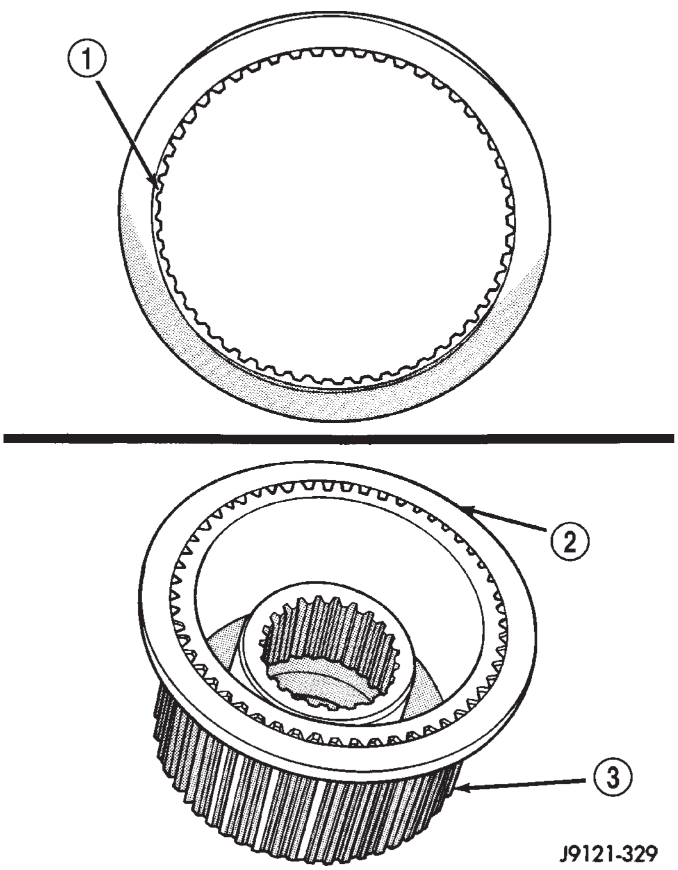


Fig. 168 Correct Position Of Direct Clutch Reaction Plate

1 - REACTION PLATE COUNTERBORE
2 - DIRECT CLUTCH REACTION PLATE (FLUSH WITH END OF HUB)
3 - CLUTCH HUB

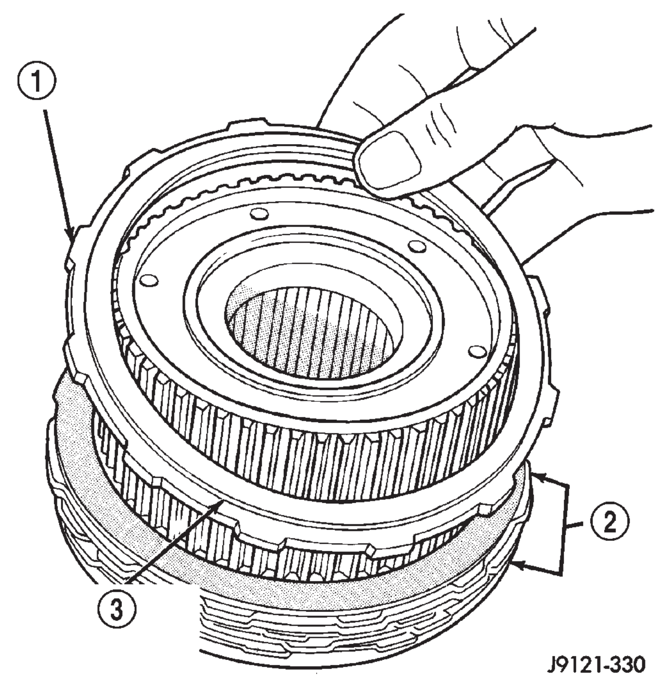


Fig. 169 Correct Position Of Direct Clutch Pressure Plate

1 - DIRECT CLUTCH PRESSURE PLATE
2 - CLUTCH PACK
3 - BE SURE SHOULDER SIDE OF PLATE FACES UPWARD

OVERDRIVE UNIT (Continued)

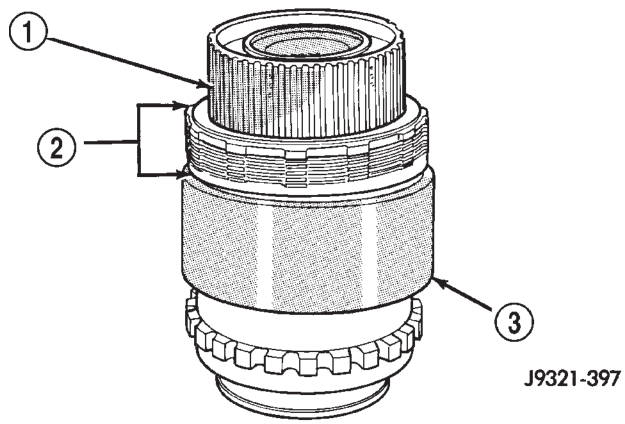


Fig. 170 Direct Clutch

1 - CLUTCH HUB
2 - DIRECT CLUTCH PACK
3 - CLUTCH DRUM

WARNING: THE NEXT STEP IN GEARTRAIN ASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH HUB AND SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE COMPRESSOR TOOL C-6227-1 AND A HYDRAULIC-TYPE SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(20) Position Compressor Tool 6227-1 on clutch hub.

(21) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

(22) Slowly compress clutch hub and spring. Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

(23) Realign clutch pack on hub and seat clutch discs and plates in clutch drum.

(24) Install direct clutch pack snap-ring (Fig. 171). Be very sure snap-ring is fully seated in clutch drum ring groove.

(25) Install clutch hub retaining ring (Fig. 172). Be very sure retaining ring is fully seated in sun gear ring groove.

(26) Slowly release press ram, remove compressor tools and remove geartrain assembly.

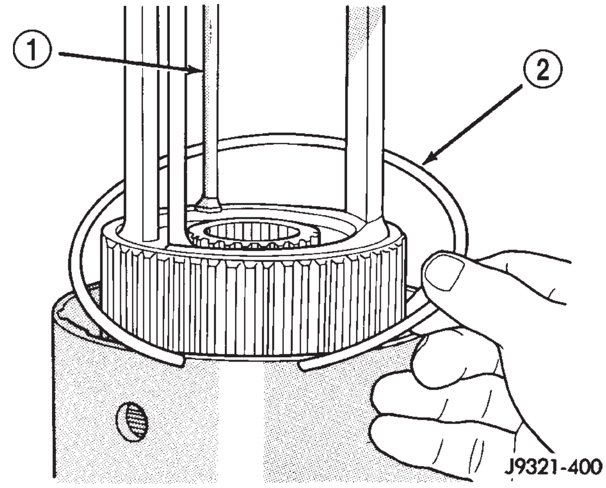


Fig. 171 Direct Clutch Pack Snap-Ring Installation

1 - SPECIAL TOOL 6227-1
2 - DIRECT CLUTCH PACK SNAP-RING

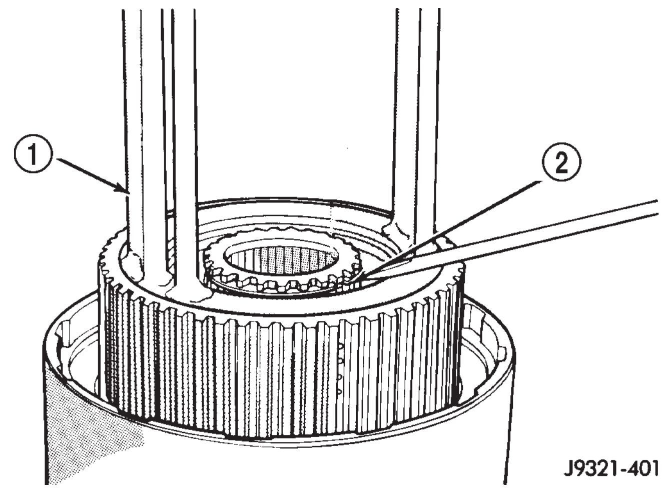


Fig. 172 Clutch Hub Retaining Ring Installation

1 - SPECIAL TOOL 6227-1
2 - CLUTCH HUB RETAINING RING

GEAR CASE

(1) Position park pawl and spring in case and install park pawl shaft. Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.

(2) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.

(3) Install park lock reaction plug. Note that plug has locating pin at rear (Fig. 173). Be sure pin is seated in hole in case before installing snap-ring.

(4) Install reaction plug snap-ring (Fig. 174). Compress snap ring only enough for installation; do not distort it.

OVERDRIVE UNIT (Continued)

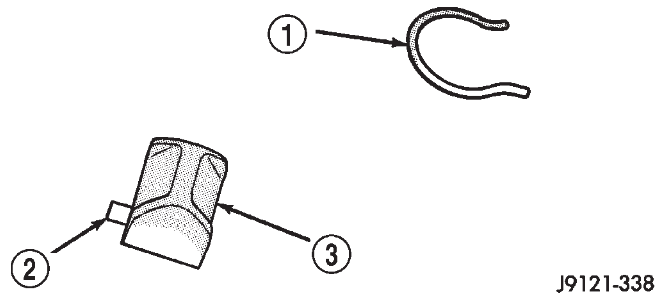


Fig. 173 Reaction Plug Locating Pin And Snap-Ring

1 - REACTION PLUG SNAP-RING (DO NOT OVERCOMPRESS TO INSTALL)

2 - LOCATING PIN

3 - PARK LOCK REACTION PLUG

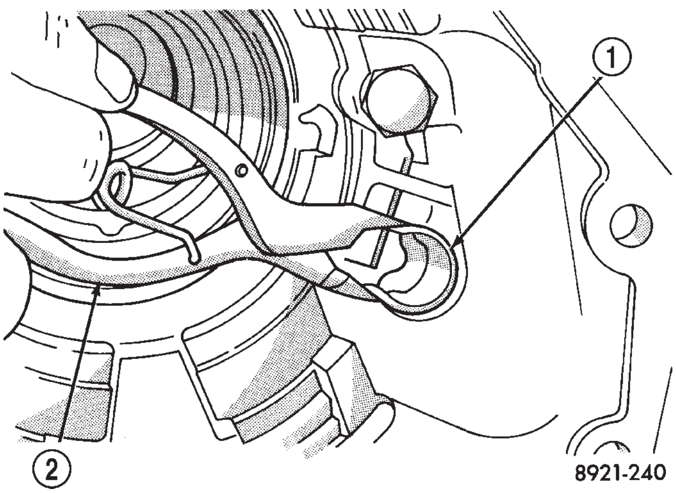


Fig. 174 Reaction Plug And Snap-Ring Installation

1 - REACTION PLUG SNAP-RING

2 - SNAP-RING PLIERS

(5) Install new seal in gear case. On 4x4 gear case, use Tool Handle C-4171 and Installer C-3860-A to seat seal in case. On 4 x 2 gear case, use same Handle C-4171 and Installer C-3995-A to seat seal in case.

(6) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 175).

(7) Support geartrain on Tool 6227-1 (Fig. 176). Be sure tool is securely seated in clutch hub.

(8) Install overdrive gear case on geartrain (Fig. 176).

(9) Expand front bearing locating ring with snap-ring pliers (Fig. 177). Then slide case downward until locating ring locks in bearing groove and release snap-ring.

(10) Install locating ring access cover and gasket in overdrive unit case (Fig. 178).

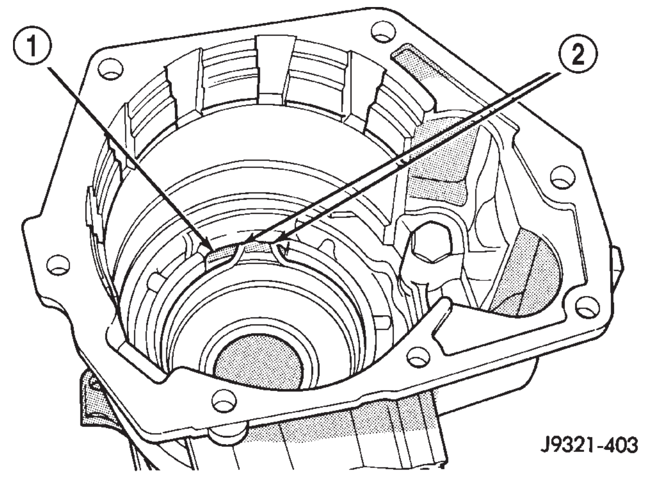


Fig. 175 Correct Rear Bearing Locating Ring Position

1 - CASE ACCESS HOLE

2 - TAB ENDS OF LOCATING RING

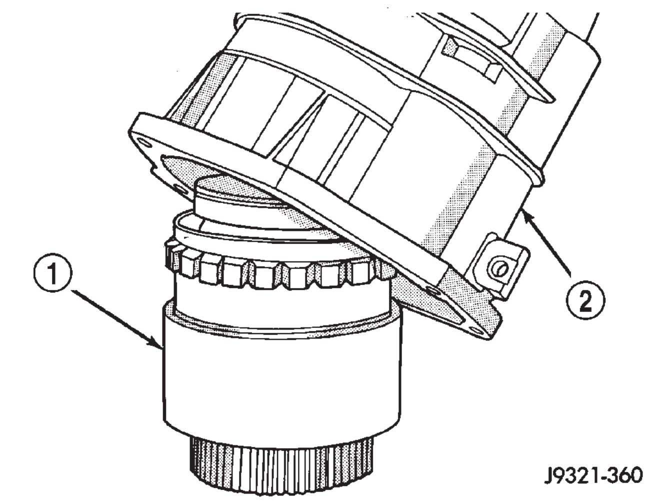


Fig. 176 Overdrive Gear Case Installation

1 - GEARTRAIN ASSEMBLY

2 - GEAR CASE

OVERDRIVE CLUTCH

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 179).

(2) Install wave spring on top of reaction ring (Fig. 180). Reaction ring and wave ring both fit in same ring groove. Use screwdriver to seat each ring securely in groove. Also ensure that the ends of the two rings are offset from each other.

NOTE: The 42RE transmission has 3 overdrive clutch discs and 2 plates.

(3) Assemble overdrive clutch pack (Fig. 181).

(4) Install overdrive clutch reaction plate first.

OVERDRIVE UNIT (Continued)

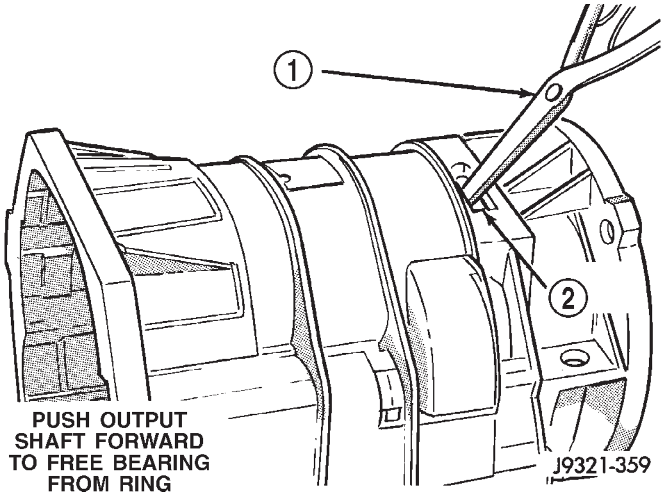


Fig. 177 Seating Locating Ring In Rear Bearing

1 - EXPAND BEARING LOCATING RING WITH SNAP-RING PLIERS
2 - ACCESS HOLE

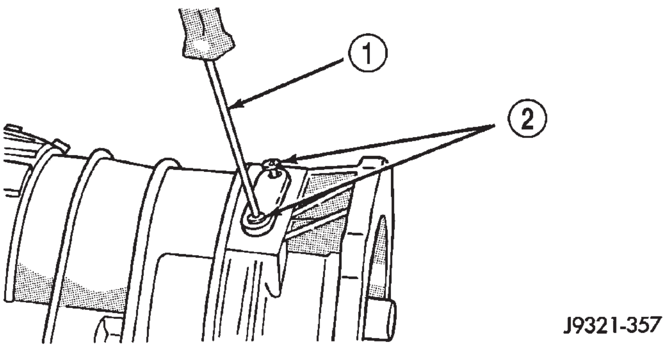


Fig. 178 Locating Ring Access Cover And Gasket Installation

1 - TORX SCREWDRIVER (T25)
2 - ACCESS COVER SCREWS

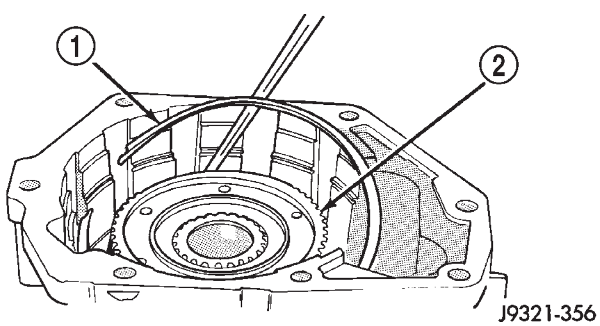


Fig. 179 Overdrive Clutch Reaction Ring Installation

1 - REACTION RING
2 - CLUTCH HUB

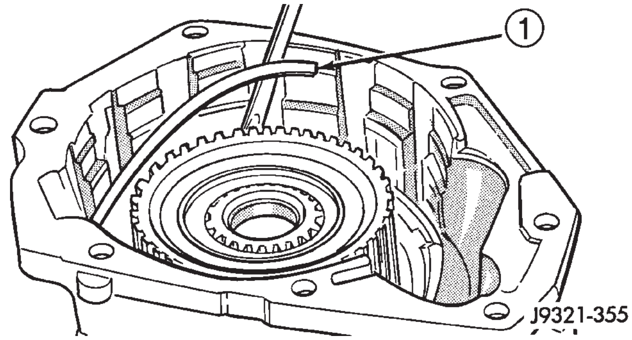


Fig. 180 Overdrive Clutch Wave Spring Installation

1 - WAVE SPRING

NOTE: The reaction plate is thinner than the pressure plate in a 42RE transmission.

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

(6) Install clutch pack pressure plate.

(7) Install clutch pack wire-type retaining ring (Fig. 182).

INTERMEDIATE SHAFT SPACER SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness intermediate shaft spacer as follows:

(a) Insert Special Tool 6312 through sun gear, planetary gear and into pilot bushing in output shaft. Be sure tool bottoms against planetary shoulder.

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 183). Then position Dial Caliper C-4962 over gauge tool.

(c) Extend sliding scale of dial caliper downward through gauge tool slot until scale contacts end of Gauge Alignment Tool 6312. Lock scale in place. Remove dial caliper tool and note distance measured (Fig. 183).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 184).

(e) Remove Gauge Alignment Tool 6312.

OVERDRIVE UNIT (Continued)

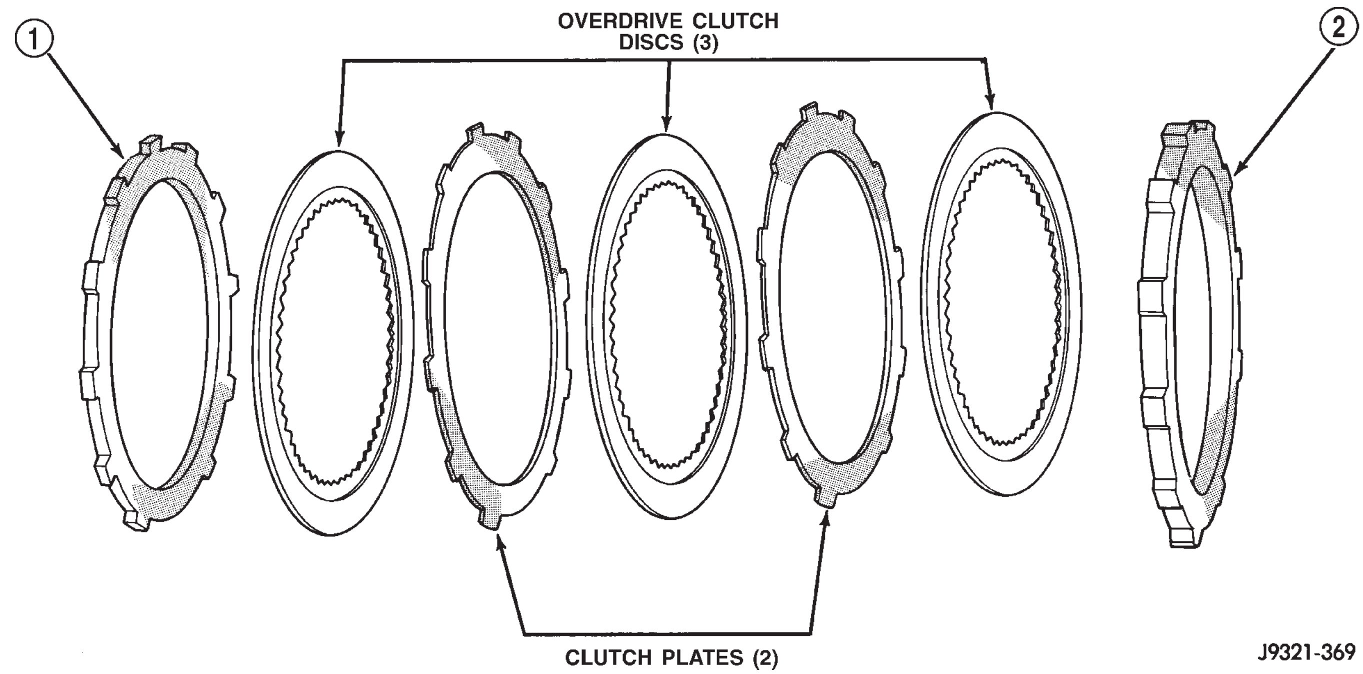


Fig. 181 42RE Overdrive Clutch Components

1 - REACTION PLATE

2 - PRESSURE PLATE

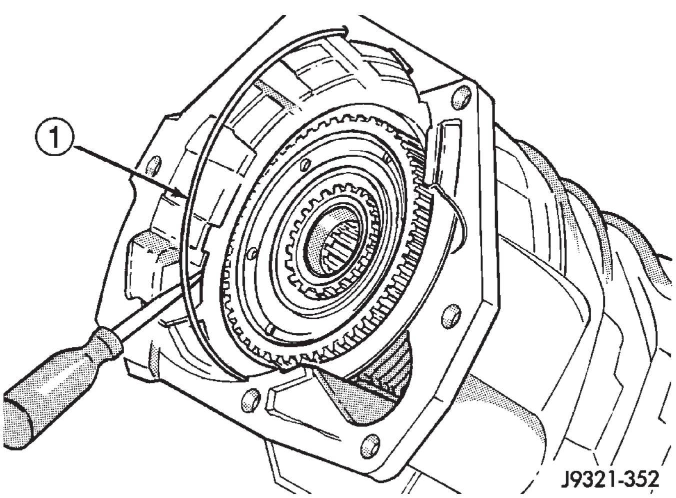


Fig. 182 Overdrive Clutch Pack Retaining Ring Installation

1 - OVERDRIVE CLUTCH PACK RETAINING RING

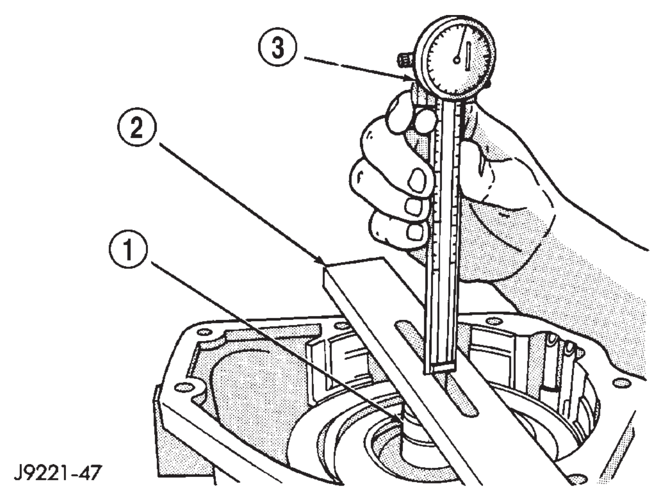


Fig. 183 Shaft End Play Measurement

1 - SPECIAL TOOL 6312

2 - SPECIAL TOOL 6311

3 - SPECIAL TOOL C-4962

OD THRUST PLATE SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness overdrive piston thrust plate as follows:

(a) Position Gauge Tool 6311 across face of overdrive case. Then position Dial Caliper C-4962 over gauge tool (Fig. 185).

(b) Measure distance to clutch hub thrust bearing seat at four points 90° apart. Then average measurements by adding them and dividing by 4.

(c) Select and install required thrust plate from information in thrust plate chart (Fig. 186).

OVERDRIVE UNIT (Continued)

End Play Measurement (Inches)	Spacer Thickness (Inches)
.7336 - .7505	.158 - .159
.7506 - .7675	.175 - .176
.7676 - .7855	.193 - .194
.7856 - .8011	.211 - .212

J9121-341

Fig. 184 Intermediate Shaft End Play Spacer Selection

(3) Leave Alignment Tool 6227-2 in place. Tool will keep planetary and clutch hub splines in alignment until overdrive unit is ready for installation on transmission.

(4) Transmission speed sensor can be installed at this time if desired. However, it is recommended that sensor not be installed until after overdrive unit is secured to transmission.

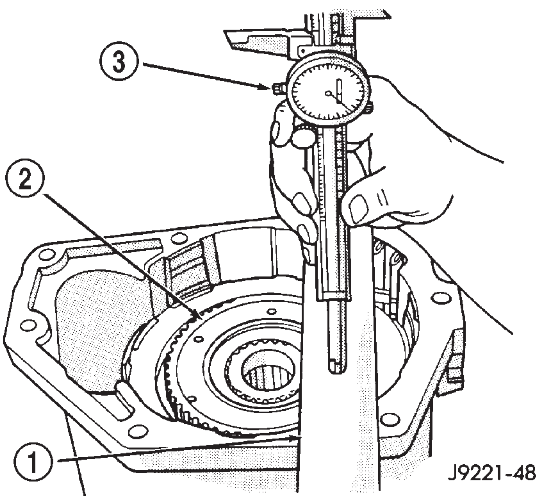


Fig. 185 Overdrive Piston Thrust Plate Measurement

1 - SPECIAL TOOL 6311
2 - DIRECT CLUTCH HUB THRUST BEARING SEAT
3 - SPECIAL TOOL C-4962

OVERDRIVE PISTON

(1) Install new seals on over drive piston.

(2) Stand transmission case upright on bellhousing.

(3) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(4) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(5) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

End Play Measurement (Inches)	Spacer Thickness (Inches)
1.7500 - 1.7649	.108 - .110
1.7650 - 1.7799	.123 - .125
1.7800 - 1.7949	.138 - .140
1.7950 - 1.8099	.153 - .155
1.8100 - 1.8249	.168 - .170
1.8250 - 1.8399	.183 - .185
1.8400 - 1.8549	.198 - .200
1.8550 - 1.8699	.213 - .215
1.8700 - 1.8849	.228 - .230
1.8850 - 1.8999	.243 - .245

J9121-342

Fig. 186 Overdrive Piston Thrust Plate Selection

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114-2 and inside Guide Ring 8114-1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

(6) Install intermediate shaft spacer on intermediate shaft.

(7) Install overdrive piston thrust plate on overdrive piston.

(8) Install overdrive piston thrust bearing on overdrive piston.

(9) Install transmission speed sensor and O-ring seal in overdrive case (Fig. 127).

INSTALLATION

(1) Be sure overdrive unit Alignment Tool 6227-2 is fully seated before moving unit. If tool is not seated and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.

(2) If overdrive piston retainer was not removed during service and original case gasket is no longer reusable, prepare new gasket by trimming it.

(3) Cut out old case gasket around piston retainer with razor knife (Fig. 187).

(4) Use old gasket as template and trim new gasket to fit.

(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. Do not use any type of sealer to secure gasket. Use petroleum jelly only.

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 188).

(7) Install thrust bearing in overdrive unit sliding hub. Use petroleum jelly to hold bearing in position.

OVERDRIVE UNIT (Continued)

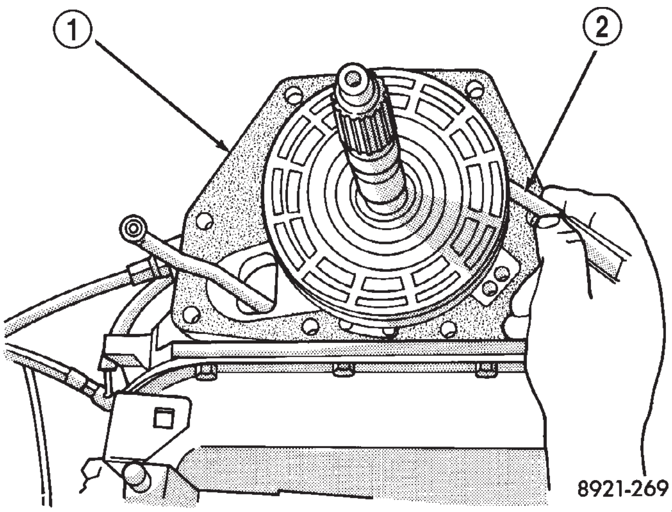


Fig. 187 Trimming Overdrive Case Gasket

1 - GASKET
2 - SHARP KNIFE

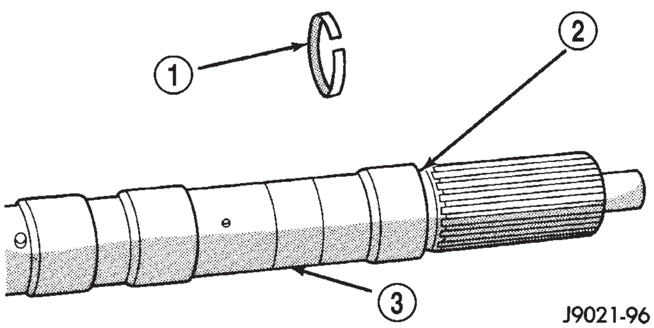


Fig. 188 Intermediate Shaft Selective Spacer Location

1 - SELECTIVE SPACER
2 - SPACER GROOVE
3 - INTERMEDIATE SHAFT

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(8) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Alignment Tool 6227-2. Overdrive unit cannot be installed if splines are not aligned. If splines have rotated out of alignment, unit will have to be disassembled to realign splines.

(9) Carefully slide Alignment Tool 6227-2 out of overdrive planetary gear and overrunning clutch splines.

(10) Raise overdrive unit and carefully slide it straight onto intermediate shaft. Insert park rod into park lock reaction plug at same time. Avoid tilting overdrive during installation as this could cause planetary gear and overrunning clutch splines to rotate out of alignment. If this occurs, it will be necessary to remove and disassemble overdrive unit to realign splines.

(11) Work overdrive unit forward on intermediate shaft until seated against transmission case.

(12) Install bolts attaching overdrive unit to transmission unit. Tighten bolts in diagonal pattern to 34 N·m (25 ft-lbs).

(13) Connect the transmission speed sensor and overdrive wiring connectors.

(14) Install the transfer case, if equipped.

(15) Align and install rear propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/ PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER

DESCRIPTION

The overrunning clutch (Fig. 189) consists of an inner race, an outer race (or cam), rollers and springs, and the spring retainer. The number of rollers and springs depends on what transmission and which overrunning clutch is being dealt with.

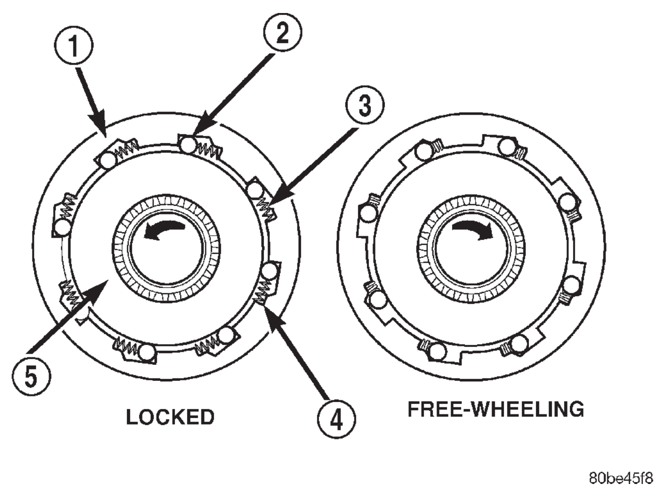


Fig. 189 Overrunning Clutch

1 - OUTER RACE (CAM)
2 - ROLLER
3 - SPRING
4 - SPRING RETAINER
5 - INNER RACE (HUB)

OPERATION

As the inner race is rotated in a clockwise direction (as viewed from the front of the transmission), the race causes the rollers to roll toward the springs, causing them to compress against their retainer. The compression of the springs increases the clearance

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER (Continued)

between the rollers and cam. This increased clearance between the rollers and cam results in a freewheeling condition. When the inner race attempts to rotate counterclockwise, the action causes the rollers to roll in the same direction as the race, aided by the pushing of the springs. As the rollers try to move in the same direction as the inner race, they are wedged between the inner and outer races due to the design of the cam. In this condition, the clutch is locked and acts as one unit.

DISASSEMBLY

NOTE: To service the overrunning clutch cam and the overdrive piston retainer, the transmission geartrain and the overdrive unit must be removed from the transmission.

(1) Remove the overdrive piston (Fig. 190).
(2) Remove the overdrive piston retainer bolts.
(3) Remove overdrive piston retainer.
(4) Remove case gasket.
(5) Mark the position of the overrunning clutch cam in the case (Fig. 191).
(6) Remove the overrunning clutch cam bolts.
(7) Remove the overrunning clutch cam.

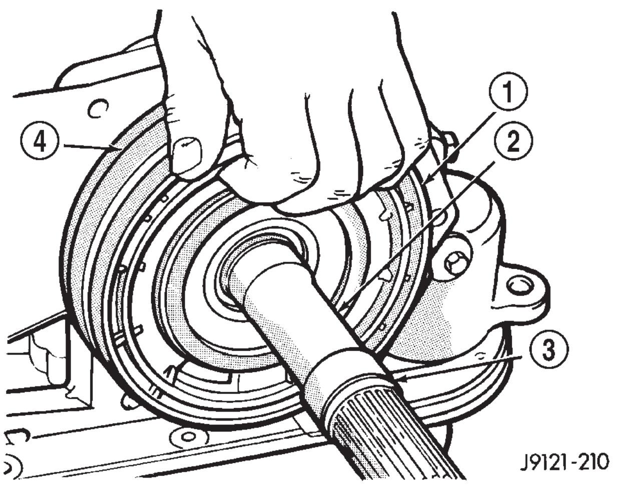


Fig. 190 Overdrive Piston Removal

1 - OVERDRIVE CLUTCH PISTON
2 - INTERMEDIATE SHAFT
3 - SELECTIVE SPACER
4 - PISTON RETAINER

CLEANING

Clean the overrunning clutch assembly, clutch cam, low-reverse drum, and overdrive piston retainer in solvent. Dry them with compressed air after cleaning.

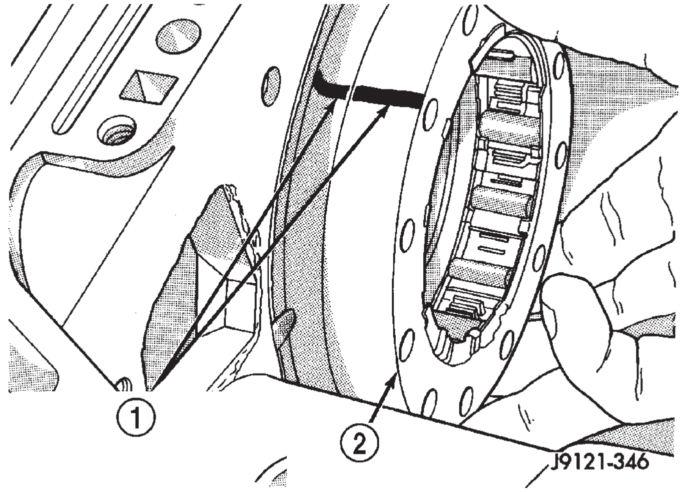


Fig. 191 Overrunning Clutch Cam Removal

1 - ALIGN MARKS IDENTIFYING NON-THREADED HOLE IN CAM AND CASE
2 - OVERRUNNING CLUTCH ASSEMBLY

INSPECTION

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse drum if the clutch race, roller surface or inside diameter is scored, worn or damaged. **Do not remove the clutch race from the low-reverse drum under any circumstances. Replace the drum and race as an assembly if either component is damaged.**

Examine the overdrive piston retainer carefully for wear, cracks, scoring or other damage. Be sure the retainer hub is a snug fit in the case and drum. Replace the retainer if worn or damaged.

ASSEMBLY

(1) Examine bolt holes in overrunning clutch cam. Note that one hole is **not threaded** (Fig. 192). This hole must align with blank area in clutch cam bolt circle (Fig. 193). Mark hole location on clutch cam and blank area in case with grease pencil, paint stripe, or scribe mark for assembly reference.

(2) Mark location of non-threaded hole in clutch cam and blank area in bolt circle with grease pencil.

(3) Align and install overrunning clutch and cam in case (Fig. 194). Be sure cam is correctly installed. Bolt holes in cam are slightly countersunk on one side. Be sure this side of cam faces rearward (toward piston retainer).

(4) Verify that non-threaded hole in clutch cam is properly aligned. Check alignment by threading a bolt into each bolt hole. Adjust clutch cam position if necessary.

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER (Continued)

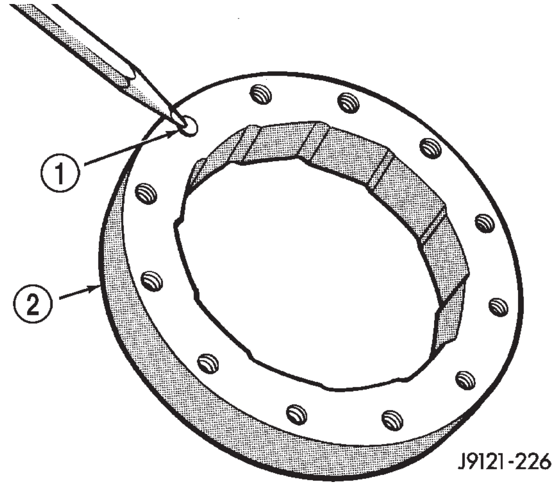


Fig. 192 Location Of Non-Threaded Hole In Clutch Cam

1 - NON-THREADED HOLE
2 - OVERRUNNING CLUTCH CAM

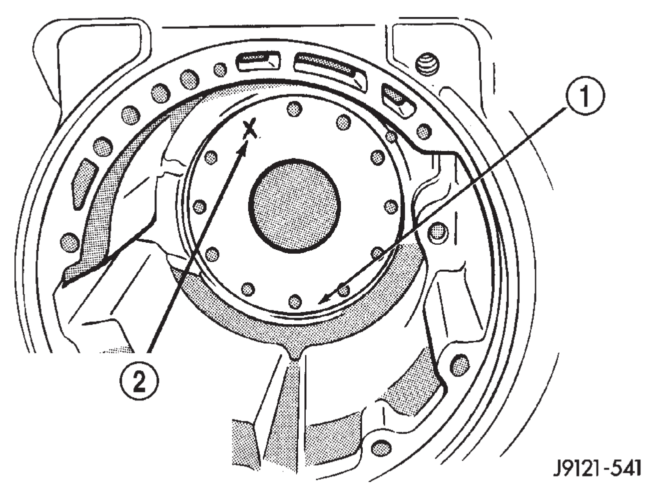


Fig. 193 Location Of Blank Area In Clutch Cam Bolt Circle

1 - OVERRUNNING CLUTCH CAM SEAT IN CASE
2 - NON-THREADED HOLE IN CLUTCH CAM ALIGNS HERE (BLANK AREA) OF SEAT

(5) Install and tighten overrunning clutch cam bolts to 17 N·m (13 ft. lbs.) torque. Note that clutch cam bolts are shorter than piston retainer bolts.

(6) Install new gasket at rear of transmission case. Use petroleum jelly to hold gasket in place. Be sure to align governor feed holes in gasket with feed passages in case (Fig. 195). Also install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.

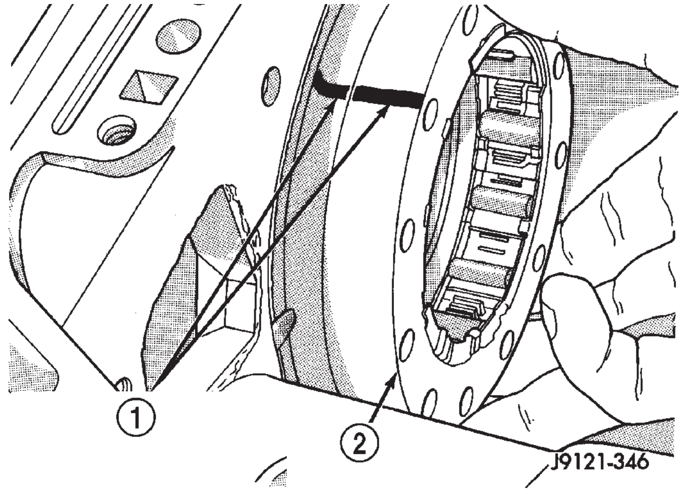


Fig. 194 Overrunning Clutch Installation

1 - ALIGN MARKS IDENTIFYING NON-THREADED HOLE IN CAM AND CASE
2 - OVERRUNNING CLUTCH ASSEMBLY

(7) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 196). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

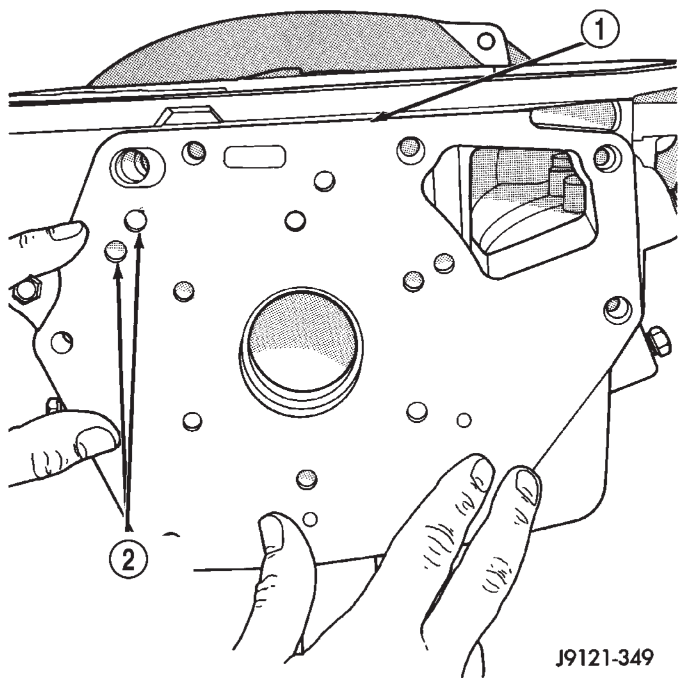


Fig. 195 Installing/Aligning Case Gasket

1 - CASE GASKET
2 - BE SURE GOVERNOR TUBE FEED HOLES IN CASE AND GASKET ARE ALIGNED

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER (Continued)

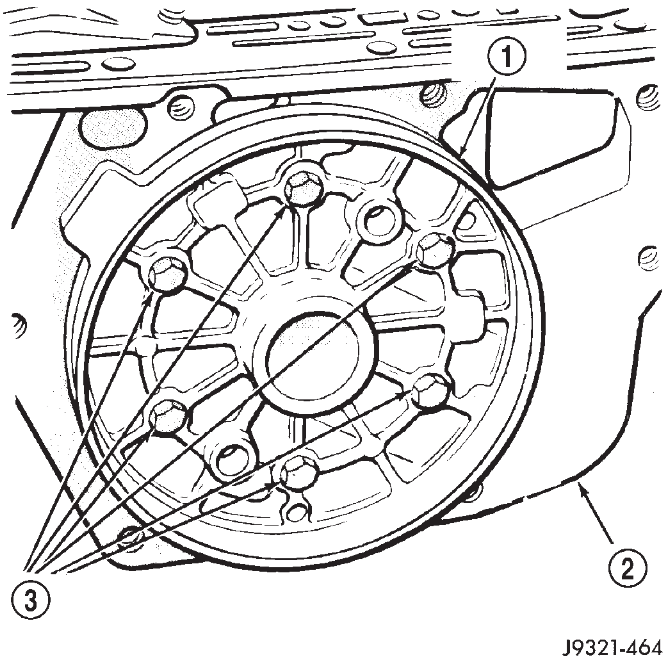


Fig. 196 Aligning Overdrive Piston Retainer

1 - PISTON RETAINER
2 - GASKET
3 - RETAINER BOLTS

(8) Install new seals on over drive piston.

(9) Stand transmission case upright on bellhousing.

(10) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(11) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(12) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114-2 and inside Guide Ring 8114-1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

NOTE: Install the remaining transmission components and the overdrive unit.

PARK LOCK CABLE

REMOVAL

(1) Place the shifter in the PARK position.

(2) Lower the steering column cover.

(3) With the ignition switch in the "RUN" position depress the park lock cable locking tab, located on top of the cable connector at the steering column and pull the park lock cable straight out.

(4) Remove the park lock cable from steering column (Fig. 197).

(5) Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(6) Disconnect the park lock cable from the shift BTSI lever and remove the cable from the shifter assembly bracket.

(7) Release the park lock cable from any remaining clips.

(8) Remove park lock cable from the vehicle.

INSTALLATION

NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Park Lock Cable.

(1) Verify that the shifter is in the PARK position.

(2) Push the park lock cable straight into the square mounting hole in the steering column until cable snaps in place.

(3) Route park lock cable to the shifter mechanism.

(4) Install the park lock cable end fitting into shifter BTSI lever.

(5) Pull rearward on the cable housing to snap park lock cable adjuster ears into floor shifter bracket.

(6) Place the ignition key cylinder in the ACCESSORY position.

(7) Push the cable adjuster lock clamp downward to lock it.

(8) Test the park lock cable operation.

(9) Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

PARK LOCK CABLE (Continued)

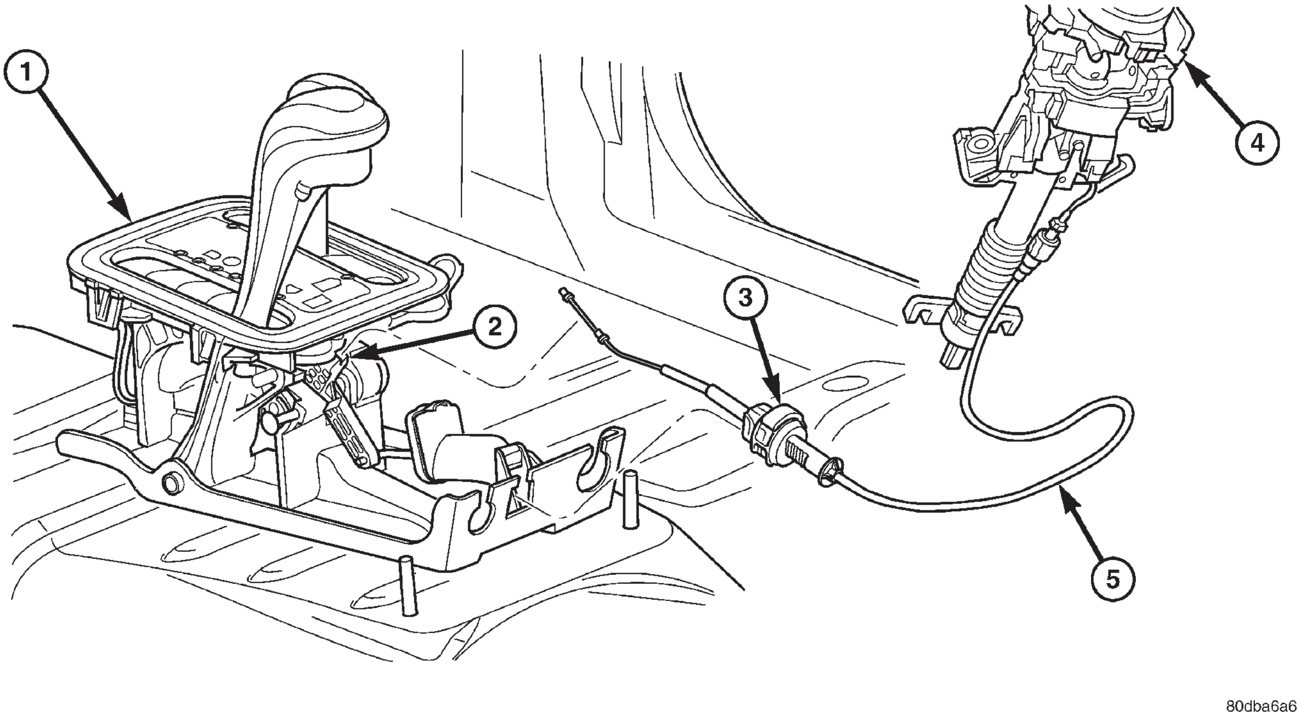


Fig. 197 Brake Transmission Shift Interlock

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

PARK/NEUTRAL POSITION SWITCH

DIAGNOSIS AND TESTING - PARK/NEUTRAL POSITION SWITCH

The center terminal of the park/neutral position switch is the starter-circuit terminal. It provides the ground for the starter solenoid circuit through the selector lever in PARK and NEUTRAL positions only. The outer terminals on the switch are for the backup lamp circuit.

SWITCH TEST

To test the switch, remove the wiring connector. Test for continuity between the center terminal and the transmission case. Continuity should exist only when the transmission is in PARK or NEUTRAL.

Shift the transmission into REVERSE and test continuity at the switch outer terminals. Continuity should exist only when the transmission is in REVERSE. Continuity should not exist between the outer terminals and the case.

Check gearshift linkage adjustment before replacing a switch that tests faulty.

REMOVAL

(1) Raise vehicle and position drain pan under switch.
(2) Disconnect switch wires.
(3) Remove switch from case.

INSTALLATION

(1) Move shift lever to PARK and NEUTRAL positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 198).

PARK/NEUTRAL POSITION SWITCH (Continued)

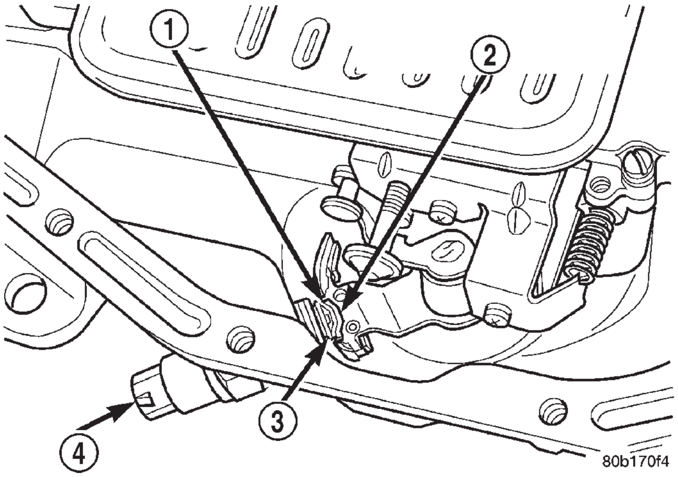


Fig. 198 Park/Neutral Position Switch

1 - NEUTRAL CONTACT
2 - MANUAL LEVER AND SWITCH PLUNGER IN REVERSE POSITION
3 - PARK CONTACT
4 - SWITCH

(2) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.
(3) Test continuity of new switch with 12V test lamp.
(4) Connect switch wires and lower vehicle.
(5) Top off transmission fluid level.

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 199) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

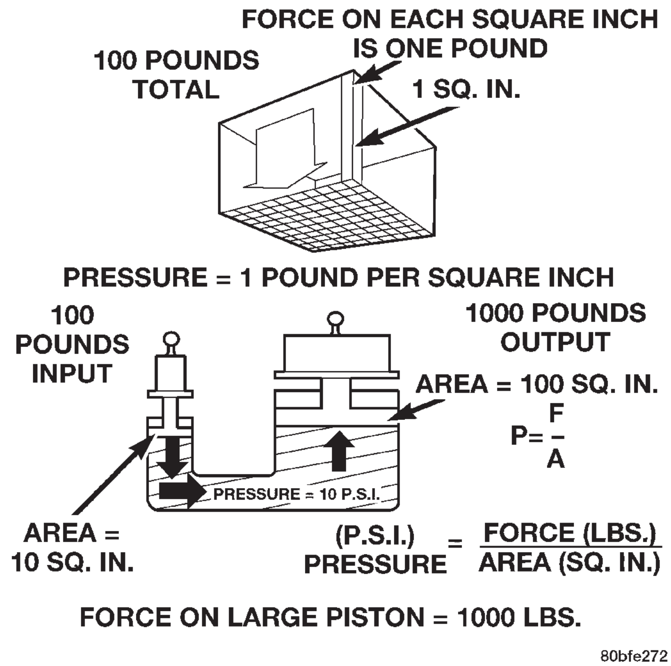


Fig. 199 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 200) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O-rings, D-rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

PISTONS (Continued)

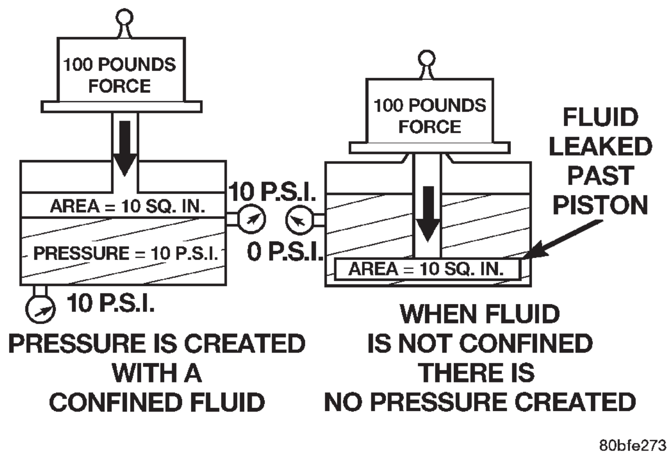


Fig. 200 Pressure on a Confined Fluid

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 201), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 201), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

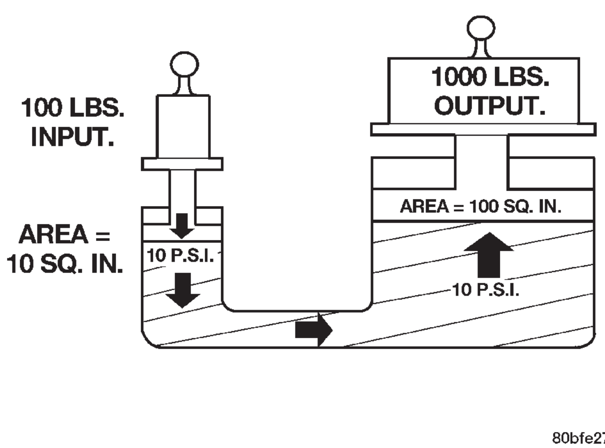


Fig. 201 Force Multiplication

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight-to-distance output rather than a pressure-to-area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 202) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

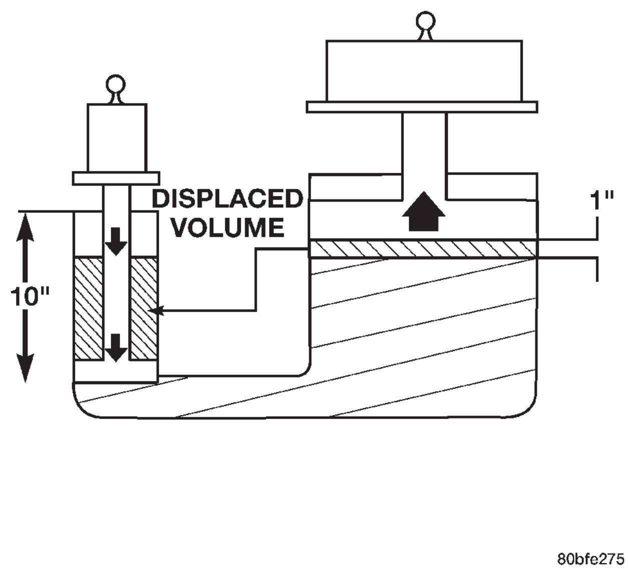


Fig. 202 Piston Travel

PLANETARY GEARTRAIN/ OUTPUT SHAFT

DESCRIPTION

The planetary gearsets (Fig. 203) are designated as the front, rear, and overdrive planetary gear assemblies and located in such order. A simple planetary gearset consists of three main members:

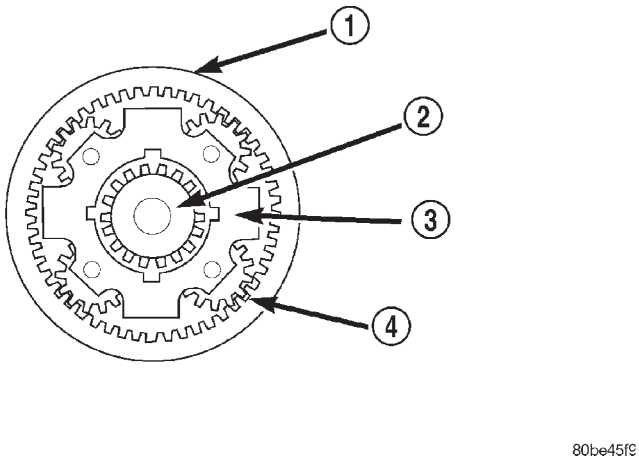


Fig. 203 Planetary Gearset

1 - ANNULUS GEAR
2 - SUN GEAR
3 - PLANET CARRIER
4 - PLANET PINIONS (4)

- The sun gear which is at the center of the system.
- The planet carrier with planet pinion gears which are free to rotate on their own shafts and are in mesh with the sun gear.
- The annulus gear, which rotates around and is in mesh with the planet pinion gears.

NOTE: The number of pinion gears does not affect the gear ratio, only the duty rating.

OPERATION

With any given planetary gearset, several conditions must be met for power to be able to flow:

- One member must be held.
- Another member must be driven or used as an input.
- The third member may be used as an output for power flow.
- For direct drive to occur, two gear members in the front planetary gearset must be driven.

NOTE: Gear ratios are dependent on the number of teeth on the annulus and sun gears.

DISASSEMBLY

(1) Remove planetary snap-ring (Fig. 204).
(2) Remove front annulus and planetary assembly from driving shell (Fig. 204).
(3) Remove snap-ring that retains front planetary gear in annulus gear (Fig. 205).
(4) Remove tabbed thrust washer and tabbed thrust plate from hub of front annulus (Fig. 206).
(5) Separate front annulus and planetary gears (Fig. 206).
(6) Remove front planetary gear front thrust washer from annulus gear hub.
(7) Separate and remove driving shell, rear planetary and rear annulus from output shaft (Fig. 207).
(8) Remove front planetary rear thrust washer from driving shell.
(9) Remove tabbed thrust washers from rear planetary gear.
(10) Remove lock ring that retains sun gear in driving shell. Then remove sun gear, spacer and thrust plates.

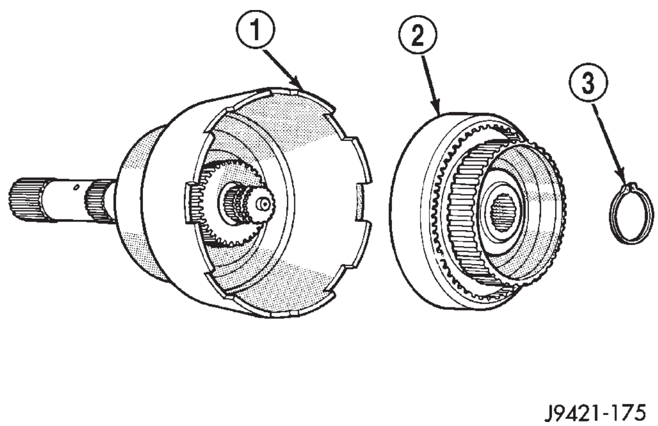


Fig. 204 Front Annulus And Planetary Assembly Removal

1 - DRIVING SHELL
2 - FRONT ANNULUS AND PLANETARY ASSEMBLY
3 - PLANETARY SNAP-RING

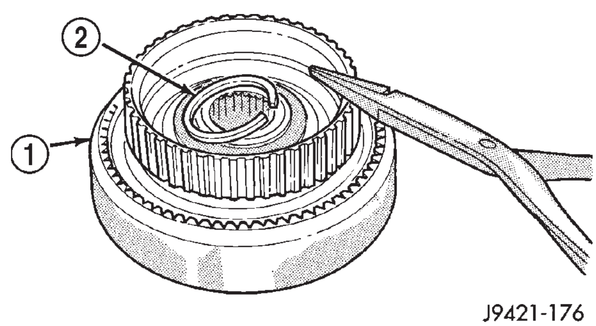


Fig. 205 Front Planetary Snap-Ring Removal

1 - FRONT ANNULUS GEAR
2 - PLANETARY SNAP-RING

PLANETARY GEARTRAIN/OUTPUT SHAFT (Continued)

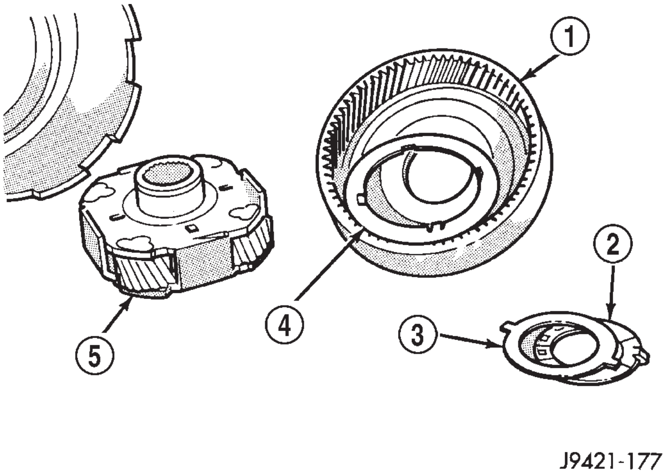


Fig. 206 Front Planetary And Annulus Gear Disassembly

1 - FRONT ANNULUS
2 - THRUST WASHER
3 - THRUST PLATE
4 - FRONT THRUST WASHER
5 - FRONT PLANETARY

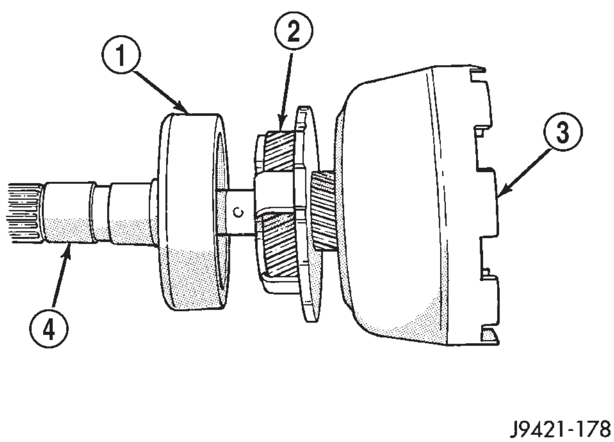


Fig. 207 Removing Driving Shell, Rear Planetary And Rear Annulus

1 - REAR ANNULUS
2 - REAR PLANETARY
3 - DRIVING SHELL
4 - OUTPUT SHAFT

INSPECTION

Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Inspect the geartrain spacers, thrust plates, snap-rings, and thrust washers. Replace any of these parts that are worn, distorted or damaged. Do not attempt to reuse these parts.

The planetary gear thrust washers are different sizes. The large diameter washers go on the front planetary and the smaller washers go on the rear planetary. All the washers have four locating tabs on them. These tabs fit in the holes or slots provided in each planetary gear.

Inspect the output shaft carefully. Pay particular attention to the machined bushing/bearing surfaces on the shaft and the governor valve shaft bore at the shaft rear.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location (especially at the governor valve shaft bore).

The annulus gears can be removed from their supports if necessary. Just remove the snap-rings and separate the two parts when replacement is necessary. In addition, the annulus gear bushings can be replaced if severely worn, or scored. However it is not necessary to replace the bushings if they only exhibit normal wear. Check bushing fit on the output shaft to be sure.

ASSEMBLY

(1) Lubricate output shaft and planetary components with transmission fluid. Use petroleum jelly to lubricate and hold thrust washers and plates in position.

(2) Assemble rear annulus gear and support if disassembled. Be sure support snap-ring is seated and that shoulder-side of support faces rearward (Fig. 208).

(3) Install rear thrust washer on rear planetary gear. Use enough petroleum jelly to hold washer in place. Also be sure all four washer tabs are properly engaged in gear slots.

(4) Install rear annulus over and onto rear planetary gear (Fig. 208).

(5) Install assembled rear planetary and annulus gear on output shaft (Fig. 209). Verify that assembly is fully seated on shaft.

PLANETARY GEARTRAIN/OUTPUT SHAFT (Continued)

(6) Install front thrust washer on rear planetary gear (Fig. 210). Use enough petroleum jelly to hold washer on gear. Be sure all four washer tabs are seated in slots.

(7) Install spacer on sun gear (Fig. 211).

(8) Install thrust plate on sun gear (Fig. 212). Note that driving shell thrust plates are interchangeable. Use either plate on sun gear and at front/rear of shell.

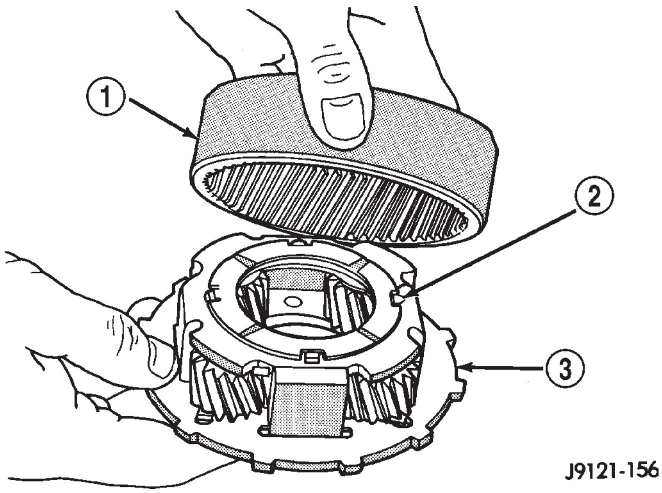


Fig. 208 Assembling Rear Annulus And Planetary Gear

1 - REAR ANNULUS GEAR
2 - TABBED THRUST WASHER
3 - REAR PLANETARY

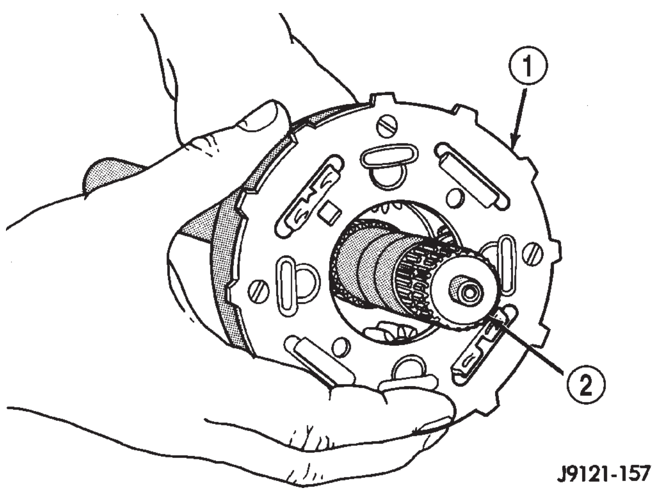


Fig. 209 Installing Rear Annulus And Planetary On Output Shaft

1 - REAR ANNULUS AND PLANETARY GEAR ASSEMBLY
2 - OUTPUT SHAFT

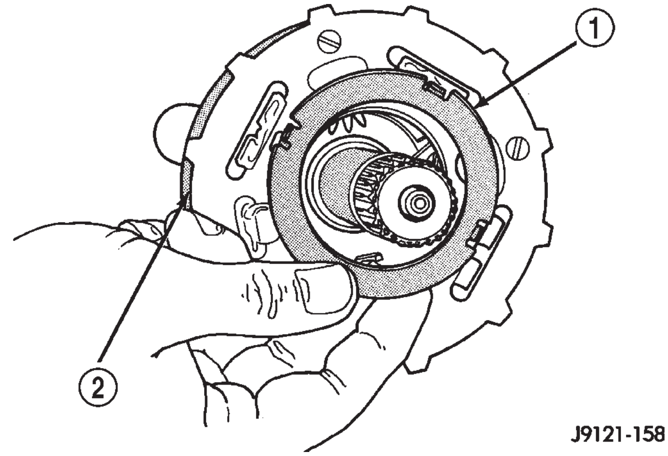


Fig. 210 Installing Rear Planetary Front Thrust Washer

1 - FRONT TABBED THRUST WASHER
2 - REAR PLANETARY GEAR

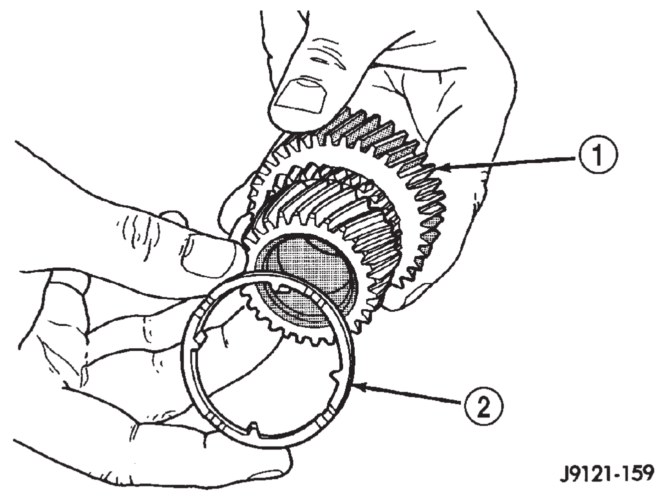


Fig. 211 Installing Spacer On Sun Gear

1 - SUN GEAR
2 - SUN GEAR SPACER

(9) Hold sun gear in place and install thrust plate over sun gear at rear of driving shell (Fig. 213).

(10) Position wood block on bench and support sun gear on block (Fig. 214). This makes it easier to align and install sun gear lock ring. Keep wood block handy as it will also be used for geartrain end play check.

PLANETARY GEARTRAIN/OUTPUT SHAFT (Continued)

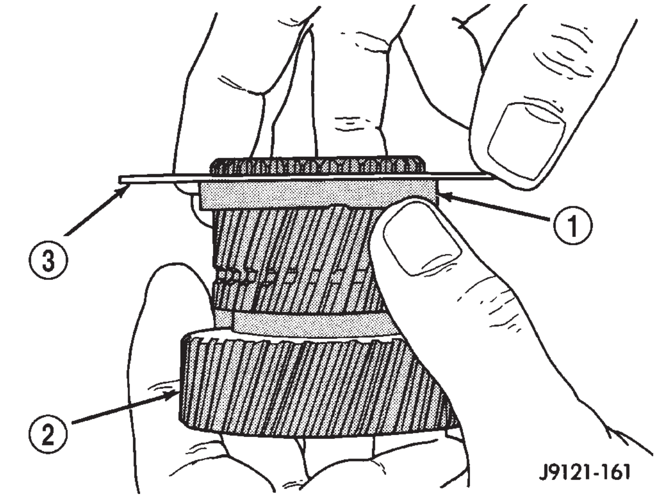


Fig. 212 Installing Driving Shell Front Thrust Plate On Sun Gear

1 - SPACER
2 - SUN GEAR
3 - THRUST PLATE

(11) Align rear thrust plate on driving shell and install sun gear lock ring. Be sure ring is fully seated in sun gear ring groove (Fig. 215).

(12) Install assembled driving shell and sun gear on output shaft (Fig. 216).

(13) Install rear thrust washer on front planetary gear (Fig. 217). Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

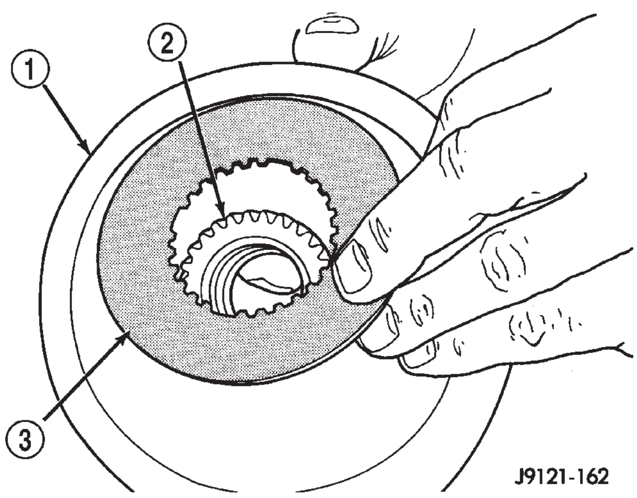


Fig. 213 Installing Driving Shell Rear Thrust Plate

1 - DRIVING SHELL
2 - SUN GEAR
3 - REAR THRUST PLATE

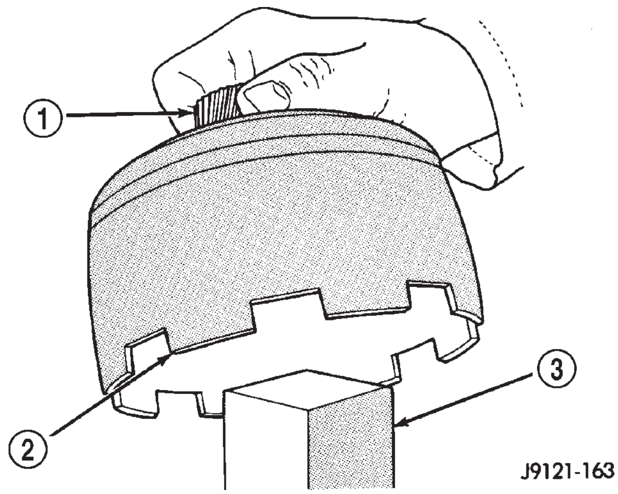


Fig. 214 Supporting Sun Gear On Wood Block

1 - SUN GEAR
2 - DRIVING SHELL
3 - WOOD BLOCK

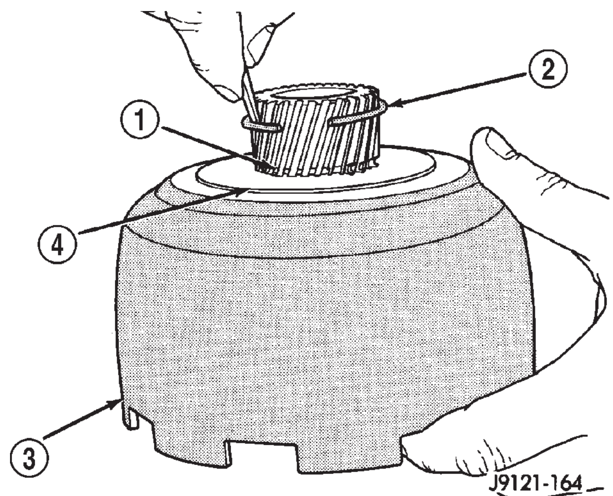


Fig. 215 Installing Sun Gear Lock Ring

1 - LOCK RING GROOVE
2 - SUN GEAR LOCK RING
3 - DRIVING SHELL
4 - REAR THRUST PLATE

PLANETARY GEARTRAIN/OUTPUT SHAFT (Continued)

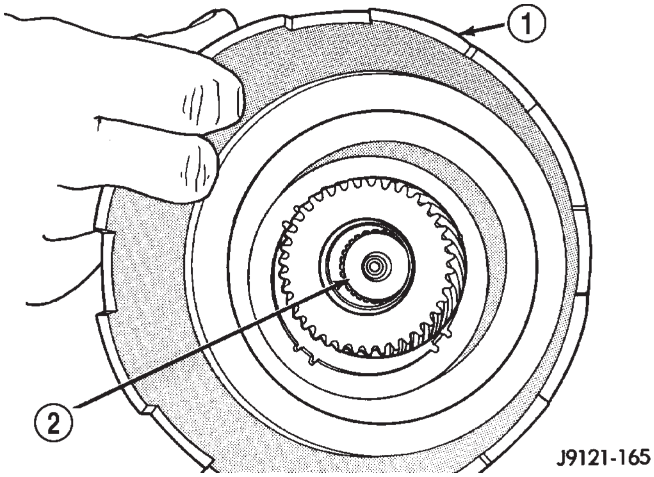


Fig. 216 Installing Assembled Sun Gear And Driving Shell On Output Shaft

1 - SUN GEAR/DRIVING SHELL ASSEMBLY
2 - OUTPUT SHAFT

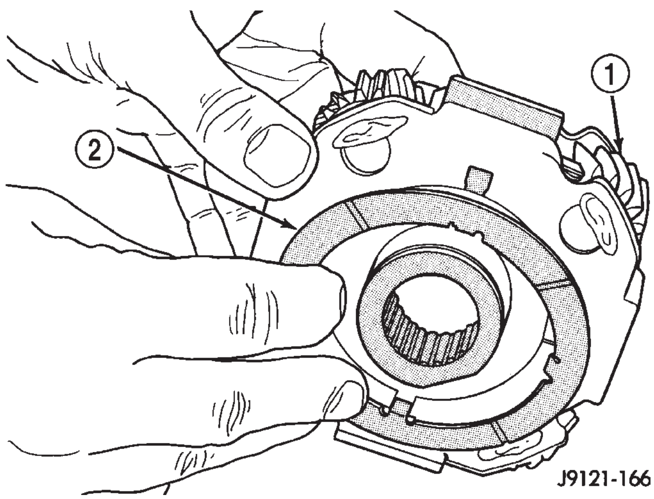


Fig. 217 Installing Rear Thrust Washer On Front Planetary Gear

1 - FRONT PLANETARY GEAR
2 - REAR TABBED THRUST WASHER

(14) Install front planetary gear on output shaft and in driving shell (Fig. 218).

(15) Install front thrust washer on front planetary gear. Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

(16) Assemble front annulus gear and support, if necessary. Be sure support snap-ring is seated.

(17) Install front annulus on front planetary (Fig. 218).

(18) Position thrust plate on front annulus gear support (Fig. 219). Note that plate has two tabs on it. These tabs fit in notches of annulus hub.

(19) Install thrust washer in front annulus (Fig. 220). Align flat on washer with flat on planetary hub. Also be sure washer tab is facing up.

(20) Install front annulus snap-ring (Fig. 221). Use snap-ring pliers to avoid distorting ring during installation. Also be sure ring is fully seated.

(21) Install planetary selective snap-ring with snap-ring pliers (Fig. 222). Be sure ring is fully seated.

(22) Turn planetary geartrain assembly over so driving shell is facing workbench. Then support geartrain on wood block positioned under forward end of output shaft. This allows geartrain components to move forward for accurate end play check.

(23) Check planetary geartrain end play with feeler gauge (Fig. 223). Gauge goes between shoulder on output shaft and end of rear annulus support.

(24) Geartrain end play should be 0.12 to 1.22 mm (0.005 to 0.048 in.). If end play is incorrect, snap-ring (or thrust washers) may have to be replaced. Snap-rings are available in three different thicknesses for adjustment purposes.

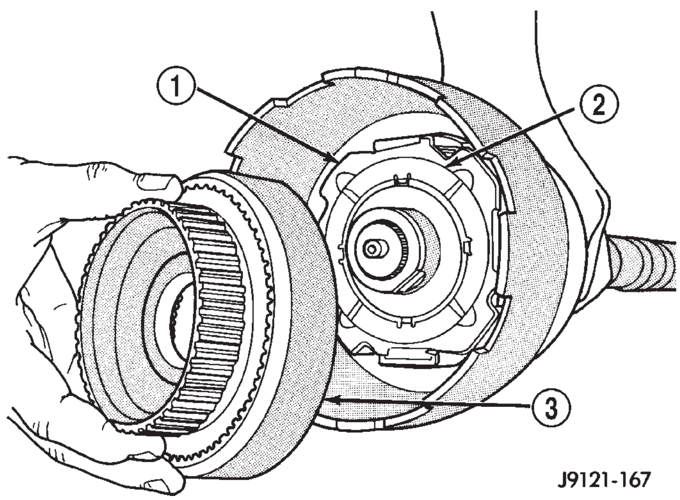


Fig. 218 Installing Front Planetary And Annulus Gears

1 - FRONT PLANETARY GEAR
2 - FRONT THRUST WASHER
3 - FRONT ANNULUS GEAR

PLANETARY GEARTRAIN/OUTPUT SHAFT (Continued)

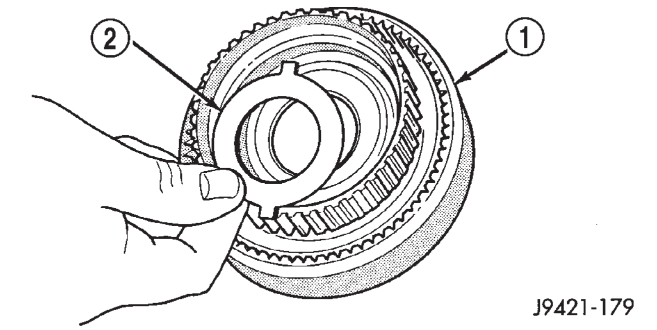


Fig. 219 Positioning Thrust Plate On Front Annulus Support

1 - FRONT ANNULUS
2 - THRUST PLATE

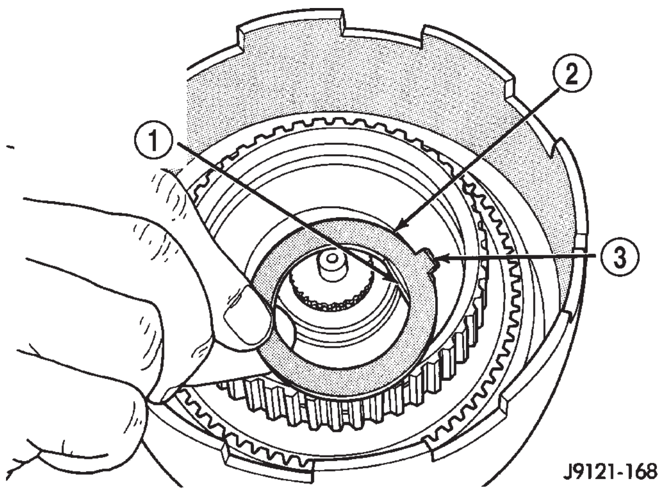


Fig. 220 Installing Front Annulus Thrust Washer

1 - WASHER FLAT ALIGNS WITH FLAT ON PLANETARY HUB
2 - FRONT ANNULUS THRUST WASHER
3 - TAB FACES FRONT

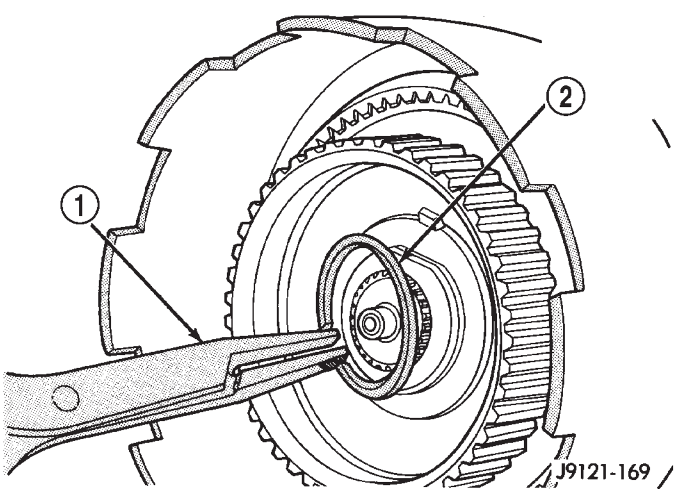


Fig. 221 Installing Front Annulus Snap-Ring

1 - SNAP-RING PLIERS
2 - FRONT ANNULUS SNAP-RING

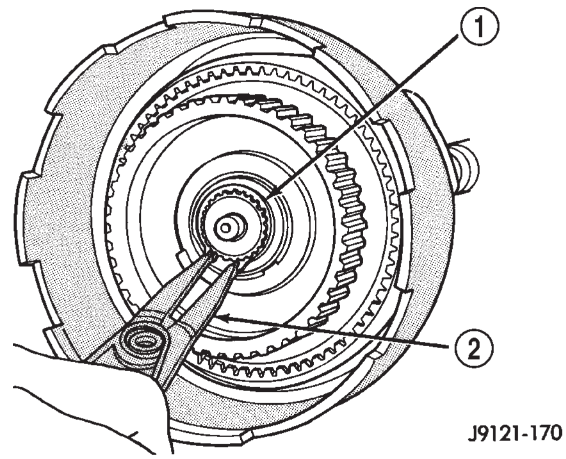


Fig. 222 Installing Planetary Selective Snap-Ring

1 - SELECTIVE SNAP-RING
2 - SNAP-RING PLIERS

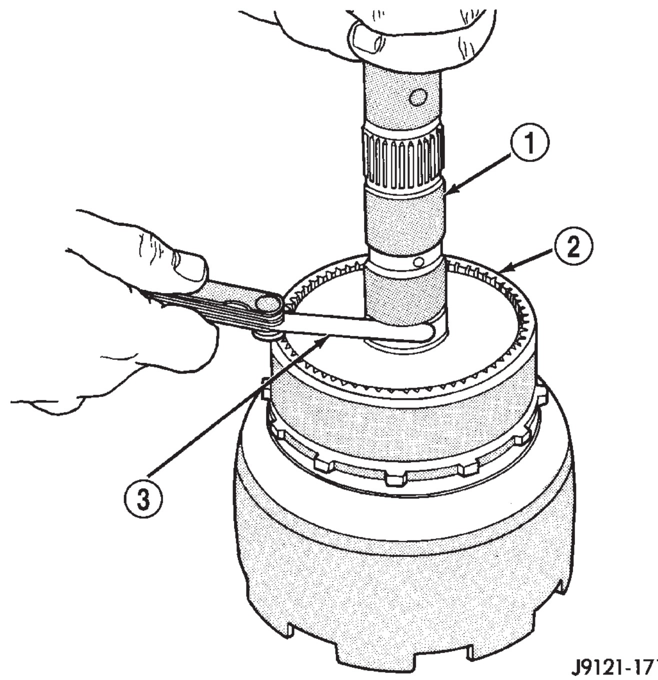


Fig. 223 Checking Planetary Geartrain End Play

1 - OUTPUT SHAFT
2 - REAR ANNULUS GEAR
3 - FEELER GAUGE

REAR CLUTCH

DESCRIPTION

The rear clutch assembly (Fig. 224) is composed of the rear clutch retainer, pressure plate, clutch plates, driving discs, piston, Belleville spring, and snap-rings. The Belleville spring acts as a lever to multiply the force applied on to it by the apply piston. The increased apply force on the rear clutch pack, in comparison to the front clutch pack, is needed to hold against the greater torque load imposed onto the rear pack. The rear clutch is directly behind the front clutch and is considered a driving component.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved spring is used to cushion the application of the clutch pack. The snap-ring is selective and used to adjust clutch pack clearance.

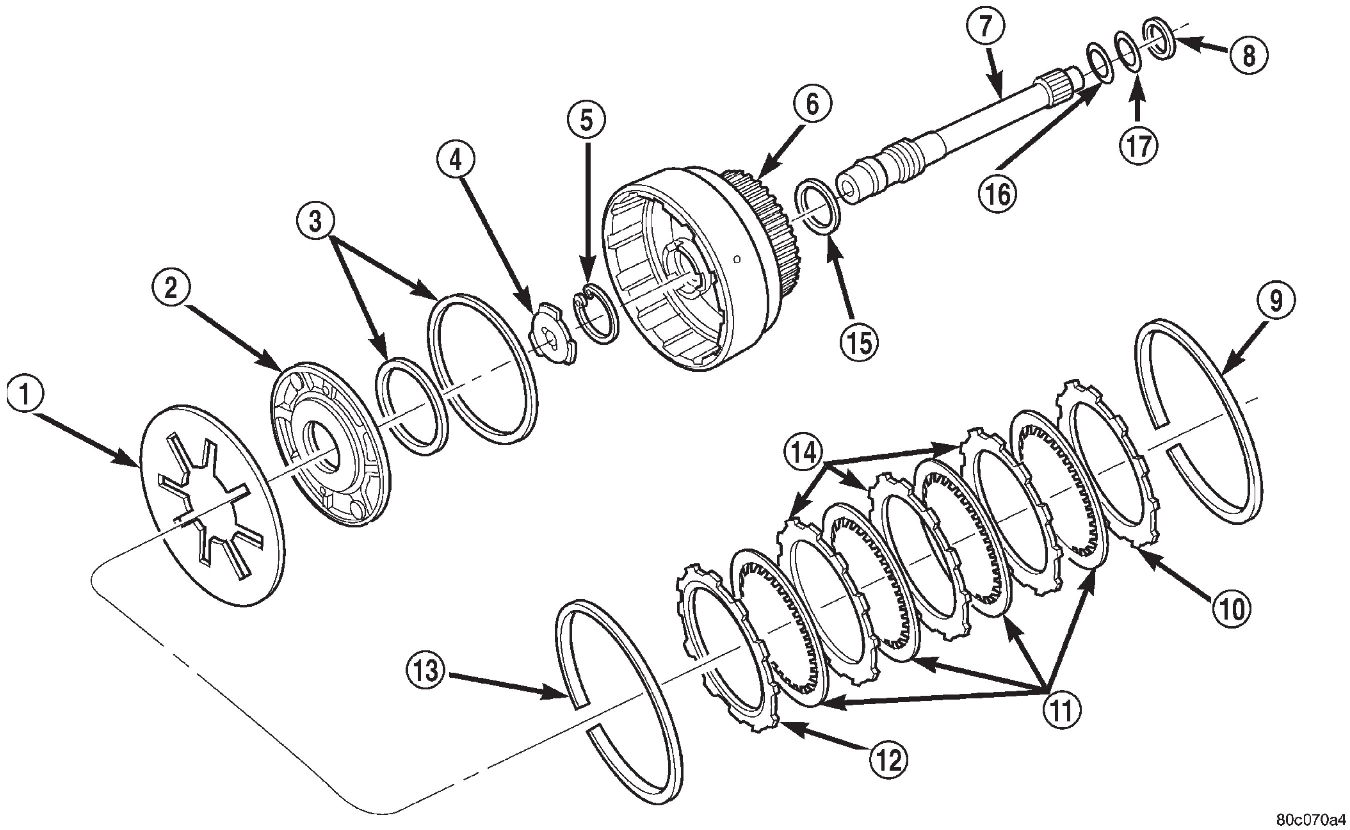


Fig. 224 Rear Clutch

1 - PISTON SPRING
2 - REAR CLUTCH PISTON
3 - CLUTCH PISTON SEALS
4 - OUTPUT SHAFT THRUST WASHER (METAL)
5 - INPUT SHAFT SNAP-RING
6 - REAR CLUTCH RETAINER
7 - INPUT SHAFT
8 - REAR CLUTCH THRUST WASHER (FIBER)
9 - CLUTCH PACK SNAP-RING (SELECTIVE)
10 - TOP PRESSURE PLATE
11 - CLUTCH DISCS (4)
12 - BOTTOM PRESSURE PLATE
13 - WAVE SPRING
14 - CLUTCH PLATES (3)
15 - RETAINER SEAL RING
16 - SHAFT REAR SEAL RING (PLASTIC)
17 - SHAFT FRONT SEAL RING (TEFLON)

REAR CLUTCH (Continued)

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one-way ball-check-valve located in the piston. The check-valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

DISASSEMBLY

(1) Remove fiber thrust washer from forward side of clutch retainer.

(2) Remove input shaft front/rear seal rings.

(3) Remove selective clutch pack snap-ring (Fig. 225).

(4) Remove top pressure plate, clutch discs, steel plates, bottom pressure plate and wave snap-ring and wave spring (Fig. 225).

(5) Remove clutch piston with rotating motion.

(6) Remove and discard piston seals.

(7) Remove input shaft snap-ring (Fig. 226). It may be necessary to press the input shaft in slightly to relieve tension on the snap-ring

(8) Press input shaft out of retainer with shop press and suitable size press tool. Use a suitably sized press tool to support the retainer as close to the input shaft as possible.

CLEANING

Clean the clutch components with solvent and dry them with compressed air. Do not use rags or shop towels to dry any of the clutch parts. Lint from such materials will adhere to component surfaces and could restrict or block fluid passages after assembly.

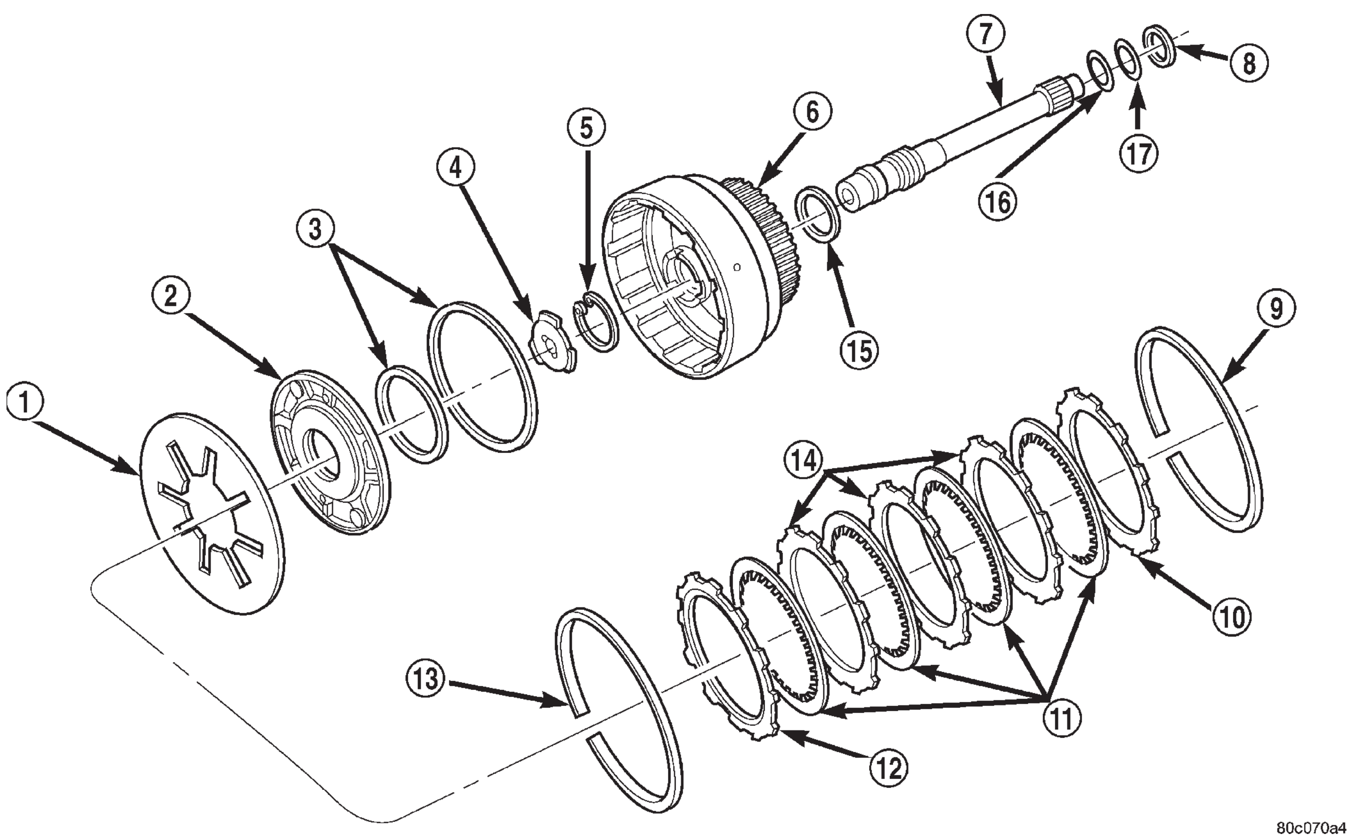


Fig. 225 Rear Clutch Components

1 - PISTON SPRING
2 - REAR CLUTCH PISTON
3 - CLUTCH PISTON SEALS
4 - OUTPUT SHAFT THRUST WASHER (METAL)
5 - INPUT SHAFT SNAP-RING
6 - REAR CLUTCH RETAINER
7 - INPUT SHAFT
8 - REAR CLUTCH THRUST WASHER (FIBER)
9 - CLUTCH PACK SNAP-RING (SELECTIVE)
10 - TOP PRESSURE PLATE
11 - CLUTCH DISCS (4)
12 - BOTTOM PRESSURE PLATE
13 - WAVE SPRING
14 - CLUTCH PLATES (3)
15 - RETAINER SEAL RING
16 - SHAFT REAR SEAL RING (PLASTIC)
17 - SHAFT FRONT SEAL RING (TEFLON)

REAR CLUTCH (Continued)

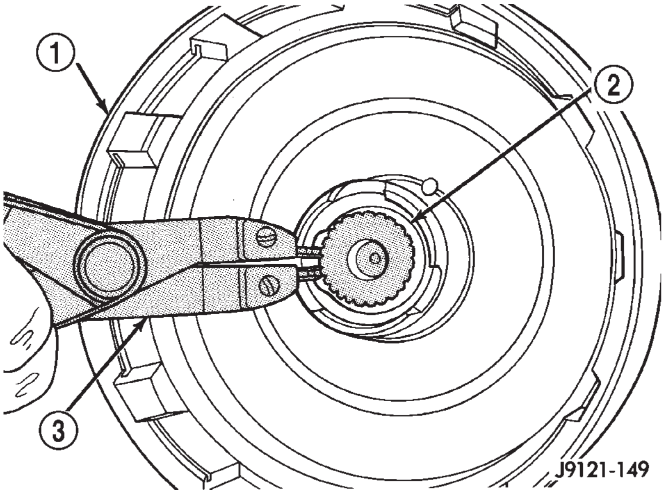


Fig. 226 Removing Input Shaft Snap-Ring

1 - REAR CLUTCH RETAINER
2 - INPUT SHAFT SNAP-RING
3 - SNAP-RING PLIERS

INSPECTION

Replace the clutch discs if warped, worn, scored, burned/charred, the lugs are damaged, or if the facing is flaking off. Replace the top and bottom pressure plates if scored, warped, or cracked. Be sure the driving lugs on the pressure and clutch plates are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston spring and wave spring if either part is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The clutch and pressure plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged. Also check action of the check balls in the retainer and piston. Each check ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or doubt exists about bushing condition.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check condition of the fiber thrust washer and metal output shaft thrust washer. Replace either washer if worn or damaged.

Check condition of the seal rings on the input shaft and clutch retainer hub. Replace the seal rings only if worn, distorted, or damaged. The input shaft front seal ring is teflon with chamfered ends. The rear ring is metal with interlocking ends.

Check the input shaft for wear, or damage. Replace the shaft if worn, scored or damaged in any way.

ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seal rings on clutch retainer hub and input shaft, if necessary, (Fig. 227) and (Fig. 228).

(a) Be sure clutch hub seal ring is fully seated in groove and is not twisted.

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then press input shaft into retainer (Fig. 229). Use a suitably sized press tool to support retainer as close to input shaft as possible.

(4) Install input shaft snap-ring (Fig. 226).

(5) Invert retainer and press input shaft in opposite direction until snap-ring is seated.

(6) Install new seals on clutch piston. Be sure lip of each seal faces interior of clutch retainer.

(7) Lubricate lip of piston seals with generous quantity of Mopar® Door Ease. Then lubricate retainer hub and bore with light coat of transmission fluid.

(8) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.020″ thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(9) Install piston spring in retainer and on top of piston (Fig. 230). Concave side of spring faces downward (toward piston).

(10) Install wave spring in retainer (Fig. 230). Be sure spring is completely seated in retainer groove.

(11) Install bottom pressure plate (Fig. 225). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

(12) Install first clutch disc in retainer on top of bottom pressure plate. Then install a clutch plate followed by a clutch disc until entire clutch pack is installed (4 discs and 3 plates are required) (Fig. 225).

(13) Install top pressure plate.

(14) Install selective snap-ring. Be sure snap-ring is fully seated in retainer groove.

(15) Using a suitable gauge bar and dial indicator, measure clutch pack clearance (Fig. 231).

(a) Position gauge bar across the clutch drum with the dial indicator pointer on the pressure plate (Fig. 231).

(b) Using two small screw drivers, lift the pressure plate and release it.

REAR CLUTCH (Continued)

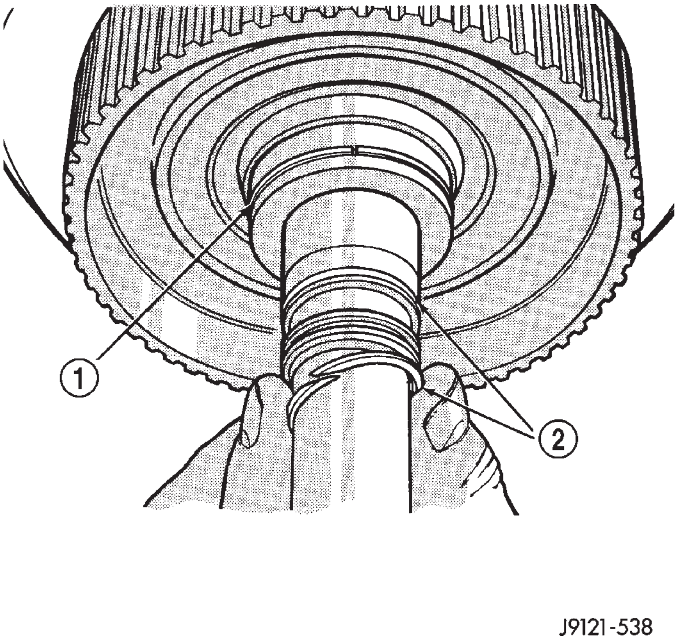


Fig. 227 Rear Clutch Retainer And Input Shaft Seal Ring Installation

1 - REAR CLUTCH RETAINER HUB SEAL RING
2 - INPUT SHAFT SEAL RINGS

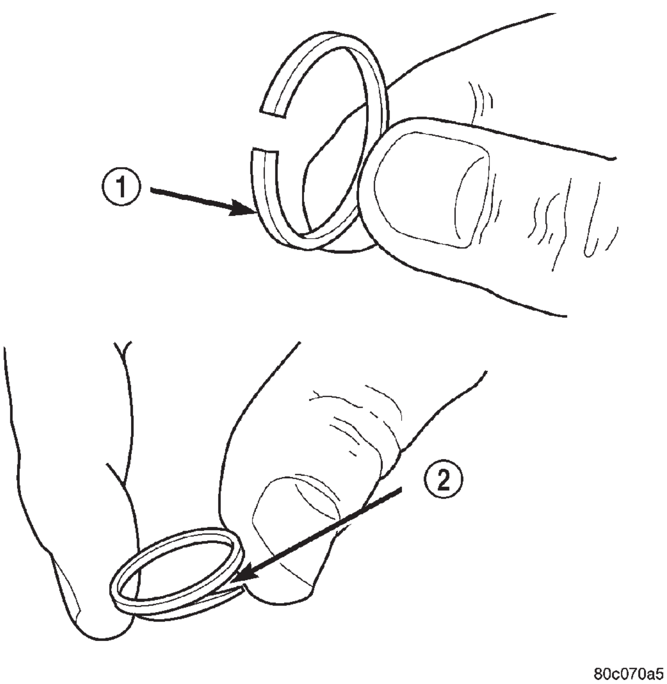


Fig. 228 Input Shaft Seal Ring Identification

1 - PLASTIC REAR SEAL RING
2 - TEFLON FRONT SEAL RING (SQUEEZE RING TOGETHER SLIGHTLY BEFORE INSTALLATION FOR BETTER FIT)

(c) Zero the dial indicator.

(d) Lift the pressure plate until it contacts the snap-ring and record the dial indicator reading.

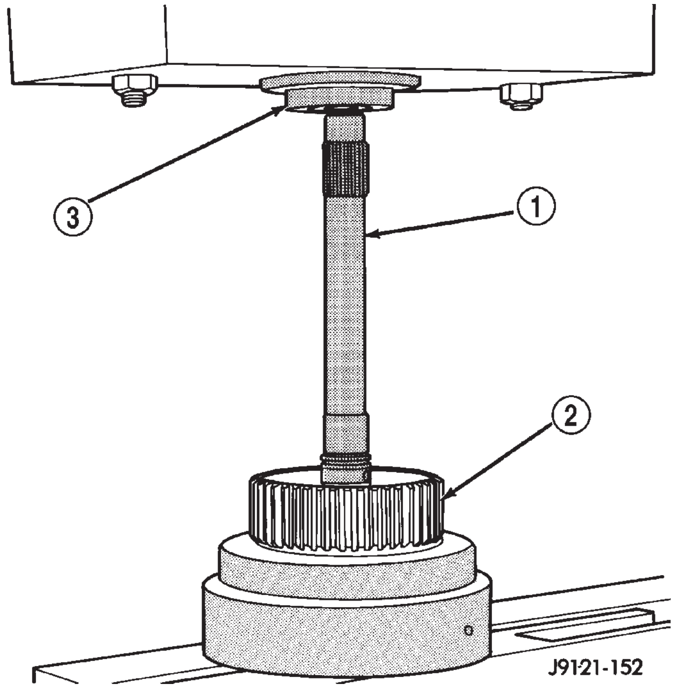


Fig. 229 Pressing Input Shaft Into Rear Clutch Retainer

1 - INPUT SHAFT
2 - REAR CLUTCH RETAINER
3 - PRESS RAM

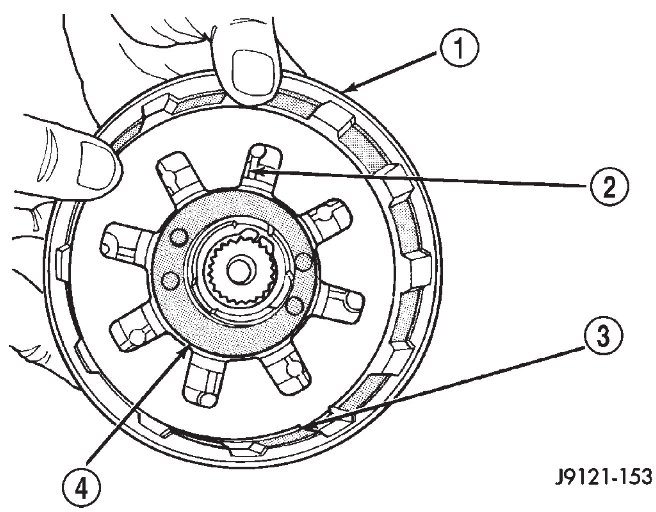


Fig. 230 Piston Spring/Wave Spring Position

1 - REAR CLUTCH RETAINER
2 - PISTON SPRING
3 - WAVE SPRING
4 - CLUTCH PISTON

Clearance should be 0.559 - 0.914 mm (0.022 - 0.036 in.). If clearance is incorrect, steel plates, discs, selective snap ring and pressure plates may have to be changed.

REAR CLUTCH (Continued)

The selective snap-ring thicknesses are:
- 0.107-0.109 in.
- 0.098-0.100 in.
- 0.095-0.097 in.
- 0.083-0.085 in.
- 0.076-0.078 in.
- 0.071-0.073 in.
- 0.060-0.062 in.

(16) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 232). Use enough petroleum jelly to hold washer in place.

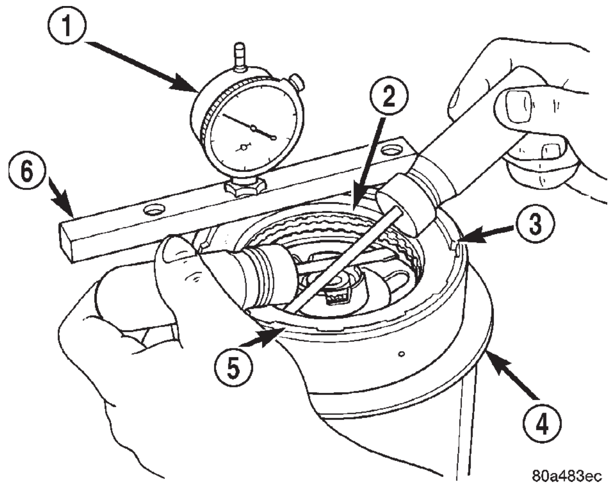


Fig. 231 Checking Rear Clutch Pack Clearance

1 - DIAL INDICATOR
2 - PRESSURE PLATE
3 - SNAP-RING
4 - STAND
5 - REAR CLUTCH
6 - GAUGE BAR

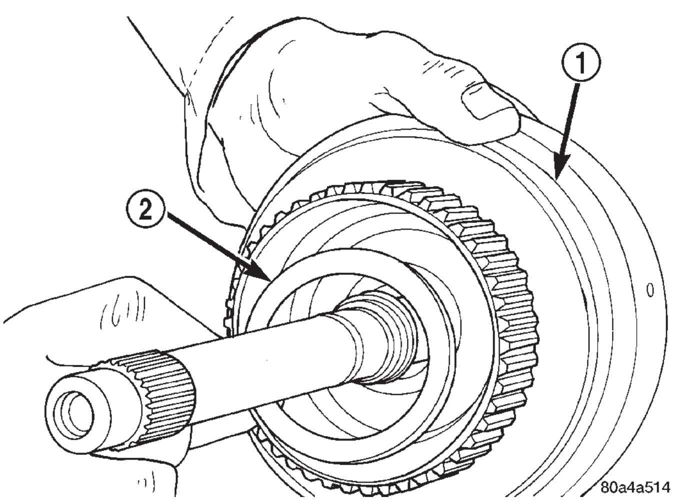


Fig. 232 Installing Rear Clutch Thrust Washer

1 - REAR CLUTCH RETAINER
2 - REAR CLUTCH THRUST WASHER

REAR SERVO

DESCRIPTION

The rear (low/reverse) servo consists of a single stage or diameter piston and a spring loaded plug. The spring is used to cushion the application of the rear (low/reverse) band.

OPERATION

While in the de-energized state (no pressure applied), the piston is held up in its bore by the piston spring. The plug is held down in its bore, in the piston, by the plug spring. When pressure is applied to the top of the piston, the plug is forced down in its bore, taking up any clearance. As the piston moves, it causes the plug spring to compress, and the piston moves down over the plug. The piston continues to move down until it hits the shoulder of the plug and fully applies the band. The period of time from the initial application, until the piston is against the shoulder of the plug, represents a reduced shocking of the band that cushions the shift.

DISASSEMBLY

(1) Remove small snap-ring and remove plug and spring from servo piston (Fig. 233).

(2) Remove and discard servo piston seal ring.

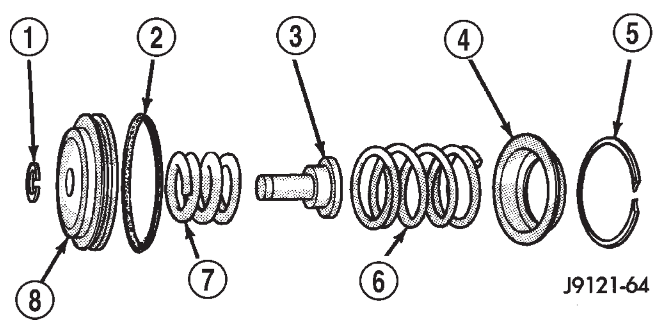


Fig. 233 Rear Servo Components

1 - SNAP-RING
2 - PISTON SEAL
3 - PISTON PLUG
4 - SPRING RETAINER
5 - SNAP-RING
6 - PISTON SPRING
7 - CUSHION SPRING
8 - PISTON

CLEANING

Remove and discard the servo piston seal ring (Fig. 234). Then clean the servo components with solvent and dry with compressed air. Replace either spring if collapsed, distorted or broken. Replace the plug and piston if cracked, bent, or worn. Discard the servo snap-rings and use new ones at assembly.

REAR SERVO (Continued)

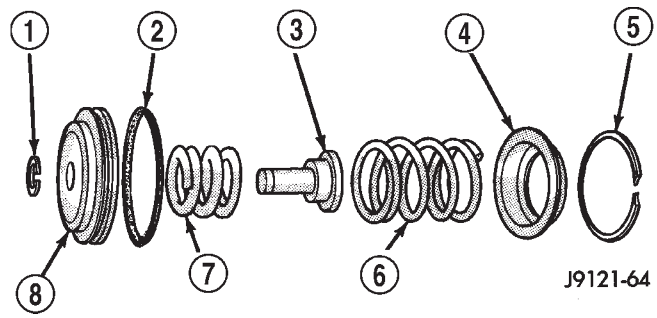


Fig. 234 Rear Servo Components

1 - SNAP-RING
2 - PISTON SEAL
3 - PISTON PLUG
4 - SPRING RETAINER
5 - SNAP-RING
6 - PISTON SPRING
7 - CUSHION SPRING
8 - PISTON

ASSEMBLY

(1) Lubricate piston and guide seals (Fig. 235) with petroleum jelly. Lubricate other servo parts with Mopar® ATF +4, type 9602, transmission fluid.

(2) Install new seal ring on servo piston.

(3) Assemble piston, plug, spring and new snap-ring.

(4) Lubricate piston seal lip with petroleum jelly.

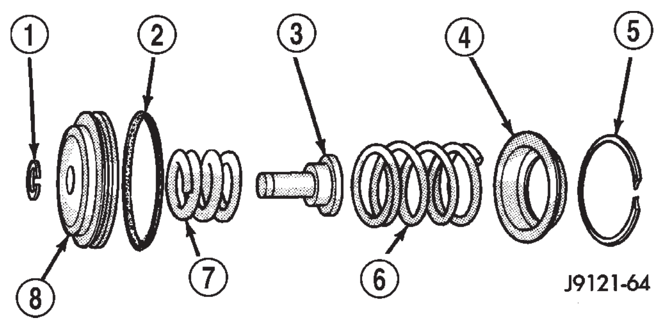


Fig. 235 Rear Servo Components

1 - SNAP-RING
2 - PISTON SEAL
3 - PISTON PLUG
4 - SPRING RETAINER
5 - SNAP-RING
6 - PISTON SPRING
7 - CUSHION SPRING
8 - PISTON

SHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- PARK (P)
- REVERSE (R)
- NEUTRAL (N)
- DRIVE (D)
- Manual SECOND (2)
- Manual LOW (1)

OPERATION

Manual LOW (1) range provides first gear only. Overrun braking is also provided in this range. Manual SECOND (2) range provides first and second gear only.

DRIVE range provides first, second third and overdrive fourth gear ranges. The shift into overdrive fourth gear range occurs only after the transmission has completed the shift into D third gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

The fourth gear upshift occurs automatically when the overdrive selector switch is in the ON position. No upshift to fourth gear will occur if any of the following are true:

- The transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F).
- The shift to third is not yet complete.
- Vehicle speed is too low for the 3-4 shift to occur.
- Battery temperature is below -5° C (23° F).

REMOVAL

(1) Remove any necessary console parts for access to shift lever assembly and shifter cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(2) Shift transmission into PARK.

(3) Disconnect the transmission shift cable at shift lever and shifter assembly bracket (Fig. 236).

(4) Disconnect the park lock cable from the shifter BTSI lever and the shifter assembly bracket. (Fig. 237)

(5) Disconnect the transfer case shift cable from the transfer case shift lever pin (Fig. 238), if equipped.

(6) Remove the clip holding the transfer case shift cable to the shifter assembly bracket, if equipped.

(7) Remove the transfer case shift cable from the shifter assembly bracket, if equipped.

SHIFT MECHANISM (Continued)

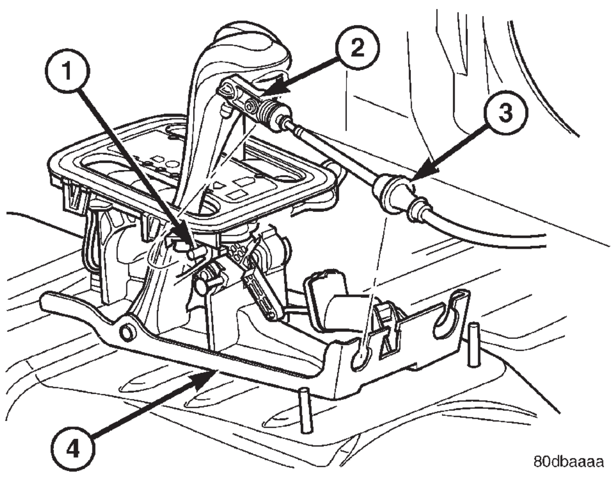


Fig. 236 Transmission Shift Cable

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

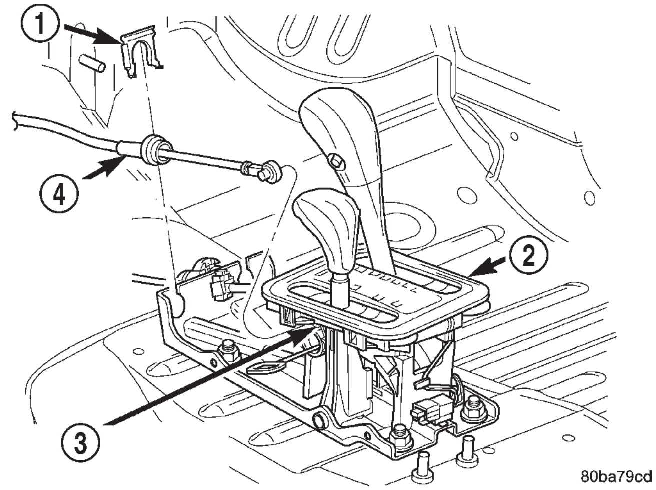


Fig. 238 Transfer Case Shift Cable

1 - CLIP
2 - SHIFTER
3 - TRANSFER CASE SHIFT LEVER PIN
4 - TRANSFER CASE SHIFT CABLE

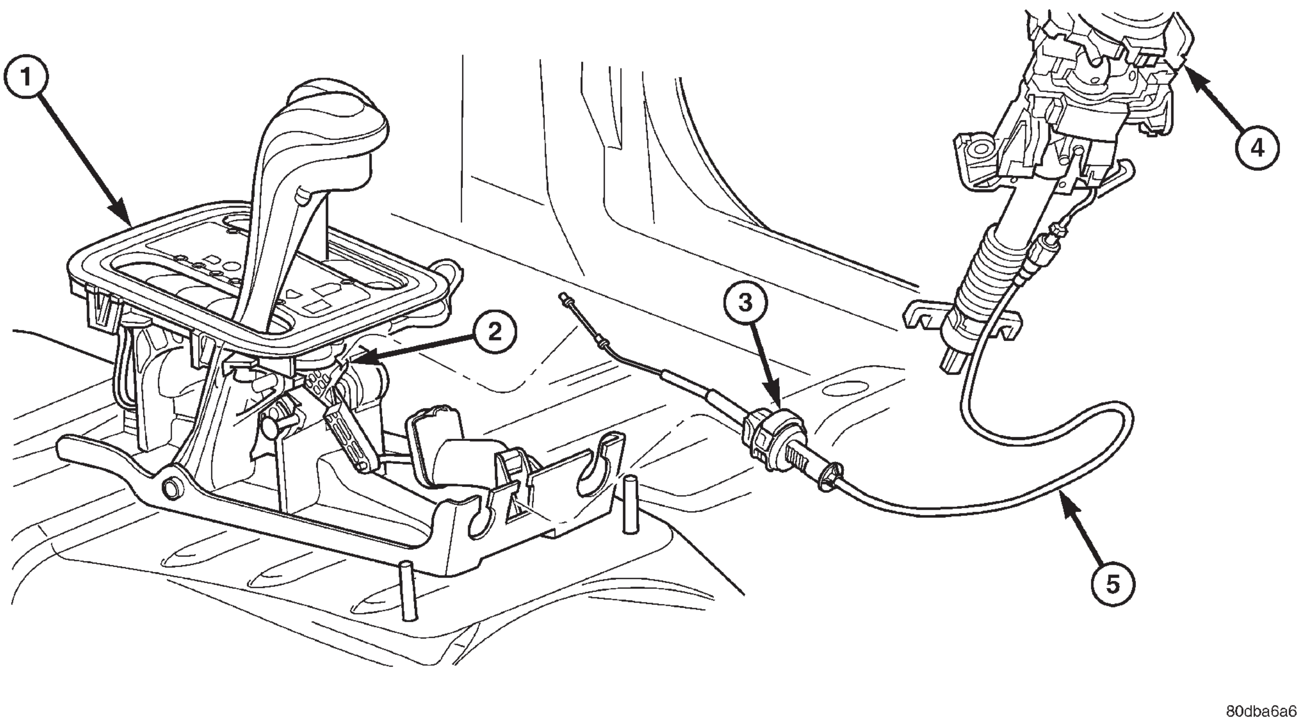


Fig. 237 Brake Transmission Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

SHIFT MECHANISM (Continued)

(8) Disengage all wiring connectors from the shifter assembly.

(9) Remove all nuts holding the shifter assembly to the floor pan (Fig. 239).

(10) Remove the shifter assembly from the vehicle.

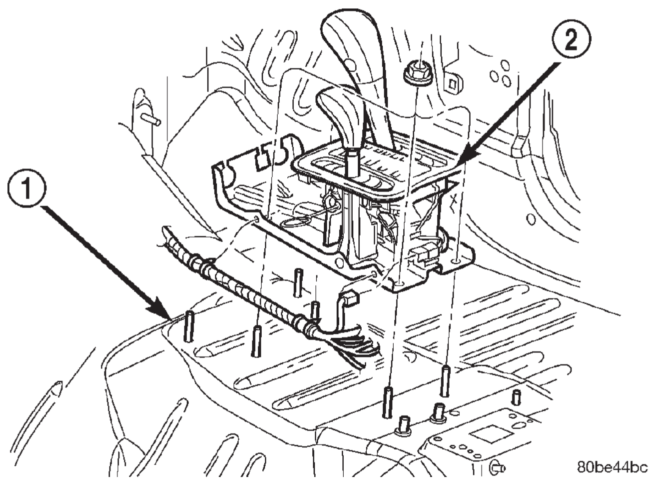


Fig. 239 Shifter Assembly

1 - FLOOR PAN
2 - SHIFTER ASSEMBLY

INSTALLATION

(1) Place the floor shifter lever in PARK position.

(2) Loosen the adjustment screw on the shift cable.

(3) Verify that the park lock cable adjustment tab is pulled upward to the unlocked position.

(4) Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.

(5) Install the transfer case shift cable to the shifter assembly bracket. Install clip to hold cable to the bracket.

(6) Snap the transfer case shift cable, if equipped, onto the transfer case shift lever pin.

(7) Install the park lock cable into the shifter assembly bracket and into the shifter BTSI lever.(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/SHIFT INTERLOCK MECHANISM - ADJUSTMENTS)

(8) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(9) Install shifter assembly onto the shifter assembly studs on the floor pan.

(10) Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in.lbs.).

(11) Snap the shift cable onto the shift lever pin.

(12) Verify that the shift lever is in the PARK position.

(13) Tighten the adjustment screw to 7 N·m (65 in.lbs.).

(14) Place the key in the accessory position.

(15) Push downward on the park lock cable adjustment tab to lock the adjustment.

(16) Verify correct shifter, park lock, and BTSI operation.

(17) Install any console parts removed for access to shift lever assembly and shift cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed**. The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or

2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

SOLENOID (Continued)

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

SPEED SENSOR

DESCRIPTION

The speed sensor (Fig. 240) is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed.

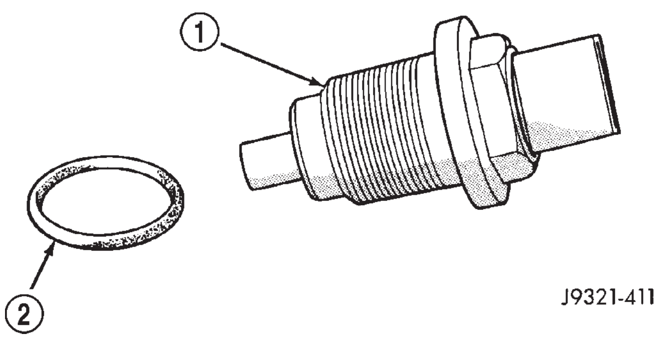


Fig. 240 Transmission Output Speed Sensor

1 - TRANSMISSION OUTPUT SHAFT SPEED SENSOR
2 - SEAL

OPERATION

Speed sensor signals are triggered by the park gear lugs as they rotate past the sensor pickup face. Input signals from the sensor are sent to the transmission control module for processing. Signals from this sensor are shared with the powertrain control module.

THROTTLE VALVE CABLE

DESCRIPTION

Transmission throttle valve cable adjustment is extremely important to proper operation. This adjustment positions the throttle valve, which controls shift speed, quality, and part-throttle downshift sensitivity.

If cable setting is too loose, early shifts and slippage between shifts may occur. If the setting is too tight, shifts may be delayed and part throttle downshifts may be very sensitive.

The transmission throttle valve is operated by a cam on the throttle lever. The throttle lever is operated by an adjustable cable (Fig. 241). The cable is attached to an arm mounted on the throttle lever shaft. A retaining clip at the engine-end of the cable is removed to provide for cable adjustment. The retaining clip is then installed back onto the throttle valve cable to lock in the adjustment.

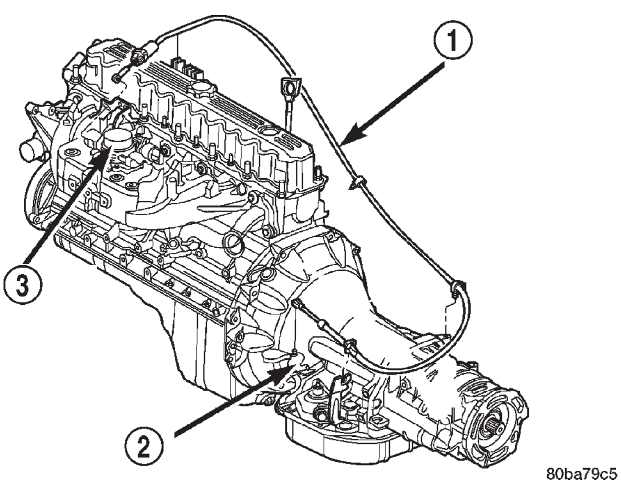


Fig. 241 Throttle Valve Cable

1 - THROTTLE VALVE CABLE
2 - THROTTLE VALVE LEVER
3 - THROTTLE BODY

ADJUSTMENTS - TRANSMISSION THROTTLE VALVE CABLE

A correctly adjusted throttle valve cable (Fig. 242) will cause the throttle lever on the transmission to move simultaneously with the throttle body lever from the idle position. Proper adjustment will allow

THROTTLE VALVE CABLE (Continued)

simultaneous movement without causing the transmission throttle lever to either move ahead of, or lag behind the lever on the throttle body.

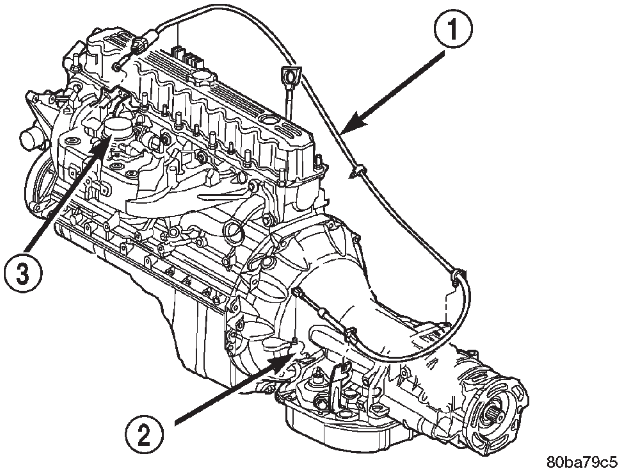


Fig. 242 Throttle Valve Cable

1 - THROTTLE VALVE CABLE
2 - THROTTLE VALVE LEVER
3 - THROTTLE BODY

ADJUSTMENT VERIFICATION

(1) Turn ignition key to OFF position.

(2) Remove air cleaner.

(3) Verify that lever on throttle body (Fig. 242) is at curb idle position. Then verify that the transmission throttle lever (Fig. 243) is also at idle (fully forward) position.

(4) Slide cable off attachment stud on throttle body lever.

(5) Compare position of cable end to attachment stud on throttle body lever:

- Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction (Fig. 244).
- If cable end and attachment stud are misaligned (off center), cable will have to be adjusted as described in Throttle Valve Cable Adjustment procedure.

(6) Reconnect cable end to attachment stud. Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle body.

- If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.
- If transmission throttle lever moves ahead of, or lags behind throttle body lever, cable adjustment will be necessary. Or, if throttle body lever prevents transmission lever from returning to closed position, cable adjustment will be necessary.

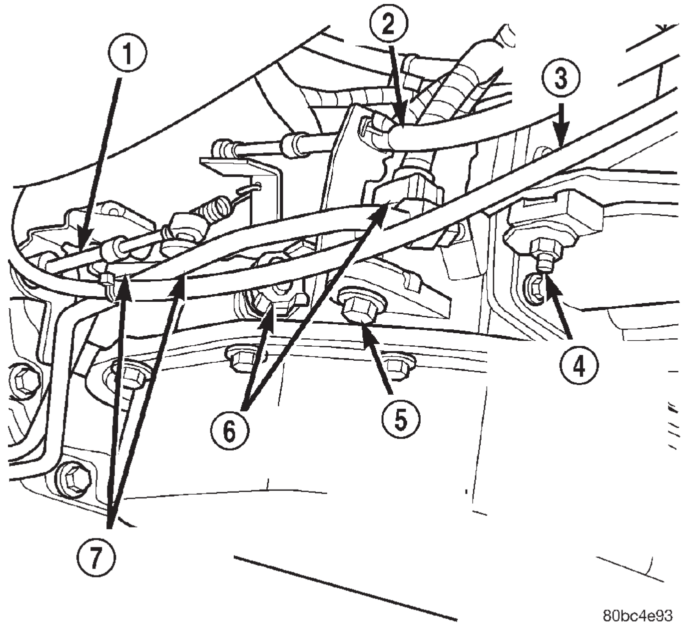


Fig. 243 Throttle Valve Cable at Transmission

1 - TRANSMISSION SHIFTER CABLE
2 - THROTTLE VALVE CABLE
3 - TRANSFER CASE SHIFTER CABLE
4 - TRANSFER CASE SHIFTER CABLE BRACKET RETAINING BOLT(S)
5 - THROTTLE VALVE CABLE BRACKET RETAINING BOLT
6 - ELECTRICAL CONNECTORS
7 - TRANSMISSION FLUID LINES

ADJUSTMENT PROCEDURE

(1) Turn ignition switch to OFF position.

(2) Remove air cleaner if necessary.

(3) Disconnect cable end from attachment stud. **Carefully slide cable off stud. Do not pry or pull cable off.**

(4) Verify that transmission throttle lever is in fully closed position. Then be sure lever on throttle body is at curb idle position.

(5) Pry the T.V. cable lock (A) into the UP position (Fig. 244). This will unlock the cable and allow for readjustment.

(6) Apply just enough tension on the T.V. cable (B) to remove any slack in the cable.**Pulling too tight will cause the T.V. lever on the transmission to move out of its idle position, which will result in an incorrect T.V. cable adjustment.** Slide the sheath of the T.V. cable (D) back and forth until the centerlines of the T.V. cable end (B) and the throttle bell crank lever (C) are aligned within one millimeter (1mm) (Fig. 244).

(7) While holding the T.V. cable in the set position push the T.V. cable lock (A) into the down position (Fig. 244). This will lock the present T.V. cable adjustment.

THROTTLE VALVE CABLE (Continued)

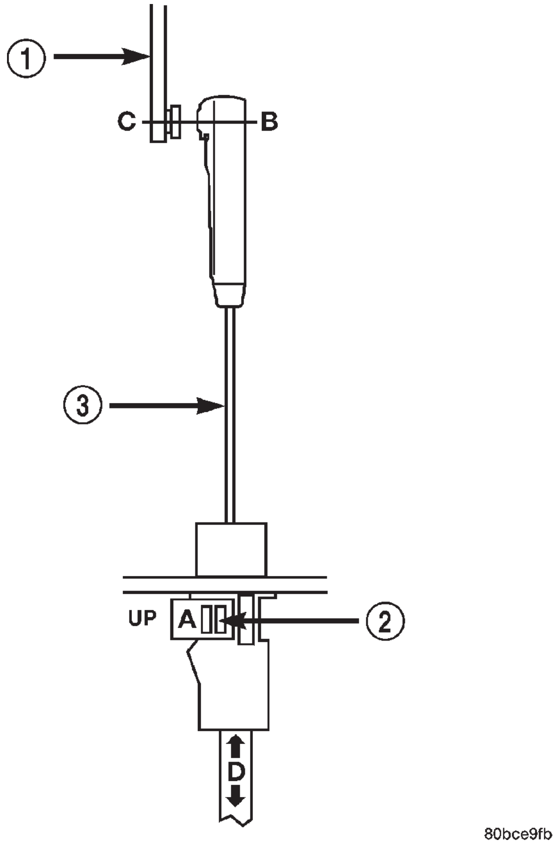


Fig. 244 Throttle Valve Cable at Throttle Linkage

1 - THROTTLE LINKAGE
2 - THROTTLE VALVE CABLE LOCKING CLIP
3 - THROTTLE VALVE CABLE

NOTE: Be sure that as the cable is pulled forward and centered on the throttle lever stud, the cable housing moves smoothly with the cable. Due to the angle at which the cable housing enters the spring housing, the cable housing may bind slightly and create an incorrect adjustment.

(8) Reconnect the T.V. cable (B) to the throttle bellcrank lever (C).

(9) Check cable adjustment. Verify transmission throttle lever and lever on throttle body move simultaneously.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 245) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid. If the fluid is contaminated, flush the all transmission fluid cooler(s) and lines.

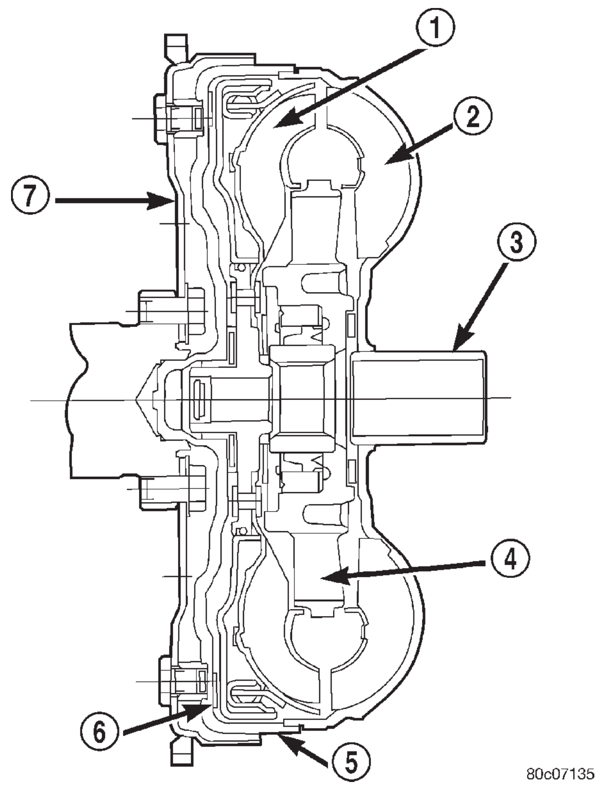


Fig. 245 Torque Converter Assembly

1 - TURBINE
2 - IMPELLER
3 - HUB
4 - STATOR
5 - FRONT COVER
6 - CONVERTER CLUTCH DISC
7 - DRIVE PLATE

TORQUE CONVERTER (Continued)

IMPELLER

The impeller (Fig. 246) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

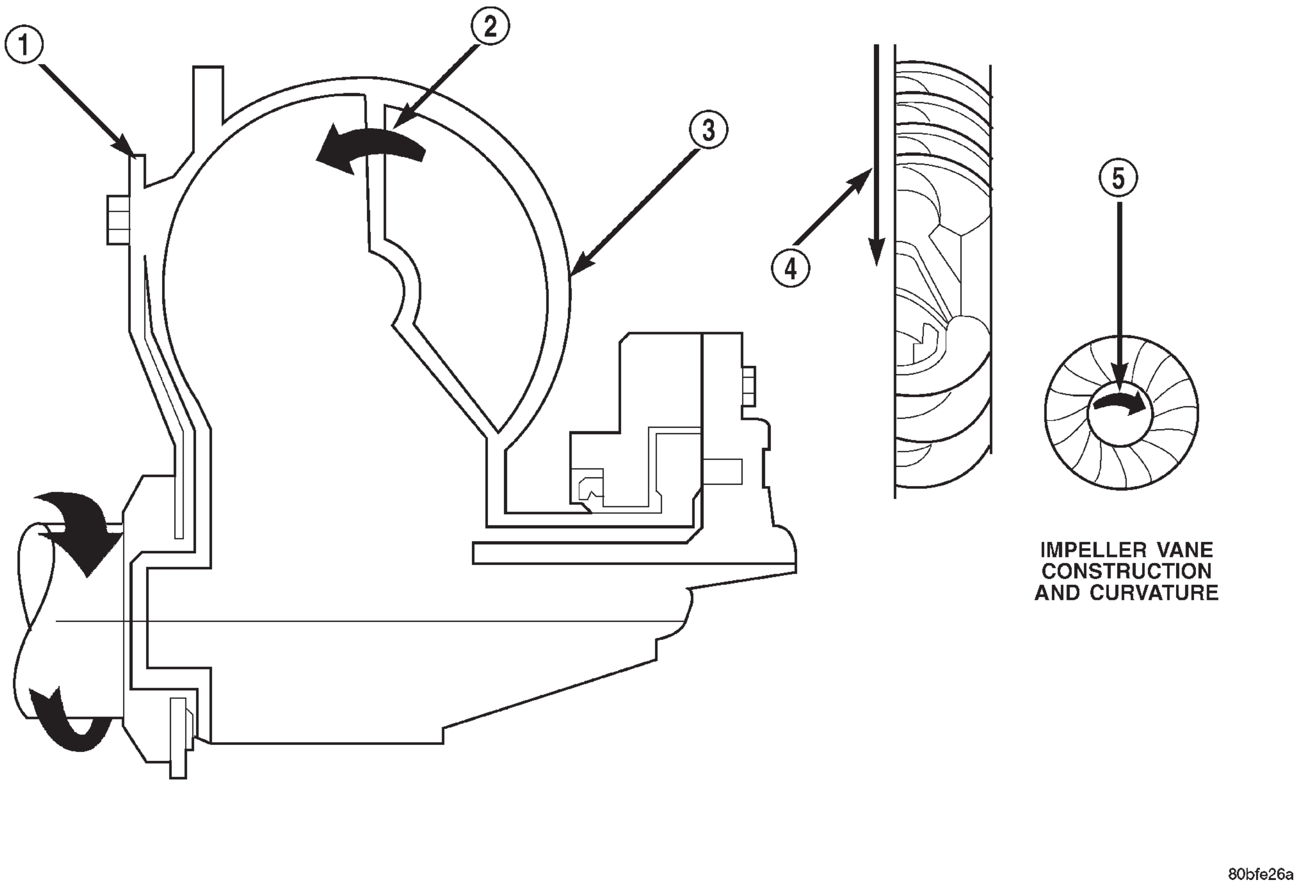


Fig. 246 Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

TORQUE CONVERTER (Continued)

TURBINE

The turbine (Fig. 247) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

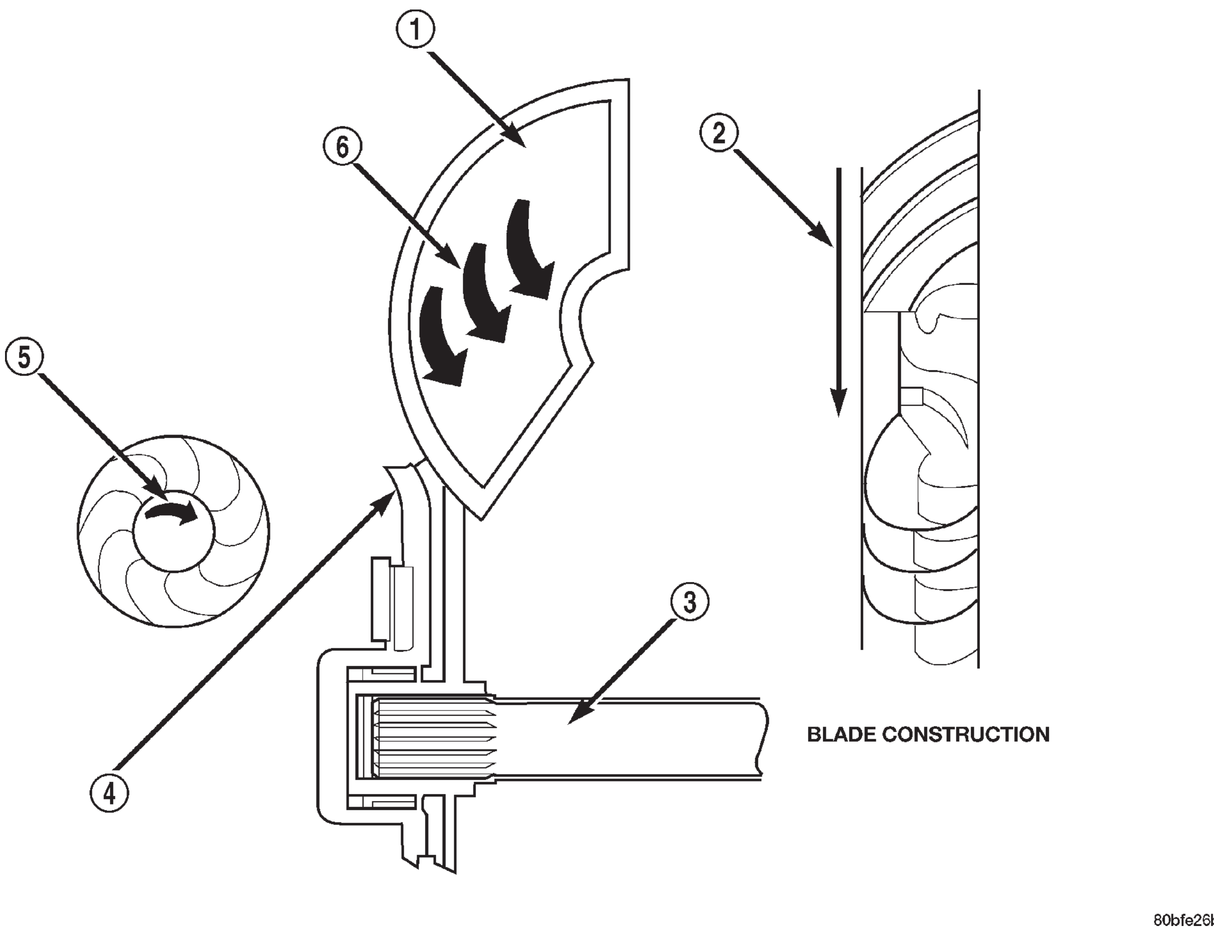


Fig. 247 Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

TORQUE CONVERTER (Continued)

STATOR

The stator assembly (Fig. 248) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 249). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

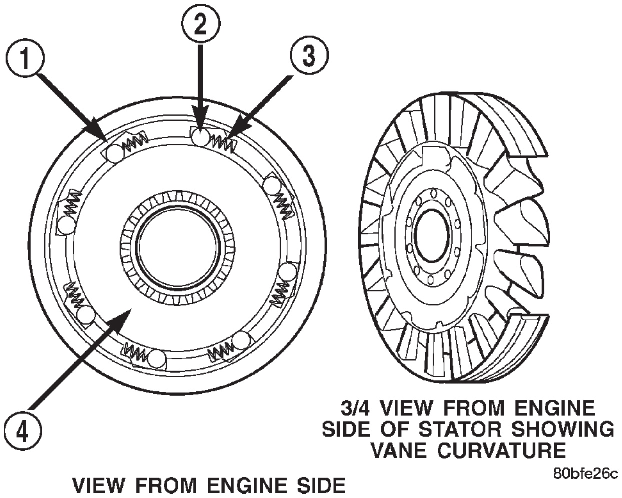


Fig. 248 Stator Components

1 - CAM (OUTER RACE)
2 - ROLLER
3 - SPRING
4 - INNER RACE

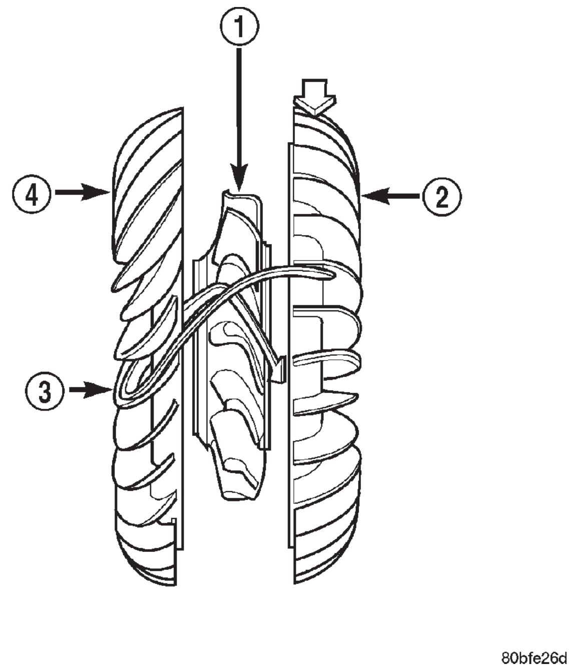


Fig. 249 Stator Location

1 - STATOR
2 - IMPELLER
3 - FLUID FLOW
4 - TURBINE

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 250) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston was added to the turbine, and a friction material was added to the inside of the front cover to provide this mechanical lock-up.

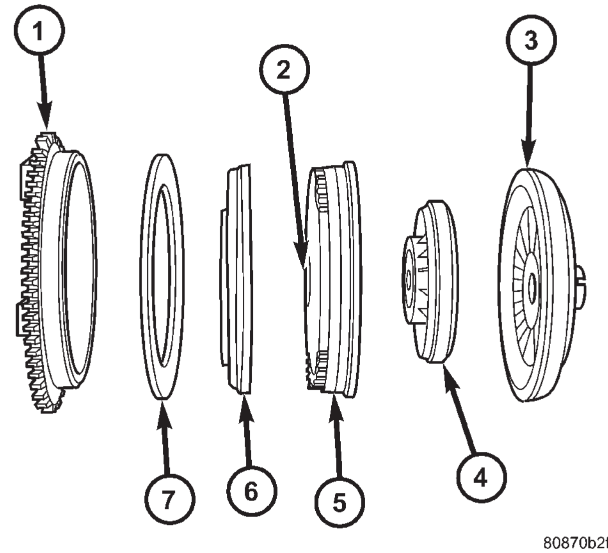


Fig. 250 Torque Converter Clutch (TCC)

1 - IMPELLER FRONT COVER
2 - THRUST WASHER ASSEMBLY
3 - IMPELLER
4 - STATOR
5 - TURBINE
6 - PISTON
7 - FRICTION DISC

TORQUE CONVERTER (Continued)

OPERATION

The converter impeller (Fig. 251) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 252). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the overrunning clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

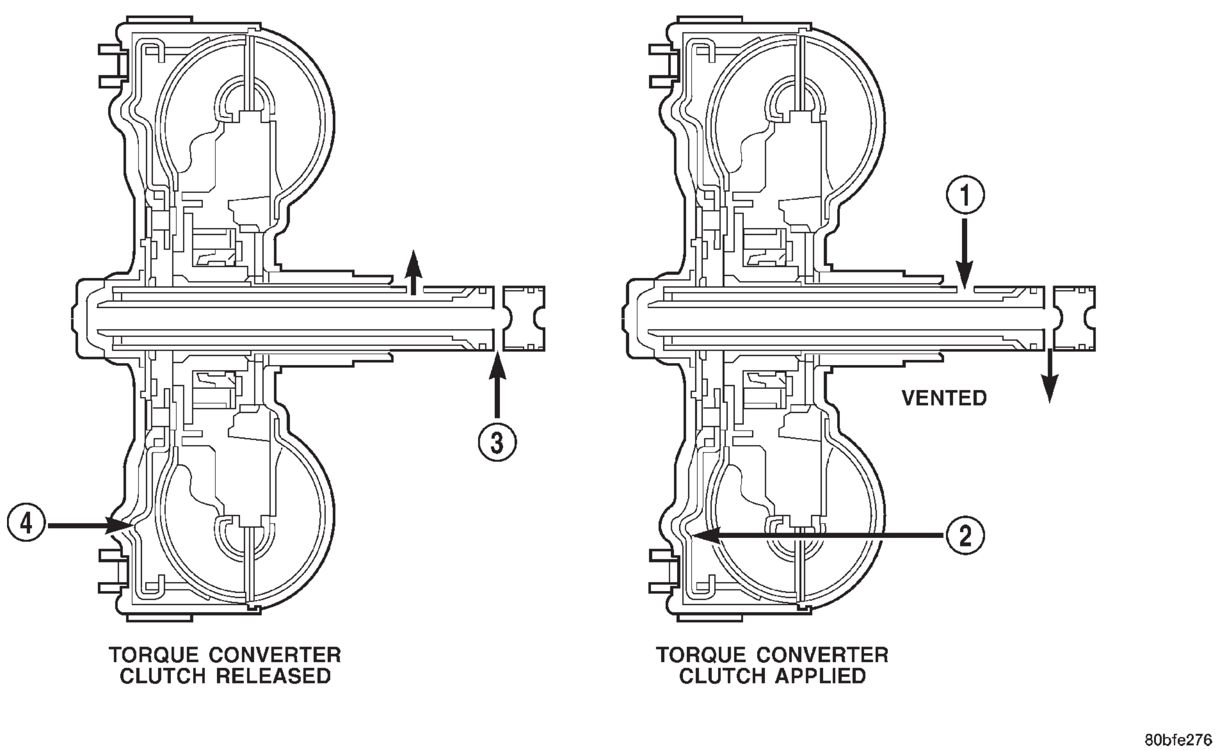


Fig. 251 Torque Converter Fluid Operation

1 - APPLY PRESSURE
2 - THE PISTON MOVES SLIGHTLY FORWARD
3 - RELEASE PRESSURE
4 - THE PISTON MOVES SLIGHTLY REARWARD

TORQUE CONVERTER (Continued)

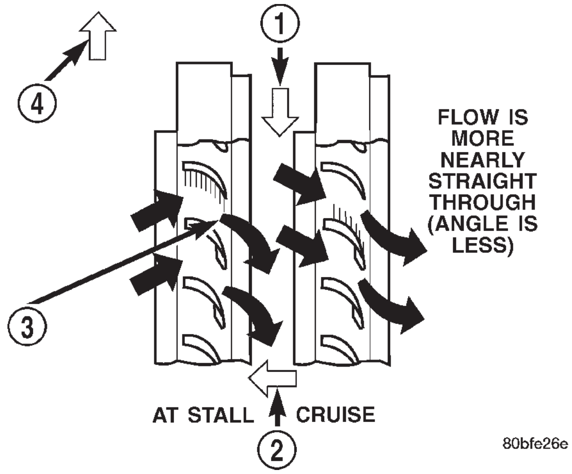


Fig. 252 Stator Operation

1 - DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 - FRONT OF ENGINE
3 - INCREASED ANGLE AS OIL STRIKES VANES
4 - DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

TORQUE CONVERTER CLUTCH (TCC)

The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear under various conditions, such as when the O/D switch is OFF, when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased.

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 253). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

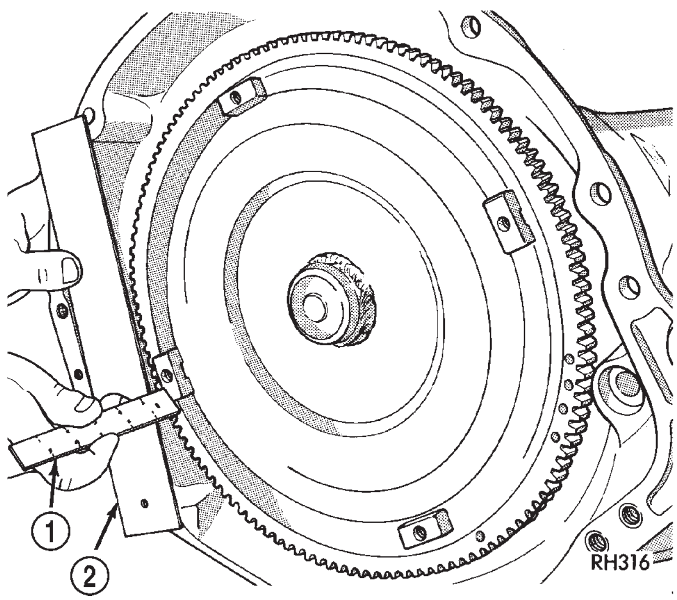


Fig. 253 Checking Torque Converter Seating - Typical

1 - SCALE
2 - STRAIGHTEDGE

TORQUE CONVERTER DRAINBACK VALVE

DESCRIPTION

The drainback valve is located in the transmission cooler outlet (pressure) line.

OPERATION

The valve prevents fluid from draining from the converter into the cooler and lines when the vehicle is shut down for lengthy periods. Production valves have a hose nipple at one end, while the opposite end is threaded for a flare fitting. All valves have an arrow (or similar mark) to indicate direction of flow through the valve.

STANDARD PROCEDURE - TORQUE CONVERTER DRAINBACK VALVE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator tank. The valve prevents fluid drainback when the vehicle is parked for lengthy periods. The valve check ball is spring loaded and has an opening pressure of approximately 2 psi.

The valve is serviced as an assembly; it is not repairable. Do not clean the valve if restricted, or contaminated by sludge, or debris. If the valve fails, or if a transmission malfunction occurs that generates significant amounts of sludge and/or clutch particles and metal shavings, the valve must be replaced.

The valve must be removed whenever the cooler and lines are reverse flushed. The valve can be flow tested when necessary. The procedure is exactly the same as for flow testing a cooler.

If the valve is restricted, installed backwards, or in the wrong line, it will cause an overheating condition and possible transmission failure.

CAUTION: The drainback valve is a one-way flow device. It must be properly oriented in terms of flow direction for the cooler to function properly. The valve must be installed in the pressure line. Otherwise flow will be blocked and would cause an overheating condition and eventual transmission failure.

TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION

Transmission fluid temperature readings are supplied to the transmission control module by the thermistor (Fig. 254). The temperature readings are used to control engagement of the fourth gear overdrive clutch, the converter clutch, and governor pressure. Normal resistance value for the thermistor at room temperature is approximately 2000 ohms.

The thermistor is part of the governor pressure sensor assembly and is immersed in transmission fluid at all times.

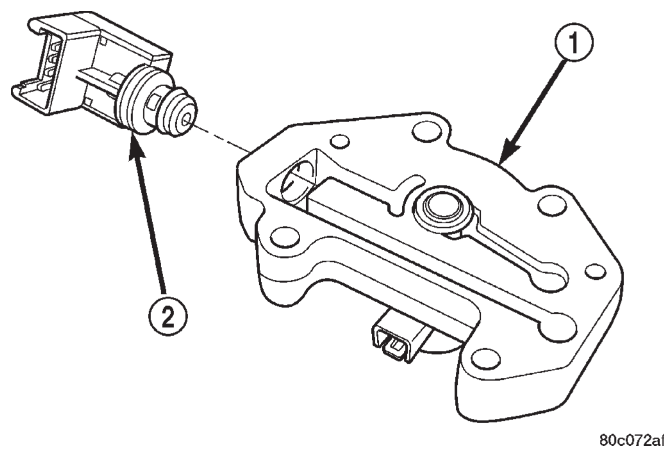


Fig. 254 Governor Pressure Sensor

1 - GOVERNOR BODY

2 - GOVERNOR PRESSURE SENSOR/TRANSMISSION FLUID TEMPERATURE THERMISTOR

OPERATION

The PCM prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 10°C (50°F).

If fluid temperature exceeds 126°C (260°F), the PCM causes a 4-3 downshift and engage the converter clutch. Engagement is according to the third gear converter clutch engagement schedule.

The overdrive OFF lamp in the instrument panel illuminates when the shift back to third occurs. The transmission will not allow fourth gear operation until fluid temperature decreases to approximately 110°C (230°F).

VALVE BODY

DESCRIPTION

The valve body consists of a cast aluminum valve body, a separator plate, and transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components (Fig. 255), (Fig. 256), (Fig. 257), and (Fig. 258):

- Regulator valve
- Regulator valve throttle pressure plug
- Line pressure plug and sleeve
- Kickdown valve
- Kickdown limit valve
- 1-2 shift valve
- 1-2 control valve
- 2-3 shift valve
- 2-3 governor plug
- 3-4 shift valve
- 3-4 timing valve
- 3-4 quick fill valve
- 3-4 accumulator
- Throttle valve
- Throttle pressure plug
- Switch valve
- Manual valve
- Converter clutch lock-up valve
- Converter clutch lock-up timing Valve
- Shuttle valve
- Shuttle valve throttle plug
- Boost Valve
- 10 check balls

By adjusting the spring pressure acting on the regulator valve, transmission line pressure can be adjusted.

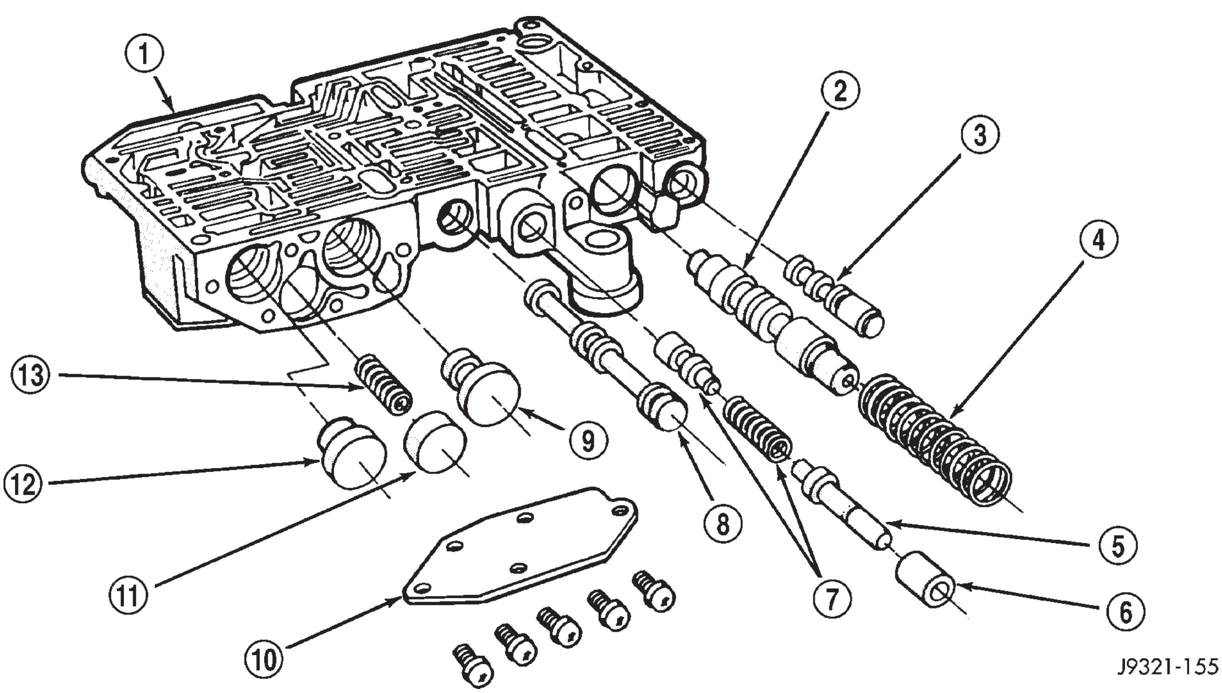


Fig. 255 Upper Housing Control Valve Locations

1 - UPPER HOUSING
2 - REGULATOR VALVE
3 - SWITCH VALVE
4 - REGULATOR VALVE SPRING
5 - KICKDOWN VALVE
6 - KICKDOWN DETENT
7 - THROTTLE VALVE AND SPRING
8 - MANUAL VALVE
9 - 1-2 GOVERNOR PLUG
10 - GOVERNOR PLUG COVER
11 - THROTTLE PLUG
12 - 2-3 GOVERNOR PLUG
13 - SHUTTLE VALVE PRIMARY SPRING

VALVE BODY (Continued)

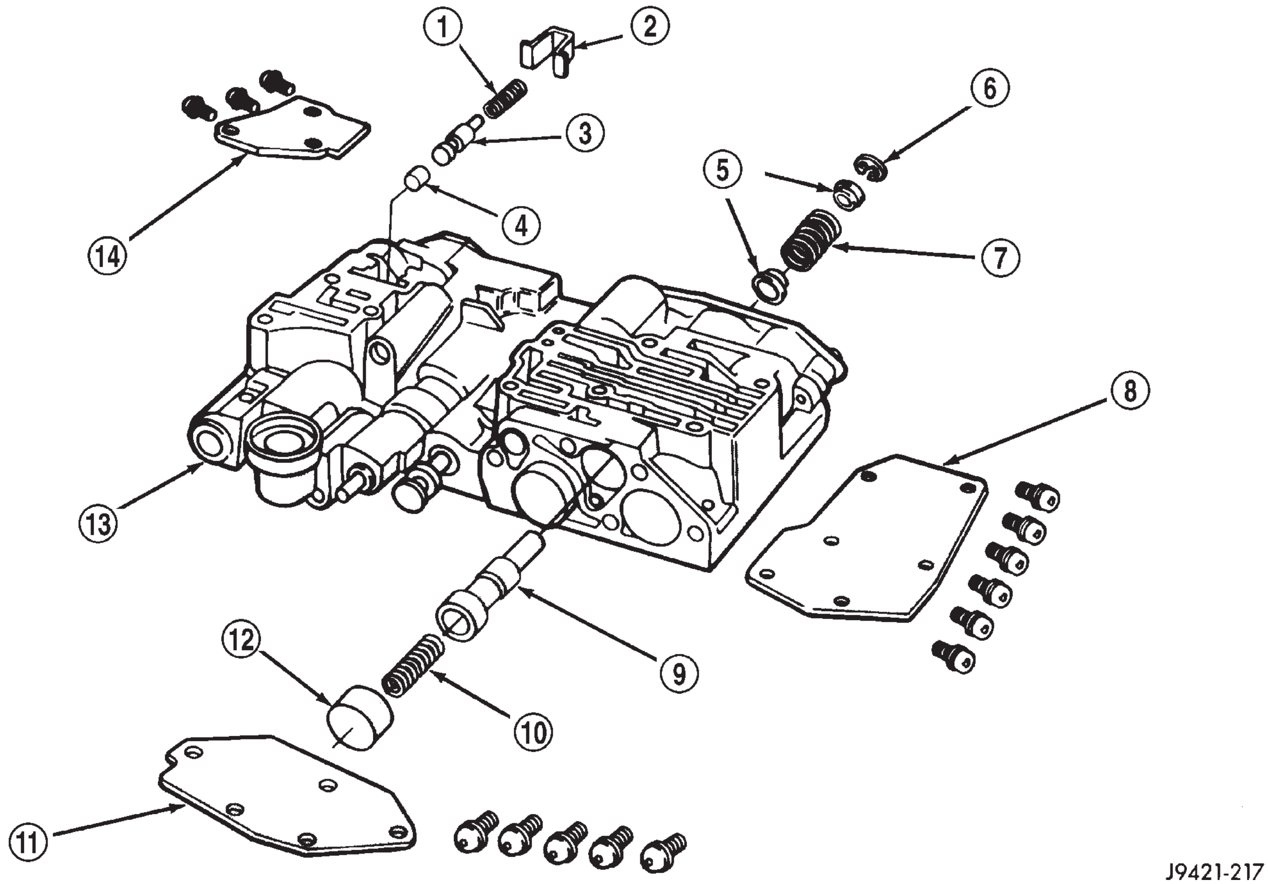


Fig. 256 Shuttle and Boost Valve Locations

1 - SPRING
2 - RETAINER
3 - BOOST VALVE
4 - BOOST VALVE PLUG
5 - SPRING GUIDES
6 - E-CLIP
7 - SHUTTLE VALVE SECONDARY SPRING
8 - SHUTTLE VALVE COVER
9 - SHUTTLE VALVE
10 - SHUTTLE VALVE PRIMARY SPRING
11 - GOVERNOR PLUG COVER
12 - THROTTLE PLUG
13 - UPPER HOUSING
14 - BOOST VALVE COVER

VALVE BODY (Continued)

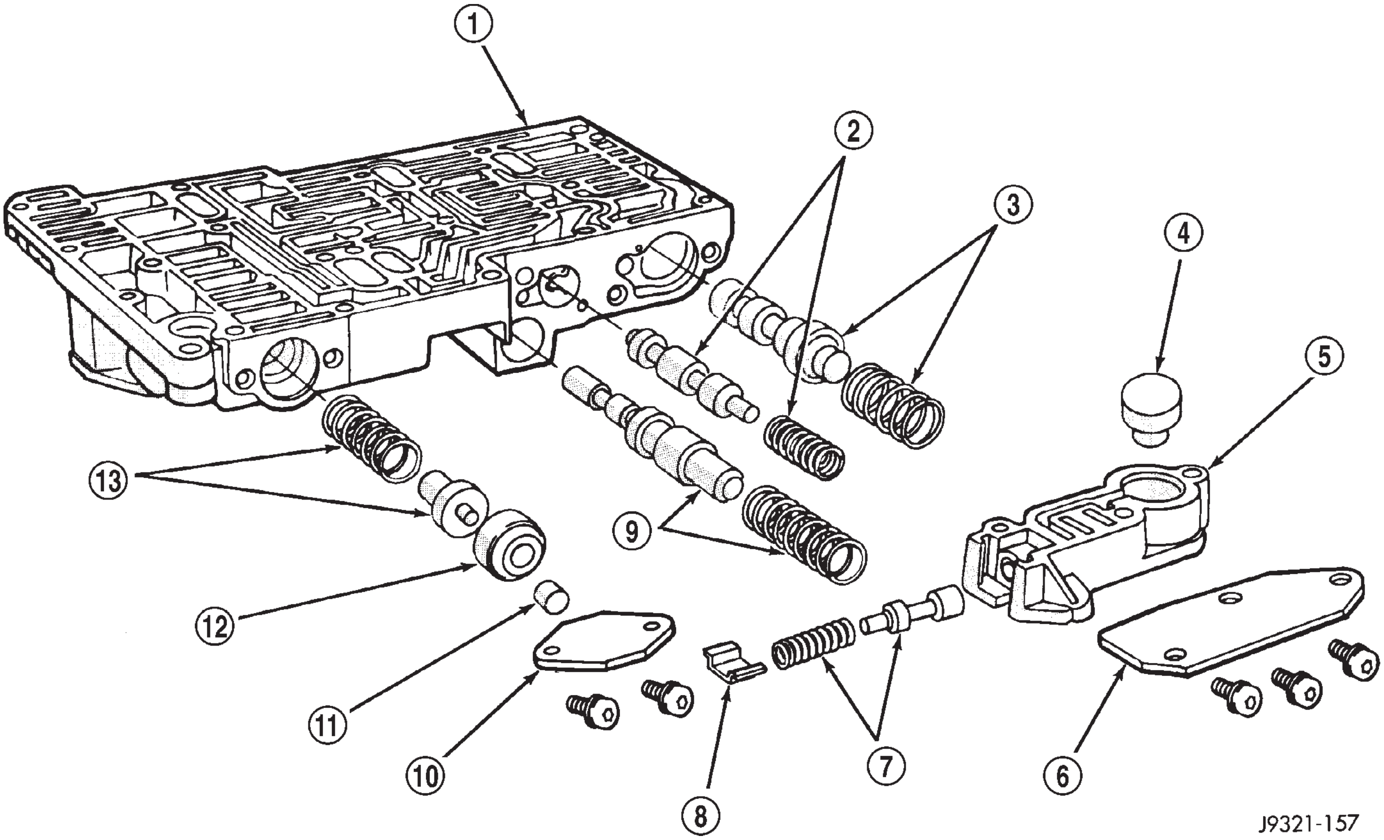


Fig. 257 Upper Housing Shift Valve and Pressure Plug Locations

1 - UPPER HOUSING
2 - 1-2 SHIFT VALVE AND SPRING
3 - 2-3 SHIFT VALVE AND SPRING
4 - 2-3 THROTTLE PLUG
5 - LIMIT VALVE HOUSING
6 - LIMIT VALVE COVER
7 - LIMIT VALVE AND SPRING
8 - RETAINER
9 - 1-2 SHIFT CONTROL VALVE AND SPRING
10 - PRESSURE PLUG COVER
11 - LINE PRESSURE PLUG
12 - PLUG SLEEVE
13 - THROTTLE PRESSURE SPRING AND PLUG

VALVE BODY (Continued)

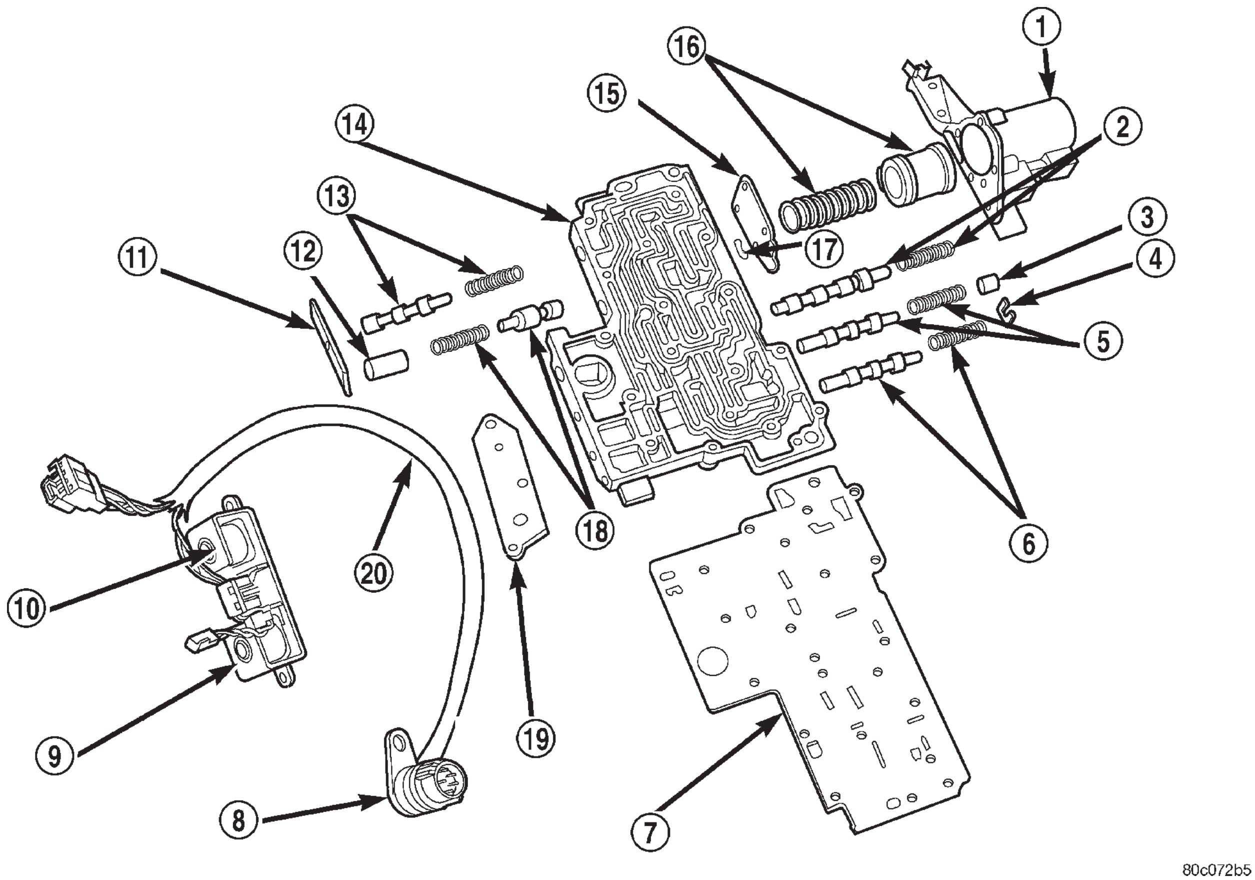


Fig. 258 Lower Housing Shift Valves and Springs

1 - 3-4 ACCUMULATOR HOUSING
2 - 3-4 SHIFT VALVE AND SPRING
3 - PLUG
4 - SPRING RETAINER
5 - CONVERTER CLUTCH VALVE AND SPRING
6 - CONVERTER CLUTCH TIMING VALVE AND SPRING
7 - OVERDRIVE SEPARATOR PLATE
8 - CASE CONNECTOR
9 - CONVERTER CLUTCH SOLENOID
10 - OVERDRIVE SOLENOID
11 - TIMING VALVE COVER
12 - PLUG
13 - 3-4 TIMING VALVE AND SPRING
14 - LOWER HOUSING
15 - ACCUMULATOR END PLATE
16 - 3-4 ACCUMULATOR PISTON AND SPRING
17 - E-CLIP
18 - 3-4 QUICK FILL SPRING AND VALVE
19 - SOLENOID GASKET
20 - HARNESS

VALVE BODY (Continued)

OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

CHECK BALLS

CHECK BALL NUMBER	DESCRIPTION
1	Allows either the manual valve to put line pressure on the 1-2 governor plug or the KD Valve to put WOT line pressure on the 1-2 governor plug.
2	Allows either the manual valve to put line pressure on the 2-3 governor plug or the KD Valve to put WOT line pressure on the 2-3 governor plug.
3	Allows either the Reverse circuit or the 3rd gear circuit to pressurize the front clutch.
4	Allows either the Manual Low circuit from the Manual Valve or the Reverse from the Manual Valve circuit to pressurize the rear servo.
5	Directs line pressure to the spring end of the 2-3 shift valve in either Manual Low or Manual 2nd, forcing the downshift to 2nd gear regardless of governor pressure.
6	Provides a by-pass around the front servo orifice so that the servo can release quickly.
7	Provides a by-pass around the rear clutch orifice so that the clutch can release quickly.
8	Directs reverse line pressure through an orifice to the throttle valve eliminating the extra leakage and insuring that Reverse line pressure pressure will be sufficient.
9	Provides a by-pass around the rear servo orifice so that the servo can release quickly.
ECE (10)	Allows the lockup clutch to used at WOT in 3rd gear by putting line pressure from the 3-4 Timing Valve on the interlock area of the 2-3 shift valve, thereby preventing a 3rd gear Lock-up to 2nd gear kickdown.

VALVE BODY (Continued)

REGULATOR VALVE

The pressure regulator valve is needed to control the hydraulic pressure within the system and reduce the amount of heat produced in the fluid. The pressure regulator valve is located in the valve body near the manual valve. The pressure regulator valve train controls the maximum pressure in the lines by metering the dumping of fluid back into the sump. Regulated pressure is referred to as "line pressure."

The regulator valve (Fig. 259) has a spring on one end that pushes the valve to the left. This closes a dump (vent) that is used to lower pressure. The closing of the dump will cause the oil pressure to increase. Oil pressure on the opposite end of the valve pushes the valve to the right, opening the dump and lowering oil pressure. The result is spring pressure working against oil pressure to maintain the oil at specific pressures. With the engine running, fluid flows from the pump to the pressure regulator valve, manual valve, and the interconnected circuits. As fluid is sent through passages to the regulator valve, the pressure pushes the valve to the right against the large spring. It is also sent to the reaction areas on the left side of the throttle pressure plug and the line pressure plug. With the gear selector in the PARK position, fluid recirculates through the regulator and manual valves back to the sump.

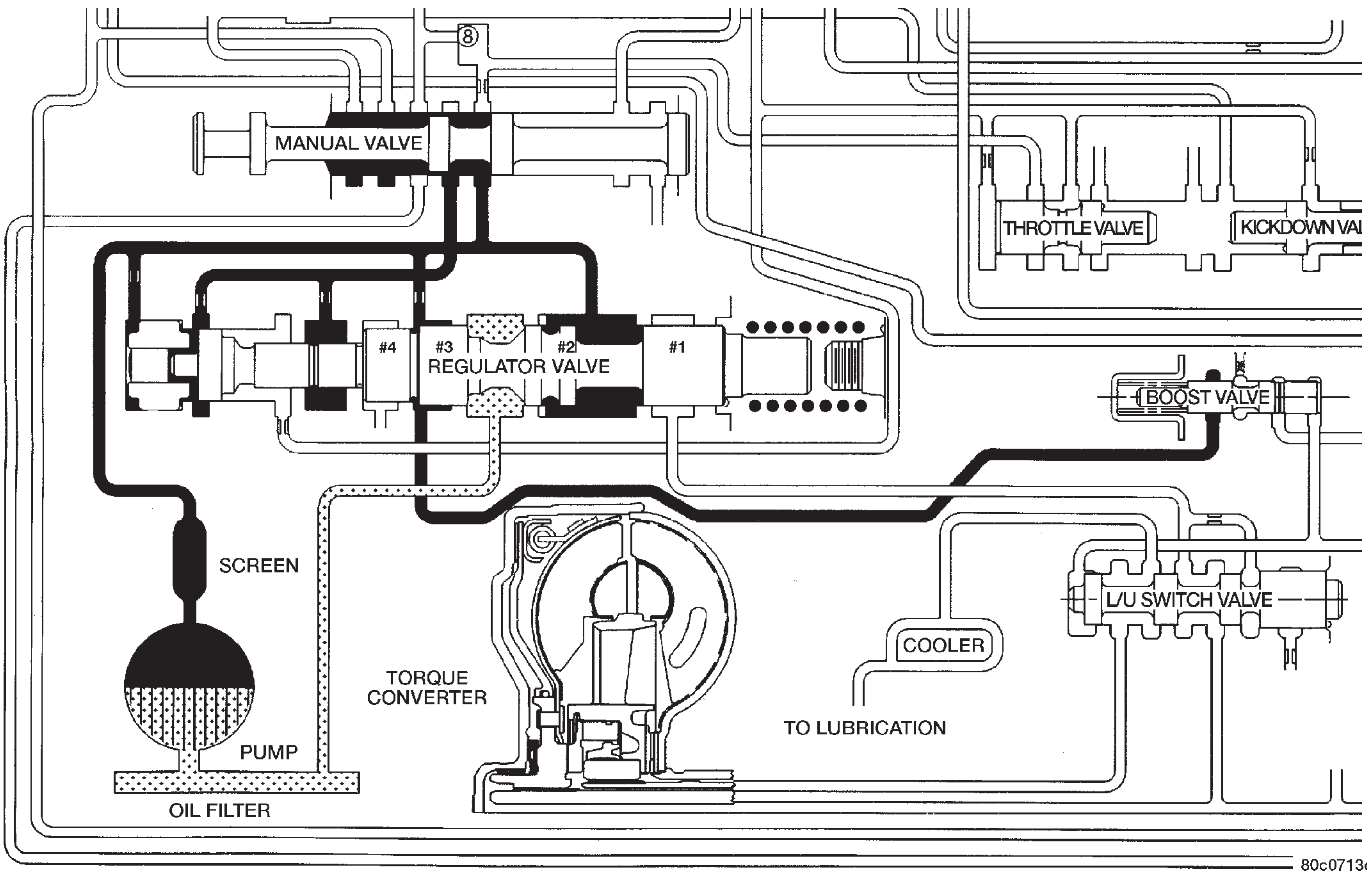


Fig. 259 Regulator Valve in PARK Position

VALVE BODY (Continued)

Meanwhile, the torque converter is filled slowly. In all other gear positions (Fig. 260), fluid flows between two right side lands to the switch valve and torque converter. At low pump speeds, the flow is controlled by the pressure valve groove to reduce pressure to the torque converter. After the torque converter and switch valve fill with fluid, the switch valve becomes the controlling metering device for torque converter pressure. The regulator valve then begins to control the line pressure for the other transmission circuits. The balance of the fluid pressure pushing the valve to the right and the spring pressure pushing to the left determines the size of the metering passage at land #2 (land #1 being at the far right of the valve in the diagram). As fluid leaks past the land, it moves into a groove connected to the filter or sump. As the land meters the fluid to the sump, it causes the pressure to reduce and the spring decreases the size of the metering passage. When the size of the metering passage is reduced, the pressure rises again and the size of the land is increased again. Pressure is regulated by this constant balance of hydraulic and spring pressure.

The metering at land #2 establishes the line pressure throughout the transmission. It is varied according to changes in throttle position and the transmission's internal condition within a range of 57-94 psi (except in REVERSE) (Fig. 261). The regulated line pressure in REVERSE (Fig. 262) is held at much higher pressures than in the other gear positions: 145-280 psi. The higher pressure for REVERSE is achieved by the manual valve blocking the supply of line pressure to the reaction area left of land #4. With this pressure blocked, there is less area for pressure to act on to balance the force of the spring on the right. This allows line pressure to push the valve train to the right, reducing the amount of fluid returned to the pump's inlet, increasing line pressure.

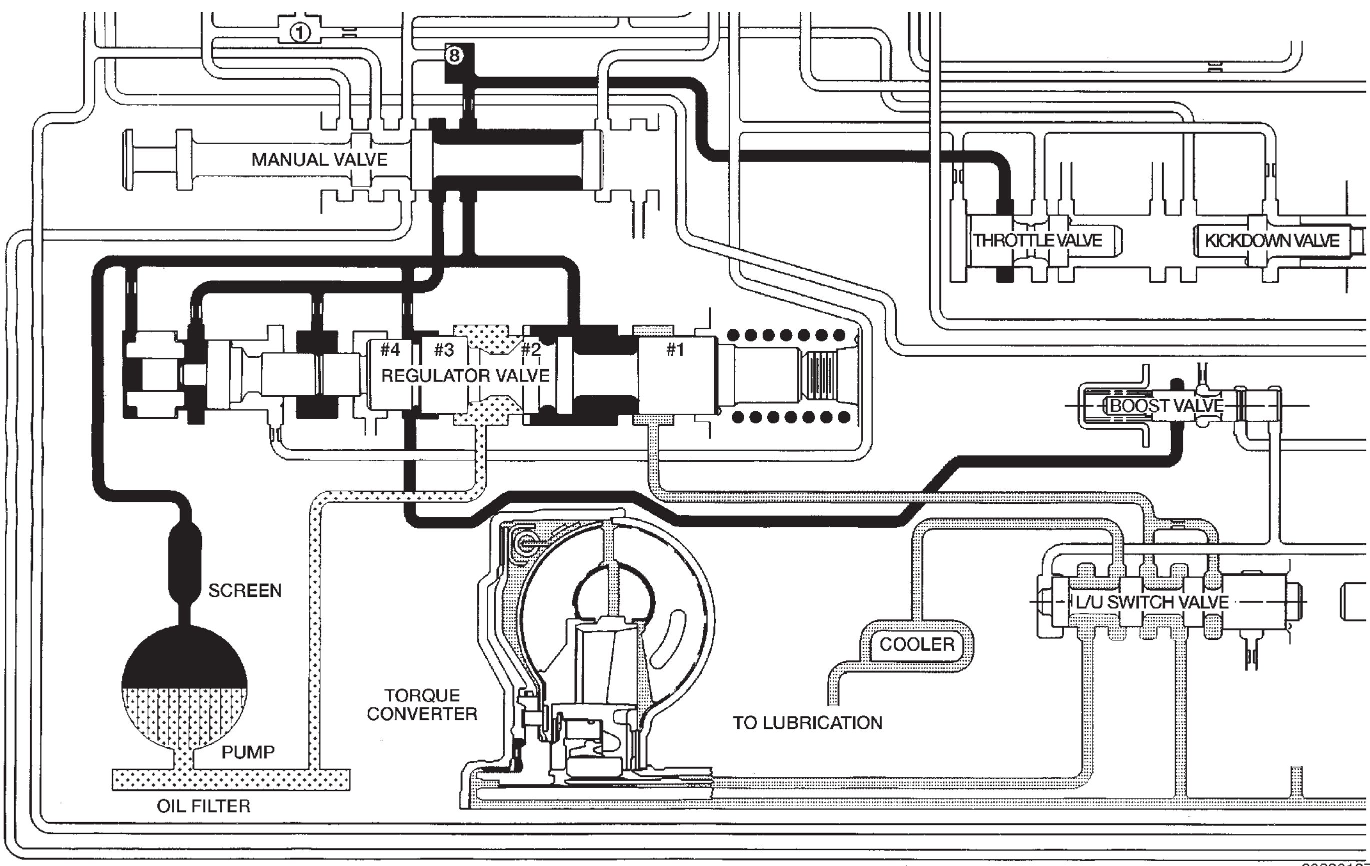


Fig. 260 Regulator Valve in NEUTRAL Position

VALVE BODY (Continued)

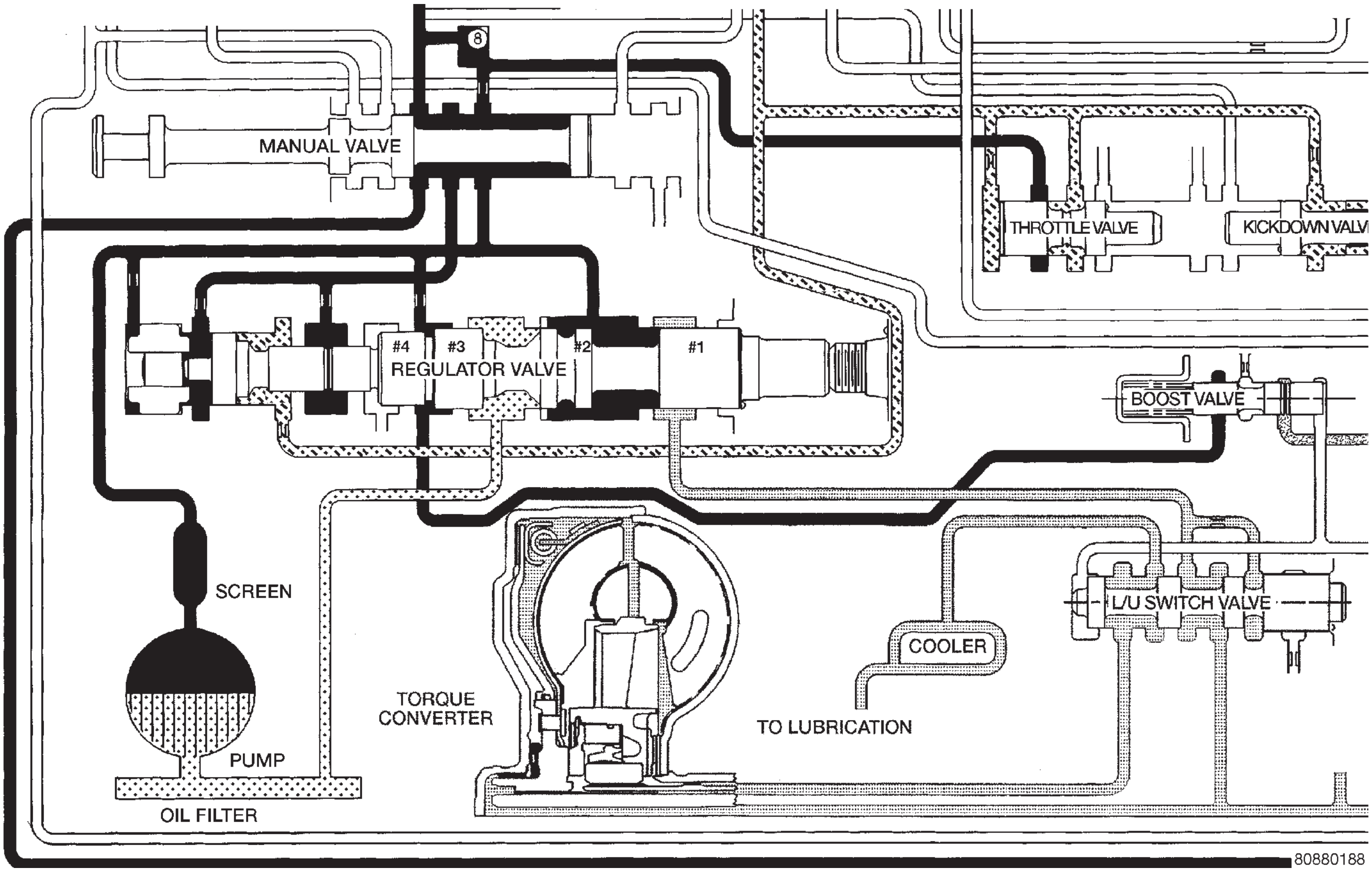


Fig. 261 Regulator Valve in DRIVE Position

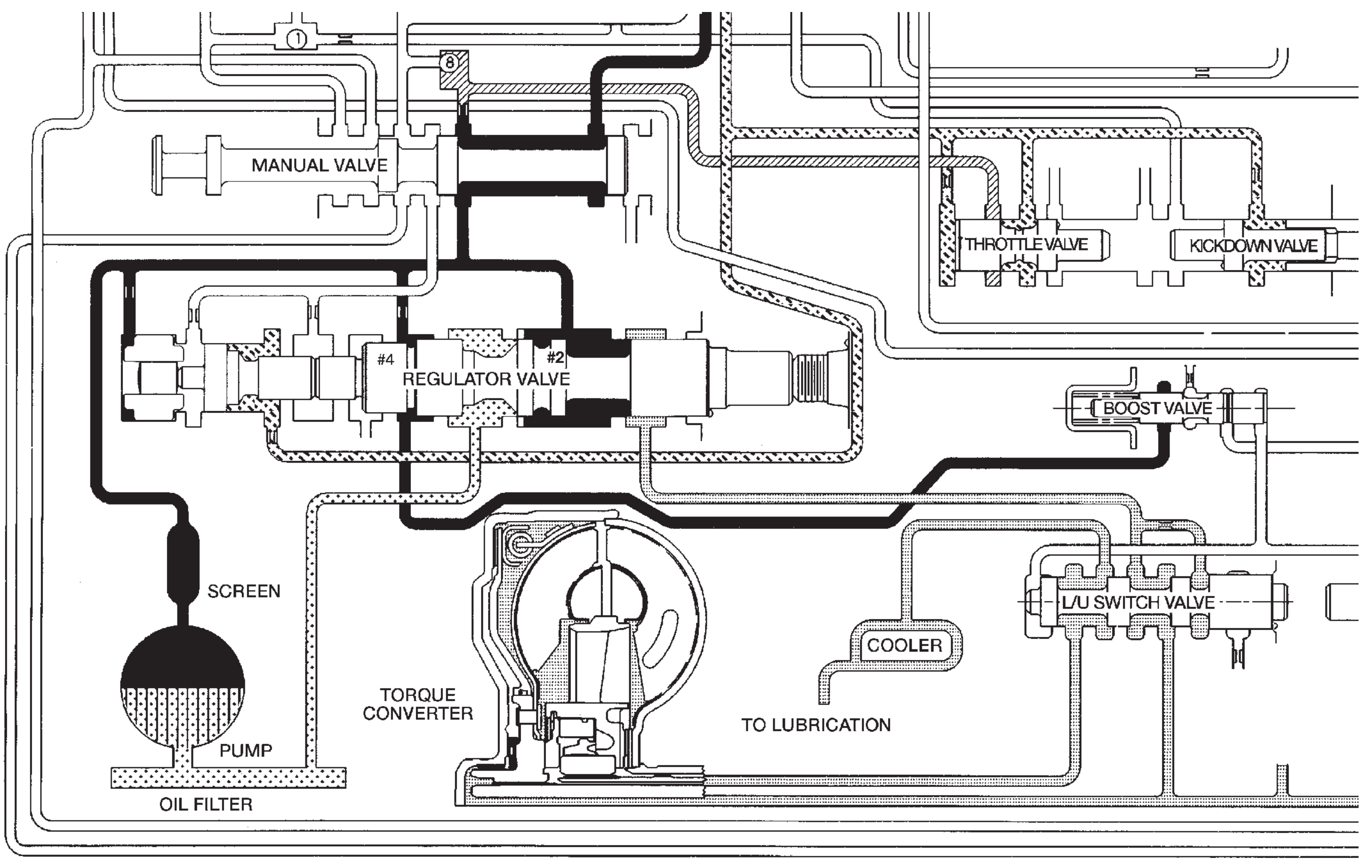


Fig. 262 Regulator Valve in REVERSE Position

VALVE BODY (Continued)

KICKDOWN VALVE

When the throttle valve is as far over to the left as it can go, the maximum line pressure possible will enter the throttle pressure circuit. In this case, throttle pressure will equal line pressure. With the kickdown valve (Fig. 263) pushed into the bore as far as it will go, fluid initially flows through the annular groove of the 2-3 shift valve (which will be in the direct drive position to the right).

After passing the annular groove, the fluid is routed to the spring end of the 2-3 shift valve. Fluid pressure reacting on the area of land #1 overcomes governor pressure, downshifting the 2-3 shift valve into the kickdown, or second gear stage of operation. The valve is held in the kickdown position by throttle pressure routed from a seated check ball (#2). Again, if vehicle speed is low enough, throttle pressure will also push the 1-2 shift valve left to seat its governor plug, and downshift to drive breakaway.

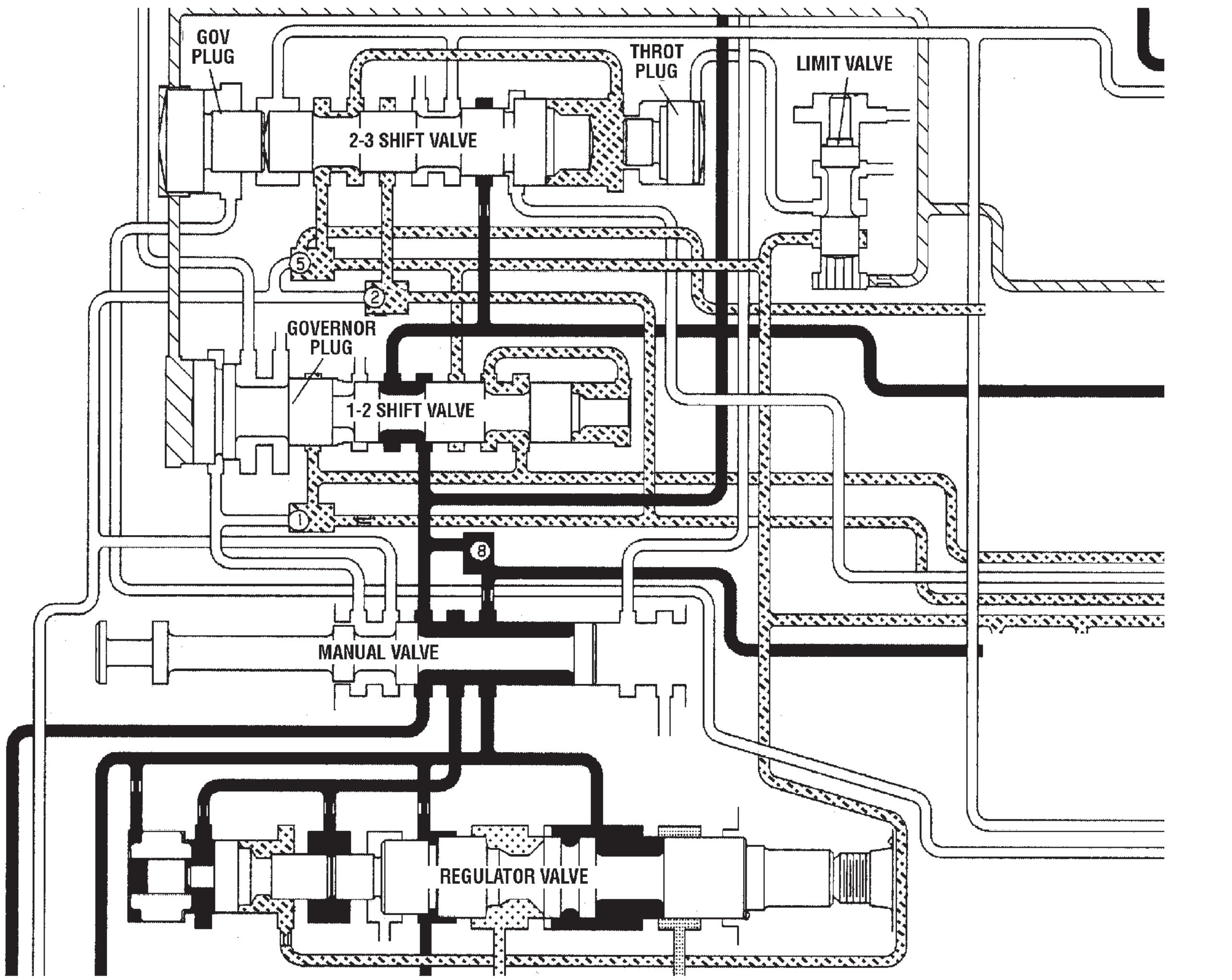


Fig. 263 Kickdown Valve-Wide Open Throttle

VALVE BODY (Continued)

KICKDOWN LIMIT VALVE

The purpose of the limit valve is to prevent a 3-2 downshift at higher speeds when a part-throttle downshift is not desirable. At these higher speeds only a full throttle 3-2 downshift will occur. At low road speeds (Fig. 264) the limit valve does not come into play and does not affect the downshifts. As the vehicle's speed increases (Fig. 265), the governor pressure also increases. The increased governor pressure acts on the reaction area of the bottom land of the limit valve overcoming the spring force trying to push the valve toward the bottom of its bore. This pushes the valve upward against the spring and bottoms the valve against the top of the housing. With the valve bottomed against the housing, the throttle pressure supplied to the valve will be closed off by the bottom land of the limit valve. When the supply of throttle pressure has been shut off, the 3-2 part throttle downshift plug becomes inoperative, because no pressure is acting on its reaction area.

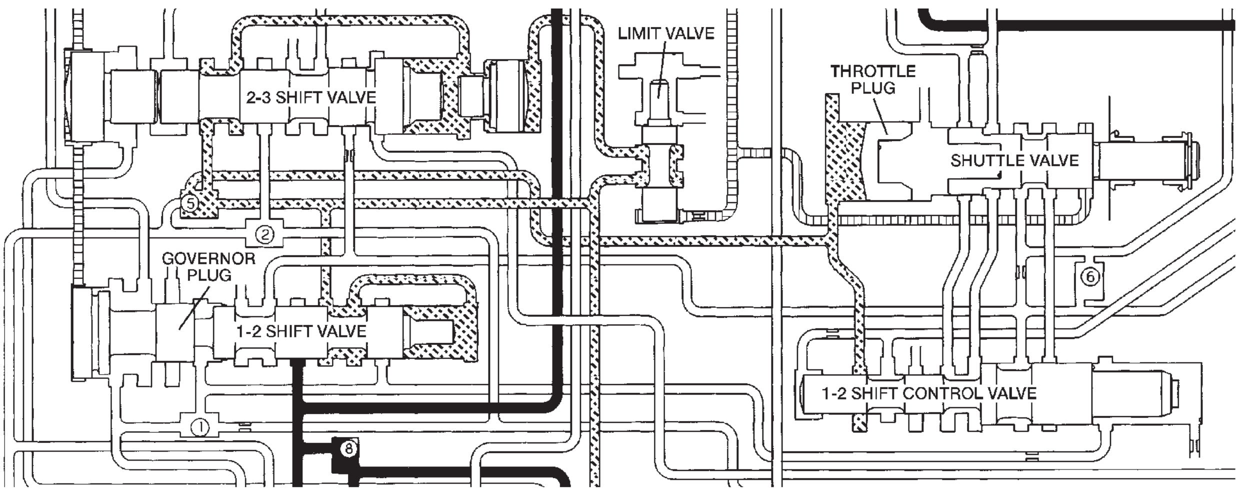


Fig. 264 Kickdown Limit Valve-Low Speeds

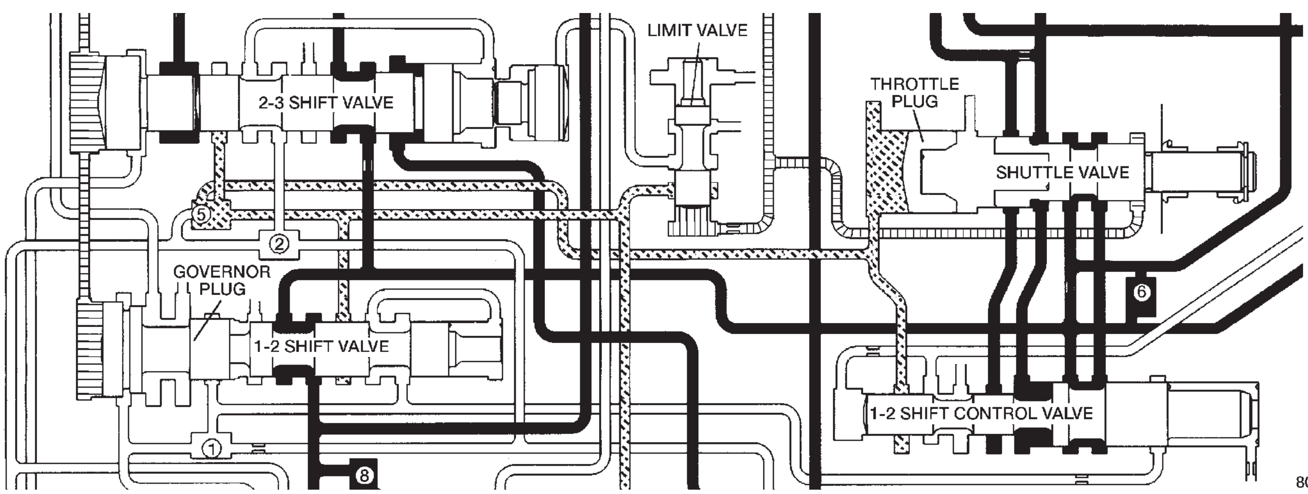


Fig. 265 Kickdown Limit Valve-High Speeds

VALVE BODY (Continued)

1-2 SHIFT VALVE

The 1-2 shift valve assembly (Fig. 266), or mechanism, consists of: the 1-2 shift valve, governor plug, and a spring on the end of the valve. After the manual valve has been placed into a forward gear range, line pressure is directed to the 1-2 shift valve. As the throttle is depressed, throttle pressure is applied to the right side of the 1-2 shift valve assembly. With throttle pressure applied to the right side of the valve, there is now both spring pressure and throttle pressure acting on the valve, holding it against the governor plug. As the vehicle begins to move and build speed, governor pressure is created and is applied to the left of the valve at the governor plug.

When governor pressure builds to a point where it can overcome the combined force of the spring and throttle pressure on the other side of the valve, the valve will begin to move over to the right. As the valve moves to the right, the middle land of the valve will close off the circuit supplying the throttle pressure to the right side of the valve. When the throttle pressure is closed off, the valve will move even farther to the right, allowing line pressure to enter another circuit and energize the front servo, applying the front band (Fig. 267).

The governor plug serves a dual purpose:

• It allows the shift valves to move either left or right, allowing both upshifts and downshifts.

• When in a manual selection position, it will be hydraulically "blocked" into position so no upshift can occur.

The physical blocking of the upshift while in the manual "1" position is accomplished by the directing of line pressure between both lands of the governor plug. The line pressure reacts against the larger land of the plug, pushing the plug back against the end plate overcoming governor pressure. With the combination of the line pressure and spring pressure, the valve cannot move, preventing any upshift.

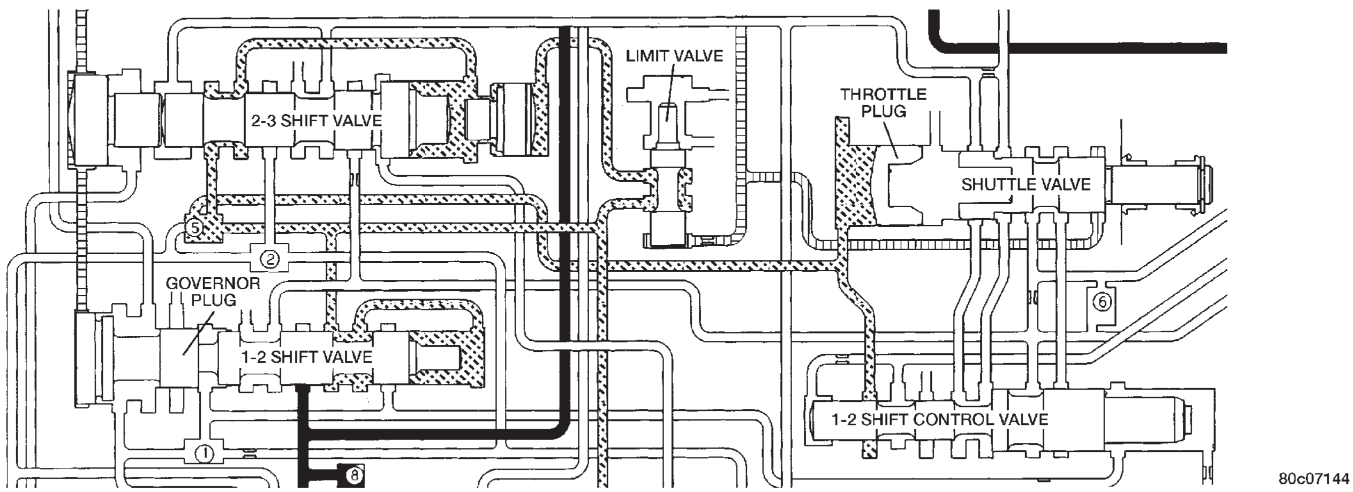


Fig. 266 1-2 Shift Valve-Before Shift

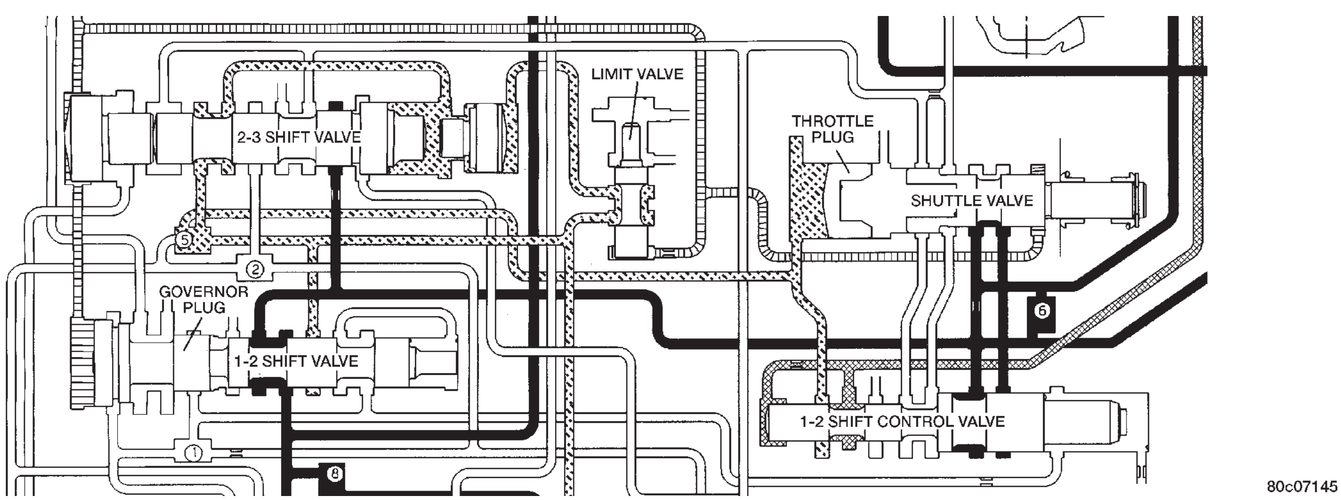


Fig. 267 1-2 Shift Valve-After Shift

VALVE BODY (Continued)

1-2 SHIFT CONTROL VALVE

It contains a valve with four lands and a spring. It is used as both a "relay" and "balanced" valve.

The valve has two specific operations (Fig. 268):

- Aid in quality of the 1-2 upshift.
- Aid in the quality and timing of the 3-2 kickdown ranges.

When the manual valve is set to the DRIVE position and the transmission is in the first or second gear range, 1-2 shift control or "modulated throttle pressure" is supplied to the middle of the accumulator piston by the 1-2 shift control valve. During the 1-2 upshift, this pressure is used to control the kickdown servo apply pressure that is needed to apply the kickdown and accumulator pistons. Thus, the 1-2 shift point is "cushioned" and the quality is improved. During a WOT kickdown, kickdown pressure is applied between the kickdown valve and the 1-2 shift control valve. This additional pressure is directed to the 1-2 shift control's spring cavity, adding to the spring load on the valve. The result of this increased "modulated" throttle pressure is a firmer WOT upshift.

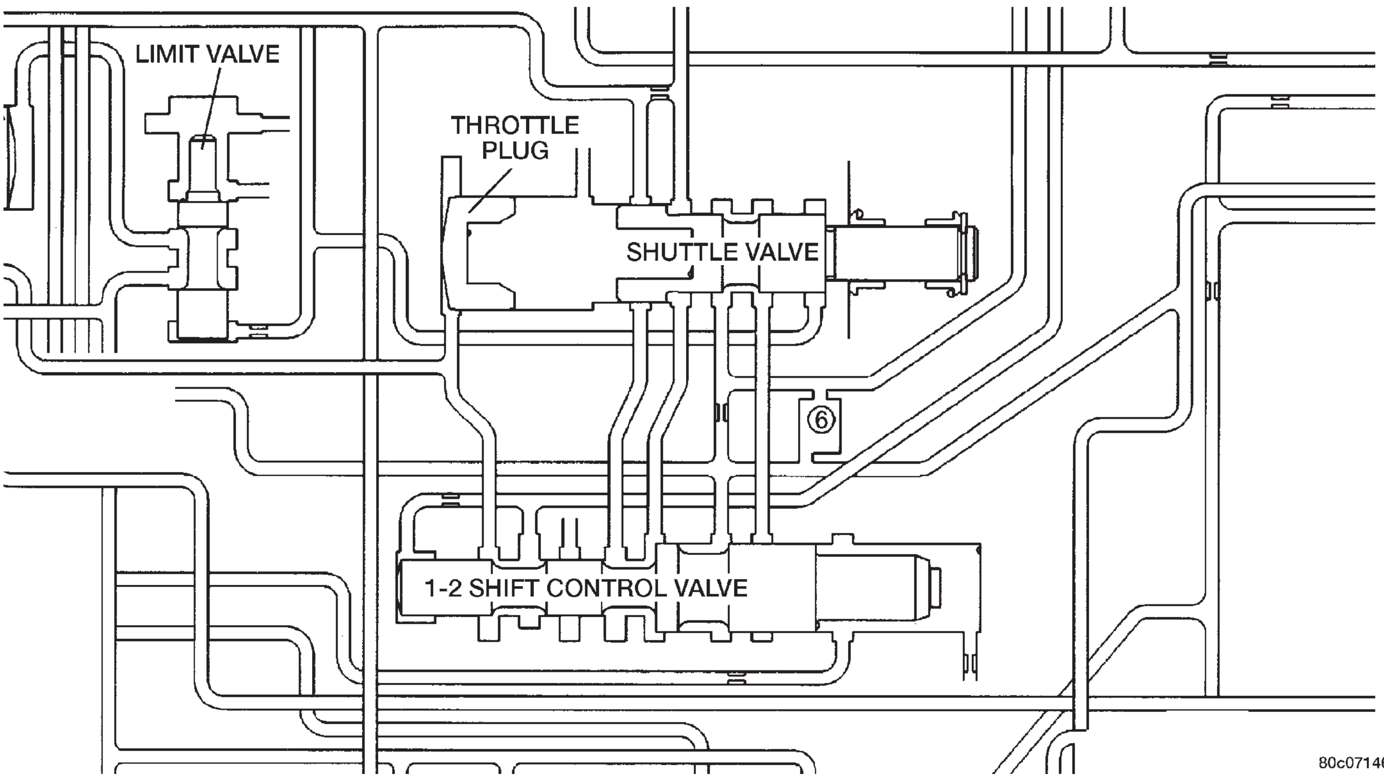


Fig. 268 1-2 Shift Control Valve

VALVE BODY (Continued)

2-3 SHIFT VALVE

The 2-3 shift valve mechanism (Fig. 269) consists of the 2-3 shift valve, governor plug and spring, and a throttle plug. After the 1-2 shift valve has completed its operation and applied the front band, line pressure is directed to the 2-3 shift valve through the connecting passages from the 1-2 shift valve. The line pressure will then dead–end at land #2 until the 2-3 valve is ready to make its shift. Now that the vehicle is in motion and under acceleration, there is throttle pressure being applied to the spring side of the valve and between lands #3 and #4.

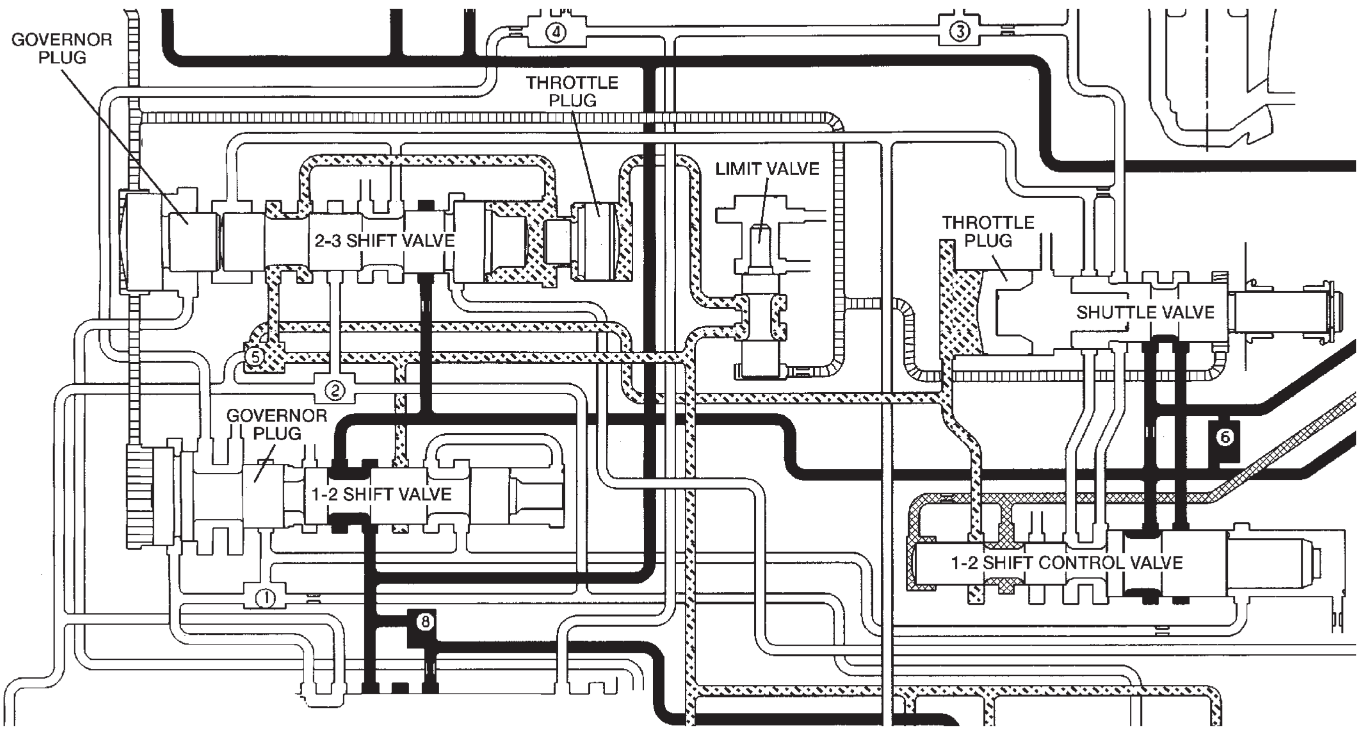


Fig. 269 2-3 Shift Valve-Before Shift

VALVE BODY (Continued)

As vehicle speed increases, governor pressure increases proportionately, until it becomes great enough to overcome the combined throttle and spring pressure on the right side of the valve. Since the throttle pressure end of the 2-3 shift valve is larger in diameter than the 1-2 shift valve, the 2-3 shift will always happen at a greater speed than the 1-2 shift. When this happens, the governor plug is forced against the shift valve moving it to the right. The shift valve causes land #4 to close the passage supplying throttle pressure to the 2-3 shift valve. Without throttle pressure present in the circuit now, the governor plug will push the valve over far enough to bottom the valve in its bore. This allows land #2 to direct line pressure to the front clutch.

After the shift (Fig. 270), line pressure is directed to the land between the shift valve and the governor plug, and to the release side of the kickdown servo. This releases the front band and applies the front clutch, shifting into third gear or direct drive. The rear clutch remains applied, as it has been in the other gears. During a manual “1” or manual “2” gear selection, line pressure is sent between the two lands of the 2-3 governor plug. This line pressure at the governor plug locks the shift valve into the second gear position, preventing an upshift into direct drive. The theory for the blocking of the valve is the same as that of the 1-2 shift valve.

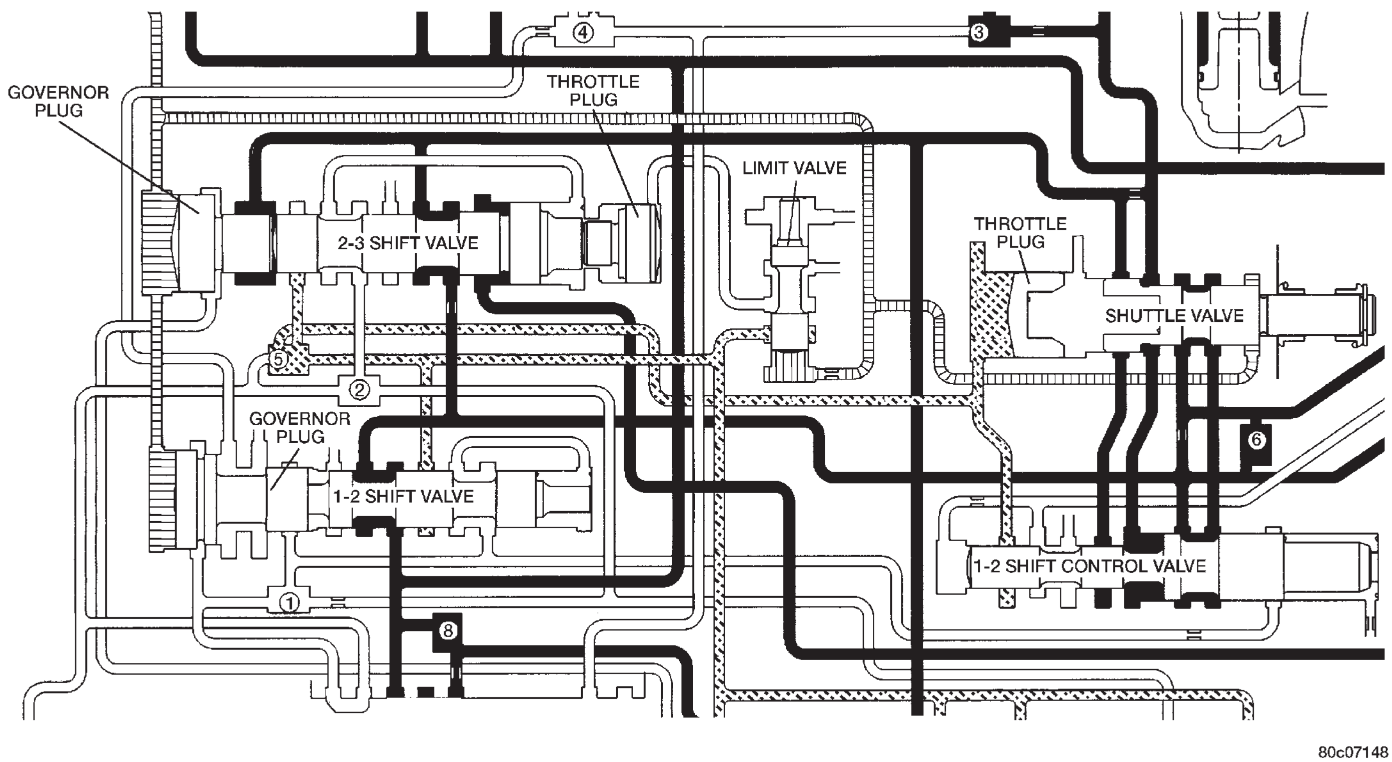


Fig. 270 2-3 Shift Valve-After Shift

VALVE BODY (Continued)

3-4 SHIFT VALVE

The PCM energizes the overdrive solenoid during the 3-4 upshift (Fig. 271). This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position (Fig. 272). This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston.

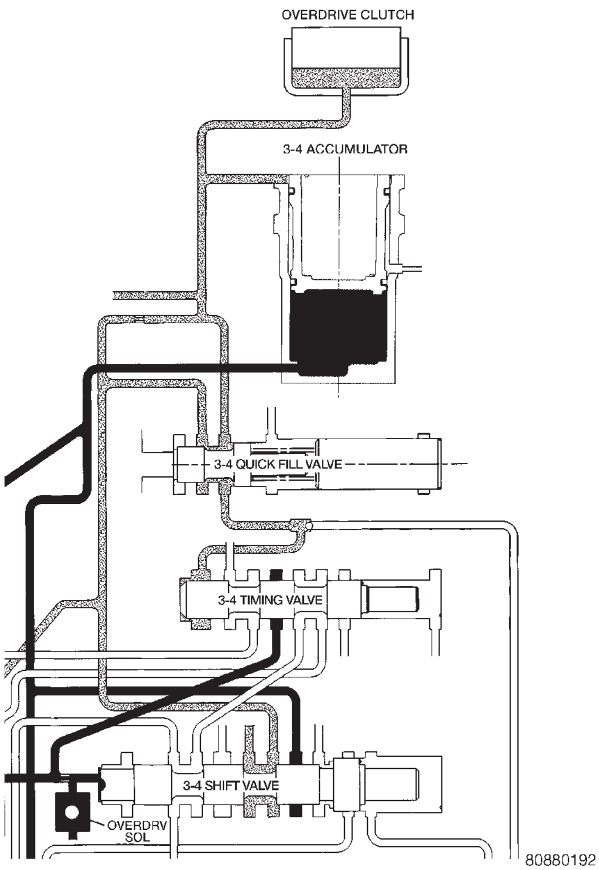


Fig. 271 3-4 Shift Valve Before Shift

3-4 TIMING VALVE

The 3-4 timing valve is moved by line pressure coming through the 3-4 shift valve (Fig. 272). After the shift, the timing valve holds the 2-3 shift valve in an upshift position. The purpose is to prevent the 2-3 valve from downshifting before the 3-4 valve (Fig. 271).

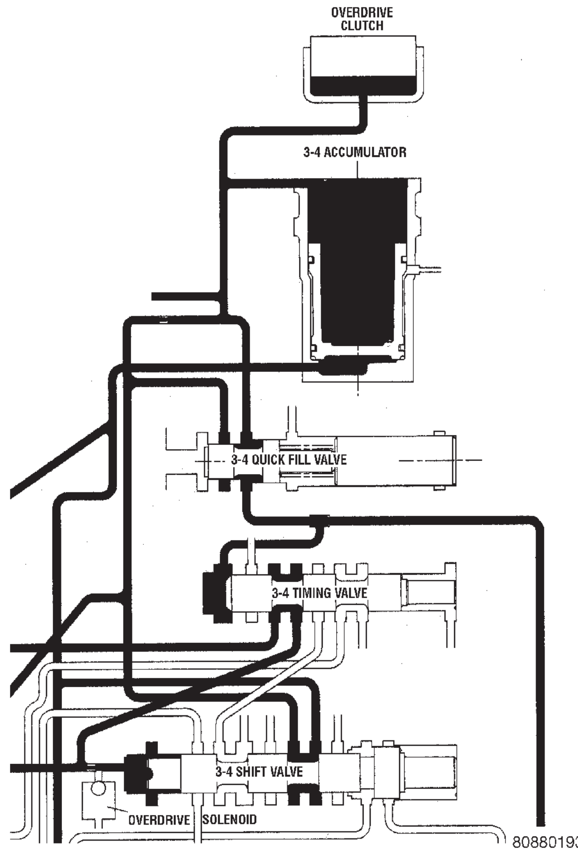


Fig. 272 3-4 Shift Valve After Shift

3-4 QUICK FILL VALVE

The 3-4 quick fill valve provides faster engagement of the overdrive clutch during 3-4 upshifts. The valve temporarily bypasses the clutch piston feed orifice at the start of a 3-4 upshift (Fig. 271). This exposes a larger passage into the piston retainer resulting in a much faster clutch fill and apply sequence. The quick fill valve does not bypass the regular clutch feed orifice throughout the 3-4 upshift. Instead, once a predetermined pressure develops within the clutch, the valve closes the bypass (Fig. 272). Clutch fill is then completed through the regular feed orifice.

VALVE BODY (Continued)

THROTTLE VALVE

In all gear positions the throttle valve (Fig. 273) is being supplied with line pressure. The throttle valve meters and reduces the line pressure that now becomes throttle pressure. The throttle valve is moved by a spring and the kickdown valve, which is mechanically connected to the throttle. The larger the throttle opening, the higher the throttle pressure (to a maximum of line pressure). The smaller the throttle opening, the lower the throttle pressure (to a minimum of zero at idle). As engine speed increases, the increase in pump speed increases pump output. The increase in pressure and volume must be regulated to maintain the balance within the transmission. To do this, throttle pressure is routed to the reaction area on the right side of the throttle pressure plug (in the regulator valve).

The higher engine speed and line pressure would open the vent too far and reduce line pressure too much. Throttle pressure, which increases with engine speed (throttle opening), is used to oppose the movement of the pressure valve to help control the metering passage at the vent. The throttle pressure is combined with spring pressure to reduce the force of the throttle pressure plug on the pressure valve. The larger spring at the right closes the regulator valve passage and maintains or increases line pressure. The increased line pressure works against the reaction area of the line pressure plug and the reaction area left of land #3 simultaneously moves the regulator valve train to the right and controls the metering passage.

The kickdown valve, along with the throttle valve, serve to delay upshifts until the correct vehicle speed has been reached. It also controls downshifts upon driver demand, or increased engine load. If these valves were not in place, the shift points would be at the same speed for all throttle positions. The kickdown valve is actuated by a cam connected to the throttle. This is accomplished through either a linkage or a cable. The cam forces the kickdown valve toward the throttle valve compressing the spring between them and moving the throttle valve. As the throttle valve land starts to uncover its port, line pressure is “metered” out into the circuits and viewed as throttle pressure. This increased throttle pressure is metered out into the circuits it is applied to: the 1-2 and 2-3 shift valves. When the throttle pressure is high enough, a 3-2 downshift will occur. If the vehicle speed is low enough, a 2-1 downshift will occur.

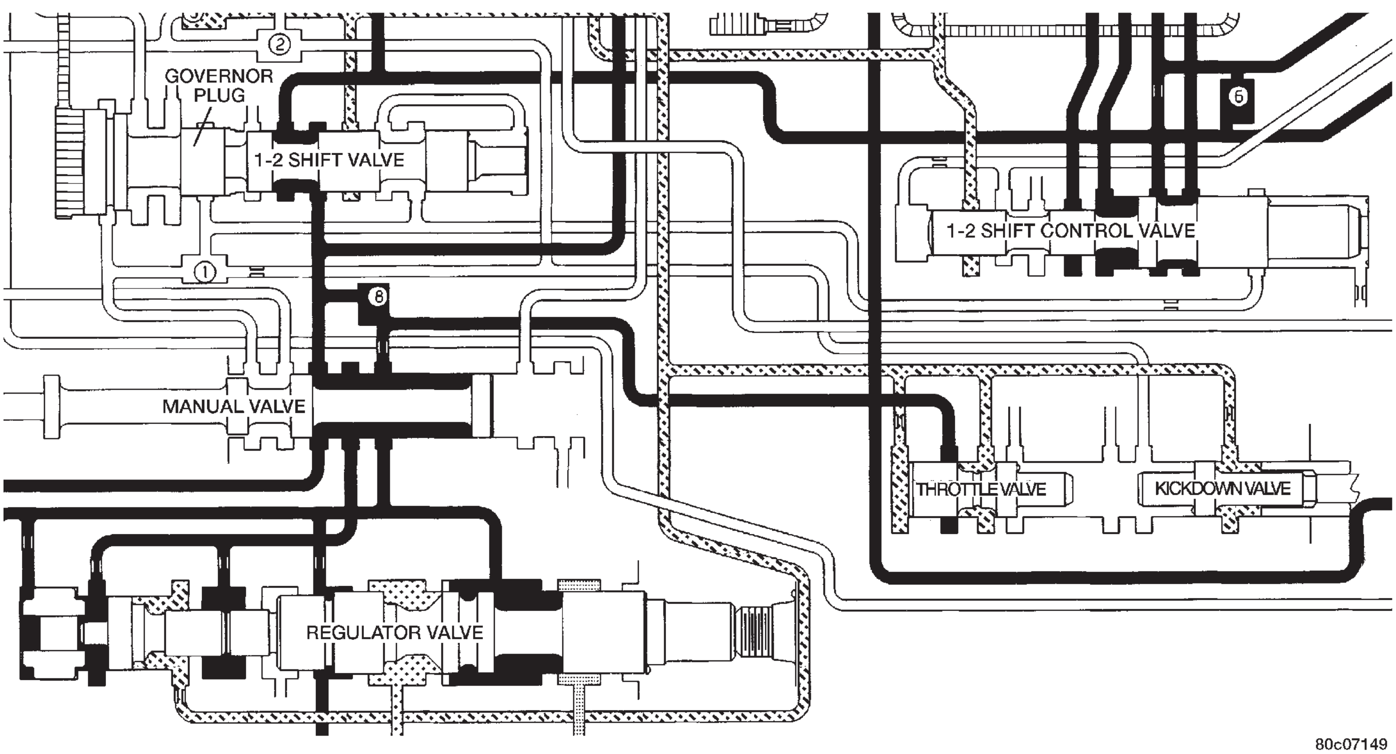


Fig. 273 Throttle Valve

VALVE BODY (Continued)

SWITCH VALVE

When the transmission is in Drive Second before the TCC application occurs (Fig. 274), the pressure regulator valve is supplying torque converter pressure to the switch valve. The switch valve directs this pressure through the transmission input shaft, into the converter, through the converter, back out between the input shaft and the reaction shaft, and back up to the switch valve. From the switch valve, the fluid pressure is directed to the transmission cooler, and lubrication pressure returns from the cooler to lubricate different portions of the transmission.

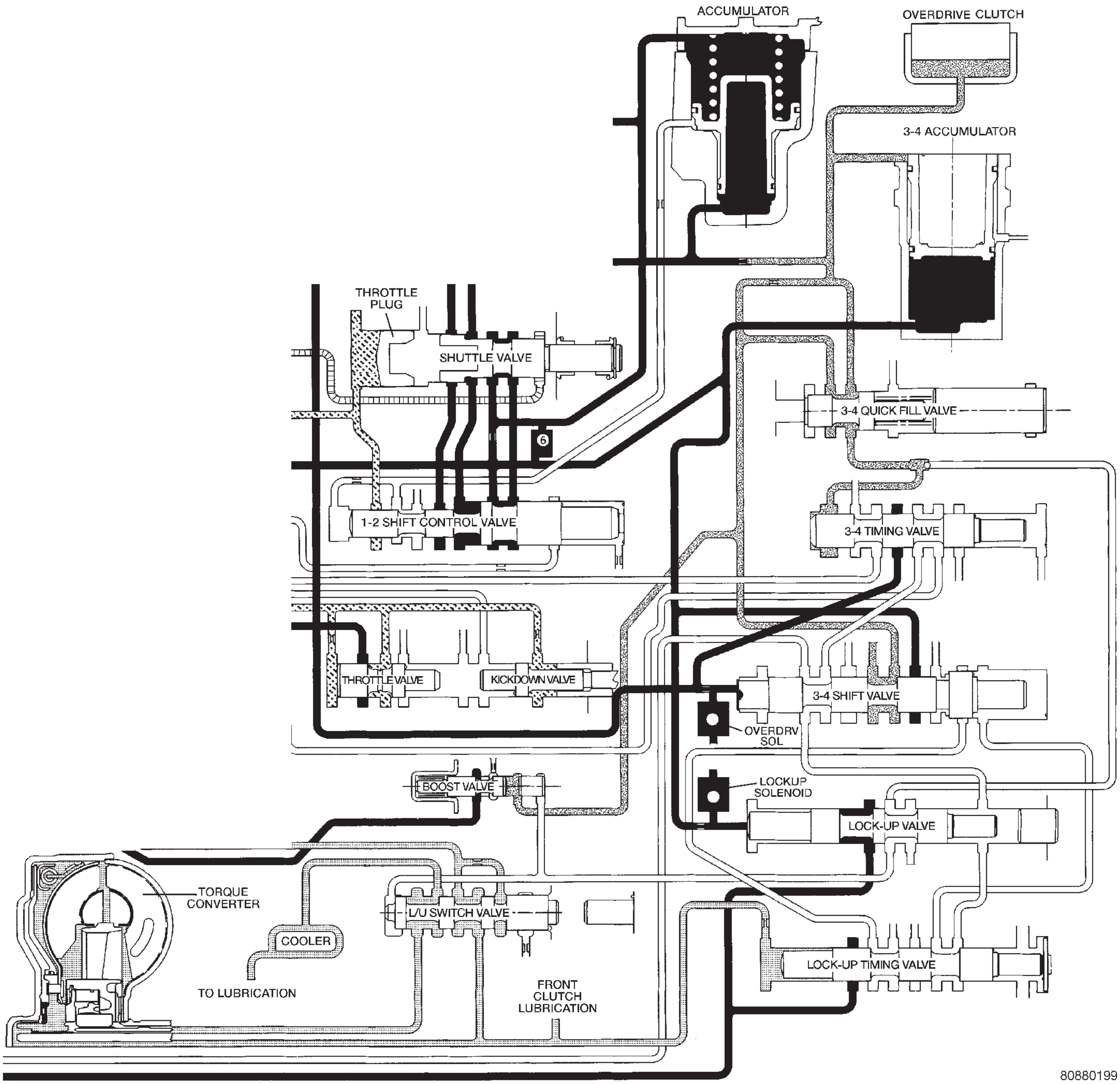


Fig. 274 Switch Valve-Torque Converter Unlocked

VALVE BODY (Continued)

Once the TCC control valve has moved to the right (Fig. 275), line pressure is directed to the tip of the switch valve, forcing the valve to the right. The switch valve now vents oil from the front of the piston in the torque converter, and supplies line pressure to the (rear) apply side of the torque converter piston. This pressure differential causes the piston to apply against the friction material, cutting off any further flow of line pressure oil. After the switch valve is shuttled right allowing line pressure to engage the TCC, torque converter pressure is directed past the switch valve into the transmission cooler and lubrication circuits.

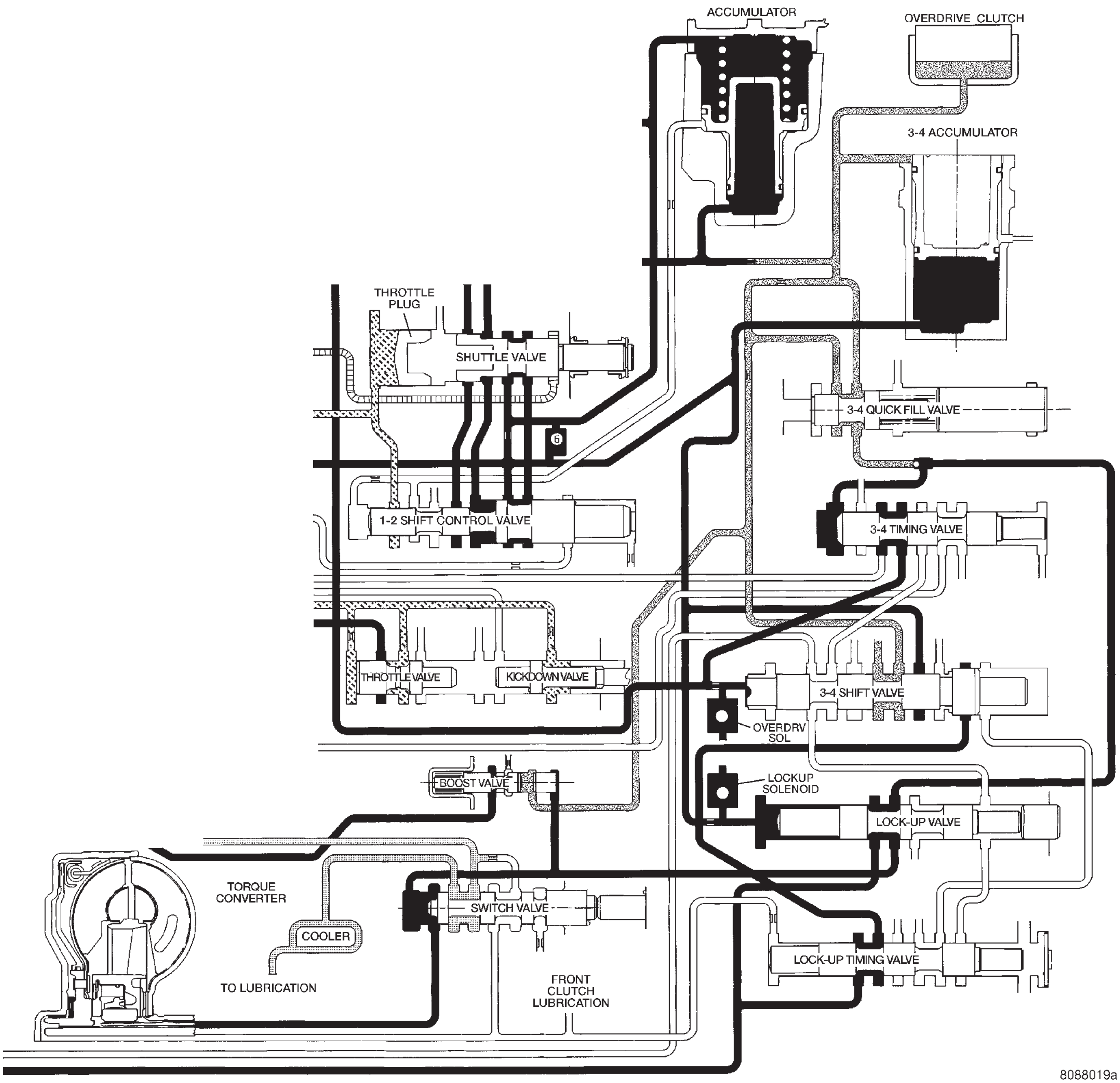


Fig. 275 Switch Valve-Torque Converter Locked

VALVE BODY (Continued)

MANUAL VALVE

The manual valve (Fig. 276) is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the side of the valve body. The valve is connected mechanically by either a cable or linkage to the gear-shift mechanism. The valve is held in each of its positions by a spring-loaded roller or ball that engages the “roostercomb” of the manual valve lever.

CONVERTER CLUTCH LOCK-UP VALVE

The torque converter clutch (TCC) lock-up valve controls the back (ON) side of the torque converter clutch. When the PCM energizes the TCC solenoid to engage the converter clutch piston, pressure is applied to the TCC lock-up valve which moves to the right and applies pressure to the torque converter clutch.

CONVERTER CLUTCH LOCK-UP TIMING VALVE

The torque converter clutch (TCC) lock-up timing valve is there to block any 4-3 downshift until the TCC is completely unlocked and the clutch is disengaged.

SHUTTLE VALVE

The assembly is contained in a bore in the valve body above the shift valves. When the manual valve is positioned in the Drive range, throttle pressure acts on the throttle plug of the shuttle valve (Fig. 268) to move it against a spring, increasing the spring force on the shuttle valve. During a part or full throttle 1-2 upshift, the throttle plug is bottomed by throttle pressure, holding the shuttle valve to the right against governor pressure, and opening a by–pass circuit. The shuttle valve controls the quality of the kickdown shift by restricting the rate of fluid discharge from the front clutch and servo release circuits. During a 3-2 kickdown, fluid discharges through the shuttle by-pass circuit. When the shuttle valve closes the by-pass circuit, fluid discharge is restricted and controlled for the application of the front band. During a 2-3 “lift foot” upshift, the shuttle valve by-passes the restriction to allow full fluid flow through the by-pass groove for a faster release of the band.

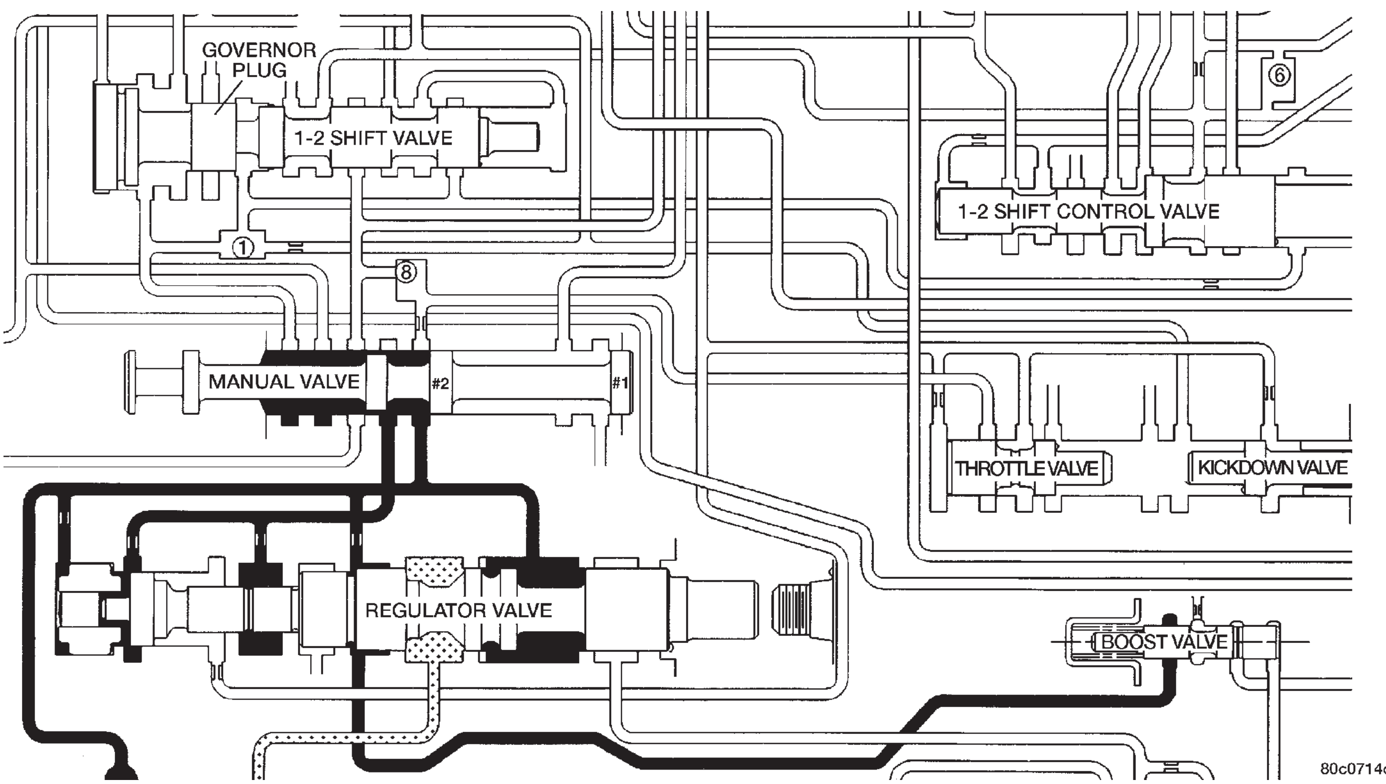


Fig. 276 Manual Valve

VALVE BODY (Continued)

BOOST VALVE

The boost valve (Fig. 277) provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts (Fig. 278), and when accelerating in fourth gear. The boost valve also serves to increase line pressure during torque converter lock-up.

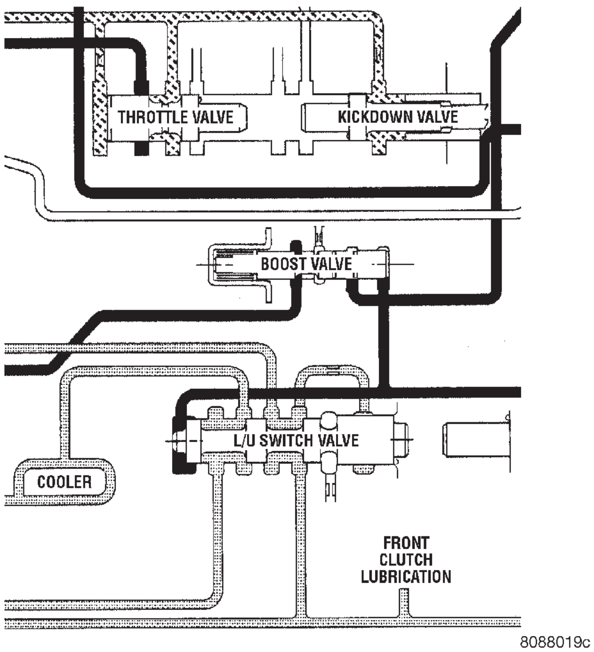


Fig. 277 Boost Valve Before Lock-up

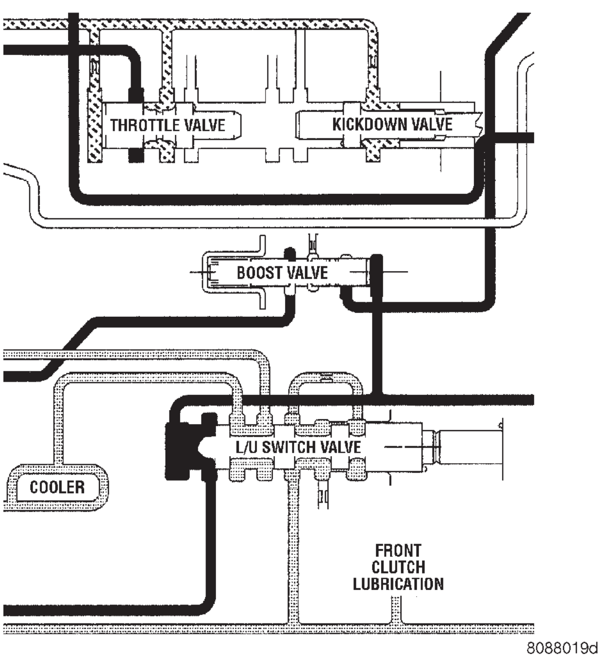


Fig. 278 Boost Valve After Lock-up

REMOVAL

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components.

The only replaceable valve body components are:

- Manual lever.
- Manual lever washer, seal, E-clip, and shaft seal.
- Manual lever detent ball.
- Throttle lever.
- Fluid filter.
- Pressure adjusting screw bracket.
- Governor pressure solenoid.
- Governor pressure sensor (includes transmission temperature thermistor).
- Converter clutch/overdrive solenoid assembly and harness.
- Governor housing gasket.
- Solenoid case connector O-rings.

(1) Shift transmission into NEUTRAL.

(2) Raise vehicle.

(3) Remove gearshift and throttle levers from shaft of valve body manual lever.

(4) Disconnect wires at solenoid case connector (Fig. 279).

(5) Position drain pan under transmission oil pan.

(6) Remove transmission oil pan and gasket.

(7) Remove fluid filter from valve body.

(8) Remove bolts attaching valve body to transmission case.

(9) Lower valve body enough to remove accumulator piston and springs.

(10) Work manual lever shaft and electrical connector out of transmission case.

(11) Lower valve body, rotate valve body away from case, pull park rod out of sprag, and remove valve body (Fig. 280).

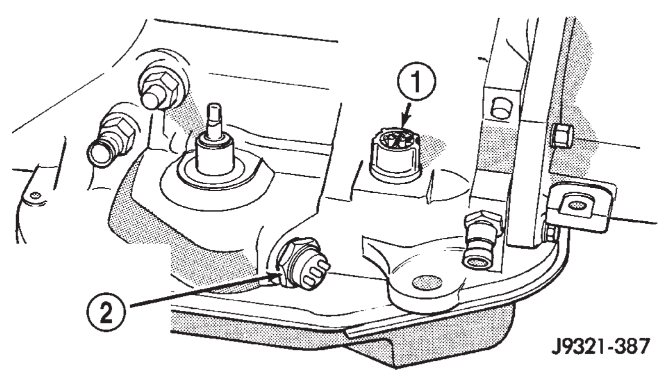


Fig. 279 Transmission Case Connector

1 - SOLENOID CASE CONNECTOR
2 - PARK/NEUTRAL POSITION SWITCH

VALVE BODY (Continued)

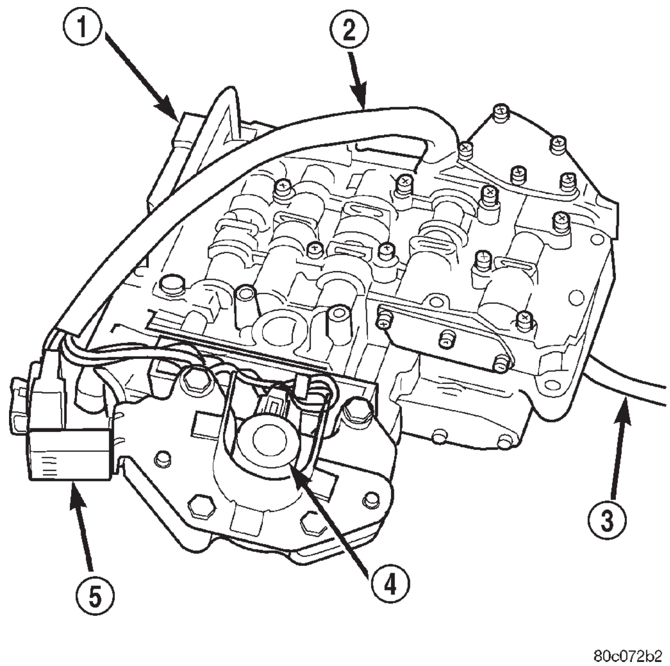


Fig. 280 Valve Body

1 - VALVE BODY
2 - WIRE HARNESS
3 - PARK ROD
4 - GOVERNOR PRESSURE SOLENOID
5 - GOVERNOR PRESSURE SENSOR

DISASSEMBLY

CAUTION: Do not clamp any valve body component in a vise. This practice can damage the component resulting in unsatisfactory operation after assembly and installation. Do not use pliers to remove any of the valves, plugs or springs and do not force any of the components out or into place. The valves and valve body housings will be damaged if force is used. Tag or mark the valve body springs for reference as they are removed. Do not allow them to become intermixed.

(1) Disconnect wires from governor pressure sensor and solenoid.

(2) Remove screws attaching governor body and retainer plate to transfer plate.

(3) Remove retainer plate, governor body and gasket from transfer plate.

(4) Remove governor pressure sensor from governor body.

(5) Remove governor pressure solenoid by pulling it straight out of bore in governor body. Remove and discard solenoid O-rings if worn, cut, or torn.

(6) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 281). Retain shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.

(7) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 282).

(8) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 283).

(9) Remove solenoid and harness assembly from valve body (Fig. 284).

(10) Remove boost valve cover (Fig. 285).

(11) Remove boost valve retainer, valve spring and boost valve (Fig. 286).

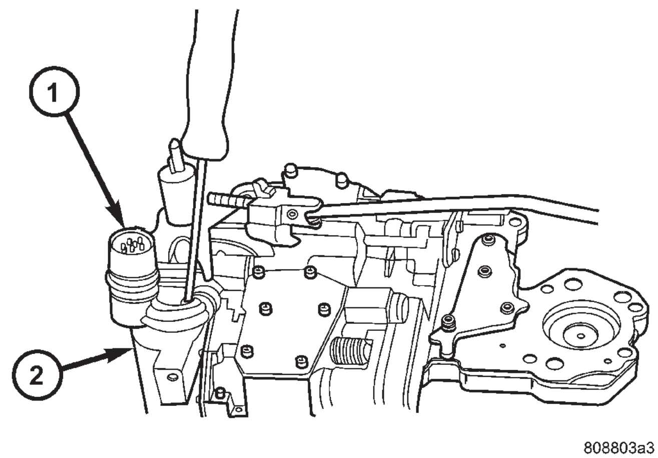


Fig. 281 Solenoid Harness Case Connector Shoulder Bolt

1 - SOLENOID HARNESS CASE CONNECTOR
2 - 3-4 ACCUMULATOR HOUSING

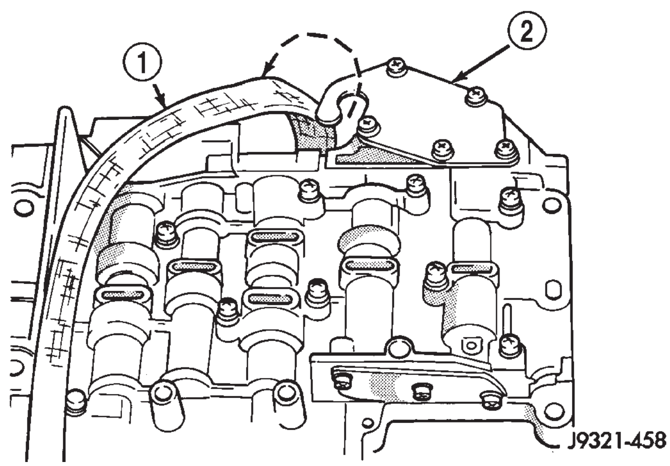


Fig. 282 Unhooking Solenoid Harness From Accumulator Cover Plate

1 - OVERDRIVE/CONVERTER SOLENOID WIRE HARNESS
2 - 3-4 ACCUMULATOR COVER PLATE

VALVE BODY (Continued)

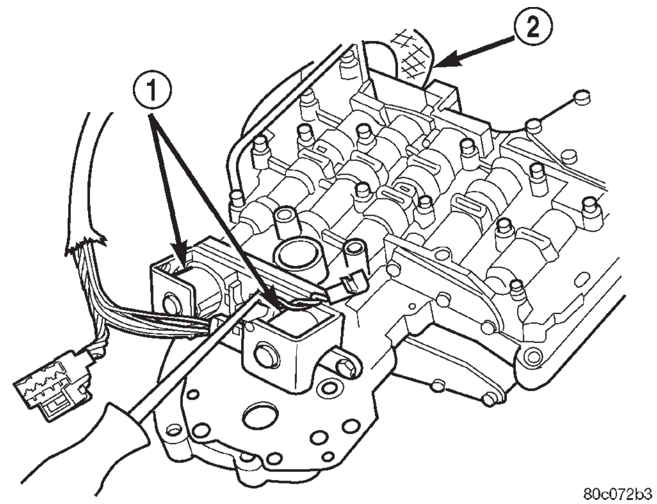


Fig. 283 Solenoid Assembly Screws

1 - OVERDRIVE/CONVERTER CLUTCH SOLENOID ASSEMBLY
2 - HARNESS

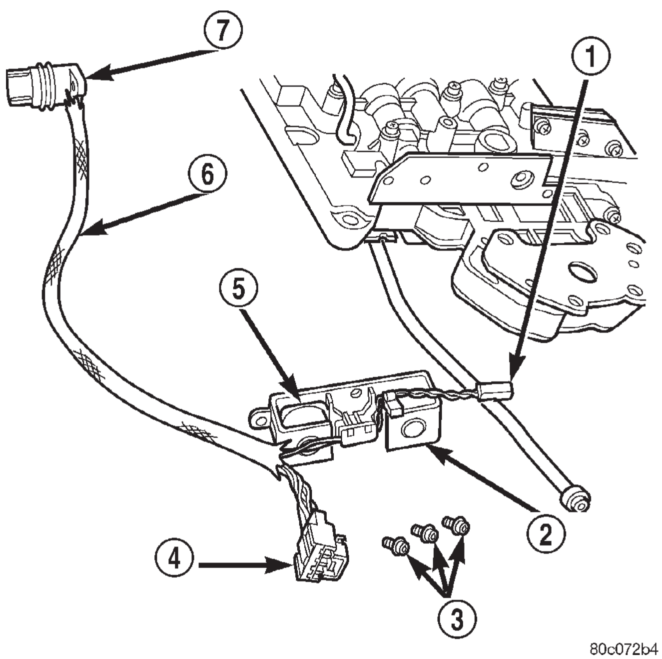


Fig. 284 Solenoid Assembly

1 - GOVERNOR SOLENOID WIRES
2 - CONVERTER CLUTCH SOLENOID
3 - SOLENOID SCREWS
4 - GOVERNOR SENSOR WIRES
5 - OVERDRIVE SOLENOID
6 - HARNESS
7 - CASE CONNECTOR

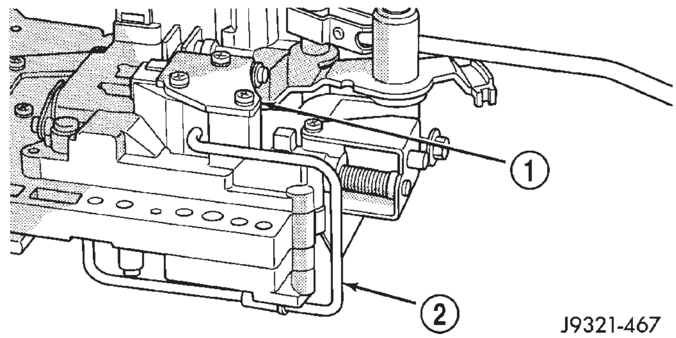


Fig. 285 Boost Valve

1 - BOOST VALVE HOUSING AND COVER
2 - BOOST VALVE TUBE

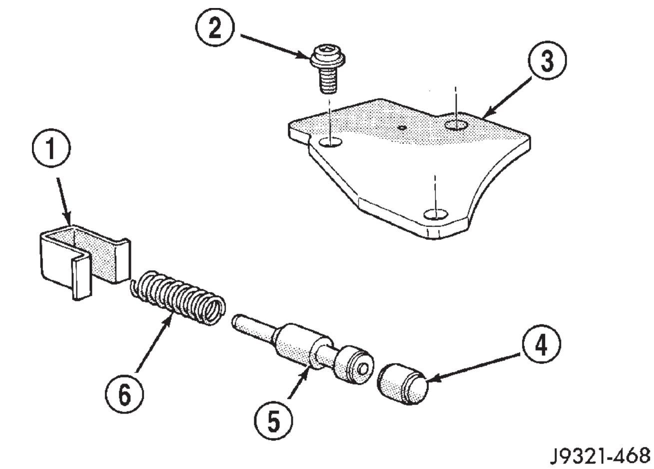


Fig. 286 Boost Valve Components

1 - SPRING AND VALVE RETAINER
2 - COVER SCREWS
3 - BOOST VALVE COVER
4 - BOOST VALVE PLUG
5 - BOOST VALVE
6 - BOOST VALVE SPRING

(12) Secure detent ball and spring with Retainer Tool 6583 (Fig. 287).

(13) Remove park rod E-clip and separate rod from manual lever (Fig. 288).

(14) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 289).

(15) Remove manual lever and throttle lever (Fig. 290). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.

VALVE BODY (Continued)

(16) Position pencil magnet next to detent housing to catch detent ball and spring. Then carefully remove Retainer Tool 6583 and remove detent ball and spring (Fig. 291).

(17) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 292). Hold bracket firmly against spring tension while removing last screw.

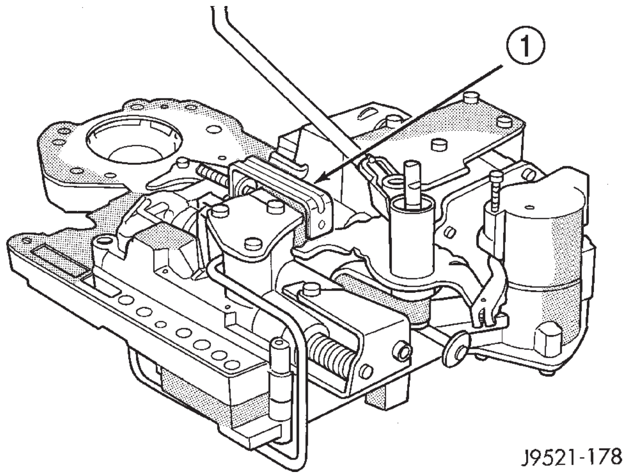


Fig. 287 Detent Ball And Spring

1 - SPECIAL TOOL 6583 POSITIONED ON DETENT HOUSING

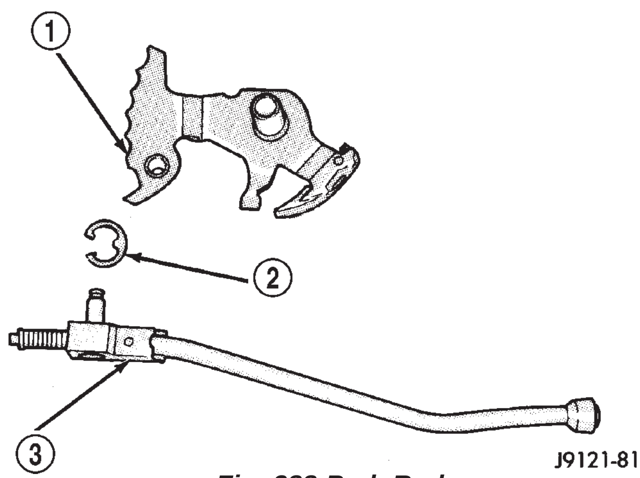


Fig. 288 Park Rod

1 - MANUAL LEVER
2 - E-CLIP
3 - PARK ROD

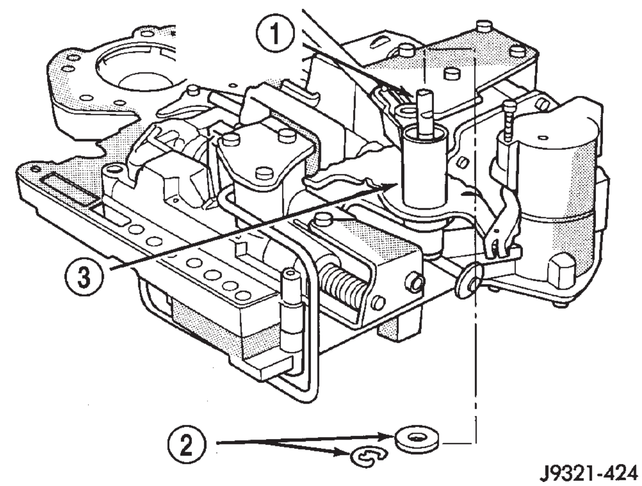


Fig. 289 Throttle Lever E-Clip And Washer

1 - THROTTLE LEVER SHAFT
2 - E-CLIP AND WASHER
3 - MANUAL SHAFT

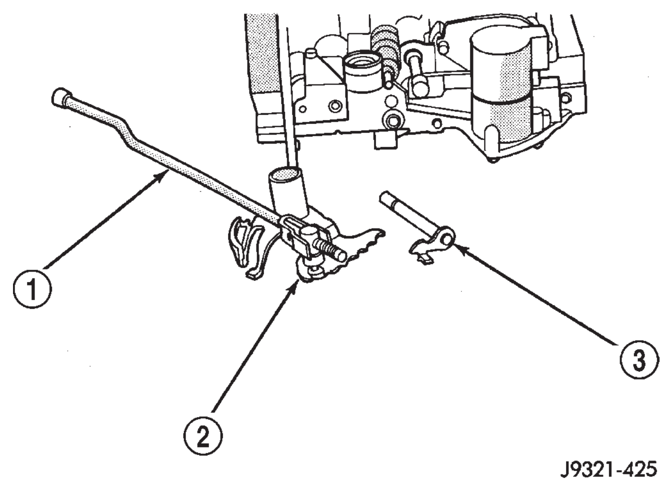


Fig. 290 Manual And Throttle Lever

1 - PARK ROD
2 - MANUAL LEVER ASSEMBLY
3 - THROTTLE LEVER

VALVE BODY (Continued)

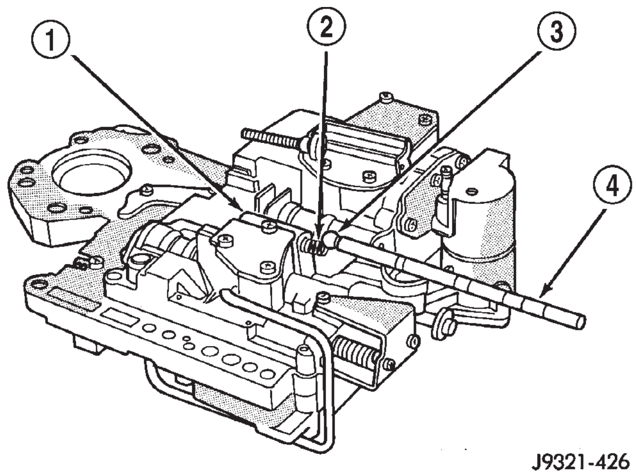


Fig. 291 Detent Ball And Spring

1 - DETENT HOUSING
2 - DETENT SPRING
3 - DETENT BALL
4 - PENCIL MAGNET

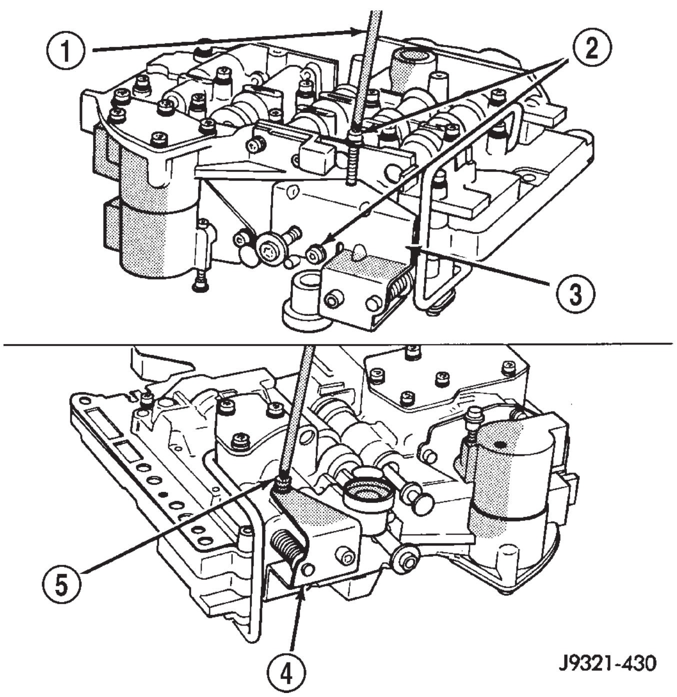


Fig. 292 Adjusting Screw Bracket Fastener

1 - T25 TORX™ BIT
2 - REMOVE THESE SCREWS FIRST
3 - BRACKET
4 - BRACKET
5 - REMOVE THIS SCREW LAST

(18) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 293). Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.

(19) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 294).

(20) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 294).

(21) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 295).

(22) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter clutch valve plug and spring (Fig. 296).

(23) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 297).

(24) Bend back tabs on boost valve tube brace (Fig. 298).

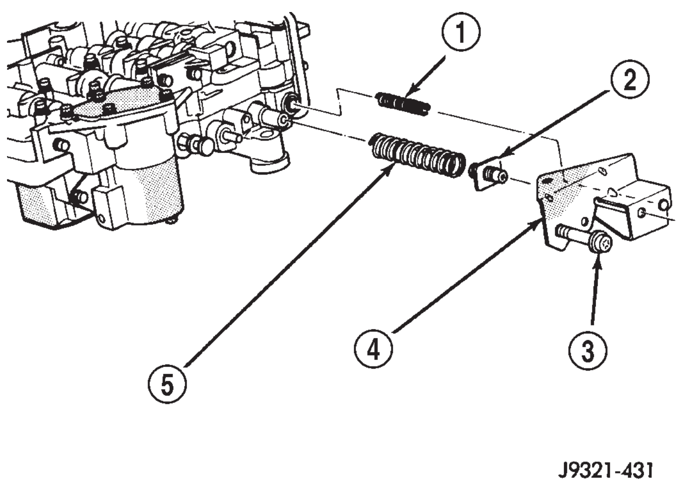


Fig. 293 Adjusting Screw Bracket And Spring

1 - SWITCH VALVE SPRING
2 - LINE PRESSURE SCREW
3 - THROTTLE PRESSURE ADJUSTING SCREW
4 - ADJUSTING SCREW BRACKET
5 - PRESSURE REGULATOR VALVE SPRING

VALVE BODY (Continued)

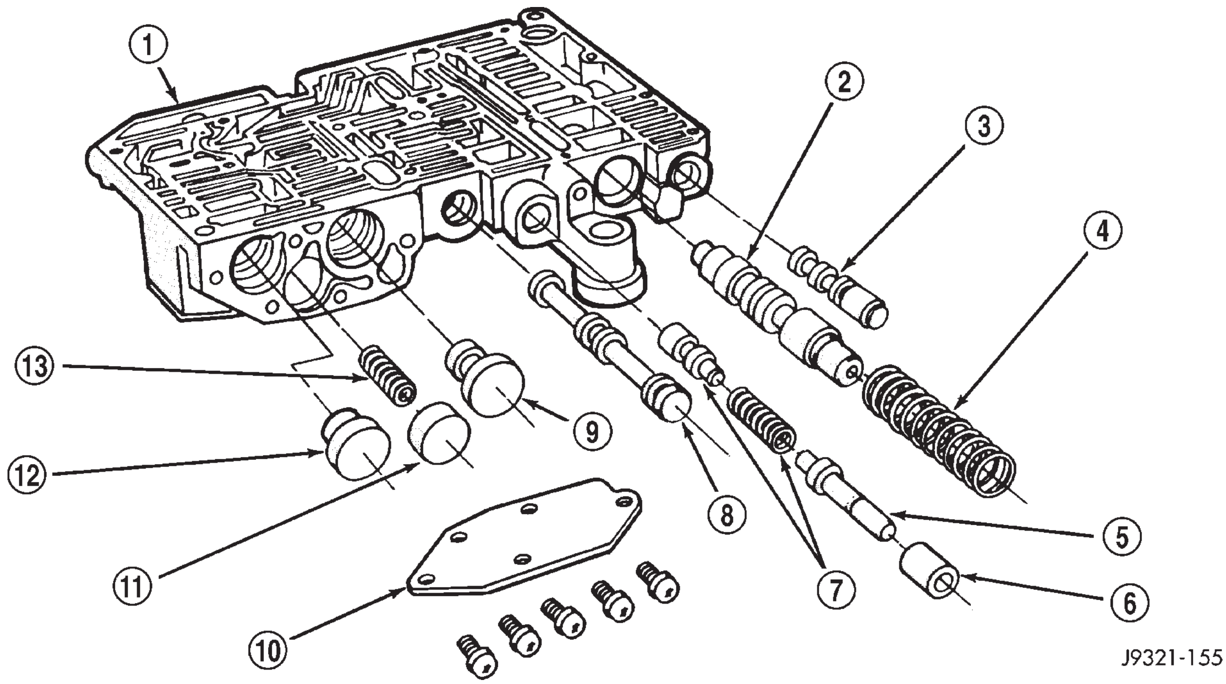


Fig. 294 Upper Housing Control Valve Locations

1 - UPPER HOUSING
2 - REGULATOR VALVE
3 - SWITCH VALVE
4 - REGULATOR VALVE SPRING
5 - KICKDOWN VALVE
6 - KICKDOWN DETENT
7 - THROTTLE VALVE AND SPRING
8 - MANUAL VALVE
9 - 1-2 GOVERNOR PLUG
10 - GOVERNOR PLUG COVER
11 - THROTTLE PLUG
12 - 2-3 GOVERNOR PLUG
13 - SHUTTLE VALVE PRIMARY SPRING

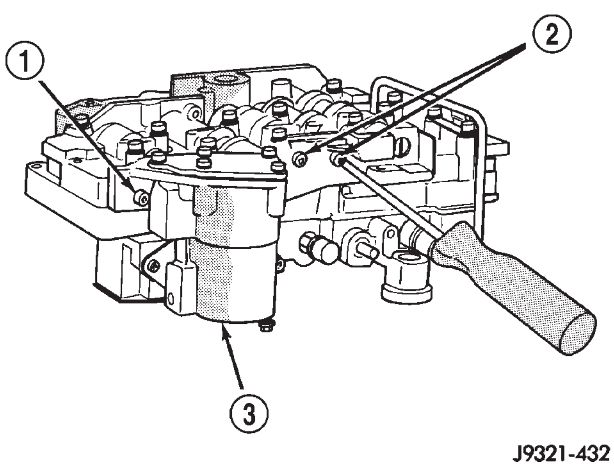


Fig. 295 Accumulator Housing Screw Locations

1 - LOOSEN THIS SCREW
2 - REMOVE THESE SCREWS
3 - 3-4 ACCUMULATOR HOUSING

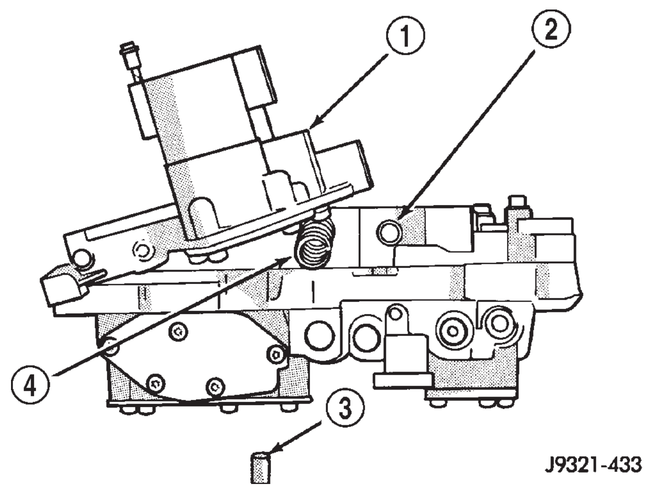


Fig. 296 3-4 Shift And Converter Clutch Valve Springs And Plug

1 - ACCUMULATOR HOUSING
2 - CONVERTER CLUTCH VALVE SPRING
3 - CLUTCH VALVE PLUG
4 - 3-4 SHIFT VALVE SPRING

VALVE BODY (Continued)

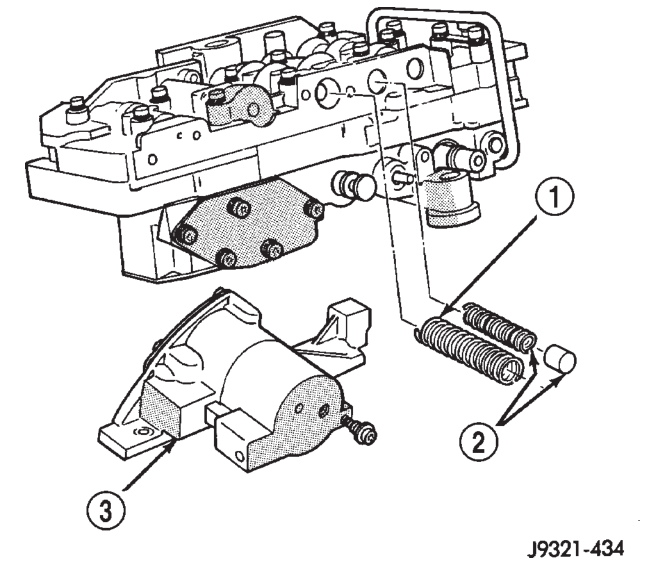


Fig. 297 Accumulator Housing, Valve Springs And Plug

1 - 3-4 SHIFT VALVE SPRING
2 - CONVERTER CLUTCH VALVE SPRING AND PLUG
3 - 3-4 ACCUMULATOR HOUSING

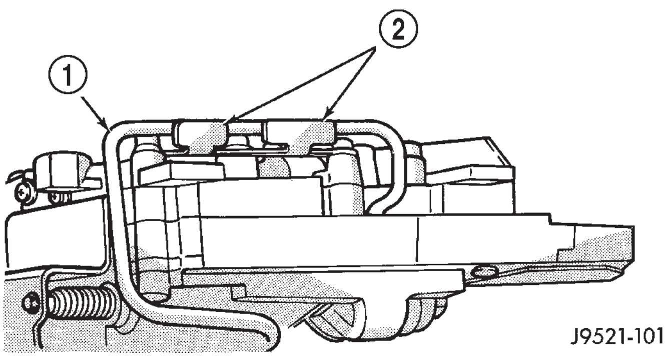


Fig. 298 Boost Valve Tube Brace

1 - BOOST VALVE TUBE
2 - TUBE BRACE (DOUBLE TAB)

(25) Remove boost valve connecting tube (Fig. 299). Disengage tube from upper housing port first. Then rock opposite end of tube back and forth to work it out of lower housing.

CAUTION: Do not use tools to loosen or pry the connecting tube out of the valve body housings. Loosen and remove the tube by hand only.

(26) Turn valve body over so lower housing is facing upward (Fig. 300). In this position, the two check balls in upper housing will remain in place and not fall out when lower housing and separator plate are removed.

(27) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 300). Note position of boost valve tube brace for assembly reference.

(28) Remove lower housing and overdrive separator plate from transfer plate (Fig. 300).

(29) Remove the ECE check ball from the transfer plate (Fig. 301). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(30) Remove transfer plate from upper housing (Fig. 302).

(31) Turn transfer plate over so upper housing separator plate is facing upward.

(32) Remove upper housing separator plate from transfer plate (Fig. 303). Note position of filter in separator plate for assembly reference.

(33) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 304).

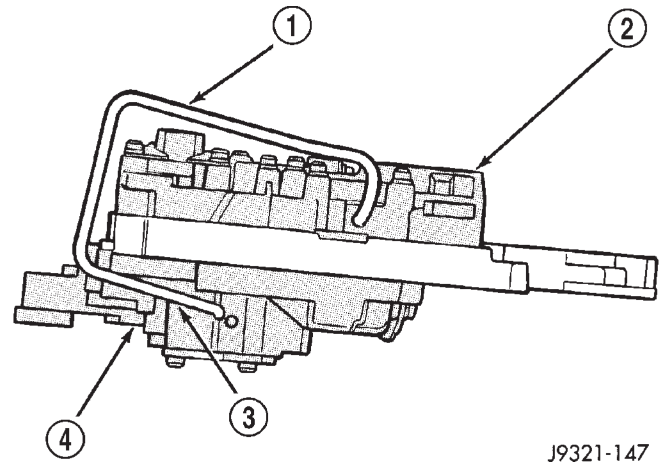


Fig. 299 Boost Valve Tube

1 - BOOST VALVE TUBE
2 - LOWER HOUSING
3 - DISENGAGE THIS END OF TUBE FIRST
4 - UPPER HOUSING

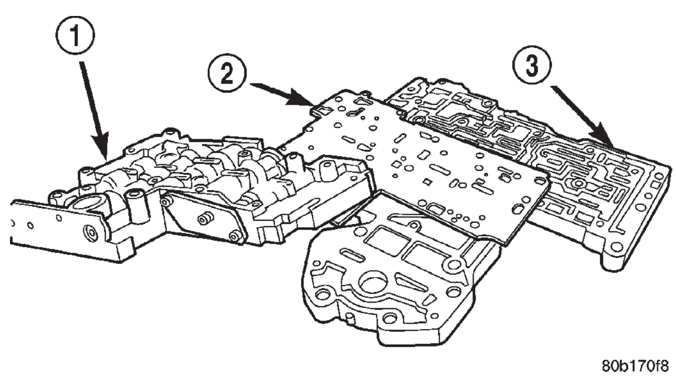


Fig. 300 Lower Housing

1 - LOWER HOUSING
2 - OVERDRIVE SEPARATOR PLATE
3 - TRANSFER PLATE AND UPPER HOUSING

VALVE BODY (Continued)

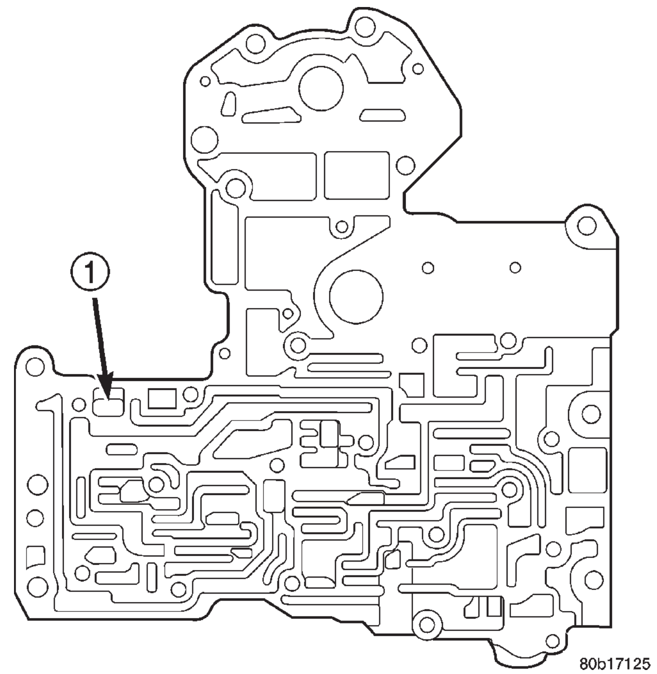


Fig. 301 ECE Check Ball

1 - ECE CHECK BALL (3/16″)

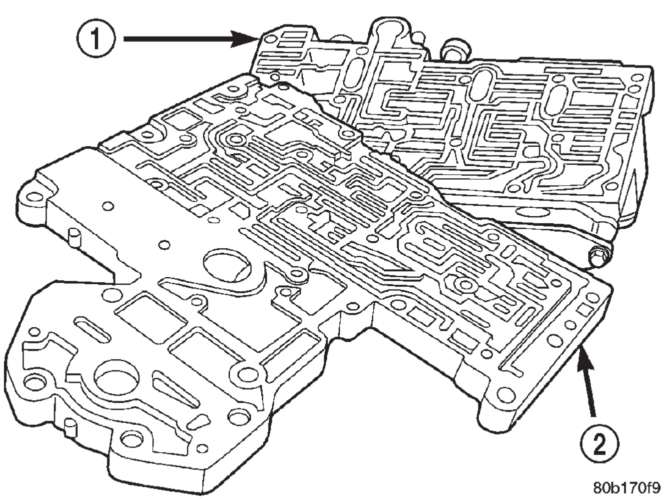


Fig. 302 Transfer Plate

1 - UPPER HOUSING
2 - TRANSFER PLATE

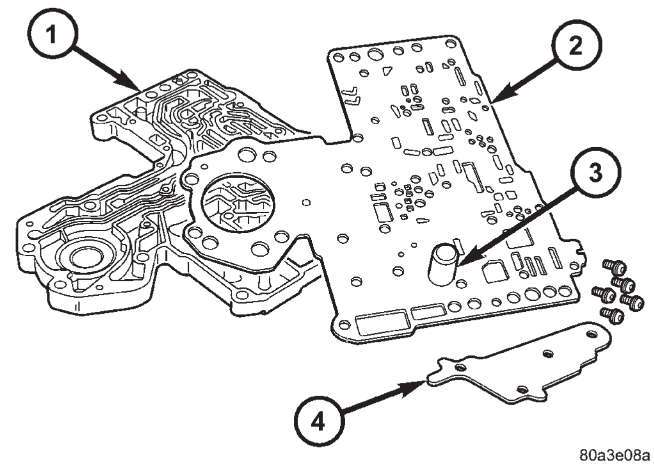


Fig. 303 Upper Housing Separator Plate

1 - TRANSFER PLATE
2 - UPPER HOUSING SEPARATOR PLATE
3 - FILTER SCREEN
4 - BRACE

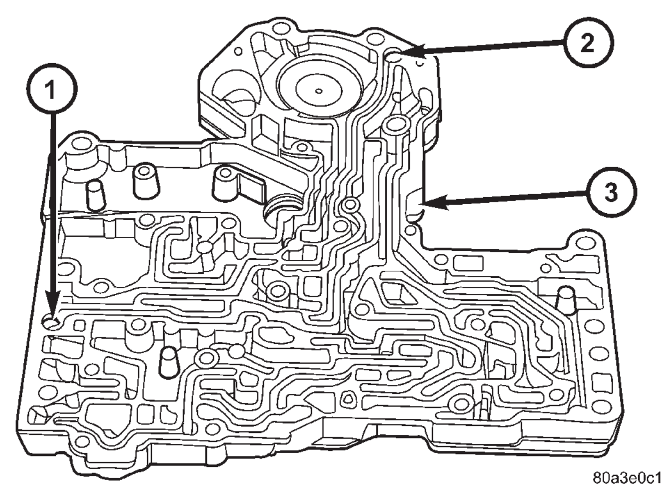


Fig. 304 Rear Clutch And Rear Servo Check Ball

1 - REAR CLUTCH CHECK BALL
2 - REAR SERVO CHECK BALL
3 - TRANSFER PLATE

VALVE BODY (Continued)

VALVE BODY UPPER HOUSING

(1) Note location of check balls in valve body upper housing (Fig. 305). Then remove the one large diameter and the six smaller diameter check balls.

(2) Remove governor plug and shuttle valve covers (Fig. 307).

(3) Remove E-clip that secures shuttle valve secondary spring on valve stem (Fig. 306).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 307).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 294).

(7) Turn upper housing around and remove limit valve and shift valve covers (Fig. 308).

(8) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 308).

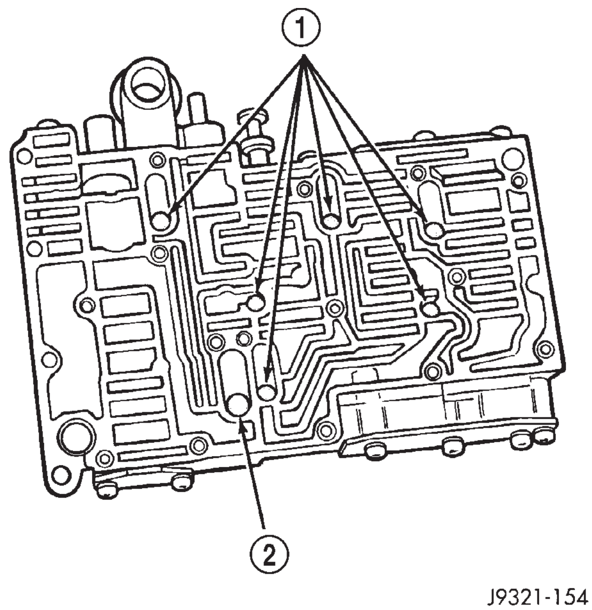


Fig. 305 Check Ball Locations In Upper Housing

1 - SMALL DIAMETER CHECK BALLS (6)
2 - LARGE DIAMETER CHECK BALL (1)

(9) Remove 1-2 shift control valve and spring (Fig. 308).

(10) Remove 1-2 shift valve and spring (Fig. 308).

(11) Remove 2-3 shift valve and spring from valve body (Fig. 308).

(12) Remove pressure plug cover (Fig. 308).

(13) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 308).

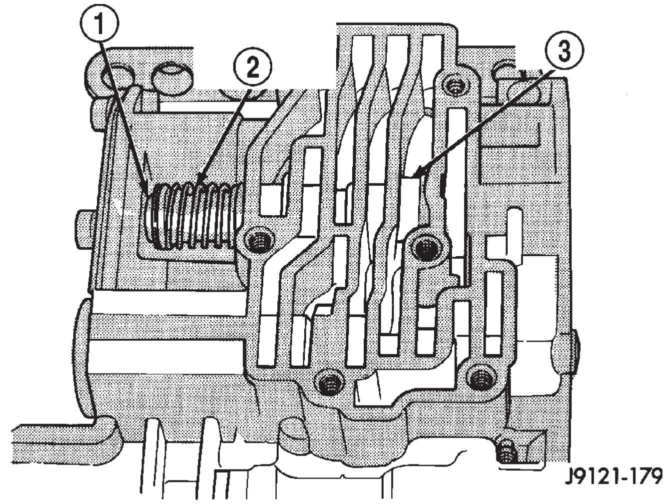


Fig. 306 Shuttle Valve E-Clip And Secondary Spring Location

1 - E-CLIP
2 - SECONDARY SPRING AND GUIDES
3 - SHUTTLE VALVE

VALVE BODY (Continued)

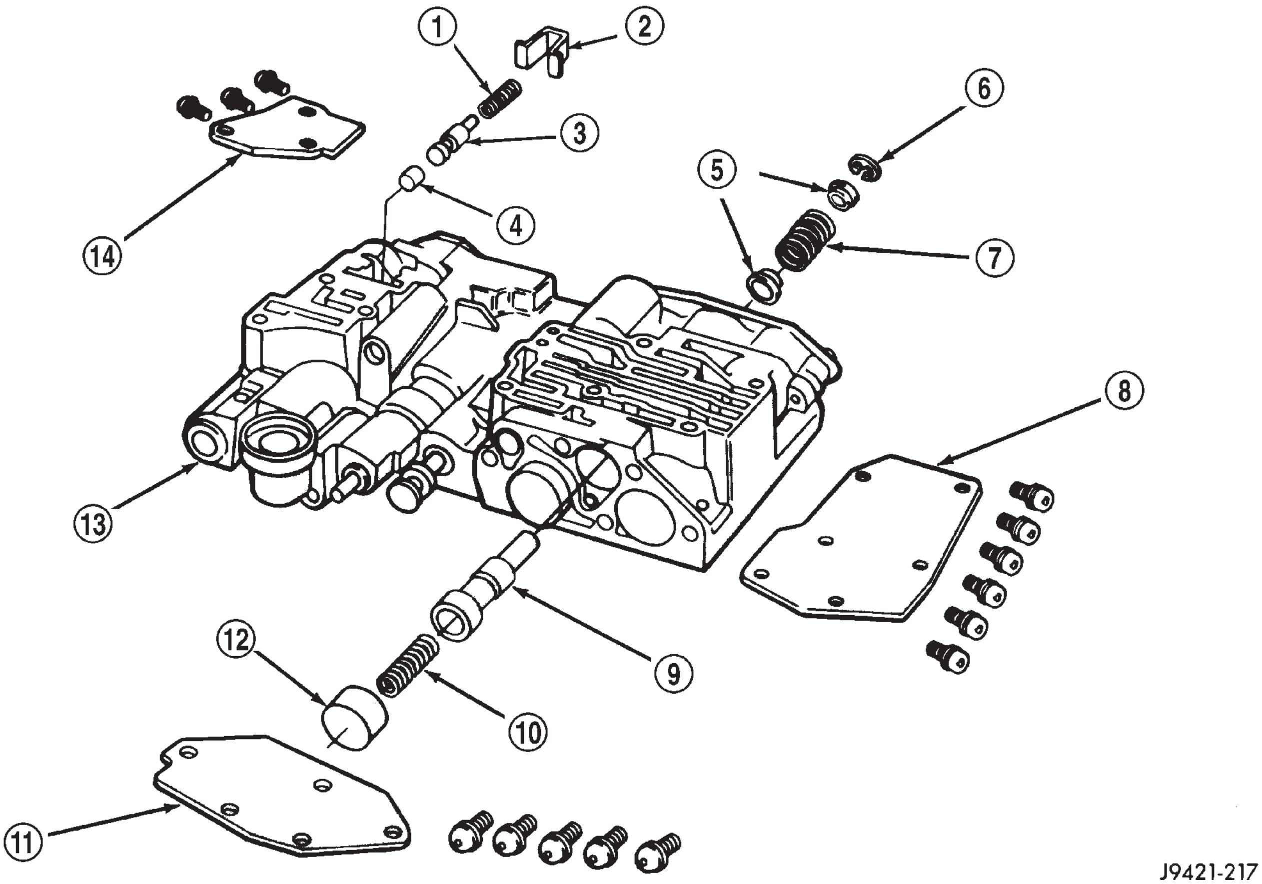


Fig. 307 Shuttle And Boost Valve Components

1 - SPRING
2 - RETAINER
3 - BOOST VALVE
4 - BOOST VALVE PLUG
5 - SPRING GUIDES
6 - E-CLIP
7 - SHUTTLE VALVE SECONDARY SPRING
8 - SHUTTLE VALVE COVER
9 - SHUTTLE VALVE
10 - SHUTTLE VALVE PRIMARY SPRING
11 - GOVERNOR PLUG COVER
12 - THROTTLE PLUG
13 - UPPER HOUSING
14 - BOOST VALVE COVER

VALVE BODY (Continued)

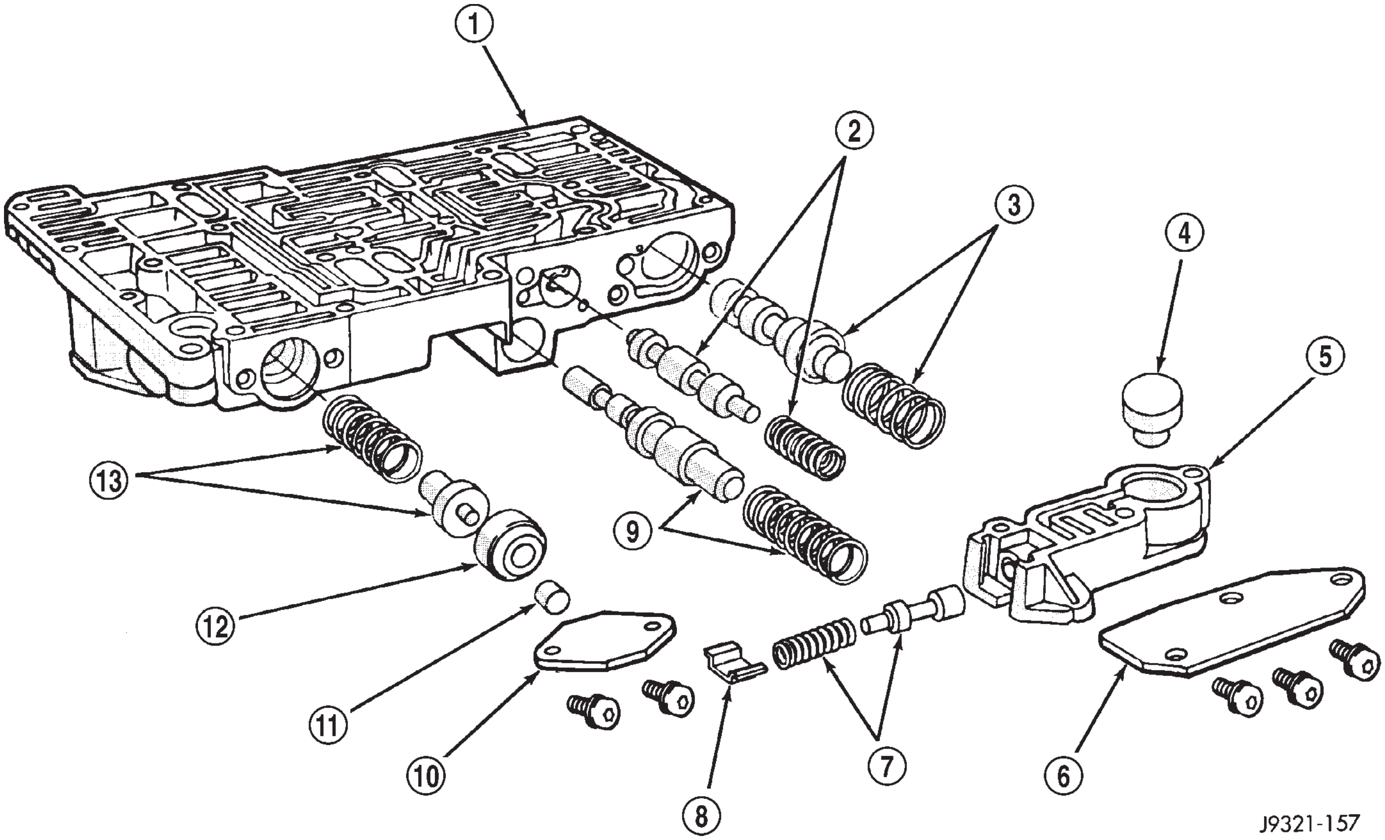


Fig. 308 Upper Housing Shift Valve And Pressure Plug Locations

1 - UPPER HOUSING
2 - 1-2 SHIFT VALVE AND SPRING
3 - 2-3 SHIFT VALVE AND SPRING
4 - 2-3 THROTTLE PLUG
5 - LIMIT VALVE HOUSING
6 - LIMIT VALVE COVER
7 - LIMIT VALVE AND SPRING
8 - RETAINER
9 - 1-2 SHIFT CONTROL VALVE AND SPRING
10 - PRESSURE PLUG COVER
11 - LINE PRESSURE PLUG
12 - PLUG SLEEVE
13 - THROTTLE PRESSURE SPRING AND PLUG

VALVE BODY (Continued)

VALVE BODY LOWER HOUSING

(1) Remove timing valve cover.
(2) Remove 3-4 timing valve and spring.
(3) Remove 3-4 quick fill valve, spring and plug.
(4) Remove 3-4 shift valve and spring.
(5) Remove converter clutch valve, spring and plug (Fig. 309).
(6) Remove converter clutch timing valve, retainer and valve spring.

3-4 ACCUMULATOR HOUSING

(1) Remove end plate from housing.
(2) Remove piston spring.
(3) Remove piston. Remove and discard piston seals (Fig. 310).

CLEANING

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the governor solenoid and sensor and the dual solenoid and harness assembly by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

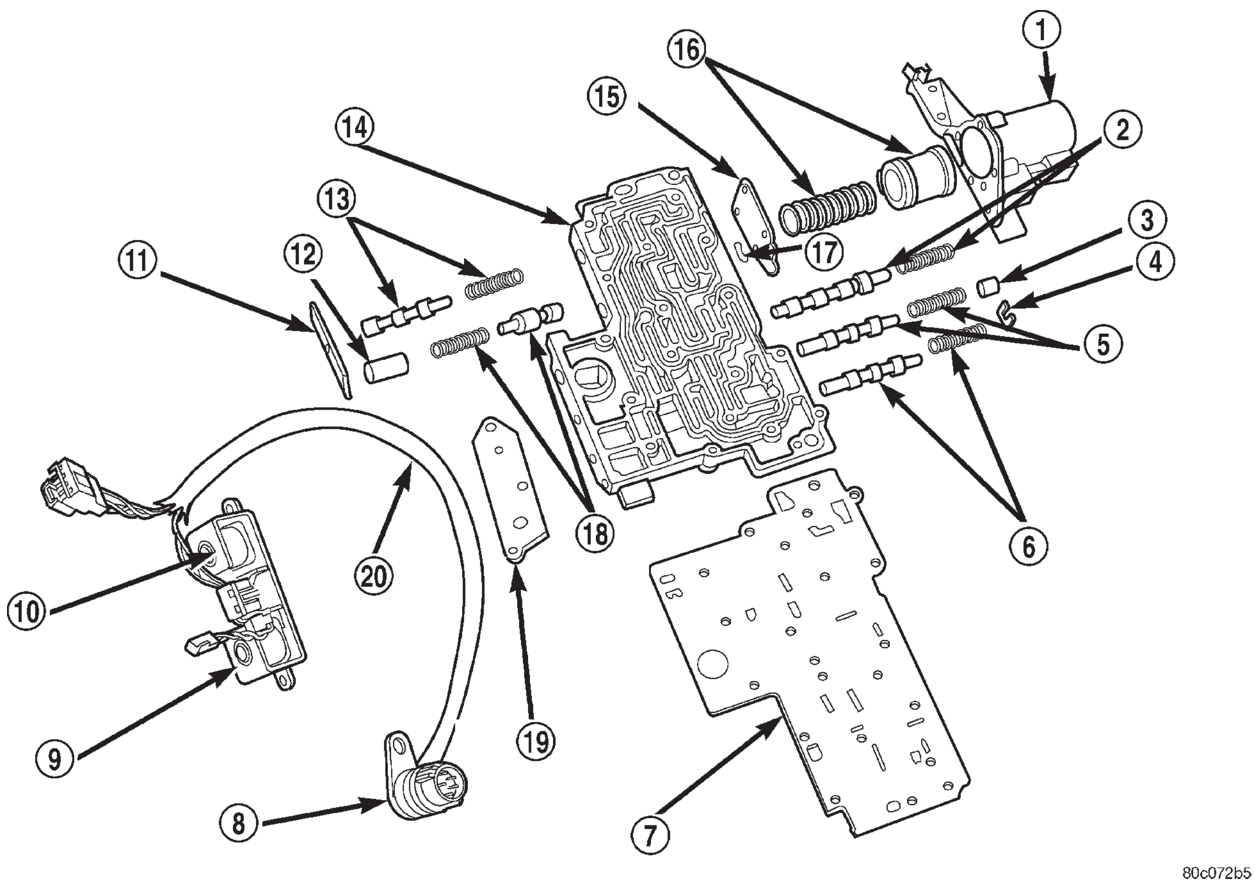


Fig. 309 Lower Housing Shift Valves and Springs

1 - 3-4 ACCUMULATOR HOUSING
2 - 3-4 SHIFT VALVE AND SPRING
3 - PLUG
4 - SPRING RETAINER
5 - CONVERTER CLUTCH VALVE AND SPRING
6 - CONVERTER CLUTCH TIMING VALVE AND SPRING
7 - OVERDRIVE SEPARATOR PLATE
8 - CASE CONNECTOR
9 - CONVERTER CLUTCH SOLENOID
10 - OVERDRIVE SOLENOID
11 - TIMING VALVE COVER
12 - PLUG
13 - 3-4 TIMING VALVE AND SPRING
14 - LOWER HOUSING
15 - ACCUMULATOR END PLATE
16 - 3-4 ACCUMULATOR PISTON AND SPRING
17 - E-CLIP
18 - 3-4 QUICK FILL SPRING AND VALVE
19 - SOLENOID GASKET
20 - HARNESS

VALVE BODY (Continued)

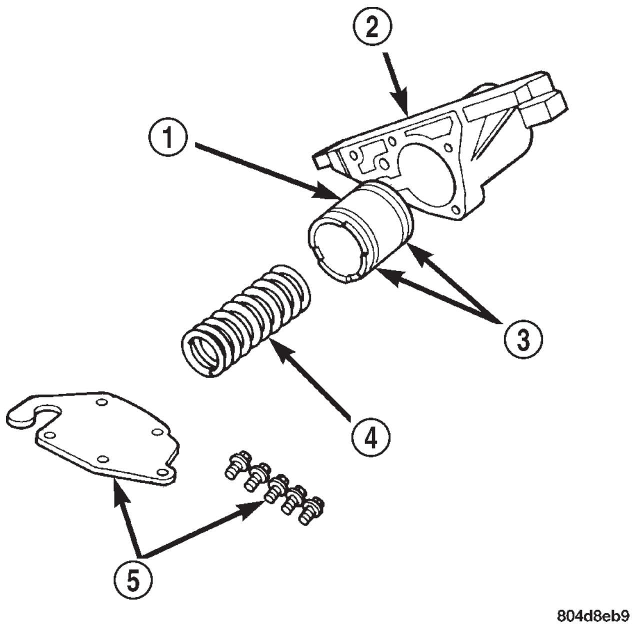


Fig. 310 Accumulator Housing Components

1 - ACCUMULATOR PISTON
2 - 3-4 ACCUMULATOR HOUSING
3 - TEFLON SEALS
4 - PISTON SPRING
5 - COVER PLATE AND SCREWS

Wipe the governor pressure sensor and solenoid valve with dry, lint free shop towels only. The O-rings on the sensor and solenoid valve are the only serviceable components. Be sure the vent ports in the solenoid valve are open and not blocked by dirt or debris. Replace the valve and/or sensor only when DRB scan tool diagnosis indicates this is necessary. Or, if either part has sustained physical damage (dented, deformed, broken, etc.).

CAUTION: Do not turn the small screw at the end of the solenoid valve for any reason. Turning the screw in either direction will ruin solenoid calibration and result in solenoid failure. In addition, the filter on the solenoid valve is NOT serviceable. Do not try to remove the filter as this will damage the valve housing.

INSPECTION

Inspect the throttle and manual valve levers and shafts. Do not attempt to straighten a bent shaft or correct a loose lever. Replace these components if worn, bent, loose or damaged in any way.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

CAUTION: Many of the valves and plugs, such as the throttle valve, shuttle valve plug, 1-2 shift valve and 1-2 governor plug, are made of coated aluminum. Aluminum components are identified by the dark color of the special coating applied to the surface (or by testing with a magnet). Do not sand aluminum valves or plugs under any circumstances. This practice could damage the special coating causing the valves/plugs to stick and bind.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.**Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Check the two separator plates for distortion or damage of any kind. Inspect the upper housing, lower housing, 3-4 accumulator housing, and transfer plate carefully. Be sure all fluid passages are clean and clear. Check condition of the upper housing and transfer plate check balls as well. The check balls and ball seats must not be worn or damaged.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

The only serviceable valve body components are listed below. The remaining valve body components are serviced only as part of a complete valve body assembly. Serviceable parts are:

- dual solenoid and harness assembly
- solenoid gasket
- solenoid case connector O-rings and shoulder bolt
- switch valve and spring

VALVE BODY (Continued)

- pressure adjusting screw and bracket assembly
- throttle lever
- manual lever and shaft seal
- throttle lever shaft seal, washer, and E-clip
- fluid filter and screws
- detent ball and spring
- valve body screws
- governor pressure solenoid
- governor pressure sensor and retaining clip
- park lock rod and E-clip

ASSEMBLY

CAUTION: Do not force valves or plugs into place during reassembly. If the valve body bores, valves and plugs are free of distortion or burrs, the valve body components should all slide into place easily. In addition, do not overtighten the transfer plate and valve body screws during reassembly. Over-tightening can distort the housings resulting in valve sticking, cross leakage and unsatisfactory operation. Tighten valve body screws to recommended torque only.

LOWER HOUSING

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid (Fig. 309).

(2) Install 3-4 timing valve spring and valve in lower housing.

(3) Install 3-4 quick fill valve in lower housing.

(4) Install 3-4 quick fill valve spring and plug in housing.

(5) Install timing valve end plate. Tighten end plate screws to 4 N·m (35 in. lbs.) torque.

3-4 ACCUMULATOR

(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid (Fig. 310).

(2) Install new seal rings on accumulator piston.

(3) Install piston and spring in housing.

(4) Install end plate on housing.

TRANSFER PLATE

(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 311).

(2) Install filter screen in upper housing separator plate (Fig. 312).

(3) Align and position upper housing separator plate on transfer plate (Fig. 313).

(4) Install brace plate (Fig. 313). Tighten brace attaching screws to 4 N·m (35 in. lbs.) torque.

(5) Install remaining separator plate attaching screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

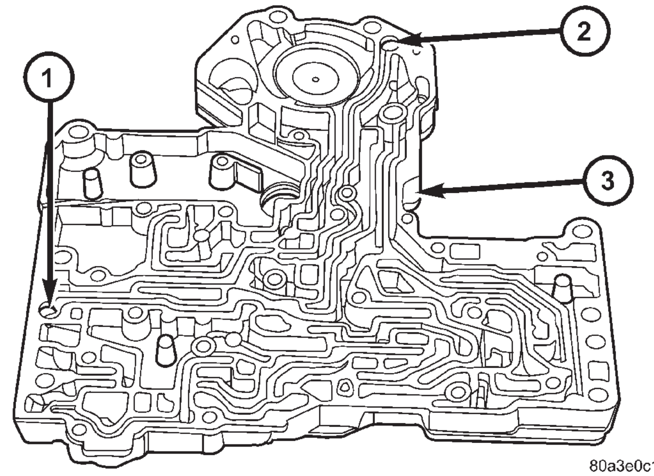


Fig. 311 Rear Clutch And Rear Servo Check Ball Locations

1 - REAR CLUTCH CHECK BALL
2 - REAR SERVO CHECK BALL
3 - TRANSFER PLATE

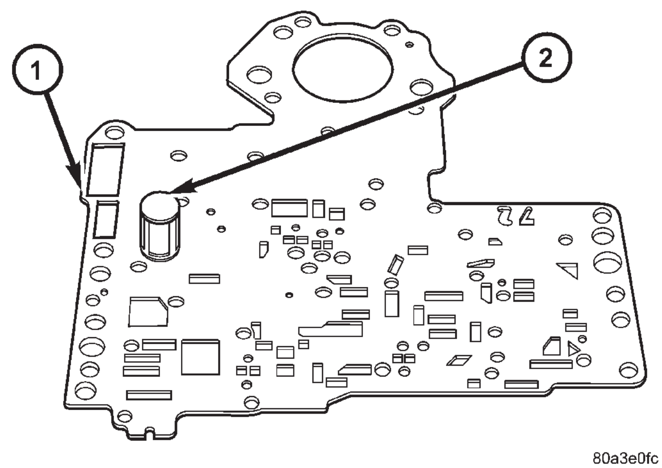


Fig. 312 Separator Plate Filter Screen Installation

1 - UPPER HOUSING SEPARATOR PLATE
2 - FILTER SCREEN

UPPER AND LOWER HOUSING

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 314). Eight check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The single small check ball is approximately 4.8 mm (3/16 in.) in diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter.

(2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 315). Be sure filter screen is seated in proper housing recess.

VALVE BODY (Continued)

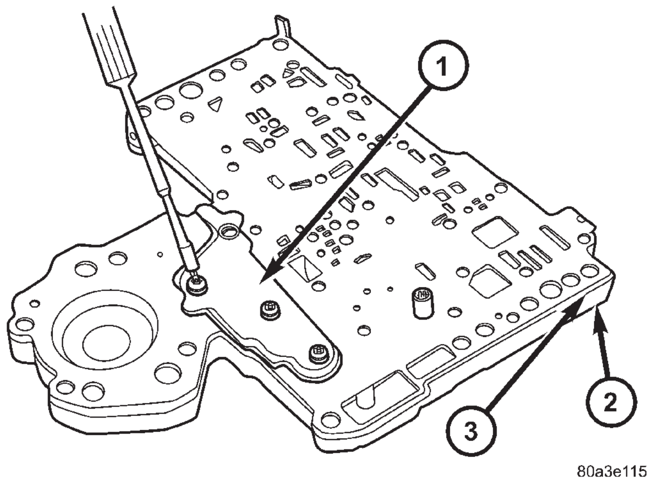


Fig. 313 Brace Plate

1 - BRACE
2 - TRANSFER PLATE
3 - SEPARATOR PLATE

(3) Install the ECE check ball into the transfer plate (Fig. 301). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(4) Position lower housing separator plate on transfer plate (Fig. 316).

(5) Install lower housing on assembled transfer plate and upper housing (Fig. 317).

(6) Install and start all valve body screws by hand except for the screws to hold the boost valve tube brace. Save those screws for later installation. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 317).

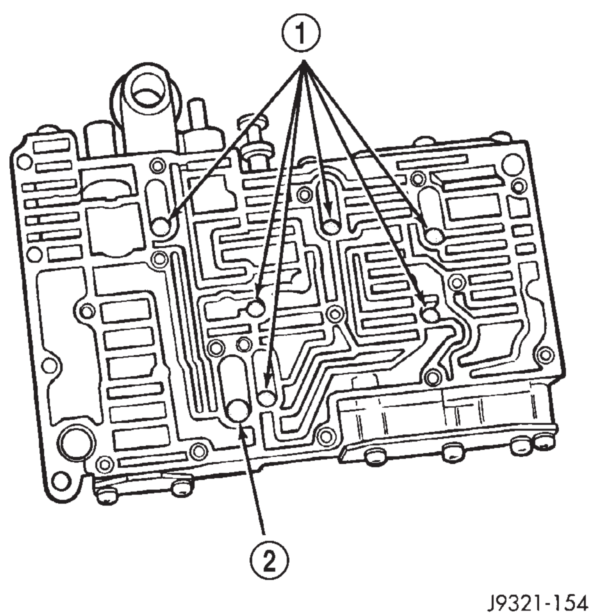


Fig. 314 Check Ball Locations In Upper Housing

1 - SMALL DIAMETER CHECK BALLS (6)
2 - LARGE DIAMETER CHECK BALL (1)

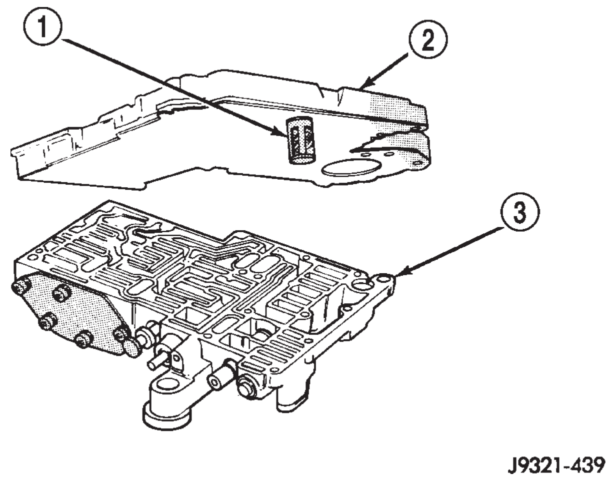


Fig. 315 Installing Transfer Plate On Upper Housing

1 - FILTER SCREEN
2 - TRANSFER PLATE/SEPARATOR PLATE ASSEMBLY
3 - UPPER HOUSING

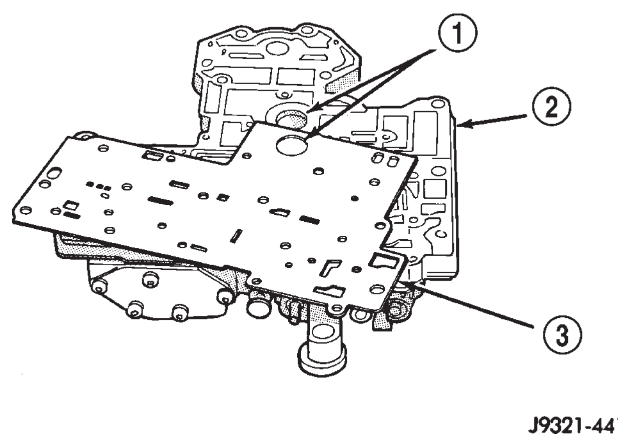


Fig. 316 Lower Housing Separator Plate

1 - BE SURE TO ALIGN BORES
2 - TRANSFER PLATE
3 - LOWER HOUSING (OVERDRIVE) SEPARATOR PLATE

VALVE BODY (Continued)

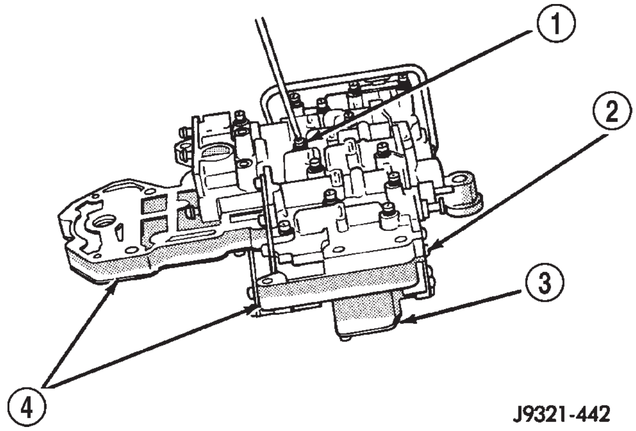


Fig. 317 Installing Lower Housing On Transfer Plate And Upper Housing

1 - VALVE BODY SCREWS (13)
2 - LOWER HOUSING
3 - UPPER HOUSING
4 - TRANSFER PLATE

UPPER HOUSING VALVE AND PLUG

Refer to (Fig. 318), (Fig. 319) and (Fig. 320) to perform the following steps.

(1) Lubricate valves, plugs, springs with clean transmission fluid.

(2) Assemble regulator valve line pressure plug, sleeve, throttle plug and spring. Insert assembly in upper housing and install cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(3) Install 1-2 and 2-3 shift valves and springs.

(4) Install 1-2 shift control valve and spring.

(5) Install retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing.

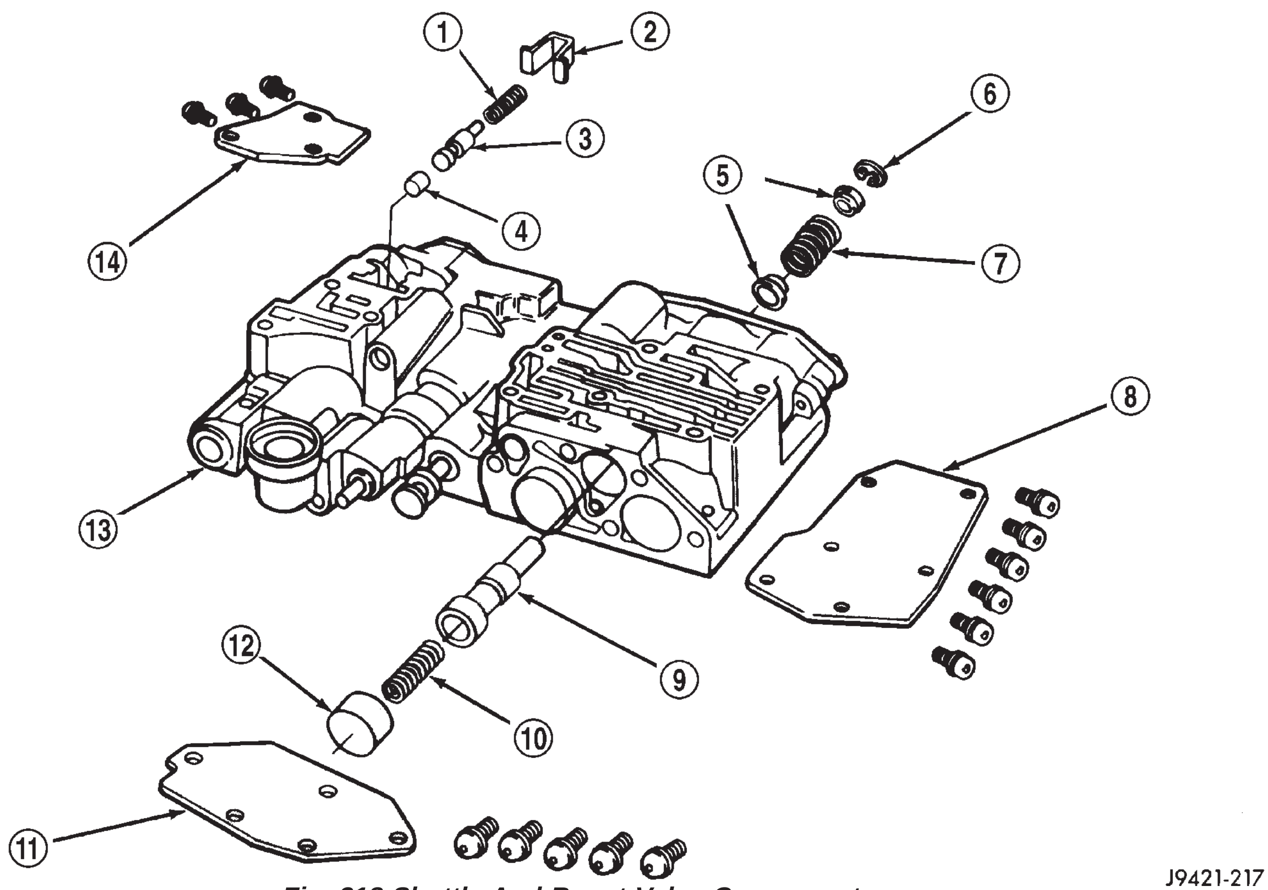


Fig. 318 Shuttle And Boost Valve Components

1 - SPRING
2 - RETAINER
3 - BOOST VALVE
4 - BOOST VALVE PLUG
5 - SPRING GUIDES
6 - E-CLIP
7 - SHUTTLE VALVE SECONDARY SPRING
8 - SHUTTLE VALVE COVER
9 - SHUTTLE VALVE
10 - SHUTTLE VALVE PRIMARY SPRING
11 - GOVERNOR PLUG COVER
12 - THROTTLE PLUG
13 - UPPER HOUSING
14 - BOOST VALVE COVER

VALVE BODY (Continued)

(6) Install limit valve housing and cover plate. Tighten screws to 4 N·m (35 in. lbs.).

(7) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Install shuttle valve into housing.

(c) Hold shuttle valve in place.

(d) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(e) Verify that spring and E-clip are properly seated before proceeding.

(8) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(9) Install 1-2 and 2-3 valve governor plugs in valve body.

(10) Install shuttle valve primary spring and throttle plug.

(11) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

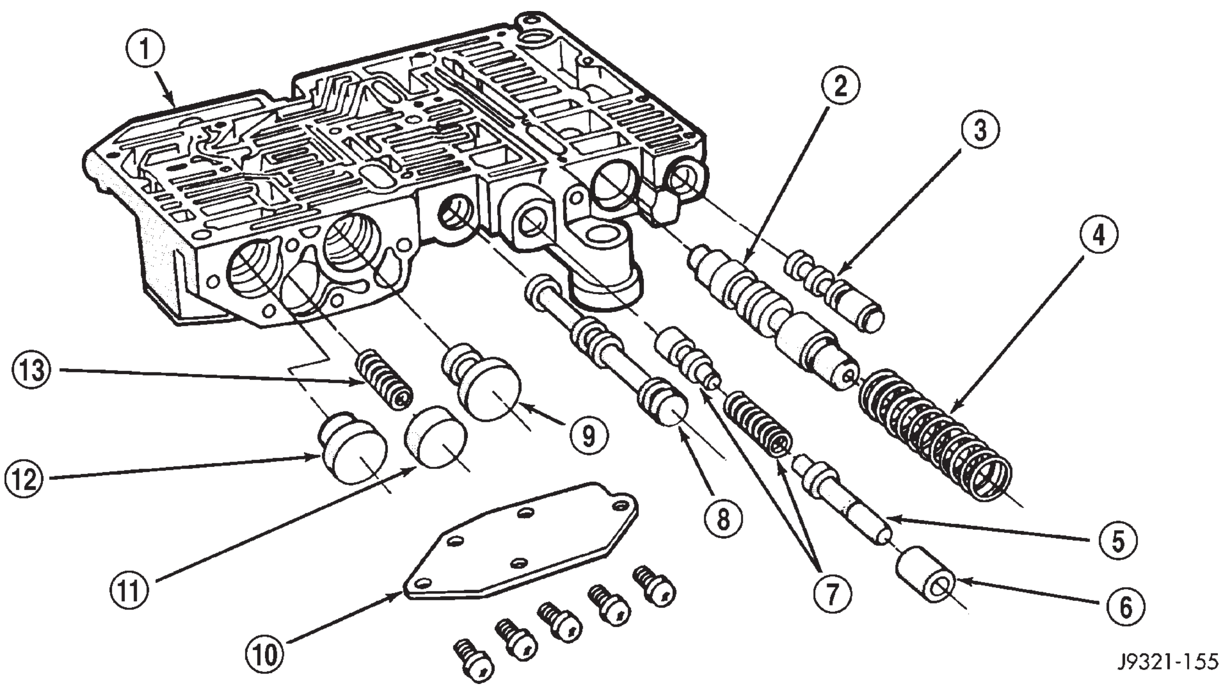


Fig. 319 Upper Housing Control Valve Locations

1 - UPPER HOUSING
2 - REGULATOR VALVE
3 - SWITCH VALVE
4 - REGULATOR VALVE SPRING
5 - KICKDOWN VALVE
6 - KICKDOWN DETENT
7 - THROTTLE VALVE AND SPRING
8 - MANUAL VALVE
9 - 1-2 GOVERNOR PLUG
10 - GOVERNOR PLUG COVER
11 - THROTTLE PLUG
12 - 2-3 GOVERNOR PLUG
13 - SHUTTLE VALVE PRIMARY SPRING

VALVE BODY (Continued)

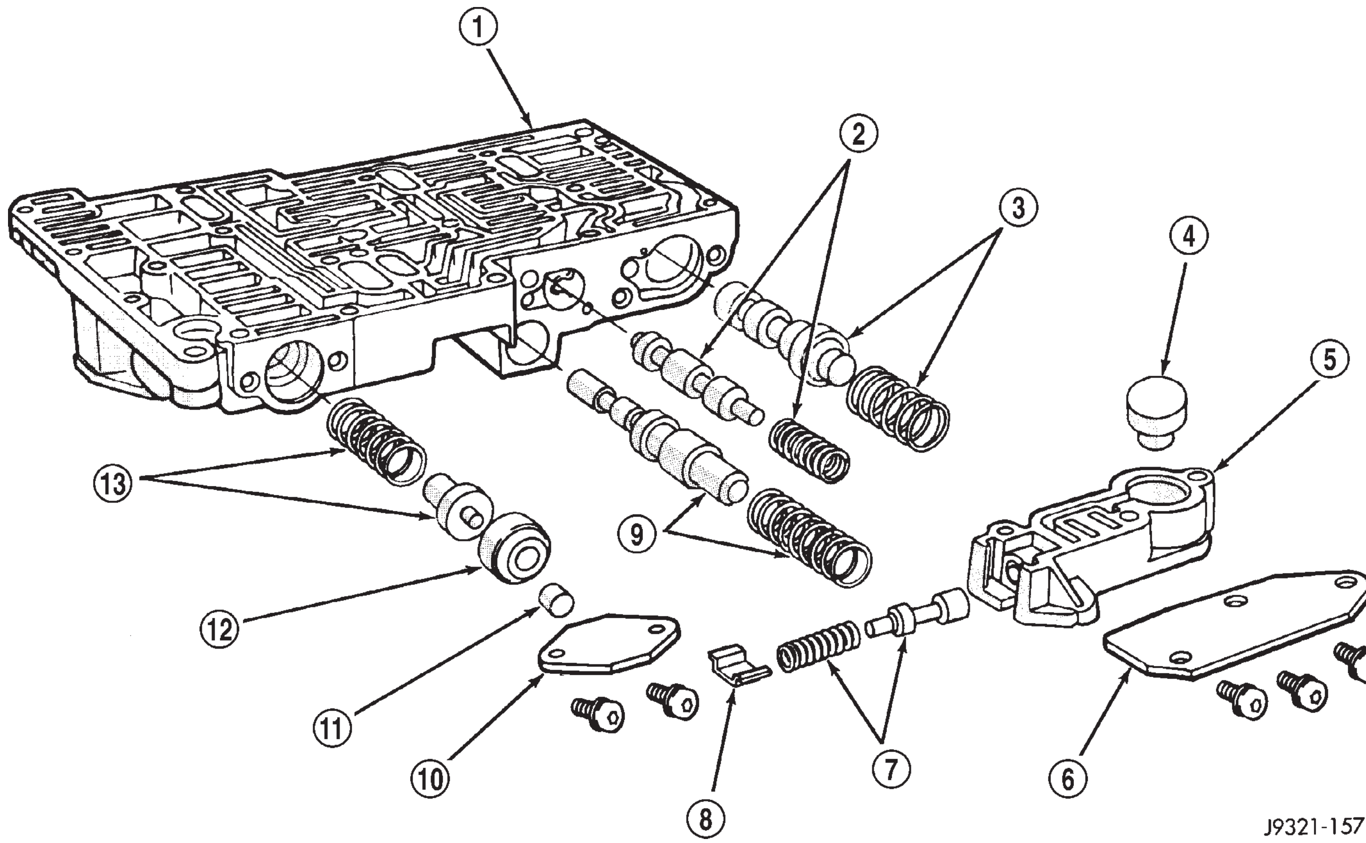


Fig. 320 Upper Housing Shift Valve And Pressure Plug Locations

1 - UPPER HOUSING
2 - 1-2 SHIFT VALVE AND SPRING
3 - 2-3 SHIFT VALVE AND SPRING
4 - 2-3 THROTTLE PLUG
5 - LIMIT VALVE HOUSING
6 - LIMIT VALVE COVER
7 - LIMIT VALVE AND SPRING
8 - RETAINER
9 - 1-2 SHIFT CONTROL VALVE AND SPRING
10 - PRESSURE PLUG COVER
11 - LINE PRESSURE PLUG
12 - PLUG SLEEVE
13 - THROTTLE PRESSURE SPRING AND PLUG

VALVE BODY (Continued)

BOOST VALVE TUBE AND BRACE

(1) Position valve body assembly so lower housing is facing upward (Fig. 321).

(2) Lubricate tube ends and housing ports with transmission fluid or petroleum jelly.

(3) Start tube in lower housing port first. Then swing tube downward and work opposite end of tube into upper housing port (Fig. 321).

(4) Insert and seat each end of tube in housings.

(5) Slide tube brace under tube and into alignment with valve body screw holes (Fig. 322).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 322).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 323).

(8) Tighten all valve body housing screws to 4 N·m (35 in. lbs.) torque after tube and brace are installed. Tighten screws in diagonal pattern starting at center and working outward.

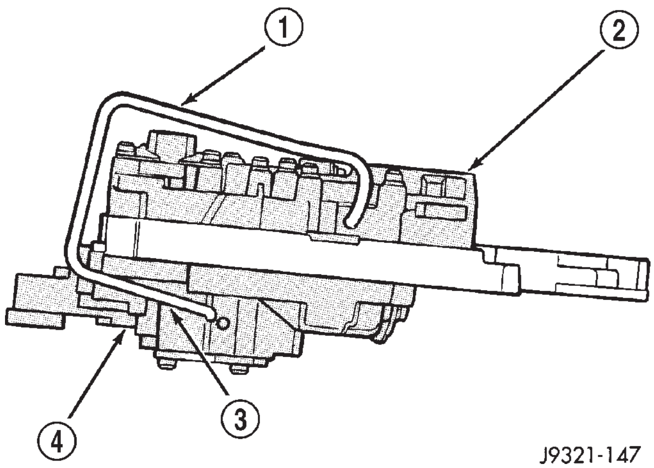


Fig. 321 Boost Valve Tube

1 - BOOST VALVE TUBE
2 - LOWER HOUSING
3 - DISENGAGE THIS END OF TUBE FIRST
4 - UPPER HOUSING

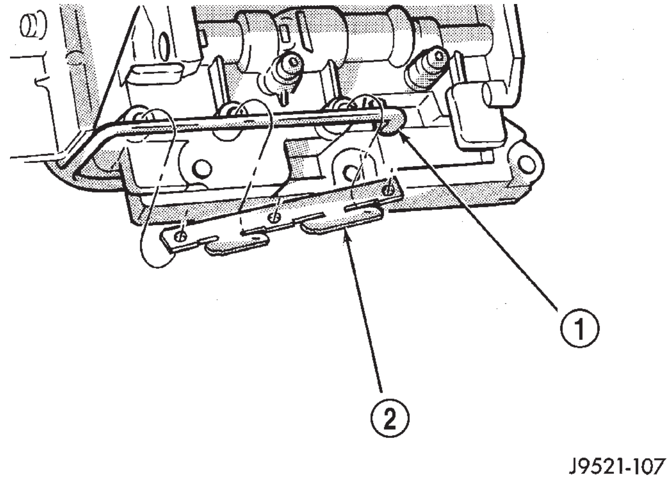


Fig. 322 Boost Valve Tube And Brace

1 - BOOST VALVE TUBE
2 - TUBE BRACE

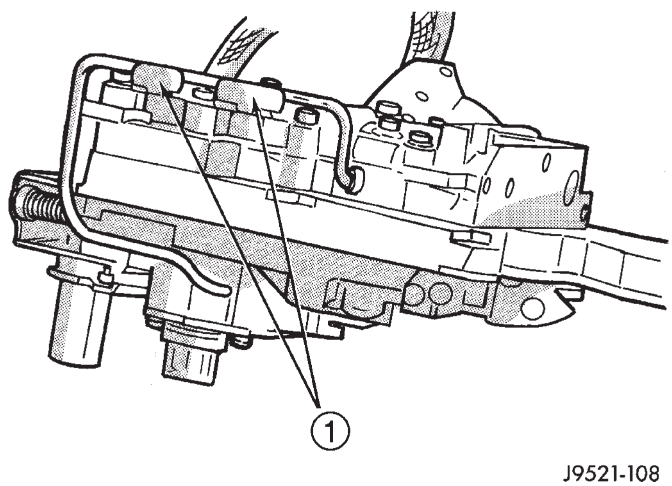


Fig. 323 Securing Boost Valve Tube With Brace Tabs

1 - BEND TABS UP AGAINST TUBE AS SHOWN

VALVE BODY (Continued)

3-4 ACCUMULATOR

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 324).

(2) Loosely attach accumulator housing with right-side screw (Fig. 324). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Install 3-4 shift valve and spring.

(4) Install converter clutch timing valve and spring.

(5) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(6) Swing accumulator housing upward over valve springs and plug.

(7) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 325). Tighten screws to 4 N·m (35 in. lbs.).

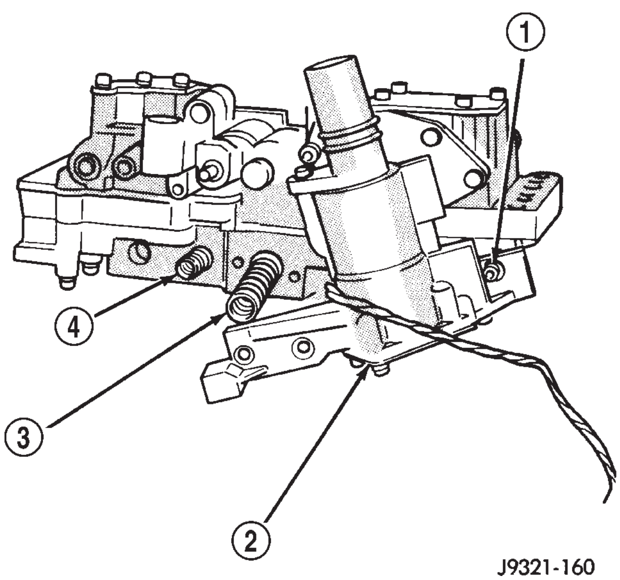


Fig. 324 Converter Clutch And 3-4 Shift Valve Springs

1 - RIGHT-SIDE SCREW
2 - 3-4 ACCUMULATOR
3 - 3-4 SHIFT VALVE SPRING
4 - CONVERTER CLUTCH VALVE SPRING

VALVE BODY FINAL

(1) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(2) Insert manual lever detent spring in upper housing.

(3) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 326).

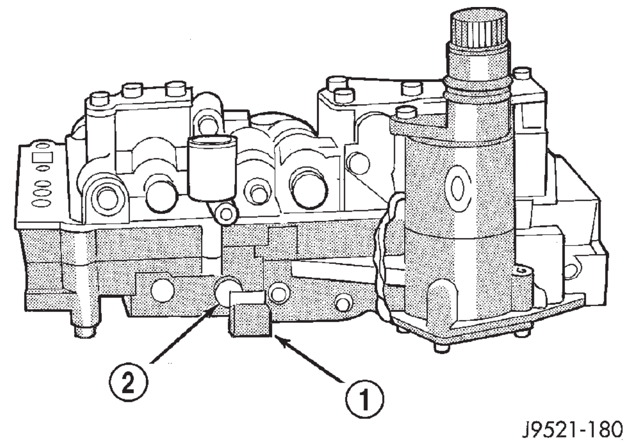


Fig. 325 Seating 3-4 Accumulator On Lower Housing

1 - ACCUMULATOR BOX
2 - CONVERTER CLUTCH VALVE PLUG

(4) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(5) Align manual lever with detent ball and manual valve. Hold throttle lever upward. Then press down on manual lever until fully seated. Remove detent ball retainer tool after lever is seated.

(6) Then install manual lever seal, washer and E-clip.

(7) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 327).

(8) Position line pressure adjusting screw in adjusting screw bracket.

(9) Install spring on end of line pressure regulator valve.

(10) Install switch valve spring on tang at end of adjusting screw bracket.

(11) Install manual valve.

(12) Install throttle valve and spring.

(13) Install kickdown valve and detent.

(14) Install pressure regulator valve.

(15) Install switch valve.

(16) Position adjusting screw bracket on valve body. Align valve springs and press bracket into place. Install short, upper bracket screws first and long bottom screw last. Verify that valve springs and bracket are properly aligned. Then tighten all three bracket screws to 4 N·m (35 in. lbs.) torque.

(17) Perform Line Pressure and Throttle Pressure adjustments. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/VALVE BODY - ADJUSTMENTS)

(18) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

VALVE BODY (Continued)

(19) Attach solenoid case connector to 3-4 accumulator with shoulder-type screw. Connector has small locating tang that fits in dimple at top of accumulator housing (Fig. 328). Seat tang in dimple before tightening connector screw.

(20) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(21) Verify that solenoid wire harness is properly routed (Fig. 329). Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.

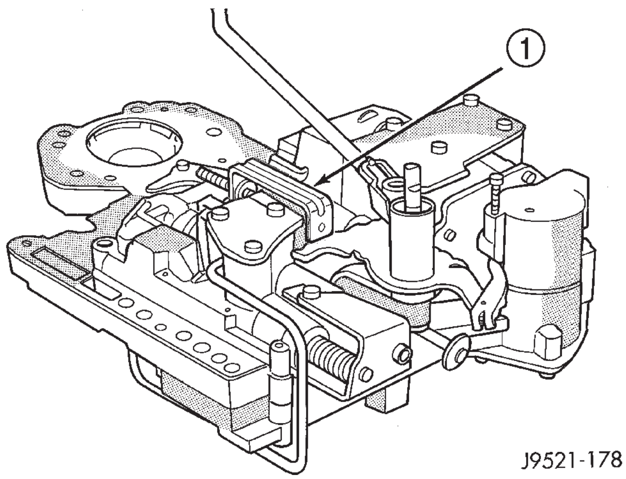


Fig. 326 Detent Ball Spring

1 - SPECIAL TOOL 6583 POSITIONED ON DETENT HOUSING

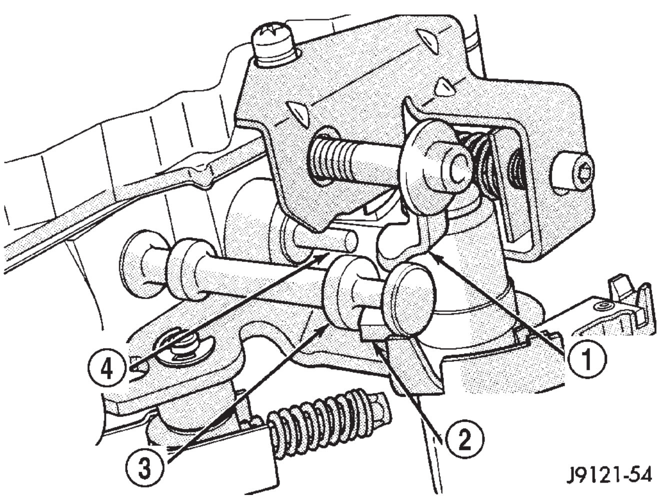


Fig. 327 Manual And Throttle Lever Alignment

1 - THROTTLE LEVER
2 - MANUAL LEVER VALVE ARM
3 - MANUAL VALVE
4 - KICKDOWN VALVE

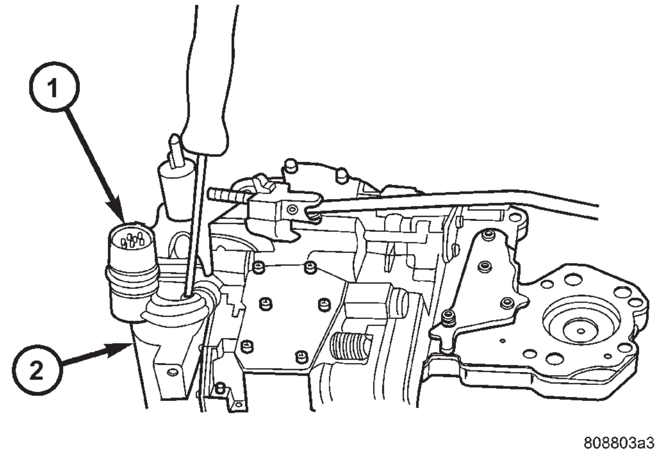


Fig. 328 Solenoid Harness Case Connector Shoulder Bolt

1 - SOLENOID HARNESS CASE CONNECTOR
2 - 3-4 ACCUMULATOR HOUSING

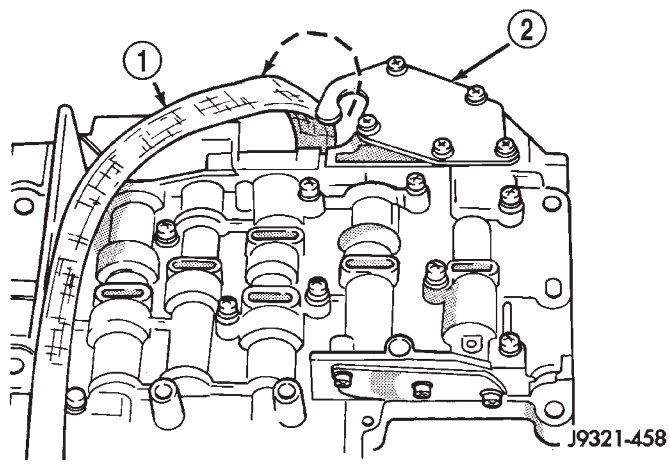


Fig. 329 Solenoid Harness Routing

1 - OVERDRIVE/CONVERTER SOLENOID WIRE HARNESS
2 - 3-4 ACCUMULATOR COVER PLATE

VALVE BODY (Continued)

GOVERNOR BODY, SENSOR AND SOLENOID

(1) Turn valve body assembly over so accumulator side of transfer plate is facing down.

(2) Install new O-rings on governor pressure solenoid and sensor.

(3) Lubricate solenoid and sensor O-rings with clean transmission fluid.

(4) Install governor pressure sensor in governor body.

(5) Install governor pressure solenoid in governor body. Push solenoid in until it snaps into place in body.

(6) Position governor body gasket on transfer plate.

(7) Install retainer plate on governor body and around solenoid. Be sure solenoid connector is positioned in retainer cutout.

(8) Align screw holes in governor body and transfer plate. Then install and tighten governor body screws to 4 N·m (35 in. lbs.) torque.

(9) Connect harness wires to governor pressure solenoid and governor pressure sensor.

(10) Install fluid filter and pan.

(11) Lower vehicle.

(12) Fill transmission with recommended fluid and road test vehicle to verify repair.

INSTALLATION

(1) Check condition of O-ring seals on valve body harness connector (Fig. 330). Replace seals on connector body if cut or worn.

(2) Check condition of manual lever shaft seal in transmission case. Replace seal if lip is cut or worn. Install new seal with 15/16 deep well socket (Fig. 331).

(3) Check condition of seals on accumulator piston (Fig. 332). Install new piston seals, if necessary.

(4) Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.

(5) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.

(6) Lubricate seal rings on valve body harness connector with petroleum jelly.

(7) Position valve body in case and work end of park lock rod into and through pawl sprag. Turn propeller shaft to align sprag and park lock teeth if necessary. The rod will click as it enters pawl. Move rod to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into this cavity.

(8) Install accumulator springs and piston into case. Then swing valve body over piston and outer spring to hold it in place.

(9) Align accumulator piston and outer spring, manual lever shaft and electrical connector in case.

(10) Then seat valve body in case and install one or two bolts to hold valve body in place.

(11) Tighten valve body bolts alternately and evenly to 11 N·m (100 in. lbs.) torque.

(12) Install new fluid filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.) torque.

(13) Install throttle and gearshift levers on valve body manual lever shaft.

(14) Check and adjust front and rear bands if necessary.

(15) Connect solenoid case connector wires.

(16) Install oil pan and new gasket. Tighten pan bolts to 13.6 N·m (125 in. lbs.) torque.

(17) Lower vehicle and fill transmission with Mopar® ATF +4, type 9602, fluid.

(18) Check and adjust gearshift and throttle valve cables, if necessary.

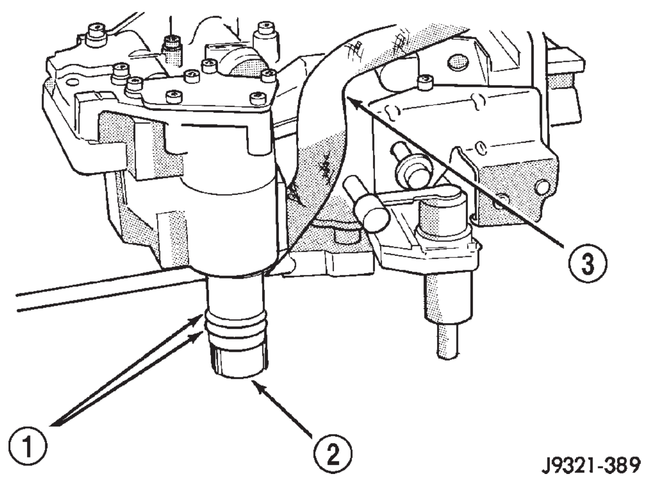


Fig. 330 Valve Body Harness Connector O-Ring Seal

1 - CONNECTOR O-RINGS
2 - VALVE BODY HARNESS CONNECTOR
3 - HARNESS

ADJUSTMENTS - VALVE BODY

CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body;

- Line Pressure
- Throttle Pressure

Line and throttle pressures are interdependent because each affects shift quality and timing. As a result, both adjustments must be performed properly and in the correct sequence. Adjust line pressure first and throttle pressure last.

VALVE BODY (Continued)

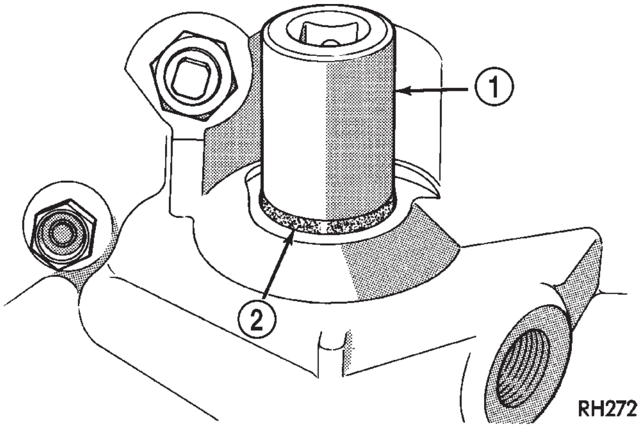


Fig. 331 Manual Lever Shaft Seal

1 - 15/16′′ SOCKET
2 - SEAL

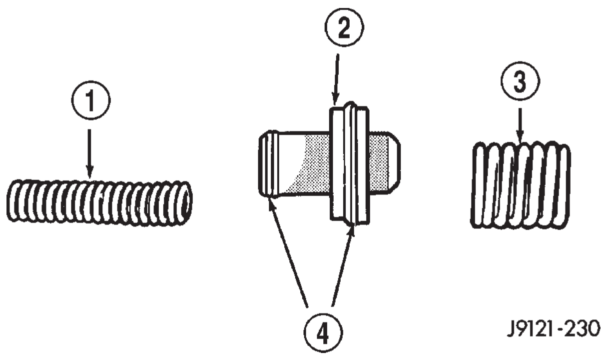


Fig. 332 Accumulator Piston Components

1 - INNER SPRING
2 - ACCUMULATOR PISTON
3 - OUTER SPRING
4 - SEAL RINGS

LINE PRESSURE ADJUSTMENT

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 333).

Distance should be 33.4 mm (1-5/16 in.).

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

NOTE: The 33.4 mm (1-5/16 in.) setting is an approximate setting. Manufacturing tolerances may make it necessary to vary from this dimension to obtain desired pressure.

One complete turn of the adjusting screw changes line pressure approximately 1-2/3 psi (9 kPa).

Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.

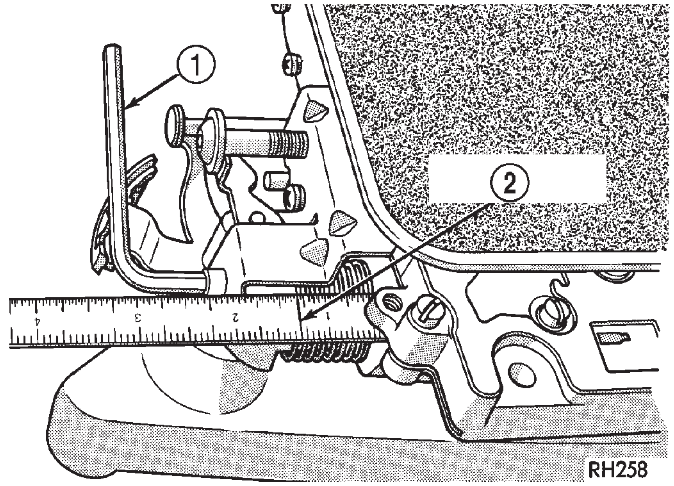


Fig. 333 Line Pressure Adjustment

1 - WRENCH
2 - 1–5/16 INCH

THROTTLE PRESSURE ADJUSTMENT

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 334).

Push the gauge tool inward to compress the kickdown valve against the spring and bottom the throttle valve.

Maintain pressure against kickdown valve spring. Turn throttle lever stop screw until the screw head touches throttle lever tang and the throttle lever cam touches gauge tool.

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

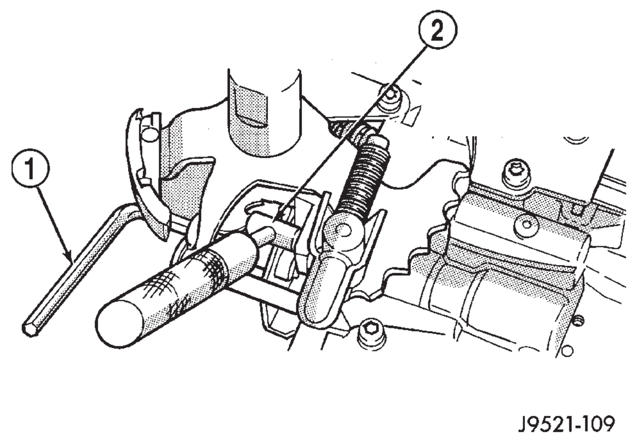


Fig. 334 Throttle Pressure Adjustment

1 - HEX WRENCH (IN THROTTLE LEVER ADJUSTING SCREW)
2 - SPECIAL TOOL C-3763 (POSITIONED BETWEEN THROTTLE LEVER AND KICKDOWN VALVE)

AUTOMATIC TRANSMISSION - 545RFE

TABLE OF CONTENTS

AUTOMATIC TRANSMISSION - 545RFE

DESCRIPTION

The 545RFE automatic transmission is a sophisticated, multi-range, electronically controlled transmission which combines optimized gear ratios for responsive performance, state of the art efficiency features and low NVH. Other features include driver adaptive shifting and three planetary gear sets to provide wide ratio capability with precise ratio steps for optimum driveability. The three planetary gear sets also make available a unique alternate second gear ratio. The primary 2nd gear ratio fits between 1st and 3rd gears for normal through-gear accelerations. The alternate second gear ratio (2prime) allows smoother 4-2 kickdowns at high speeds to provide 2nd gear passing performance over a wider highway cruising range. An additional overdrive ratio (0.67:1) is also provided for greater fuel economy and less NVH at highway speeds.

The hydraulic portion of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components.

The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Three multiple disc holding clutches
- Five hydraulic accumulators
- Three planetary gear sets
- Dual Stage Hydraulic oil pump
- Valve body
- Solenoid pack

The TCM is the “heart” or “brain” of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

AUTOMATIC TRANSMISSION - 545RFE (Continued)

TRANSMISSION IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan sealing surface (Fig. 1). Refer to this information when ordering replacement parts. A label is attached to the transmission case above the stamped numbers. The label gives additional information which may also be necessary for identification purposes.

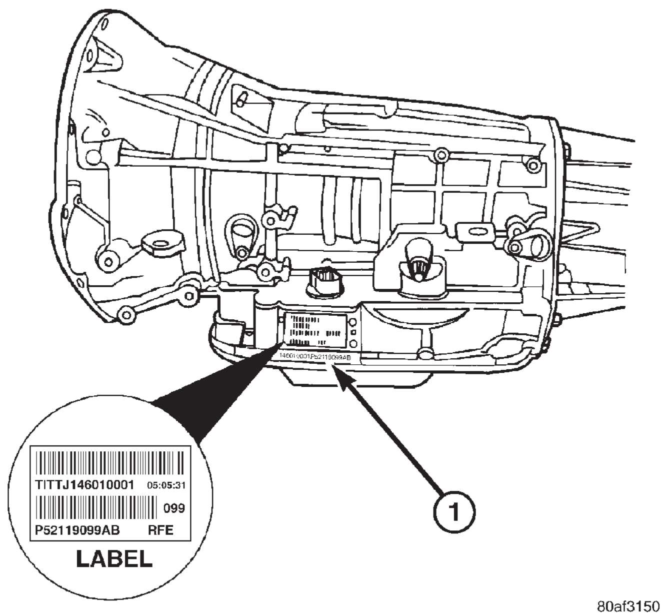


Fig. 1 Transmission Part And Serial Number Location

GEAR RATIOS The 545RFE gear ratios are:

1st	3.00:1
2nd	1.67:1
2nd Prime	1.50:1
3rd	1.00:1
4th	0.75:1
5th	0.67:1
Reverse	3.00:1

OPERATION

The 545RFE offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

To help reduce efficiency-robbing parasitic losses, the transmission includes a dual-stage transmission fluid pump with electronic output pressure control. Under most driving conditions, pump output pressure greatly exceeds that which is needed to keep the clutches applied. The 545RFE pump-pressure control system monitors input torque and adjusts the pump pressure accordingly. The primary stage of the pump works continuously; the second stage is bypassed when demand is low. The control system also monitors input and output speed and, if incipient clutch slip is observed, the pressure control solenoid duty cycle is varied, increasing pressure in proportion to demand.

A high-travel torque converter damper assembly allows earlier torque converter clutch engagement to reduce slippage. Needle-type thrust bearings reduce internal friction. The 545RFE is packaged in a one-piece die-cast aluminum case. To reduce NVH, the case has high lateral, vertical and torsional stiffness. It is also designed to maximize the benefit of the structural dust cover that connects the bottom of the bell housing to the engine bedplate, enhancing overall power train stiffness. Dual filters protect the pump and other components. A pump return filter is added to the customary main sump filter. Independent lubrication and cooler circuits assure ample pressure for normal transmission operation even if the cooler is obstructed or the fluid cannot flow due to extremely low temperatures.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, SECOND, and THIRD gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in “limp-in” mode) in the event of a electronic control system failure, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC’s, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRB scan tool.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on a 545RFE automatic transmission, check for Diagnostic Trouble Codes with the DRB® scan tool.

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

AUTOMATIC TRANSMISSION - 545RFE (Continued)

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

DIAGNOSIS AND TESTING - PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

(1) Check for transmission fault codes using DRB® scan tool.

(2) Check fluid level and condition.

(3) Adjust gearshift cable if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts, and engages.

(5) Perform stall test if complaint is based on sluggish acceleration. Or, if abnormal throttle opening is needed to maintain normal speeds with a properly tuned engine.

(6) Perform hydraulic pressure test if shift problems were noted during road test.

(7) Perform air-pressure test to check clutch operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift cable.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged driveplate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

DIAGNOSIS AND TESTING - ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line presure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

CLUTCH APPLICATION CHART

SLP	UD	OD	R	2C	4C	L/R	OVERRUNNING
P–PARK						ON	
R–REVERSE			ON			ON	
N-NEUTRAL						ON	
D–OVERDRIVE FIRST	ON					ON*	ON
SECOND	ON			ON			
SECOND PRIME	ON				ON		
THIRD	ON	ON					
FOURTH		ON			ON		
FIFTH		ON		ON			
LIMP-IN	ON	ON					
2–FIRST	ON					ON*	ON
SECOND	ON			ON			
LIMP-IN	ON			ON			
1–LOW	ON					ON	ON

*L/R clutch is on only with the output shaft speed below 150 rpm.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

DIAGNOSIS AND TESTING - HYDRAULIC PRESSURE TEST

An accurate tachometer and pressure test gauges are required. Test Gauge C-3293-SP has a 300 psi range and is used at all locations where pressures exceed 100 psi.

Pressure Test Port Locations

Only two pressure ports are supplied on the transmission case. The torque converter clutch apply and release ports are located on the right side of the transmission case (Fig. 2).

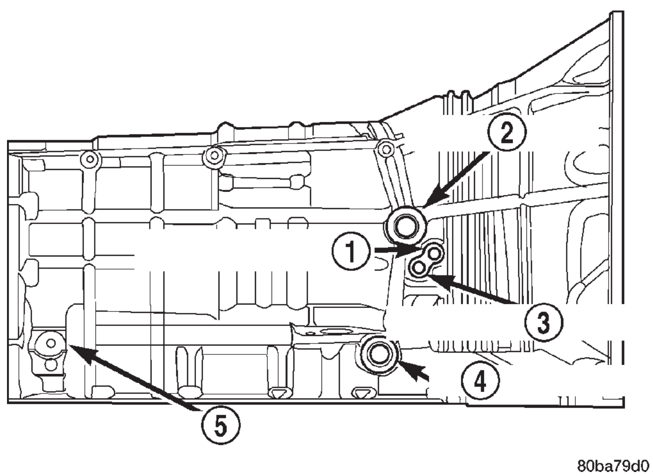


Fig. 2 Torque Converter Pressure Locations

1 - TCC RELEASE
2 - TO COOLER
3 - TCC APPLY
4 - FROM COOLER
5 - LINE PRESSURE SENSOR

To determine the line pressure, there are two available methods. The DRB® scan tool can be used to read line pressure from the line pressure sensor. The second method is to install Line Pressure Adapter 8259 (Fig. 4) into the transmission case and then install the pressure gauge and the original sensor into the adapter. This will allow a comparison of the DRB® readings and the gauge reading to determe the accuracy of the line pressure sensor. The DRB® line pressure reading should match the gauge reading within ±10 psi.

In order to access any other pressure tap locations, the transmission oil pan must be removed, the pressure port plugs removed and Valve Body Pressure Tap Adapter 8258-A (Fig. 5) installed. The extensions supplied with Adapter 8258-A will allow the installation of pressure gauges to the valve body. Refer to (Fig. 3) for correct pressure tap location identification.

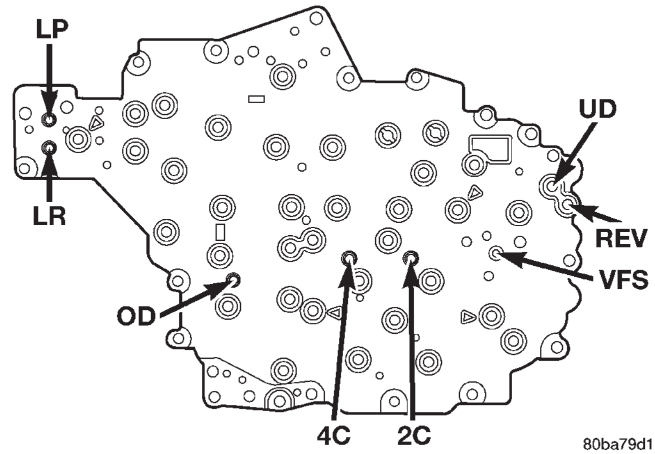


Fig. 3 Pressure Tap Locations

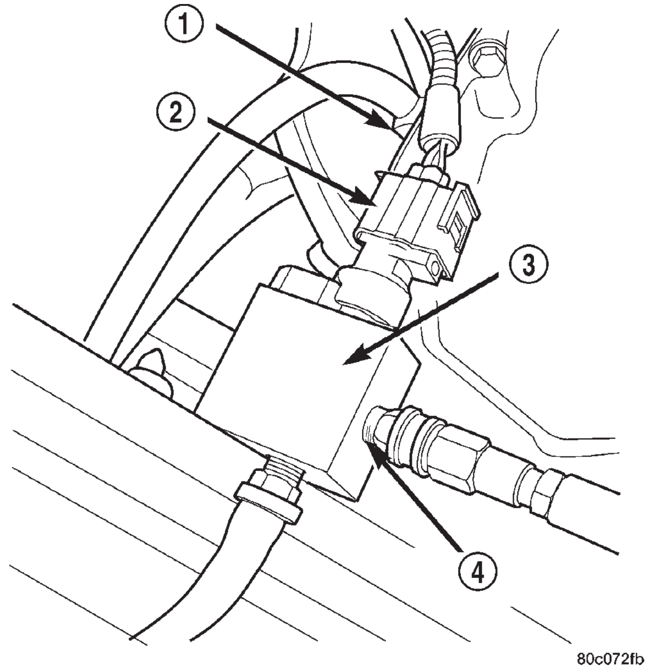


Fig. 4 Line Pressure Adapter 8259

1 - LINE PRESSURE SENSOR PORT
2 - LINE PRESSURE SENSOR
3 - TOOL 8259
4 - PRESSURE TAP

TEST PROCEDURE

All pressure readings should be taken with the transmission fluid level full, transmission oil at the normal operating temperature, and the engine at 1500 rpm. Check the transmission for proper operation in each gear position that is in question or if a specific element is in question, check the pressure readings in at least two gear positions that employ that element. Refer to the Hydraulic Schematics at the rear of this section to determine the correct pressures for each element in a given gear position.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

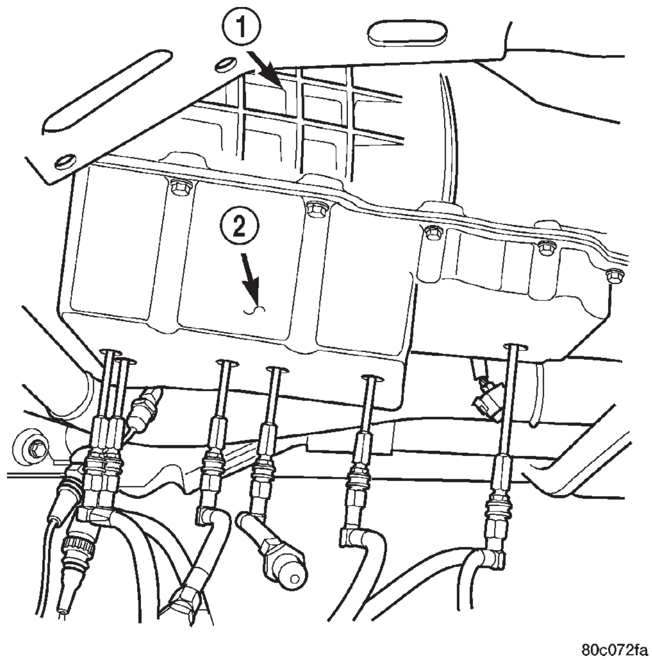


Fig. 5 Valve Body Pressure Tap Adapter 8258-A

1 - 545RFE TRANSMISSION
2 - TOOL 8258-A

NOTE: The 545RFE utilizes closed loop control of pump line pressure. The pressure readings may therefore vary greatly but should always follow line pressure.

Some common pressures that can be measured to evaluate pump and clutch performance are the upshift/downshift pressures and the garage shift pressures. The upshift/downshift pressure for all shifts except the 4-5 shift is 120 psi. The upshift pressure for the 4-5 shift is 130 psi. The garage shift pressure when performing a N-R shift is 220 psi. The garage shift pressure for the R-N and N-1 shifts is 120 psi.

DIAGNOSIS AND TESTING - AIR CHECKING TRANSMISSION CLUTCH OPERATION

Air-pressure testing can be used to check transmission clutch operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The clutch apply passages are shown (Fig. 6).

NOTE: The air supply which is used must be free of moisture and dirt. Use a pressure of 30 psi to test clutch operation.

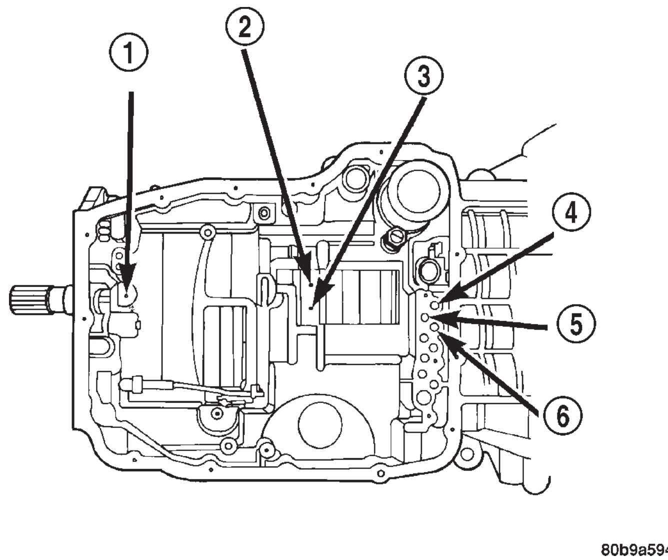


Fig. 6 Air Pressure Test Passages

1 - LOW REVERSE CLUTCH
2 - 4TH CLUTCH
3 - 2ND CLUTCH
4 - OVERDRIVE CLUTCH
5 - UNDERDRIVE CLUTCH
6 - REVERSE CLUTCH

Apply air pressure at each port. If the clutch is functioning, a soft thump will be heard as the clutch is applied. The clutch application can also be felt by touching the appropriate element while applying air pressure. As the air pressure is released, the clutch should also release.

DIAGNOSIS AND TESTING - CONVERTER HOUSING FLUID LEAK

When diagnosing converter housing fluid leaks, two items must be established before repair.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Torque converter seal leaks tend to move along the drive hub and onto the rear of the converter. Pump cover seal tend to run down the cover and the inside surface of the bellhousing.

Some leaks, or suspected leaks, may be particularly difficult to locate. If necessary, a Mopar® approved dye may be used to locate a leak.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 7).

(2) Leaks at the converter hub weld (Fig. 7).

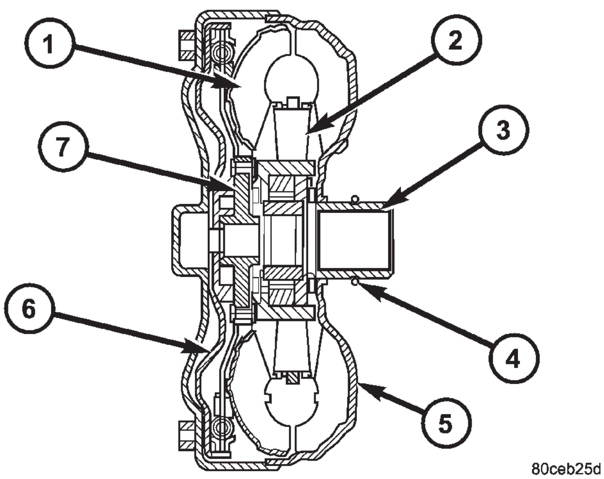


Fig. 7 Torque Converter Assembly

1 - TURBINE ASSEMBLY
2 - STATOR
3 - CONVERTER HUB
4 - O-RING
5 - IMPELLER ASSEMBLY
6 - CONVERTER CLUTCH PISTON
7 - TURBINE HUB

STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, converter hub o-ring, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

(1) Disconnect the negative battery cable.

(2) Raise and support the vehicle

(3) Mark propeller shaft and axle yokes for assembly alignment.

(4) Remove the rear propeller shaft

(5) Remove the front propeller shaft.

(6) Remove the engine to transmission collar (Fig. 8).

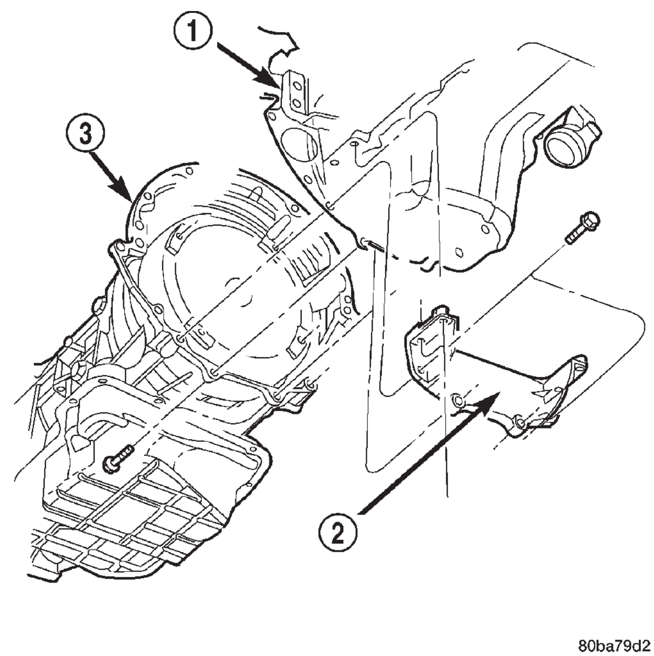


Fig. 8 Transmission Collar

1 - ENGINE
2 - ENGINE TO TRANSMISSION COLLAR
3 - TRANSMISSION

(7) Remove the exhaust support bracket from the rear of the transmission.

(8) Disconnect and lower or remove any necessary exhaust components.

(9) Remove the starter motor.

(10) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(11) Disconnect wires from solenoid and pressure switch assembly, input and output speed sensors, and line pressure sensor.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(12) Disconnect gearshift cable from transmission manual valve lever (Fig. 9).

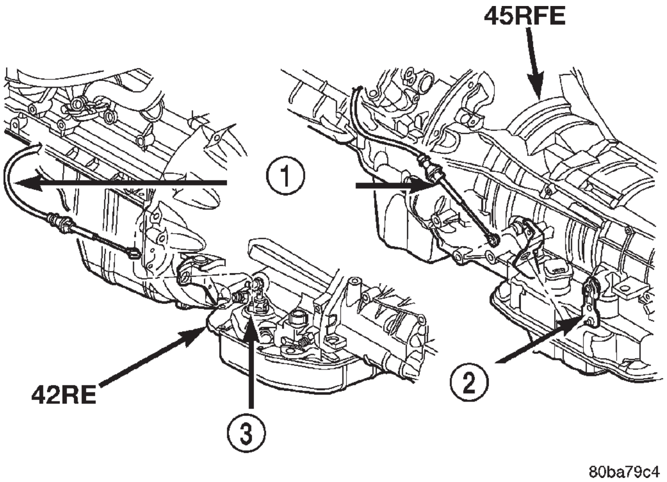


Fig. 9 Transmission Shift Cable

1 - SHIFT CABLE
2 - MANUAL LEVER
3 - MANUAL LEVER

(13) Disconnect transfer case shift cable from the transfer case shift lever (Fig. 10).

(14) Remove the clip securing the transfer case shift cable into the cable support bracket.

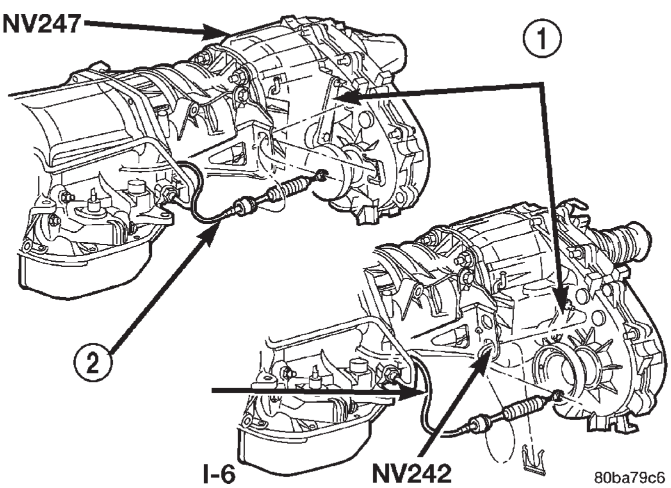


Fig. 10 Transfer Case Shift Cable

1 - TRANSFER CASE SHIFT LEVER
2 - TRANSFER CASE SHIFT CABLE

(15) Disconnect transmission fluid cooler lines at transmission fittings and clips.

(16) Disconnect the transmission vent hose from the transmission.

(17) Support rear of engine with safety stand or jack.

(18) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(19) Remove bolts securing rear support and cushion to transmission and crossmember (Fig. 11).

(20) Remove bolts attaching crossmember to frame and remove crossmember.

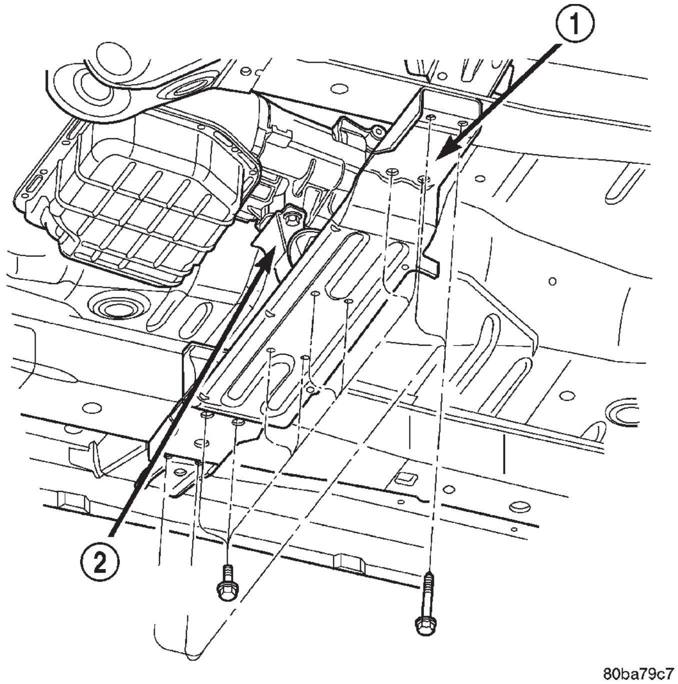


Fig. 11 Rear Transmission Crossmember

1 - CROSSMEMBER
2 - REAR TRANSMISSION MOUNT

(21) Remove transfer case (Fig. 12) and (Fig. 13).

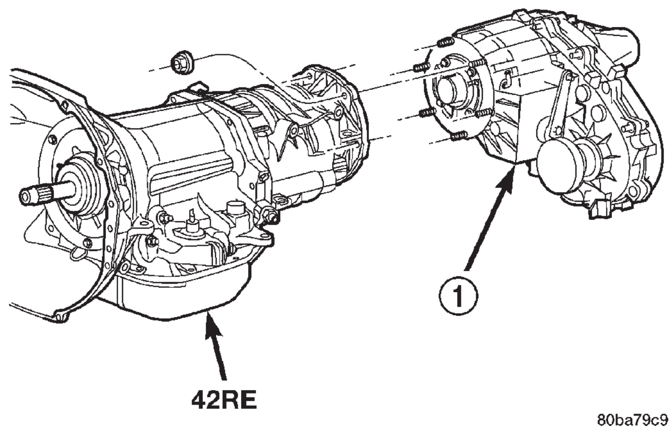


Fig. 12 Remove NV247 Transfer Case

1 - NV247 TRANSFER CASE

(22) Remove all remaining converter housing bolts.

(23) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(24) Hold torque converter in place during transmission removal.

(25) Lower transmission and remove assembly from under the vehicle.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

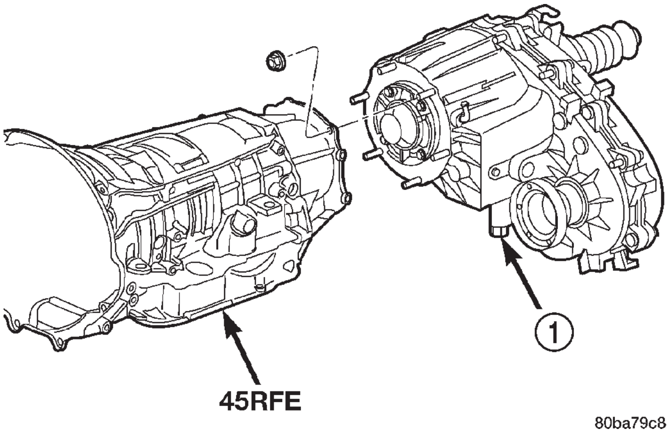


Fig. 13 Remove NV242 Transfer Case

1 - NV242 TRANSFER CASE

(26) To remove torque converter, carefully slide torque converter out of the transmission.

DISASSEMBLY

(1) Drain fluid from transmission.

(2) Clean exterior of transmission with suitable solvent or pressure washer.

(3) Remove the torque converter from the transmission.

(4) Remove the manual shift lever from the transmission.

(5) Remove the input, output, and line pressure sensors from the transmission case (Fig. 14).

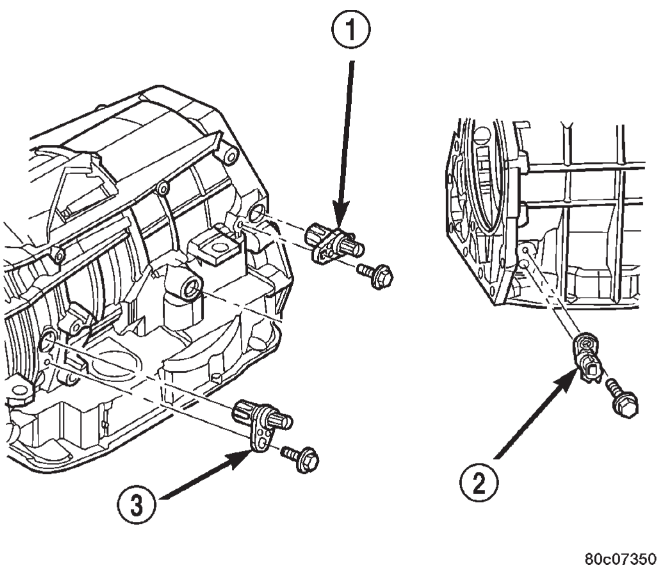


Fig. 14 Remove Input, Output, and Line Pressure Sensors

1 - OUTPUT SPEED SENSOR
2 - LINE PRESSURE SENSOR
3 - INPUT SPEED SENSOR

(6) Inspect the ends of the sensors for debris, which may indicate the nature of the transmission failure.

(7) Install Support Stand 8257 onto the transmission case (Fig. 15).

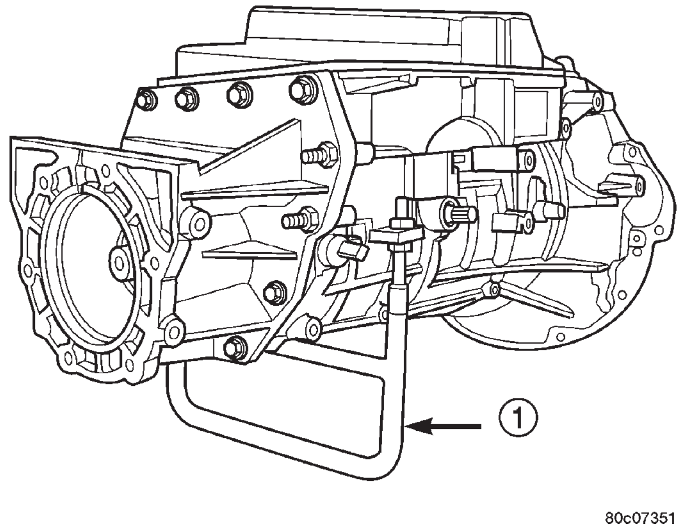


Fig. 15 Install Support Stand - Tool 8257

1 - TOOL 8257

(8) Using Adapter 8266-1 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the input shaft end-play (Fig. 16).

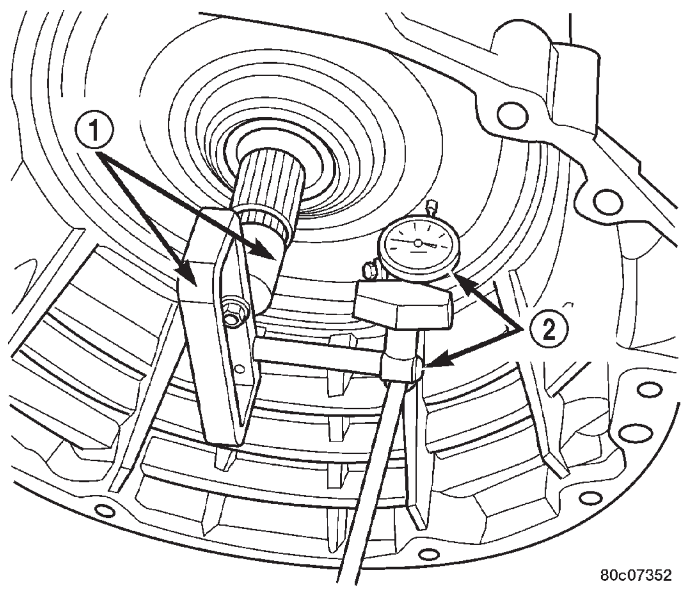


Fig. 16 Measure Input Shaft End Play

1 - TOOL 8266
2 - TOOL C-3339

AUTOMATIC TRANSMISSION - 545RFE (Continued)

NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

(9) Remove the bolts holding the transmission extension/adapter housing to the transmission case.

(10) Remove the extension/adapter housing from the transmission case.

(11) Using Alignment Plate 8261, Adapter 8266-17 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the output shaft end-play (Fig. 17).

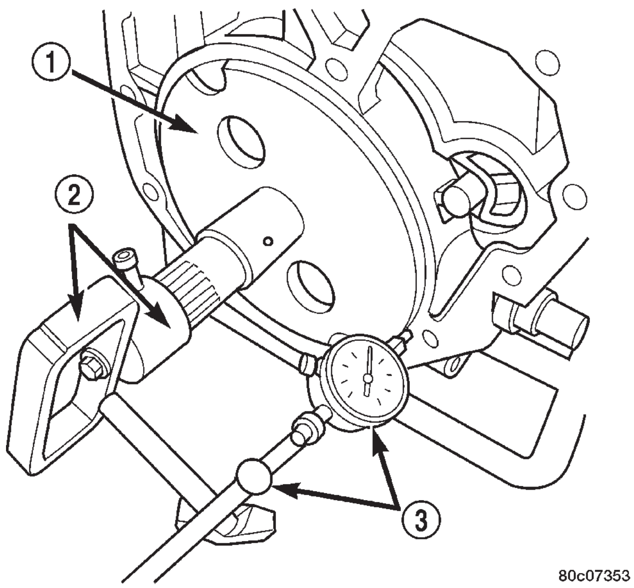


Fig. 17 Measure Output Shaft End Play

1 - TOOL 8261
2 - TOOL 8266
3 - TOOL C-3339

(12) Remove the bolts holding the transmission oil pan to the transmission case.

(13) Remove the transmission oil pan from the transmission case.

(14) Remove the primary oil filter and the oil cooler return filter (Fig. 18).

(15) Remove the cooler return filter bypass valve.

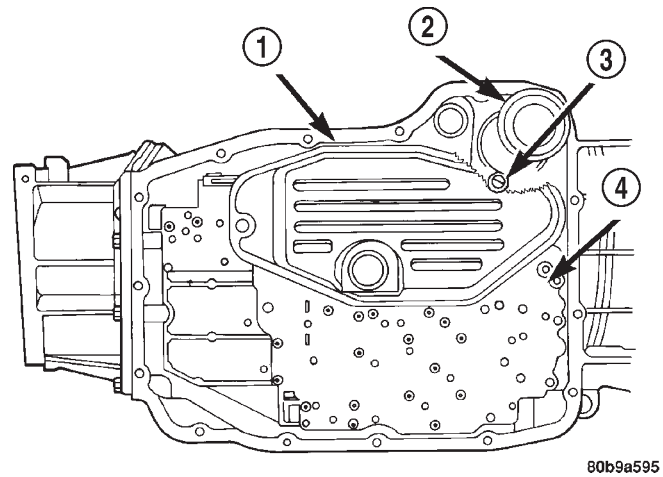


Fig. 18 Remove Primary Oil and Cooler Filters

1 - PRIMARY OIL FILTER
2 - COOLER RETURN FILTER
3 - COOLER RETURN FILTER BYPASS VALVE
4 - VALVE BODY

(16) Remove the bolts holding the valve body to the transmission case (Fig. 19).

(17) Remove the valve body from the transmission case.

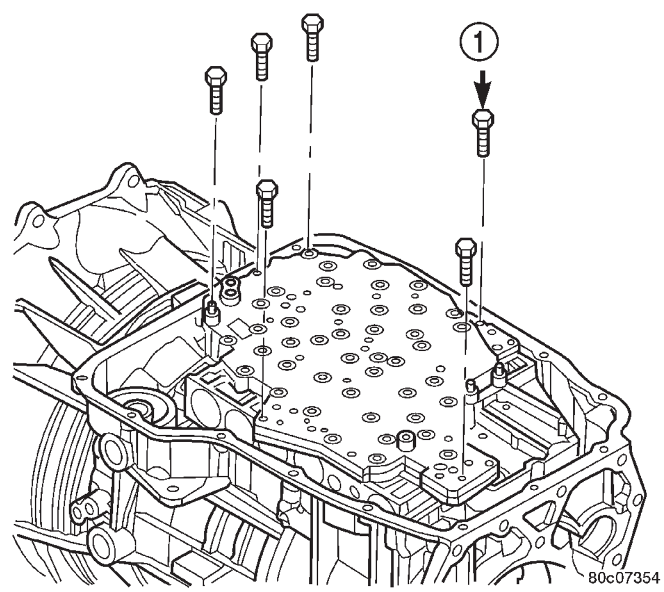


Fig. 19 Remove Valve Body Assembly

1 - VALVE BODY TO CASE BOLT (6)

(18) Remove the outer snap-ring securing the transmission front cover into the transmission case (Fig. 20).

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(19) Remove the inner snap-ring securing the transmission front cover to the oil pump (Fig. 20).

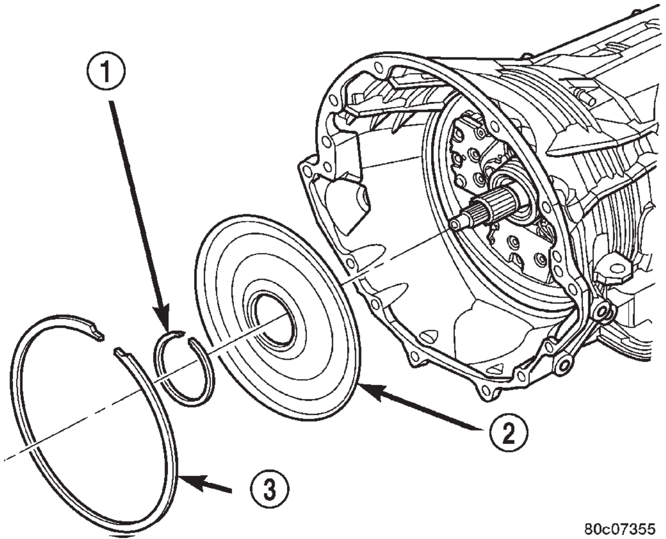


Fig. 20 Remove Transmission Front Cover

1 - INNER SNAP-RING
2 - TRANSMISSION COVER
3 - OUTER SNAP-RING

(20) Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover from the transmission case.

(21) Remove the bolts holding the oil pump into the transmission case (Fig. 21).

(22) Remove the oil pump. Hold inward on the input shaft to prevent pulling the input clutch assembly with the oil pump (Fig. 21).

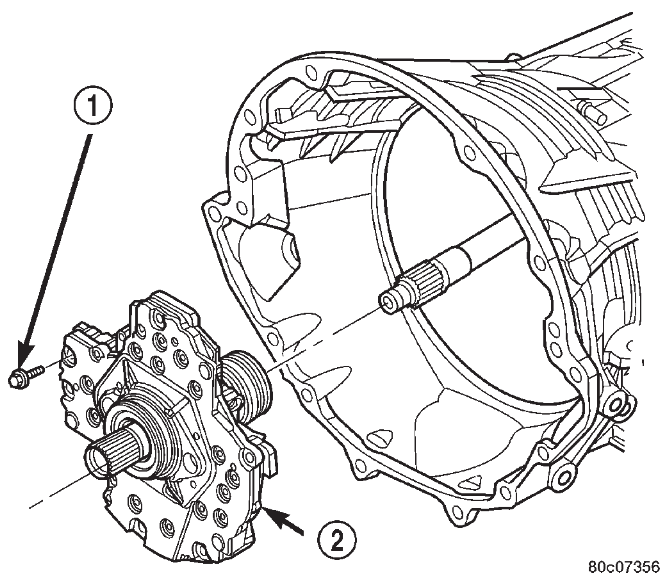


Fig. 21 Remove Oil Pump

1 - OIL PUMP TO CASE BOLT (6)
2 - OIL PUMP

(23) Remove the number 1 bearing from the input clutch assembly (Fig. 22).

(24) Remove the input clutch assembly from the transmission case (Fig. 22).

(25) Remove the number 5 bearing and selective thrust plate from the input clutch assembly (Fig. 22), or the 4C clutch retainer/bulkhead.

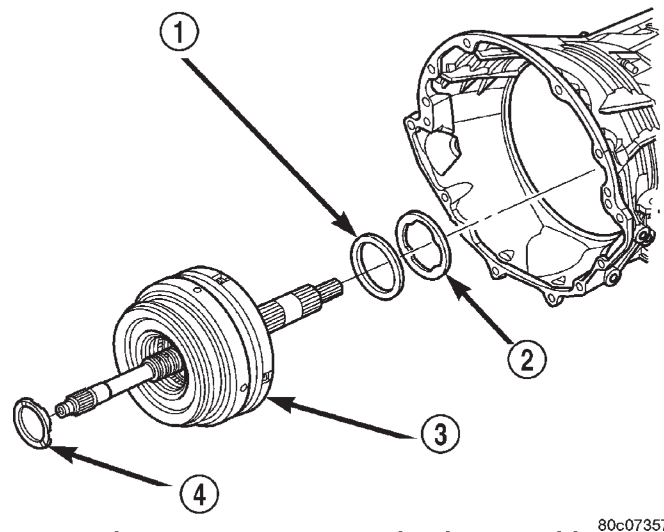


Fig. 22 Remove Input Clutch Assembly

1 - BEARING NUMBER 5
2 - THRUST PLATE (SELECT)
3 - INPUT CLUTCH ASSEMBLY
4 - BEARING NUMBER 1

(26) Remove the 4C clutch retainer/bulkhead tapered snap-ring from the transmission case (Fig. 23).

(27) Remove the 4C clutch retainer/bulkhead from the transmission case (Fig. 23).

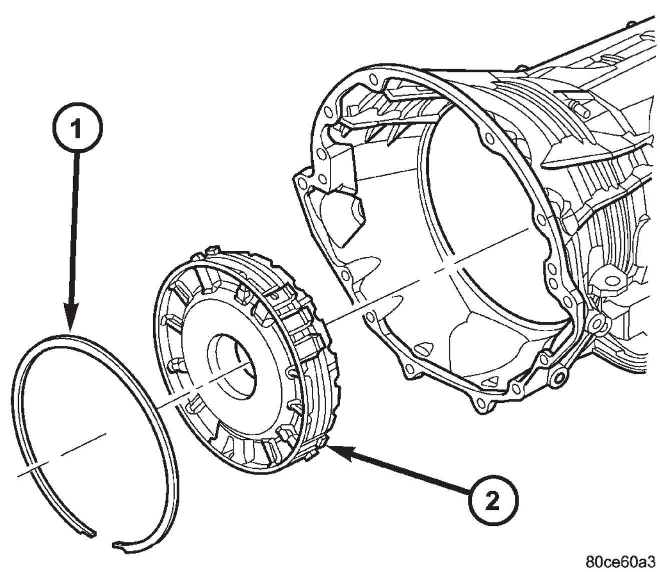


Fig. 23 Remove 4C Clutch Retainer/Bulkhead

1 - SNAP-RING
2 - 4C CLUTCH RETAINER/BULKHEAD

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(28) Remove the front 2C clutch pack snap-ring from the transmission case (Fig. 24).

(29) Remove the 2C clutch pack from the transmission case (Fig. 24).

(30) Remove the rear selective plate and number 6 bearing from the reaction annulus (Fig. 25).

(31) Remove the reaction annulus from the reaction planetary carrier (Fig. 25).

(32) Remove the number 7 bearing (Fig. 25).

(33) Remove the reaction sun gear (Fig. 25).

(34) Remove the number 8 bearing from the reaction planetary carrier (Fig. 25).

(35) Remove the reaction planetary carrier (Fig. 25). Note that this planetary gear set has three pinion gears.

(36) Remove the number 9 bearing from the reverse planetary gear set (Fig. 25).

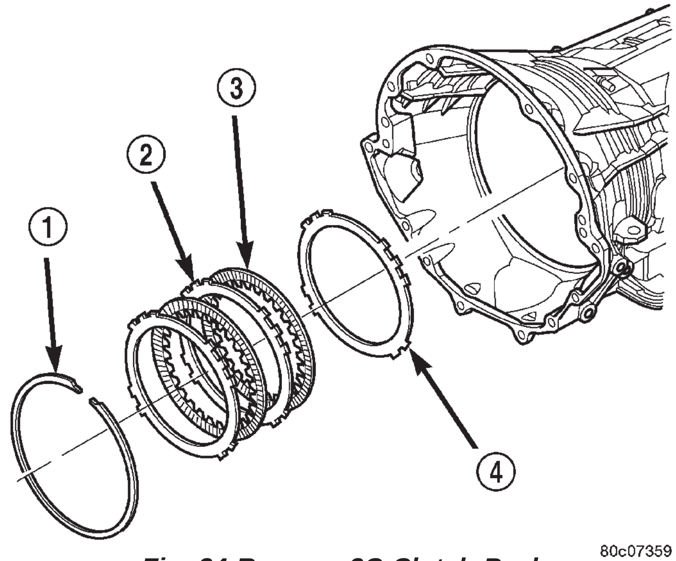


Fig. 24 Remove 2C Clutch Pack

1 - SNAP-RING
2 - PLATE
3 - DISC
4 - REACTION PLATE

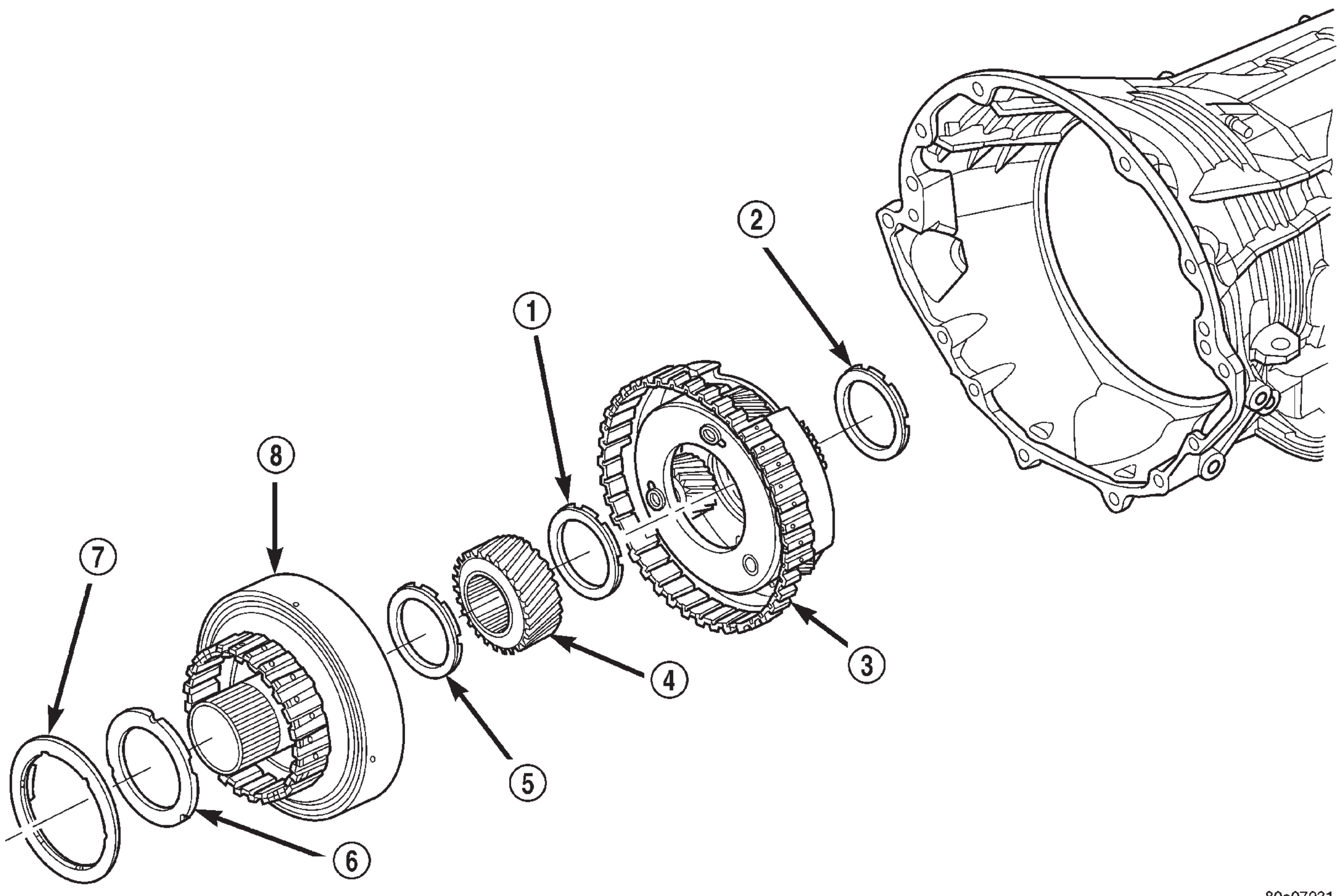


Fig. 25 Remove Reaction Annulus and Carrier

1 - BEARING NUMBER 8
2 - BEARING NUMBER 9
3 - REACTION PLANETARY CARRIER
4 - REACTION SUN GEAR
5 - BEARING NUMBER 7
6 - THRUST PLATE (SELECT)
7 - BEARING NUMBER 6
8 - REACTION ANNULUS

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(37) Remove the snap-ring holding the park sprag gear onto the output shaft (Fig. 26).

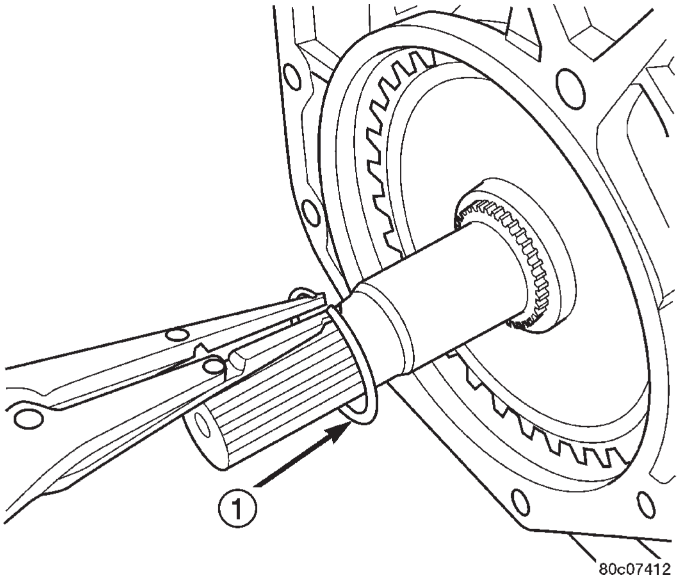


Fig. 26 Remove Park Sprag Snap-Ring

1 - SNAP-RING

(38) Remove the park sprag gear from the output shaft (Fig. 27).

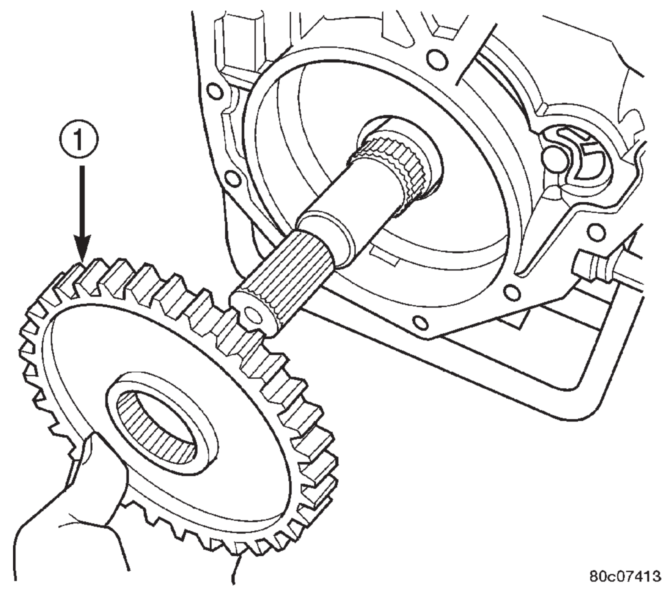


Fig. 27 Remove Park Sprag Gear

1 - PARK SPRAG GEAR

(39) Remove the input/reverse planetary assembly (Fig. 28).

(40) Remove the number 12 bearing from the input/reverse planetary assembly (Fig. 28).

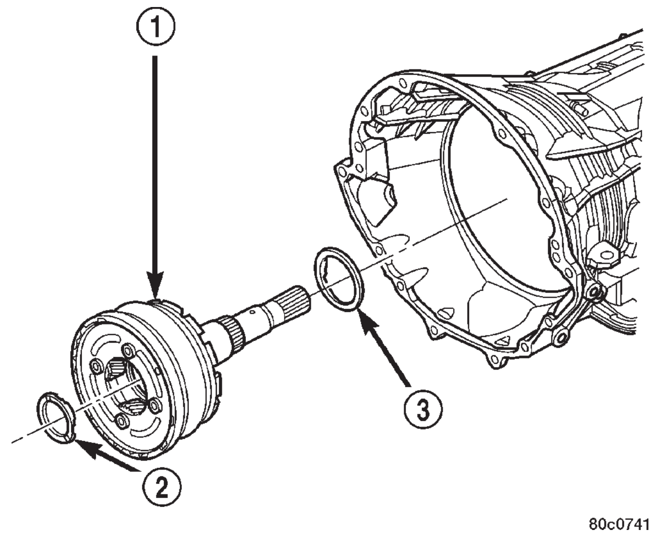


Fig. 28 Remove Input/Reverse Planetary Assembly

1 - INPUT/REVERSE PLANETARY ASSEMBLY
2 - BEARING NUMBER 9
3 - BEARING NUMBER 12

(41) Remove the snap-ring holding the low/reverse clutch retainer into the transmission case (Fig. 29).

(42) Remove the low/reverse clutch retainer from the transmission case (Fig. 29).

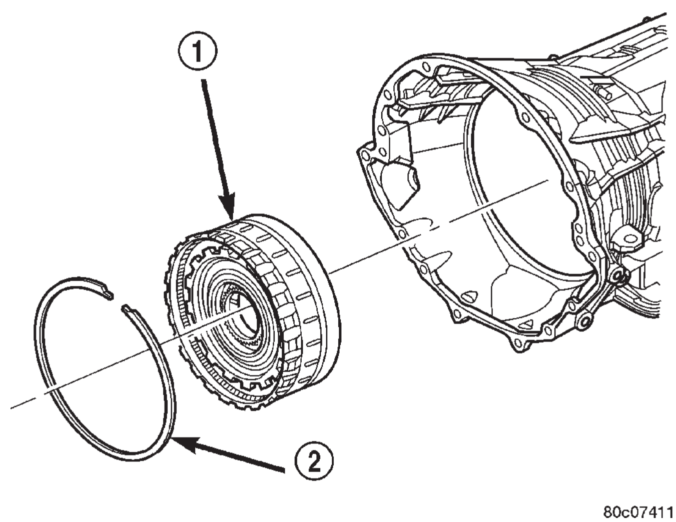


Fig. 29 Remove Low/Reverse Clutch Retainer

1 - LOW/REVERSE OVERRUNNING CLUTCH ASSEMBLY
2 - SNAP-RING

(43) Remove the park pawl rod and e-clip (Fig. 30).

(44) Remove the park pawl rod guide snap-ring (Fig. 30).

(45) Remove the park pawl rod guide (Fig. 30).

(46) Remove the park pawl pivot shaft, park pawl, and spring (Fig. 30).

(47) Remove the manual selector shaft (Fig. 30).

AUTOMATIC TRANSMISSION - 545RFE (Continued)

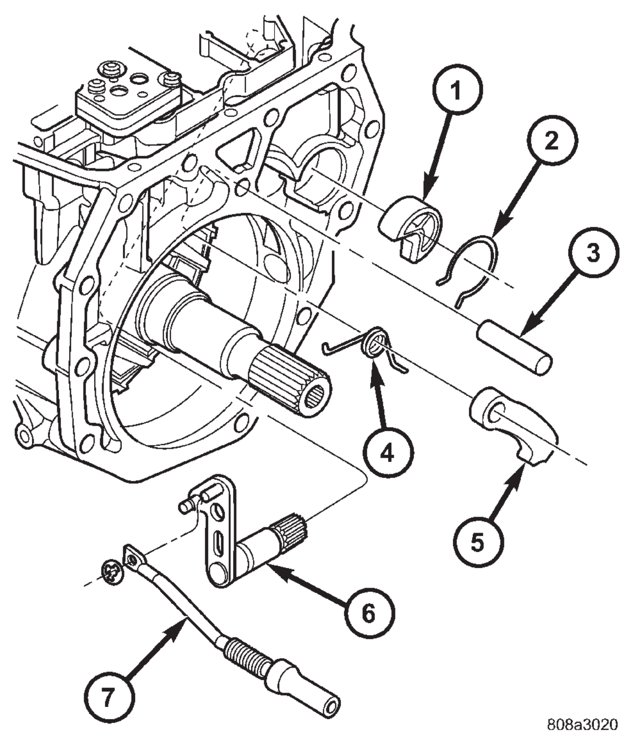


Fig. 30 Manual Shaft/Park Lock Components

1 - GUIDE
2 - SNAP-RING
3 - SHAFT
4 - SPRING
5 - PARK PAWL
6 - MANUAL SHAFT/LEVER
7 - PARK ROD

(48) Remove the manual selector shaft seal.
(49) Remove the dipstick tube seal.

CLEANING

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar® ATF +4, Type 9602, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

INSPECTION

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.
(2) Install the cooler filter bypass valve.
(3) Torque the bypass valve to specification. The valve uses a tapered pipe thread and excessive torque can damage the transmission case. Tighten the cooler filter bypass valve to 4.5 N·m (40 in.lbs.).
(4) Install a new selector shaft seal using Seal Installer 8253 (Fig. 31).

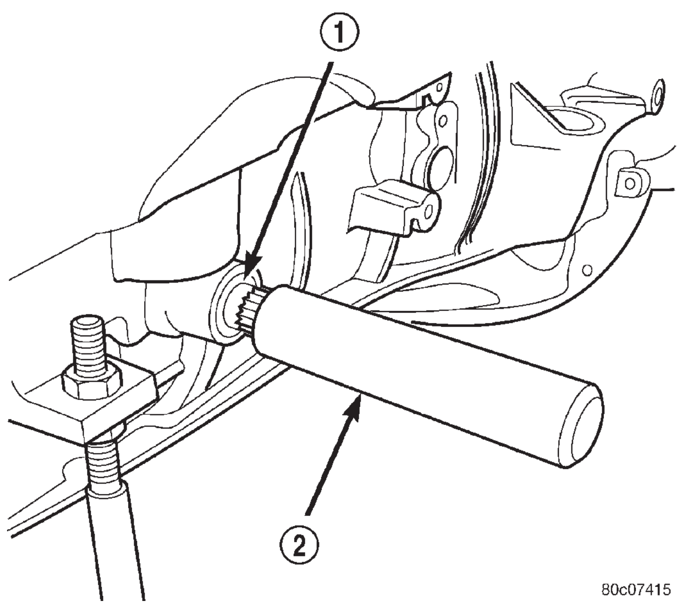


Fig. 31 Install Selector Shaft

1 - SEAL
2 - TOOL 8253

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(5) Install the manual selector shaft and retaining screw. Tighten the manual selector shaft retaining screw to 28 N·m (250 in.lbs.).

(6) Install the park pawl, spring, and shaft (Fig. 32).

(7) Install the park rod and e-clip (Fig. 32).

(8) Install the park rod guide and snap-ring (Fig. 32).

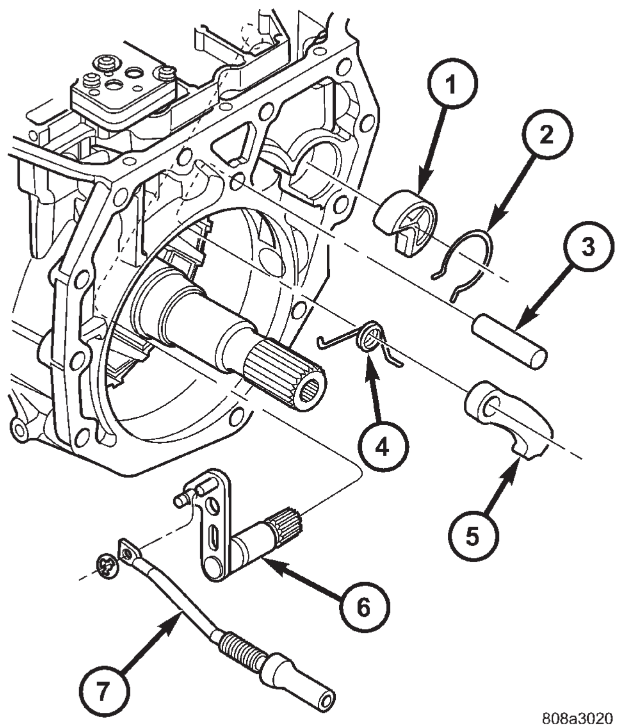


Fig. 32 Manual Shaft/Park Lock Components

1 - GUIDE
2 - SNAP-RING
3 - SHAFT
4 - SPRING
5 - PARK PAWL
6 - MANUAL SHAFT/LEVER
7 - PARK ROD

(9) Install a new dipstick tube seal using Seal Installer 8254 (Fig. 33).

NOTE: Before final assembly of transmission centerline, the 2C/4C clutch components should be installed into position and measured as follows:

(10) Install the 2C reaction plate into the transmission case (Fig. 34). The reaction plate is directional. The plate must be installed with the flat side toward the front of the transmission.

(11) Install the 2C clutch pack into the transmission case (Fig. 34).

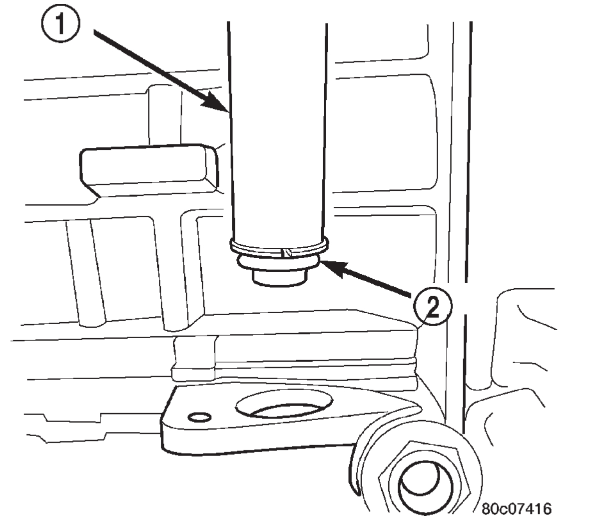


Fig. 33 Install Dipstick Tube Seal Using Tool 8254

1 - TOOL 8254
2 - SEAL

(12) Install the flat 2C clutch snap-ring into the transmission case (Fig. 34).

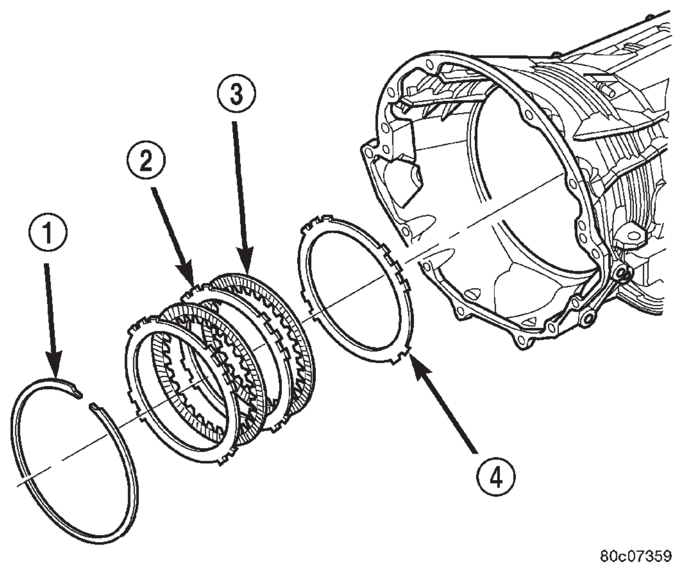


Fig. 34 Install 2C Clutch Pack

1 - SNAP-RING
2 - PLATE
3 - DISC
4 - REACTION PLATE

(13) Install the 4C retainer/bulkhead into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area.

(14) Install the 4C retainer/bulkhead tapered snap-ring into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(15) Using a feeler gauge through the opening in the rear of the transmission case, measure the 2C clutch pack clearance between the 2C reaction plate and the transmission case at four different points. The average of these measurements is the 2C clutch pack clearance. The correct clutch clearance is 0.455-1.335 mm (0.018-0.053 in.). The reaction plate is not selective. If the clutch pack clearance is not within specification, the reaction plate, all the friction discs, and steels must be replaced.

(16) Remove the 4C retainer/bulkhead and all of the 2C clutch components from the transmission case.

(17) Install the low/reverse clutch assembly (Fig. 35). Make sure that the oil feed hole points toward the valve body area and that the bleed orifice is aligned with the notch in the rear of the transmission case.

(18) Install the snap-ring to hold the low/reverse clutch retainer into the transmission case (Fig. 35). The snap-ring is tapered and must be installed with the tapered side forward. Once installed, verify that the snap-ring is fully seated in the snap-ring groove.

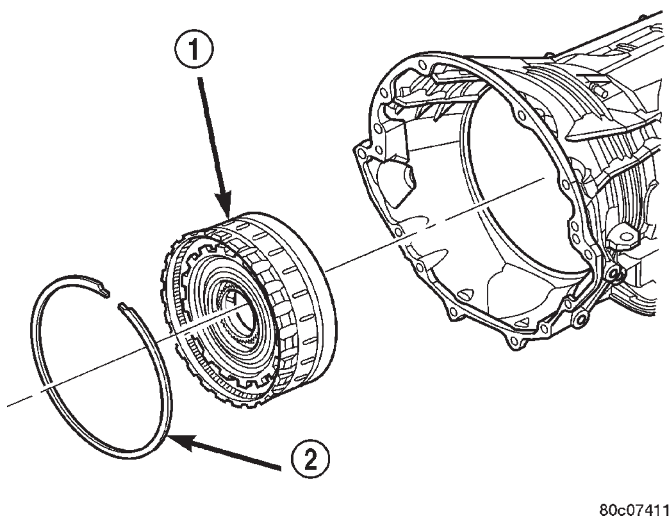


Fig. 35 Install Low/Reverse Clutch Retainer

1 - LOW/REVERSE OVERRUNNING CLUTCH ASSEMBLY
2 - SNAP-RING

(19) Air check the low/reverse clutch and verify correct overrunning clutch operation.

(20) Install the number 12 bearing over the output shaft and against the rear planetary gear set. The flat side of the bearing goes toward the planetary gearset and the raised tabs on the inner race should face the rear of the transmission.

(21) Install the reverse/input planetary assembly through the low/reverse clutch assembly (Fig. 36).

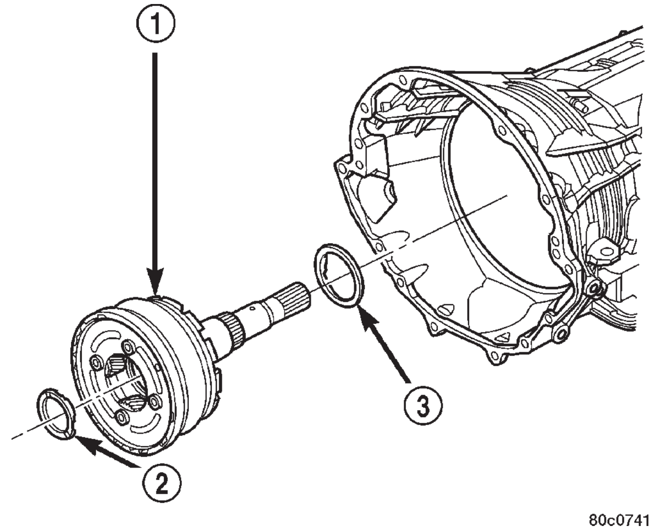


Fig. 36 Install Input/Reverse Planetary Assembly

1 - INPUT/REVERSE PLANETARY ASSEMBLY
2 - BEARING NUMBER 9
3 - BEARING NUMBER 12

(22) Install the park sprag onto the output shaft (Fig. 37).

(23) Install the snap-ring to hold the park sprag onto the output shaft (Fig. 38).

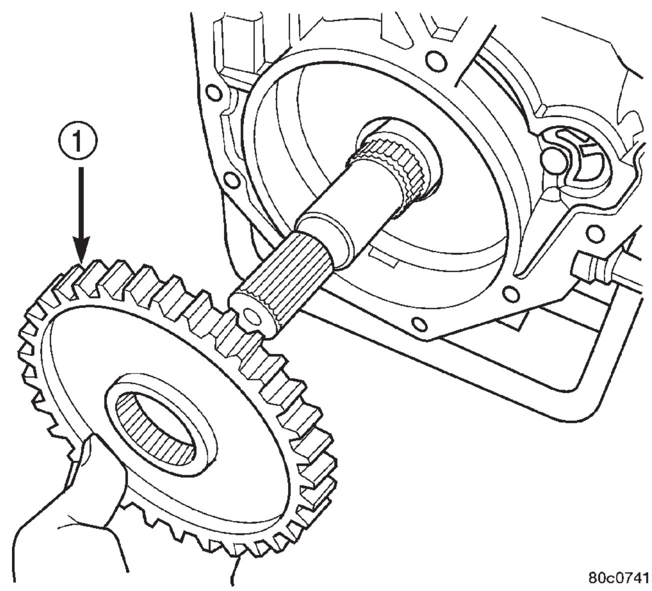


Fig. 37 Install Park Sprag Gear

1 - PARK SPRAG GEAR

AUTOMATIC TRANSMISSION - 545RFE (Continued)

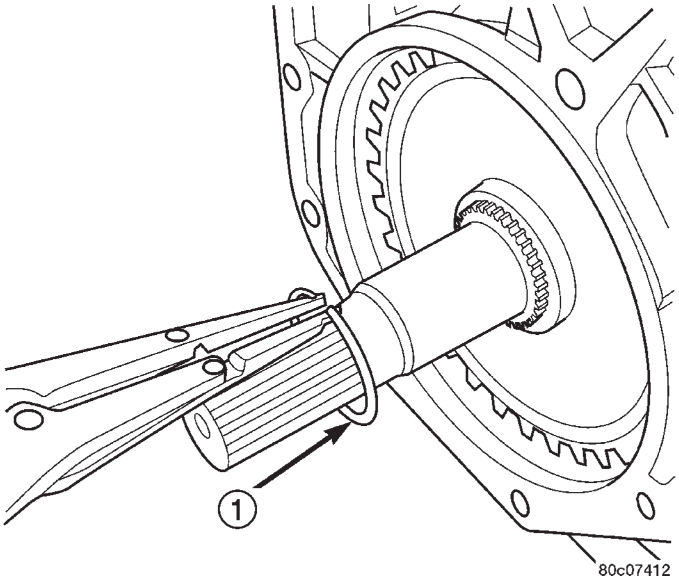


Fig. 38 Install Park Sprag Snap-Ring

1 - SNAP-RING

(24) Install the 2C reaction plate into the transmission case (Fig. 39). The reaction plate is directional. The plate must be installed with the flat side toward the front of the transmission.

(25) Install the 2C clutch pack into the transmission case (Fig. 39).

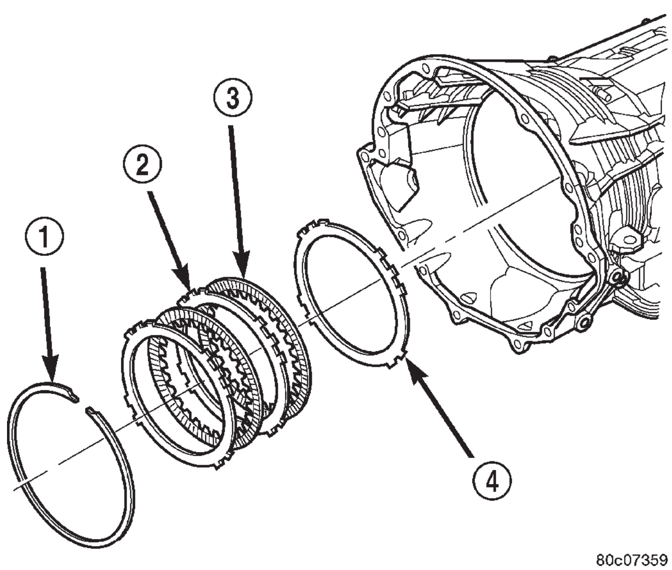


Fig. 39 Install 2C Clutch Pack

1 - SNAP-RING
2 - PLATE
3 - DISC
4 - REACTION PLATE

(26) Install the number 8 bearing inside the reaction carrier with the outer race against the reaction planetary carrier.

(27) Install the reaction planetary gear set and the number 9 bearing, with the inner race against the reaction planetary carrier, into the transmission case (Fig. 40).

(28) Install the flat 2C clutch snap-ring into the transmission case (Fig. 39).

(29) Install the reaction sun gear into the reaction planetary gear set. **Make sure** the small shoulder is facing the front of the transmission (Fig. 40).

(30) Install the number 7 bearing onto the reaction sun gear with the inner race against the sun gear (Fig. 40).

(31) Install the output shaft selective thrust plate onto the reaction annulus with the oil grooves facing the annulus gear and the tabs and notches aligned as shown in (Fig. 41).

(32) Install the number 6 bearing against the output shaft selective thrust plate with the flat side against the thrust plate (Fig. 40) and the raised tabs on the inner race facing the front of the transmission.

(33) Install the reaction annulus into the reaction planetary gear set (Fig. 40).

(34) Install the 4C retainer/bulkhead into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area. Rotate the reaction annulus during the installation of the 4C retainer/bulkhead to ease installation.

(35) Install the 4C retainer/bulkhead tapered snap-ring into the transmission case (Fig. 42) with the taper toward the front of the case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

(36) Air check the 2C and 4C clutch operation.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

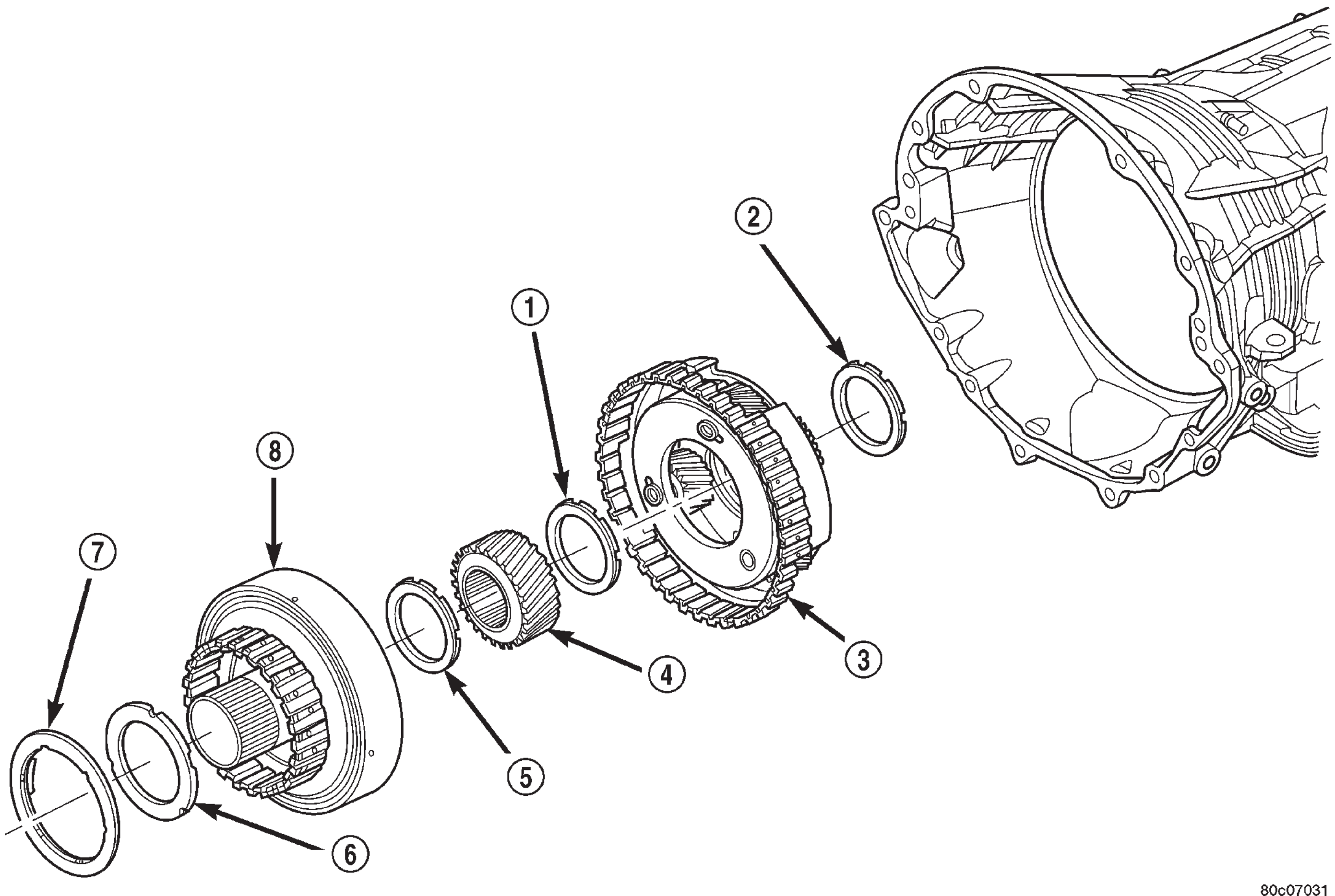


Fig. 40 Install Reaction Annulus and Carrier

1 - BEARING NUMBER 8
2 - BEARING NUMBER 9
3 - REACTION PLANETARY CARRIER
4 - REACTION SUN GEAR
5 - BEARING NUMBER 7
6 - THRUST PLATE (SELECT)
7 - BEARING NUMBER 6
8 - REACTION ANNULUS

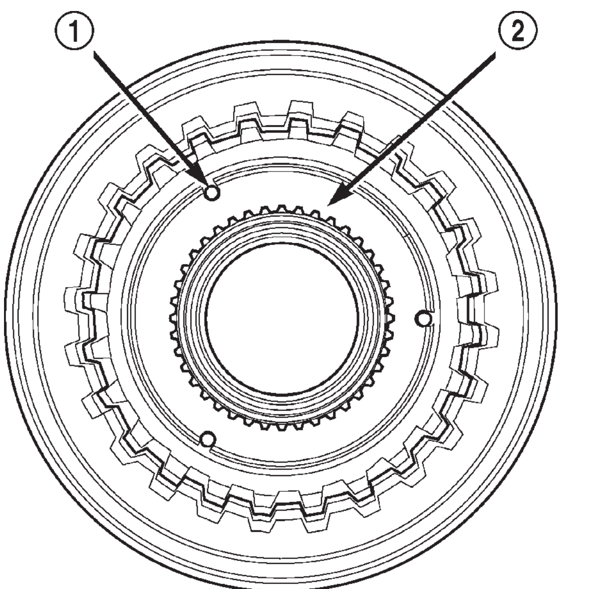


Fig. 41 Thrust Plate Alignment

1 - LOCATING LUG (3)
2 - THRUST PLATE

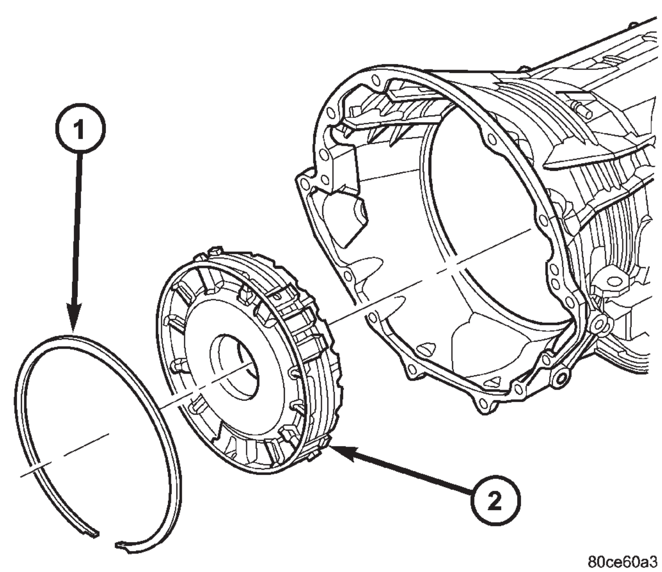


Fig. 42 Install 4C Clutch Retainer/Bulkhead

1 - SNAP-RING
2 - 4C CLUTCH RETAINER/BULKHEAD

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(37) Using Alignment Plate 8261, Adapter 8266-17 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the output shaft end-play (Fig. 43). The correct output shaft end-play is 0.22-0.55 mm (0.009-0.021 in.). Adjust as necessary. Install the chosen output shaft selective thrust plate and re-measure end-play to verify selection.

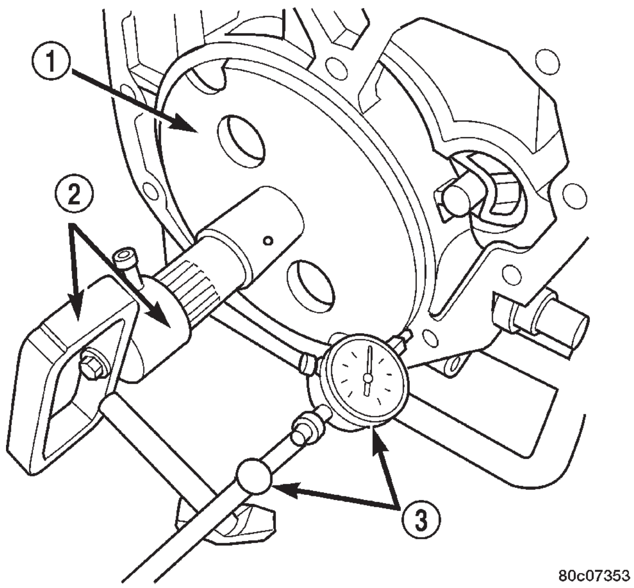


Fig. 43 Measure Output Shaft End Play

1 - TOOL 8261
2 - TOOL 8266
3 - TOOL C-3339

(38) Apply a bead of RTV silicone and install the extension/adapter housing onto the transmission case.

(39) Install and torque the bolts to hold the extension/adapter housing onto the transmission case. The correct torque is 54 N·m (40 ft.lbs.).

(40) Install the number 5 bearing and selective thrust plate onto the 4C retainer/bulkhead (Fig. 44). Be sure that the outer race of the bearing is against the thrust plate.

(41) Install the input clutch assembly into the transmission case (Fig. 44). Make sure that the input clutch assembly is fully installed by performing a visual inspection through the input speed sensor hole. If the tone wheel teeth on the input clutch assembly are centered in the hole, the assembly is fully installed.

(42) Install the number 1 bearing with the outer race up in the pocket of the input clutch assembly (Fig. 44).

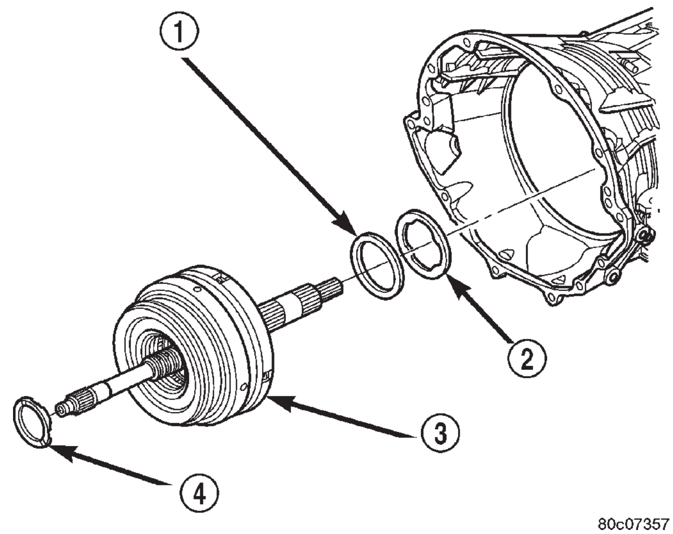


Fig. 44 Install Input Clutch Assembly

1 - BEARING NUMBER 5
2 - THRUST PLATE (SELECT)
3 - INPUT CLUTCH ASSEMBLY
4 - BEARING NUMBER 1

(43) Install the oil pump into the transmission case (Fig. 45).

(44) Install the bolts to hold the oil pump into the transmission case. Tighten the oil pump bolts to 28 N·m (250 in.lbs.).

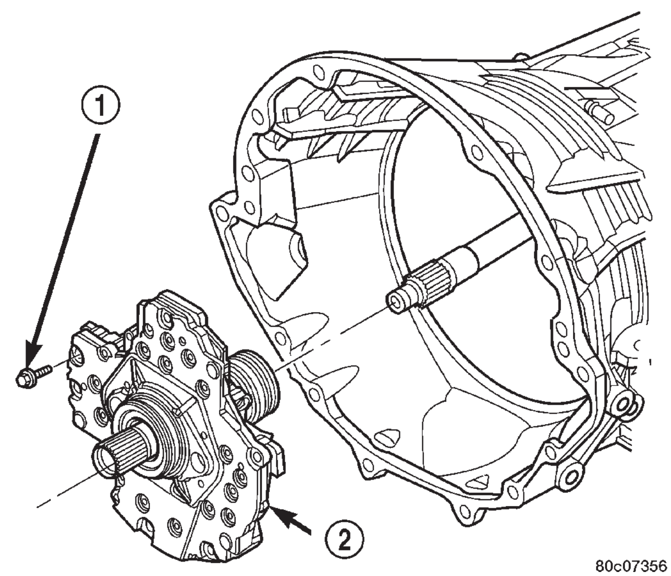


Fig. 45 Install Oil Pump

1 - OIL PUMP TO CASE BOLT (6)
2 - OIL PUMP

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(45) Using Adapter 8266-1 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the input shaft end-play (Fig. 46). The correct end-play is 0.46-0.89 mm (0.018-0.035 in.). Adjust as necessary. Install the chosen thrust plate on the number 5 bearing and re-measure end-play to verify selection.

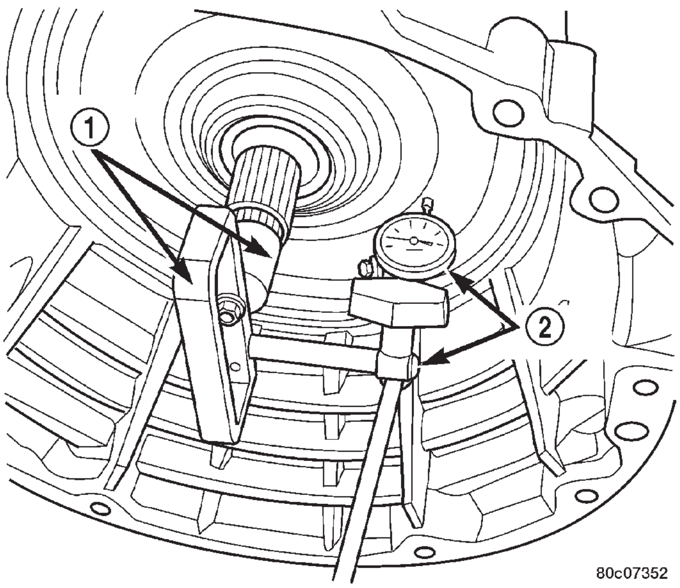


Fig. 46 Measure Input Shaft End Play

1 - TOOL 8266
2 - TOOL C-3339

NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

(46) Install the transmission front cover into the transmission case (Fig. 47).

(47) Install the outer snap-ring to hold the transmission front cover into the transmission case (Fig. 47).

(48) Partially install the inner transmission front cover snap-ring onto the oil pump (Fig. 47).

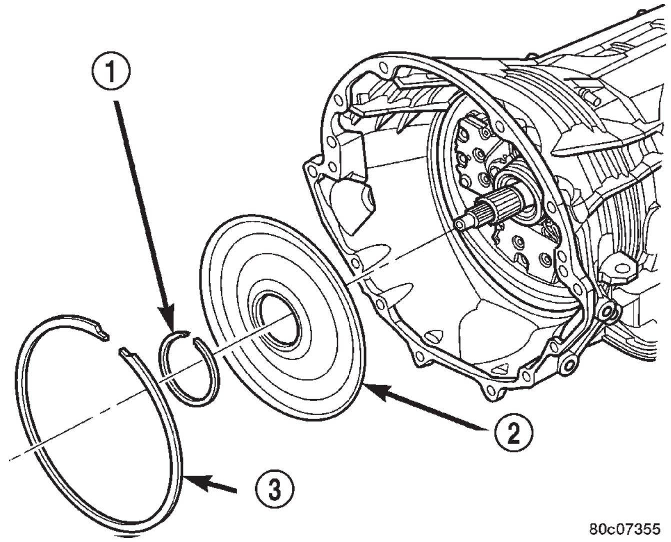


Fig. 47 Install the Transmission Front Cover

1 - INNER SNAP-RING
2 - TRANSMISSION COVER
3 - OUTER SNAP-RING

(49) Using Installer 8255, install the inner transmission front cover snap-ring the remainder of the way onto the oil pump (Fig. 48).

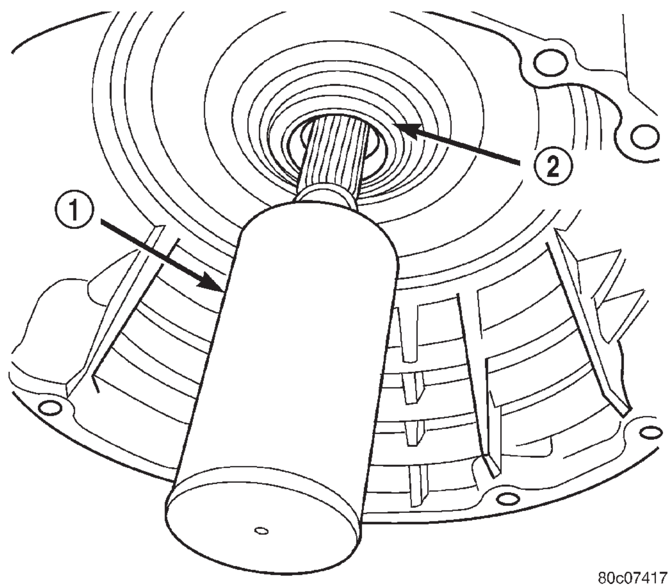


Fig. 48 Seat Snap-Ring Using Tool 8255

1 - TOOL 8255
2 - SNAP-RING

(50) Install the valve body (Fig. 49). Verify that the pin on the manual lever has properly engaged the TRS selector plate. Tighten the valve body to transmission case bolts to 12 N·m (105 in.lbs.).

AUTOMATIC TRANSMISSION - 545RFE (Continued)

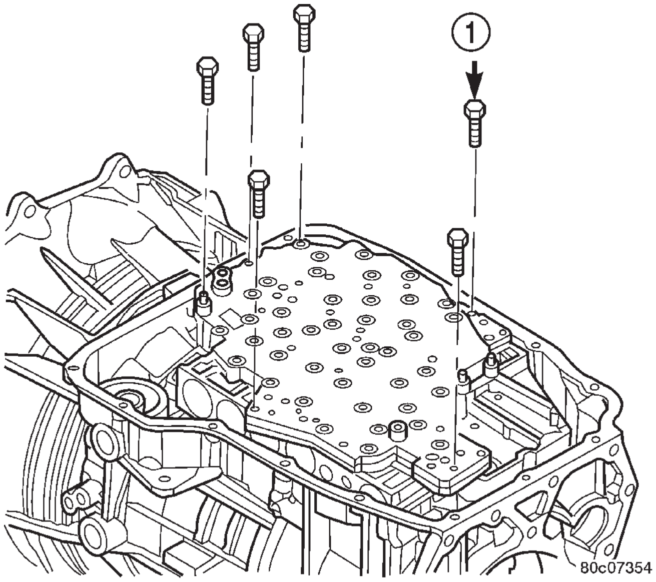


Fig. 49 Install Valve Body Assembly

1 - VALVE BODY TO CASE BOLT (6)

(51) Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.

CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.

(52) Install the primary oil filter and the oil cooler return filter (Fig. 50). Tighten the screw to hold the primary oil filter to the valve body to 4.5 N·m (40 in.lbs.). Using Oil Filter Wrench 8321, tighten the cooler return oil filter to the transmission case to 14 N·m (125 in.lbs.).

(53) Apply RTV silicone to the oil pan and install the transmission oil pan. Tighten the bolts to 12 N·m (105 in.lbs.).

(54) Install the input, output, and line pressure sensors (Fig. 51). Tighten the bolts to 12 N·m (105 in.lbs.).

(55) Install the manual shift lever from the transmission. Torque the retaining cross-bolt to 16 N·m (140 in.lbs.).

INSTALLATION

(1) Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free of any debris. The hub must be smooth to avoid damaging pump seal at installation.

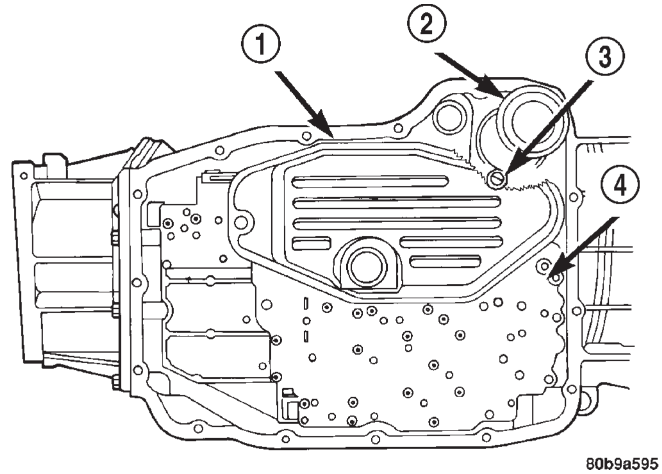


Fig. 50 Install Primary Oil and Cooler Filters

1 - PRIMARY OIL FILTER
2 - COOLER RETURN FILTER
3 - COOLER RETURN FILTER BYPASS VALVE
4 - VALVE BODY

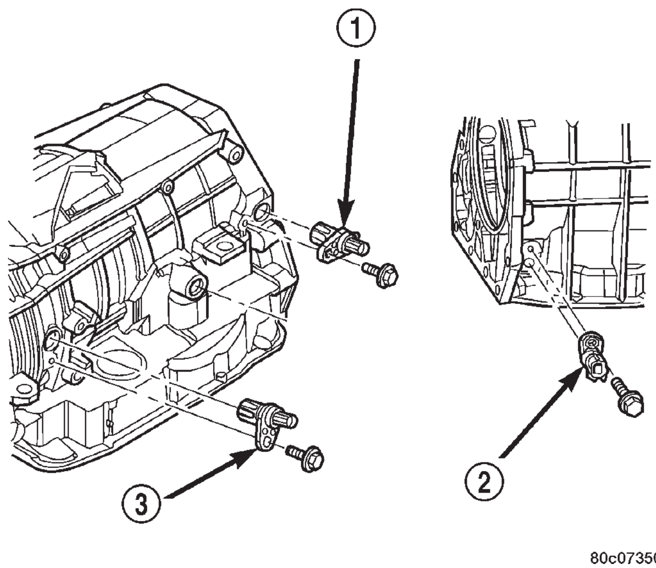


Fig. 51 Install Input, Output, and Line Pressure Sensors

1 - OUTPUT SPEED SENSOR
2 - LINE PRESSURE SENSOR
3 - INPUT SPEED SENSOR

(2) If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.

(3) Lubricate oil pump seal lip with transmission fluid.

(4) Align converter and oil pump.

AUTOMATIC TRANSMISSION - 545RFE (Continued)

(5) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(6) Check converter seating with steel scale and straightedge (Fig. 52). Surface of converter lugs should be at least 13 mm (1/2 in.) to rear of straightedge when converter is fully seated.

(7) Temporarily secure converter with C-clamp.

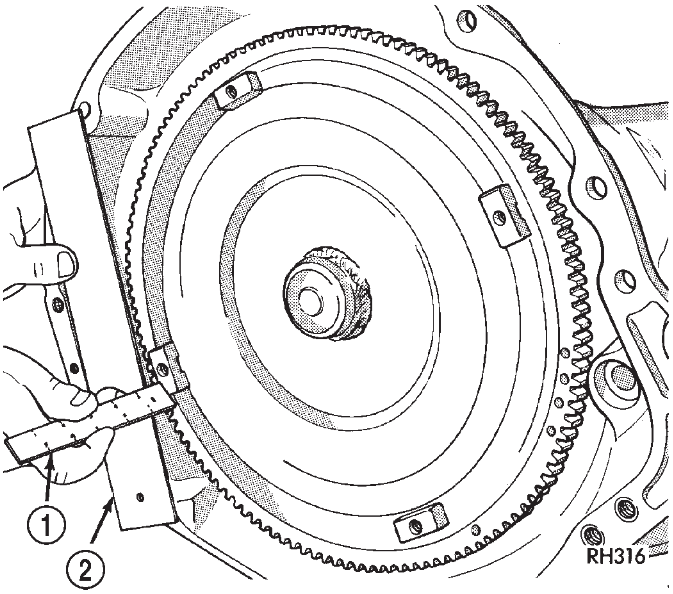


Fig. 52 Checking Torque Converter Seating - Typical

1 - SCALE
2 - STRAIGHTEDGE

(8) Position transmission on jack and secure it with chains.

(9) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

(10) Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.

(11) Raise transmission and align the torque converter with the drive plate and the transmission converter housing with the engine block.

(12) Move transmission forward. Then raise, lower, or tilt transmission to align the converter housing with the engine block dowels.

(13) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.

(14) Install two bolts to attach the transmission to the engine.

(15) Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).

(16) Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).

(17) Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).

(18) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).

(19) Remove engine support fixture.

(20) Install new plastic retainer grommet on any shift cable that was disconnected. Grommets should not be reused. Use pry tool to remove rod from grommet and cut away old grommet. Use pliers to snap new grommet into cable and to snap grommet onto lever.

(21) Connect gearshift cable to transmission.

(22) Connect wires to solenoid and pressure switch assembly connector, input and output speed sensors, and line pressure sensor. Be sure transmission harnesses are properly routed.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(23) Install all torque converter-to-driveplate bolts by hand.

(24) Verify that the torque converter is pulled flush to the driveplate. Tighten bolts to 31 N·m (270 in. lbs.).

(25) Install starter motor and cooler line bracket.

(26) Connect cooler lines to transmission.

(27) Install transmission fill tube.

(28) Install exhaust components.

(29) Install transfer case. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).

(30) Install the transfer case shift cable to the cable support bracket and the transfer case shift lever.

(31) Install the transmission collar onto the transmission and the engine. Tighten the bolts to 54 N·m (40 ft.lbs.).

(32) Align and connect propeller shaft(s).

(33) Adjust gearshift cable if necessary.

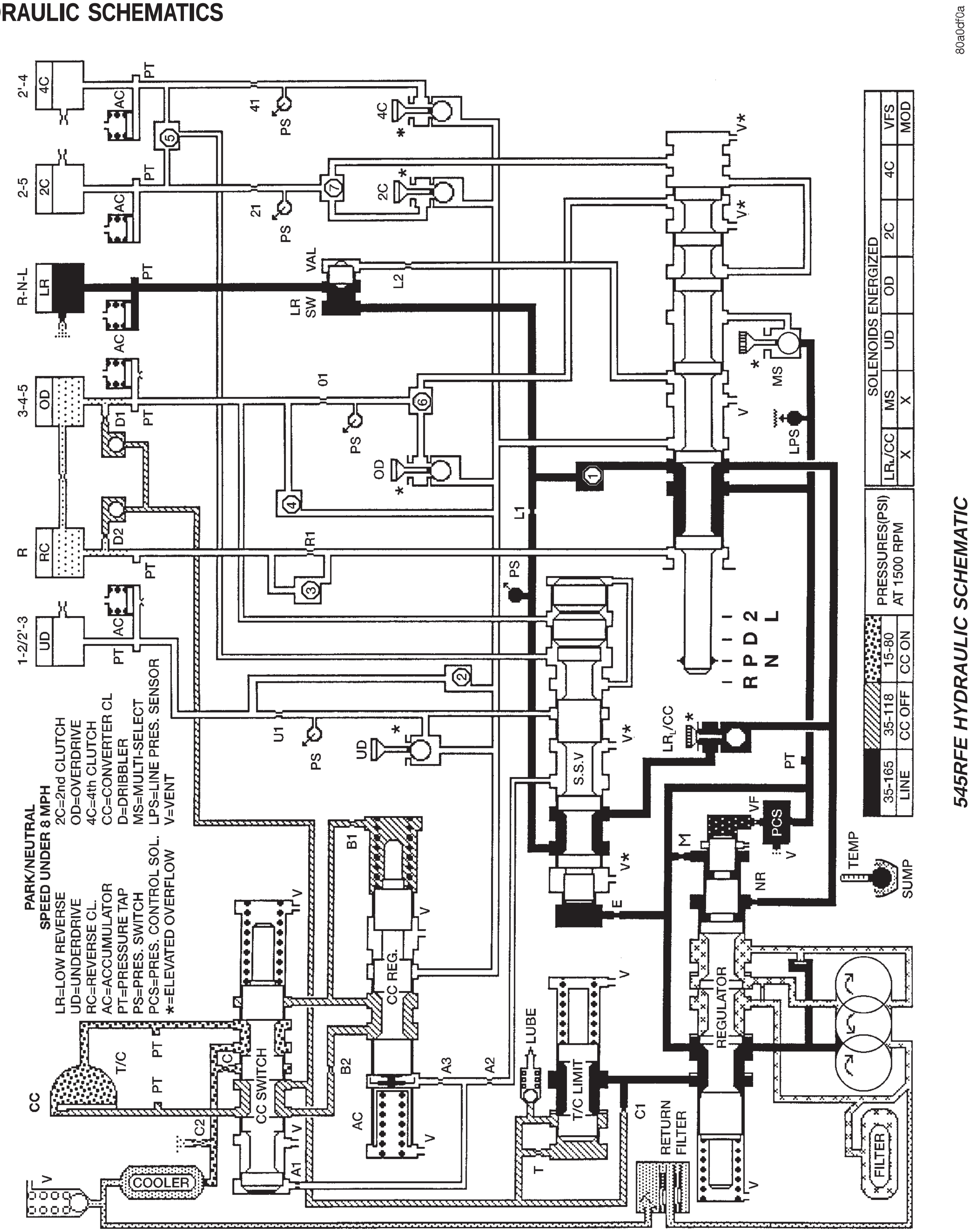
(34) Lower vehicle.

(35) Fill transmission with Mopar® ATF +4, type 9602, Automatic Transmission fluid.

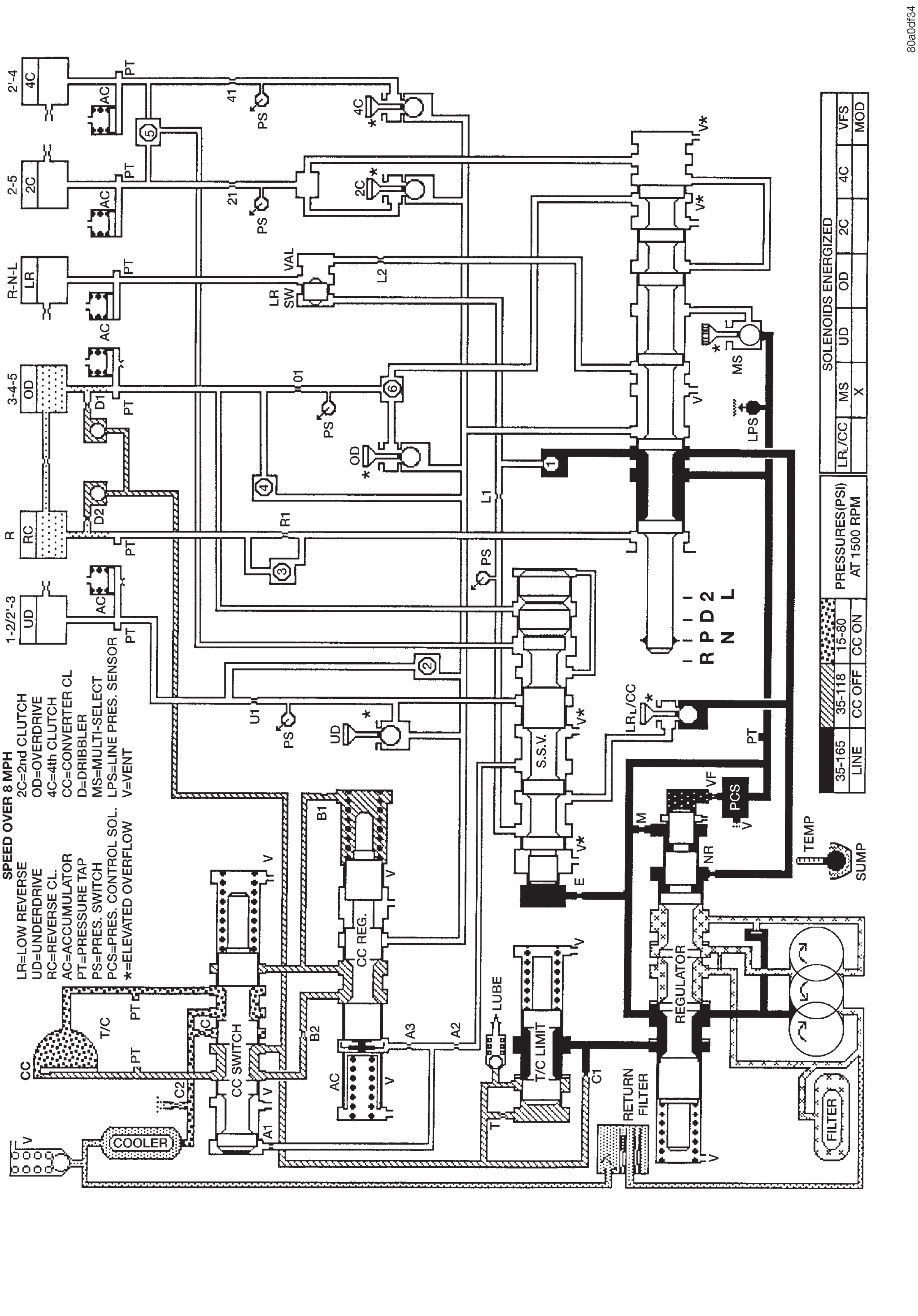
AUTOMATIC TRANSMISSION - 545RFE (Continued)

SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS

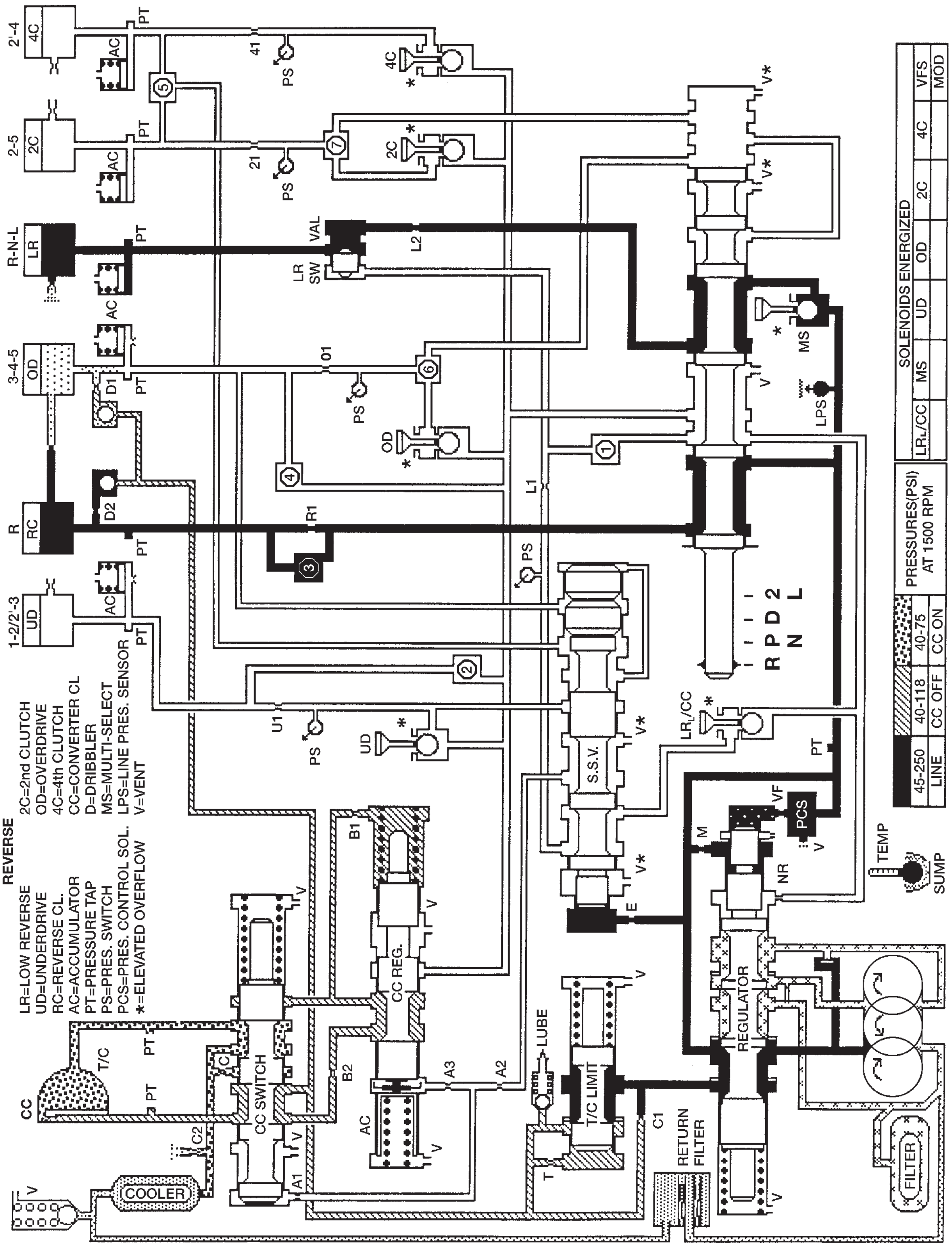


AUTOMATIC TRANSMISSION - 545RFE (Continued)



545RFE HYDRAULIC SCHEMATIC

AUTOMATIC TRANSMISSION - 545RFE (Continued)



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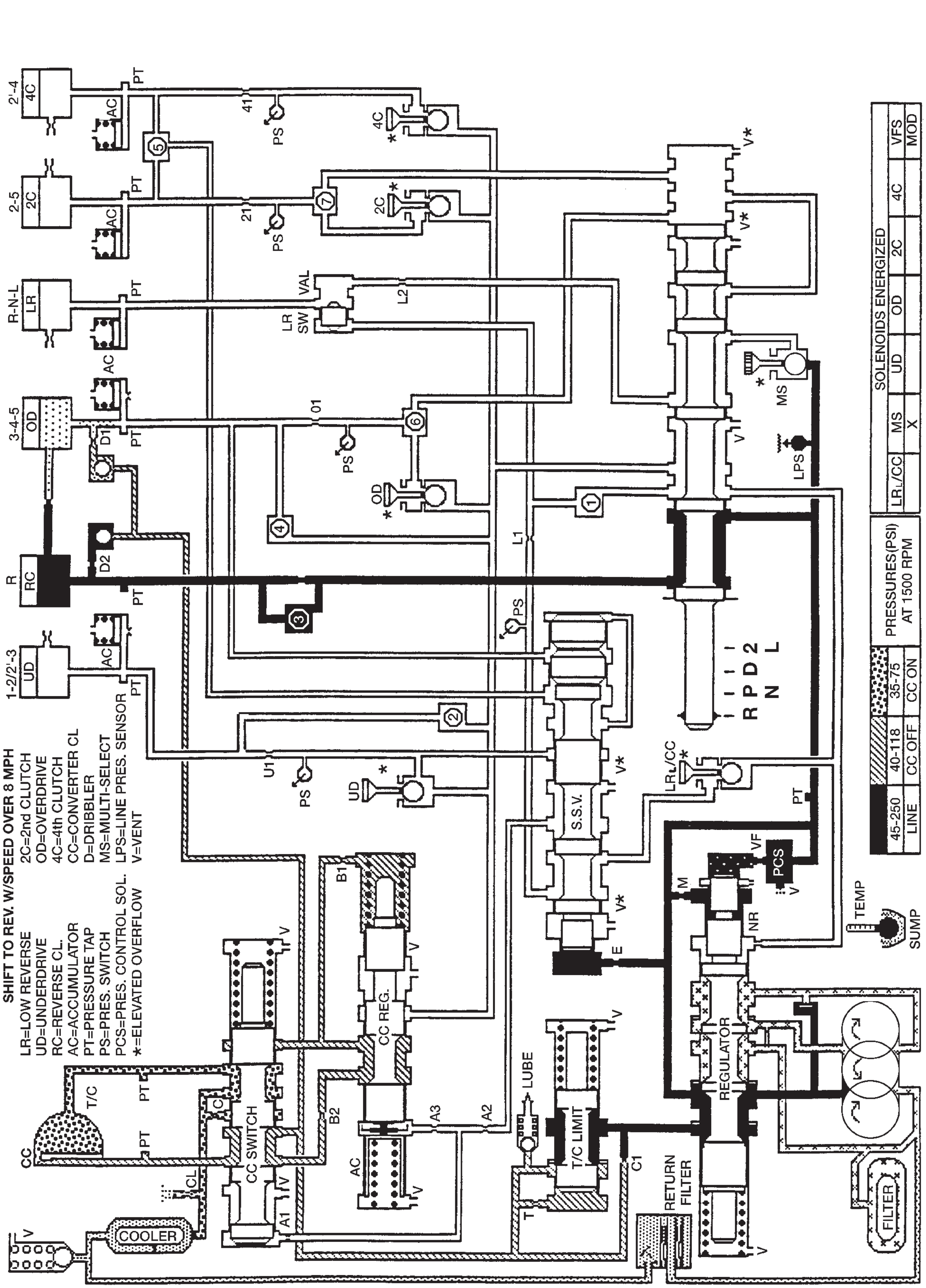

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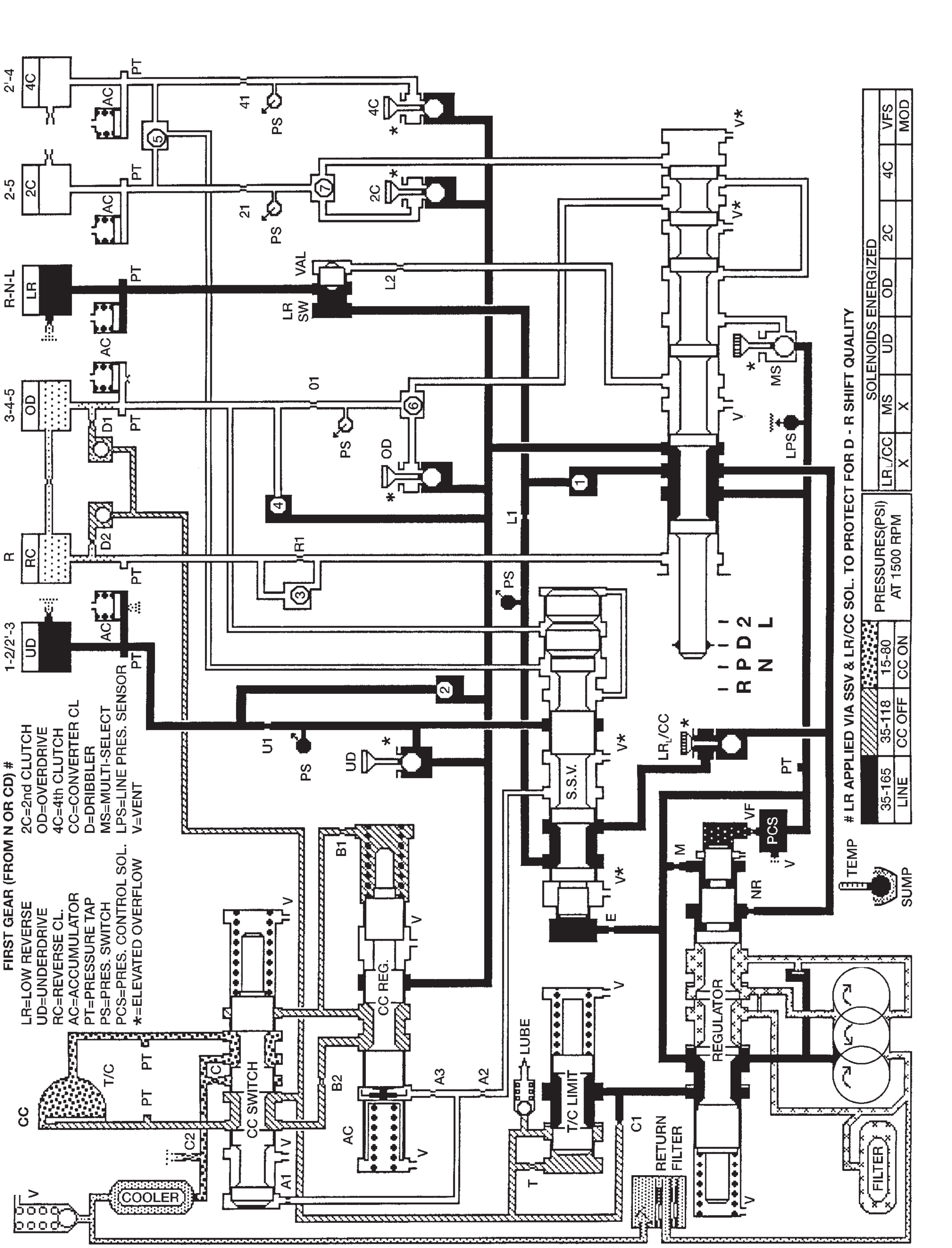
AUTOMATIC TRANSMISSION - 545RFE (Continued)



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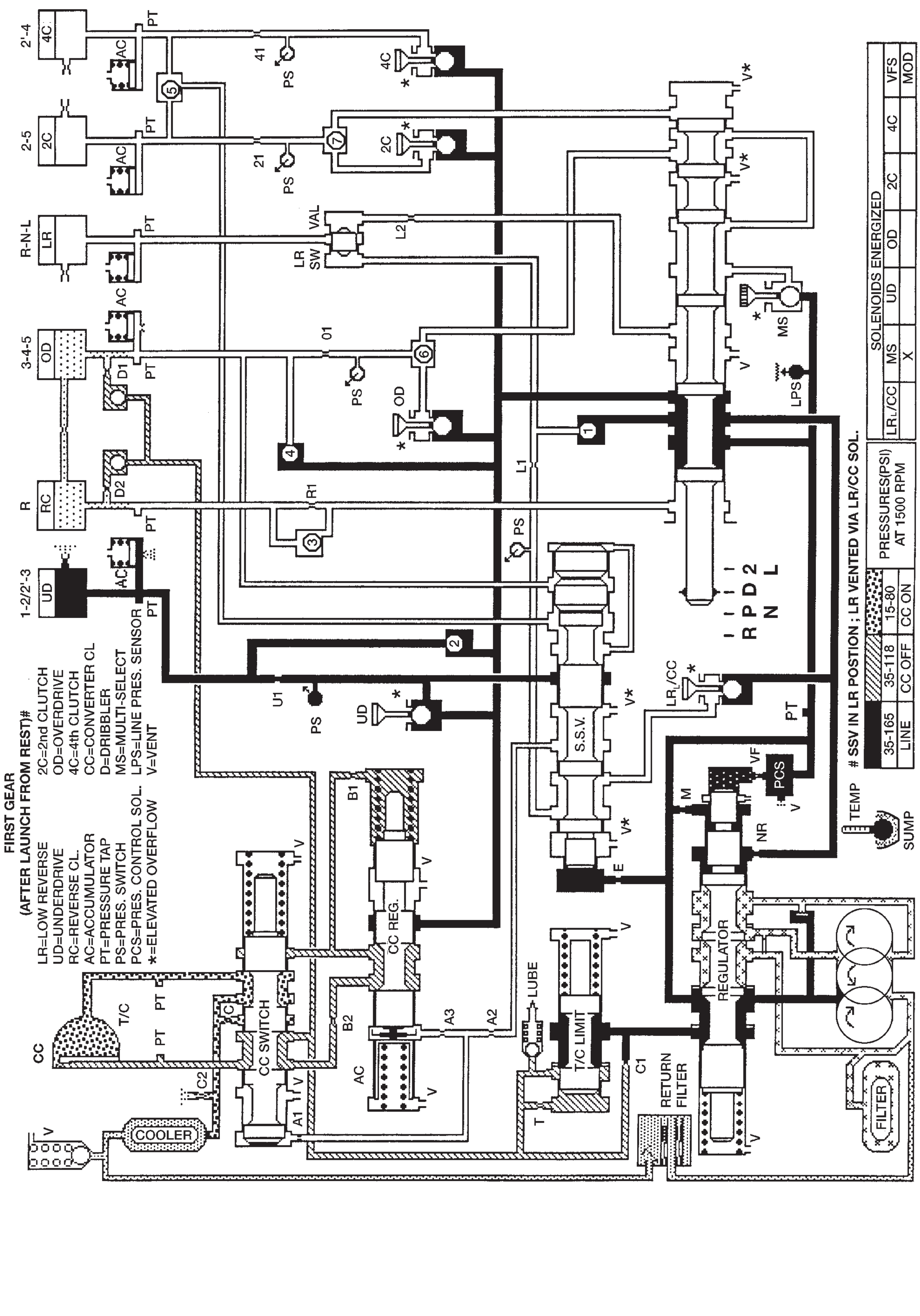
AUTOMATIC TRANSMISSION - 545RFE (Continued)



545RFE HYDRAULIC SCHEMATIC

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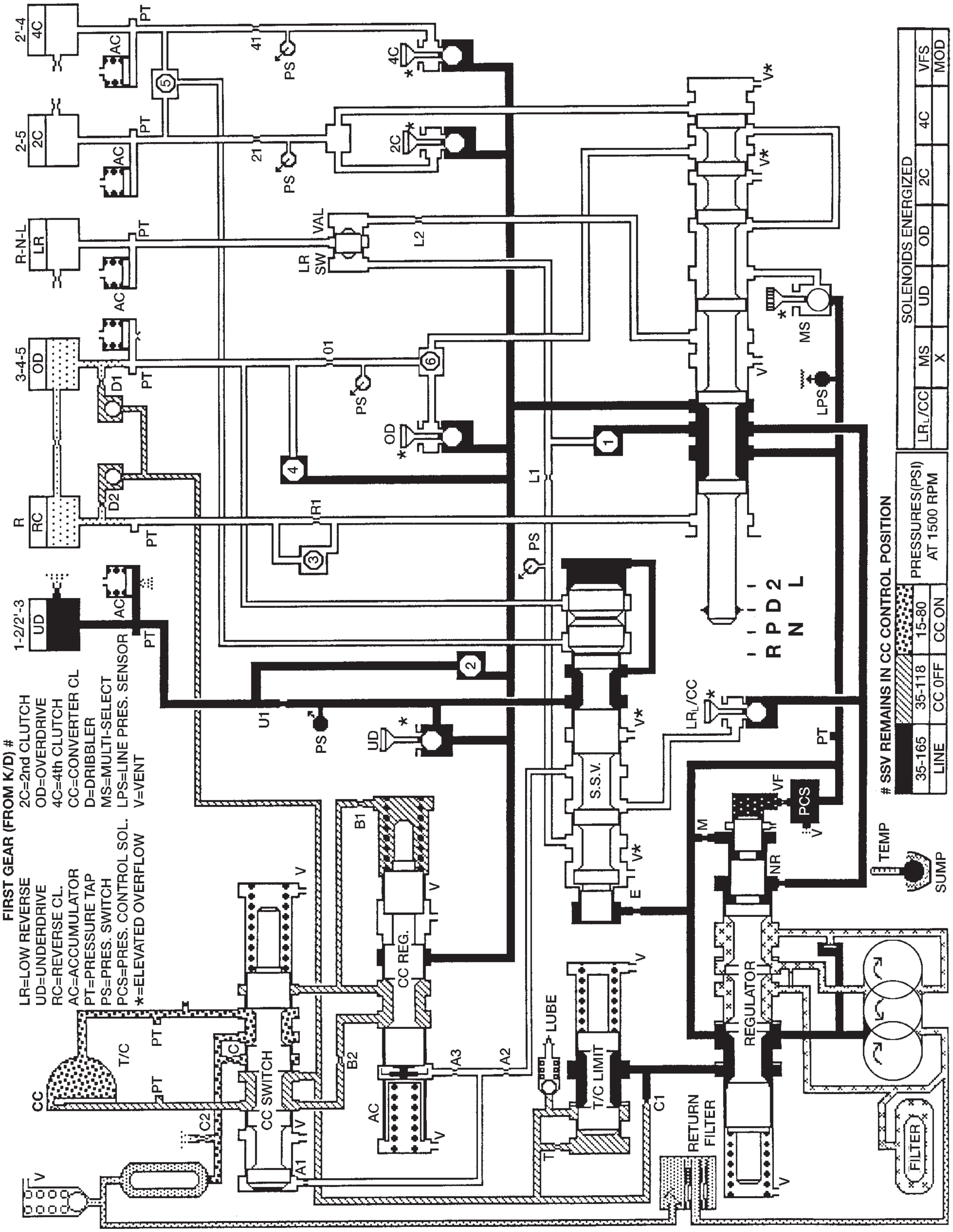
AUTOMATIC TRANSMISSION - 545RFE (Continued)



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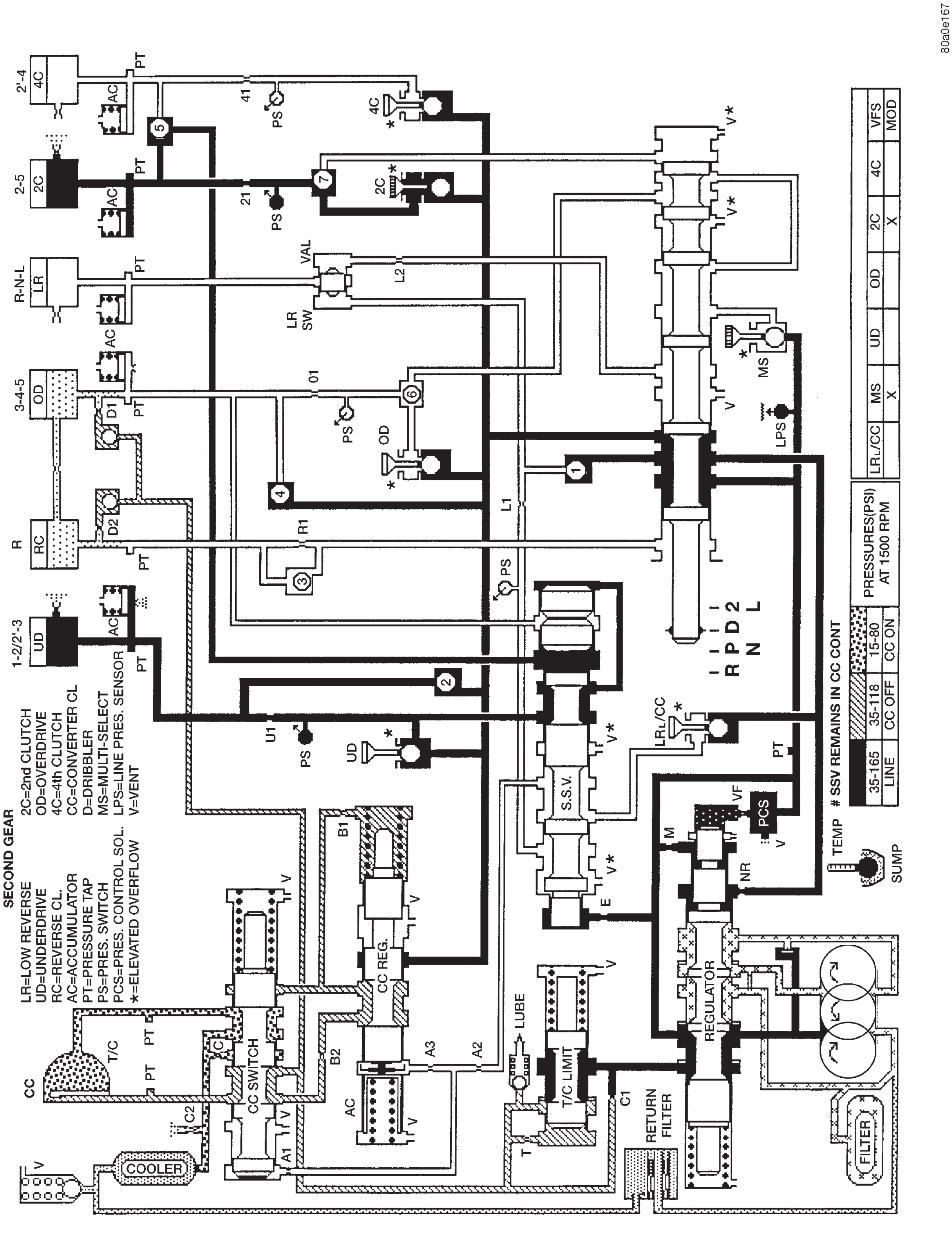

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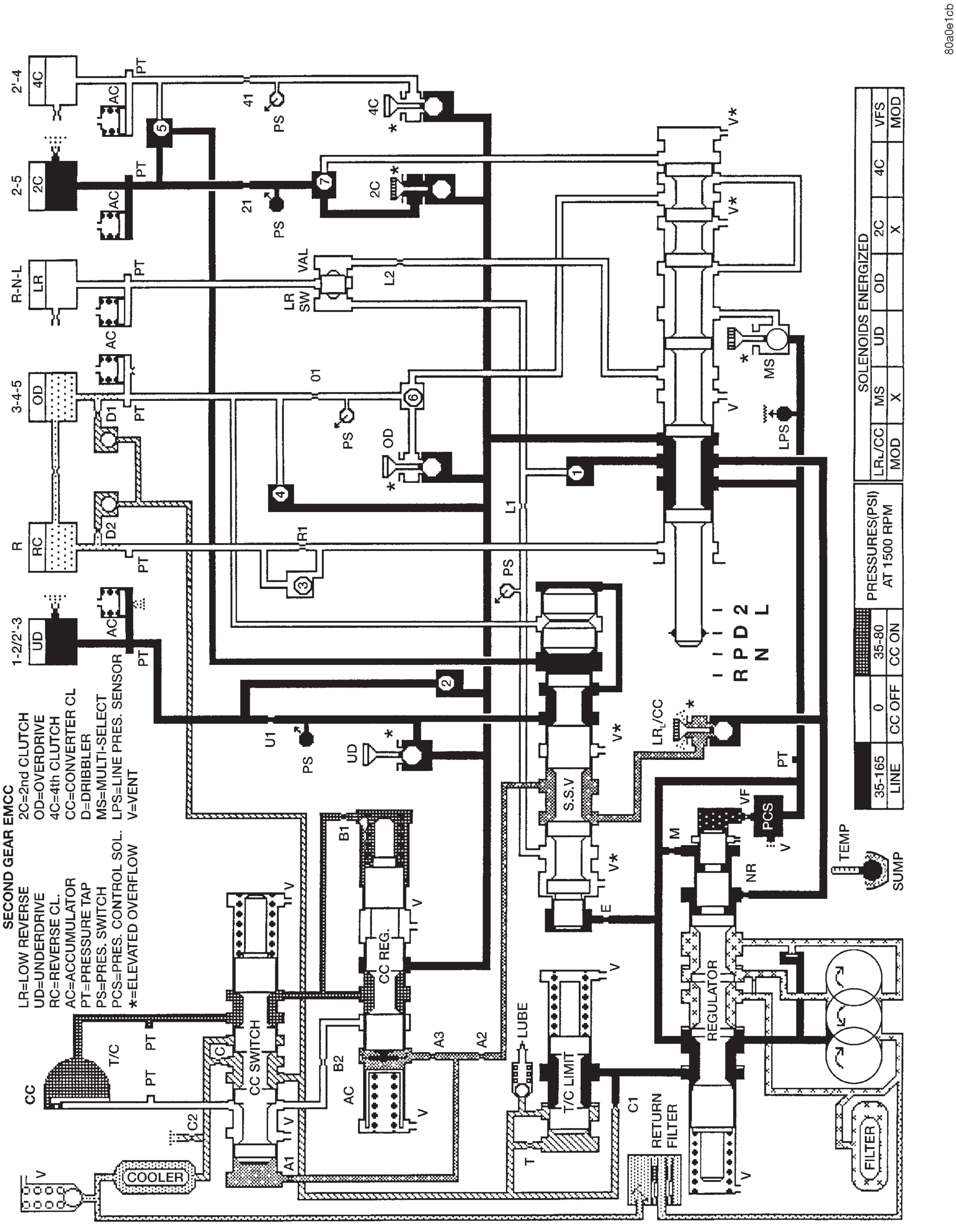

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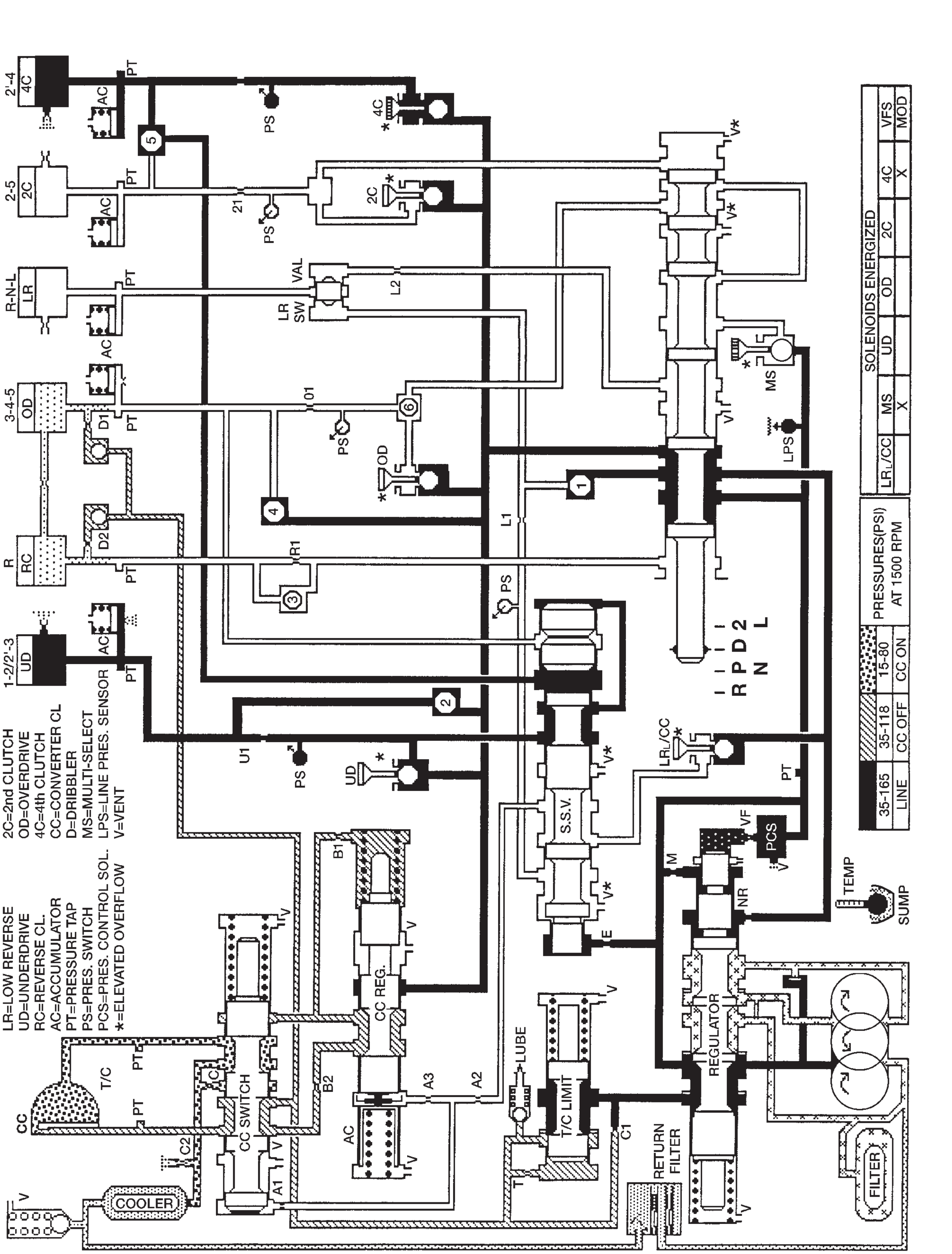

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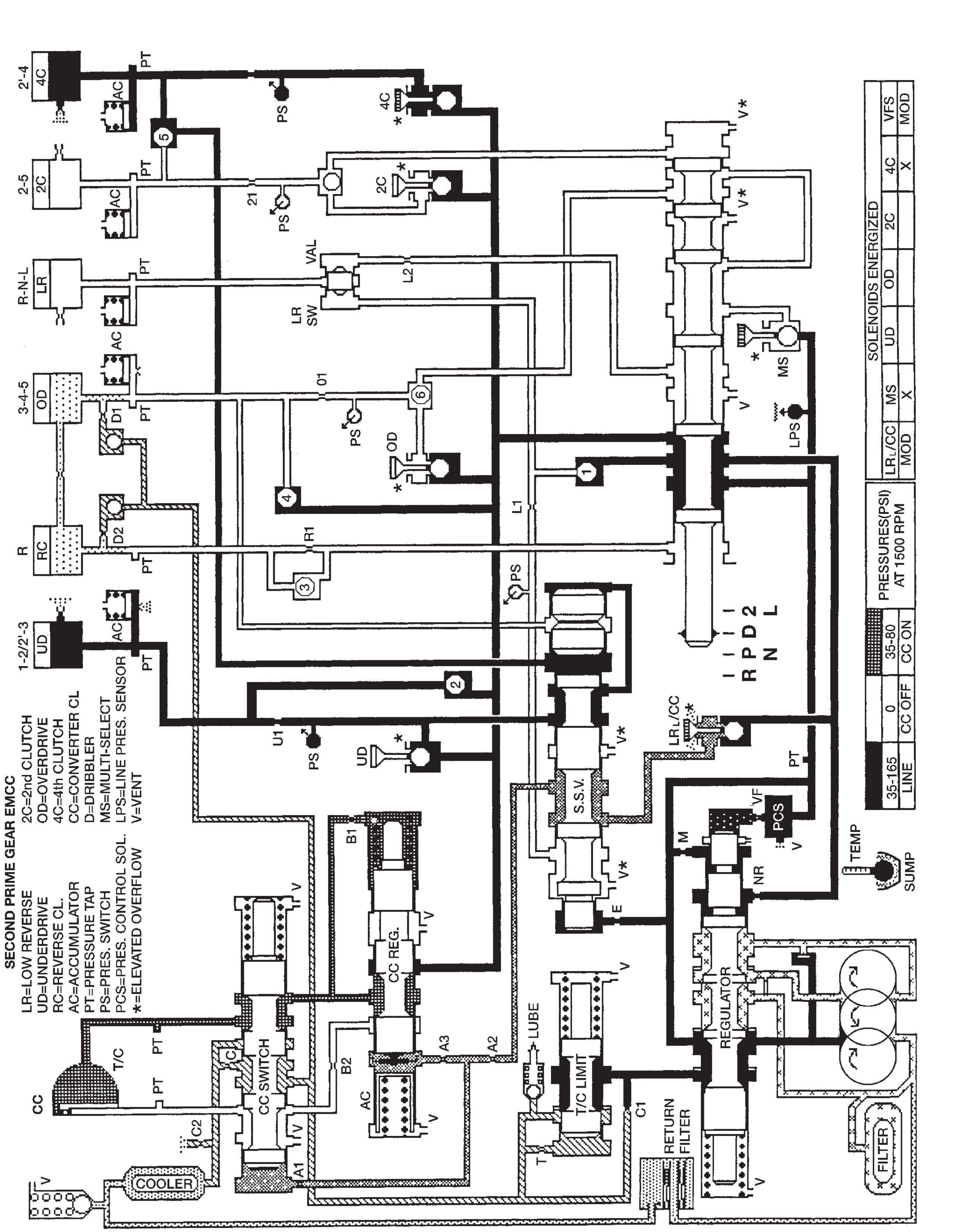

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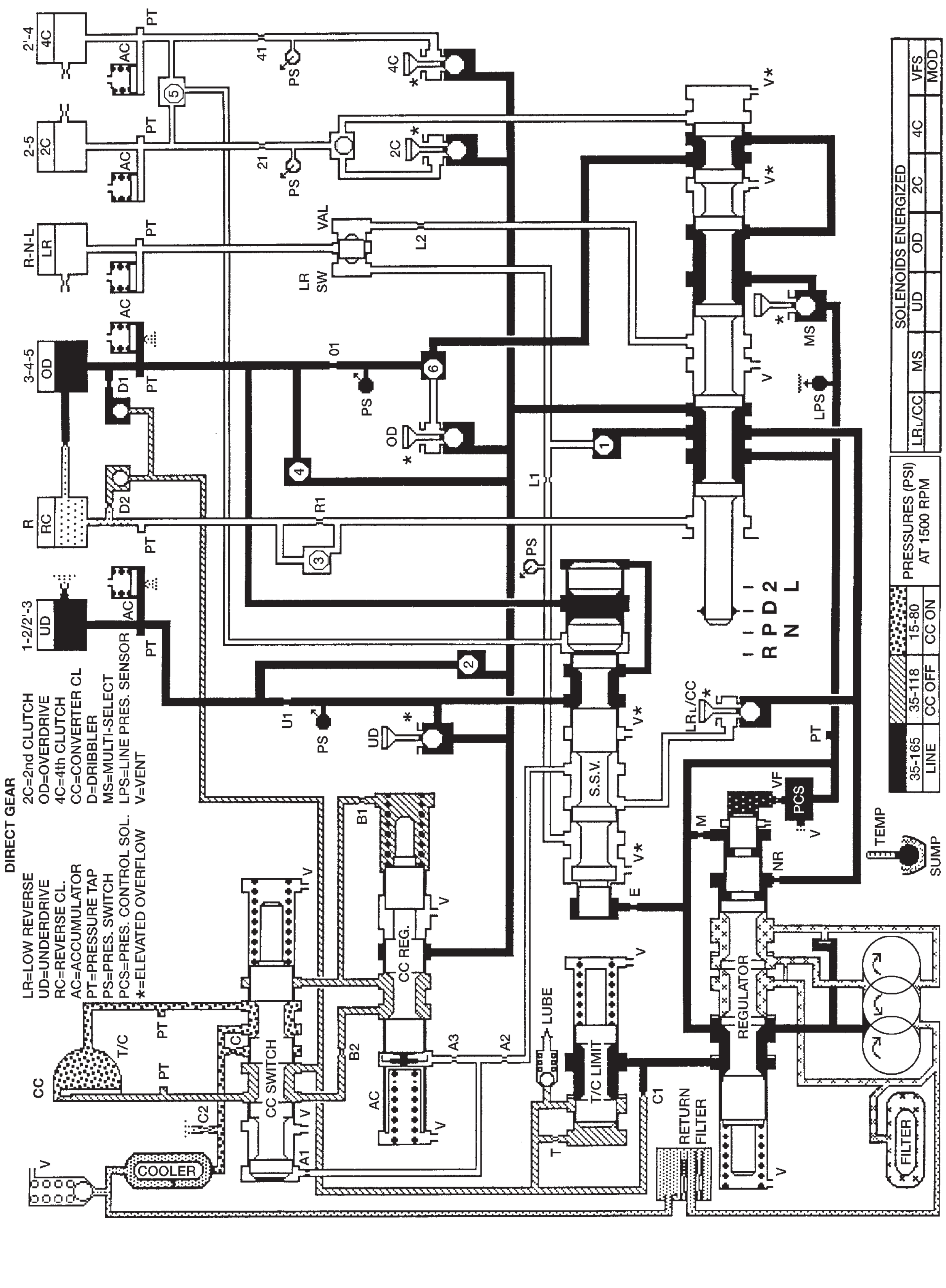

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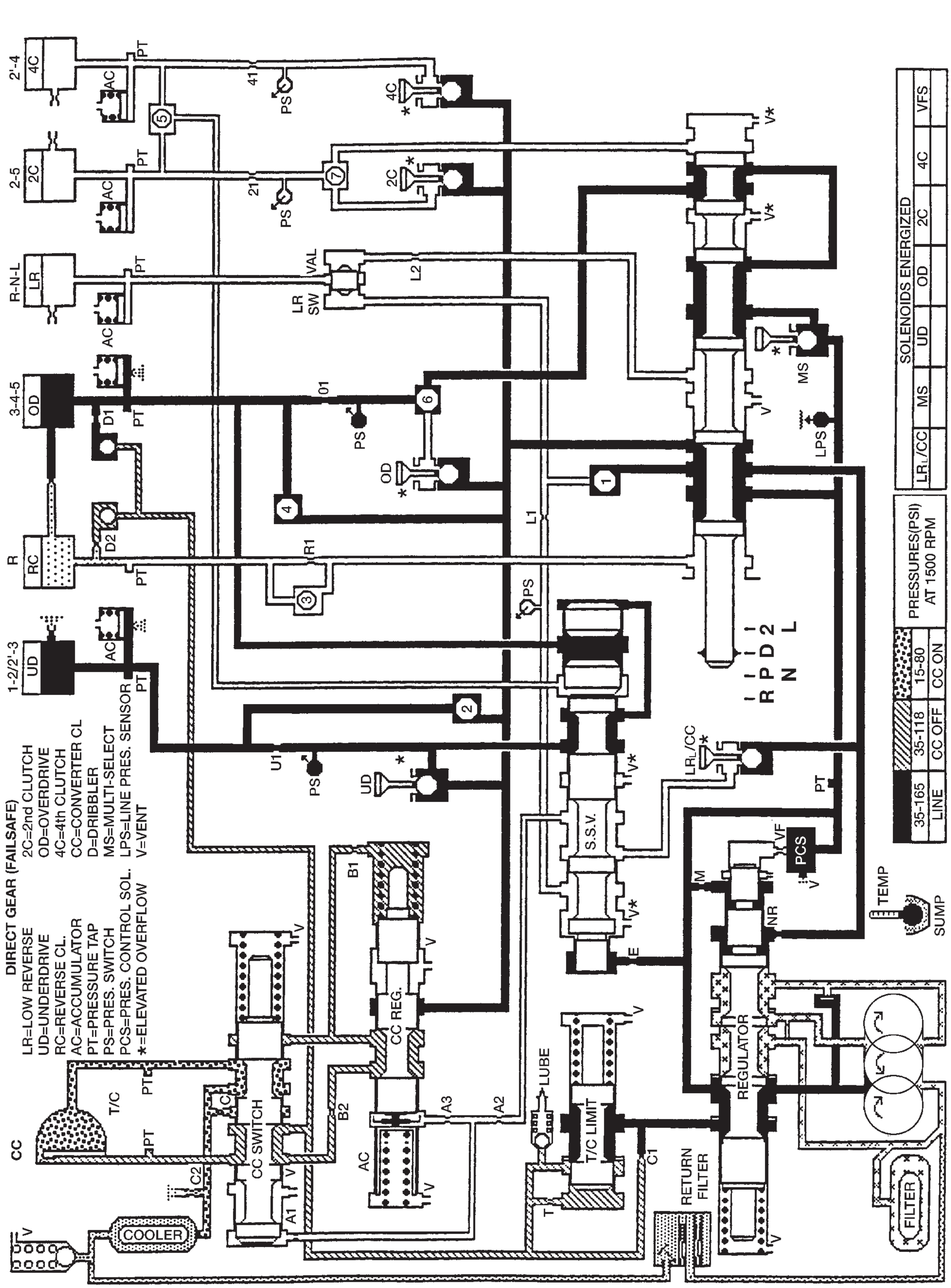

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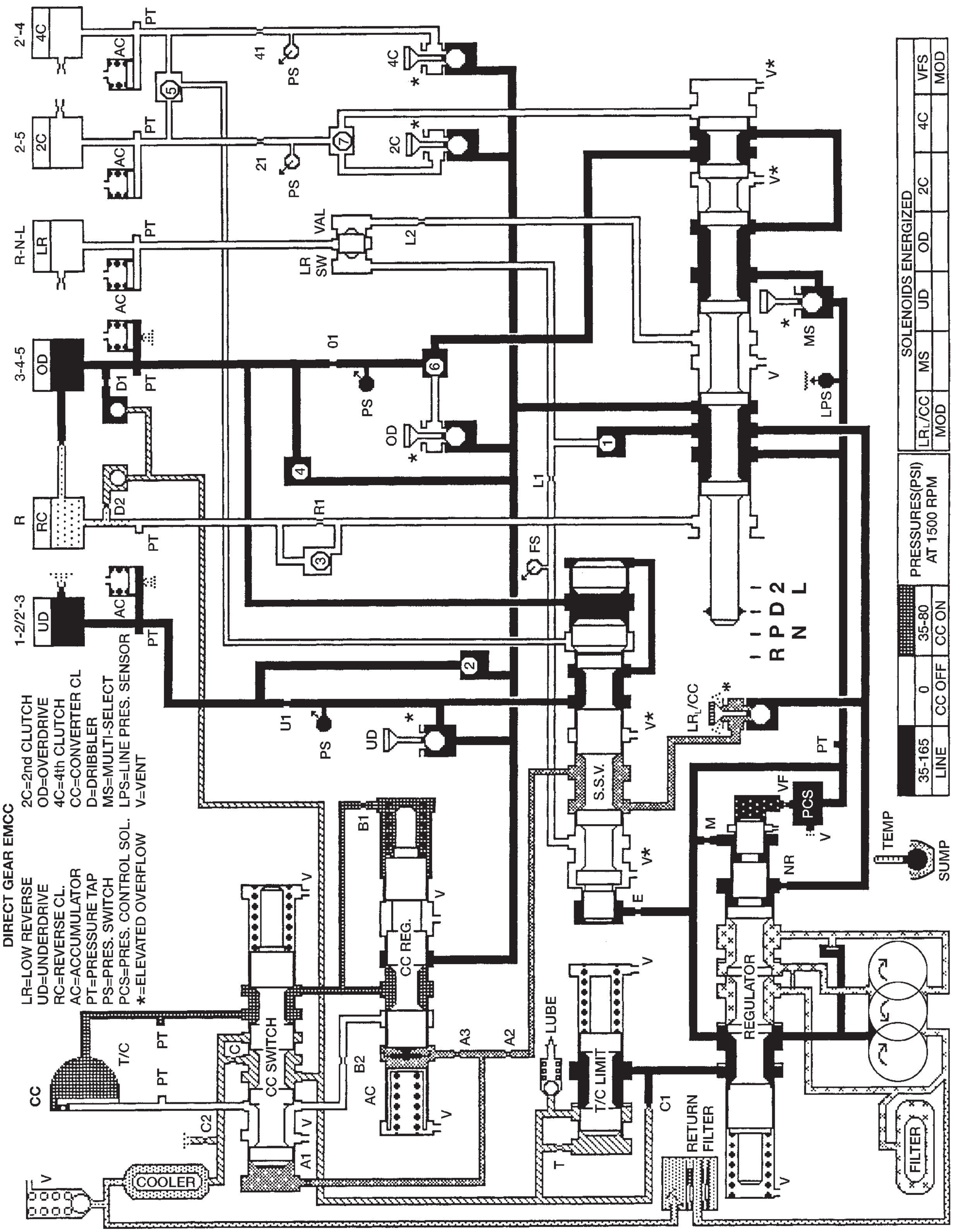

545RFE HYDRAULIC SCHEMATIC

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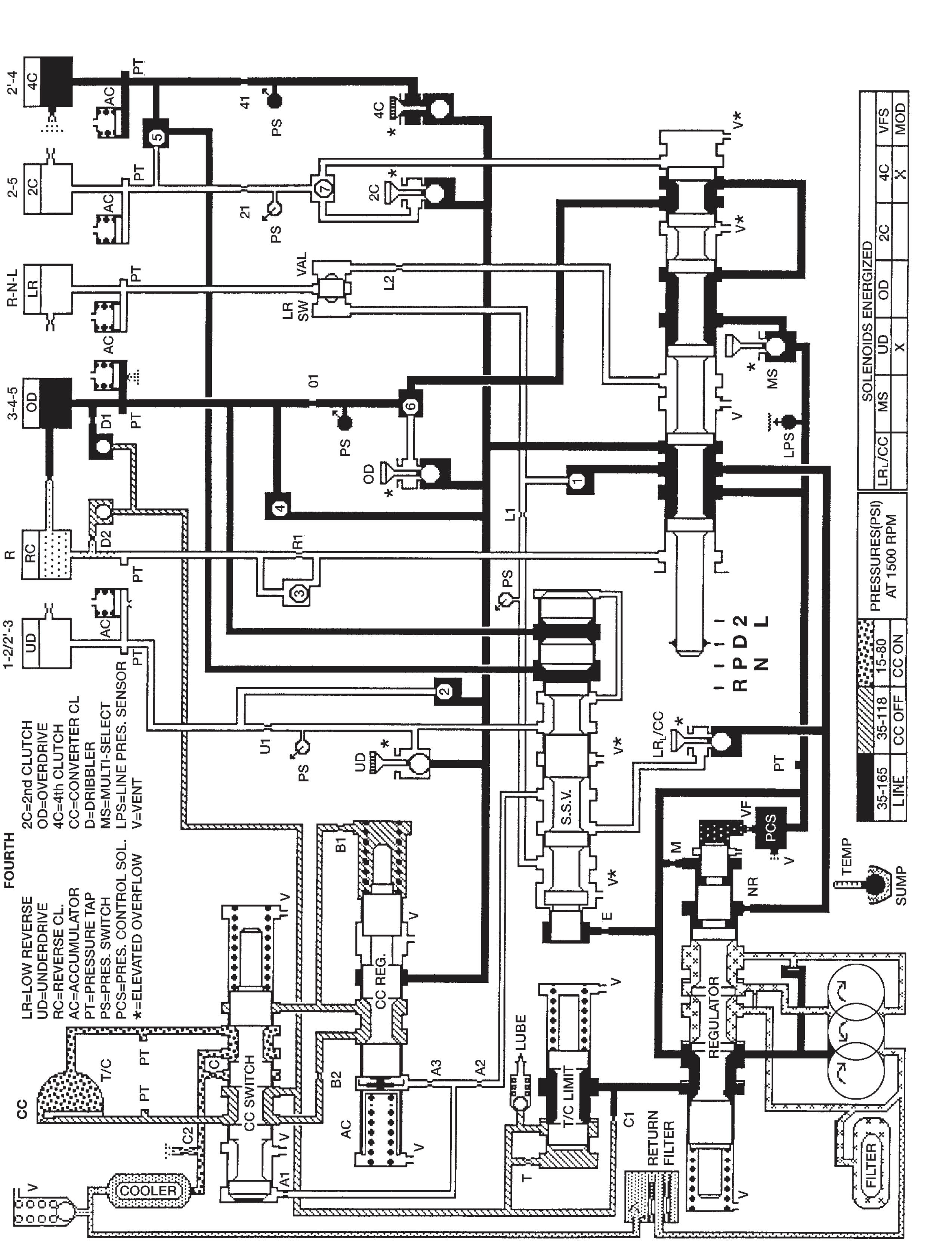

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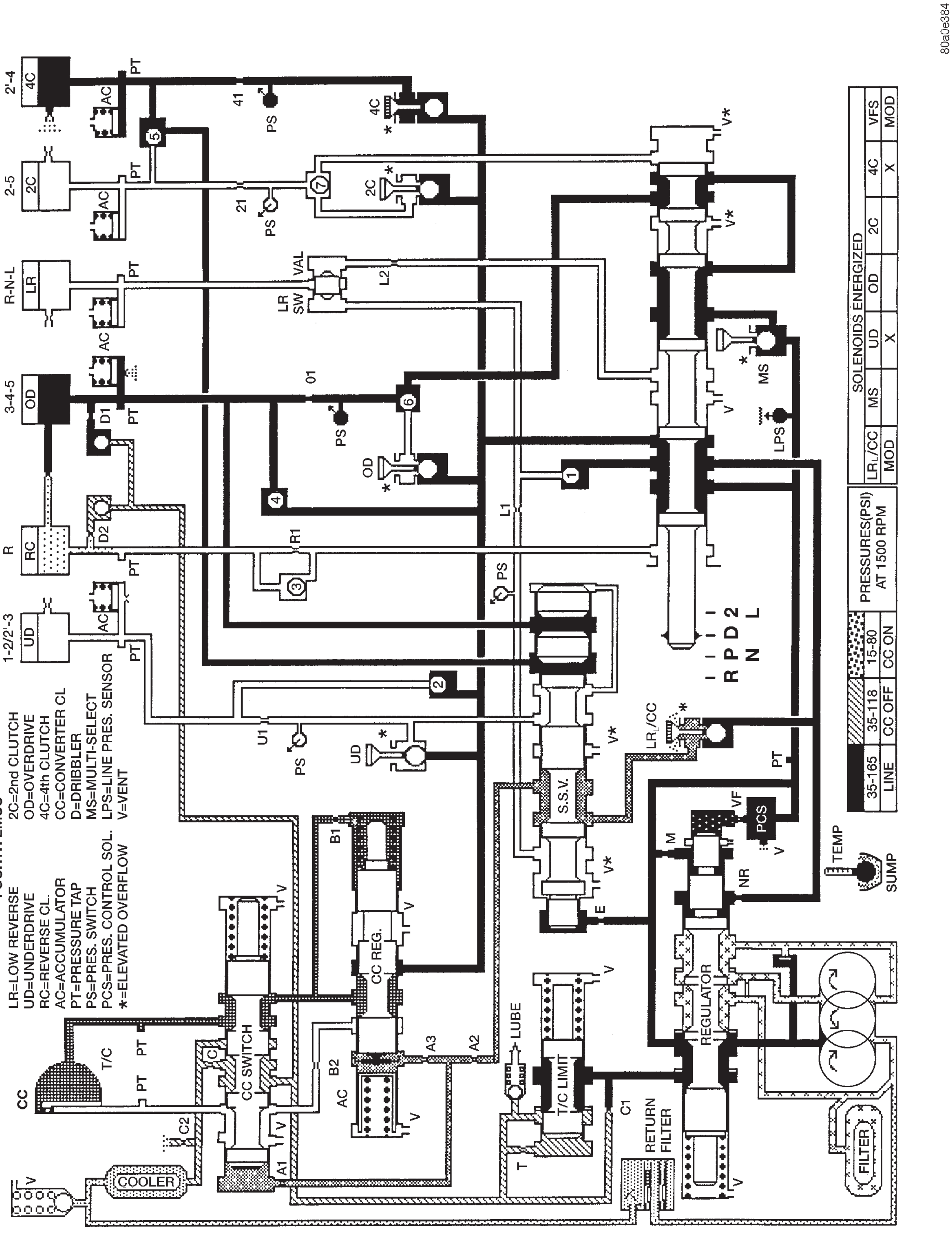
AUTOMATIC TRANSMISSION - 545RFE (Continued)



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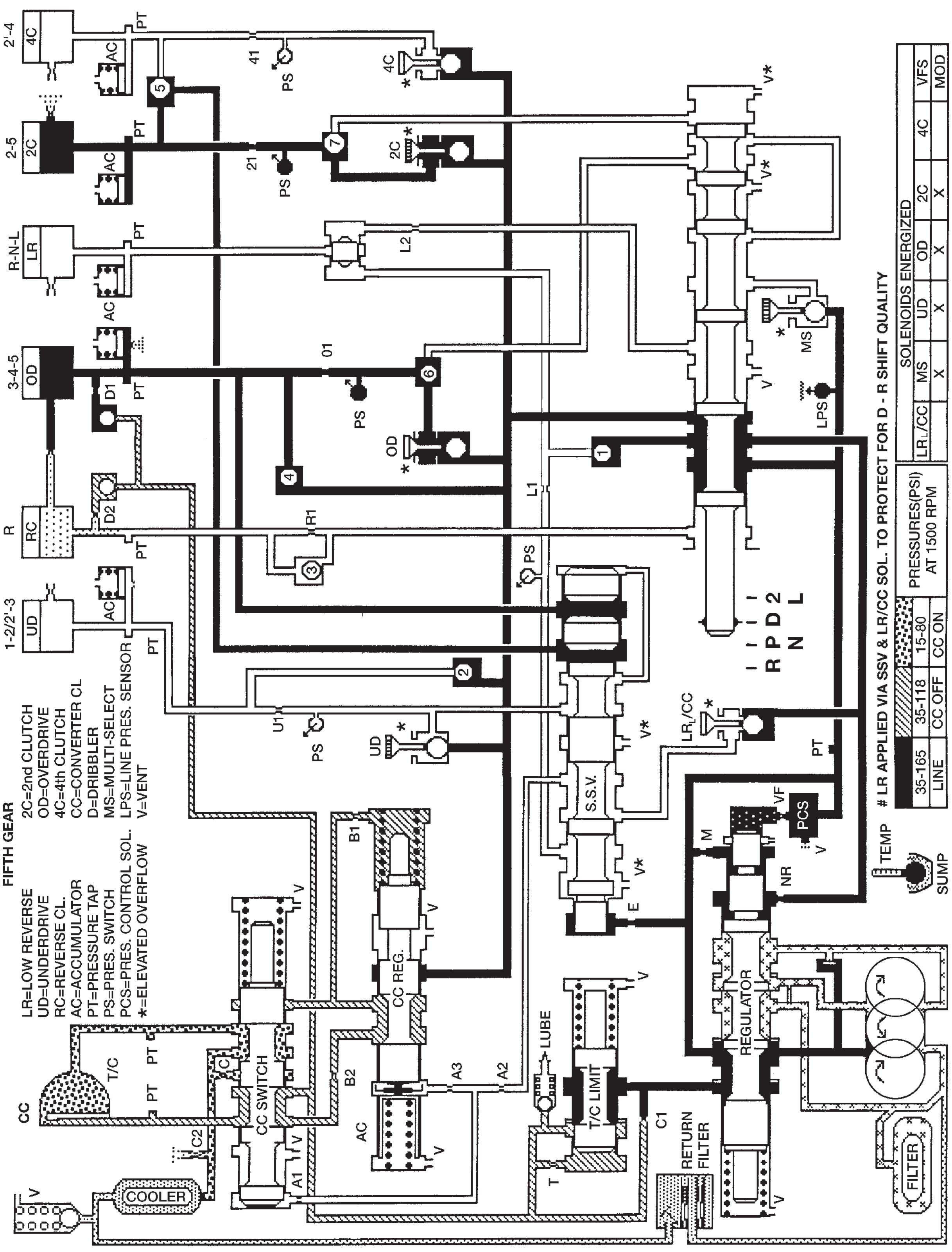

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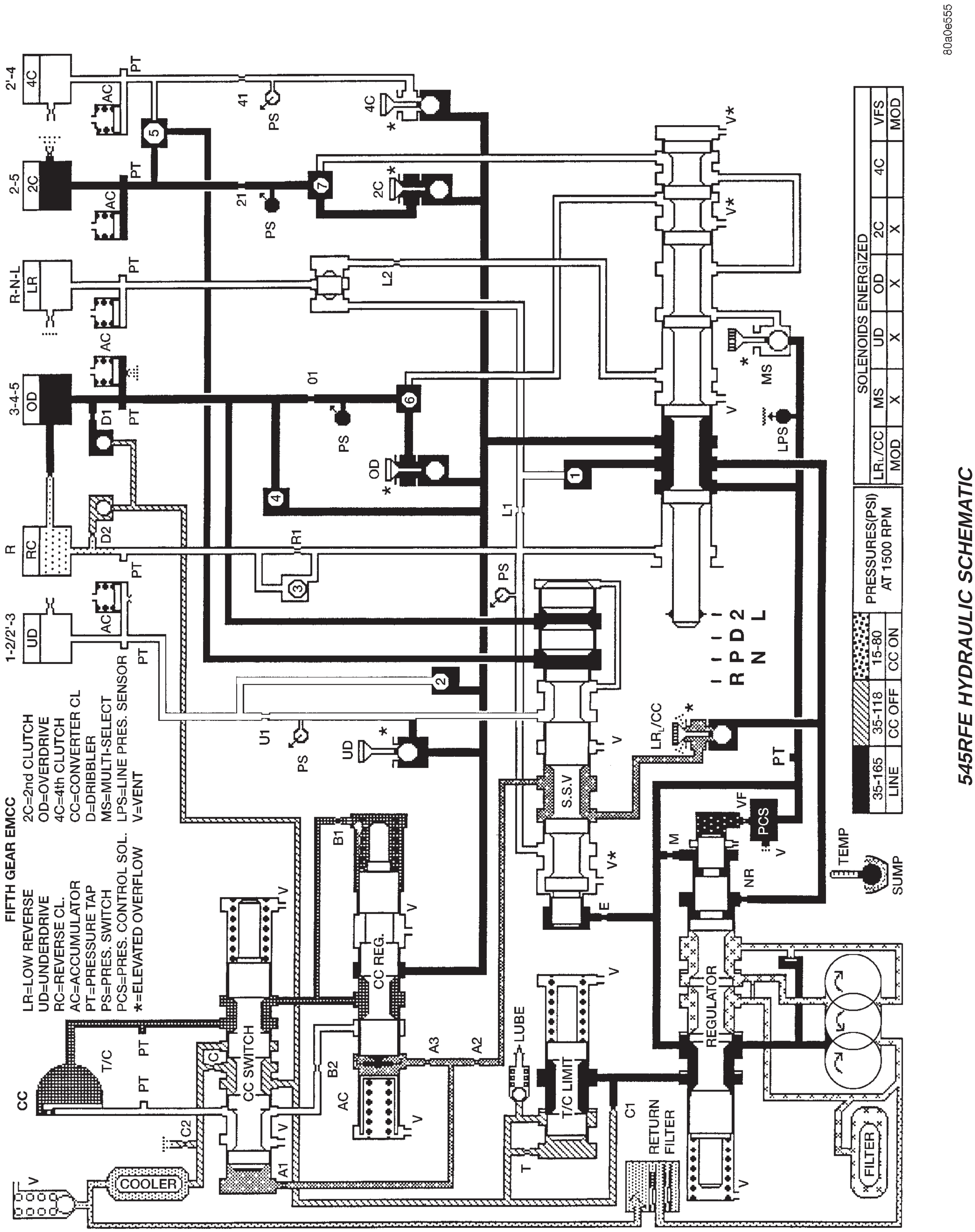

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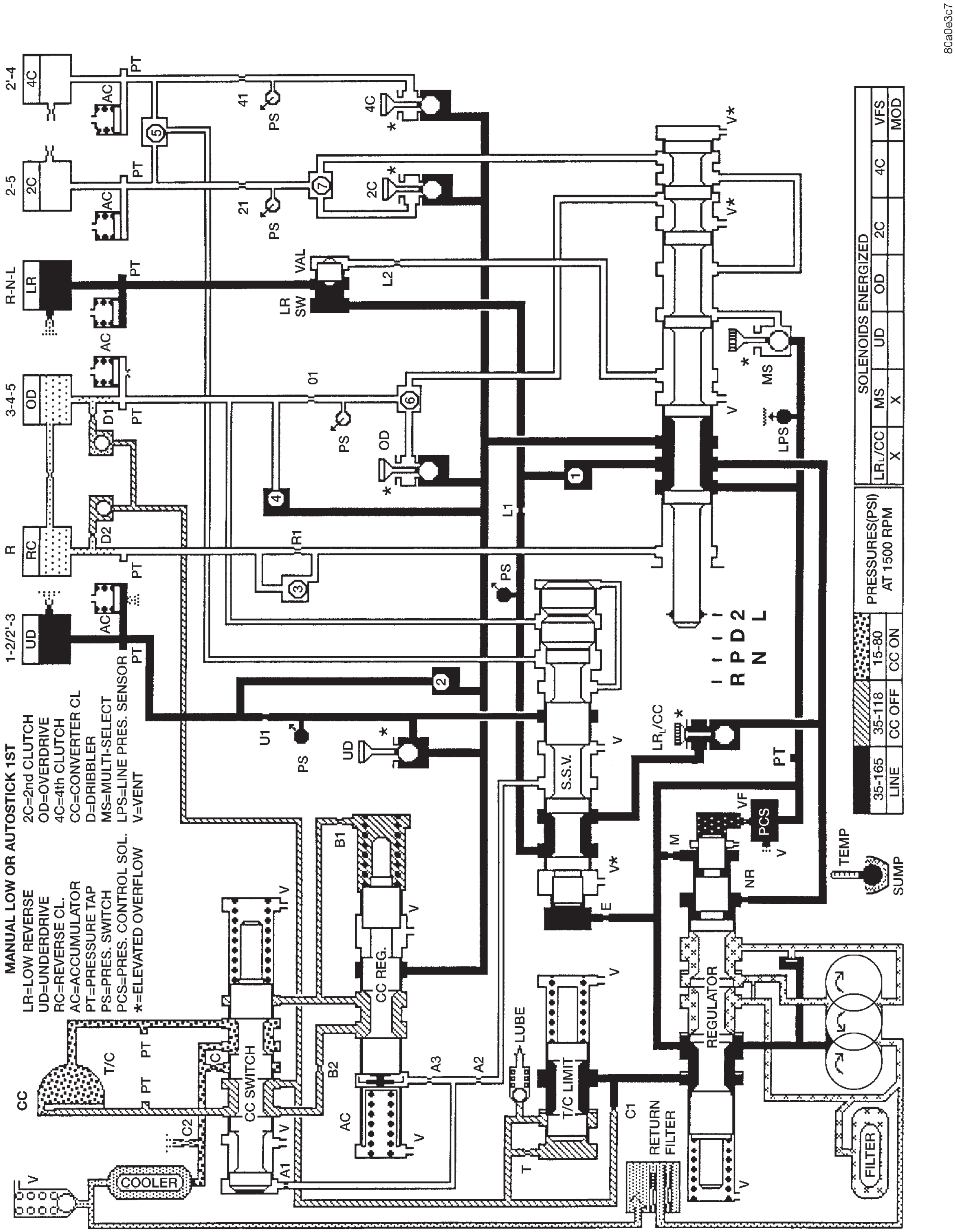

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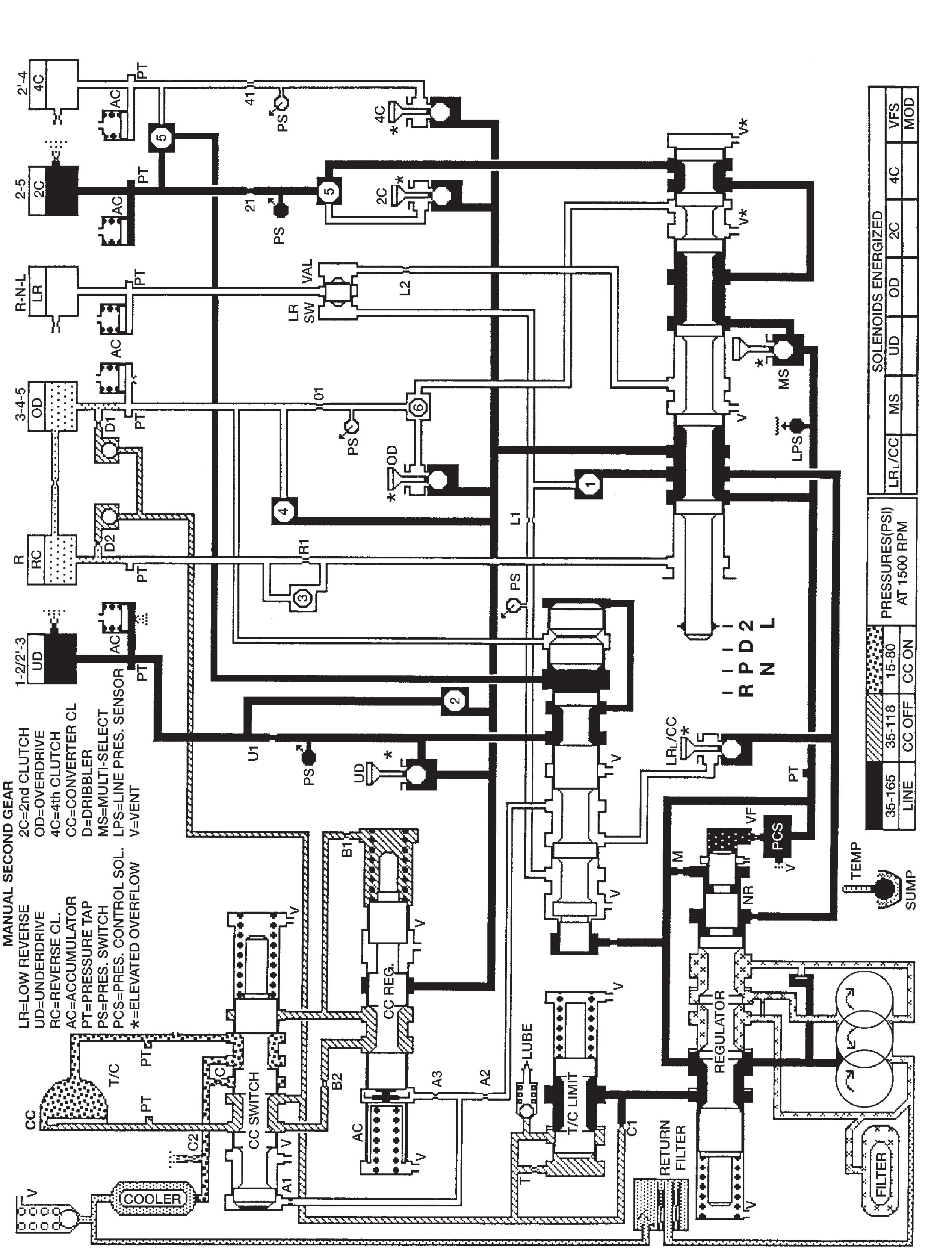

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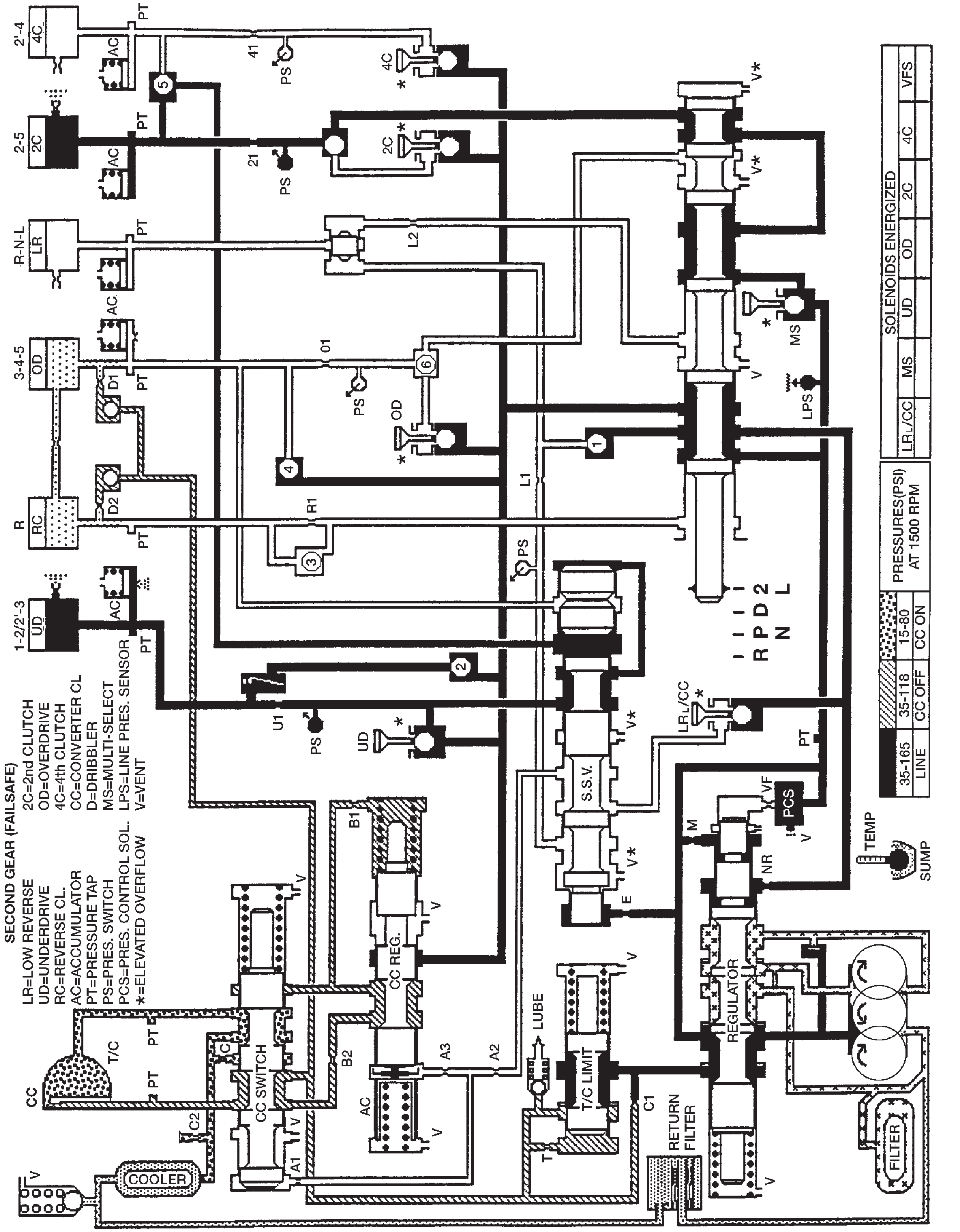

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545RFE HYDRAULIC SCHEMATIC

AUTOMATIC TRANSMISSION - 545RFE (Continued)

SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
Output Shaft End Play	0.22-0.55 mm	0.009-0.021 in.
Input Shaft End Play	0.46-0.89 mm	0.018-0.035 in.
2C Clutch Pack Clearance	0.455-1.335 mm	0.018-0.053 in.
4C Clutch Pack Clearance	0.770-1.390 mm	0.030-0.055 in.
L/R Clutch Pack Clearance	1.00-1.74 mm	0.039-0.069 in.
OD Clutch Pack Clearance	1.103-1.856 mm	0.043-0.073 in.
UD Clutch Pack Clearance	0.84-1.54 mm	0.033-0.061 in.
Reverse Clutch Pack Clearance	0.81-1.24 mm	0.032-0.049 in.
Recommended fluid	Mopar® ATF +4, type 9602	

GEAR RATIOS

1ST	3.00:1
2ND	1.67:1
2ND Prime	1.50:1
3RD	1.0:1
4TH	0.75:1
5TH	0.67:1
REVERSE	3.00:1

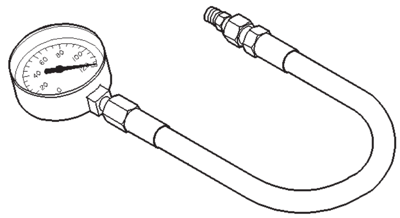
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fitting, cooler line at trans	17.5	-	155
Bolt, torque convertor	31	23	-
Bolt/nut, crossmember	68	50	-
Bolt, driveplate to crankshaft	75	55	-
Bolt, oil pan	11.8	-	105
Screw, primary fluid filter	4.5	-	40
Bolt, oil pump	28.2	-	250
Bolt, oil pump body to cover	4.5	-	40
Screw, plate to oil pump body	4.5	-	40
Bolt, valve body to case	11.8	-	105
Plug, pressure test port	5.1	-	45
Bolt, reaction shaft support	11.8	-	105
Screw, valve body to transfer plate	5.6	-	50
Screw, solenoid module to transfer plate	5.7	-	50
Screw, accumulator cover	4.5	-	40
Screw, detent spring	4.5	-	40
Bolt, input speed sensor	11.8	-	105
Bolt, output speed sensor	11.8	-	105
Bolt, line pressure sensor	11.8	-	105
Bolt, extension housing	54	40	-
Valve, cooler return filter bypass	4.5	-	40
Screw, manual valve cam retaining	4.5	-	40
Bolt, manual lever	28.2	-	250

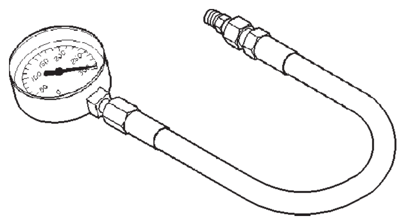
AUTOMATIC TRANSMISSION - 545RFE (Continued)

SPECIAL TOOLS

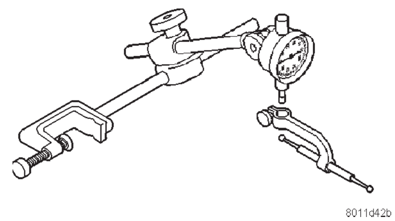
RFE TRANSMISSION



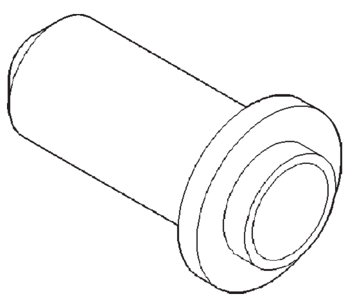
Gauge, Oil Pressure - C-3292



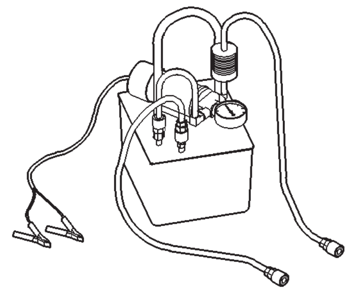
Gauge, Oil Pressure - C-3293SP



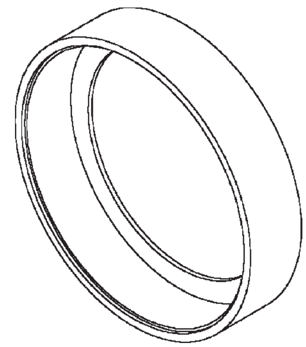
Dial Indicator - C-3339



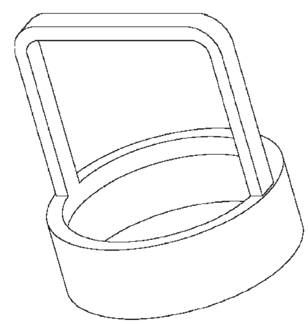
Installer, Seal - C-3860-A



Flusher, Oil Cooler - 6906-C

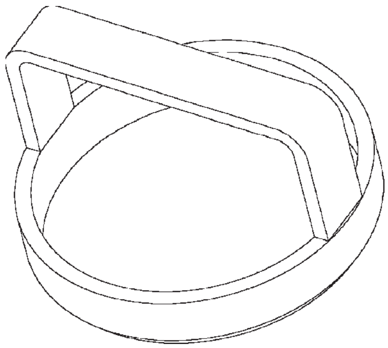


Compressor, Spring - 8249

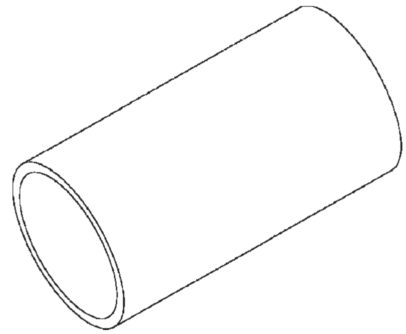


Compressor, Spring - 8250

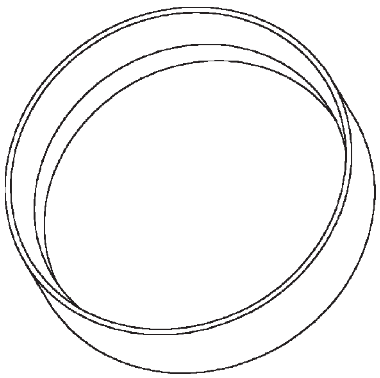
AUTOMATIC TRANSMISSION - 545RFE (Continued)



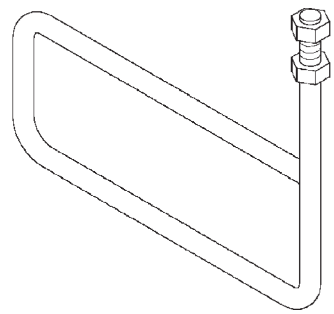
Compressor, Spring - 8251



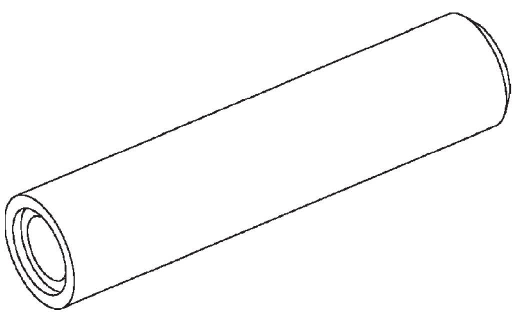
Installer, Snap-ring - 8255



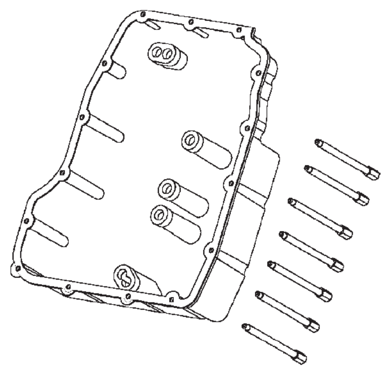
Installer, Piston - 8252



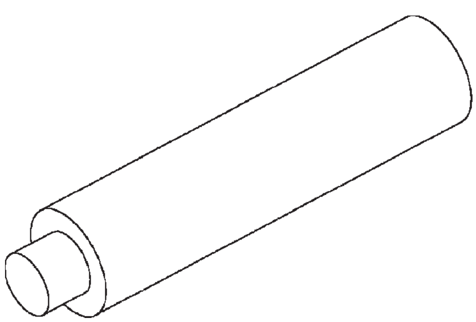
Stand, Support - 8257



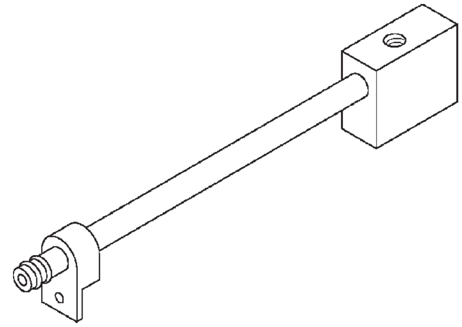
Installer, Seal - 8253



Adapter, Pressure Tap - 8258-A

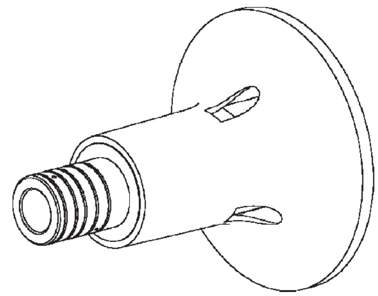


Installer, Seal - 8254

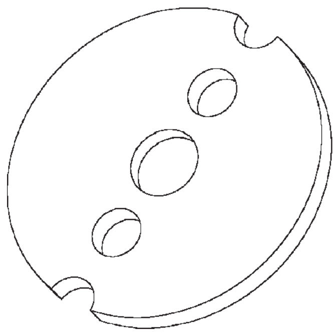


Adapter, Line Pressure - 8259

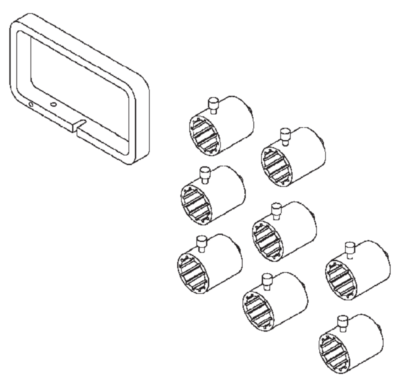
AUTOMATIC TRANSMISSION - 545RFE (Continued)



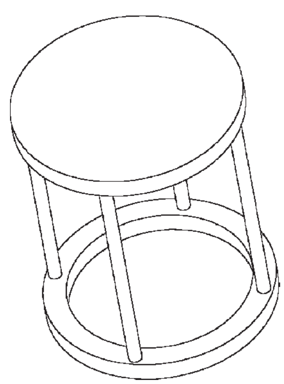
Fixture, Input Clutch Pressure - 8260



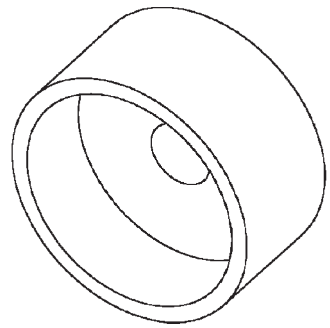
Plate, Alignment - 8261



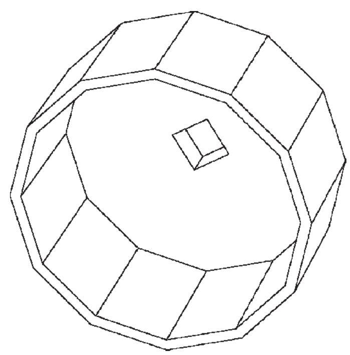
End Play Set - 8266



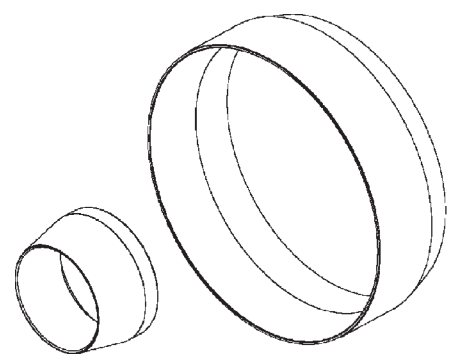
Compressor, Spring - 8285



Installer, Bearing - 8320



Wrench, Filter - 8321



Installer, Piston - 8504

4C RETAINER/BULKHEAD

DISASSEMBLY

(1) Remove the 2C piston belleville spring snap-ring from the 4C retainer /bulkhead (Fig. 53).

(2) Remove the 2C piston Belleville spring from the retainer/bulkhead (Fig. 53).

(3) Remove the 2C piston from the retainer/bulkhead. Use 20 psi of air pressure to remove the piston if necessary.

(4) Remove the 4C clutch snap-ring from the retainer/bulkhead (Fig. 53).

(5) Remove the 4C clutch pack from the retainer/bulkhead (Fig. 53).

(6) Using Spring Compressor 8250 and a suitable shop press, compress the 4C piston return spring and remove the snap-ring (Fig. 53).

(7) Remove the 4C piston return spring and piston from the retainer/bulkhead (Fig. 53). Use 20 psi of air pressure to remove the piston if necessary.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install new seals on the 2C and 4C pistons (Fig. 53).

(3) Lubricate all seals with Mopar® ATF +4, type 9602 prior to installation.

(4) Install the 4C piston into the 4C retainer/bulkhead (Fig. 53).

(5) Position the 4C piston return spring onto the 4C piston.

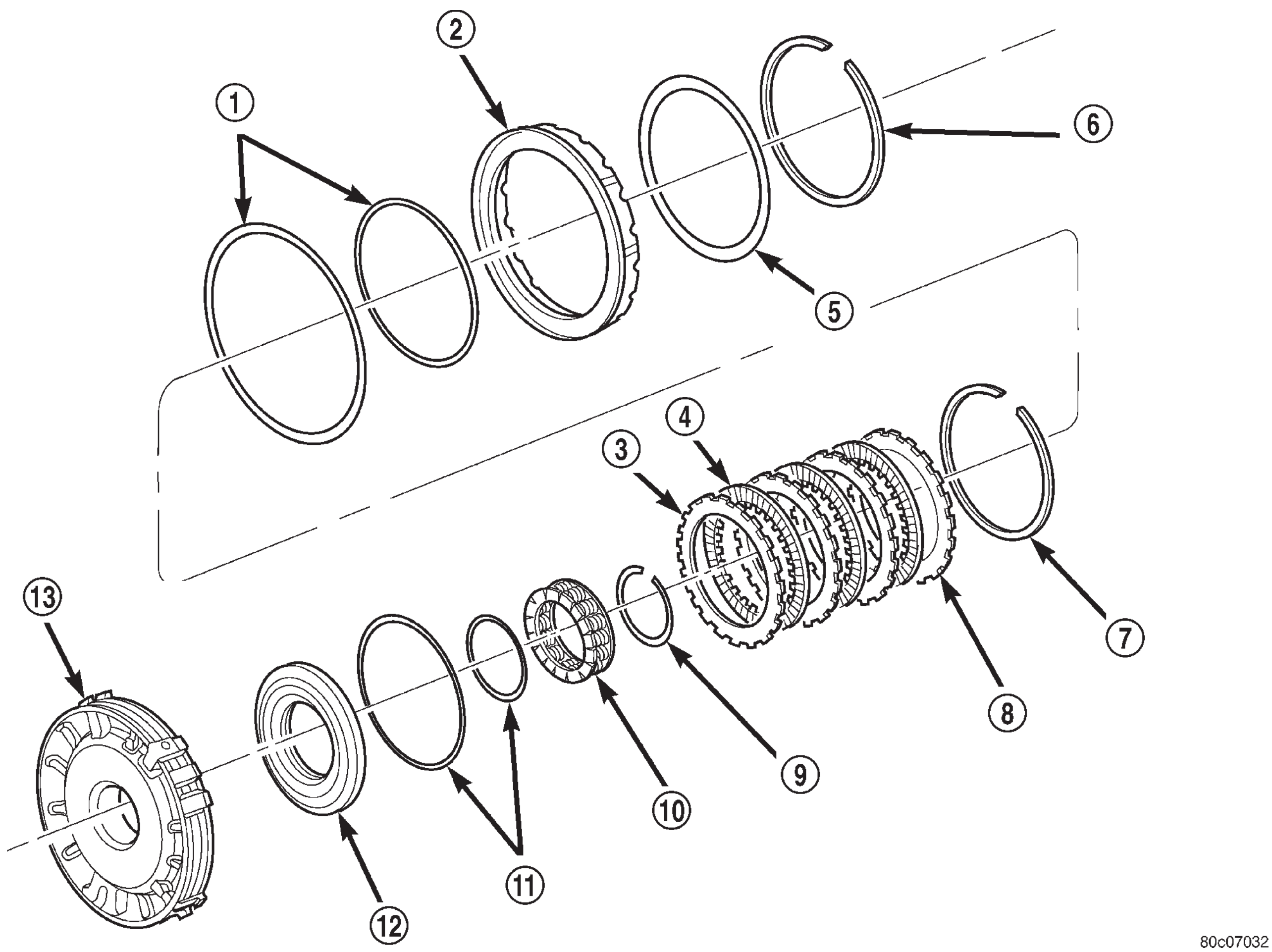


Fig. 53 4C Retainer/Bulkhead Components

1 - SEAL
2 - 2C PISTON
3 - PLATE
4 - DISC
5 - 2C BELLEVILLE SPRING
6 - SNAP-RING
7 - SNAP-RING (SELECT)
8 - REACTION PLATE
9 - SNAP-RING
10 - RETURN SPRING
11 - SEAL
12 - 4C PISTON
13 - 4C RETAINER/BULKHEAD

4C RETAINER/BULKHEAD (Continued)

(6) Using Spring Compressor 8250 and a suitable shop press, compress the 4C piston return spring and install the snap-ring (Fig. 54).

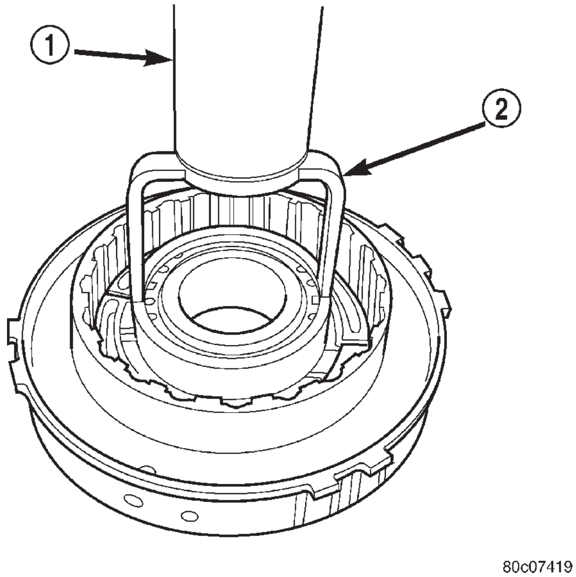


Fig. 54 Compress 4C Piston Return Spring Using Tool 8250

1 - PRESS
2 - TOOL 8250

(7) Assemble and install the 4C clutch pack into the retainer/bulkhead (Fig. 53) with the steel separator plate against the piston.

(8) Install the 4C reaction plate and snap-ring into the retainer/bulkhead (Fig. 53). The 4C reaction plate is non-directional.

(9) Measure the 4C clutch clearance. The correct clutch clearance is 0.77-1.39 mm (0.030-0.055 in.). The snap-ring is selectable. Install the chosen snap-ring and re-measure to verify the selection.

(10) Install the 2C piston into the retainer/bulkhead (Fig. 53).

(11) Position the 2C Belleville spring onto the 2C piston.

(12) Position the 2C Belleville spring snap-ring onto the 2C Belleville spring (Fig. 53).

(13) Using Spring Compressor 8249 and a suitable shop press (Fig. 55), compress the belleville spring until the snap-ring is engaged with the snap-ring groove in the retainer/bulkhead.

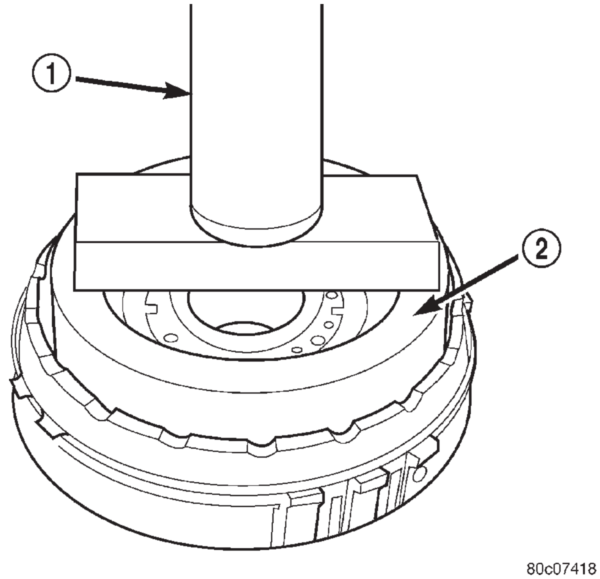


Fig. 55 Compress 2C Belleville Spring Using Tool 8249

1 - PRESS
2 - TOOL 8249

ADAPTER HOUSING SEAL

REMOVAL

(1) Remove the transfer case from the transmission.

(2) Using a screw mounted on a slide hammer, remove the adapter housing seal.

INSTALLATION

(1) Clean the adapter seal bore in the adapter housing of any residue or particles remaining from the original seal.

(2) Install new oil seal in the adapter housing using Seal Installer C-3860-A (Fig. 56). A properly installed seal is flush to the face of the seal bore.

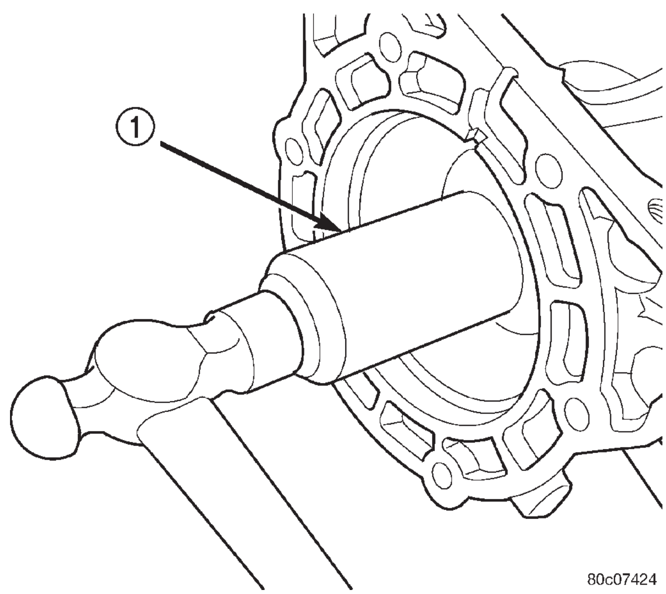


Fig. 56 Adapter Housing Seal Installation

1 - TOOL C-3860-A

(3) Install the transfer case onto the transmission.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

DESCRIPTION

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 57).

OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shifter assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK

(1) Verify that the key can only be removed in the PARK position

(2) When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.

(3) Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.

(4) Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.

(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

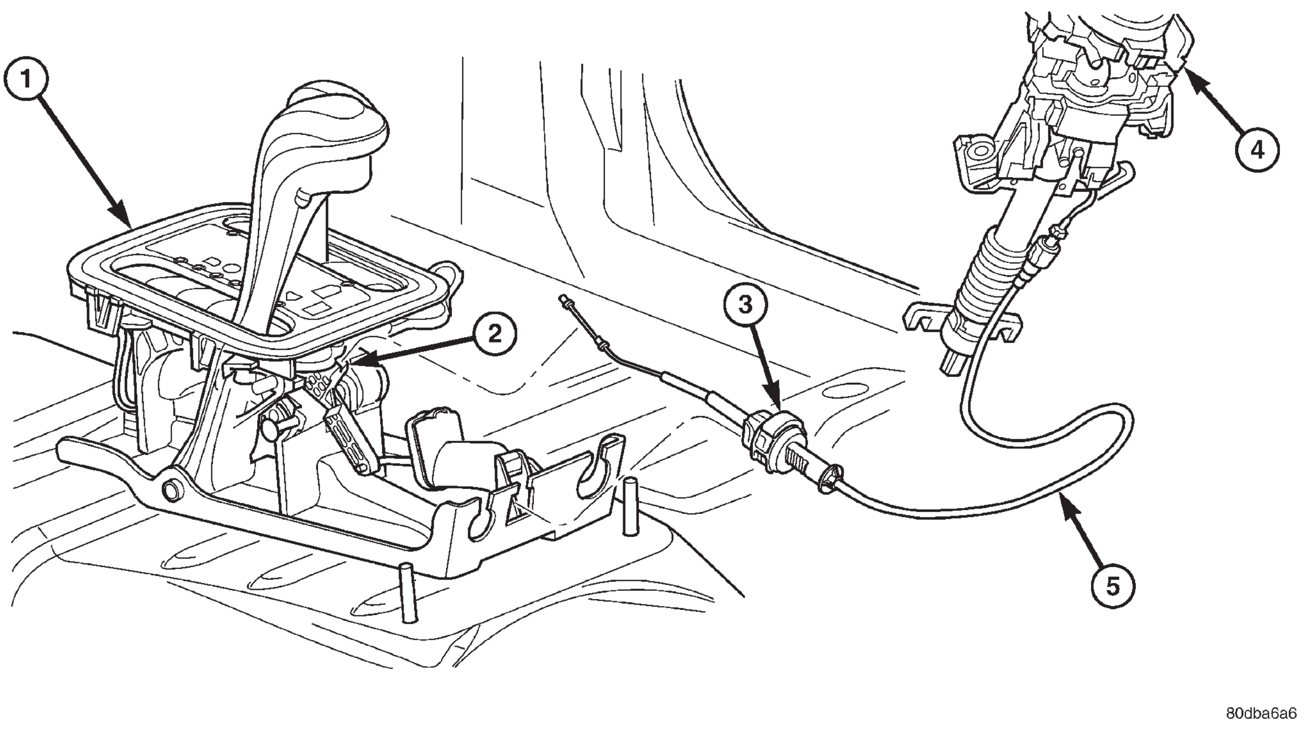


Fig. 57 Ignition Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

ADJUSTMENTS - BRAKE TRANSMISSION SHIFT INTERLOCK

The park interlock cable is part of the brake/shift lever interlock system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of PARK.

ADJUSTMENT PROCEDURE

(1) Remove floor console as necessary for access to the brake transmission shift interlock cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(2) Shift the transmission into the PARK position.

(3) Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**

(4) Pull cable lock button up to release cable (Fig. 58).

(5) Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.

(6) Push lock button down until it snaps in place.

BTSI FUNCTION CHECK

(1) Verify removal of ignition key allowed in PARK position only.

(2) When the shift lever is in PARK, and the shift handle push-button is in the out position, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the off position.

(4) Shifting out of PARK should not be possible while applying normal push-button force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gear and NEUTRAL, or PARK, may be done without depressing foot brake with ignition switch in run or start positions.

(7) The floor shifter lever and gate positions should be in alignment with all transmission detent positions.

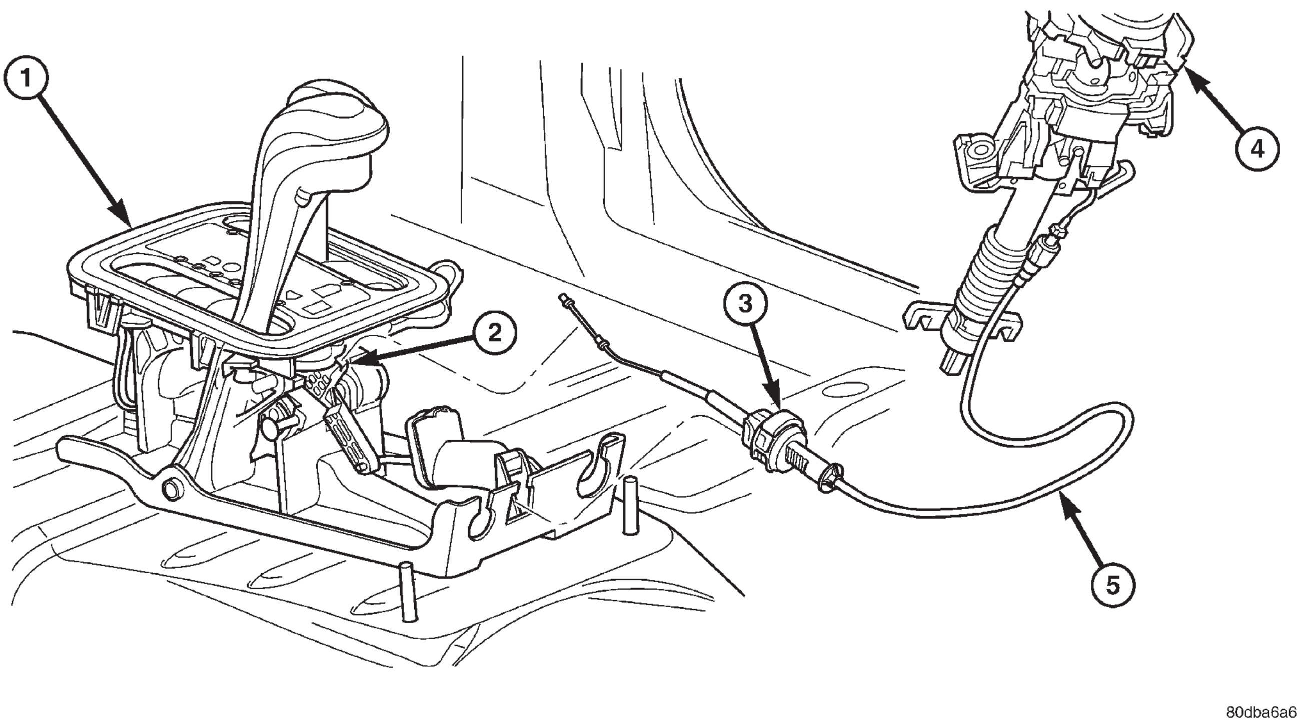


Fig. 58 Brake Transmission Shift Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

(8) Engine starts must be possible with shifter lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gate positions other than PARK or NEUTRAL.

(9) With shifter lever handle push-button not depressed and lever detent in:

• PARK position- apply forward force on center of handle and remove pressure. Engine start must be possible.

• PARK position- apply rearward force on center of handle and remove pressure. Engine start must be possible.

• NEUTRAL position- engine start must be possible.

• NEUTRAL position, engine running and brakes applied- Apply forward force on center of shift handle. Transmission should not be able to shift into REVERSE detent.

FLUID AND FILTER

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has three primary causes.

(1) Internal clutch slippage, usually caused by low line pressure, inadequate clutch apply pressure, or clutch seal failure.

(2) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(3) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

DIAGNOSIS AND TESTING - FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

• adding incorrect fluid
• failure to clean dipstick and fill tube when checking level
• engine coolant entering the fluid
• internal failure that generates debris
• overheat that generates sludge (fluid breakdown)
• failure to reverse flush cooler and lines after repair
• failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

FLUID AND FILTER (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmssion has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the P (PARK) and N (NEUTRAL) positions. Place the selector lever in P (PARK) to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level will be approximately at the upper COLD hole of the dipstick at 70° F fluid temperature.

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.

(1) Start engine and apply parking brake.
(2) Shift the transmission into DRIVE for approximately 2 seconds.
(3) Shift the transmission into REVERSE for approximately 2 seconds.
(4) Shift the transmission into PARK.
(5) Hook up DRB® scan tool and select transmission.
(6) Select sensors.
(7) Read the transmission temperature value.
(8) Compare the fluid temperature value with the chart. (Fig. 59)
(9) Adjust transmission fluid level shown on the dipstick according to the chart.

NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.

(10) Check transmission for leaks.

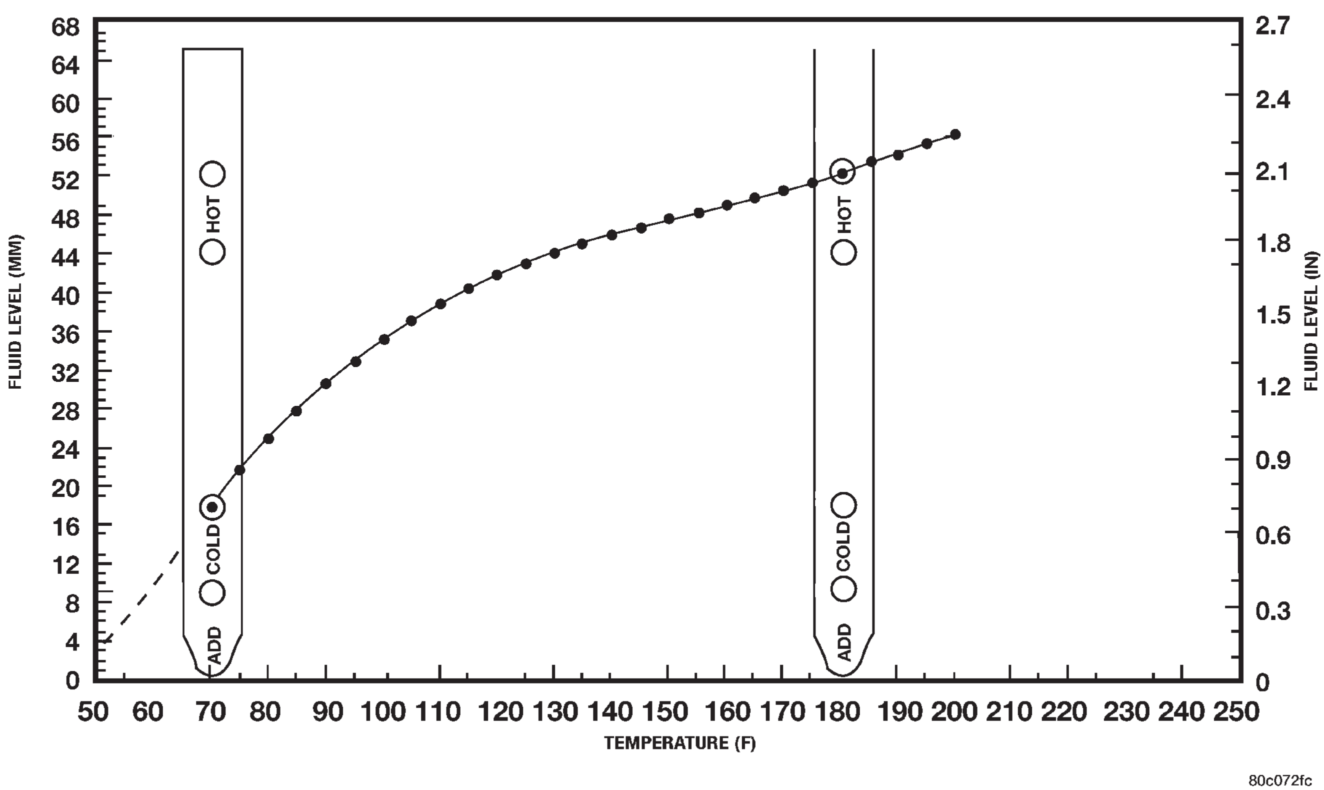


Fig. 59 Transmission Fluid Temperature Chart

FLUID AND FILTER (Continued)

STANDARD PROCEDURE - FLUID AND FILTER REPLACEMENT

For proper service intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission.

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolts holding pan to transmission.

(7) While holding pan level, lower pan away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screw holding filter to valve body (Fig. 60).

(10) Separate filter from valve body and oil pump and pour fluid in filter into drain pan.

(11) Remove and discard the oil filter seal from the bottom of the oil pump.

(12) If replacing the cooler return filter, use Oil Filter Wrench 8321 to remove the filter from the transmission.

(13) Dispose of used trans fluid and filter(s) properly.

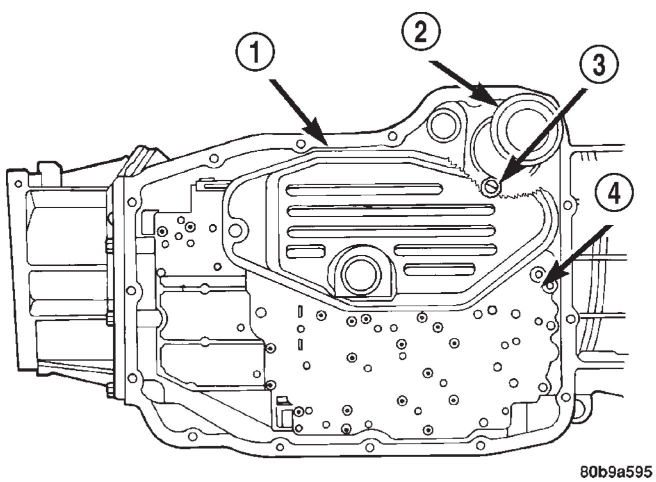


Fig. 60 Transmission Filters - 4X4 Shown

1 - PRIMARY OIL FILTER
2 - COOLER RETURN FILTER
3 - COOLER RETURN FILTER BYPASS VALVE
4 - VALVE BODY

INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch material on the bottom of the pan does not indicate a problem unless accompanied by a slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts of debris, refer to the diagnosis section of this group.

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean original sealing material from surface of transmission case and the transmission pan.

INSTALLATION

(1) Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.

CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.

(2) Place replacement filter in position on valve body and into the oil pump.

(3) Install screw to hold filter to valve body (Fig. 60). Tighten screw to 4.5 N·m (40 in. lbs.) torque.

(4) Install new cooler return filter onto the transmission, if necessary. Torque the filter to 14.12 N·m (125 in.lbs.).

(5) Place bead of Mopar® RTV sealant onto the transmission case sealing surface.

(6) Place pan in position on transmission.

(7) Install bolts to hold pan to transmission. Tighten bolts to 11.8 N·m (105 in. lbs.) torque.

(8) Lower vehicle and fill transmission with Mopar® ATF +4, type 9602 fluid.

STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF +4 to transmission:

(a) If only fluid and filter were changed, add **10 pints (5 quarts)** of ATF +4 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **24 pints (12 quarts)** of ATF +4 to transmission.

(3) Check the transmission fluid (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/FLUID - STANDARD PROCEDURE) and adjust as required.

GEARSHIFT CABLE

DIAGNOSIS AND TESTING - GEARSHIFT CABLE

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

(a) PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.

(b) PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.

(c) NEUTRAL position - Normal position. Engine starts must be possible.

(d) NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

REMOVAL

(1) Shift transmission into PARK.

(2) Raise vehicle.

(3) Remove the shift cable eyelet from the transmission manual shift lever (Fig. 61).

(4) Remove shift cable from the cable support bracket.

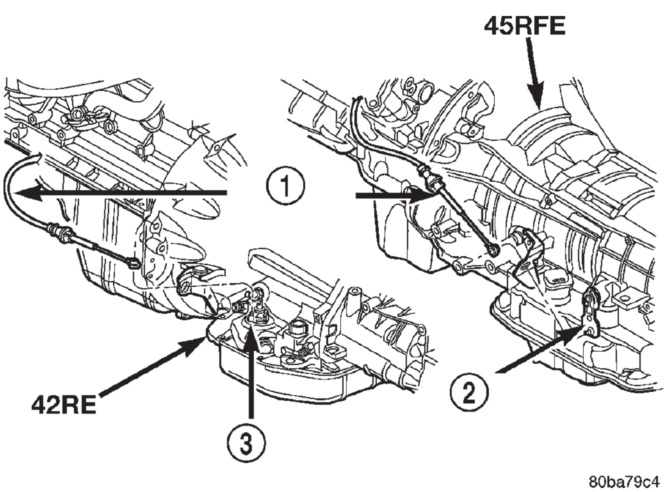


Fig. 61 Remove Shift Cable From Transmission

1 - SHIFT CABLE
2 - MANUAL LEVER
3 - MANUAL LEVER

(5) Lower vehicle.

(6) Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 62).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 63).

(9) Pull cable through floor panel opening.

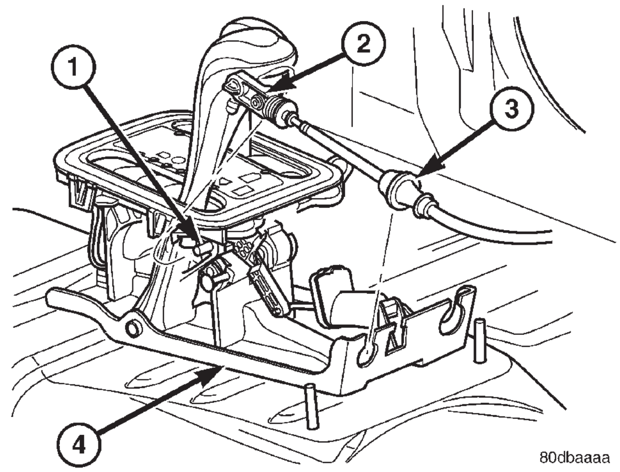


Fig. 62 Transmission Shift Cable at Shifter

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

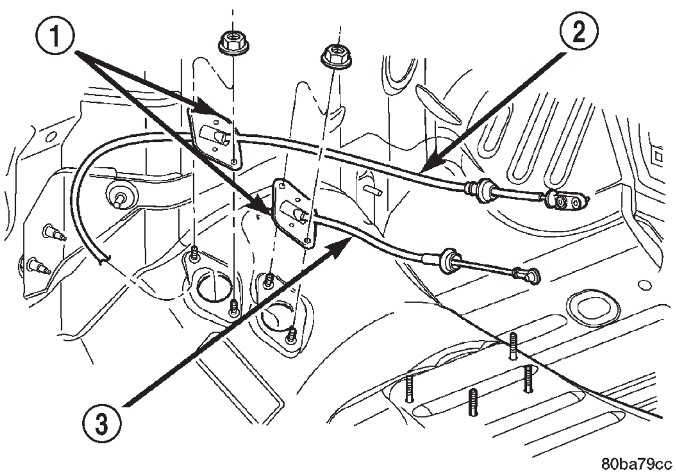


Fig. 63 Shift Cables at Floor Pan

1 - SEAL PLATES
2 - TRANSMISSION SHIFT CABLE
3 - TRANSFER CASE SHIFT CABLE

(10) Remove shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

GEARSHIFT CABLE (Continued)

(3) Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).

(4) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(5) Place the floor shifter lever in PARK position.

(6) Loosen the adjustment screw on the shift cable.

(7) Snap the shift cable onto the shift lever pin.

(8) Raise the vehicle.

(9) Install the shift cable to the shift cable support bracket.

(10) Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.

(11) Snap the shift cable onto the transmission manual shift lever.

(12) Lower vehicle.

(13) Verify that the shift lever is in the PARK position.

(14) Tighten the adjustment screw to 7 N·m (65 in.lbs.).

(15) Verify correct shifter operation.

(16) Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

ADJUSTMENTS - GEARSHIFT CABLE

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the park/neutral position switch or TRS may be faulty.

(1) Shift transmission into PARK.

(2) Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(3) Loosen the shift cable adjustment screw (Fig. 64).

(4) Raise vehicle.

(5) Unsnap cable eyelet from transmission shift lever (Fig. 65).

(6) Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(8) Snap cable eyelet onto transmission shift lever.

(9) Lower vehicle

(10) Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).

(11) Verify correct operation.

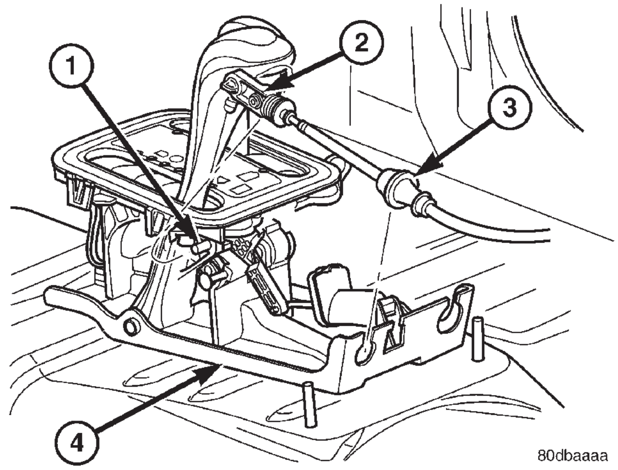


Fig. 64 Shift Cable at the Shifter

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

(12) Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

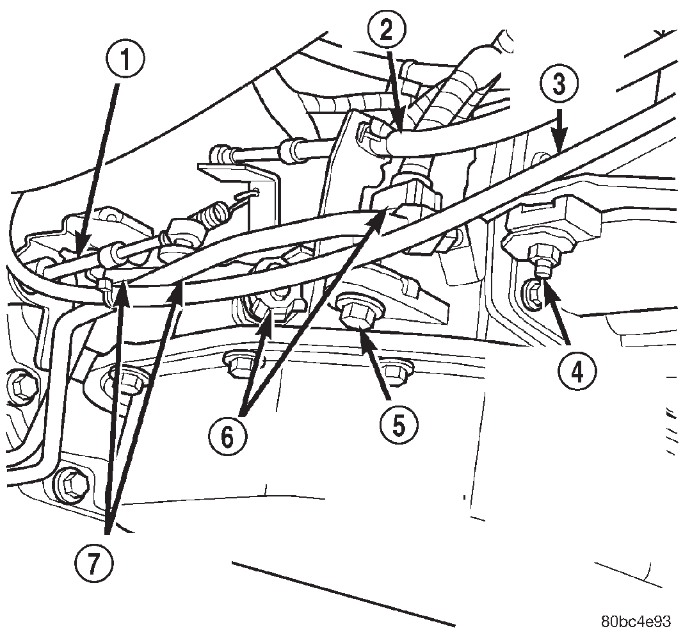


Fig. 65 Shift Cable at Transmission

1 - TRANSMISSION SHIFTER CABLE
2 - THROTTLE VALVE CABLE
3 - TRANSFER CASE SHIFTER CABLE
4 - TRANSFER CASE SHIFTER CABLE BRACKET RETAINING BOLT(S)
5 - THROTTLE VALVE CABLE BRACKET RETAINING BOLT
6 - ELECTRICAL CONNECTORS
7 - TRANSMISSION FLUID LINES

HOLDING CLUTCHES

DESCRIPTION

Three hydraulically applied multi-disc clutches are used to hold some planetary geartrain components stationary while the input clutches drive others. The 2C, 4C, and Low/Reverse clutches are considered holding clutches. The 2C and 4C clutches are located in the 4C retainer/bulkhead (Fig. 66), while the Low/Reverse clutch is located at the rear of the transmission case (Fig. 67).

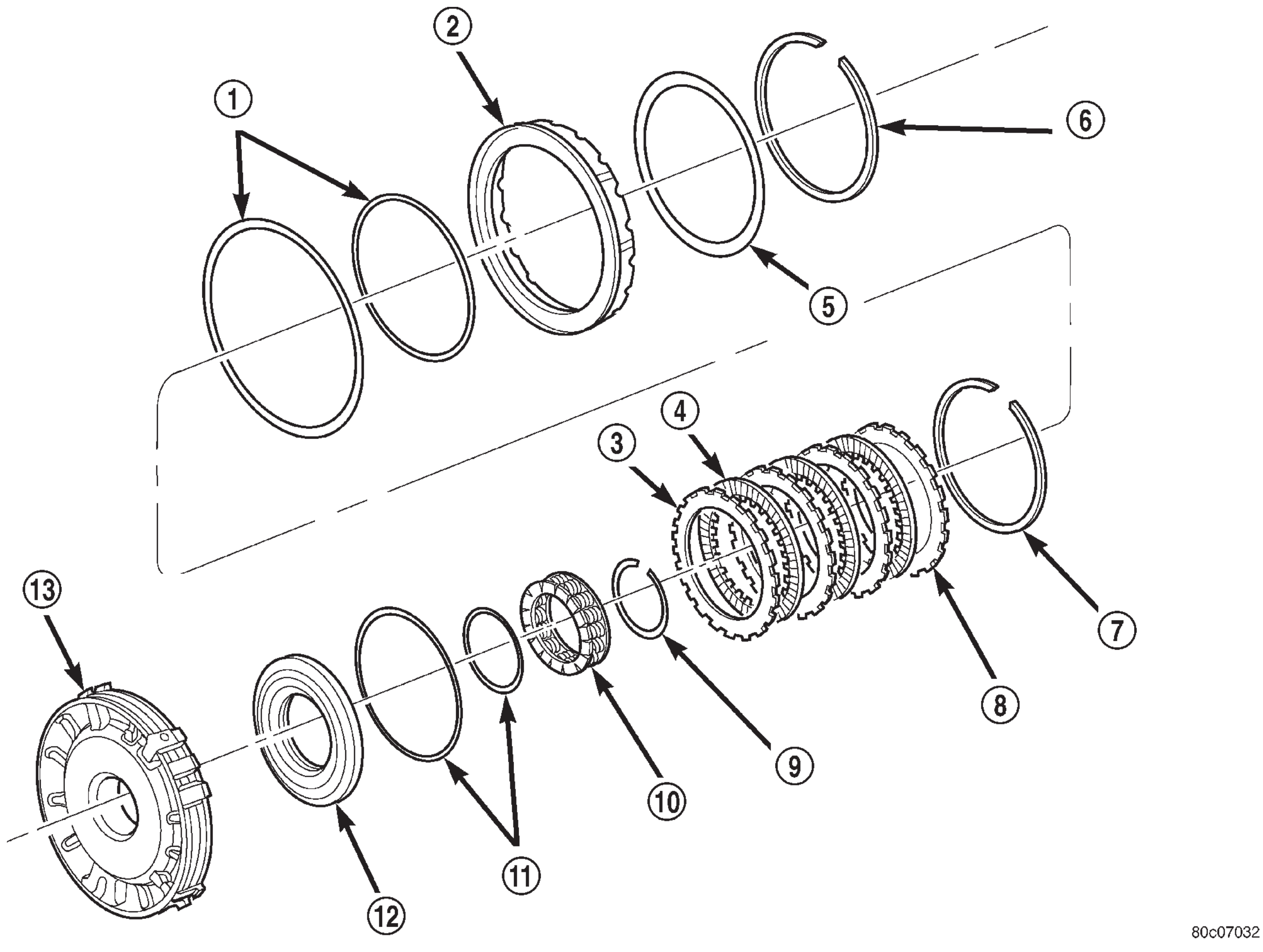


Fig. 66 2C and 4C Clutches

1 - SEAL
2 - 2C PISTON
3 - PLATE
4 - DISC
5 - 2C BELLEVILLE SPRING
6 - SNAP-RING
7 - SNAP-RING (SELECT)
8 - REACTION PLATE
9 - SNAP-RING
10 - RETURN SPRING
11 - SEAL
12 - 4C PISTON
13 - 4C RETAINER/BULKHEAD

HOLDING CLUTCHES (Continued)

OPERATION

2C CLUTCH

The 2C clutch is hydraulically applied in second and fifth gear by pressurized fluid against the 2C piston. When the 2C clutch is applied, the reverse sun gear assembly is held or grounded to the transmission case by holding the reaction planetary carrier.

4C CLUTCH

The 4C clutch is hydraulically applied in second prime and fourth gear by pressurized fluid against the 4C clutch piston. When the 4C clutch is applied, the reaction annulus gear is held or grounded to the transmission case.

LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gear, only at low speeds, by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the input annulus assembly is held or grounded to the transmission case.

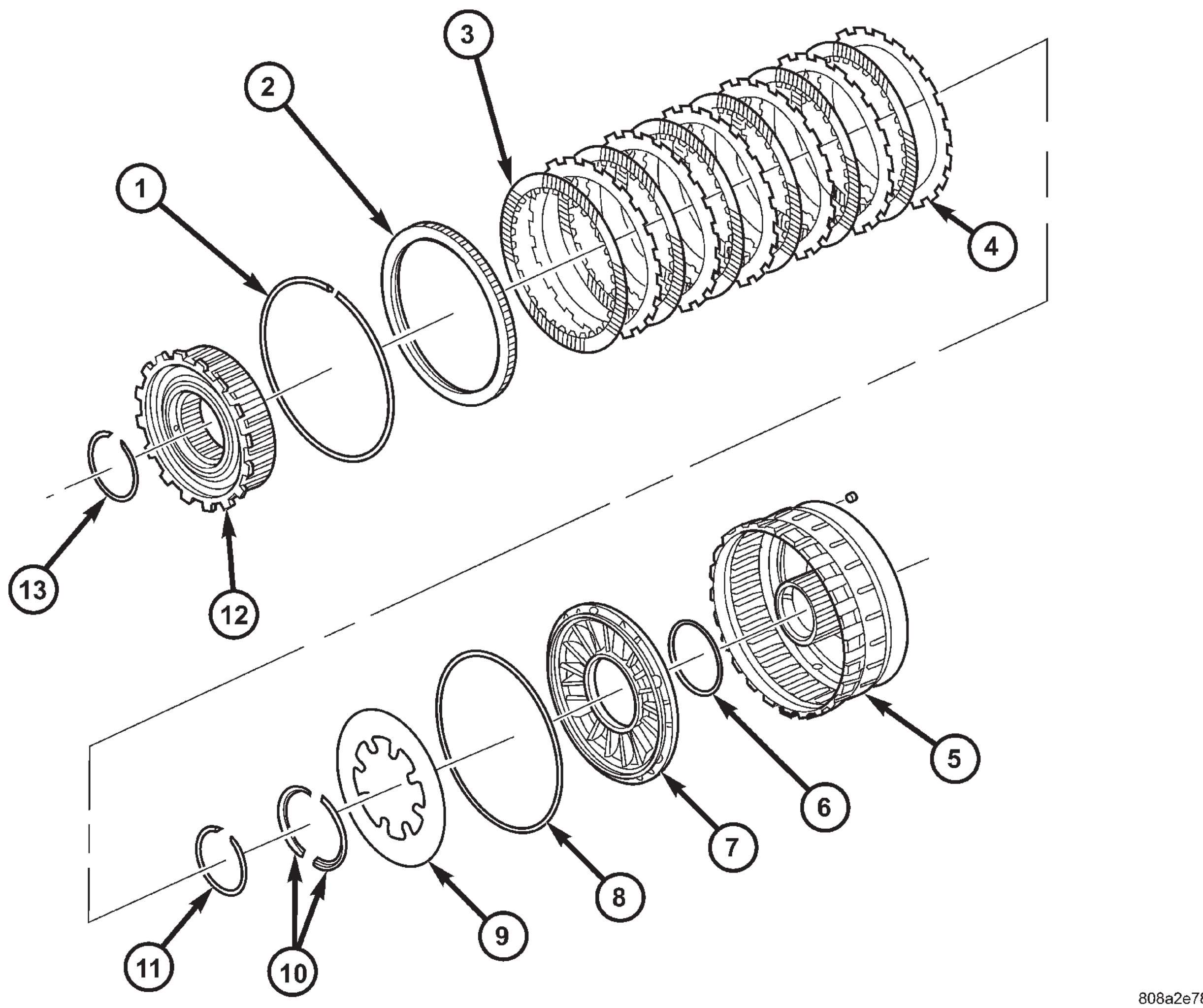


Fig. 67 Low/Reverse Clutch

1 - SNAP-RING (SELECT)
2 - REACTION PLATE
3 - DISC
4 - PLATE
5 - L/R CLUTCH RETAINER
6 - SEAL
7 - PISTON
8 - SEAL
9 - BELLEVILLE SPRING
10 - RETAINER
11 - SNAP-RING
12 - OVERRUNNING CLUTCH
13 - SNAP-RING

INPUT CLUTCH ASSEMBLY

DESCRIPTION

Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly (Fig. 68) and (Fig. 69). The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, second prime, and third (direct) gears by pressurized fluid against the underdrive piston.

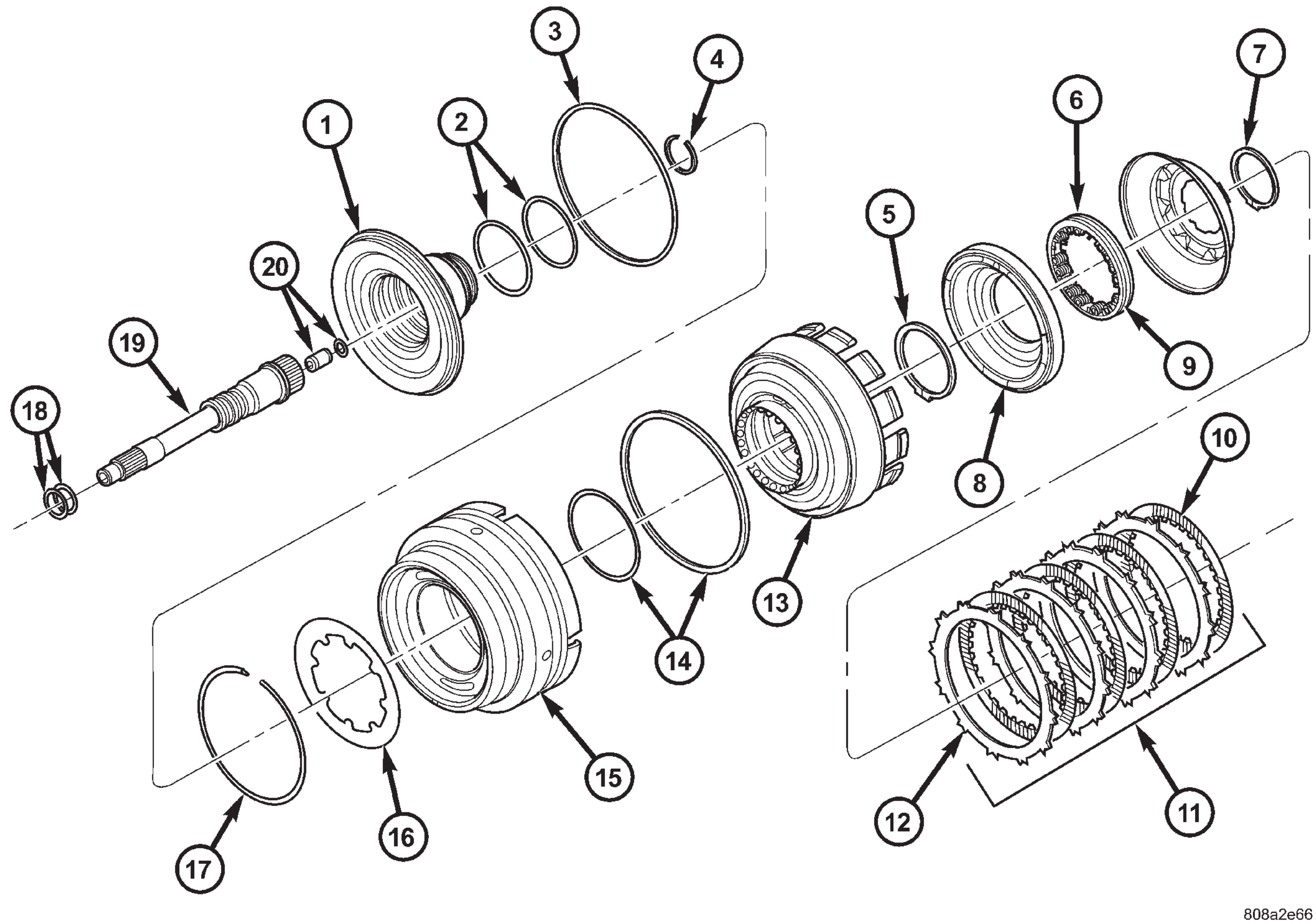


Fig. 68 Input Clutch Assembly - Part 1

1 - INPUT CLUTCH HUB
2 - O-RING SEALS
3 - SEAL
4 - SNAP-RING
5 - SNAP-RING
6 - UD BALANCE PISTON
7 - SNAP-RING
8 - UD PISTON
9 - SPRING
10 - DISC
11 - UD CLUTCH
12 - PLATE
13 - CLUTCH RETAINER
14 - SEAL
15 - OD/REV PISTON
16 - BELLEVILLE SPRING
17 - SNAP-RING
18 - SEAL RINGS
19 - INPUT SHAFT
20 - LUBRICATION CHECK VALVE AND SNAP-RING

INPUT CLUTCH ASSEMBLY (Continued)

When the underdrive clutch is applied, the underdrive hub drives the input sun gear.

OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct), fourth, and fifth gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the reverse carrier/input annulus assembly.

REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the reaction annulus gear is driven.

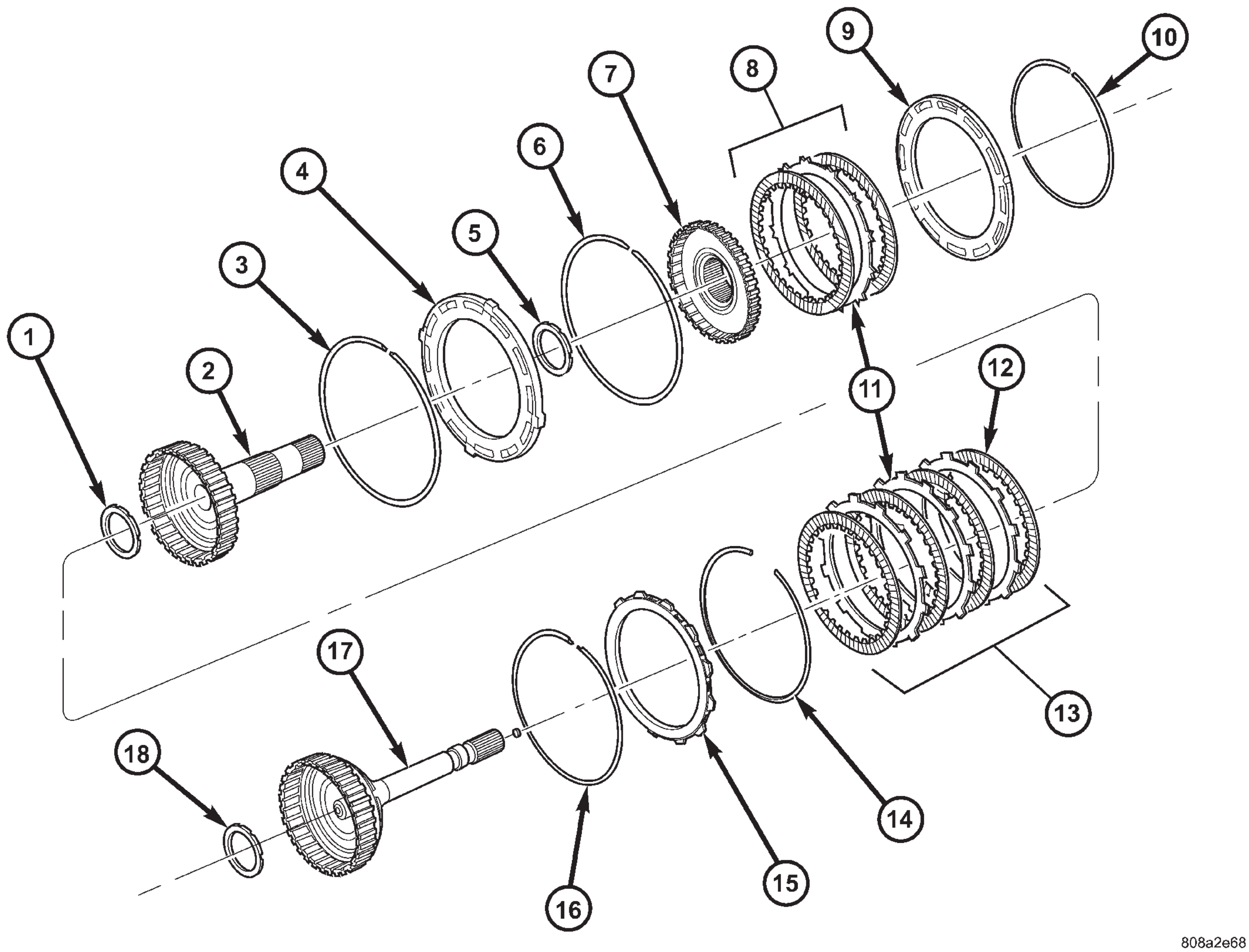


Fig. 69 Input Clutch Assembly - Part 2

1 - BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - BEARING NUMBER 2

INPUT CLUTCH ASSEMBLY (Continued)

DISASSEMBLY

(1) Remove the reverse reaction plate selective snap-ring from the input clutch retainer (Fig. 70).

(2) Remove the reverse reaction plate from the input clutch retainer.

(3) Remove the reverse hub and reverse clutch pack from the input clutch retainer.

(4) Remove the number 4 bearing from the overdrive hub.

(5) Remove the overdrive hub from the input clutch retainer (Fig. 70).

(6) Remove the number 3 bearing from the underdrive hub.

(7) Remove the OD/reverse reaction plate snap-ring from the input clutch retainer.

(8) Remove the underdrive hub, overdrive clutch, and overdrive reaction plate from the input clutch retainer (Fig. 70).

NOTE: The overdrive friction discs and steel discs are thicker than the matching components in the underdrive and reverse clutches.

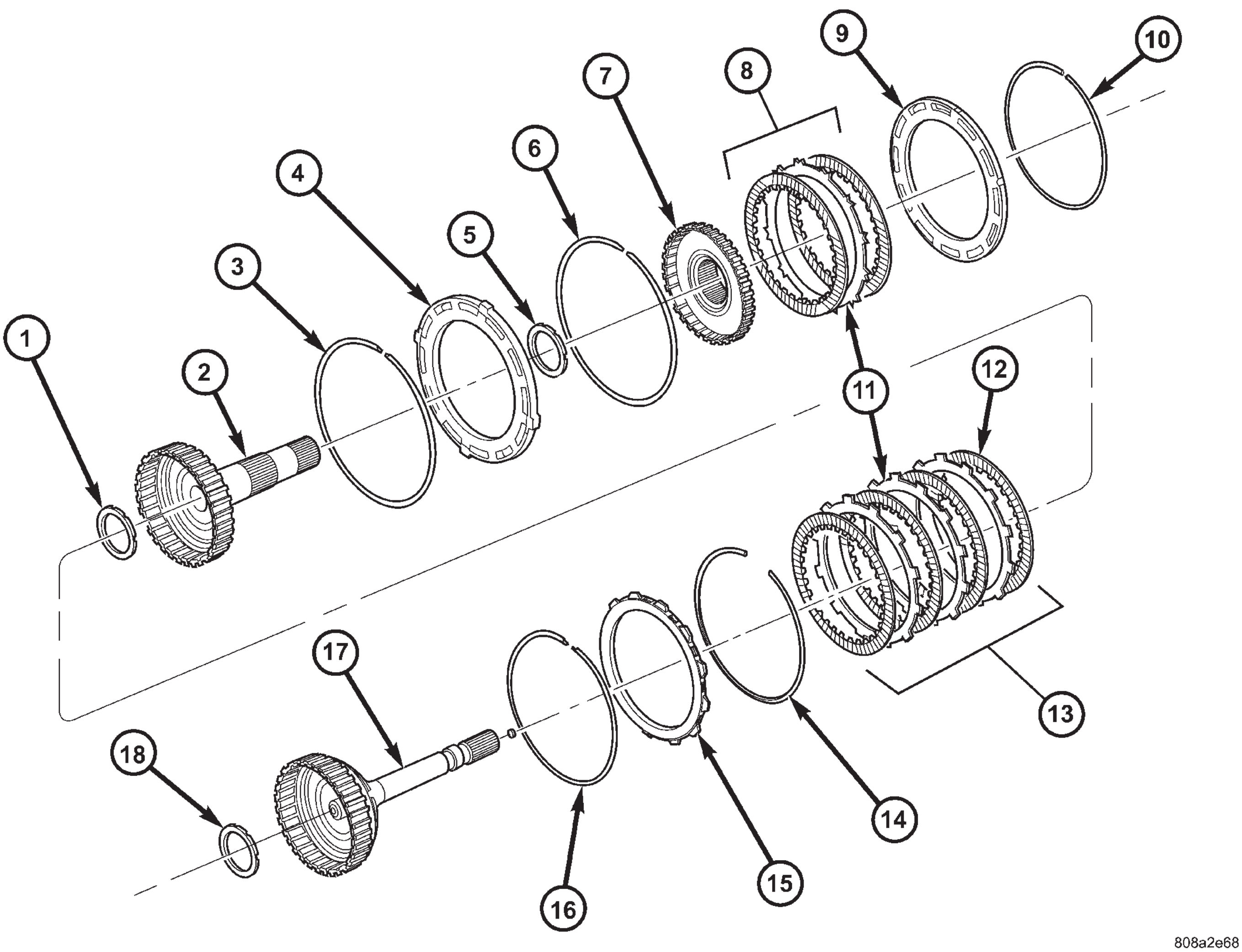


Fig. 70 Input Clutch Assembly - Part 2

1 - BEARING NUMBER 3
2 - OD HUB/SHAFT
3 - SNAP-RING (WAVE)
4 - REV/OD REACTION PLATE
5 - BEARING NUMBER 4
6 - SNAP-RING (FLAT)
7 - REVERSE HUB/SHAFT
8 - REVERSE CLUTCH
9 - REVERSE REACTION PLATE
10 - SNAP-RING (SELECT)
11 - PLATE
12 - DISC
13 - OD CLUTCH
14 - SNAP-RING (TAPERED)
15 - UD/OD REACTION PLATE
16 - SNAP-RING (FLAT)
17 - UD HUB/SHAFT
18 - BEARING NUMBER 2

INPUT CLUTCH ASSEMBLY (Continued)

(9) Remove the number 2 bearing from the input clutch hub.

(10) Remove the overdrive clutch wave snap-ring from the input clutch retainer.

(11) Remove the UD/OD reaction plate tapered snap-ring from the input clutch retainer.

(12) Remove the UD/OD reaction plate from the input clutch retainer.

(13) Remove the UD/OD reaction plate flat snap-ring from the input clutch retainer (Fig. 70).

(14) Remove the underdrive clutch pack from the input clutch retainer (Fig. 72).

(15) Using Spring Compressor 8251, compress the UD/OD balance piston and remove the snap-ring from the input clutch hub (Fig. 71).

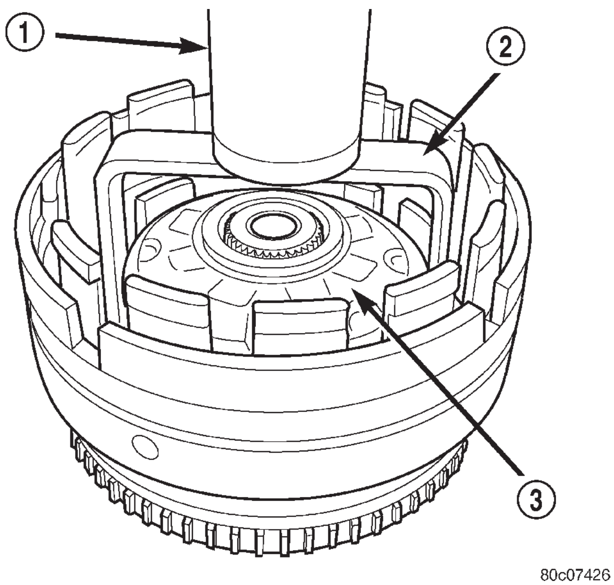


Fig. 71 Compressing UD/OD Balance Piston Using Tool 8251

1 - PRESS
2 - TOOL 8251
3 - BALANCE PISTON

(16) Remove the UD/OD balance piston and piston return spring from the input clutch retainer (Fig. 72).

(17) Remove the underdrive piston from the input clutch retainer (Fig. 72).

NOTE: Both the UD/OD balance piston and the underdrive piston have seals molded onto them. If the seal is damaged, do not attempt to install a new seal onto the piston. The piston/seal must be replaced as an assembly.

(18) Remove the input clutch retainer tapered snap-ring.

(19) Separate input clutch retainer from input clutch hub.

(20) Separate OD/reverse piston from input clutch hub retainer (Fig. 72).

(21) Remove all seals and o-rings from the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to make note of which o-ring belongs in which location.

ASSEMBLY

(1) Install all new seals and o-rings onto the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to install the correct o-ring in the correct location.

(2) Check the transmission lubrication check valve located in the input shaft using shop air. The valve should only allow air flow in one direction. If the valve allows no air flow, or air flow in both directions, the valve will need to be replaced.

(3) Lubricate all seals with Mopar® ATF +4, type 9602, prior to installation.

(4) Assemble the OD/reverse piston onto the input clutch hub (Fig. 73).

(5) Assemble the input clutch retainer onto the input clutch hub.

(6) Install the input clutch retainer tapered snap-ring with tapered side up onto the input clutch hub.

INPUT CLUTCH ASSEMBLY (Continued)

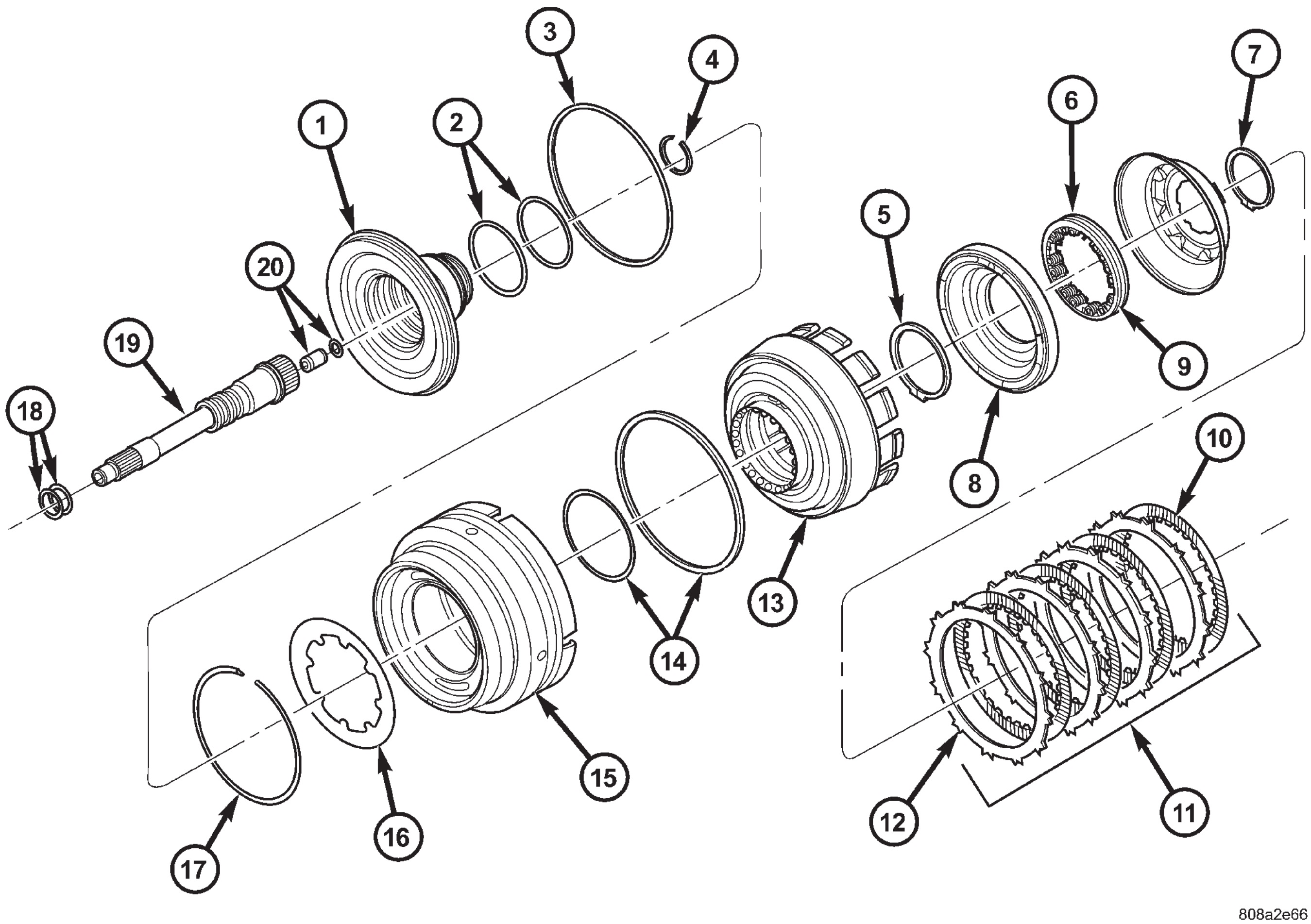


Fig. 72 Input Clutch Assembly - Part 1

1 - INPUT CLUTCH HUB
2 - O-RING SEALS
3 - SEAL
4 - SNAP-RING
5 - SNAP-RING
6 - UD BALANCE PISTON
7 - SNAP-RING
8 - UD PISTON
9 - SPRING
10 - DISC
11 - UD CLUTCH
12 - PLATE
13 - CLUTCH RETAINER
14 - SEAL
15 - OD/REV PISTON
16 - BELLEVILLE SPRING
17 - SNAP-RING
18 - SEAL RINGS
19 - INPUT SHAFT
20 - LUBRICATION CHECK VALVE AND SNAP-RING

INPUT CLUTCH ASSEMBLY (Continued)

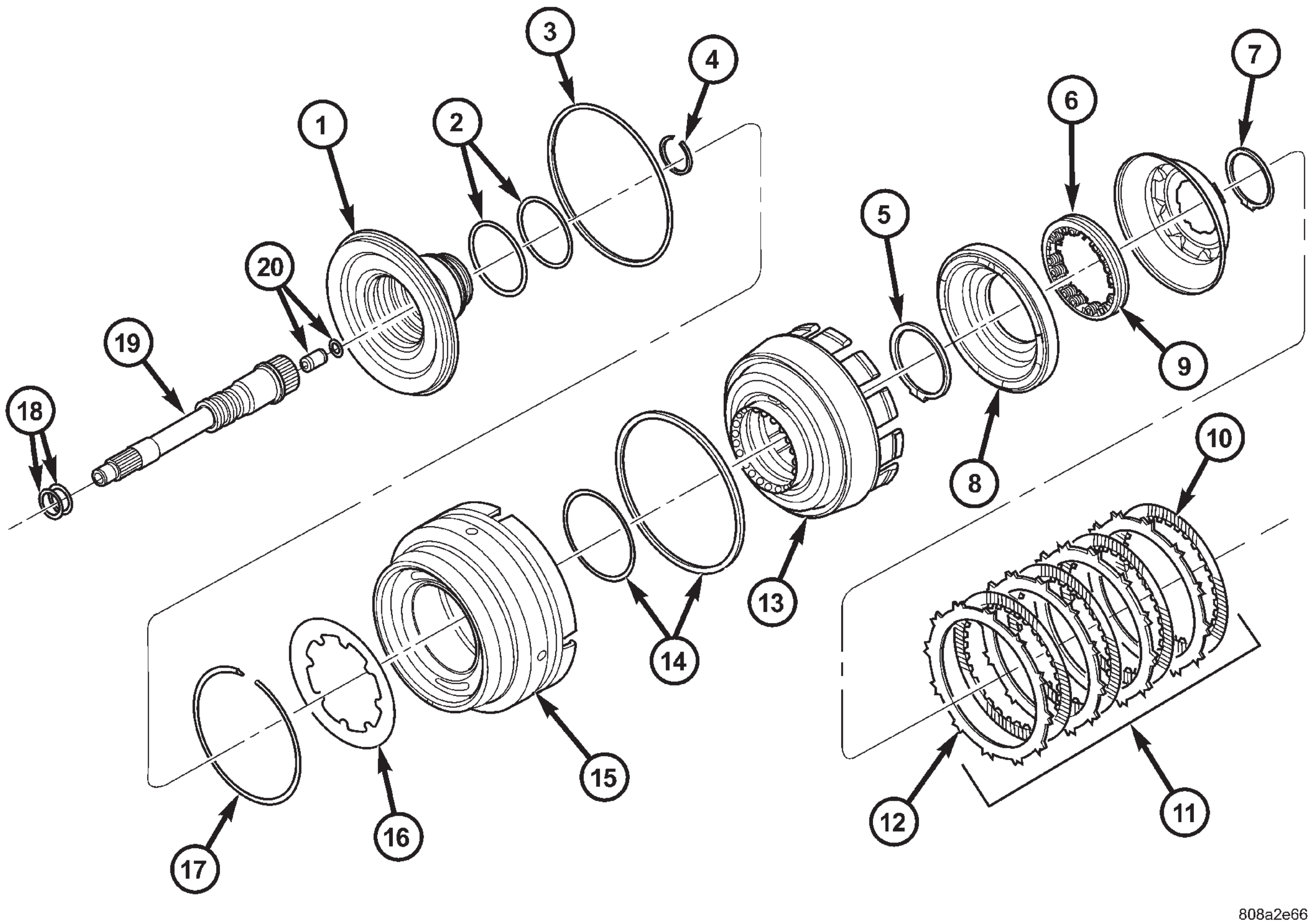


Fig. 73 Input Clutch Assembly - Part I

1 - INPUT CLUTCH HUB
2 - O-RING SEALS
3 - SEAL
4 - SNAP-RING
5 - SNAP-RING
6 - UD BALANCE PISTON
7 - SNAP-RING
8 - UD PISTON
9 - SPRING
10 - DISC
11 - UD CLUTCH
12 - PLATE
13 - CLUTCH RETAINER
14 - SEAL
15 - OD/REV PISTON
16 - BELLEVILLE SPRING
17 - SNAP-RING
18 - SEAL RINGS
19 - INPUT SHAFT
20 - LUBRICATION CHECK VALVE AND SNAP-RING

INPUT CLUTCH ASSEMBLY (Continued)

(7) Install Piston Guides 8504 into the input clutch retainer (Fig. 74) and onto the input clutch hub to guide the inner and outer underdrive piston seals into position.

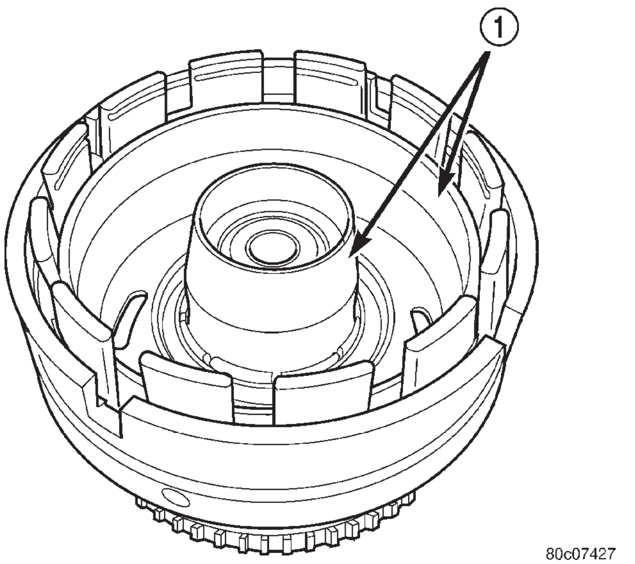


Fig. 74 Install Underdrive Piston Using Tool 8504

1 - TOOL 8504

(8) Install the underdrive piston into the input clutch retainer and over the input clutch hub (Fig. 73).

(9) Install the UD/OD balance piston return spring pack into the input clutch retainer.

(10) Install Piston Guide 8252 into the input clutch retainer (Fig. 75) to guide the UD/OD balance piston seal into position inside the underdrive piston.

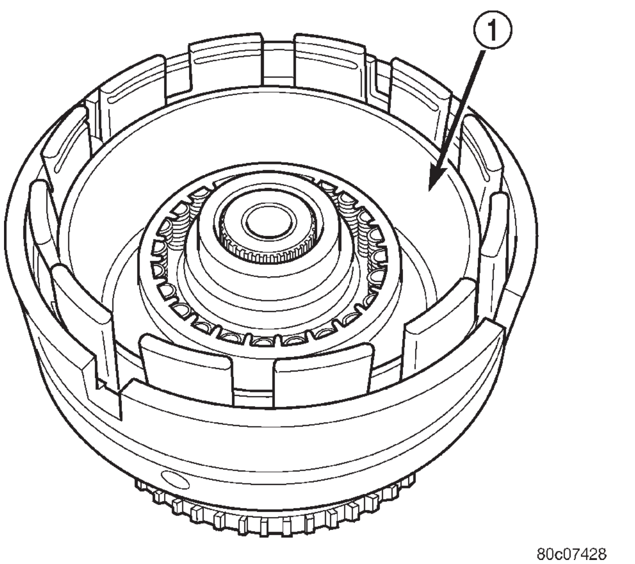


Fig. 75 Install Balance Piston Using Tool 8252

1 - TOOL 8252

(11) Install the UD/OD balance piston into the input clutch retainer and the underdrive piston.

(12) Using Spring Compressor 8251, compress the UD/OD return spring pack and secure the piston in place with the snap-ring (Fig. 76).

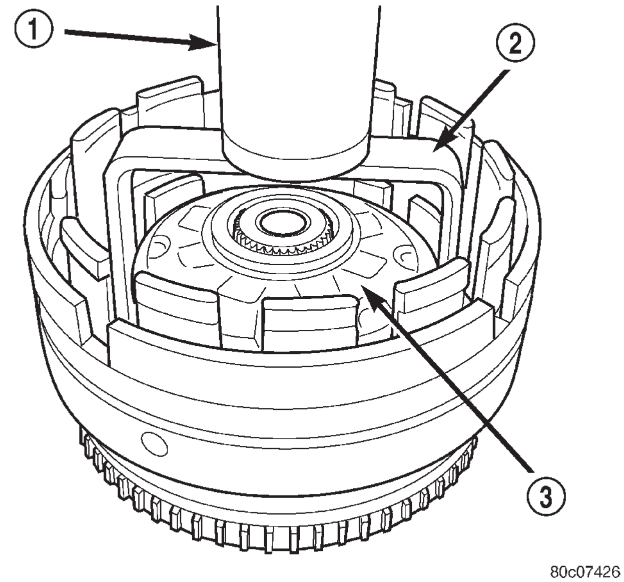


Fig. 76 Compressing UD/OD Balance Piston Using Tool 8251

1 - PRESS
2 - TOOL 8251
3 - BALANCE PISTON

INPUT CLUTCH ASSEMBLY (Continued)

(13) Install the underdrive clutch pack into the input clutch retainer (Fig. 73).

(14) Install the UD/OD reaction plate lower flat snap-ring (Fig. 77). The correct snap-ring can be identified by the two tabbed ears.

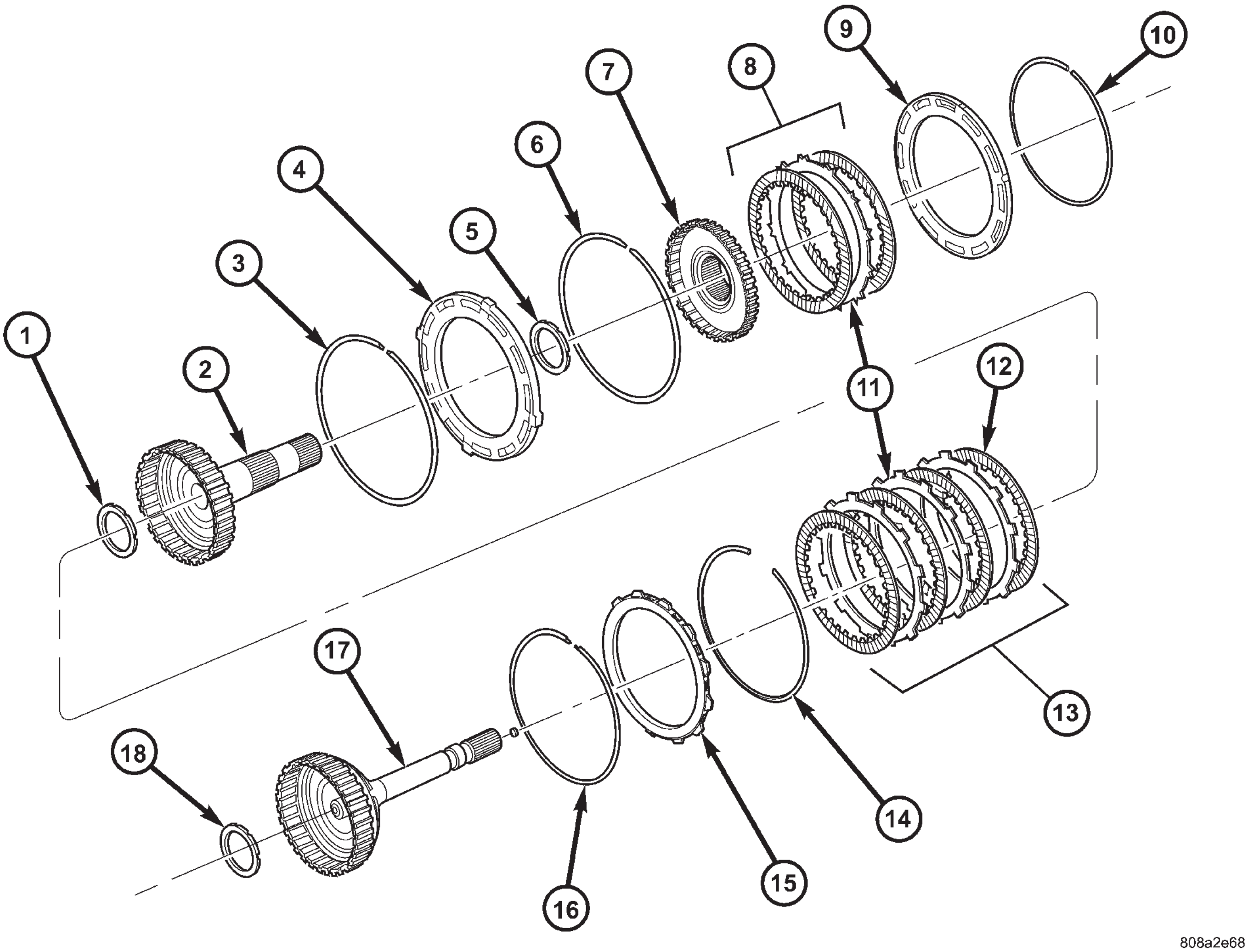


Fig. 77 Input Clutch Assembly - Part II

1 - BEARING NUMBER 3	10 - SNAP-RING (SELECT)
2 - OD HUB/SHAFT	11 - PLATE
3 - SNAP-RING (WAVE)	12 - DISC
4 - REV/OD REACTION PLATE	13 - OD CLUTCH
5 - BEARING NUMBER 4	14 - SNAP-RING (TAPERED)
6 - SNAP-RING (FLAT)	15 - UD/OD REACTION PLATE
7 - REVERSE HUB/SHAFT	16 - SNAP-RING (FLAT)
8 - REVERSE CLUTCH	17 - UD HUB/SHAFT
9 - REVERSE REACTION PLATE	18 - BEARING NUMBER 2

INPUT CLUTCH ASSEMBLY (Continued)

(15) Install the UD/OD reaction plate into the input clutch retainer. The reaction plate is to be installed with the big step down.

(16) Install the UD/OD reaction plate upper tapered snap-ring with tapered side up.

(17) Install the input clutch assembly into Input Clutch Pressure Fixture 8260 (Fig. 78). Mount a dial indicator to the assembly, push down on the clutch discs and zero the indicator against the underdrive clutch discs (Fig. 79). Apply 20 psi of air pressure to the underdrive clutch and record the dial indicator reading. Measure and record UD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with UD clutch pack clearance specification. The correct clutch clearance is 0.84-1.54 mm (0.033-0.061 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.

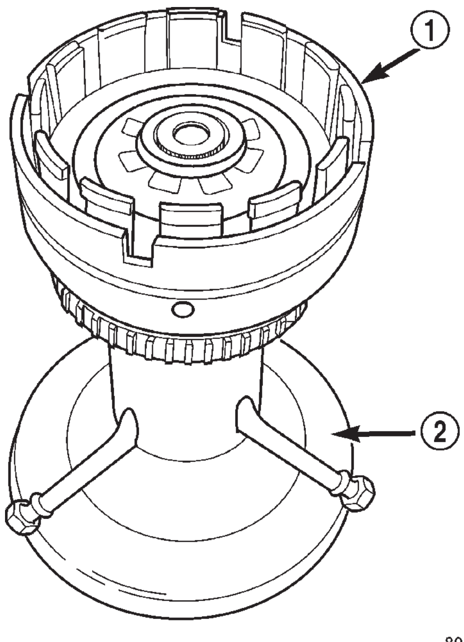


Fig. 78 Input Clutch Assembly Mounted on Tool 8260

1 - INPUT CLUTCH ASSEMBLY
2 - TOOL 8260

(18) Install the overdrive clutch pack into the input clutch retainer (Fig. 77). The overdrive steel separator plates can be identified by the lack of the half-moon cuts in the locating tabs.

(19) Install the overdrive clutch wavy snap-ring with the two tabbed ears into the input clutch retainer.

(20) Install the OD/reverse reaction plate into the input clutch retainer. The reaction plate is non-directional (Fig. 77).

(21) Install the OD/reverse reaction plate flat snap-ring into the input clutch retainer.

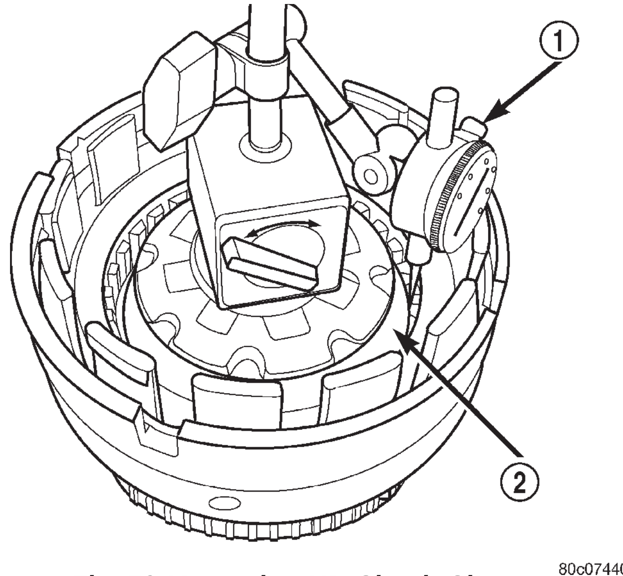


Fig. 79 Measuring UD Clutch Clearance

1 - TOOL C-3339
2 - UNDERDRIVE CLUTCH PACK

(22) Mount a dial indicator to the assembly and zero the indicator against the OD/reverse reaction plate (Fig. 80). Apply 20 psi of air pressure to the overdrive clutch and record the dial indicator reading. Measure and record OD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with OD clutch pack clearance specification.Verify that the clutch clearance is 1.103-1.856 mm (0.043-0.073 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.

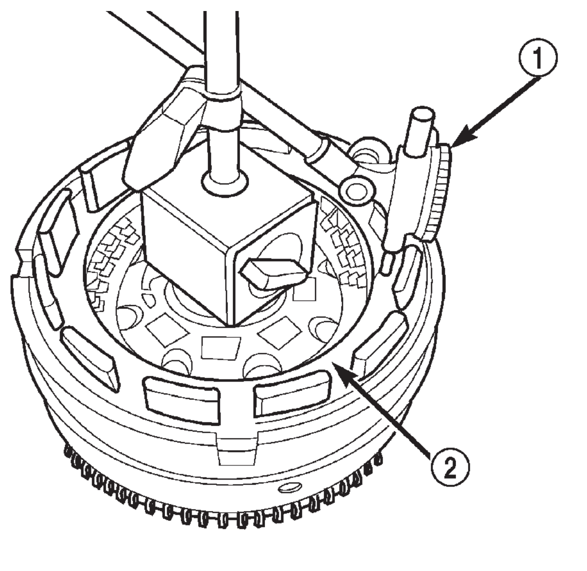


Fig. 80 Measuring OD Clutch Clearance

1 - TOOL C-3339
2 - OD/REV REACTION PLATE

INPUT CLUTCH ASSEMBLY (Continued)

(23) Install the reverse clutch pack into the input clutch retainer (Fig. 77).

(24) Install the reverse reaction plate into the input clutch retainer.

(25) Install the reverse reaction plate selective snap-ring into the input clutch retainer.

(26) Mount a dial indicator to the assembly, push down on the clutch discs, pull up on the reaction plate to ensure the plate is properly seated and zero the indicator against the reverse clutch discs (Fig. 81). Apply 20 psi of air pressure to the reverse clutch and record the dial indicator reading. Measure and record Reverse clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with Reverse clutch pack clearance specification. The correct clutch clearance is 0.58-1.47 mm (0.023-0.058 in.). Adjust as necessary. Install the chosen snap-ring and re-measure to verify selection.

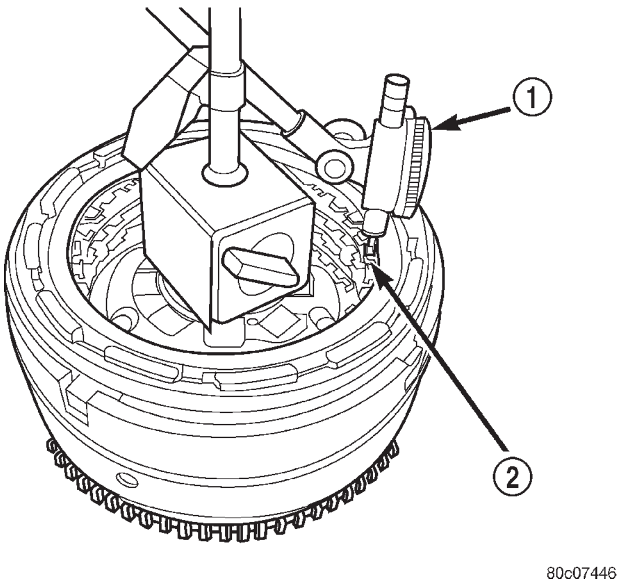


Fig. 81 Measuring Reverse Clutch Clearance

1 - TOOL C-3339
2 - REVERSE CLUTCH PACK

(27) Remove the reverse clutch pack from the input clutch retainer.

(28) Install the number 2 bearing onto the underdrive hub with outer race against the hub with petroleum jelly.

(29) Install the underdrive hub into the input clutch retainer.

(30) Install the number 3 bearing into the overdrive hub with the outer race against the hub with petroleum jelly.

(31) Install the overdrive hub into the input clutch retainer.

(32) Install the number 4 bearing into the reverse hub with outer race against the hub with petroleum jelly.

(33) Install the reverse hub into the input clutch retainer.

(34) Install the complete reverse clutch pack.

(35) Install the reverse reaction plate and snap-ring.

(36) Push up on reaction plate to allow reverse clutch to move freely.

INPUT SPEED SENSOR

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the input speed sensor (Fig. 82).

(4) Remove the bolt holding the input speed sensor to the transmission case.

(5) Remove the input speed sensor from the transmission case.

INSTALLATION

(1) Install the input speed sensor into the transmission case.

(2) Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).

INPUT SPEED SENSOR (Continued)

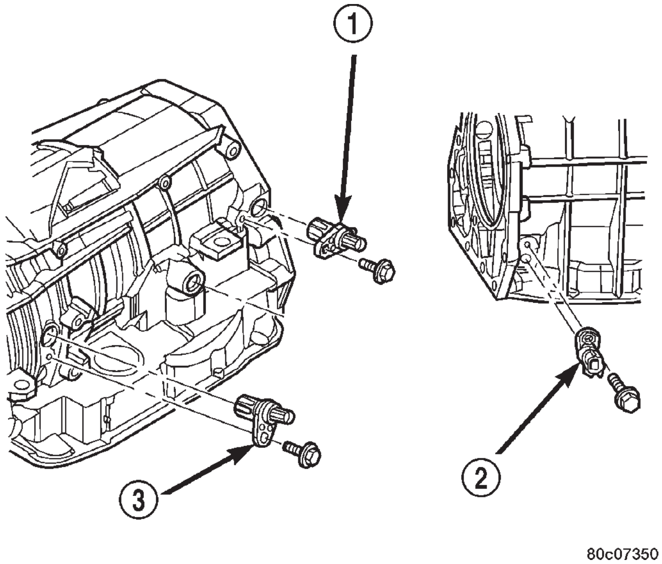


Fig. 82 Input Speed Sensor

1 - OUTPUT SPEED SENSOR
2 - LINE PRESSURE SENSOR
3 - INPUT SPEED SENSOR

(3) Install the wiring connector onto the input speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

LINE PRESSURE (LP) SENSOR

DESCRIPTION

The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid, mounted on the side of the solenoid and pressure switch assembly. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

OPERATION

The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts and when the transmission is in the PARK and NEUTRAL positions. This is done to ensure consistent shift quality. During all other operation, the actual line pressure is compared to the desired line pressure and adjustments are made to the pressure control solenoid duty cycle.

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the line pressure sensor (Fig. 83).

(4) Remove the bolt holding the line pressure sensor to the transmission case.

(5) Remove the line pressure sensor from the transmission case.

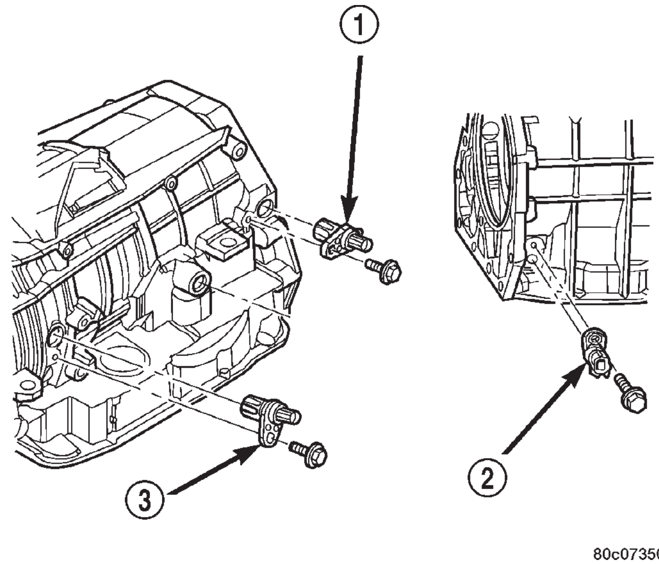


Fig. 83 Line Pressure Sensor

1 - OUTPUT SPEED SENSOR
2 - LINE PRESSURE SENSOR
3 - INPUT SPEED SENSOR

INSTALLATION

(1) Install the line pressure sensor into the transmission case.

(2) Install the bolt to hold the line pressure sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).

(3) Install the wiring connector onto the line pressure sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

LOW/REVERSE CLUTCH

DISASSEMBLY

(1) Remove the inner overrunning clutch snap-ring from the low/reverse clutch retainer (Fig. 84).

(2) Remove the outer low/reverse reaction plate flat snap-ring (Fig. 84).

(3) Remove the low/reverse clutch and the overrunning clutch from the low/reverse clutch retainer as an assembly (Fig. 84).

(4) Separate the low/reverse clutch from the overrunning clutch.

(5) Remove the overrunning clutch snap-ring (Fig. 85).

(6) Remove the spacer from the overrunning clutch (Fig. 85).

(7) Separate the inner and outer races of the overrunning clutch (Fig. 85).

(8) Remove the overrunning clutch lower snap-ring (Fig. 85).

(9) Using Spring Compressor 8285 and a suitable shop press (Fig. 86), compress the low/reverse piston Belleville spring and remove the split retaining ring

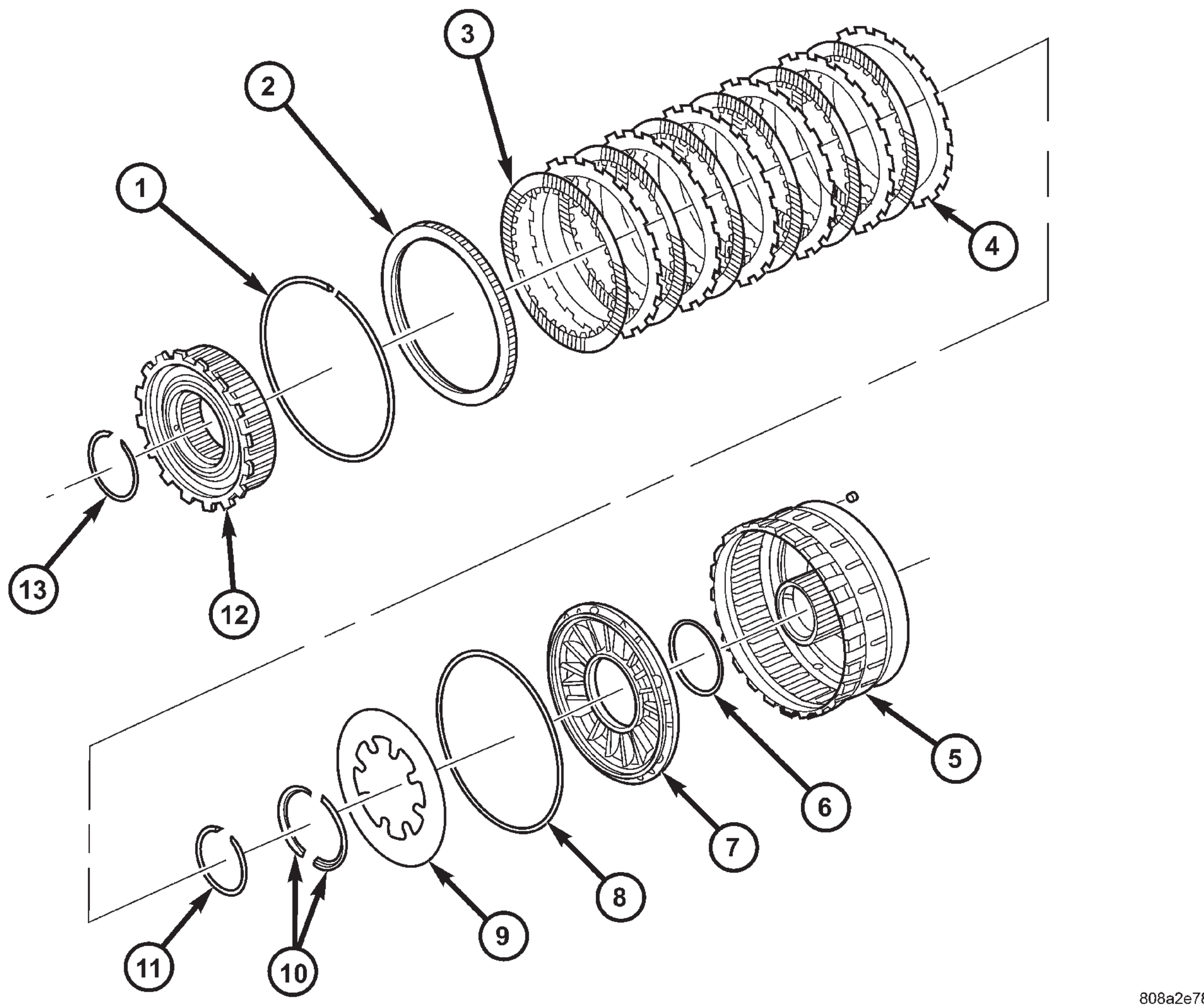


Fig. 84 Low/Reverse Clutch Assembly

1 - SNAP-RING (SELECT)
2 - REACTION PLATE
3 - DISC
4 - PLATE
5 - L/R CLUTCH RETAINER
6 - SEAL
7 - PISTON
8 - SEAL
9 - BELLEVILLE SPRING
10 - RETAINER
11 - SNAP-RING
12 - OVERRUNNING CLUTCH
13 - SNAP-RING

LOW/REVERSE CLUTCH (Continued)

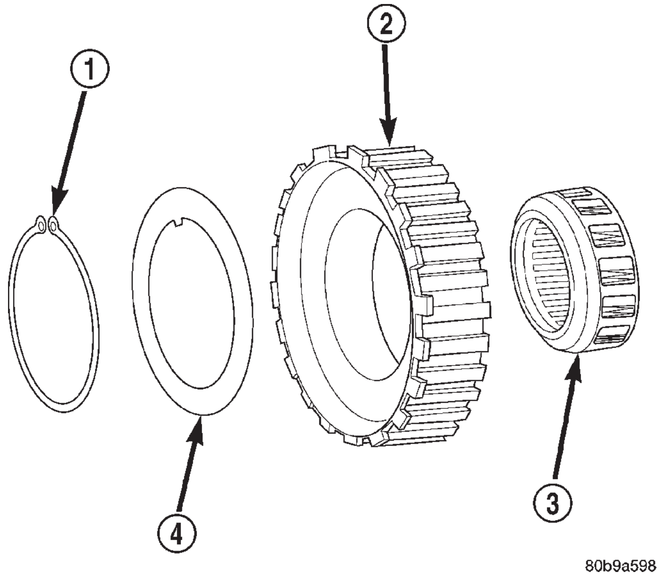


Fig. 85 Overrunning Clutch

1 - SNAP-RING
2 - OUTER RACE
3 - OVERRUNNING CLUTCH
4 - SPACER

holding the Belleville spring into the low/reverse clutch retainer.

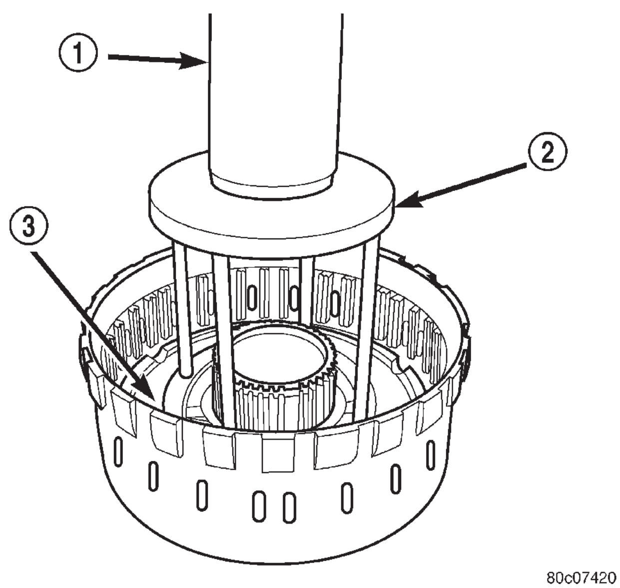


Fig. 86 Compress Low/Reverse Belleville Spring Using Tool 8285

1 - PRESS
2 - TOOL 8285
3 - BELLEVILLE SPRING

(10) Remove the low/reverse clutch Belleville spring and piston from the low/reverse clutch retainer. Use 20 psi of air pressure to remove the piston if necessary.

CLEANING

Clean the overrunning clutch assembly, clutch cam, and low-reverse clutch retainer. Dry them with compressed air after cleaning.

INSPECTION

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse clutch retainer if the clutch race, roller surface or inside diameter is scored, worn or damaged.

ASSEMBLY

(1) Check the bleed orifice to ensure that it is not plugged or restricted.

(2) Install a new seal on the low/reverse piston. Lubricate the seal with Mopar® ATF +4, type 9602, prior to installation.

(3) Install the low/reverse piston into the low/reverse clutch retainer.

(4) Position the low/reverse piston Belleville spring on the low/reverse piston.

(5) Using Spring Compressor 8285 and a suitable shop press (Fig. 86), compress the low/reverse piston Belleville spring and install the split retaining ring to hold the Belleville spring into the low/reverse clutch retainer.

(6) Install the lower overrunning clutch snap-ring (Fig. 85).

(7) Assemble the inner and outer races of the overrunning clutch (Fig. 85).

(8) Position the overrunning clutch spacer on the overrunning clutch.

(9) Install the upper overrunning clutch snap-ring (Fig. 85).

(10) Assemble and install the low/reverse clutch pack into the low/reverse clutch retainer (Fig. 84).

(11) Install the low/reverse reaction plate into the low/reverse clutch retainer (Fig. 84). The reaction plate is directional and must be installed with the flat side down.

(12) Install the low/reverse clutch pack snap-ring (Fig. 84). The snap-ring is selectable and should be chosen to give the correct clutch pack clearance.

(13) Measure the low/reverse clutch pack clearance and adjust as necessary. The correct clutch clearance is 1.00-1.74 mm (0.039-0.075 in.).

(14) Install the overrunning clutch into the low/reverse clutch retainer making sure that the index splines are aligned with the retainer.

(15) Install the overrunning clutch inner snap-ring.

OIL PUMP

DESCRIPTION

The oil pump (Fig. 87) is located at the front of the transmission inside the bell housing and behind the transmission front cover. The oil pump consists of two independent pumps (Fig. 88), a number of valves (Fig. 89), a front seal (Fig. 90), and a bolt on reaction shaft. The converter clutch switch and regulator valves, pressure regulator valve, and converter pressure limit valve are all located in the oil pump valve body.

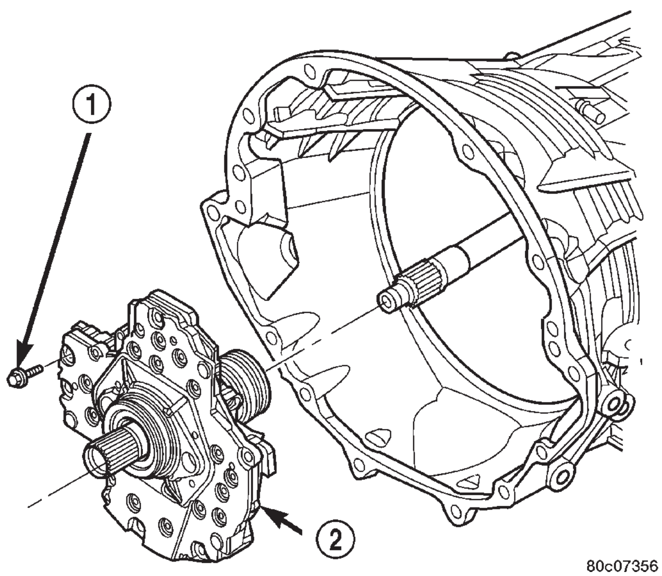


Fig. 87 Oil Pump

1 - OIL PUMP TO CASE BOLT (6)
2 - OIL PUMP

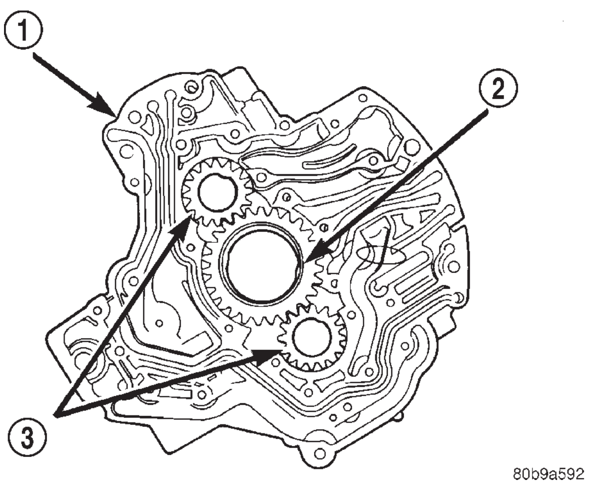


Fig. 88 Oil Pump Gears

1 - PUMP HOUSING
2 - DRIVE GEAR
3 - DRIVEN GEARS

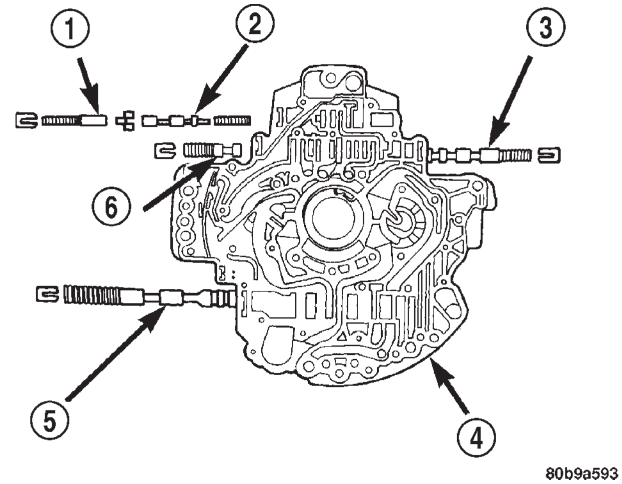


Fig. 89 Oil Pump Valves

1 - TORQUE CONVERTER CLUTCH ACCUMULATOR VALVE
2 - TORQUE CONVERTER CLUTCH CONTROL VALVE
3 - TORQUE CONVERTER CLUTCH SWITCH VALVE
4 - PUMP VALVE BODY
5 - PRESSURE REGULATOR VALVE
6 - TORQUE CONVERTER CLUTCH LIMIT VALVE

OPERATION

As the torque converter rotates, the converter hub rotates the oil pump drive gear. As the drive gear rotates both driven gears, a vacuum is created when the gear teeth come out of mesh. This suction draws fluid through the pump inlet from the oil pan. As the gear teeth come back into mesh, pressurized fluid is forced into the pump outlet and to the oil pump valves.

At low speeds, both sides of the pump supply fluid to the transmission. As the speed of the torque converter increases, the flow from both sides increases until the flow from the primary side alone is sufficient to meet system demands. At this point, the check valve located between the two pumps closes. The secondary side is shut down and the primary side supplies all the fluid to the transmission.

CONVERTER CLUTCH SWITCH VALVE

The converter clutch switch valve is used to control the hydraulic pressure supplied to the front (OFF) side of the torque converter clutch.

CONVERTER CLUTCH REGULATOR VALVE

The converter clutch regulator valve is used to control the hydraulic pressure supplied to the back (ON) side of the torque converter clutch.

TORQUE CONVERTER LIMIT VALVE

The torque converter limit valve serves to limit the available line pressure to the torque converter clutch to approximately 120 psi.

OIL PUMP (Continued)

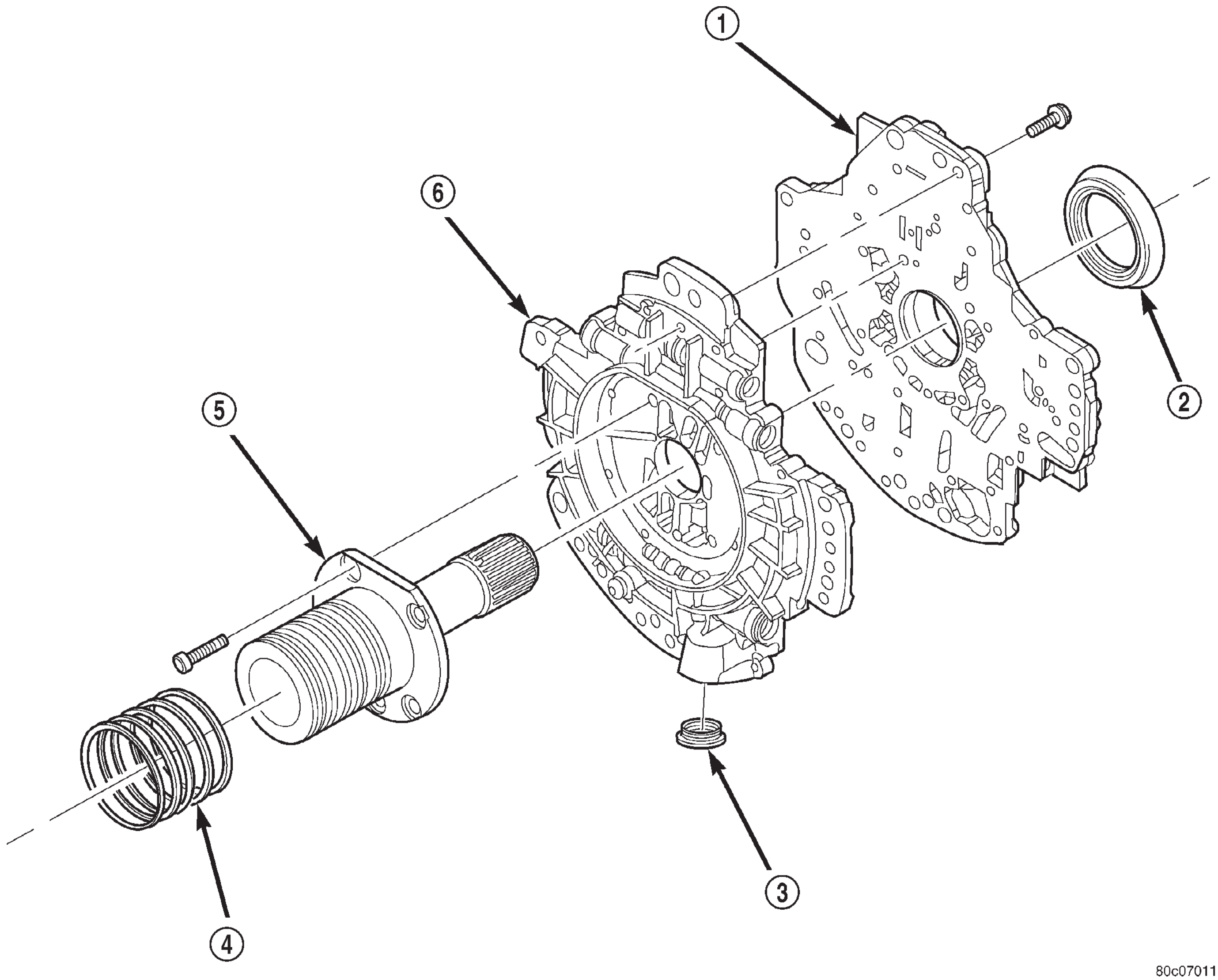


Fig. 90 Oil Pump Reaction Shaft

1 - PUMP HOUSING	4 - SEAL RING (5)
2 - SEAL	5 - REACTION SHAFT SUPPORT
3 - OIL FILTER SEAL	6 - PUMP VALVE BODY

STANDARD PROCEDURE - OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

(1) Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at 1800 rpm**, with the shift selector in neutral. Verify that the transmission fluid temperature is below 104.5° C (220° F) for this test.

(3) If one quart of transmission fluid is collected in the container in 30 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 30 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.

(4) Re-connect the **To cooler** line to the transmission cooler inlet.

OIL PUMP (Continued)

(5) Refill the transmission to proper level.

DISASSEMBLY

(1) Remove the bolts holding the reaction shaft support to the oil pump (Fig. 91).

(2) Remove the reaction shaft support from the oil pump (Fig. 91).

(3) Remove all bolts holding the oil pump halves together (Fig. 91).

(4) Using suitable prying tools, separate the oil pump sections by inserting the tools in the supplied areas and prying the halves apart.

NOTE: The oil pump halves are aligned to each other through the use of two dowels. Be sure to pry upward evenly to prevent damage to the oil pump components.

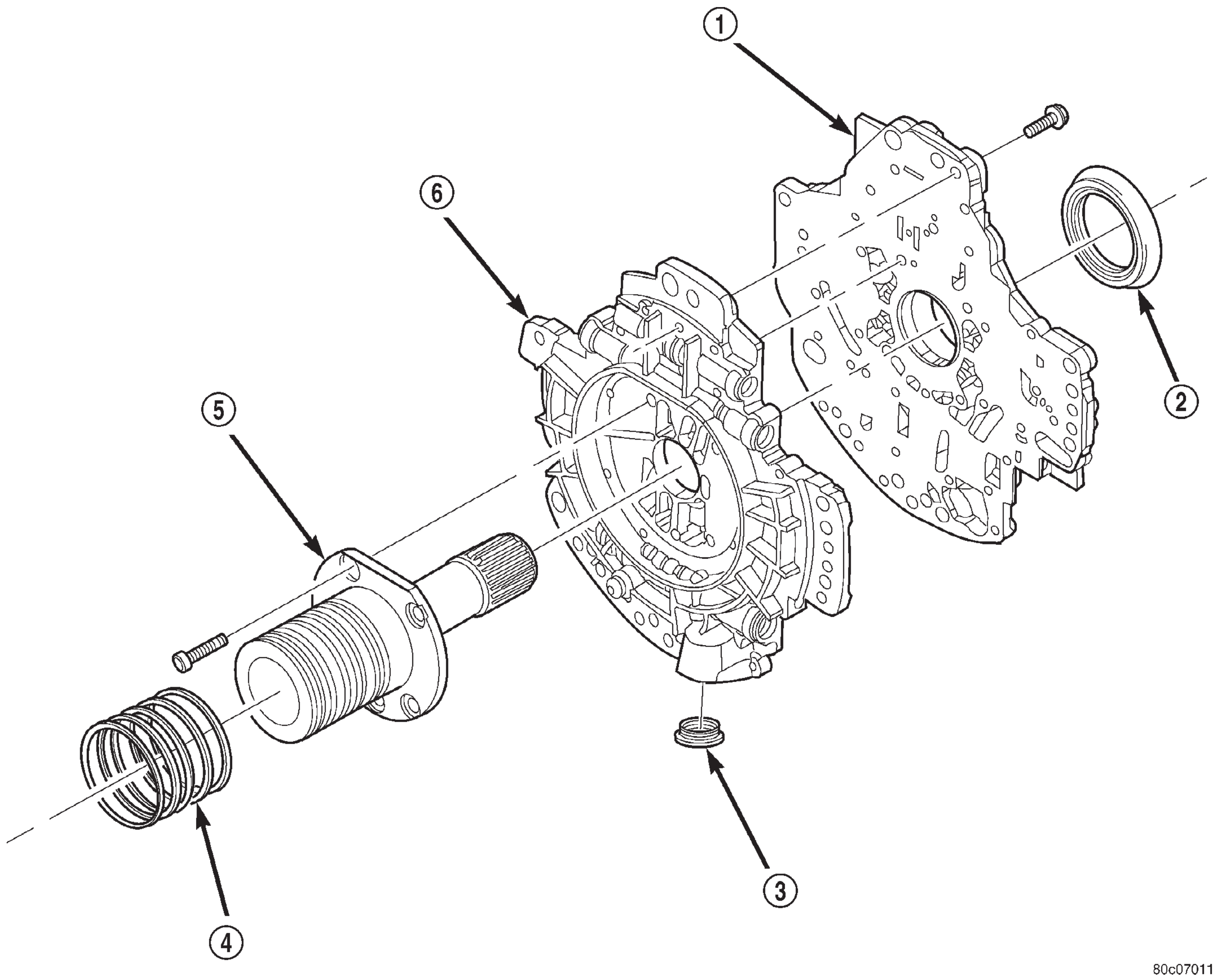


Fig. 91 Oil Pump Assembly

1 - PUMP HOUSING
2 - SEAL
3 - OIL FILTER SEAL
4 - SEAL RING (5)
5 - REACTION SHAFT SUPPORT
6 - PUMP VALVE BODY

OIL PUMP (Continued)

(5) Remove the screws holding the separator plate onto the oil pump body (Fig. 92).

(6) Remove the separator plate from the oil pump body (Fig. 92).

(7) Mark all gears for location. The gears are select fit and if the oil pump is to be reused, the gears must be returned to their original locations.

(8) Remove the oil pump gears from the oil pump case (Fig. 92).

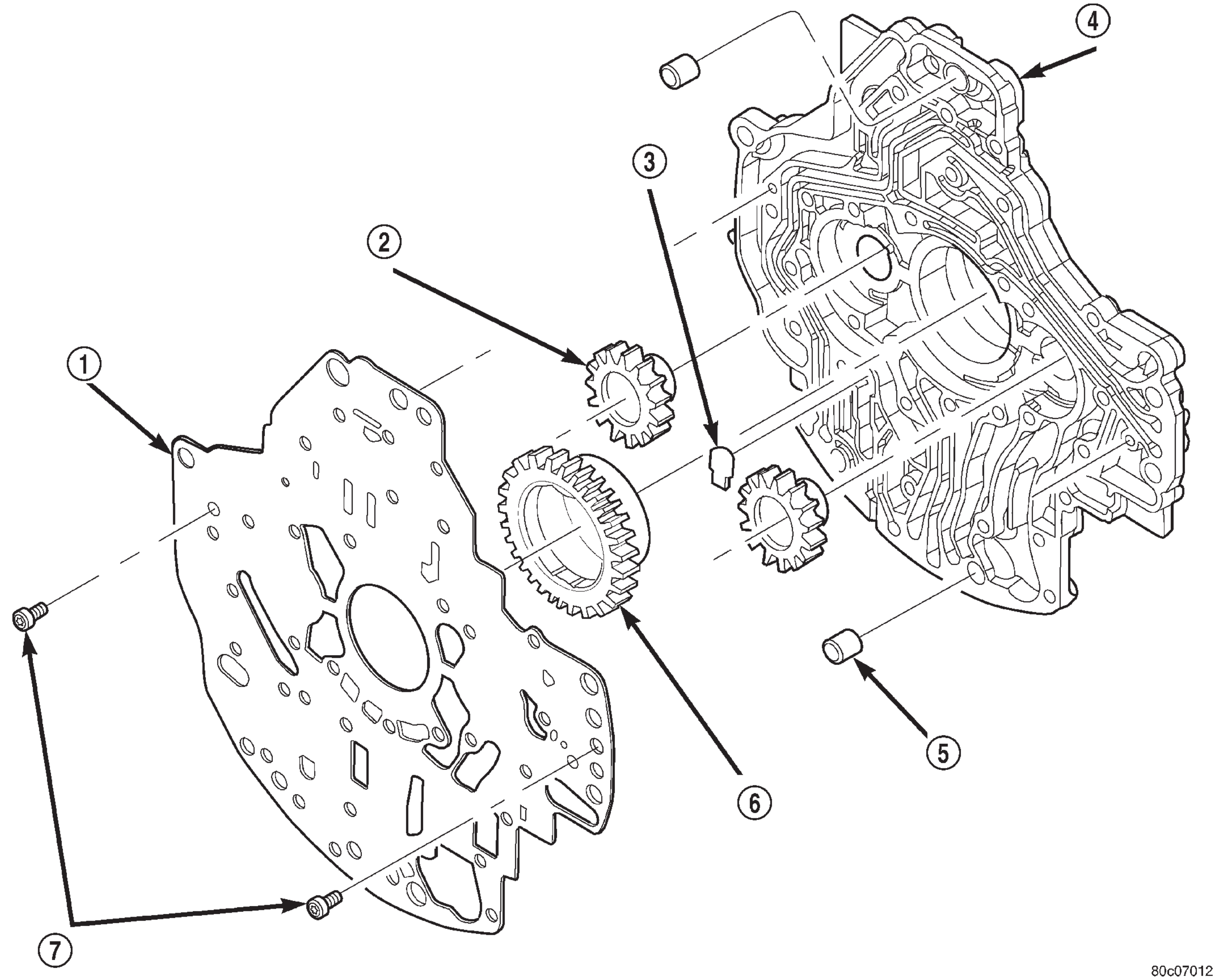


Fig. 92 Oil Pump Housing and Gears

1 - SEPARATOR PLATE
2 - DRIVEN GEAR (2)
3 - CHECK VALVE
4 - PUMP HOUSING
5 - DOWEL (2)
6 - DRIVE GEAR
7 - SCREW

OIL PUMP (Continued)

(9) Remove the oil pump valve retainers and associated valve and spring one at a time (Fig. 93) (Fig. 94). Mark the combination of components as a group and tag them as to the location from which they were removed.

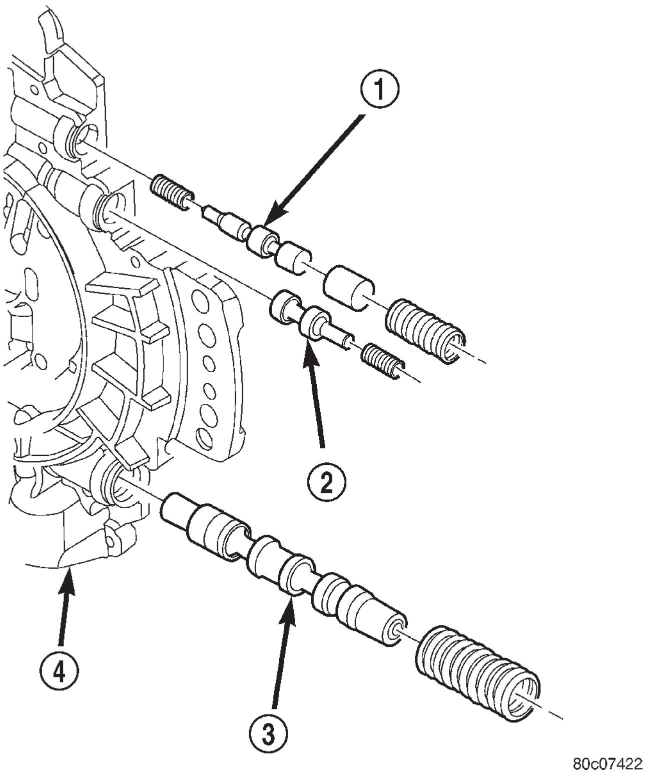


Fig. 93 Oil Pump Valve Body

1 - T/C REGULATOR VALVE
2 - T/C LIMIT VALVE
3 - REGULATOR VALVE
4 - OIL PUMP VALVE BODY

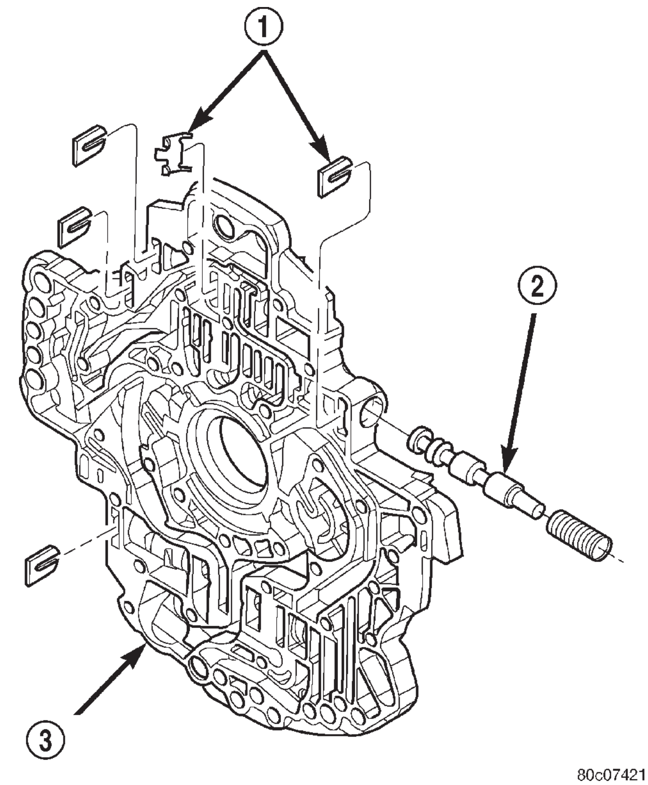


Fig. 94 T/C Switch Valve

1 - RETAINER
2 - T/C SWITCH VALVE
3 - OIL PUMP VALVE BODY

CLEANING

Clean pump and support components with solvent and dry them with compressed air.

INSPECTION

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump reaction shaft support bushings. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the oil pump cover. Use a penlight to view the bore interiors. Replace the oil pump if any bores are distorted or scored. Inspect all of the valve springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

OIL PUMP (Continued)

ASSEMBLY

(1) Clean and inspect all components. Make sure that all passages are thoroughly cleaned and are free from dirt or debris. Make sure that all valves move freely in their proper bore. Make sure that all gear pockets and bushings are free from excessive wear and scoring. Replace the oil pump if any excessive wear or scoring is found.

(2) Coat the gears with Mopar® ATF +4, type 9602, and install into their original locations.

(3) Lubricate the oil pump valves with Mopar® ATF +4, type 9602, and install the valve, spring and retainer into the appropriate oil pump valve body bore (Fig. 93) (Fig. 94).

(4) Place the separator plate onto the oil pump body (Fig. 92).

(5) Install the screws to hold the separator plate onto the oil pump body (Fig. 92). Tighten the screws to 4.5 N·m (40 in.lbs.).

(6) Position the oil pump cover onto the locating dowels (Fig. 91).

(7) Seat the two oil pump halves together and install all bolts finger tight.

(8) Torque all bolts down slowly starting in the center and working outward. The correct torque is 4.5 N·m (40 in.lbs.).

(9) Verify that the oil pump gears rotate freely and smoothly.

(10) Position the reaction shaft support into the oil pump (Fig. 91).

(11) Install and torque the bolts to hold the reaction shaft support to the oil pump (Fig. 91). The correct torque is 12 N·m (105 in.lbs.).

OIL PUMP FRONT SEAL

REMOVAL

(1) Remove transmission from the vehicle.

(2) Remove the torque converter from the transmission.

(3) Using a screw mounted in a slide hammer, remove the oil pump front seal.

INSTALLATION

(1) Clean seal bore of the oil pump of any residue or particles from the original seal.

(2) Install new oil seal in the oil pump housing using Seal Installer C-3860-A (Fig. 95).

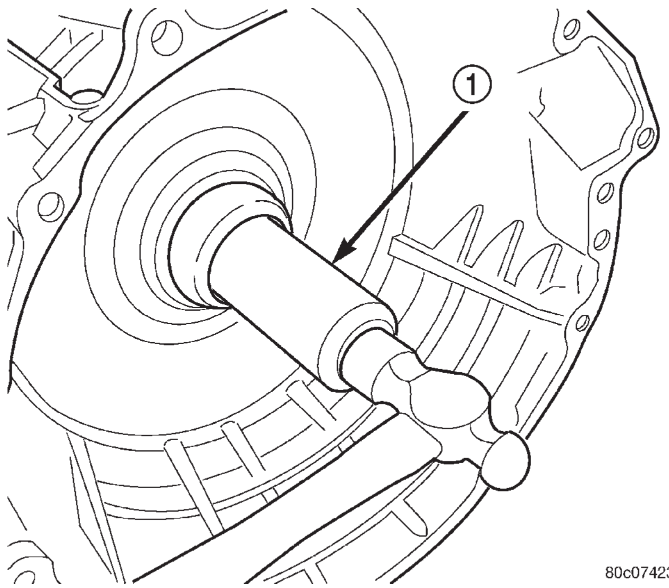


Fig. 95 Install Oil Pump Front Seal

1 - TOOL C-3860-A

OUTPUT SPEED SENSOR

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the output speed sensor (Fig. 96).

(4) Remove the bolt holding the output speed sensor to the transmission case.

(5) Remove the output speed sensor from the transmission case.

INSTALLATION

(1) Install the output speed sensor into the transmission case.

(2) Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).

(3) Install the wiring connector onto the output speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

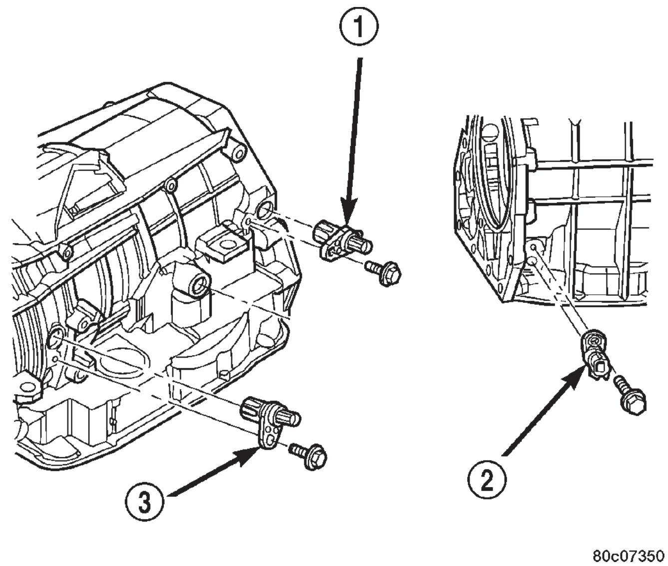


Fig. 96 Output Speed Sensor

1 - OUTPUT SPEED SENSOR
2 - LINE PRESSURE SENSOR
3 - INPUT SPEED SENSOR

OVERDRIVE SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

OPERATION

At key-on, fourth and fifth gear operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoids and allow upshifts to fourth and fifth gears. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

PARK LOCK CABLE

REMOVAL

(1) Place the shifter in the PARK position.

(2) Lower the steering column cover.

(3) With the ignition switch in the “RUN” position depress the park lock cable locking tab, located on top of the cable connector at the steering column and pull the park lock cable straight out.

(4) Remove the park lock cable from steering column (Fig. 97).

(5) Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(6) Disconnect the park lock cable from the shift BTSI lever and remove the cable from the shifter assembly bracket.

(7) Release the park lock cable from any remaining clips.

(8) Remove park lock cable from the vehicle.

INSTALLATION

NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Park Lock Cable.

(1) Verify that the shifter is in the PARK position.

(2) Push the park lock cable straight into the square mounting hole in the steering column until cable snaps in place.

(3) Route park lock cable to the shifter mechanism.

(4) Install the park lock cable end fitting into shifter BTSI lever.

(5) Pull rearward on the cable housing to snap park lock cable adjuster ears into floor shifter bracket.

(6) Place the ignition key cylinder in the ACCESSORY position.

(7) Push the cable adjuster lock clamp downward to lock it.

(8) Test the park lock cable operation.

(9) Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

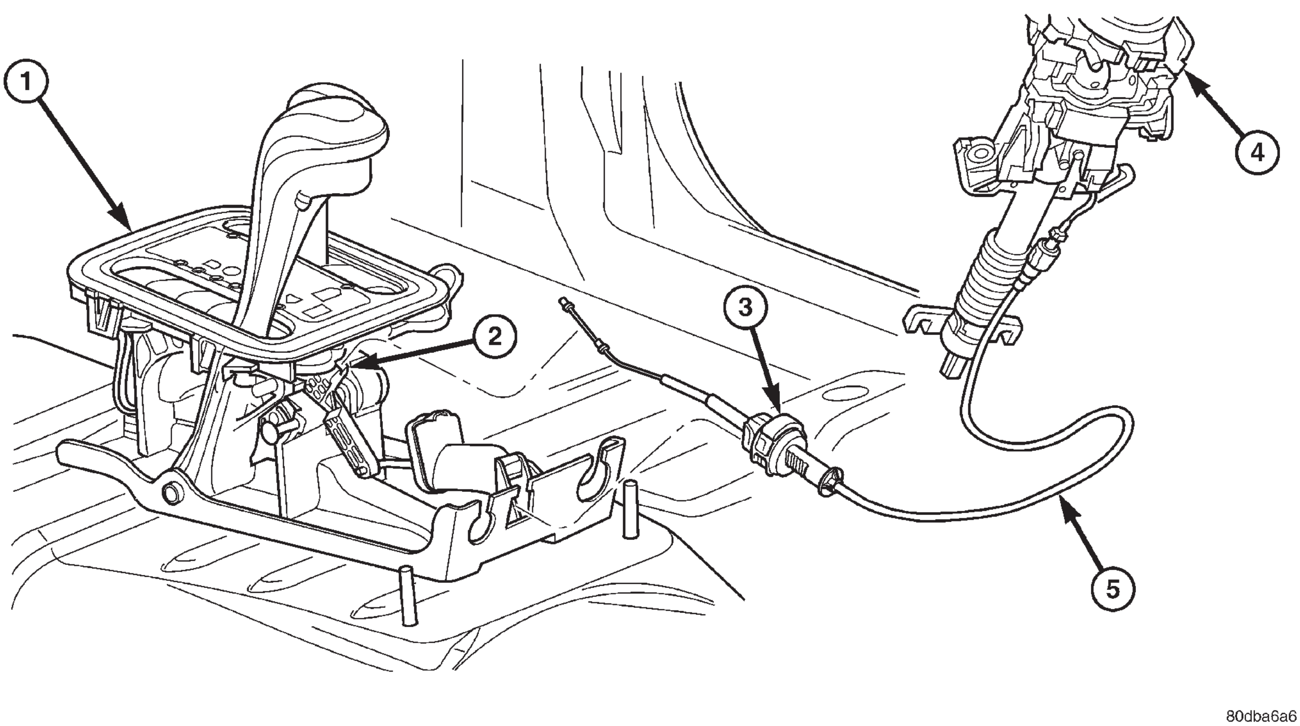


Fig. 97 Brake Transmission Shift Interlock

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 98) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

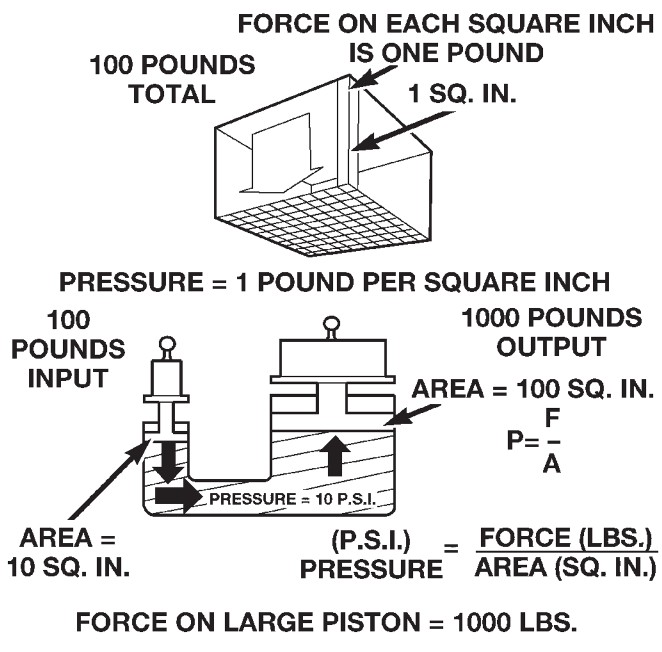


Fig. 98 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 99) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O-rings, D-rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

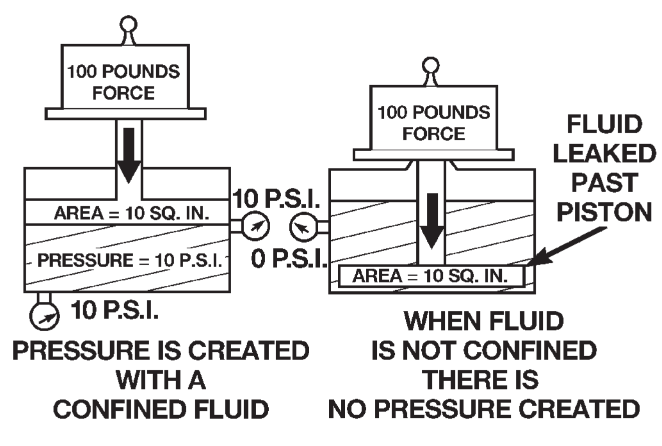


Fig. 99 Pressure on a Confined Fluid

PISTONS (Continued)

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 100), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 100), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

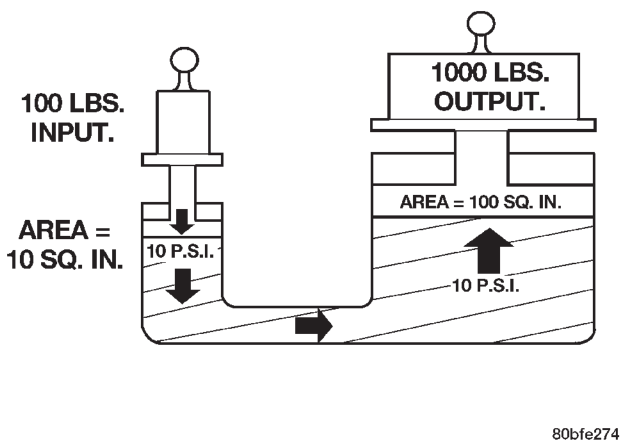


Fig. 100 Force Multiplication

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight-to-distance output rather than a pressure-to-area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 101) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

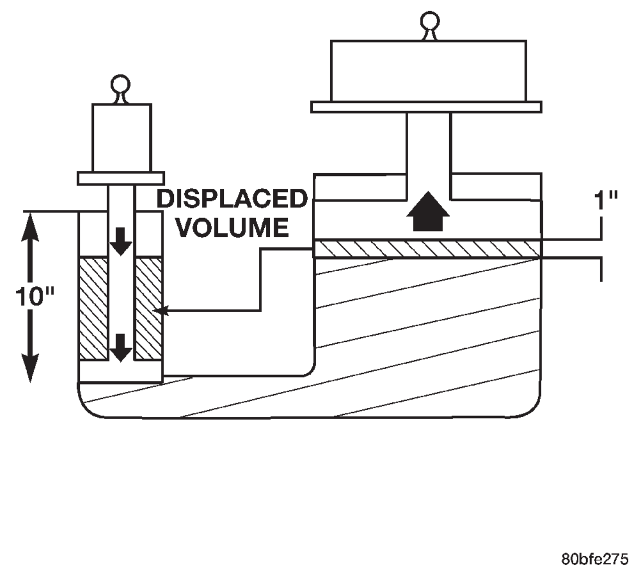


Fig. 101 Piston Travel

PLANETARY GEARTRAIN

DESCRIPTION

The planetary geartrain is located behind the 4C retainer/bulkhead, toward the rear of the transmission. The planetary geartrain consists of three primary assemblies:

- Reaction (Fig. 102).
- Reverse (Fig. 103).
- Input (Fig. 103).

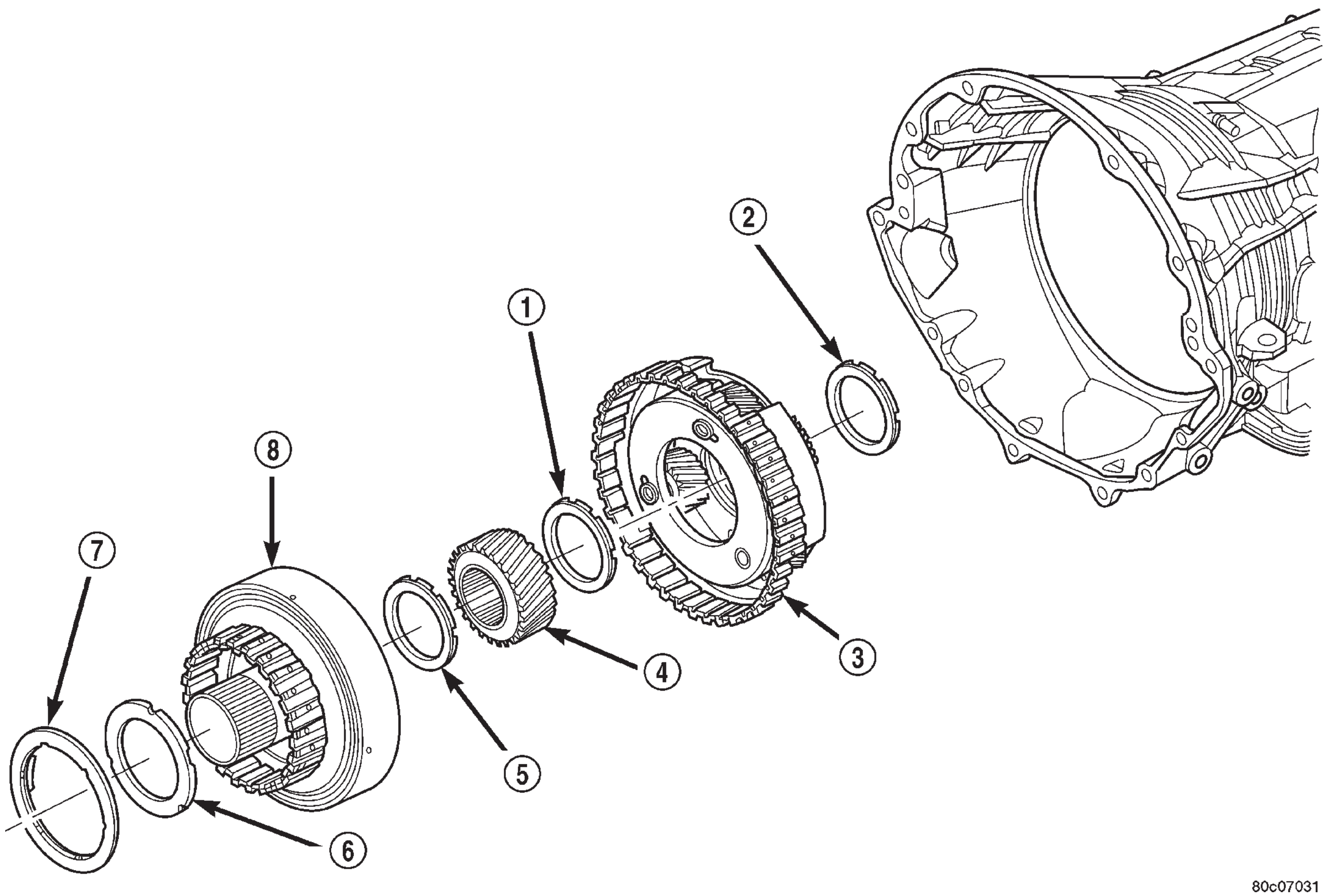


Fig. 102 Reaction Planetary Geartrain

1 - BEARING NUMBER 8
2 - BEARING NUMBER 9
3 - REACTION PLANETARY CARRIER
4 - REACTION SUN GEAR
5 - BEARING NUMBER 7
6 - THRUST PLATE (SELECT)
7 - BEARING NUMBER 6
8 - REACTION ANNULUS

PLANETARY GEARTRAIN (Continued)

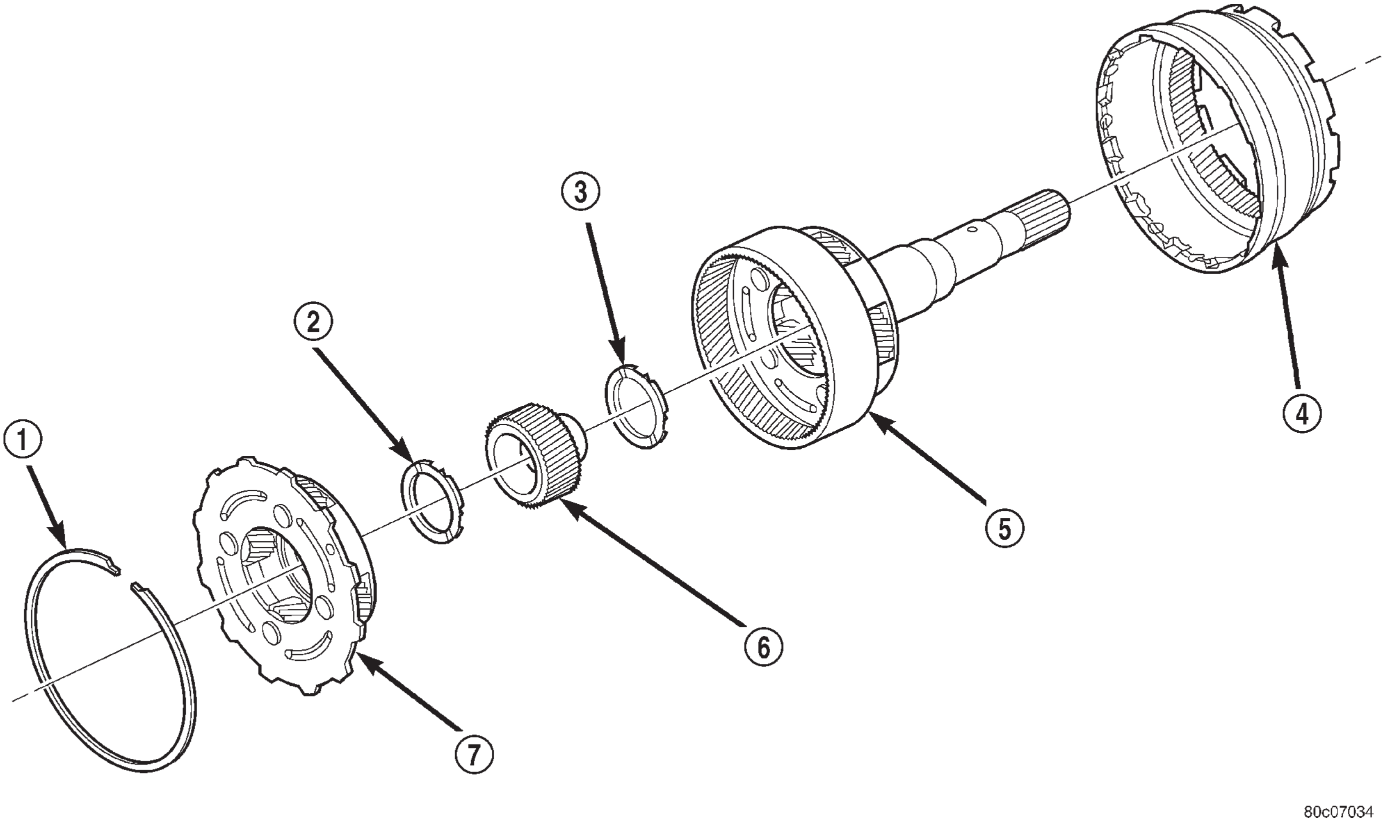


Fig. 103 Reverse/Input Planetary Geartrain

1 - SNAP-RING
2 - BEARING NUMBER 10
3 - BEARING NUMBER 11
4 - INPUT ANNULUS
5 - INPUT PLANETARY CARRIER
6 - INPUT SUN GEAR
7 - REVERSE PLANETARY CARRIER

OPERATION

REACTION PLANETARY GEARTRAIN

The reaction planetary carrier and reverse sun gear of the reaction planetary geartrain are a single component which is held by the 2C clutch when required. The reaction annulus gear is a stand alone component that can be driven by the reverse clutch or held by the 4C clutch. The reaction sun gear is driven by the overdrive clutch.

REVERSE PLANETARY GEARTRAIN

The reverse planetary geartrain is the middle of the three planetary sets. The reverse planetary carrier can be driven by the overdrive clutch as required. The reverse planetary carrier is also splined to the input annulus gear, which can be held by the low/reverse clutch. The reverse planetary annulus, input planetary carrier, and output shaft are all one piece.

INPUT PLANETARY GEARTRAIN

The input sun gear of the input planetary geartrain is driven by the underdrive clutch.

DISASSEMBLY

(1) Remove the snap-ring holding the input annulus into the input carrier (Fig. 104).

(2) Remove the input annulus from the input carrier (Fig. 104).

(3) Remove the number 9 bearing from the reverse planetary carrier. Note that this planetary carrier has four pinion gears.

(4) Remove the reverse planetary gear carrier (Fig. 104).

(5) Remove the number 10 bearing from the input sun gear (Fig. 104).

(6) Remove the input sun gear from the input carrier (Fig. 104).

(7) Remove the number 11 bearing from the input carrier (Fig. 104).

CLEANING

Clean the planetary components in solvent and dry them with compressed air.

INSPECTION

Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable.

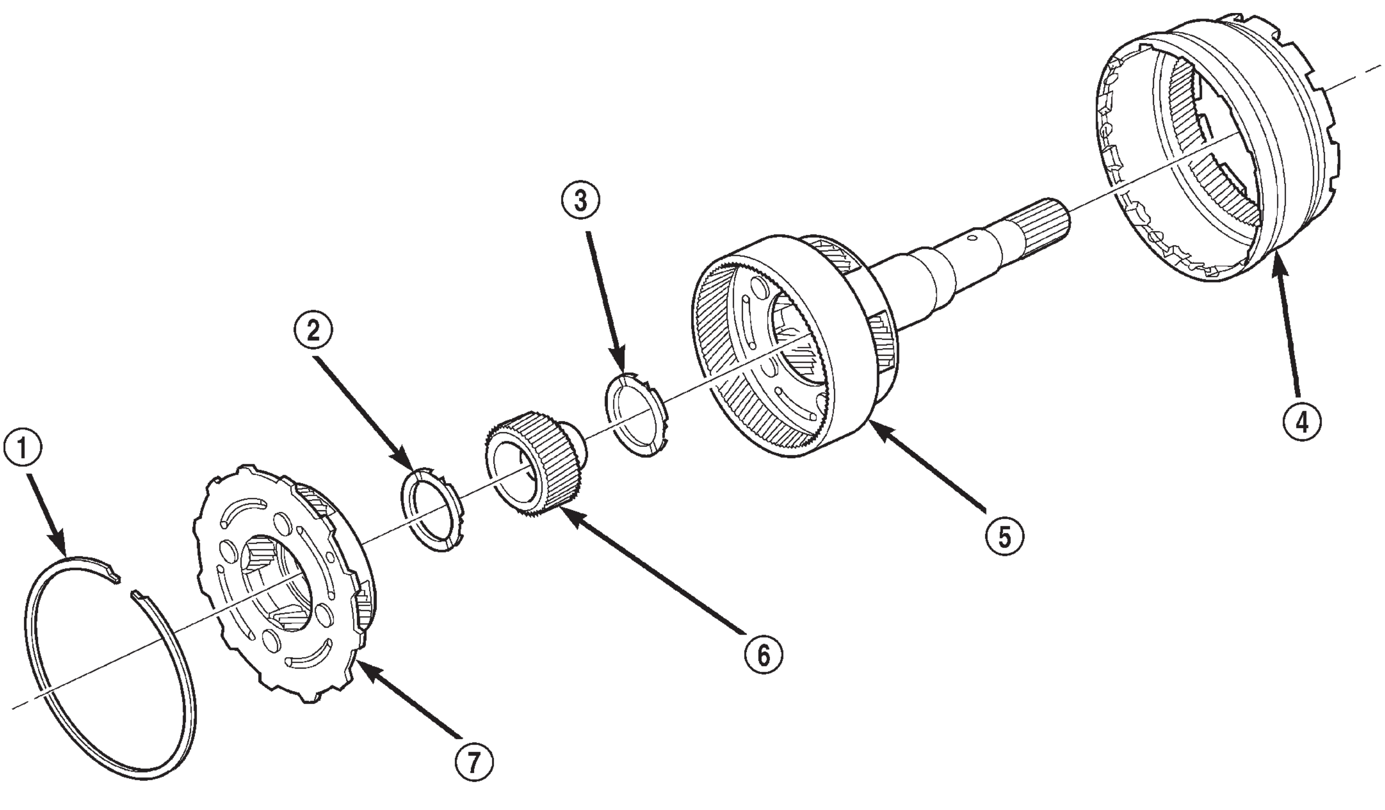


Fig. 104 Reverse/Input Planetary Carrier Assembly

1 - SNAP-RING
2 - BEARING NUMBER 10
3 - BEARING NUMBER 11
4 - INPUT ANNULUS
5 - INPUT PLANETARY CARRIER
6 - INPUT SUN GEAR
7 - REVERSE PLANETARY CARRIER

PLANETARY GEARTRAIN (Continued)

Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install the number 11 bearing into the input planetary carrier so that the inner race will be toward the front of the transmission (Fig. 104).

(3) Install the input sun gear into the input carrier (Fig. 104).

(4) Install the number 10 bearing onto the rear of the reverse planetary carrier with the inner race toward the carrier (Fig. 104).

(5) Install the number 9 bearing onto the front of the reverse planetary carrier with the outer race toward the carrier and the inner race facing upward (Fig. 104).

(6) Install the reverse planetary gear carrier into the input carrier (Fig. 104).

(7) Install the input annulus gear into the input carrier (Fig. 104).

(8) Install the snap-ring to hold the input annulus gear into the input carrier (Fig. 104).

SHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

MANUAL LOW (1) range provides FIRST gear only. Overrun braking is also provided in this range. MANUAL SECOND (2) range provides FIRST and SECOND gear only.

DRIVE range provides FIRST, SECOND, THIRD and OVERDRIVE FOURTH and FIFTH gear ranges. The shift into OVERDRIVE FOURTH and FIFTH gear range occurs only after the transmission has completed the shift into D THIRD gear range. No further movement of the shift mechanism is required to complete the 3-4 or 4-5 shifts.

The FOURTH and FIFTH gear upshifts occurs automatically when the overdrive selector switch is in the ON position. An upshift to FOURTH and FIFTH gears may not occur or may be delayed in some of the possible shift schedules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - OPERATION)

REMOVAL

(1) Remove any necessary console parts for access to shift lever assembly and shifter cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(2) Shift transmission into PARK.

(3) Disconnect the transmission shift cable at shift lever and shifter assembly bracket (Fig. 105).

(4) Disconnect the park lock cable from the shifter BTSI lever and the shifter assembly bracket. (Fig. 106)

(5) Disconnect the transfer case shift cable from the transfer case shift lever pin (Fig. 107), if equipped.

(6) Remove the clip holding the transfer case shift cable to the shifter assembly bracket, if equipped.

(7) Remove the transfer case shift cable from the shifter assembly bracket, if equipped.

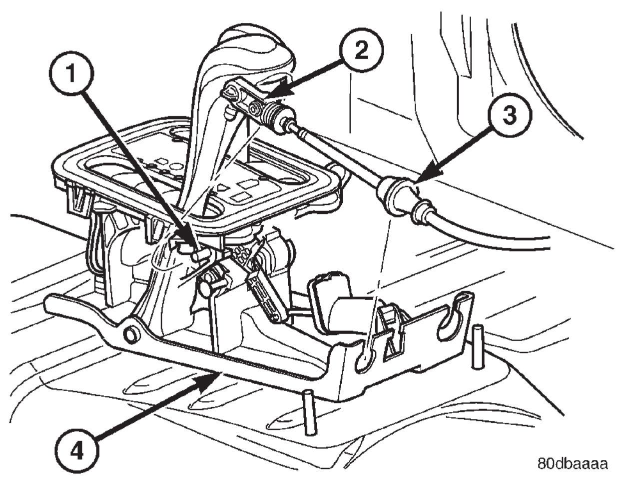


Fig. 105 Transmission Shift Cable

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

(8) Disengage all wiring connectors from the shifter assembly.

(9) Remove all nuts holding the shifter assembly to the floor pan (Fig. 108).

SHIFT MECHANISM (Continued)

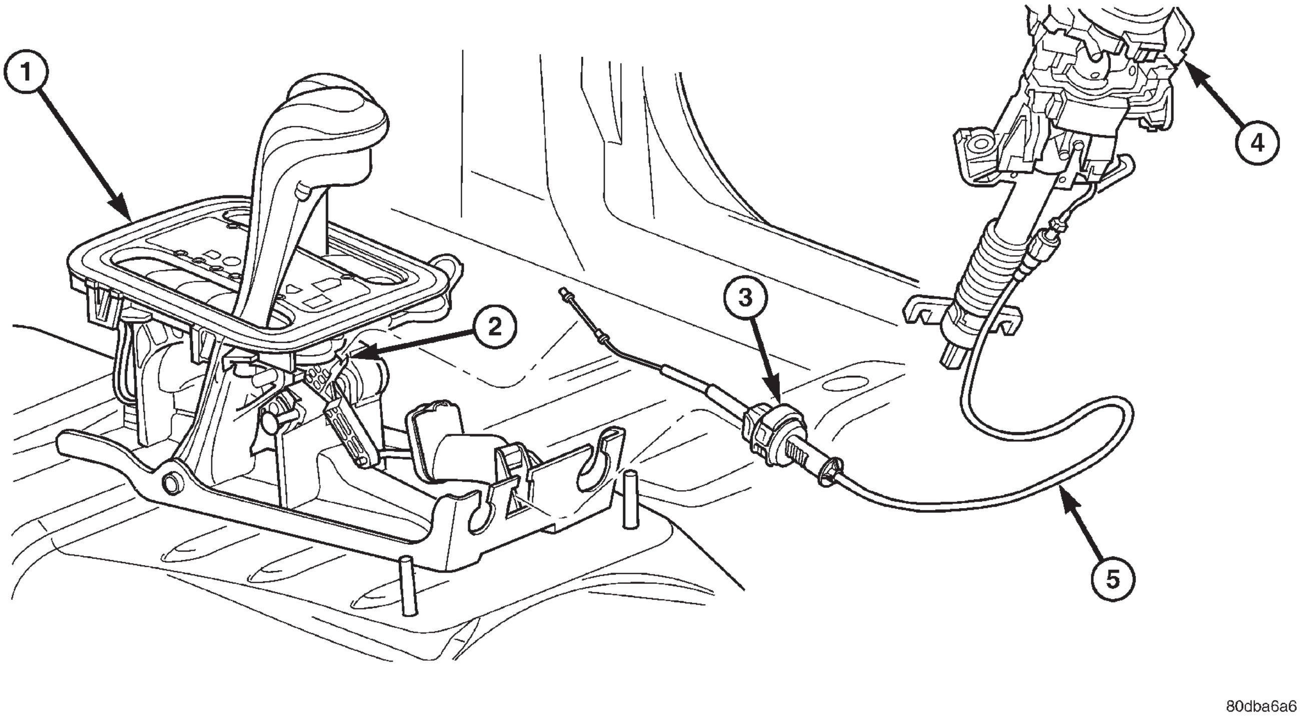


Fig. 106 Brake Transmission Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

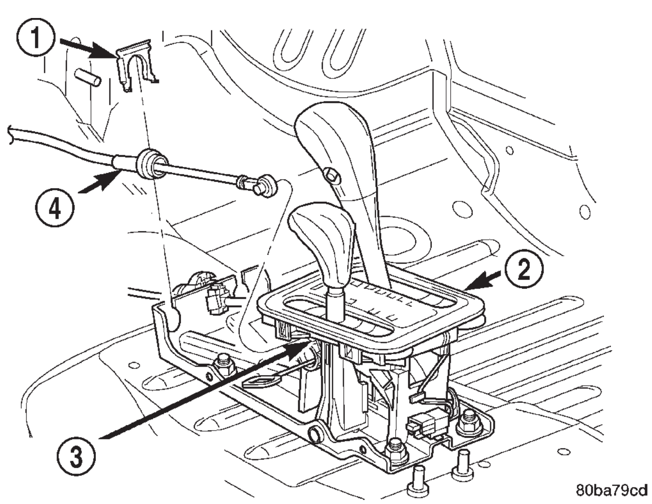


Fig. 107 Transfer Case Shift Cable

1 - CLIP
2 - SHIFTER
3 - TRANSFER CASE SHIFT LEVER PIN
4 - TRANSFER CASE SHIFT CABLE

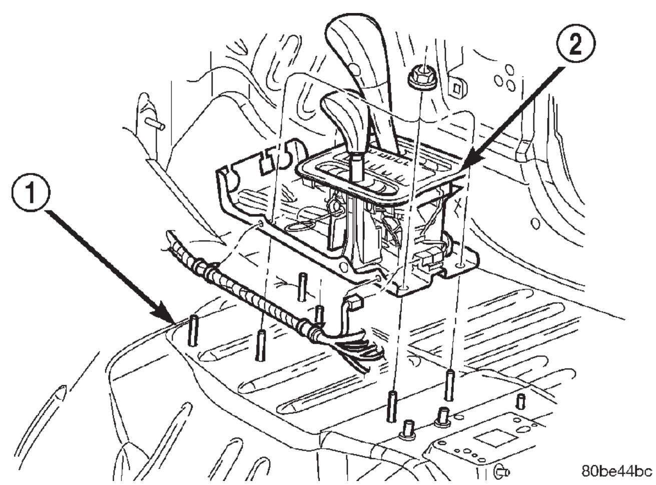


Fig. 108 Shifter Assembly

1 - FLOOR PAN
2 - SHIFTER ASSEMBLY

(10) Remove the shifter assembly from the vehicle.

SHIFT MECHANISM (Continued)

INSTALLATION

(1) Place the floor shifter lever in PARK position.

(2) Loosen the adjustment screw on the shift cable.

(3) Verify that the park lock cable adjustment tab is pulled upward to the unlocked position.

(4) Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.

(5) Install the transfer case shift cable to the shifter assembly bracket. Install clip to hold cable to the bracket.

(6) Snap the transfer case shift cable, if equipped, onto the transfer case shift lever pin.

(7) Install the park lock cable into the shifter assembly bracket and into the shifter BTSI lever.(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/SHIFT INTERLOCK MECHANISM - ADJUSTMENTS)

(8) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(9) Install shifter assembly onto the shifter assembly studs on the floor pan.

(10) Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in.lbs.).

(11) Snap the shift cable onto the shift lever pin.

(12) Verify that the shift lever is in the PARK position.

(13) Tighten the adjustment screw to 7 N·m (65 in.lbs.).

(14) Place the key in the accessory position.

(15) Push downward on the park lock cable adjustment tab to lock the adjustment.

(16) Verify correct shifter, park lock, and BTSI operation.

(17) Install any console parts removed for access to shift lever assembly and shift cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

SOLENOID SWITCH VALVE

DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the valve body and controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th,and 5th gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

SOLENOIDS

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed**. The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or

2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

SOLENOIDS (Continued)

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 109) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The converter clutch engages in third gear. The torque converter hub drives the transmission oil (fluid) pump and contains an o-ring seal to better control oil flow.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid. If the fluid is contaminated, flush the fluid cooler and lines.

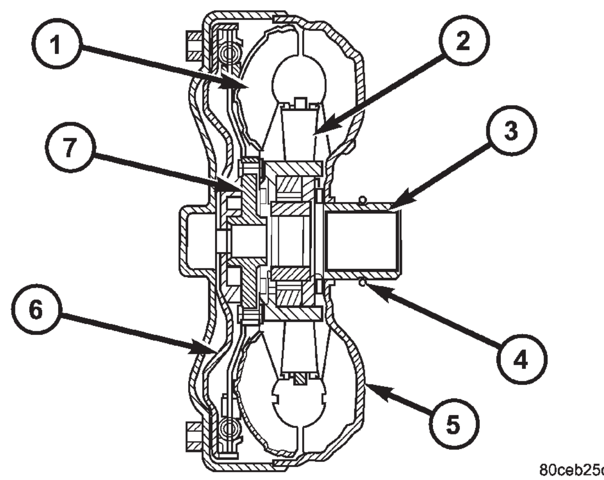


Fig. 109 Torque Converter Assembly

1 - TURBINE ASSEMBLY
2 - STATOR
3 - CONVERTER HUB
4 - O-RING
5 - IMPELLER ASSEMBLY
6 - CONVERTER CLUTCH PISTON
7 - TURBINE HUB

TORQUE CONVERTER (Continued)

IMPELLER

The impeller (Fig. 110) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

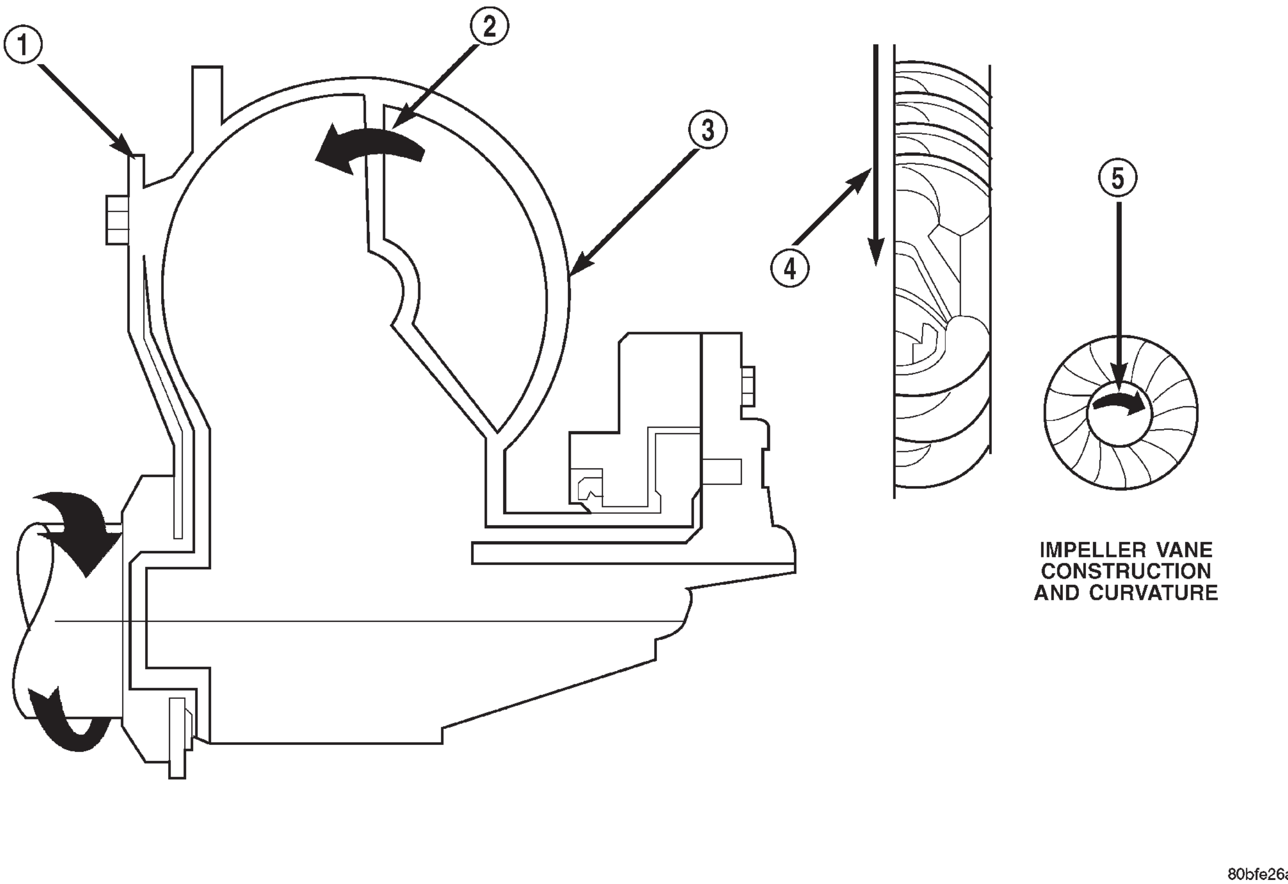


Fig. 110 Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

TORQUE CONVERTER (Continued)

TURBINE

The turbine (Fig. 111) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

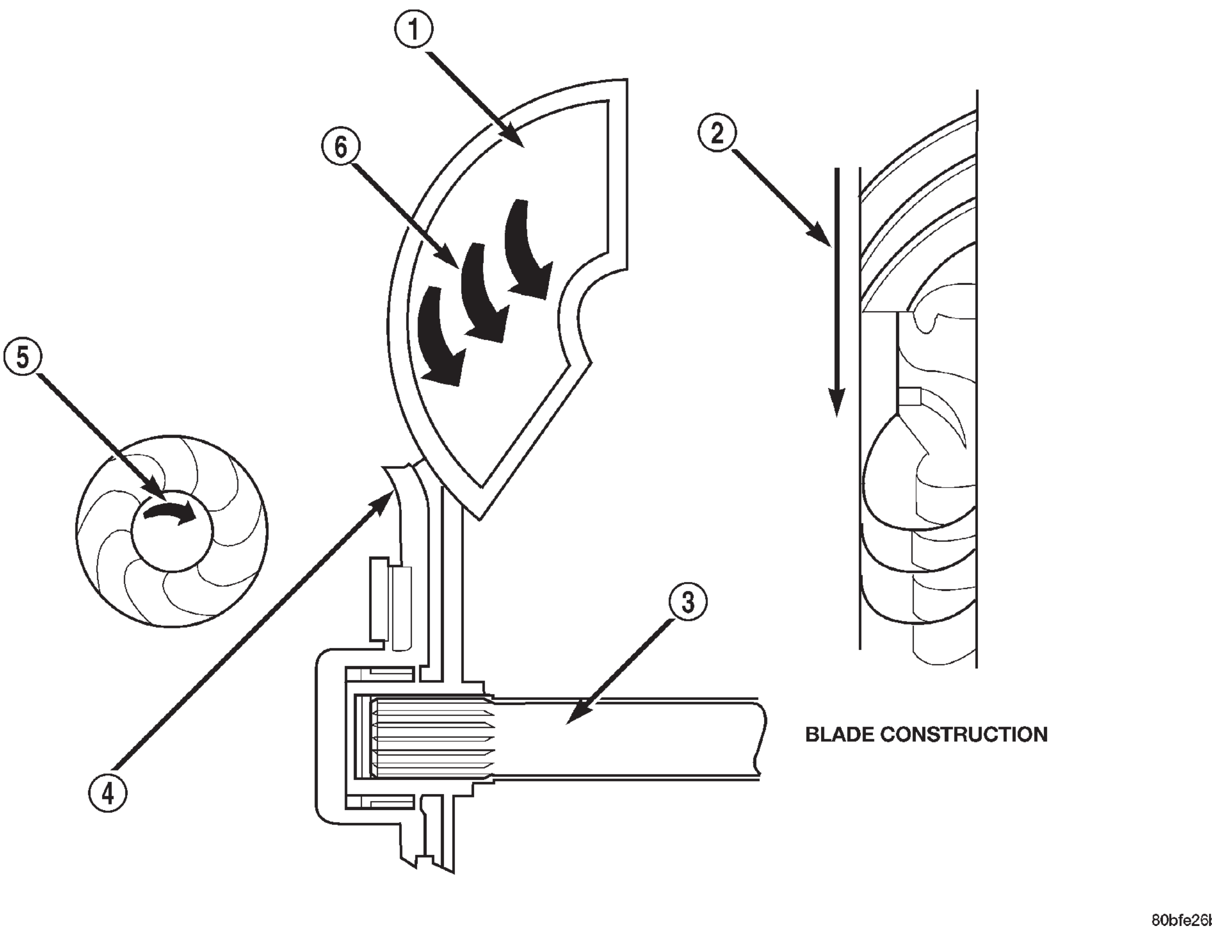


Fig. 111 Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

TORQUE CONVERTER (Continued)

STATOR

The stator assembly (Fig. 112) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 113). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

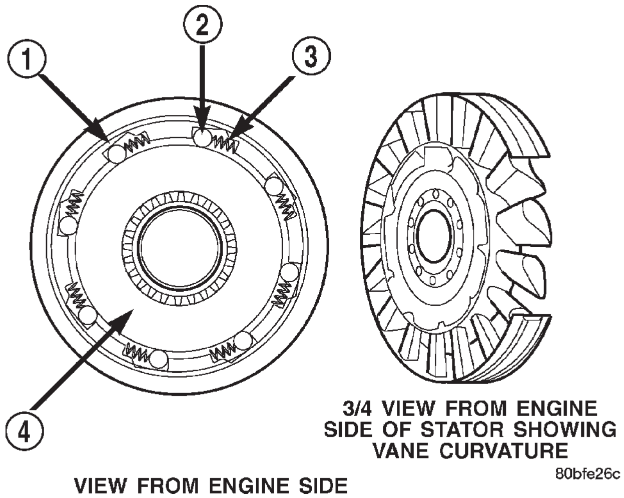


Fig. 112 Stator Components

1 - CAM (OUTER RACE)
2 - ROLLER
3 - SPRING
4 - INNER RACE

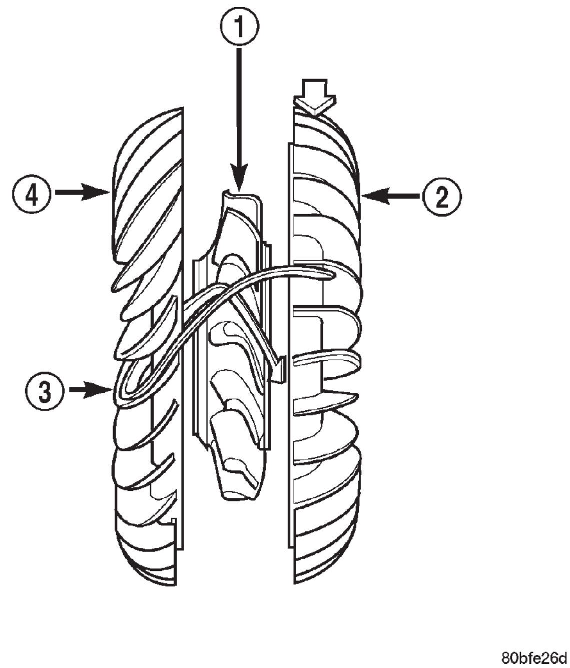


Fig. 113 Stator Location

1 - STATOR
2 - IMPELLER
3 - FLUID FLOW
4 - TURBINE

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 114) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston with friction material was added to the turbine assembly to provide this mechanical lock-up.

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

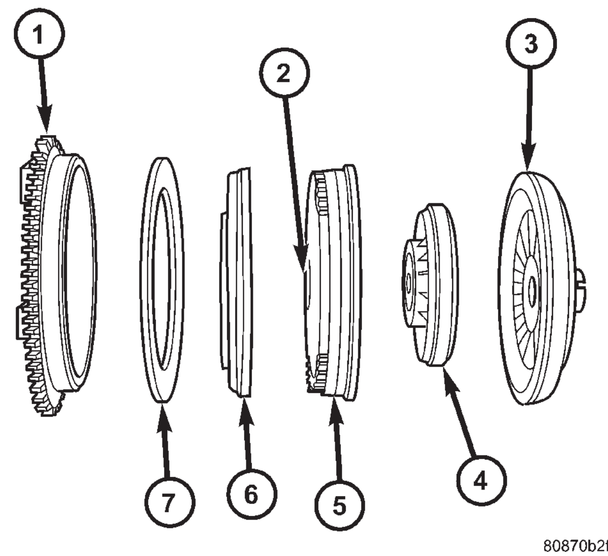


Fig. 114 Torque Converter Clutch (TCC)

1 - IMPELLER FRONT COVER
2 - THRUST WASHER ASSEMBLY
3 - IMPELLER
4 - STATOR
5 - TURBINE
6 - PISTON
7 - FRICTION DISC

TORQUE CONVERTER (Continued)

OPERATION

The converter impeller (Fig. 115) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 116). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

The clutch can be engaged in second, third, fourth, and fifth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph). If the control switch is in the OFF

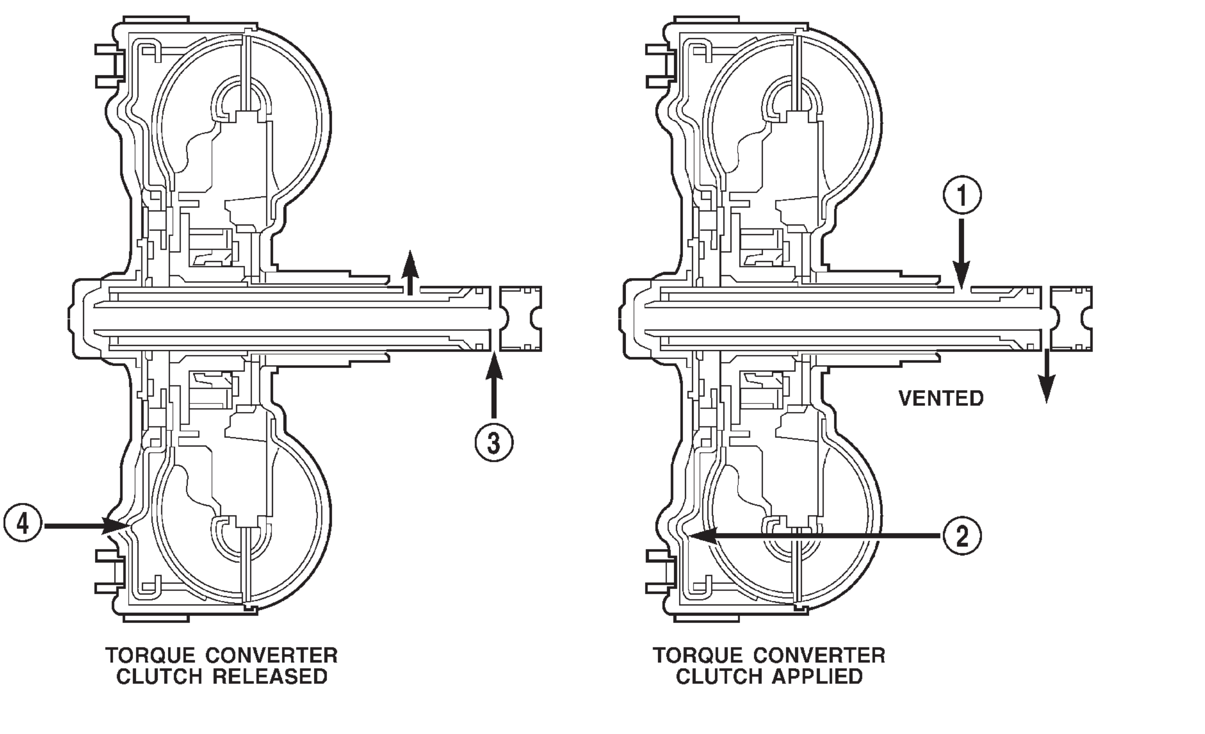


Fig. 115 Torque Converter Fluid Operation - Typical

1 - APPLY PRESSURE
2 - THE PISTON MOVES SLIGHTLY FORWARD
3 - RELEASE PRESSURE
4 - THE PISTON MOVES SLIGHTLY REARWARD

TORQUE CONVERTER (Continued)

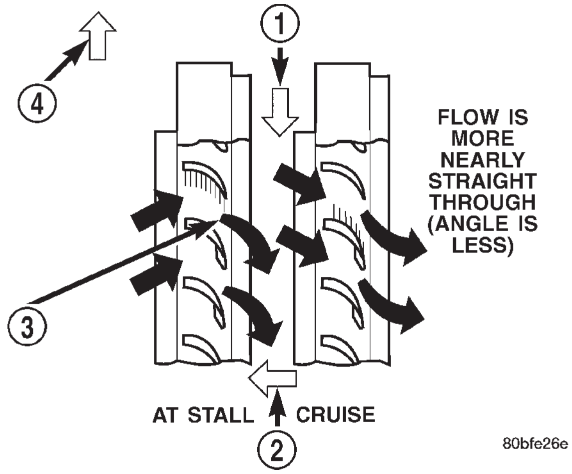


Fig. 116 Stator Operation

1 - DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES

2 - FRONT OF ENGINE

3 - INCREASED ANGLE AS OIL STRIKES VANES

4 - DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive flats for sharp edges, burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper or crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free from debris. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or converter hub o-ring while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 117). Surface of converter lugs should be at least 13 mm (1/2 in.) to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

TORQUE CONVERTER (Continued)

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

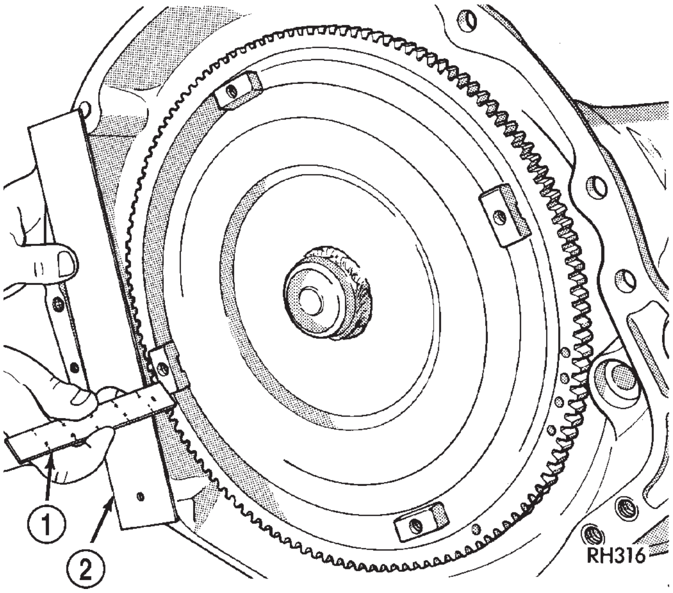


Fig. 117 Checking Torque Converter Seating-Typical

1 - SCALE
2 - STRAIGHTEDGE

TRANSMISSION CONTROL RELAY

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

TRANSMISSION RANGE SENSOR

DESCRIPTION

The Transmission Range Sensor (TRS) is part of the solenoid module, which is mounted to the top of the valve body inside the transmission.

The Transmission Range Sensor (TRS) has five switch contact pins that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply +12 V to the backup lamps in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transmission temperature to the TCM and PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

There are many possible combinations of open and closed switches (codes). Seven of these possible codes are related to gear position and five are recognized as “between gear” codes. This results in many codes which should **never occur**. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

GEAR	C5	C4	C3	C2	C1
Park	CL	OP	OP	CL	CL
Temp 1	CL	OP	OP	CL	OP
Reverse	OP	OP	OP	CL	OP
Temp 2	OP	OP	CL	CL	OP
Neutral 1	OP	OP	CL	CL	CL
Neutral 2	OP	CL	CL	CL	CL
Temp 3	OP	CL	CL	CL	OP
Drive	OP	CL	CL	OP	OP
Temp 4	OP	CL	OP	OP	OP
Manual 2	CL	CL	OP	OP	OP
Temp 5	CL	OP	OP	OP	OP
Manual 1	CL	OP	CL	OP	OP

TRANSMISSION SOLENOID/ TRS ASSEMBLY

DESCRIPTION

The transmission solenoid/TRS assembly is internal to the transmission and mounted on the valve body assembly (Fig. 118). The assembly consists of six solenoids that control hydraulic pressure to the six friction elements (transmission clutches), and the torque converter clutch. The pressure control solenoid is located on the side of the solenoid/TRS assembly. The solenoid/TRS assembly also contains five pressure switches that feed information to the TCM.

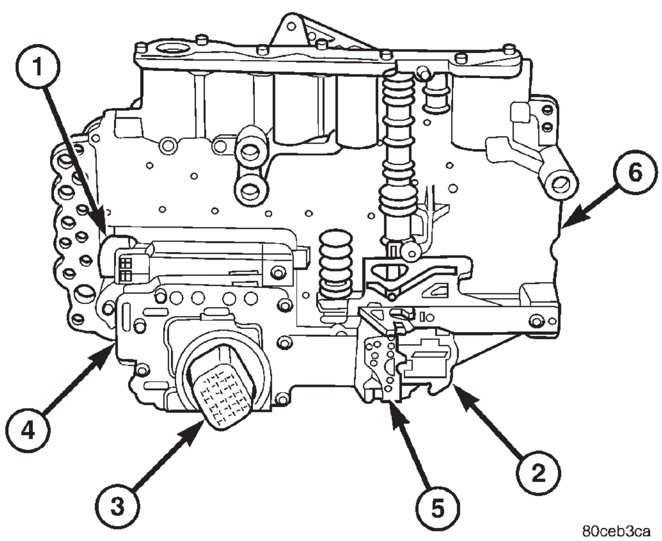


Fig. 118 Transmission Solenoid/TRS Assembly

1 - PRESSURE CONTROL SOLENOID
2 - TRANSMISSION RANGE SELECTOR PLATE
3 - 23-WAY CONNECTOR
4 - SOLENOID PACK
5 - TRANSMISSION RANGE SENSOR
6 - VALVE BODY

OPERATION

SOLENOIDS

Solenoids are used to control the L/R, 2C, 4C, OD, and UD friction elements. The reverse clutch is controlled by line pressure and the position of the manual valve in the valve body. All the solenoids are contained within the Solenoid and Pressure Switch Assembly. The solenoid and pressure switch assembly contains one additional solenoid, Multi-Select (MS), which serves primarily to provide 2nd and 3rd gear limp-in operation.

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid as necessary. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The MS and UD solenoids are normally applied to allow transmission limp-in in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

PRESSURE SWITCHES

The TCM relies on five pressure switches to monitor fluid pressure in the L/R, 2C, 4C, UD, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at 23 psi and open at 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

GEAR	L/R	2C	4C	UD	OD
R	OP	OP	OP	OP	OP
P/N	CL	OP	OP	OP	OP
1ST	CL*	OP	OP	CL	OP
2ND	OP	CL	OP	CL	OP
2ND PRIME	OP	OP	CL	CL	OP
D	OP	OP	OP	CL	CL
4TH	OP	OP	CL	OP	CL
5TH	OP	CL	OP	OP	CL

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

TRANSMISSION SOLENOID/TRS ASSEMBLY (Continued)

REMOVAL

(1) Remove the valve body from the transmission (Fig. 119).

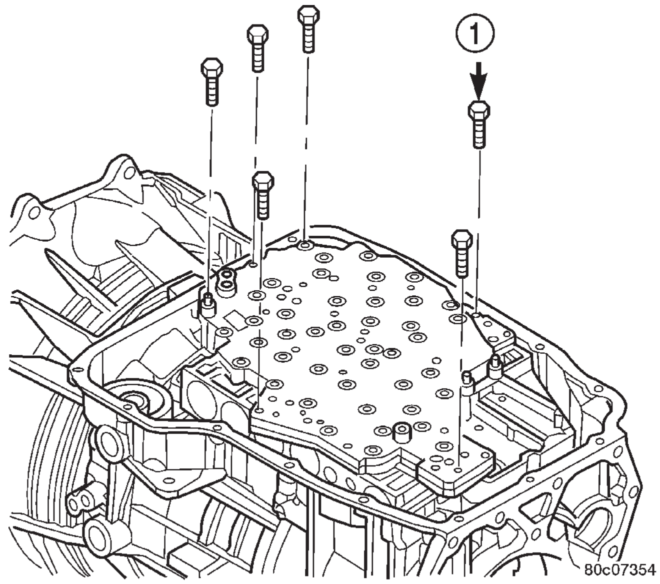


Fig. 119 Valve Body Bolts

1 - VALVE BODY TO CASE BOLT (6)

(2) Remove the screws holding the transmission solenoid/TRS assembly onto the valve body (Fig. 120).

(3) Separate the transmission solenoid/TRS assembly from the valve body.

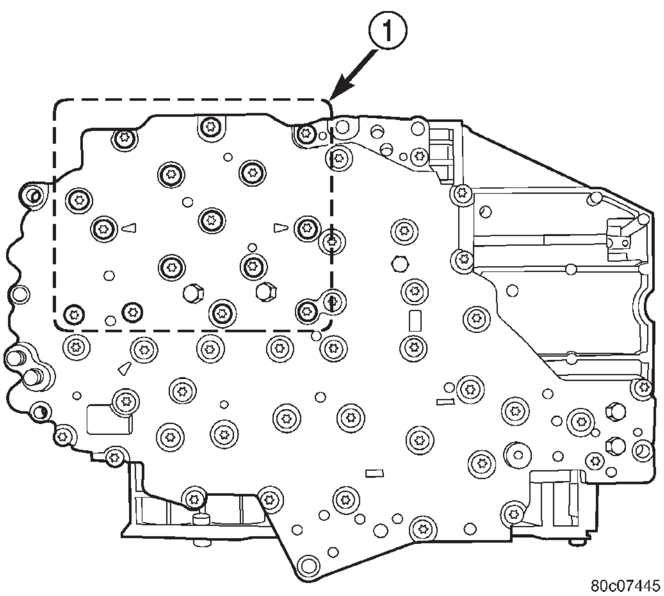


Fig. 120 Ttransmission Solenoid/TRS Assembly Screws

1 - SOLENOID PACK BOLTS (15)

INSTALLATION

(1) Place TRS selector plate in the PARK position.

(2) Position the transmission solenoid/TRS assembly onto the valve body. Be sure that both alignment dowels are fully seated in the valve body and that the TRS switch contacts are properly positioned in the selector plate

(3) Install the screws to hold the transmission solenoid/TRS assembly onto the valve body.

(4) Tighten the solenoid assembly screws adjacent to the arrows cast into the bottom of the valve body first. Tighten the screws to 5.7 N·m (50 in.lbs.).

(5) Tighten the remainder of the solenoid assembly screws to 5.7 N·m (50 in.lbs.).

(6) Install the valve body into the transmission.

TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS).

OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in.

Calculated Temperature

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

VALVE BODY

DESCRIPTION

The valve body consists of a cast aluminum valve body, a separator plate, and a transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components (Fig. 121) and (Fig. 122):

- Solenoid switch valve
- Manual valve
- Low/reverse switch valve
- 5 Accumulators
- 7 check balls

OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

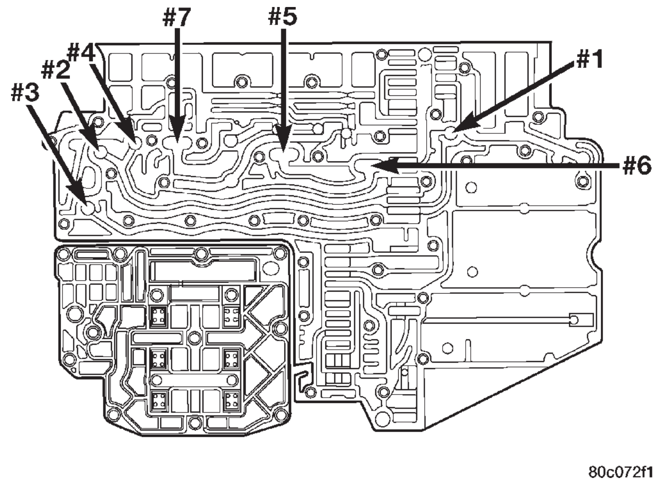


Fig. 122 Check Ball Locations

SOLENOID SWITCH VALVE

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will

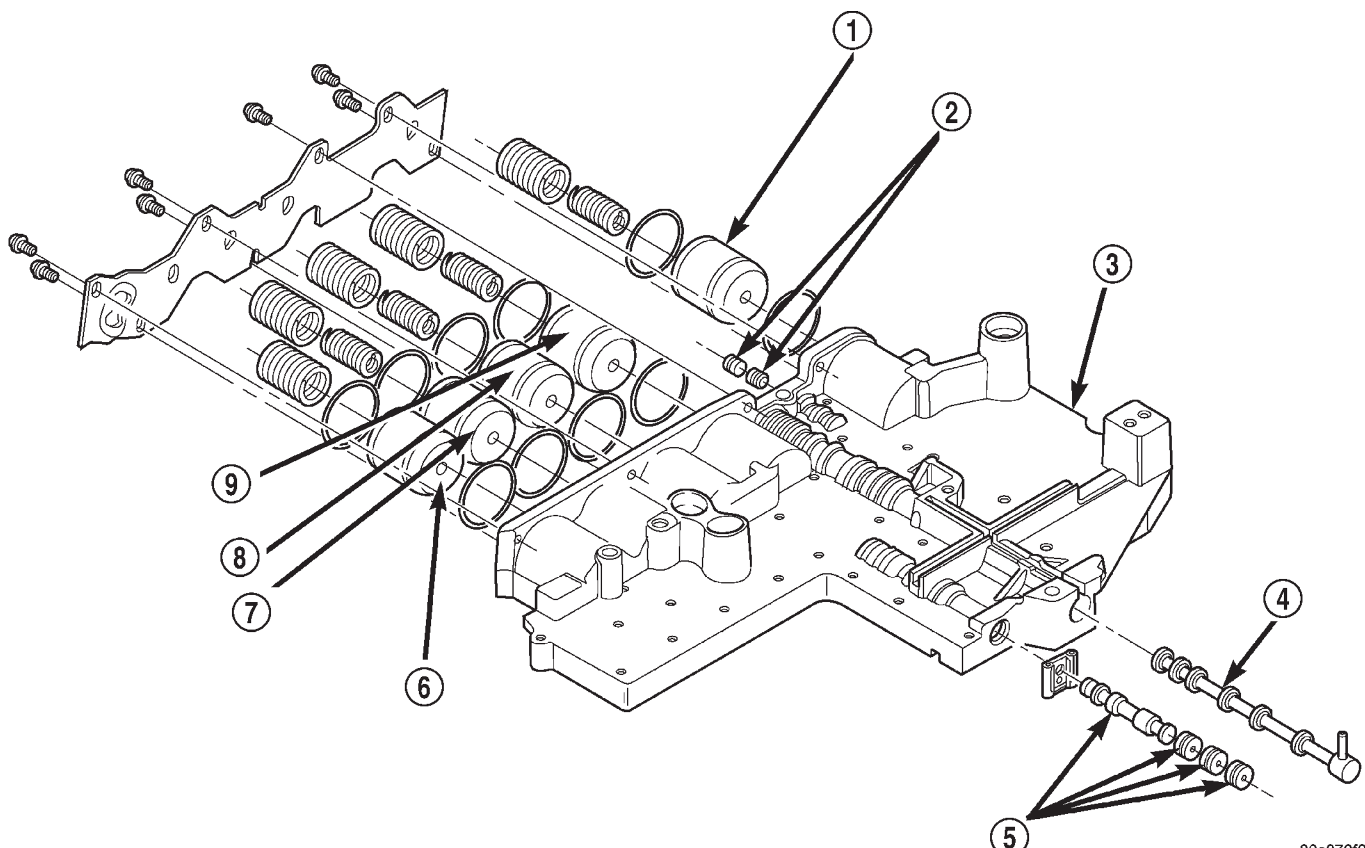


Fig. 121 Valve Body Components

1 - LOW/REVERSE ACCUMULATOR
2 - LOW/REVERSE SWITCH VALVE
3 - UPPER VALVE BODY
4 - MANUAL VALVE
5 - SOLENOID SWITCH VALVE
6 - OVERDRIVE ACCUMULATOR
7 - UNDERDRIVE ACCUMULATOR
8 - 4C ACCUMULATOR
9 - 2C ACCUMULATOR

VALVE BODY (Continued)

be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and fifth gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

MANUAL VALVE

The manual valve is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the top of the valve body. The valve is connected mechanically by a cable to the gearshift mechanism. The valve is held in each of its positions by a roller detent spring (Fig. 123) that engages the “roostercomb” of the TRS selector plate.

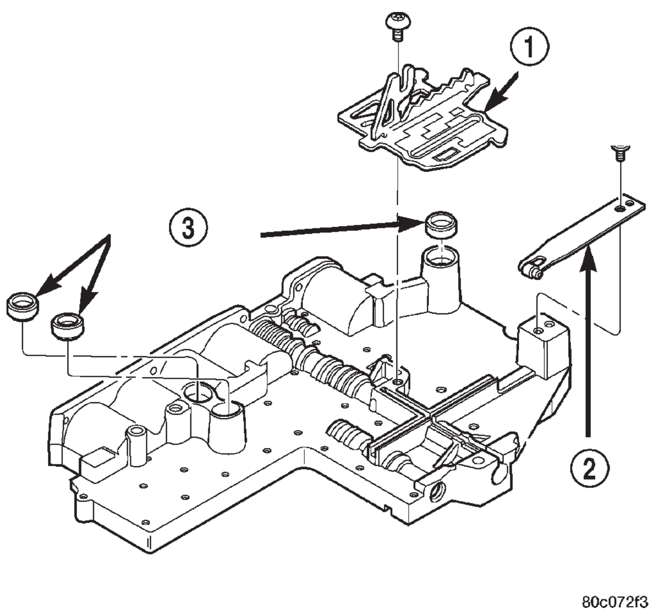


Fig. 123 TRS Selector Plate and Detent Spring

1 - TRS SELECTOR PLATE
2 - DETENT SPRING
3 - CLUTCH PASSAGE SEALS

LOW/REVERSE SWITCH VALVE

The low/reverse switch valve allows the low/reverse clutch to be operated by either the LR/CC solenoid or the MS solenoid.

REMOVAL

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/VALVE BODY - DISASSEMBLY)

(1) Shift transmission into PARK.

(2) Raise vehicle.

(3) Disconnect wires at the solenoid and pressure switch assembly connector.

(4) Position drain pan under transmission oil pan.

(5) Remove transmission oil pan.

(6) Remove the primary oil filter from valve body. (Fig. 124)

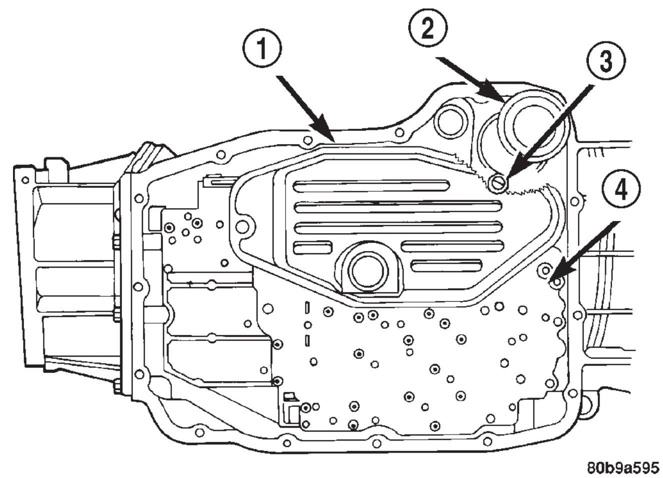


Fig. 124 Remove Primary Oil Filter

1 - PRIMARY OIL FILTER
2 - COOLER RETURN FILTER
3 - COOLER RETURN FILTER BYPASS VALVE
4 - VALVE BODY

VALVE BODY (Continued)

(7) Remove bolts attaching valve body to transmission case (Fig. 125).

(8) Lower the valve body and work the electrical connector out of transmission case.

(9) Separate the valve body from the transmission.

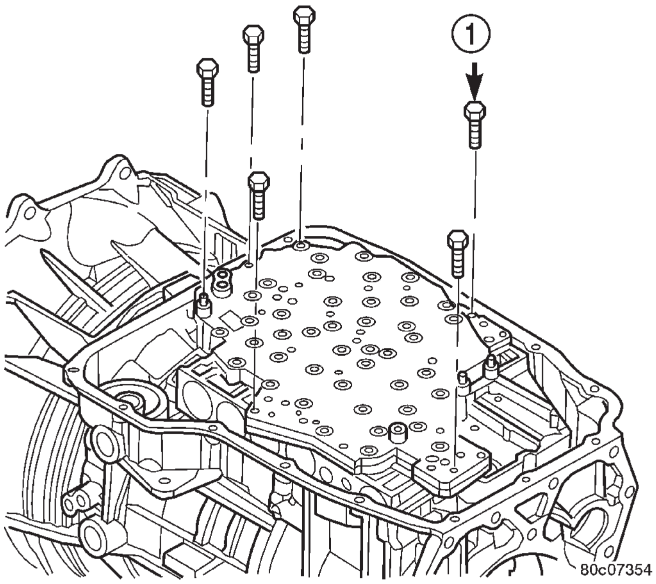


Fig. 125 Valve Body Bolts

1 - VALVE BODY TO CASE BOLT (6)

DISASSEMBLY

(1) Remove the screws holding the solenoid and pressure switch assembly to the valve body (Fig. 126). Do not remove the screws on the top of the solenoid and pressure switch assembly.

(2) Separate the solenoid and pressure switch assembly from the valve body.

(3) Remove the screw holding the detent spring (Fig. 127) onto the valve body.

(4) Remove the detent spring from the valve body.

(5) Remove the TRS selector plate from the valve body and the manual valve.

(6) Remove the clutch passage seals from the valve body, if necessary.

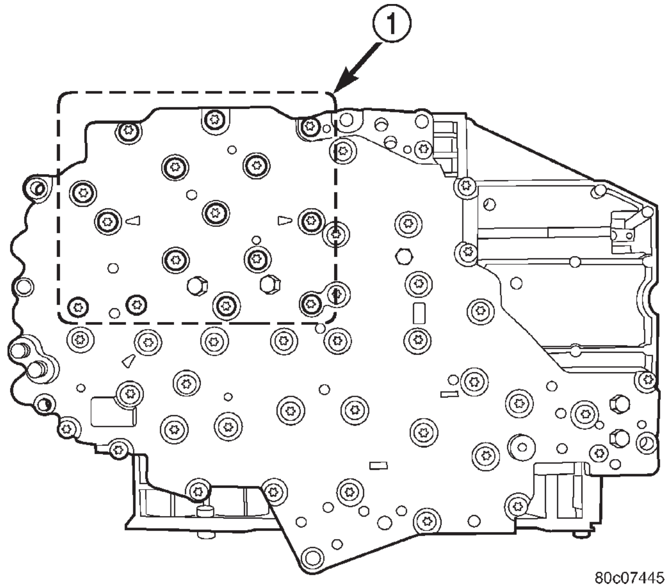


Fig. 126 Solenoid and Pressure Switch Assembly Screws

1 - SOLENOID PACK BOLTS (15)

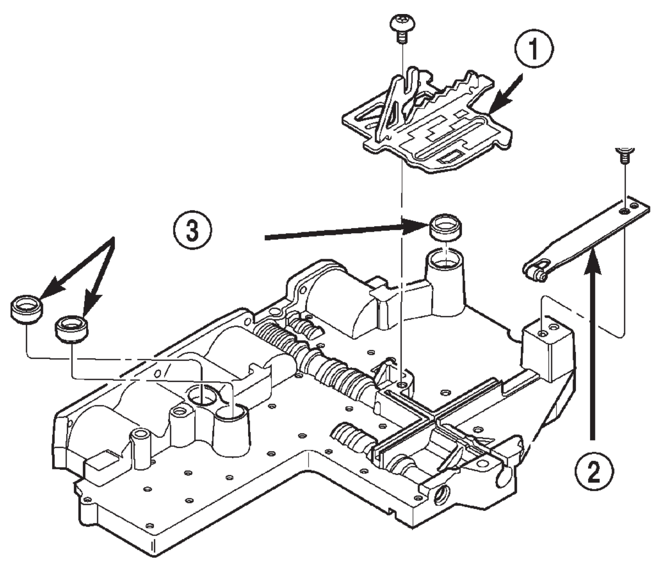


Fig. 127 Valve Body External Components

1 - TRS SELECTOR PLATE
2 - DETENT SPRING
3 - CLUTCH PASSAGE SEALS

VALVE BODY (Continued)

(7) Remove the screws holding the accumulator cover onto the valve body (Fig. 128).

(8) Remove the accumulator springs and pistons from the valve body. Note which accumulator piston and spring belong in each location.

(9) Place the valve body on the bench with the transfer plate upward.

NOTE: The valve body contains seven check balls. The transfer plate must be placed upward to prevent losing the check balls when the transfer plate is removed from the valve body.

(10) Remove the screws holding the valve body to the valve body transfer plate.

(11) Remove the transfer plate from the valve body. Note the location of all check balls (Fig. 129).

(12) Remove the check balls from the valve body.

(13) Remove the retainers securing the solenoid switch valve, manual valve, and the low/reverse switch valve into the valve body and remove the associated valve and spring. Tag each valve and spring combination with location information to aid in assembly. (Fig. 130)

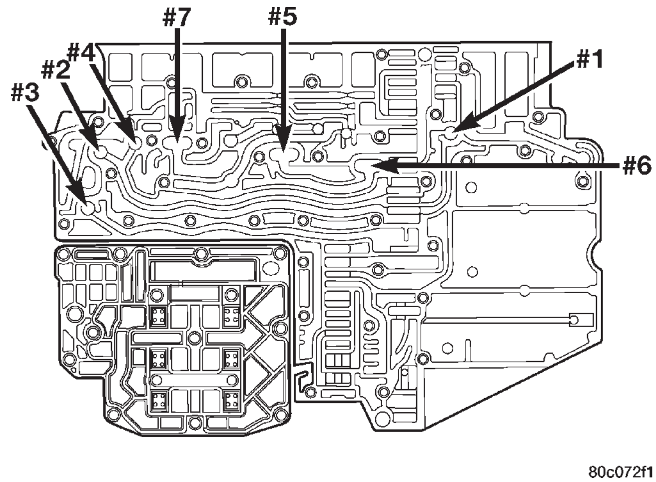


Fig. 129 Check Ball Locations

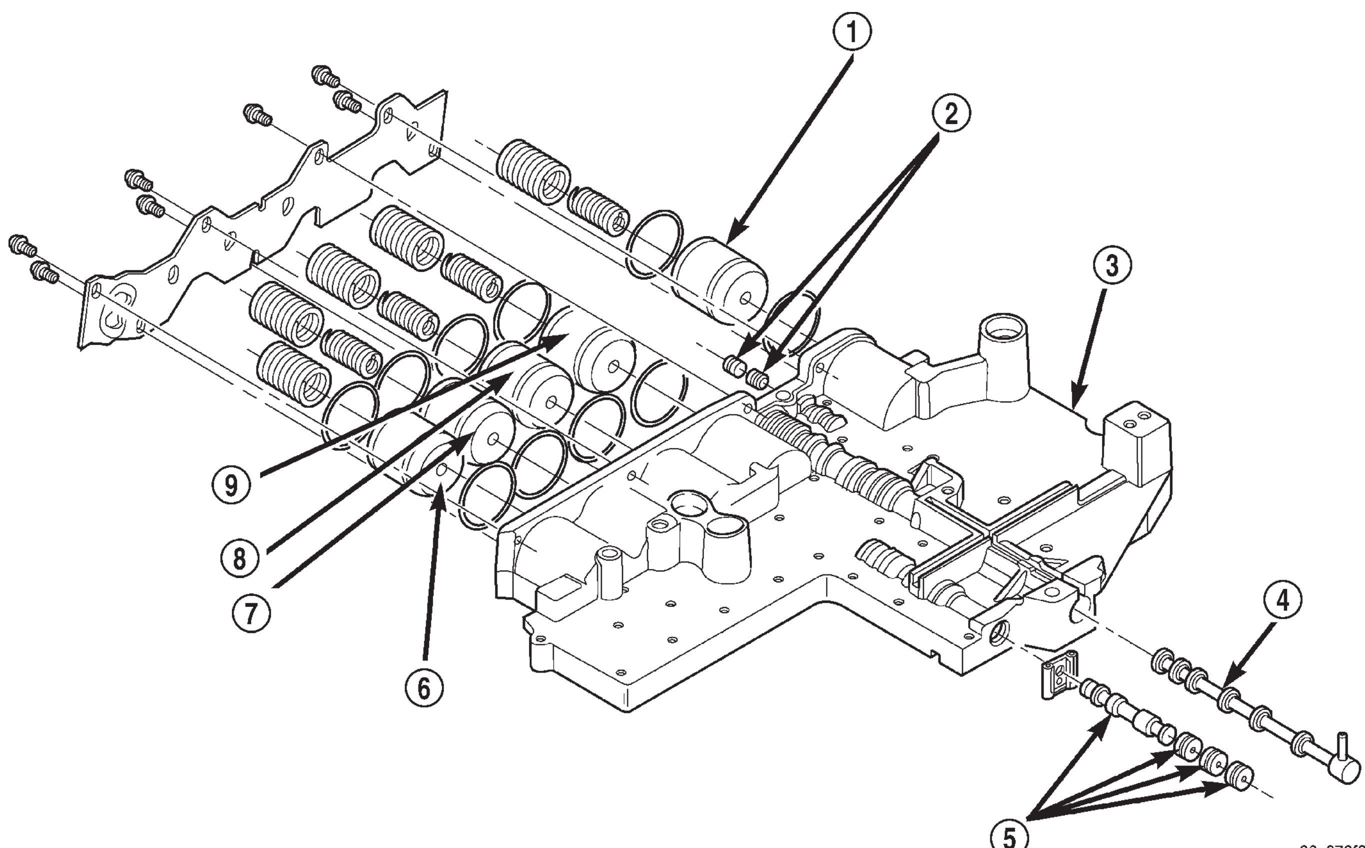


Fig. 128 Valve Body Components

1 - LOW/REVERSE ACCUMULATOR
2 - LOW/REVERSE SWITCH VALVE
3 - UPPER VALVE BODY
4 - MANUAL VALVE
5 - SOLENOID SWITCH VALVE
6 - OVERDRIVE ACCUMULATOR
7 - UNDERDRIVE ACCUMULATOR
8 - 4C ACCUMULATOR
9 - 2C ACCUMULATOR

VALVE BODY (Continued)

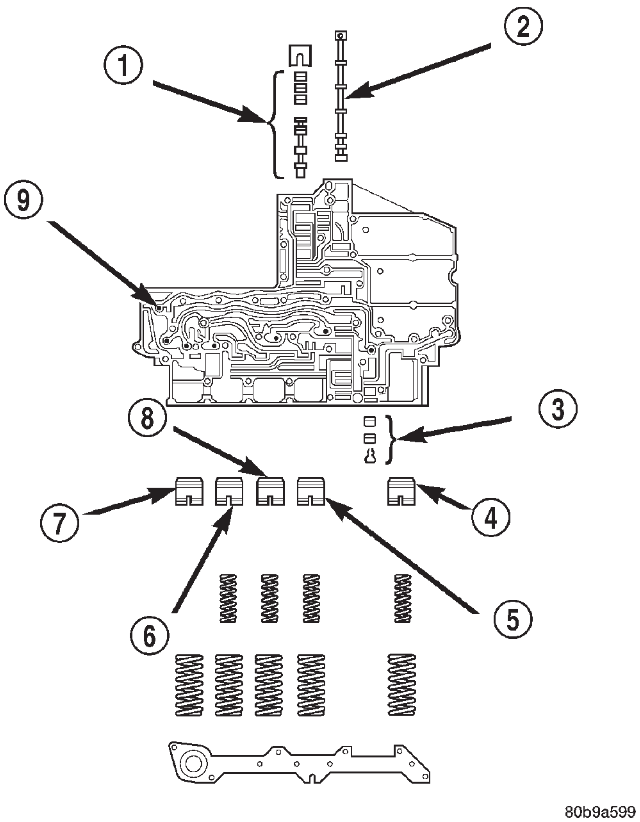


Fig. 130 Valve Body Components

1 - SOLENOID SWITCH VALVE
2 - MANUAL VALVE
3 - LOW REVERSE SWITCH VALVE
4 - LOW REVERSE ACCUMULATOR
5 - 2ND CLUTCH ACCUMULATOR
6 - UNDERDRIVE ACCUMULATOR
7 - OVERDRIVE ACCUMULATOR
8 - 4TH CLUTCH ACCUMULATOR
9 - CHECK BALLS (7)

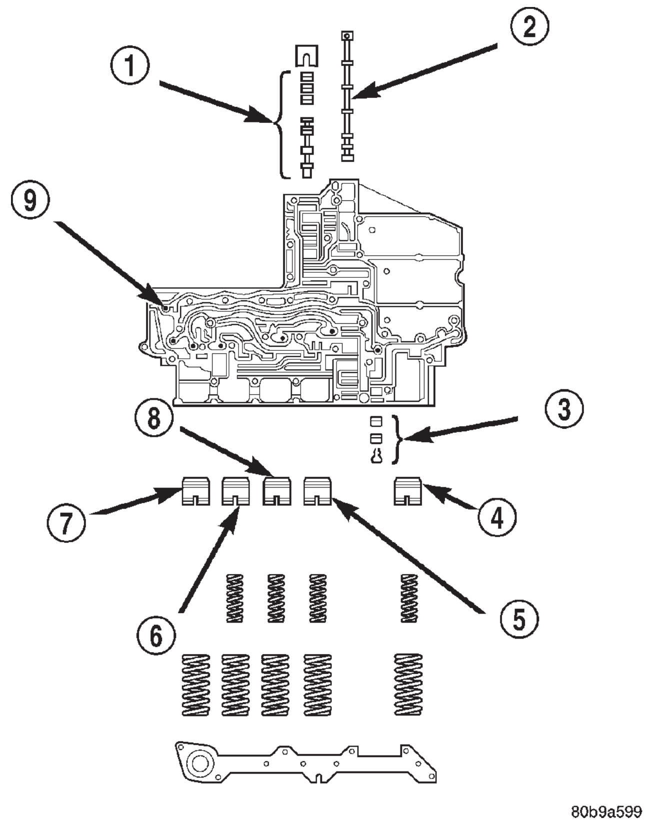


Fig. 131 Valve Body Components

1 - SOLENOID SWITCH VALVE
2 - MANUAL VALVE
3 - LOW REVERSE SWITCH VALVE
4 - LOW REVERSE ACCUMULATOR
5 - 2ND CLUTCH ACCUMULATOR
6 - UNDERDRIVE ACCUMULATOR
7 - OVERDRIVE ACCUMULATOR
8 - 4TH CLUTCH ACCUMULATOR
9 - CHECK BALLS (7)

CLEANING

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution. (Fig. 131)

Do not immerse any of the electrical components in cleaning solution. Clean the electrical components by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

INSPECTION

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straight-edge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

Inspect the valves and plugs (Fig. 132) for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

VALVE BODY (Continued)

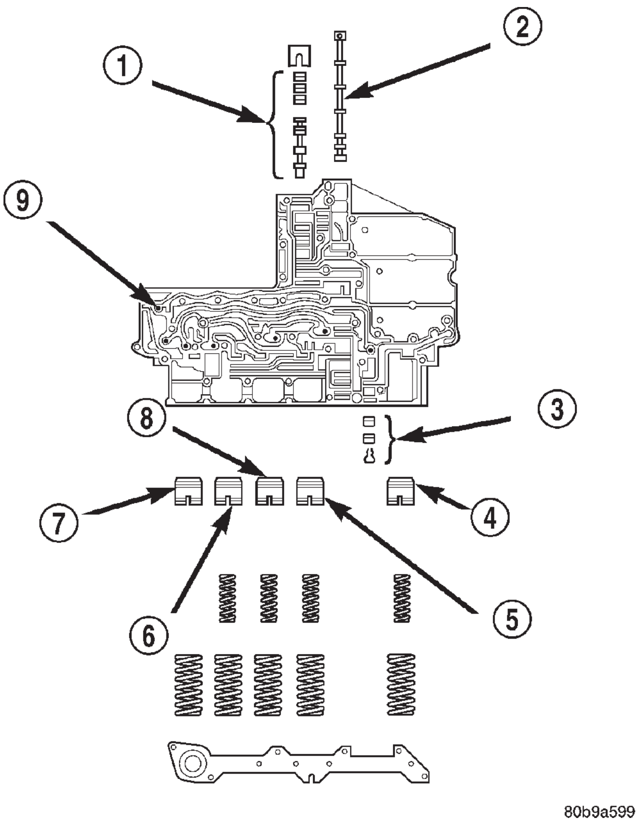


Fig. 132 Valve Body Components

1 - SOLENOID SWITCH VALVE
2 - MANUAL VALVE
3 - LOW REVERSE SWITCH VALVE
4 - LOW REVERSE ACCUMULATOR
5 - 2ND CLUTCH ACCUMULATOR
6 - UNDERDRIVE ACCUMULATOR
7 - OVERDRIVE ACCUMULATOR
8 - 4TH CLUTCH ACCUMULATOR
9 - CHECK BALLS (7)

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

Inspect all the accumulator bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the accumulator springs. The springs must be free of distortion, warpage or broken coils.

Inspect all the fluid seals on the valve body (Fig. 133). Replace any seals that are cracked, distorted, or damaged in any way. These seals pass fluid pressure directly to the clutches. Any pressure leak at these points, may cause transmission performance problems.

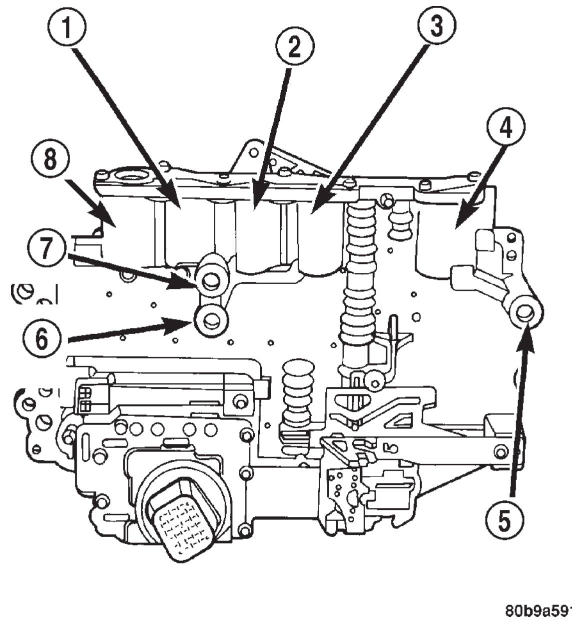


Fig. 133 Valve Body Seals

1 - UNDERDRIVE ACCUMULATOR (2 SPRINGS)
2 - 4TH CLUTCH ACCUMULATOR (2 SPRINGS)
3 - 2ND CLUTCH ACCUMULATOR (2 SPRINGS)
4 - LOW REVERSE ACCUMULATOR (2 SPRINGS)
5 - LOW/REVERSE PASSAGE SEAL
6 - 2ND CLUTCH PASSAGE SEAL
7 - 4TH CLUTCH PASSAGE SEAL
8 - OVERDRIVE ACCUMULATOR (1 SPRING)

ASSEMBLY

(1) Lubricate valves, springs, and the housing valve bores with clean transmission fluid.

(2) Install solenoid switch valve, manual valve, and the low/reverse switch valve into the valve body.

(3) Install the retainers to hold each valve into the valve body.

(4) Install the valve body check balls into their proper locations.

(5) Position the transfer plate onto the valve body.

(6) Install the screws to hold the transfer plate to the valve body. Tighten the screws to 5.6 N·m (50 in. lbs.).

(7) Install the accumulator pistons and springs into the valve body in the location from which they were removed. Note that all accumulators except the overdrive have two springs. The overdrive accumulator piston has only one spring.

VALVE BODY (Continued)

(8) Position the accumulator cover onto the valve body.

(9) Install the screws to hold the accumulator cover onto the valve body. Tighten the screws to 4.5 N·m (40 in. lbs.).

(10) Install the TRS selector plate onto the valve body and the manual valve.

(11) Install the solenoid and pressure switch assembly onto the valve body.

(12) Install the screws to hold the solenoid and pressure switch assembly onto the valve body. Tighten the screws to 5.7 N·m (50 in. lbs.). Tighten the screws adjacent to the arrows cast into the bottom of the transfer plate first.

(13) Position the detent spring onto the valve body.

(14) Install the screw to hold the detent spring onto the valve body. Tighten the screw to 4.5 N·m (40 in. lbs.).

(15) Install new clutch passage seals onto the valve body, if necessary

INSTALLATION

(1) Check condition of seals on valve body and the solenoid and pressure switch assembly. Replace seals if cut or worn.

(2) Place TRS selector plate in the PARK position.

(3) Place the transmission in the PARK position.

(4) Lubricate seal on the solenoid and pressure switch assembly connector with petroleum jelly.

(5) Position valve body in transmission and align the manual lever on the valve body to the pin on the transmission manual shift lever.

(6) Seat valve body in case and install one or two bolts to hold valve body in place.

(7) Tighten valve body bolts alternately and evenly to 12 N·m (105 in. lbs.) torque.

(8) Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.

CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.

(9) Place replacement filter in position on valve body and into the oil pump.

(10) Install screw to hold filter to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.

(11) Connect the solenoid and pressure switch assembly connector.

(12) Install oil pan. Tighten pan bolts to 12 N·m (105 in. lbs.) torque.

(13) Lower vehicle and fill transmission with Mopar® ATF +4, type 9602, fluid.

(14) Check and adjust gearshift cable, if necessary.

TRANSFER CASE - NV242

TABLE OF CONTENTS

TRANSFER CASE - NV242

DESCRIPTION

The NV242 is a full transfer case (Fig. 1). It provides full time 2-wheel, or 4-wheel drive operation.

A differential in the transfer case is used to control torque transfer to the front and rear axles. A low range gear provides increased low speed torque capability for off road operation. The low range provides a 2.72:1 reduction ratio.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

TRANSFER CASE IDENTIFICATION

Two versions of the NV242 are used in the WJ vehicles, NV242LD and NV242HD. The two transfer cases can be distinguished from one another by the rear output shaft retainer. The NV242LD uses a rubber boot to cover the rear output shaft, while the NV242HD uses a cast aluminum housing. Other than this difference, the two transfer cases are serviced the same.

A circular ID tag is attached to the rear case of each transfer case (Fig. 2). The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

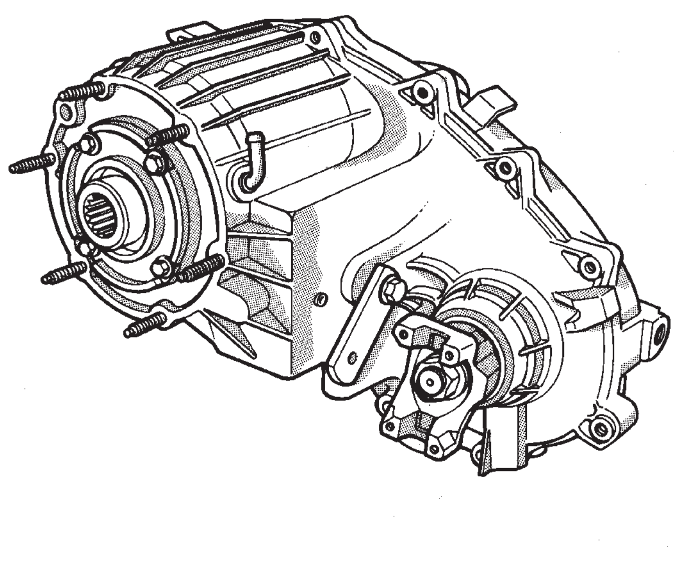


Fig. 1 NV242 Transfer Case

The transfer case serial number also represents the date of build.

SHIFT MECHANISM

Operating ranges are selected with a lever in the floor mounted shifter assembly. The shift lever is connected to the transfer case range lever by an adjustable cable. A straight line shift pattern is used. Range positions are marked on the shifter bezel.

TRANSFER CASE - NV242 (Continued)

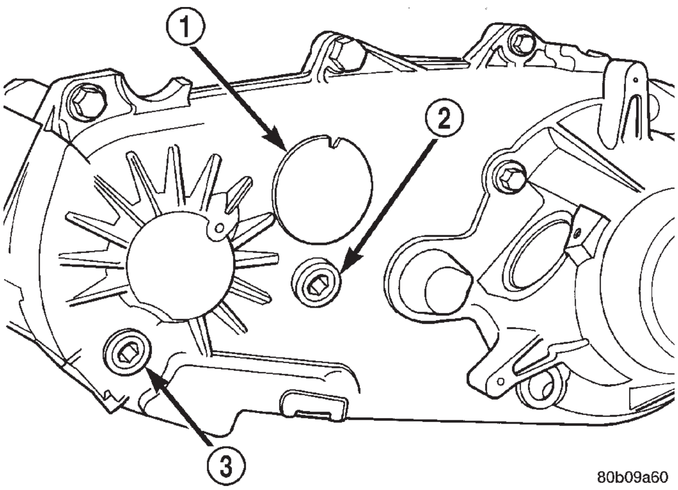


Fig. 2 Fill/Drain Plug And I.D. Tag Locations

1 - I.D. TAG
2 - FILL PLUG
3 - DRAIN PLUG

OPERATION

The input gear is splined to the transmission output shaft. It drives the mainshaft through the planetary gear and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchro mechanism for shifting.

OPERATING RANGES

NV242 operating ranges are 2WD (2-wheel drive), 4x4 part-time, 4x4 full time, and 4 Lo.

The 2WD and 4x4 full time ranges can be used at any time and on any road surface.

The 4x4 part-time and 4 Lo ranges are for off road use only. The only time these ranges can be used on hard surface roads, is when the surface is covered with snow and ice.

DIAGNOSIS AND TESTING - TRANSFER CASE - NV242

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case difficult to shift or will not shift into desired range.	1) Transfer case shift linkage binding.	1) Repair or replace linkage as necessary.
	2) Insufficient or incorrect lubricant.	2) Drain and refill transfer case with the correct type and quantity of lubricant.
	3) Internal transfer case components binding, worn, or damaged.	3) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct type and quantity of lubricant.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.
Transfer case will not shift through 4X4 part time range (light remains on)	1) Incomplete shift due to drivetrain torque load.	1) Momentarily release the accelerator pedal to complete the shift.
	2) Incorrect tire pressure.	2) Correct tire pressure as necessary.
	3) Excessive Tire wear.	3) Correct tire condition as necessary.
	4) Excessive vehicle loading.	4) Correct as necessary.

TRANSFER CASE - NV242 (Continued)

REMOVAL

(1) Shift transfer case into NEUTRAL.

(2) Raise vehicle.

(3) Remove transfer case drain plug and drain transfer case lubricant.

(4) Mark front and rear propeller shaft yokes for alignment reference.

(5) Support transmission with jack stand.

(6) Remove rear crossmember and skid plate, if equipped (Fig. 3).

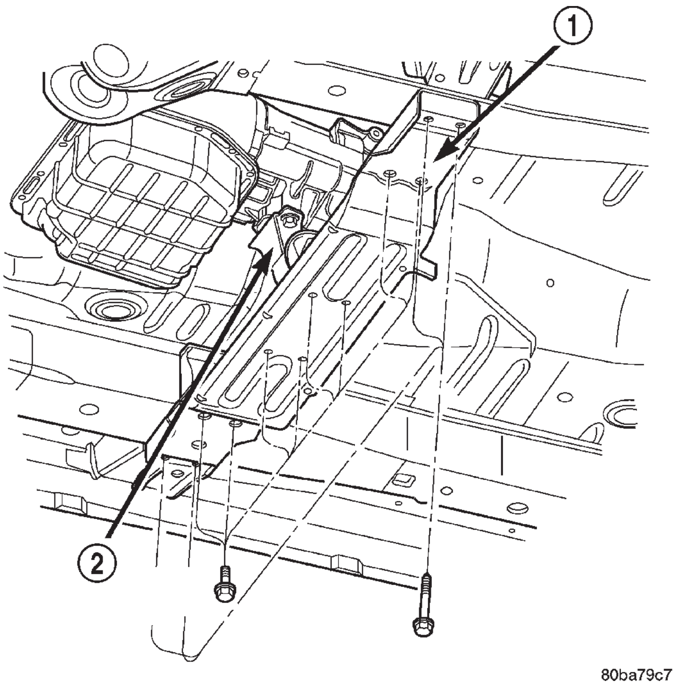


Fig. 3 Crossmember Removal

1 - CROSSMEMBER
2 - REAR TRANSMISSION MOUNT

(7) Disconnect front/rear propeller shafts at transfer case. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(8) Disconnect transfer case cable from range lever.

(9) Disconnect transfer case vent hose (Fig. 4) and transfer case position sensor.

(10) Support transfer case with transmission jack.

(11) Secure transfer case to jack with chains.

(12) Remove nuts attaching transfer case to transmission.

(13) Pull transfer case and jack rearward to disengage transfer case.

(14) Remove transfer case from under vehicle.

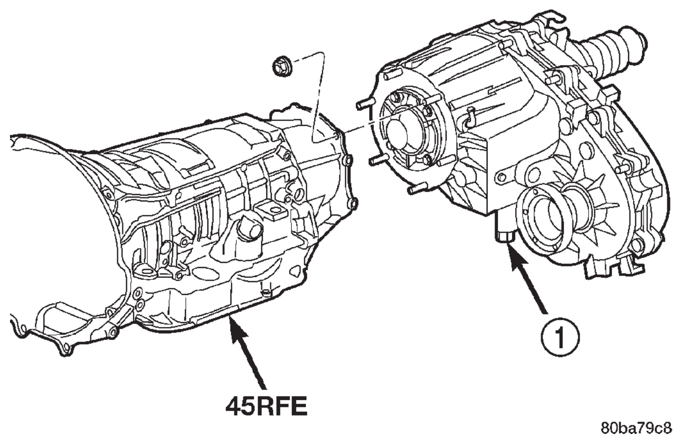


Fig. 4 Transfer Case Mounting

1 - NV242 TRANSFER CASE

DISASSEMBLY

REAR RETAINER - NV242LD

(1) Remove output shaft boot. Spread band clamp that secures boot on slinger with a suitable awl. Then slide boot off shaft (Fig. 5).

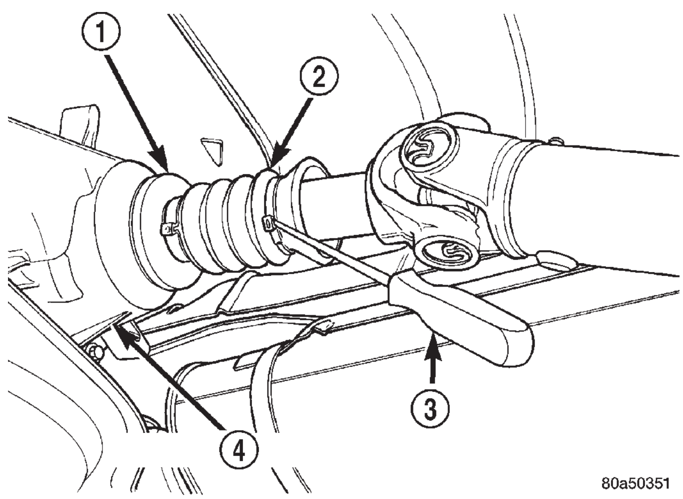


Fig. 5 Output Boot - Typical

1 - SLINGER
2 - BOOT
3 - AWL
4 - TRANSFER CASE

TRANSFER CASE - NV242 (Continued)

(2) Using puller MD-998056-A, remove rear slinger (Fig. 6).

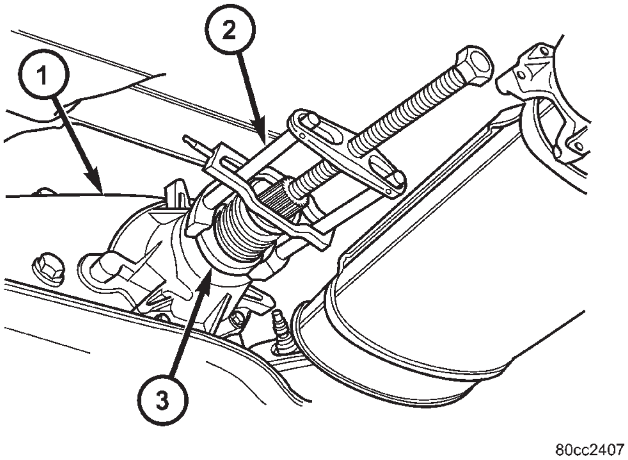


Fig. 6 Rear Slinger Removal

1 - TRANSFER CASE
2 - SPECIAL TOOL MD998056-A
3 - SLINGER

(3) Remove rear seal from retainer (Fig. 7). Use pry tool, or collapse seal with punch to remove it.

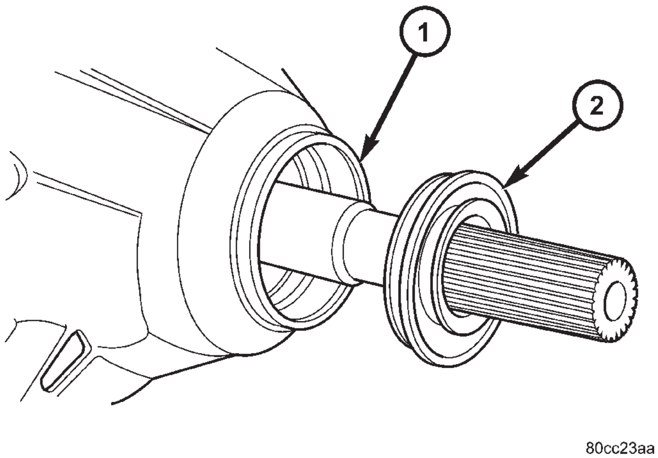


Fig. 7 Rear Retainer Seal

1 - REAR RETAINER
2 - OUTPUT SHAFT SEAL

(4) Remove rear output bearing I.D. retaining ring (Fig. 8).

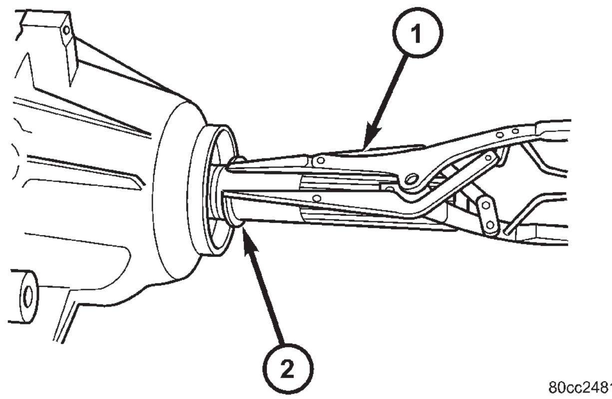


Fig. 8 Output Shaft Rear Bearing Retaining Ring

1 - SNAP-RING PLIERS
2 - RETAINING RING

(5) Remove rear retainer bolts.

(6) Remove rear retainer. Tap retainer with mallet and pry upward to break sealer bead. Then slide retainer off case and output shaft (Fig. 9).

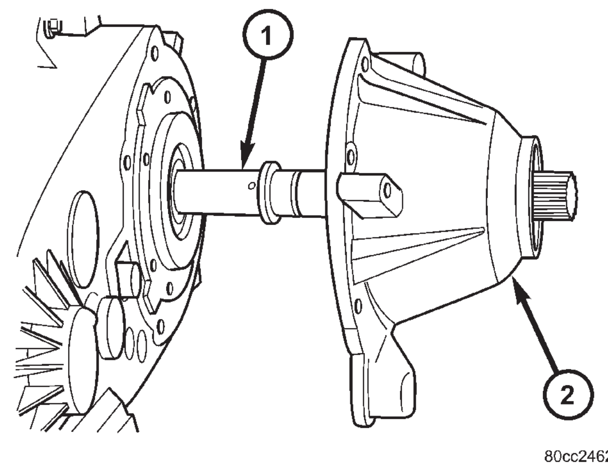


Fig. 9 Rear Retainer Removal

1 - MAINSHAFT
2 - REAR RETAINER

TRANSFER CASE - NV242 (Continued)

REAR RETAINER - NV242HD

(1) Remove extension housing bolts.

(2) Tap extension housing with plastic or rawhide mallet to loosen sealer (Fig. 10).

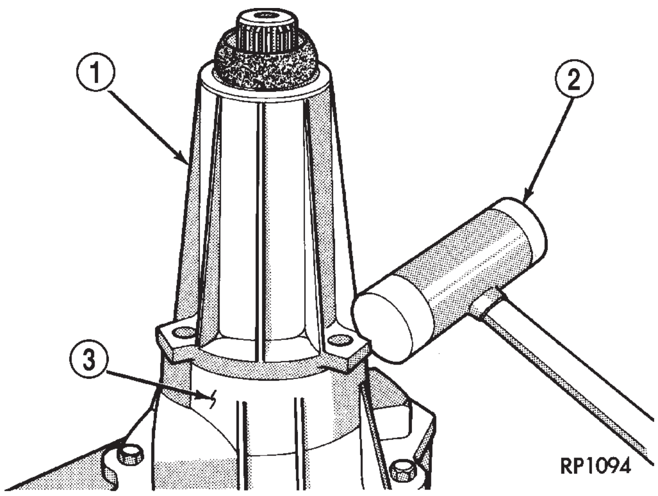


Fig. 10 Remove Extension Housing

1 - EXTENSION HOUSING
2 - PLASTIC HAMMER
3 - REAR RETAINER

(3) Separate extension housing from rear retainer.

(4) Remove rear bearing snap-ring (Fig. 11).

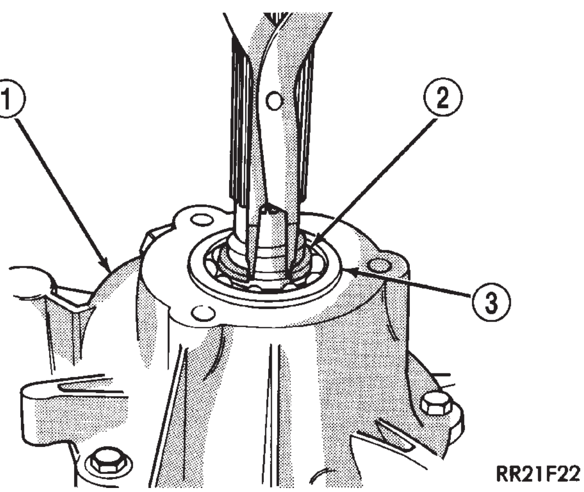


Fig. 11 Remove the Output Bearing Snap-ring

1 - REAR RETAINER
2 - SNAP-RING
3 - REAR BEARING

(5) Remove bolts holding rear retainer to rear case half.

(6) Loosen rear retainer with pry tool to break sealer bead. Pry only against retainer boss as shown (Fig. 12).

(7) Slide retainer off case and output shaft (Fig. 13).

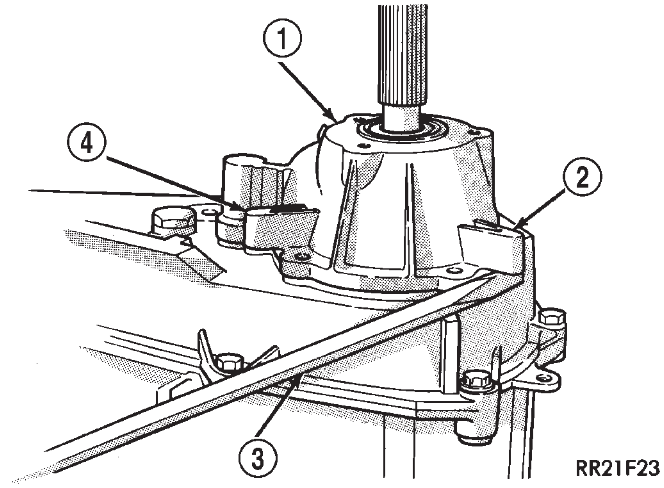


Fig. 12 Loosening Rear Retainer

1 - REAR RETAINER
2 - TAB (2)
3 - SCREWDRIVER
4 - TAB

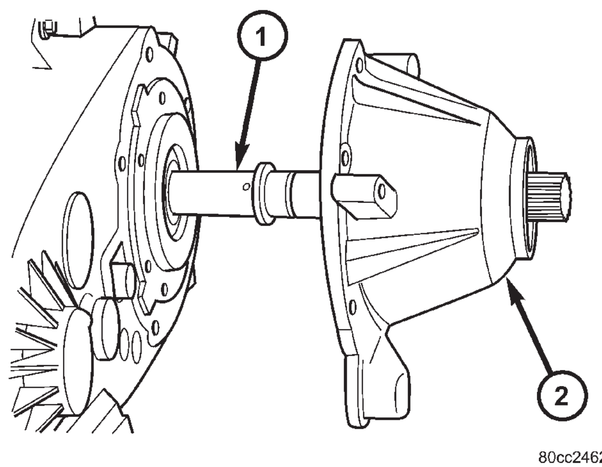


Fig. 13 Rear Retainer Removal

1 - MAINSHAFT
2 - REAR RETAINER

OIL PUMP AND REAR CASE HALF

(1) Remove rear bearing O.D. retaining ring with snap ring pliers. Then tilt pump and slide it off output shaft (Fig. 14)

(2) Remove pickup tube O-ring from pump (Fig. 15) but do not disassemble pump; it is not a repairable part.

(3) Remove seal from oil pump with pry tool.

(4) Remove bolts attaching rear case to front case (Fig. 16). Note position of the two black finish bolts at each end of the case. These bolts go through the case dowels and require a washer under the bolt head.

TRANSFER CASE - NV242 (Continued)

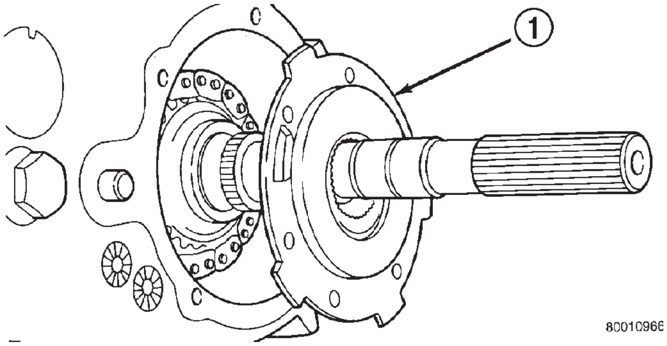


Fig. 14 Oil Pump Removal

1 - OIL PUMP

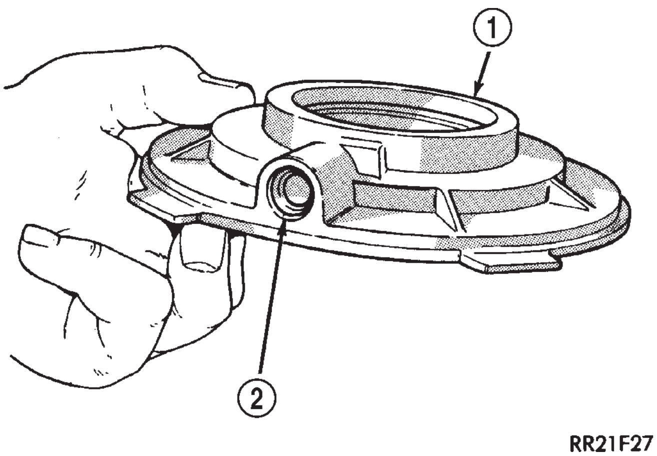


Fig. 15 Pickup Tube O-Ring Location

1 - OIL PUMP
2 - O-RING

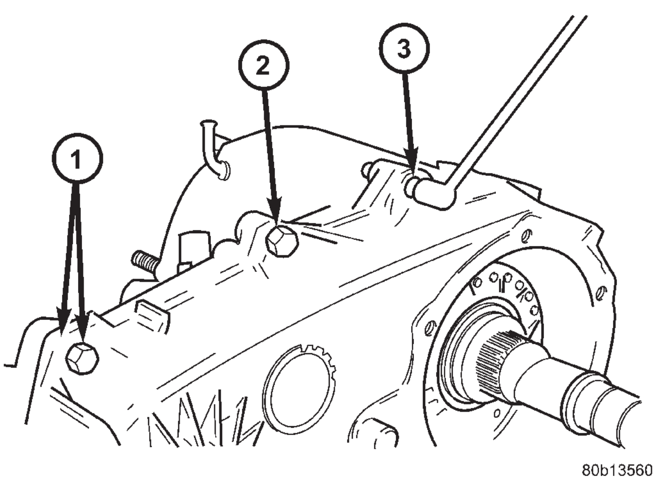


Fig. 16 Spline And Dowel Bolt Locations

1 - DOWEL BOLT AND WASHER (2)
2 - CASE BOLTS
3 - SPLINE HEAD BOLT (1)

(5) Remove rear case from front case (Fig. 17). Insert screwdrivers into slots cast into each end of case. Then pry upward to break sealer bead and remove rear case.

CAUTION: Do not pry on the sealing surface of either case half as the surfaces will become damaged.

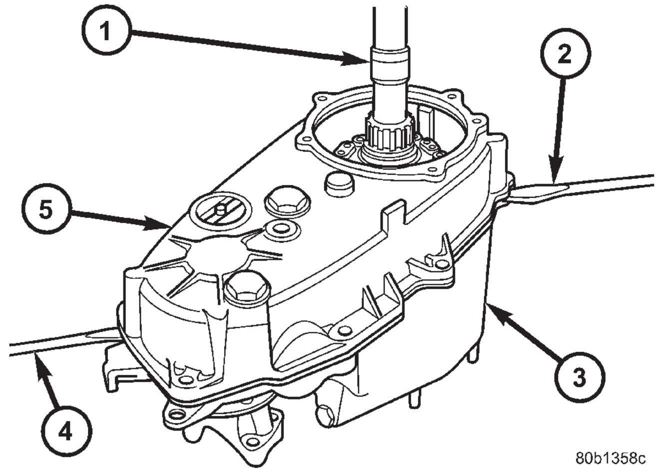


Fig. 17 Loosening/Removing Rear Case

1 - MAINSHAFT
2 - SCREWDRIVER
3 - FRONT CASE
4 - SCREWDRIVER
5 - REAR CASE

(6) Remove oil pickup tube and screen from rear case (Fig. 18).

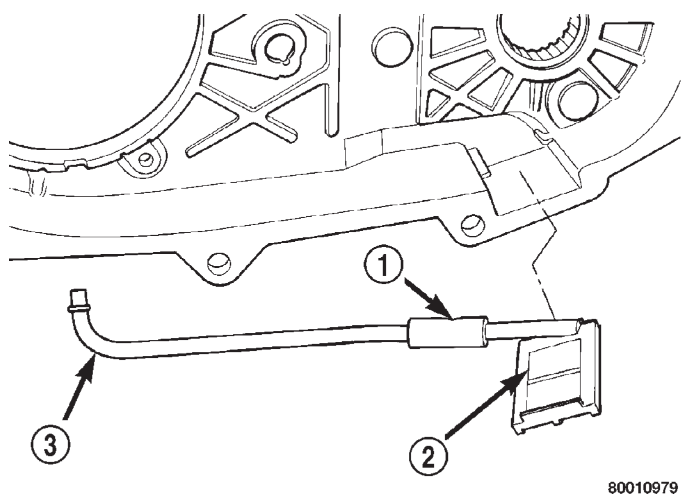


Fig. 18 Oil Pickup Screen, Hose And Tube Removal

1 - CONNECTING HOSE
2 - PICKUP SCREEN
3 - PICKUP TUBE

TRANSFER CASE - NV242 (Continued)

COMPANION FLANGE AND RANGE LEVER

(1) Remove transfer case position sensor (Fig. 19).

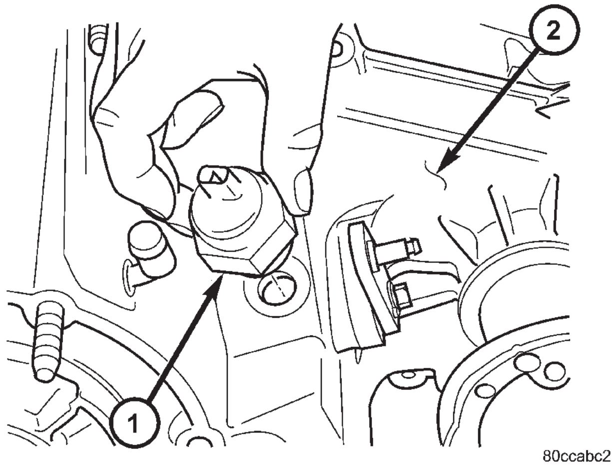


Fig. 19 Remove Transfer Case Position Sensor

1 - TRANSFER CASE POSITION SENSOR
2 - TRANSFER CASE

(2) Install two bolts (Fig. 20) partially into the propellor shaft companion flange, 180° from each other.

(3) Install the rectangular end of the Flange Holder C-3281 over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.

(4) Use Remover C-452 (Fig. 21) to remove the companion flange.

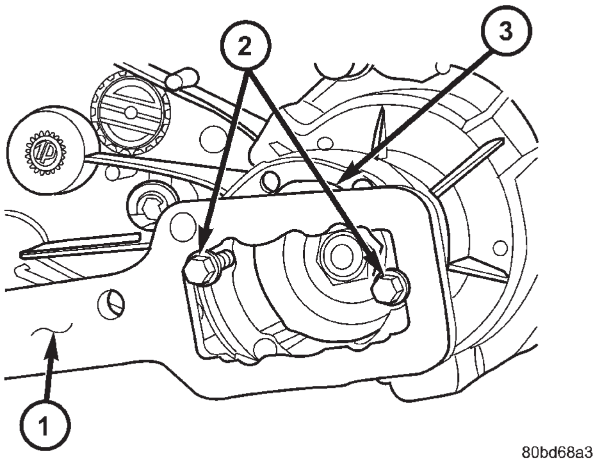


Fig. 20 Hold Companion Flange - Typical

1 - HOLDER C-3281
2 - BOLTS
3 - COMPANION FLANGE

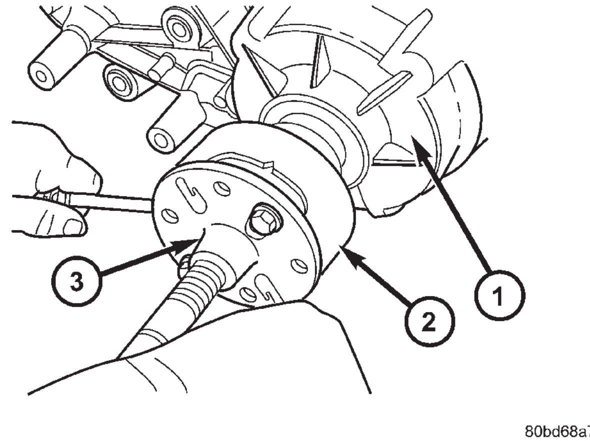


Fig. 21 Remove Companion Flange - Typical

1 - TRANSFER CASE
2 - COMPANION FLANGE
3 - REMOVER C-452

(5) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(6) Remove the bolt (Fig. 22) that attaches the range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft.

NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.

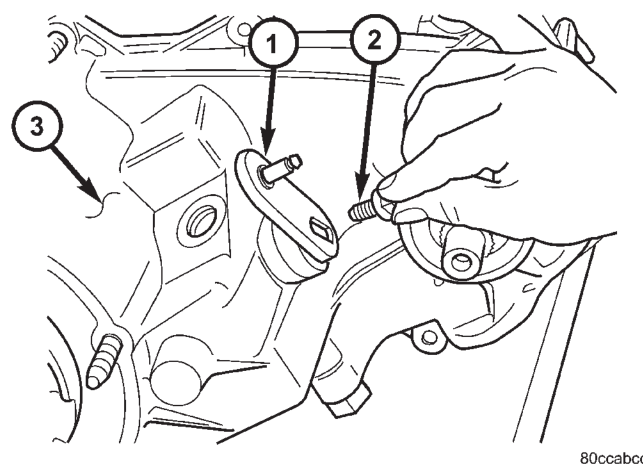


Fig. 22 Remove Shift Lever Bolt - Typical

1 - RANGE LEVER
2 - RANGE LEVER BOLT
3 - TRANSFER CASE

TRANSFER CASE - NV242 (Continued)

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Remove drive sprocket snap-ring (Fig. 23).

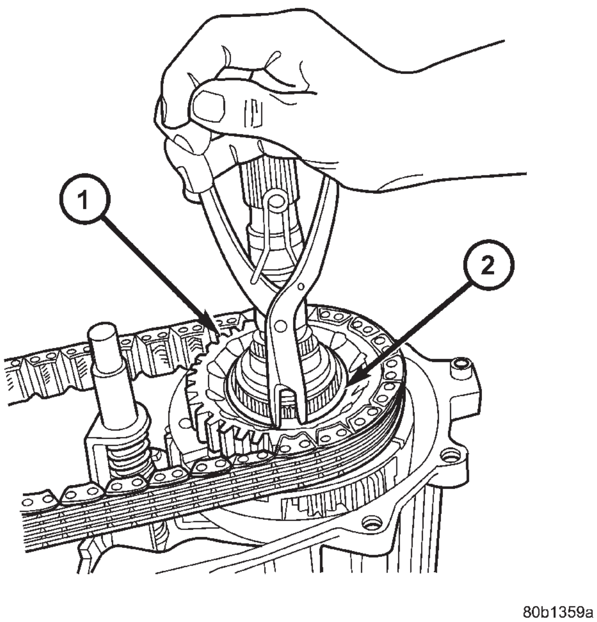


Fig. 23 Drive Sprocket Snap-Ring Removal

1 - DRIVE SPROCKET
2 - DRIVE SPROCKET SNAP-RING

(2) Remove drive sprocket and chain (Fig. 24).
(3) Remove front output shaft (Fig. 25).

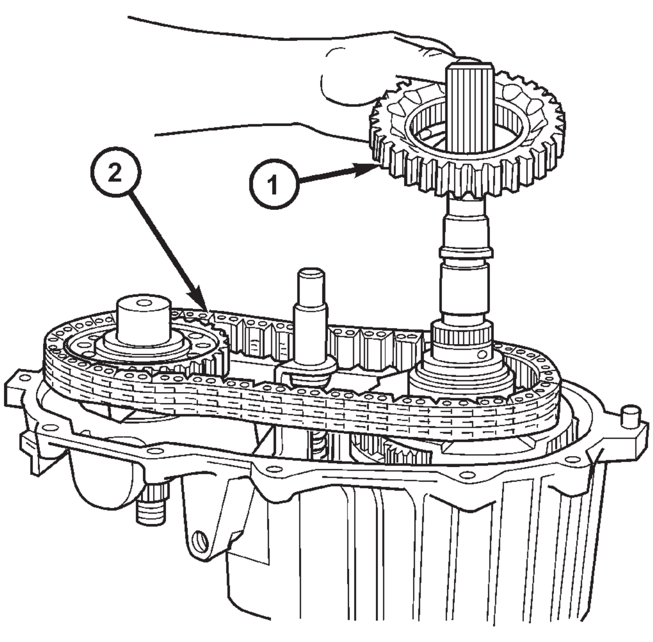


Fig. 24 Drive Sprocket And Chain Removal

1 - DRIVE SPROCKET
2 - DRIVE CHAIN

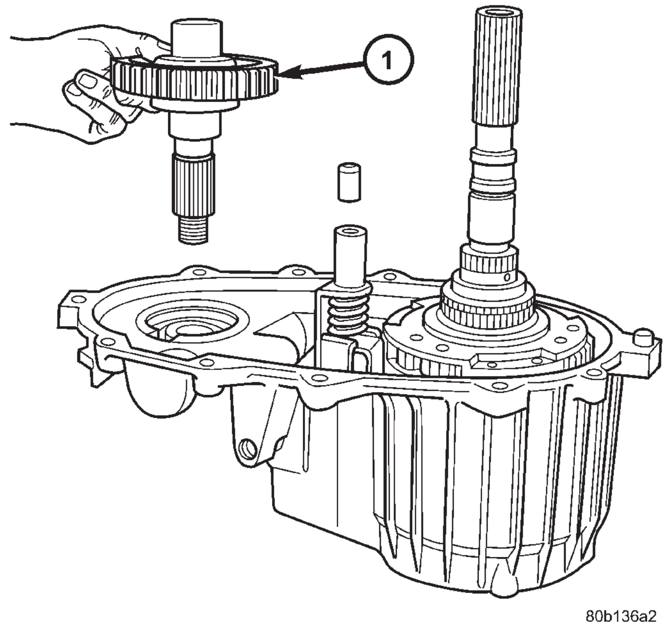


Fig. 25 Removing Front Output Shaft

1 - FRONT OUTPUT SHAFT

SHIFT FORKS AND MAINSHAFT

(1) Remove shift detent plug, spring and pin (Fig. 26).

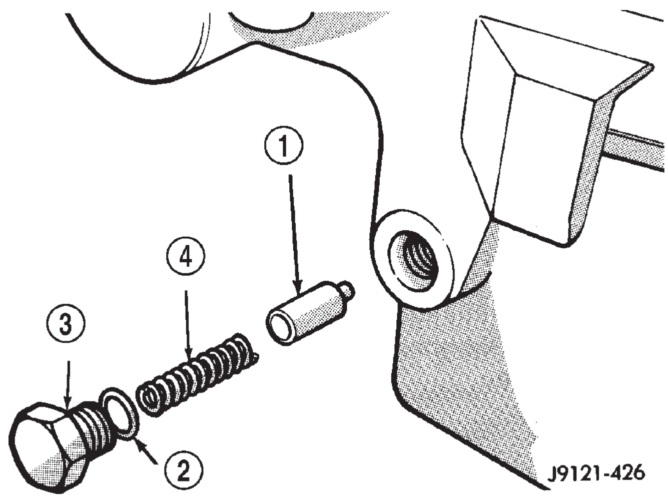


Fig. 26 Detent Component Removal

1 - PLUNGER
2 - O-RING
3 - PLUG
4 - SPRING

TRANSFER CASE - NV242 (Continued)

(2) Remove seal plug from low range fork lockpin access hole. Then move shift sector to align low range fork lockpin with access hole.

(3) Remove range fork lockpin with size number one easy-out tool as follows:

(a) Insert easy-out tool through access hole in side of transfer case and into lock-pin.

(b) Tap easy-out tool into lock-pin with hammer until tool is securely engaged into the lock-pin.

(c) Install a t-handle, such as from a tap and die set, onto the easy-out tool.

(d) Securely tighten the t-handle onto the tool.

(e) In one motion, pull upward and turn the t-handle counter-clockwise to remove the lock-pin.

(4) Remove shift rail by pulling it straight up and out of fork (Fig. 27).

(5) Remove mode fork and mainshaft as assembly (Fig. 28).

(6) Remove mode shift sleeve and mode fork assembly from mainshaft (Fig. 29). Note position of mode sleeve in fork and remove sleeve.

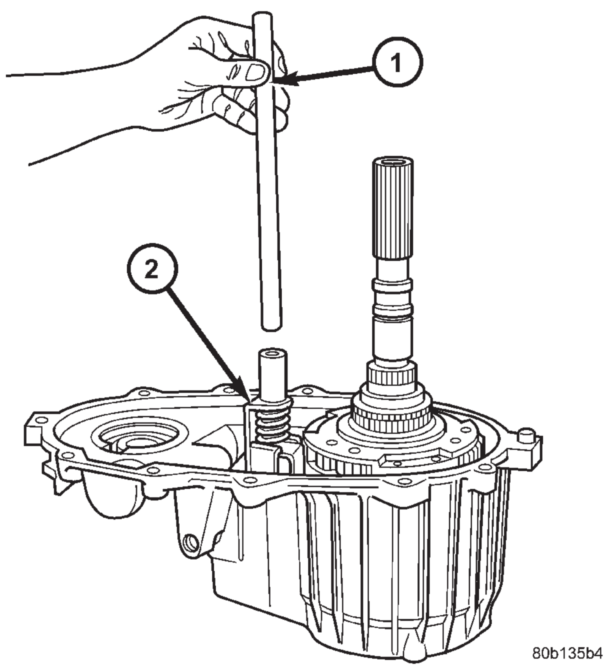


Fig. 27 Shift Rail Removal

1 - SHIFT RAIL
2 - MODE FORK

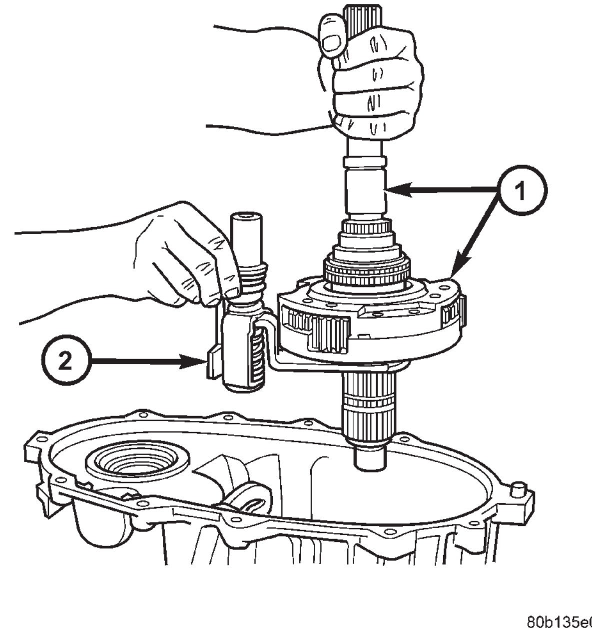


Fig. 28 Mainshaft And Mode Fork Removal

1 - MAINSHAFT ASSEMBLY
2 - MODE FORK

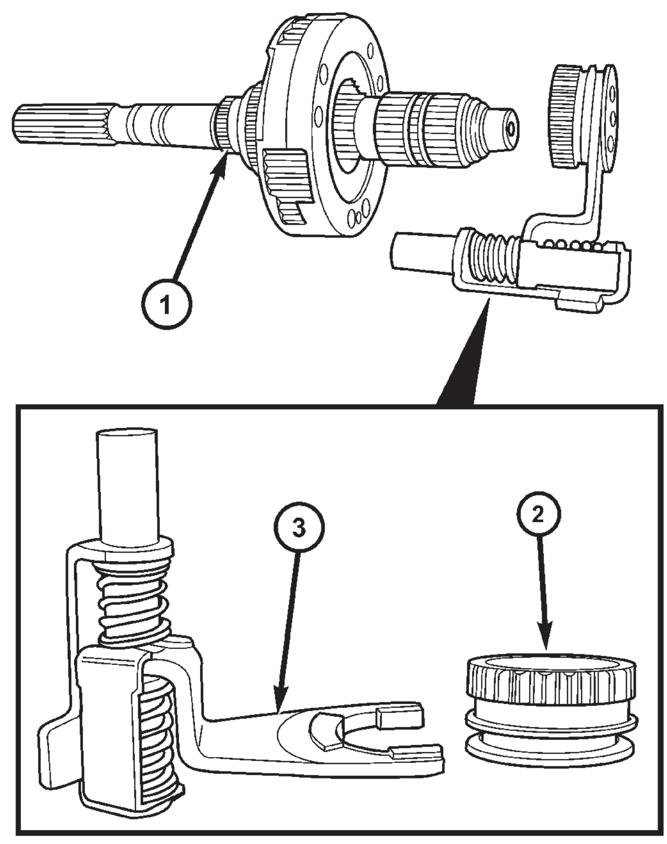


Fig. 29 Separate Mode Fork And Sleeve

1 - MAINSHAFT
2 - MODE SLEEVE
3 - MODE FORK ASSEMBLY

TRANSFER CASE - NV242 (Continued)

(7) Remove intermediate clutch shaft snap-ring (Fig. 30).

(8) Remove clutch shaft thrust ring (Fig. 31).

(9) Remove intermediate clutch shaft (Fig. 32).

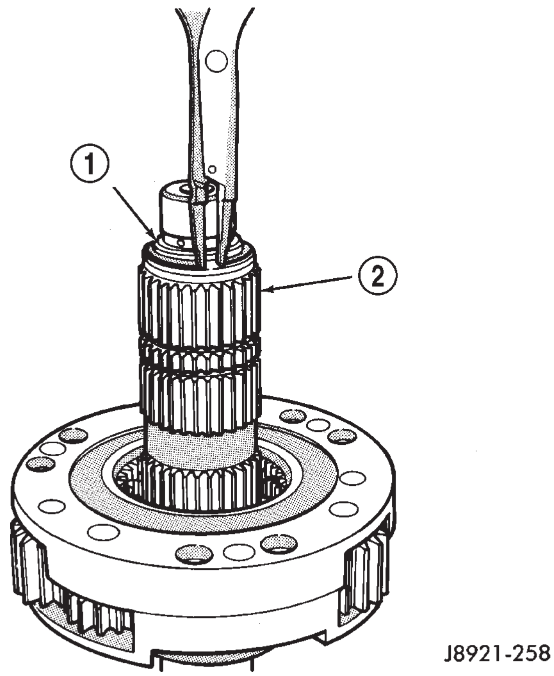


Fig. 30 Intermediate Clutch Shaft Snap-Ring Removal

1 - SNAP-RING
2 - INTERMEDIATE CLUTCH SHAFT

Fig. 31 Clutch Shaft Thrust Ring Removal

1 - CLUTCH SHAFT THRUST RING

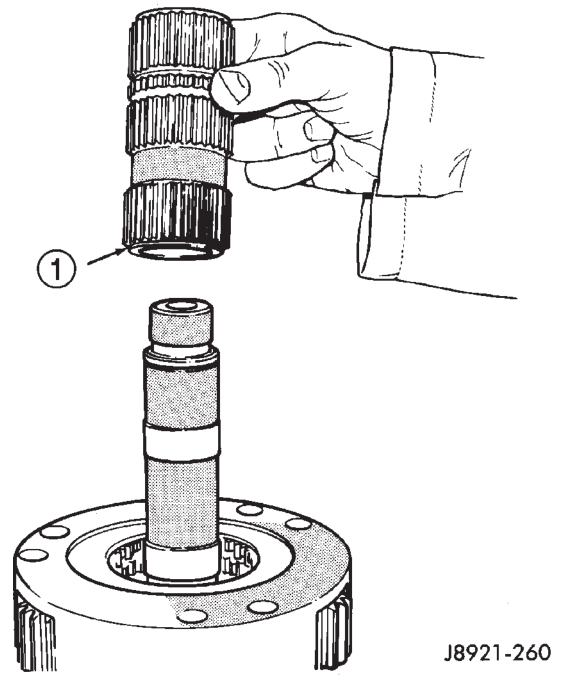


Fig. 32 Intermediate Clutch Shaft Removal

1 - INTERMEDIATE CLUTCH SHAFT

(10) Remove differential snap-ring (Fig. 33).

(11) Remove differential (Fig. 34).

(12) Remove differential needle bearings and both needle bearing thrust washers from mainshaft.

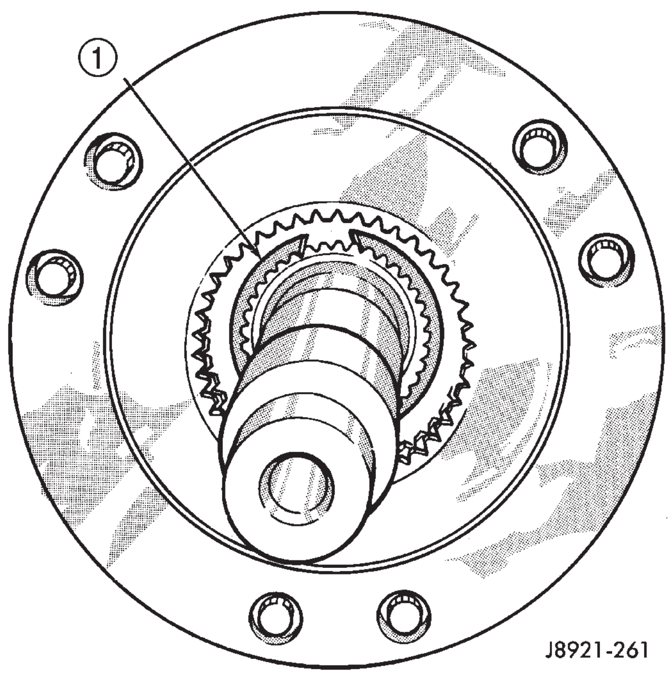


Fig. 33 Differential Snap-Ring Removal

1 - DIFFERENTIAL SNAP-RING

TRANSFER CASE - NV242 (Continued)

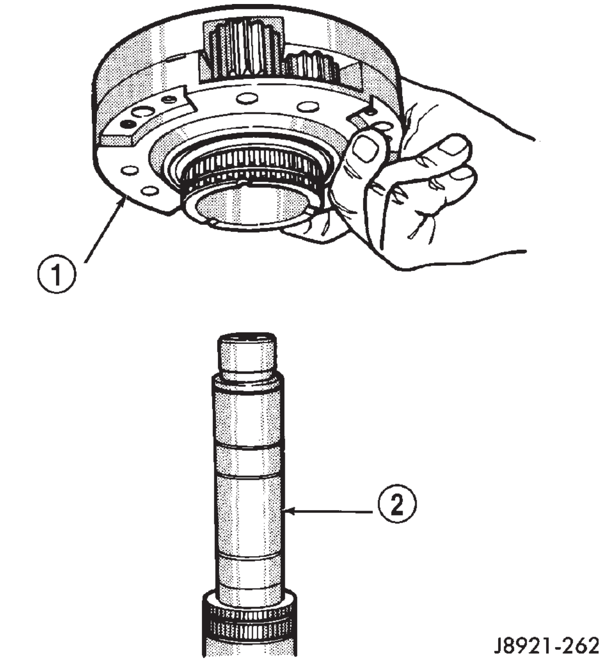


Fig. 34 Differential Removal

1 - DIFFERENTIAL
2 - MAINSHAFT

(13) Slide low range fork pin out of shift sector slot.

(14) Remove low range fork and sleeve (Fig. 35).

(15) Remove shift sector.

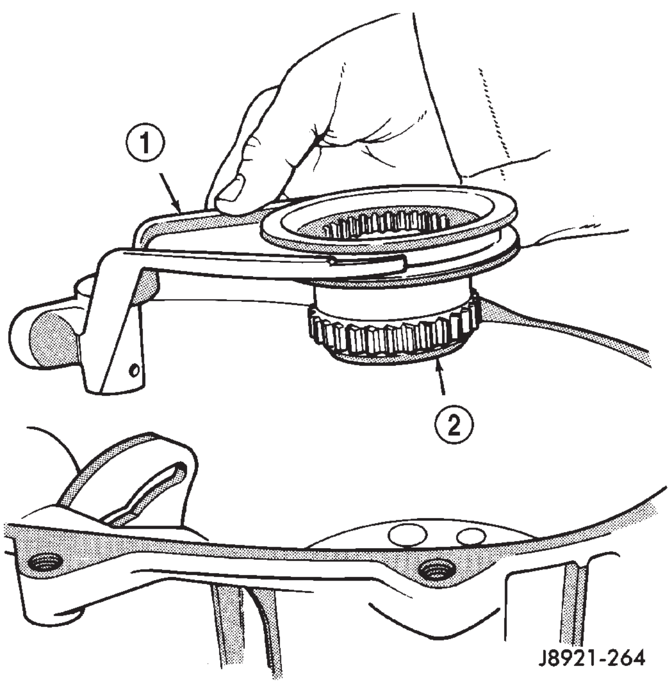


Fig. 35 Low Range Fork And Hub Removal

1 - LOW RANGE FORK
2 - FORK HUB

(16) Remove the shift sector shaft bushing and o-ring (Fig. 36).

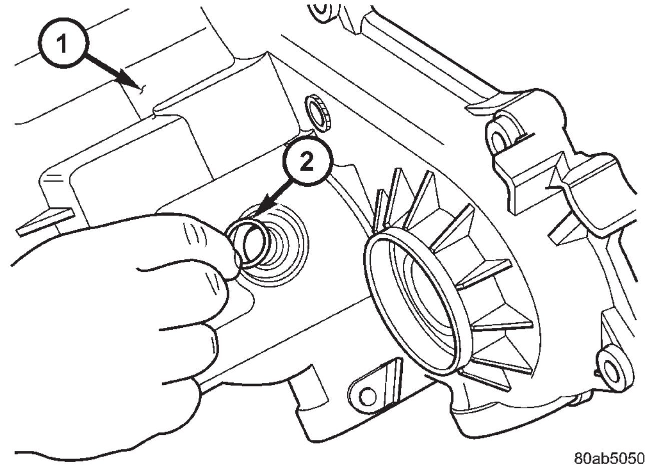


Fig. 36 Remove the Shift Sector O-Ring

1 - TRANSFER CASE FRONT HOUSING
2 - SHIFT SECTOR O-RING

INPUT GEAR/LOW RANGE ASSEMBLY

(1) Remove front bearing retainer bolts.

(2) Remove front bearing retainer. Carefully pry retainer loose with screwdriver (Fig. 37). Position screwdriver in slots cast into retainer.

(3) Remove input gear snap-ring (Fig. 38).

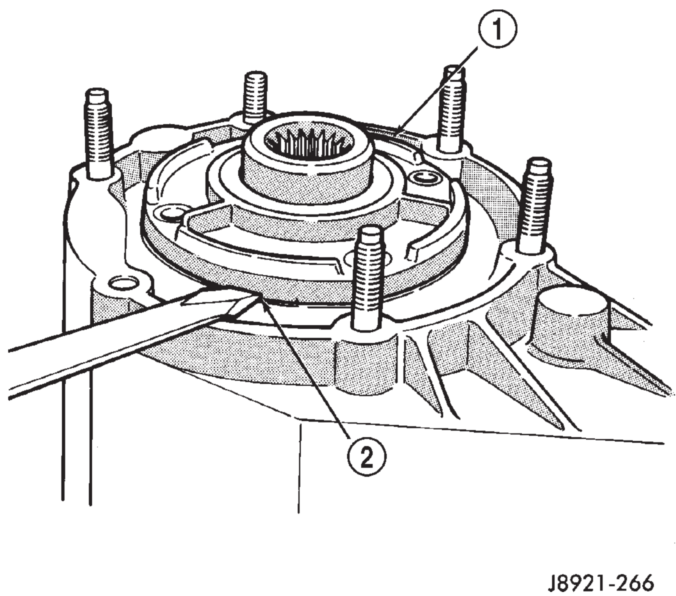


Fig. 37 Front Bearing Retainer Removal

1 - FRONT BEARING RETAINER
2 - RETAINER SLOT

TRANSFER CASE - NV242 (Continued)

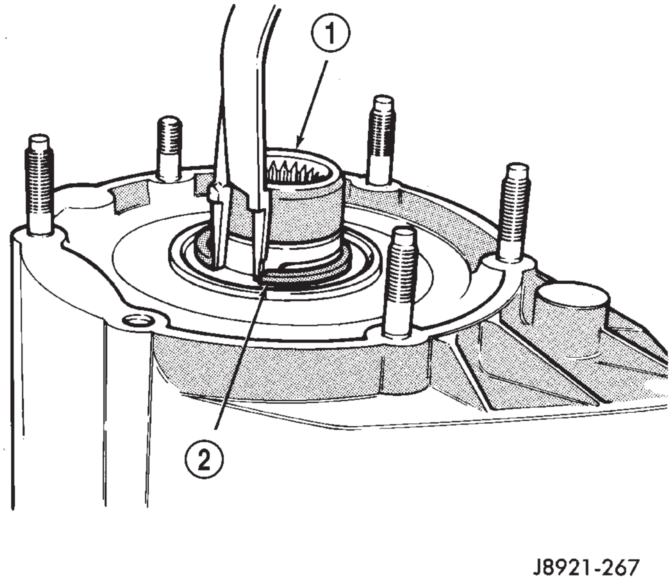


Fig. 38 Input Gear Snap Ring Removal

1 - INPUT GEAR
2 - SNAP-RING

(4) Remove input/low range gear assembly from bearing with Tool Handle C-4171 and Tool 7829A (Fig. 39).

(5) Remove low range gear snap-ring (Fig. 40).

(6) Remove input gear retainer, thrust washers and input gear from low range gear (Fig. 41).

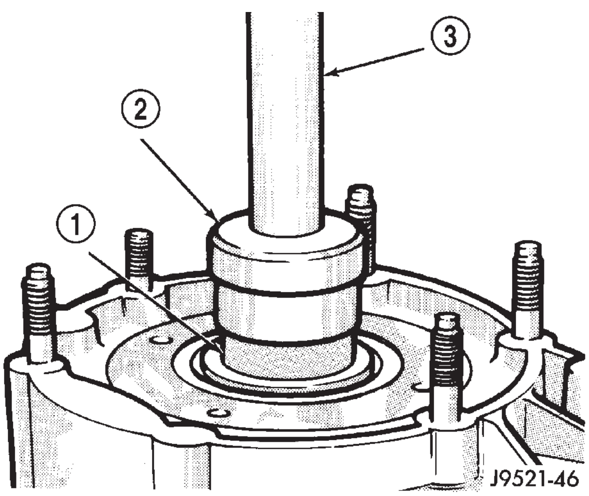


Fig. 39 Input And Low Range Gear Assembly Removal

1 - INPUT-LOW RANGE GEARS
2 - SPECIAL TOOL 7829-A
3 - SPECIAL TOOL C-4171

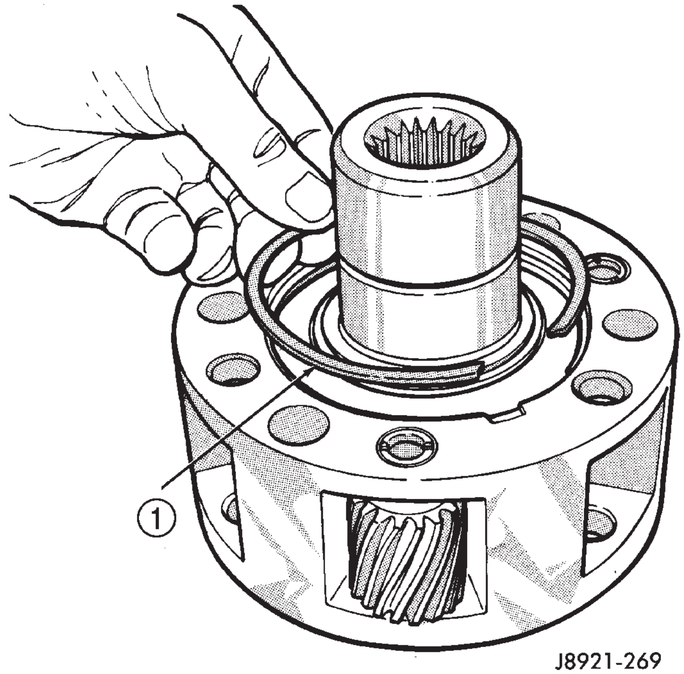


Fig. 40 Remove Low Range Gear Snap-Ring

1 - LOW RANGE GEAR SNAP-RING

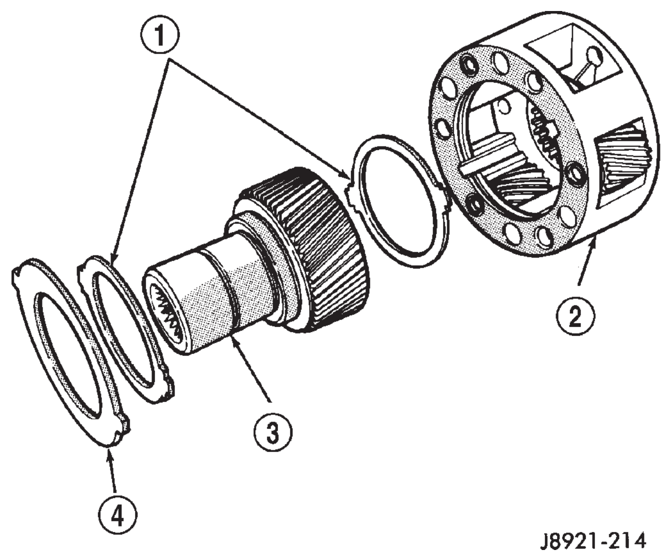


Fig. 41 Low Range And Input Gear Assembly

1 - THRUST WASHERS
2 - LOW RANGE GEAR
3 - INPUT GEAR
4 - RETAINER

TRANSFER CASE - NV242 (Continued)

(7) Inspect low range annulus gear (Fig. 42). **Gear is not a serviceable component. If damaged, replace gear and front case as assembly.**

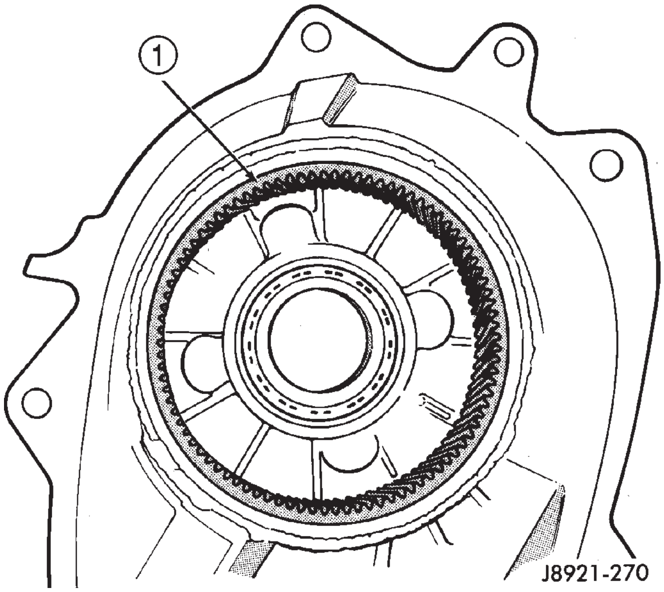


Fig. 42 Inspecting Low Range Annulus Gear

1 - LOW RANGE ANNULUS GEAR

(8) Remove oil seals from following components:
- front bearing retainer.
- rear retainer.
- oil pump.
- case halves.

DIFFERENTIAL

(1) Mark differential case halves for reference.
(2) Remove differential case bolts.
(3) Invert differential on workbench.
(4) Separate top case from bottom case. Use slots in case halves to pry them apart (Fig. 43).
(5) Remove thrust washers and planet gears from case pins (Fig. 44).
(6) Remove mainshaft and sprocket gears from bottom case (Fig. 45). Note gear position for reference before separating them.

CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

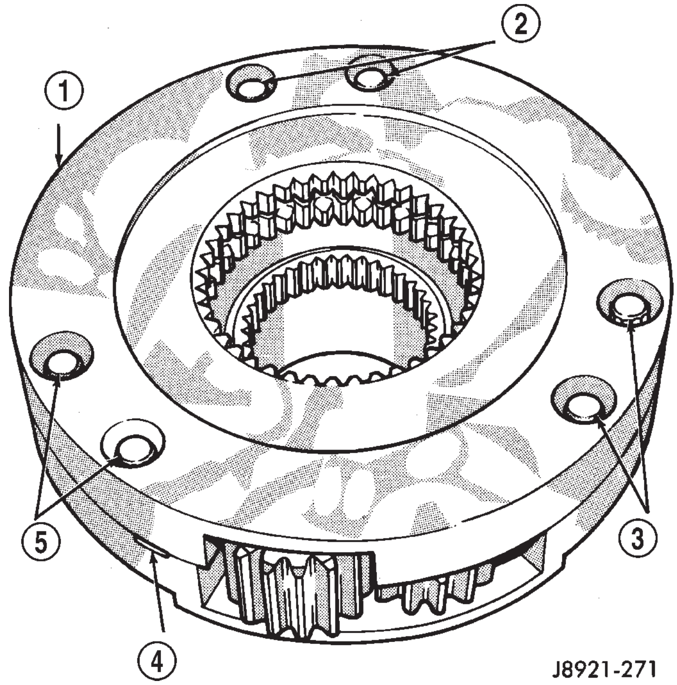


Fig. 43 Separating Differential Case Halves

1 - TOP CASE
2 - CASE BOLTS
3 - CASE BOLTS
4 - CASE SLOTS
5 - CASE BOLTS

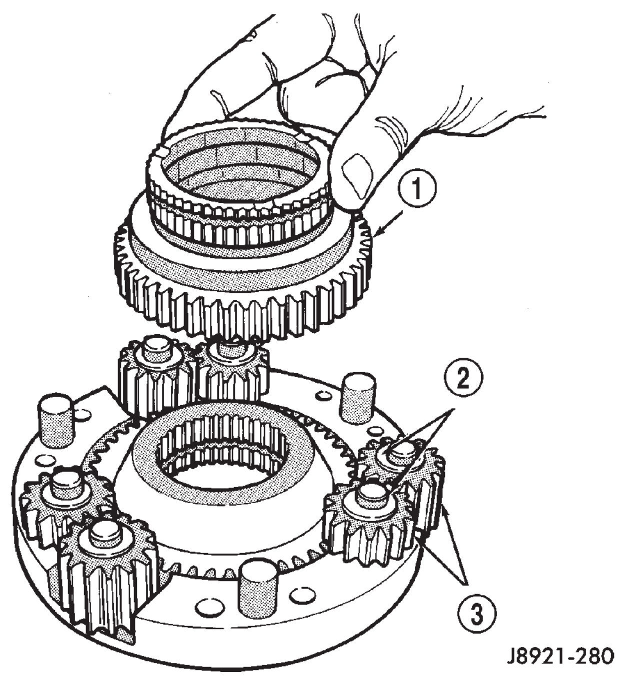


Fig. 44 Planet Gears And Thrust Washer Removal

1 - MAINSHAFT GEAR
2 - THRUST WASHERS (12)
3 - PLANET GEARS (6)

TRANSFER CASE - NV242 (Continued)

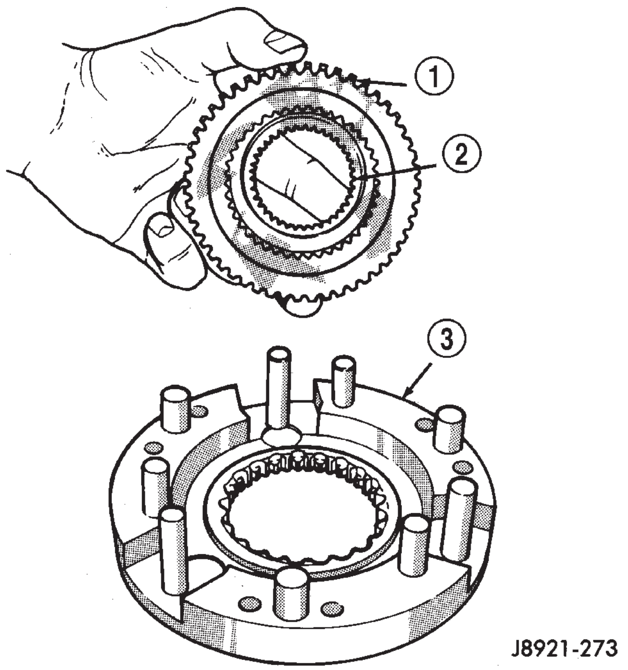


Fig. 45 Mainshaft And Sprocket Gear Removal

1 - MAINSHAFT GEAR
2 - SPROCKET GEAR
3 - BOTTOM CASE

INSPECTION

MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear (Fig. 46). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring and both thrust washers for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

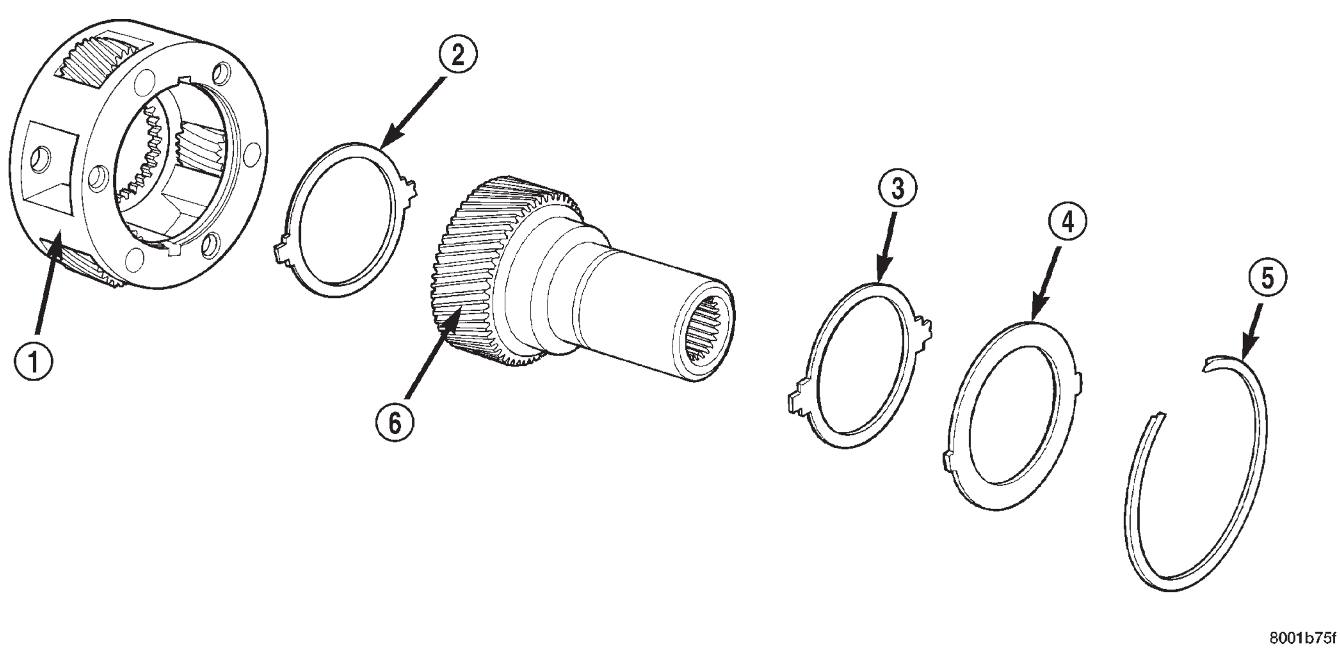


Fig. 46 Input Gear And Carrier Components

1 - PLANETARY CARRIER
2 - REAR THRUST WASHER
3 - FRONT THRUST WASHER
4 - CARRIER LOCK RING
5 - CARRIER LOCK RETAINING RING
6 - INPUT GEAR

TRANSFER CASE - NV242 (Continued)

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (Fig. 47). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

Inspect the shift fork wear pads. The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are also serviceable.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

REAR RETAINER/BEARING/ SEAL/SLINGER/BOOT

Inspect the retainer components (Fig. 48). Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

Replace the slinger and seal outright; do not reuse either part.

Replace any part if distorted, bent, or broken. Also replace the boot if cut or torn. Replace the boot band clamps, do not reuse them.

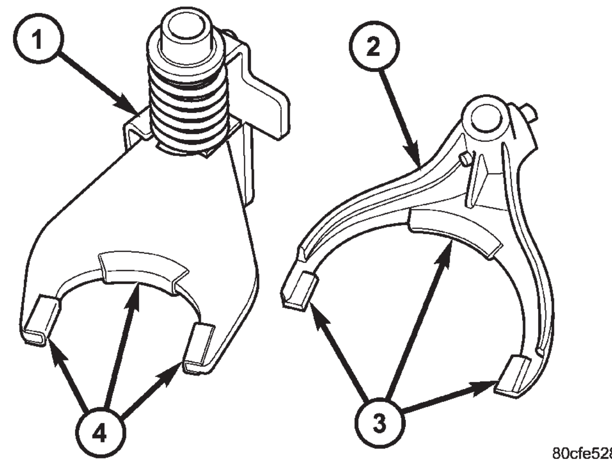


Fig. 47 Shift Fork And Wear Pad Locations

1 - MODE FORK
2 - RANGE FORK
3 - WEAR PADS (SERVICEABLE)
4 - WEAR PADS (SERVICEABLE)

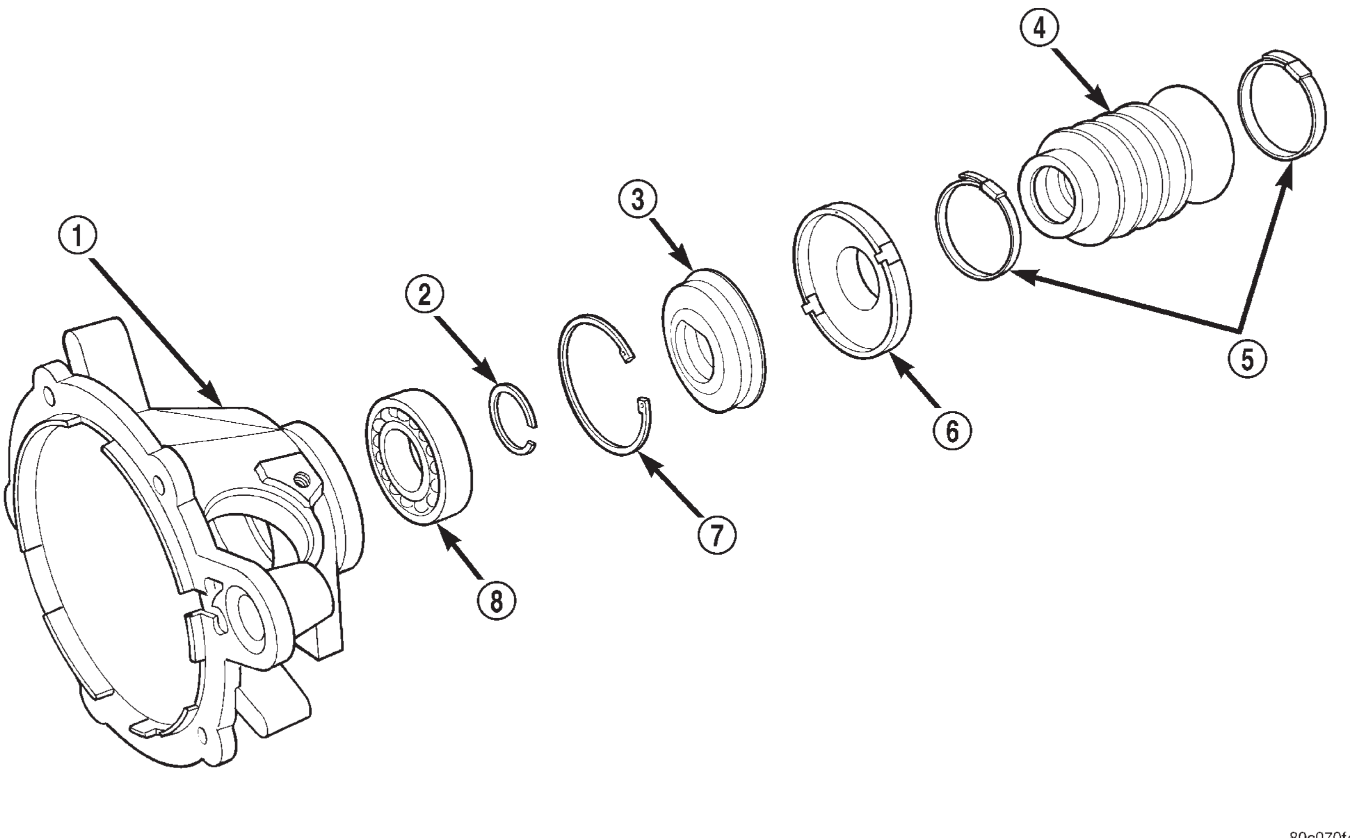


Fig. 48 Rear Retainer - Typical

1 - REAR RETAINER	5 - BAND CLAMPS
2 - REAR BEARING I.D. MAINSHAFT RETAINING RING	6 - REAR SLINGER
3 - REAR SEAL	7 - REAR BEARING O.D. RETAINING RING
4 - BOOT	8 - REAR BEARING

TRANSFER CASE - NV242 (Continued)

REAR OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces of the yoke slinger (Fig. 49). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320-400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

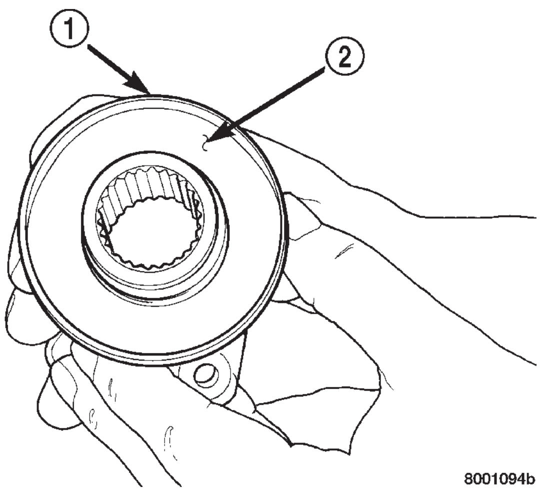


Fig. 49 Seal Contact Surface Of Yoke Slinger

1 - FRONT SLINGER (PART OF YOKE)
2 - SEAL CONTACT SURFACE MUST BE CLEAN AND SMOOTH

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (Fig. 50)

FRONT-REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and 3M all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

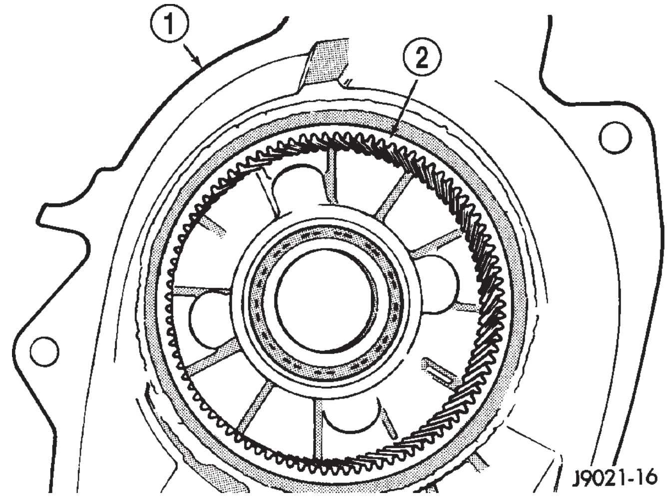


Fig. 50 Low Range Annulus Gear

1 - FRONT CASE
2 - LOW RANGE ANNULUS GEAR

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

ASSEMBLY

Lubricate transfer case components with automatic transmission fluid or petroleum jelly (where indicated) during assembly.

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

TRANSFER CASE - NV242 (Continued)

BEARING AND SEAL

(1) Remove snap-ring that retains front output shaft front bearing in case (Fig. 51). Then remove bearing. Use hammer handle, or hammer and brass punch to tap bearing out of case.

(2) Install new front output shaft front bearing with Tool Handle C-4171 and Installer 8033-A with the tapered cone upward (Fig. 52).

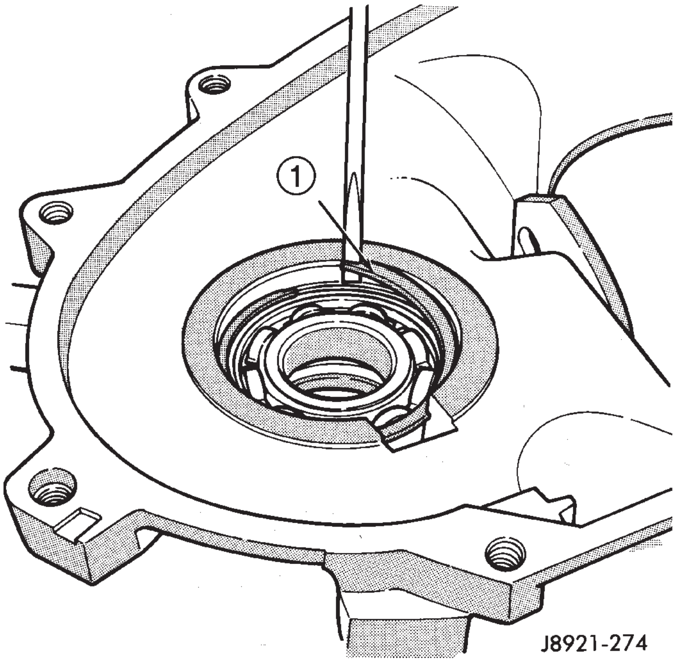


Fig. 51 Front Output Shaft Front Bearing Snap-Ring Removal

1 - FRONT BEARING SNAP-RING

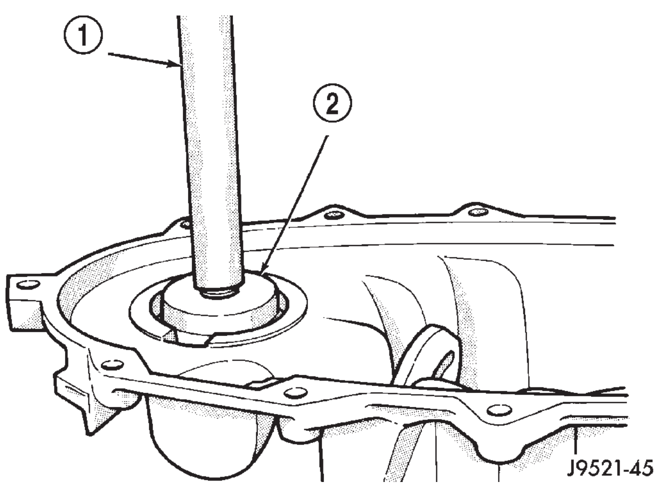


Fig. 52 Front Output Shaft Front Bearing Installation

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 8033-A

(3) Install front bearing snap-ring (Fig. 51).

(4) Remove front output shaft seal using an appropriate pry tool (Fig. 53) or slide-hammer mounted screw.

(5) Install new front output shaft oil seal with Installer 6952-A (Fig. 54).

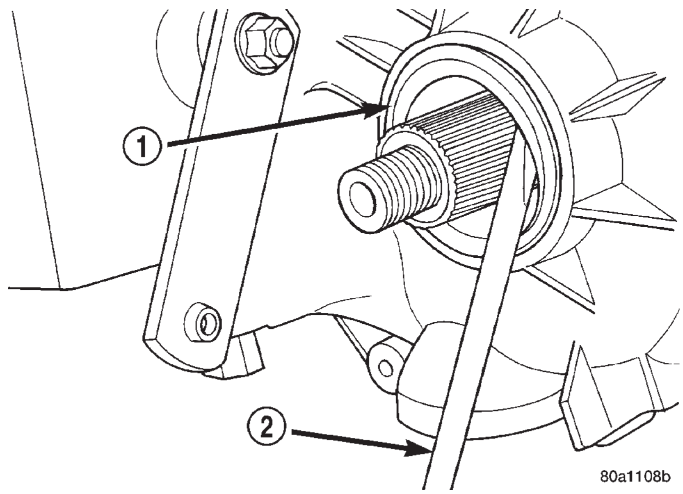


Fig. 53 Remove Front Output Shaft Seal

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

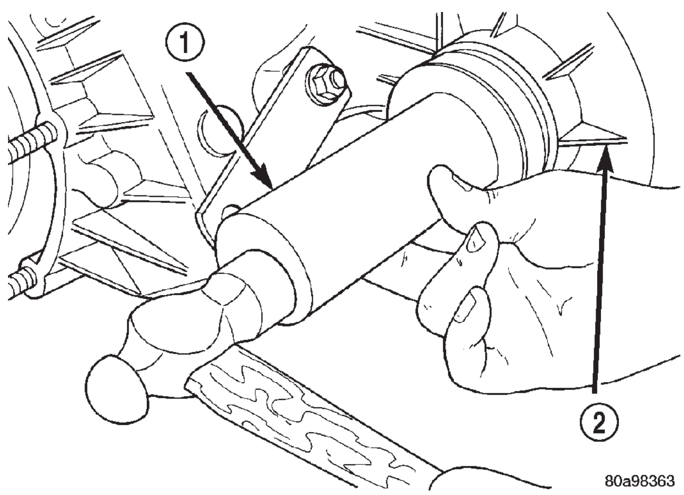


Fig. 54 Install Front Output Shaft Seal

1 - INSTALLER 6952-A
2 - TRANSFER CASE

TRANSFER CASE - NV242 (Continued)

(6) Remove input gear bearing with Tool Handle C-4171 and Remover C-4210 (Fig. 55).

(7) Install snap-ring on new input gear bearing.

(8) Install new input gear bearing with Tool Handle C-4171 and Remover C-4210. Install bearing far enough to seat snap-ring against case (Fig. 56).

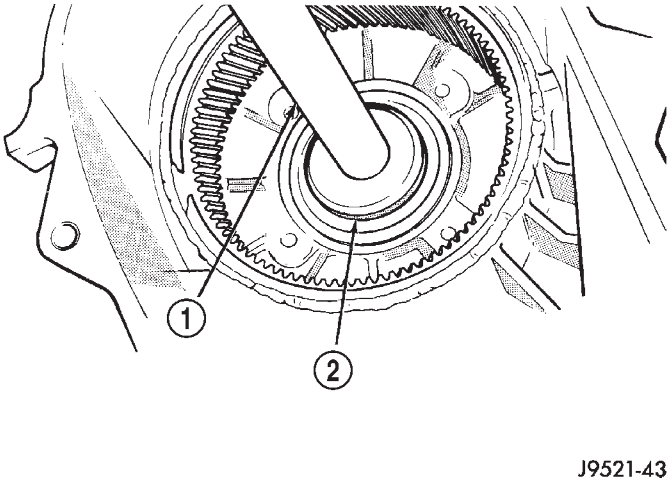


Fig. 55 Input Gear Bearing Removal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL C-4210

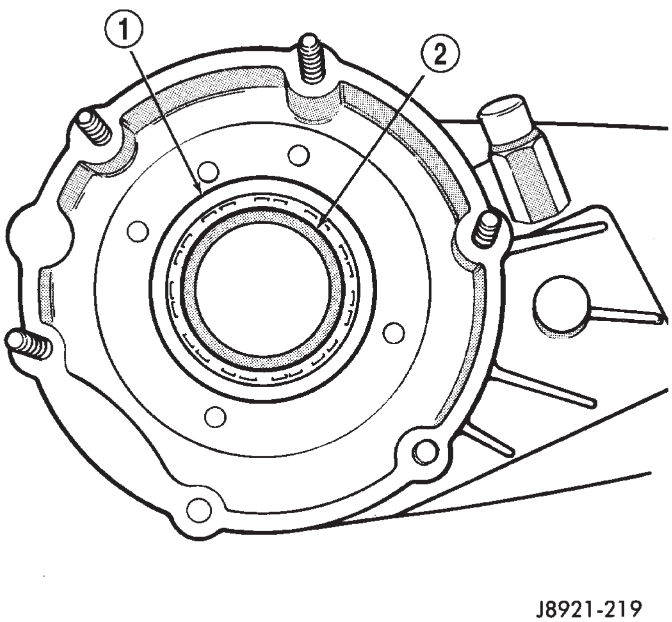


Fig. 56 Seating Input Gear Bearing

1 - SNAP-RING
2 - INPUT SHAFT BEARING

(9) Remove the input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 57).

(10) Install new pilot bearing with Installer 8128 and Handle C-4171 (Fig. 58).

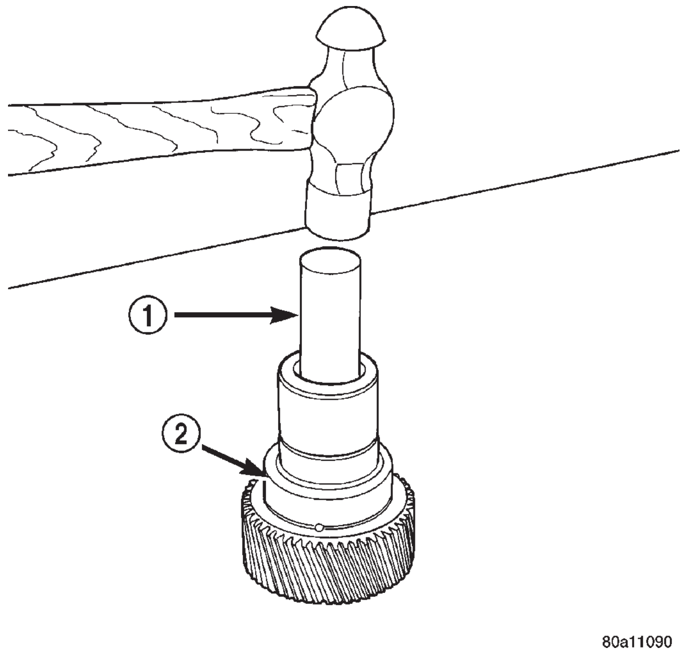


Fig. 57 Remove Input Gear Pilot Bearing

1 - DRIFT
2 - INPUT GEAR

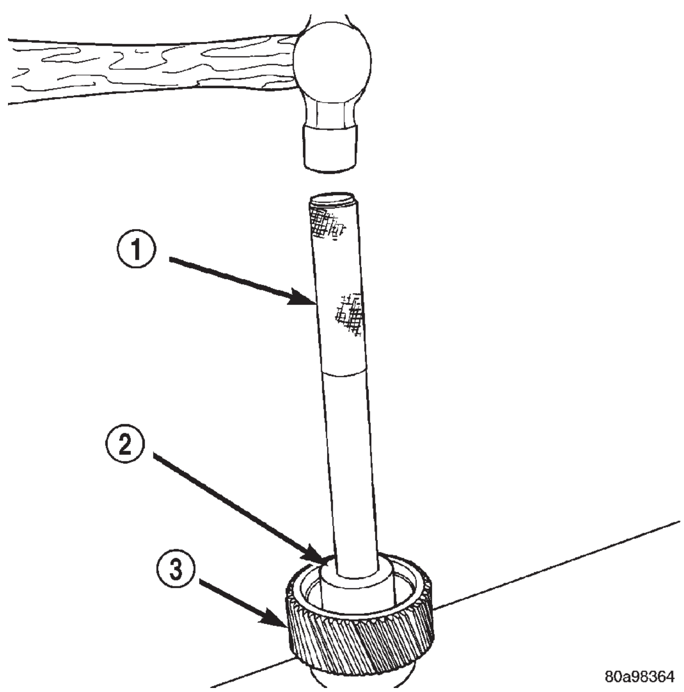


Fig. 58 Install Input Gear Pilot Bearing

1 - HANDLE C-4171
2 - INSTALLER 8128
3 - INPUT GEAR

TRANSFER CASE - NV242 (Continued)

(11) Install new seal in front bearing retainer with Installer 7884 (Fig. 59).

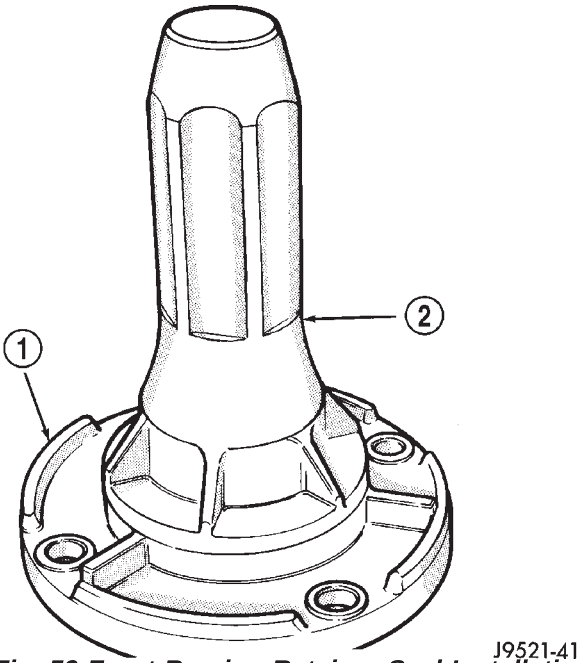


Fig. 59 Front Bearing Retainer Seal Installation

1 - FRONT BEARING RETAINER
2 - SPECIAL TOOL 7884

(12) Remove output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 60).

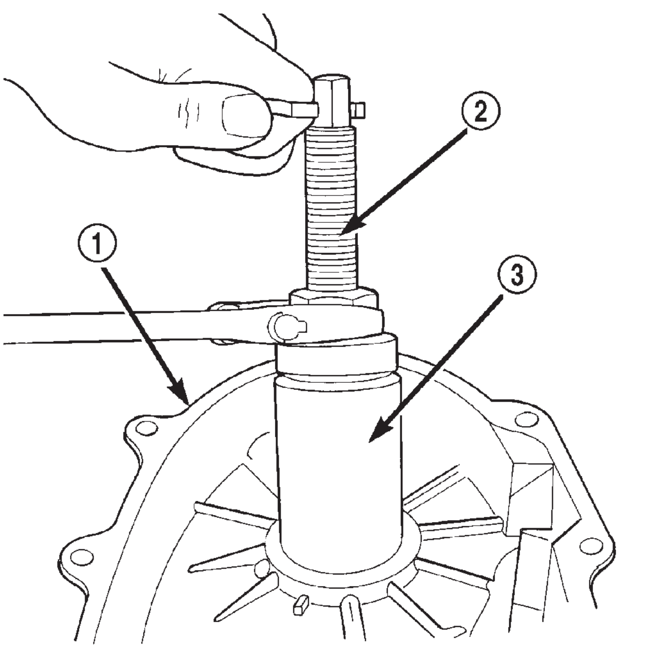


Fig. 60 Remove Front Output Shaft Rear Bearing

1 - REAR CASE
2 - SPECIAL TOOL L-4454-1 AND L-4454-3
3 - SPECIAL TOOL 8148

(13) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 61). Lubricate bearing after installation.

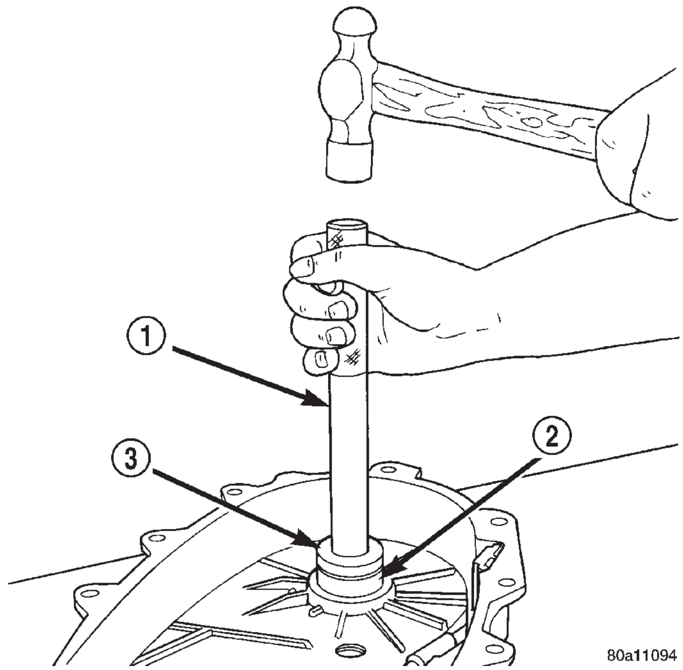


Fig. 61 Install Front Output Shaft Rear Bearing

1 - HANDLE C-4171
2 - OUTPUT SHAFT INNER BEARING
3 - INSTALLER 5066

(14) Install new seal in oil pump feed housing with Special Tool 7888 (Fig. 62).

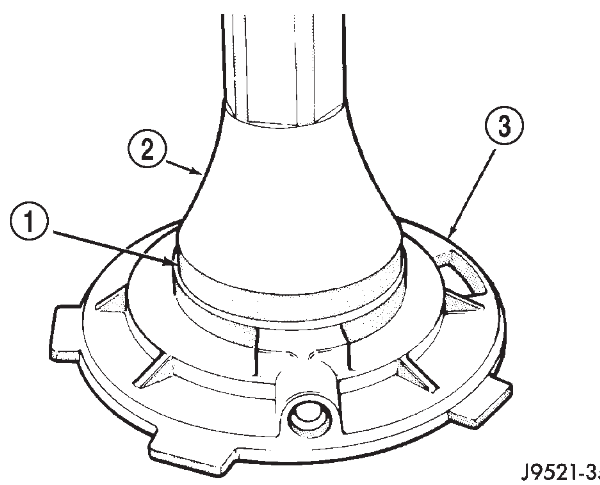


Fig. 62 Oil Pump Seal Installation

1 - HOUSING SEAL
2 - SPECIAL TOOL 7888
3 - OIL PUMP FEED HOUSING

TRANSFER CASE - NV242 (Continued)

(15) Install new pickup tube O-ring in oil pump (Fig. 63).

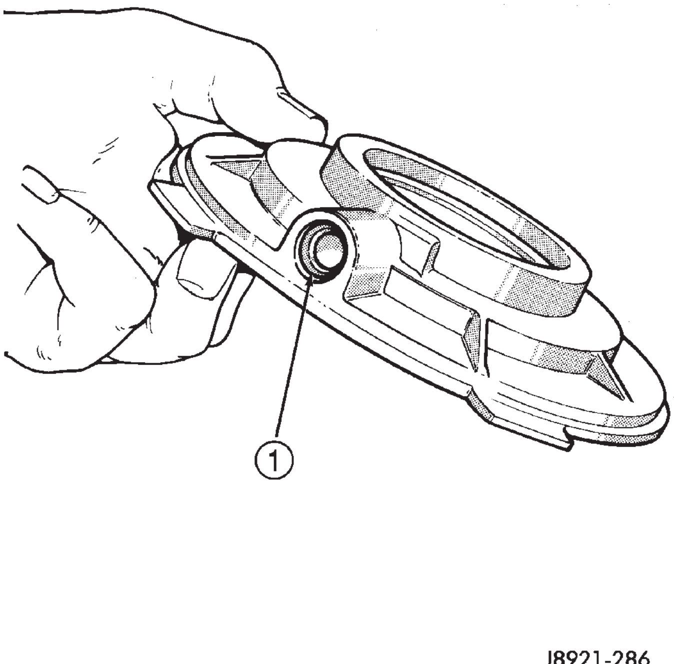


Fig. 63 Pickup Tube O-Ring Installation

1 - PICKUP TUBE O-RING

(16) Remove rear retainer bearing with Installer 8128 and Handle C-4171, NV242HD only.

(17) Install rear bearing in retainer with Handle C-4171 and Installer 5064 (Fig. 64), NV242HD only.

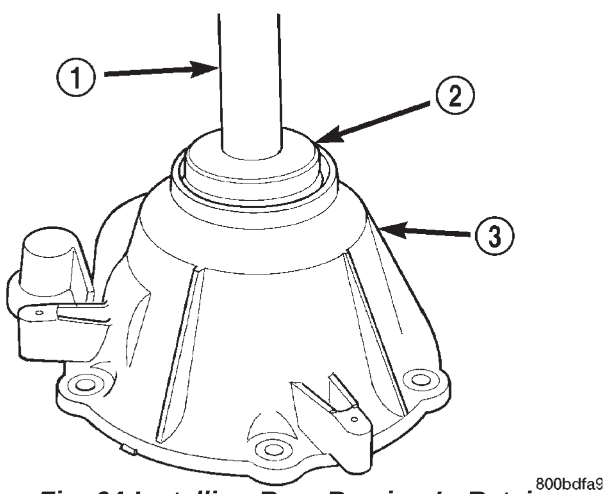


Fig. 64 Installing Rear Bearing In Retainer

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 5064
3 - REAR RETAINER

DIFFERENTIAL

(1) Lubricate differential components with automatic transmission fluid.

(2) Install sprocket gear in differential bottom case (Fig. 65).

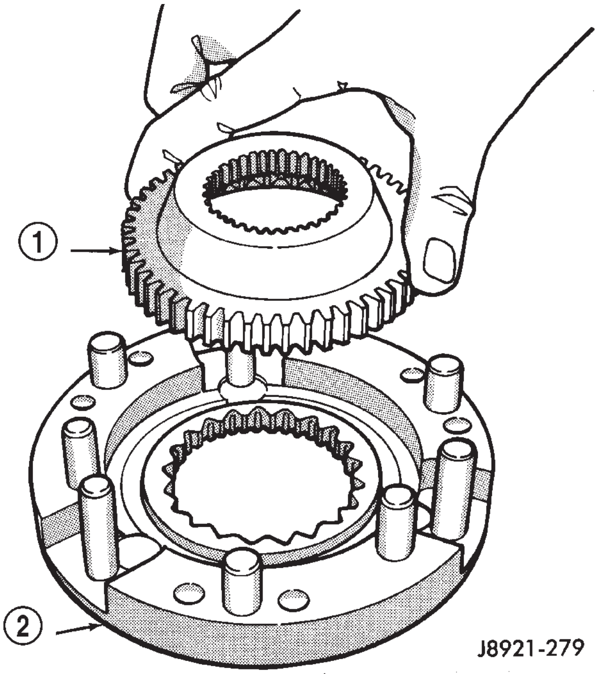


Fig. 65 Installing Differential Sprocket Gear

1 - SPROCKET GEAR
2 - BOTTOM CASE

(3) Install differential planet gears and new thrust washers (Fig. 66). **Be sure thrust washers are installed at top and bottom of each planet gear.**

(4) Install differential mainshaft gear (Fig. 66).

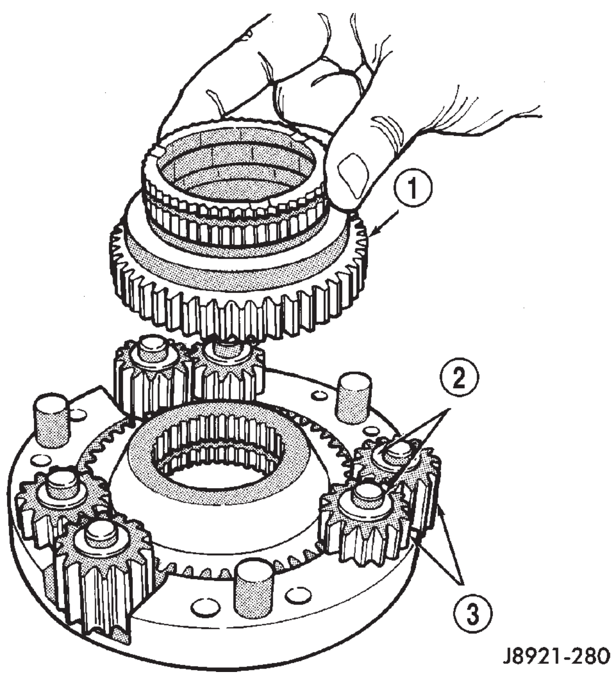


Fig. 66 Installing Mainshaft And Planet Gears

1 - MAINSHAFT GEAR
2 - THRUST WASHERS (12)
3 - PLANET GEARS (6)

(5) Align and position differential top case on bottom case (Fig. 67). Align using scribe marks made at disassembly.

(6) While holding differential case halves together, invert the differential and start the differential case bolts.

(7) Tighten differential case bolts to specified torque.

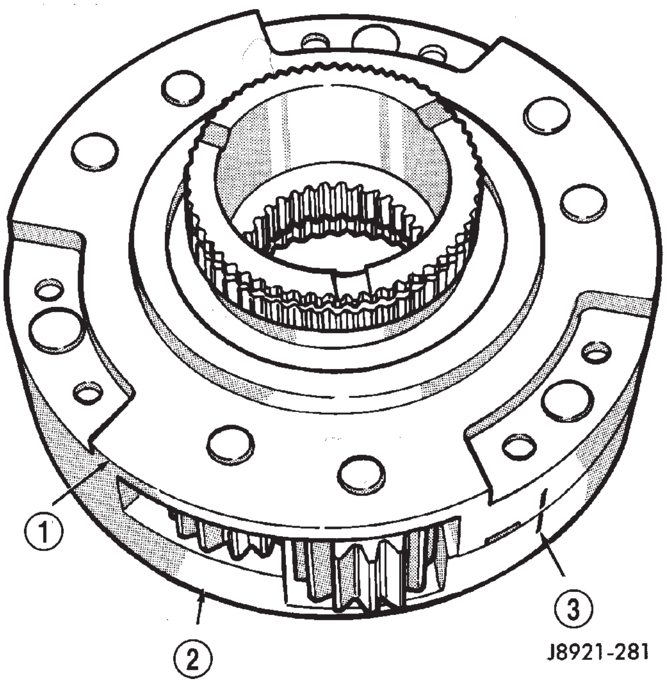


Fig. 67 Differential Case Assembly

1 - TOP CASE
2 - BOTTOM CASE
3 - CASE ALIGNMENT MARKS

INPUT GEAR/LOW RANGE ASSEMBLY

(1) Assemble low range gear, input gear thrust washers, input gear and input gear retainer (Fig. 68).

(2) Install low range gear snap ring (Fig. 69).

(3) Lubricate input gear and low range gears with automatic transmission fluid.

(4) Start input gear shaft into front case bearing.

(5) Press input gear shaft into front bearing.

(6) Install new input gear snap ring (Fig. 70).

(7) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to seal surface of front bearing retainer.

(8) Install front bearing retainer (Fig. 71). Tighten retainer bolts to 16 ft. lbs. (21 N·m) torque.

SHIFT FORKS, SECTOR, AND MAINSHAFT

(1) Install the shift sector shaft o-ring and bushing.

(2) Install shift sector.

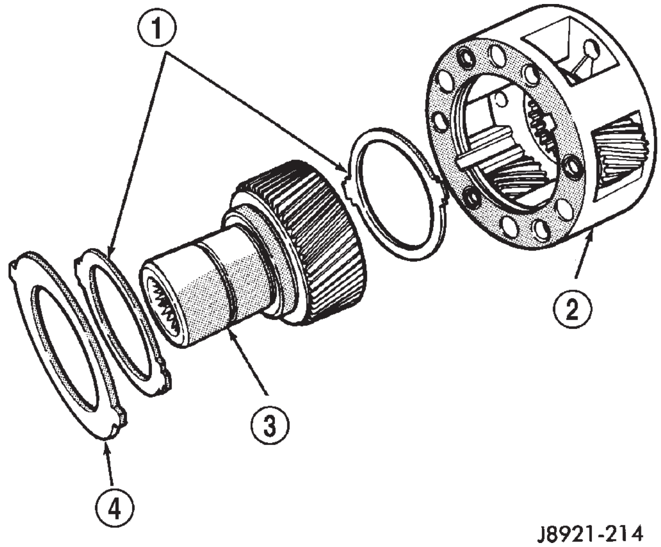


Fig. 68 Low Range And Input Gear Assembly

1 - THRUST WASHERS
2 - LOW RANGE GEAR
3 - INPUT GEAR
4 - RETAINER

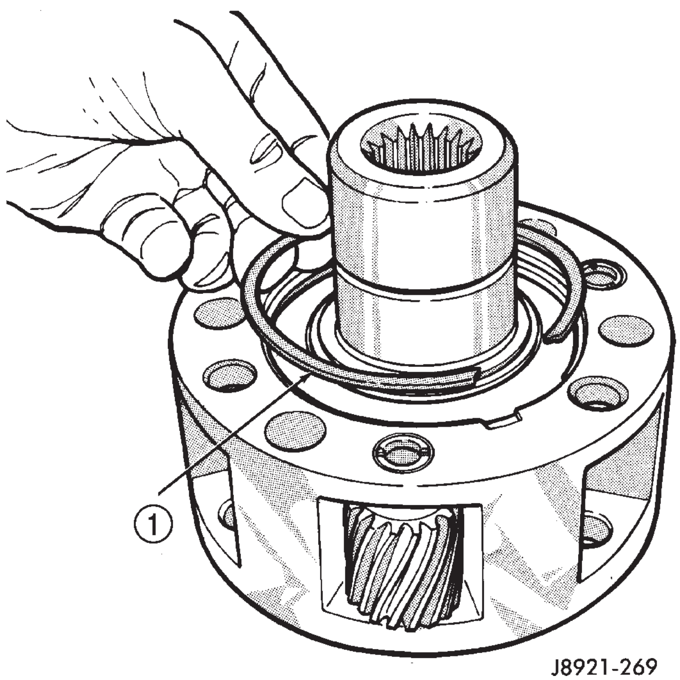


Fig. 69 Install Low Range Gear Snap-Ring

1 - LOW RANGE GEAR SNAP-RING

(3) Install new pads on low range fork, if necessary.

(4) Assemble low range fork and sleeve.

TRANSFER CASE - NV242 (Continued)

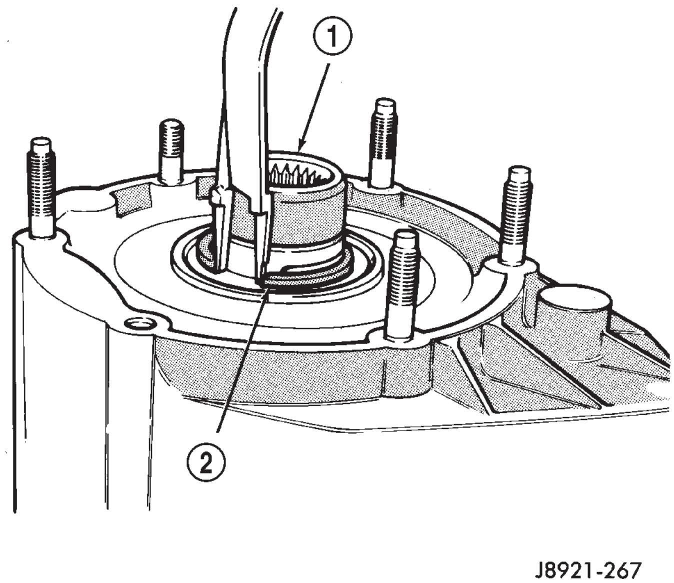


Fig. 70 Input Gear Snap-Ring Installation

1 - INPUT GEAR
2 - SNAP-RING

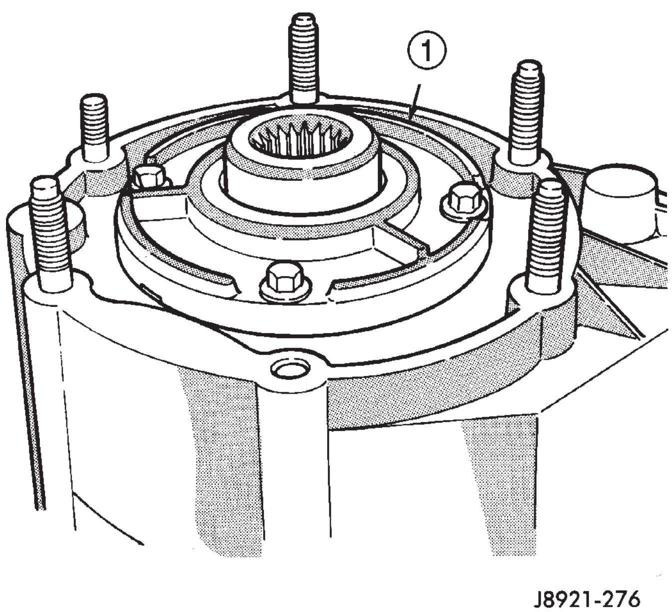


Fig. 71 Installing Front Bearing Retainer

1 - FRONT BEARING RETAINER

(5) Position low range fork and sleeve in case. Be sure low range fork pin is engaged in shift sector slot.

(6) Install first mainshaft bearing spacer on mainshaft (Fig. 72).

(7) Install bearing rollers on mainshaft (Fig. 72). Coat bearing rollers with generous quantity of petroleum jelly to hold them in place.

(8) Install remaining bearing spacer on mainshaft (Fig. 72). Do not displace any bearings while installing spacer.

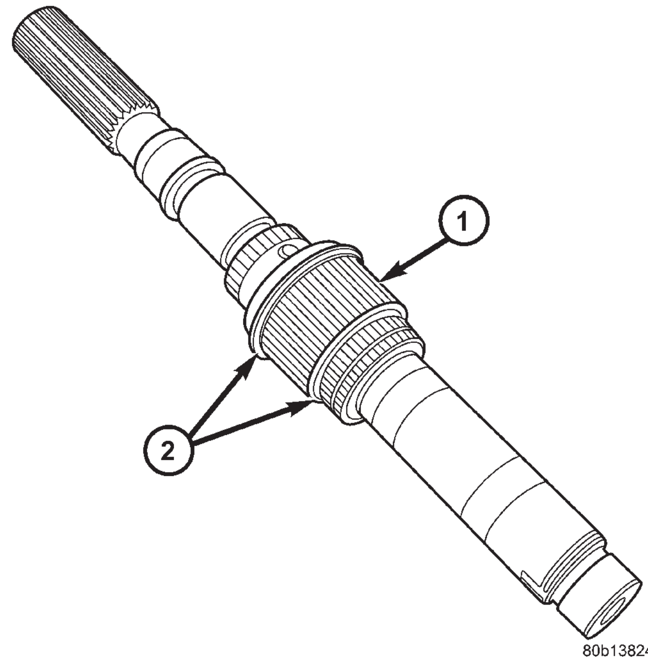


Fig. 72 Installing Mainshaft Bearing Rollers and Spacers

1 - MAINSHAFT BEARING ROLLERS
2 - BEARING SPACERS

(9) Install differential (Fig. 73). Do not displace mainshaft bearings when installing differential.

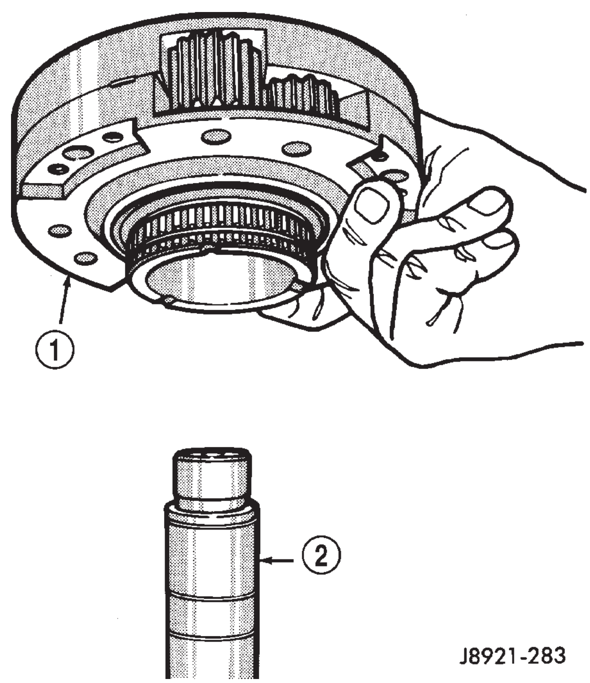


Fig. 73 Differential Installation

1 - DIFFERENTIAL
2 - MAINSHAFT

TRANSFER CASE - NV242 (Continued)

(10) Install differential snap-ring (Fig. 74).

(11) Install intermediate clutch shaft (Fig. 75).

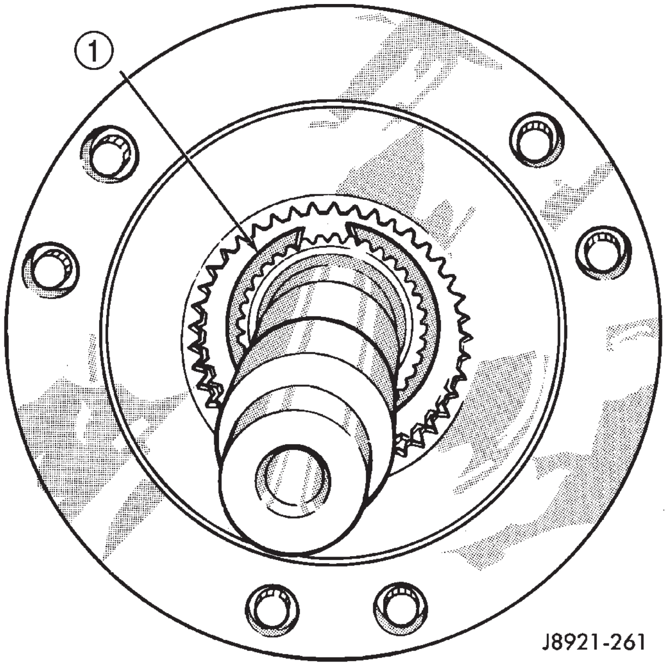


Fig. 74 Installing Differential Snap-Ring

1 - DIFFERENTIAL SNAP-RING

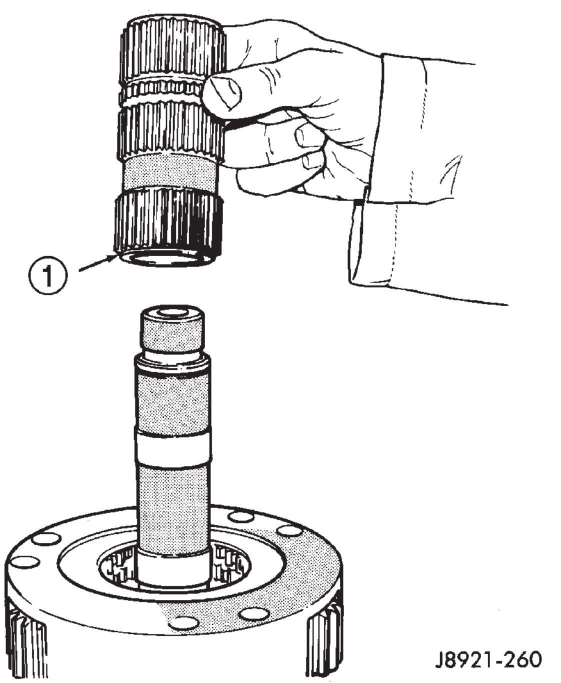


Fig. 75 Installing Intermediate Clutch Shaft

1 - INTERMEDIATE CLUTCH SHAFT

(12) Install clutch shaft thrust washer (Fig. 76).

(13) Install clutch shaft snap-ring (Fig. 77).

(14) Inspect mode fork assembly (Fig. 78). Replace pads and bushing if necessary. Replace fork tube if bushings inside tube are worn or damaged. Also check springs and slider bracket (Fig. 78). Replace worn, damaged components.

Fig. 76 Installing Clutch Shaft Thrust Washer

1 - CLUTCH SHAFT THRUST RING

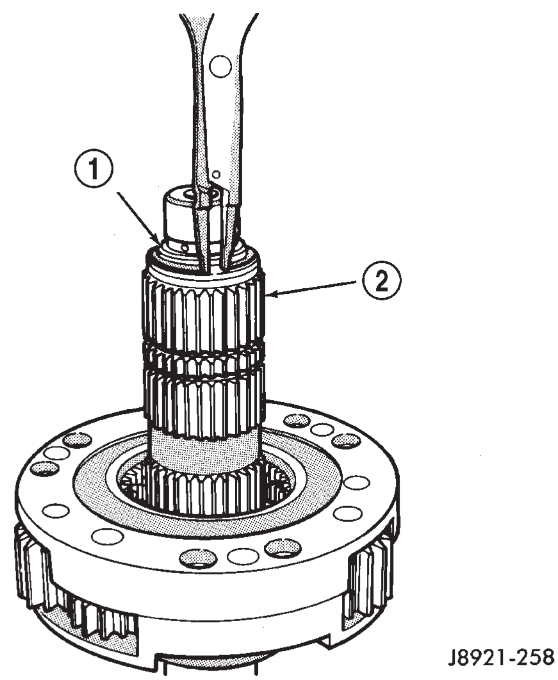


Fig. 77 Installing Clutch Shaft Snap-Ring

1 - SNAP-RING

2 - INTERMEDIATE CLUTCH SHAFT

TRANSFER CASE - NV242 (Continued)

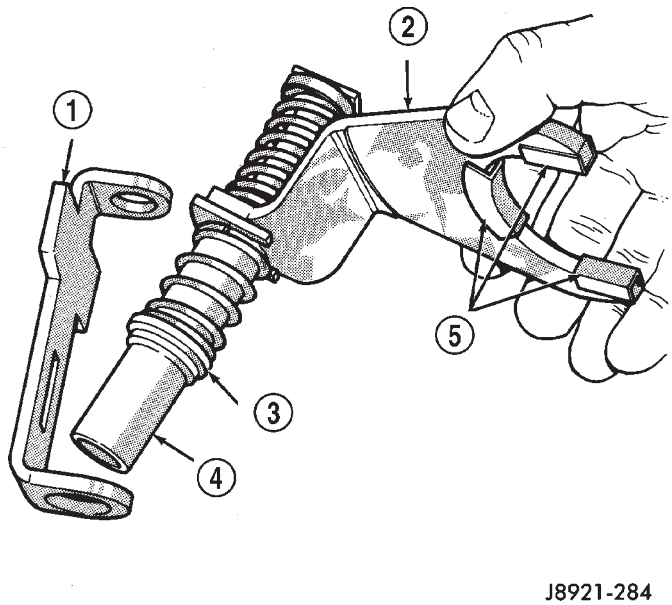


Fig. 78 Mode Fork Assembly Inspection

1 - SLIDER
2 - MODE FORK
3 - BUSHING/SPRING
4 - TUBE
5 - PADS

(15) Install mode sleeve in mode fork (Fig. 79). Then install assembled sleeve and fork on mainshaft. Be sure mode sleeve splines are engaged in differential splines.

(16) Install mode fork and mainshaft assembly in case (Fig. 80). Rotate mainshaft slightly to engage shaft with low range gears.

(17) Rotate mode fork pin into shift sector slot.

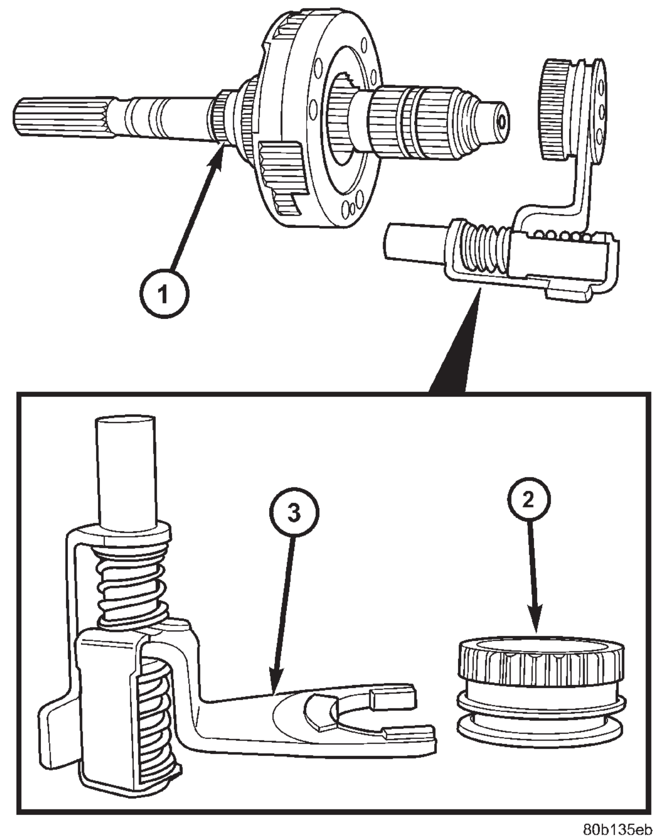


Fig. 79 Installing Mode Fork And Sleeve

1 - MAINSHAFT
2 - MODE SLEEVE
3 - MODE FORK ASSEMBLY

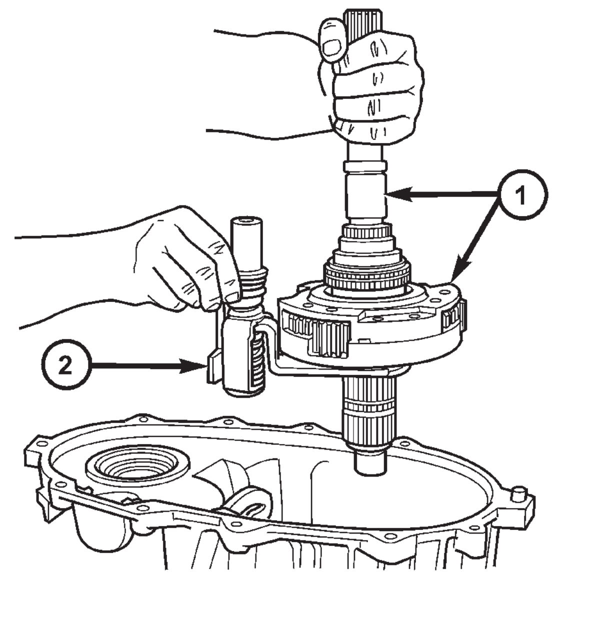


Fig. 80 Assembled Mainshaft And Mode Fork Installation

1 - MAINSHAFT ASSEMBLY
2 - MODE FORK

TRANSFER CASE - NV242 (Continued)

(18) Install shift rail (Fig. 81). Be sure rail is seated in both shift forks.

(19) Rotate shift sector to align lockpin hole in low range fork with access hole in case.

(20) Insert an easy-out in range fork lockpin to hold it securely for installation (Fig. 82). Lockpin is slightly tapered on one end. Insert tapered end into fork and rail.

(21) Insert lockpin through access hole and into shift fork (Fig. 82). Then remove easy-out and seat the pin with pin punch.

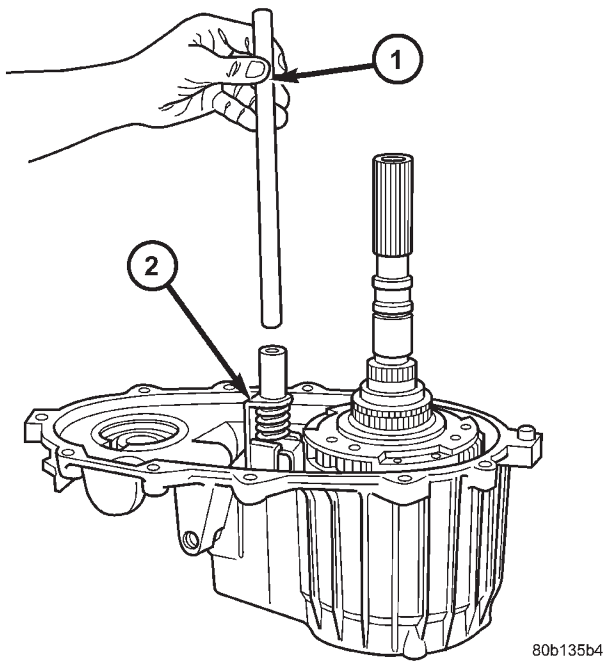


Fig. 81 Shift Rail Installation

1 - SHIFT RAIL
2 - MODE FORK

(22) Install plug in lockpin access hole.

(23) Install detent plunger, detent spring and detent plug in case (Fig. 83).

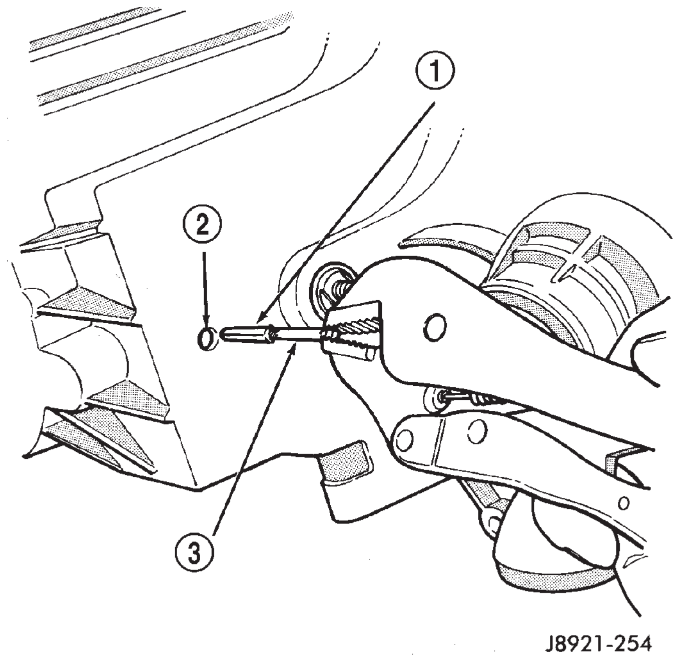


Fig. 82 Installing Low Range Fork Lockpin

1 - LOW RANGE FORK LOCK PIN
2 - ACCESS HOLE
3 - EASY-OUT

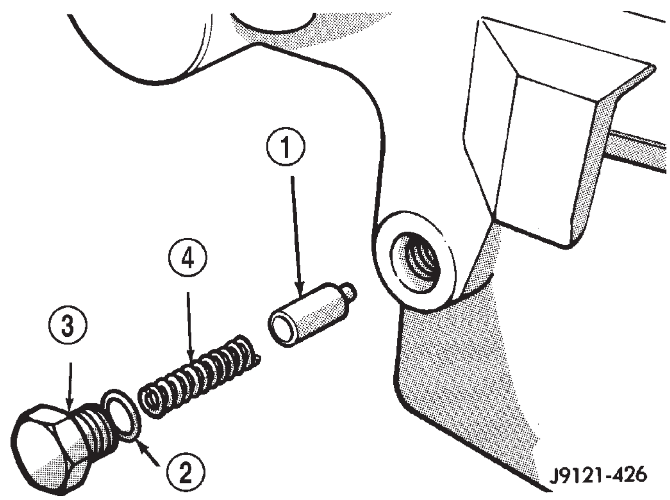


Fig. 83 Detent Pin, Spring And Plug Installation

1 - PLUNGER
2 - O-RING
3 - PLUG
4 - SPRING

TRANSFER CASE - NV242 (Continued)

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Install front output shaft (Fig. 84).

(2) Install drive chain (Fig. 84). Engage chain with front output shaft sprocket teeth.

(3) Install drive sprocket (Fig. 84). Engage drive sprocket teeth with chain. Then engage sprocket splines with mainshaft splines.

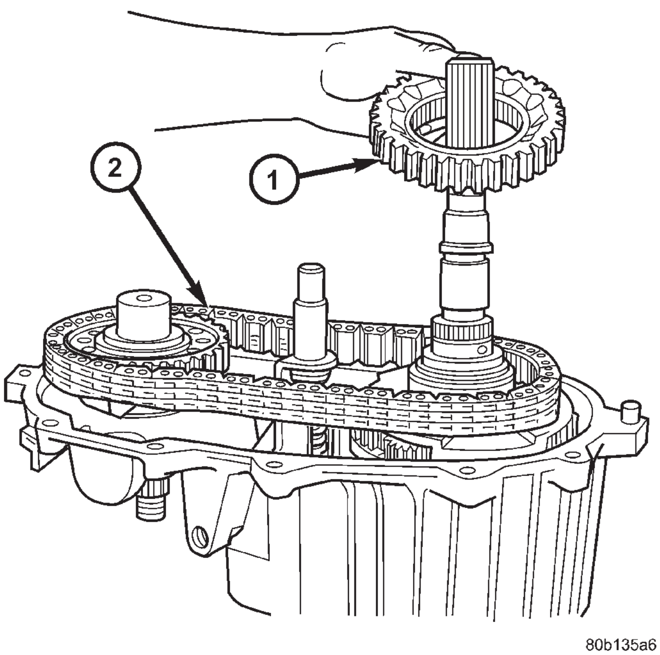


Fig. 84 Drive Chain And Sprocket Installation

1 - DRIVE SPROCKET
2 - DRIVE CHAIN

(4) Install drive sprocket snap-ring (Fig. 85).

OIL PUMP AND REAR CASE

(1) Insert oil pickup tube in oil pump and attach oil screen and connector hose to pickup tube. Then install assembled pump, tube and screen in rear case (Fig. 86). Be sure screen is seated in case slot as shown.

(2) Install magnet in front case pocket (Fig. 87).

(3) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to seal surface of front case.

(4) Align and install rear case on front case. Be sure case locating dowels are in place and that mainshaft splines are engaged in oil pump inner gear.

(5) Install and tighten front case-to-rear case bolts to 41 N·m (30 ft. lbs.) torque. **Be sure to install a washer under each bolt used at case dowel locations.**

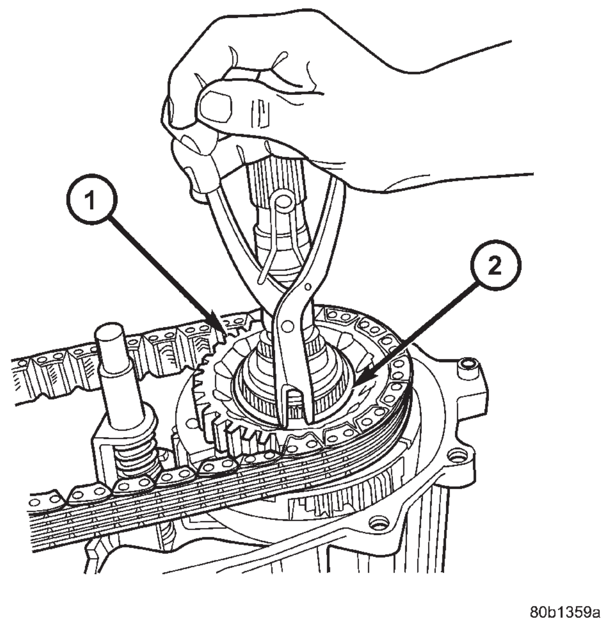


Fig. 85 Drive Sprocket Snap-Ring Installation

1 - DRIVE SPROCKET
2 - DRIVE SPROCKET SNAP-RING

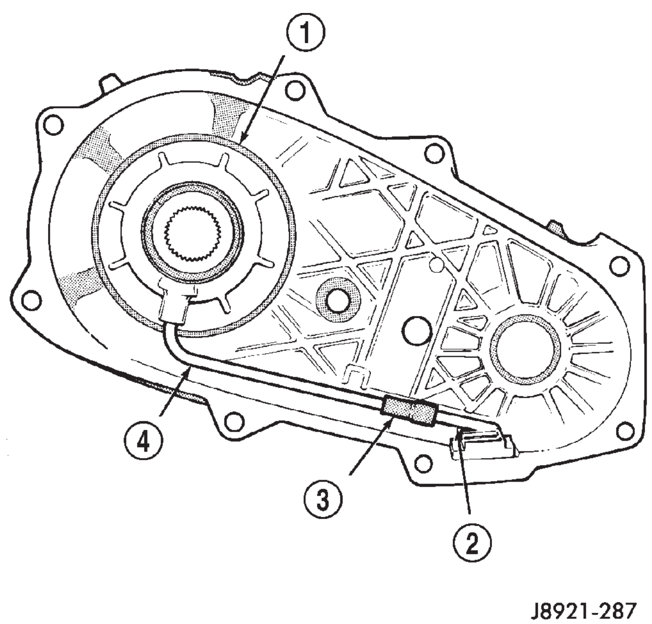


Fig. 86 Oil Screen And Pickup Tube Installation

1 - OIL PUMP
2 - OIL SCREEN
3 - CONNECTOR
4 - PICKUP TUBE

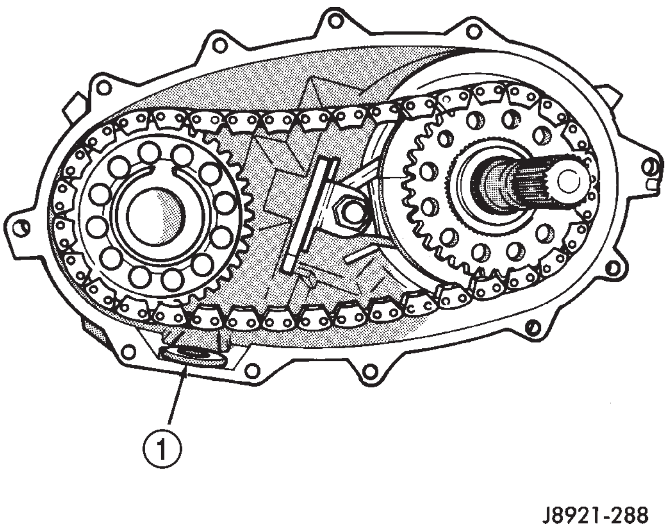


Fig. 87 Installing Case Magnet

1 - MAGNET

REAR RETAINER - NV242LD

(1) Apply bead of Mopar® Sealer, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 in.

(2) Install rear retainer on rear case. Tighten retainer bolts to 20-27 N·m (15-20 ft. lbs.) torque.

(3) Install rear bearing I.D. retaining ring and spacer on output shaft.

(4) Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.

(5) Slide seal onto Seal Protector 6992 (Fig. 88). Slide seal protector and seal onto output shaft.

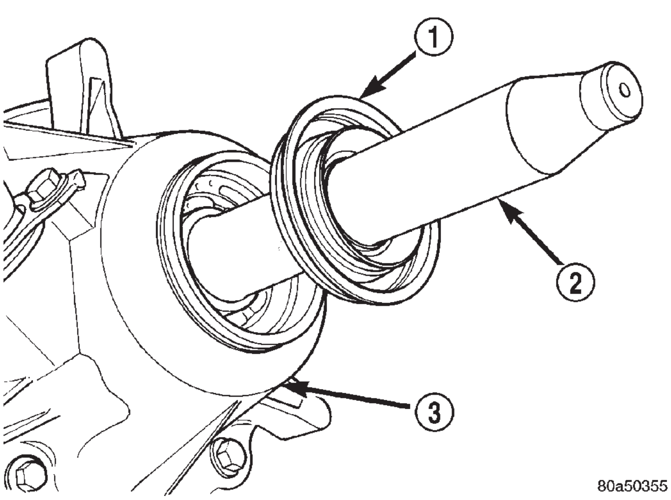


Fig. 88 Output Shaft Seal and Protector

1 - OUTPUT SHAFT SEAL
2 - SPECIAL TOOL 6992
3 - TRANSFER CASE

(6) Slide Installer C-4076-B onto seal protector with the recessed side of the tool toward the seal. Drive seal into rear bearing retainer with Installer C-4076-B and Handle MD-998323 (Fig. 89).

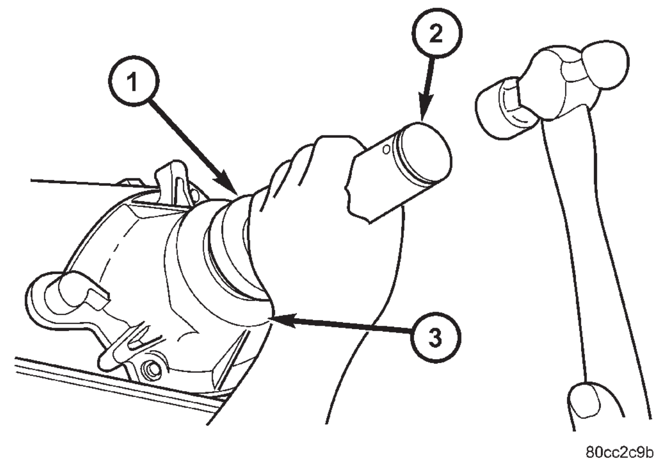


Fig. 89 Rear Seal Installation

1 - SPECIAL TOOL 8691
2 - HANDLE
3 - TRANSFER CASE

(7) Install rear slinger with Installer 8408.

(8) Install boot on output shaft slinger and crimp retaining clamp with tool C-4975-A (Fig. 90).

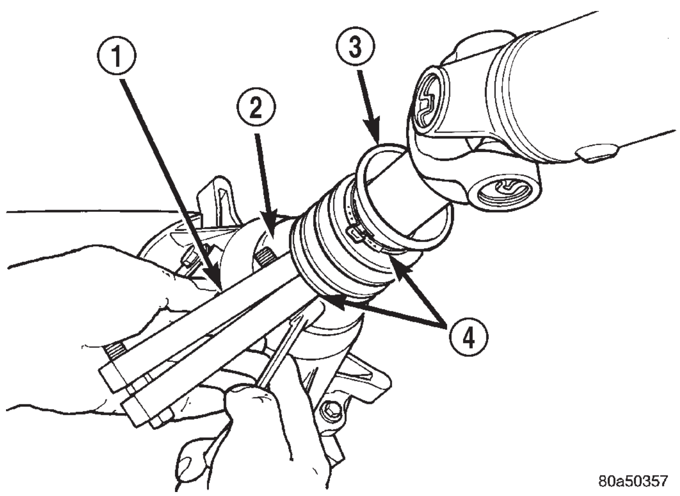


Fig. 90 Slinger Boot Installation

1 - SPECIAL TOOL C-4975-A
2 - SLINGER
3 - BOOT
4 - CLAMP

TRANSFER CASE - NV242 (Continued)

NV242HD REAR RETAINER

(1) Apply bead of Mopar® Sealer, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 in.

(2) Install rear retainer on rear case. Tighten retainer bolts to 20-27 N·m (15-20 ft. lbs.) torque.

(3) Install new output shaft bearing snap-ring (Fig. 91). Lift mainshaft slightly to seat snap-ring in shaft groove, if necessary.

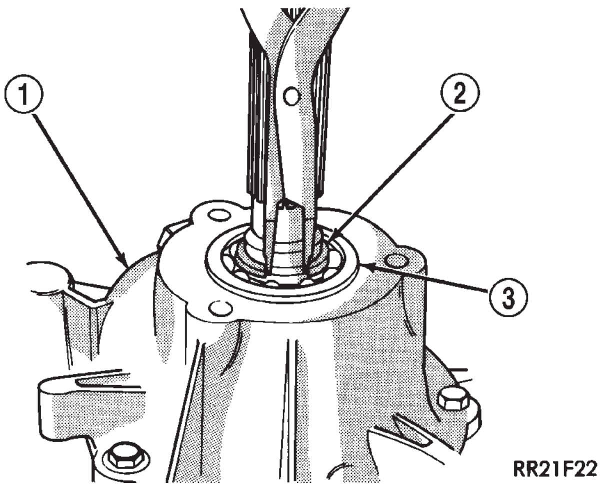


Fig. 91 Install Output Bearing Snap-ring

1 - REAR RETAINER
2 - SNAP-RING
3 - REAR BEARING

(4) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting surface of extension housing. Allow sealer to set-up slightly before proceeding.

(5) Install extension housing on rear retainer.

(6) Install extension housing bolts and tighten to 35-46 N·m (26-34 ft. lbs.).

COMPANION FLANGE

(1) Lubricate companion flange hub with transmission fluid and install flange on front shaft.

(2) Install new seal washer on front shaft.

(3) Install flange on front shaft and tighten nut to 122-176 N·m (90-130 ft. lbs.).

INSTALLATION

(1) Mount transfer case on a transmission jack.

(2) Secure transfer case to jack with chains.

(3) Position transfer case under vehicle.

(4) Align transfer case and transmission shafts and install transfer case on transmission.

(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 4).

(6) Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

(7) Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.

(8) Install rear crossmember and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(9) Remove transmission jack and support stand.

(10) Connect shift rod to transfer case range lever.

(11) Connect transfer case vent hose and transfer case position sensor.

(12) Adjust transfer case shift cable.

(13) Lower vehicle and verify transfer case shift operation.

TRANSFER CASE - NV242 (Continued)

SPECIFICATIONS

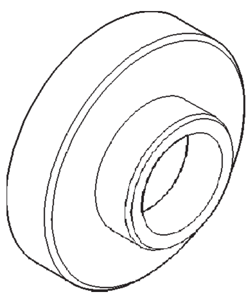
TRANSFER CASE - NV242

TORQUE SPECIFICATIONS

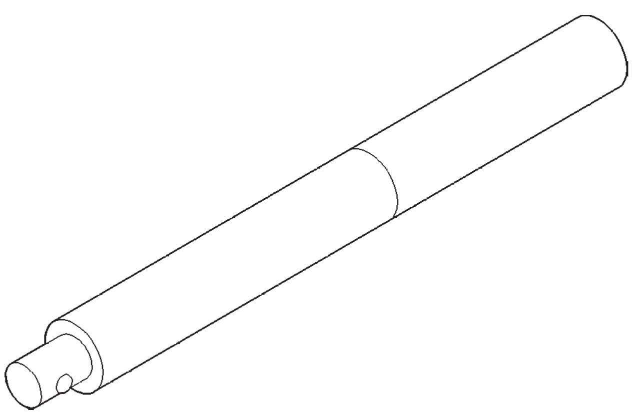
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-24	11.8-17.7	-
Bolt, Diff. Case	17-27	12.5-19.9	-
Plug, Drain/Fill	20-34	15-25	-
Bolt, Front Brg. Retainer	16-27	11.8-19.9	-
Bolt, Case Half	35-46	25.8-33.9	-
Nut, Front Yoke	122-176	90-130	-
Screw, Oil Pump	1.2-1.8	-	12-15
Nut, Range Lever	27-34	19.9-25	-
Bolt, Rear Retainer	35-46	25.8-33.9	-
Nuts, Mounting	35	25.8	-
Bolts, U-Joint	19	14	-

SPECIAL TOOLS

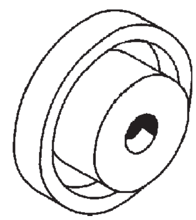
TRANSFER CASE - NV242



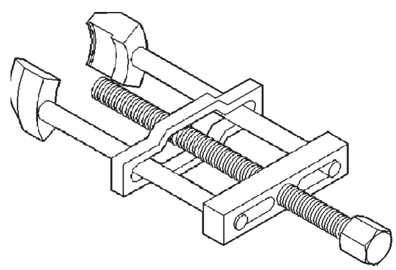
Installer, Seal - C-4076-B



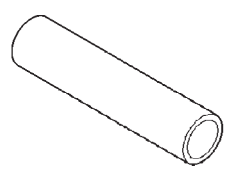
Handle, Universal - C-4171



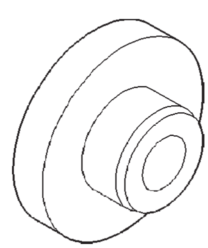
Remover, Bearing - C-4210



Puller, Slinger - MD-998056-A

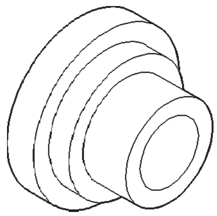


Installer - MD-998323

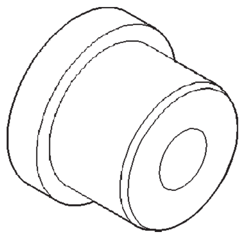


Installer, Bearing - 5064

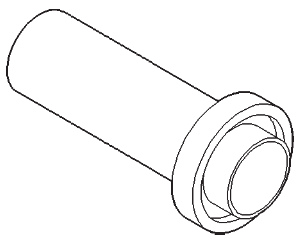
TRANSFER CASE - NV242 (Continued)



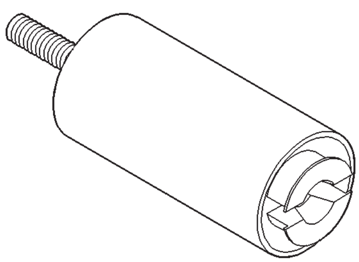
Installer, Bearing - 8128



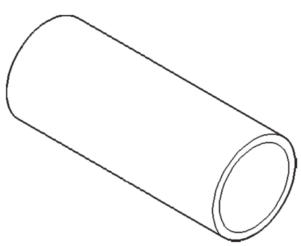
Installer, Bearing - 5066



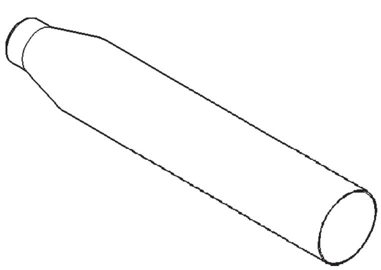
Installer, Seal - 6952-A



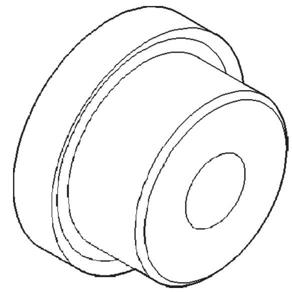
Remover, Bearing - L-4454



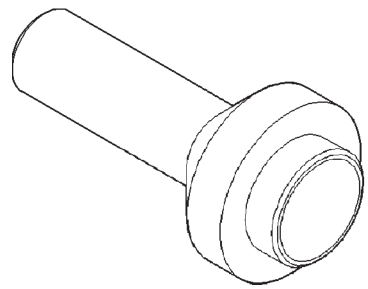
Cup - 8148



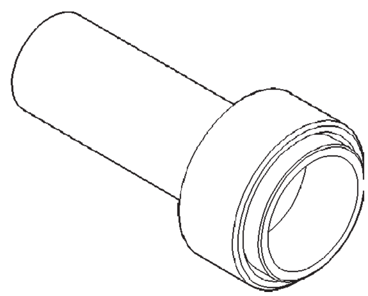
Protector, Seal - 6992



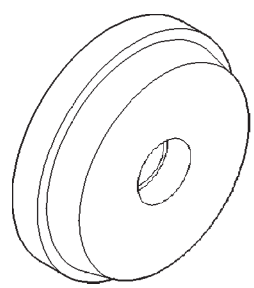
Installer, Input Gear Bearing - 7829-A



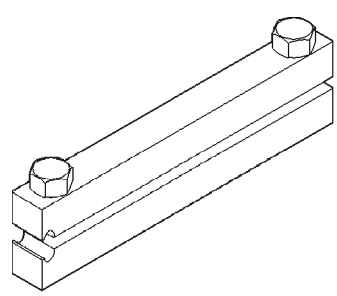
Installer, Seal - 7884



Installer, Pump Housing Seal - 7888



Installer, Bearing - 8033-A



Installer, Boot Clamp - C-4975-A

FLUID

STANDARD PROCEDURE - FLUID DRAIN/ REFILL

The fill and drain plugs are both in the rear case (Fig. 92).

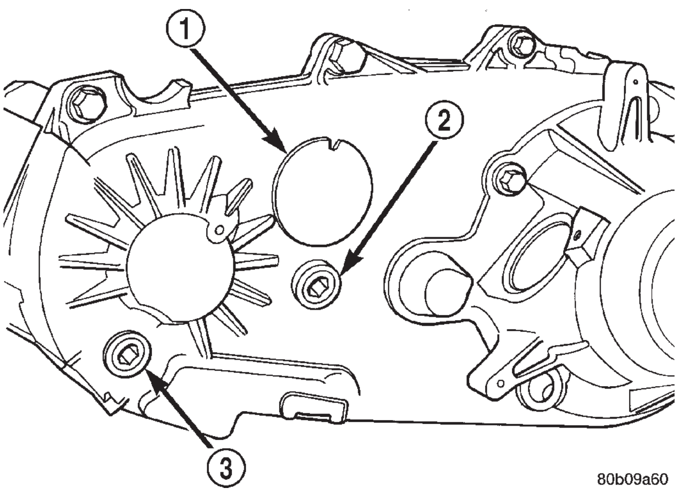


Fig. 92 Fill/Drain Plug and I.D. Tag Location - Typical

1 - I.D. TAG
2 - FILL PLUG
3 - DRAIN PLUG

(1) Raise vehicle.
(2) Position drain pan under transfer case.
(3) Remove drain and fill plugs and drain lubricant completely.
(4) Install drain plug. Tighten plug to 20-34 N·m (15-25 ft. lbs.).
(5) Remove drain pan.
(6) Fill transfer case to bottom edge of fill plug opening with Mopar® Transfer Case Lubricant.
(7) Install and tighten fill plug to 20-34 N·m (15-25 ft. lbs.).
(8) Lower vehicle.

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle.
(2) Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/ PROPELLER SHAFT - REMOVAL)
(3) Remove front output shaft companion flange.
(4) Remove seal from front case with pry tool (Fig. 93).

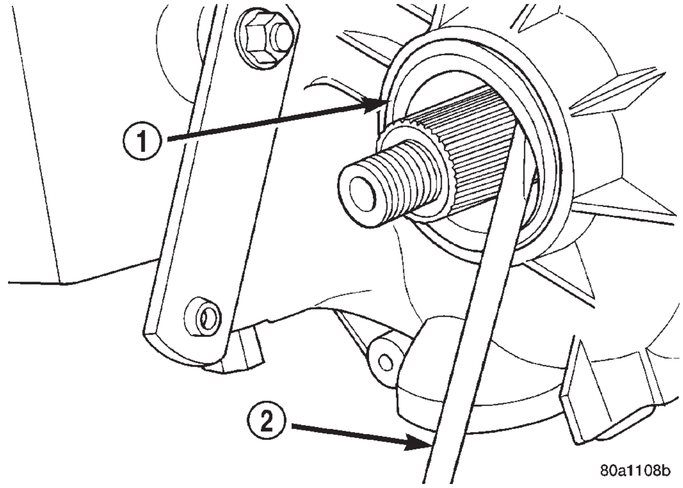


Fig. 93 Remove Front Output Shaft Seal

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 6952-A as follows:

(a) Place new seal on tool. Garter spring on seal goes toward interior of case.

(b) Start seal in bore with light taps from hammer (Fig. 94). Once seal is started, continue tapping seal into bore until installer tool seats against case.

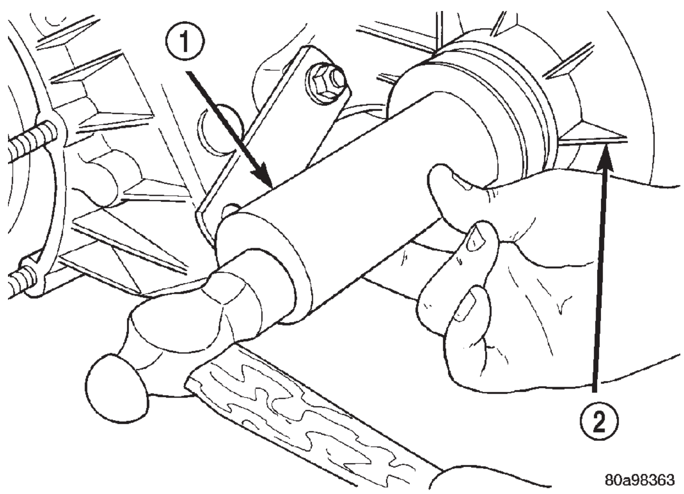


Fig. 94 Front Output Seal Installation

1 - INSTALLER 6952-A
2 - TRANSFER CASE

(2) Install companion flange and tighten nut to 122-176 (90-130 ft. lbs.) torque.
(3) Install front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/ PROPELLER SHAFT - INSTALLATION)

POSITION SENSOR

DESCRIPTION

The transfer case position sensor (Fig. 95) is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.

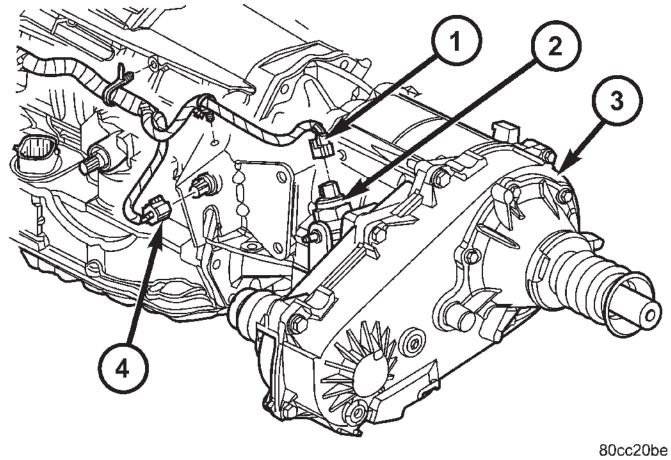


Fig. 95 Transfer Case Position Sensor and Connector

1 - TRANSFER CASE POSITION SENSOR CONNECTOR
2 - TRANSFER CASE POSITION SENSOR
3 - TRANSFER CASE
4 - OUTPUT SPEED SENSOR CONNECTOR

OPERATION

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the Operating Mode Versus Resistance table for the correct resistance for each position (Fig. 96).

OPERATING MODE VERSUS RESISTANCE

SENSOR POSITION	OPERATING MODE	SENSOR RESISTANCE (ohms)
1	2WD	1124-1243
2	4WD PART TIME	650-719
3	4WD FULL TIME	389-431
4	NEUTRAL	199-221
5	4WD LOW	57-64

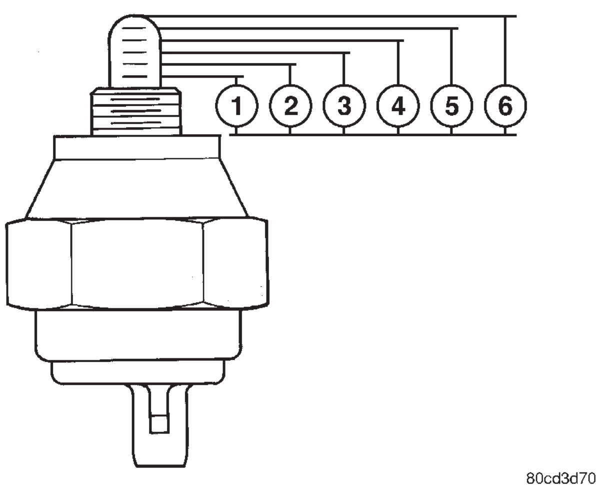


Fig. 96 Position Sensor Linear Movement

1 - POSITION 1 - 10mm ±0.5mm
2 - POSITION 2 - 12mm ±0.5mm
3 - POSITION 3 - 14mm ±0.5mm
4 - POSITION 4 - 16mm ±0.5mm
5 - POSITION 5 - 18mm ±0.5mm
6 - POSITION 6 - 20mm±0.5mm - FULL EXTENSION

POSITION SENSOR (Continued)

REMOVAL

(1) Raise and support the vehicle.

(2) Disengage the transfer case position sensor connector from the position sensor (Fig. 97).

(3) Remove the position sensor from the transfer case.

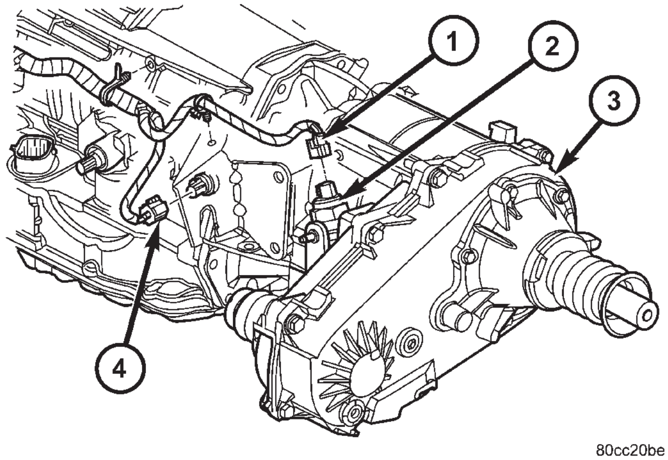


Fig. 97 Transfer Case Position Sensor and Connector

1 - TRANSFER CASE POSITION SENSOR CONNECTOR
2 - TRANSFER CASE POSITION SENSOR
3 - TRANSFER CASE
4 - OUTPUT SPEED SENSOR CONNECTOR

INSTALLATION

(1) Inspect the o-ring seal on the transfer case position sensor. Replace the o-ring if necessary.

(2) Install the transfer case position sensor into the transfer case. Torque the sensor to 20-34 N·m (15-25 ft.lbs.).

(3) Engage the transfer case position sensor connector to the position sensor.

(4) Lower vehicle.

(5) Verify proper sensor operation.

REAR RETAINER BUSHING AND SEAL - NV242HD

REMOVAL

(1) Raise vehicle.

(2) Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(3) Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.

(4) Using Remover 6957, remove bushing from rear retainer (Fig. 98).

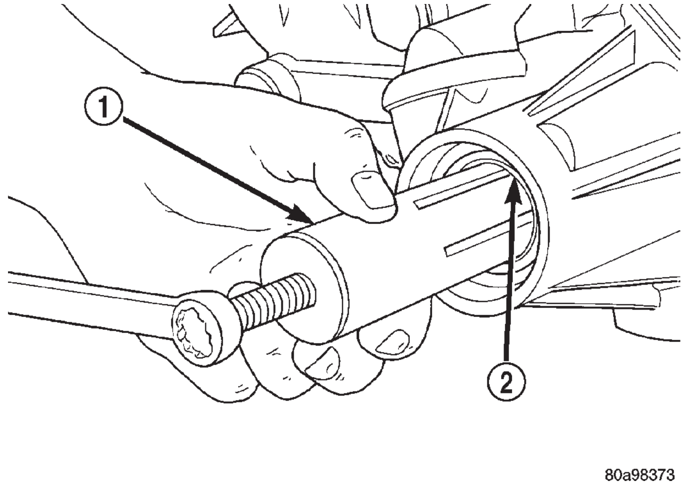


Fig. 98 Rear Retainer Bushing Removal

1 - REMOVER 6957
2 - REAR RETAINER BUSHING

INSTALLATION

(1) Clean fluid residue from sealing surface and inspect for defects.

(2) Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.

(3) Using Installer 8160, drive bushing into retainer until installer seats against case (Fig. 99).

(4) Using Installer C-3995-A, install seal in rear retainer (Fig. 100).

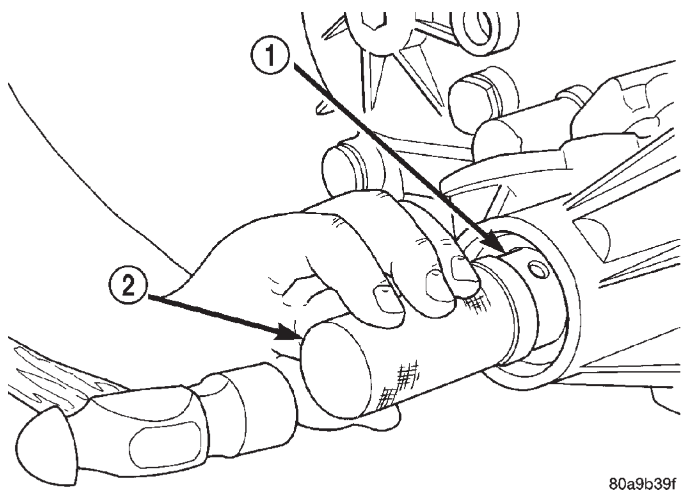


Fig. 99 Rear Retainer Bushing Install

1 - REAR RETAINER BUSHING
2 - INSTALLER 8160

REAR RETAINER BUSHING AND SEAL - NV242HD (Continued)

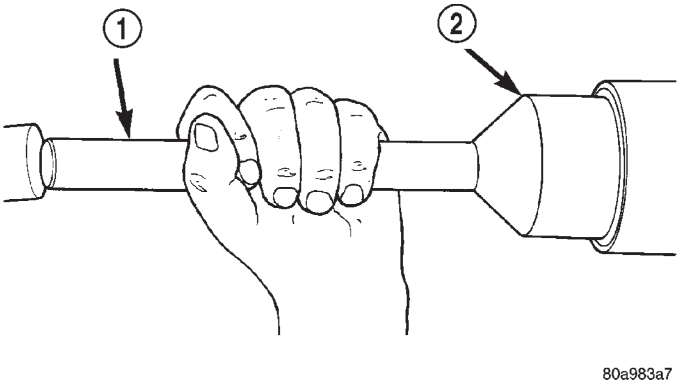


Fig. 100 Install Rear Retainer Seal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL C-3995-A

(5) Install the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

(6) Verify proper fluid level.

(7) Lower vehicle.

SHIFT CABLE

REMOVAL

(1) Shift transfer case into NEUTRAL.

(2) Raise vehicle.

(3) Disconnect the shift cable eyelet from the transfer case shift lever (Fig. 101).

(4) Remove shift cable from the cable support bracket.

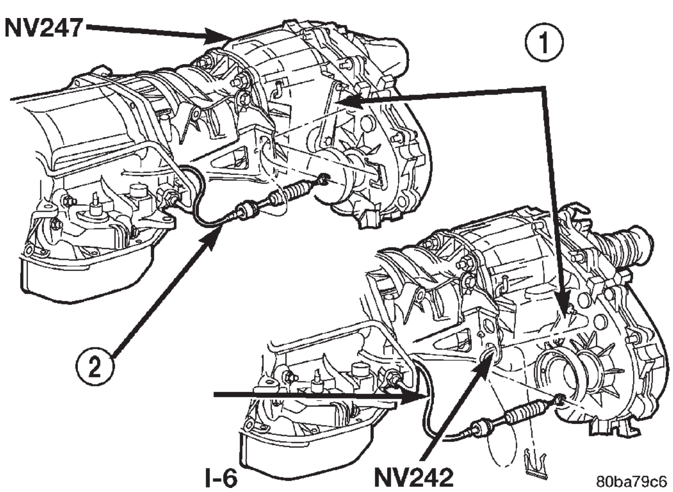


Fig. 101 Transfer Case Shift Cable at Transfer Case

1 - TRANSFER CASE SHIFT LEVER
2 - TRANSFER CASE SHIFT CABLE

(5) Lower vehicle.

(6) Remove any necessary console parts for access to shift lever assembly and shift cable.

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 102).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 103).

(9) Pull cable through floor panel opening.

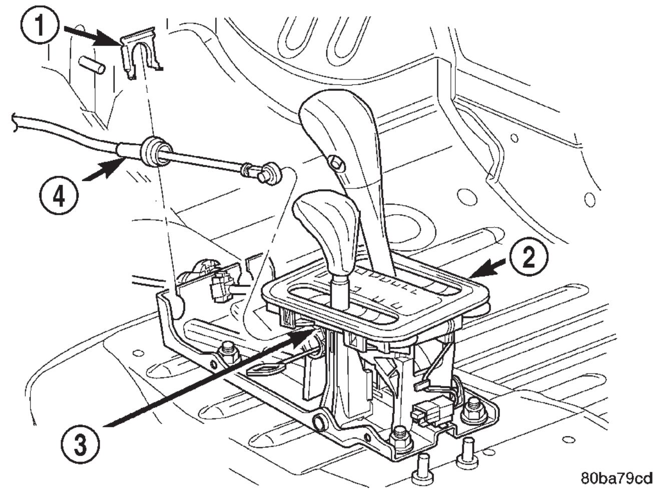


Fig. 102 Transfer Case Shift Cable at Shifter

1 - CLIP
2 - SHIFTER
3 - TRANSFER CASE SHIFT LEVER PIN
4 - TRANSFER CASE SHIFT CABLE

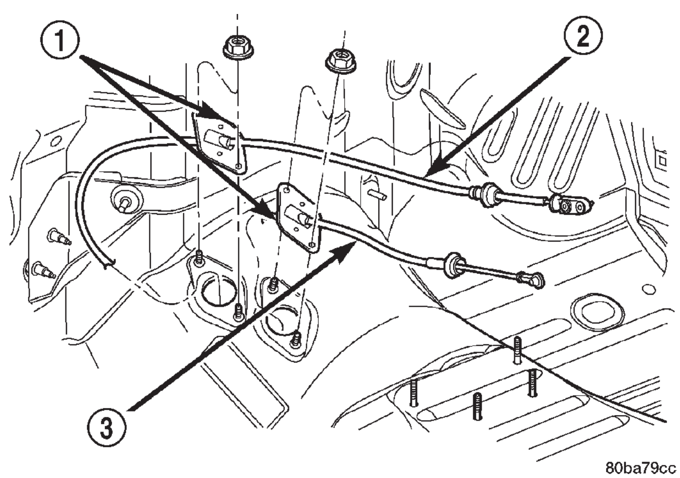


Fig. 103 Shift Cables at Floor Pan

1 - SEAL PLATES
2 - TRANSMISSION SHIFT CABLE
3 - TRANSFER CASE SHIFT CABLE

(10) Remove transfer case shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan (Fig. 103). Tighten nuts to 7 N·m (65 in.lbs.).

SHIFT CABLE (Continued)

(4) Install the transfer case shift cable to the shifter assembly bracket. Seat cable in bracket and install clip (Fig. 102).

(5) Verify the transfer case shift lever (at console) is in the NEUTRAL position.

(6) Snap the cable onto the shift lever pin (Fig. 102).

(7) Raise the vehicle.

(8) Install the shift cable to the shift cable support bracket and install clip (Fig. 101).

(9) Verify that the transfer case is still in the NEUTRAL position.

(10) Snap the shift cable onto the transfer case shift lever (Fig. 101).

(11) Lower vehicle.

(12) Verify correct transfer case operation in all ranges.

(13) Install any console parts removed for access to transfer case shift cable.

TRANSFER CASE - NV247

TABLE OF CONTENTS

TRANSFER CASE - NV247

DESCRIPTION

The NV247 (Fig. 1) is an on-demand 4-wheel drive transfer case with two operating ranges and a neutral position. Operating ranges are 4-high and 4-low. The 4-low range is used for extra pulling power in off-road situations.

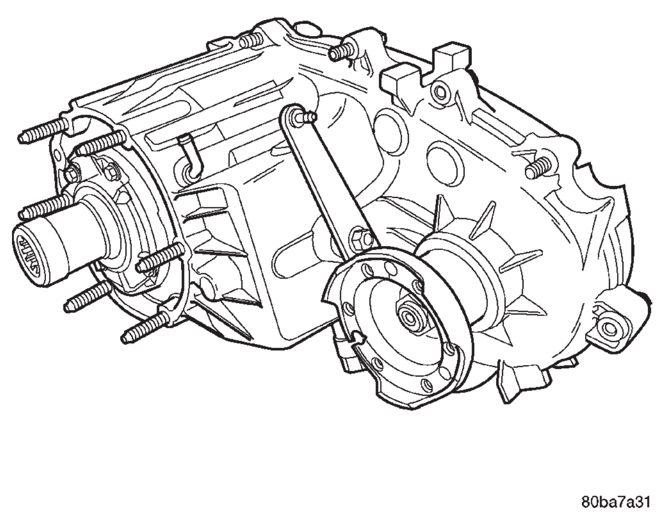


Fig. 1 NV247 Transfer Case

TRANSFER CASE IDENTIFICATION

A circular I.D. tag is attached to the rear case of each NV247 transfer case (Fig. 2). The tag indicates the following information:

- Model number
- Serial number
- Assembly number
- Gear ratio
- Location of manufacture

The transfer case serial number also represents the date of build.

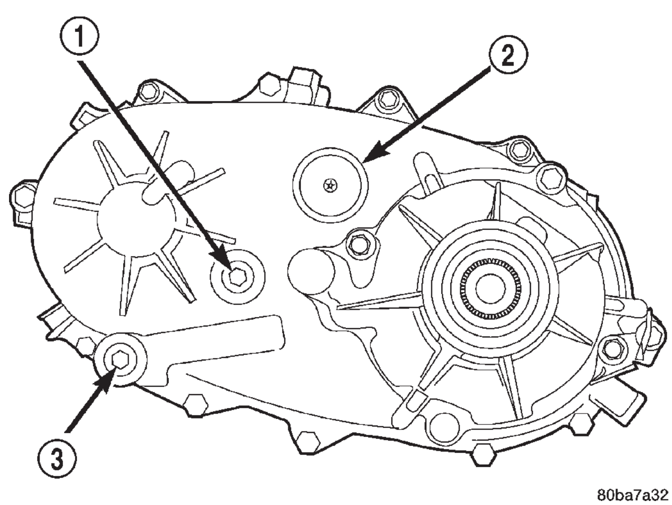


Fig. 2 Transfer Case I.D. Tag

1 - FILL PLUG
2 - I.D. TAG
3 - DRAIN PLUG

TRANSFER CASE - NV247 (Continued)

OPERATION

Under normal driving conditions, the system operates conventionally, and the majority of available torque is applied to the rear wheels. However, when front-to-rear wheel speed variations exist, the progressive differential transfers torque to the axle with the better traction, thus minimizing wheel spin and maximizing control.

The key to this design is a progressive coupling (Fig. 3), which is supplied with pressurized oil by a gerotor style pump. The pump rotor and case are driven by the front and rear driveshafts respectively, and deliver pressurized oil flow to the coupling in proportion to their speed difference. The progressive coupling contains a multi-disc clutch pack that is alternately splined to the front and rear driveshafts, and controls torque variation between the front and rear driveshafts as dictated by the pump.

A set of orifices and valves control the speed-differential starting point and rate of torque transfer rise in the clutch. This allows the system to disregard the normal speed differences between axles that result from variations in front-to-rear loading and typical cornering.

Transfer case operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable cable. Range positions are marked on the shifter bezel plate.

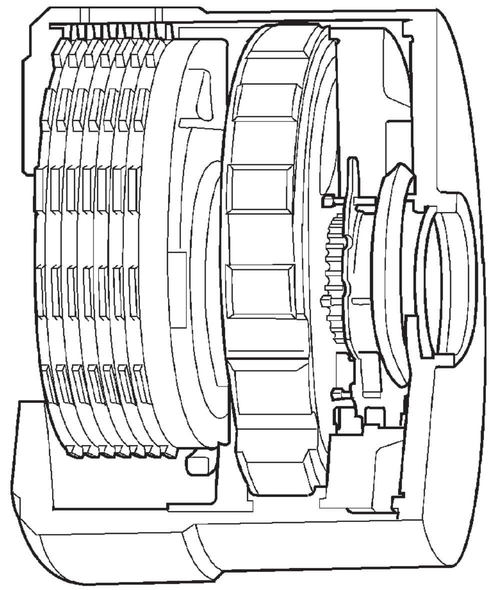


Fig. 3 Progressive Coupling

DIAGNOSIS AND TESTING - TRANSFER CASE - NV247

CONDITION	POSSIBLE CAUSE	CORRECTION
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	1. Vehicle speed too great to permit shifting	1. Reduce speed to 3-4 km/h (2-3 mph) before attempting to shift
	2. Transfer case external shift cable binding	2. Lubricate, repair or replace cable, or thighten loose components as necessary
	3. Insufficient or incorrect lubricant	3. Drain and refill to edge of fill hole with correct lubricant
	4. Internal components binding, worn, or damaged	4. Disassemble unit and replace worn or damaged components as necessary
TRANSFER CASE NOISY IN ALL MODES	1. Insufficient or incorrect lubricant	1. Drain and refill to edge of fill hole with correct lubricant. **If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise**

TRANSFER CASE - NV247 (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
NOISY IN—OR JUMPS OUT OF 4WD LOW RANGE	1. Transfer case not completely engaged in 4WD LOW (possibly from shift to 4L while rolling)	1. Stop vehicle, shift transfer case to neutral, then shift back to 4WD LOW
	2. Shift linkage loose, binding, or is misadjusted	2. Tighten, lubricate, or repair linkage as necessary. Adjust linkage if necessary
	3. Range fork cracked, inserts worn, or fork is binding on shift rail	3. Disassemble unit and repair as necessary
	4. Annulus gear or lockplate worn or damaged	4. Disassemble unit and repair as necessary
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	1. Transfer case over filled	1. Drain to correct level
	2. Vent closed or restricted	2. Clear or replace vent if necessary
	3. Output shaft seals damaged or installed correctly	3. Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.

REMOVAL

(1) Shift transfer case into NEUTRAL.
(2) Raise vehicle.
(3) Remove transfer case drain plug and drain transfer case lubricant.
(4) Mark front and rear propeller shaft yokes for alignment reference.
(5) Support transmission with jack stand.
(6) Remove rear crossmember and skid plate, if equipped (Fig. 4).
(7) Disconnect front propeller shaft from transfer case at companion flange. Remove rear propeller shaft from vehicle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

CAUTION: Do not allow propshafts to hang at attached end. Damage to joint can result.

(8) Disconnect transfer case cable from range lever.
(9) Disconnect transfer case vent hose (Fig. 5).
(10) Support transfer case with transmission jack.
(11) Secure transfer case to jack with chains.
(12) Remove nuts attaching transfer case to transmission.
(13) Pull transfer case and jack rearward to disengage transfer case (Fig. 5).
(14) Remove transfer case from under vehicle.

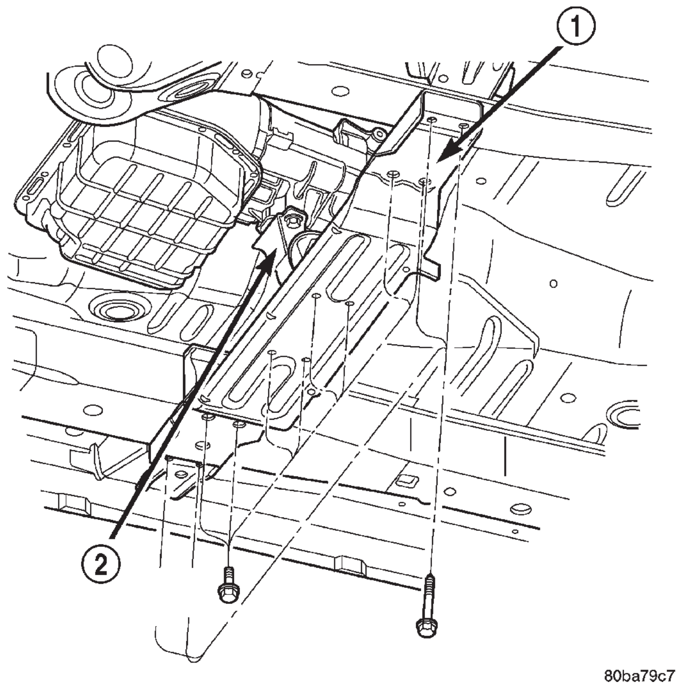


Fig. 4 Crossmember Removal

1 - CROSSMEMBER
2 - REAR TRANSMISSION MOUNT

DISASSEMBLY

Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

TRANSFER CASE - NV247 (Continued)

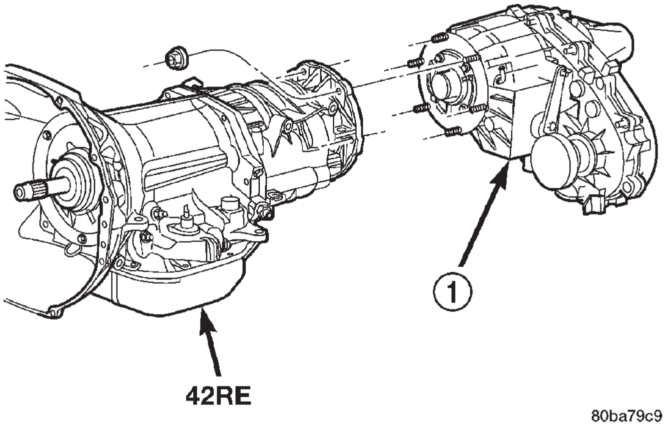


Fig. 5 Transfer Case Mounting

1 - NV247 TRANSFER CASE

REAR RETAINER AND OIL PUMP

(1) Remove rear retainer bolts (Fig. 6).

(2) Remove rear bearing locating ring access plug (Fig. 7).

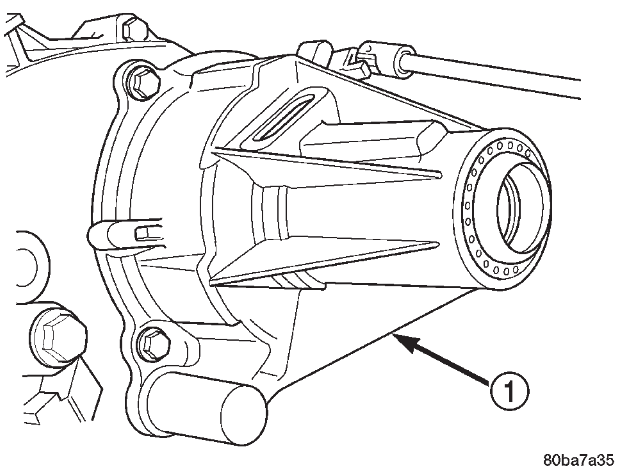


Fig. 6 Rear Retainer Bolt Removal

1 - REAR RETAINER

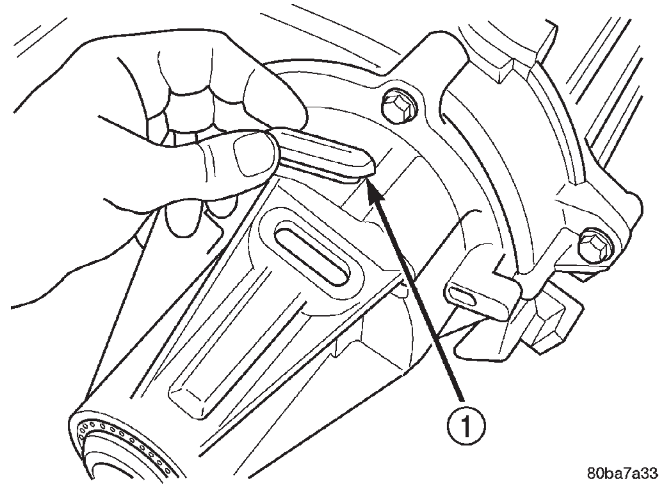


Fig. 7 Remove Rubber Access Plug

1 - PLUG

(3) Loosen rear retainer with pry tool to break sealer bead. Pry only against retainer boss as shown (Fig. 8).

(4) Remove rear retainer as follows:

(a) Spread rear bearing locating ring with snap ring pliers (Fig. 9).

(b) Then slide retainer off mainshaft and rear bearing (Fig. 10).

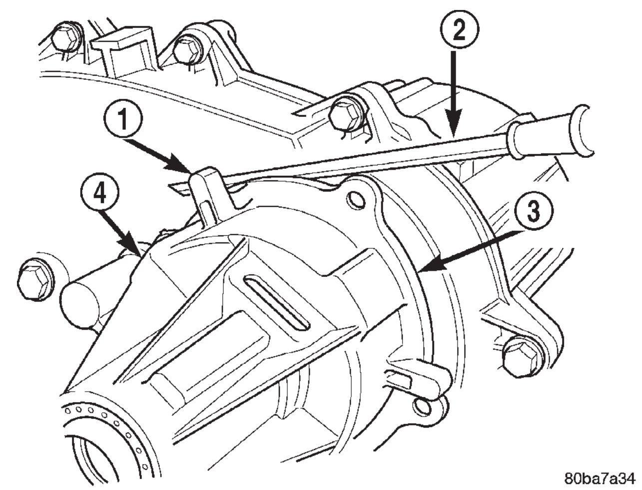


Fig. 8 Loosening Rear Retainer

1 - RETAINER BOSS
2 - PRY TOOL
3 - SEALER BEAD
4 - REAR RETAINER

TRANSFER CASE - NV247 (Continued)

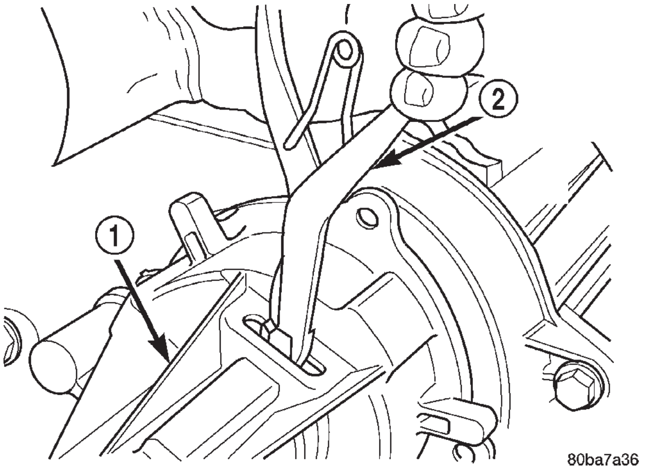


Fig. 9 Disengaging Rear Bearing Locating Ring

1 - REAR RETAINER
2 - PARALLEL JAW SNAP-RING PLIERS

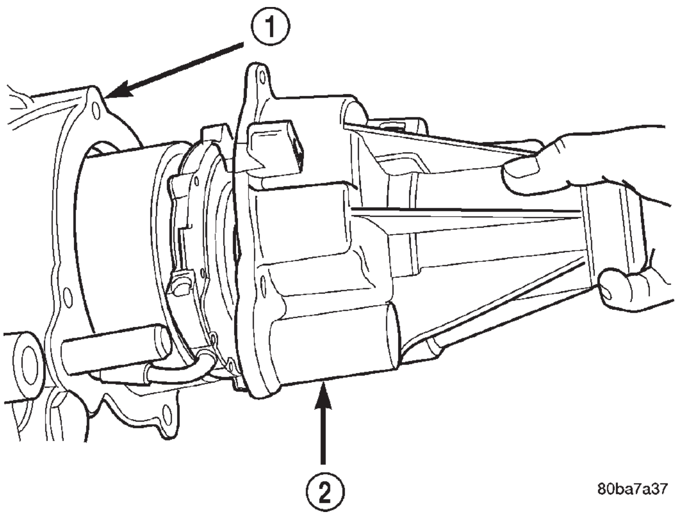


Fig. 10 Rear Retainer Removal

1 - REAR CASE
2 - REAR RETAINER

(5) Remove rear bearing snap-ring.

(6) Remove rear bearing. Note position of bearing locating ring groove for assembly reference.

(7) Disengage oil pickup tube from oil pump and remove oil pump assembly (Fig. 11).

(8) Remove pick-up tube o-ring from oil pump (Fig. 12), if necessary. Do not disassemble the oil pump, it is not serviceable.

COMPANION FLANGE AND RANGE LEVER

(1) Remove front companion flange nut as follows:

(a) Move range lever to 4L position.

(b) Remove nut with socket and impact wrench.

(2) Remove companion flange. If flange is difficult to remove by hand, remove it with bearing splitter, or

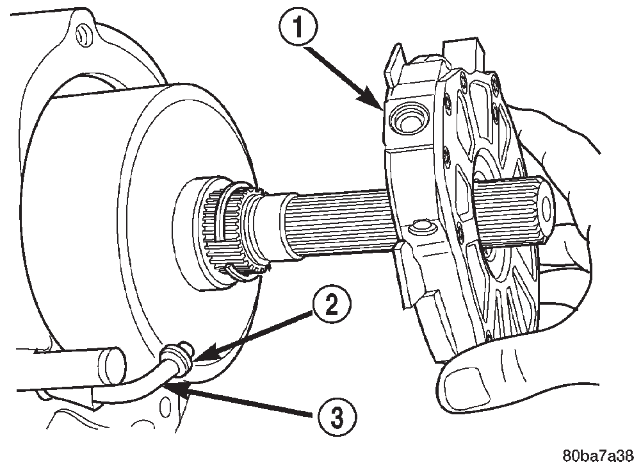


Fig. 11 Rear Bearing and Oil Pump Removal

1 - OIL PUMP
2 - TUBE O-RING
3 - OIL PICKUP TUBE

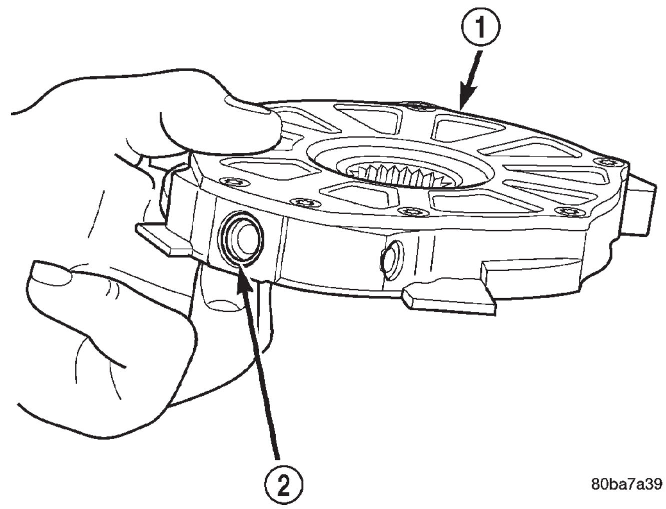


Fig. 12 Pick-up Tube O-ring Location

1 - OIL PUMP
2 - O-RING

with standard two jaw puller. Be sure puller tool is positioned on flange and not on slinger as slinger will be damaged.

(3) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(4) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft.

NOTE: Note position of range lever so it can be re-installed correctly.

TRANSFER CASE - NV247 (Continued)

REAR CASE

(1) Support transfer case so rear case is facing upward.

(2) Remove bolts holding front case to rear case. The case alignment bolt require flat washers (Fig. 13).

(3) Loosen rear case with flat blade screwdriver to break sealer bead. Insert screwdriver blade only into notches provided at each end of case (Fig. 14).

(4) Remove rear case (Fig. 15).

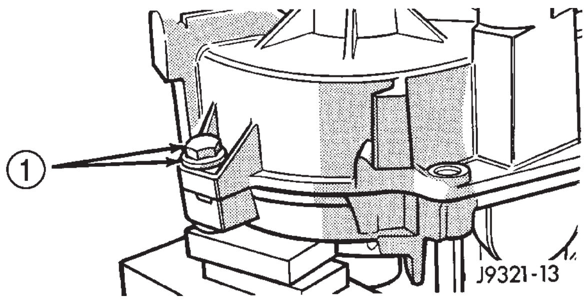


Fig. 13 Rear Case Alignment Bolt Locations

1 - ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

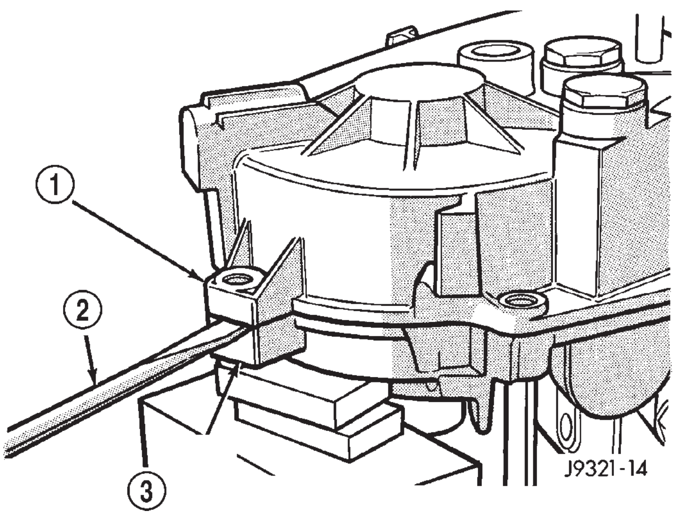


Fig. 14 Loosening Rear Case

1 - REAR CASE
2 - PRY TOOL (IN CASE SLOT)
3 - FRONT CASE

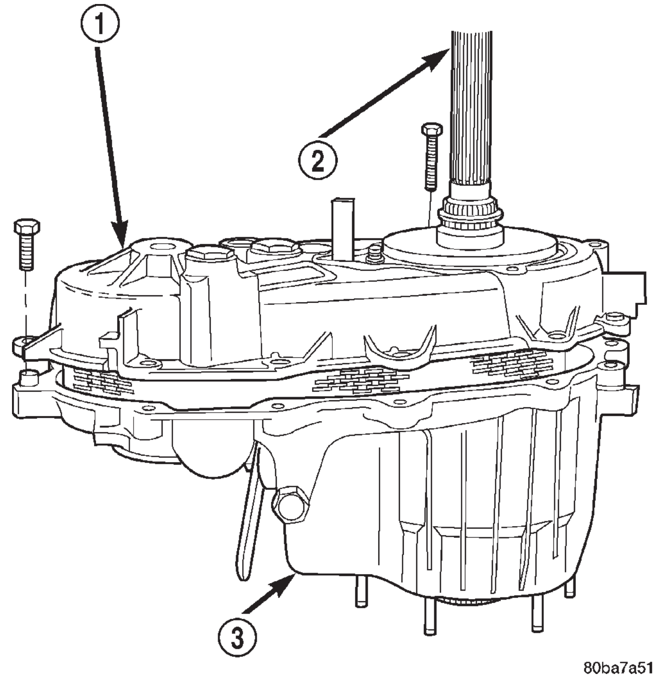


Fig. 15 Rear Case Removal

1 - REAR HOUSING
2 - MAINSHAFT
3 - TRANSFER CASE

PROGRESSIVE COUPLING

(1) Remove oil pump locating snap-ring and progressive coupling thrust washer from the mainshaft (Fig. 16).

(2) Remove progressive coupling from mainshaft (Fig. 16).

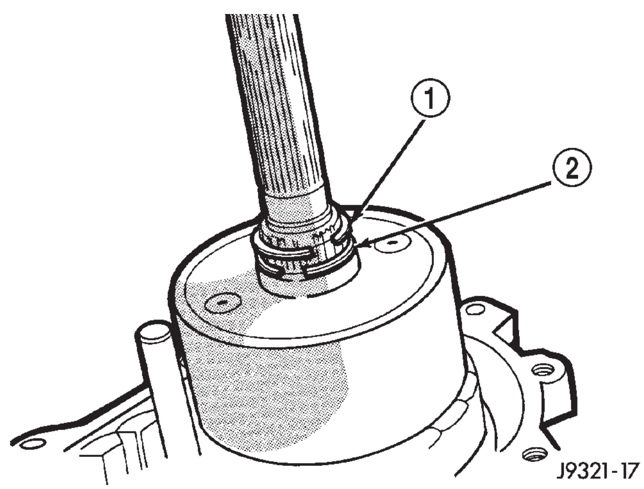


Fig. 16 Progressive Coupling Removal

1 - SNAP-RING
2 - PROGRESSIVE COUPLING

TRANSFER CASE - NV247 (Continued)

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Remove oil pickup tube from rear case (Fig. 17).

(2) Remove drive gear snap-ring (Fig. 18).

(3) Disengage drive gear (Fig. 18). Pry gear upward and off mainshaft as shown.

(4) Remove front output shaft, drive chain and drive gear as assembly (Fig. 18).

(5) Remove output shaft drive gear snap ring.

(6) Remove output shaft drive gear from output shaft.

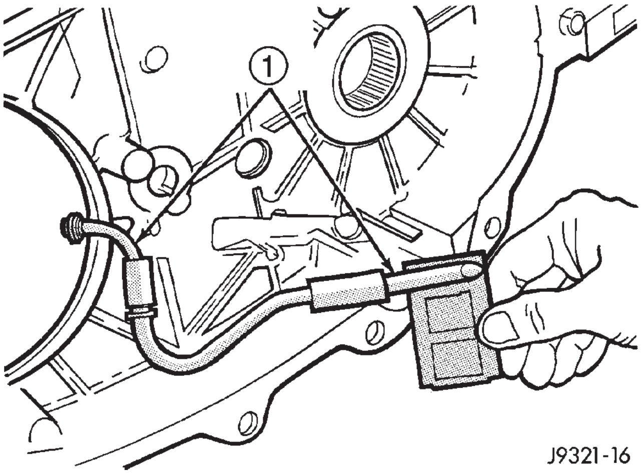


Fig. 17 Oil Pickup Tube Removal

1 - OIL PICKUP TUBE

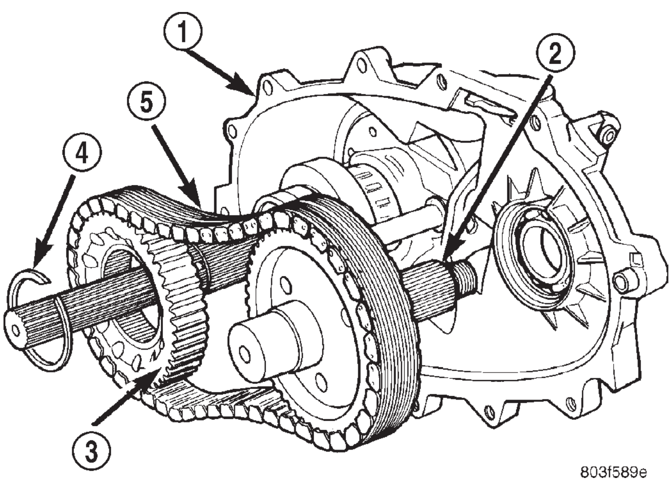


Fig. 18 Front Output Shaft, Drive Gear And Chain Removal

1 - REAR HOUSING
2 - OUTPUT SHAFT AND SPROCKET
3 - MAINSHAFT SPROCKET
4 - SNAP-RING
5 - DRIVE CHAIN

SHIFT FORKS AND MAINSHAFT

(1) Remove detent plug, O-ring, detent spring and detent plunger (Fig. 19).

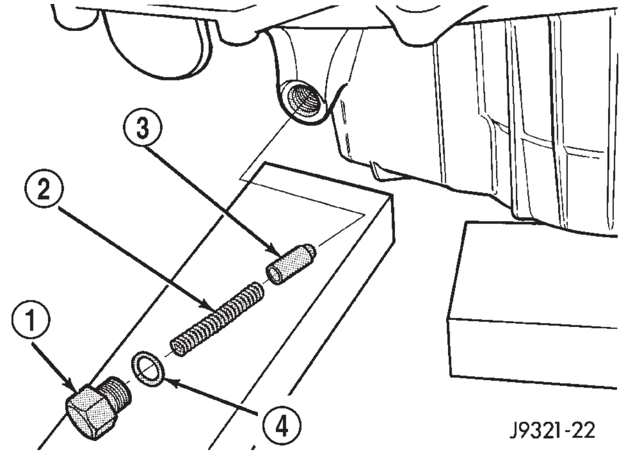


Fig. 19 Detent Plug, Spring And Plunger Removal

1 - DETENT PLUG
2 - DETENT SPRING
3 - DETENT PLUNGER
4 - PLUG O-RING

(2) Remove shift rail from shift fork and transfer case housing.

(3) Rotate range shift fork until it disengages from shift sector.

(4) Remove mainshaft and shift fork from input gear pilot bearing.

NOTE: Loose needle bearings are used to support the drive sprocket hub on the mainshaft. Do not lift mainshaft by drive sprocket hub or needle bearings will become dislodged.

(5) Wrap rag around mainshaft underneath drive sprocket hub and remove drive sprocket hub from mainshaft. Be sure to retrieve all the drive sprocket hub needle bearings.

(6) Remove snap ring holding clutch sleeve onto mainshaft.

TRANSFER CASE - NV247 (Continued)

(7) Remove range clutch sleeve, blockout spring, locking clutch, and locking clutch spring from mainshaft (Fig. 20).

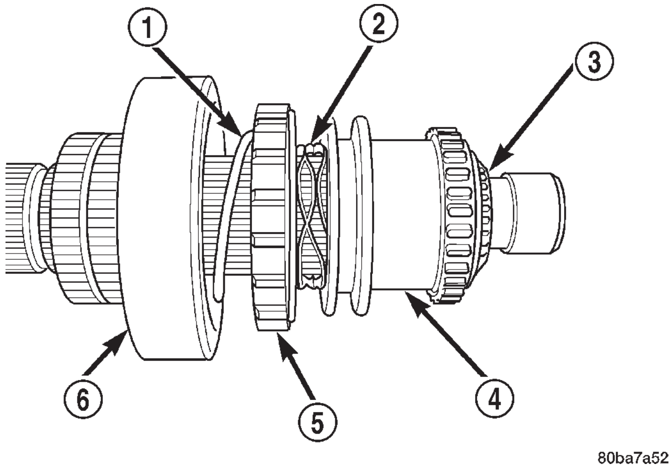


Fig. 20 Range Clutch Sleeve, Blockout Spring, Locking Clutch and Spring

1 - LOCKING CLUTCH SPRING
2 - BLOCKOUT SPRING
3 - SNAP-RING
4 - RANGE CLUTCH SLEEVE
5 - LOCKING CLUTCH
6 - DRIVE SPROCKET HUB

(8) Remove shift sector. Rotate and tilt sector as needed to remove it (Fig. 21).

(9) Remove shift sector bushing and O-ring (Fig. 22).

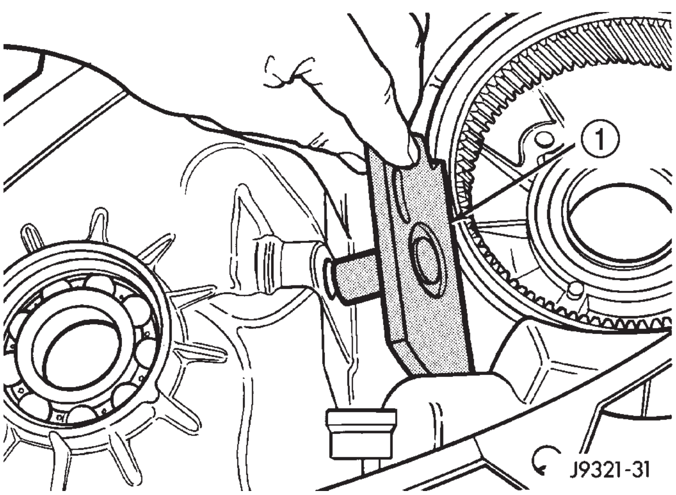


Fig. 21 Shift Sector Removal

1 - SHIFT SECTOR

INPUT GEAR/LOW RANGE ASSEMBLY

(1) Turn front case on side so front bearing retainer is accessible.

(2) Remove front bearing retainer bolts (Fig. 23).

(3) Remove front bearing retainer as follows:

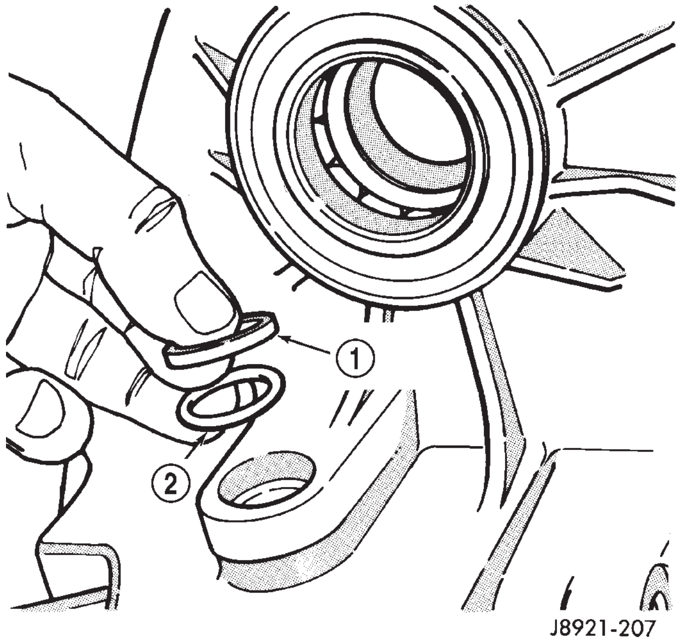


Fig. 22 Sector Bushing And O-Ring Removal

1 - SHIFT SECTOR BUSHING
2 - O-RING

(a) Loosen retainer with flat blade screwdriver to break sealer bead. **To avoid damaging case and retainer, position screwdriver blade only in slots provided in retainer (Fig. 24).**

(b) Then remove retainer from case and gear.

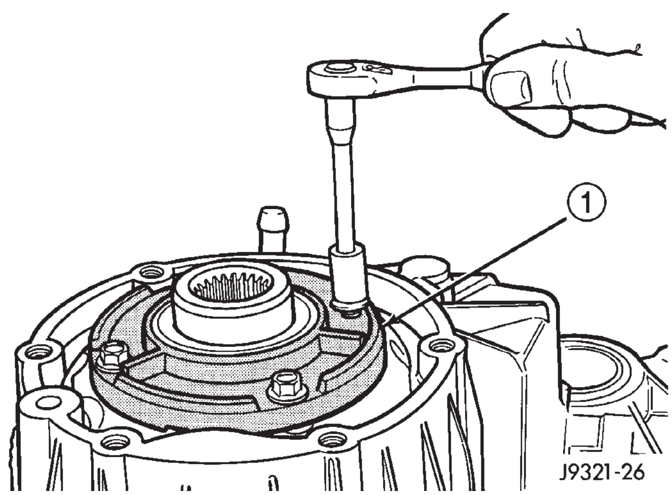


Fig. 23 Front Bearing Retainer Bolt Removal

1 - FRONT BEARING RETAINER

TRANSFER CASE - NV247 (Continued)

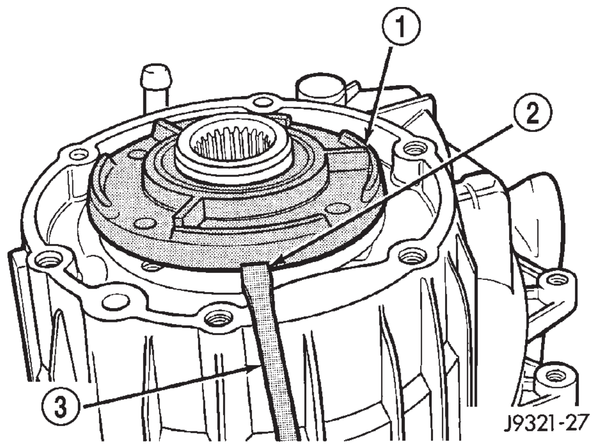


Fig. 24 Front Bearing Retainer Removal

1 - FRONT BEARING RETAINER
2 - RETAINER NOTCH
3 - FLAT BLADE SCREWDRIVER

(4) Remove snap-ring that retains input gear shaft in front bearing (Fig. 25).

(5) Remove input and low range gear assembly (Fig. 26).

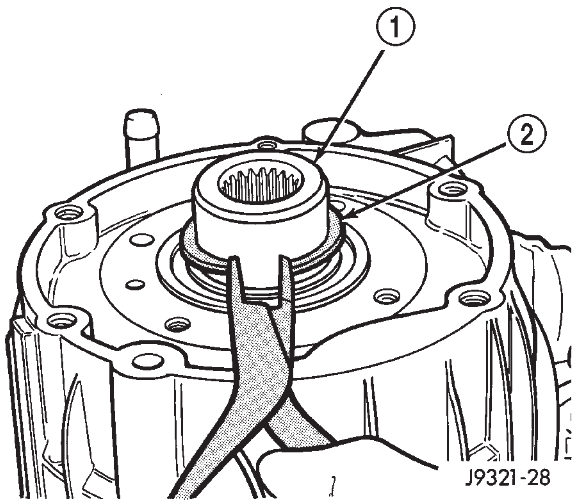


Fig. 25 Input Gear Snap-Ring Removal

1 - INPUT GEAR
2 - SNAP-RING

(6) Remove oil seals from following components:

- front bearing retainer.
- rear retainer.
- case halves.

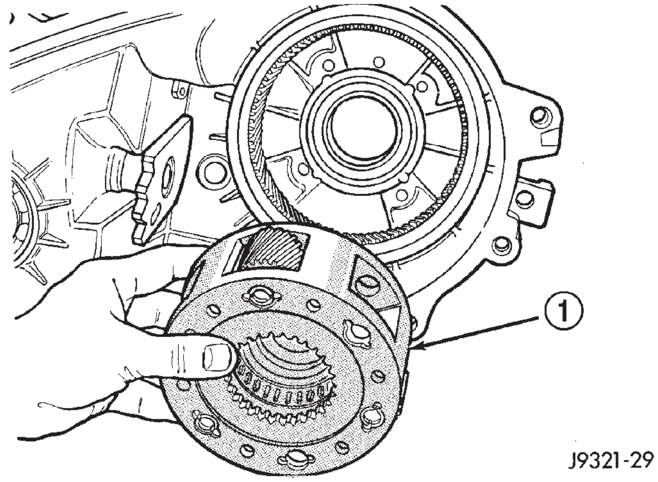


Fig. 26 Input And Low Range Gear Assembly Removal

1 - INPUT AND LOW RANGE GEAR ASSEMBLY

INPUT AND LOW RANGE GEAR

(1) Remove snap-ring that retains input gear in low range gear (Fig. 27).

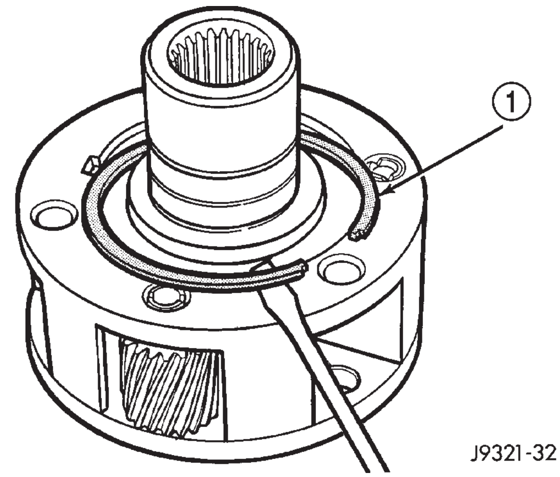


Fig. 27 Input Gear Snap-Ring Removal

1 - INPUT GEAR SNAP-RING

TRANSFER CASE - NV247 (Continued)

(2) Remove retainer (Fig. 28).

(3) Remove front tabbed thrust washer (Fig. 29).

(4) Remove input gear (Fig. 30).

(5) Remove rear tabbed thrust washer from low range gear (Fig. 31).

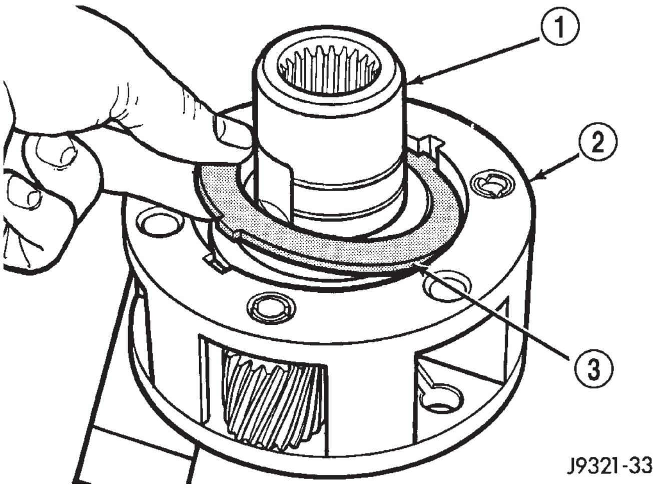


Fig. 28 Input Gear Retainer

1 - INPUT GEAR
2 - LOW RANGE GEAR
3 - RETAINER

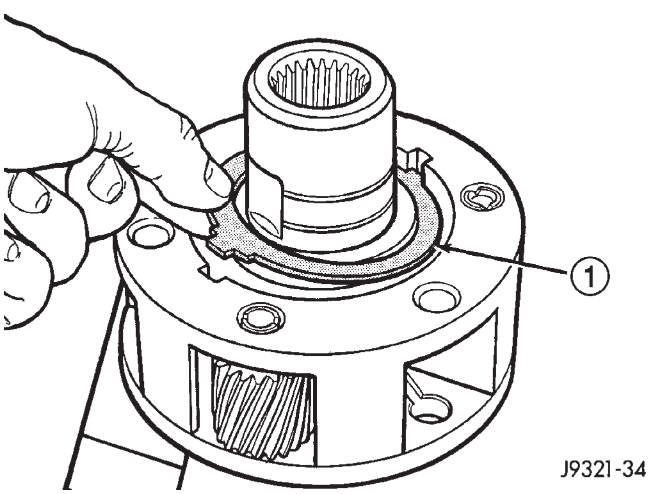


Fig. 29 Front Tabbed Thrust Washer

1 - FRONT TABBED THRUST WASHER

CLEANING

Clean the transfer case components with parts cleaning solvent. Flush the oil passages in the cases and drivetrain components with solvent. This will help remove dirt and particles from these passages.

Dry the transfer case components with compressed air or allow them to air dry on clean shop towels.

Apply compressed air through all oil passages in the cases and gear components to clear them of any residue.

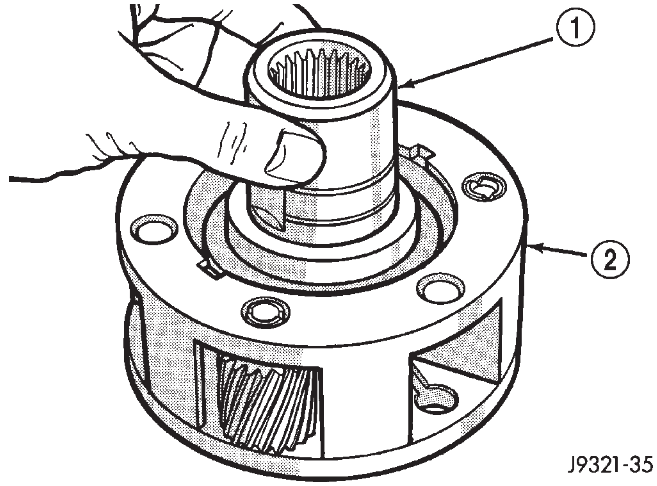


Fig. 30 Input Gear Removal

1 - INPUT GEAR
2 - LOW RANGE GEAR

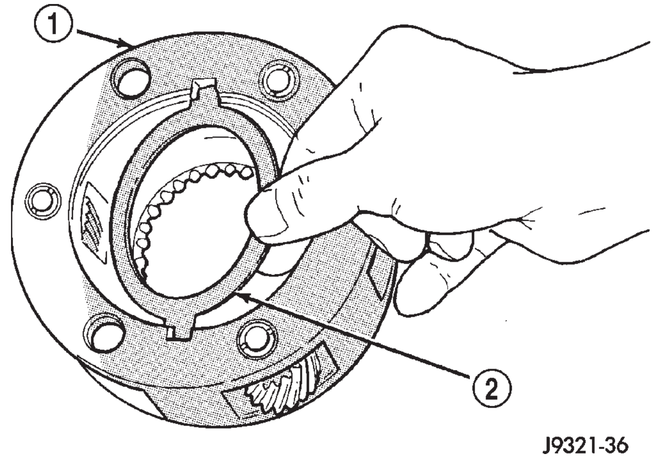


Fig. 31 Rear Tabbed Thrust Washer Removal

1 - LOW RANGE GEAR
2 - REAR TABBED THRUST WASHER

INSPECTION

MAINSHAFT

Examine the mainshaft components carefully for evidence of wear or damage.

Replace the thrust washers if worn or damaged.

Replace the mainshaft and sprocket gears if the teeth or gear bores are worn or damaged.

Replace the mainshaft bearings if worn, flat spotted, brinelled, or damaged in any way.

Replace the mainshaft if it is bent, exhibits wear or damage to the bearing surfaces, splines or gear teeth.

TRANSFER CASE - NV247 (Continued)

INPUT AND LOW RANGE GEARS

Inspect the low range gear pinions and pinion pins. Replace the low range gear if any of the pins or pinions are worn or damaged.

Inspect the thrust washers, retainer, and snap-ring. Replace the snap-ring if bent, or distorted. Replace the thrust washers and retainer if worn, cracked or damaged in any way.

Examine the input gear carefully. Be sure the gear teeth and bearing surfaces are in good condition. Replace the gear if wear or damage is evident.

Check the input gear pilot bearing. Rotate the bearing and check for roughness or noise. Also check bearing position in the bore. The bearing should be recessed approximately 2.5 mm (0.100 in.) below the top edge of the bore. The bearing should not be seated at the bottom of the bore. Replace the bearing if worn, or roughness is evident. Replace both the gear and bearing if the bearing is a loose fit in the bore.

GEAR CASE AND RETAINERS

Examine both case halves and retainers carefully. Replace any retainer or case half if wear, cracks, or other damage is evident.

Check condition of the low range annulus gear and the shift rail bushing in the front case (Fig. 32). The low range annulus gear is not a serviceable part. Replace the gear and case as an assembly if the gear is loose, worn, or damaged. The shift rail bushing is a serviceable part and can be replaced if necessary.

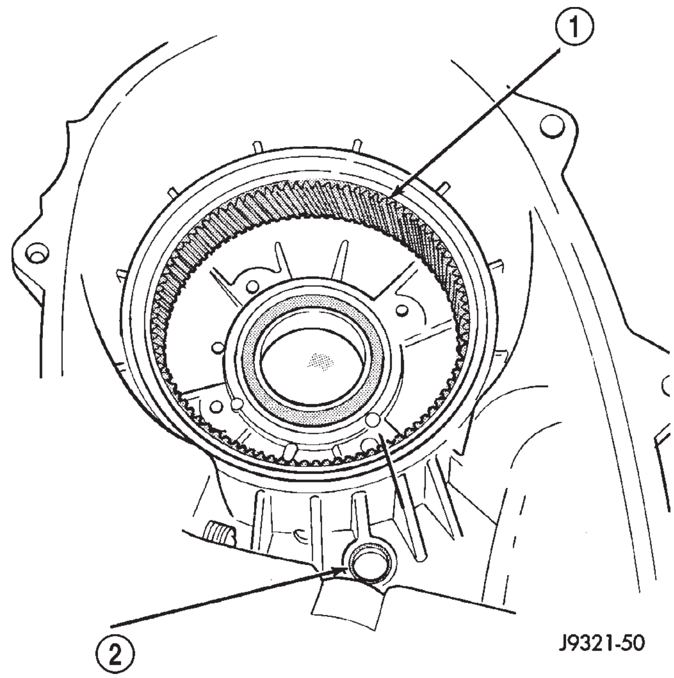


Fig. 32 Low Range Annulus Gear Location

1 - LOW RANGE ANNULUS GEAR
2 - SHIFT RAIL BUSHING

Check the bushing in the rear retainer. Replace the bushing if worn or scored.

Examine the sealing surfaces of both case halves and retainers. Small burrs, or scratches on these surfaces can be reduced with crocus cloth or a fine tooth file.

Examine condition of the shift rail bushing in the front case. If the bushing is worn or damaged, it can be removed with a blind hole type puller. A replacement bushing can be installed with a suitable size driver. Recess the bushing slightly below the edge of the bore but do not seat it all the into the case.

GEARTRAIN

Inspect the mainshaft splines, gear teeth and bearing surfaces carefully for evidence of wear, or damage. Replace the shaft if necessary. do not attempt to salvage it if damaged.

The shift rail and range fork are an assembly. Replace both parts if either is damaged. However, the nylon pads in the fork can be replaced if worn, or cracked.

Inspect the transfer case snap-rings closely. Do not attempt to salvage a distorted snap-ring by straightening or reshaping it. Replace any snap-ring that is distorted, or worn.

Inspect the low range gear, input gear and the gear thrust washers retainer, and snap-ring. The low range gear is serviced as an assembly only. Replace the gear if the case or pinions are damaged.

During inspection, also make sure the seal surface of the input gear is in good condition. Minor nicks on this surface can be reduced with crocus cloth. However, replace the gear if the seal surface is severely scored or worn.

OIL PUMP AND PROGRESSIVE COUPLING

The oil pump and progressive coupling are not serviceable components. Replace the coupling as an assembly if it is damaged. Replace the oil pump as an assembly if the gear teeth are worn, or if the pump has become damaged.

BEARINGS AND SEALS

The transfer case seals should be replaced during overhaul. Use new seals in the input gear bearing retainer, front case and rear retainer. Also replace the yoke seal washer and the detent plug O-ring.

Check condition of each transfer case bearing. Replace any bearing exhibiting signs of roughness, wear, or damage.

TRANSFER CASE - NV247 (Continued)

ASSEMBLY

Lubricate transfer case components with Mopar® Transfer Case Lubricant or petroleum jelly (where indicated) during assembly.

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

BEARINGS AND SEALS

(1) Remove front output shaft seal from front case with pry tool (Fig. 33).

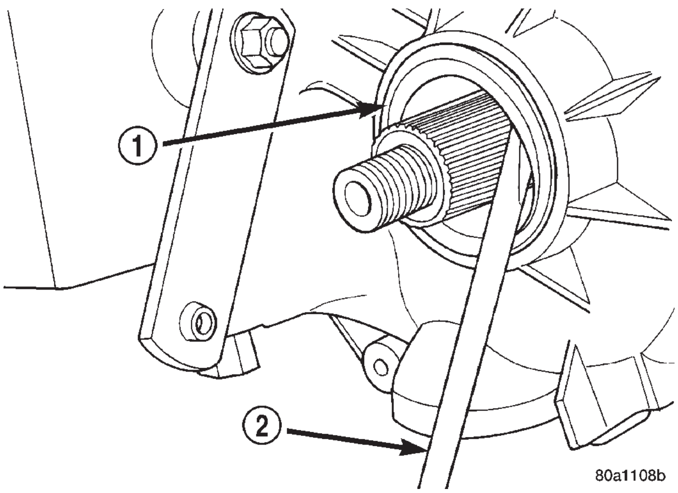


Fig. 33 Remove Front Output Shaft Seal

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

(2) Remove snap-ring that retains front output shaft bearing in front case (Fig. 34).

(3) Using tool 6953, remove bearing from front case (Fig. 35).

(4) Using tool 6953, install new bearing.

(5) Install snap-ring to hold bearing into case.

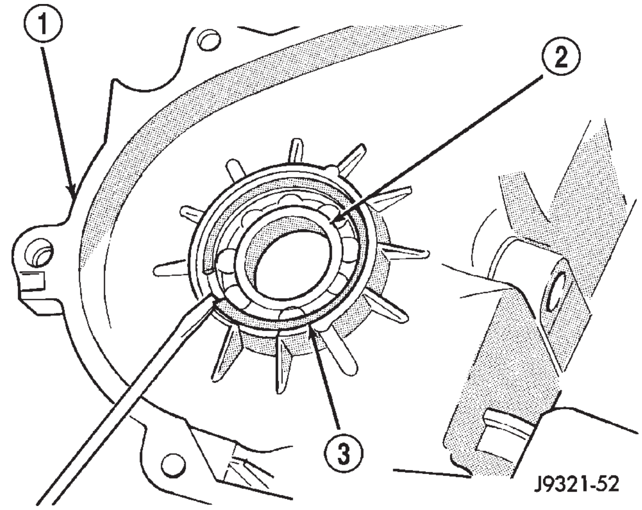


Fig. 34 Output Shaft Front Bearing Snap-Ring Removal

1 - FRONT CASE
2 - OUTPUT SHAFT FRONT BEARING
3 - BEARING SNAP-RING

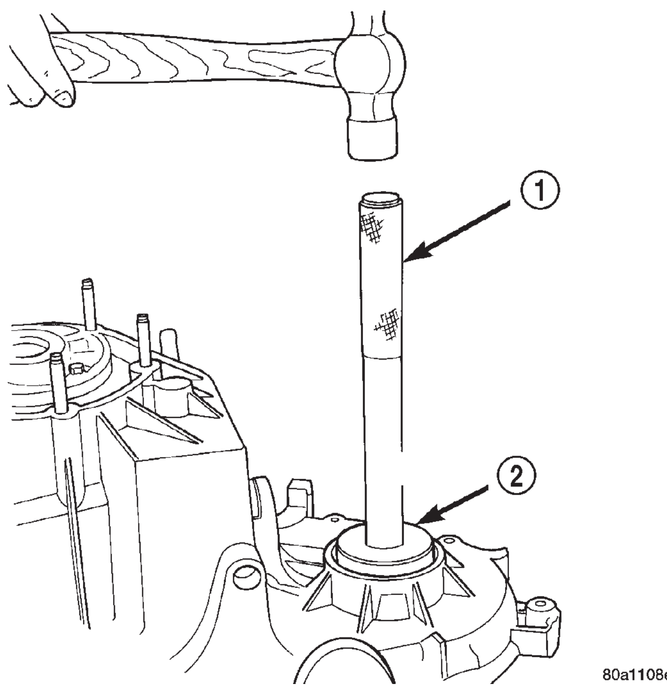


Fig. 35 Remove Output Shaft Front Bearing

1 - HANDLE C-4171
2 - REMOVER/INSTALLER 6953

TRANSFER CASE - NV247 (Continued)

(6) Install new front output seal in front case with Installer Tool 6952-A as follows:

(a) Place new seal on tool. **Garter spring on seal goes toward interior of case.**

(b) Start seal in bore with light taps from hammer (Fig. 36). Once seal is started, continue tapping seal into bore until installer tool bottoms against case.

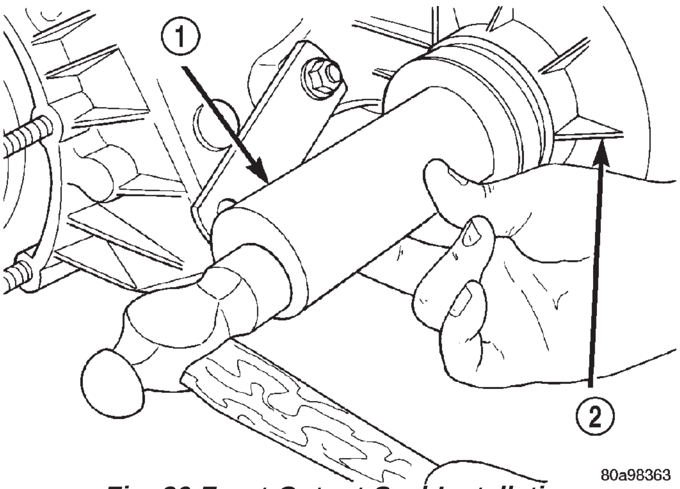


Fig. 36 Front Output Seal Installation

1 - INSTALLER 6952-A
2 - TRANSFER CASE

(7) Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 37).

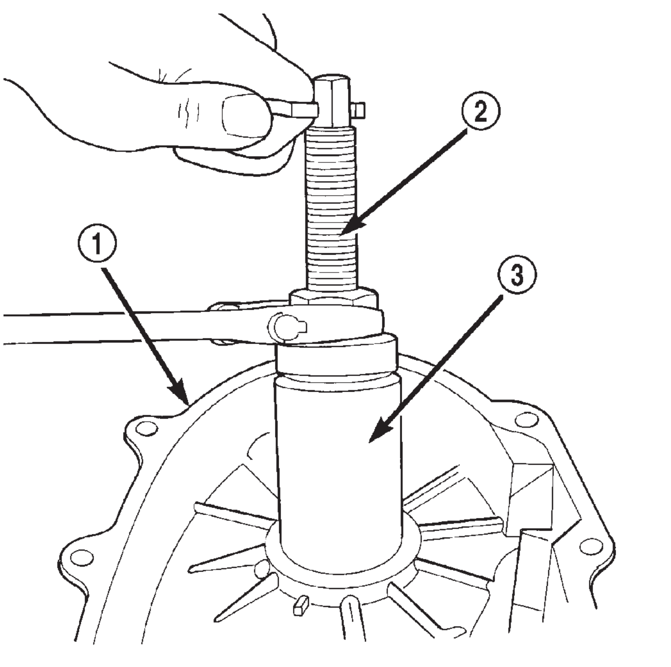


Fig. 37 Output Shaft Rear Bearing Removal

1 - REAR CASE
2 - SPECIAL TOOL L-4454-1 AND L-4454-3
3 - SPECIAL TOOL 8148

(8) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 38). **The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 39).**

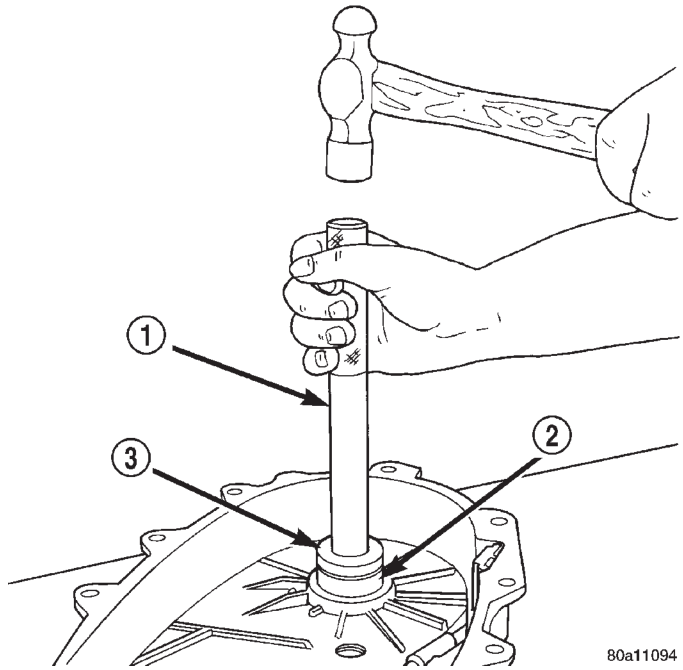


Fig. 38 Output Shaft Rear Bearing Installation

1 - HANDLE C-4171
2 - OUTPUT SHAFT INNER BEARING
3 - INSTALLER 5066

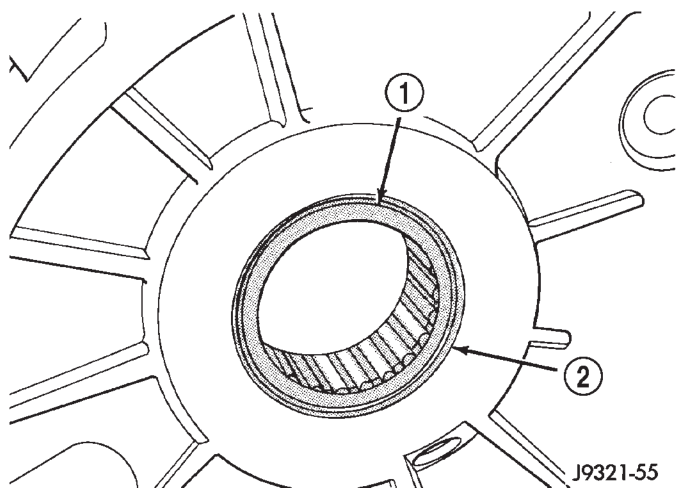


Fig. 39 Output Shaft Rear Bearing Installation Depth

1 - BEARING (SEATED) AT LOWER EDGE OF CHAMFER
2 - CHAMFER

TRANSFER CASE - NV247 (Continued)

(9) Using Remover C-4210 and Handle C-4171, drive input shaft bearing from inside the annulus gear opening in the case. (Fig. 40).

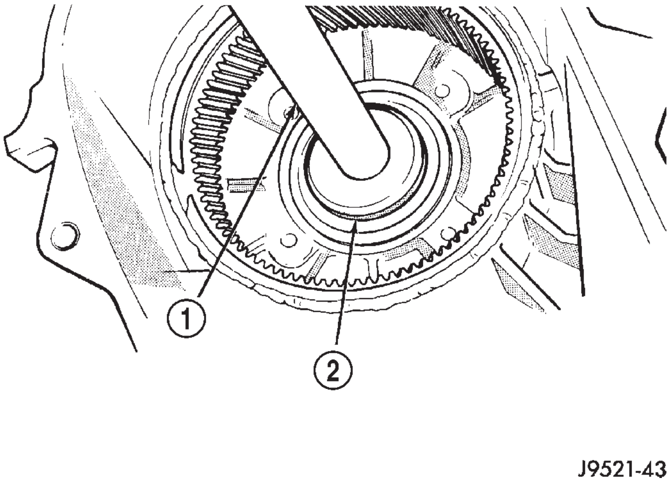


Fig. 40 Input Shaft Bearing Removal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL C-4210

(10) Install locating ring on new bearing.

(11) Position case so forward end is facing upward.

(12) Using Remover C-4210 and Handle C-4171, drive input shaft bearing into case. The bearing locating ring must be fully seated against case surface (Fig. 41).

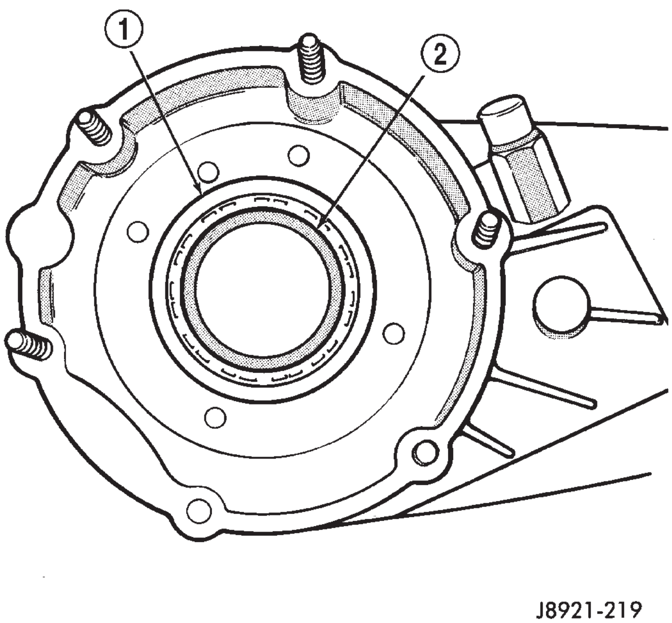


Fig. 41 Seating Input Shaft Bearing

1 - SNAP-RING
2 - INPUT SHAFT BEARING

(13) Remove input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 42).

(14) Install new pilot bearing with Installer 8128 and Handle C-4171 (Fig. 43).

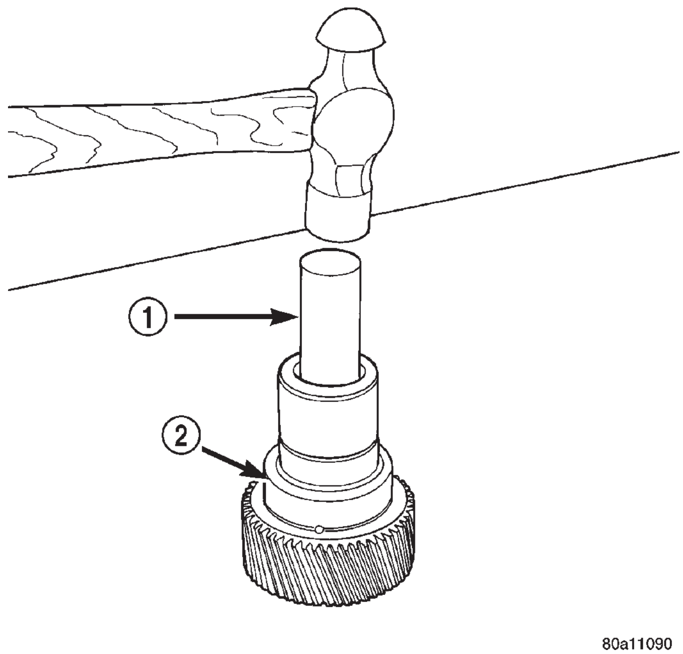


Fig. 42 Remove Input Gear Pilot Bearing

1 - DRIFT
2 - INPUT GEAR

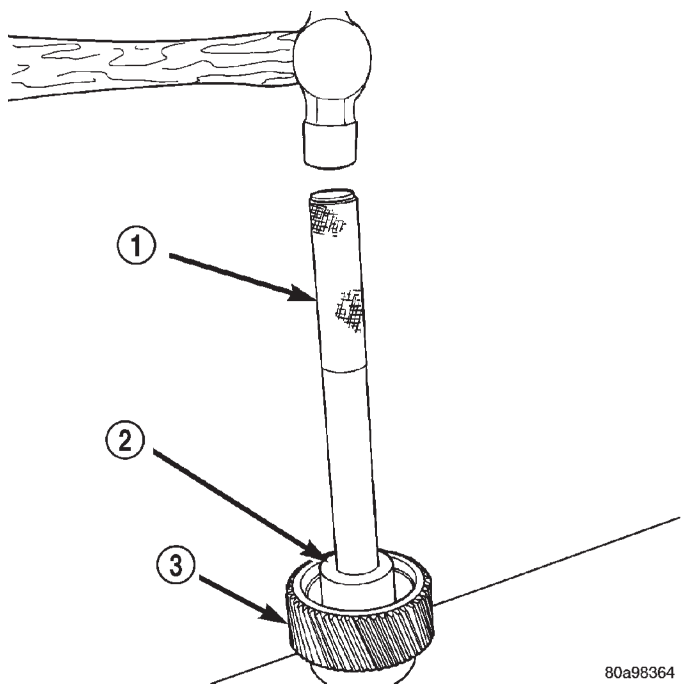


Fig. 43 Install Input Gear Pilot Bearing

1 - HANDLE C-4171
2 - INSTALLER 8128
3 - INPUT GEAR

TRANSFER CASE - NV247 (Continued)

(15) Remove front bearing retainer seal with suitable pry tool.

(16) Install new front bearing retainer with Installer 7884 (Fig. 44).

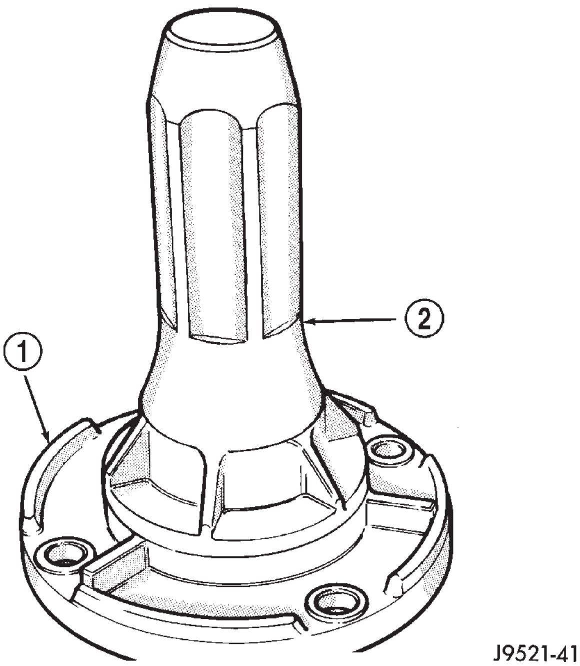


Fig. 44 Install Front Bearing Retainer Seal

1 - FRONT BEARING RETAINER
2 - SPECIAL TOOL 7884

INPUT AND LOW RANGE GEAR

(1) Lubricate gears and thrust washers (Fig. 45) with transfer case lubricant.

(2) Install first thrust washer in low range gear (Fig. 45). Be sure washer tabs are properly aligned in gear notches.

(3) Install input gear in low range gear. Be sure input gear is fully seated.

(4) Install remaining thrust washer in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.

(5) Install retainer on input gear and install snap-ring.

(6) Align and install low range/input gear assembly in front case (Fig. 46). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

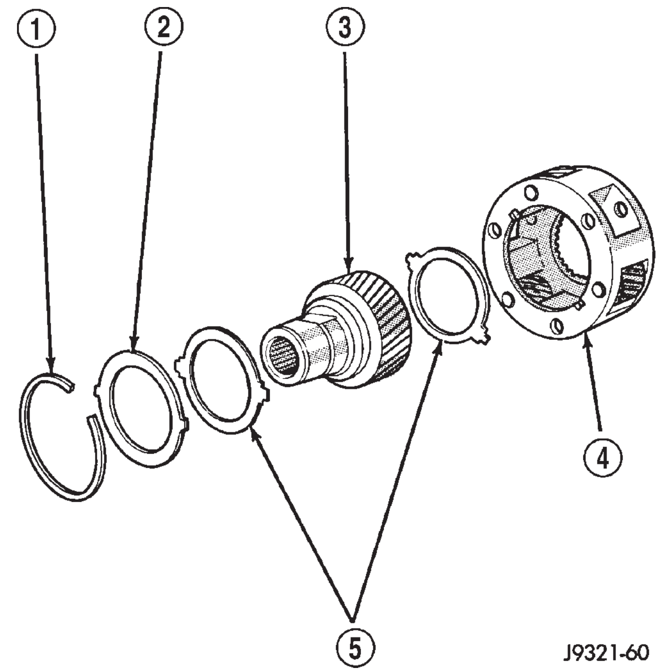


Fig. 45 Input/Low Range Gear Components

1 - SNAP-RING
2 - RETAINER PLATE
3 - INPUT GEAR
4 - LOW RANGE GEAR
5 - THRUST WASHERS

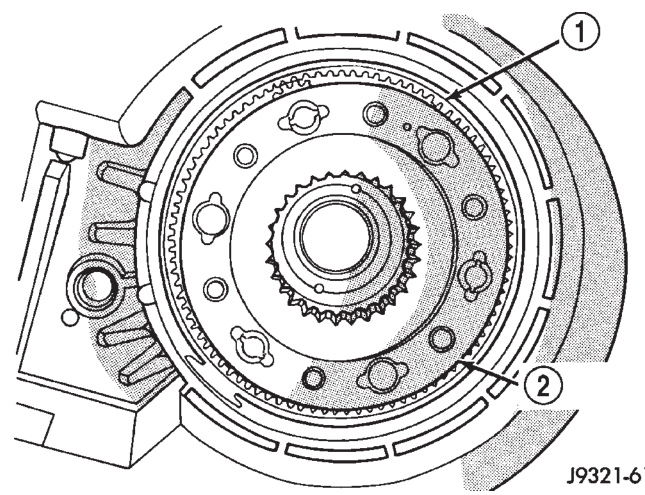


Fig. 46 Input/Low Range Gear Installation

1 - ANNULUS GEAR
2 - INPUT/LOW RANGE GEAR

TRANSFER CASE - NV247 (Continued)

(7) Install snap-ring to hold input/low range gear into front bearing (Fig. 47).

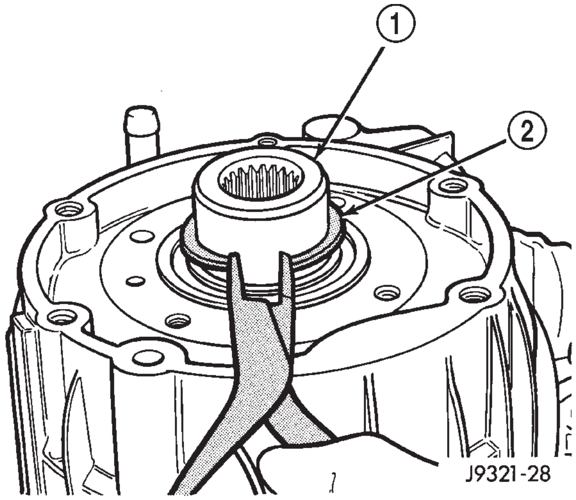


Fig. 47 Install Input Gear Snap-Ring

1 - INPUT GEAR
2 - SNAP-RING

(8) Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.

(9) Apply a 3 mm (1/8 in.) bead of Mopar® gasket maker or silicone adhesive to sealing surface of retainer.

(10) Align cavity in seal retainer with fluid return hole in front of case.

CAUTION: Do not block fluid return cavity on sealing surface of retainer when applying Mopar® gasket maker or silicone adhesive sealer. Seal failure and fluid leak can result.

(11) Install bolts to hold retainer to transfer case (Fig. 48). Tighten to 21 N·m (16 ft. lbs.) of torque.

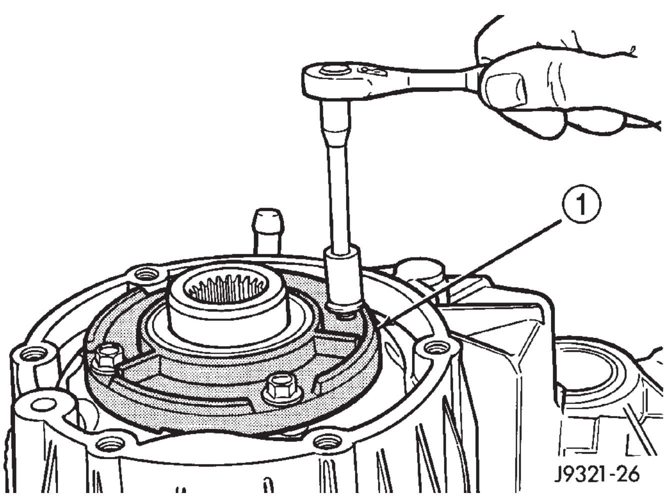


Fig. 48 Install Front Bearing Retainer

1 - FRONT BEARING RETAINER

SHIFT FORKS AND MAINSHAFT

(1) Install new sector shaft O-ring and bushing (Fig. 49).

(2) Install shift sector (Fig. 50).

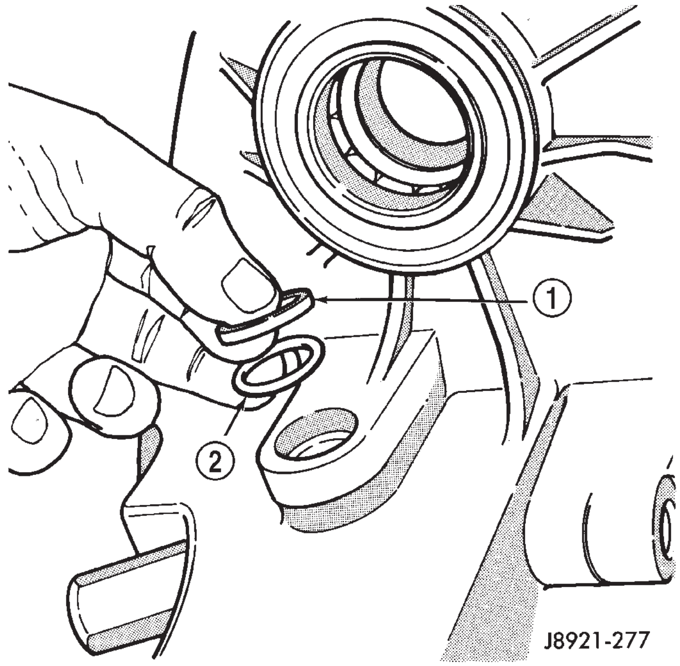


Fig. 49 Sector O-Ring And Bushing Installation

1 - SECTOR BUSHING
2 - O-RING

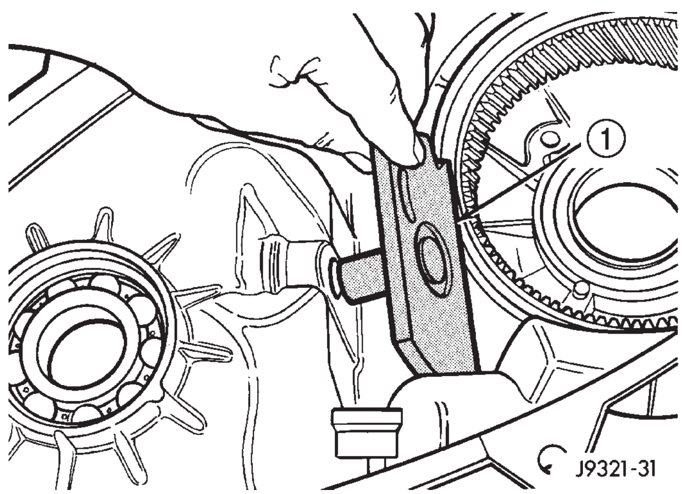


Fig. 50 Shift Sector Installation

1 - SHIFT SECTOR

(3) Install locking clutch spring, locking clutch, blockout spring, and range clutch sleeve, to mainshaft as shown in (Fig. 51). Install snap ring.

(4) Install drive sprocket hub to mainshaft and manually load the needle bearings.

(5) Install new pads on range fork, if necessary.

TRANSFER CASE - NV247 (Continued)

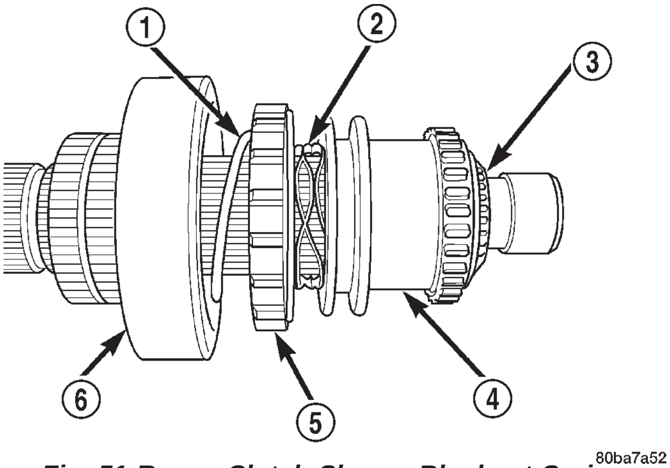


Fig. 51 Range Clutch Sleeve, Blockout Spring, Locking Clutch and Spring

1 - LOCKING CLUTCH SPRING
2 - BLOCKOUT SPRING
3 - SNAP-RING
4 - RANGE CLUTCH SLEEVE
5 - LOCKING CLUTCH
6 - DRIVE SPROCKET HUB

(6) Install range shift fork to range clutch sleeve. Install mainshaft/range shift fork assembly into transfer case and input planetary assembly. Rotate fork until it engages with slot in shift sector.

(7) Install shift rail to shift range fork and transfer case housing.

(8) Rotate shift sector to NEUTRAL position.

(9) Install new O-ring on detent plug (Fig. 52).

(10) Lubricate detent plunger with transfer case lubricant or light coat of petroleum jelly.

(11) Install detent plunger, spring and plug (Fig. 52).

(12) Verify that plunger is properly engaged in sector.

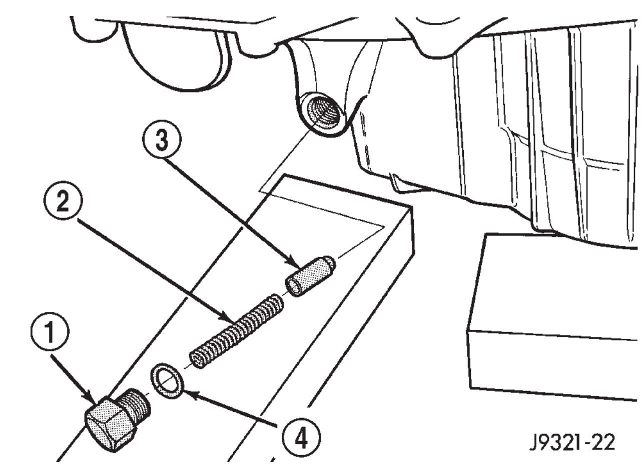


Fig. 52 Shift Detent Components

1 - DETENT PLUG
2 - DETENT SPRING
3 - DETENT PLUNGER
4 - PLUG O-RING

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Lubricate front output shaft-sprocket assembly, drive chain and drive sprocket with transfer case lubricant.

(2) Assemble drive chain, drive sprocket and front output shaft (Fig. 53).

(3) Start drive sprocket on mainshaft.

(4) Guide front shaft into bearing and drive sprocket onto mainshaft drive gear (Fig. 53).

(5) Install drive sprocket snap-ring (Fig. 54).

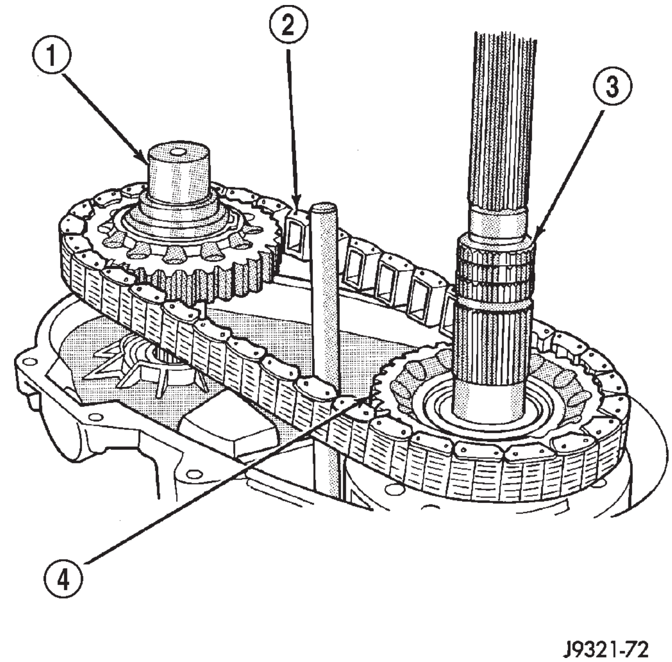


Fig. 53 Installing Drive Chain, Front Output Shaft And Drive Sprocket

1 - FRONT OUTPUT SHAFT
2 - DRIVE CHAIN
3 - MAINSHAFT
4 - DRIVE GEAR

TRANSFER CASE - NV247 (Continued)

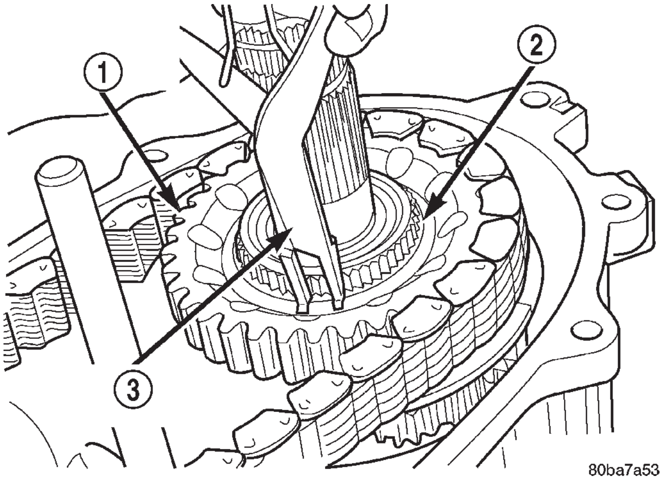


Fig. 54 Installing Drive Sprocket Snap-Ring

1 - MAINSHAFT DRIVE SPROCKET
2 - DRIVE SPROCKET SNAP-RING
3 - SNAP-RING PLIERS

(6) Install roller bearings if removed.

(7) Install progressive coupling (Fig. 55).

(8) Install the progressive coupling thrust washer over the output shaft and against the coupling.

(9) Install the oil pump locating snap-ring onto the output shaft.

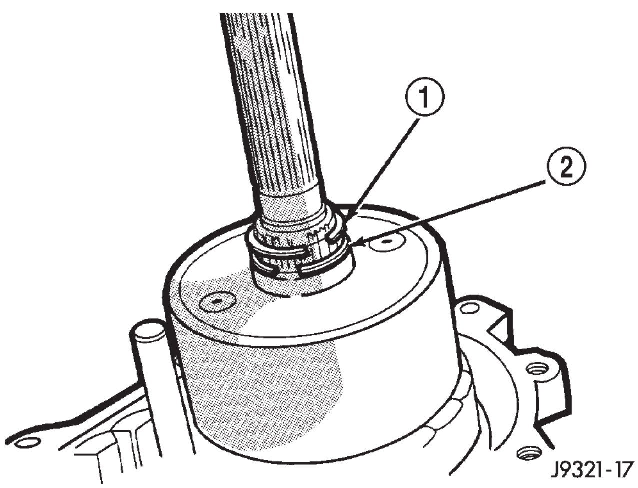


Fig. 55 Progressive Coupling Installation

1 - SNAP-RING
2 - PROGRESSIVE COUPLING

(10) Install oil pickup tube in rear case. Be sure tube is seated in case notch as shown (Fig. 56).

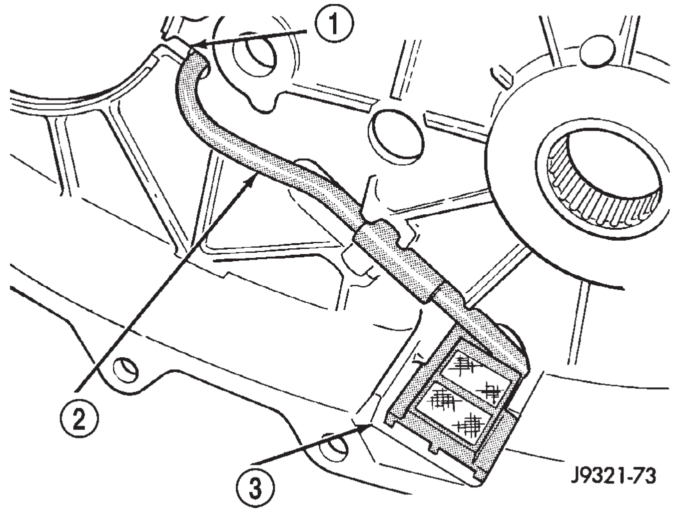


Fig. 56 Oil Pickup Tube Installation

1 - CASE NOTCH
2 - OIL PICKUP TUBE ASSEMBLY
3 - CASE SLOT

(11) Install magnet in front case pocket (Fig. 57).

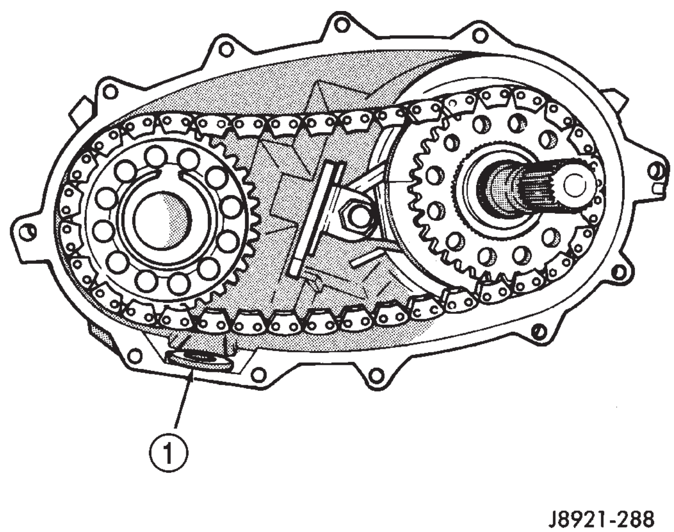


Fig. 57 Installing Case Magnet

1 - MAGNET

TRANSFER CASE - NV247 (Continued)

(12) Clean sealing flanges of front case and rear case with a wax and grease remover.

(13) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting flange of front case. Work sealer bead around bolt holes as shown (Fig. 58).

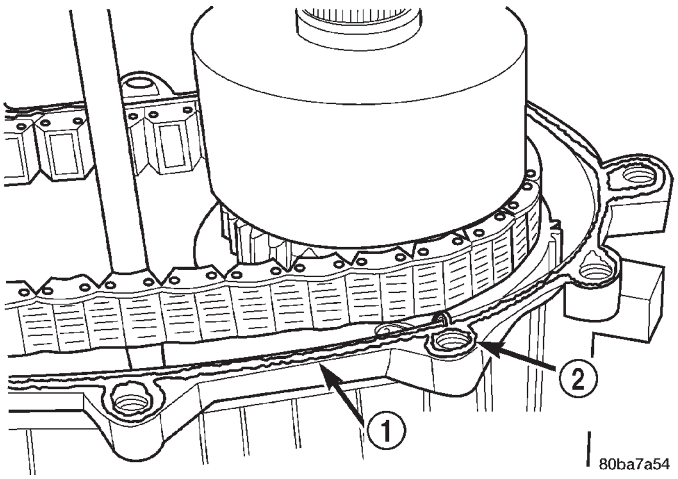


Fig. 58 Applying Sealer To Front Case Flange

1 - FRONT CASE FLANGE
2 - SEALER BEAD

(14) Align and install rear case on front case (Fig. 59).

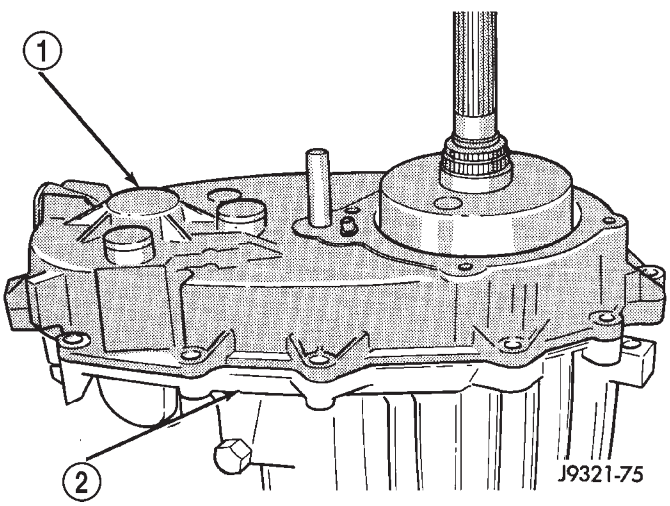


Fig. 59 Rear Case Installation

1 - REAR CASE
2 - FRONT CASE

(15) Verify that oil pickup tube is still seated in case notch and tube end is pointed toward mainshaft (Fig. 60).

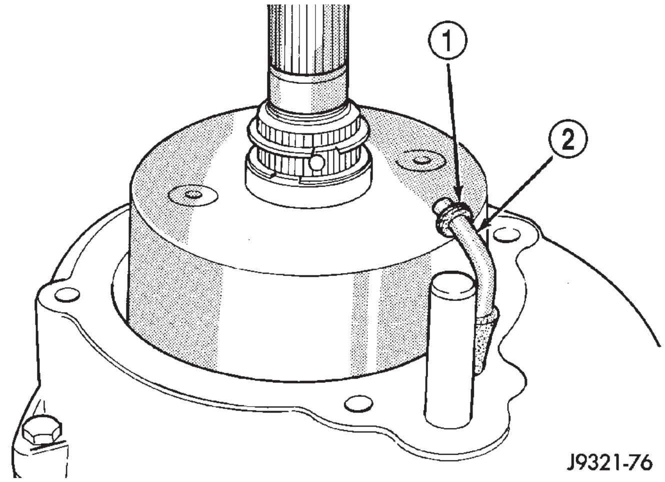


Fig. 60 Checking Position Of Oil Pickup Tube

1 - TUBE O-RING
2 - CORRECT PICKUP TUBE POSITION

(16) Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (Fig. 61).

(17) Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

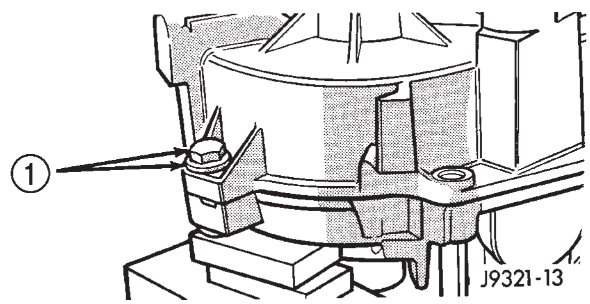


Fig. 61 Alignment Bolt

1 - ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

TRANSFER CASE - NV247 (Continued)

COMPANION FLANGE AND RANGE LEVER

(1) Install range lever, washer and locknut on sector shaft (Fig. 62). Tighten locknut to 27-34 N·m (20-25 ft. lbs.) torque.

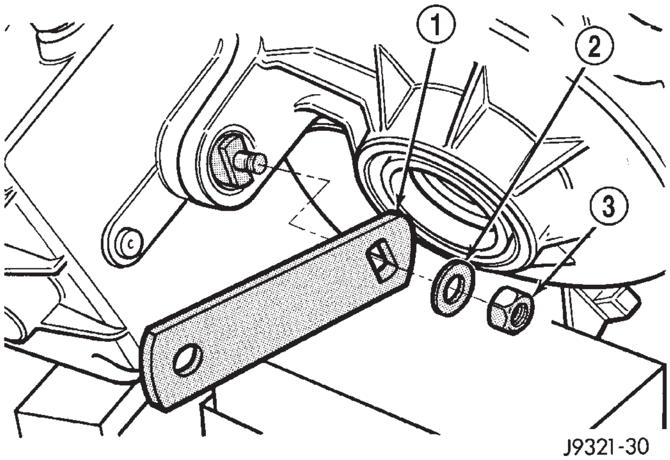


Fig. 62 Range Lever Installation - Typical

1 - RANGE LEVER
2 - WASHER
3 - LOCKNUT

(2) Install new seal washer on front output shaft (Fig. 63).

(3) Lubricate flange hub with transfer case lubricant and install flange on front shaft.

(4) Install new seal washer on front shaft.

(5) Install companion flange and new nut on front output shaft.

(6) Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281, or similar tool to hold flange while tightening yoke nut.

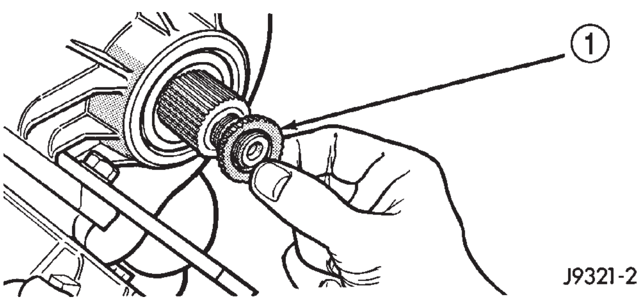


Fig. 63 Flange Seal Washer Installation

1 - YOKE SEAL WASHER

REAR RETAINER AND OIL PUMP

(1) Install new O-ring on flanged end of oil pickup tube.

(2) Install oil pump (Fig. 64).

(3) Insert oil pickup tube in pump (Fig. 65).

(4) Install rear bearing on mainshaft (Fig. 65). Locating ring groove in bearing goes toward end of mainshaft.

(5) Install rear bearing retaining snap-ring (Fig. 66).

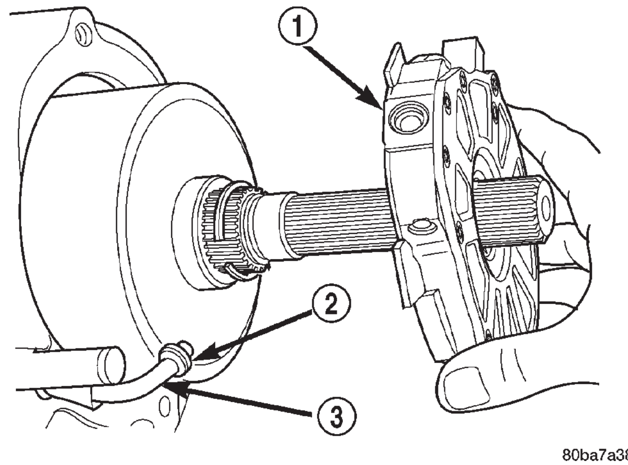


Fig. 64 Installing Oil Pump

1 - OIL PUMP
2 - TUBE O-RING
3 - OIL PICKUP TUBE

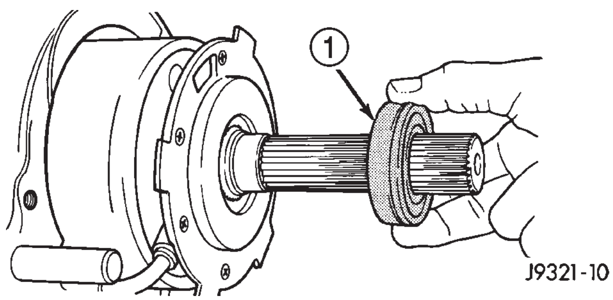


Fig. 65 Rear Bearing Installation

1 - REAR BEARING

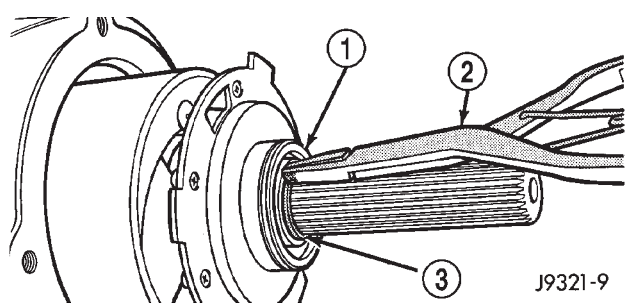


Fig. 66 Rear Bearing Snap-Ring Installation

1 - REAR BEARING
2 - SNAP-RING PLIERS
3 - SNAP-RING

(6) Install rear bearing locating ring in rear retainer, if ring was removed during overhaul.

TRANSFER CASE - NV247 (Continued)

(7) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting surface of rear retainer. Allow sealer to set-up slightly before proceeding.

(8) Slide rear retainer onto mainshaft (Fig. 67).

(9) Spread rear bearing locating ring and slide rear retainer into place on rear case (Fig. 68).

(10) Install and tighten rear retainer bolts to 27-34 N·m (20-25 ft. lbs.).

(11) Install rubber access plug (Fig. 69).

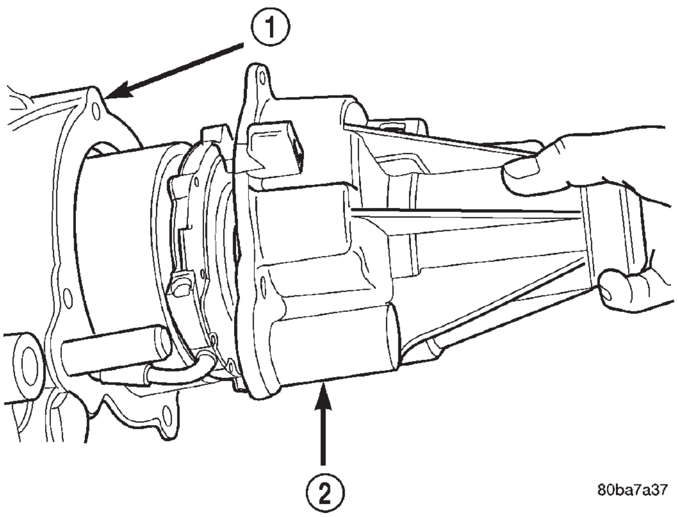


Fig. 67 Rear Retainer Installation

1 - REAR CASE
2 - REAR RETAINER

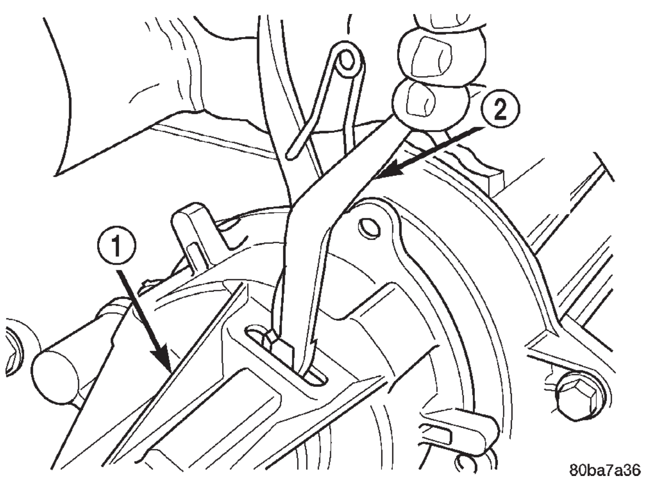


Fig. 68 Engaging Rear Bearing Locating Ring

1 - REAR RETAINER
2 - PARALLEL JAW SNAP-RING PLIERS

FINAL ASSEMBLY

(1) Install drain plug. Tighten plug to 41-54 N·m (30-40 ft. lbs.) torque.

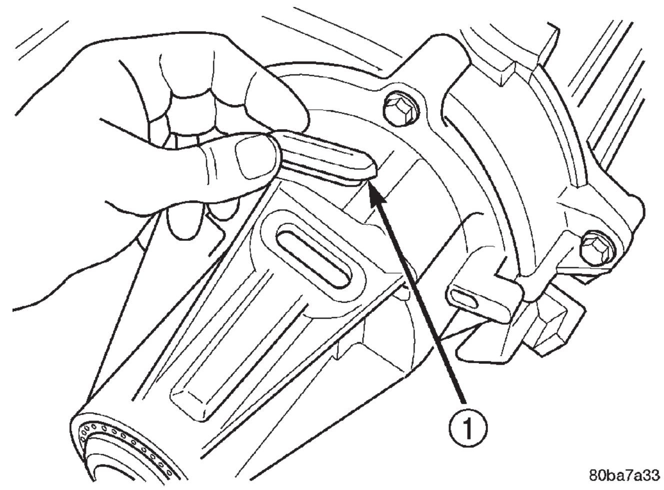


Fig. 69 Installing Rubber Access Plug

1 - PLUG

(2) Level transfer case and fill it with Mopar® Transfer Case Lubricant. Correct fill level is to bottom edge of fill plug hole.

(3) Install and tighten fill plug to 41-54 N·m (30-40 ft. lbs.) torque.

INSTALLATION

(1) Mount transfer case on a transmission jack.

(2) Secure transfer case to jack with chains.

(3) Position transfer case under vehicle.

(4) Align transfer case and transmission shafts and install transfer case on transmission.

(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 70).

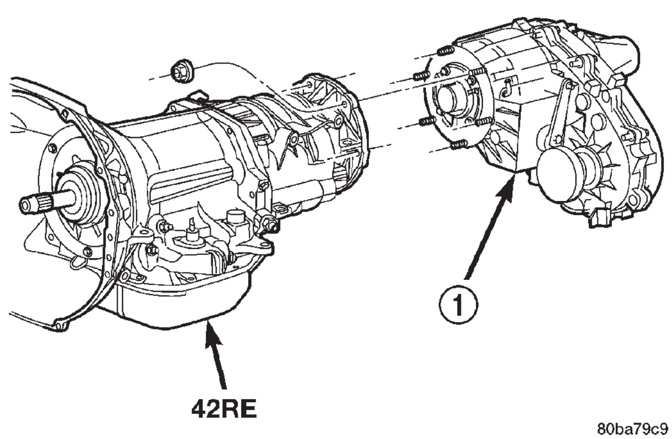


Fig. 70 Install Transfer Case

1 - NV247 TRANSFER CASE

TRANSFER CASE - NV247 (Continued)

(6) Connect front propeller shaft and install rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

(7) Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.

(8) Install rear crossmember (Fig. 71) and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(9) Remove transmission jack and support stand.

(10) Verify transfer case is in NEUTRAL. Connect shift cable to transfer case range lever.

(11) Lower vehicle and verify transfer case shift operation.

(12) Adjust the transfer case shift cable, if necessary.

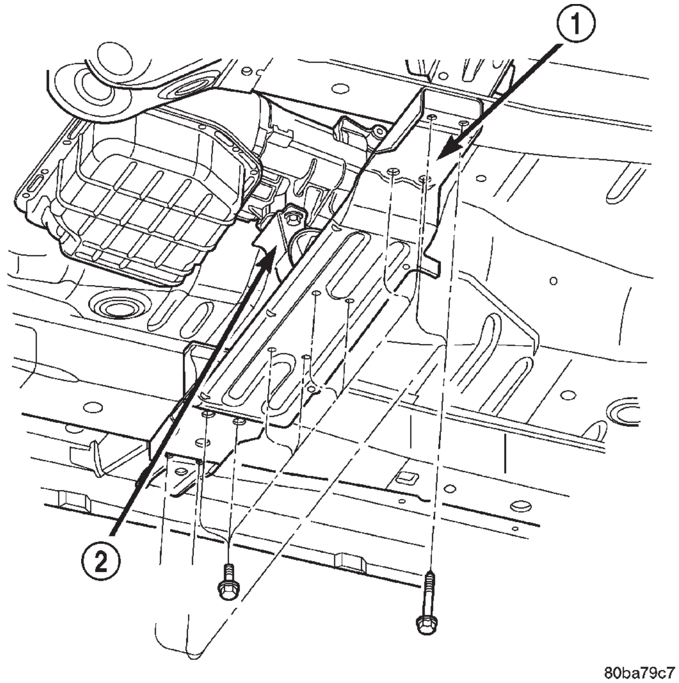


Fig. 71 Crossmember Installation

1 - CROSSMEMBER
2 - REAR TRANSMISSION MOUNT

SPECIFICATIONS

TRANSFER CASE - NV247

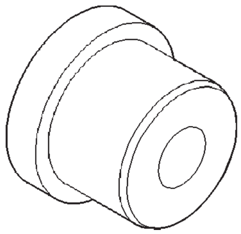
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, crossmember	41-47	30.2-34.7	-
Plug, Detent	16-24	11.8-17.7	-
Plugs, drain/fill	20-34	15-25	-
Bolts, front brg. retainer	16-24	11.8-17.7	-
Bolts, case half	27-34	19.9-25	-
Nut, companion flange	122-176	90-130	-
Bolts, rear extension	27-34	19.9-25	-
Lock-nut, shift	27-34	19.9-25	-
Nuts, T-case mount stud	33-41	24.3-30.2	-

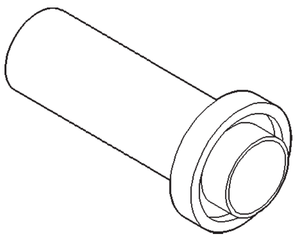
TRANSFER CASE - NV247 (Continued)

SPECIAL TOOLS

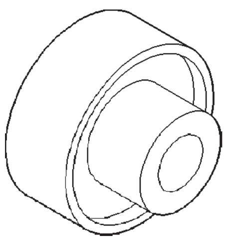
TRANSFER CASE - NV247



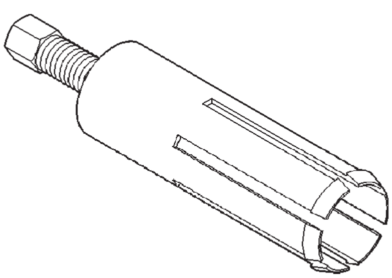
Installer, Bearing - 5066



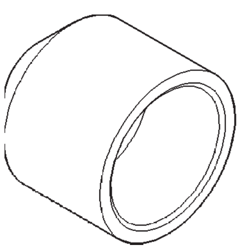
Installer, Seal - 6952-A



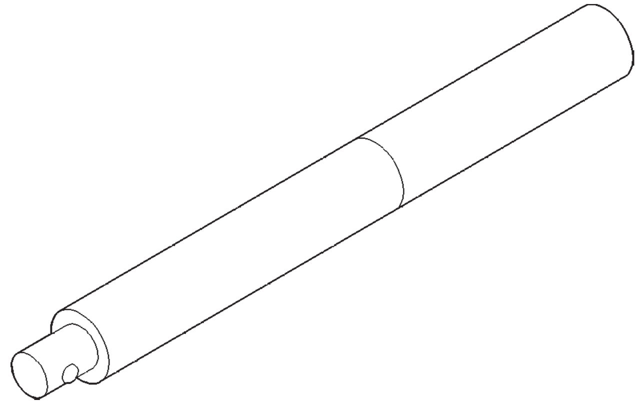
Installer, Bearing - 6953



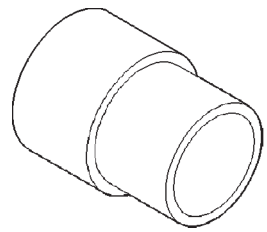
Remover, Bushing - 6957



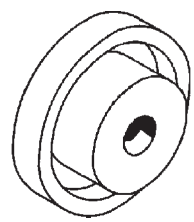
Installer, Seal - C-3995-A



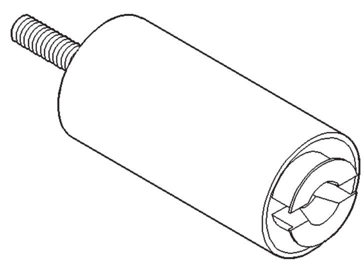
Handle - C-4171



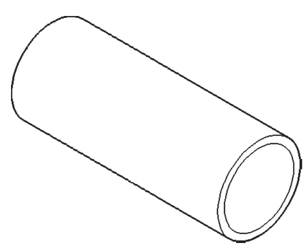
Installer, Bushing - 8145



Remover, Bearing - C-4210

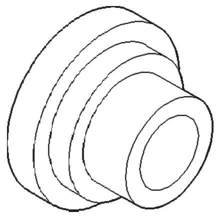


Remover, Bearing - L-4454

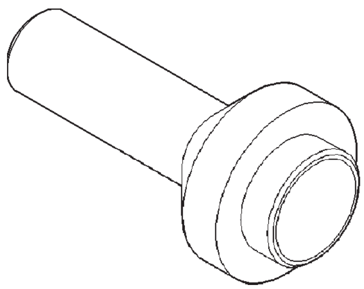


Cup - 8148

TRANSFER CASE - NV247 (Continued)



Installer, Bearign - 8128



Installer, Seal - 7884

FLUID

STANDARD PROCEDURE - FLUID DRAIN/ REFILL

The fill and drain plugs are both in the rear case (Fig. 72).

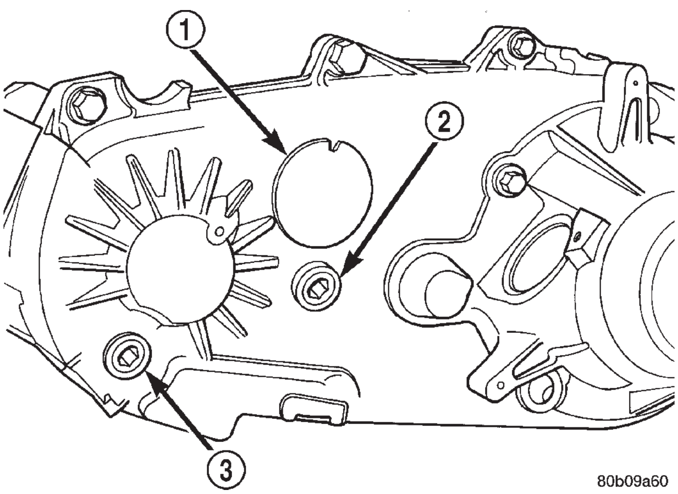


Fig. 72 Fill/Drain Plug and I.D. Tag Location - Typical

1 - I.D. TAG
2 - FILL PLUG
3 - DRAIN PLUG

(1) Raise vehicle.
(2) Position drain pan under transfer case.
(3) Remove drain and fill plugs and drain lubricant completely.
(4) Install drain plug. Tighten plug to 20-34 N·m (15-25 ft. lbs.).
(5) Remove drain pan.
(6) Fill transfer case to bottom edge of fill plug opening with Mopar® Transfer Case Lubricant.
(7) Install and tighten fill plug to 20-34 N·m (15-25 ft. lbs.).
(8) Lower vehicle.

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle on hoist.
(2) Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/ PROPELLER SHAFT - REMOVAL)
(3) Remove front output shaft companion shaft.
(4) Remove seal from front case with pry tool (Fig. 73).

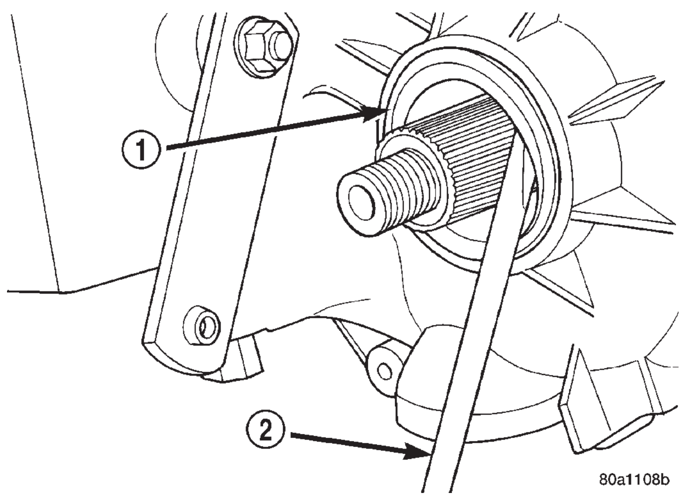


Fig. 73 Remove Front Output Shaft Seal

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 6952-A as follows:
 (a) Place new seal on tool. Garter spring on seal goes toward interior of case.
 (b) Start seal in bore with light taps from hammer (Fig. 74). Once seal is started, continue tapping seal into bore until installer tool seats against case.
(2) Install companion flange and torque nut to 122-176 N·m (90-130 ft. lbs.).
(3) Install front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/ PROPELLER SHAFT - INSTALLATION)

FRONT OUTPUT SHAFT SEAL (Continued)

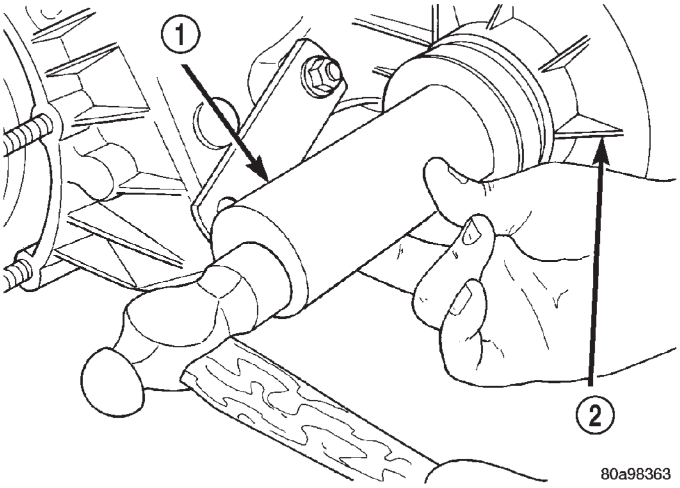


Fig. 74 Front Output Seal Installation

1 - INSTALLER 6952-A
2 - TRANSFER CASE

REAR RETAINER BUSHING AND SEAL

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(3) Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.

(4) Using Remover 6957, remove bushing from rear retainer (Fig. 75).

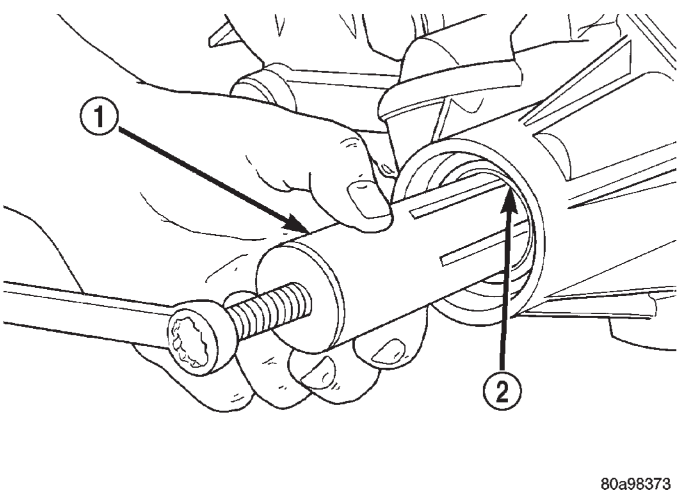


Fig. 75 Rear Retainer Bushing Removal

1 - REMOVER 6957
2 - REAR RETAINER BUSHING

INSTALLATION

(1) Clean fluid residue from sealing surface and inspect for defects.

(2) Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.

(3) Using Installer 8145, drive bushing into retainer until installer seats against case (Fig. 76).

(4) Using Installer C-3995-A, install seal in rear retainer (Fig. 77).

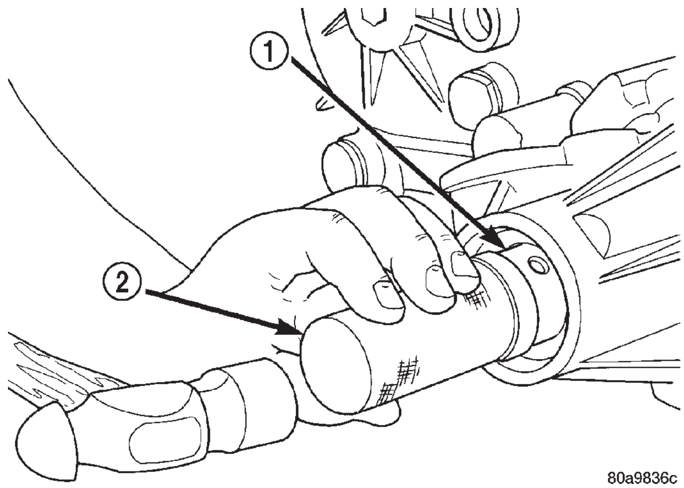


Fig. 76 Rear Retainer Bushing Installation

1 - REAR RETAINER BUSHING
2 - INSTALLER 8145

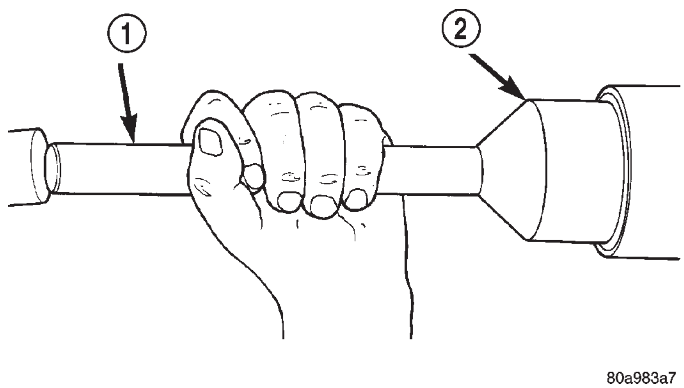


Fig. 77 Install Rear Retainer Seal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL C-3995-A

(5) Install rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

(6) Verify proper fluid level.

(7) Lower vehicle.

SHIFT CABLE

REMOVAL

(1) Shift transfer case into NEUTRAL.

(2) Raise vehicle.

(3) Disconnect the shift cable eyelet from the transfer case shift lever (Fig. 78).

(4) Remove shift cable from the cable support bracket.

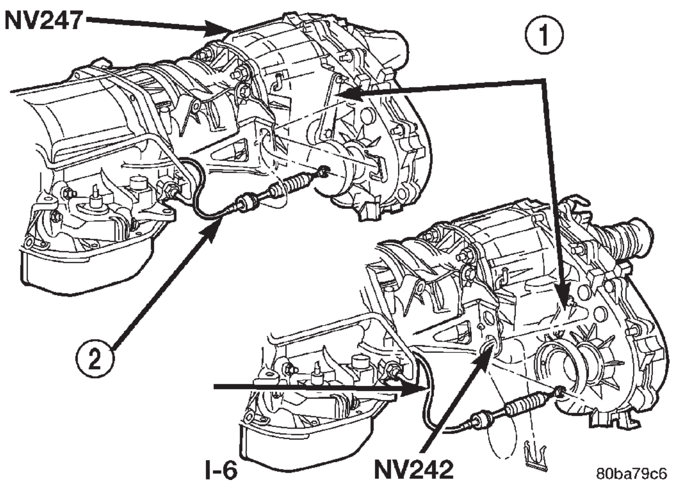


Fig. 78 Transfer Case Shift Cable at Transfer Case

1 - TRANSFER CASE SHIFT LEVER
2 - TRANSFER CASE SHIFT CABLE

(5) Lower vehicle.

(6) Remove any necessary console parts for access to shift lever assembly and shift cable.

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 79).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 80).

(9) Pull cable through floor panel opening.

(10) Remove transfer case shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan (Fig. 80). Tighten nuts to 7 N·m (65 in.lbs.).

(4) Install the transfer case shift cable to the shifter assembly bracket. Seat cable in bracket and install clip (Fig. 79).

(5) Verify the transfer case shift lever (at console) is in the NEUTRAL position.

(6) Snap the cable onto the shift lever pin (Fig. 79).

(7) Raise the vehicle.

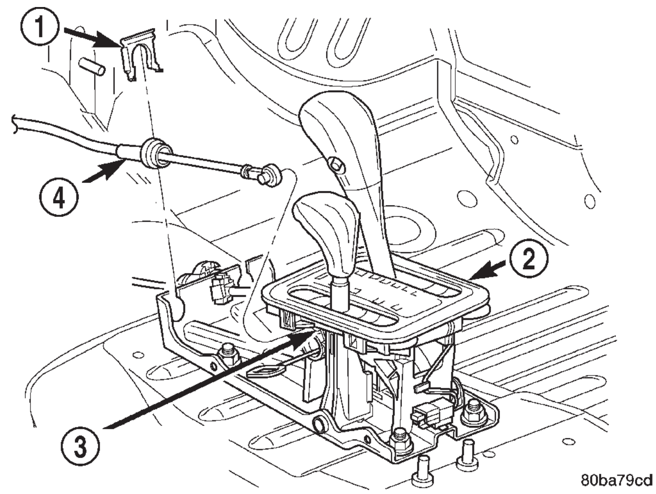


Fig. 79 Transfer Case Shift Cable at Shifter

1 - CLIP
2 - SHIFTER
3 - TRANSFER CASE SHIFT LEVER PIN
4 - TRANSFER CASE SHIFT CABLE

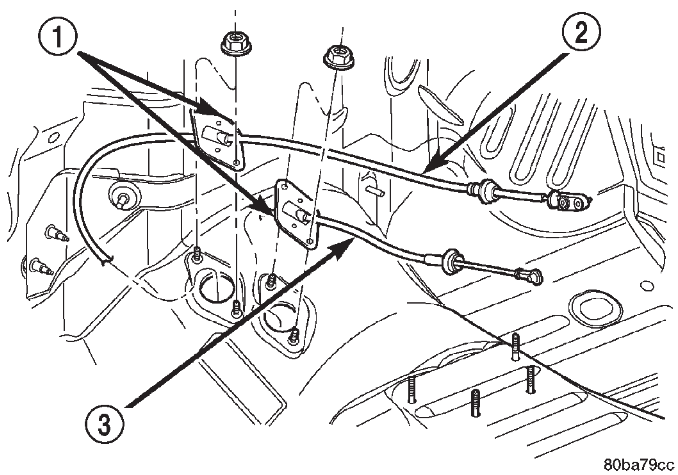


Fig. 80 Shift Cables at Floor Pan

1 - SEAL PLATES
2 - TRANSMISSION SHIFT CABLE
3 - TRANSFER CASE SHIFT CABLE

(8) Install the shift cable to the shift cable support bracket and install clip (Fig. 78).

(9) Verify that the transfer case is still in the NEUTRAL position.

(10) Snap the shift cable onto the transfer case shift lever (Fig. 78).

(11) Lower vehicle.

(12) Verify correct transfer case operation in all ranges.

(13) Install any console parts removed for access to transfer case shift cable.

TIRES/WHEELS

TABLE OF CONTENTS

TIRES/WHEELS

DIAGNOSIS AND TESTING - TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel (Fig. 1).

Lateral runout is the **wobble** of the tire or wheel.

Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

METHOD 1 (RELOCATE WHEEL ON HUB)

(1) Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

(2) Check wheel bearings and adjust if adjustable or replace if necessary.

(3) Check the wheel mounting surface.

(4) Relocate wheel on the mounting, two studs over from the original position.

(5) Tighten wheel nuts until all are properly torqued, to eliminate brake distortion.

(6) Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

METHOD 2 (RELOCATE TIRE ON WHEEL)

NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.

TIRES/WHEELS (Continued)

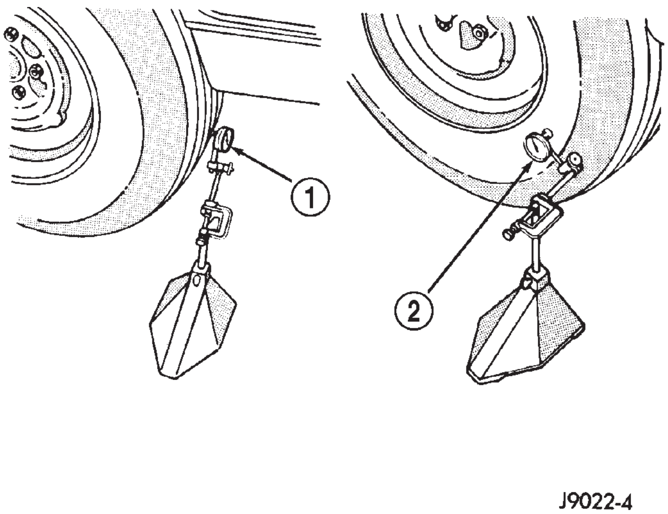


Fig. 1 Checking Tire/Wheel/Hub Runout

1 - RADIAL RUNOUT
2 - LATERAL RUNOUT

(1) Remove tire from wheel and mount wheel on service dynamic balance machine.

(2) Check wheel radial runout (Fig. 2) and lateral runout (Fig. 3).

- STEEL WHEELS: Radial runout 0.040 in., Lateral runout 0.045 in. (maximum)
- ALUMINUM WHEELS: Radial runout 0.030 in., Lateral runout 0.035 in. (maximum)

(3) If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout,(Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE) .

STANDARD PROCEDURE

STANDARD PROCEDURE - TIRE AND WHEEL BALANCE

It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

NOTE: Static should be used only when a two plane balancer is not available.

NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.

For static balancing, find the location of the heavy spot causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight

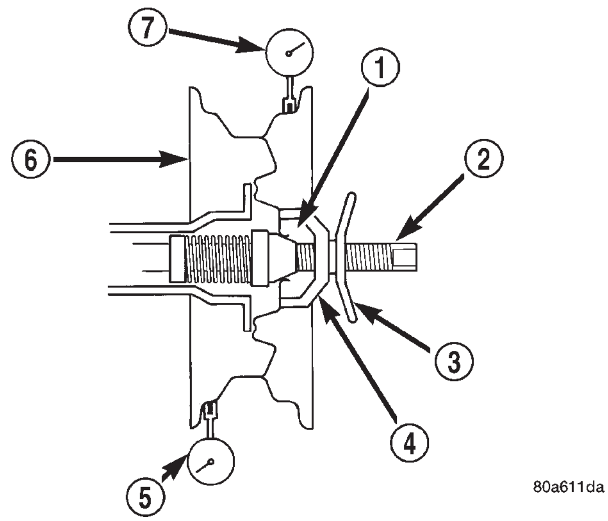


Fig. 2 Radial Runout

1 - MOUNTING CONE
2 - SPINDLE SHAFT
3 - WING NUT
4 - PLASTIC CUP
5 - DIAL INDICATOR
6 - WHEEL
7 - DIAL INDICATOR

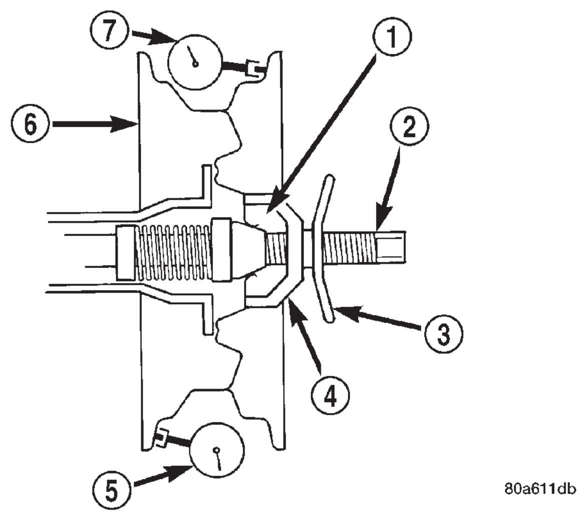


Fig. 3 Lateral Runout

1 - MOUNTING CONE
2 - SPINDLE SHAFT
3 - WING NUT
4 - PLASTIC CUP
5 - DIAL INDICATOR
6 - WHEEL
7 - DIAL INDICATOR

TIRES/WHEELS (Continued)

required to counter balance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 4).

For dynamic balancing, the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (Fig. 5).

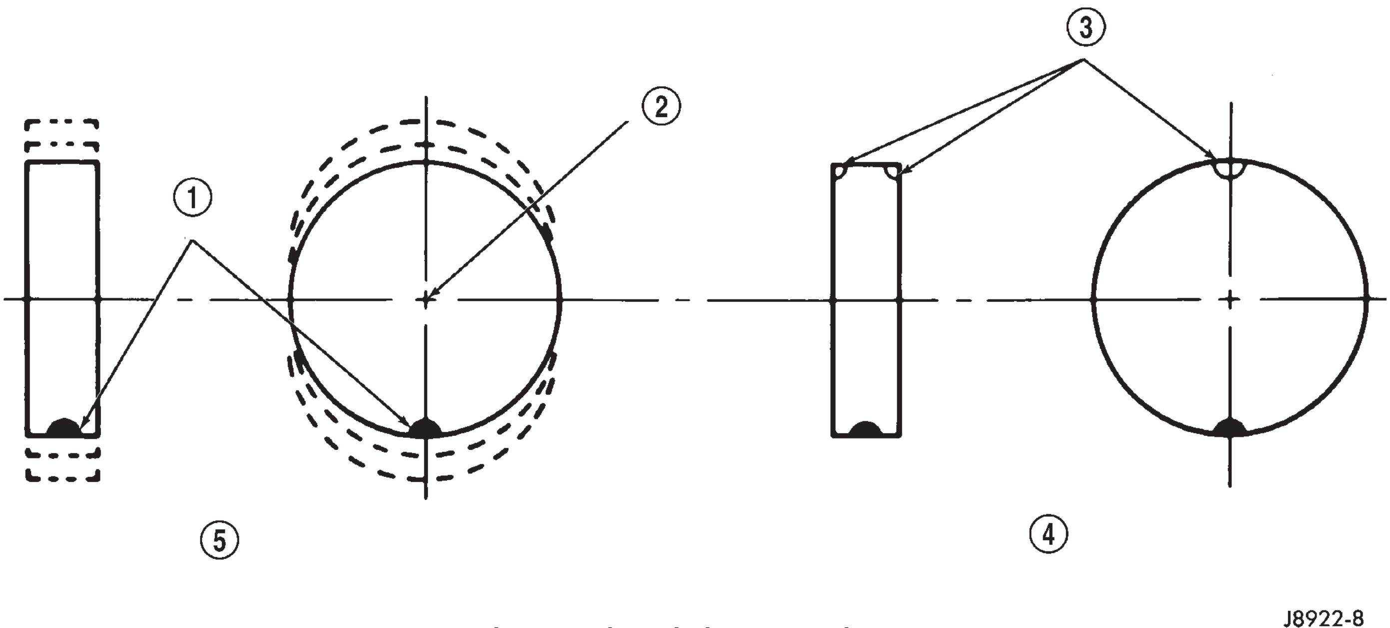


Fig. 4 Static Unbalance & Balance

1 - HEAVY SPOT
2 - CENTER LINE OF SPINDLE
3 - ADD BALANCE WEIGHTS HERE
4 - CORRECTIVE WEIGHT LOCATION
5 - TIRE OR WHEEL TRAMP, OR WHEEL HOP

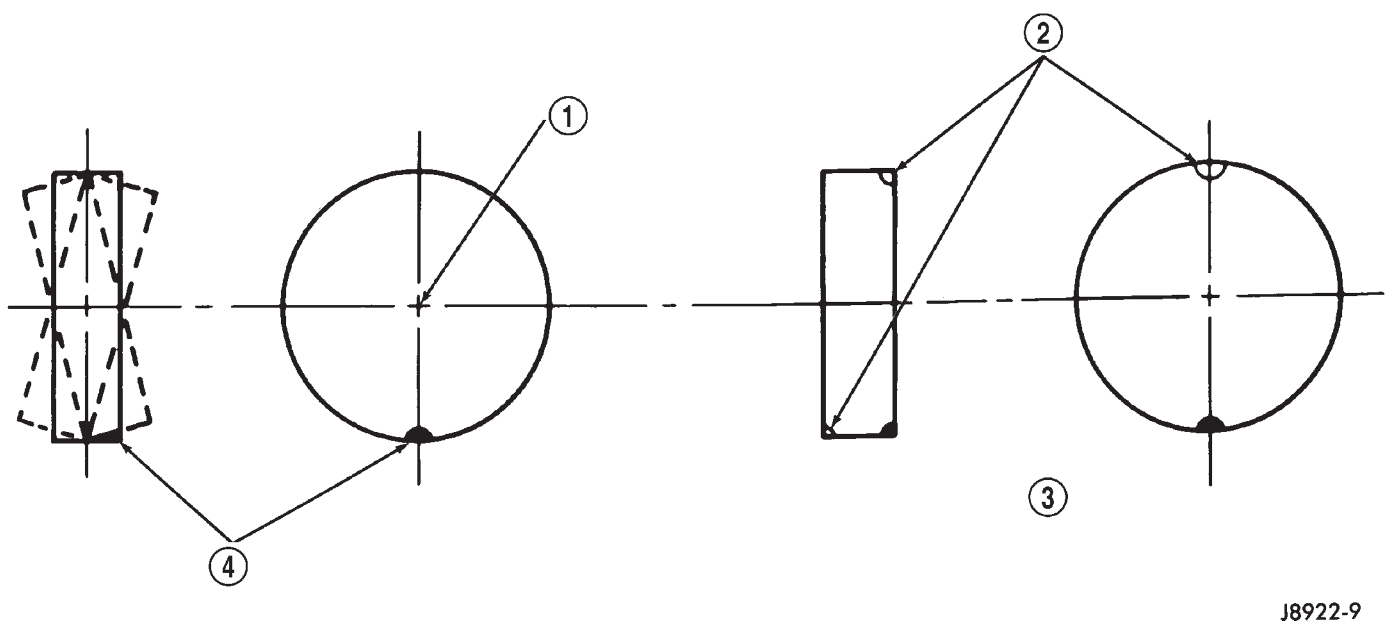


Fig. 5 Dynamic Unbalance & Balance

1 - CENTER LINE OF SPINDLE
2 - ADD BALANCE WEIGHTS HERE
3 - CORRECTIVE WEIGHT LOCATION
4 - HEAVY SPOT WHEEL SHIMMY AND VIBRATION

TIRES/WHEELS (Continued)

STANDARD PROCEDURE - MATCH MOUNTING

Tires and wheels are currently not match mounted at the factory. Match mounting is a technique used to reduce runout in the wheel/tire assembly. This means that the high spot of the tire is aligned with the low spot on the wheel rim. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot on the inside of the rim. If the outside label has been removed the tire will have to be removed to locate the dot on the inside of the rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Use a dial indicator to locate the high spot of the tire on the center tread rib (Fig. 6). Record the indicator reading and mark the high spot on the tire. Place a mark on the tire at the valve stem location (Fig. 7).

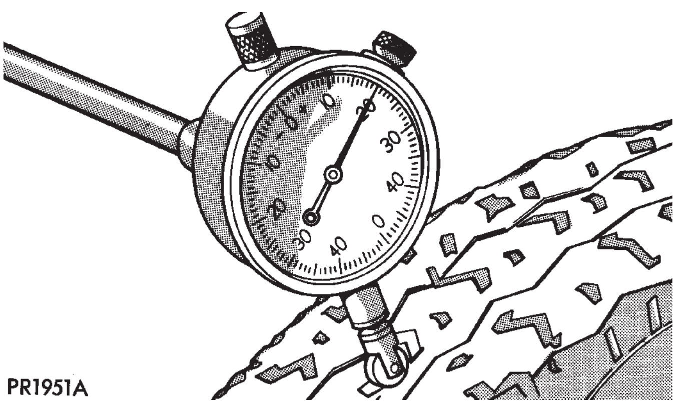


Fig. 6 Dial Indicator

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 8).

(3) Measure the total runout again and mark the tire to indicate the high spot.

(4) If runout is still excessive use the following procedures.

(a) If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.

(b) If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications,(Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING).

(c) If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 9). This procedure will normally reduce the runout to an acceptable amount.

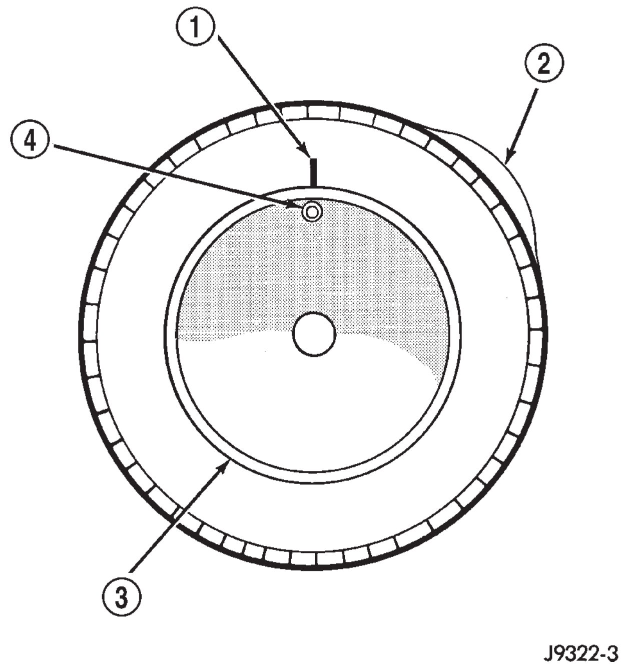


Fig. 7 First Measurement On Tire

1 - REFERENCE MARK
2 - 1ST MEASUREMENT
HIGH SPOT MARK TIRE AND RIM
3 - WHEEL
4 - VALVE STEM

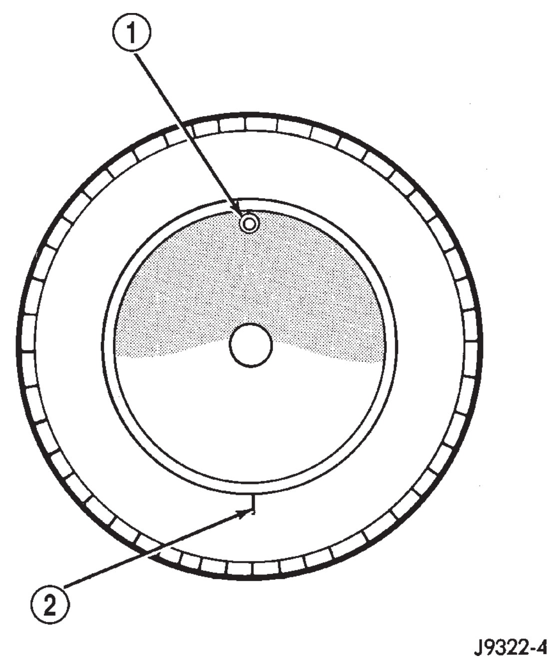


Fig. 8 Remount Tire 180 Degrees

1 - VALVE STEM
2 - REFERENCE MARK

TIRES/WHEELS (Continued)

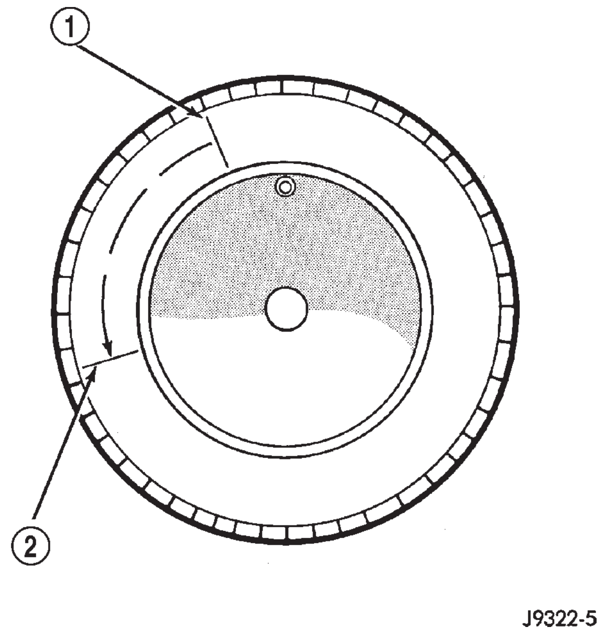


Fig. 9 Remount Tire 90 Degrees In Direction of Arrow

1 - 2ND HIGH SPOT ON TIRE
2 - 1ST HIGH SPOT ON TIRE

STANDARD PROCEDURE - TIRE ROTATION

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is (Fig. 10). Other rotation methods can be used, but they will not provide all the tire longevity benefits.

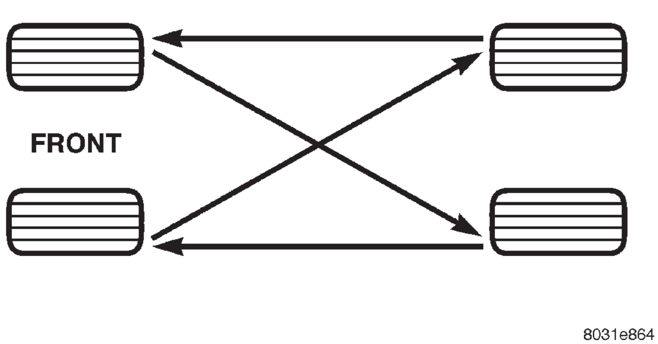


Fig. 10 Tire Rotation Pattern

STANDARD PROCEDURE - WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

NOTE: Do not use chrome plated lug nuts with chrome plated wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification (Fig. 11). **Never use oil or grease on studs or nuts.**

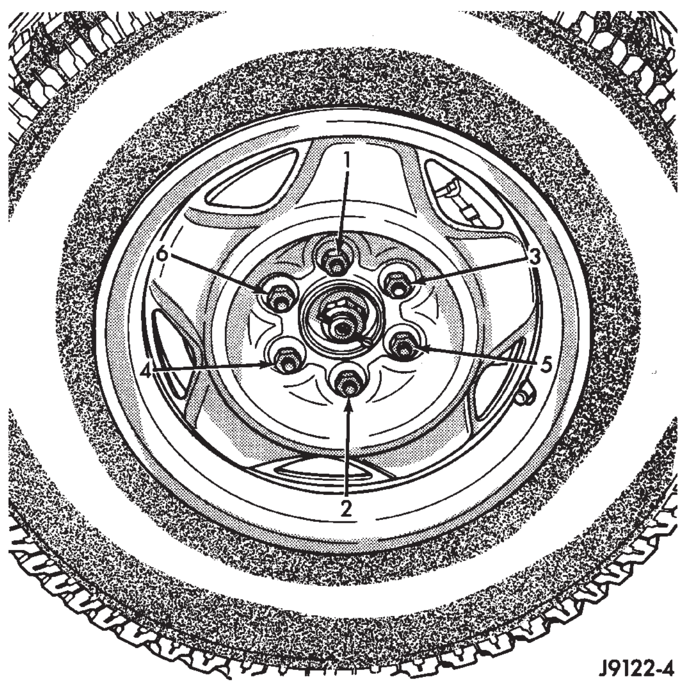


Fig. 11 LUG NUT TIGHTENING PATTERN - TYPICAL

TIRES

DESCRIPTION

DESCRIPTION - TIRES

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation.(Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE), This will help to achieve a greater tread life.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 12).

Performance tires have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. These ratings are:

- **Q** up to 100 mph
- **S** up to 112 mph
- **T** up to 118 mph
- **U** up to 124 mph
- **H** up to 130 mph
- **V** up to 149 mph
- **Z** more than 149 mph (consult the tire manufacturer for the specific speed rating)

An All Season type tire will have either **M + S, M & S or M–S** (indicating mud and snow traction) imprinted on the side wall.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

DESCRIPTION - RADIAL–PLY TIRES

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

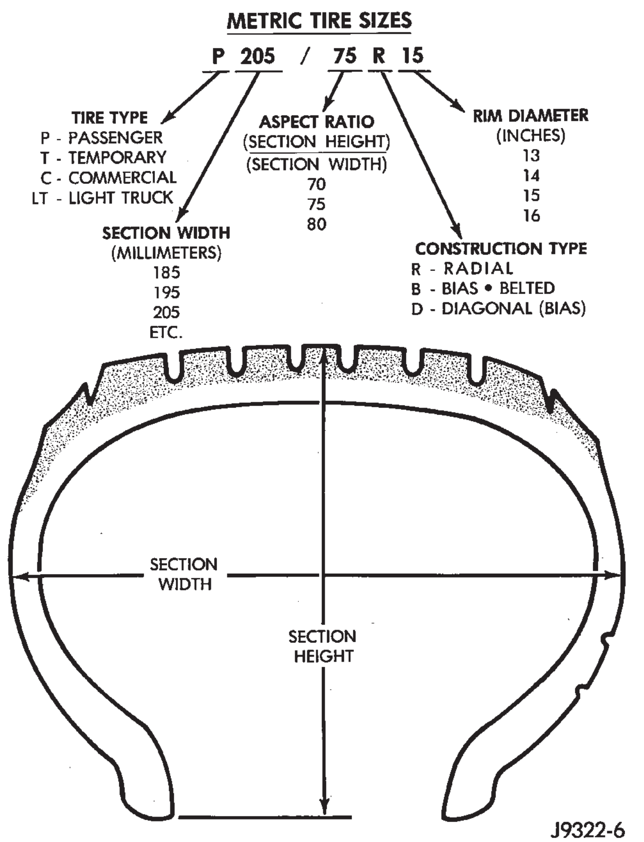


Fig. 12 Tire Identification

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

DESCRIPTION - TIRE INFLATION PRESSURES

Under inflation will cause rapid shoulder wear, tire flexing, and possible tire failure (Fig. 13).

Over inflation will cause rapid center wear and loss of the tire's ability to cushion shocks (Fig. 14).

Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy

TIRES (Continued)

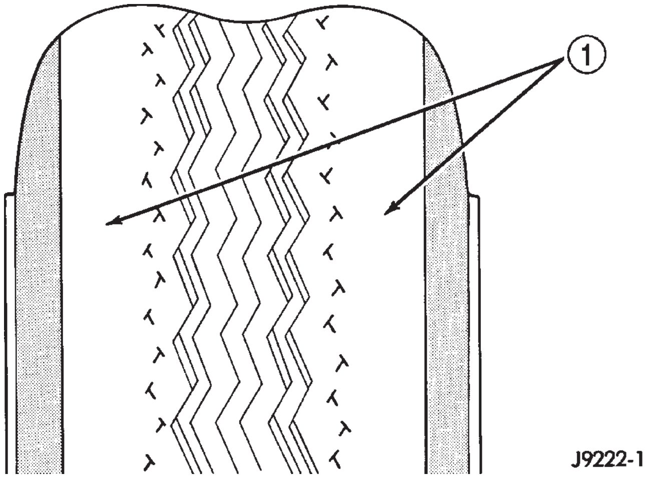


Fig. 13 Under Inflation Wear

1 - THIN TIRE THREAD AREAS

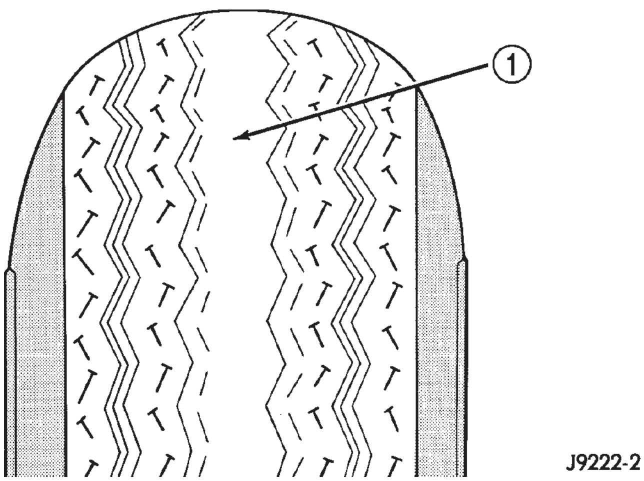


Fig. 14 Over Inflation Wear

1 - THIN TIRE THREAD AREA

- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the Tire Inflation Pressure Chart provided with the vehicles Owners Manual. A Certification Label on the drivers side door pillar provides the minimum tire and rim size for the vehicle. The label also list the cold inflation pressure for these tires at full load operation

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once a month. Tire pressure decreases as the ambient temperature drops. Check tire pressure frequently when ambient temperature varies widely.

Tire inflation pressures are cold inflation pressure. The vehicle must sit for at least 3 hours to obtain the correct cold inflation pressure reading. Or be driven less than one mile after sitting for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND TREAD WEAR. THIS MAY CAUSE THE TIRE TO FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

DESCRIPTION - TIRE PRESSURE FOR HIGH SPEED

Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

DESCRIPTION - REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

DIAGNOSIS AND TESTING - TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band (Fig. 15).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

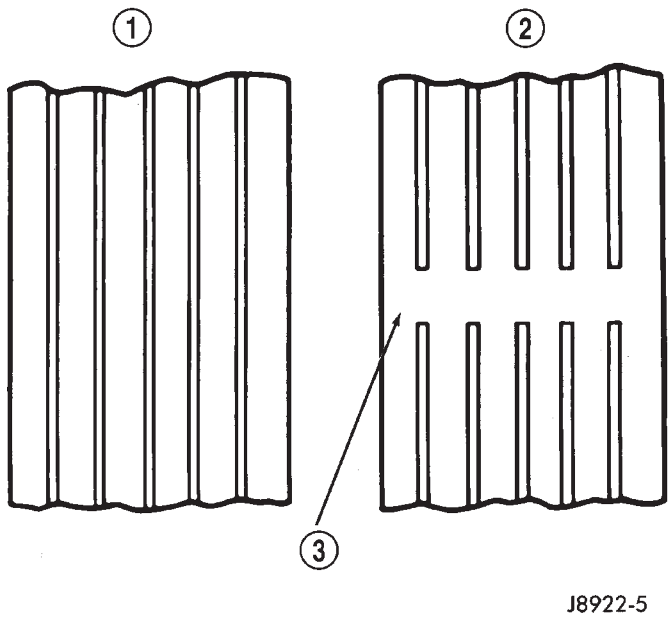


Fig. 15 Tread Wear Indicators

1 - TREAD ACCEPTABLE
2 - TREAD UNACCEPTABLE
3 - WEAR INDICATOR

DIAGNOSIS AND TESTING - TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other (Fig. 16).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 16).

DIAGNOSIS AND TESTING - TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

STANDARD PROCEDURE - REPAIRING LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 17). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and tighten to proper torque specification (Refer to 22 - TIRES/WHEELS/ WHEELS - SPECIFICATIONS).

TIRES (Continued)

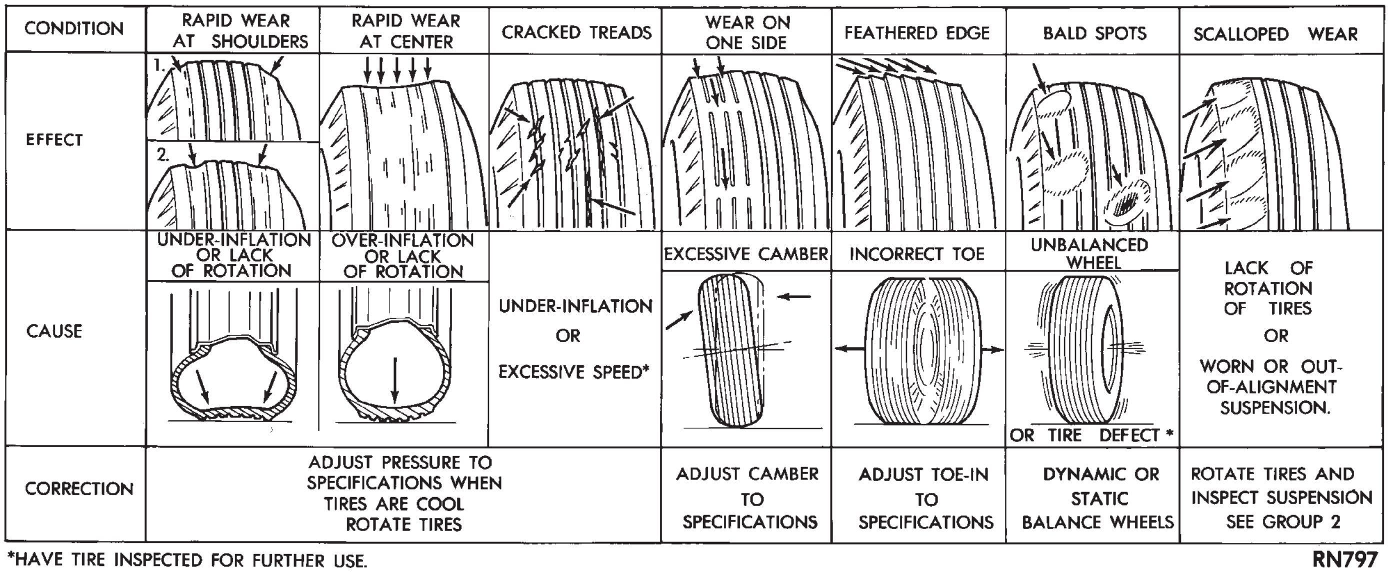


Fig. 16 Tire Wear Patterns

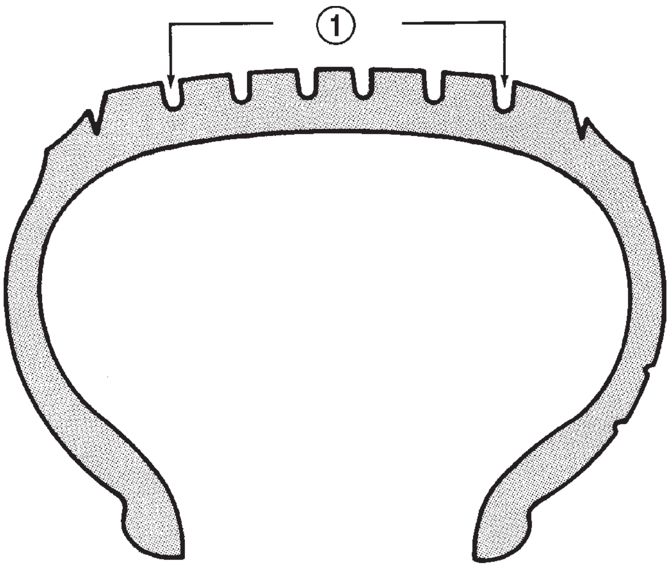


Fig. 17 Tire Repair Area

1 - REPAIRABLE AREA

CLEANING

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.

SPECIFICATIONS

TIRES

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
TIRE	P225/75R16
TIRE	P245/70R16
TIRE	P235/65R17

SPECIFICATIONS -

SPECIFICATIONS

DESCRIPTION - RIM	SPECIFICATION - TIRE
BASE LAREDO (2.7L & 4.0L) 16x7	P225/75R16
OPTIONAL LAREDO (2.7L, 4.0L, 4.7L) 16x7	P245/70R16
LAREDO 4.7L (JAPAN & AUSTRALIA) 17x7.5	P235/65R17
OPTIONAL LAREDO (UP COUNTRY) 17x7.5	P235/65R17
BASE LIMITED 17x7.5	P235/65R17
OPTIONAL LIMITED (UP COUNTRY) & OVERLAND 17x7.5	P235/65R17
BASE WHEEL / SNOW TIRE	P235/65R17

SPARE TIRE

DESCRIPTION - SPARE / TEMPORARY TIRE

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 50 M.P.H. when using the temporary spare tire. Refer to Owner's Manual for complete details.

WHEELS

DESCRIPTION

The rim size is on the vehicle safety certification label located on the drivers door shut face. The size of the rim is determined by the drivetrain package. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.

All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 18) .

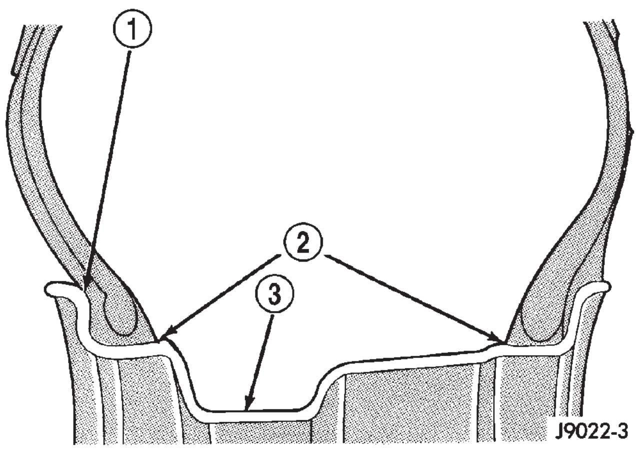


Fig. 18 Safety Rim

1 - FLANGE
2 - RIDGE
3 - WELL

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.

The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.

DIAGNOSIS AND TESTING - WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

STANDARD PROCEDURE - WHEEL REPLACEMENT

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

NOTE: Do not use chrome plated lug nuts with chrome plated wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs or nuts.**

Wheels must be replaced if they have:

- Excessive runout

WHEELS (Continued)

- Bent or dented
- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:

- Load carrying capacity
- Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Lug Nut 1/2 X 20 with 60° Cone	115-150	85-115	—

STUDS

REMOVAL

CAUTION: Do not use a hammer to remove wheel studs.

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove brake caliper, caliper adapter and rotor,(Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
(4) Remove stud from hub with Remover C-4150A (Fig. 19).

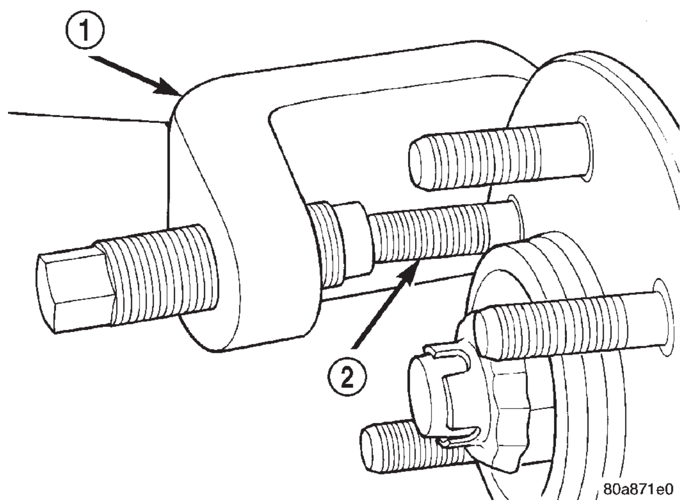


Fig. 19 Wheel Stud Removal

1 - REMOVER
2 - WHEEL STUD

INSTALLATION

CAUTION: Do not use a hammer to remove wheel studs.

(1) Install the new stud into the hub flange.
(2) Install the three washers onto the stud, then install the lug nut with the flat side of the nut against the washers.
(3) Tighten the lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.
(4) Remove the lug nut and washers.
(5) Install the brake rotor, caliper adapter, and caliper,(Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
(6) Install the wheel and tire assembly, use new lug nut on stud or studs that were replaced.
(7) Remove the support and lower vehicle.

TIRE PRESSURE MONITORING SENSOR

DESCRIPTION

The EVIC will monitor the tire pressure signals from the five tire sensors and determine if any tire has gone below the low pressure threshold or raised above the high pressure threshold. Refer to the table below.

LOW TIRE PRESSURE THRESHOLDS	
SYSTEM STATUS INDICATOR	TIRE PRESSURE
ON	179 kPa (26 PSI)
OFF	214 kPa (31 PSI)

HIGH TIRE PRESSURE THRESHOLDS	
SYSTEM STATUS INDICATOR	TIRE PRESSURE
ON	310 kPa (45 PSI)
OFF	276 kPa (40 PSI)

The Remote Tire Pressure Monitors (RTPM) are not internally serviceable. For a Sensor Failure or Low Battery fault, the RTPM must be replaced.

OPERATION

If equipped with the Tire Pressure Monitoring System, each of the vehicle's five wheels will have a valve stem with a pressure sensor and radio transmitter built in. Signals from the tire pressure sensors are received and interpreted by the Electronic Vehicle Information Center (EVIC). A sensor in a mounted wheel will broadcast its detected pressure once per minute when the vehicle is moving faster than 40 km/h (25 mph). The spare tire sensor will broadcast once every hour. Each sensor's broadcast is uniquely coded so that the EVIC can determine location. The individual tire pressures can be displayed graphically on the EVIC

DIAGNOSIS AND TESTING - TIRE PRESSURE MONITORING SYSTEM

All Tire Pressure Monitoring System Faults are specific to one location. If a ″BATTERY LOW″ or ″SENSOR FAILURE″ fault is detected, the location will be displayed. The appropriate sensor/transmitter can then be replaced. If a single sensor/transmitter cannot be detected by the EVIC, replace that sensor transmitter. If none of the sensors/transmitters can be detected, refer to symptoms in the EVIC section. For additional system description and diagnosis, refer to Tire Pressure Monitoring in the Body Diagnostic manual.

REMOVAL - TIRE PRESSURE SENSOR/ TRANSMITTER

(1) Remove the tire/wheel from the vehicle.

CAUTION: When removing the stick on balancing weights from the wheel, do not use an abrasive cleaner or a cleaner which will damage the protective finish on the wheel.

(2) Remove the balancing weights from the wheel.

NOTE: The cap used on this valve stem contains an O-ring seal to prevent contamination and moisture from entering the valve stem. Retain this valve stem cap for re-use. Do not substitute a regular valve stem cap in its place.

(3) Remove the cap from the valve stem.

NOTE: The valve stem used on this vehicle is made of aluminum and the core is nickel plated brass. The original valve stem core must be reinstalled and not substituted for a valve stem core made of a different material. This is required to prevent corrosion in the valve stem caused by the different metals.

(4) Using the appropriate tool, remove the core from the valve stem (Fig. 20).

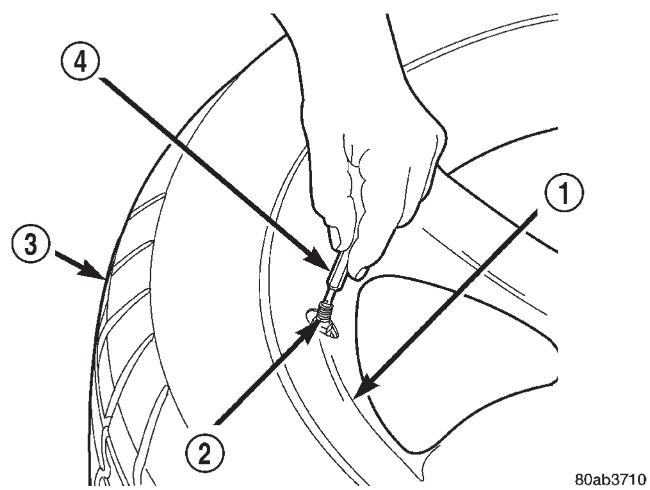


Fig. 20 REMOVING VALVE STEM CORE - TYPICAL

1 - WHEEL
2 - VALVE STEM
3 - TIRE
4 - VALVE STEM CORE TOOL

(5) Let the tire fully deflate.

SENSOR (Continued)

CAUTION: The pressure transmitter must be removed from the wheel and dropped into the tire prior to breaking the bead and dismounting the tire. Failure to do this will greatly increase the risk of damaging the pressure transducer when servicing the tire.

(6) Remove nut mounting valve stem of pressure sensor/transmitter to the wheel (Fig. 21). Drop sensor/transmitter into tire.

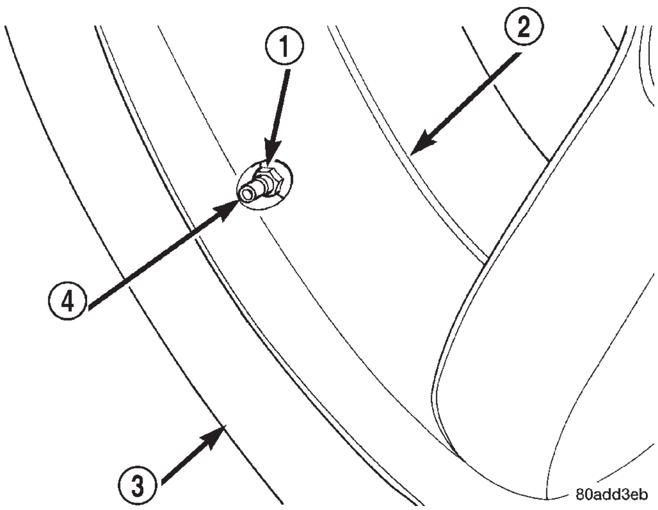


Fig. 21 VALVE STEM/PRESSURE TRANSMITTER - TYPICAL

1 - NUT
2 - WHEEL
3 - TIRE
4 - VALVE STEM

CAUTION: When breaking the top and bottom bead of the tire off the wheel, care must be used so the bead breaking mechanism on the tire changer does not damage the wheel. This includes the surface of the wheel flange on the inside of the wheel.

(7) Using the tire changer manufacturers procedure, first break down the upper bead of the tire. Then break down the bottom bead of the tire.

CAUTION: When dismounting the upper tire bead from the wheel, the proper procedure must be used. Not using the proper procedure will result in damage to the wheel and tire.

(8) Dismount the upper bead of the tire from the wheel. **The upper bead must be fully dismounted from the wheel to remove the tire pressure transmitter from the inside of the tire. The bottom bead of the tire does not need to be removed from the wheel.**

(9) Pull upward on the tire (Fig. 22). Reach into the tire and remove the pressure sensor/transmitter from inside the tire.

Fig. 22 PRESSURE TRANSMITTER REMOVAL - TYPICAL

1 - TIRE
2 - WHEEL
3 - PRESSURE TRANSMITTER

INSTALLATION - TIRE PRESSURE SENSOR/ TRANSMITTER

NOTE: When installing the tire pressure sensor/ transmitter, inspect the sealing O-ring at the bottom of the valve stem for any sign of damage or deterioration. Replace O-ring if necessary, before installing the pressure transmitter on the wheel. Also, be sure the surface of the wheel that the O-ring seals against is clean and not damaged.

SENSOR (Continued)

(1) Install the tire pressure sensor/transmitter on the wheel (Fig. 23).

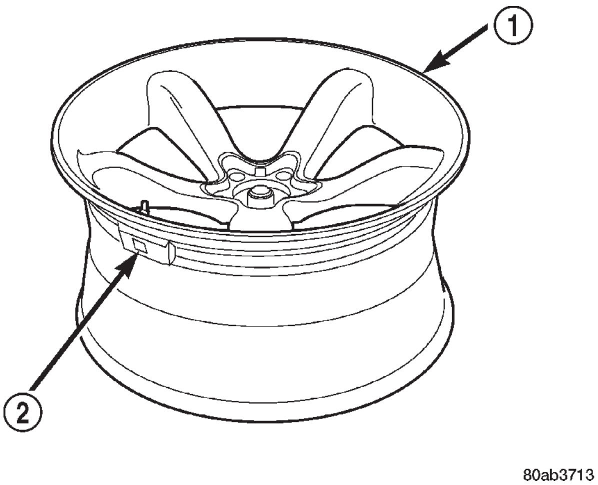


Fig. 23 TIRE PRESSURE SENSOR/TRANSMITTER - TYPICAL

1 - WHEEL
2 - TIRE PRESSURE TRANSMITTER

(2) Tighten the tire pressure sensor/transmitter mounting nut to a torque of 11 N·m (97 in. lbs.) (Fig. 24). When tightening the sensor/transmitter nut, hold the transmitter so it does not rotate. If the sensor/transmitter rotates so the top edge is not level with the wheel (Fig. 25), damage to the transmitter will occur when mounting the tire. If the top edge of the transmitter is not level with the wheel, it can be rotated into position by lightly tapping it with your hand.

CAUTION: When mounting the upper bead of the extended mobility tire, the proper procedure must be used. Not using the proper procedure will result in damage to the wheel and tire.

(3) Mount the upper bead of the tire on the wheel.
(4) Install the original or an OEM replacement valve stem cap on the valve stem.
(5) Using a soap solution, check that no air leak is present where the valve stem mounts to the wheel.
(6) Balance the tire/wheel assembly using the correct procedure for using wheel flange mount and stick-on wheel weights. For balancing information and wheel weight positioning, (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE).
(7) Install the tire/wheel on the vehicle (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE).
(8) Program the identification code for the new tire pressure sensor/transmitter into the TPM module.

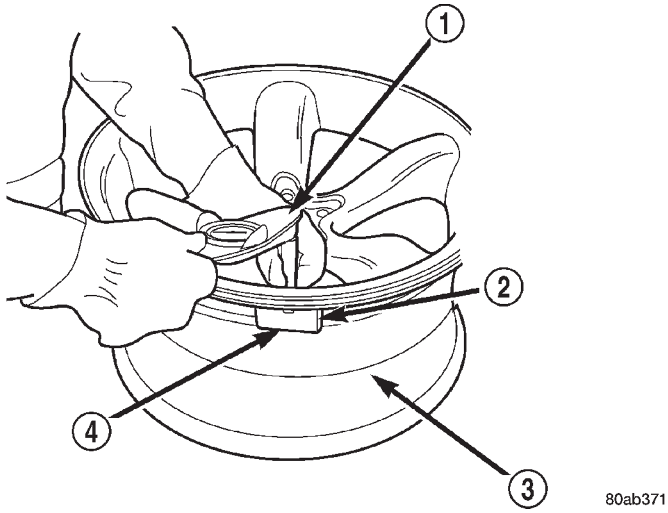


Fig. 24 TIGHTENING SENSOR/TRANSDUCER - TYPICAL

1 - TORQUE WRENCH
2 - WHEN TORQUING TRANSMITTER MOUNTING NUT DO NOT LET THIS END OF TRANSMITTER ROTATE AWAY FROM THE WHEEL
3 - WHEEL
4 - TIRE PRESSURE TRANSMITTER

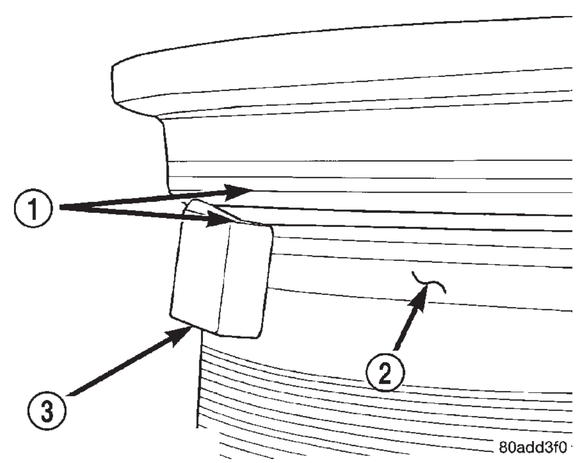


Fig. 25 CORRECTLY POSITIONED SENSOR/TRAN - TYPICAL

1 - THE TOP EDGES OF THE TIRE PRESSURE SENSOR/TRANSMITTER MUST BE FLUSH WITH THE WHEEL HERE
2 - WHEEL
3 - TIRE PRESSURE SENSOR/TRANSMITTER

(9) Verify that the TPM module has been programmed with the identification code from the new tire pressure sensor/transmitter Refer to the appropiate electrical section. If the identification code and tire pressure thresholds from the new tire pressure transmitter are present in the receivers memory the new tire pressure transmitter has been correctly programmed to the receiver.

BODY

TABLE OF CONTENTS

BODY

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the

BODY (Continued)

leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

STANDARD PROCEDURE

STANDARD PROCEDURE - BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

(1) When necessary, lubricate the operating mechanisms with the specified lubricants.

BODY (Continued)

(2) Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.

(3) Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.

(4) The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.

(5) The door lock cylinders should be lubricated twice each year (preferably autumn and spring).

(a) Spray a small amount of lock cylinder lubricant directly into the lock cylinder.

(b) Apply a small amount to the key and insert it into the lock cylinder.

(c) Rotate it to the locked position and then back to the unlocked position several times.

(d) Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.

STANDARD PROCEDURE - DRILLING AND WELDING

When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.

Always have a fire extinguisher ready for use when welding.

SPECIFICATIONS

BODY LUBRICANTS

COMPONENT	SERVICE INTERVAL	LUBRICANT
Door Hinges	As Required	Multi-Purpose Grease NLGI GC-LB (Water Resistant) (1)
Door Latches	As Required	Multi-Purpose Grease NLGI GC-LB (Water Resistant) (1)
Hood Latch, Release Mechanism and Safety Latch	As Required (When Performing Other Underhood Service)	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Hood Hinges	As Required	Engine Oil
Seat Track and Release Mechanism	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Liftgate Hinge	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Liftgate Support Arms	As Required	Engine Oil
Liftgate Latches	As Required	White Spray Lubricant (3)
Liftgate Release Handle (Pivot and Slide Contact Surfaces)	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Window System Components	As Required	White Spray Lubricant (3)
Lock Cylinders	Twice a Year	Lock-Cylinder Lubricant (4)
Parking Brake Mechanism	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (1)
1 = Mopar Wheel Bearing Grease (High Temp) 2 = Mopar Multi-Mileage Lubricant 3 = Mopar Spray White Lube 4 = Mopar Lock Cylinder Lubricant		

BODY (Continued)

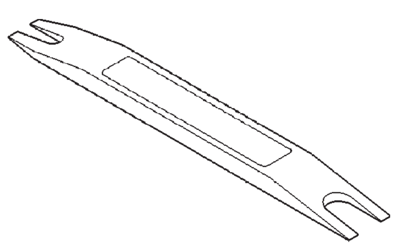
SPECIFICATIONS - TORQUE

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
BUCKET SEAT BACK FRAME RECLINER BOLTS TO SEAT CUSHION FRAME	28	20	—
BUCKET SEAT RECLINER TO SEAT BACK FRAME BOLTS	28	20	—
BUCKET SEAT TRACK ADJUSTER NUTS TO SEAT CUSHION FRAME	28	20	—
FRONT BUCKET SEAT TO FLOOR PAN BOLTS	40	30	—
FRONT BUCKET SEAT TO FLOOR PAN FRONT BOLTS	40	30	—
FRONT DOOR HINGE BOLTS	35	26	—
FRONT DOOR LATCH TO DOOR SCREWS	10	—	89
FRONT DOOR STRIKER TO B-PILLAR	28	20	—
HOOD LATCH TO RADIATOR CROSSMEMBER	11	8	—
LIFT GATE LATCH STRIKER TO D-PILLAR NUTS	10	—	89
REAR DOOR LATCH TO DOOR SCREWS	10	—	89
REAR DOOR STRIKER TO C-PILLAR SCREWS	28	20	—
REAR SEAT BACK LATCH/HINGE TO SEAT BACK FRAME	28	20	—
REAR SEAT BACK LEFT SIDE SUPPORT BRACKET TO CENTER PIVOT BRACKET	28	20	—
REAR SEAT BACK RIGHT SIDE SUPPORT BRACKET	28	20	—
REAR SEAT CUSHION LATCH BASE PANEL SCREWS	8	—	75
REAR SEAT CUSHION TO FLOOR PAN BOLTS	11	8	—
SUNROOF MODULE TO ROOF PANEL NUTS	11	8	—

SPECIAL TOOLS

BODY



Remover, Moldings C-4829

DECKLID/HATCH/LIFTGATE/TAILGATE

TABLE OF CONTENTS

EXTERIOR HANDLE

REMOVAL

(1) Remove the liftgate trim panel refer to (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).

(2) Remove the latch, outside handle linkage, and power lock connector.

(3) Remove the fasteners attaching the outside handle to the liftgate.

(4) Remove the outside handle from the liftgate.

INSTALLATION

(1) Position the outside handle on the liftgate.

(2) Install the fasteners attaching outside handle to liftgate.

(3) Connect outside handle link and power lock connector.

(4) Install liftgate trim panel, refer to (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - INSTALLATION).

FLIP-UP GLASS

REMOVAL

CAUTION: DO NOT DISCONNECT THE PROP ROD CYLINDERS WITH THE LIFTGATE FLIP UP GLASS CLOSED. THE PROP ROD PISTONS ARE OPERATED BY HIGH PRESSURE GAS. THIS PRESSURE COULD CAUSE DAMAGE AND/OR PERSONAL INJURY IF THEY ARE REMOVED WHILE THE PISTONS ARE COMPRESSED.

(1) Using a trim stick or other suitable device, separate the flip up glass hinge cover from the hinge on the liftgate (Fig. 1).

(2) Open liftgate flip up glass. Support the glass for ease of repair.

(3) Using a small flat blade or equivalent tool, gently pry open the locking caps on the end of the prop rods.

(4) Remove prop rod cylinders from ball studs.

(5) Lower the flip up glass.

(6) Remove hinge fasteners from liftgate.

(7) Separate flip up glass from liftgate.

FLIP-UP GLASS (Continued)

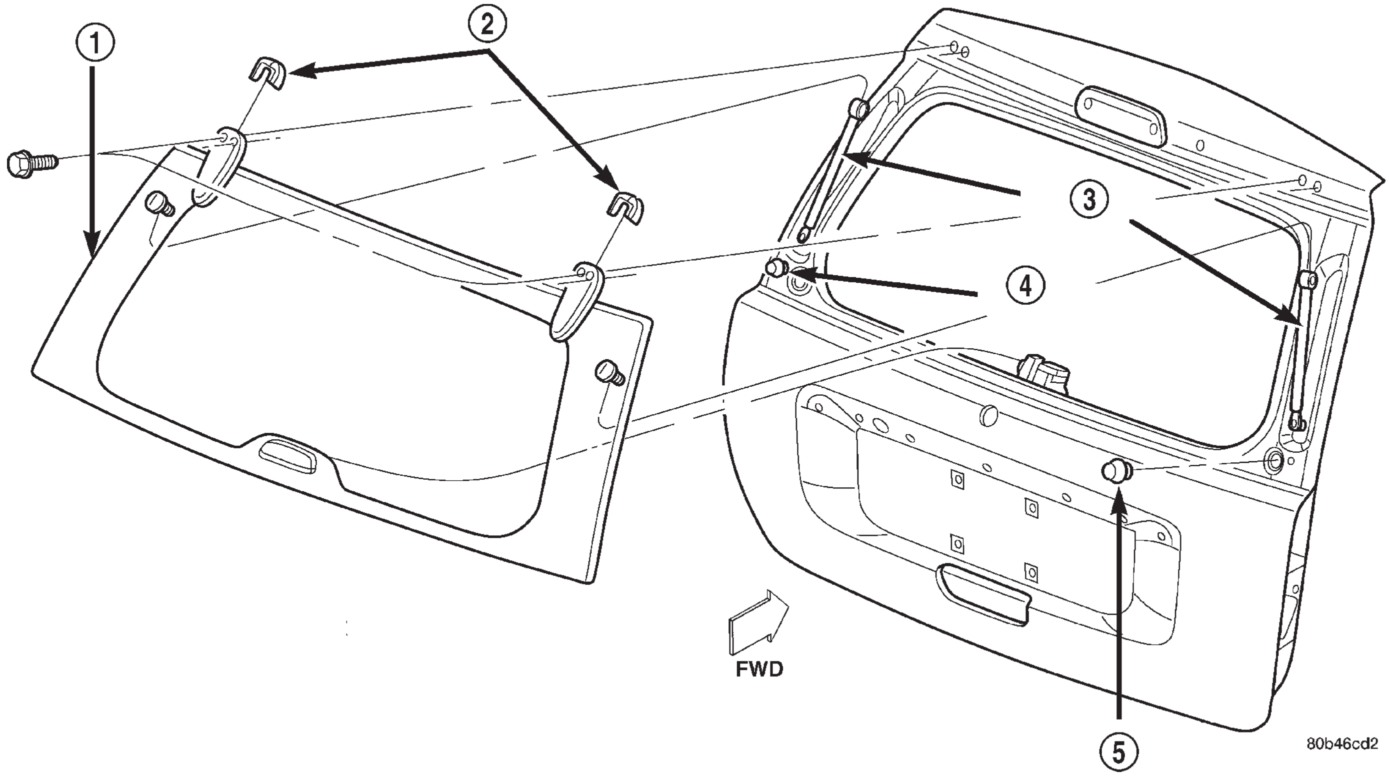


Fig. 1 Flip-Up Glass

1 - FLIP-UP GLASS
2 - HINGE COVER
3 - SUPPORT PROP
4 - BUMPER
5 - BUMPER

INSTALLATION

(1) Position flip up glass on liftgate.

(2) Install hinge fasteners, hand tight only.

(3) With the glass panel in the fully open position, fully raised position, push the glass forward to completely seat the hinges. Tighten hinge fasteners to 6N·m (60 in. lbs.).

(4) Install prop rods on ball studs and compress locking caps to lock rods on ball studs.

(5) Lower the flip up glass and install the flip up glass hinge cover.

(6) Check the flip up glass for proper alignment and latching.

FLIP-UP GLASS LATCH

REMOVAL

(1) Open liftgate flip up glass.

(2) Remove the trim panel (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).

(3) Remove latch (Fig. 2).

(4) Disconnect switch connectors.

(5) Remove latch from liftgate.

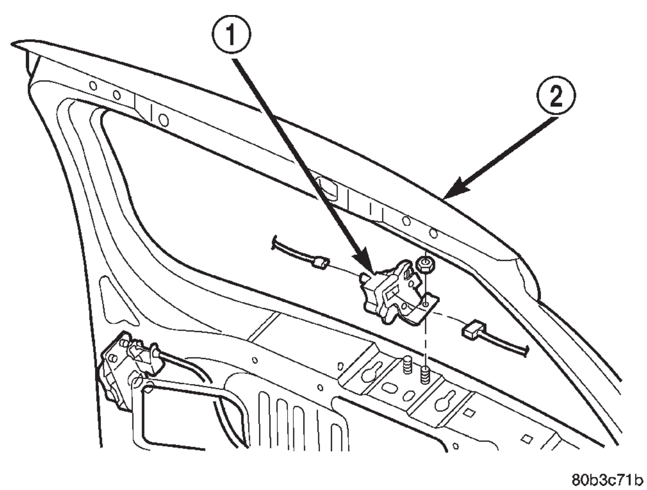


Fig. 2 Flip-up Glass Latch

1 - LATCH
2 - LIFTGATE

INSTALLATION

(1) Position the latch on the liftgate (Fig. 2).

(2) Connect switch connectors.

(3) Adjust latch to the proper position, and tighten the fasteners to 11 N·m (100 in. lbs.).

FLIP-UP GLASS LATCH (Continued)

(4) Close flip up glass panel and verify proper operation.

(5) Install liftgate trim panel, refer to (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - INSTALLATION).

FLIP-UP GLASS LATCH STRIKER

REMOVAL

(1) Raise flip up glass panel.

(2) Mark the position of the handle/striker on the glass panel.

(3) Remove the screws attaching the handle/striker to the glass.

INSTALLATION

(1) Position the handle/striker on the glass panel and align the reference marks.

(2) Install the screws attaching the handle/striker to the glass panel. Tighten the fasteners to 6 N·m (60 in. lbs.).

FLIP-UP GLASS SWITCH

REMOVAL

(1) Remove license plate lamp housing/trim panel from liftgate, refer to (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LICENSE PLATE LAMP UNIT - REMOVAL).

(2) Squeeze the locking tabs inward to release the switch from the housing.

(3) Disconnect the switch harness connector, remove the switch from the housing.

INSTALLATION

(1) Install switch harness connector.

(2) Position switch in housing, snap switch into place.

(3) Install license plate lamp housing/trim panel onto liftgate, refer to (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LICENSE PLATE LAMP UNIT - INSTALLATION).

HINGE

REMOVAL

NOTE: It is not necessary to remove the liftgate to replace one or both hinges. The hinges can be replaced one at a time.

(1) Open the liftgate. Support the liftgate for ease of repair.

(2) Remove the liftgate header trim panel.

(3) Mark the hinge location with a grease pencil or other suitable device.

(4) Remove the hinge screws (Fig. 5).

(5) Remove hinge.

INSTALLATION

NOTE: It is not necessary to remove the liftgate to replace one or both hinges. The hinges can be replaced one at a time.

(1) Position the hinge on the roof panel and on the liftgate. (Use 3M™ Fast and Firm or equivalent on the hinge to body mating surfaces as a sealant.

(2) Install and tighten hinge screws at roof panel to 28N·m (21 ft. lbs.).

(3) Install hinge screws at liftgate. Tighten screws to 28N·m (21 ft. lbs.).

(4) Install liftgate header trim panel.

(5) Check the liftgate for proper alignment and operation.

LATCH

REMOVAL

(1) Raise the liftgate.
(2) Remove the liftgate trim panel (Fig. 3).
(3) Disconnect the power connector.
(4) Disconnect the outside handle link from the latch.
(5) Remove the latch screws and remove latch.

INSTALLATION

(1) Install the latch into the liftgate and tighten the screws to 7N·m (5 ft. lbs.).
(2) Connect the outside handle to the liftgate latch.
(3) Plug in the connector for the power.
(4) Install the liftgate trim panel.

LATCH STRIKER

REMOVAL

(1) Raise liftgate.
(2) Remove tail lamp, refer to (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/TAIL LAMP - REMOVAL).
(3) Remove nuts attaching striker to D-pillar (Fig. 4).
(4) Separate striker from D-pillar.

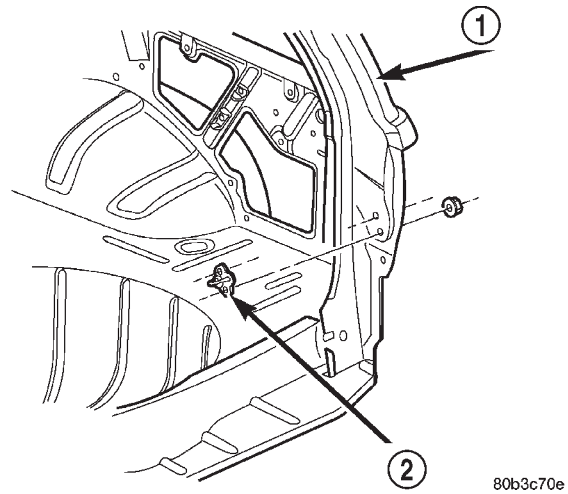


Fig. 4 Liftgate Latch Striker

1 - D-PILLAR
2 - STRIKER

INSTALLATION

(1) Position striker on D-pillar.
(2) Install nuts attaching striker to D-pillar. Tighten nuts to 10 N·m (7 ft. lbs.) torque (Fig. 4).
(3) Install tail lamp (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/TAIL LAMP - INSTALLATION).

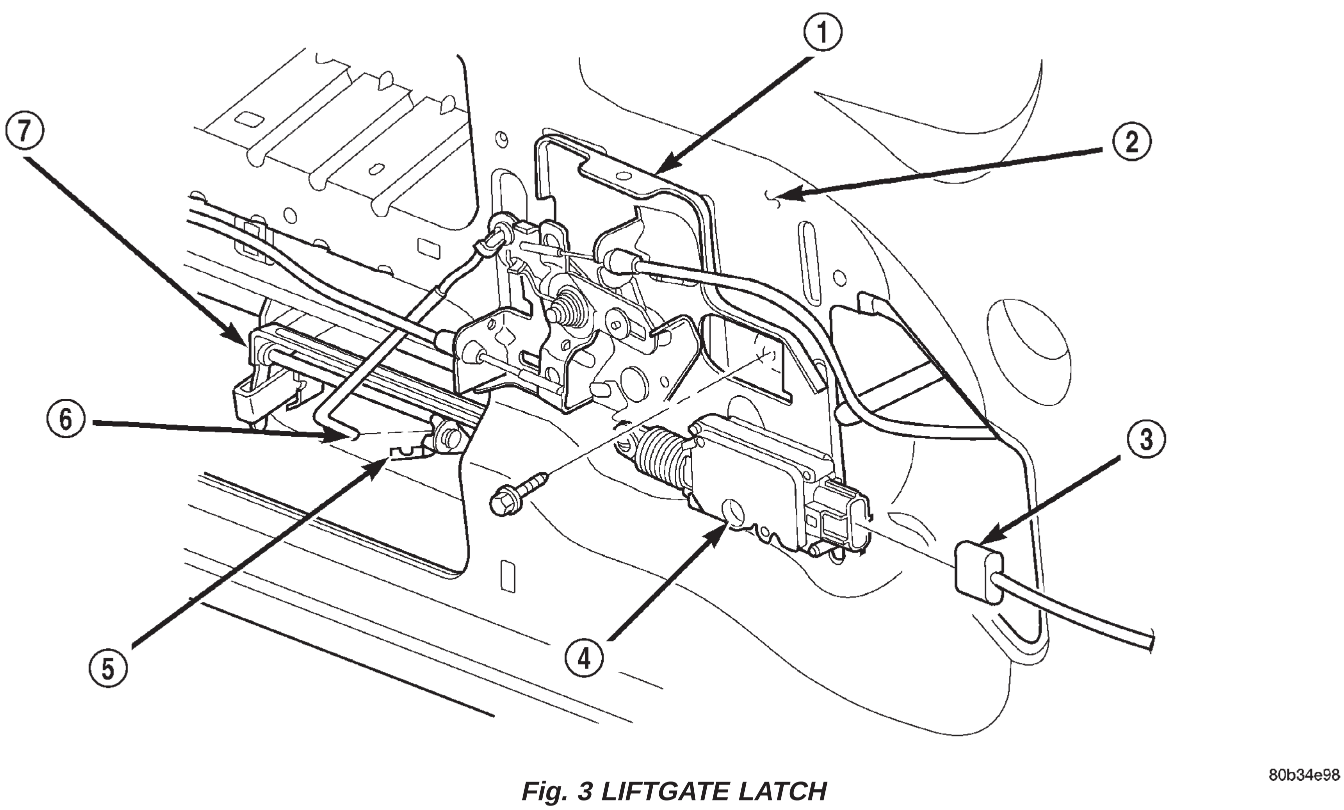


Fig. 3 LIFTGATE LATCH

1 - LATCH
2 - LIFTGATE
3 - CONNECTOR
4 - ACTUATOR
5 - CLIP
6 - OUTSIDE HANDLE TO LATCH ROD
7 - OUTSIDE HANDLE

LIFTGATE

REMOVAL

CAUTION: DO NOT DISCONNECT THE SUPPORT ROD CYLINDERS WITH THE LIFTGATE CLOSED. THE SUPPORT ROD PISTONS ARE OPERATED BY HIGH PRESSURE GAS. THIS PRESSURE COULD CAUSE DAMAGE AND /OR PERSONAL INJURY IF THEY ARE REMOVED WHILE THE PISTONS ARE COMPRESSED.

(1) Open the liftgate. Support the liftgate for ease of repair.
(2) Remove the liftgate trim panel.
(3) Remove the prop rods from the liftgate.
(4) Unplug the wire harnesses and disconnect the washer hose.
(5) Mark the hinge location with a wax pencil or other suitable device (Fig. 5).
(6) Remove the hinge screws and remove liftgate from vehicle.

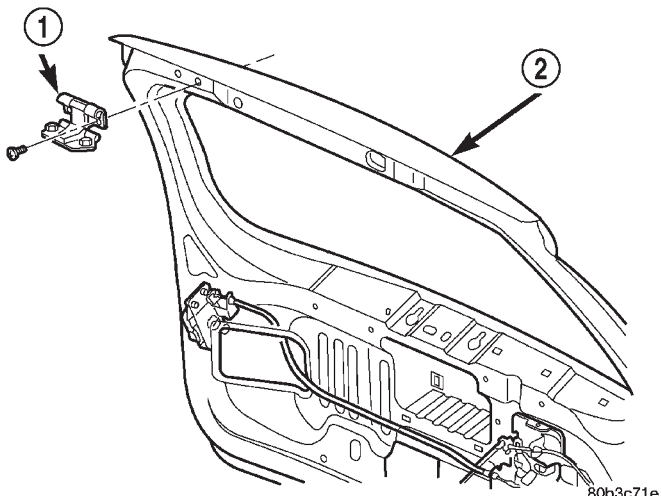


Fig. 5 Liftgate

1 - HINGE
2 - LIFTGATE

INSTALLATION

(1) Position the liftgate on the vehicle and align the witness marks.
(2) Install the hinge screws at liftgate. Tighten hinge screws to 28N·m (21ft. lbs.).
(3) Connect the wire harnesses and the washer hose.
(4) Install the trim panel.
(5) Install the prop rods.
(6) Close the liftgate and check for proper latching and alignment.

ADJUSTMENTS

LIFTGATE ADJUSTMENT

The position of the liftgate can be adjusted upward or downward by the use of slots in the hinge. An inward or outward adjustment is achieved by use of slots in the body. If an inward or outward adjustment is needed, use 3M™ Fast and Firm or equivalent on the hinge to body mating surface as a sealant.

TRIM PANEL

REMOVAL

REMOVAL - LIFTGATE TRIM PANEL

NOTE: The liftgate trim panel is attached with screws and spring clips.

(1) Raise the liftgate.
(2) Remove the screws securing the liftgate trim panel to the liftgate (Fig. 6).
(3) Disconnect the rear window defroster wires.
(4) Using a trim stick, or other suitable tool, pry the liftgate trim panel off the liftgate.

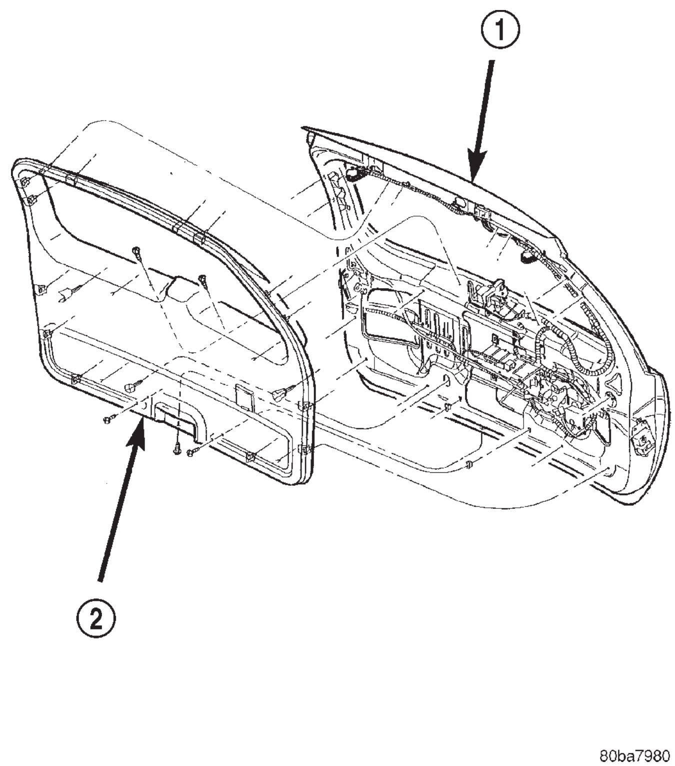


Fig. 6 Liftgate Trim Panel

1 - LIFTGATE
2 - LIFTGATE TRIM PANEL

TRIM PANEL (Continued)

REMOVAL - LOWER LIFTGATE OPENING TRIM PANEL

(1) Remove screws at outboard end of lower liftgate trim panel.

(2) Open the spare tire cover and remove the screws near the center of the lower liftgate trim panel (Fig. 7).

(3) Remove the lower liftgate trim panel.

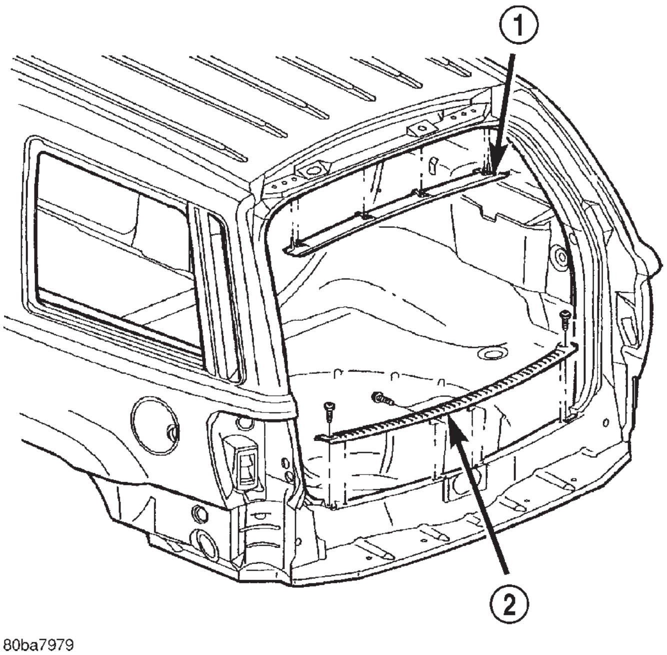


Fig. 7 Liftgate Opening Trim Panel

1 - UPPER LIFTGATE OPENING TRIM PANEL
2 - LOWER LIFTGATE OPENING TRIM PANEL

INSTALLATION

INSTALLATION - LIFTGATE TRIM PANEL

NOTE: The liftgate trim panel is attached with screws and spring clips.

(1) Align the liftgate trim panel spring clips and press the panel into the liftgate.

(2) Install the trim panel screws.

(3) Connect the rear defroster wires.

INSTALLATION - LOWER LIFTGATE OPENING TRIM PANEL

(1) Align the screw holes and locators to the holes in the liftgate opening.

(2) Install the screws in the liftgate opening trim panel.

(3) Install the spare tire cover.

LIFTGATE INSULATOR

REMOVAL

(1) Remove the liftgate trim panel, refer to (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).

(2) Separate the liftgate insulator from the liftgate and trim panel (Fig. 8).

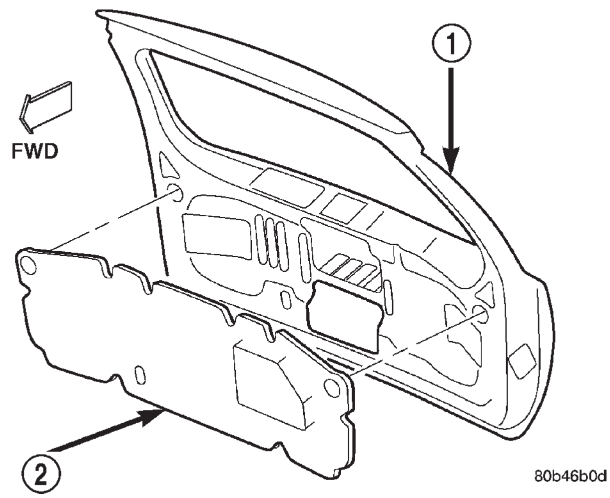


Fig. 8 Liftgate Insulator Pad

1 - LIFTGATE
2 - INSULATION PAD

INSTALLATION

(1) Thoroughly clean the area of any adhesive or insulation material.

(2) Install the insulator in the liftgate.

(3) Install the liftgate trim panel refer to (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - INSTALLATION).

DOOR - FRONT

TABLE OF CONTENTS

CHECK STRAP

REMOVAL

(1) Remove the waterdam, refer to (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL).

(2) Remove speaker.

(3) Remove screws attaching door check to A-pillar.

(4) Remove nuts attaching door check to door (Fig. 1).

(5) Remove door check through speaker location hole.

INSTALLATION

(1) Position door check on door through speaker location hole (Fig. 1).

(2) Install nuts attaching door check to door.

(3) Install screws attaching door check to A-pillar.

(4) Install speaker.

(5) Install the waterdam, refer to (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION).

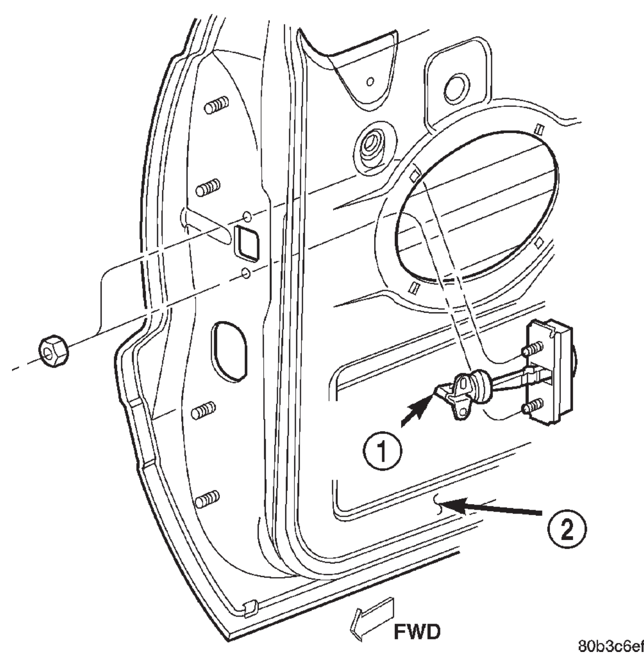


Fig. 1 Door Check

1 - DOOR CHECK
2 - FRONT DOOR

DOOR

REMOVAL

(1) Disconnect front door harness connector (Fig. 2).
(2) Support door with padded floor jack.
(3) Remove retaining clips from hinge pins.
(4) Tap out hinge pins.
(5) Separate door from vehicle.

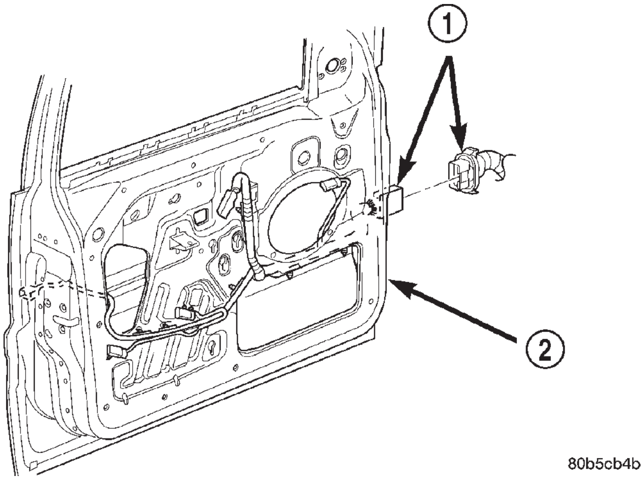


Fig. 2 Front Door Harness Connector

1 - HARNESS CONNECTOR
2 - DOOR

INSTALLATION

(1) Position door at vehicle and align hinges.
(2) Install hinge pins.
(3) Install retaining clips for hinge pins.
(4) Connect front door harness connector (Fig. 2).

ADJUSTMENTS

DOOR ADJUSTMENT

Minor adjustment for alignment of the door is made by moving the latch striker.

IN AND OUT

(1) Loosen the latch striker.
(2) Tap the latch striker inward if the door character line is outboard of the body character line or tap the latch striker outward if the door character line is inboard of the body character line.
(3) Inspect the alignment. If correct, tighten striker to 28 N·m (21 ft. lbs.).

UP AND DOWN

(1) Loosen the latch striker.
(2) Tap the latch striker downward if the door character line is higher than the body character line or tap the latch striker upward if the door character line is lower than the body character line.
(3) Inspect the alignment. If correct, tighten to 28 N·m (21 ft. lbs.).

DOOR GLASS

REMOVAL

(1) Locate glass to full down position.
(2) Remove the waterdam, refer to (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL).
(3) Remove inner belt weatherstrip, refer to (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR INNER BELT WEATHERSTRIP - REMOVAL).
(4) Remove outer belt weatherstrip, refer to (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR OUTER BELT WEATHERSTRIP - REMOVAL).
(5) Locate glass to 3/4 up position.
(6) Using a long flat blade or hook type tool, disengage clips (Fig. 3) attaching glass retainer to glass lift plate.
(7) Carefully push bottom of glass panel outward to disengage glass retainer studs from lift plate (Fig. 4).
(8) Lift glass upward and out of door.

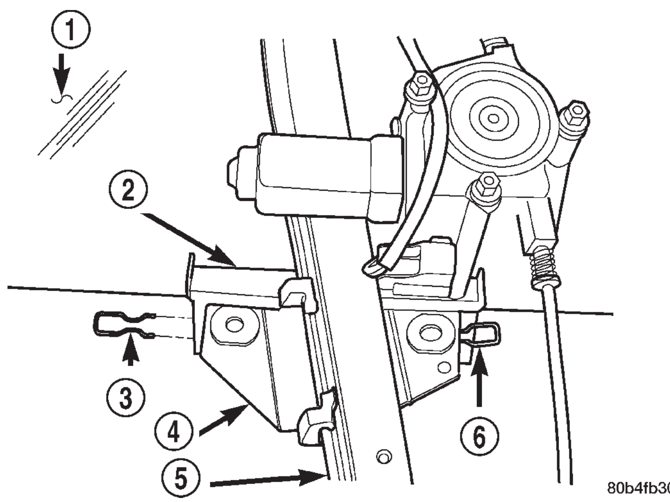


Fig. 3 Front Door Glass Clips

1 - GLASS
2 - RETAINER
3 - CLIP
4 - LIFT PLATE
5 - REGULATOR
6 - CLIP

INSTALLATION

(1) Lower glass into position.
(2) Carefully align glass retainer studs with lift plate and insert studs into lift plate.

DOOR GLASS (Continued)

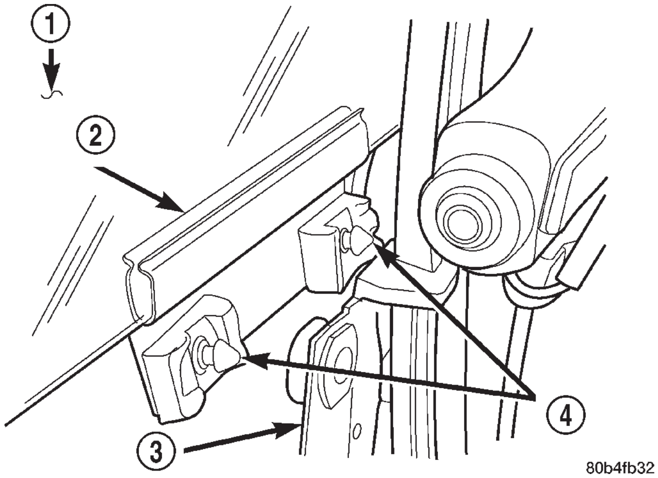


Fig. 4 Front Door Glass Retainer

1 - GLASS
2 - RETAINER
3 - LIFT PLATE
4 - STUD

(3) Engage clips attaching glass retainer to glass lift plate.
(4) Locate glass to full down position.
(5) Install outer belt weatherstrip, (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR OUTER BELT WEATHERSTRIP - INSTALLATION).
(6) Install inner belt weatherstrip, (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR INNER BELT WEATHERSTRIP - INSTALLATION).
(7) Install waterdam, refer to (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION).

EXTERIOR HANDLE

REMOVAL

(1) Remove glass run channel, refer to (Refer to 23 - BODY/DOOR - FRONT/GLASS RUN CHANNEL - REMOVAL).
(2) Disconnect lock cylinder to latch rod.
(3) Disconnect outside handle to latch rod
(4) Remove fasteners attaching outside handle to door (Fig. 5).
(5) Remove outside handle from door.
(6) Disconnect anti-theft harness connector, if equipped.
(7) Separate outside handle from vehicle.

INSTALLATION

(1) Position outside handle at door (Fig. 5).
(2) Connect anti-theft harness connector, if equipped.
(3) Position outside handle in door.

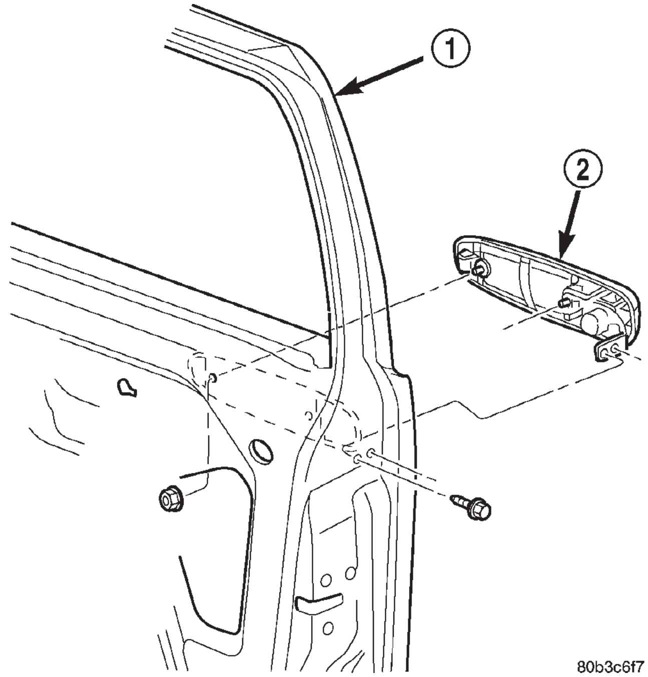


Fig. 5 Front Door Outside Handle

1 - DOOR
2 - OUTSIDE HANDLE

(4) Install fasteners attaching outside handle to door.
(5) Connect outside handle to latch rod
(6) Connect lock cylinder to latch rod.
(7) Install glass run channel, refer to (Refer to 23 - BODY/DOOR - FRONT/GLASS RUN CHANNEL - INSTALLATION).

GLASS RUN CHANNEL

REMOVAL

NOTE: Only the rearward glass run channel is serviceable.

(1) Remove the waterdam, refer to (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL).
(2) Remove inner belt weatherstrip, refer to (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR INNER BELT WEATHERSTRIP - REMOVAL).
(3) Remove outer belt weatherstrip, refer to (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR OUTER BELT WEATHERSTRIP - REMOVAL).
(4) Remove bolt attaching run channel to inner door panel (Fig. 6).
(5) Peel back glass run channel weatherstrip on rear run channel.
(6) Pull glass run channel downward to separate from door.

GLASS RUN CHANNEL (Continued)

(7) Remove glass run channel from door.

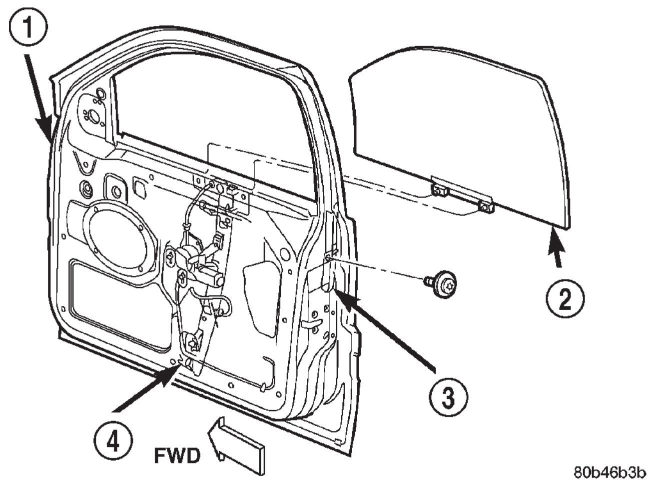


Fig. 6 Front Door Glass Run Channel

1 - DOOR
2 - GLASS
3 - GLASS RUN CHANNEL
4 - REGULATOR

INSTALLATION

(1) Position glass run channel in door (Fig. 6).

(2) Align glass run channel with door frame run channel and slide channel upward to secure door.

(3) Press glass run channel weatherstrip into rear run channel.

(4) Install bolt attaching run channel to inner door panel.

(5) Install outer belt weatherstrip, (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR OUTER BELT WEATHERSTRIP - INSTALLATION).

(6) Install inner belt weatherstrip, (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR INNER BELT WEATHERSTRIP - INSTALLATION).

(7) Install the waterdam, (Refer to 23 - BODY/ DOOR - FRONT/WATERDAM - INSTALLATION).

HINGE

REMOVAL

(1) Open and support door.

(2) Using a wax pencil, or other suitable device, reference mark the hinge placement

(3) Disconnect the door wire harness.

(4) Remove the door check from the “A” pillar (Fig. 7).

(5) Remove the fasteners retaining the door hinge to the door (Fig. 8).

(6) Remove the door.

(7) Remove the hinge from the “A” pillar.

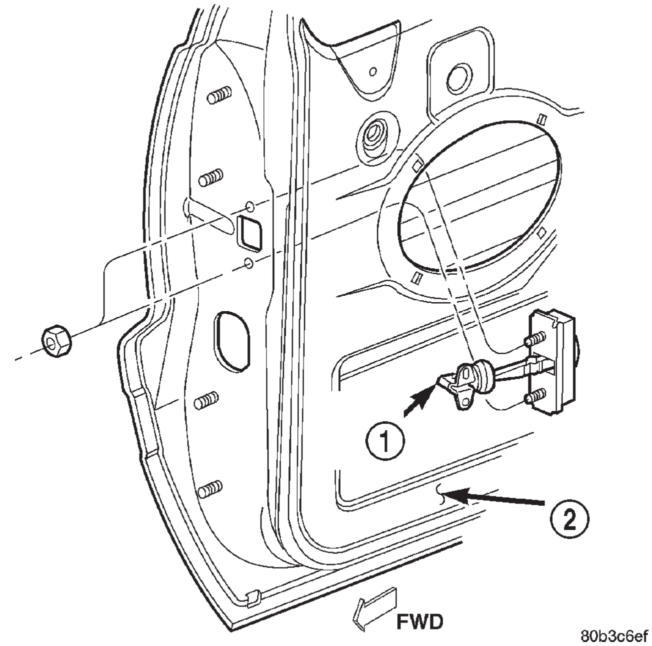


Fig. 7 Front Door Check

1 - DOOR CHECK
2 - FRONT DOOR

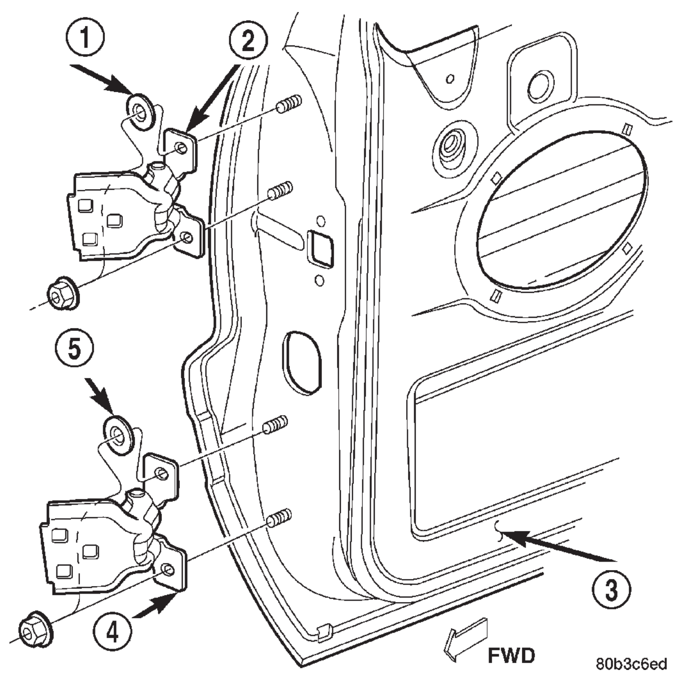


Fig. 8 Front Door Hinges

1 - WASHER
2 - UPPER HINGE
3 - FRONT DOOR
4 - LOWER HINGE
5 - WASHER

HINGE (Continued)

INSTALLATION

(1) Position hinge on “A” pillar. (Use 3M® Fast and Firm or equivalent on the hinge to body mating surface as a sealant.)

(2) Install hinge to body bolts, but do not tighten.

(3) Align the hinge to the reference marks and torque the bolts to 35N·m (26 ft. lbs.).

(4) Install the door on the hinge and align with the reference marks.

(5) Tighten the door to hinge fasteners.

(6) For adjustment see door adjustment procedure.

INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove door trim panel, refer to (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).

(2) Disconnect latch and lock rods from inside handle actuator.

(3) Remove screws attaching inside handle actuator to trim panel (Fig. 9).

(4) Separate inside handle actuator from trim panel.

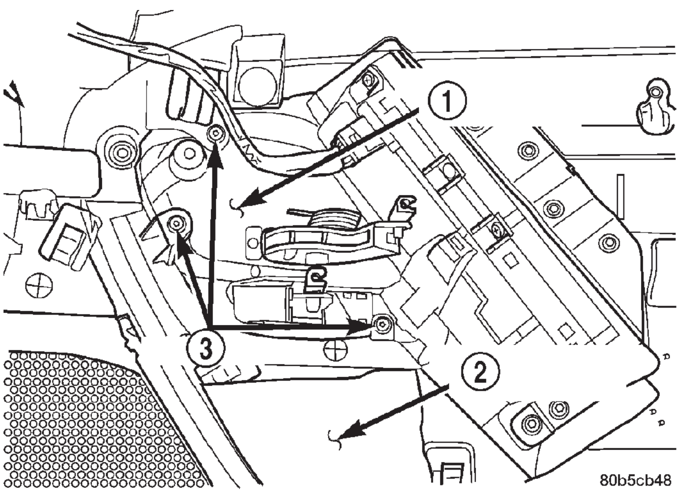


Fig. 9 Front Door Inside Handle Actuator

1 - INSIDE HANDLE ACTUATOR
2 - DRIVER’S DOOR TRIM PANEL
3 - SCREW

INSTALLATION

(1) Position inside handle actuator in trim panel.

(2) Install screws attaching inside handle actuator to trim panel (Fig. 9).

(3) Connect latch and lock rods to inside handle actuator.

(4) Install door trim panel, refer to (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).

LATCH

REMOVAL

(1) Remove glass run channel, refer to (Refer to 23 - BODY/DOOR - FRONT/GLASS RUN CHANNEL - REMOVAL).

(2) Remove screws attaching door latch to door (Fig. 10).

(3) Disconnect all rods from door latch.

(4) Disconnect wire harness connector, if equipped.

(5) Separate door latch from door.

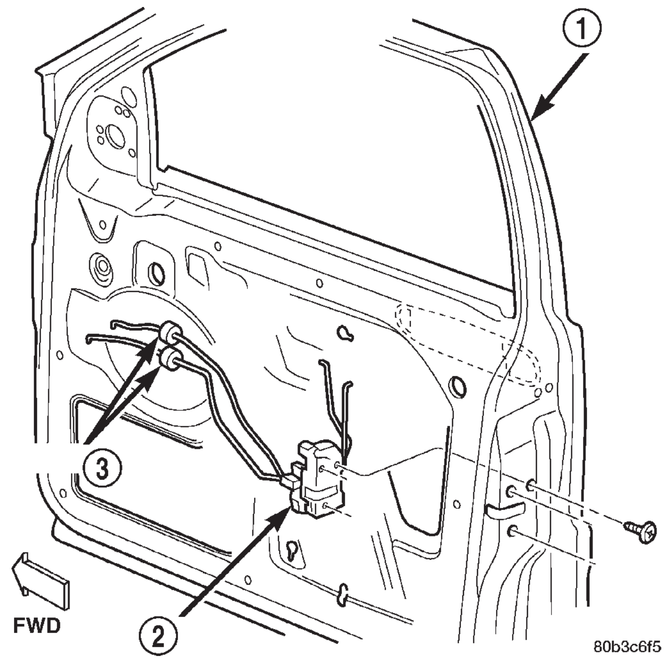


Fig. 10 Door Latch

1 - DOOR
2 - LATCH
3 - ISOLATOR

INSTALLATION

(1) Position door latch at door.

(2) Connect wire harness connector, if equipped.

(3) Connect all rods to door latch.

(4) Install screws attaching door latch to door. Tighten screws to 10 N·m (7 ft. lbs.) torque (Fig. 10).

(5) Install glass run channel, refer to (Refer to 23 - BODY/DOOR - FRONT/GLASS RUN CHANNEL - INSTALLATION).

LATCH (Continued)

ADJUSTMENTS

DOOR LATCH

DOOR LATCH ADJUSTMENT

(1) Locate access hole (Fig. 11).

(2) Insert a 5/32-inch hex-wrench through hole and into adjustment screw. Loosen screw.

(3) Operate outside handle button several times to release any restriction because of mis-alignment.

(4) Tighten adjustment screw to 3 N·m (30 in-lbs) torque.

(5) Test handle button and lock cylinder for proper operation.

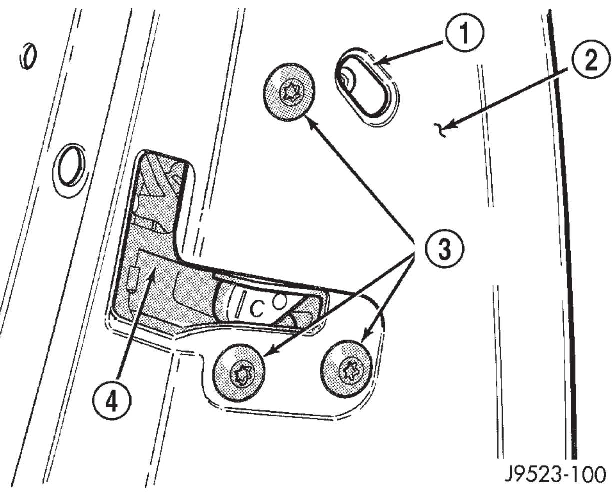


Fig. 11 Door Latch Adjustment

1 - ACCESS HOLE
2 - DOOR
3 - LATCH MOUNTING BOLTS
4 - LATCH

LATCH STRIKER

REMOVAL

(1) Remove screws attaching striker to B-pillar.

(2) Separate striker and spacer from B-pillar (Fig. 12).

INSTALLATION

(1) Position striker and spacer on B-pillar.

(2) Install screws attaching striker to B-pillar. Tighten screws to 28 N·m (20 ft. lbs.) torque (Fig. 12).

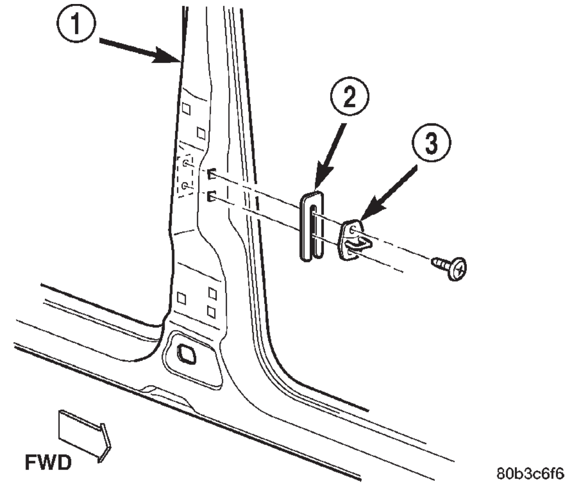


Fig. 12 Front Door Latch Striker

1 - B-PILLAR
2 - SPACER
3 - STRIKER

LOCK CYLINDER

REMOVAL

(1) Remove outside door handle, refer to (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - REMOVAL).

(2) Remove screw securing lock cylinder retainer to outside door handle (Fig. 13).

(3) Separate lock cylinder from door handle.

(4) Disconnect lock cylinder switch, if equipped.

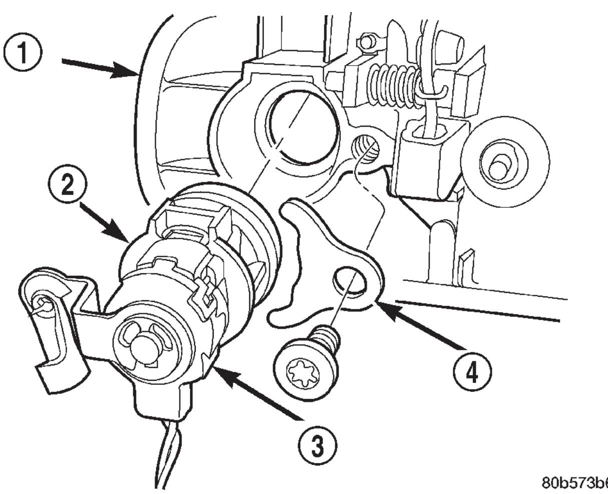


Fig. 13 Front Door Lock Cylinder

1 - OUTSIDE DOOR HANDLE
2 - LOCK CYLINDER
3 - ANTI-THEFT SWITCH
4 - RETAINER

LOCK CYLINDER (Continued)

INSTALLATION

(1) Connect lock cylinder switch, if equipped.

(2) Position lock cylinder in door handle.

(3) Position lock cylinder retainer and install screw (Fig. 13).

(4) Install outside door handle, refer to (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - INSTALLATION).

TRIM PANEL

REMOVAL

(1) Remove trim plug from mirror flag bezel.

(2) Remove screws attaching trim panel to door (Fig. 14).

(3) Using trim remover (C-4829 or equivalent), detach trim panel perimeter push-in fasteners from door inner panel.

(4) Lift trim panel upward and separate from door.

(5) If equipped, disconnect harness connectors for power accessories.

(6) Disconnect latch rods from inside handle actuator.

(7) Separate trim panel from vehicle.

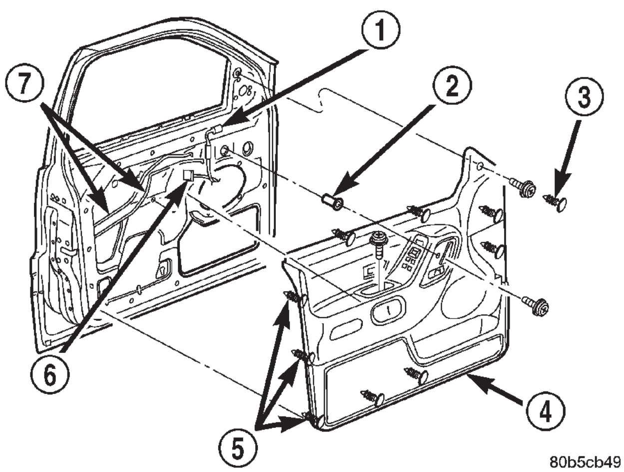


Fig. 14 Front Door Trim Panel

1 - HARNESS CONNECTOR
2 - NUTSERT
3 - TRIM PLUG
4 - TRIM PANEL
5 - PUSH-IN FASTENER
6 - HARNESS CONNECTOR
7 - LATCH RODS

INSTALLATION

(1) Connect latch rods to inside handle actuator.

(2) If equipped, connect harness connectors to power accessories.

(3) Position trim panel on door inner panel.

(4) Press trim panel push-in fasteners inward around perimeter of door.

(5) Install screws attaching trim panel to door (Fig. 14).

(6) Install trim plug in mirror flag bezel.

WATERDAM

REMOVAL

(1) Remove door trim panel, refer to (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).

(2) Peel the waterdam from door.

(3) Route all harnesses and linkage rods through waterdam as necessary.

(4) Separate waterdam from door (Fig. 15).

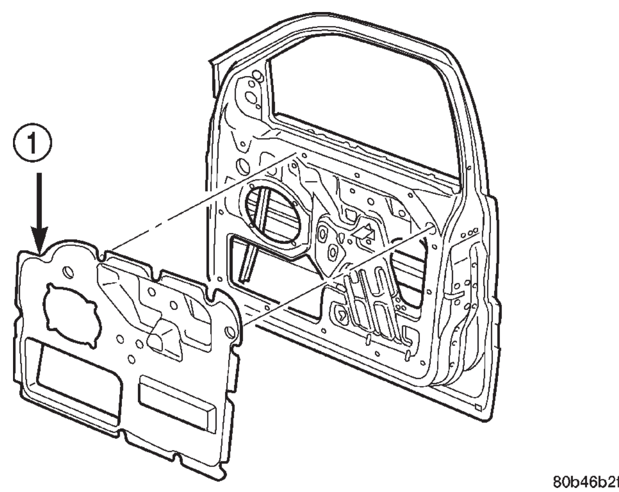


Fig. 15 Front Door Waterdam

1 - INSULATOR PAD

INSTALLATION

(1) Waterdam contact surface must be free of contaminants. Clean as necessary.

(2) Route all harnesses and linkage rods through waterdam as necessary.

(3) Position waterdam on door and align all holes.

(4) Press waterdam on door (Fig. 15).

(5) Install door trim panel, refer to (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).

WINDOW REGULATOR

REMOVAL

(1) Remove front door glass, refer to (Refer to 23 - BODY/DOOR - FRONT/DOOR GLASS - REMOVAL).

(2) Loosen bolts attaching regulator to inner door panel (Fig. 16).

(3) Remove bolt attaching regulator to inner door panel (Fig. 17).

(4) Lift regulator upward to disengage bolts from door inner panel.

(5) Disengage power window regulator harness connector, if equipped.

(6) Remove regulator through access hole in door.

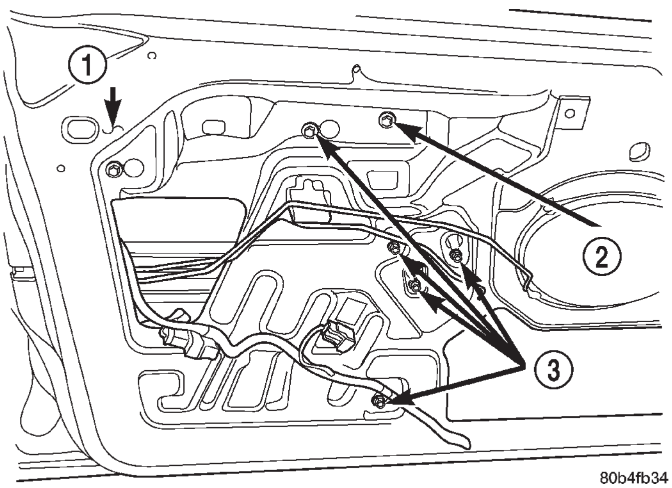


Fig. 16 Front Door Regulator Bolts

1 - FRONT DOOR
2 - REMOVE BOLT
3 - LOOSEN BOLTS

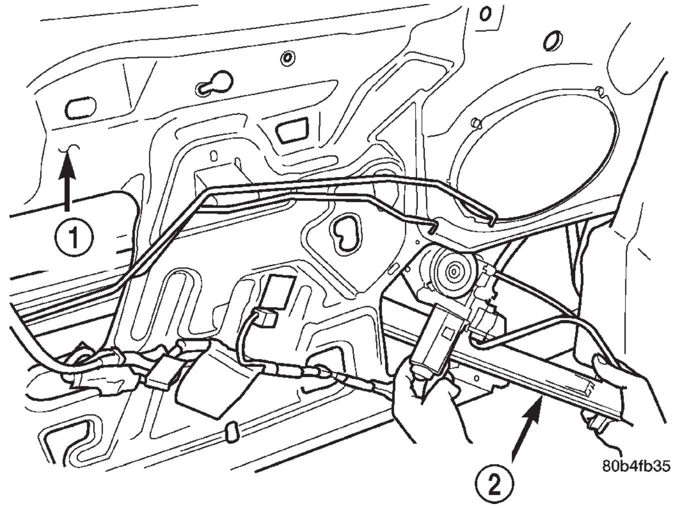


Fig. 17 Front Door Window Regulator

1 - FRONT DOOR
2 - REGULATOR

INSTALLATION

(1) Position regulator in door through access hole.

(2) Engage power window regulator harness connector, if equipped.

(3) Lift regulator upward and engage bolts in door inner panel key hole slots.

(4) Install bolt attaching regulator to inner door panel.

(5) Tighten bolts attaching regulator to inner door panel.

(6) Install front door glass, refer to (Refer to 23 - BODY/DOOR - FRONT/GLASS RUN CHANNEL - INSTALLATION).

DOORS - REAR

TABLE OF CONTENTS

CHECK STRAP

REMOVAL

(1) Remove waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL).
(2) Remove speaker.
(3) Remove screws attaching door check to B-pillar.
(4) Remove nuts attaching door check to door (Fig. 1).
(5) Remove door check through speaker location hole.

INSTALLATION

(1) Position door check on door through speaker location hole.
(2) Install nuts attaching door check to door (Fig. 1).
(3) Install screws attaching door check to B-pillar.
(4) Install speaker.
(5) Install waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - INSTALLATION).

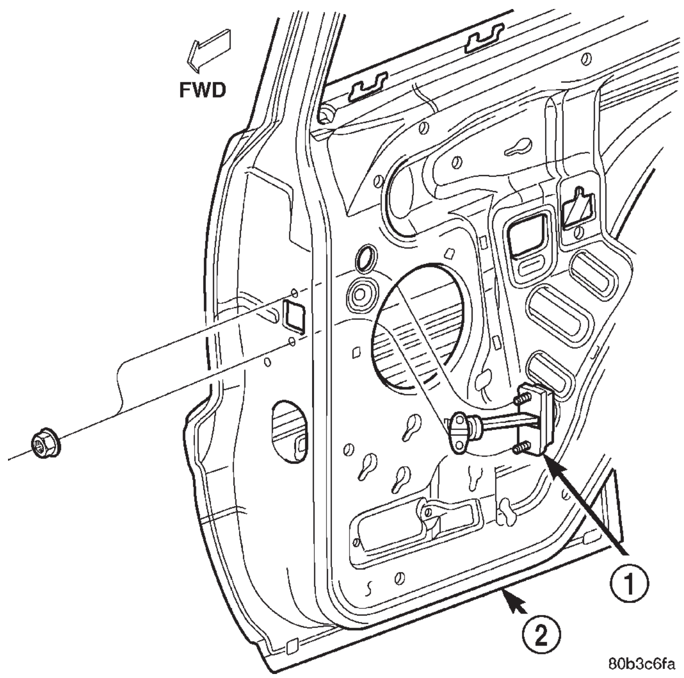


Fig. 1 Door Check

1 - DOOR CHECK
2 - REAR DOOR

DOOR

REMOVAL

(1) Disconnect rear door harness connector (Fig. 2).
(2) Support door with padded floor jack.
(3) Remove retaining clips from hinge pins.
(4) Tap out hinge pins.
(5) Separate door from vehicle.

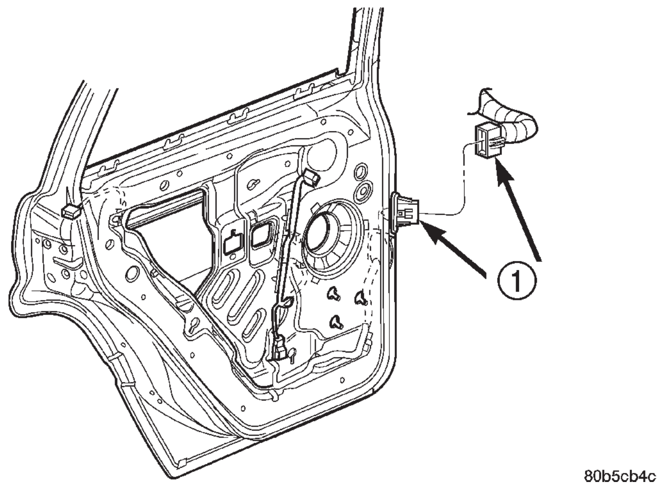


Fig. 2 Rear Door Harness Connector

1 - HARNESS CONNECTOR

INSTALLATION

(1) Position door at vehicle and align hinges.
(2) Install hinge pins.
(3) Install retaining clips for hinge pins.
(4) Connect rear door harness connector (Fig. 2).

DOOR GLASS

REMOVAL

(1) Remove waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL).
(2) Remove inner belt weatherstrip, refer to (Refer to 23 - BODY/WEATHERSTRIP/SEALS/RDR INNER BELT WEATHERSTRIP - REMOVAL).
(3) Remove stationary glass, refer to (Refer to 23 - BODY/STATIONARY GLASS/DOOR GLASS - REMOVAL).
(4) Disengage clips attaching window glass to lift plate.
(5) Press studs out of lift plate.
(6) Lift window glass from door (Fig. 3).

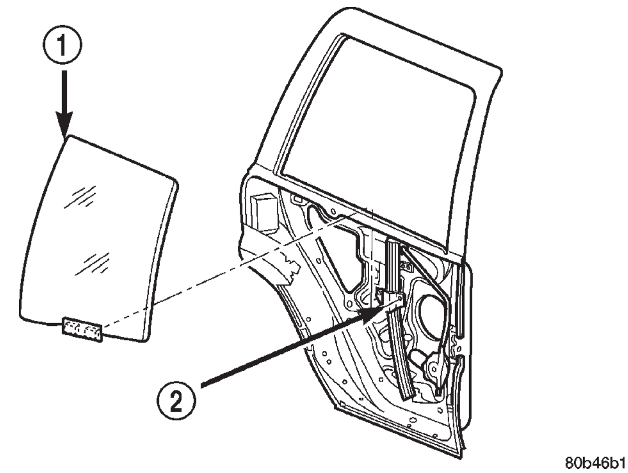


Fig. 3 Glass Channel

1 - GLASS
2 - REGULATOR

INSTALLATION

(1) Position window glass in door (Fig. 3).
(2) Engage studs into lift plate.
(3) Engage clips attaching window glass to lift plate.
(4) Install stationary glass, refer to (Refer to 23 - BODY/STATIONARY GLASS/DOOR GLASS - INSTALLATION).
(5) Install inner belt weatherstrip, refer to (Refer to 23 - BODY/WEATHERSTRIP/SEALS/RDR INNER BELT WEATHERSTRIP - INSTALLATION).
(6) Install waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - INSTALLATION).

EXTERIOR HANDLE

REMOVAL

(1) Remove waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL).
(2) Locate glass to full up position.
(3) Disconnect lock knob to latch rod.
(4) Disconnect outside handle to latch rod.
(5) Remove fasteners attaching outside handle to door (Fig. 4).
(6) Remove outside handle from door.
(7) Separate outside handle from vehicle.

EXTERIOR HANDLE (Continued)

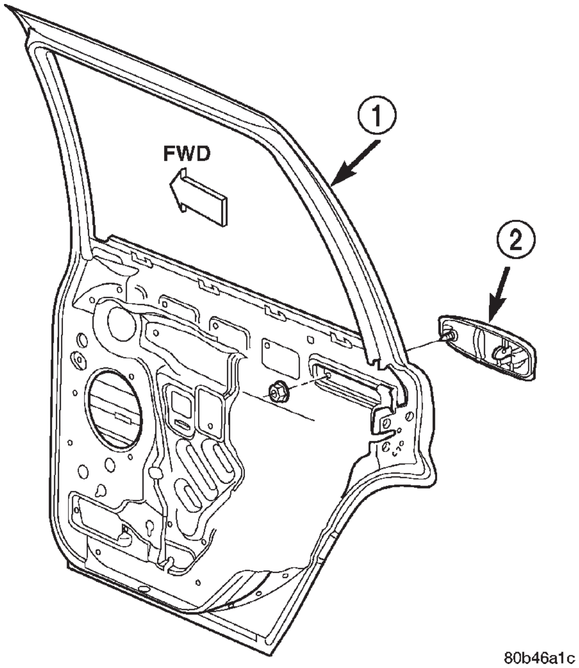


Fig. 4 Front

1 - DOOR
2 - OUTSIDE HANDLE

INSTALLATION

(1) Position outside handle in door.
(2) Install fasteners attaching outside handle to door (Fig. 4).
(3) Connect outside handle to latch rod.
(4) Connect lock knob to latch rod.
(5) Locate glass to full down position.
(6) Install waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - INSTALLATION).

HINGE

REMOVAL

(1) Open front door and rear door.
(2) Reference mark hinges for installation (Fig. 5).
(3) Support rear door for removal of hinges.
(4) Remove B pillar trim.
(5) Remove nuts holding door to hinge.
(6) Remove door.
(7) Remove bolts holding hinge to B pillar.

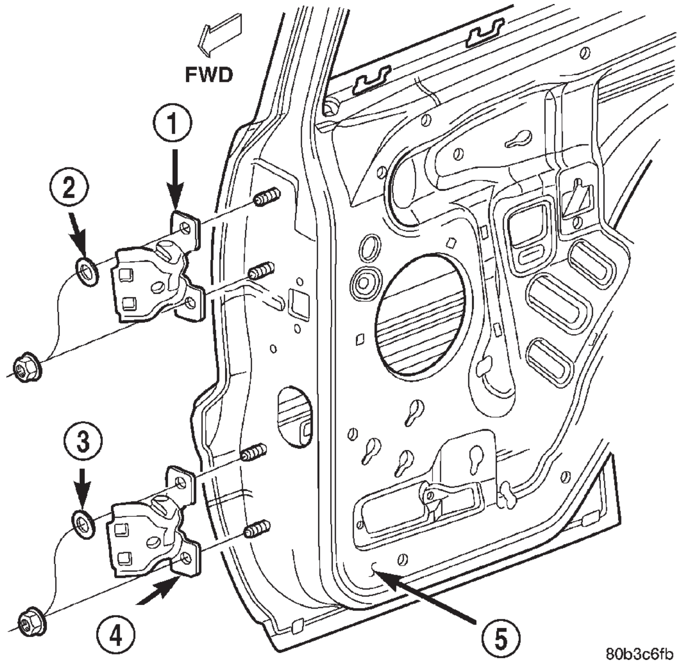


Fig. 5 Rear Door Hinge

1 - UPPER HINGE
2 - WASHER
3 - WASHER
4 - LOWER HINGE
5 - REAR DOOR

INSTALLATION

(1) Install hinge on B pillar and align reference marks (Fig. 5).
(2) Install bolts holding hinge to B pillar. Tighten bolts to 35N·m (23 ft. lbs.).
(3) Install door on hinge and align reference marks. Install bolts and tighten to 35N·m (26 ft. lbs.).
(4) Check door for fit and ease of operation. Adjust as necessary, refer to (Refer to 23 - BODY/DOOR - FRONT/DOOR - ADJUSTMENTS).
(5) Install B pillar trim.

INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove door trim panel, refer to (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).

(2) Disconnect latch and lock rods from inside handle actuator.

(3) Remove screws attaching inside handle actuator to trim panel (Fig. 6).

(4) Separate inside handle actuator from trim panel.

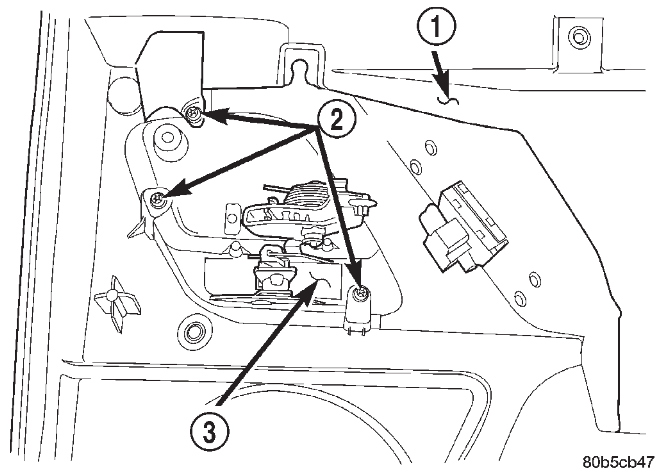


Fig. 6 Rear Door Inside Handle Actuator

1 - REAR DOOR TRIM PANEL
2 - SCREW
3 - INSIDE HANDLE ACTUATOR

INSTALLATION

(1) Position inside handle actuator in trim panel.

(2) Install screws attaching inside handle actuator to trim panel (Fig. 6).

(3) Connect latch and lock rods to inside handle actuator.

(4) Install door trim panel, refer to (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).

LATCH

REMOVAL

(1) Remove waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL).

(2) Remove screws attaching latch to door (Fig. 7).

(3) Disconnect rods from door latch.

(4) Separate door latch from door.

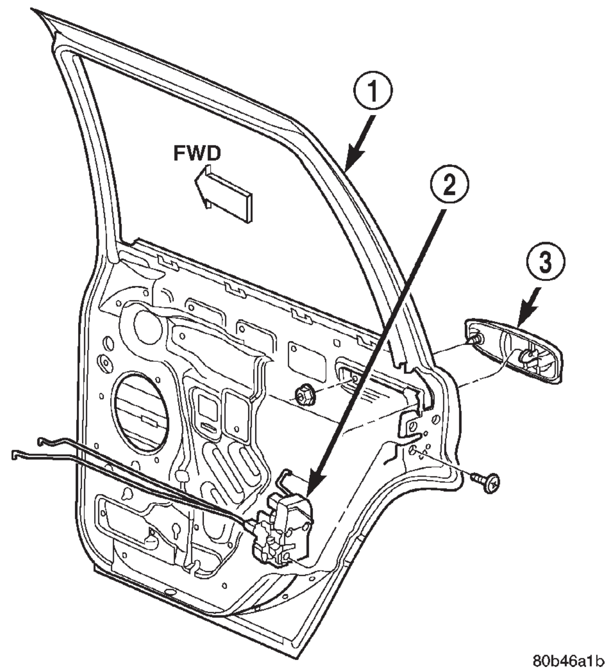


Fig. 7 Rear Door Latch

1 - DOOR
2 - LATCH
3 - OUTSIDE HANDLE

INSTALLATION

(1) position latch in door.

(2) Connect rods to door latch.

(3) Install screws attaching latch to door. Tighten screws to 10 N·m (95 in. lbs.) torque (Fig. 7).

(4) Install waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - INSTALLATION).

LATCH STRIKER

REMOVAL

(1) Remove screws attaching striker to C-pillar (Fig. 8).
(2) Separate striker and spacer from vehicle.

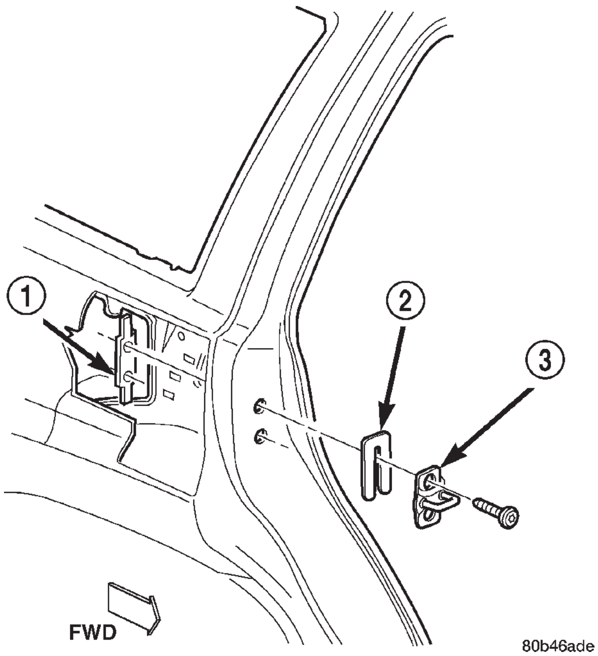


Fig. 8 Rear Door Latch Striker

1 - TAPPING PLATE
2 - SPACER
3 - STRIKER

INSTALLATION

(1) Position striker and spacer on C-pillar.
(2) Install screws. Tighten to 28 N·m (250 in. lbs.) torque.

TRIM PANEL

REMOVAL

(1) Remove screws attaching trim panel to door (Fig. 9).
(2) Using trim remover (C-4829 or equivalent), detach trim panel perimeter push-in fasteners from door inner panel.
(3) Lift trim panel upward and separate from door.
(4) If equipped, disconnect harness connectors for power accessories.
(5) Disconnect latch rods from inside handle actuator.
(6) Separate trim panel from vehicle.

INSTALLATION

(1) Connect latch rods to inside handle actuator.

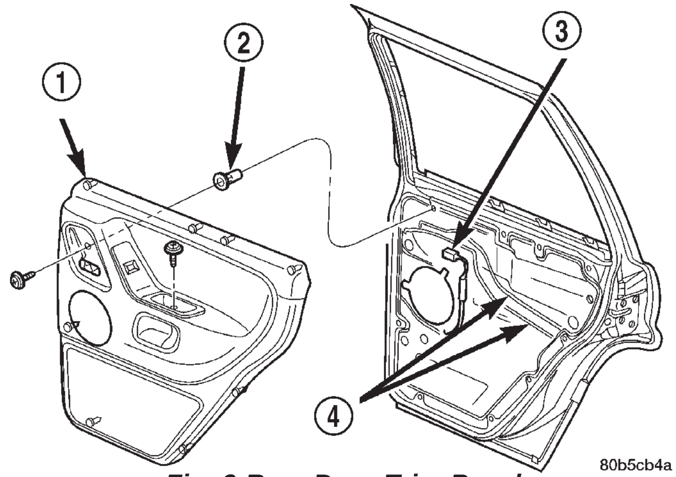


Fig. 9 Rear Door Trim Panel

1 - TRIM PANEL
2 - NUTSERT
3 - HARNESS CONNECTOR
4 - LATCH RODS

(2) If equipped, connect harness connectors to power accessories.
(3) Position trim panel on door inner panel.
(4) Press trim panel push-in fasteners inward around perimeter of door.
(5) Install screws attaching trim panel to door (Fig. 9).

WATERDAM

REMOVAL

(1) Remove door trim panel, refer to (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).
(2) Peel the waterdam from door.
(3) Route all harnesses and linkage rods through waterdam as necessary.
(4) Separate waterdam from door (Fig. 10).

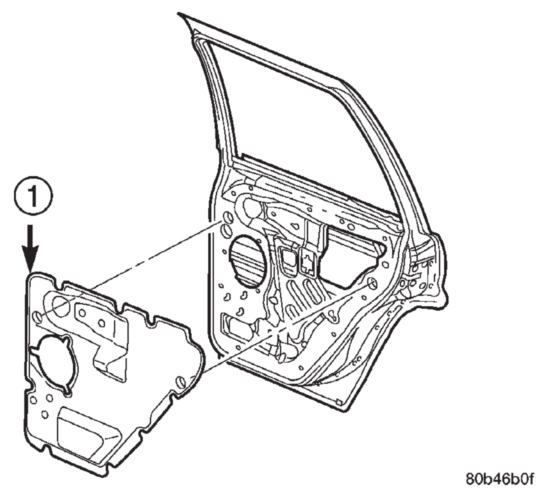


Fig. 10 Rear Door Waterdam

1 - INSULATOR PAD

WATERDAM (Continued)

INSTALLATION

(1) Waterdam contact surface must be free of contaminants. Clean as necessary.

(2) Route all harnesses and linkage rods through waterdam as necessary.

(3) Position waterdam on door and align all holes (Fig. 10).

(4) Press waterdam on door.

(5) Install door trim panel, refer to (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).

WINDOW REGULATOR

REMOVAL

(1) Remove waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL).

(2) Remove the stationary glass, refer to (Refer to 23 - BODY/STATIONARY GLASS/DOOR GLASS - REMOVAL).

(3) Raise the door glass and support.

(4) Disconnect the speaker harness and power window harness, if equipped.

(5) Remove the window clips retaining regulator (Fig. 11).

(6) Remove the door glass.

(7) Remove the fasteners retaining the regulator (Fig. 12).

(8) Remove the regulator.

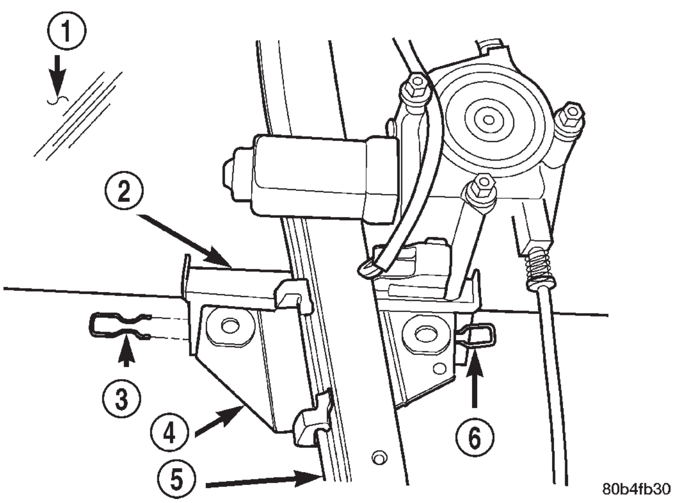


Fig. 11 Window Regulator Retainer Clips

1 - GLASS
2 - RETAINER
3 - CLIP
4 - LIFT PLATE
5 - REGULATOR
6 - CLIP

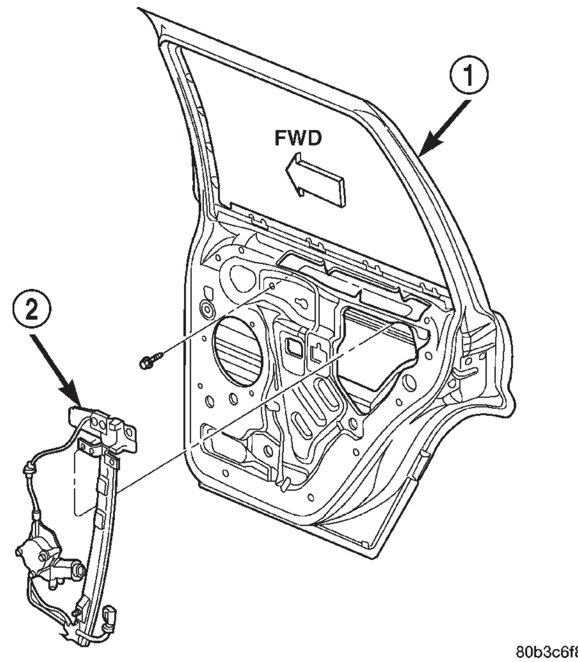


Fig. 12 Rear Door Window Regulator

1 - DOOR
2 - REGULATOR

INSTALLATION

(1) Position the window regulator in the door.

(2) Install the fasteners retaining the regulator (Fig. 12).

(3) Install the door glass.

(4) Install the window clips retaining regulator (Fig. 11).

(5) Lower the door glass.

(6) Install the stationary glass, refer to (Refer to 23 - BODY/STATIONARY GLASS/DOOR GLASS - INSTALLATION).

(7) Connect the power window and speaker harness if equipped.

(8) Install the waterdam, refer to (Refer to 23 - BODY/DOORS - REAR/WATERDAM - INSTALLATION).

(9) Cycle the glass and check for proper operation.

EXTERIOR

TABLE OF CONTENTS

BODY SIDE MOLDINGS

REMOVAL

REMOVAL–FRONT DOOR

(1) Open the front door.

(2) Using a trim stick, pry the upper rear edge off the door. Continue to the front edge of the front door (Fig. 1).

(3) Using a heat gun, warm the adhesive tape on the lower edge of the cladding and pull the cladding from the door.

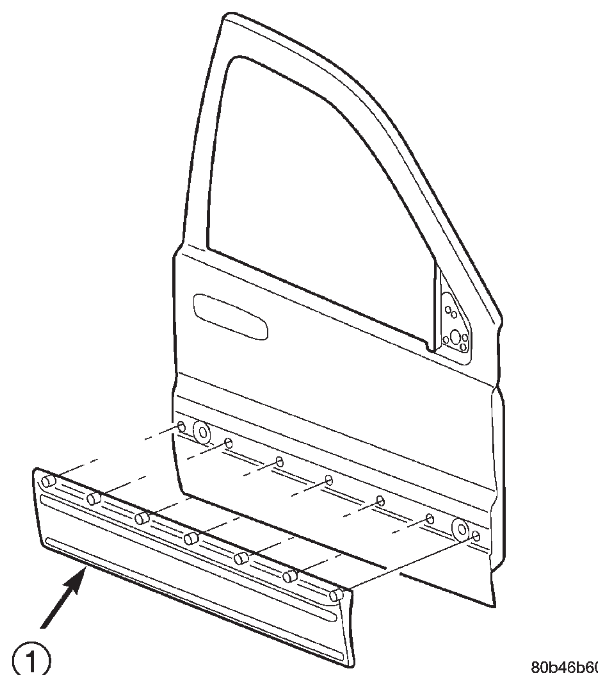


Fig. 1 Front Door Cladding

1 - CLADDING

BODY SIDE MOLDINGS (Continued)

REMOVAL–REAR DOOR

(1) Open the rear door.

(2) Using a trim stick, pry the upper rear edge off the door. Continue towards the front edge of the rear door (Fig. 2).

(3) Using a heat gun, warm the adhesive tape on the bottom of the cladding and remove the cladding.

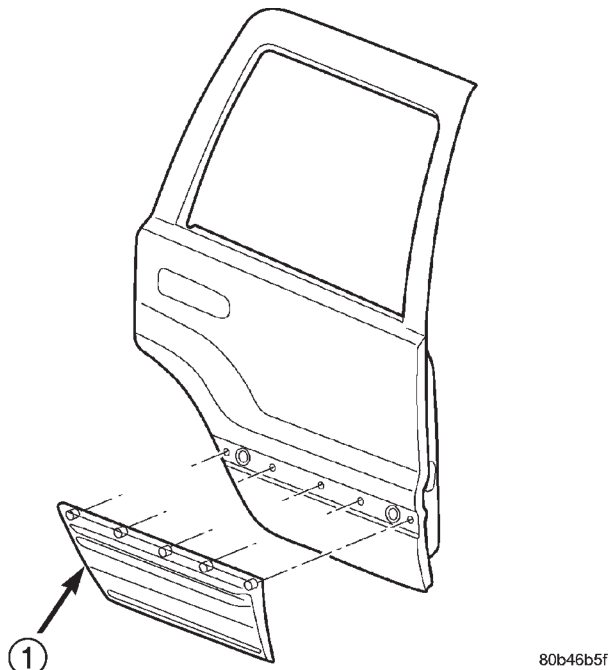


Fig. 2 Rear Door Cladding

1 - CLADDING

REMOVAL–FENDER/QUARTER PANEL

(1) Remove the screws at wheel opening (Fig. 3).

(2) Using a trim stick, gently pry bottom of cladding up.

(3) Lift upwards and remove cladding.

INSTALLATION

INSTALLATION–FRONT DOOR

(1) Clean the area thoroughly with Mopar Super Kleen, or equivalent.

(2) Align the body side cladding with the slots in the door. Press the adhesive pad to the door and snap the retainers into the slots.

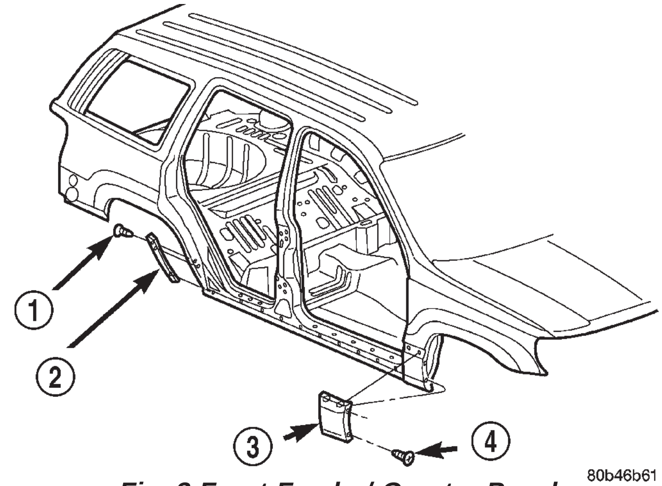


Fig. 3 Front Fender/ Quarter Panel

1 - SCREW
2 - QUARTER PANEL CLADDING
3 - FRONT FENDER CLADDING
4 - SCREW

INSTALLATION–REAR DOOR

(1) Clean the area thoroughly with Mopar Super Kleen, or equivalent.

(2) Align the body side cladding with the slots in the door. Press the adhesive pad to the door and snap the retainers into the slots.

INSTALLATION–FENDER/QUARTER PANEL

(1) Thoroughly clean the area with Mopar Super Kleen or equivalent.

(2) Align the cladding with the screw holes in the fender.

(3) Press the cladding in place.

(4) Install the screws at the wheel opening.

COWL GRILLE

REMOVAL

(1) Remove wiper arms, refer to (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL).

(2) Remove plenum seal.

(3) Remove plastic push nuts attaching cowl cover to cowl (Fig. 4).

(4) Remove windshield washer tubes at connector.

(5) Remove cowl cover from cowl.

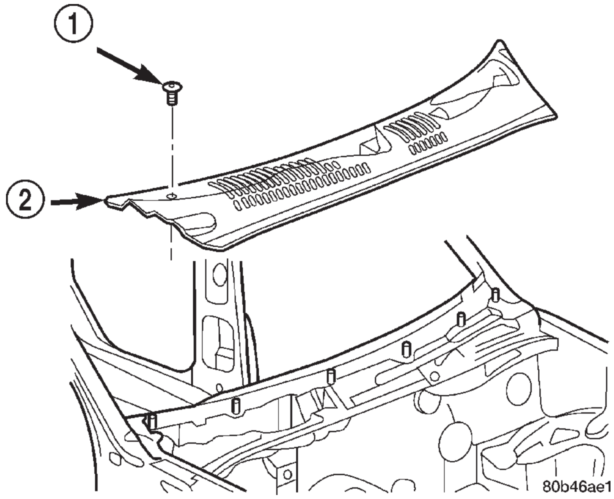


Fig. 4 Cowl Cover

1 - PLASTIC NUT
2 - COWL COVER

INSTALLATION

(1) Position cowl cover on cowl.

(2) Install windshield washer tubes at connector.

(3) Install plastic push nuts attaching cowl cover to cowl (Fig. 4).

(4) Install plenum seal.

(5) Install windshield wiper arms, refer to (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION).

D-PILLAR APPLIQUE

REMOVAL

(1) Using a trim stick, carefully pry applique from panel (Fig. 5).

INSTALLATION

(1) Position applique on panel with retainers aligned.

(2) Press applique firmly in place.

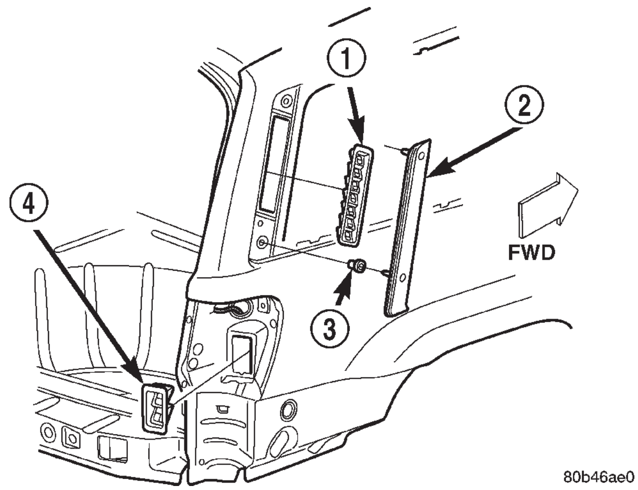


Fig. 5 D-Pillar Applique & Air Exhauster

1 - D-PILLAR EXHAUSTER
2 - D-PILLAR APPLIQUE
3 - CLIP
4 - TAIL LAMP EXHAUSTER

D-PILLAR AIR EXHAUSTER

REMOVAL

(1) Remove D-pillar applique, refer to (Refer to 23 - BODY/EXTERIOR/COWL GRILLE SCREEN - REMOVAL).

(2) Carefully pry air exhauster from D-pillar using a flat blade screwdriver (Fig. 5).

INSTALLATION

(1) Reseal air exhauster using foam tape.

(2) Install air exhauster on D-pillar.

(3) Install D-pillar applique, refer to (Refer to 23 - BODY/EXTERIOR/COWL GRILLE SCREEN - INSTALLATION).

AIR EXHAUSTER

REMOVAL

(1) Remove tail lamp, refer to (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/TAIL LAMP - REMOVAL).

(2) Using a trim stick, pry the top of the air exhauster downward to detach the retaining clips.

(3) Separate air exhauster from vehicle (Fig. 5).

INSTALLATION

(1) Position air exhauster in opening.

(2) Press air exhauster inward to secure.

(3) Install tail lamp, refer to (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/TAIL LAMP - INSTALLATION).

EXTERIOR NAME PLATES

REMOVAL

NOTE: Exterior nameplates are attached to body panels with adhesive tape.

(1) Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.

(2) If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun. Do not exceed 52°C (120°F) when heating emblem.

(3) Insert a plastic trim stick or a hard wood wedge behind the emblem to separate the adhesive backing from the body.

(4) Clean adhesive residue from body with MOPAR Super Clean solvent or equivalent.

INSTALLATION

(1) Remove protective cover from adhesive tape on back of emblem.

(2) Position emblem properly on body.

(3) Press emblem firmly to body with palm of hand.

(4) If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun to assure adhesion. Do not exceed 52°C (120°F) when heating emblem.

FRONT FENDER

REMOVAL

(1) Using a wax crayon or equivalent, mark position of fender.

(2) Remove front fender liner.

(3) Pull back fascia and remove screws attaching fender to fascia.

(4) Remove screws attaching lower fender bracket located behind fascia.

(5) Remove screws attaching fender to rocker panel (Fig. 6).

(6) Remove screws attaching rear of fender to A-pillar brackets.

(7) Open hood.

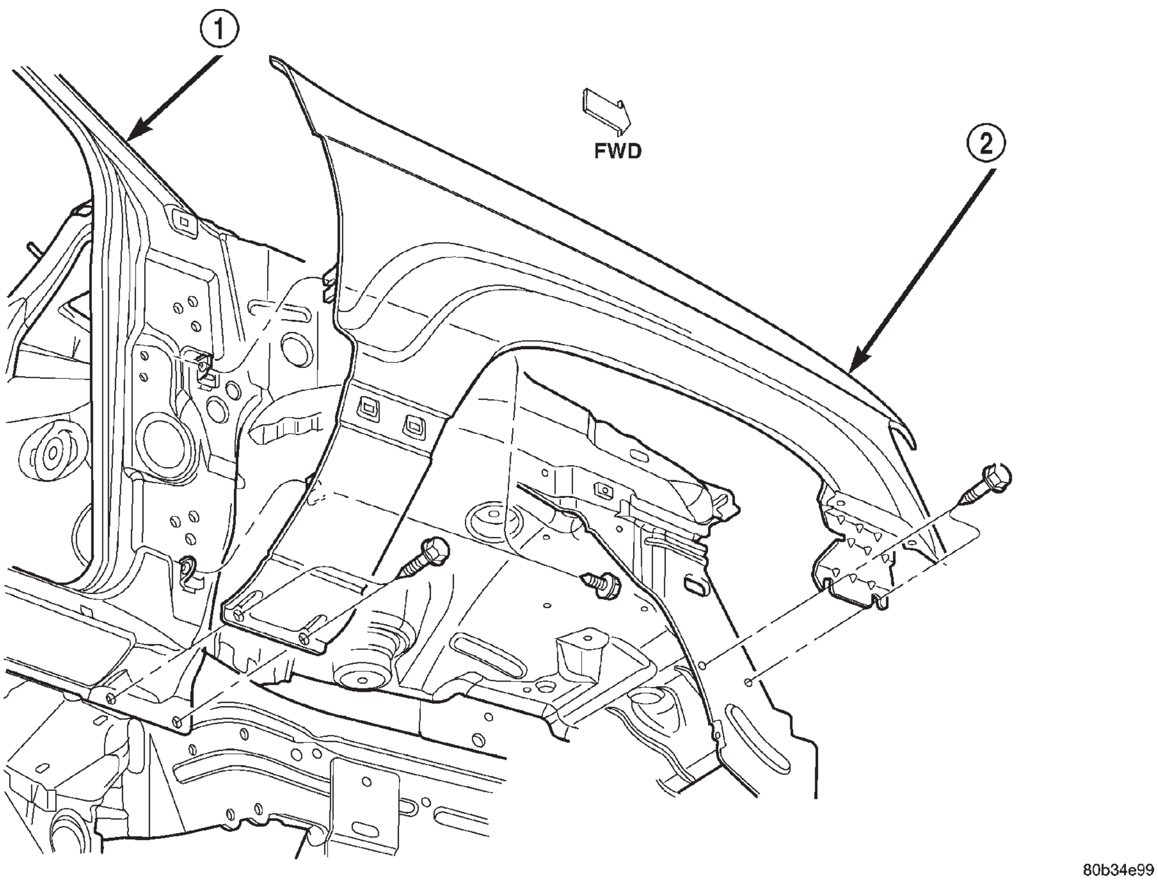


Fig. 6 Fender Mounting

1 - BODY
2 - FENDER

FRONT FENDER (Continued)

(8) Loosen screw under hood hinge, attaching fender to engine compartment rail.

(9) Remove screws attaching fender to engine compartment rail (Fig. 7).

(10) Right fender only:

(a) If equipped, remove radio antenna.

(11) Separate fender from body.

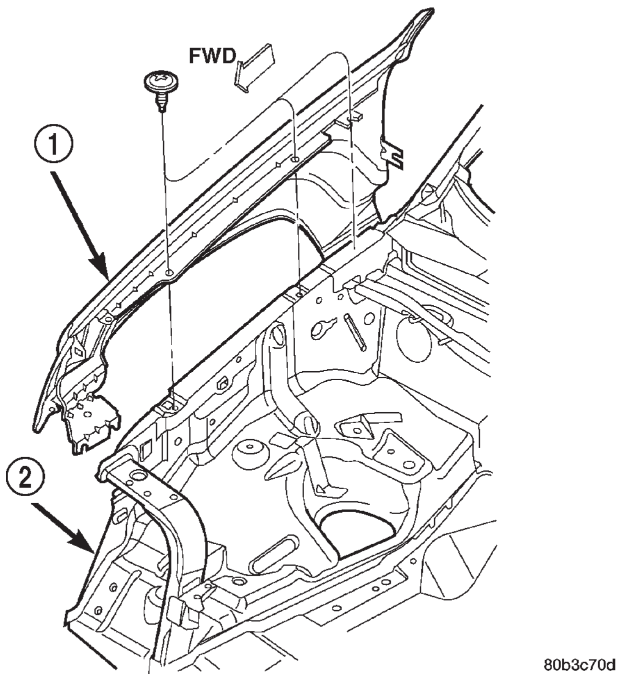


Fig. 7 Upper Fender Mounting

1 - FENDER
2 - BODY

INSTALLATION

(1) Position fender on body.

(2) Right fender only:

(a) If equipped, install radio antenna.

(3) Install all screws finger-tight.

(4) Align fender with adjacent body panels and wax crayon reference marks.

(5) Tighten all screws.

(6) Install inner fender liner.

FUEL FILL DOOR

REMOVAL

(1) Open the fuel filler door.

(2) Remove the screws attaching the door to the quarter panel (Fig. 8).

(3) Remove the door from the panel.

INSTALLATION

(1) Position the fuel filler door on the quarter panel with the screw holes aligned.

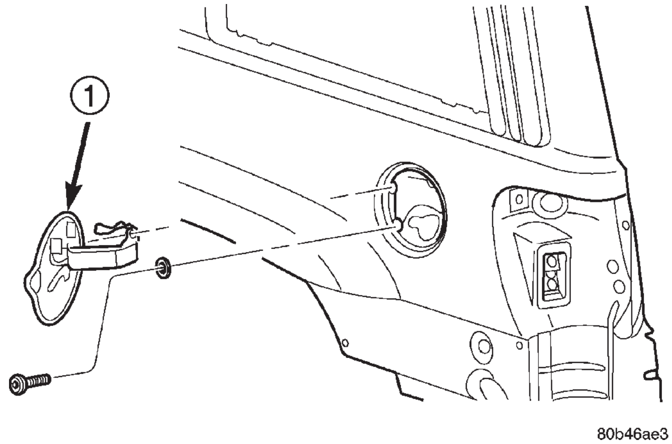


Fig. 8 Fuel Filler Door

1 - FUEL FILL DOOR

(2) Install the screws attaching the fuel filler door to the quarter panel.

GRILLE

REMOVAL

(1) Remove fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(2) Disengage retainers attaching grille insert to grille/fascia.

(3) Separate grille insert from grille/fascia (Fig. 9).

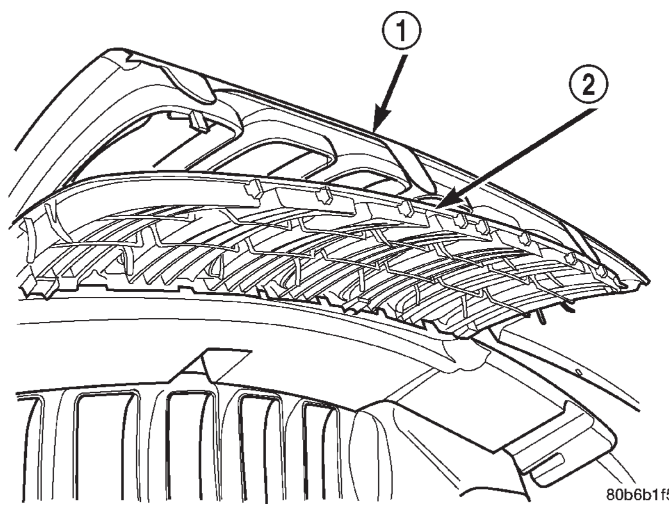


Fig. 9 Grille Insert

1 - GRILLE/FASCIA
2 - INSERT

INSTALLATION

(1) Position grille insert in grille/fascia (Fig. 9).

(2) Engage retainers attaching grille insert to grille/fascia.

GRILLE (Continued)

(3) Install fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

HEADLAMP MOUNTING MODULE

REMOVAL

CAUTION: Take special care when handling the HMM not to damage the upper mounting tabs. Step #3 must be performed prior to removing HMM from the vehicle to prevent damage to HMM.

(1) Remove fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).

(2) Remove inner fender liner.

(3) Reach into the wheelhouse opening and disengage the retainer attaching the HMM to each side of the body.

(4) Remove bolts attaching headlamp mounting module to body (Fig. 10).

(5) Disconnect headlamp wire harness connectors.

(6) Separate headlamp mounting module from vehicle.

INSTALLATION

(1) Position headlamp mounting module at vehicle.

(2) Connect headlamp wire harness connectors.

(3) Engage the retainer attaching the HMM to each side of the body.

(4) Install bolts attaching headlamp mounting module to body (Fig. 10).

(5) Install inner fender liner.

(6) Install front fascia, refer to (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).

LUGGAGE RACK

REMOVAL

NOTE: The skid strips are attached to the roof panel with adhesive.

(1) Using a trim stick, or other suitable device, pry support cover off.

(2) If necessary, slide the crossbars to expose the screws attaching the slide rails to the supports.

(3) Remove the screws retaining the slide rails to the supports.

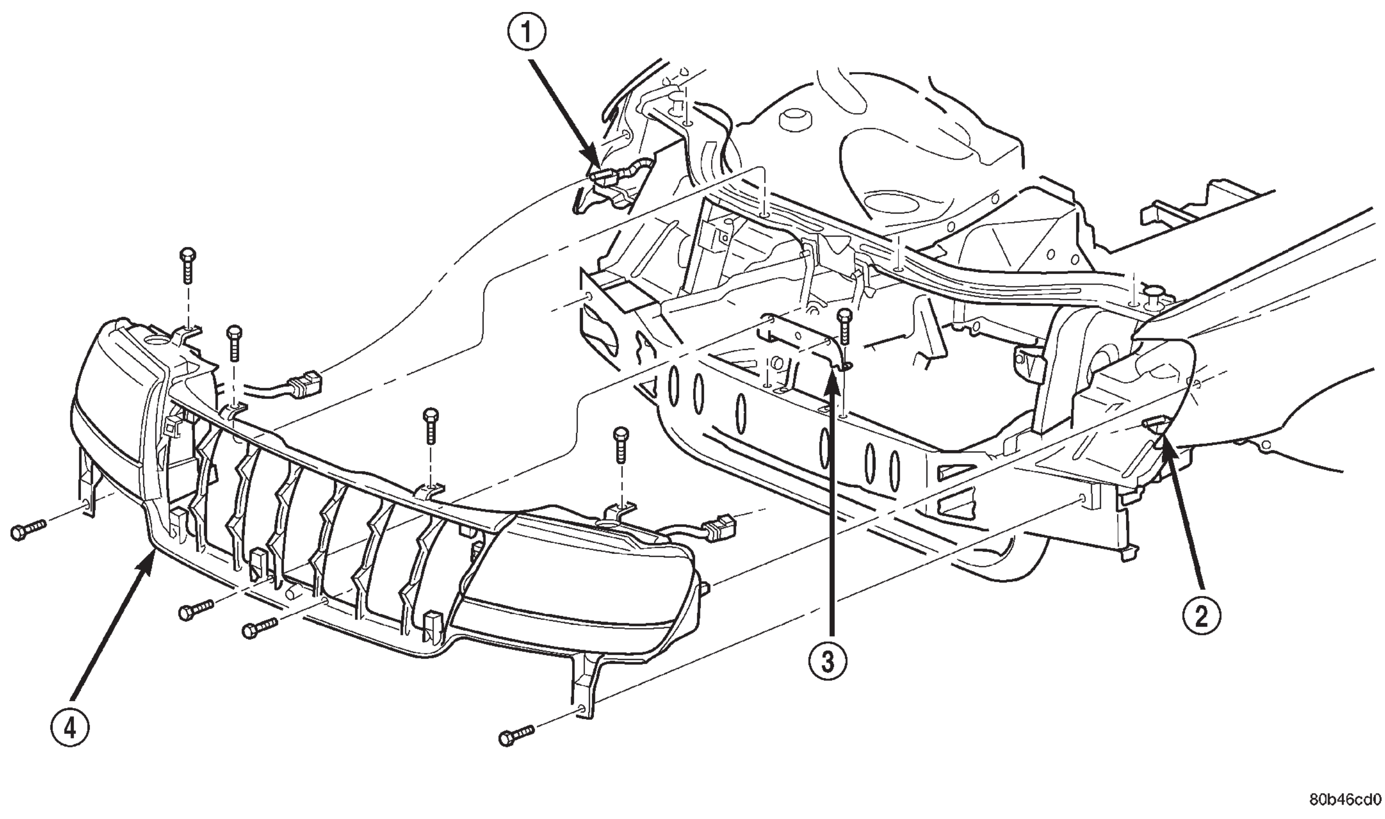


Fig. 10 Headlamp Mounting Module

1 - CONNECTOR
2 - CONNECTOR
3 - MOUNTING BRACKET
4 - HEADLAMP MODULE

LUGGAGE RACK (Continued)

(4) Remove the screws attaching the supports to the roof panel.

(5) Separate the supports from the roof panel.

NOTE: If a crossbar needs to be serviced, the forward or rearward supports will have to be removed.

INSTALLATION

(1) Position the supports on the roof panel and install the screw. Be sure that the gasket is properly seated.

(2) Position the luggage rack on the supports.

(3) Install the screws attaching the side rails to the supports.

(4) Position the supports covers on the supports and press into place.

SIDE VIEW MIRROR GLASS

REMOVAL

(1) With damaged mirror still on vehicle, position mirror glass down and centered.

(2) Position a wide leverage device between the bottom edge of the glass and the mirror shell.

(3) Firmly apply pressure in an upward direction until glass assembly disengages from adapter plate.

(4) Disconnect the heater wire terminal, if equipped, or the EC plug, if equipped.

INSTALLATION

(1) Connect the heater wire terminal or the EC plug, if equipped.

(2) Position the replacement glass in the mirror shell and align the four snap tabs with the four cavities in the shell.

(3) Apply firm pressure inward until the replacement glass assembly engages with the adapter plate. Correct assembly will result in a firm click. Glass assembly should exhibit even gaps to the shell when complete.

(4) Pull lightly on corners of glass assembly to ensure all four snaps are engaged and there is no free play.

SIDE VIEW MIRROR

REMOVAL

(1) Remove door trim panel, refer to (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).

(2) Disengage power mirror harness connector, if equipped.

(3) Remove mirror flag seal.

(4) Remove nuts attaching mirror to door (Fig. 11).

(5) Separate mirror from door.

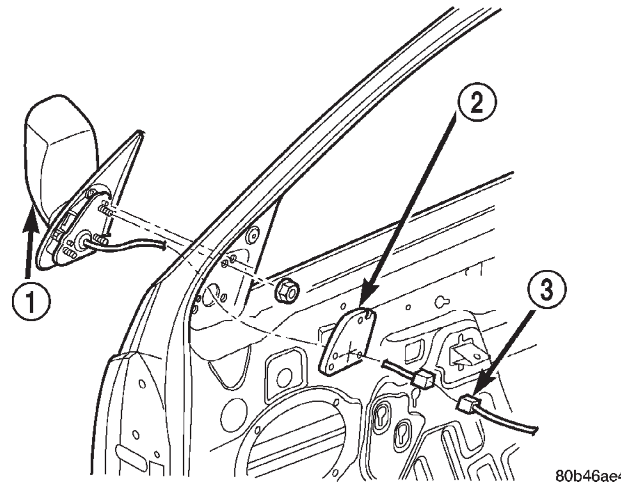


Fig. 11 Side View Mirror

1 - SIDEVIEW MIRROR
2 - MIRROR FLAG SEAL
3 - CONNECTOR

INSTALLATION

(1) Position mirror on door. Verify that gasket seal is properly positioned.

(2) Install nuts attaching mirror to door (Fig. 11).

(3) Install mirror retaining nuts.

(4) Install mirror flag seal.

(5) Engage power mirror harness connector, if equipped.

(6) Install door trim panel, refer to (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).

ROCK RAIL

REMOVAL

(1) Remove the bolts and remove the rock rail. (Fig. 12)

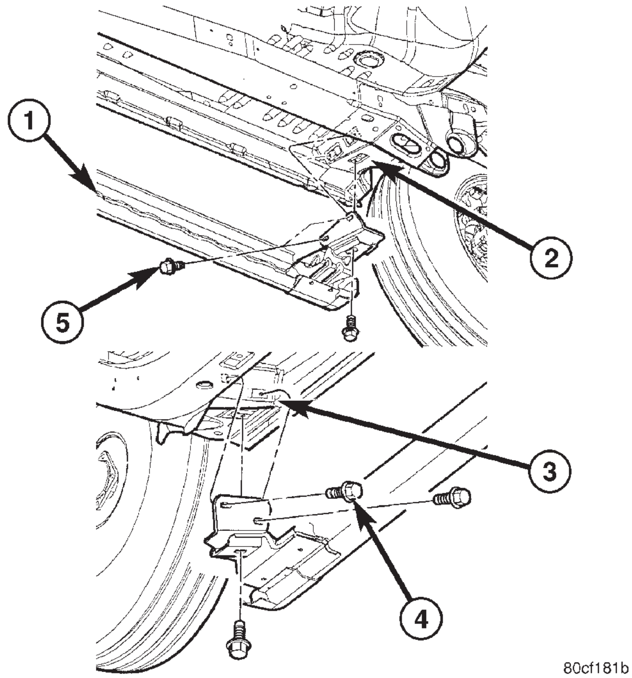


Fig. 12 ROCK RAIL

1 - ROCK RAIL
2 - J-NUTS (3)
3 - J-NUTS (3)
4 - BOLTS (3)
5 - BOLTS (3)

INSTALLATION

NOTE: Shims may be used to adjust rock rail positioning, if required.

(1) Loosen the rear bracket slide bolts. (Fig. 13)
(2) Install the rock rail and install the bolts.
(3) Tighten the front bolts to 27 N·m (20 ft. lbs.).
(4) Slide the rear bracket to contact the mounting surface and tighten the rear mounting bolts to 27 N·m (20 ft. lbs.).
(5) Tighten the slide bolts to 27 N·m (20 ft. lbs.).
(6) Loosen the end cap bolts and slide the end caps against the body.
(7) Tighten the end cap bolts.

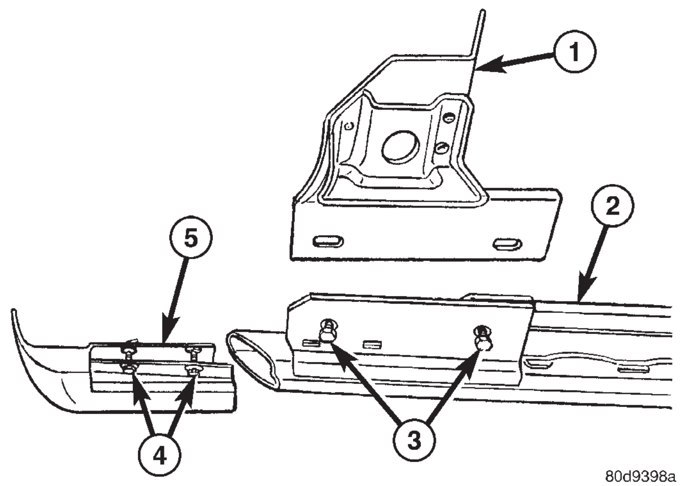


Fig. 13 REAR ROCK RAIL BRACKET

1 - REAR BRACKET
2 - ROCK RAIL
3 - REAR BRACKET BOLTS (2)
4 - END CAP BOLTS (2 PER CAP)
5 - END CAP (2)

HOOD

TABLE OF CONTENTS

GAS PROP

REMOVAL

(1) Raise and support hood.

(2) Using a small flat blade, pry the retainer attaching hood support prop to lower ball stud.

(3) Slide retainer attaching hood support prop upper ball stud downward.

(4) Disconnect hood support prop from lower ball stud and rotate support prop upward and disconnect from upper ball stud (Fig. 1).

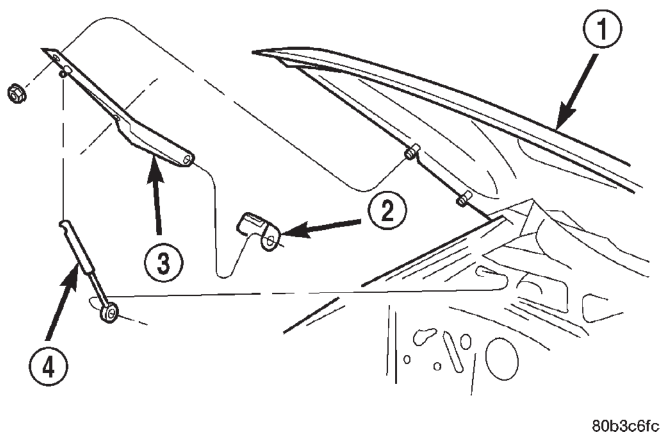


Fig. 1 Hood Support Prop

1 - HOOD
2 - COVER
3 - HINGE
4 - PROP

INSTALLATION

(1) Position hood support prop on upper ball stud (Fig. 1).

(2) Slide retainer upward to secure support prop to upper ball stud.

(3) Position support prop on lower ball stud and press retainer inward to secure.

HINGE

REMOVAL

(1) Raise and support hood.

(2) Using a wax crayon or equivalent, mark position of hinge.

(3) Remove hood hinge prop rod.

(4) Remove nuts attaching hinge to hood (Fig. 1).

(5) Remove bolts attaching hinge to body.

(6) Separate hinge from vehicle.

INSTALLATION

(1) Position hinge on vehicle and align reference marks.

(2) Install bolts attaching hinge to body.

(3) Install nuts attaching hinge to hood.

(4) Install hood hinge prop rod.

HOOD

REMOVAL

(1) Raise hood.

(2) If equipped, disconnect underhood lamp harness connector. (Connector is located under cowl cover).

(3) Using a wax crayon or equivalent, mark location of hood hinges on hood for installation alignment.

(4) Support hood in the open position.

(5) Remove hood support prop rods.

HOOD (Continued)

(6) Remove bolts attaching hinges to hood.

(7) With the aid of a helper, remove hood from vehicle.

INSTALLATION

(1) Position hood on hinges.

(2) Install bolts finger-tight.

(3) Align hinges with installation reference marks and tighten bolts.

(4) Install hood support prop rods.

(5) Connect underhood lamp connector.

(6) Inspect hood for proper alignment and adjust as necessary.

ADJUSTMENTS

HOOD ADJUSTMENT

The hood attaching holes are enlarged to aid front, back and side to side adjustment.

(1) If hood is low in relation to cowl panel, insert shims between hinge and hood.

(2) Adjust hood bumper in or out to adjust hood-to-fender height alignment.

(3) Adjust the hood latch as necessary. Tighten the nuts to 11N·m (8 ft. lbs.).

(4) Align the latch striker so that striker enters the latch squarely and without binding.

INSULATION

REMOVAL

(1) Raise the hood.

(2) Remove the insulation panel fasteners.

(3) Remove the hood insulation panel.

INSTALLATION

(1) Position the insulation panel on the underside of the hood.

(2) Install the insulation panel fasteners.

(3) Close the hood.

LATCH

REMOVAL

(1) Remove nuts attaching latch to radiator cross-member support (Fig. 2).

(2) Disconnect hood release cable from latch.

(3) Separate latch from vehicle.

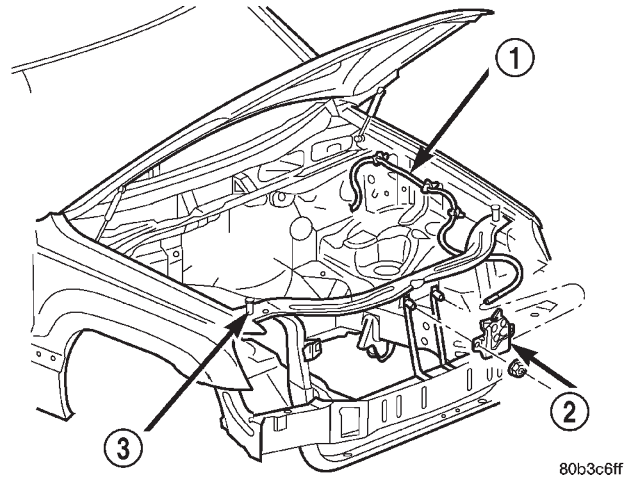


Fig. 2 Hood Latch

1 - HOOD RELEASE CABLE
2 - LATCH
3 - BUMPER

INSTALLATION

(1) Connect latch release cable to latch.

(2) Position latch on radiator crossmember support.

(3) Install nuts attaching latch to radiator cross-member support. Tighten nuts to 11 N·m (8 ft. lbs.) torque (Fig. 2).

LATCH RELEASE CABLE

REMOVAL

(1) Disconnect cable from hood latch (Fig. 3).

(2) Disconnect cable from retaining clips on left inner fender panel.

(3) Remove left cowl side trim panel.

(4) Remove fasteners attaching cable bracket to cowl side panel (Fig. 4).

(5) Route cable through dash panel and remove it from under instrument panel.

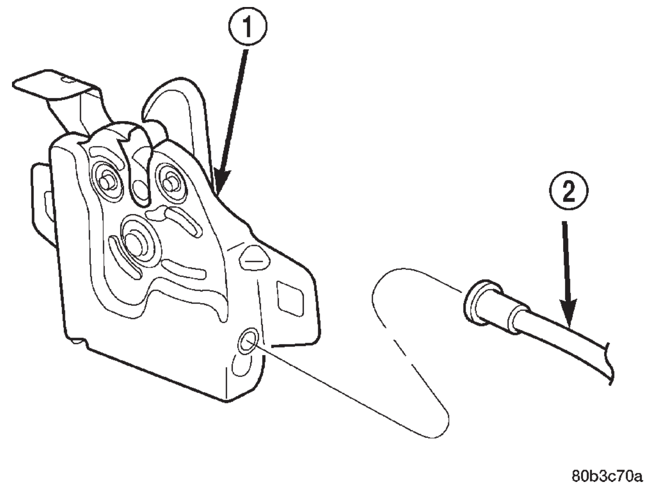


Fig. 3 Hood Latch

1 - HOOD LATCH
2 - HOOD RELEASE CABLE

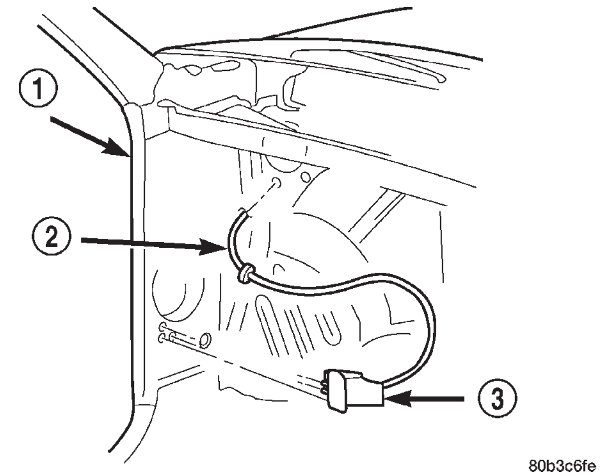


Fig. 4 Hood Release Cable

1 - LOWER COWL
2 - HOOD RELEASE CABLE
3 - RELEASE HANDLE

INSTALLATION

(1) Route cable through hole in dash panel into engine compartment.

(2) Pull cable forward and seat grommet in dash panel.

(3) Position cable bracket on cowl side panel and install fasteners (Fig. 4).

(4) Install left cowl side trim panel.

(5) Route and install cable in retaining clips on left inner fender panel.

(6) Connect cable to hood latch (Fig. 3).

INSTRUMENT PANEL SYSTEM

TABLE OF CONTENTS

INSTRUMENT PANEL SYSTEM

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim from the right and left A-pillars. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).

(3) Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).

(4) Remove the four nuts that secure the instrument panel to the studs on the dash panel near the windshield fence line (Fig. 1).

(5) Remove the scuff plates from the right and left front door sills. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - REMOVAL).

(6) Remove the trim panels from the right and left inner cowl sides. (Refer to 23 - BODY/INTERIOR/COWL TRIM - REMOVAL).

(7) Remove the console from the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(8) Remove the fuse cover from the Junction Block (JB). (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - REMOVAL).

(9) Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(10) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(11) Remove the steering column bracket from the instrument panel steering column support bracket. (Refer to 23 - BODY/INSTRUMENT PANEL/IP STEERING COLUMN BRACKET - REMOVAL).

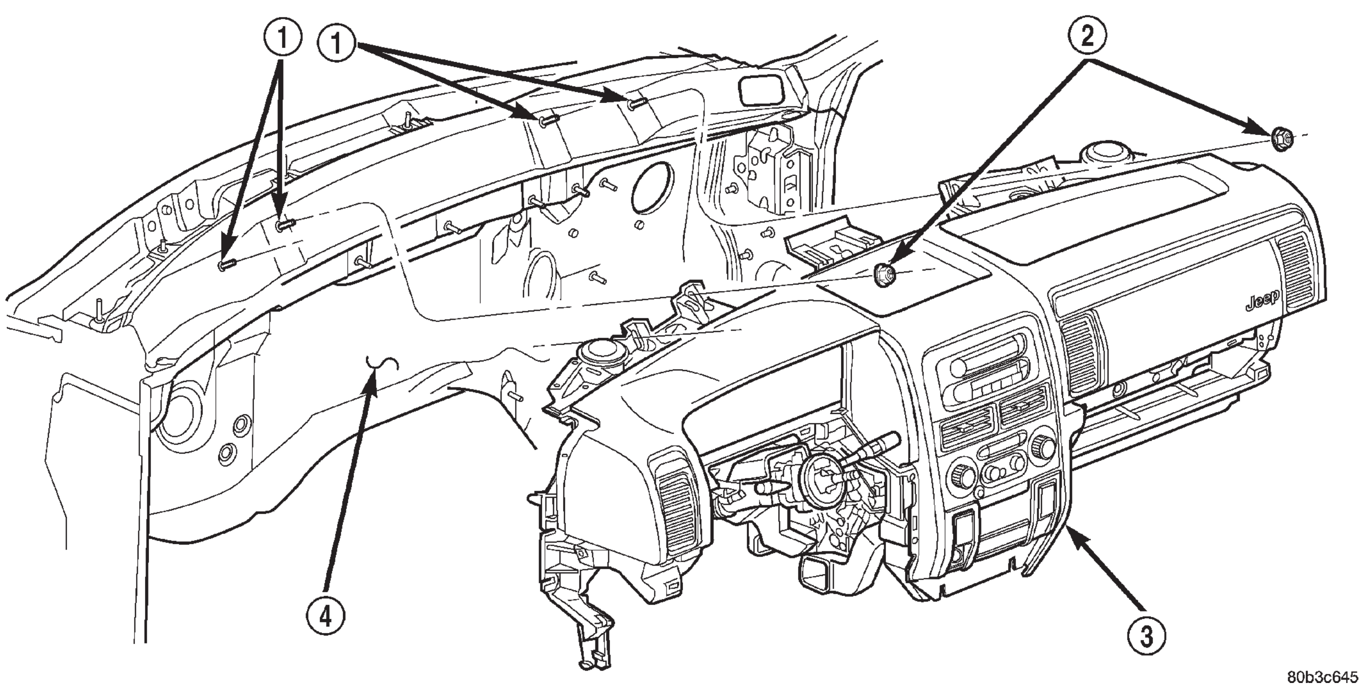


Fig. 1 Instrument Panel to Dash Panel Mounting

1 - STUD (4)
2 - NUT (4)
3 - INSTRUMENT PANEL
4 - DASH PANEL

INSTRUMENT PANEL SYSTEM (Continued)

(12) Remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 2).

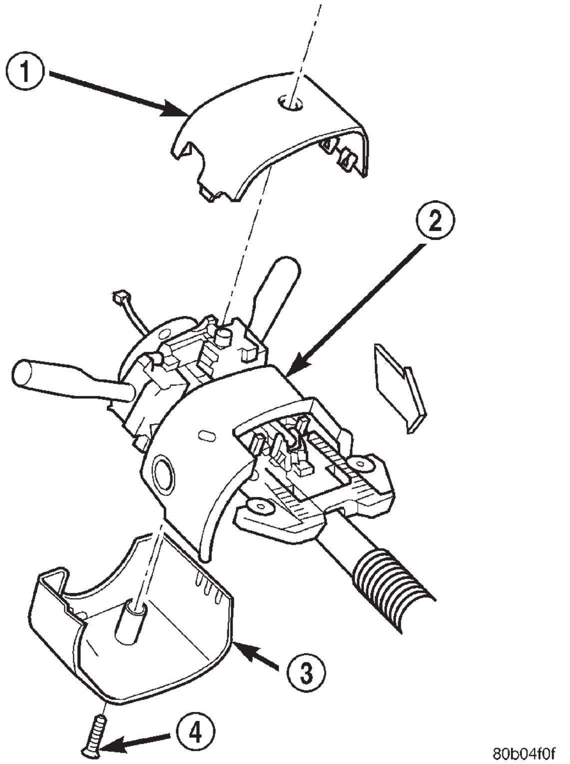


Fig. 2 Steering Column Shrouds Remove/Install

1 - UPPER TILTING COLUMN SHROUD
2 - FIXED COLUMN SHROUD
3 - LOWER TILTING COLUMN SHROUD
4 - SCREW

(13) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(14) Disconnect the instrument panel wire harness connectors from the following steering column components (Fig. 3):

- the two lower clockspring connector receptacles
- the left multi-function switch connector receptacle
- the right multi-function switch connector receptacle
- the two ignition switch connector receptacles
- the shifter interlock solenoid connector receptacle
- if the vehicle is so equipped, the Sentry Key Immobilizer Module (SKIM) connector receptacle.

(15) Turn the ignition switch to the On position, then release and remove the shifter interlock cable connector from the ignition lock housing receptacle.

(16) Turn the ignition switch back to the Lock position to prevent steering wheel rotation and the

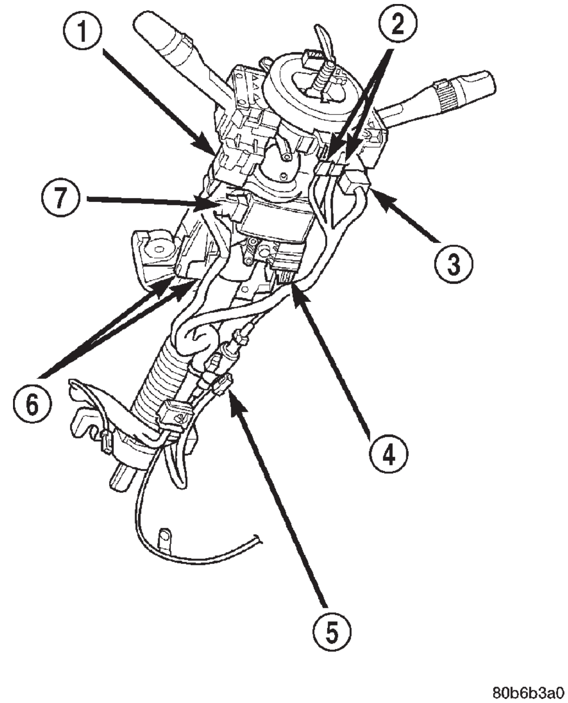


Fig. 3 Steering Column Connections

1 - LEFT MULTIFUNCTION SWITCH CONNECTOR
2 - LOWER CLOCKSPRING CONNECTORS
3 - RIGHT MULTIFUNCTION SWITCH CONNECTOR
4 - SHIFTER INTERLOCK CABLE CONNECTOR
5 - SHIFTER INTERLOCK SOLENOID CONNECTOR
6 - IGNITION SWITCH CONNECTOR RECEPTACLES
7 - SKIM CONNECTOR

loss of clockspring centering following steering column removal.

(17) Remove the bolt that secures the coupler to the lower steering column shaft (Fig. 4).

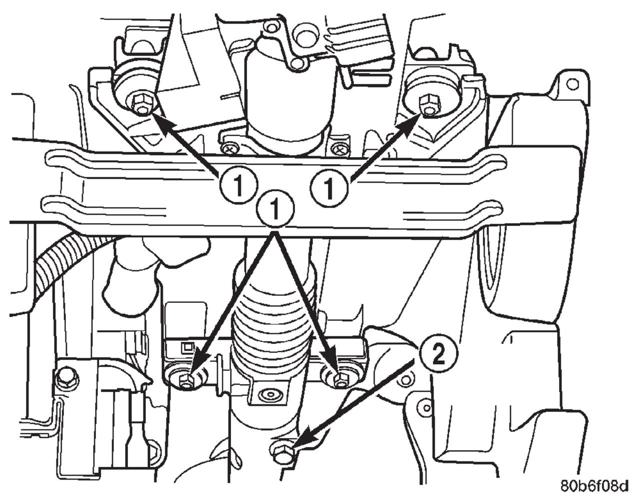


Fig. 4 Steering Column Mounting

1 - COLUMN MOUNTING NUTS
2 - COUPLER BOLT

INSTRUMENT PANEL SYSTEM (Continued)

(18) Remove the four nuts that secure the steering column to the studs on the instrument panel steering column support bracket.

(19) Remove the steering column from the instrument panel. Be certain that the steering wheel is locked and secured from rotation to prevent the loss of clockspring centering.

(20) Disconnect the left and right body wire harness connectors, the Ignition Off Draw (IOD) wire harness connector and the fused B(+) wire harness connector from the connector receptacles of the JB (Fig. 5).

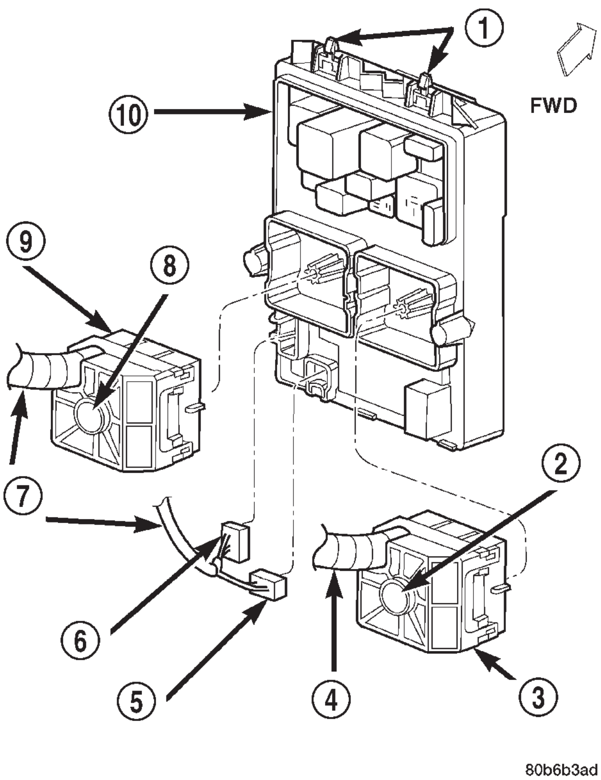


Fig. 5 Junction Block Connections

1 - SNAP CLIPS
2 - SCREW
3 - CONNECTOR
4 - LEFT BODY WIRE HARNESS
5 - IOD CONNECTOR
6 - FUSED B+ CONNECTOR
7 - RIGHT BODY WIRE HARNESS
8 - SCREW
9 - CONNECTOR
10 - JUNCTION BLOCK

(21) Disconnect the instrument panel wire harness connectors from the following floor panel transmission tunnel components (Fig. 6):

- the Airbag Control Module (ACM) connector receptacle
- the park brake switch terminal
- the transmission shifter connector receptacle.

(22) Remove the two nuts that secure the instrument panel wire harness ground eyelets to the studs on the floor panel transmission tunnel in front of and behind the ACM.

(23) Disengage the retainers that secure the instrument panel wire harness to the floor panel transmission tunnel.

(24) Remove the instrument panel to center floor tunnel bracket from the instrument panel and the floor panel transmission tunnel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER FLOOR TUNNEL BRACKET - REMOVAL).

(25) Remove the one screw that secures the floor duct to the heater and air conditioner housing near the driver side of the floor panel transmission tunnel and remove the duct from the housing.

(26) If the vehicle is equipped with the manual heating and air conditioning system, disconnect the vacuum harness connector located near the driver side of the floor panel transmission tunnel behind the driver side floor duct.

(27) Remove the one screw that secures the instrument panel steering column support bracket to the driver side end of the heater and air conditioner housing (Fig. 7).

(28) Remove the one screw that secures the instrument panel steering column support bracket to the intermediate bracket on the driver side dash panel (Fig. 8).

INSTRUMENT PANEL SYSTEM (Continued)

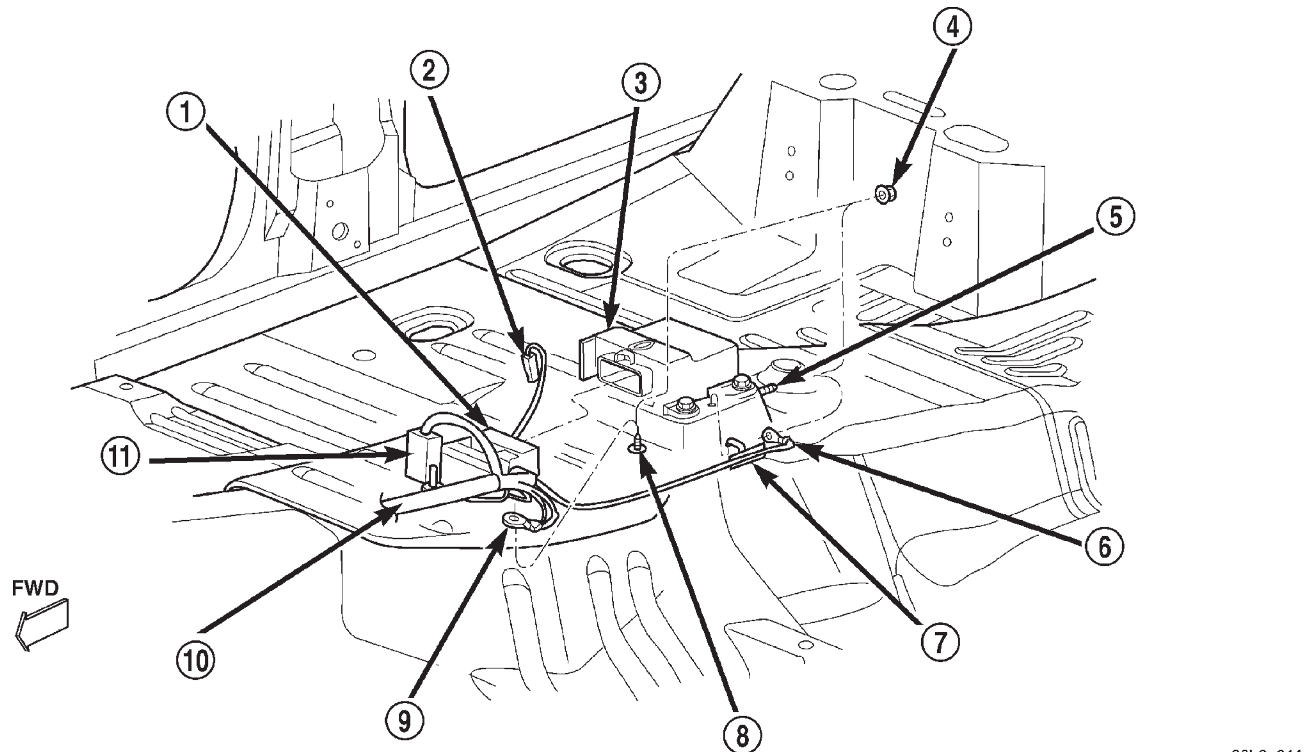


Fig. 6 Floor Panel Transmission Tunnel

1 - AIRBAG CONTROL MODULE CONNECTOR
2 - PARK BRAKE SWITCH CONNECTOR
3 - AIRBAG CONTROL MODULE
4 - NUT (2)
5 - STUD
6 - GROUND EYELET
7 - RETAINER
8 - STUD
9 - GROUND EYELET
10 - INSTRUMENT PANEL WIRE HARNESS
11 - TRANSMISSION SHIFTER CONNECTOR

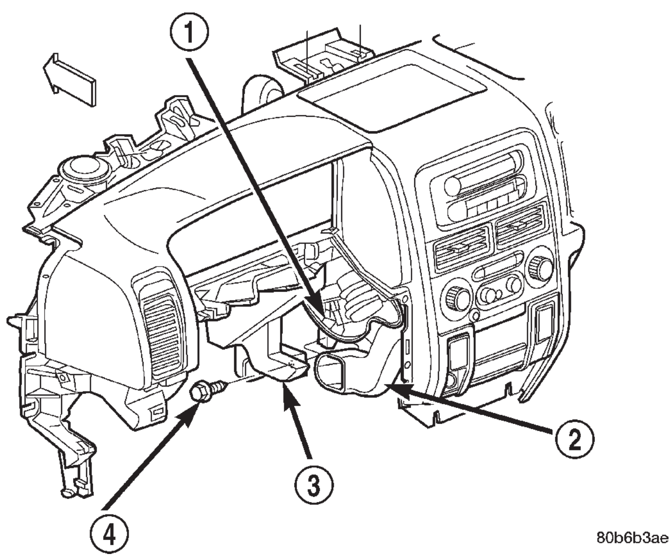


Fig. 7 Instrument Panel to Heater-A/C Housing - Driver Side

1 - HEATER AND AIR CONDITIONER HOUSING
2 - FLOOR DUCT
3 - INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET
4 - SCREW

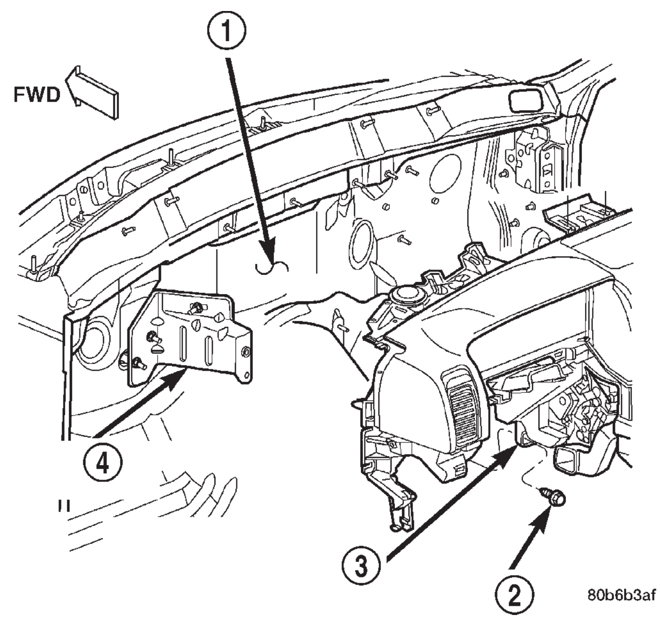


Fig. 8 Instrument Panel to Intermediate Bracket Mounting

1 - DASH PANEL
2 - SCREW
3 - INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET
4 - INTERMEDIATE BRACKET

INSTRUMENT PANEL SYSTEM (Continued)

(29) Remove the nut that secures the instrument panel steering column support bracket to the stud on the driver side cowl plenum panel (Fig. 9).

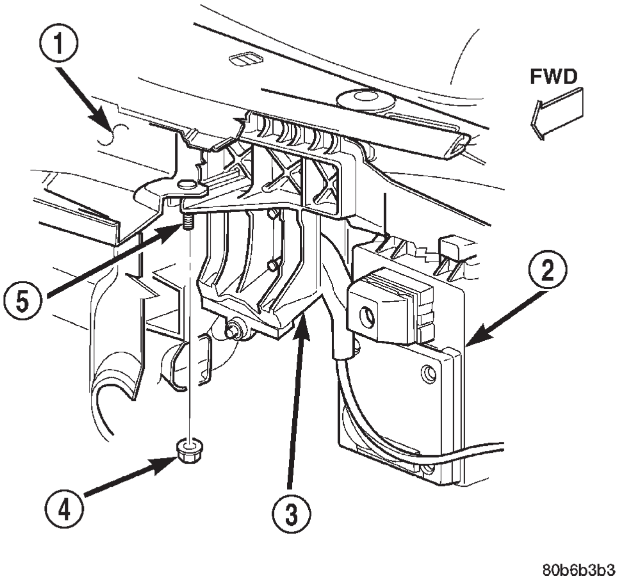


Fig. 9 Instrument Panel to Cowl Plenum Mounting

1 - COWL PLENUM PANEL
2 - JUNCTION BLOCK
3 - INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET
4 - NUT
5 - STUD

(30) Remove the two screws that secure the instrument panel to the driver side cowl side inner panel (Fig. 10).

(31) Remove the end cap from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL END CAP - REMOVAL).

(32) Remove the lower right center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP LOWER RIGHT CENTER BEZEL - REMOVAL).

(33) Disconnect the instrument panel wire harness connector from the lower cavity of the inline connector on the passenger side cowl side inner panel (Fig. 11).

(34) Disconnect the two halves of the radio antenna coaxial cable connector near the right cowl side inner panel under the end of the instrument panel.

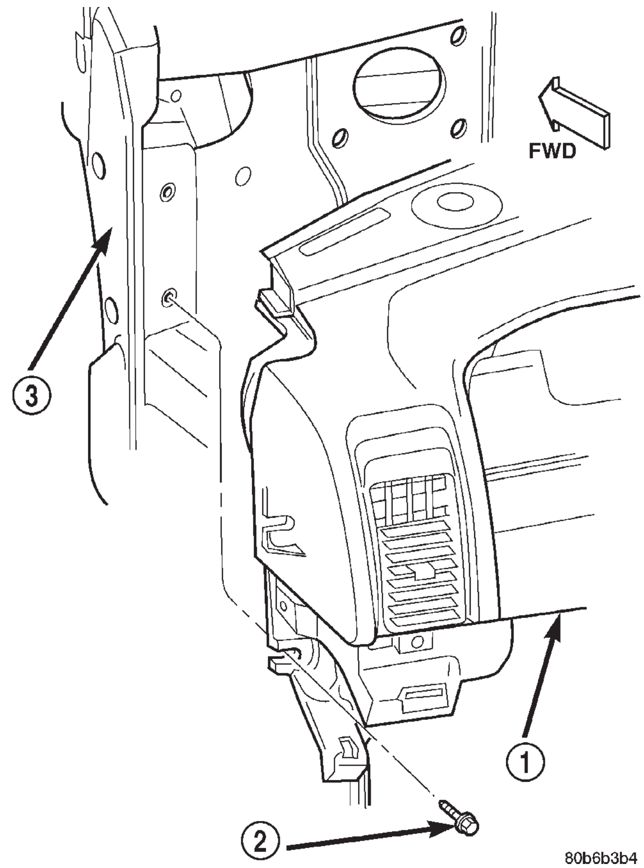


Fig. 10 Instrument Panel to Driver Side Cowl Side Inner Panel Mounting

1 - INSTRUMENT PANEL
2 - SCREW (2)
3 - COWL SIDE PANEL

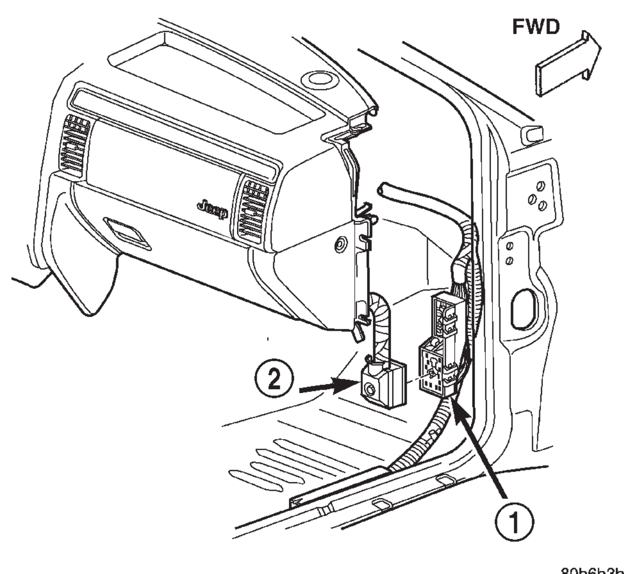


Fig. 11 Instrument Panel Passenger Side Connection

1 - INLINE CONNECTOR
2 - INSTRUMENT PANEL WIRE HARNESS CONNECTOR

INSTRUMENT PANEL SYSTEM (Continued)

(35) Disconnect the two instrument panel wire harness connectors from the two heater and air conditioner housing connectors located near the blower motor on the passenger side end of the housing (Fig. 12).

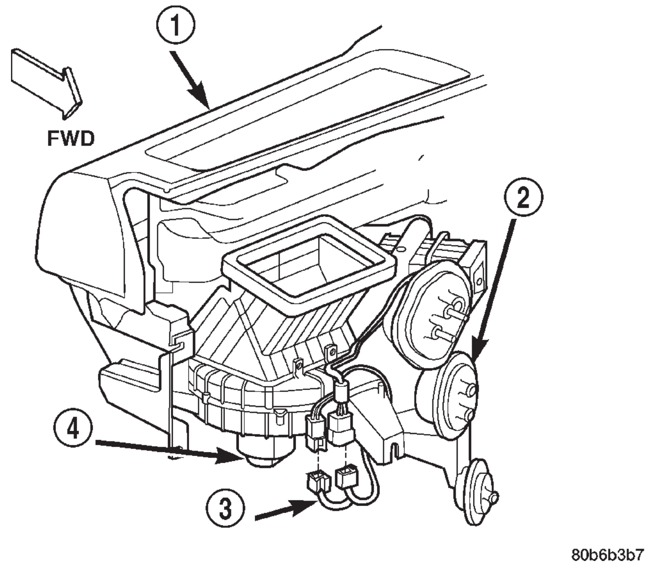


Fig. 12 Heater and Air Conditioner Housing Connections

1 - INSTRUMENT PANEL
2 - HVAC HOUSING
3 - INSTRUMENT PANEL WIRE HARNESS
4 - BLOWER MOTOR

(36) Remove the two screws that secure the passenger side instrument panel structural duct to the heater and air conditioner housing (Fig. 13).

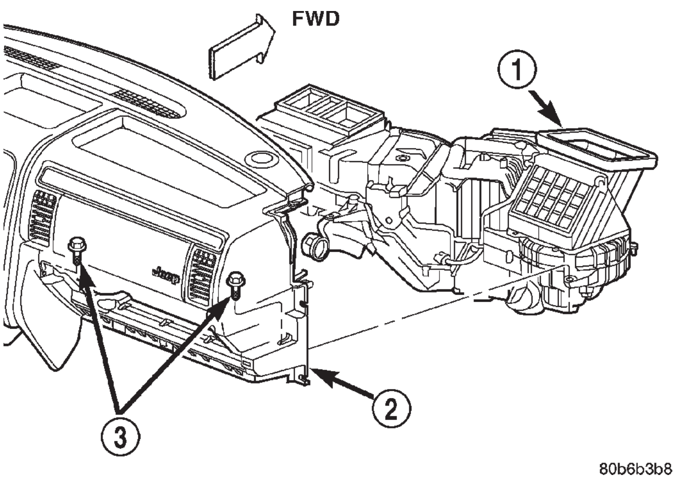


Fig. 13 Passenger Side Instrument Panel to Heater-A/C Housing Mounting

1 - HEATER AND AIR CONDITIONER HOUSING
2 - INSTRUMENT PANEL STRUCTURAL DUCT
3 - SCREW (2)

(37) Remove the two screws that secure the instrument panel to the passenger side cowl side inner panel (Fig. 14).

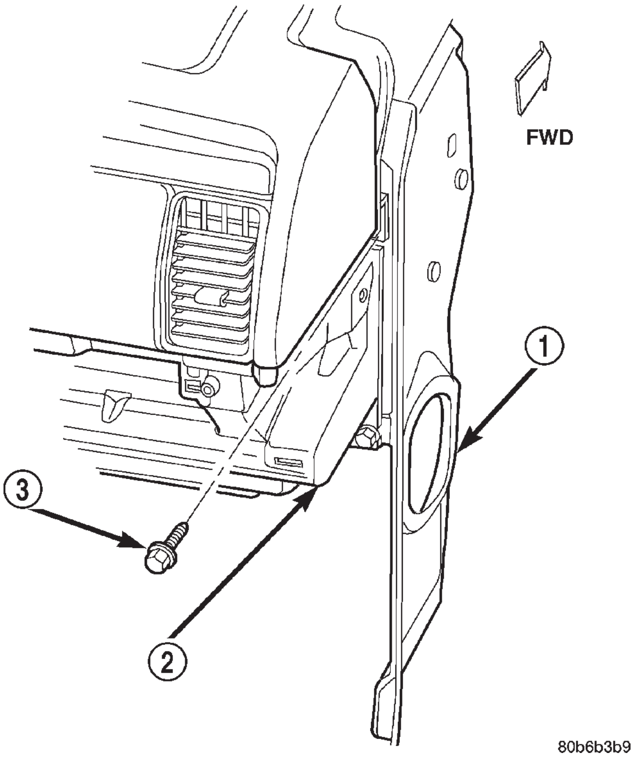


Fig. 14 Instrument Panel to Passenger Side Cowl Side Inner Panel Mounting

1 - COWL SIDE INNER PANEL
2 - INSTRUMENT PANEL STRUCTURAL DUCT
3 - SCREW (2)

(38) With the aid of an assistant, lift the instrument panel assembly upward off of the studs on the dash panel near the windshield fence line and to disengage the molded plastic hook formations on the instrument panel structural duct from the guide holes at each cowl side inner panel.

(39) Pull the instrument panel rearward from the dash panel and the cowl side inner panels and remove it through the driver side front door of the vehicle.

INSTRUMENT PANEL SYSTEM (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Prior to installing the instrument panel into the vehicle, loosen the three nuts that secure the instrument panel intermediate bracket and the accelerator pedal assembly to the studs on the dash panel (Fig. 8).

(2) With the aid of an assistant, load the instrument panel assembly through the driver side front door of the vehicle and hang it on the studs on the dash panel near the windshield fence line (Fig. 1).

(3) Be certain that the molded plastic hook formations on the instrument panel structural duct are inserted into and seated in the guide holes at each cowl side inner panel.

(4) Loosely install the two screws that secure each end of the instrument panel to the cowl side inner panels.

(5) Install and tighten the two screws that secure the passenger side instrument panel structural duct to the heater and air conditioner housing (Fig. 13). Tighten the screws to 11.8 N·m (105 in. lbs.).

(6) Install and tighten the one screw that secures the instrument panel steering column support bracket to the driver side end of the heater and air conditioner housing (Fig. 7). Tighten the screw to 11.8 N·m (105 in. lbs.).

(7) Tighten the two screws that secure each end of the instrument panel to the cowl side inner panels (Fig. 10) and (Fig. 14). Tighten the screws to 11.8 N·m (105 in. lbs.).

(8) Install and tighten the one screw that secures the instrument panel steering column support bracket to the intermediate bracket on the driver side dash panel (Fig. 8). Tighten the screw to 11.3 N·m (100 in. lbs.).

(9) Tighten the three nuts that secure the instrument panel intermediate bracket and the accelerator pedal assembly to the studs on the dash panel. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(10) Install and tighten the four nuts that secure the instrument panel to the studs on the dash panel near the windshield fence line. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(11) Install and tighten the nut that secures the instrument panel steering column support bracket to the stud on the driver side cowl plenum panel (Fig. 9). Tighten the nut to 28.2 N·m (250 in. lbs.).

(12) Reinstall the instrument panel to center floor tunnel bracket onto the instrument panel and the floor panel transmission tunnel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER FLOOR TUNNEL BRACKET - INSTALLATION).

(13) Reconnect the two instrument panel wire harness connectors to the two heater and air conditioner housing connectors located near the blower motor on the passenger side end of the housing (Fig. 12).

(14) Reconnect the two halves of the radio antenna coaxial cable connector near the right cowl side inner panel under the end of the instrument panel.

(15) Reconnect the instrument panel wire harness connector to the lower cavity of the inline connector on the passenger side cowl side inner panel and tighten the connector screw (Fig. 11). Tighten the screw to 4 N·m (36 in. lbs.).

(16) Reinstall the lower right center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP LOWER RIGHT CENTER BEZEL - INSTALLATION).

(17) Reinstall the end cap onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - INSTALLATION).

(18) If the vehicle is equipped with the manual heating and air conditioning system, reconnect the vacuum harness connector located near the driver side of the floor panel transmission tunnel behind the driver side floor duct.

(19) Position the driver side floor duct to the heater and air conditioner housing near the driver side of the floor panel transmission tunnel (Fig. 7).

(20) Install and tighten the one screw that secures the driver side floor duct to the heater and air conditioner housing near the driver side of the floor panel transmission tunnel. Tighten the screw to 2.2 N·m (20 in. lbs.).

(21) Route the instrument panel wire harness to the floor panel transmission tunnel and engage the retainers that secure the harness to the mounting brackets on the tunnel (Fig. 6).

(22) Install the instrument panel wire harness ground eyelets to the studs on the floor panel transmission tunnel in front of and behind the airbag control module and secure the eyelets with nuts. Tighten the nuts to 7.3 N·m (65 in. lbs.).

INSTRUMENT PANEL SYSTEM (Continued)

(23) Reconnect the instrument panel wire harness connectors to the following floor panel transmission tunnel components:

- the Airbag Control Module (ACM) connector receptacle
- the park brake switch terminal
- the transmission shifter connector receptacle.

(24) Reconnect the left and right body wire harness connectors, the Ignition Off Draw (IOD) wire harness connector and the fused B(+) wire harness connector to the connector receptacles of the Junction Block (JB) and tighten the connector screws (Fig. 5). Tighten the screws to 4 N·m (36 in. lbs.).

(25) Engage the lower steering column shaft with the steering shaft coupler and position the steering column to the mounting studs on the instrument panel steering column support bracket (Fig. 4).

(26) Install and tighten the four nuts that secure the steering column to the studs on the instrument panel steering column support bracket. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(27) Install and tighten the bolt that secures the coupler to the lower steering column shaft. Tighten the bolt to 49 N·m (36 ft. lbs.).

(28) Turn the ignition switch to the On position, then install the shifter interlock cable connector into the ignition lock housing receptacle.

(29) Reconnect the instrument panel wire harness connectors to the following steering column components (Fig. 3):

- the two lower clockspring connector receptacles
- the left multi-function switch connector receptacle
- the right multi-function switch connector receptacle
- the two ignition switch connector receptacles
- the shifter interlock solenoid connector receptacle
- if the vehicle is so equipped, the Sentry Key Immobilizer Module (SKIM) connector receptacle.

(30) Position the lower tilting steering column shroud to the steering column multi-function switch mounting housing, then install and tighten the screw that secures the shroud to the housing (Fig. 2). Tighten the screw to 1.9 N·m (17 in. lbs.).

(31) Position the upper tilting steering column shroud over the steering column. Align the upper and lower shrouds with each other and snap the two halves together.

(32) Reinstall the steering column bracket onto the instrument panel steering column support bracket. (Refer to 23 - BODY/INSTRUMENT PANEL/IP STEERING COLUMN BRACKET - INSTALLATION).

(33) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(34) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(35) Reinstall the fuse cover onto the Junction Block (JB). (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - INSTALLATION).

(36) Reinstall the console onto the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(37) Reinstall the trim panels onto the right and left inner cowl sides. (Refer to 23 - BODY/INTERIOR/COWL TRIM - INSTALLATION).

(38) Reinstall the scuff plates onto the right and left front door sills. (Refer to 23 - BODY/INTERIOR/DOOR SILL SCUFF PLATE - INSTALLATION).

(39) Reinstall the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION).

(40) Reinstall the trim onto the right and left A-pillars. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).

(41) Reconnect the battery negative cable.

CLUSTER BEZEL

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Place the tilt steering wheel in its fully lowered position.

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the cluster bezel away from the instrument panel far enough to disengage the four snap clips from their receptacles (Fig. 15).

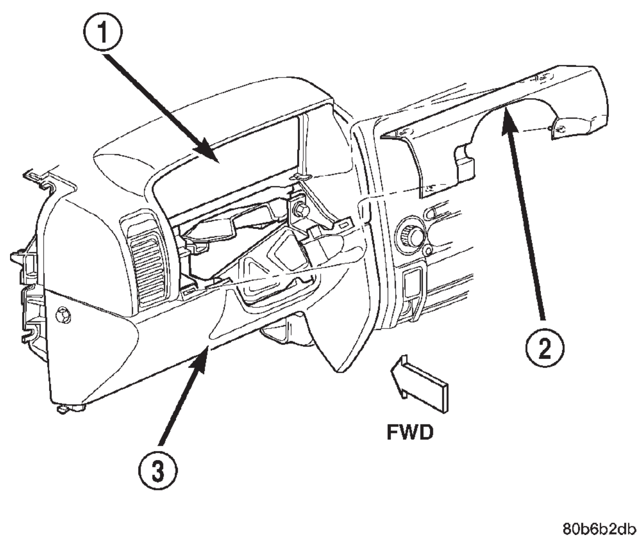


Fig. 15 Cluster Bezel Remove/Install

1 - INSTRUMENT CLUSTER
2 - INSTRUMENT PANEL CLUSTER BEZEL
3 - STEERING COLUMN OPENING COVER

(4) Being certain not to scratch the instrument cluster lens with the two snap clips on the lower edge of the cluster bezel, roll the top of the cluster bezel rearward over the top of the steering column.

(5) If the vehicle is so equipped, reach behind the cluster bezel to access and disconnect the instrument panel wire harness connector for the headlamp leveling switch from the switch connector receptacle.

(6) Remove the cluster bezel from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the cluster bezel onto the instrument panel (Fig. 15).

(2) If the vehicle is so equipped, reach behind the cluster bezel to access and reconnect the instrument panel wire harness connector for the headlamp leveling switch to the switch connector receptacle.

(3) Being certain not to scratch the instrument cluster lens with the two snap clips on the lower edge of the cluster bezel, slide the lower edge of the cluster bezel forward and down over the top of the steering column to position it onto the instrument panel.

(4) Align the two snap clips on the lower edge of the cluster bezel with their receptacles in the instrument panel.

(5) Press firmly on the cluster bezel over each of the lower snap clip locations until each of the snap clips is fully engaged in its receptacle.

(6) Align the two receptacles on the upper edge of the cluster bezel with the snap clips on the instrument panel.

(7) Press firmly on the cluster bezel over each of the upper snap clip locations until each of the snap clips is fully engaged in its receptacle.

(8) Reconnect the battery negative cable.

GLOVE BOX

STANDARD PROCEDURE - GLOVE BOX ROLL DOWN

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box until the integral stops on the back edge of the glove box bin are resting against the rubber stop bumpers in the upper glove box opening reinforcement.

(3) Using hand pressure, lift upward on the arm of the pneumatic glove box door damper on the outboard side of the glove box bin to unsnap the damper connector feature from the keyed slot in the bin (Fig. 16).

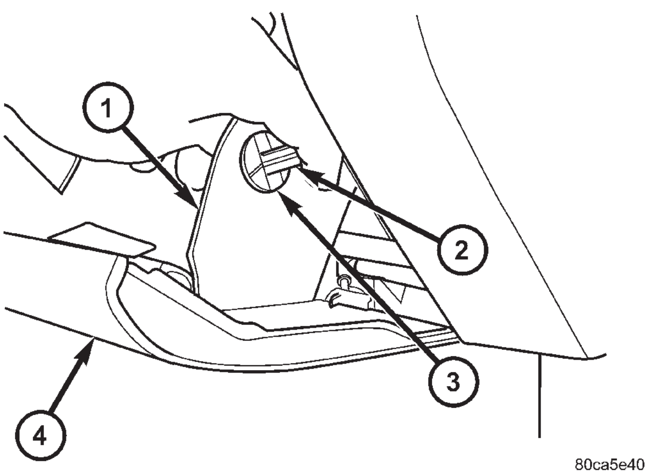


Fig. 16 Glove Box Damper

1 - BIN
2 - DAMPER
3 - CONNECTOR
4 - GLOVE BOX DOOR

(4) Reach into the glove box and with the middle finger of each hand, deflect the rubber flap of the two glove box stop bumpers on the upper glove box opening reinforcement toward the front of the vehicle.

(5) With the glove box stop bumpers deflected, roll the glove box door downward until the integral stops on the back edge of the glove box bin pass through the rubber stop bumper openings in the upper glove box opening reinforcement (Fig. 17)

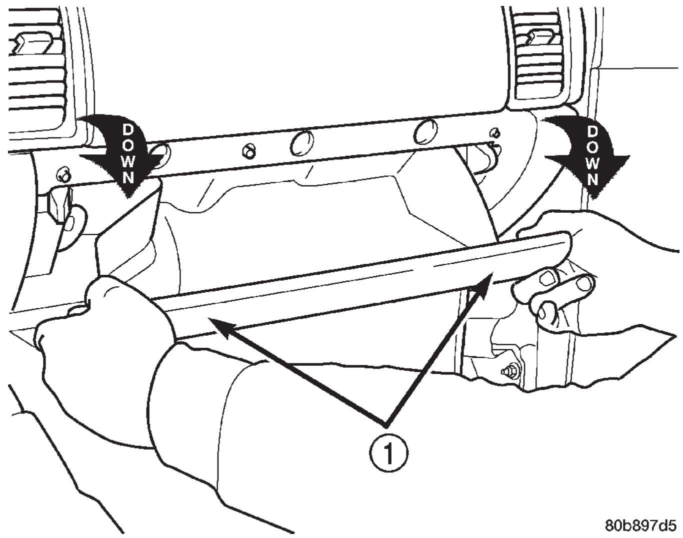


Fig. 17 Glove Box Roll Down

1 - GLOVE BOX DOOR

(6) Before rolling the glove box back up into the instrument panel, grasp the pneumatic glove box damper arm and pull the connector feature rearward to the end of its travel. The rubber stop bumpers will be deflected automatically by the integral stops on the back of the glove box when the glove box is rolled back up into the instrument panel.

(7) With the glove box stops oriented behind the stop bumpers, position the connector feature of the damper to the keyed slot on the outboard end of the glove box bin.

(8) Using hand pressure, press downward on the damper arm until the damper connector feature snaps back into the keyed slot.

GLOVE BOX (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Roll the glove box down from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - STANDARD PROCEDURE - GLOVE BOX ROLL DOWN).

NOTE: Be certain to use care not to damage or remove the glove box hinge bumpers on the lower instrument panel glove box opening reinforcement when removing the glove box from the instrument panel.

(3) Firmly grip both ends of the glove box door, then twist and pull the door as necessary to disengage the inboard hinge hook from the inboard hinge pin on the instrument panel and reorient the hook to the underside of the hinge pin (Fig. 18).

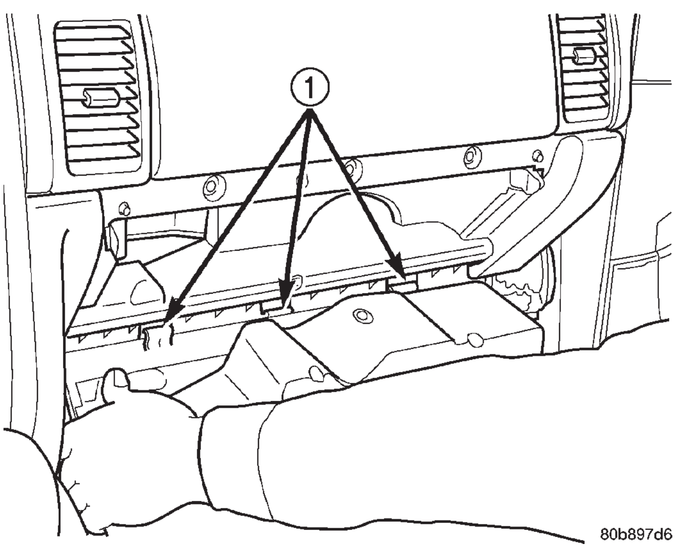


Fig. 18 Glove Box Remove/Install

1 - GLOVE BOX HINGE HOOKS AND HINGE PINS (3)

(4) Raise the glove box door until it is perpendicular to the instrument panel.

(5) Twist the door slightly in the counterclockwise direction and use a jiggling action to disengage the remaining two hinge hooks from their respective hinge pins on the instrument panel.

(6) Remove the glove box from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Be certain to use care not to damage or remove the glove box hinge bumpers on the lower instrument panel glove box opening reinforcement when installing the glove box onto the instrument panel.

(1) Position the glove box to the instrument panel with the outboard hinge hook oriented over the outboard hinge pin and the center hinge hook oriented under the center hinge pin (Fig. 18).

(2) Raise the glove box door until it is perpendicular to the instrument panel.

(3) Firmly grip both ends of the glove box door and twist the door slightly in the clockwise direction to engage the inboard glove box hinge hook over the inboard hinge pin on the instrument panel.

(4) Roll the glove box back up into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - STANDARD PROCEDURE - GLOVE BOX ROLL DOWN).

(5) Reconnect the battery negative cable.

GLOVE BOX LATCH

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Roll down the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - STANDARD PROCEDURE - GLOVE BOX ROLL DOWN).

(3) Remove the three screws that secure the glove box latch to the inner glove box door (Fig. 19).

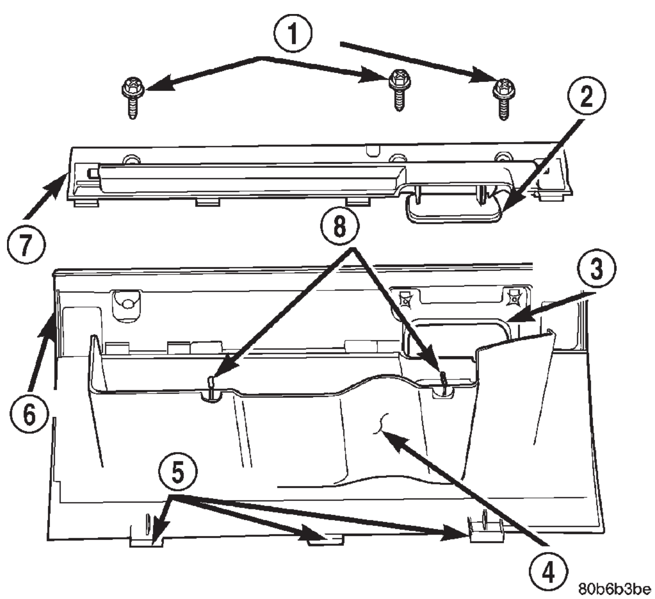


Fig. 19 Glove Box Latch Remove/Install

1 - SCREW (3)
2 - LATCH HANDLE
3 - LATCH HANDLE POCKET
4 - BIN
5 - HINGE HOOKS
6 - DOOR
7 - GLOVE BOX LATCH
8 - STOPS

(4) Lift up on the latch handle on the outer glove box door far enough to loosen the latch assembly on the inner glove box door.

(5) Remove the latch unit from the inner glove box door.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the latch unit to the inner glove box door (Fig. 19).

(2) Guide the latch handle into the latch handle pocket on the outer glove box door.

(3) Install and tighten the three screws that secure the glove box latch to the inner glove box door. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Roll the glove box back up into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - STANDARD PROCEDURE - GLOVE BOX ROLL DOWN).

(5) Reconnect the battery negative cable.

GLOVE BOX LATCH STRIKER

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) If the inboard glove box latch striker is being serviced, remove the lower right center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP LOWER RIGHT CENTER BEZEL - REMOVAL). If the outboard glove box latch striker is being serviced, remove the end cap from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - REMOVAL).

(3) Remove the one screw that secures the upper mounting flange of the glove box latch striker to the instrument panel structural duct at either side of the glove box opening (Fig. 20).

(4) Pull the upper mounting flange of the glove box latch striker downward to disengage the hook formation on the lower end of the striker from the mounting hole in the instrument panel structural duct.

(5) Remove the glove box latch striker from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

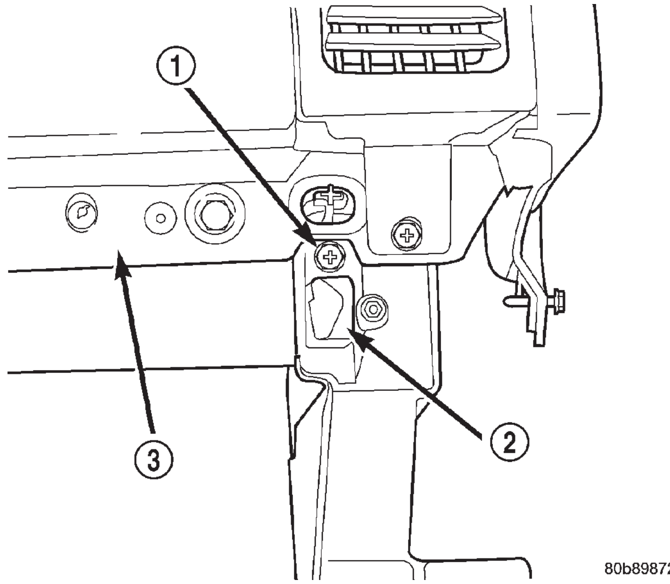

Fig. 20 Glove Box Latch Striker Remove/Install

1 - SCREW
2 - GLOVE BOX LATCH STRIKER
3 - INSTRUMENT PANEL TOP PAD

(1) Position the glove box latch striker to the instrument panel.

(2) Engage the hook formation on the lower end of the glove box latch striker in the mounting hole in the instrument panel structural duct.

(3) Roll the upper mounting flange of the glove box latch striker upward until it is flush with the instrument panel structural duct on either side of the glove box opening.

(4) Install and tighten the screw that secures the upper mounting flange of the glove box latch striker to the instrument panel structural duct (Fig. 20). Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) If the inboard glove box latch striker was serviced, reinstall the lower right center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP LOWER RIGHT CENTER BEZEL - INSTALLATION). If the outboard glove box latch striker was serviced, reinstall the end cap onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - INSTALLATION).

(6) Reconnect the battery negative cable.

INSTRUMENT PANEL END CAP

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unlatch and open the glove box.

(3) Remove the one screw that secures the outboard end of the end cap to the instrument panel top pad (Fig. 21).

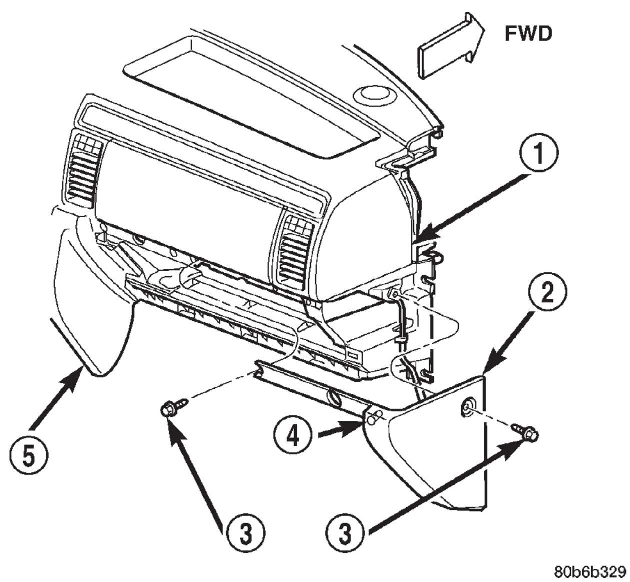

Fig. 21 Instrument Panel End Cap Remove/Install

1 - INSTRUMENT PANEL TOP PAD
2 - END CAP
3 - SCREW (4)
4 - BUMPER
5 - LOWER RIGHT CENTER BEZEL

(4) Remove the three screws that secure the end cap to the instrument panel glove box opening.

(5) Pull the end cap straight back from the instrument panel to disengage the one snap clip that secures it to the receptacle in the instrument panel structural duct.

(6) Remove the end cap from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Be certain that the glove box catch bumper is installed in the mounting hole nearest the outboard end of the end cap extension over the instrument panel upper glove box opening reinforcement (Fig. 21).

(2) Position the end cap to the instrument panel. Be certain that the end of the end cap extension near the center of the upper glove box opening reinforcement is positioned underneath the end of the extension from the lower right center bezel.

(3) Align the snap clip on the end cap with the receptacle on the instrument panel structural duct.

(4) Press firmly on the instrument panel end cap over the snap clip location until the snap clip is fully engaged in its receptacle.

(5) Install and tighten the three screws that secure the end cap to the instrument panel glove box opening. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Install and tighten the one screw that secures the outboard end of the end cap to the instrument panel top pad. Tighten the screw to 2.2 N·m (20 in. lbs.).

(7) Close and latch the glove box.

(8) Reconnect the battery negative cable.

INSTRUMENT PANEL STUCTURAL DUCT

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.
(2) Remove the instrument panel from the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).
(3) Place the instrument panel on a suitable work surface. Be certain to take the proper precautions to protect the instrument panel from any possible cosmetic damage.
(4) Remove all of the individual components that remain secured to the instrument panel structural duct as described elsewhere in this service information.

INSTALLATION

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(1) Reinstall all of the individual components that were removed from the instrument panel structural duct as described elsewhere in this service information.
(2) Reinstall the instrument panel into the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).
(3) Reconnect the battery negative cable.

INSTRUMENT PANEL TOP COVER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.
(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry the rear edge (farthest from the windshield) of the top cover up and away from the instrument panel far enough to disengage the four snap clip retainers from their receptacles in the instrument panel top pad (Fig. 22).

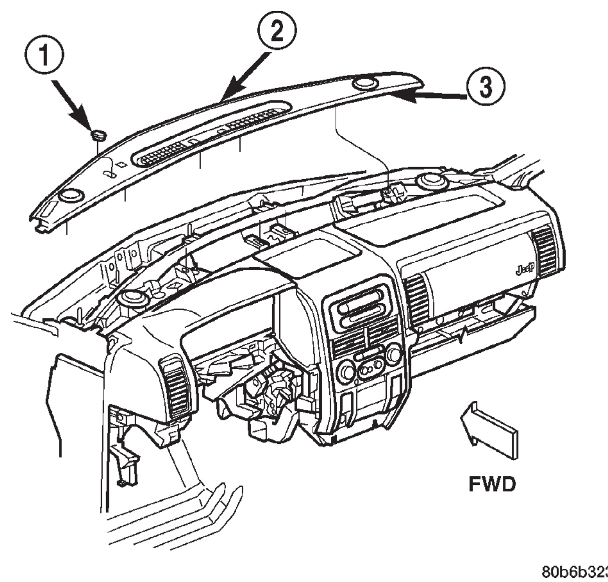

Fig. 22 Instrument Panel Top Cover Remove/Install

1 - ULTRA LIGHT SENSOR PLUG
2 - SEAL
3 - INSTRUMENT PANEL TOP COVER

(3) Remove the top cover from the top of the instrument panel.

INSTALLATION

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(1) If the vehicle is not equipped with the optional automatic headlamps light sensor/vehicle theft security system indicator, be certain that the hole plug is installed in the clearance hole located to the outboard side of the driver side defroster outlet in the instrument panel top cover (Fig. 22).

(2) Before installing the top cover onto the top of the instrument panel, be certain that the rubber top cover seal is properly positioned on the forward edge of the top cover panel.

(3) Position the top cover onto the top of the instrument panel.

(4) Align the four snap clips on the top cover with the snap clip receptacles in the instrument panel top pad.

(5) Press firmly downward on the top cover over each of the four snap clip locations until each of the snap clips is fully seated in their receptacles in the instrument panel top pad.

(6) Reconnect the battery negative cable.

INSTRUMENT PANEL TOP PAD

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim from the right and left A-pillars. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).

(3) Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).

(4) Remove the four nuts that secure the instrument panel top pad to the studs on the dash panel near the windshield fence line (Fig. 23).

(5) Remove the speakers from the instrument panel top pad. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL - INSTRUMENT PANEL SPEAKER).

(6) Disengage the retainer that secures each of the two instrument panel wire harness speaker take outs to the mounting hole in the instrument panel top pad. Tuck the loose ends of these speaker take outs down the defroster ducts to keep them out of the way during the remainder of this procedure.

(7) If the vehicle is so equipped, remove the two screws that secure the automatic headlamp light sensor/vehicle theft security system indicator unit to the instrument panel top pad just outboard of the driver side defroster outlet. Move the sensor/indicator unit towards the windshield to keep it out of the way during the remainder of this procedure.

(8) Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(9) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(10) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(11) Roll the glove box down from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - STANDARD PROCEDURE - GLOVE BOX ROLL DOWN).

(12) Remove the end cap from the passenger side lower outboard end of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - REMOVAL).

(13) Remove the lower right center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP LOWER RIGHT CENTER BEZEL - REMOVAL).

(14) Remove the glove box lamp and switch from the instrument panel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/GLOVE BOX LAMP/SWITCH - REMOVAL).

INSTRUMENT PANEL TOP PAD (Continued)

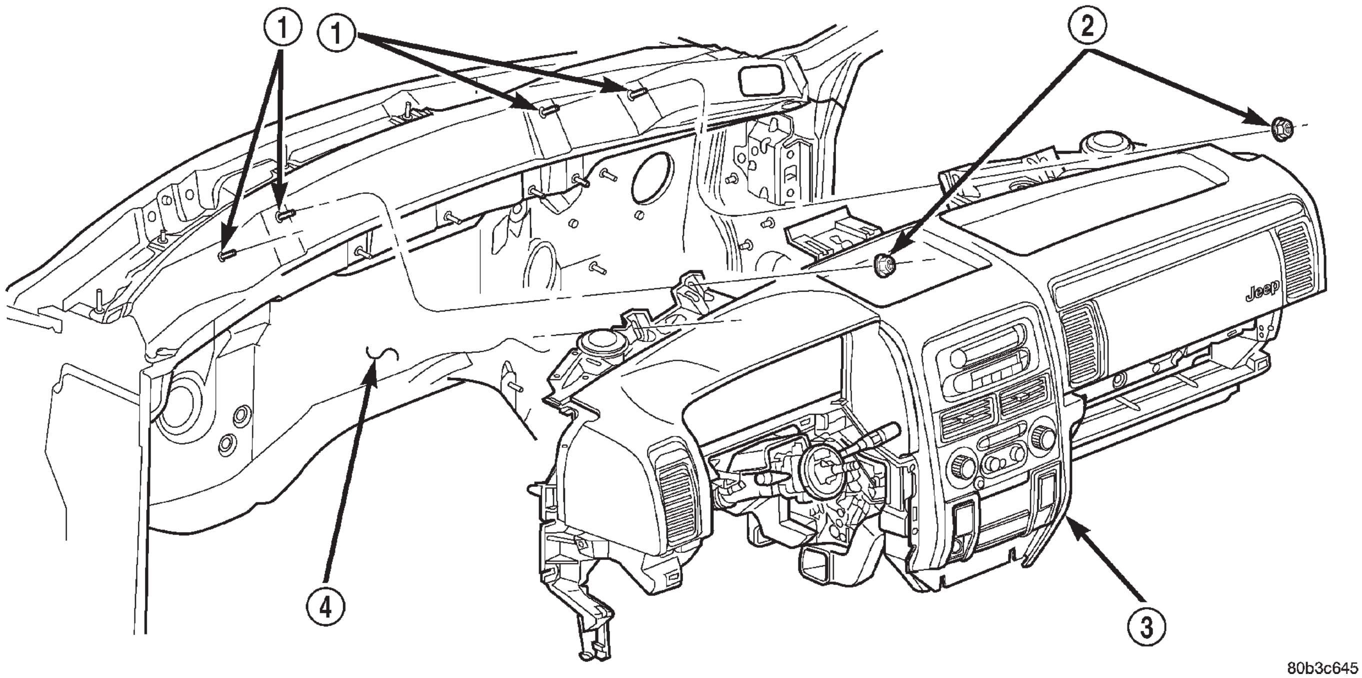

Fig. 23 Instrument Panel Top Pad to Dash Panel Mounting

1 - STUD (4)
2 - NUT (4)
3 - INSTRUMENT PANEL
4 - DASH PANEL

(15) Remove the two large screws on the glove box opening upper reinforcement that secure the top pad to the instrument panel structural duct (Fig. 24).

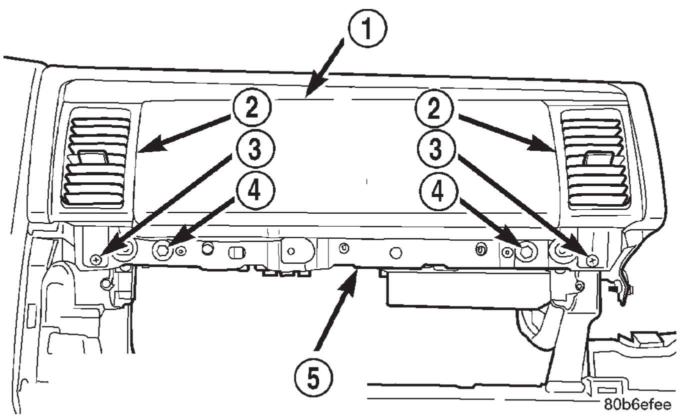

Fig. 24 Instrument Panel Top Pad to Glove Box Opening Mounting

1 - PASSENGER SIDE TRIM BEZEL
2 - PANEL OUTLETS
3 - SMALL SCREWS
4 - LARGE SCREWS
5 - GLOVE BOX OPENING UPPER REINFORCEMENT

(16) Remove the two small screws on the glove box opening upper reinforcement that secure the panel outlets to the instrument panel structural duct.

(17) Remove the center upper bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER BEZEL - UPPER - REMOVAL).

(18) Remove the center lower bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER BEZEL - LOWER - REMOVAL).

(19) Remove the four screws that secure the radio to the instrument panel structural duct. Pull the radio out of the instrument panel only far enough to access the screws that secure the top pad to the instrument panel structural duct.

(20) Remove the four screws that secure the heater-A/C control to the instrument panel structural duct. Pull the heater-A/C control out of the instrument panel only far enough to access the screws that secure the top pad to the instrument panel structural duct.

(21) Remove all of the screws that secure the perimeter of the top pad to the instrument panel structural duct.

INSTRUMENT PANEL TOP PAD (Continued)

(22) Remove the front bin from the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(23) Reach through the front bin opening of the floor console to access and remove the two screws that secure the center floor tunnel bracket to the instrument panel.

(24) Reach through the front bin opening of the floor console to access and loosen the two nuts that secure the center floor tunnel bracket to the studs on the floor panel transmission tunnel.

(25) Slide the center floor tunnel bracket rearward in the vehicle far enough to disengage the locating hole in the lower flange of the top pad from the locating pin on the instrument panel structural duct (Fig. 25).

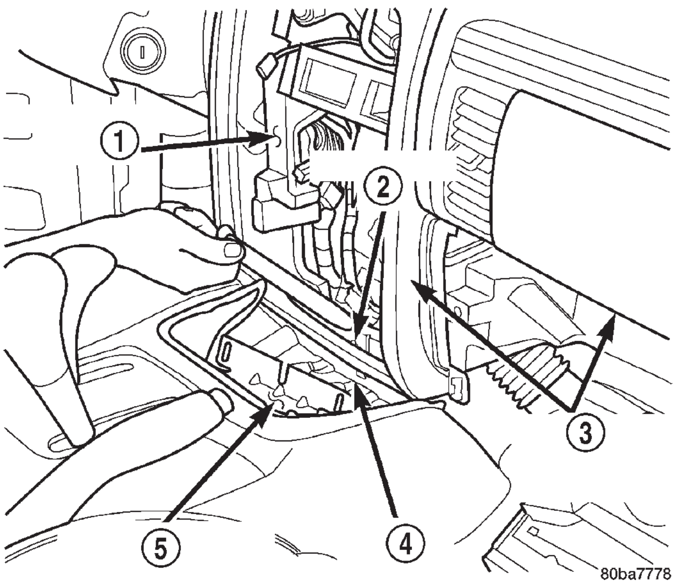

Fig. 25 Instrument Panel Top Pad Remove/Install

1 - STRUCTURAL DUCT
2 - LOCATING PIN
3 - INSTRUMENT PANEL TOP PAD
4 - LOWER FLANGE
5 - CENTER FLOOR TUNNEL BRACKET

(26) Remove the instrument panel top pad from the instrument panel structural duct.

INSTALLATION

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If the top pad is being replaced with a new unit, be certain to transfer or install the panel outlets and the passenger side trim bezel to the new unit before it is installed on the instrument panel structural duct. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/AIR OUTLETS - REMOVAL) and (Refer to 23 - BODY/INSTRUMENT PANEL/IP TRIM BEZEL - PASSENGER - REMOVAL).

(1) Position the instrument panel top pad over the instrument panel structural duct and the studs on the dash panel near the windshield fence line.

(2) Route the instrument panel wire harness take out for the glove box lamp and switch unit to the switch mounting hole in the upper glove box opening reinforcement.

(3) Reach through the front bin opening of the floor console to engage the locating hole in the lower flange of the top pad with the locating pin on the instrument panel structural duct (Fig. 25).

(4) Reach through the front bin opening of the floor console to slide the center floor tunnel bracket forward in the vehicle far enough to capture the lower flange of the top pad between the bracket and the structural duct.

(5) Reach through the front bin opening of the floor console to install and tighten the two screws that secure the center floor tunnel bracket to the instrument panel. Tighten the screws to 11.8 N·m (105 in. lbs.).

INSTRUMENT PANEL TOP PAD (Continued)

(6) Reach through the front bin opening of the floor console to access and tighten the two nuts that secure the center floor tunnel bracket to the studs on the floor panel transmission tunnel. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(7) Reinstall the front bin into the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(8) Install and tighten all of the screws that secure the perimeter of the top pad to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(9) Install and tighten the four screws that secure the heater-A/C control to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(10) Install and tighten the four screws that secure the radio to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(11) Reinstall the center lower bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER BEZEL - LOWER - INSTALLATION).

(12) Reinstall the center upper bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER BEZEL - UPPER - INSTALLATION).

(13) Install and tighten the two large screws on the glove box opening upper reinforcement that secure the top pad to the instrument panel structural duct (Fig. 24). Tighten the screws to 11.8 N·m (105 in. lbs.).

(14) Install and tighten the two small screws on the glove box opening upper reinforcement that secure the panel outlets to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(15) Reinstall the glove box lamp and switch into the instrument panel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/GLOVE BOX LAMP/SWITCH - INSTALLATION).

(16) Reinstall the lower right center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP LOWER RIGHT CENTER BEZEL - INSTALLATION).

(17) Reinstall the end cap onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - INSTALLATION).

(18) Roll the glove box back up into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - STANDARD PROCEDURE - GLOVE BOX ROLL DOWN).

(19) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(20) Reinstall the instrument cluster into the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(21) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(22) If the vehicle is so equipped, position the automatic headlamp light sensor/vehicle theft security system indicator unit to the instrument panel top pad just outboard of the driver side defroster outlet. Install and tighten the two screws that secure the sensor/indicator unit. Tighten the screws to 2.2 N·m (20 in. lbs.).

(23) Engage the retainer that secures each of the two instrument panel wire harness speaker take outs to the mounting hole in the instrument panel top pad.

(24) Reinstall the speakers onto the instrument panel top pad. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION - INSTRUMENT PANEL SPEAKER).

(25) Install and tighten the four nuts that secure the instrument panel top pad to the studs on the dash panel near the windshield fence line (Fig. 23). Tighten the nuts to 11.8 N·m (105 in. lbs.).

(26) Reinstall the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION).

(27) Reinstall the trim onto the right and left A-pillars. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).

(28) Reconnect the battery negative cable.

INSTRUMENT PANEL C-CHANNEL COVER BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(3) Place the instrument panel top down on a suitable work surface. Be certain to take the proper precautions to protect the top of the instrument panel from any possible cosmetic damage.

(4) Disengage the radio antenna coaxial cable retainer from the mounting hole in the instrument panel wire harness mounting tab on the passenger side outboard end of the instrument panel C-channel cover bracket.

(5) Remove the screw that secures the instrument panel wire harness mounting tab on the passenger side outboard end of the instrument panel C-channel cover bracket (Fig. 26).

(6) Remove the screw that secures the passenger side courtesy lamp to the lower tab of instrument panel C-channel cover bracket.

(7) Remove the eight screws that secure the C-channel cover bracket to the instrument panel structural duct.

(8) Remove the C-channel cover bracket from the instrument panel structural duct.

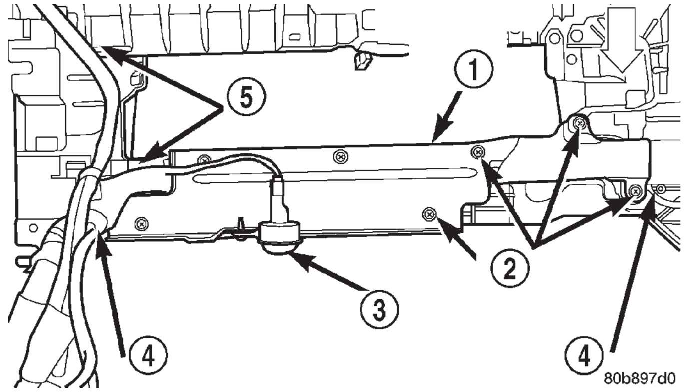

Fig. 26 Instrument Panel C-Channel Cover Bracket Remove/Install

1 - C-CHANNEL COVER BRACKET
2 - SCREWS (8)
3 - PASSENGER SIDE COURTESY LAMP
4 - INSTRUMENT PANEL WIRE HARNESS
5 - STRUCTURAL DUCT

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the C-channel cover bracket to the instrument panel structural duct.

(2) Install and tighten the eight screws that secure the C-channel cover bracket to the instrument panel structural duct (Fig. 26). Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Position the passenger side courtesy lamp to the lower tab of instrument panel C-channel cover bracket.

(4) Install and tighten the screw that secures the passenger side courtesy lamp to the lower tab of instrument panel C-channel cover bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) Position the instrument panel wire harness mounting tab to the passenger side outboard end of the instrument panel C-channel cover bracket.

(6) Install and tighten the screw that secures the instrument panel wire harness mounting tab to the passenger side outboard end of the instrument panel C-channel cover bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(7) Engage the radio antenna coaxial cable retainer in the mounting hole in the instrument panel wire harness mounting tab on the passenger side outboard end of the instrument panel C-channel cover bracket.

(8) Reinstall the instrument panel into the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

(9) Reconnect the battery negative cable.

INSTRUMENT PANEL CENTER BEZEL - LOWER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the center lower bezel away from the instrument panel far enough to disengage the four snap clips from their receptacles (Fig. 27).

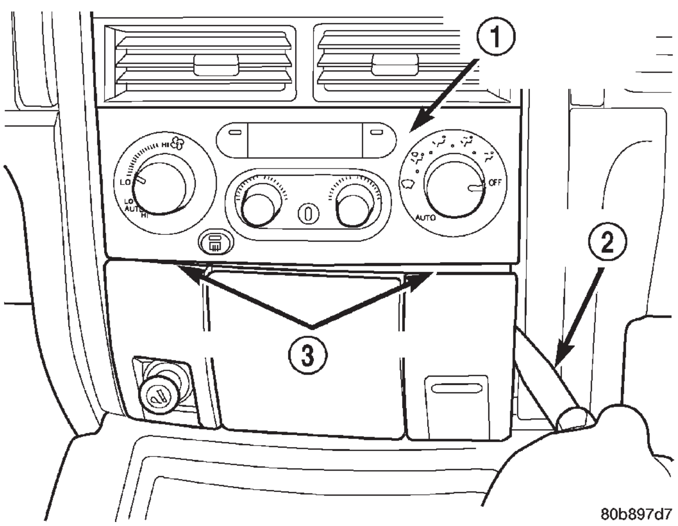

Fig. 27 Instrument Panel Center Lower Bezel Remove/Install

1 - HEATER AND AIR CONDITIONER CONTROLS
2 - TRIM STICK
3 - CENTER LOWER BEZEL

(3) Pull the center lower bezel away from the instrument panel far enough to access the instrument panel wire harness connectors.

(4) Squeeze the mounting legs of the ash receiver lamp hood and remove it from the rectangular hole in the ash receiver flame shield.

(5) If the vehicle is so equipped, disconnect the instrument panel wire harness connectors for the two heated seat switches from the switch connector receptacles.

(6) Disconnect the instrument panel wire harness connectors for the cigar lighter and accessory power outlet from the lighter and outlet connector receptacles.

(7) Remove the center lower bezel from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the center lower bezel to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors for the cigar lighter and the accessory power outlet to the lighter and outlet connector receptacles.

(3) If the vehicle is so equipped, reconnect the instrument panel wire harness connectors for the two heated seat switches to the switch connector receptacles.

(4) Squeeze the mounting legs of the ash receiver lamp hood and install them into the rectangular hole in the ash receiver flame shield.

(5) Align the two lower snap clips on the center lower bezel with their receptacles in the instrument panel top pad.

(6) Using hand pressure, press firmly and evenly on the center lower bezel over each of the lower snap clip locations until each of the snap clips is fully engaged in its receptacle.

(7) Align the two upper snap clips on the center lower bezel with their receptacles in the instrument panel top pad.

(8) Using hand pressure, press firmly and evenly on the center lower bezel over each of the upper snap clip locations until each of the snap clips is fully engaged in its receptacle.

(9) Reconnect the battery negative cable.

INSTRUMENT PANEL CENTER BEZEL - UPPER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the center upper bezel away from the instrument panel far enough to disengage the four snap clips from their receptacles (Fig. 28).

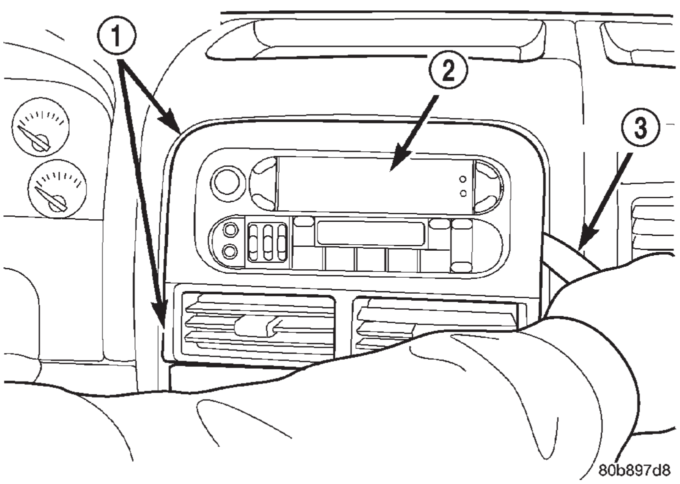

Fig. 28 Instrument Panel Center Upper Bezel Remove/Install

1 - CENTER UPPER BEZEL
2 - RADIO
3 - TRIM STICK

(3) Remove the center upper bezel from the instrument panel.

INSTALLATION

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(1) Position the center upper bezel onto the instrument panel.

(2) Align the four snap clips on the center upper bezel with their receptacles in the instrument panel top pad.

(3) Using hand pressure, press firmly and evenly on the center upper bezel over each of the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL CENTER FLOOR TUNNEL BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the front bin from the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(3) Reach through the front bin opening of the floor console to access and disengage the instrument

INSTRUMENT PANEL CENTER FLOOR TUNNEL BRACKET (Continued)

panel wire harness retainer from the mounting hole on the driver side of the instrument panel center floor tunnel bracket.

(4) Remove the two screws that secure the center floor tunnel bracket to the instrument panel (Fig. 29).

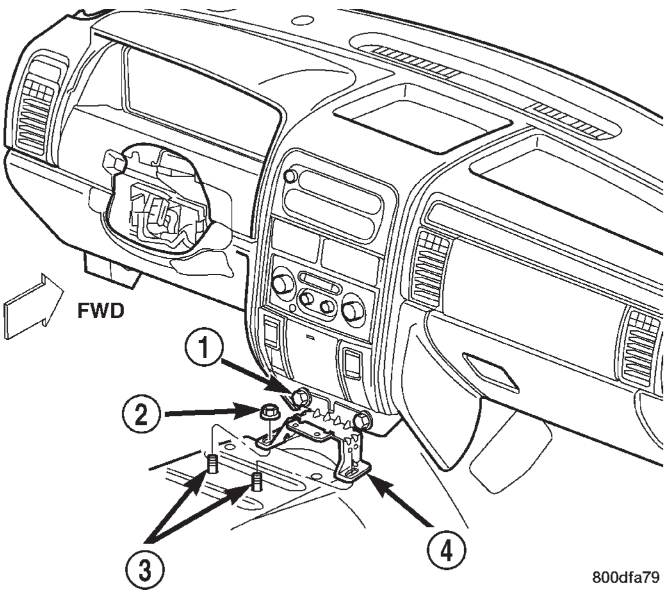

Fig. 29 Instrument Panel Center Floor Tunnel Bracket Remove/Install

1 - SCREW (2)
2 - NUT (2)
3 - STUDS
4 - CENTER FLOOR TUNNEL BRACKET

(5) Remove the two nuts that secure the center floor tunnel bracket to the studs on the floor panel transmission tunnel.

(6) Remove the center floor tunnel bracket from the instrument panel and the floor panel transmission tunnel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the center floor tunnel bracket over the floor panel transmission tunnel studs and slide it up against the instrument panel (Fig. 29).

(2) Install and tighten the two nuts that secure the center floor tunnel bracket to the studs on the floor panel transmission tunnel. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(3) Install and tighten the two screws that secure the center floor tunnel bracket to the instrument panel. Tighten the screws to 11.3 N·m (100 in. lbs.).

(4) Reach through the front bin opening of the floor console to access and engage the instrument panel wire harness retainer with the mounting hole on the driver side of the instrument panel center floor tunnel bracket.

(5) Reinstall the front bin into the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(6) Reconnect the battery negative cable.

INSTRUMENT PANEL COURTESY LAMP BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel fuse cover from the bottom of the Junction Block (JB) and Body Control Module (BCM) unit. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - REMOVAL).

(3) Reach under the steering column opening cover to access and remove the screw that secures the courtesy lamp unit to the lower end of the instrument panel courtesy lamp bracket near the inboard side of the JB (Fig. 30).

(4) Remove the courtesy lamp from the lower end of the courtesy lamp bracket.

INSTRUMENT PANEL COURTESY LAMP BRACKET (Continued)

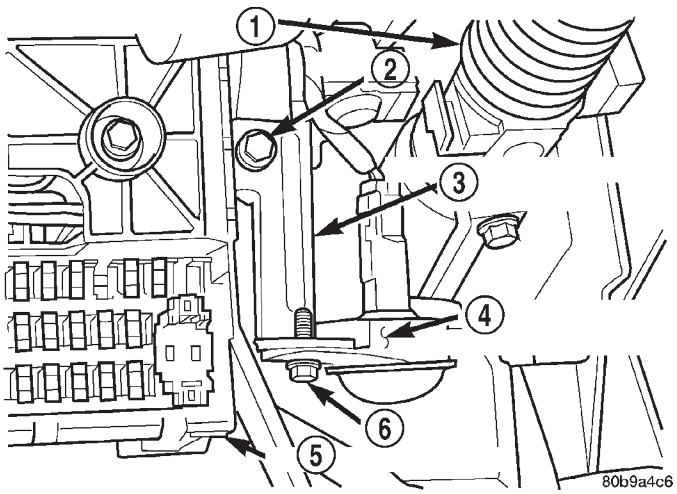

Fig. 30 Instrument Panel Courtesy Lamp Bracket Remove/Install

1 - STEERING COLUMN
2 - SCREW
3 - COURTESY LAMP BRACKET
4 - DRIVER SIDE COURTESY LAMP
5 - JUNCTION BLOCK
6 - SCREW

(5) Reach under the steering column opening cover to access and remove the screw that secures the courtesy lamp bracket and the inboard side of the JB to the instrument panel steering column support bracket.

(6) Remove the courtesy lamp bracket from the inboard side of the JB and the instrument panel steering column support bracket.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Reach under the instrument panel to position the upper end of the courtesy lamp bracket to the inboard side of the Junction Block (JB) and the instrument panel steering column support bracket (Fig. 30).

(2) Install and tighten the screw that secures the courtesy lamp bracket and the inboard side of the JB to the instrument panel steering column support bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Position the courtesy lamp to the lower end of the courtesy lamp bracket.

(4) Install and tighten the screw that secures the courtesy lamp to the lower end of the courtesy lamp bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) Reinstall the instrument panel fuse cover to the bottom of the JB and Body Control Module (BCM) unit. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - INSTALLATION).

(6) Reconnect the battery negative cable.

INSTRUMENT PANEL INTERMEDIATE BRACKET

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the accelerator pedal assembly from the shoulder studs on the dash panel. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ACCELERATOR PEDAL - REMOVAL).

(3) Remove the instrument panel from the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(4) Remove the one nut that secures the instrument panel intermediate bracket to the stud on the dash panel (Fig. 31).

(5) Remove the instrument panel intermediate bracket from the two shoulder studs and the one stud on the dash panel.

INSTRUMENT PANEL INTERMEDIATE BRACKET (Continued)

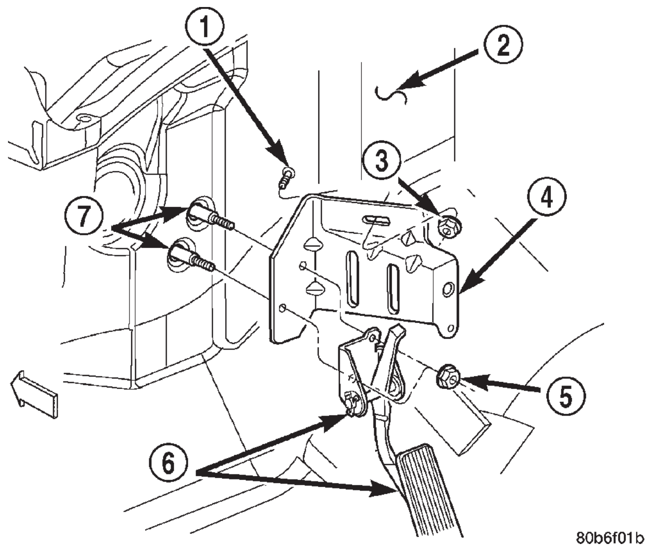

Fig. 31 Instrument Panel Intermediate Bracket Remove/Install

1 - STUD
2 - DASH PANEL
3 - NUT (2)
4 - INTERMEDIATE BRACKET
5 - NUT (2)
6 - ACCELERATOR PEDAL
7 - SHOULDER STUDS

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the instrument panel intermediate bracket to the two shoulder studs and the one stud on the dash panel (Fig. 31).

(2) Loosely install the one nut that secures the intermediate bracket to the one stud on the dash panel.

(3) Reinstall the instrument panel into the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

(4) Reinstall the accelerator pedal assembly onto the shoulder studs on the dash panel. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ACCELERATOR PEDAL - INSTALLATION).

(5) Reconnect the battery negative cable.

INSTRUMENT PANEL LOWER RIGHT CENTER BEZEL

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Unlatch and open the glove box.

(3) Remove the three screws that secure the lower right center bezel to the instrument panel glove box opening (Fig. 32).

(4) Pull the lower right center bezel straight back from the instrument panel to disengage the two snap clips that secure it to the receptacles in the instrument panel top pad.

(5) Remove the lower right center bezel from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Be certain that the glove box catch bumper is installed in the mounting hole nearest the inboard

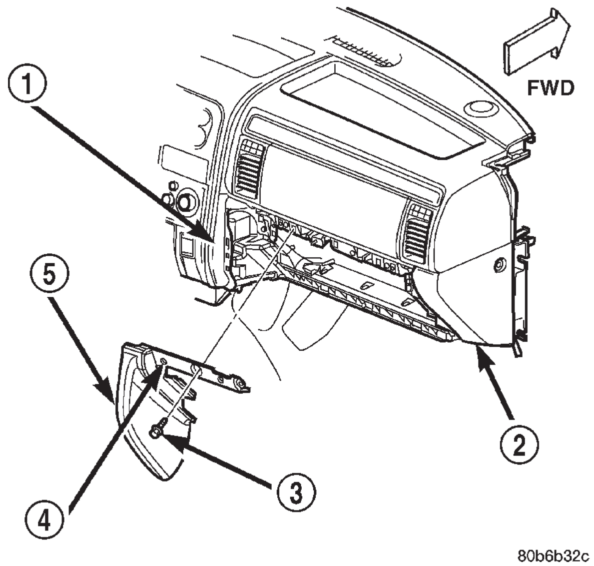

Fig. 32 Instrument Panel Lower Right Center Bezel Remove/Install

1 - INSTRUMENT PANEL TOP PAD
2 - END CAP
3 - SCREWS (3)
4 - BUMPER
5 - LOWER RIGHT CENTER BEZEL

end of the lower right center bezel extension over the instrument panel upper glove box opening reinforcement.

(2) Position the lower right center bezel to the instrument panel. Be certain that the end of the lower right center bezel extension near the center of the upper glove box opening reinforcement is positioned on top of the end of the extension from the end cap (Fig. 32).

(3) Align the snap clips on the lower right center bezel with the receptacles in the instrument panel top pad.

(4) Using hand pressure, press firmly on the lower right center bezel over each of the snap clip locations until the snap clips are fully engaged in their receptacles.

(5) Install and tighten the three screws that secure the lower right center bezel to the instrument panel glove box opening. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Close and latch the glove box.

(7) Reconnect the battery negative cable.

INSTRUMENT PANEL PLENUM BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(3) Place the instrument panel top down on a suitable work surface. Be certain to take the proper precautions to protect the top of the instrument panel from any possible cosmetic damage.

(4) Remove the one screw that secures the plenum bracket to the instrument panel steering column support bracket (Fig. 33).

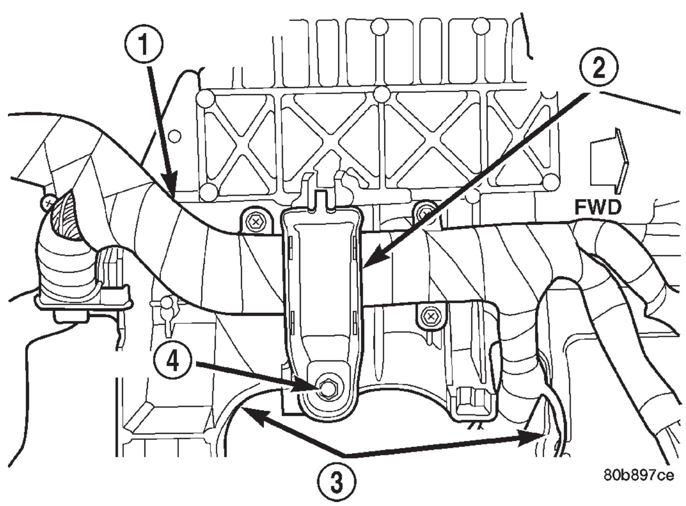

Fig. 33 Instrument Panel Plenum Bracket Remove/Install

1 - INSTRUMENT PANEL WIRE HARNESS
2 - PLENUM BRACKET
3 - STEERING COLUMN SUPPORT BRACKET
4 - SCREW

(5) Remove the plenum bracket from the instrument panel steering column support bracket.

INSTRUMENT PANEL PLENUM BRACKET (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the plenum bracket to the instrument panel steering column support bracket (Fig. 33).

(2) Install and tighten the one screw that secures the plenum bracket to the instrument panel steering column support bracket. Tighten the screw to 11.8 N·m (105 in. lbs.).

(3) Reinstall the instrument panel into the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL STEERING COLUMN BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) Remove the four screws that secure the steering column bracket to the instrument panel steering column support bracket (Fig. 34).

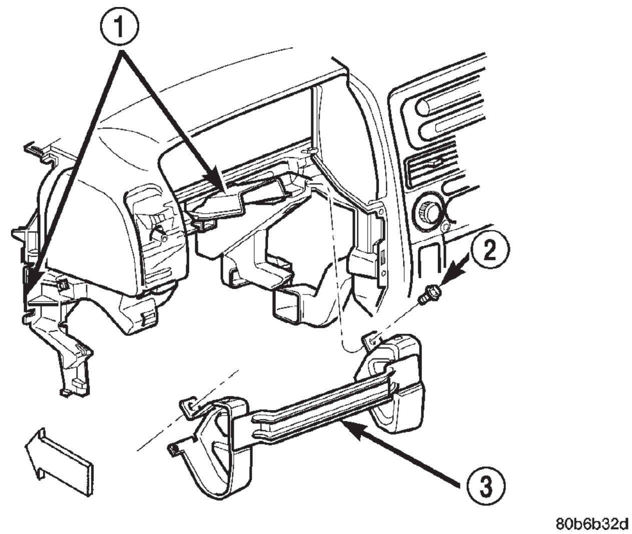

Fig. 34 Instrument Panel Steering Column Bracket Remove/Install

1 - INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET
2 - SCREW (4)
3 - INSTRUMENT PANEL STEERING COLUMN BRACKET

(4) Remove the steering column bracket from the instrument panel steering column support bracket.

INSTALLATION

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(1) Position the steering column bracket to the instrument panel steering column support bracket (Fig. 34).

(2) Install and tighten the four screws that secure the steering column bracket to the instrument panel steering column support bracket. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Reinstall the steering column opening cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Remove the instrument panel plenum bracket from the steering column support bracket. (Refer to 23 - BODY/INSTRUMENT PANEL/IP PLENUM BRACKET - REMOVAL).

(4) Remove the three screws that secure the instrument panel wire harness mounting tabs to the back of the steering column support bracket.

(5) Remove the two screws that secure the 16-way data link connector to the instrument panel steering column support bracket and remove the connector from the bracket (Fig. 35).

(6) Remove the Junction Block (JB) and Body Control Module (BCM) unit from the instrument panel steering column support bracket, but do not disconnect any of the instrument panel wire harness connectors from the unit. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - REMOVAL).

(7) From the face of the instrument panel, remove the five screws that secure the steering column support bracket to the instrument panel structural duct.

(8) Remove the steering column support bracket from the instrument panel structural duct.

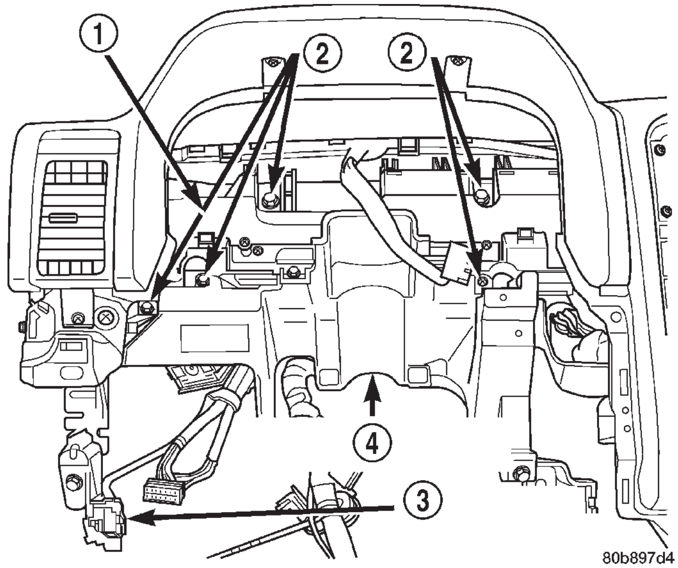

Fig. 35 Instrument Panel Steering Column Support Bracket Remove/Install

1 - STRUCTURAL DUCT
2 - SCREWS (5)
3 - 16–WAY DATA LINK CONNECTOR
4 - STEERING COLUMN SUPPORT BRACKET

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the steering column support bracket to the instrument panel structural duct.

(2) From the face of the instrument panel, install and tighten the five screws that secure the steering column support bracket to the instrument panel structural duct (Fig. 35). Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Position the instrument panel wire harness mounting tabs to the back of the steering column support bracket.

(4) Install and tighten the three screws that secure the instrument panel wire harness mounting tabs to the back of the steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Reinstall the instrument panel plenum bracket onto the steering column support bracket. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL PLENUM BRACKET - INSTALLATION).

(6) Reinstall the Junction Block (JB) and Body Control Module (BCM) unit onto the instrument

INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET (Continued)

panel steering column support bracket. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - INSTALLATION).

(7) Position the 16-way data link connector to the instrument panel steering column support bracket.

(8) Install and tighten the two screws that secure the 16-way data link connector to the instrument panel steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(9) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(10) Reconnect the battery negative cable.

INSTRUMENT PANEL TRIM BEZEL - DRIVER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the driver side trim bezel up and away from the instrument panel far enough to disengage the two snap clips from their receptacles (Fig. 36).

(3) Remove the driver side trim bezel from the instrument panel top pad.

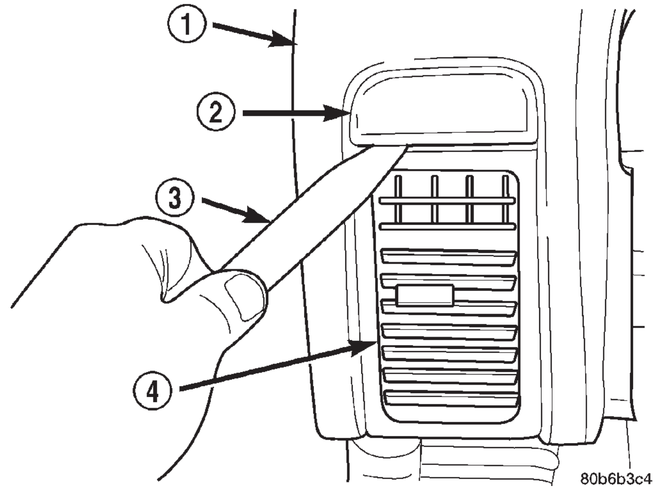

Fig. 36 Instrument Panel Driver Side Trim Bezel Remove/Install

1 - INSTRUMENT PANEL TOP PAD
2 - DRIVER SIDE TRIM BEZEL
3 - TRIM STICK
4 - PANEL OUTLET

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the driver side trim bezel to the instrument panel top pad.

(2) Align the snap clips on the driver side trim bezel with the receptacles in the instrument panel top pad.

(3) Using hand pressure, press firmly and evenly on the driver side trim bezel over the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL TRIM BEZEL - PASSENGER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the top pad from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP PAD - REMOVAL).

(3) From the underside of the top pad, remove the four screws from the top of the passenger airbag door that secure the passenger side trim bezel to the instrument panel (Fig. 37).

(4) Remove the passenger side trim bezel from the instrument panel top pad.

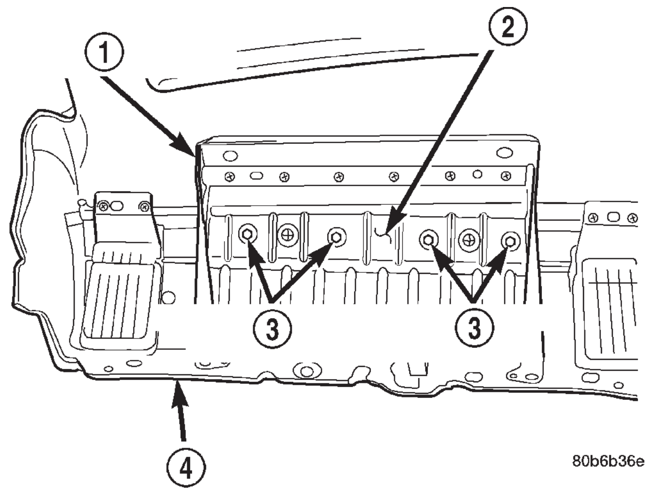

Fig. 37 Instrument Panel Passenger Side Trim Bezel Remove/Install

1 - INSTRUMENT PANEL AIRBAG DOOR REINFORCEMENT
2 - PASSENGER AIRBAG DOOR
3 - PASSENGER SIDE TRIM BEZEL SCREWS (4)
4 - INSTRUMENT PANEL TOP PAD

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the passenger side trim bezel to the instrument panel top pad.

(2) From the underside of the top pad, install and tighten the four screws through the passenger airbag door that secure the passenger side trim bezel to the instrument panel (Fig. 37). Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Reinstall the top pad onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP PAD - INSTALLATION).

(4) Reconnect the battery negative cable.

POWER OUTLET DOOR

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center lower bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER BEZEL - LOWER - REMOVAL).

(3) With the power outlet door in the open position, carefully spread the power outlet door hinge arms far enough to disengage the pivot pins from the pivots on the back side of the center lower bezel (Fig. 38).

NOTE: The power outlet door is more easily serviced while in the open position. The illustration shows the door in the closed position for improved visibility of the assist spring orientation and anchor point details.

(4) Disengage the stepped ends of the assist spring from the anchor holes in the inboard power outlet door hinge arm and in the side of the ash receiver housing.

(5) Remove the power outlet door from the instrument panel center lower bezel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE,

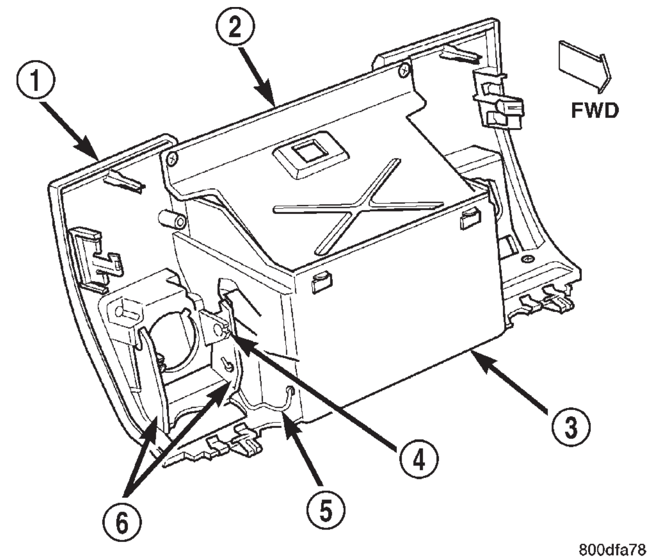

Fig. 38 Instrument Panel Power Outlet Door Remove/Install

1 - CENTER LOWER BEZEL
2 - ASH RECEIVER FLAME SHIELD
3 - ASH RECEIVER HOUSING
4 - PIVOT PINS
5 - ASSIST SPRING
6 - POWER OUTLET DOOR HINGE ARMS

THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the power outlet door to the instrument panel center lower bezel.

(2) Engage the stepped ends of the assist spring with the anchor holes in the inboard power outlet door hinge arm and in the side of the ash receiver housing (Fig. 38).

(3) With the power outlet door in the open position, carefully spread the power outlet door hinge arms far enough to engage the pivot pins with the pivots on the back side of the lower center bezel.

(4) Reinstall the center lower bezel into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP CENTER BEZEL - LOWER - INSTALLATION).

(5) Reconnect the battery negative cable.

STEERING COLUMN OPENING COVER

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse cover from the Junction Block (JB) and Body Control Module (BCM) unit under the driver side outboard end of the instrument panel. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - REMOVAL).

(3) Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(4) Remove the one screw that secures the outboard end of the steering column opening cover to the U-nut on the outboard end of the instrument panel top pad (Fig. 39).

(5) Remove the two screws that secure the lower edge of the steering column opening cover to the U-nuts on the instrument panel steering column support bracket.

(6) Pull the steering column opening cover rearward to disengage the three snap clips (one outboard and two inboard) that secure it to the receptacles in the instrument panel.

(7) Remove the steering column opening cover from the instrument panel.

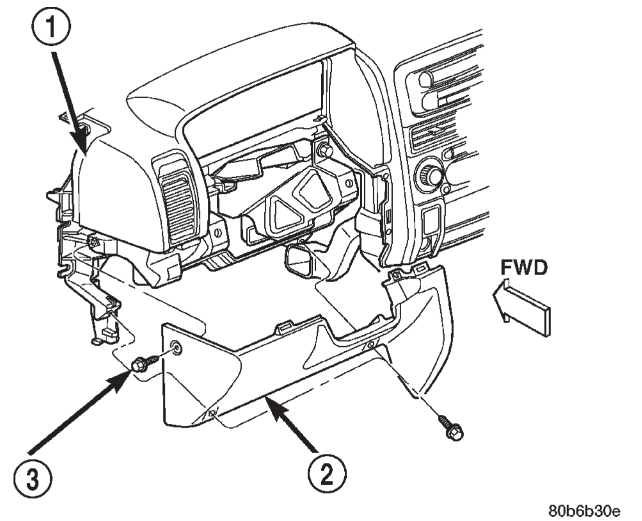

Fig. 39 Steering Column Opening Cover Remove/Install

1 - INSTRUMENT PANEL TOP PAD
2 - STEERING COLUMN OPENING COVER
3 - SCREW (3)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the steering column opening cover onto the instrument panel (Fig. 39).

(2) Align the three snap clips on the steering column opening cover with their receptacles in the instrument panel.

(3) Using hand pressure, press firmly and evenly on the steering column opening cover over the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Install and tighten the two screws that secure the lower edge of the steering column opening cover to the instrument panel steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install and tighten the one screw that secures the outboard end of the steering column opening cover to the U-nut on the outboard end of the instrument panel top pad. Tighten the screw to 2.2 N·m (20 in. lbs.).

(6) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(7) Reinstall the fuse cover onto the Junction Block (JB) and Body Control Module (BCM) unit under the driver side outboard end of the instrument panel. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE COVER - INSTALLATION).

(8) Reconnect the battery negative cable.

INTERIOR

TABLE OF CONTENTS

A-PILLAR TRIM

REMOVAL

The A-pillar trim is attached to the A-pillar with spring clips.

(1) Grasp A-pillar trim and pull trim outward from A-pillar (Fig. 1).

(2) Separate A-pillar trim from A-pillar.

INSTALLATION

(1) Position A-pillar trim on A-pillar and, starting at the bottom, press into place (Fig. 1).

(2) Using a trim stick or other suitable tool, carefully cover the edge of the trim with weatherstrip.

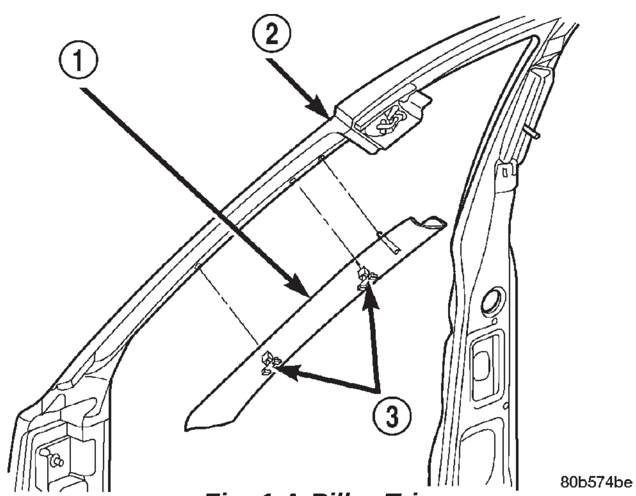

Fig. 1 A-Pillar Trim

1 - A-PILLAR TRIM
2 - A-PILLAR
3 - SPRING CLIP

ASSIST HANDLE

REMOVAL

(1) Remove the screws holding the assist handle to the roof panel.

(2) Remove the assist handle from the roof panel.

INSTALLATION

(1) Align the assist handle with the screw holes in the roof panel.

(2) Install the screws holding the assist handle to the roof panel.

B-PILLAR LOWER TRIM

REMOVAL

(1) Remove front door sill trim (Refer to 23 - BODY/INTERIOR/DOOR SILL TRIM - REMOVAL).

(2) Remove front seat shoulder belt anchor bolt.

(3) Remove front seat shoulder belt height adjustment knob and turning loop.

(4) Remove screw attaching front of quarter panel trim to floor.

(5) Remove screws attaching front and rear of B-pillar lower trim to floor.

(6) Remove screw attaching B-pillar lower trim to B-pillar (Fig. 2).

(7) Grasp B-pillar lower trim and pull outward to separate from B-pillar.

(8) Route seat/shoulder belt through access slot in B-pillar lower trim.

(9) Separate B-pillar lower trim from B-pillar.

INSTALLATION

(1) Position B-pillar lower trim panel at B-pillar (Fig. 2).

(2) Route seat/shoulder belt through access slot in B-pillar lower trim.

(3) Press B-pillar lower trim onto B-pillar.

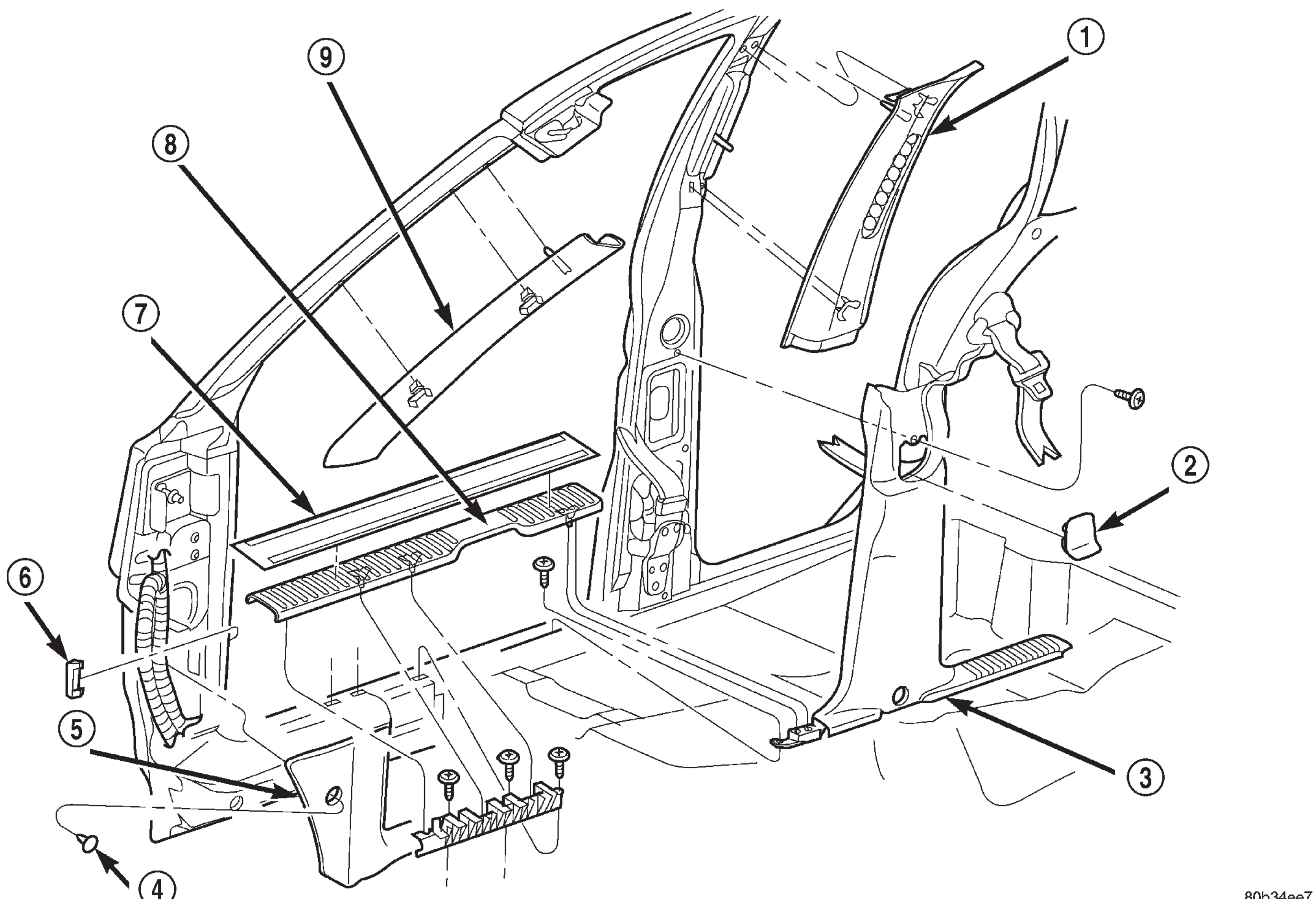

Fig. 2 B-Pillar Trim Panel

1 - B-PILLAR UPPER TRIM
2 - ACCESS COVER
3 - B-PILLAR LOWER TRIM
4 - PLASTIC NUT
5 - COWL LOWER TRIM
6 - CLIP
7 - SCUFF PLATE
8 - SILL TRIM
9 - A-PILLAR TRIM

B-PILLAR LOWER TRIM (Continued)

(4) Install screw attaching B-pillar lower trim to B-pillar.

(5) Install screw attaching front of B-pillar lower trim to floor.

(6) Install screw attaching front of quarter panel trim to floor.

(7) Install front seat shoulder belt anchor bolt.

(8) Install front seat shoulder belt height adjustment knob and turning loop.

(9) Install front door sill trim (Refer to 23 - BODY/INTERIOR/DOOR SILL TRIM - INSTALLATION).

B-PILLAR UPPER TRIM

REMOVAL

(1) Remove shoulder belt height adjustment knob.

(2) Remove front seat belt turning loop.

(3) Remove the screw attaching lower B pillar trim.

(4) Pull lower B pillar trim out far enough to remove upper trim panel.

(5) Grasp upper B-pillar trim and pull outward to detach from B-pillar (Fig. 2).

INSTALLATION

(1) Position trim panel on B-pillar (Fig. 2).

(2) Ensure trim panel covers inner edge of door opening weatherstrip and press inward to seat.

(3) Install screw attaching lower B pillar trim panel.

(4) Install front seat belt turning loop.

(5) Install shoulder belt height adjustment knob.

CARPETS AND FLOOR MATS

REMOVAL

REMOVAL - FRONT CARPET

(1) Remove door sill trim (Refer to 23 - BODY/INTERIOR/DOOR SILL TRIM - REMOVAL).

(2) Remove the B-pillar lower trim, refer to (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).

(3) Remove front seats (Refer to 23 - BODY/SEATS/SEAT - REMOVAL).

(4) Remove the rear seats lower cushions (Refer to 23 - BODY/SEATS/SEAT CUSHION - REMOVAL).

(5) Remove center floor console (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

(6) Remove any other interfering trim or molding.

(7) Lift carpet and mat from floor panel.

REMOVAL - CARGO AREA CARPET

(1) Lift tailgate.

(2) Fold rear seat cushions forward.

(3) Remove rear seat backs (Refer to 23 - BODY/SEATS/REAR SEAT BACK - REMOVAL).

(4) Remove the rear shoulder belts (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT & RETRACTOR - REMOVAL).

(5) Remove the retractable security cargo cover assembly.

(6) Remove the spare tire cover.

(7) Remove the rear cargo tie down footman loops. The side mounted footman loops are retained by screws. The floor footman loops are riveted (Fig. 3).

(8) Remove the C pillar trim (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL).

(9) Remove the CD changer, if equipped (Refer to 8 - ELECTRICAL/AUDIO/CD CHANGER - REMOVAL).

(10) Remove the Infinity amp, if equipped (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - REMOVAL).

(11) Lift the carpet.

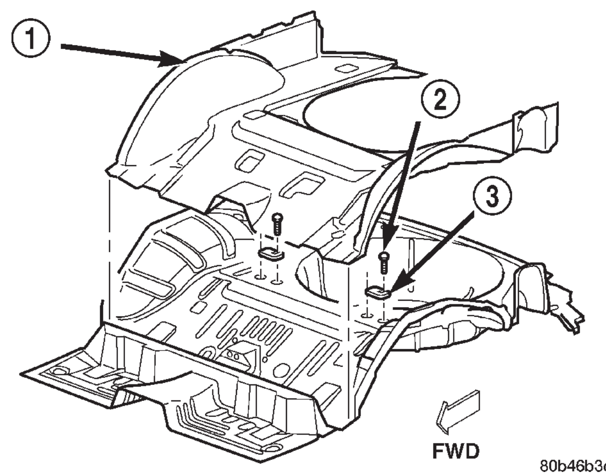

Fig. 3 Cargo Area Carpet

1 - CARGO AREA CARPET
2 - RIVET
3 - CARGO TIE-DOWN LOOP

INSTALLATION

INSTALLATION - FRONT CARPET

(1) Carefully lay the carpet and mat on the floor panel. Align the carpet to allow installation of the components fastened to the floor panel.

(2) Install the center console (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

(3) Install the front seats (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION).

(4) Install the rear seat cushions (Refer to 23 - BODY/SEATS/SEAT CUSHION - INSTALLATION).

CARPETS AND FLOOR MATS (Continued)

(5) Install the lower B pillar trim (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).

(6) Install the door sill trim (Refer to 23 - BODY/INTERIOR/DOOR SILL TRIM - INSTALLATION).

(7) Install any other moldings or trim panels removed.

INSTALLATION - CARGO AREA CARPET

(1) Thoroughly clean the area with Mopar Super Kleen®, or equivalent.

(2) Lay the new carpet in.

(3) Install the "C" pillar trim (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION).

(4) Install the CD changer, if equipped (Refer to 8 - ELECTRICAL/AUDIO/CD CHANGER - INSTALLATION).

(5) Install the footman loops (Fig. 3).

(6) Install the rear shoulder belts (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT & RETRACTOR - INSTALLATION).

(7) Install the rear seat backs (Refer to 23 - BODY/SEATS/REAR SEAT BACK - INSTALLATION).

(8) Install the Infinity amp, if equipped (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - INSTALLATION).

(9) Install the spare tire cover.

(10) Install the retractable security cover.

COWL TRIM

REMOVAL

(1) Remove front door sill trim (Refer to 23 - BODY/INTERIOR/DOOR SILL TRIM - REMOVAL).

(2) Remove screws attaching cowl trim to floor.

(3) Remove plastic nut.

(4) Grasp cowl trim and pull outward to separate from clip.

(5) Separate cowl trim from vehicle.

INSTALLATION

(1) Position cowl trim and press into place.

(2) Install screws attaching cowl trim to floor.

(3) Install plastic nut.

(4) Install front door sill trim (Refer to 23 - BODY/INTERIOR/DOOR SILL TRIM - INSTALLATION).

C-PILLAR TRIM

REMOVAL

(1) Remove rear shoulder belt turning loop.

(2) Remove rear shoulder belt height adjustment knob.

(3) Remove screws attaching quarter panel trim.

(4) Pull quarter panel trim outward as necessary.

(5) Grasp C-pillar upper trim and pull outward to disengage from C-pillar (Fig. 4).

(6) Route rear shoulder belt through access hole.

(7) Separate C-pillar upper trim from vehicle.

INSTALLATION

(1) Position C-pillar upper trim at C-pillar (Fig. 4).

(2) Route rear shoulder belt through access hole.

(3) Press C-pillar upper trim onto C-pillar.

(4) Press quarter panel trim into place as necessary.

(5) Ensure front edge of trim is covered by weatherstrip.

(6) Install screws attaching quarter panel trim.

(7) Install rear shoulder belt height adjustment knob.

(8) Install rear shoulder belt turning loop.

C-PILLAR TRIM (Continued)

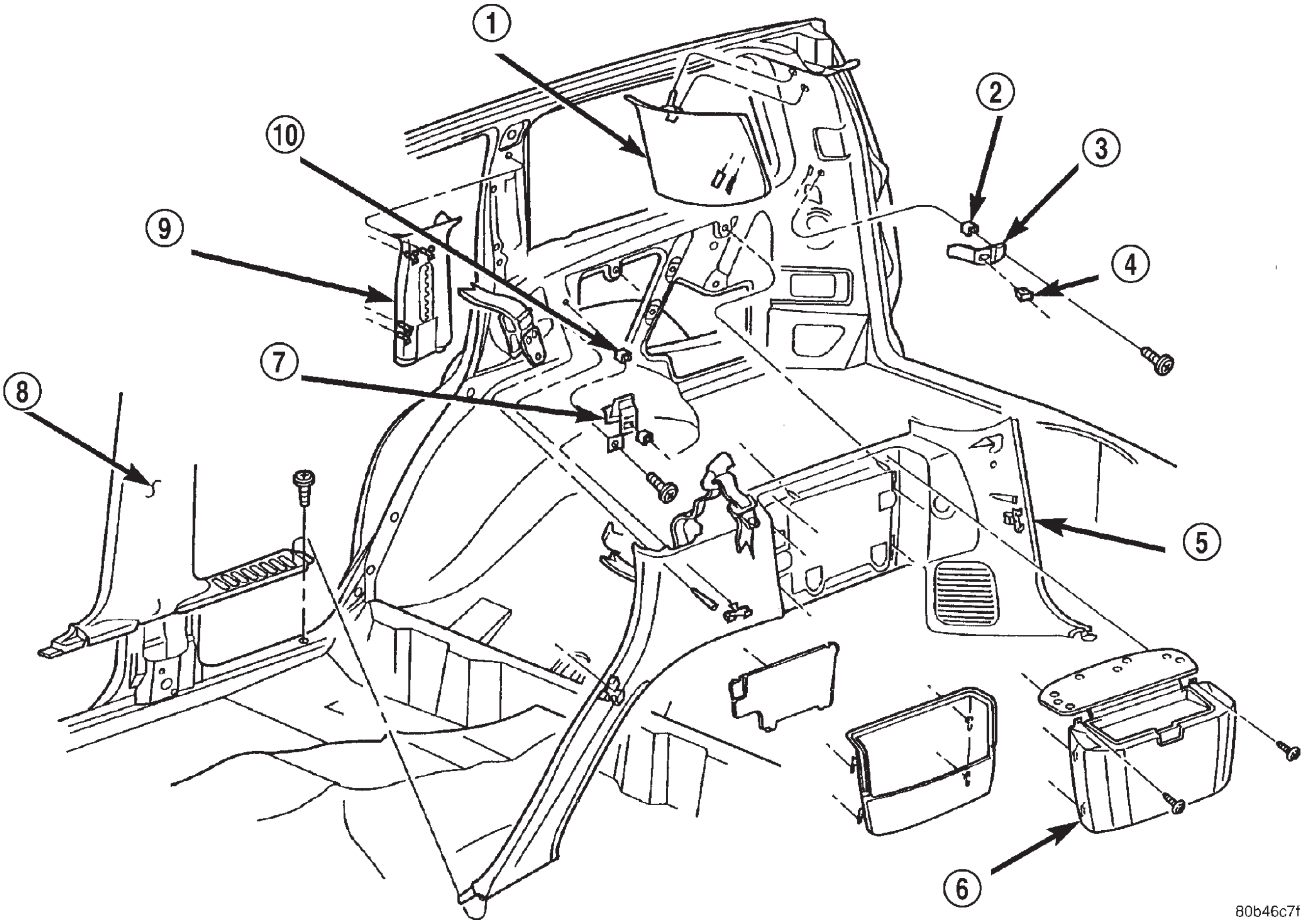

Fig. 4 Right Side Trim Panel

1 - D-PILLAR TRIM
2 - SNAP-IN NUT
3 - BRACKET
4 - SNAP-IN NUT
5 - QUARTER TRIM PANEL
6 - STORAGE BIN
7 - BRACKET
8 - B-PILLAR LOWER TRIM
9 - C-PILLAR UPPER TRIM
10 - SNAP-IN NUT

DOOR SILL SCUFF PLATE

REMOVAL

(1) Using a trim stick or other suitable tool, carefully pry up the scuff plate from the door sill (Fig. 5).

(2) Remove the scuff plate.

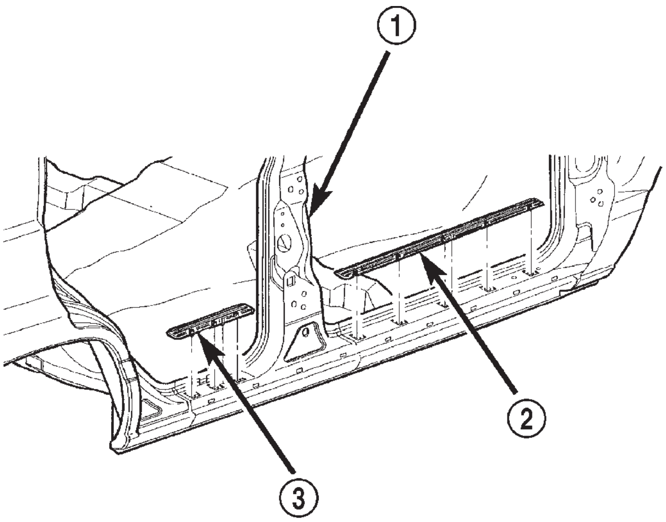

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Fig. 5 Door Sill Scuff Plates

1 - B-PILLAR
2 - FRONT DOOR SCUFF PLATE
3 - REAR DOOR SCUFF PLATE

INSTALLATION

(1) Install the scuff plate on the door sill (Fig. 5).

(2) Press the molded in snap retainers into the door sill.

DOOR SILL TRIM

REMOVAL

The sill trim molding is held in place with molded in snap retainers (Fig. 6).

(1) Using a trim stick or other suitable device, carefully pry up one corner of the sill trim.

(2) Grasp the edge of the trim and pull up gently to release the snap retainers.

INSTALLATION

(1) Position the sill molding on the door sill.

(2) Press the snap retainers into place.

DOOR SILL TRIM (Continued)

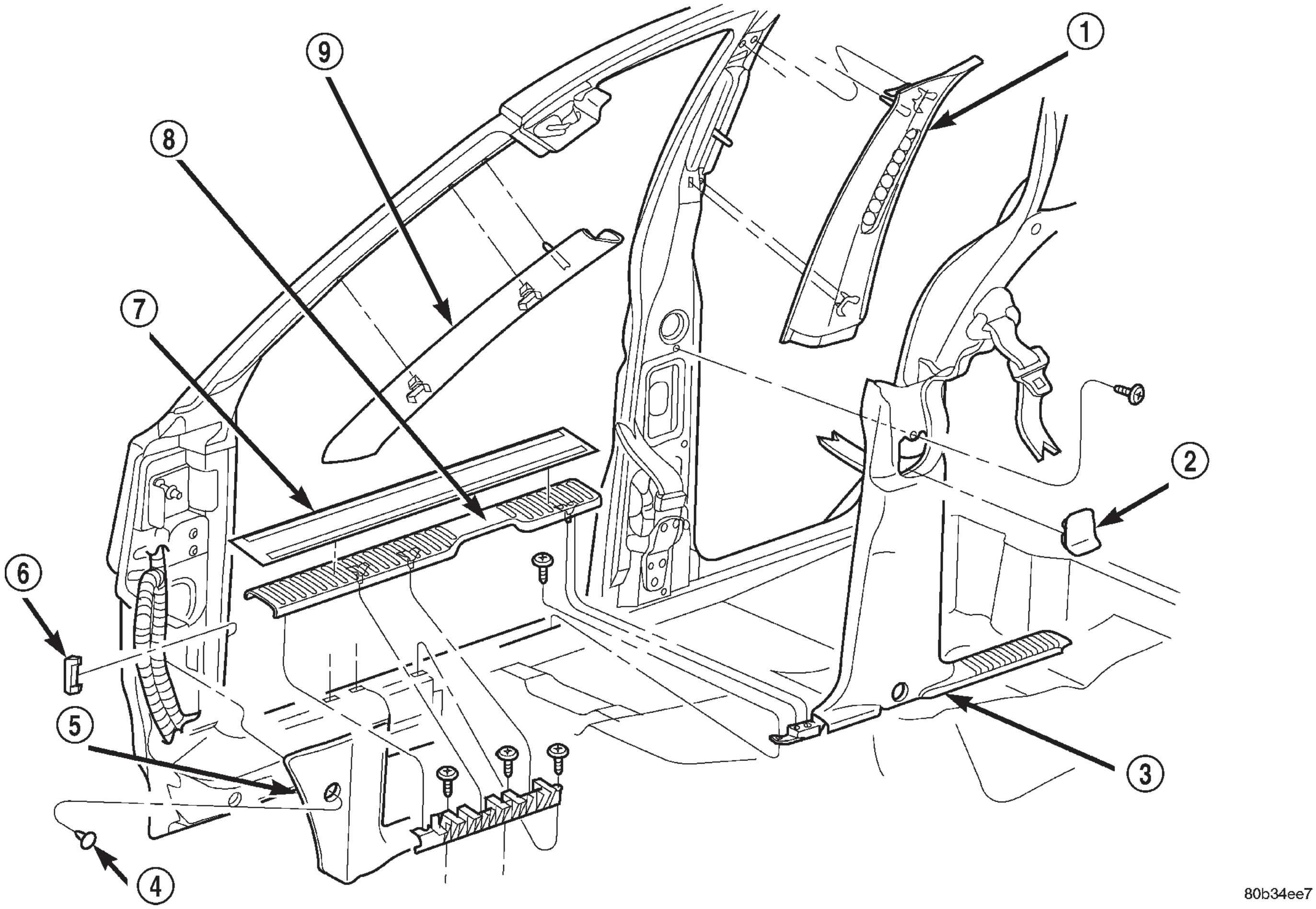


Fig. 6 Sill Trim Molding

1 - B-PILLAR UPPER TRIM
2 - ACCESS COVER
3 - B-PILLAR LOWER TRIM
4 - PLASTIC NUT
5 - COWL LOWER TRIM
6 - CLIP
7 - SCUFF PLATE
8 - SILL TRIM
9 - A-PILLAR TRIM

D-PILLAR TRIM

REMOVAL

The D-pillar trim is attached to the D-pillar with spring clips (Fig. 7).

(1) Remove liftgate opening upper trim panel (Refer to 23 - BODY/INTERIOR/LIFTGATE OPENING UPPER TRIM - REMOVAL).

(2) Grasp D-pillar trim and pull outward from D-pillar.

(3) Separate D-pillar trim from D-pillar.

INSTALLATION

(1) Position D-pillar trim panel at D-pillar and press into place.

(2) Install upper liftgate opening trim panel (Refer to 23 - BODY/INTERIOR/LIFTGATE OPENING UPPER TRIM - INSTALLATION).

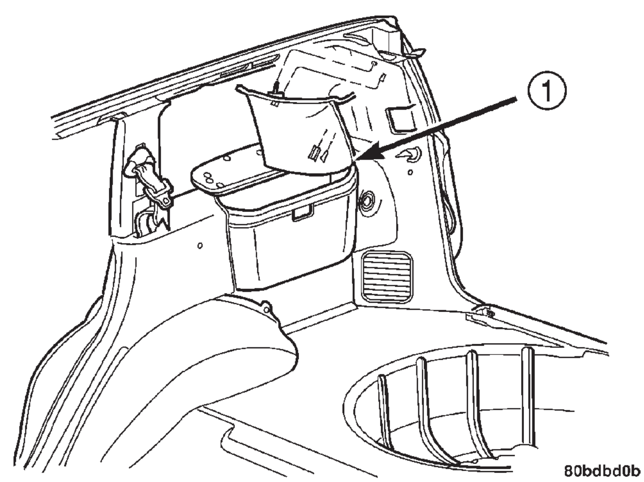


Fig. 7 D Pillar Upper Trim

1 - D PILLAR UPPER TRIM

FLOOR CONSOLE

REMOVAL

CAUTION: The ACM should be depowered by disconnecting the negative battery cable in any operation requiring the key to be turned “ON”, while working in the console area. E.G. console, carpet, or seat removal or installation; shifter linkage adjustment or replacement; parking brake cable replacement or adjustment. Failure to take proper precautions could result in accidental airbag deployment and possible personal injury.

(1) Set park brake.
(2) Place transmission shift lever and transfer case lever in full rearward position.
(3) Remove mat from front bin and remove screws attaching front of console to floor (Fig. 8).
(4) Remove screws attaching rear bin to console.
(5) Remove rear bin.
(6) Pull rear passenger cupholder outward to access screws.
(7) Remove screws attaching rear of console to floor.
(8) Lift the console upward and rearward.
(9) Remove console from vehicle.

INSTALLATION

CAUTION: The ACM should be depowered by disconnecting the negative battery cable in any operation requiring the key to be turned “ON”, while working in the console area. E.G. console, carpet, or seat removal or installation; shifter linkage adjustment or replacement; parking brake cable replacement or adjustment. Failure to take proper precautions could result in accidental airbag deployment and possible personal injury.

(1) Position console in vehicle. Ensure rear passenger HEVAC duct is engaged.
(2) Install screws attaching rear of console to floor.
(3) Position rear bin in console.
(4) Install screws attaching rear bin to console.
(5) Install screws attaching front of console to floor and place front bin mat in front bin.
(6) Return transmission shift lever and transfer case lever to original position.
(7) Release park brake.

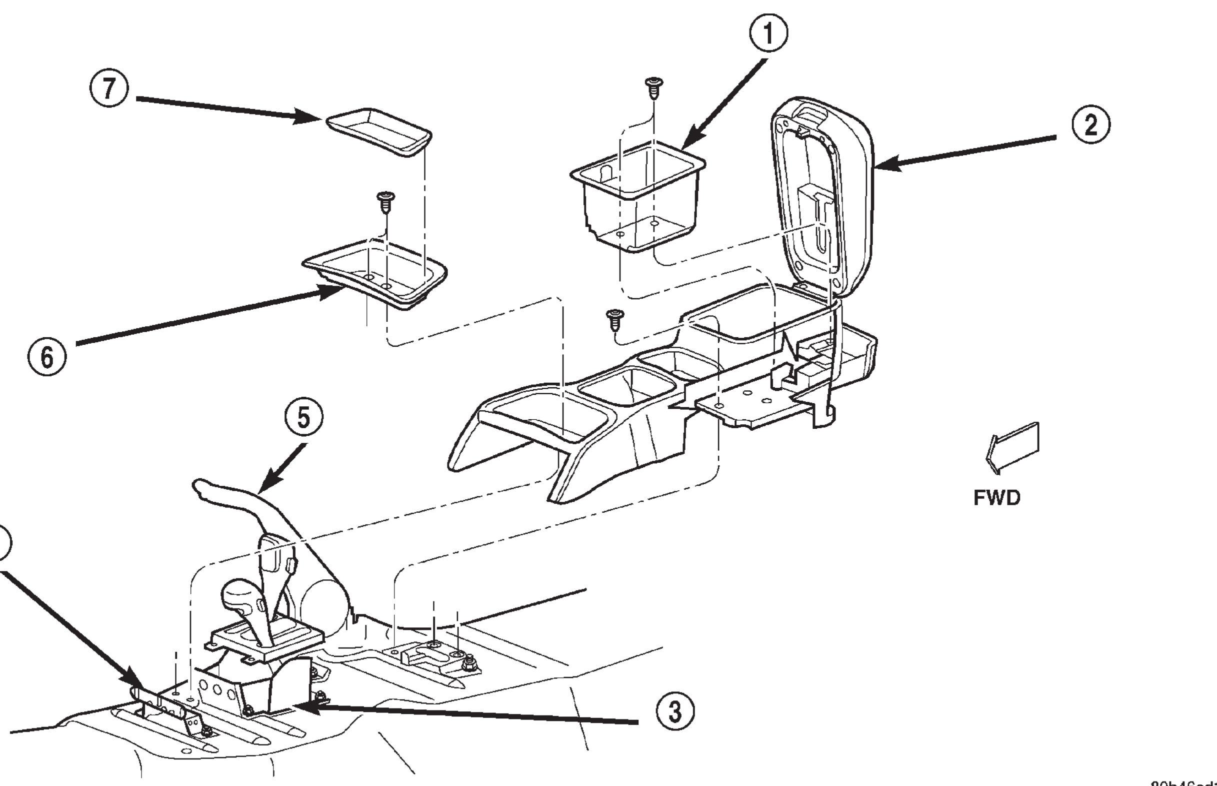


Fig. 8 Floor Console

1 - REAR BIN
2 - CONSOLE LID
3 - SHIFTER CONSOLE
4 - BRACKET
5 - PARKING BRAKE
6 - FRONT PIN
7 - MAT

HEADLINER

REMOVAL

CAUTION: The headliner is a one-piece, molded component. It has limited flexibility and must not be bent. Damage may possibly result.

(1) Record radio presets and disconnect negative battery cable.
(2) Remove A pillar trim moldings (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).
(3) Remove B pillar upper trim moldings (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL).
(4) Remove C pillar trim moldings (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL).
(5) Remove D pillar trim molding (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - REMOVAL).
(6) Remove the sun visors (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).
(7) Disconnect the vanity lamp electrical connector.
(8) Remove assist handles from roof rails (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - REMOVAL).
(9) Remove dome lamp and overhead console, if equipped.
(10) Remove rear cargo/dome lamp.
(11) Remove sun roof pinch welt, if equipped.
(12) Disengage rear washer hose from liftgate (Fig. 9).
(13) Disengage the wire harness connectors at rear of headliner.
(14) Disconnect the rear washer hose at the left "A" pillar (Fig. 10).
(15) Disengage the wire harness for the sunroof, if equipped.
(16) Fold down the rear seats, move the front seats full forward, and lower the front seat backs.
(17) Partially lower the headliner and disengage the sunroof drain hoses, if equipped (Fig. 11).
(18) With the aid of an assistant, remove the headliner through the liftgate opening.

INSTALLATION

(1) With the aid of an assistant, position the headliner in the vehicle.
(2) Connect the sunroof drain hoses, if equipped.
(3) Connect the sunroof harness, the rear wire harnesses, and the washer hose at the "A" pillar and at the liftgate.
(4) Install the sunroof pinch welt, if equipped.
(5) Install the roof rail assist handles (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - INSTALLATION).

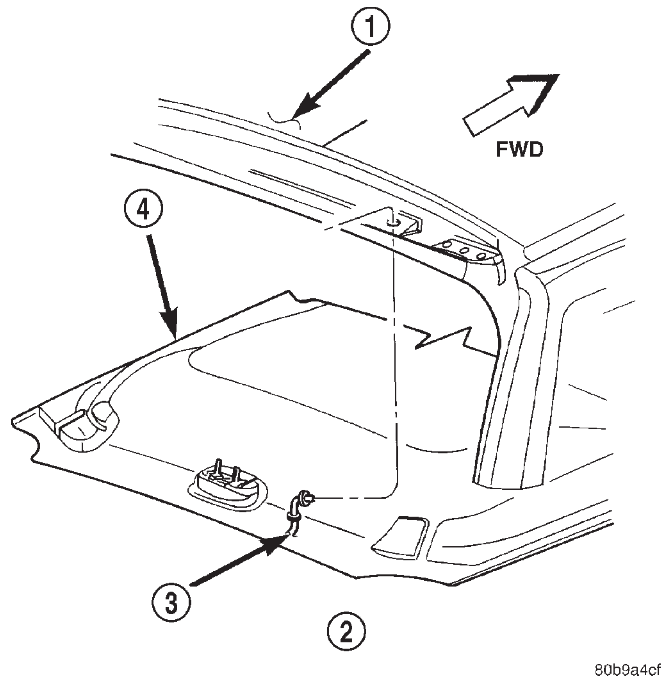


Fig. 9 Liftgate Washer Hose Routing at Rear of Headliner

1 - ROOF
2 - REAR WASHER HOSE ROUTING
3 - REAR WASHER HOSE
4 - HEADLINER

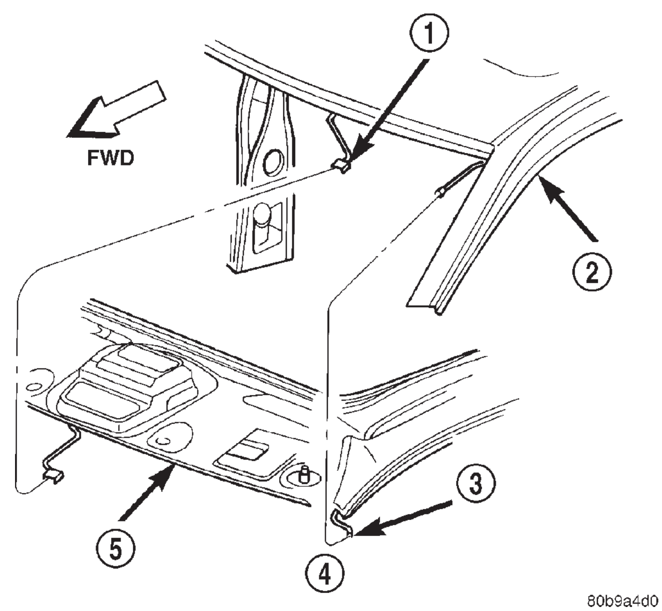


Fig. 10 Rear Liftgate Washer Hose Routing at A Pillar

1 - OVERHEAD CONSOLE WIRE HARNESS
2 - ROOF
3 - REAR WASHER HOSE
4 - REAR WASHER HOSE ROUTING
5 - HEADLINER

HEADLINER (Continued)

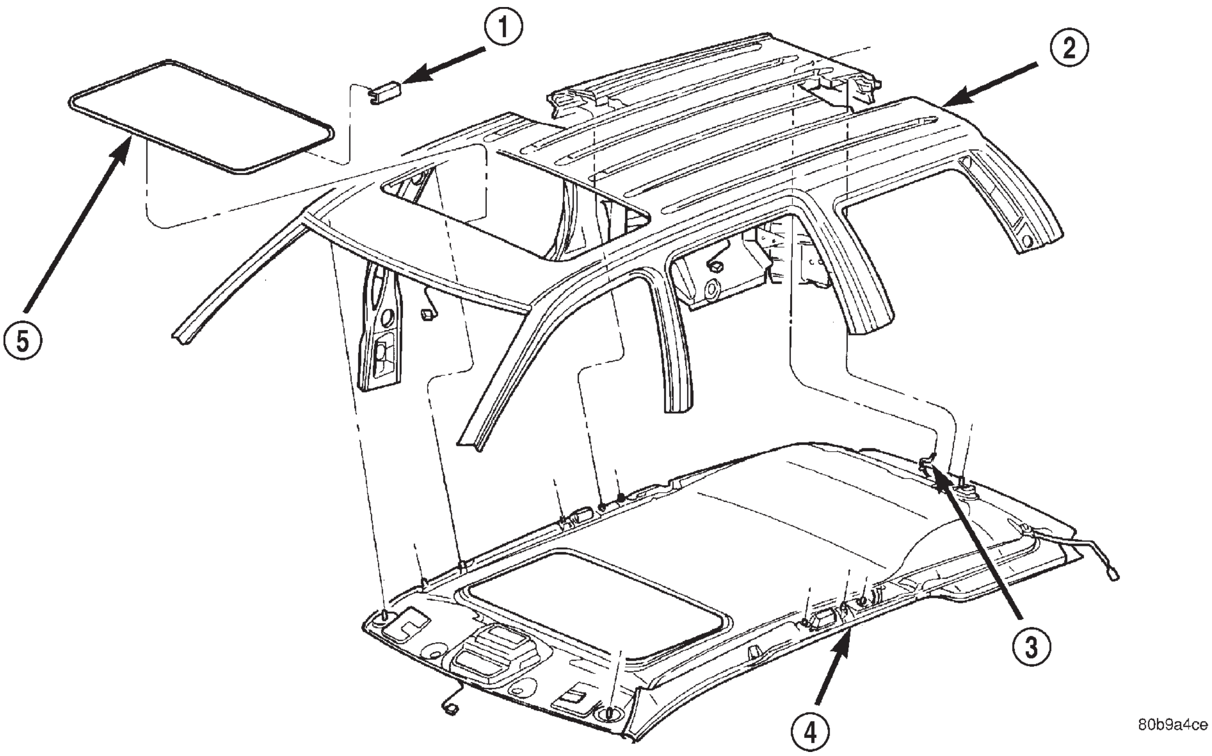


Fig. 11 Headliner

1 - SUNROOF PINCH WELT
2 - ROOF
3 - REAR WASHER HOSE
4 - HEADLINER
5 - SUNROOF

(6) Install the sun visors (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).

(7) Install the overhead console, if equipped.

(8) Install the rear cargo/dome lamp.

(9) Install the D pillar trim (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - INSTALLATION).

(10) Install the C pillar trim (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION).

(11) Install the upper B pillar trim (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION).

(12) Install the A pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).

(13) Connect the negative battery cable.

LIFTGATE OPENING UPPER TRIM

REMOVAL

The upper liftgate opening trim is held on with spring clips.

(1) Grasp the rear of the trim piece and pull down and back to disengage clips (Fig. 12).

(2) Slide the trim piece to the rear to disengage headliner locating hooks.

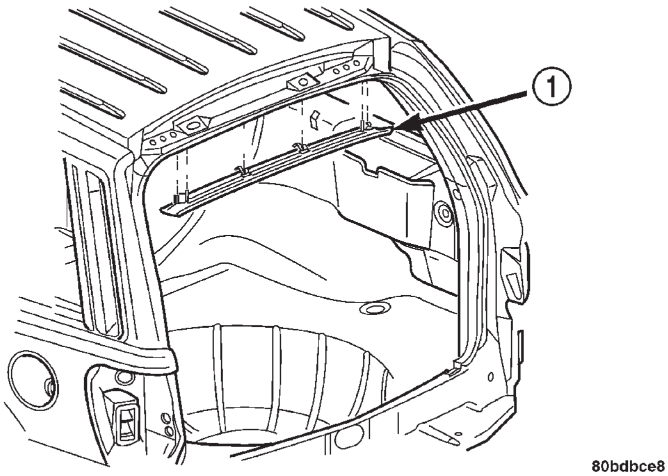


Fig. 12 Upper Liftgate Opening Trim

1 - UPPER LIFTGATE OPENING TRIM

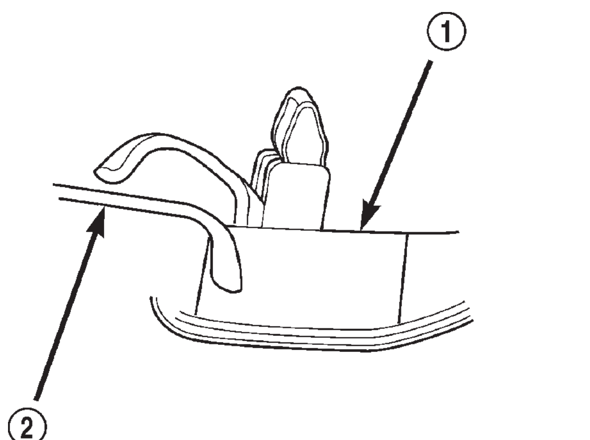


Fig. 13 Headliner Locating Hooks

1 - UPPER LIFTGATE OPENING TRIM
2 - HEADLINER

INSTALLATION

The liftgate upper opening trim piece is equipped with headliner locating hooks (Fig. 13).

(1) Align the locating hooks with the slots in the headliner.

(2) Engage the spring clips and press the liftgate upper opening trim panel into place.

QUARTER TRIM PANEL

REMOVAL

(1) Move rear seat to cargo position.

(2) If equipped, remove sunshade cover.

(3) Open liftgate.

(4) Remove upper and lower liftgate opening trim panels (Refer to 23 - BODY/INTERIOR/LIFTGATE OPENING UPPER TRIM - REMOVAL).

(5) Remove D-pillar upper trim (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - REMOVAL).

(6) Remove storage bin (right side only) (Refer to 23 - BODY/INTERIOR/REAR STORAGE BOX - REMOVAL).

(7) Remove C-pillar upper trim panel (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL).

(8) Remove mounting screws.

(9) Pull quarter trim panel forward and disengage connectors for CD player and power outlet, if equipped.

(10) Pull quarter trim panel extension in the rear door opening upward.

(11) Remove rear quarter trim panel.

INSTALLATION

(1) Position quarter trim panel, engage connectors for CD player and power outlet, if equipped, and align screw holes.

(2) Install quarter trim panel.

(3) Install C-pillar upper trim panel (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION).

(4) Install storage bin (Refer to 23 - BODY/INTERIOR/REAR STORAGE BOX - INSTALLATION).

(5) Install D-pillar upper trim panel (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - INSTALLATION).

(6) Install upper and lower liftgate opening trim panels (Refer to 23 - BODY/INTERIOR/LIFTGATE OPENING UPPER TRIM - INSTALLATION).

(7) If equipped, install sunshade cover.

(8) Install cargo loops.

(9) Move the rear seat to the upright position.

REAR STORAGE BOX

REMOVAL

(1) Open the storage bin lid and remove screws on each side of the lid hinge.

(2) Pull upward sharply on the bottom of the bin to disengage hooks.

(3) Raise bin and move inboard to disengage the quarter trim panel.

REAR STORAGE BOX (Continued)

INSTALLATION

(1) Position the bin hooks high in the slots on the quarter trim panel.

(2) Push downward until the bin snaps into place.

(3) Install the hinge screws.

REAR VIEW MIRROR

REMOVAL

(1) If equipped, disconnect mirror harness connector.

(2) Loosen the mirror base setscrew (Fig. 14).

(3) Slide the mirror base upward and off the bracket.

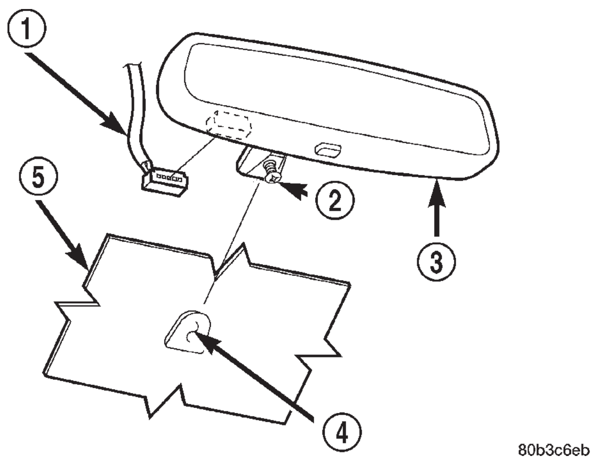


Fig. 14 Rear View Mirror

1 - CONNECTOR
2 - SCREW
3 - REAR VIEW MIRROR
4 - SUPPORT BUTTON
5 - WINDSHIELD

INSTALLATION

INSTALLATION

(1) Position the mirror base at the bracket and slide it downward onto the support bracket (Fig. 14).

(2) Tighten the setscrew 1 N·m (15 in. lbs.) torque.

(3) If equipped, connect mirror harness connector.

INSTALLATION - REARVIEW MIRROR SUPPORT BRACKET

(1) Mark the position for the mirror bracket on the outside of the windshield glass with a wax pencil.

(2) Clean the bracket contact area on the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.

(3) Sand the surface on the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.

(4) Apply accelerator to the surface on the bracket according to the following instructions:

(a) Crush the vial to saturate the felt applicator.

(b) Remove the paper sleeve.

(c) Apply accelerator to the contact surface on the bracket.

(d) Allow the accelerator to dry for five minutes.

(e) Do not touch the bracket contact surface after the accelerator has been applied.

(5) Apply adhesive accelerator to the bracket contact surface on the windshield glass. Allow the accelerator to dry for one minute. Do not touch the glass contact surface after the accelerator has been applied.

(6) Install the bracket according to the following instructions:

(a) Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.

(b) Apply an even coat of adhesive to the contact surface on the bracket.

(c) Align the bracket with the marked position on the windshield glass.

(d) Press and hold the bracket in place for at least one minute.

NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.

(7) Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.

(8) Allow the adhesive to cure for an additional 8-10 minutes before installing the mirror.

SUN VISOR

REMOVAL

(1) Remove screws attaching sunvisor arm support bracket to headliner and roof panel.

(2) Disengage electrical connections for vanity mirror, if equipped.

(3) Detach sunvisor from support bracket.

(4) Remove sunvisor from vehicle.

(5) Remove retaining screw and support bracket.

INSTALLATION

(1) Install the retaining screw and support bracket.

(2) Position the sunvisor in the vehicle.

(3) Connect the electrical harness for the lighted vanity mirror, if equipped.

(4) Attach the sunvisor to the support bracket.

(5) Install the support bracket w/sunvisor onto the headliner and roof panel.

PAINT

TABLE OF CONTENTS

PAINT

SPECIFICATIONS - PAINT CODES

EXTERIOR COLORS

EXTERIOR COLOR	DAIMLERCHRYSLER CODE
Dark Garnet Red Pearlcoat	XRV
Inferno Red Tinted Pearlcoat	WEL
Woodland Brown Satin Glow	YUB
Onyx Green Pearlcoat	YJR
Steel Blue Pearlcoat	XBQ
Patriot Blue Pearlcoat	WBT
Silverstone Metallic Clearcoat	XS5
Graphite Metallic Clearcoat	ZDR
Black Clearcoat	DX8
Stone White Clearcoat	SW1

INTERIOR COLORS

INTERIOR COLOR	DAIMLERCHRYSLER CODE
Dark Slate Grey	DV
Taupe	L5
Sandstone	T5
Dark Slate/Light Slate	DB

LAREDO FASCIA/CLADDING COLORS

COLOR	DAIMLERCHRYSLER CODE
Dark Grey Metallic	XS9

PAINT CODE

DESCRIPTION

Exterior vehicle body colors are identified on the Body Code plate. The plate is located on the in the engine compartment and attached to the top of the right frame rail. Refer to the Introduction section at the front of this manual for body code plate description. The paint code is also identified on the Vehicle Safety Certification Label which is located on the drivers door shut face. The first digit of the paint code listed on the vehicle indicates the sequence of application, i.e.: P = primary coat, Q = secondary coat.

BASE COAT/CLEAR COAT FINISH

DESCRIPTION

The original equipment finish is a multi-step process that involves cleaning, electrodeposition (e-coat), base coat, and clear coat steps. Additionally, selected areas of the vehicle may be coated with an anti-chip finish.

PAINT TOUCH-UP

DESCRIPTION

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Top Coat. Refer to Introduction group of this manual for Body Code Plate information.

WARNING: USE AN OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

OPERATION

(1) Scrape loose paint and corrosion from inside scratch or chip.

(2) Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.

(3) Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the defect without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.

(4) Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.

(5) On vehicles without clear coat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

WARNING: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT. AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

FINESSE SANDING/BUFFING & POLISHING

DESCRIPTION

CAUTION: Do not remove more than .5 mils of clearcoat finish, if equipped. Base coat paint must retain clear coat for durability.
Use a Paint Thickness Gauge #PR-ETG-2X or equivalent to determine film thickness before and after the repair.

Minor acid etching, orange peel, or smudging in clearcoat or single-stage finishes can be reduced with light finesse sanding, hand buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

SEATS

TABLE OF CONTENTS

FRONT HEADREST

REMOVAL

(1) Depress head restraint release button and lift head restraint to full up position.

(2) Using a small flat blade, depress tab on right side head restraint release button and using your hand, simultaneously press tab on left side head restraint release button (Fig. 1) and pull head restraint up to separate from seat back.

INSTALLATION

(1) Position head restraint in seat back, press tab on left side head restraint release button and push down head restraint to secure.

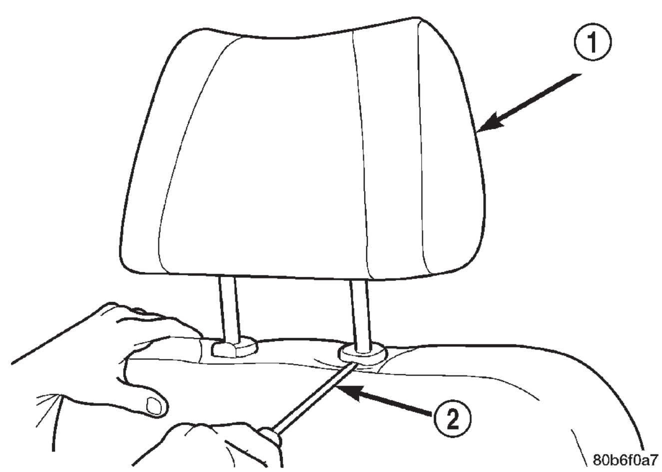


Fig. 1 Head Restraint

1 - HEAD RESTRAINT
2 - FLAT BLADE

FRONT HEADREST SLEEVE

REMOVAL

(1) Remove head restraint (Refer to 23 - BODY/SEATS/FRONT HEADREST - REMOVAL).

(2) Remove seat back cover (Refer to 23 - BODY/SEATS/FRONT SEAT BACK COVER - REMOVAL).

(3) Remove hog rings attaching cushion pad to seat back frame (Fig. 2).

(4) Remove cushion pad from seat back frame.

(5) Rotate head restraint sleeve 1/4 turn counter-clockwise to release retaining tab.

(6) Pull sleeve from seat back frame (Fig. 3).

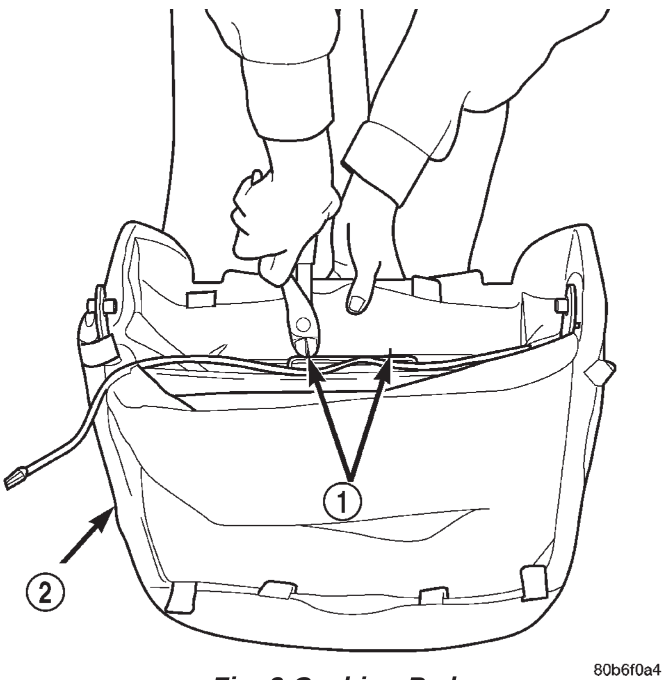


Fig. 2 Cushion Pad

1 - HOG RING
2 - SEAT BACK CUSHION PAD

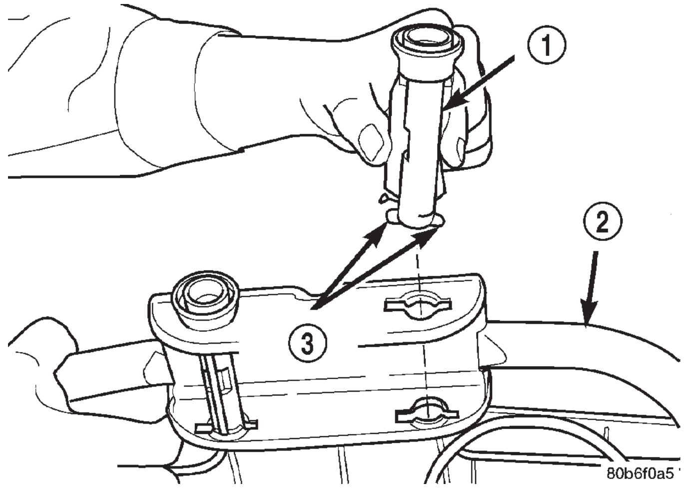


Fig. 3 Head Restraint Sleeve

1 - HEAD RESTRAINT SLEEVE
2 - SEAT BACK FRAME
3 - RETAINING TAB

INSTALLATION

(1) Position sleeve in seat back frame.

(2) Rotate head restraint sleeve 1/4 turn clockwise to engage retaining tab.

(3) Install cushion pad onto seat back frame.

(4) Install hog rings attaching cushion pad to seat back frame.

(5) Install seat back cover (Refer to 23 - BODY/SEATS/FRONT SEAT BACK COVER - INSTALLATION).

(6) Install head restraint (Refer to 23 - BODY/SEATS/FRONT HEADREST - INSTALLATION).

FRONT SEAT

REMOVAL

(1) Move seat to full rearward position.

(2) Remove front bolts attaching seat to floor pan (Fig. 4).

(3) Move seat to full forward position.

(4) Using a trim stick, pry cover from seat track (power seat only).

(5) Remove rear bolts attaching seat to floor pan.

(6) If equipped, disconnect power seat wire harness connector.

(7) Remove seat from vehicle.

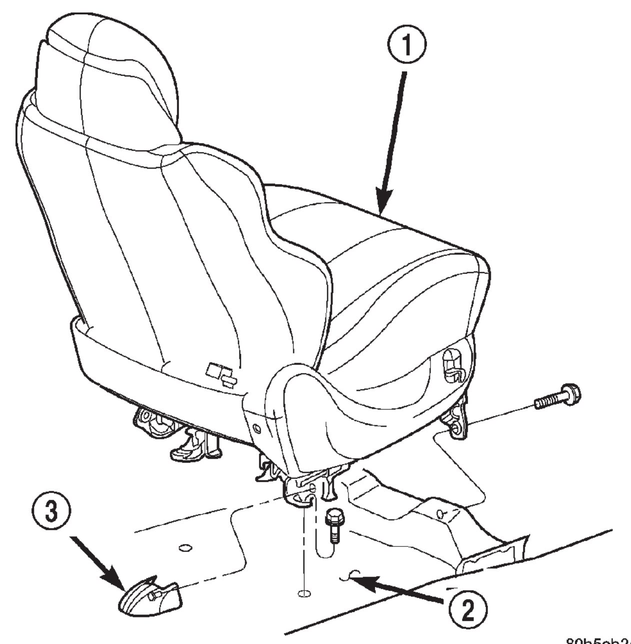


Fig. 4 Front Bucket Seat

1 - POWER BUCKET SEAT
2 - FLOOR PAN
3 - SEAT TRACK COVER

FRONT SEAT (Continued)

INSTALLATION

(1) Position seat on floor pan.
(2) If equipped, connect power seat wire harness connector.
(3) Install rear bolts attaching seat to floor pan. Tighten bolts to 40 N·m (30 ft. lbs.) torque.
(4) If equipped, install cover on seat track.
(5) Move seat to full rearward position.
(6) Install front bolts attaching seat to floor pan. Tighten bolts to 40 N·m (30 ft. lbs.) torque.

FRONT SEAT BACK

REMOVAL

(1) Move seat to full rearward position.
(2) Remove inboard bolt attaching seat back frame to seat cushion frame.
(3) Move seat to full forward position.
(4) Move seat back to full recline position.
(5) Remove screws attaching seat side shield to seat frame.
(6) Disconnect wire harness connector from recliner motor, if equipped.
(7) From the underside of the seat, disconnect the wire harness connector for the power lumber and/or heated seat, if equipped.
(8) Remove outboard bolts attaching recliner to seat cushion frame.
(9) Route the power lumber and/or heated seat harness through the seat cushion cover, if equipped.
(10) Separate seat back from seat cushion.

INSTALLATION

(1) Position seat back on seat cushion.
(2) Route the power lumber and heater harness through the seat cushion cover, if equipped.
(3) Install recliner bolts attaching seat back frame to seat cushion frame. Tighten bolts to 28 N·m (20 ft. lbs.) torque.
(4) Install the inboard bolt attaching seat back frame to seat cushion frame. Tighten bolt to 47N·m (35 ft.lbs.).
(5) Connect wire harness connector to recliner motor and/or heated seat, if equipped.
(6) From the underside of the seat, connect the power lumber and/or heated seat wire harness connector to the seat harness, if equipped.
(7) Install screws attaching seat side shield to seat frame.

FRONT SEAT BACK COVER

REMOVAL

(1) Remove head restraint (Refer to 23 - BODY/SEATS/FRONT HEADREST - REMOVAL).
(2) Using a trim stick, carefully pry head restraint release button caps from the top of seat back.
(3) Remove seat back (Refer to 23 - BODY/SEATS/FRONT SEAT BACK - REMOVAL).
(4) Disengage J-strap at base of seat back.
(5) Slide hand between the face of the seat back pad and the cushion cover and carefully separate hook and loop fastener (Fig. 5).
(6) Roll cover upward and disengage hog rings.
(7) Roll cover upward to top of seat back.
(8) Separate cover from seat back.

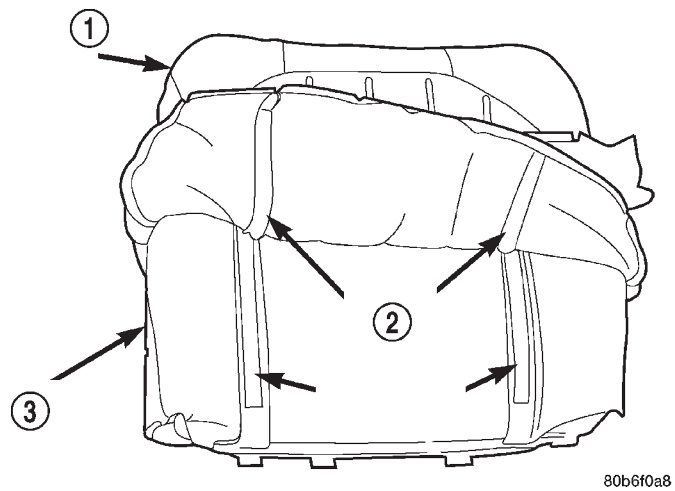


Fig. 5 Seat Back Cover

1 - SEAT BACK COVER
2 - HOOK AND LOOP FASTENER
3 - SEAT BACK PAD

INSTALLATION

(1) Position cover inside-out at the top of seat back.
(2) Roll cover downward.
(3) Engage hog rings.
(4) Align seat back cover with hook and loop fasteners and secure.
(5) Roll cover downward.
(6) Engage J-strap at base of seat back.
(7) Install seat back (Refer to 23 - BODY/SEATS/FRONT SEAT BACK - INSTALLATION).

NOTE: The taller head restraint release button cap is positioned on the left hand side and the head restraint button cap with the hidden button is positioned on the right hand side.

FRONT SEAT BACK COVER (Continued)

(8) Position head restraint release button caps on head restraint sleeves and press to secure.

(9) Install head restraint (Refer to 23 - BODY/SEATS/FRONT HEADREST - INSTALLATION).

FRONT SEAT CUSHION/COVER

REMOVAL

(1) Remove seat from vehicle (Refer to 23 - BODY/SEATS/FRONT SEAT - REMOVAL).

(2) Remove seat back (Refer to 23 - BODY/SEATS/FRONT SEAT BACK - REMOVAL).

(3) Disengage J-straps attaching cushion cover to seat cushion frame.

(4) Disengage hog rings attaching cushion cover to cushion frame at rear of seat along bottom of cushion cover (Fig. 6).

(5) Roll up edges of cover and route seat function switches through access hole on outboard side of seat cushion, if equipped.

(6) Disengage seat cushion heater element connector, if equipped.

(7) Disengage hog rings attaching cover to cushion along cover insert.

(8) Separate seat cushion cover from seat cushion.

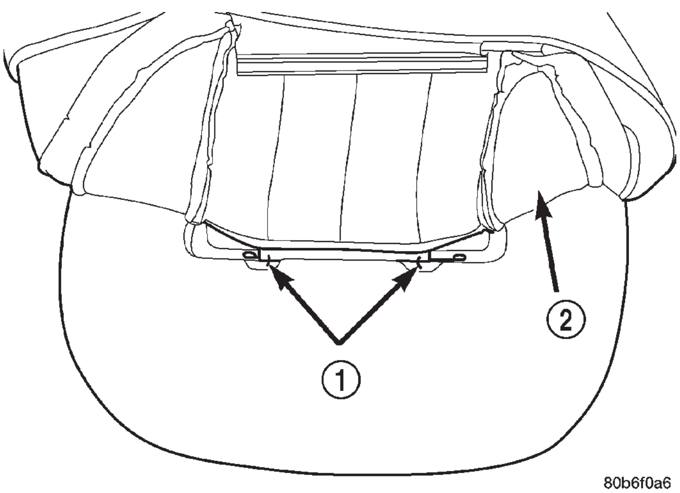


Fig. 6 Seat Cushion Cover

1 - HOG RING
2 - CUSHION COVER

INSTALLATION

(1) Position seat cover on cushion.

(2) Engage hog rings attaching cushion cover to cushion along insert.

(3) Engage seat cushion heater element connector, if equipped.

(4) Route seat function switches through access hole on outboard side of seat cushion, if equipped.

(5) Engage J-straps attaching cushion cover to seat cushion frame.

(6) Engage hog rings attaching cushion cover to cushion frame.

(7) Install seat back (Refer to 23 - BODY/SEATS/FRONT SEAT BACK - INSTALLATION).

(8) Install seat (Refer to 23 - BODY/SEATS/FRONT SEAT - INSTALLATION).

FRONT SEAT SIDE SHIELD

REMOVAL

(1) Remove screws attaching side shield to seat frame.

(2) Disconnect wire harness connectors from power seat and power lumbar switches, if equipped.

(3) Separate side shield from seat.

INSTALLATION

(1) Position side shield on seat.

(2) Connect wire harness connectors to power seat and power lumbar switches, if equipped.

(3) Install screws attaching side shield to seat frame.

SEAT TRACK & RECLINER ASSEMBLY

REMOVAL

(1) Remove seat back (Refer to 23 - BODY/SEATS/FRONT SEAT BACK - REMOVAL).

(2) Disengage J-strap at base of seat back.

(3) Roll seat back cover upward to access bolts attaching recliner to seat back frame.

(4) Remove bolts attaching recliner to seat back frame.

(5) Separate recliner from seat back.

INSTALLATION

(1) Position recliner on seat back.

(2) Install bolts attaching recliner to seat back frame. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Roll seat back cover downward.

(4) Engage J-strap at base of seat back.

(5) Install seat back (Refer to 23 - BODY/SEATS/FRONT SEAT BACK - INSTALLATION).

SEAT TRACK ADJUSTER

REMOVAL

(1) Remove seat (Refer to 23 - BODY/SEATS/FRONT SEAT - REMOVAL).

(2) Remove side shield (Refer to 23 - BODY/SEATS/FRONT SEAT SIDE SHIELD - REMOVAL).

(3) Remove nuts attaching seat track adjuster to seat cushion frame (Fig. 7) and (Fig. 8). Roll cushion trim cover up to access the two front nuts.

(4) Disengage clips attaching wire harness to adjuster.

(5) Disengage seat memory module connector, if equipped.

(6) Separate seat track from seat cushion frame.

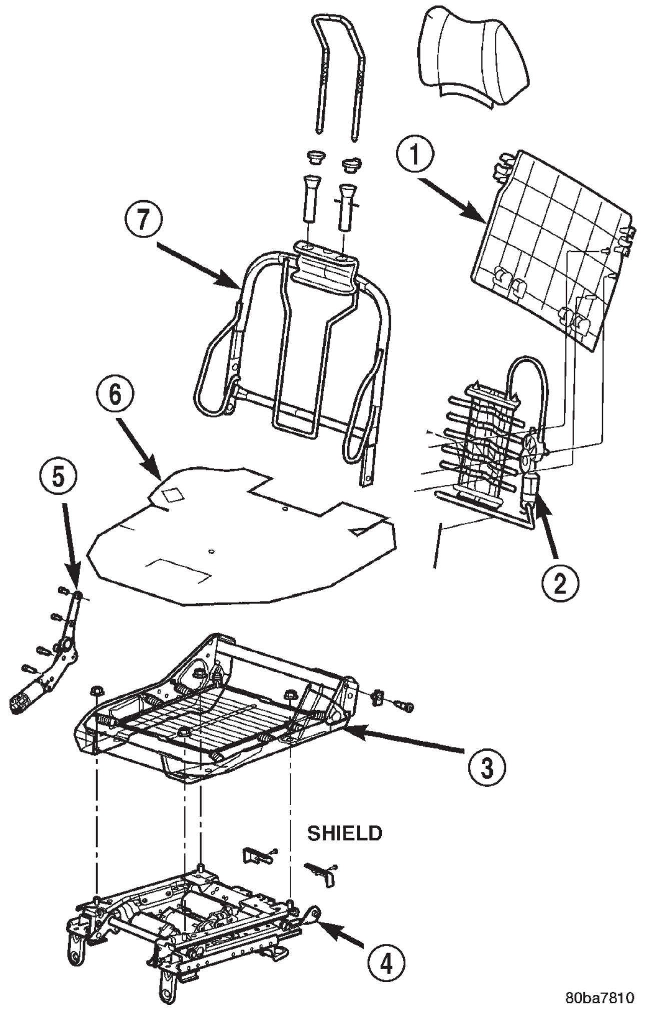


Fig. 7 Seat Track Adjuster—Power

1 - BACK PANEL
2 - LUMBAR ASSEMBLY
3 - SEAT CUSHION FRAME
4 - POWER SEAT TRACK ADJUSTER
5 - POWER RECLINER
6 - SEAT CUSHION PAD
7 - SEAT BACK FRAME

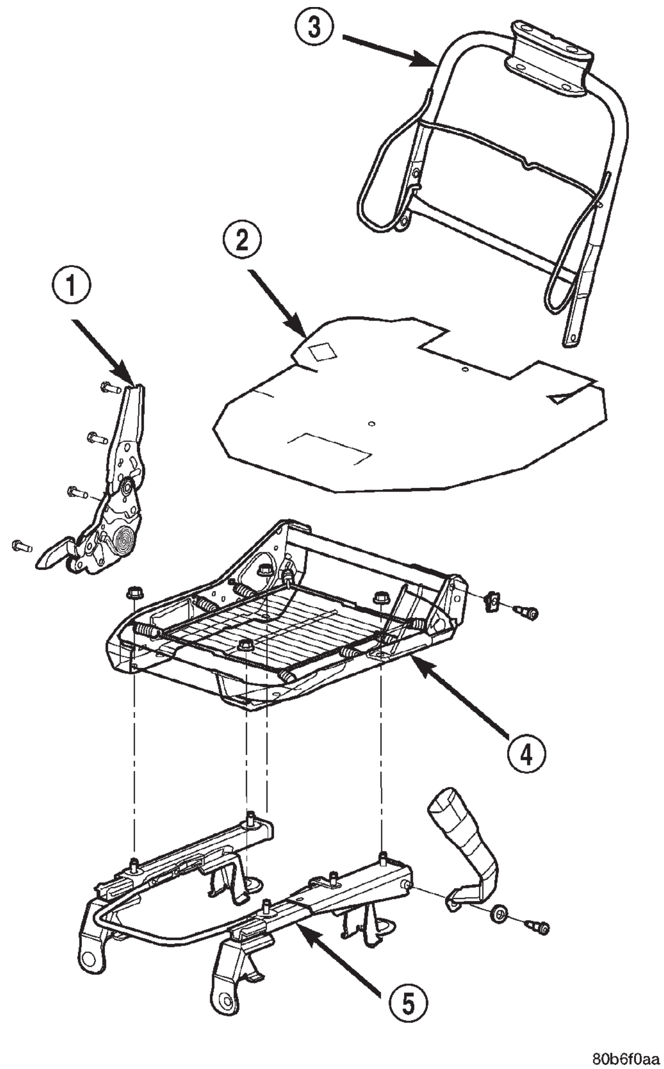


Fig. 8 Seat Track Adjuster — Manual

1 - MANUAL RECLINER
2 - SEAT CUSHION PAD
3 - SEAT BACK FRAME
4 - SEAT CUSHION FRAME
5 - MANUAL SEAT TRACK ADJUSTER

INSTALLATION

(1) Transfer seat memory module, if equipped.

(2) Position seat track on seat cushion frame.

(3) Route harness through frame and engage clips attaching wire harness to adjuster.

(4) Engage seat memory module connector, if equipped.

(5) Install nuts attaching seat track adjuster to seat cushion frame. Tighten nuts to 28 N·m (20 ft. lbs.) torque.

(6) Install the side shield (Refer to 23 - BODY/SEATS/FRONT SEAT SIDE SHIELD - INSTALLATION).

(7) Install seat (Refer to 23 - BODY/SEATS/FRONT SEAT - INSTALLATION).

REAR HEADREST

REMOVAL

(1) Depress head rest release button and lift head rest to full up position.

(2) Using a small flat blade, depress tab on outboard side head rest release button and using your hand, simultaneously press tab on inboard side head rest release button (Fig. 9) and pull head rest up to separate from seat back.

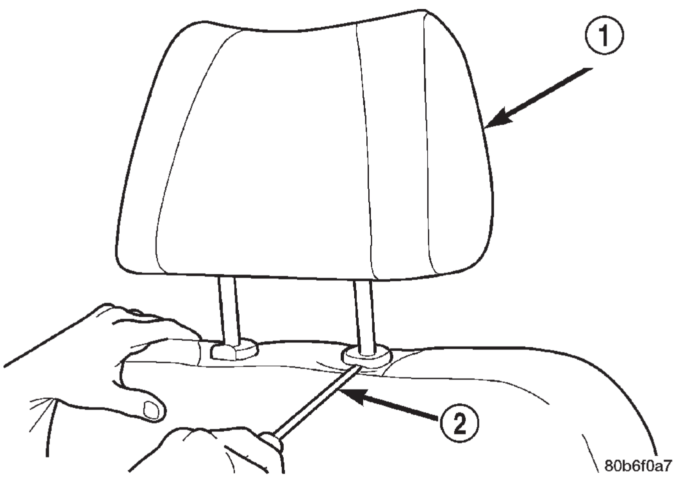


Fig. 9 Head Rest

1 - HEAD RESTRAINT
2 - FLAT BLADE

INSTALLATION

(1) Position head rest in seat back, press tab on inboard side head rest release button cap and push down head restraint to secure.

REAR HEADREST RELEASE KNOB

REMOVAL

(1) Using a razor knife or equivalent, cut the release knob from the release lever.

(2) Pull the release knob from the lever (Fig. 10).

INSTALLATION

(1) Position the release knob on the lever and press to snap in place.

REAR HEADREST FOLDING MECHANISM

REMOVAL

(1) Remove the head rest (Refer to 23 - BODY/SEATS/REAR HEADREST - REMOVAL).

(2) Remove folding mechanism cover (Fig. 10).

(3) Remove the screws that secure the head rest bun to the folding mechanism.

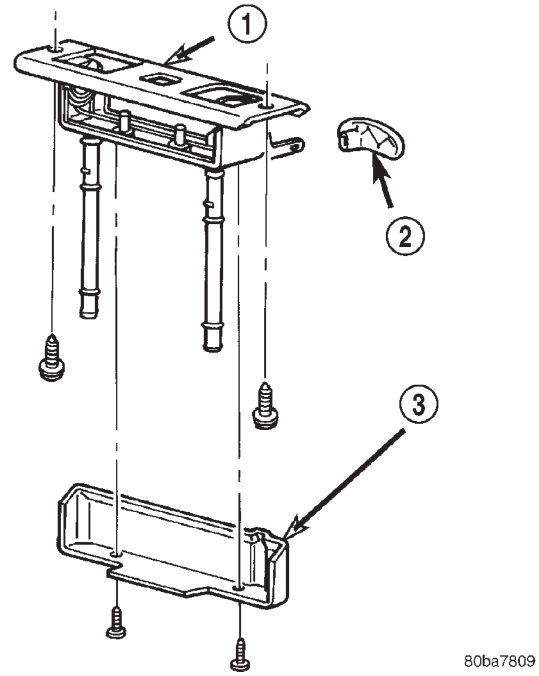


Fig. 10 Rear Seat Head Rest Folding Mechanism

1 - REAR SEAT HEAD REST FOLDING MECHANISM
2 - RELEASE KNOB
3 - FOLDING MECHANISM COVER

NOTE: The folding release knob is always located on the outboard side.

INSTALLATION

(1) Position the head rest bun on the folding mechanism and install the screws.

(2) Install the folding mechanism cover.

(3) Install the head restraint (Refer to 23 - BODY/SEATS/REAR HEADREST - INSTALLATION).

REAR HEADREST SLEEVE

REMOVAL

(1) Remove seat back (Refer to 23 - BODY/SEATS/REAR SEAT BACK - REMOVAL).

(2) Remove head rest (Refer to 23 - BODY/SEATS/REAR HEADREST - REMOVAL).

(3) Remove head rest caps.

(4) Remove seat back cover (Refer to 23 - BODY/SEATS/REAR SEAT BACK COVER - REMOVAL).

(5) Rotate head rest sleeve 1/4 turn counter-clockwise to release retaining tab.

(6) Pull sleeve from seat back frame.

INSTALLATION

(1) Position sleeve in seat back frame.

(2) Rotate head rest sleeve 1/4 turn clockwise to engage retaining tab.

(3) Install seat back cover (Refer to 23 - BODY/SEATS/REAR SEAT BACK COVER - INSTALLATION).

(4) Install head rest caps.

NOTE: The head rest cap with the taller button is always on the inboard side of the seat back.

(5) Install the head rest (Refer to 23 - BODY/SEATS/REAR HEADREST - INSTALLATION).

NOTE: The folding head rest release knob is always on the outboard side.

(6) Install the seat back (Refer to 23 - BODY/SEATS/REAR SEAT BACK - INSTALLATION).

REAR SEAT BACK

REMOVAL

(1) Move rear seat cushions to forward cargo position.

(2) Remove bolts attaching seatback side support bracket to floor pan (right side) (Fig. 11).

(3) Tilt seatback forward, and slide it outboard to detach it from pin on center pivot bracket.

(4) Remove right side (60%) seatback from vehicle.

(5) Remove bolts attaching seatback side support bracket and center pivot bracket to floor pan (left side).

(6) Remove left side (40%) seatback from vehicle.

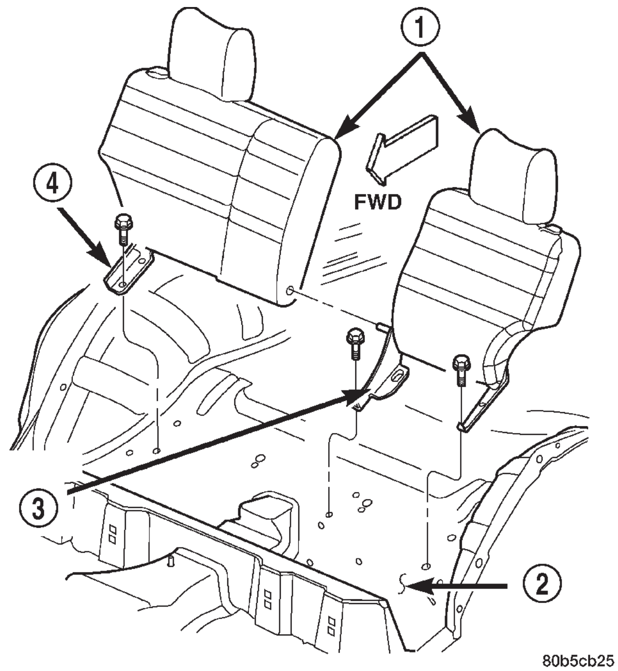


Fig. 11 Rear Seat Back

1 - SEAT BACK
2 - FLOOR PAN
3 - CENTER PIVOT BRACKET
4 - SIDE SUPPORT BRACKET

INSTALLATION

(1) Position left side (40%) seatback in vehicle.

(2) Position left side support bracket and center pivot bracket with bolt holes aligned and install bolts. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Position right side (60%) seatback in vehicle.

(4) Install seatback onto center pivot bracket pin. Ensure seat back is properly engaged on the center pivot pin.

(5) Position right side support bracket with bolt holes aligned and install bolts. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(6) Return seat cushions to seating position.

REAR SEAT BACK COVER

REMOVAL

(1) Remove seat back (Refer to 23 - BODY/SEATS/ REAR SEAT BACK - REMOVAL).

(2) Remove head restraint (Refer to 23 - BODY/ SEATS/REAR HEADREST - REMOVAL).

(3) Remove head restraint caps.

(4) Disengage J-straps on outboard side of seat back.

(5) Disengage J-straps at base of seat back.

(6) Remove screws attaching latch release handle to seat back frame.

(7) Roll seat back cover upward.

(8) Disengage hook and loop fasteners attaching seat back cover to seat back pad (Fig. 12).

(9) Roll seat back cover upward and route latch release handle through seat back cover.

(10) Separate seat back cover from seat back.

(11) Separate seat back pad from seat back frame.

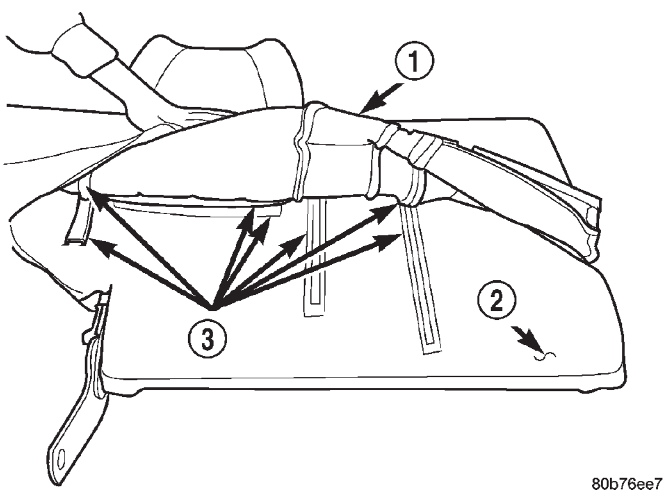


Fig. 12 Rear Seat Back Cover

1 - SEAT BACK COVER
2 - SEAT BACK PAD
3 - HOOK AND LOOP FASTENER

INSTALLATION

(1) Position seat back cover and pad on seat back frame.

(2) Route latch release handle through seat back cover.

(3) Roll seat back cover partially downward aligning holes in seat back cover for head restraint and latch release handle.

(4) Roll seat back cover downward align and engage hook and loop fasteners to seat back pad.

(5) Engage J-straps at base of seat back.

(6) Engage J-straps on outboard side of seat back.

(7) Install screws attaching latch release handle to seat back frame.

(8) Install head restraint (Refer to 23 - BODY/ SEATS/REAR HEADREST - INSTALLATION).

(9) Install seat back (Refer to 23 - BODY/SEATS/ REAR SEAT BACK - INSTALLATION).

REAR SEAT CUSHION

REMOVAL

(1) Disengage seat cushion at rear by pulling upward on release strap.

(2) Remove bolts attaching seat cushion to floor pan (Fig. 13).

(3) Remove seat cushion from vehicle.

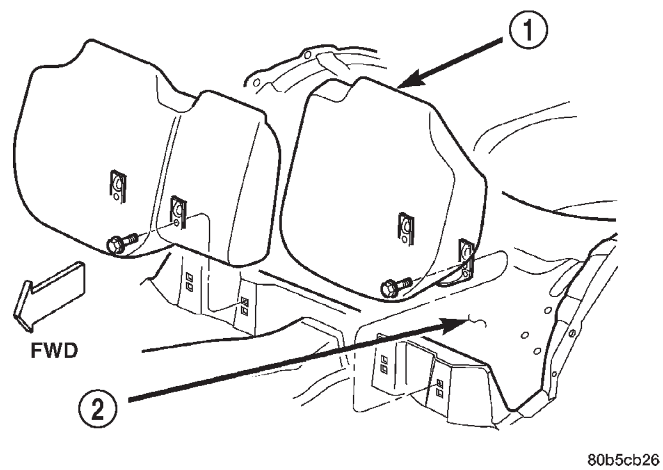


Fig. 13 Rear Seat Cushion

1 - SEAT CUSHION
2 - FLOOR PAN

INSTALLATION

(1) Position seat cushion in vehicle.

(2) Install bolts attaching seat cushion to floor pan. Tighten bolts to 11 N·m (8 ft. lbs.) torque.

(3) Lock seat cushion down by pressing firmly on center of cushion until latch engages.

REAR SEAT CUSHION COVER

REMOVAL

(1) Remove rear seat cushion (Refer to 23 - BODY/SEATS/REAR SEAT CUSHION - REMOVAL).

(2) From the underside of the seat, disengage J-straps attaching cover to seat cushion base panel.

(3) Remove push-in fasteners attaching cushion cover to seat cushion base panel (Fig. 14).

(4) Roll back cover.

(5) Disengage hog rings attaching cushion cover to seat cushion foam pad.

(6) Separate cushion cover from seat cushion foam pad.

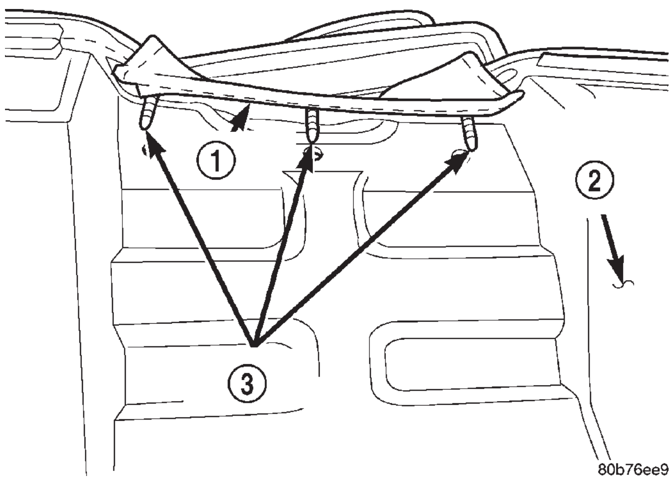


Fig. 14 Push-in Fasteners

1 - CUSHION COVER
2 - SEAT CUSHION BASE PANEL
3 - PUSH-IN FASTENER

INSTALLATION

(1) Position cushion cover on seat cushion foam pad.

(2) Engage hog rings attaching cushion cover to seat cushion foam pad.

(3) Align cushion cover and engage J-straps attaching cushion cover to seat cushion base panel.

(4) Install push-in fasteners attaching cushion cover to seat cushion base panel.

(5) Install rear seat cushion (Refer to 23 - BODY/SEATS/REAR SEAT CUSHION - INSTALLATION).

REAR SEAT CUSHION RELEASE LATCH

REMOVAL

(1) Unlatch seat and pivot seat upward.

(2) Disengage J-strap at seat cushion base panel.

(3) Roll back cushion cover.

(4) Remove screws attaching latch to base panel.

(5) Separate latch from base panel.

INSTALLATION

(1) Position latch on base panel.

(2) Install screws attaching latch to base panel. Tighten screws to 8 N·m (75 in. lbs.) torque.

(3) Route the cushion release strap from the loop on the latch through the slot in the trim cover.

(4) Engage J-strap at seat cushion base panel.

(5) latch seat.

FOLDING REAR SEAT BACK LATCH HANDLE

REMOVAL

(1) Pull handle to release latch.

(2) Remove screws attaching release handle to seat back frame.

(3) Using a small flat blade, disengage retainers securing latch release cable housing to latch release handle.

(4) Rotate cable end until barrel end aligns with key hole slot in latch release handle.

(5) Disengage cable barrel end from release handle.

(6) Separate latch release handle from seat back (Fig. 15).

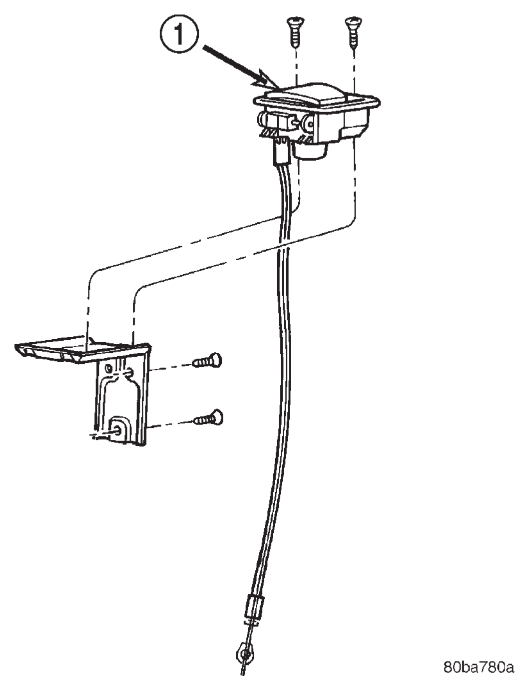


Fig. 15 Rear Seat Release Handle

1 - REAR SEAT FOLDING RELEASE HANDLE

INSTALLATION

(1) Route cable end into latch release handle.

(2) Rotate cable end until barrel end aligns with key hole slot in latch release handle and insert into handle.

(3) Engage retainers securing latch release cable housing to latch release handle.

(4) Position latch release handle in seat back. Ensure seat back cover is properly aligned.

(5) Install screws attaching release handle to seat back frame.

FOLDING REAR SEAT BACK LATCH/HINGE

REMOVAL

(1) Remove seat back (Refer to 23 - BODY/SEATS/ REAR SEAT BACK - REMOVAL).

(2) Disengage J-straps on outboard side of seat back.

(3) Disengage release cable from latch.

(4) Remove bolts attaching latch/hinge to seat back frame.

(5) Separate latch/hinge from seat back frame.

INSTALLATION

(1) Position latch/hinge on seat back frame.

(2) Install bolts attaching latch/hinge to seat back frame. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Engage latch release cable.

(4) Engage J-straps on outboard side of seat back.

(5) Install seat back (Refer to 23 - BODY/SEATS/ REAR SEAT BACK - INSTALLATION).

STATIONARY GLASS

TABLE OF CONTENTS

DOOR GLASS

REMOVAL

(1) Remove door trim panel.
(2) Remove waterdam.
(3) Remove inner belt weatherstrip.
(4) Remove bolt attaching bottom of rear glass run channel to door.
(5) Pull run channel downward and separate from door.
(6) Remove screws attaching stationary door glass frame to door (Fig. 1) and (Fig. 2).
(7) Separate stationary door glass from door.

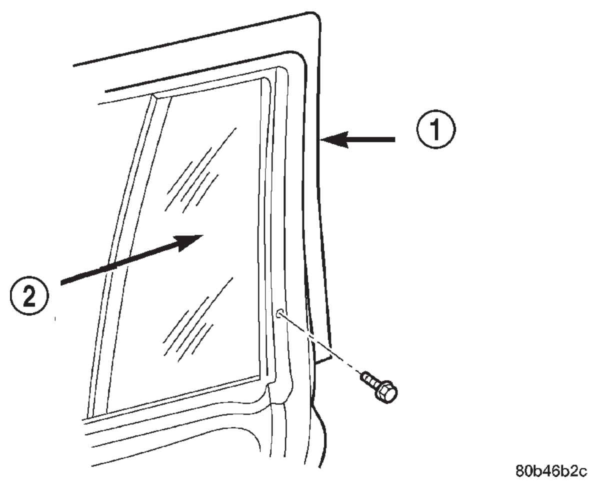


Fig. 1 Stationary Door Glass

1 - DOOR
2 - STATIONARY DOOR GLASS

INSTALLATION

(1) Position stationary door glass in door.
(2) Install screws attaching stationary door glass frame to door.
(3) Install glass run channel.
(4) Install inner belt weatherstrip.
(5) Install waterdam.
(6) Install door trim panel.

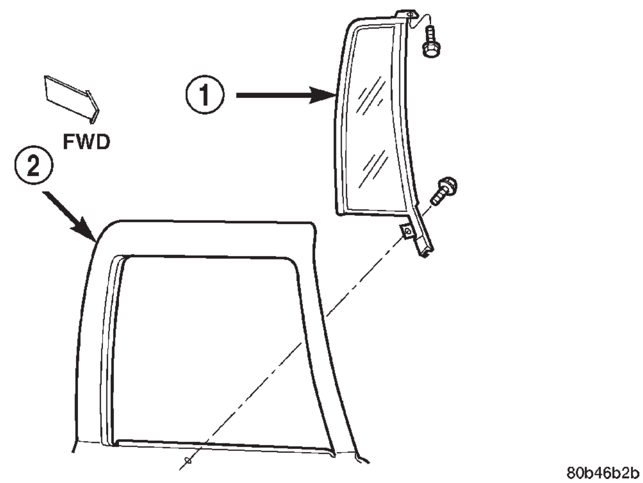


Fig. 2 Stationary Door Glass

1 - STATIONARY DOOR GLASS
2 - DOOR

QUARTER WINDOW

REMOVAL

(1) Cut urethane bonding from around quarter window glass using a suitable sharp cold knife. A pneumatic cutting device can be used if available.
(2) Separate glass from vehicle.

INSTALLATION

CAUTION: Open a window before installing glass. This will avoid pressurizing the passenger compartment. If a door or liftgate is slammed before urethane is cured, water leaks can result.

The window opening fence should be cleaned of old urethane bonding material.
(1) Clean inside of glass with Mopar Glass Cleaner and lint-free cloth.
(2) Apply PVC (vinyl) primer 25 mm (1 in.) wide around edge of glass. Wipe with clean/dry lint-free cloth.

QUARTER WINDOW (Continued)

(3) Apply fence primer around edge of fence. Allow at least eighteen minutes drying time.

(4) Apply a 10 mm (0.4 in.) bead of urethane around window vinyl border location.

(5)
Position glass into window opening and lock clips into place (Fig. 3).

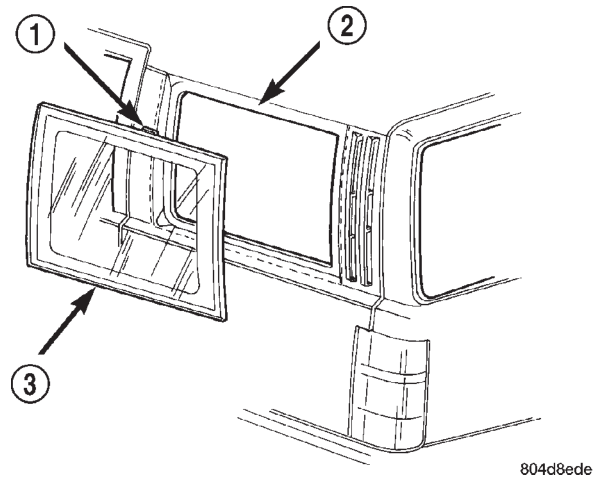


Fig. 3 Quarter Window Glass

1 - CLIP
2 - ROOF PANEL
3 - QUARTER WINDOW GLASS

WINDSHIELD

REMOVAL

(1) Remove inside rear view mirror.

(2) Remove cowl cover.

(3) Remove screws attaching windshield side molding to A-pillar (Fig. 4).

(4) Remove upper windshield molding.

(5) Cut urethane bonding from around windshield using a suitable sharp cold knife. A pneumatic cutting device can be used if available (Fig. 5).

(6) Separate windshield from vehicle.

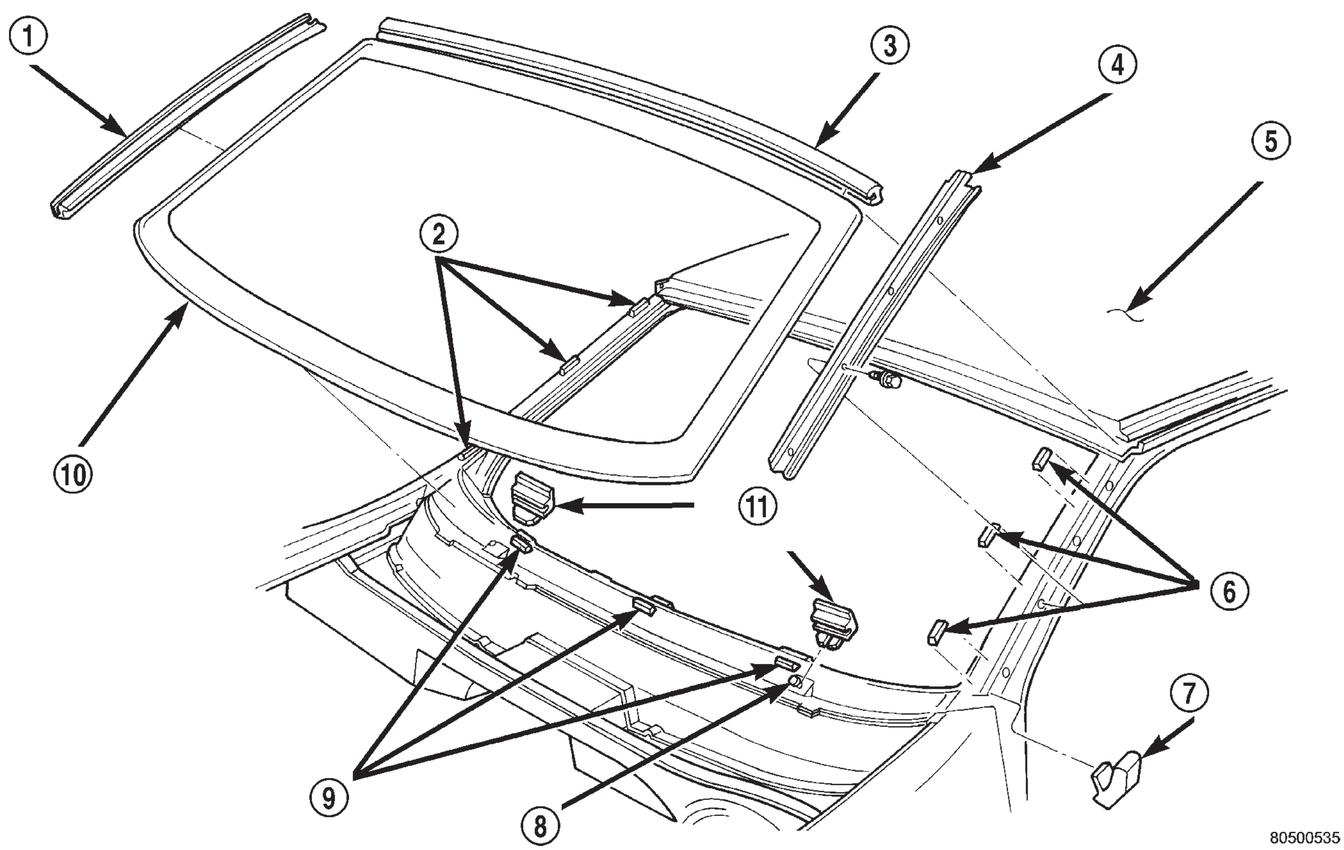


Fig. 4 Windshield

1 - SIDE MOLDING
2 - SUPPORT SPACER
3 - UPPER MOLDING
4 - SIDE MOLDING
5 - ROOF PANEL
6 - SUPPORT SPACER
7 - BLOCKER
8 - STUD
9 - SUPPORT SPACER
10 - WINDSHIELD
11 - ALIGNMENT SPACER

WINDSHIELD (Continued)

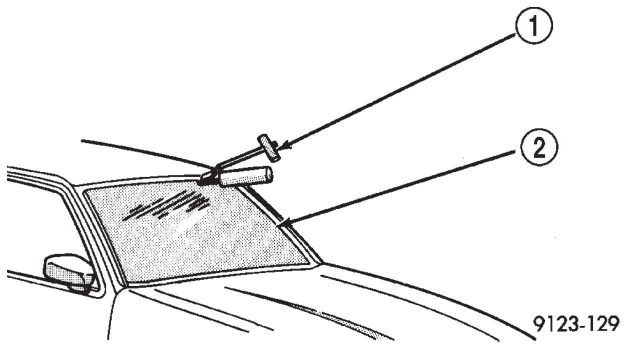


Fig. 5 Cut Urethane Around Windshield—Typical

1 - COLD KNIFE
2 - WINDSHIELD

INSTALLATION

WARNING: REVIEW ALL WARNINGS AND CAUTIONS IN THIS GROUP BEFORE PRECEDING WITH INSTALLATION.

CAUTION: Open a window before installing windshield. This will avoid pressurizing the passenger compartment. If a door or liftgate is slammed before urethane is cured, water leaks can result.

The windshield fence should be cleaned of old urethane bonding material. Support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

(1) Place replacement windshield into windshield opening. Position glass in the center of the opening against the support spacers. Mark the glass at the support spacers with a grease pencil or masking tape and ink pen to use as a reference for installation. Remove replacement windshield from windshield opening (Fig. 6).

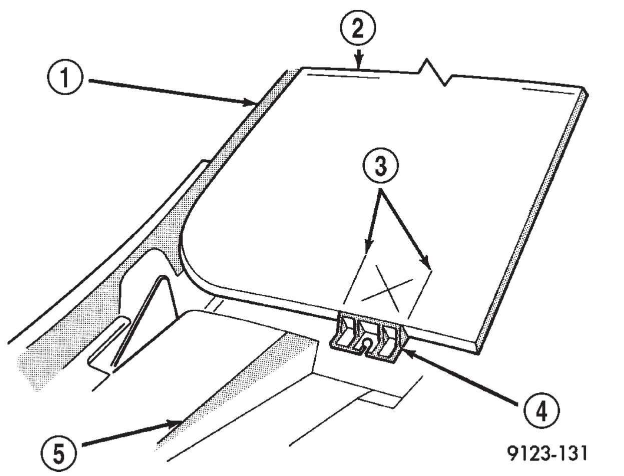


Fig. 6 Center Windshield and Mark at Support Spacers

1 - A-PILLAR
2 - WINDSHIELD
3 - MARKS
4 - SUPPORT SPACER
5 - COWL

(2) Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart (Fig. 7).

(3) Clean inside of windshield with Mopar Glass Cleaner and lint-free cloth.

(4) Apply clear glass primer 25 mm (1 in.) wide around edge of windshield. Wipe with clean/dry lint-free cloth.

(5) Apply black-out primer 15 mm (.75 in.) wide on top and sides of windshield and 25 mm (1 in.) on bottom of windshield. Allow at least three minutes drying time.

(6) Position windshield spacers on lower fence above support spacers at the edge of the windshield opening (Fig. 4).

(7) Apply a 10 mm (0.4 in.) bead of urethane around perimeter of windshield along the inside of the moldings. Apply two beads along the bottom edge.

(8) Install upper molding onto windshield.

(9) Apply fence primer around the perimeter of the windshield opening fence. Allow at least 18 minutes drying time.

(10) With aid of a helper, position windshield over windshield opening. Align reference marks at bottom of windshield to support spacers.

(11) Slowly lower windshield glass to windshield opening fence. Guide top molding into proper position if necessary. Push windshield inward to fence spacers at bottom and until top molding is flush to roof line.

(12) Clean excess urethane from exterior with Mopar Super Clean or equivalent.

(13) Install windshield side moldings.

(14) Install cowl cover and wipers.

(15) Install inside rear view mirror.

(16) After urethane has cured, water test windshield to verify repair.

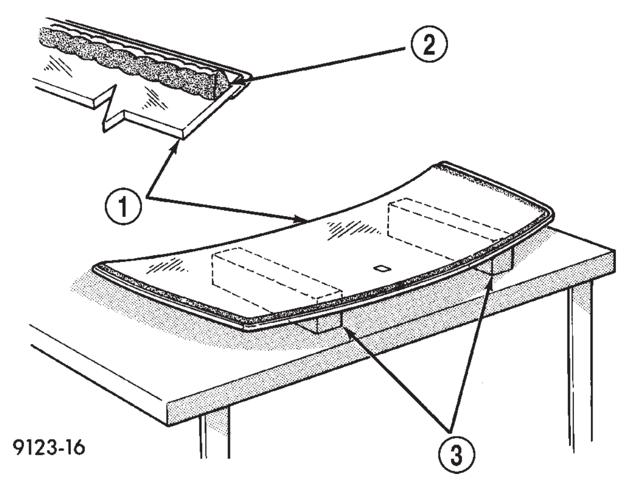


Fig. 7 Work Surface Set up and Molding Installation

1 - WINDSHIELD AND MOULDINGS
2 - URETHANE BEAD AROUND GLASS 7mm (.3 in.) FROM EDGE
3 - BLOCKS

SUNROOF

TABLE OF CONTENTS

SUNROOF

DESCRIPTION

WARNING: Keep fingers and other body parts out of sunroof opening at all times.

The sunroof features a power sliding glass panel and a sunshade which can be manually positioned anywhere along its travel, rearward of glass panel front edge.

The sunroof is electrically operated from a switch located on the mini overhead console. To operate the sunroof the ignition switch must be in the On/Run position. The sunroof has both manual and Express Open modes of operation when opening. To open the sunroof in the Express Open mode, the switch is pressed rearward for less than **1 second.** This causes the sunroof glass to automatically retract and stop at a position slightly forward of full open that reduces low speed wind buffeting. The sunroof can also be opened manually by pressing and holding the switch rearward. Once the switch is held reward for more than **1 second,** the glass will retract in the manual mode. Releasing the switch at any time during travel will cause the sunroof to stop at the current position.

To close the sunroof from an open position, the switch must be pushed forward and held until the sunroof glass comes to a complete stop. Releasing the switch at any time in this mode will cause the sunroof to stop at the current position.

To vent the sunroof from the closed position, the switch is pushed forward and held. Releasing the switch at any time during travel will cause the sunroof to stop at the current vent position. To reach the fully vented position, continue to hold the switch forward until vent motion stops. To close the sunroof from the vent position, push and hold the switch rearward until the glass comes to a complete stop.

DIAGNOSIS AND TESTING - SUNROOF

CAUTION: The sunroof motor is only to be powered through the vehicle battery and vehicle wire harness. Applying power to the sunroof motor leads will cause failure of the sunroof control unit.

Before beginning sunroof diagnostics verify that all other power accessories are in proper operating condition. Refer to Sunroof Diagnostic Chart for possible causes. If not, a common electrical problem may exist. Refer to Group 8W, Wiring Diagrams, of this publication for circuit, splice and component descriptions. Check the condition of the circuit protection (20 amp high current fuse (battery feed) located in the Power Distribution Center (PDC). Check the cover of the PDC for location of the fuse. Check for correct operation of the sunroof delay relay. Inspect all wiring connector pins for proper engagement and continuity. Check for battery voltage at battery and ignition pins of the power sunroof express module wiring connector. Refer to Group 8W, Wiring Diagrams, for circuit information. The controller will not operate at less than 10 volts. Check the ground at the sunroof express module.

Before beginning diagnosis for wind noise or water leaks, verify that the problem was not caused by

SUNROOF (Continued)

releasing the control switch before the sunroof was fully closed. The sunroof module has a water-management system. During washing high-pressure water may be forced between the glass panel seal and the roof opening. Normally this water will drain. However, when some type of drying blower system is used, like those found in automatic car washes, the water may not have a chance to drain before the blower forces air between the seal and the roof opening. This causes the water to blow over the edge of the module and onto the headlining.

Refer to (Fig. 1) Sunroof Assembly for exploded view of the sunroof.

SYMPTOM	STEP	POSSIBLE CAUSE
Sunroof squeaks when opening/closing.	1	Identify if the cause is a seal squeak. If seal is worn, replace the seal.
	2	Check seal compression for uniformity in opening, If not uniform, glass is not centered in opening.
	3	Re-center glass by repositioning module in opening.
	4	Identify if mechanism squeaks.
	5	Check for lubrication, re-lube if necessary.
	6	Check for dirt/debris in tracks, clean and re-lube.
	7	Identify if motor squeaks, replace the motor.
Water leaks into the vehicle.	1	Check for a good connection at the drain tubes, re-connect where needed.
	2	Check for plugged/pinched hoses throughout.
	3	Adjust the glass panel. Refer to glass panel adjustments in this section.
	4	Check seal for wear/damage, replace glass as necessary.
Motor inoperative.	1	Check connectors at the motor, switch, control module and power source.
	2	Check for defective control module, replace if necessary.
	3	Replace the motor.
Motor noise when opening/ closing.	1	Identify if motor noise, replace motor.
	2	Insure noise is from the motor and not cables, (cable ratcheting).
Grinding noise when opening/ closing.	1	Identify if the motor is grinding, replace motor.
(Mechanism noise, scraping.)	2	Check for lubrication in tracks and mechanism, re-lube if necessary.
	3	Check for dirt/debris in tracks, clean and re-lube.
(Cable ratcheting.)	4	Cables ratchet at the motor pinion; mechanism jammed, fix mechanism and replace cables and motor bracket.
Wind noise when sunroof fully closed.	1	Check seal compression for uniformity in opening, If not uniform, glass is not centered in opening.
	2	Glass not adjusted flush to roof. Refer to glass panel adjustments in this section.
	3	Mechanism not fully closed. A) Motor out of time, re-time motor/mechanism. Refer to glass panel adjustments in this section. B) Cable ratcheting, replace cables and motor bracket.
	4	Seal worn, replace glass.
Sunroof will not open/close.	1	Check switch and switch connection.

SUNROOF (Continued)

SYMPTOM	STEP	POSSIBLE CAUSE
	2	Check mechanism for binding (result of forcing the glass closed/ broken components).
	3	See motor inoperative above.
Sunroof ″rattles″, anytime, closed/open.	1	Loose attachment screws (module), re-fasten and adjust module.
	2	Loose glass panel, re-fasten and adjust glass panel.
	3	Loose drain channel, refasten/secure to repair.
	4	Broken mechanism, replace the sunroof assembly module.
	5	Mechanism not fully closed. A) Motor out of time, re-time motor/mechanism. Refer to glass panel adjustments in this section. B) Cable ratcheting, replace cables and motor bracket.
	6	Check for sunshade out of track or for sunshade broken slide block.
	7	Loose wind deflector. Replace if broken.
	8	Loose wind deflector spring. Replace if loose.
Sunshade squeaks/rattles, anytime. -OR- Sunshade force high/low or binding during operation.	1	Sunshade slide blocks out of track(s), put back in tracks.
	2	Missing felt pads on the drain channel, add felt pads.
	3	Felt on the drain channel rolling off, (sunshade rubs on adhesive), replace felt pads.
	4	Slide block binding in sunshade, free-up slide block by actuating a couple times, grease slide block(s) and spring(s).
	5	Broken slide block in sunshade, replace slide block.
	6	Slide block spring missing, replace spring and slide block.
	7	Sunshade interference with drain channel or trim welt, replace trim welt and/or sunshade.
Motor/sunroof control module operation: Auto open doesn’t work, or doesn’t stop at closed position.	1	After power disconnect or replacement, sunroof module has to complete on full cycle to program the sunroof control module. Full cycle = close > open > close > vent > close.

SUNROOF (Continued)

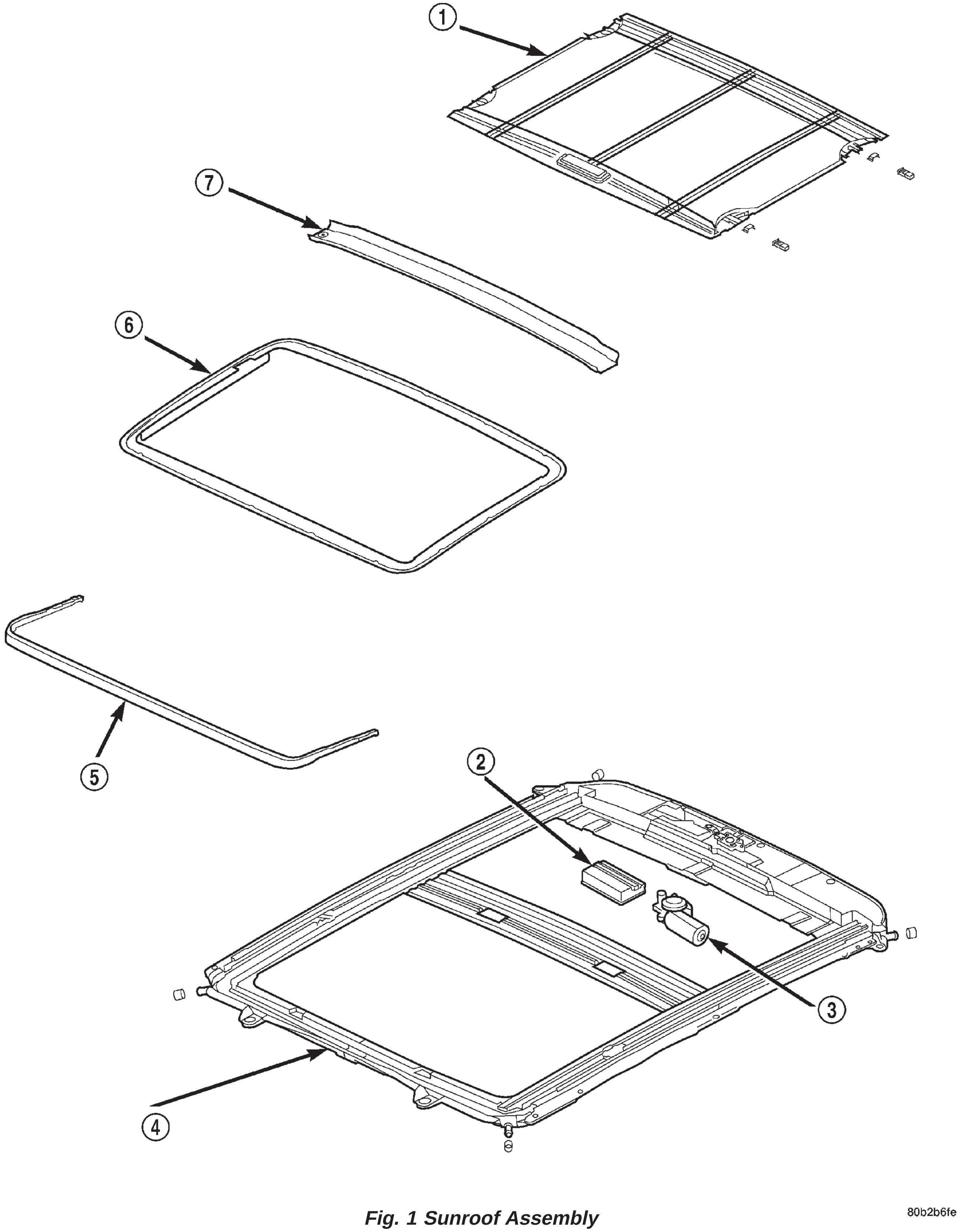


Fig. 1 Sunroof Assembly

1 - SUNSHADE
2 - EXPRESS MODULE
3 - DRIVE MOTOR
4 - FRAME ASSEMBLY
5 - WIND DEFLECTOR
6 - GLASS PANEL
7 - DRAIN CHANNEL

DRAIN TUBE

REMOVAL

(1) Remove the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)

(2) Disengage clamps attaching drain tube to sunroof (Fig. 2).

(3) Tape the end of the old drain tube to the new drain tube. Ensure that the tape build up on the tube ends is not excessive.

(4) Remove front/rear trim panels as necessary to disengage clamps securing drain tube to body.

(5) Remove the drain tube plug from the underside of the vehicle.

(6) From the underside of the vehicle carefully, pull/route the drain tube through the body panel. Applying a soapy water solution to the new tube may aid in this procedure.

INSTALLATION

(1) Install the plug adapter to the bottom of the drain tube.

(2) Engage clamps securing drain tube to body (Fig. 2).

(3) Install front/rear trim panels as necessary.

(4) Install drain tube to sunroof and engage clamp.

(5) Install the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)

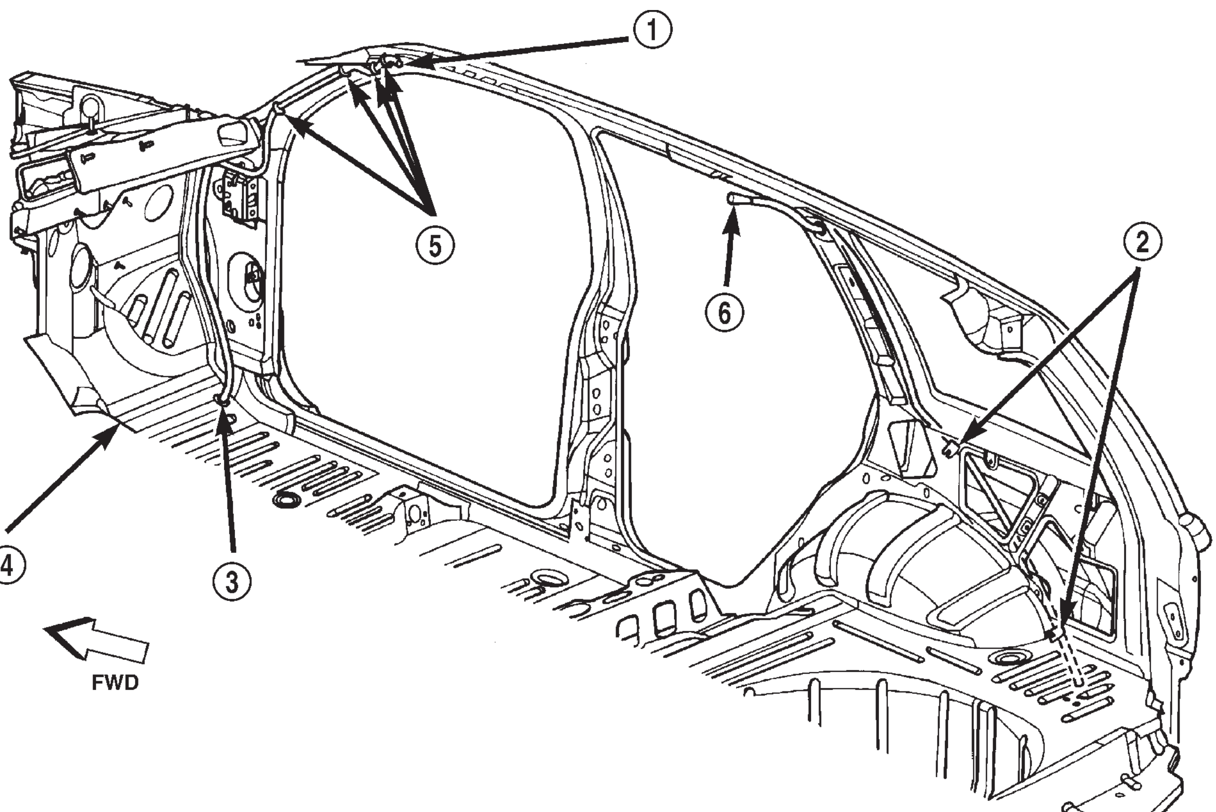


Fig. 2 Sunroof Drain Hose Routing

1 - DRAIN HOSE
2 - CLAMPS
3 - PLUG
4 - FLOOR
5 - CLAMPS
6 - DRAIN HOSE

CONTROL MODULE

REMOVAL

(1) Move the glass panel to the fully closed position.

(2) Remove the A-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL)

(3) Remove the sun visors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL)

(4) Remove the overhead console. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL)

(5) Lower headliner as necessary to gain access to the sunroof express module.

(6) Disconnect the express module wire harness connectors.

(7) Remove express module screw.

(8) Remove express module from the keyway by sliding module towards the center of the vehicle.

INSTALLATION

(1) Insert sunroof express module in the keyway located in the sunroof module and slide the module outward to lock it into position.

(2) Install the sunroof express module screw.

(3) Connect the wire connectors to the sunroof express module.

(4) Install the headliner into position.

(5) Install the overhead console. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION)

(6) Install the sun visors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION)

(7) Install the A-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION)

(8) Test sunroof operation, adjust if necessary. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS)

DRIVE MOTOR

REMOVAL

CAUTION: The sunroof system is timed from the factory so that the motor shuts off automatically when the sunroof window reaches a certain position. Extreme care must be taken when removing the motor, timing may be thrown off causing possible damage to the sunroof system. Anytime the motor is removed from the sunroof assembly the sunroof glass panel must be in the FULLY CLOSED POSITION or the unit will be out of timing. The drive motor cannot be reset to the park position after being removed.

CAUTION: The sunroof motor should only be powered through the vehicle battery and sunroof wire harness. Applying power to the sunroof motor leads will cause failure of the control module.

(1) Move glass panel to the fully closed position.

(2) Remove the A-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL)

(3) Remove the B-pillar upper trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL)

(4) Remove the C-pillar trim. (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL)

(5) Remove the D-pillar trim. (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - REMOVAL)

(6) Remove the sunvisors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL)

(7) Remove the overhead console. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL)

(8) Disconnect the control switch wire connector.

(9) Remove headliner as necessary to gain access to sunroof drive motor. Refer to Headliner Removal and Installation for proper procedures.

(10) Disconnect the drive motor wire harness connectors (Fig. 3).

(11) Remove drive motor fasteners and remove motor from the sunroof housing.

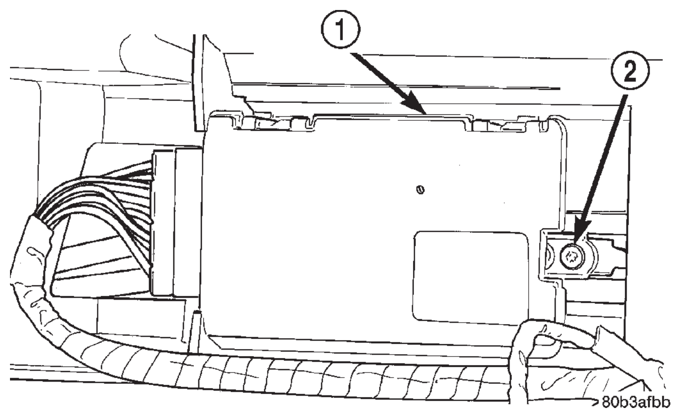


Fig. 3 Sunroof Drive Motor and Express Module

1 - EXPRESS MODULE
2 - SCREW

INSTALLATION

(1) Ensure that the window is in the fully closed position before mounting the motor. If motor fails with the window in the open position the sunroof glass panel timing will have to be timed. The new motor comes in the fully closed position and with a gage for setting cable timing. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS - TIMING)

(2) Place drive motor into position on the sunroof housing and install fasteners.

DRIVE MOTOR (Continued)

(3) Connect express module, drive motor, and control switch wire connectors.

(4) Set headliner into position.

(5) Test sunroof operation, adjust as necessary. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS)

(6) Finish installing the headliner.

(7) Connect the control switch wire connector.

(8) Install the overhead console. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION)

(9) Install the sunvisors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION)

(10) Install the D-pillar trim. (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - INSTALLATION)

(11) Install the C-pillar trim. (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION)

(12) Install the B-pillar upper trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION)

(13) Install the A-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION)

WIND DEFLECTOR

REMOVAL

(1) Open sunroof glass panel.

(2) Push down one corner of the wind deflector and let the other corner rise up (Fig. 4).

(3) Push the low corner towards the opposite side of the vehicle until tab on sunshade clears the body. Then raise the corner up.

(4) Repeat the procedure to the other corner.

(5) Lift wind deflector to 90% of the way.

(6) Push the attaching ends of the deflector to the rear of the vehicle to disengage the deflector.

INSTALLATION

(1) Place wind deflector at 90% in the vertical position to the sunroof. With the sunroof open.

(2) Push ends of the deflector towards the front of the vehicle to engage ends.

(3) Lower wind deflector to normal position.

(4) Push one corner to the opposite side of the vehicle until tab clears vehicle body and lower deflector for that corner.

(5) Push the side that was just installed completely down.

(6) Push the opposite corner cross vehicle until tab clears the body. Then lower deflector to position.

(7) Test sunroof operation.

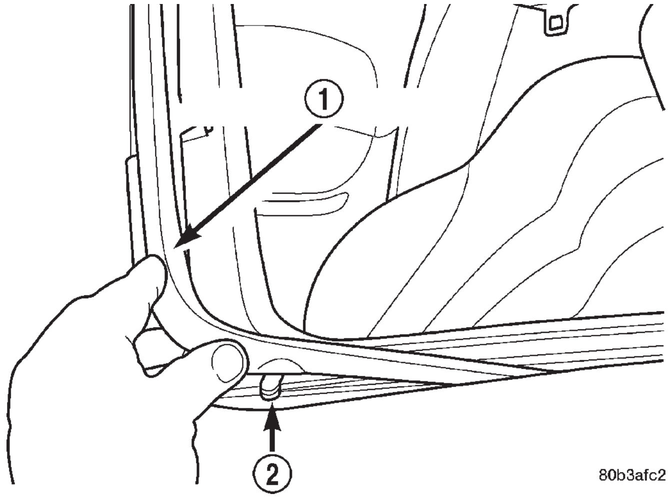


Fig. 4 Wind Deflector

1 - WIND DEFLECTOR
2 - TAB

GLASS PANEL

REMOVAL

(1) Slide sunshade rearward to the open position.

(2) Move the glass panel to the fully closed position.

(3) Remove the four attaching screws (Fig. 5).

(4) Lift off glass panel and remove from vehicle.

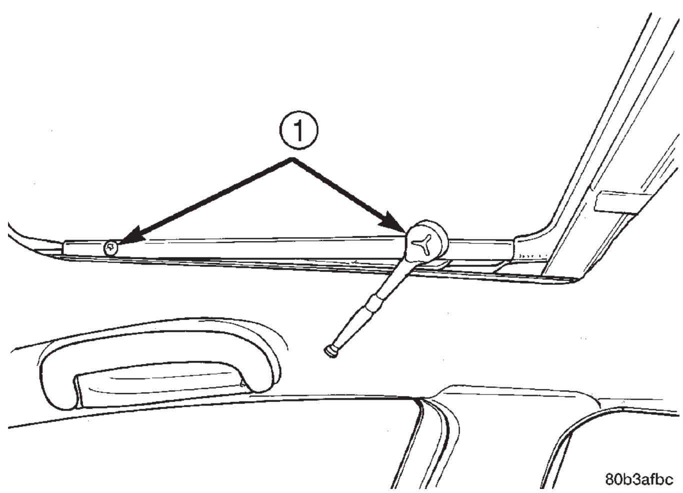


Fig. 5 Sunroof Glass Panel Removal

1 - ATTACHING SCREW

GLASS PANEL (Continued)

INSTALLATION

NOTE: Sunroof glass must be set in place and attached as close as possible to flush with the roof surface. For wind noise reasons, care must be taken to ensure that the glass is not remounted either a) Overflush to the roof surface at the front edge of the glass, or b) Underflush to the roof surface at the rear edge of the glass.

(1) Position glass panel in to opening.
(2) Start the four attaching screws.
(3) Tighten screws.
(4) Verify sunroof operation and alignment. Check fit and adjust as necessary. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS - FIT)

ADJUSTMENTS

ADJUSTMENTS - FIT

(1) Move the sunshade rearward to the open position.
(2) Move the sunroof glass panel to the fully closed position.
(3) Loosen the forward screws on each side enough to make the front adjustment.
(4) Adjust the front of the sunroof glass panel 1 mm (1/32 inch) below the top surface of the roof panel.
(5) Tighten the front two screws.
(6) Loosen the rear screws on each side enough to make the rear adjustment.
(7) Adjust the rear of the sunroof glass panel 1 mm (1/32 inch) above the top surface of the roof panel.
(8) Tighten the rear two screws.
(9) Check for proper fit. If not OK, repeat glass panel adjustment.

ADJUSTMENT - TIMING

NOTE: A gage comes with the new motor.

(1) If the glass panel was not in the fully closed position, when the motor was removed, the sunroof glass panel needs to be timed, before the new motor is installed.
(2) Remove sunroof glass panel.
(3) Set gage into the track near the rear of the opening between the driver slide and the bracket (Fig. 6).
(4) Move the driver slide forward or aft to get proper setting.
(5) Repeat the operation on the other side.
(6) Install drive motor.

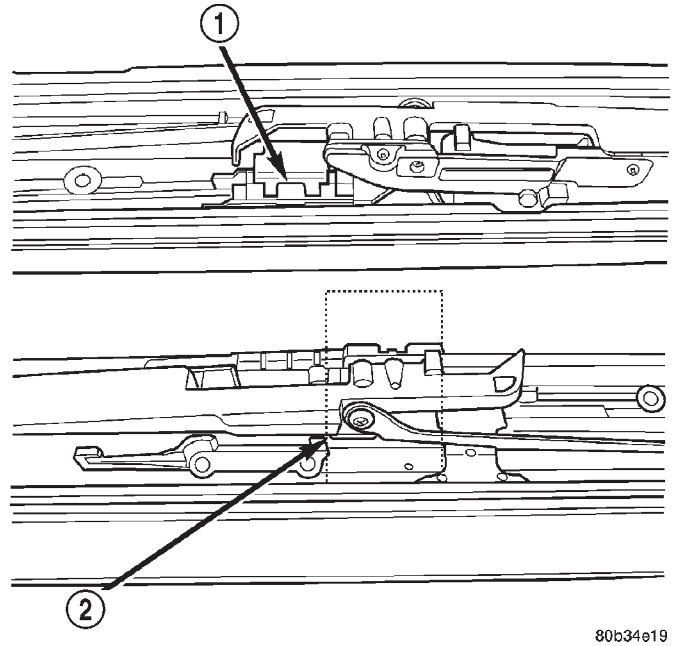


Fig. 6 Sunroof Drive Cable Timing

1 - MOVE DRIVER SLIDE FORWARD/AFT
2 - GAGE

SUNSHADE

REMOVAL

(1) Open sunroof approximately 50% of the way.
(2) Push sunshade down until tabs clear glass.
(3) Move sunshade forward of glass panel.
(4) Compress the spring loaded plungers holding the guide blocks in the track.
(5) Slide the sunshade forward while lifting the front through the opening until the rear guide blocks are accessible.

CAUTION: Use care not to crease the sunshade when removing or installing.

(6) Disengage rear guide blocks from track.

INSTALLATION

(1) Install the sunshade from outside of the vehicle with the sunroof fully open.
(2) Put rear guide blocks into sunshade guide track.
(3) Push sunshade back and down through the sunroof opening.
(4) Using a flat blade tool, put front guide blocks into the sunshade track. By pushing the block towards the center of the vehicle.
(5) Move the glass panel to approximately halfway to the fully closed position.

SUNSHADE (Continued)

(6) Push sunshade down until the sunshade clears the glass then move sunshade rearward behind the glass panel.

HOUSING ASSEMBLY

REMOVAL

(1) Move glass panel to the fully closed position.

(2) Disconnect battery negative cable.

(3) Recline both front seats.

(4) Remove headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)

(5) Disconnect the drain tubes from sunroof housing (Fig. 7).

(6) Loosen fasteners attaching sunroof housing assembly.

(7) With the aid of a helper, remove fasteners attaching sunroof housing assembly to roof panel.

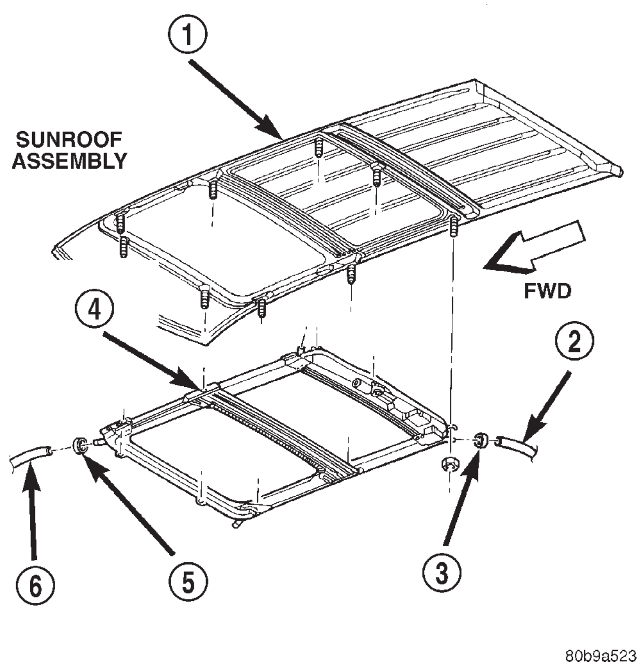


Fig. 7 SUNROOF ASSEMBLY

1 - ROOF
2 - DRAIN HOSE
3 - CLAMP
4 - SUNROOF ASSEMBLY
5 - CLAMP
6 - DRAIN HOSE

INSTALLATION

(1) Raise the sunroof housing assembly and guide into position and start fasteners (Fig. 7).

(2) Tighten the fasteners, front to rear, attaching the sunroof module to roof panel. Tighten the fasteners, front to rear, to 11 N·m (97 in. lbs.) torque.

(3) Connect the drain tubes to the sunroof housing.

(4) Set headliner into position.

(5) Connect express module, drive motor, and control switch wire connectors.

(6) Test sunroof operation, adjust as necessary.

(7) Finish installing the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)

(8) Connect battery negative cable.

WEATHERSTRIP/SEALS

TABLE OF CONTENTS

B-PILLAR DOOR SEAL

REMOVAL

The B-pillar seal is attached to the rear door with adhesive tape.

(1) Peel seal from the door (Fig. 1).

INSTALLATION

(1) Clean contact area with Mopar® Super Kleen or equivalent.

(2) Remove carrier from seal.

(3) Align seal on door and press into place.

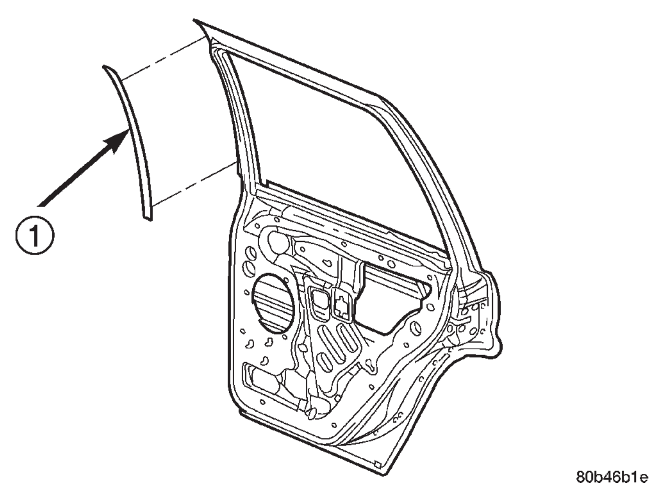


Fig. 1 B-Pillar Seal

1 - B-PILLAR SEAL

COWL WEATHERSTRIP

REMOVAL

(1) Raise hood.
(2) Pull cowl plenum seal from cowl.
(3) Separate cowl plenum seal from cowl (Fig. 2).

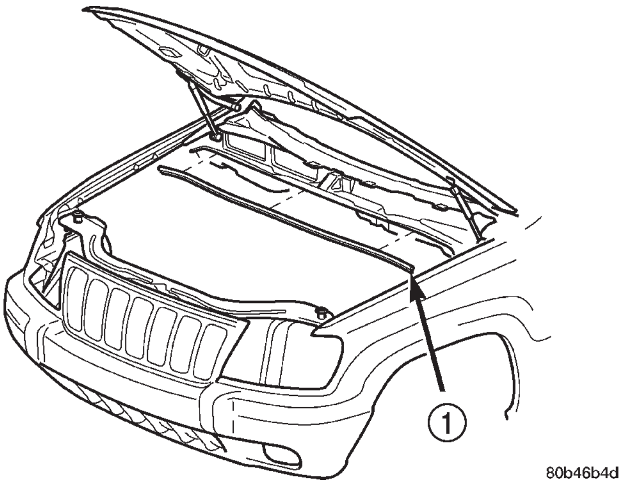


Fig. 2 Cowl Plenum Seal

1 - PLENUM SEAL

INSTALLATION

(1) Position cowl plenum seal on cowl.
(2) Press cowl plenum seal to seat.

FRONT DOOR GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove inner belt weatherstrip (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR INNER BELT WEATHERSTRIP - REMOVAL).
(2) Remove outer belt weatherstrip (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR OUTER BELT WEATHERSTRIP - REMOVAL).
(3) Grasp seal from upper run channel corner and firmly pull weatherstrip from flange and run channel (Fig. 3).

INSTALLATION

NOTE: Soapy water may be used to aid in installation.

(1) Remove front door speaker.
(2) Position weatherstrip on flange aligning each corner.
(3) Press weatherstrip into position.
(4) Carefully move door glass for and aft and press weatherstrip into glass run channels.
(5) Install front door speaker.

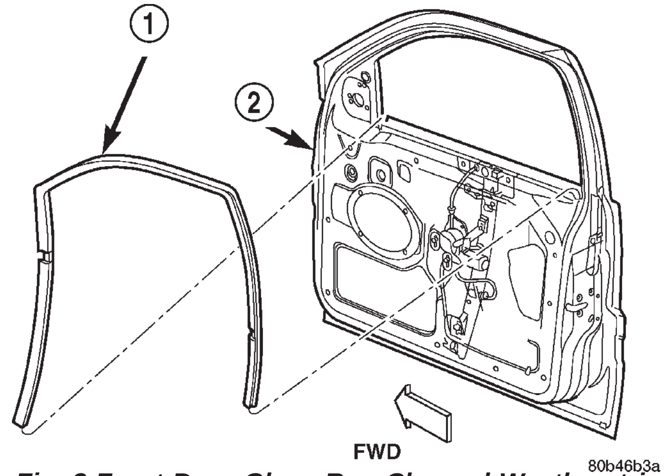


Fig. 3 Front Door Glass Run Channel Weatherstrip

1 - GLASS RUN CHANNEL WEATHERSTRIP
2 - DOOR

(6) Install outer belt weatherstrip (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR OUTER BELT WEATHERSTRIP - INSTALLATION).
(7) Install inner belt weatherstrip (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FDR INNER BELT WEATHERSTRIP - INSTALLATION).

FRONT DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
(2) Using a trim stick or other suitable device, carefully pry up inner edge of seal (Fig. 4).
(3) Grasp the edge of the seal and pull upward to remove seal from door flange.

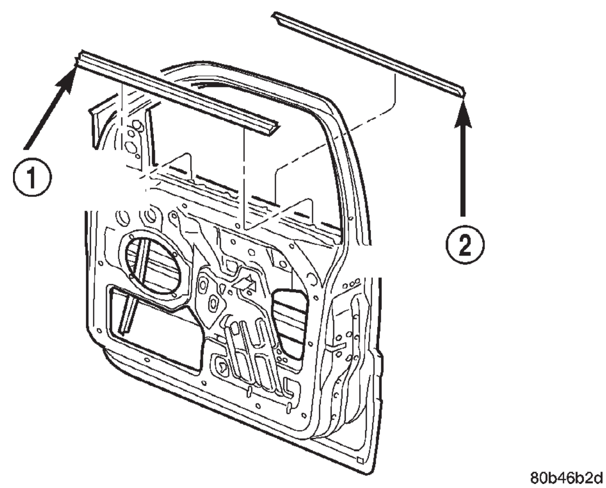


Fig. 4 Inner/Outer Belt Weather Strip

1 - INNER BELT WEATHERSTRIP
2 - OUTER BELT WEATHERSTRIP

FRONT DOOR INNER BELT WEATHERSTRIP (Continued)

INSTALLATION

(1) Position the seal on the door flange.

(2) Firmly press downward to seat seal on the door flange.

(3) Install the door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).

FDR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Lower the door glass.

(2) Remove the screw from the inner door panel attaching the seal to outer door panel (Fig. 4).

(3) Pull the seal rearward to release from the side view mirror bezel.

(4) Lift seal and separate from door panel.

INSTALLATION

(1) Position seal on the door panel.

(2) Push the seal forward to install under the side view mirror bezel.

(3) Install the screw from the inner door panel attaching the seal to outer door panel.

(4) Raise the door glass.

FLIP-UP GLASS WEATHERSTRIP

REMOVAL

(1) Raise flip up glass.

(2) Carefully pull the seal away from the flange around the edge of the glass opening (Fig. 5).

(3) Remove it from the vehicle.

INSTALLATION

(1) Thoroughly clean the surface of the flange as necessary.

(2) Align the weather strip seal with the window opening corners.

(3) Firmly seat the seal around the entire flange. But the seal ends together and smooth out any remaining length.

(4) Weatherstrip break should be 120mm left of latch opening. Cut any surplus from non-plug end only.

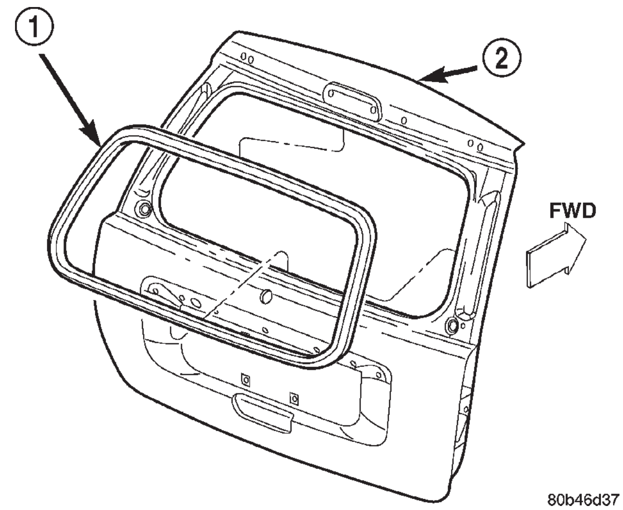


Fig. 5 Flip-up Glass Weatherstrip

1 - WEATHERSTRIP
2 - LIFTGATE W/FLIP-UP GLASS

FRONT DOOR 2ND WEATHERSTRIP

REMOVAL

The front door secondary weatherstrip is attached to the door shutface with push-in fasteners.

(1) Open door.

(2) Using a trim panel removal tool, remove push-in fasteners attaching secondary weatherstrip to door shutface (Fig. 6).

(3) Separate secondary weatherstrip from door.

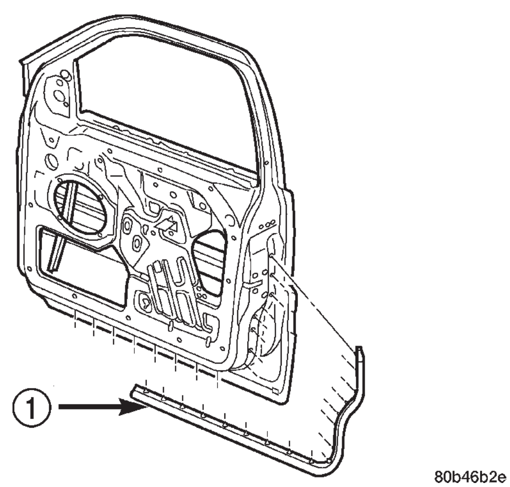


Fig. 6 Front Door Secondary Weatherstrip

1 - SECONDARY WEATHERSTRIP

INSTALLATION

(1) Clean contact area as necessary.

(2) Position secondary weatherstrip on door shutface.

(3) Install push-in fasteners attaching secondary weatherstrip to door shutface.

FRONT DOOR WEATHERSTRIP

REMOVAL

(1) Remove A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).

(2) Remove B-pillar upper trim (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL).

(3) Remove B-pillar lower trim (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).

(4) Pull weatherstrip from door opening flange.

INSTALLATION

(1) Position weatherstrip at corners.

(2) Move upward and around edge of door opening seating weatherstrip onto flange (Fig. 7).

(3) Engage connector plug with each end of weatherstrip at bottom of door opening.

(4) Install B-pillar lower trim (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).

(5) Install B-pillar upper trim (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION).

(6) Install A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).

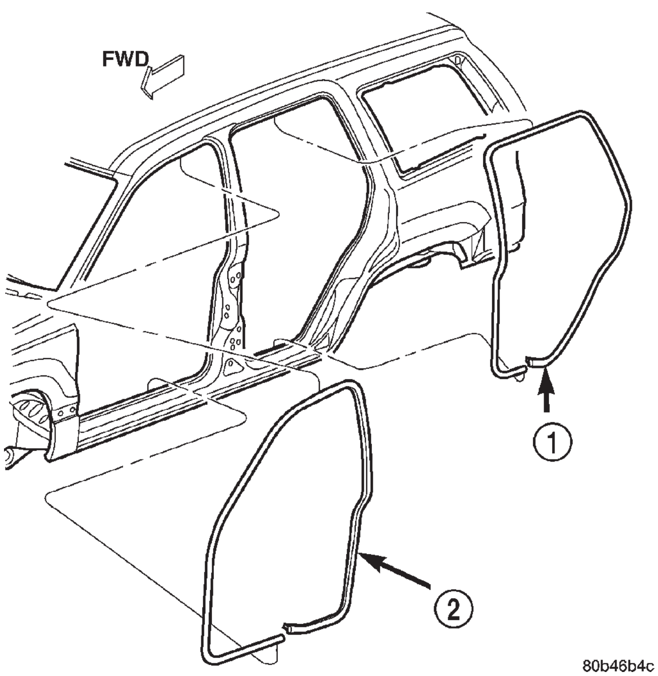


Fig. 7 Door Opening

1 - REAR DOOR OPENING WEATHERSTRIP
2 - FRONT DOOR OPENING WEATHERSTRIP

HOOD SEAL

REMOVAL

(1) Raise hood.

(2) Pull hood seal from upper radiator crossmember.

(3) Separate seal from upper radiator crossmember (Fig. 8).

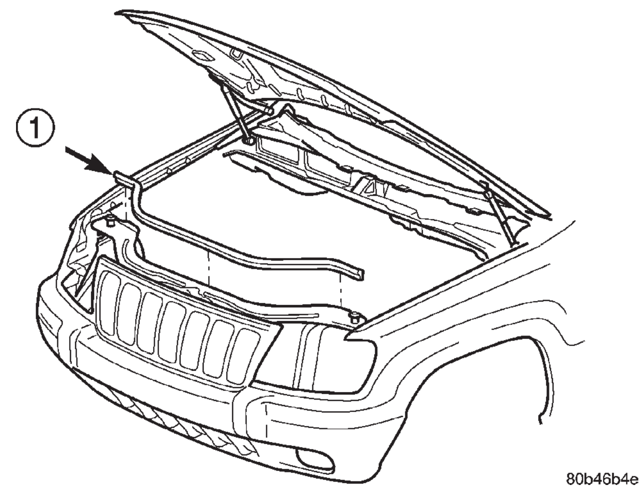


Fig. 8 Hood Seal

1 - HOOD SEAL

INSTALLATION

(1) Position seal on upper radiator crossmember.

(2) Press seal onto upper radiator crossmember to seat.

LIFTGATE OPENING WEATHERSTRIP

REMOVAL

(1) Pull seal away from flange around edge of liftgate opening.
(2) Separate weatherstrip from opening (Fig. 9).
(3) Clean weatherstrip flange as necessary.

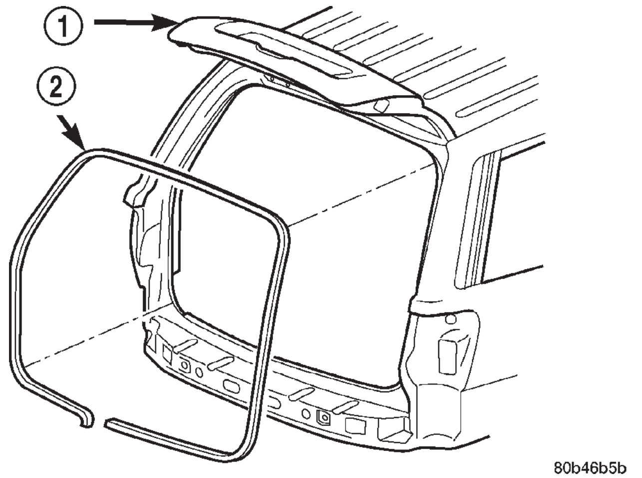


Fig. 9 Liftgate Opening Weatherstrip

1 - LIFTGATE
2 - WEATHERSTRIP

INSTALLATION

(1) Position weatherstrip in opening with left end of seal at opening centerline.
(2) Press weatherstrip onto flange in a clockwise direction.
(3) Center and butt weatherstrip ends together at centerline.
(4) If necessary, cut surplus from weatherstrip (non-plug end only).

RDR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove door trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).
(2) Using a trim stick, carefully pry rear inner edge of inner belt weatherstrip upward.
(3) Grasp weatherstrip and pull upward to separate from door flange (Fig. 10).

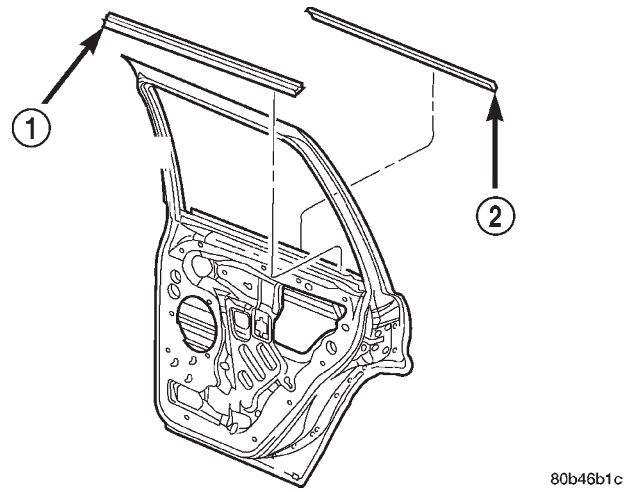


Fig. 10 Rear Door Inner/Outer Belt Weatherstrip

1 - INNER BELT WEATHERSTRIP
2 - OUTER BELT WEATHERSTRIP

INSTALLATION

(1) Position weatherstrip on door flange.
(2) Firmly press downward to seat weatherstrip on flange.
(3) Install trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).

RDR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Remove trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).
(2) Using a small flat blade, disengage tangs attaching outer belt weatherstrip to inner door panel.
(3) Lift weatherstrip upward and separate from door (Fig. 10).

INSTALLATION

(1) Position the weatherstrip onto the door flange.
(2) Force the weatherstrip onto door flange and engage tangs. Continue rearward until it is seated on flange.
(3) Instal trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).

RDR SECONDARY WEATHERSTRIP

REMOVAL

The rear door secondary weatherstrip is attached to the door shutface with push-in fasteners.

(1) Open door.

(2) Using a trim panel removal tool, remove push-in fasteners attaching secondary weatherstrip to door shutface.

(3) Separate secondary weatherstrip from door (Fig. 11).

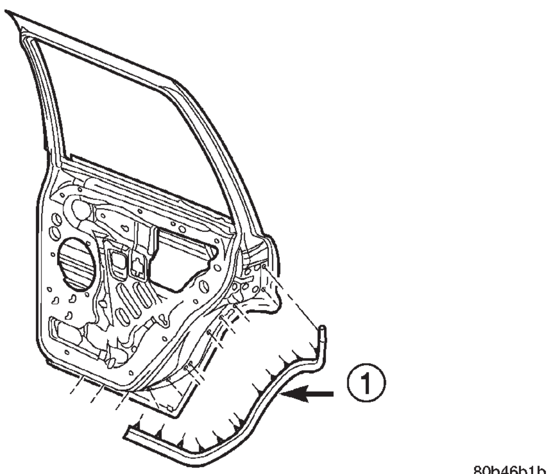


Fig. 11 Rear Door Secondary Weatherstrip

1 - SECONDARY WEATHERSTRIP

INSTALLATION

(1) Clean contact area as necessary.

(2) Position secondary weatherstrip on door shutface.

(3) Install push-in fasteners attaching secondary weatherstrip to door shutface.

REAR DOOR WEATHERSTRIP

REMOVAL

(1) Remove C-pillar trim (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - REMOVAL).

(2) Remove B-pillar upper trim (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL).

(3) Remove B-pillar lower trim(Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).

(4) Remove screws at front of quarter trim panel.

(5) Pull weatherstrip from door opening flange.

INSTALLATION

(1) Position weatherstrip at corners.

(2) Move upward and around edge of door opening seating weatherstrip onto flange (Fig. 7).

(3) Engage connector plug with each end of weatherstrip at bottom of door opening.

(4) Install screws at front of quarter trim panel.

(5) Install B-pillar lower trim (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).

(6) Install B-pillar upper trim (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION).

(7) Install C-pillar trim (Refer to 23 - BODY/INTERIOR/C-PILLAR TRIM - INSTALLATION).

ROOF RAIL WEATHERSTRIP / RETAINR

REMOVAL

(1) Open front and rear doors.

(2) Remove secondary seal from retainer to access the screws holding the retainer to the A pillar and roof panel.

(3) Remove the screws holding the retainer in place (Fig. 12).

(4) Remove the retainer.

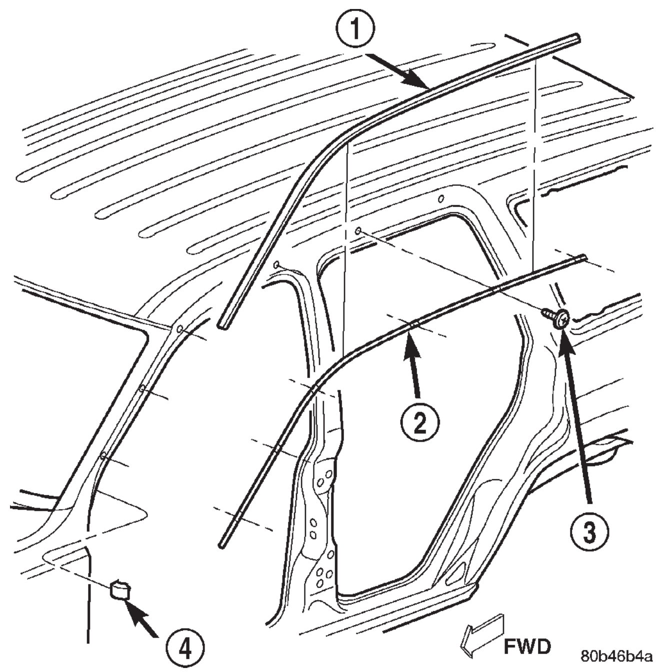


Fig. 12 Upper Body Seal With Retainer

1 - ROOF RAIL WEATHERSTRIP
2 - RETAINER
3 - SCREW
4 - BLOCKER

INSTALLATION

(1) Position the retainer on the A pillar and roof panel.

(2) Align the screw holes and install the screws.

(3) Install secondary seal.

BODY STRUCTURE

TABLE OF CONTENTS

GAP AND FLUSH

SPECIFICATIONS - GAP AND FLUSH

DESCIPTION	FIGURE
FRONT VIEW	1
REAR VIEW	2

GAP AND FLUSH (Continued)

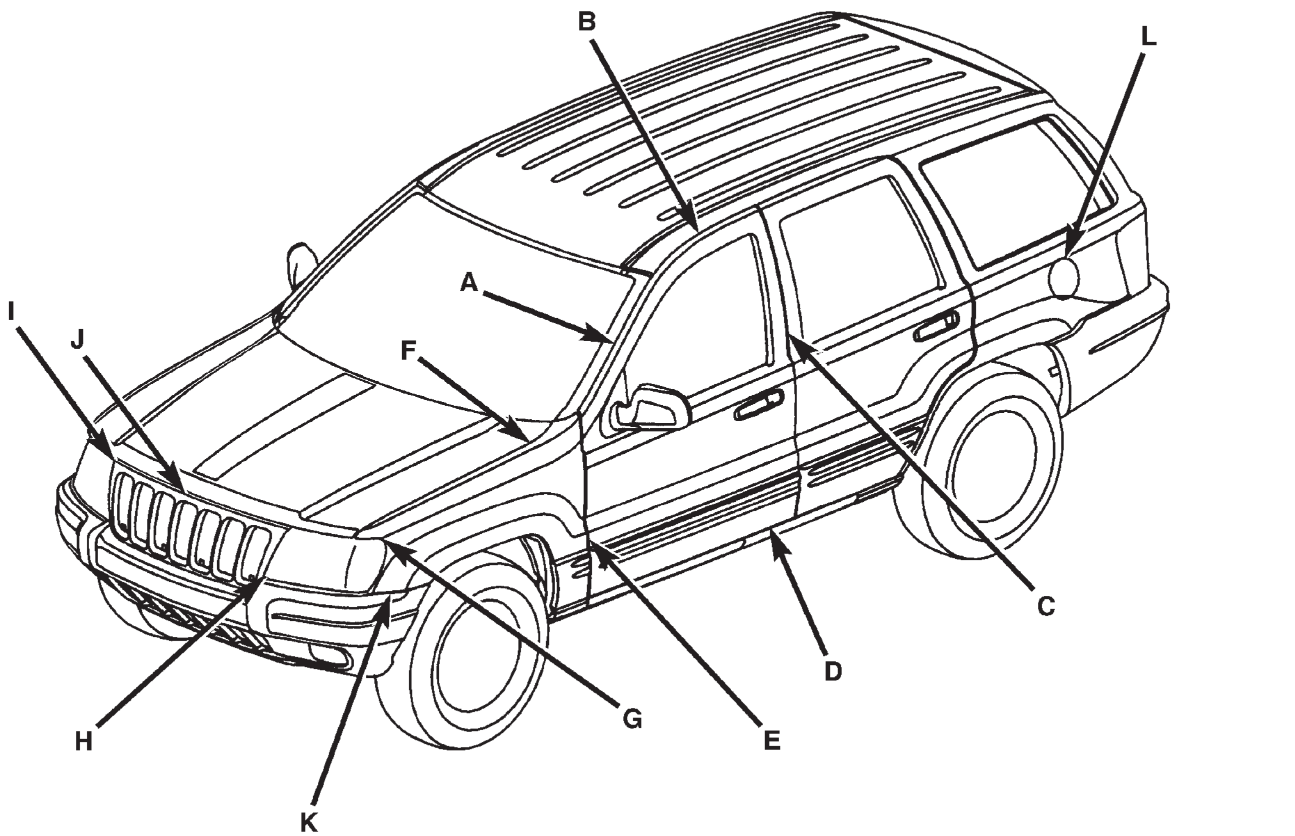


Fig. 1 FRONT VIEW

NOTE:
All measurements are in mm.

LOCATION	DESCRIPTION	GAP	FLUSH
A	Front Door to Windshield Pillar	N/A	3.0 +/- 1.0
B	Front Door Header to Aperture	6.0 +/- 1.0	1.0 +/- 1.5
C	Front Door to Rear Door	5.0 +/- 1.0	0.0 +/- 1.0
D	Front Door to Aperture at Sill	7.0 +/- 1.5	N/A
E	Front Door to Fender	5.0 +/- 1.0	0.5 +/- 1.0
F	Hood to Fender	5.0 +/- 1.0	0.0 +/- 1.0
G	Headlamp to Fender	5.0 +/- 2.0	3.0 +/- 2.0
H	Headlamp to Grille	5.5 +/- 2.0	0.0 +/- 2.0
I	Grille to Headlamp	N/A	0.0 +/- 1.0
J	Grille to Hood	10.0 +/- 2.0	0.8 +/- 2.0
K	Front Fascia to Fender	Net + 1.0 - 0.0	3.0 +/- 3.0
L	Fuel Filler Door to Bodyside	3.0 +/- 0.75	0.5 +/- 0.75

GAP AND FLUSH (Continued)

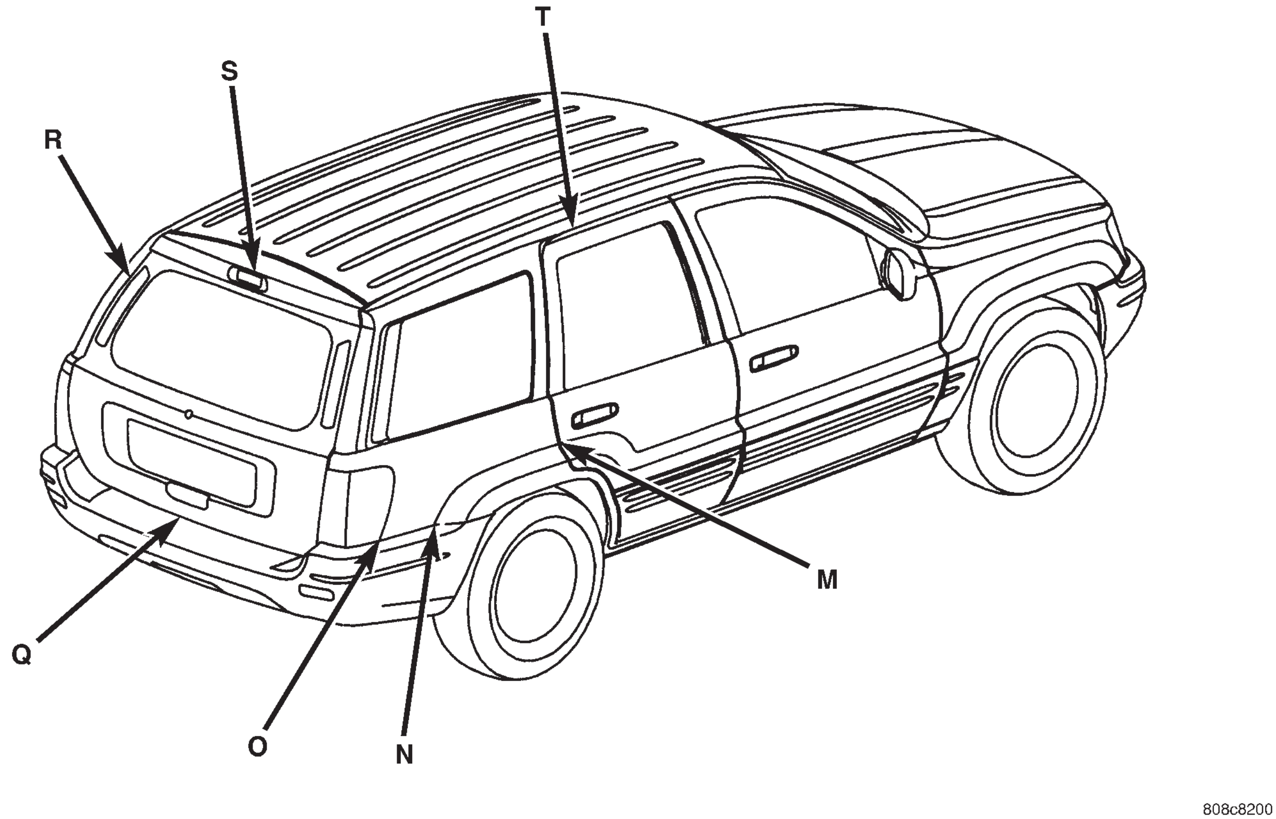


Fig. 2 REAR VIEW

NOTE:
All measurements are in mm.

LOCATION	DESCRIPTION	GAP	FLUSH
M	Rear Door to Quarter Panel	5.0 +/- 1.0	0.0 +/- 1.0
N	Aperture to Rear Fascia	Net to 1.0	3.0 +/- 2.0
O	Taillamp to Quarter Panel	2.0 +/- 1.0	3.0 +/- 1.5
Q	Liftgate to Fascia	10.0 +/- 3.0	N/A
R	Liftgate to Aperture	5.0 +/- 1.5	1.0 +/- 1.0
S	Liftgate to Roof	11.0 +/- 1.5	1.0 +/- 1.0
T	Rear Door Header to Aperture	6.0 +/- 1.0	1.0 +/- 1.5

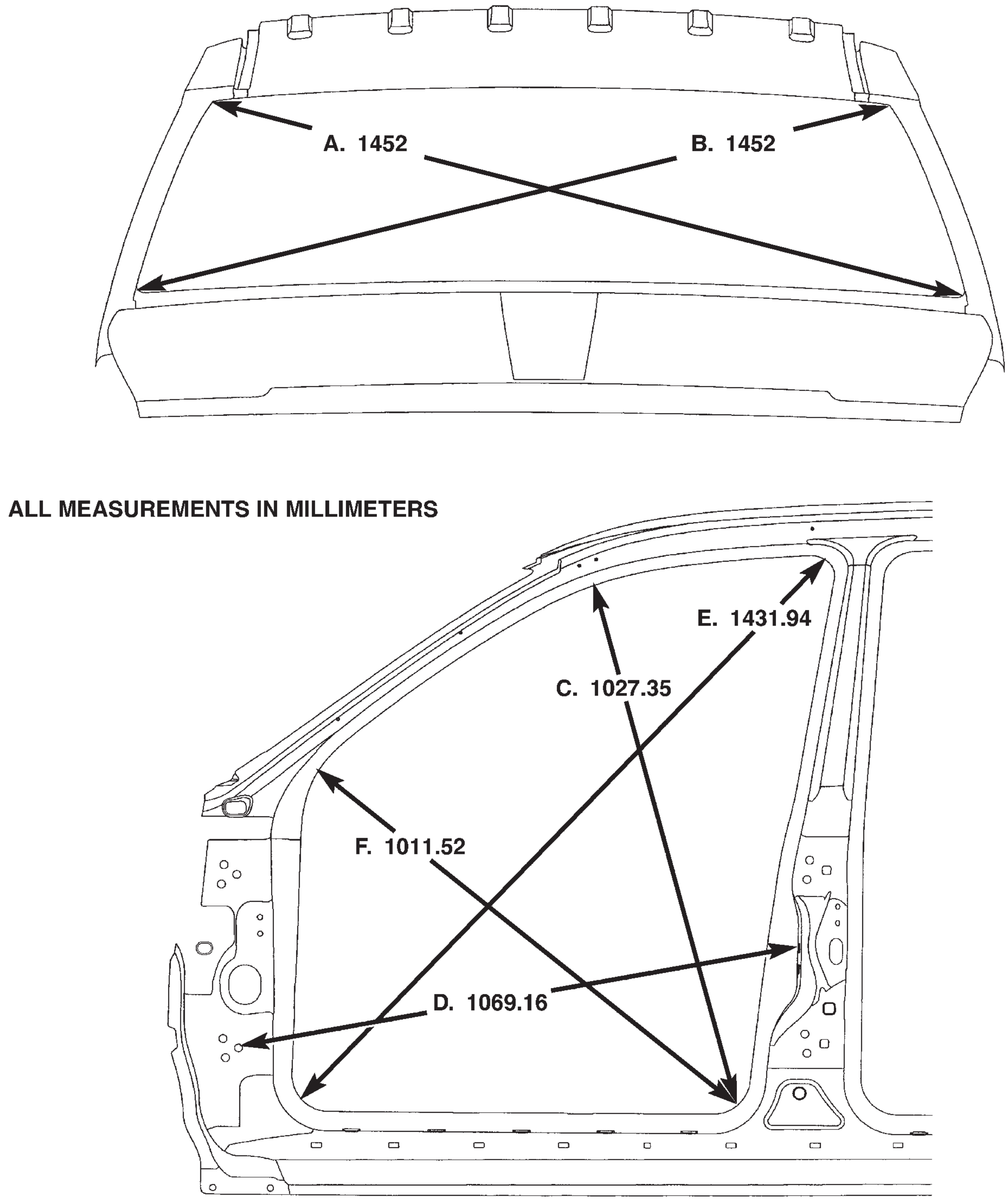
OPENING DIMENSIONS

SPECIFICATIONS - BODY OPENING DIMENSIONS

DESCRIPTION	FIGURE
WINDSHIELD AND FRONT DOOR OPENING	3
REAR DOOR AND QUARTER GLASS OPENING	4
LIFTGATE OPENING AND ENGINE COMPARTMENT	5

2002 WJ Service Manual
Publication No. 81-370-02064
TSB 26-11-01 November 2001

OPENING DIMENSIONS (Continued)



A. & B. Center of radius at bottom to center of radius at top.

C. Center of front door lower rear corner radius to center of A-pillar radius.

D. Center of door hinge mount to center of door striker mount.

E. Center of radius at bottom front to center of radius at top rear.

F. Center of radius at bottom rear to center of radius at lower A-pillar.

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Fig. 3 WINDSHIELD AND FRONT DOOR OPENING

OPENING DIMENSIONS (Continued)

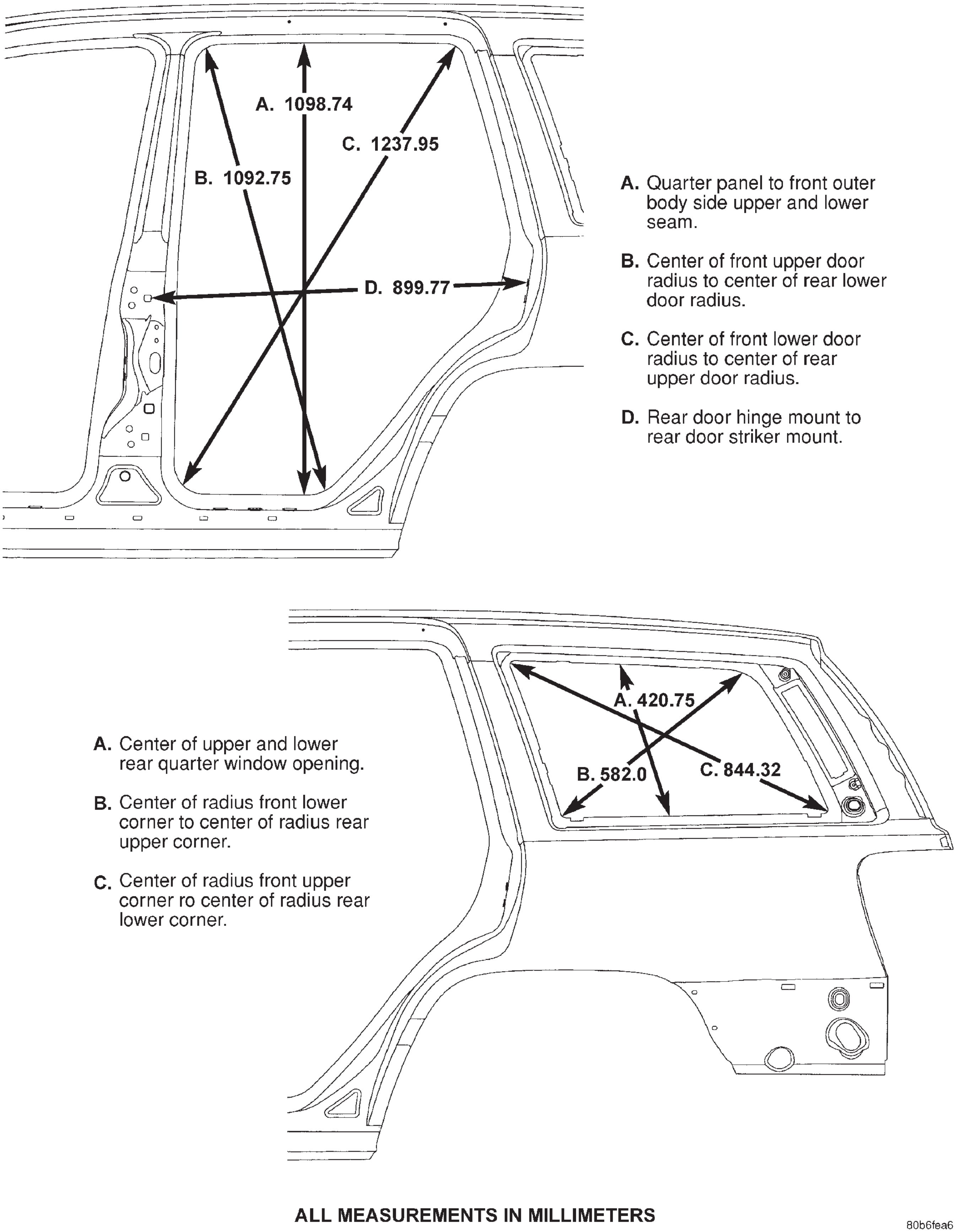


Fig. 4 REAR DOOR AND QUARTER GLASS OPENING

OPENING DIMENSIONS (Continued)

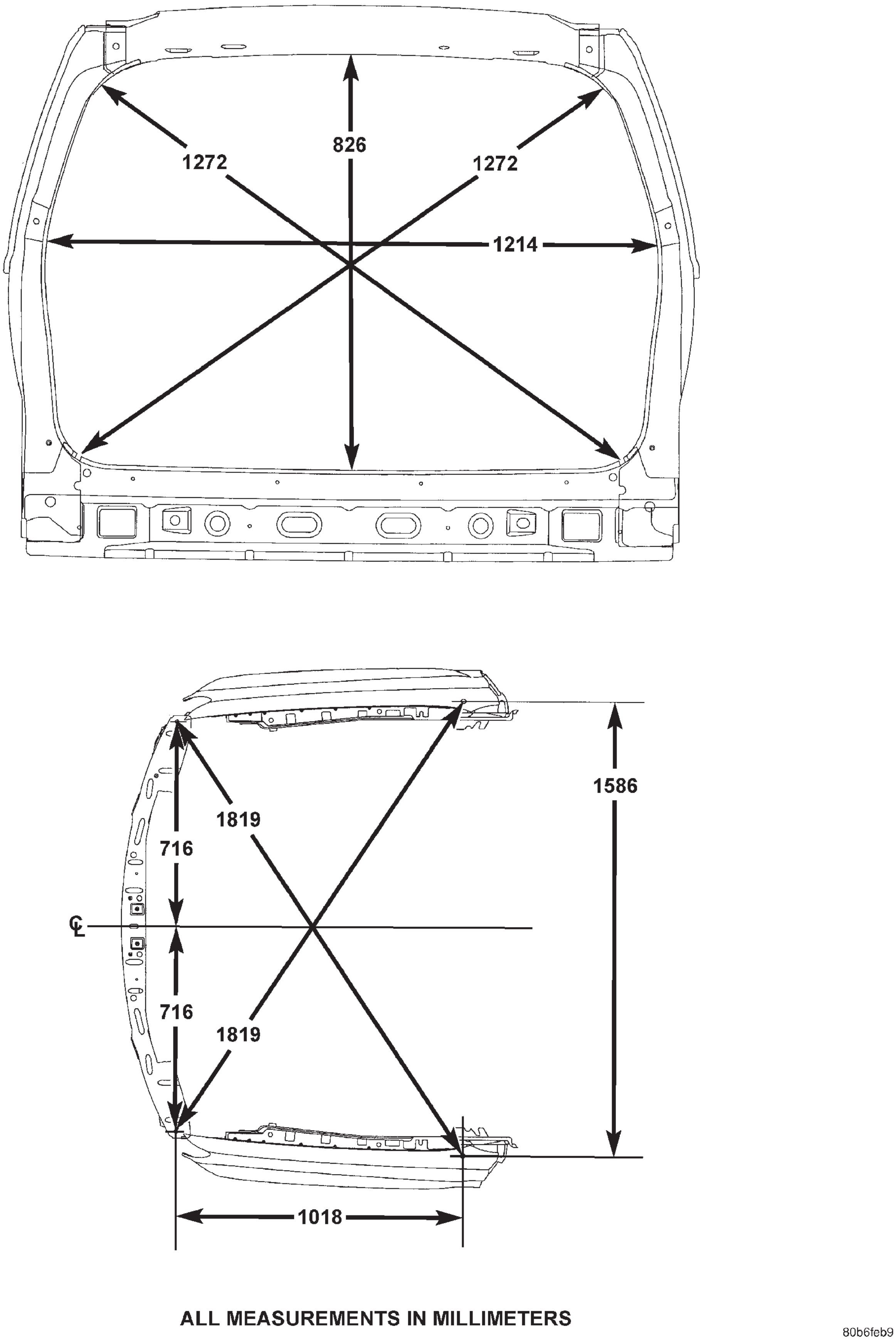


Fig. 5 LIFTGATE OPENING AND ENGINE COMPARTMENT

SEALER LOCATIONS

SPECIFICATIONS

SEALER LOCATIONS

INDEX

DESCRIPTION	FIGURE
APPLICATION METHODS	6
COWL PLENUM AND DASH PANEL	7
DASH, COWL AND PLENUM	8
INNER FENDER AND COWL	9
LOWER PLENUM AND BAFFLE	10
A-PILLAR	11
COWL SIDE ATTACHMENT	12
BODYSIDE ATTACHMENT	13
BODYSIDE INNER AND OUTER TO COWL	14
FENDER ATTACHMENT	15
DOOR HINGE BOLT HOLES	16
A-PILLAR AND B-PILLAR HINGE AREA	17
B-PILLAR AND SILL	18
SILL AND B-PILLAR	19
BODYSIDE APERTURE AND REAR WHEELHOUSE	20
FUEL FILLER GUSSET	21
OUTER WHEELHOUSE FLANGE	22
LIFTGATE OPENING	23
INNER WHEELHOUSE FLANGE TO BODYSIDE APERTURE	24
WHEELHOUSE LOWER	25
REAR INNER CROSSMEMBER	26
ROOF TO BODY SIDE APERTURE	27

SEALER LOCATIONS (Continued)

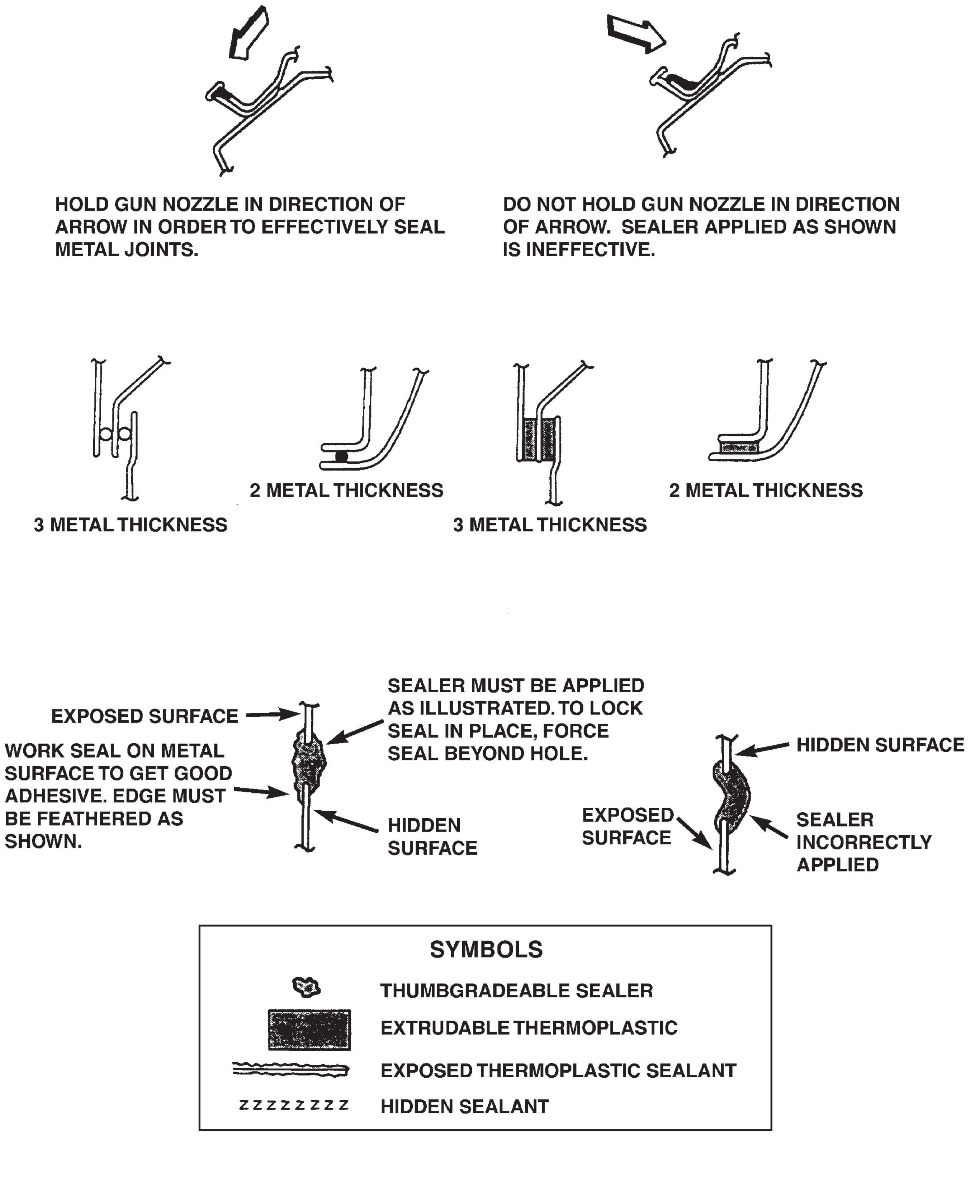


Fig. 6 APPLICATION METHODS

SEALER LOCATIONS (Continued)

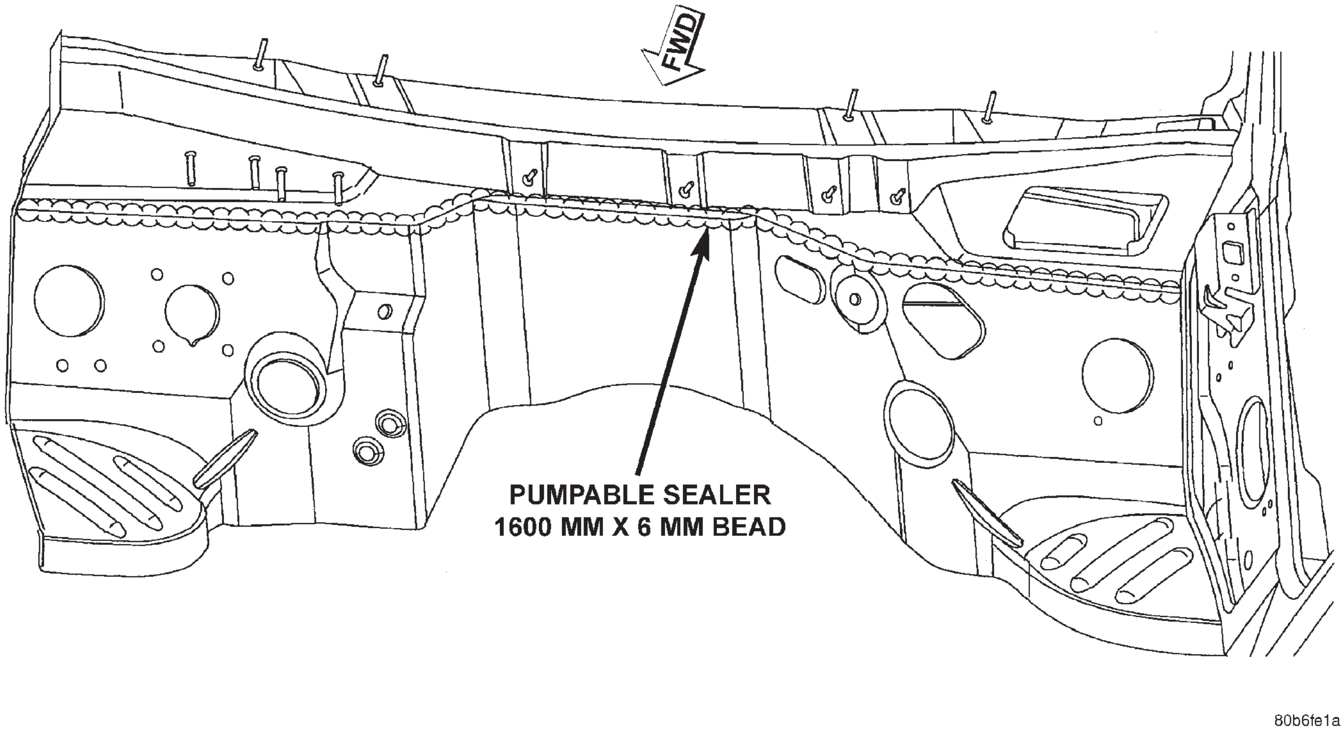


Fig. 7 COWL PLENUM AND DASH PANEL

SEALER LOCATIONS (Continued)

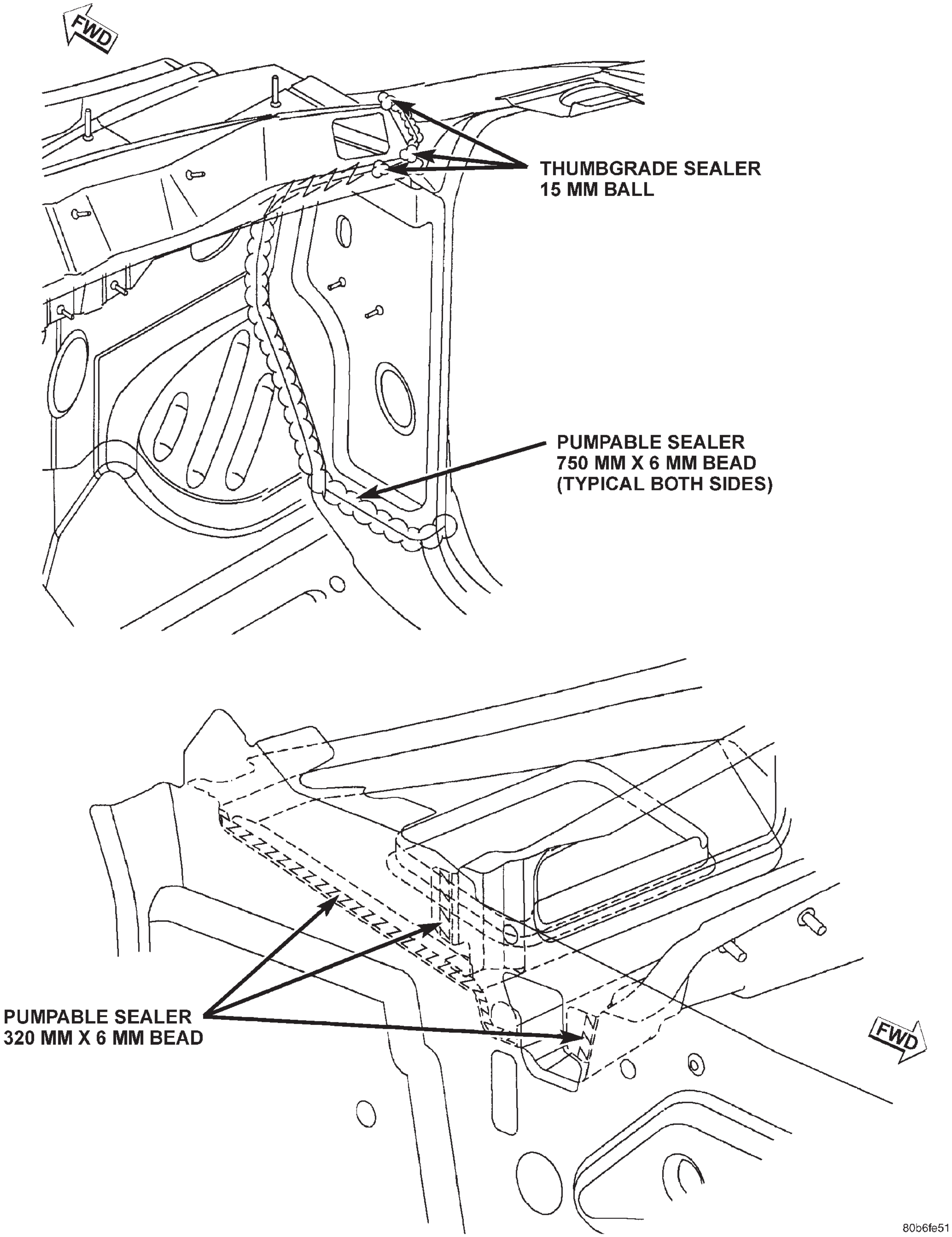


Fig. 8 DASH, COWL AND PLENUM

SEALER LOCATIONS (Continued)

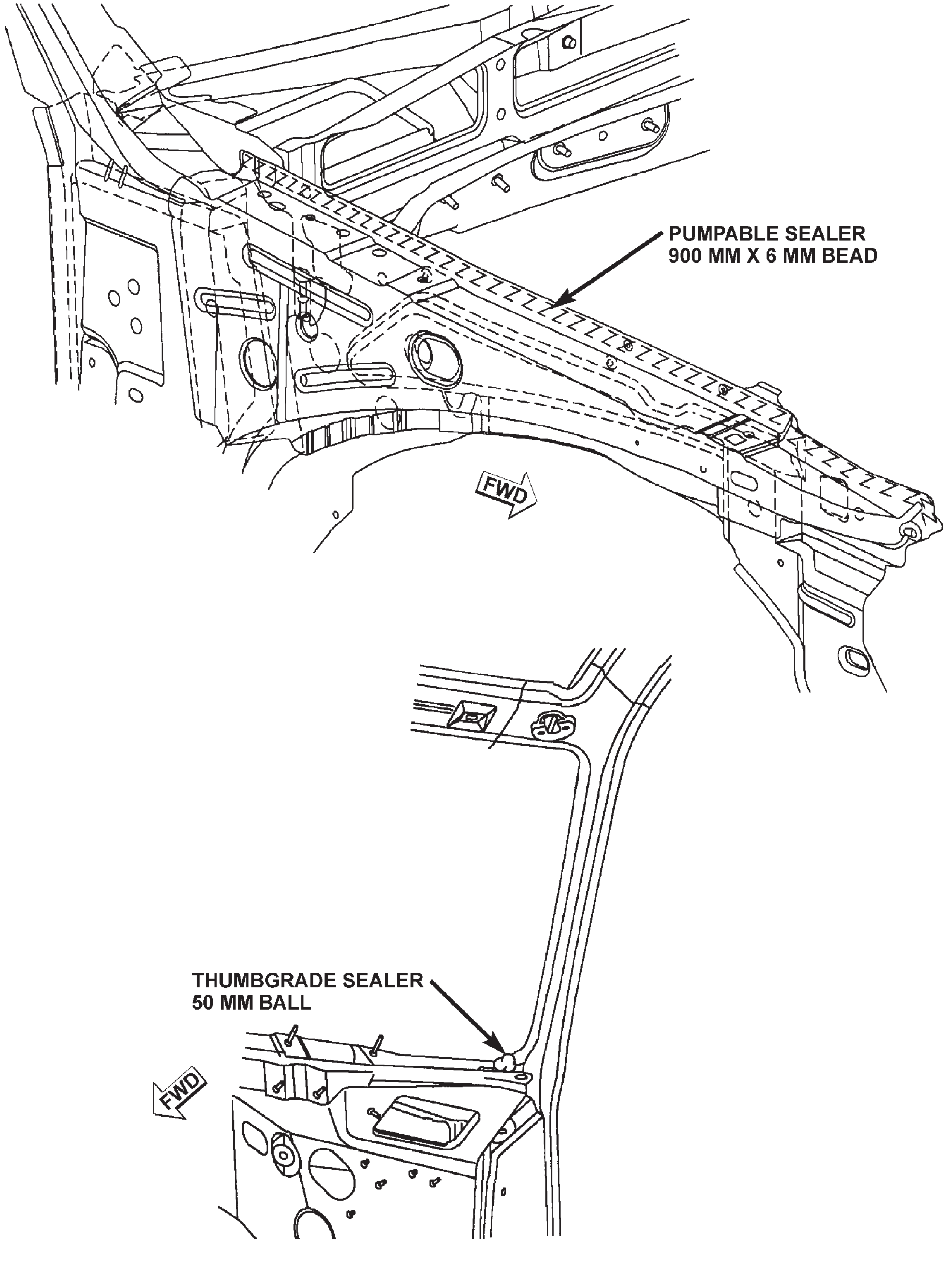


Fig. 9 INNER FENDER AND COWL

SEALER LOCATIONS (Continued)

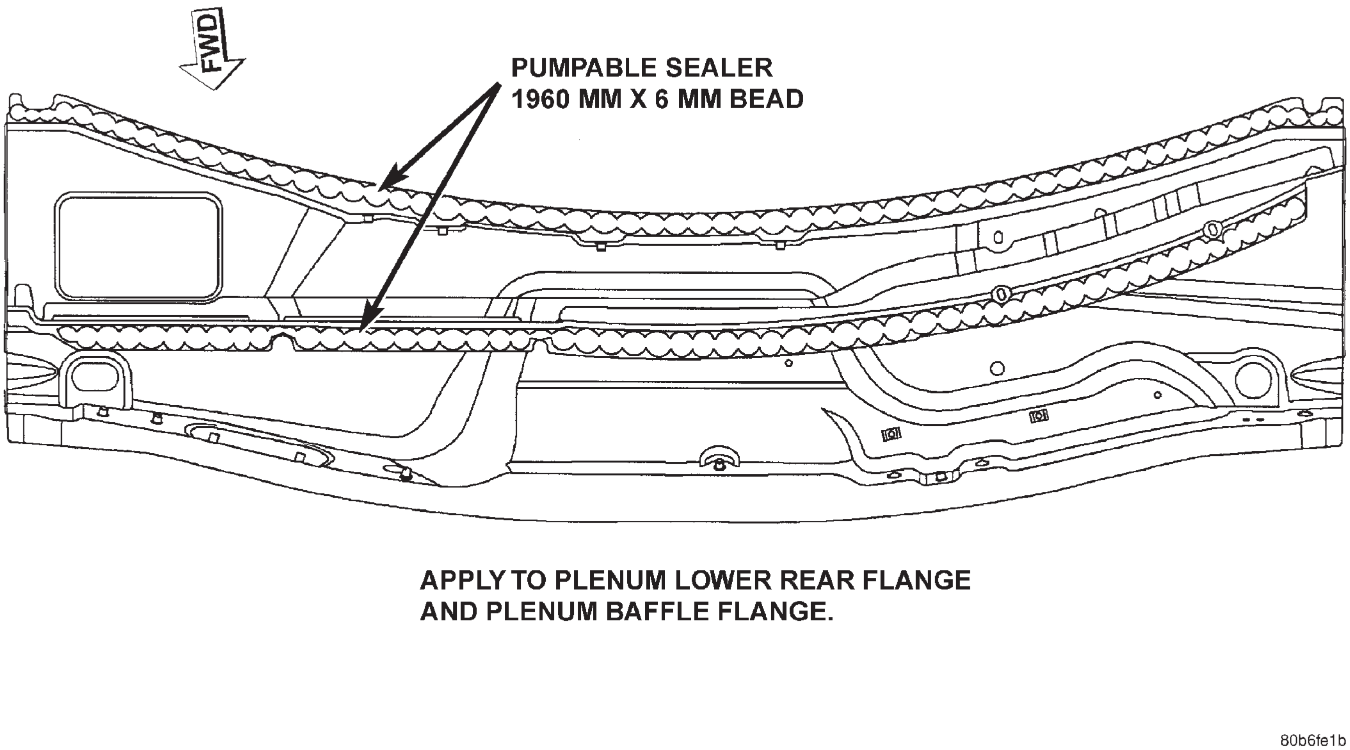


Fig. 10 LOWER PLENUM AND BAFFLE

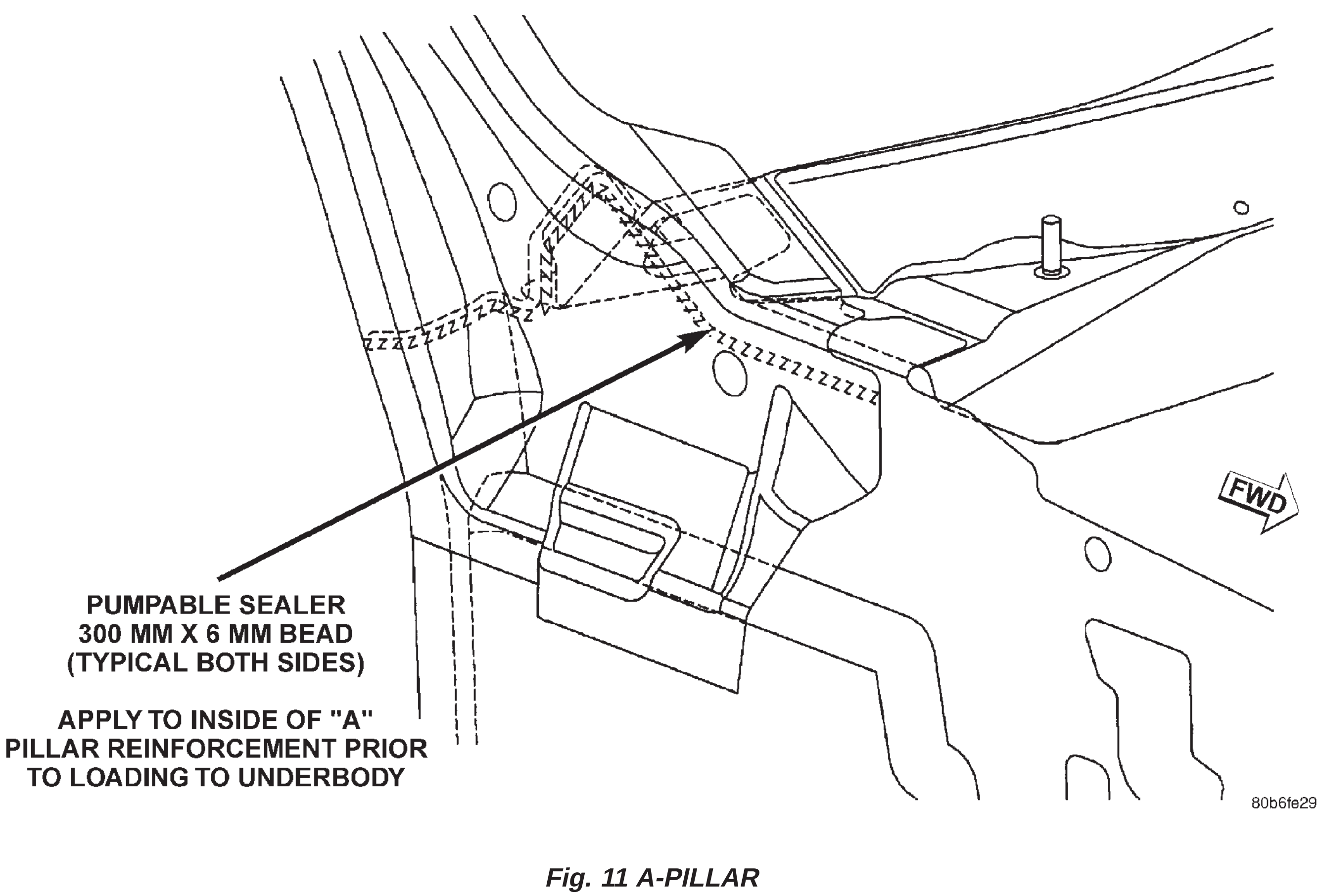


Fig. 11 A-PILLAR

SEALER LOCATIONS (Continued)

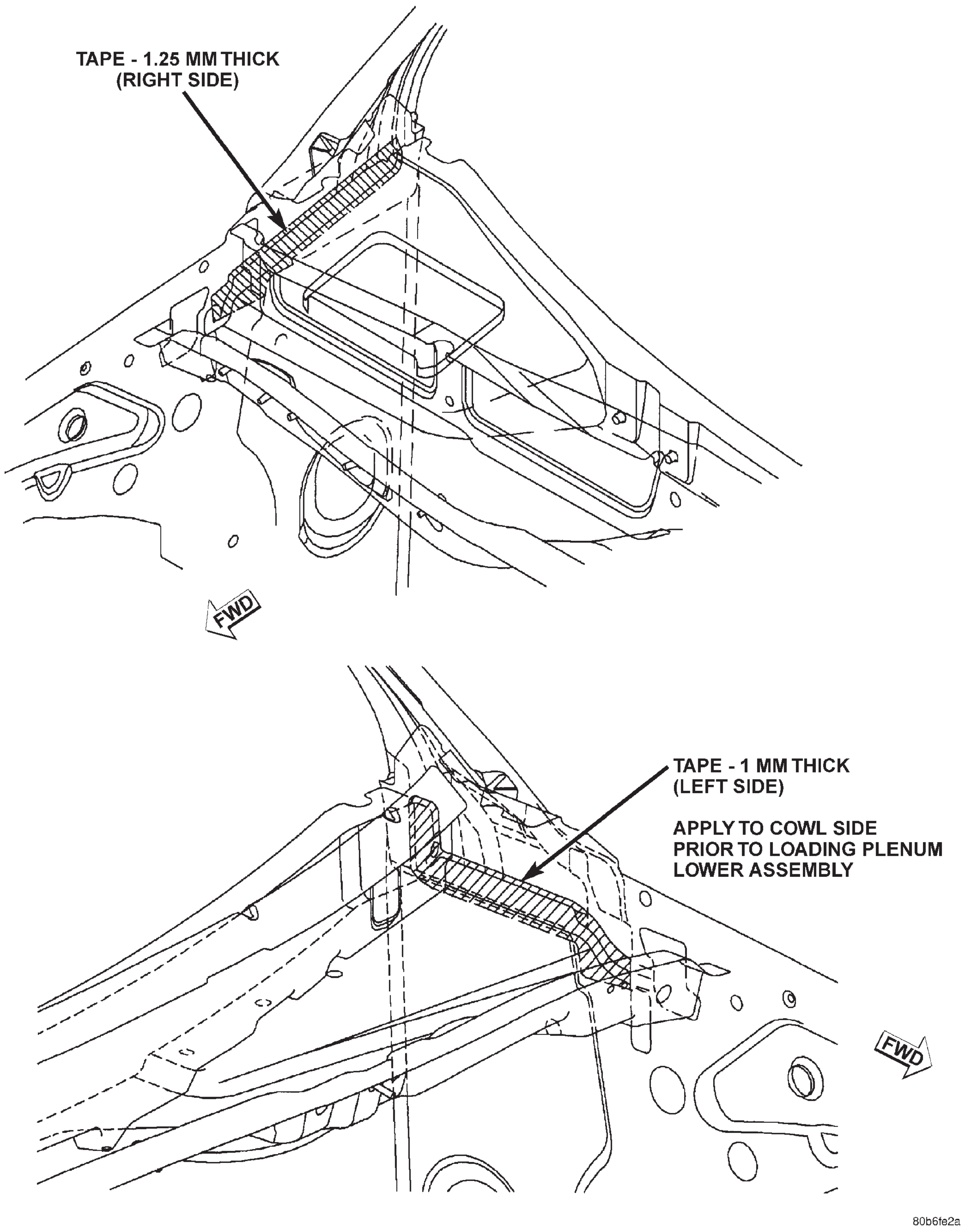


Fig. 12 COWL SIDE ATTACHMENT

SEALER LOCATIONS (Continued)

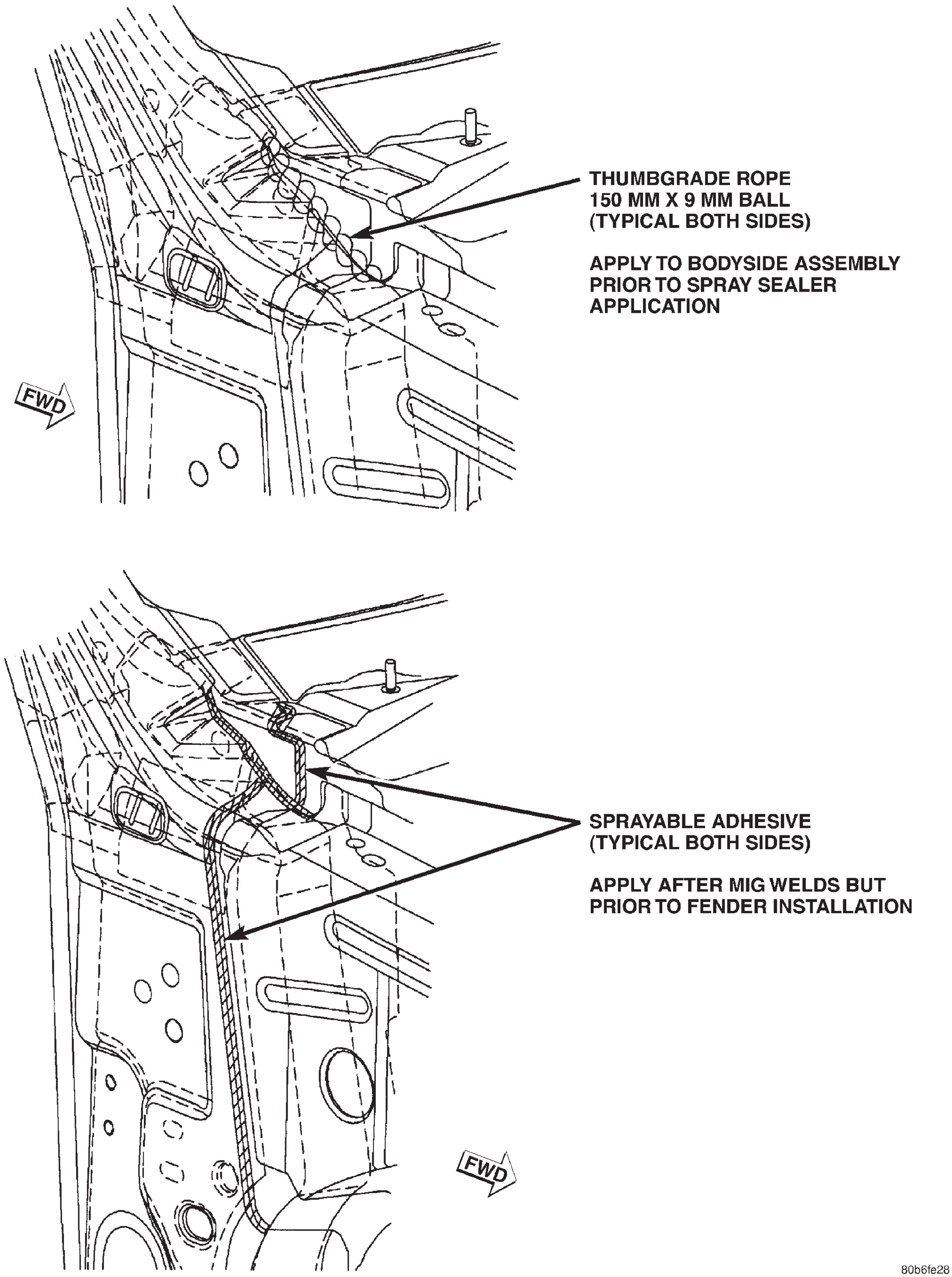


Fig. 13 BODYSIDE ATTACHMENT

SEALER LOCATIONS (Continued)

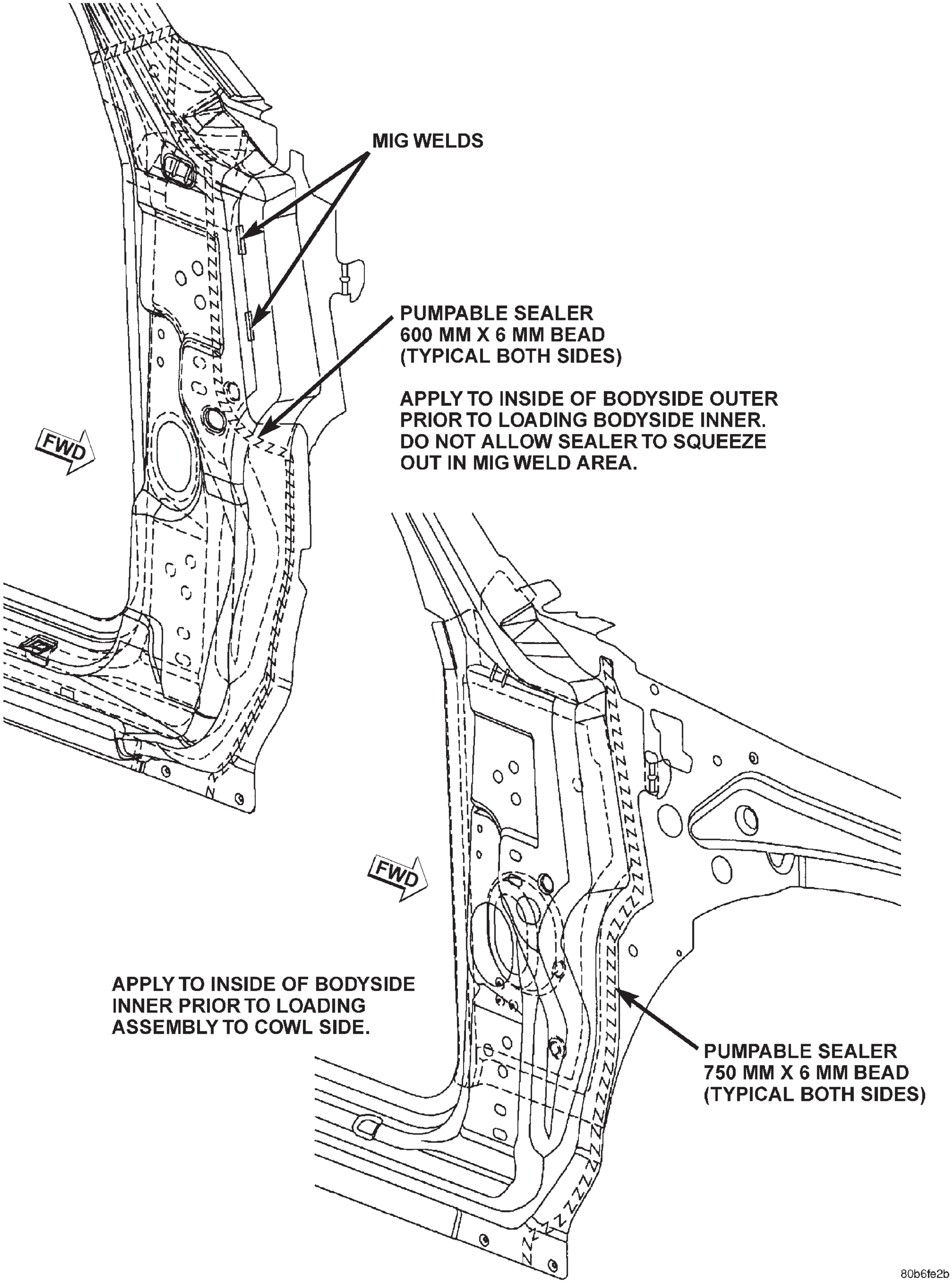


Fig. 14 BODYSIDE INNER AND OUTER TO COWL

SEALER LOCATIONS (Continued)

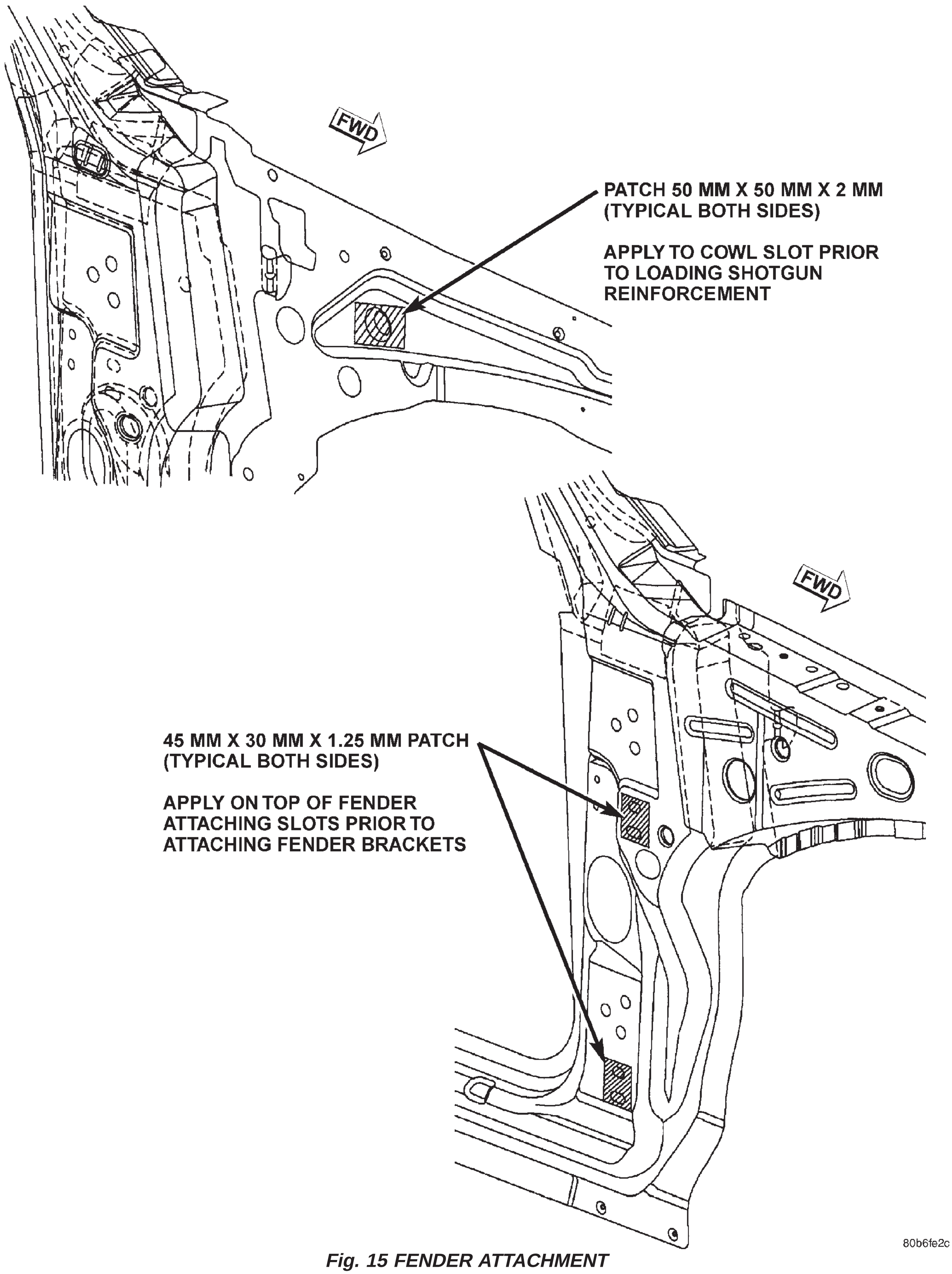


Fig. 15 FENDER ATTACHMENT

SEALER LOCATIONS (Continued)

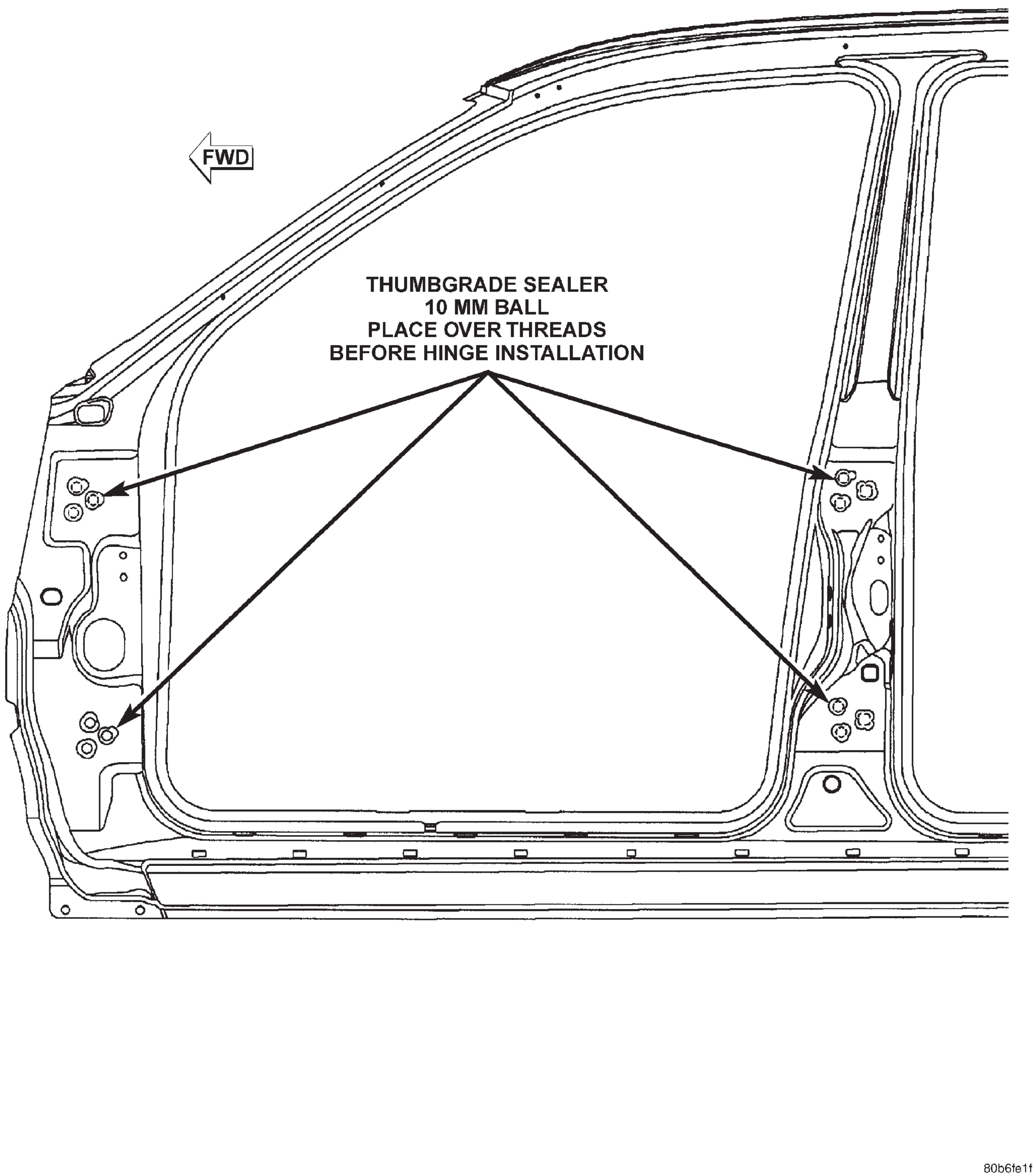


Fig. 16 DOOR HINGE BOLT HOLES

SEALER LOCATIONS (Continued)

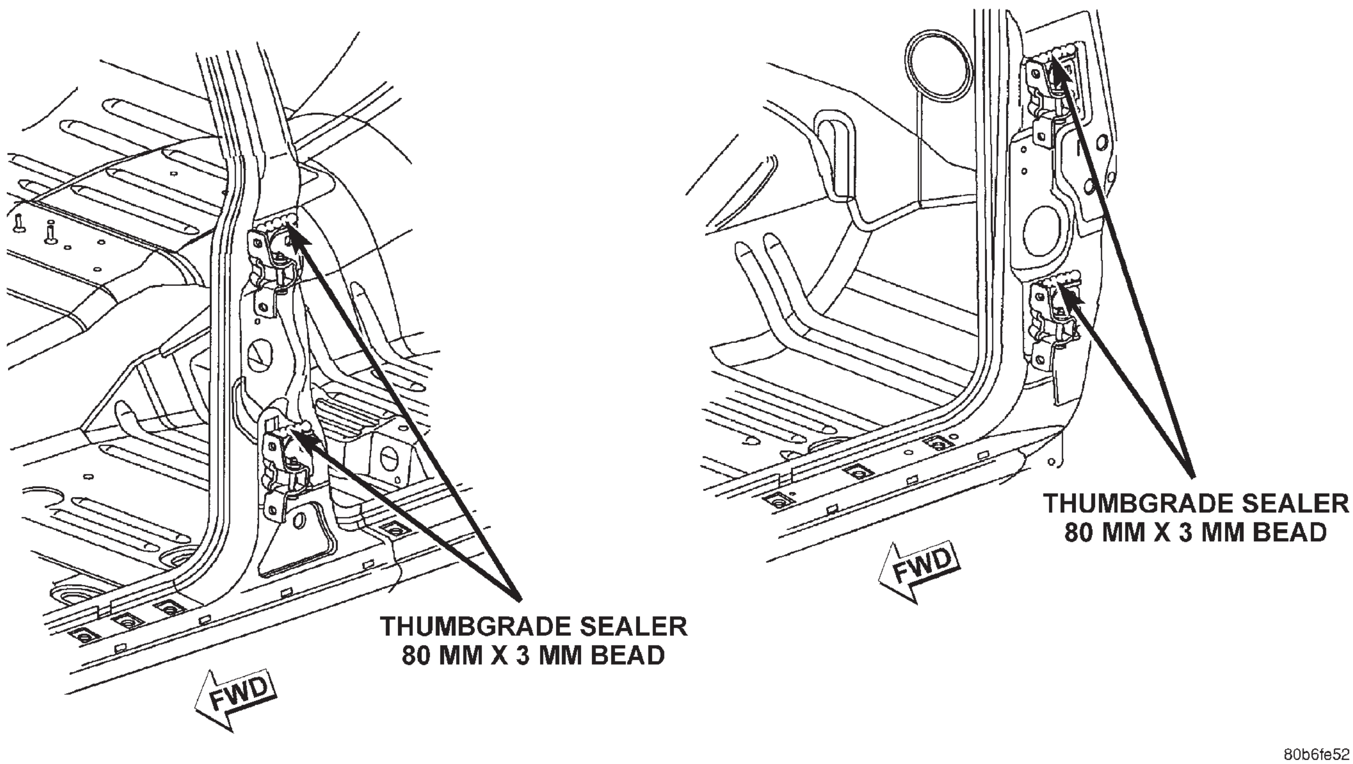


Fig. 17 A-PILLAR AND B-PILLAR HINGE AREA

SEALER LOCATIONS (Continued)

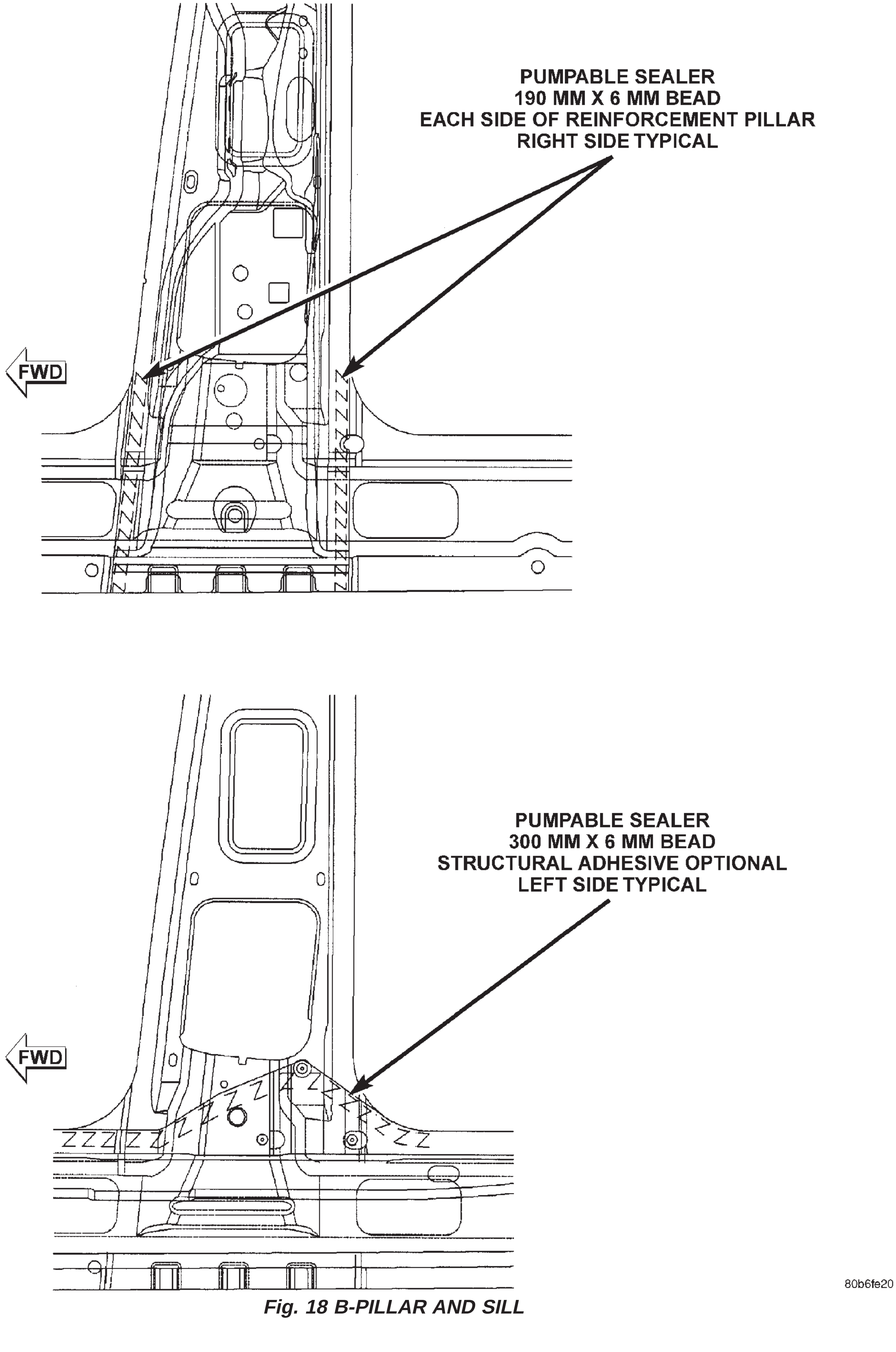


Fig. 18 B-PILLAR AND SILL

SEALER LOCATIONS (Continued)

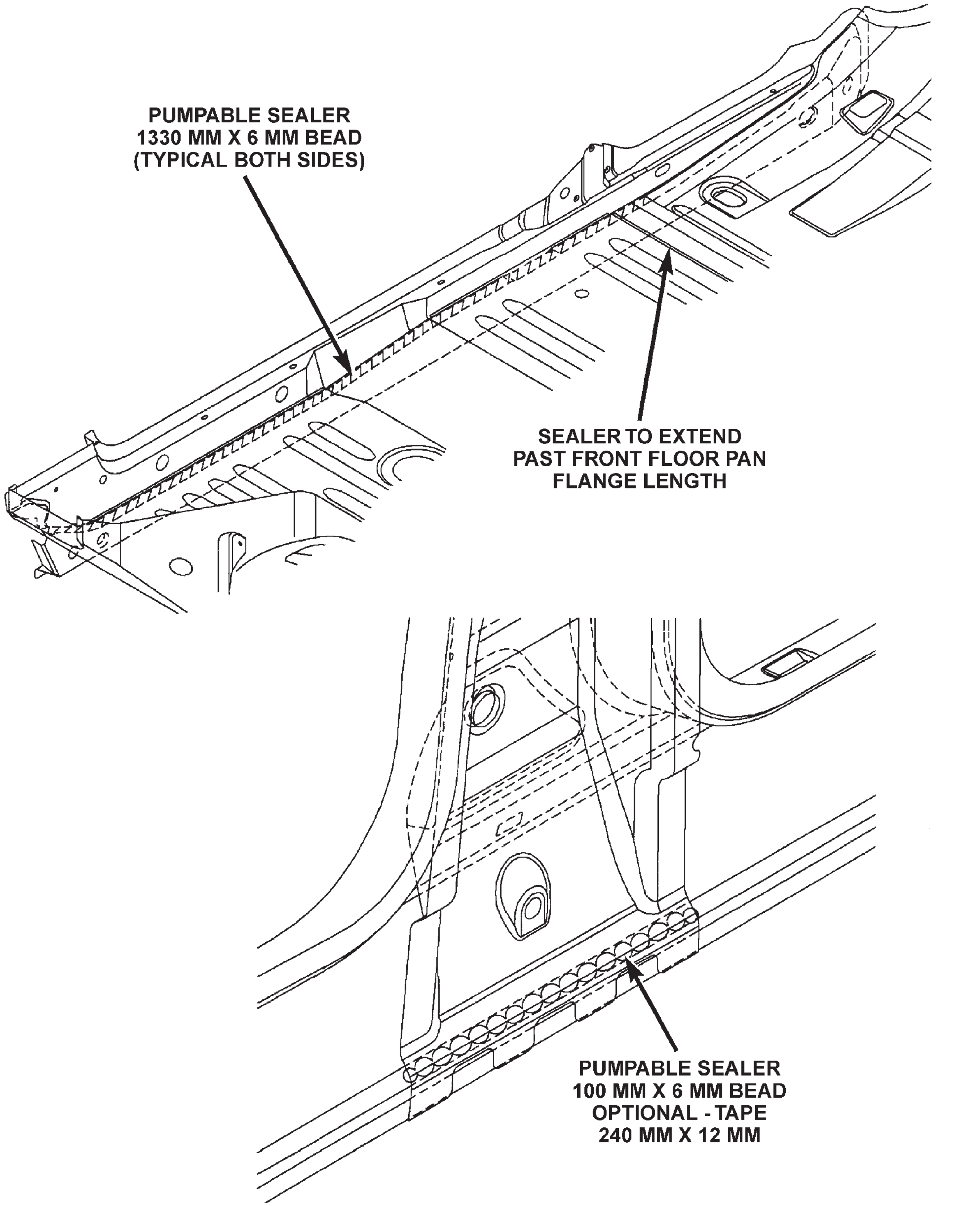


Fig. 19 SILL AND B-PILLAR

SEALER LOCATIONS (Continued)

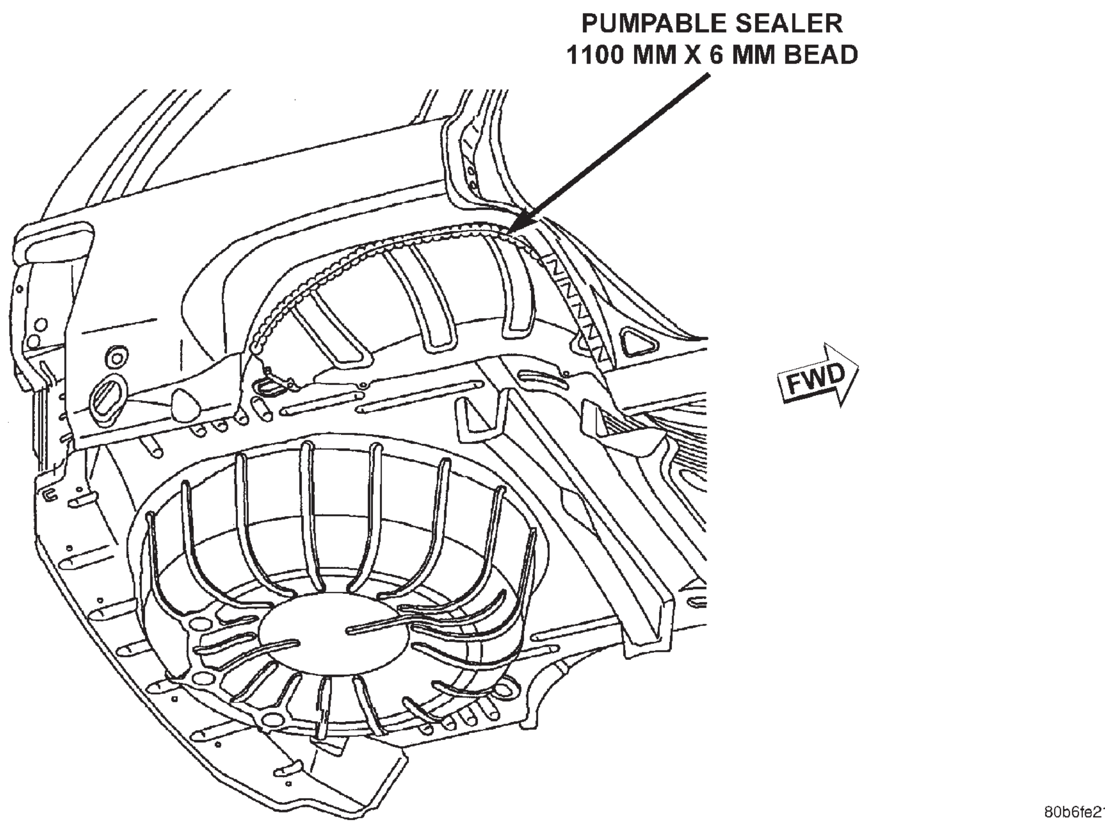


Fig. 20 BODYSIDE APERTURE AND REAR WHEELHOUSE

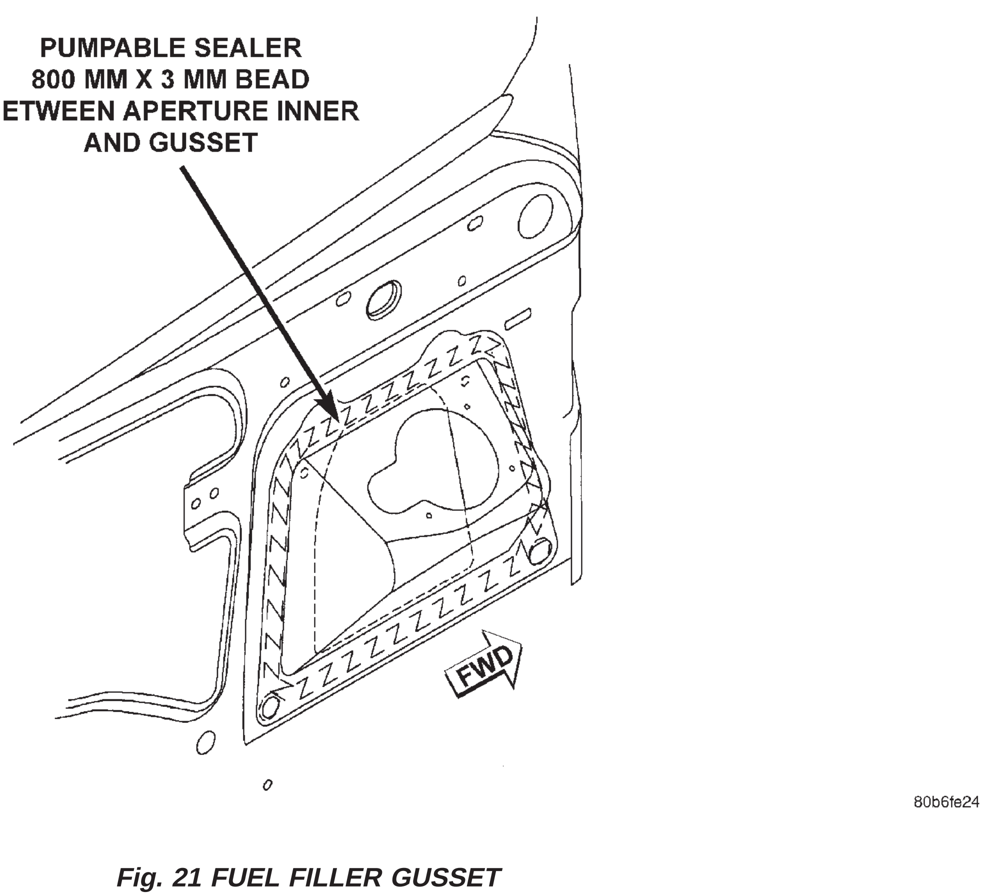


Fig. 21 FUEL FILLER GUSSET

SEALER LOCATIONS (Continued)

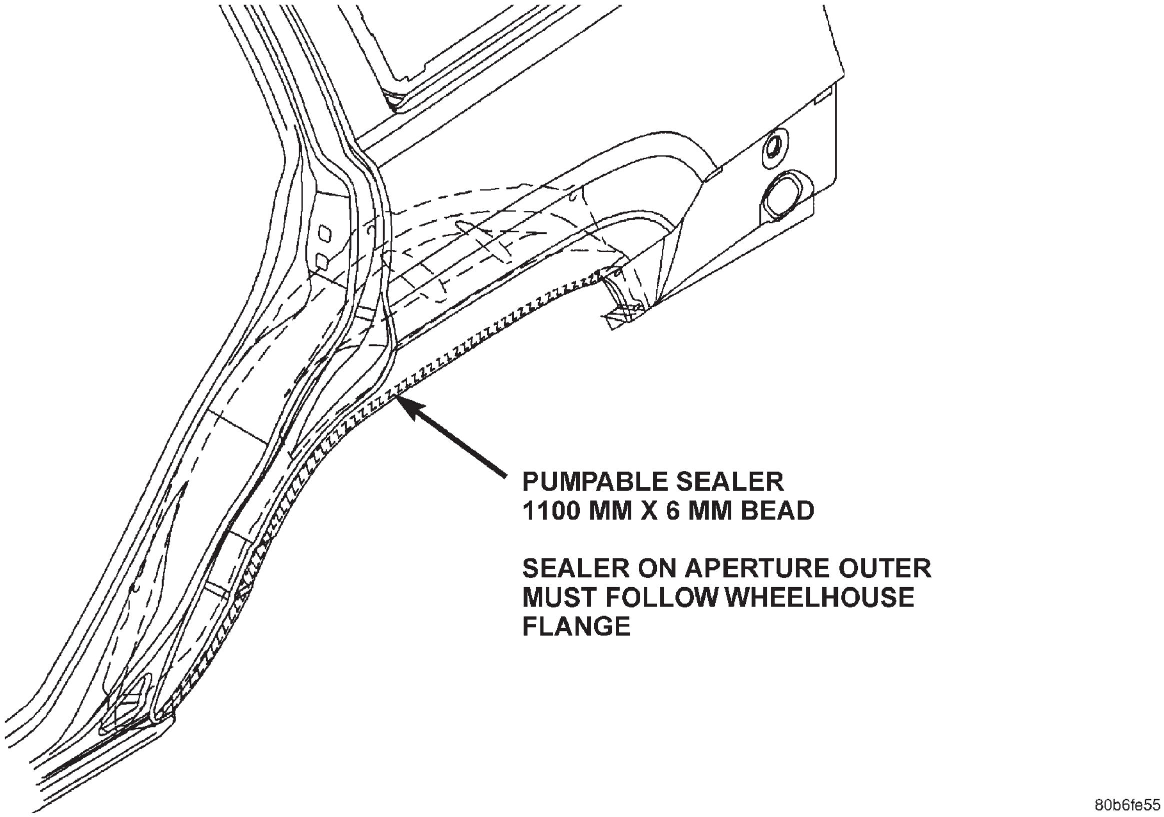


Fig. 22 OUTER WHEELHOUSE FLANGE

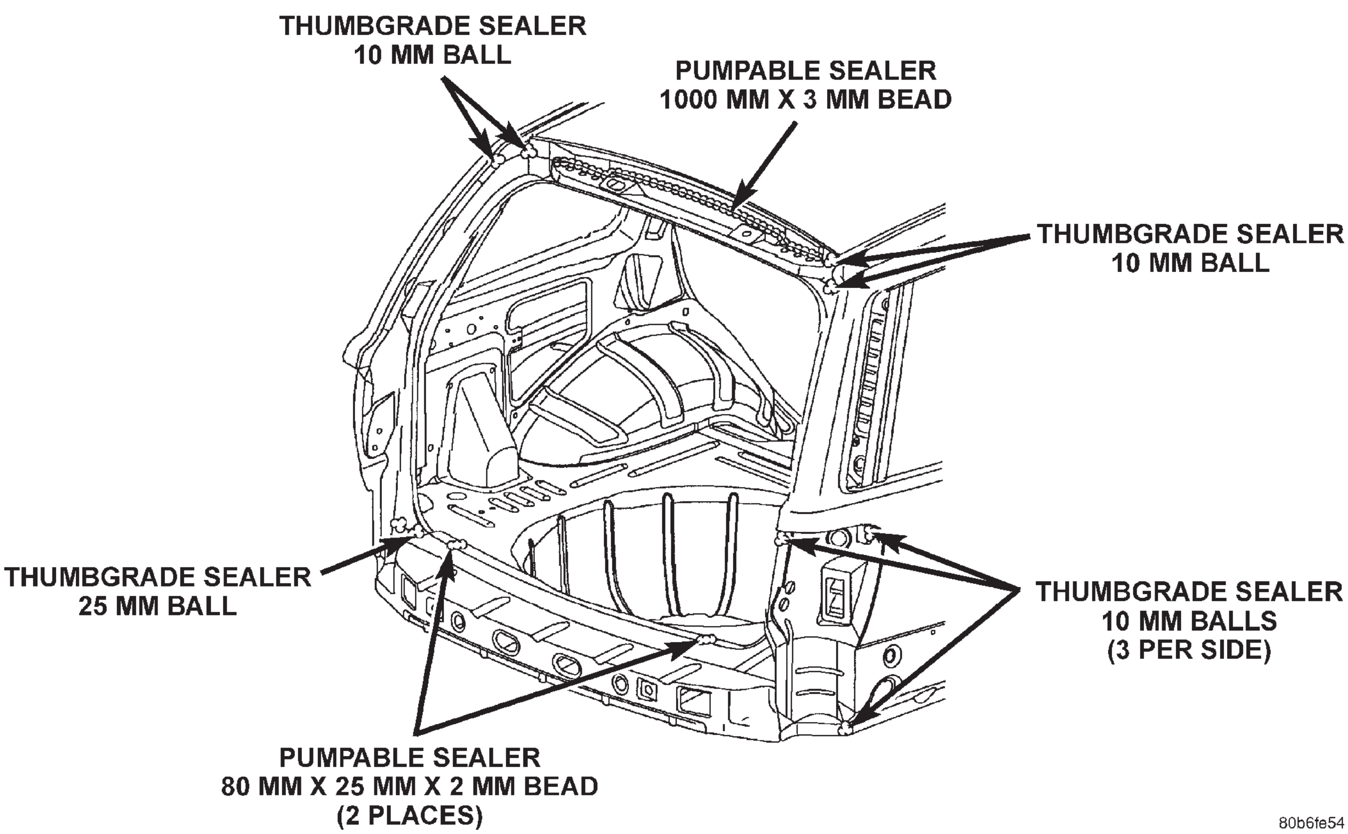


Fig. 23 LIFTGATE OPENING

SEALER LOCATIONS (Continued)

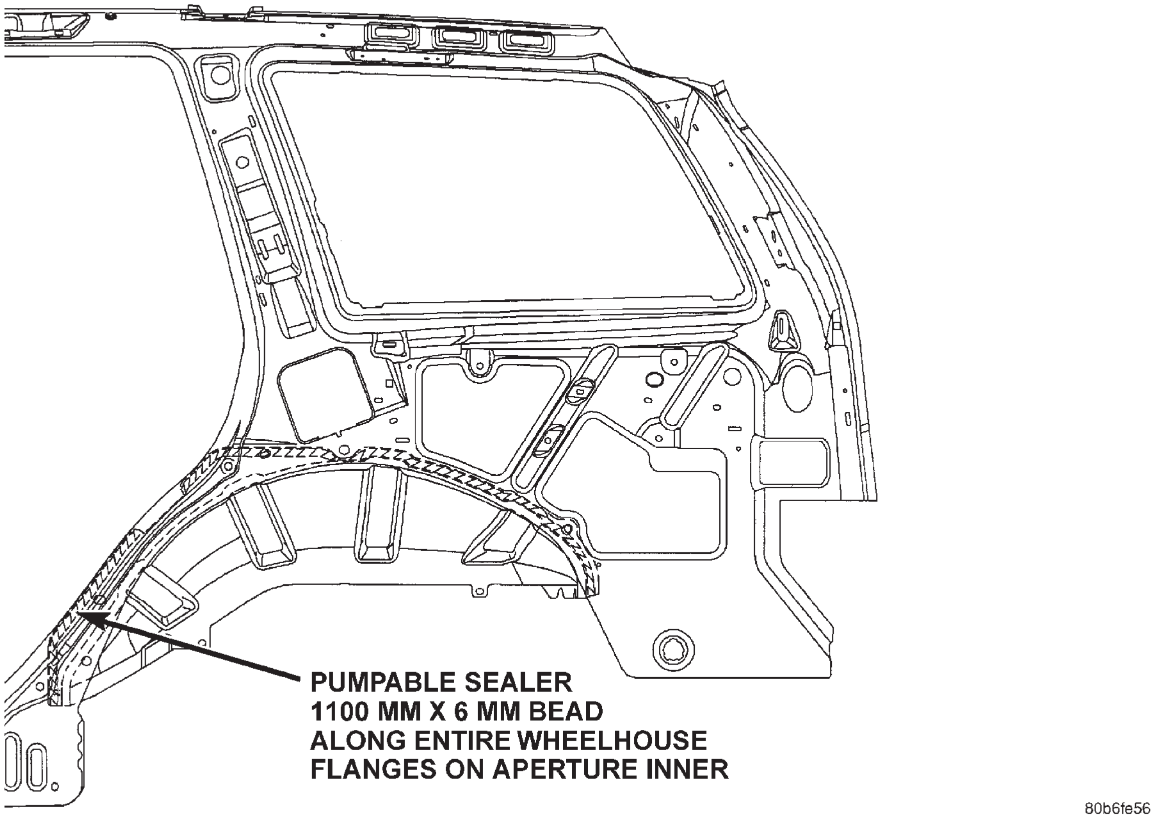


Fig. 24 INNER WHEELHOUSE FLANGE TO BODYSIDE APERTURE

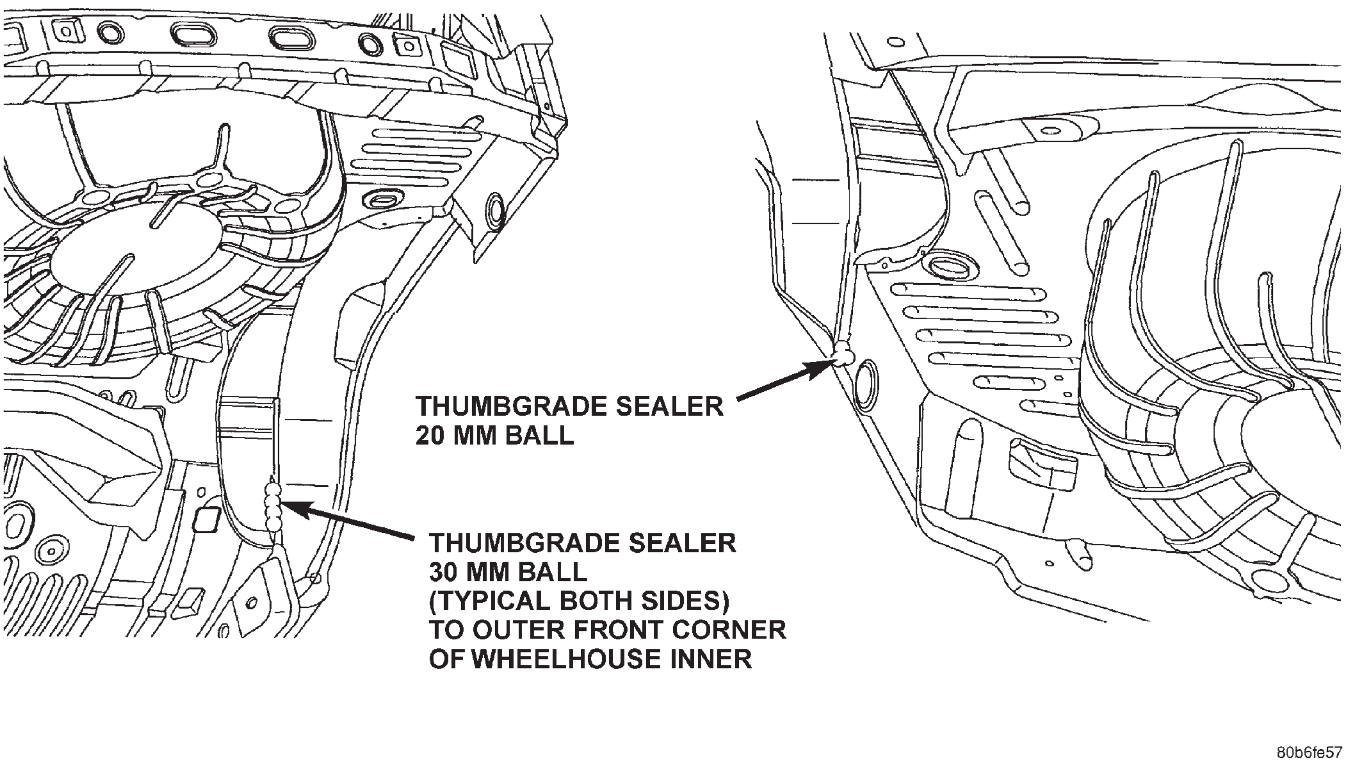


Fig. 25 WHEELHOUSE LOWER

SEALER LOCATIONS (Continued)

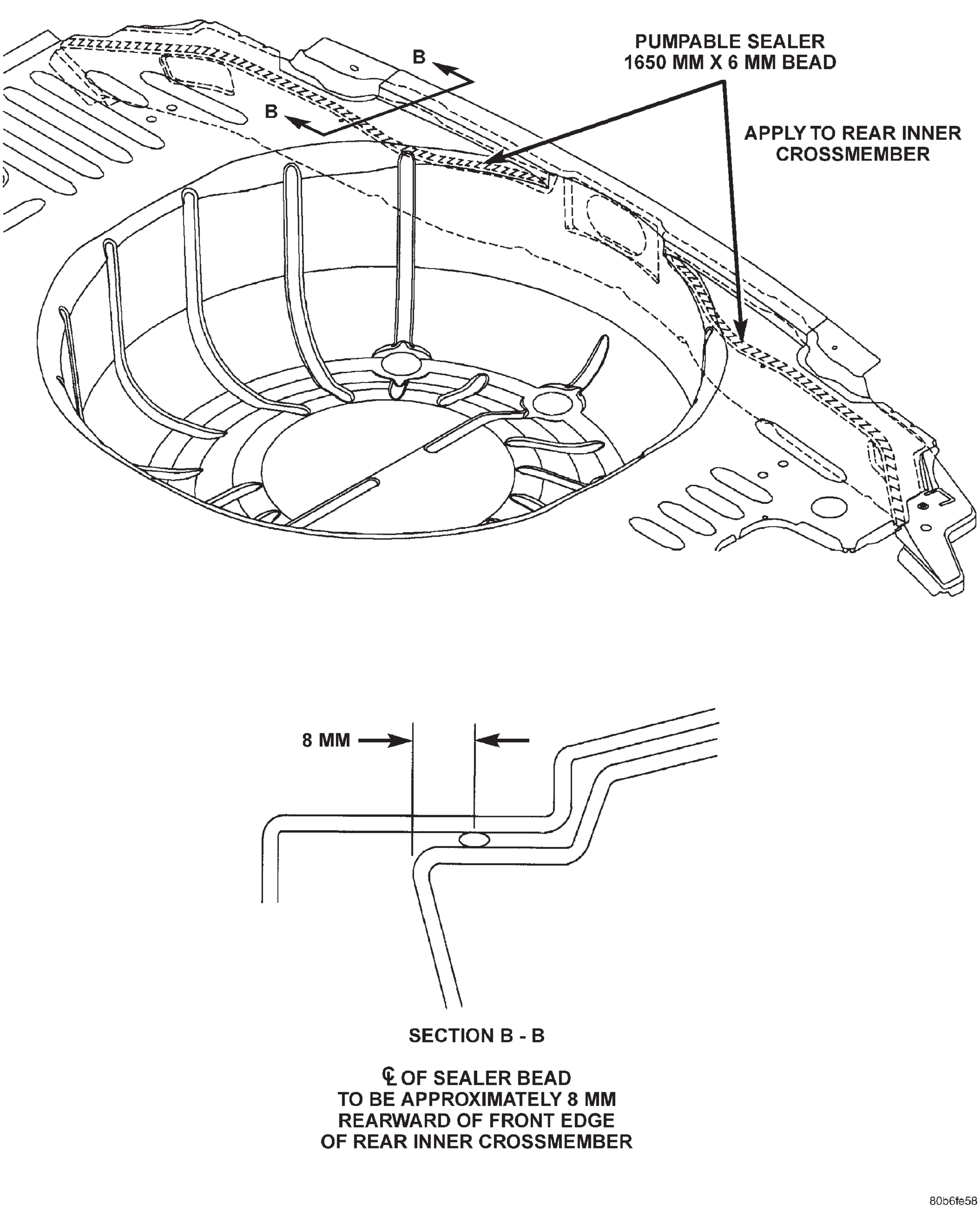


Fig. 26 REAR INNER CROSSMEMBER

SEALER LOCATIONS (Continued)

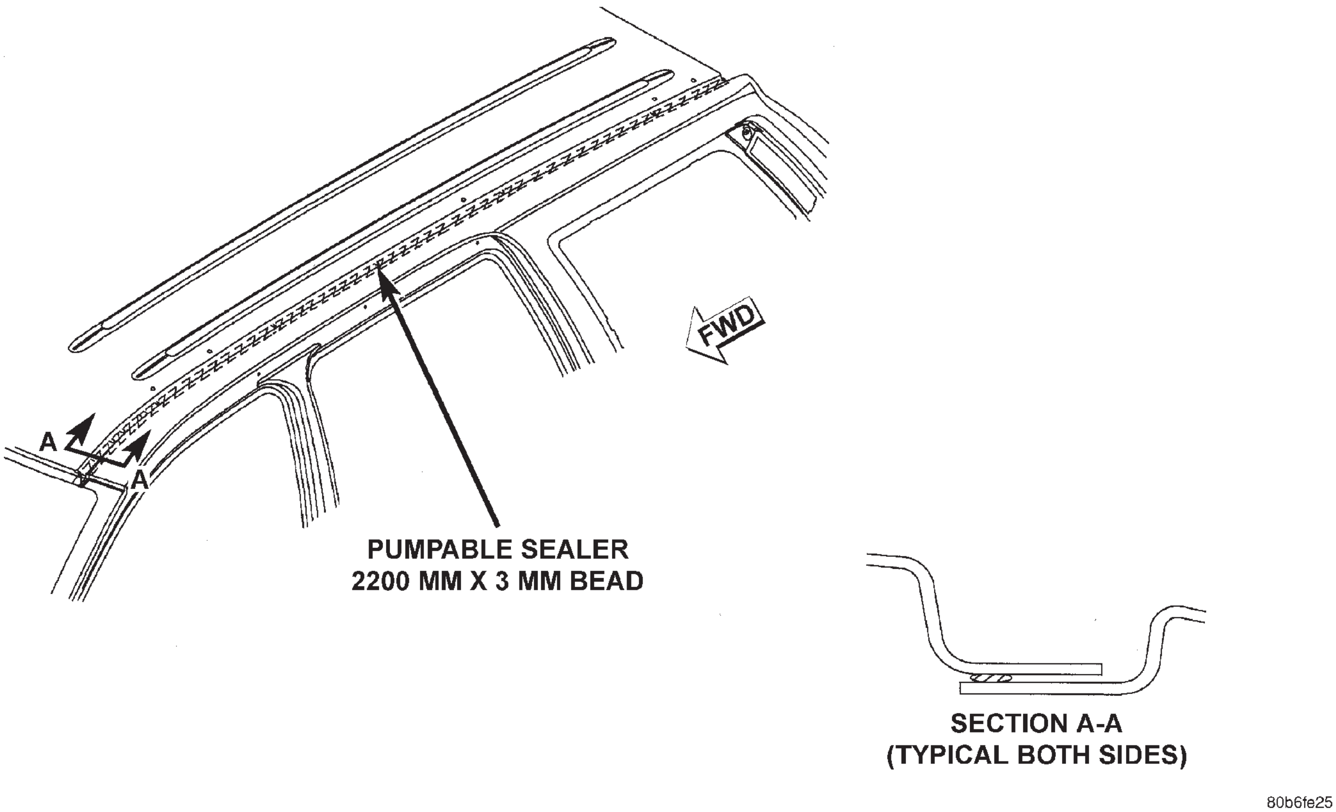


Fig. 27 ROOF TO BODY SIDE APERTURE

STUCTURAL ADHESIVE LOCATIONS

SPECIFICATIONS - STRUCTURAL ADHESIVE LOCATIONS

INDEX

DESCRIPTION	FIGURE
COWL PLENUM	28
DASH PANEL AND FRONT FLOOR PAN	29
PLENUM AND WINDSHIELD WIPER MOUNTING	30
FRONT FLOOR PAN AND SILLS	31
FRONT AND CENTER FLOOR PAN	32
FRONT PAN AND INNER BODY SIDE APERTURE	33
REAR SEAT CROSSMEMBER	34
REAR INNER WHEELHOUSE	35
FLOOR PAN AND SILL ASSEMBLY	36
FLOOR PAN	37
REAR INNER WHEELHOUSE AND REAR FLOOR PAN	38
RIGHT INNER BODYSIDE APERTURE	39
BODY SIDE INNER PANEL AND WHEELHOUSE	40
BODY SIDE OUTER PANEL AND REAR WHEELHOUSE OUTER PANEL	41
D-PILLAR AND FUEL FILLER GUSSETS	42
LIFTGATE	43
TAILLAMP MOUNTING PANEL	44
TAILLAMP	45
REAR INNER CROSSMEMBER	46
ROOF BOWS	47
REAR LOWER HEADER	48

STUCTURAL ADHESIVE LOCATIONS (Continued)

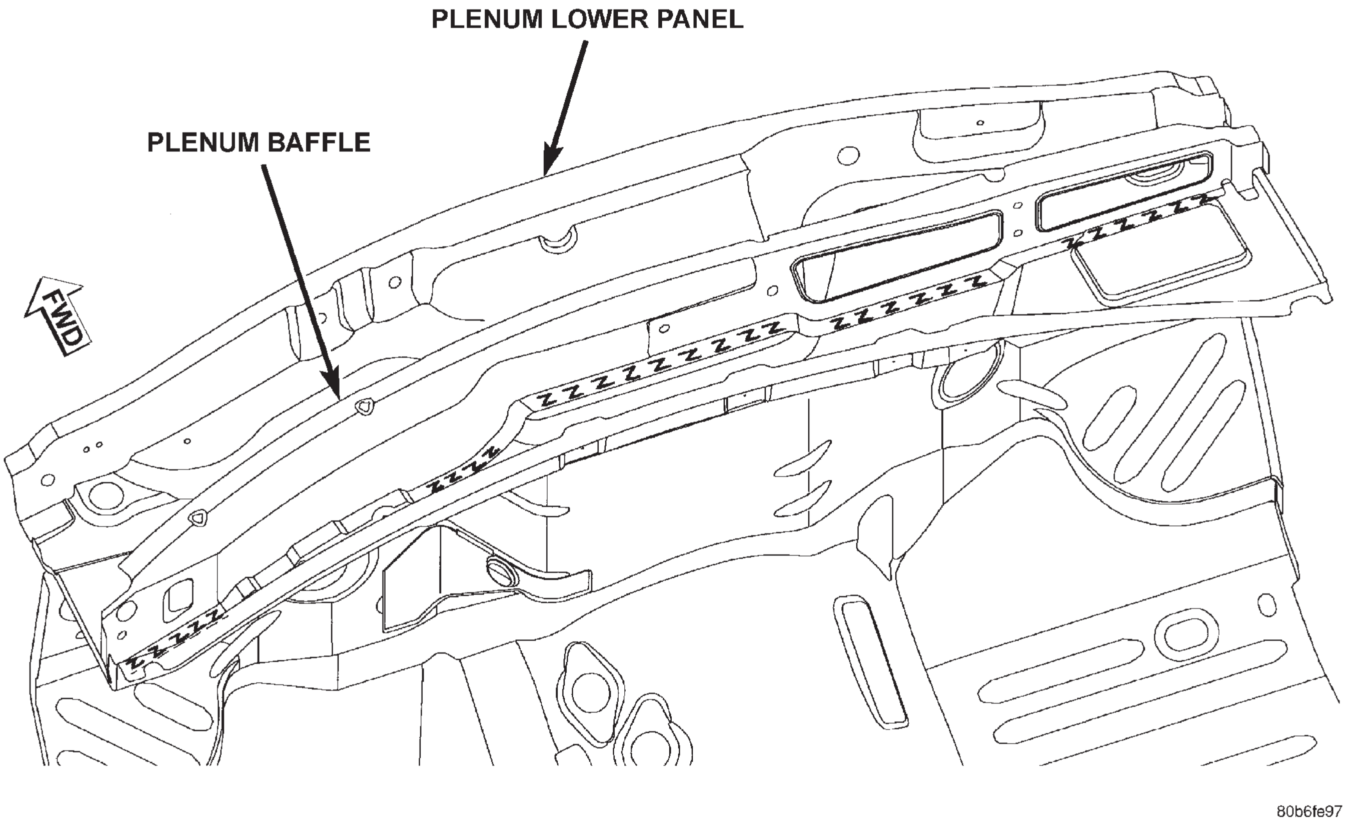


Fig. 28 COWL PLENUM

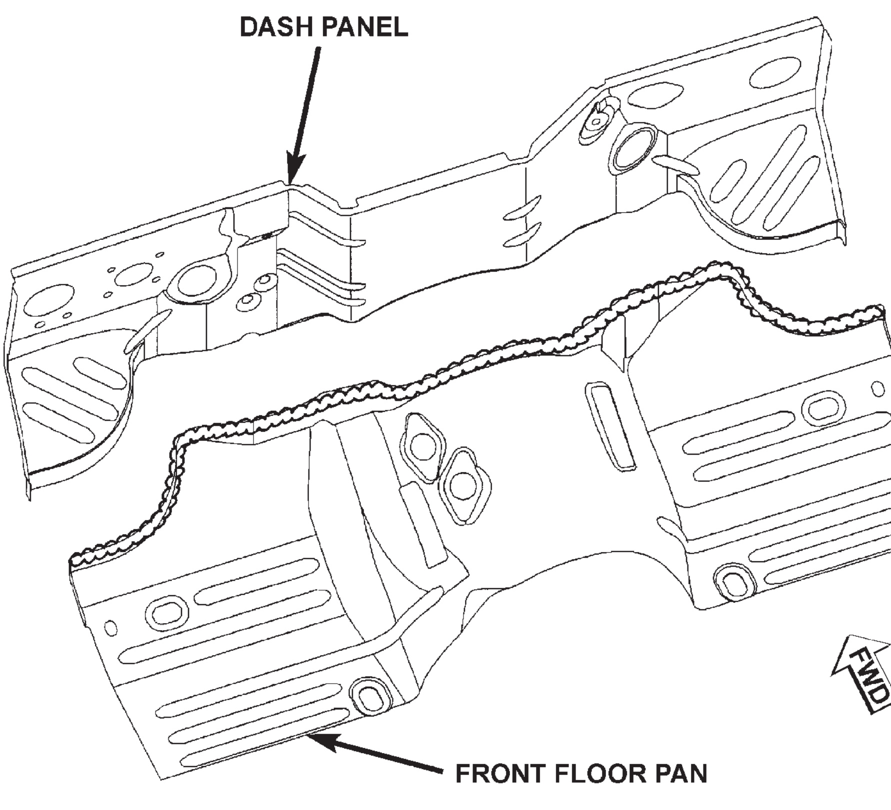


Fig. 29 DASH PANEL AND FRONT FLOOR PAN

STUCTURAL ADHESIVE LOCATIONS (Continued)

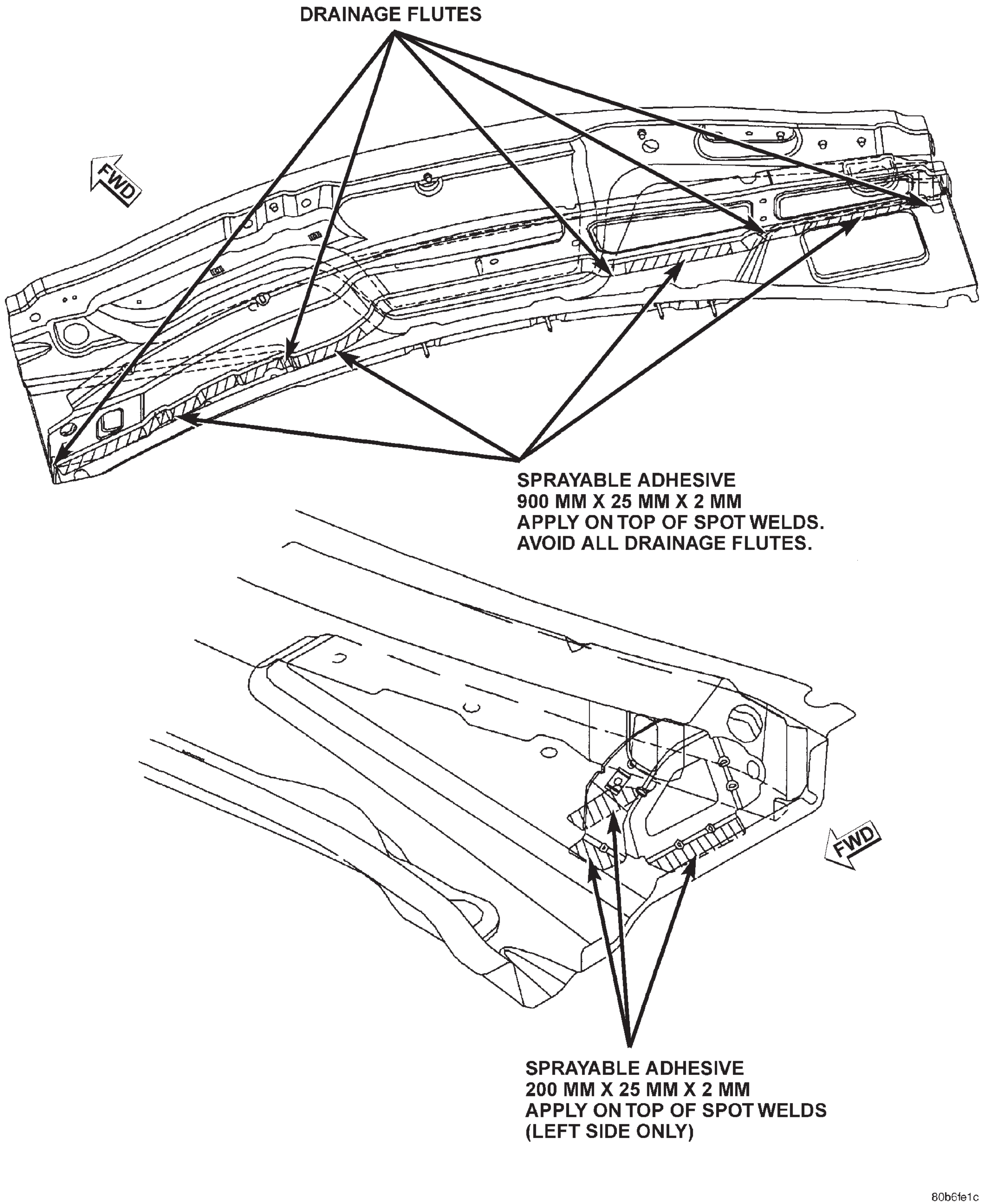


Fig. 30 PLENUM AND WINDSHIELD WIPER MOUNTING

STUCTURAL ADHESIVE LOCATIONS (Continued)

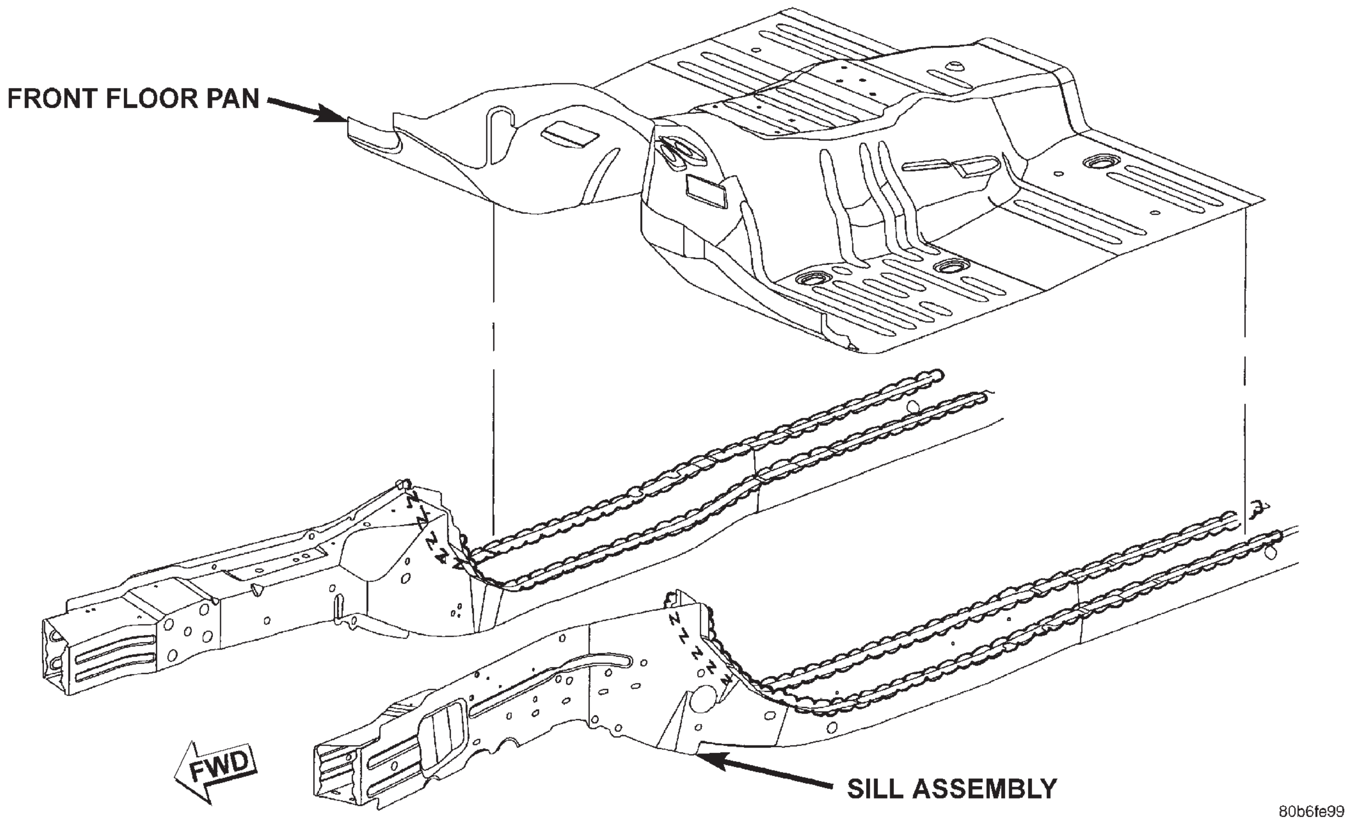


Fig. 31 FRONT FLOOR PAN AND SILLS

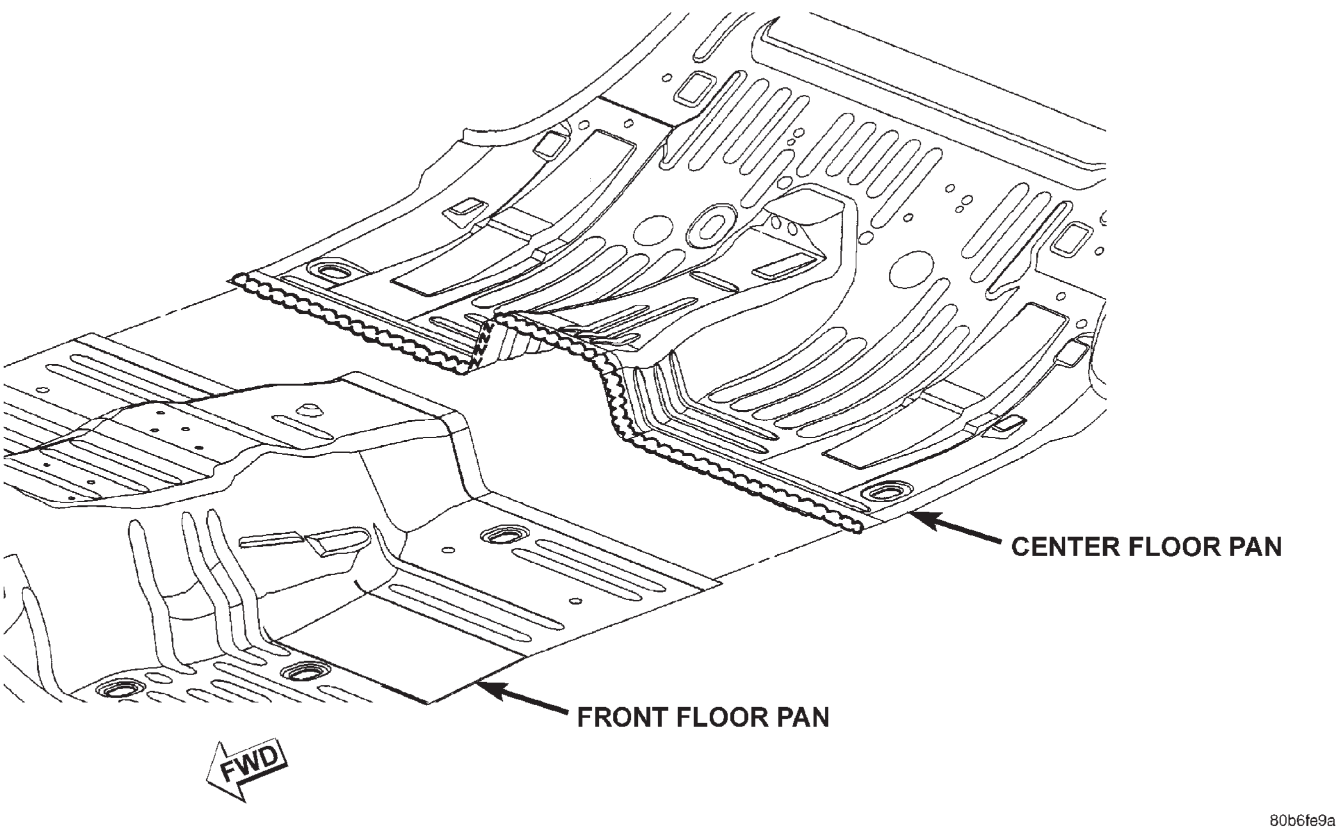


Fig. 32 FRONT AND CENTER FLOOR PAN

STUCTURAL ADHESIVE LOCATIONS (Continued)

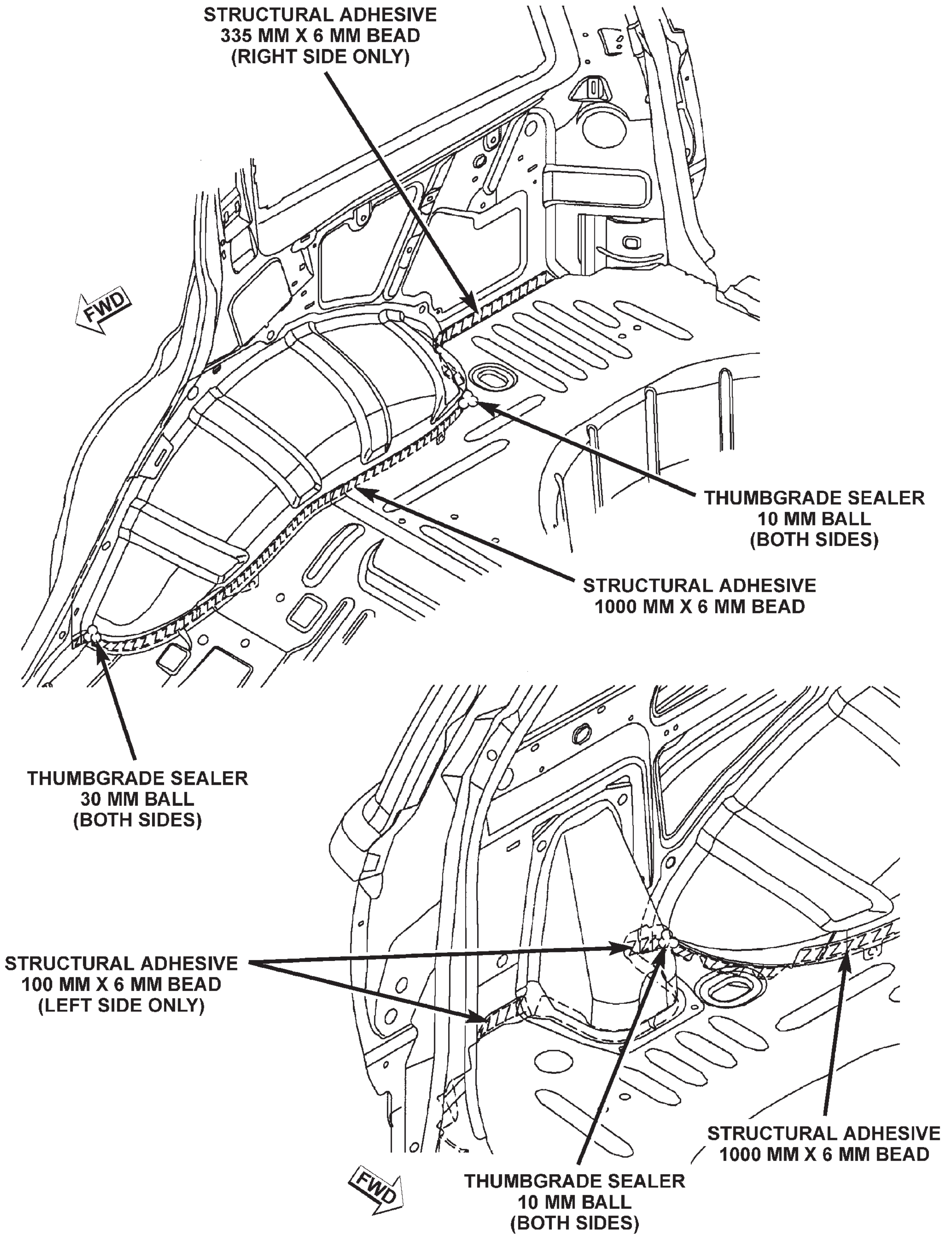


Fig. 33 FRONT PAN AND INNER BODY SIDE APERTURE

STUCTURAL ADHESIVE LOCATIONS (Continued)

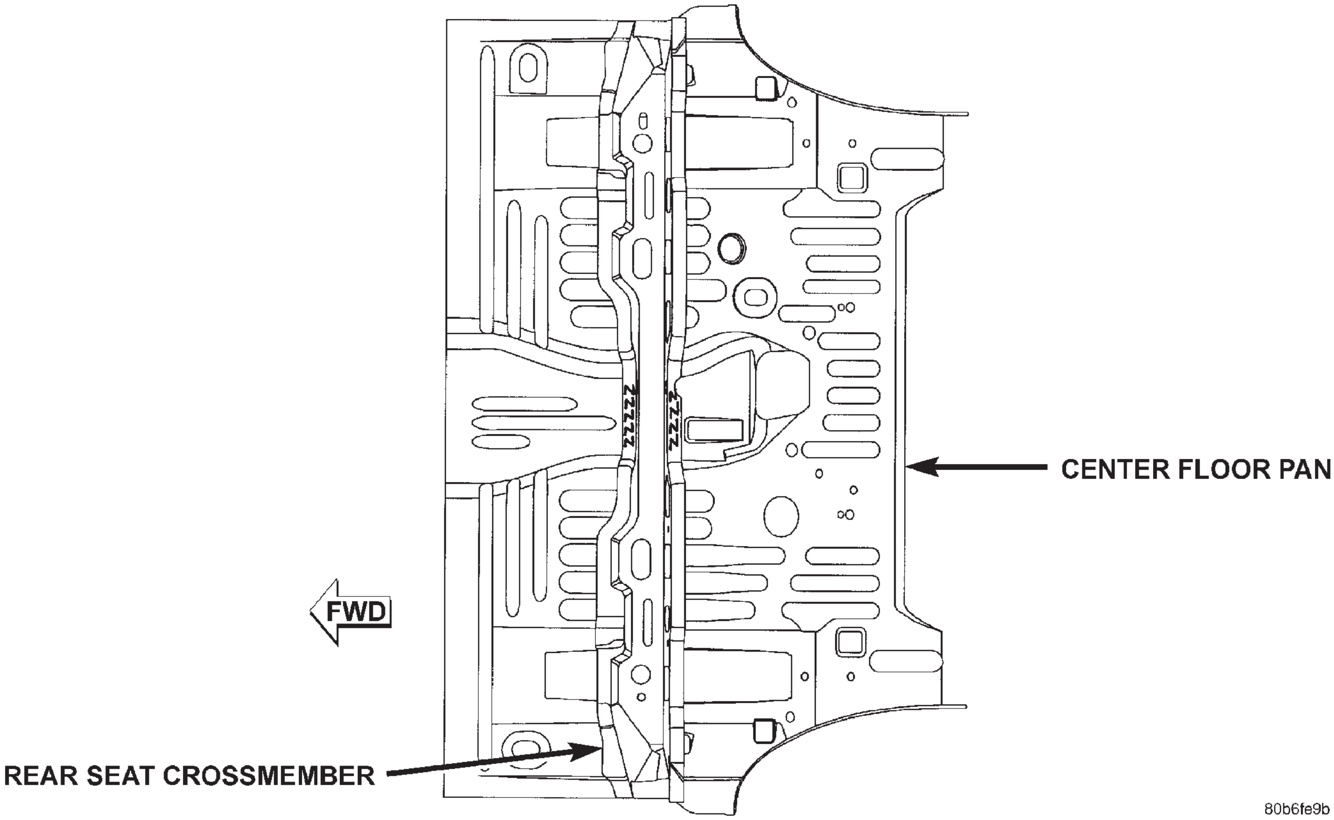


Fig. 34 REAR SEAT CROSSMEMBER

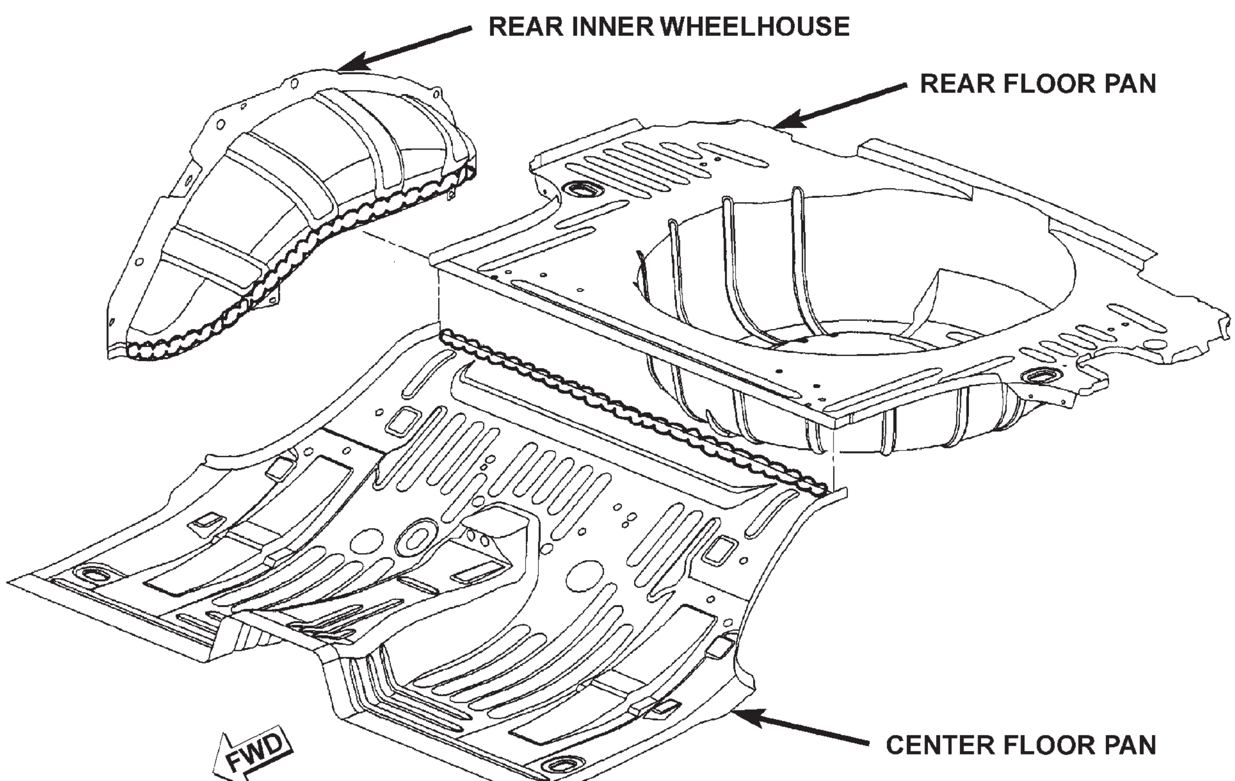


Fig. 35 REAR INNER WHEELHOUSE

STUCTURAL ADHESIVE LOCATIONS (Continued)

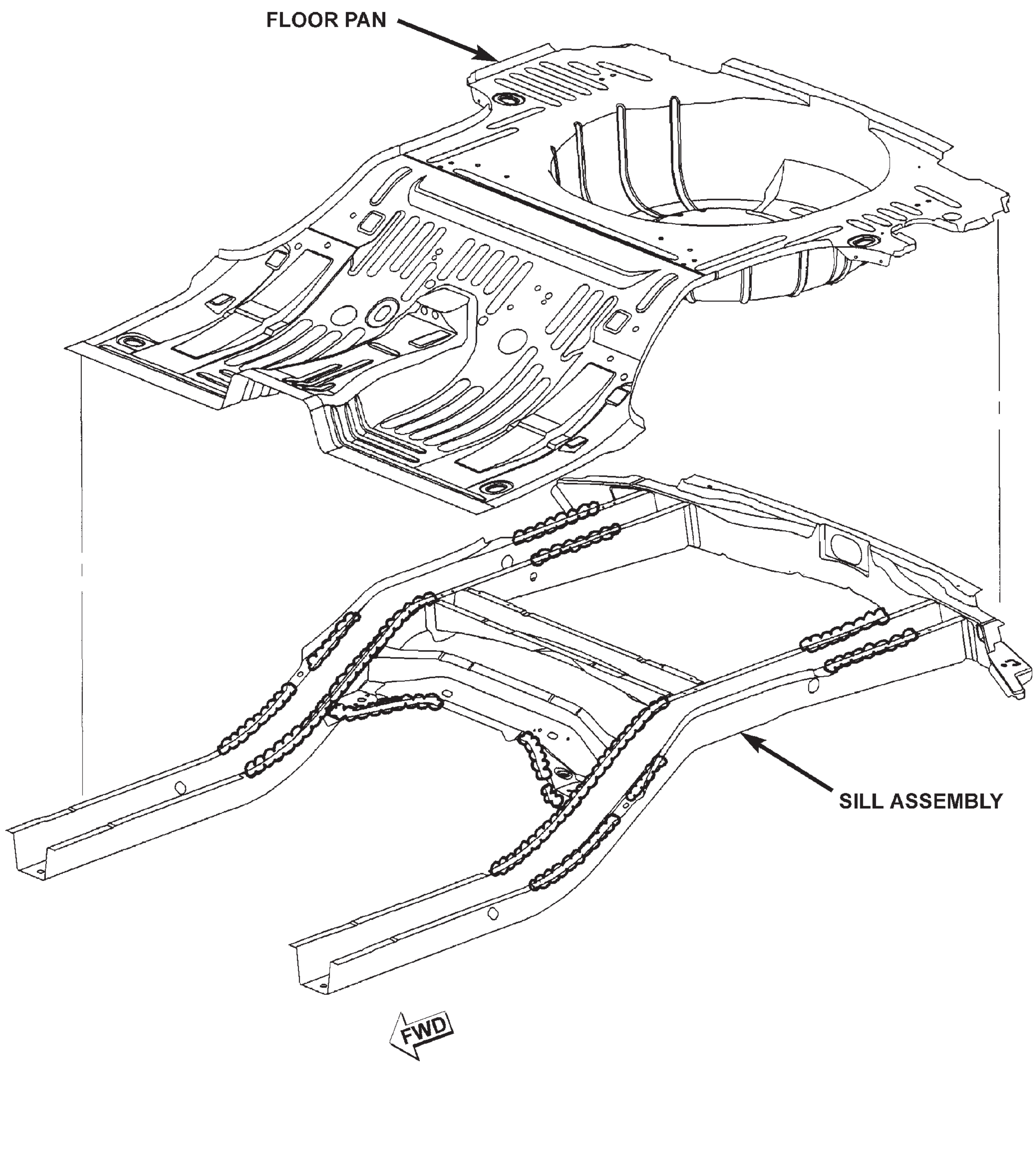


Fig. 36 FLOOR PAN AND SILL ASSEMBLY

STUCTURAL ADHESIVE LOCATIONS (Continued)

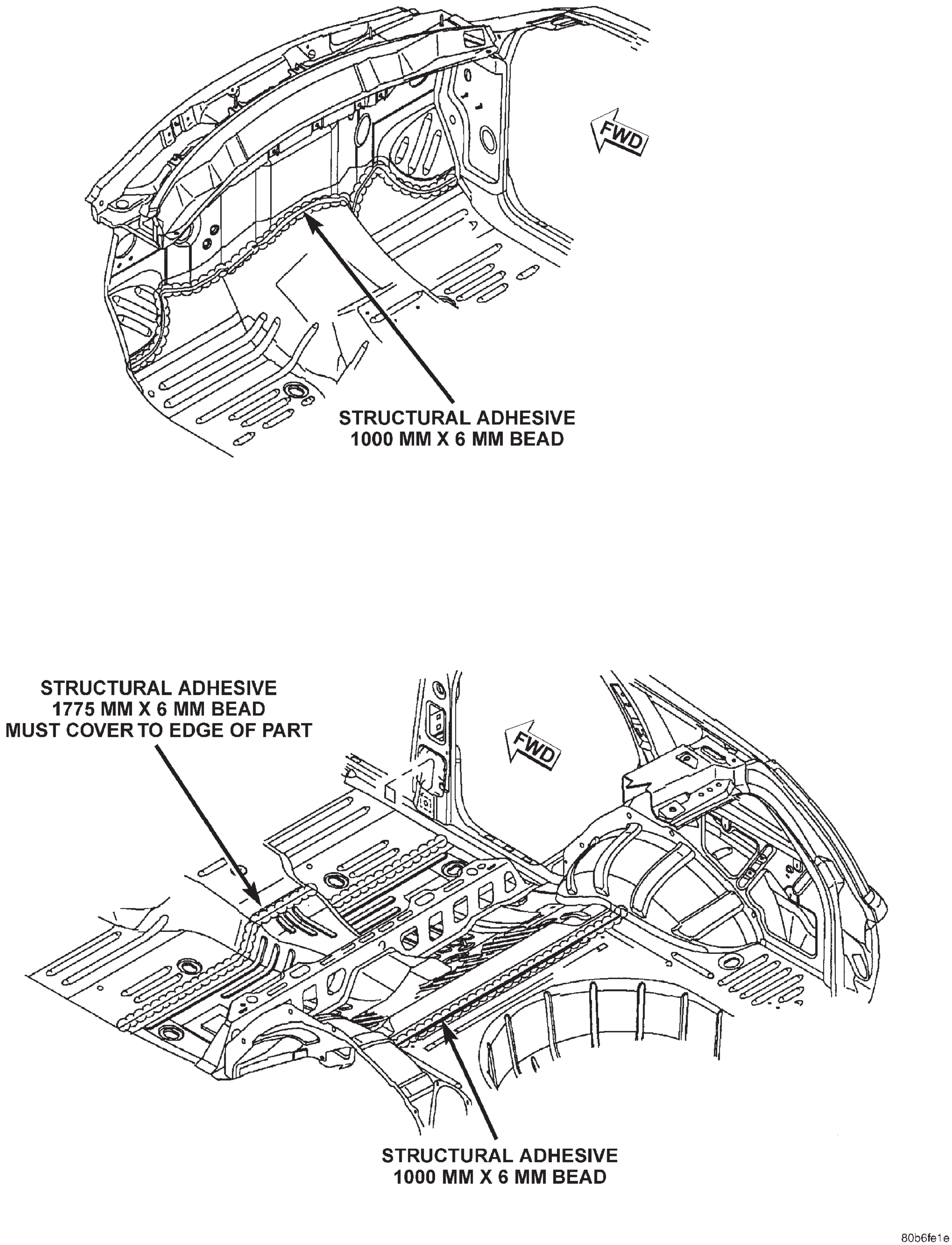


Fig. 37 FLOOR PAN

STUCTURAL ADHESIVE LOCATIONS (Continued)

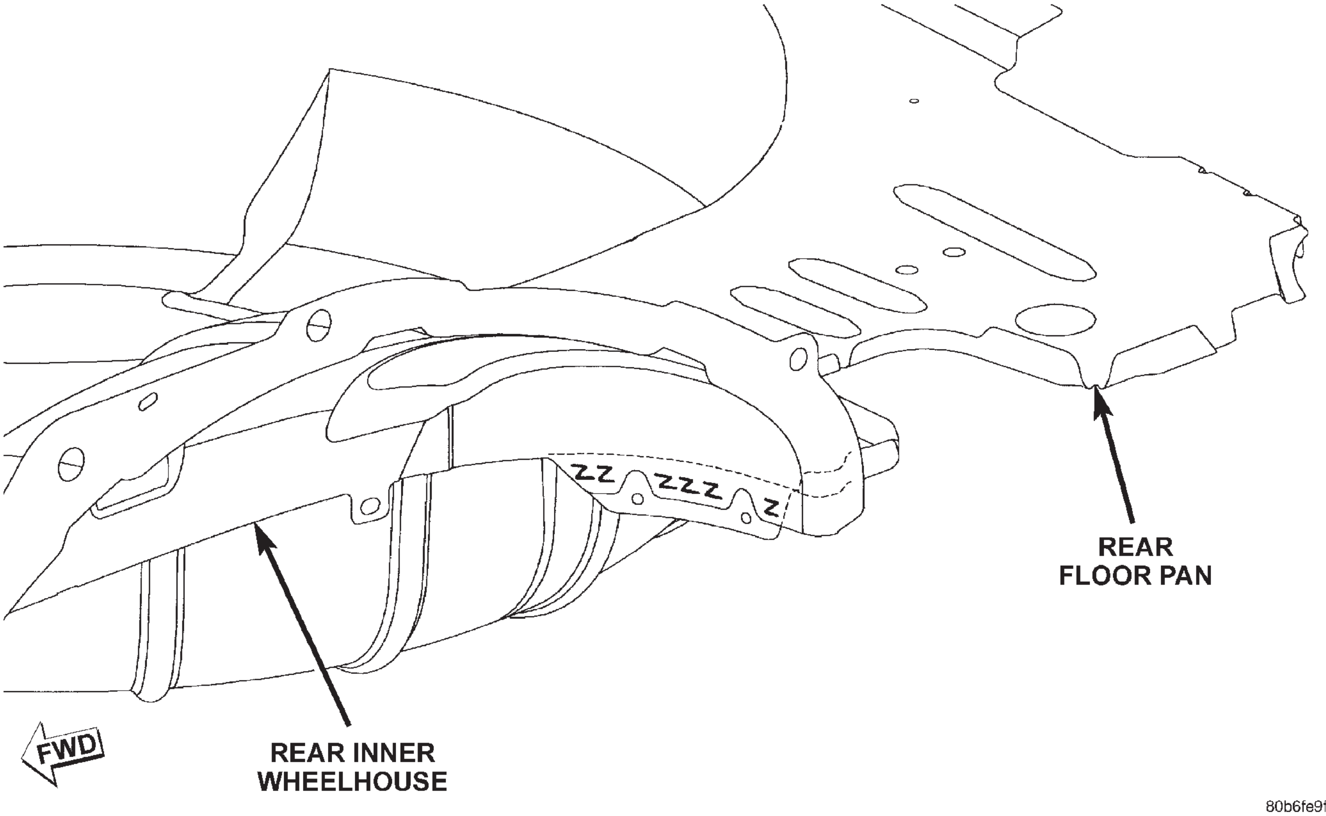


Fig. 38 REAR INNER WHEELHOUSE AND REAR FLOOR PAN

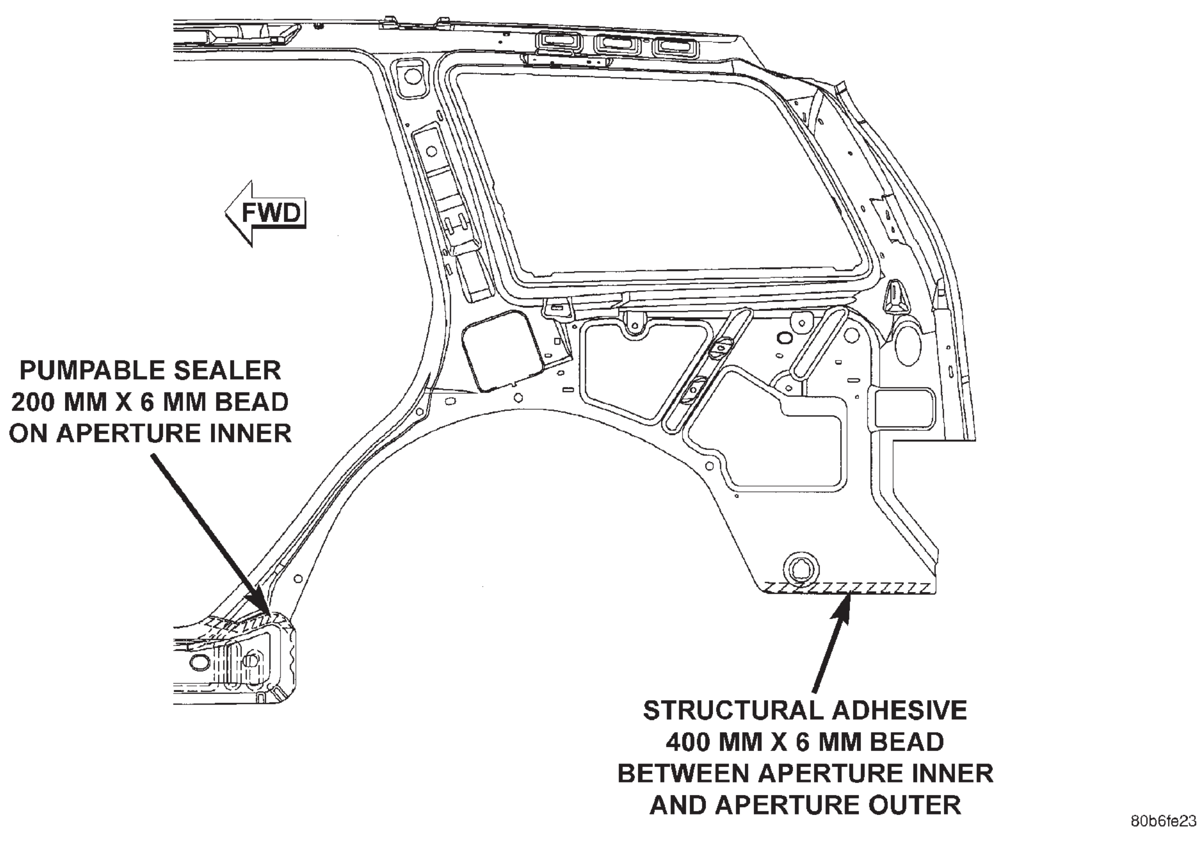


Fig. 39 RIGHT INNER BODYSIDE APERTURE

STUCTURAL ADHESIVE LOCATIONS (Continued)

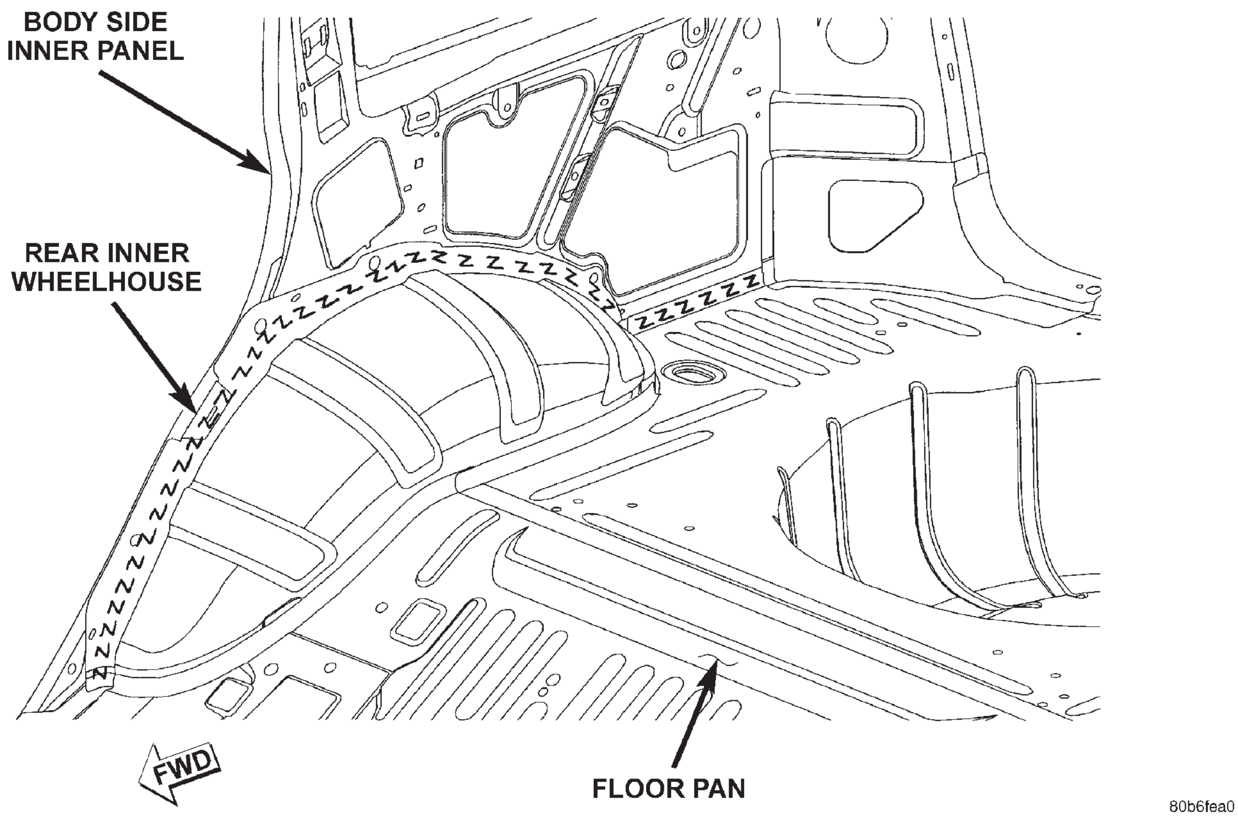


Fig. 40 BODY SIDE INNER PANEL AND WHEELHOUSE

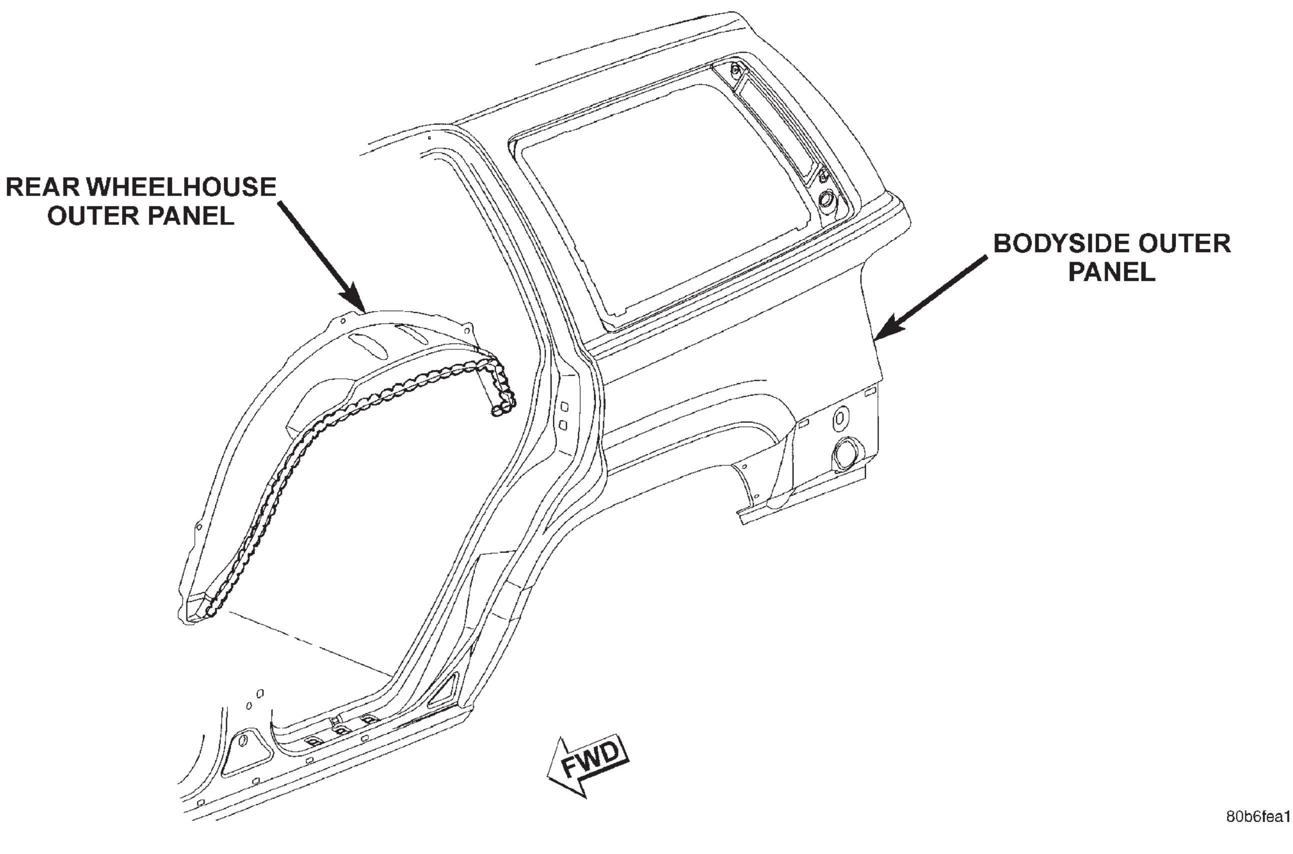


Fig. 41 BODY SIDE OUTER PANEL AND REAR WHEELHOUSE OUTER PANEL

STUCTURAL ADHESIVE LOCATIONS (Continued)

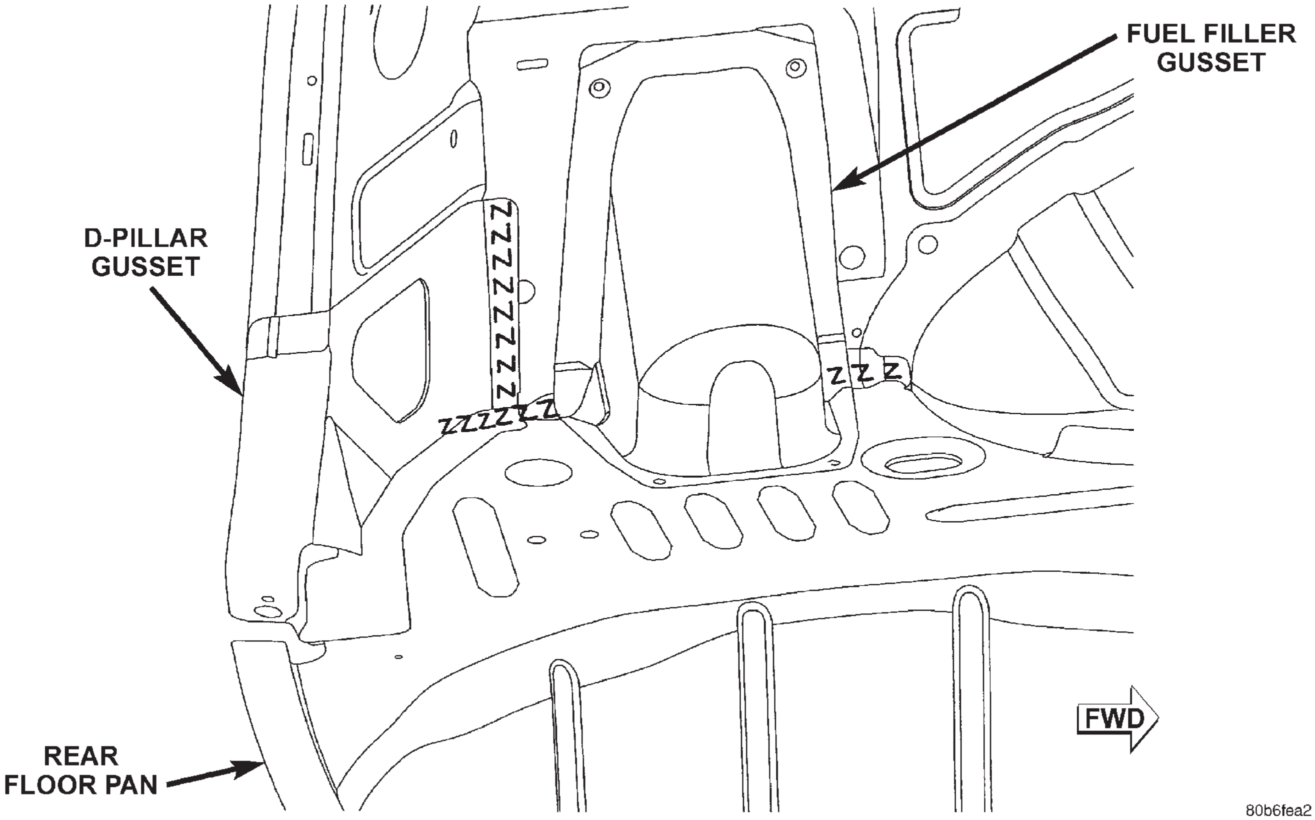


Fig. 42 D-PILLAR AND FUEL FILLER GUSSETS

STUCTURAL ADHESIVE LOCATIONS (Continued)

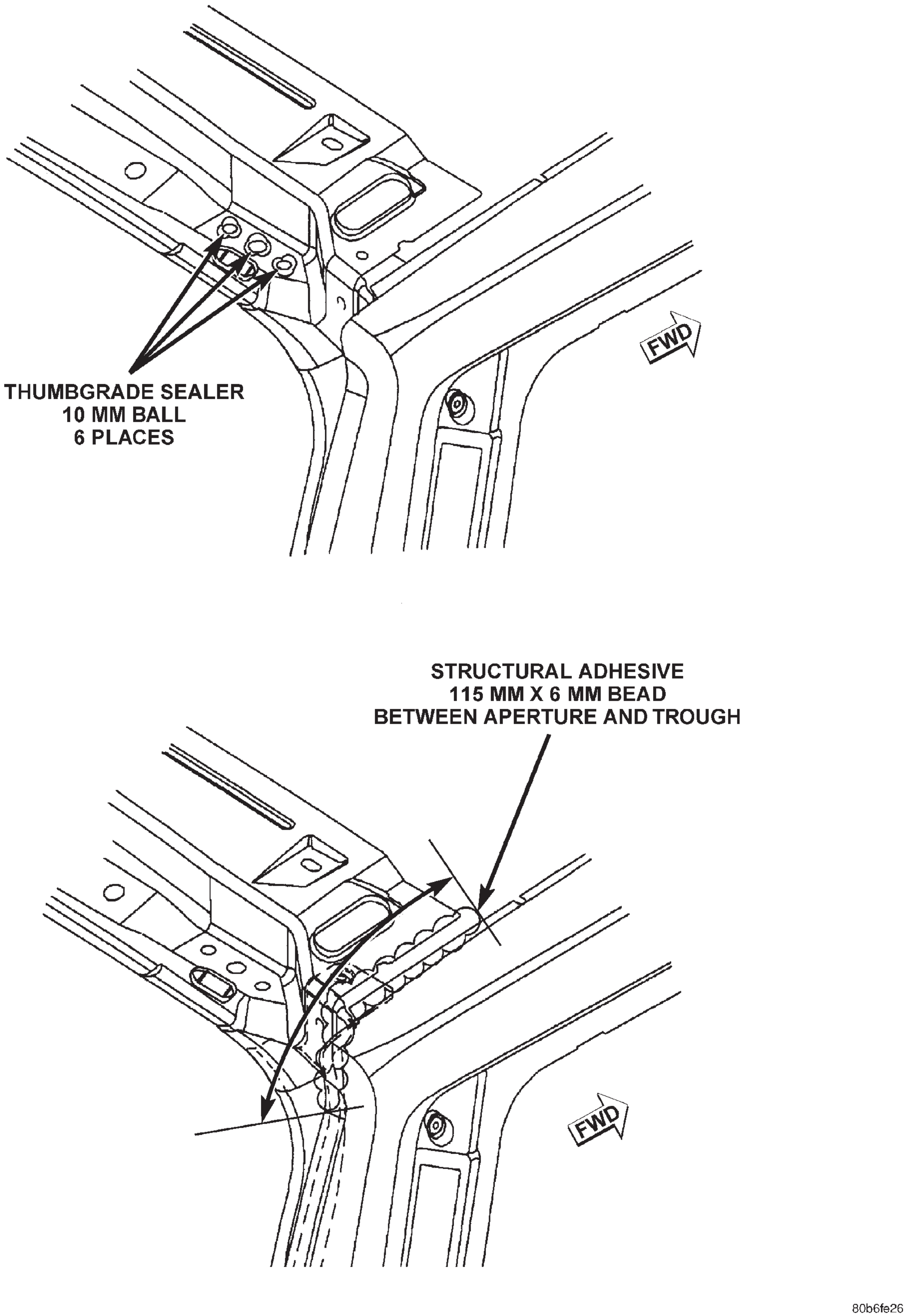


Fig. 43 LIFTGATE

STUCTURAL ADHESIVE LOCATIONS (Continued)

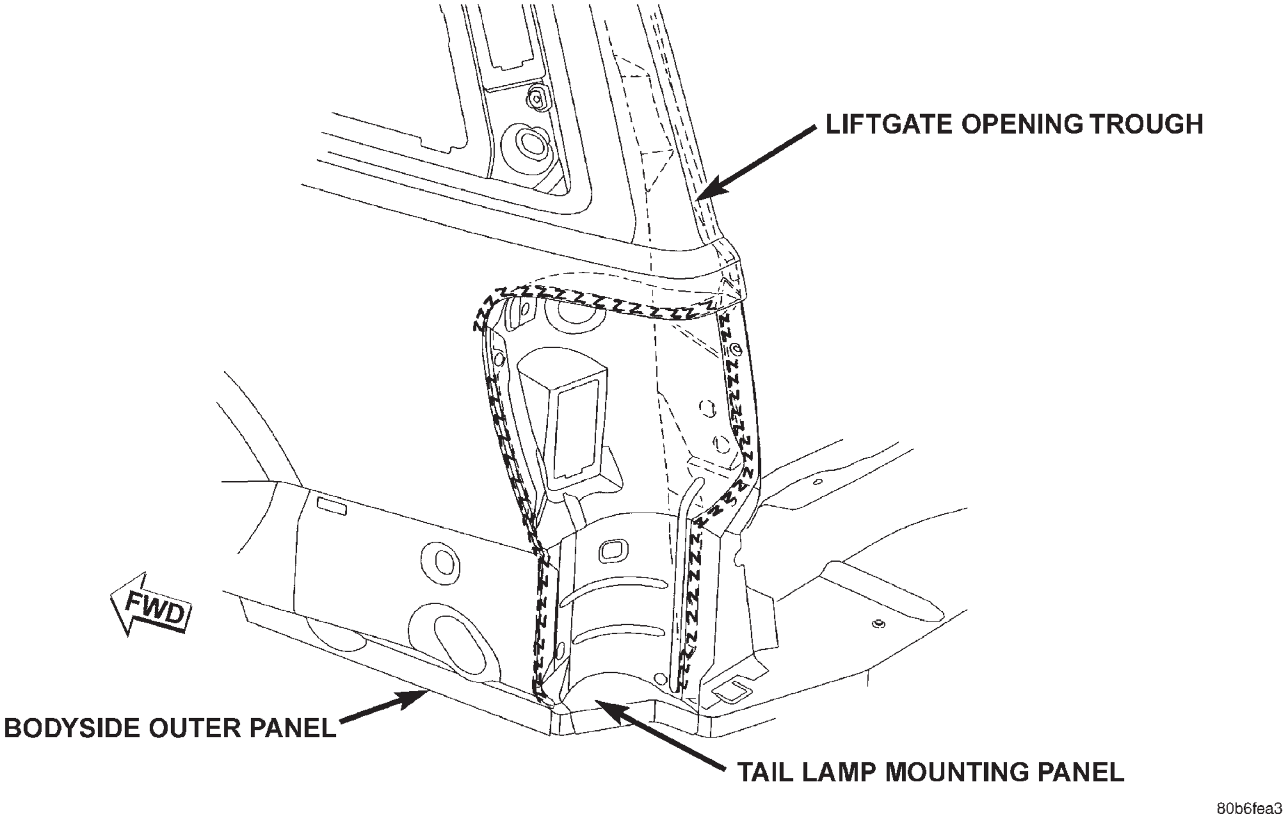


Fig. 44 TAILLAMP MOUNTING PANEL

STUCTURAL ADHESIVE LOCATIONS (Continued)

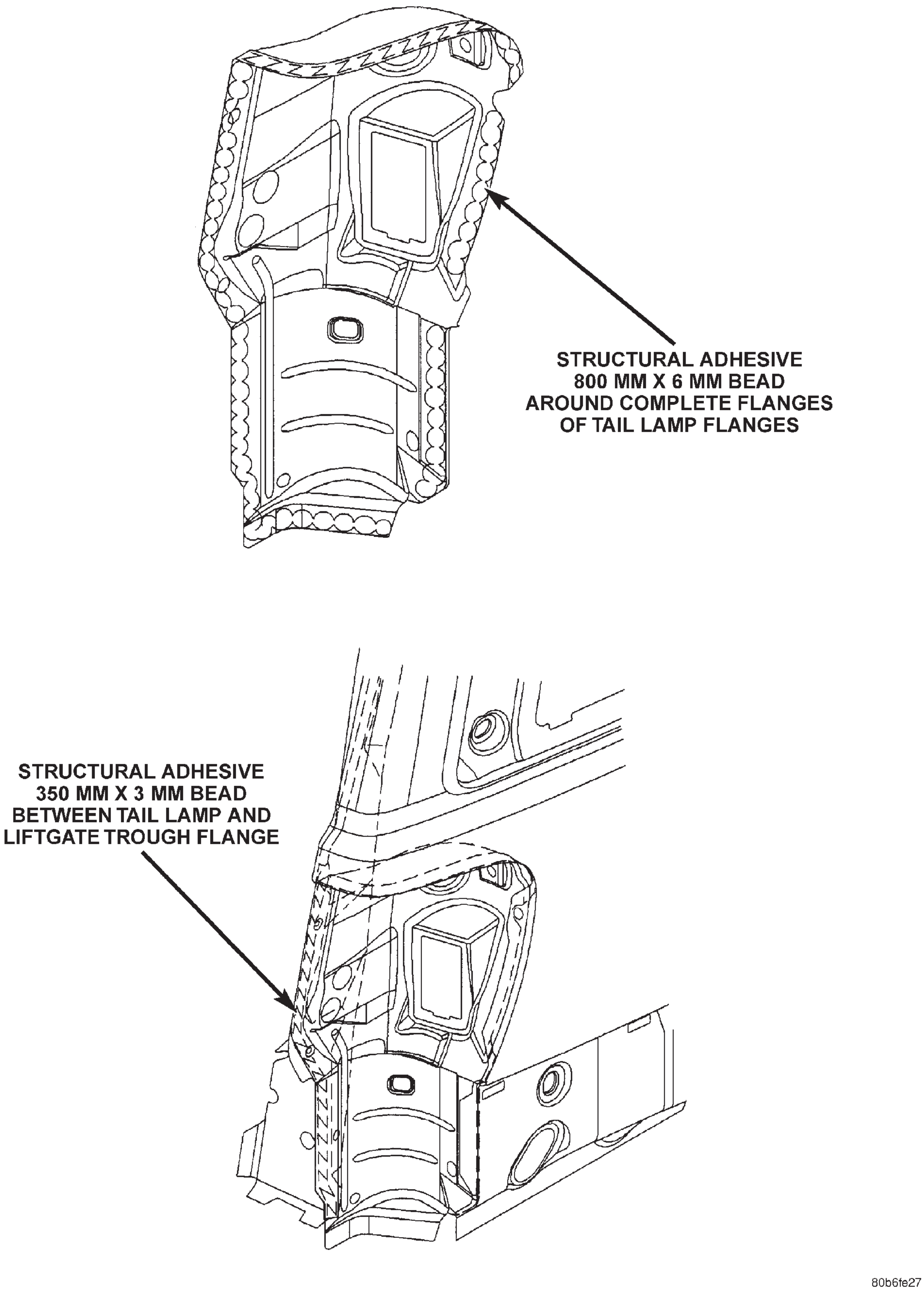


Fig. 45 TAILLAMP

STUCTURAL ADHESIVE LOCATIONS (Continued)

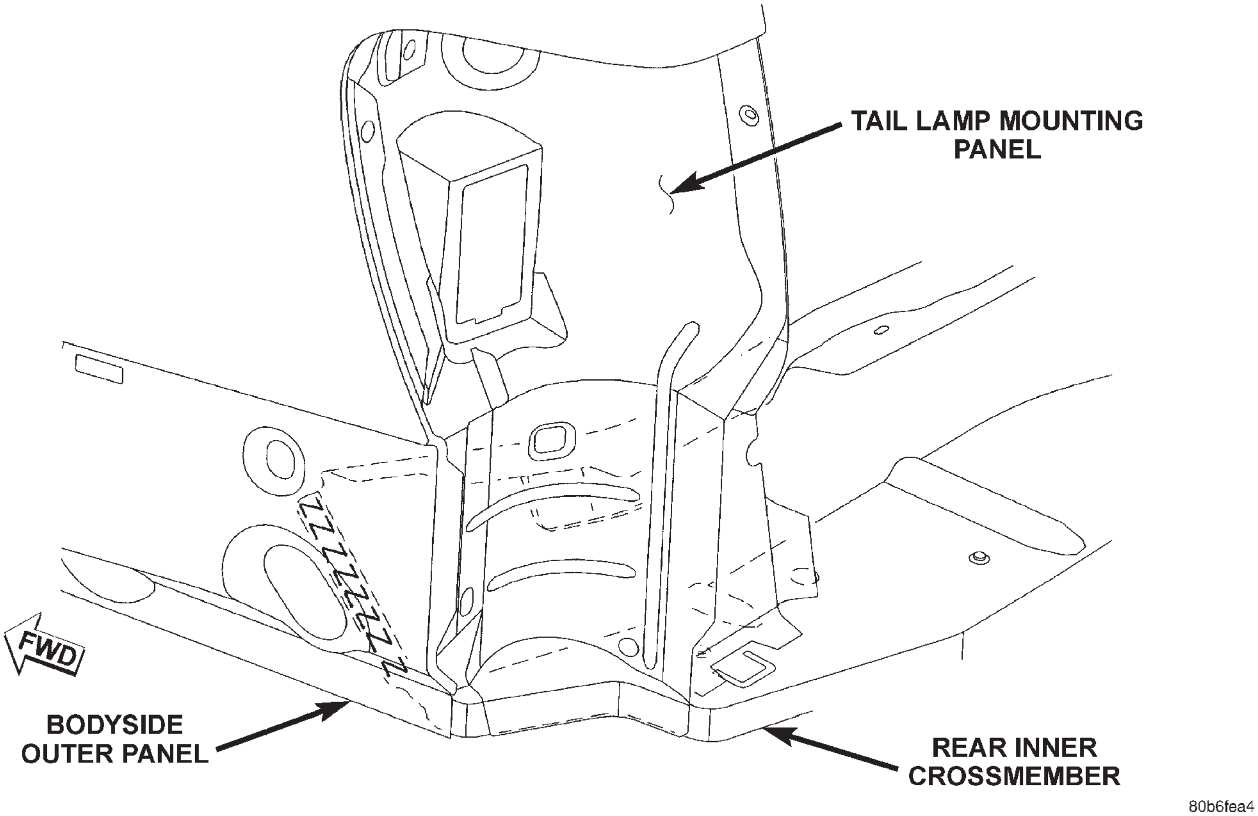


Fig. 46 REAR INNER CROSSMEMBER

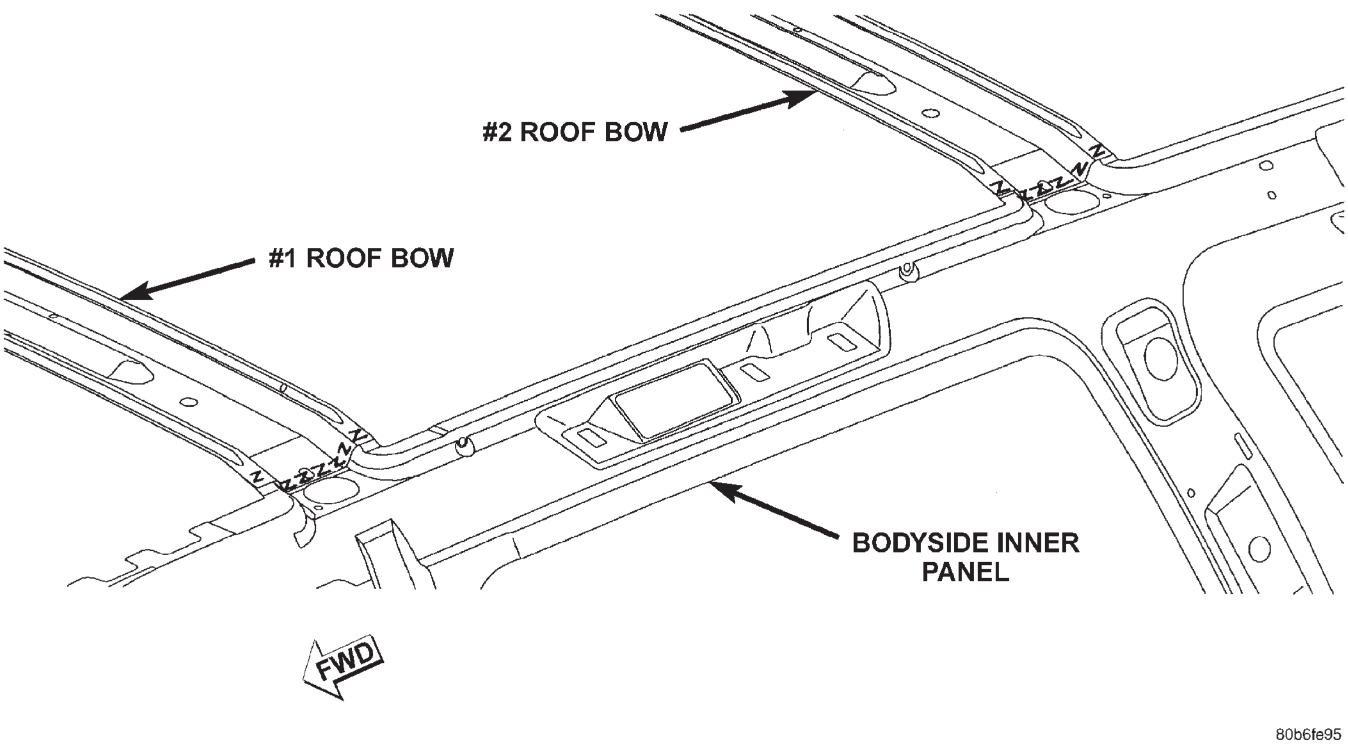


Fig. 47 ROOF BOWS

STUCTURAL ADHESIVE LOCATIONS (Continued)

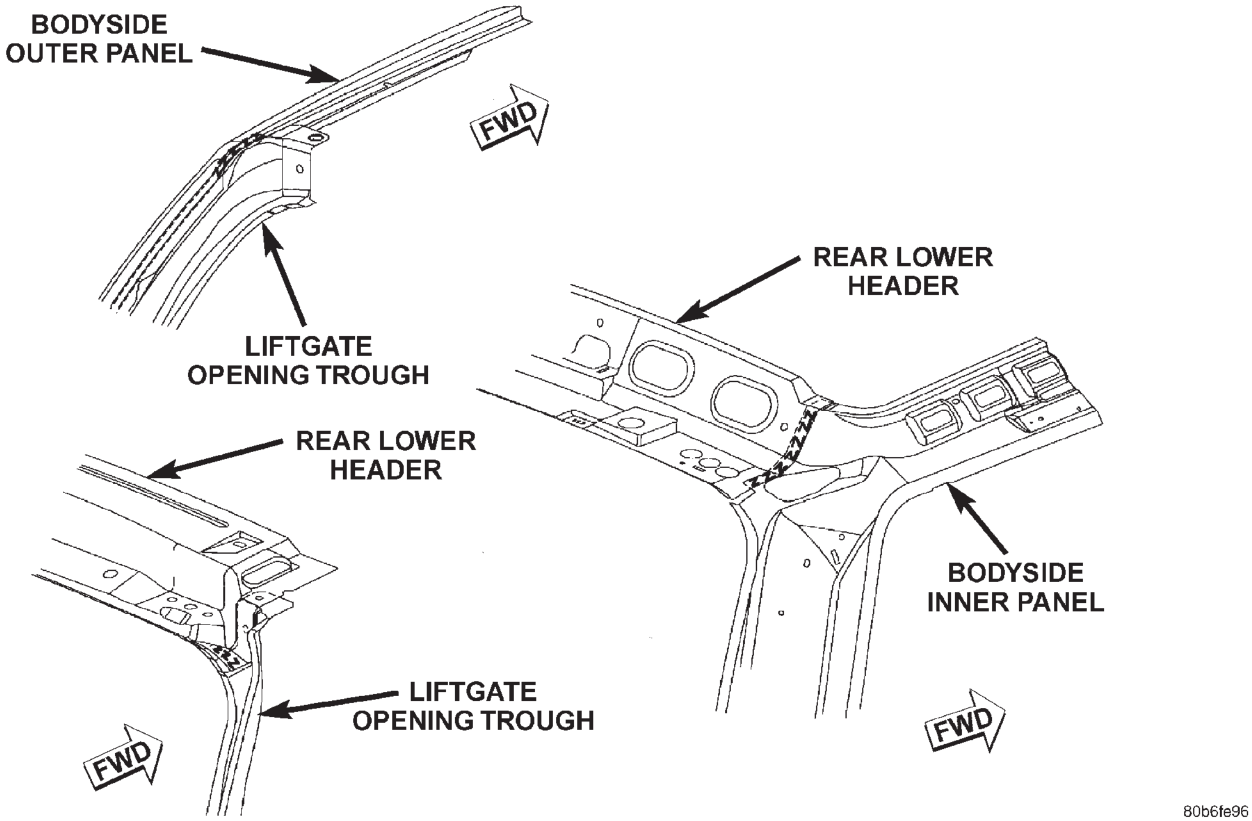


Fig. 48 REAR LOWER HEADER

WELD LOCATIONS

SPECIFICATIONS

WELD LOCATIONS

INDEX

DESCRIPTION	FIGURE
RADIATOR SUPPORT BRACKETS	49
FRONT SUSPENSION SUPPORT REINFORCEMENT	50
FRONT LOWER CROSSMEMBER TO COWL SIDE PANEL	51
FRONT SILL TO LOWER CROSSMEMBER	52
FRONT FENDER MOUNTING BRACKET AND REINFORCEMENT	53
FRONT SUSPENSION SUPPORT TO SILLS AND COWL SIDE PANEL	54
LEFT INSTRUMENT PANEL BRACKET TO COWL SIDE PANEL	55
COWL SIDE UPPER REINFORCEMENT TO COWL SIDE AND FRONT SUSPENSION SUPPORT	56
COWL SIDE PANEL TO DASH PANEL AND INNER BODYSIDE PANEL AND SILL	57
PLENUM ASSEMBLY TO COWL SIDE PANEL	58
FRONT LOWER CROSSMEMBER	59
FRONT SUSPENSION SUPPORT TO DASH	60
WIPER MOUNTING BRACKETS TO PLENUM ASSEMBLY	61
COWL TOP AND PLENUM ASSEMBLY	62
LOWER PLENUM REINFORCEMENT TO LOWER PLENUM PANEL	63
DASH PANEL TO LOWER PLENUM PANEL	64
PLENUM ASSEMBLY TO COWL	65
COWL PANEL TO BODYSIDE SILL	66
COWL PANEL TO FRONT FLOOR PAN	67
FRONT SILLS TO DASH AND FRONT FLOOR PAN	68
COWL SIDE PANEL DASH INNER BODYSIDE AND OUTER BODYSIDE PANELS	69
UPPER FRONT INNER PILLAR TO ROOF AND COWL	70
DOOR OPENINGS	71
B-PILLAR REINFORCEMENT TO INNER BODYSIDE APERTURE	72
REAR QUARTER WINDOW TO BODYSIDE APERTURE INNER AND OUTER	73
LOWER REAR QUARTER TO BODYSIDE APERTURE INNER AND OUTER	74
INNER TRACK BAR, LOWER CONTROL ARM AND TRANSMISSION CROSSMEMBER BRACKETS TO FRONT SILLS	75
TRANSMISSION CROSSMEMBER BRACKET AND REINFORCEMENT TO FRONT SILLS	76
UPPER SILLS AND UPPER CONTROL ARM REINFORCEMENT AND BRACKETS TO FRONT SILLS	77
REINFORCEMENT TO FRONT OUTER SILLS	78
FRONT INNER SILL TO FRONT OUTER SILL	79
OUTER TRACK BAR BRACKET TO FRONT OUTER SILL	80

WELD LOCATIONS (Continued)

DESCRIPTION	FIGURE
REINFORCEMENT FOR FRONT ENGINE MOUNTING AND STEERING GEAR TO FRONT INNER SILL	81
LARGE AND SMALL SWAY BAR TAPPING PLATES TO FRONT INNER SILLS	82
FRONT AND REAR DOOR HINGE TAPPING PLATES	83
REAR DOOR STRIKER REINFORCEMENT	84
TAIL LAMP MOUNTING PANELS	85
ROOF PANEL TO BODYSIDE APERTURE	86
ROOF PANEL TO REAR HEADER	87
UPPER REAR HEADER TO LOWER HEADER	88
FRONT HEADER AND ROOF BOWS TO INNER PANEL	89
FRONT SEAT/SHOULDER BELT TO INNER PANEL REINFORCEMENT	90
REAR SEAT/SHOULDER BELT TO INNER PANEL REINFORCEMENT	91
FUEL FILLER GUSSET TO INNER QUARTER PANEL	92
FRONT FLOOR PAN TO SILL REINFORCEMENT	93
CENTER FLOOR PAN TO REAR SEAT CROSSMEMBER	94
FRONT FLOOR PAN TO FRONT SEAT REINFORCEMENT AND RAILS	95
CENTER FLOOR PAN TO UPPER CONTROL ARM CROSSMEMBER AND RAILS	96
REAR FLOOR PAN TO RAILS AND SPRING GUIDE CROSSMEMBER	97
REAR RAILS	98
UPPER CONTROL ARM CROSSMEMBER TO REAR RAIL	99
REAR RAIL REINFORCEMENT TO REAR RAILS	100
UPPER CONTROL ARM REINFORCEMENTS TO REAR RAIL	101
OUTER TRANSMISSION CROSSMEMBER REINFORCEMENT TO RAIL AND BODYSIDE SILL	102
BODYSIDE SILL TO FLOOR PAN	103
REAR RAILS TO REAR CROSSMEMBER	104
INNER WHEELHOUSE TO FLOOR PAN	105
INNER WHEELHOUSE TO INNER BODYSIDE APERTURE AND FLOOR PAN	106
OUTER WHEELHOUSE TO OUTER BODYSIDE APERTURE	107
OUTER WHEELHOUSE TO INNER BODYSIDE APERTURE	108
INNER BODYSIDE APERTURE TO OUTER BODYSIDE APERTURE	109
REAR INBOARD SEAT BELT REINFORCEMENT TO FLOOR PAN	110

WELD LOCATIONS (Continued)

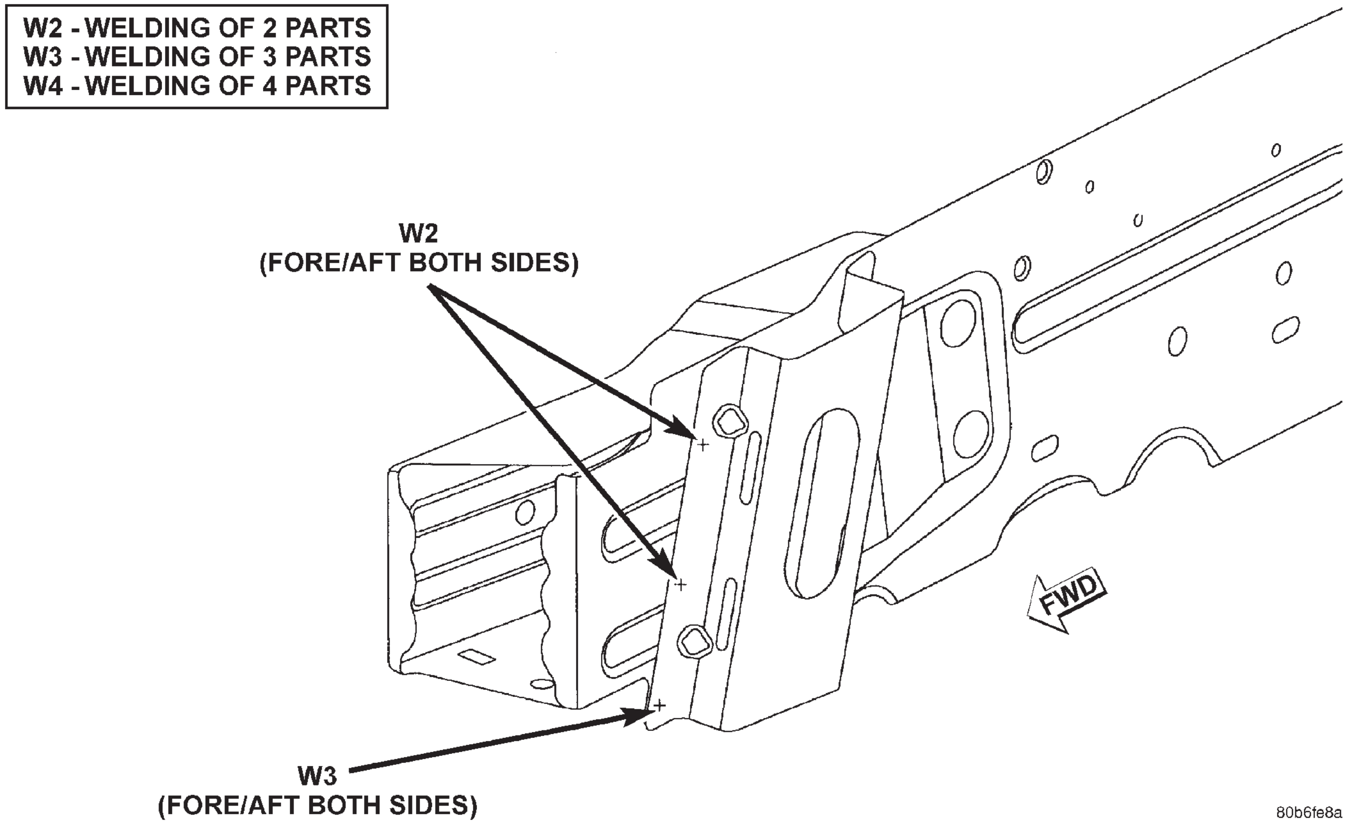


Fig. 49 RADIATOR SUPPORT BRACKETS

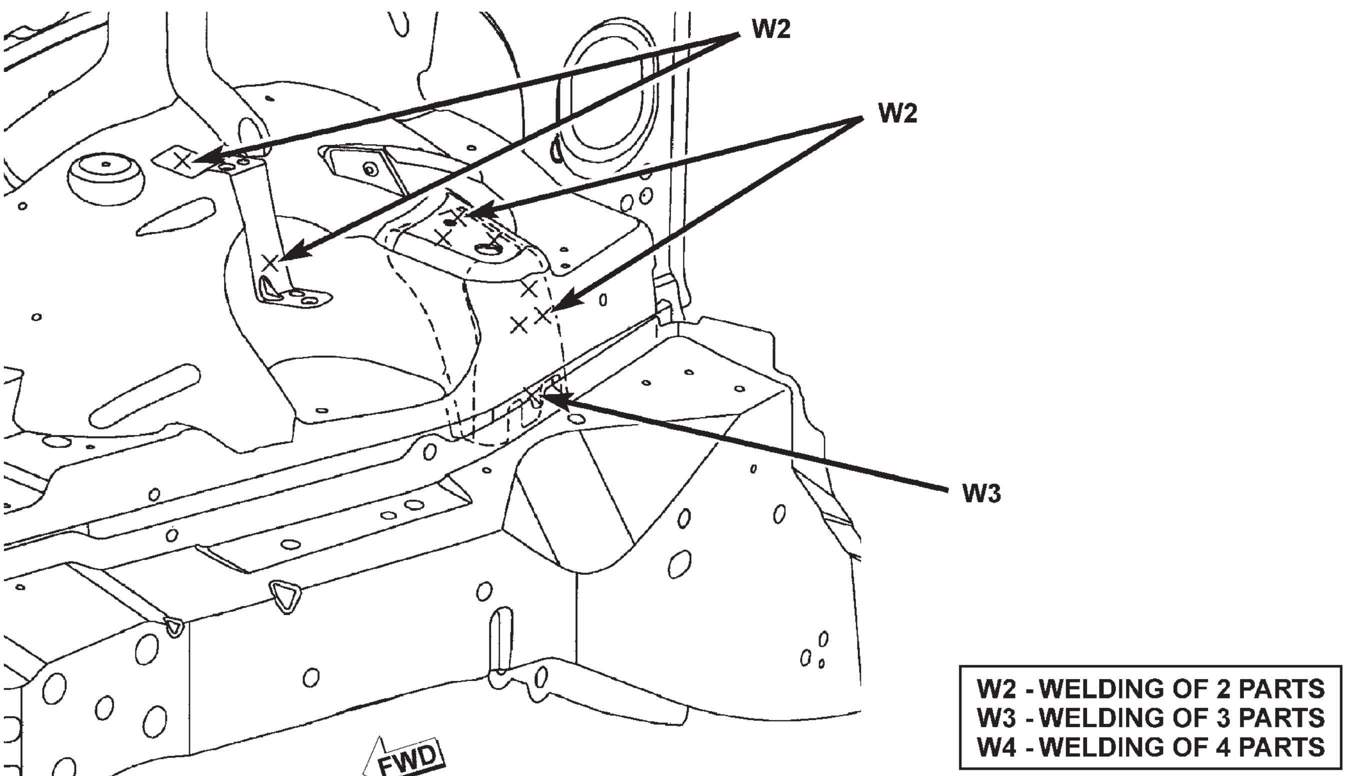


Fig. 50 FRONT SUSPENSION SUPPORT REINFORCEMENT

WELD LOCATIONS (Continued)

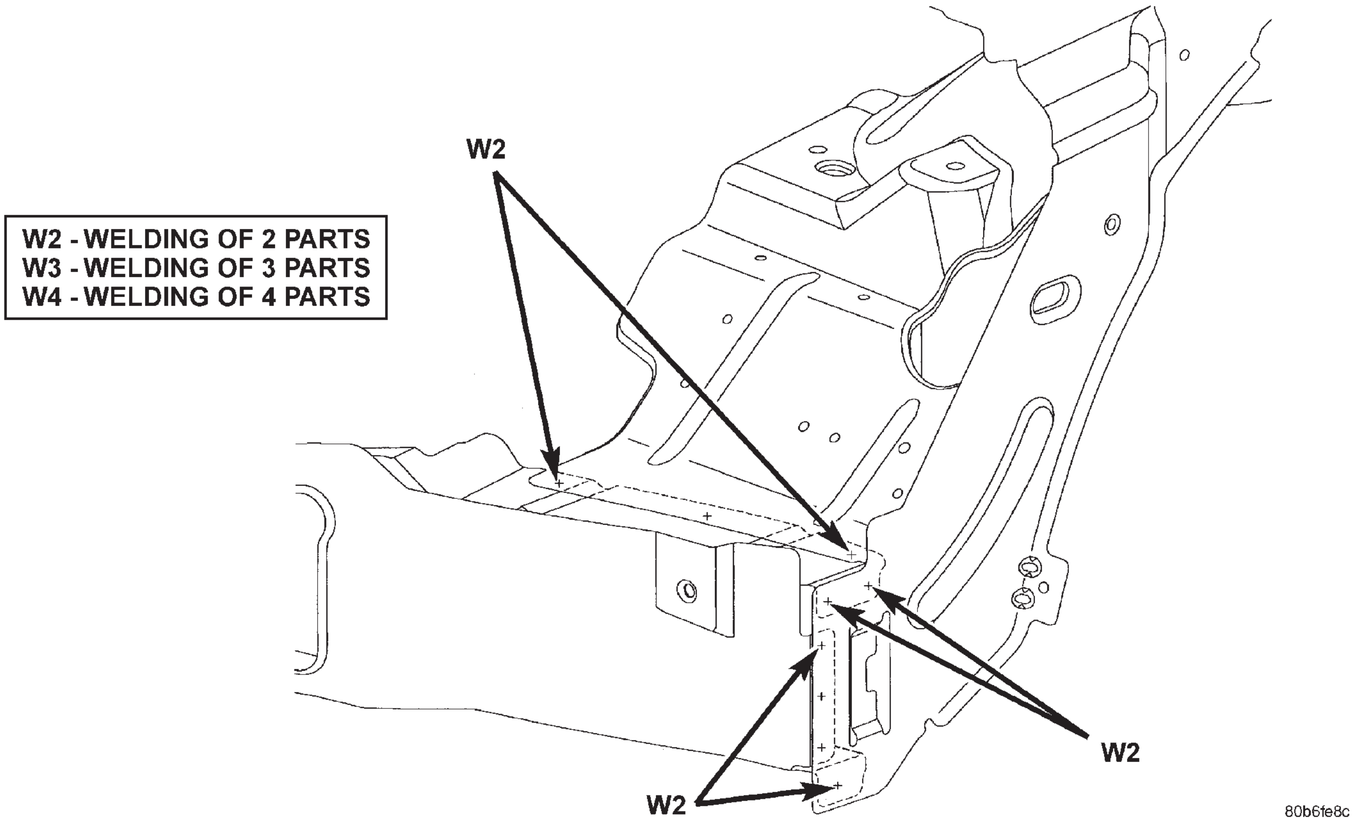


Fig. 51 FRONT LOWER CROSSMEMBER TO COWL SIDE PANEL

WELD LOCATIONS (Continued)

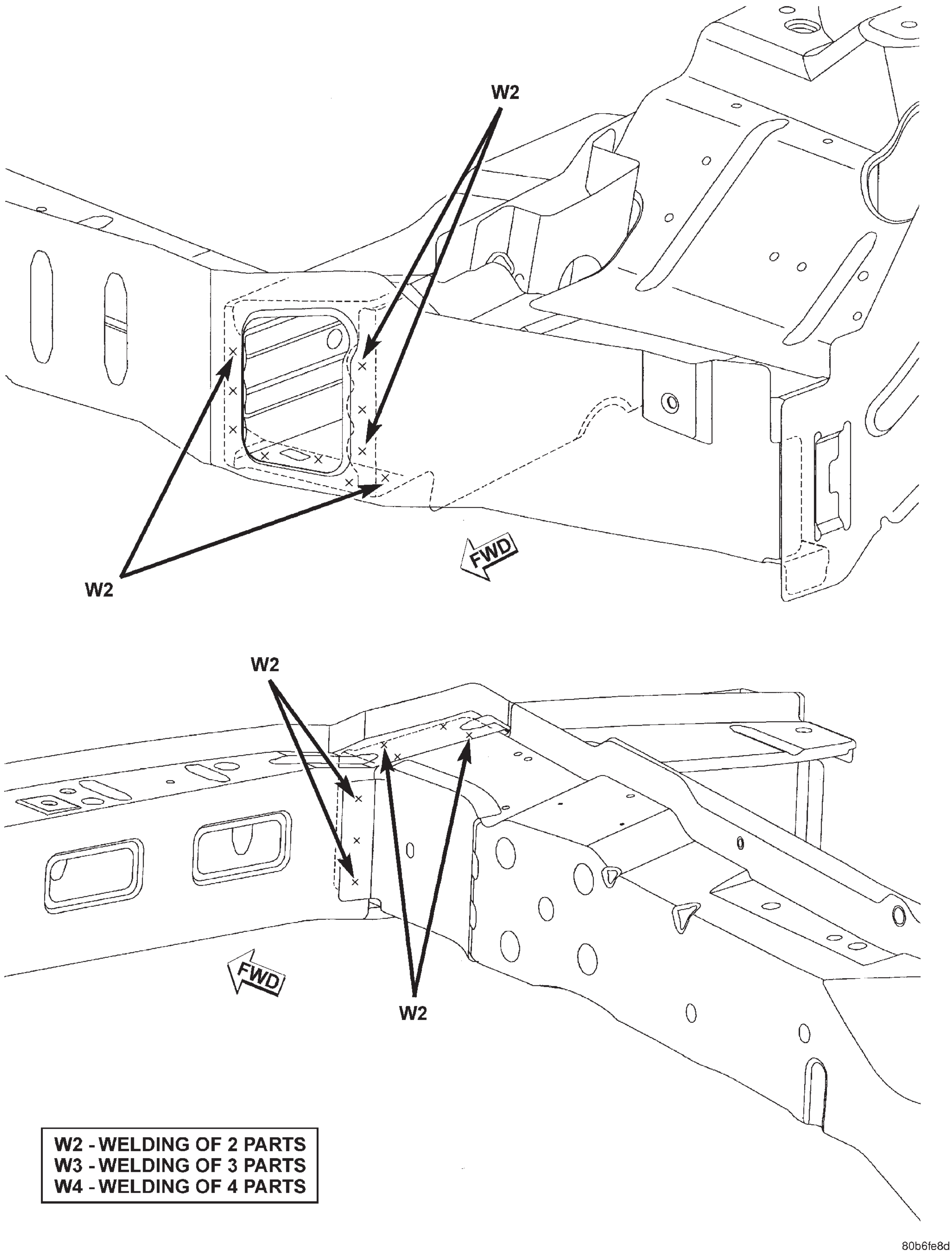


Fig. 52 FRONT SILL TO LOWER CROSSMEMBER

WELD LOCATIONS (Continued)

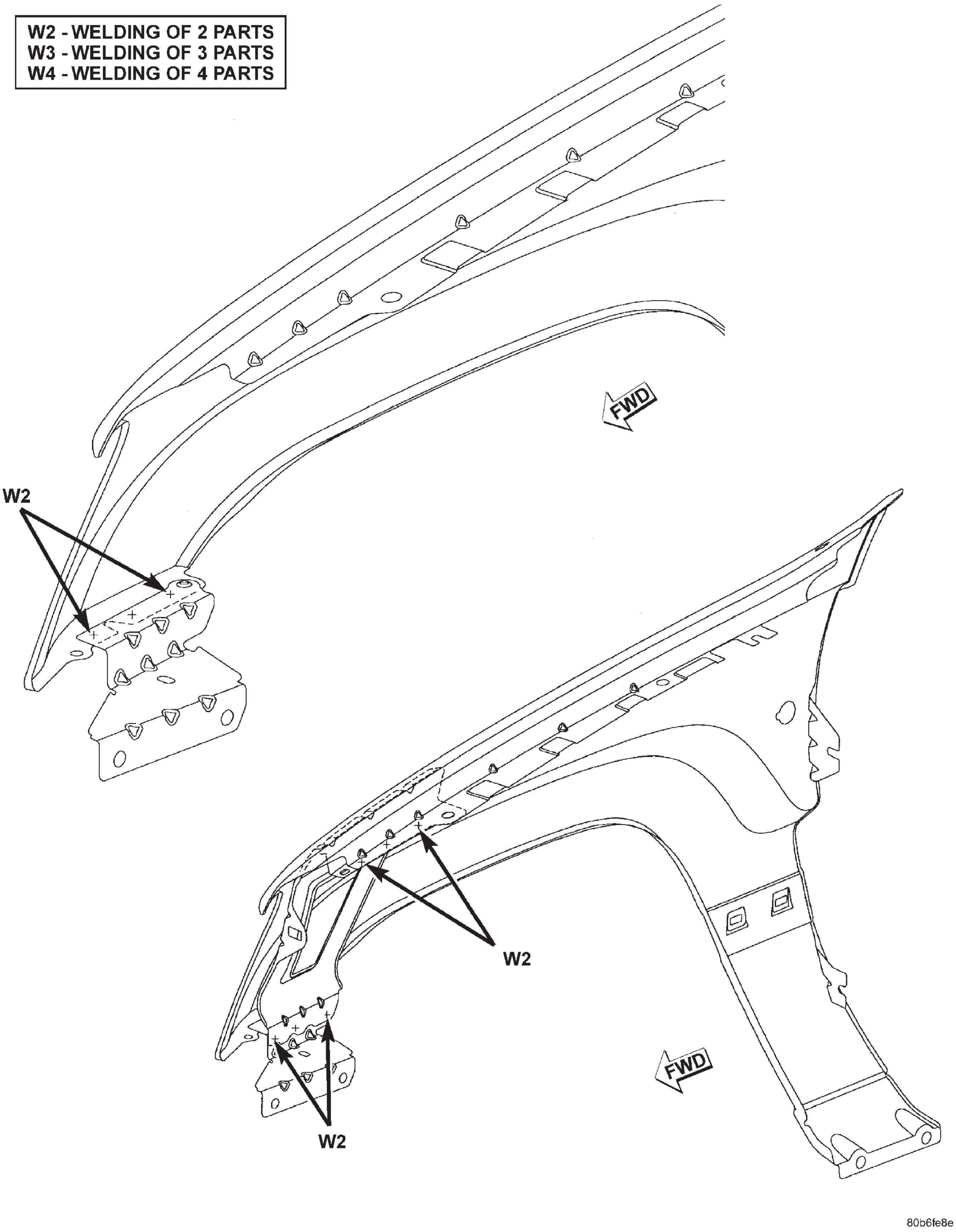
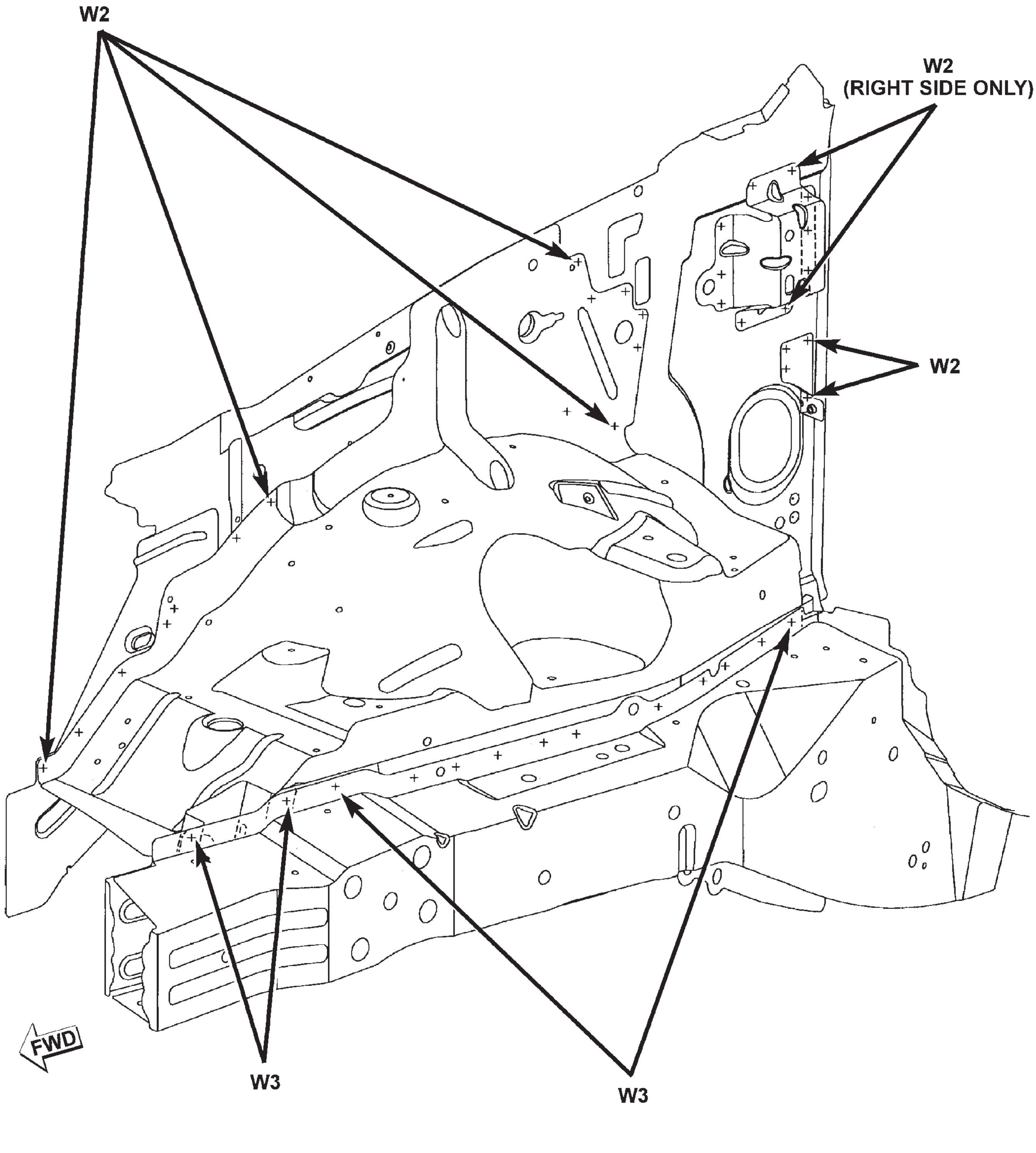


Fig. 53 FRONT FENDER MOUNTING BRACKET AND REINFORCEMENT

WELD LOCATIONS (Continued)



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

Fig. 54 FRONT SUSPENSION SUPPORT TO SILLS AND COWL SIDE PANEL

WELD LOCATIONS (Continued)

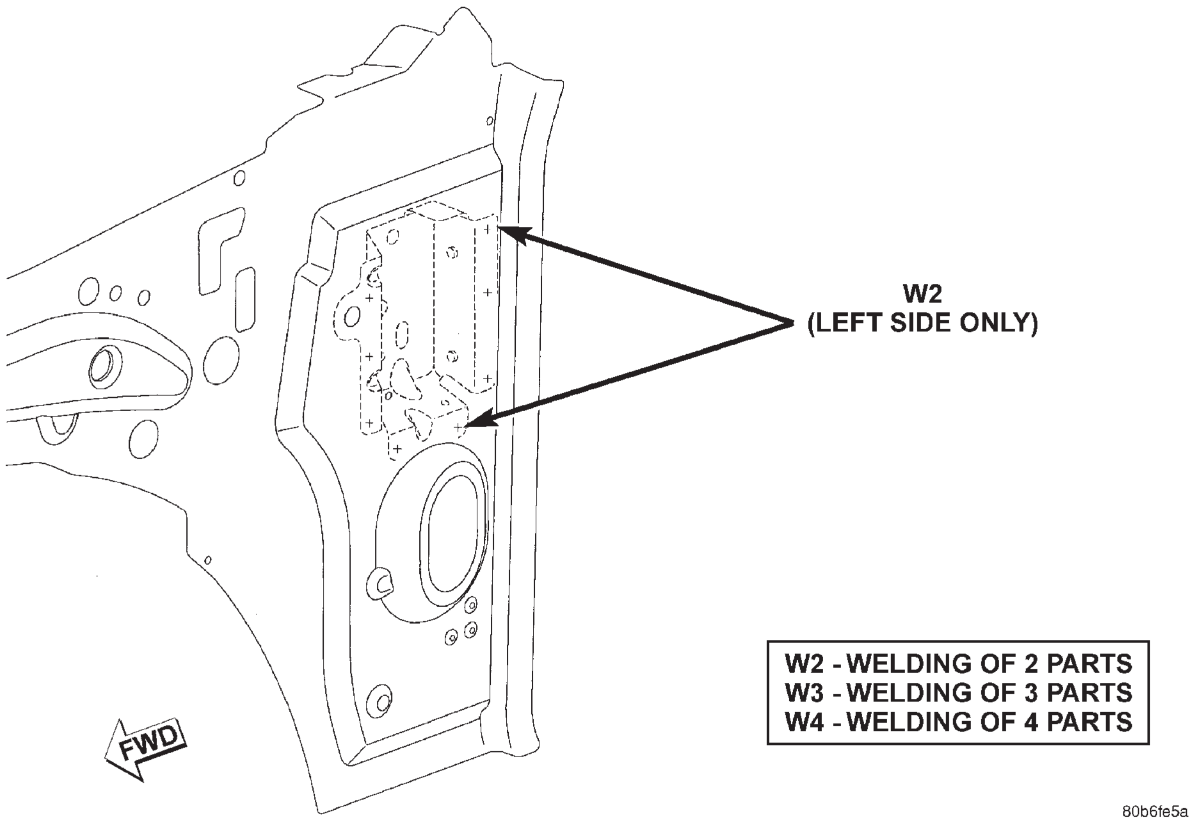


Fig. 55 LEFT INSTRUMENT PANEL BRACKET TO COWL SIDE PANEL

WELD LOCATIONS (Continued)

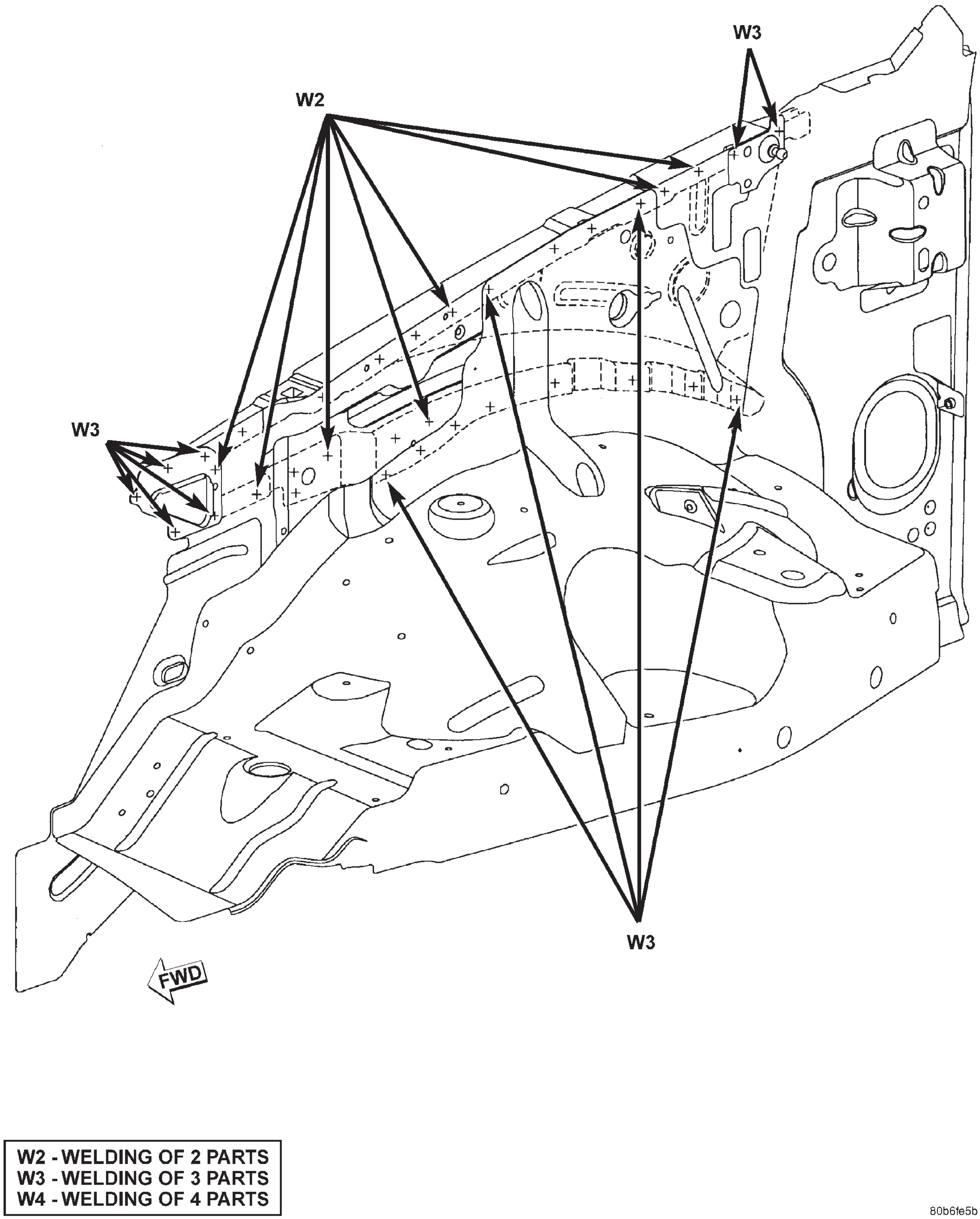


Fig. 56 COWL SIDE UPPER REINFORCEMENT TO COWL SIDE AND FRONT SUSPENSION SUPPORT

WELD LOCATIONS (Continued)

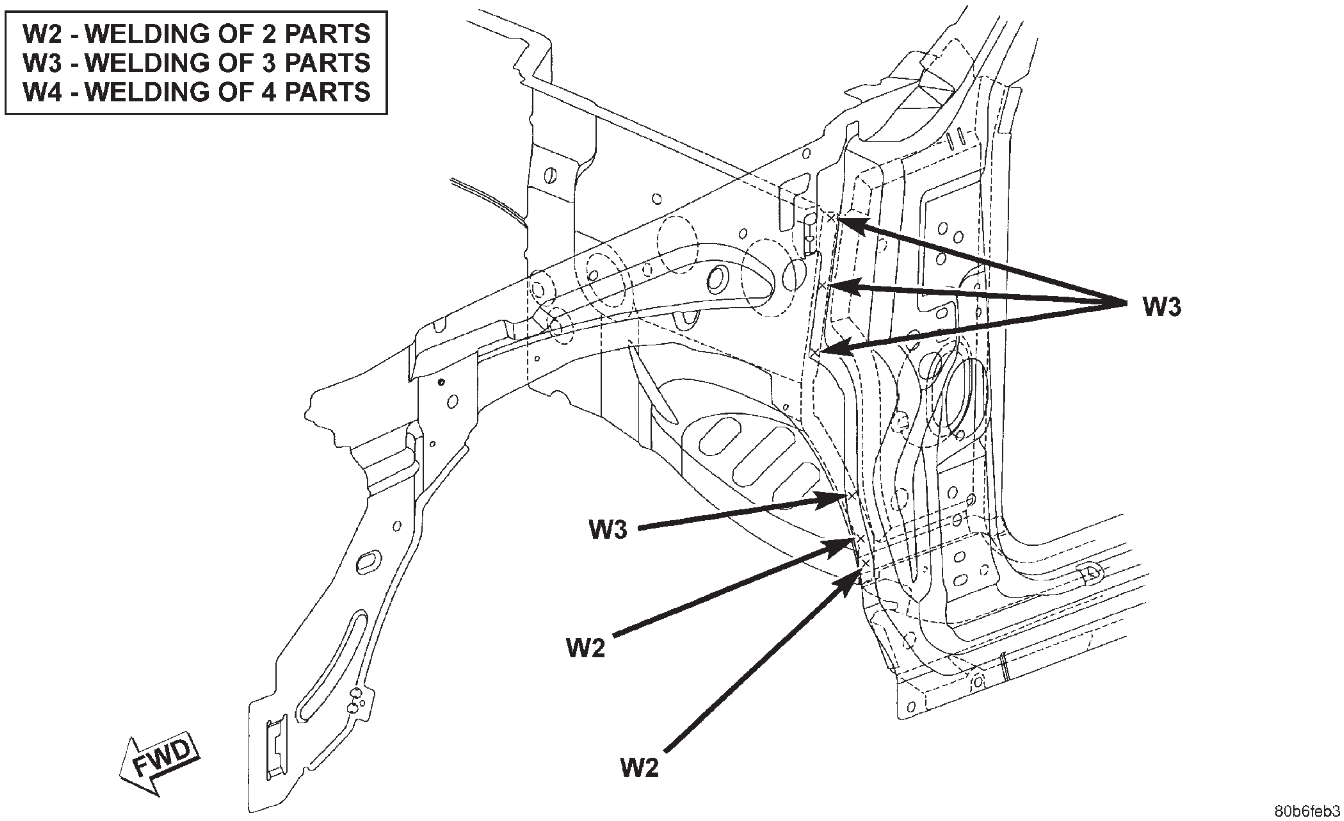


Fig. 57 COWL SIDE PANEL TO DASH PANEL AND INNER BODYSIDE PANEL AND SILL

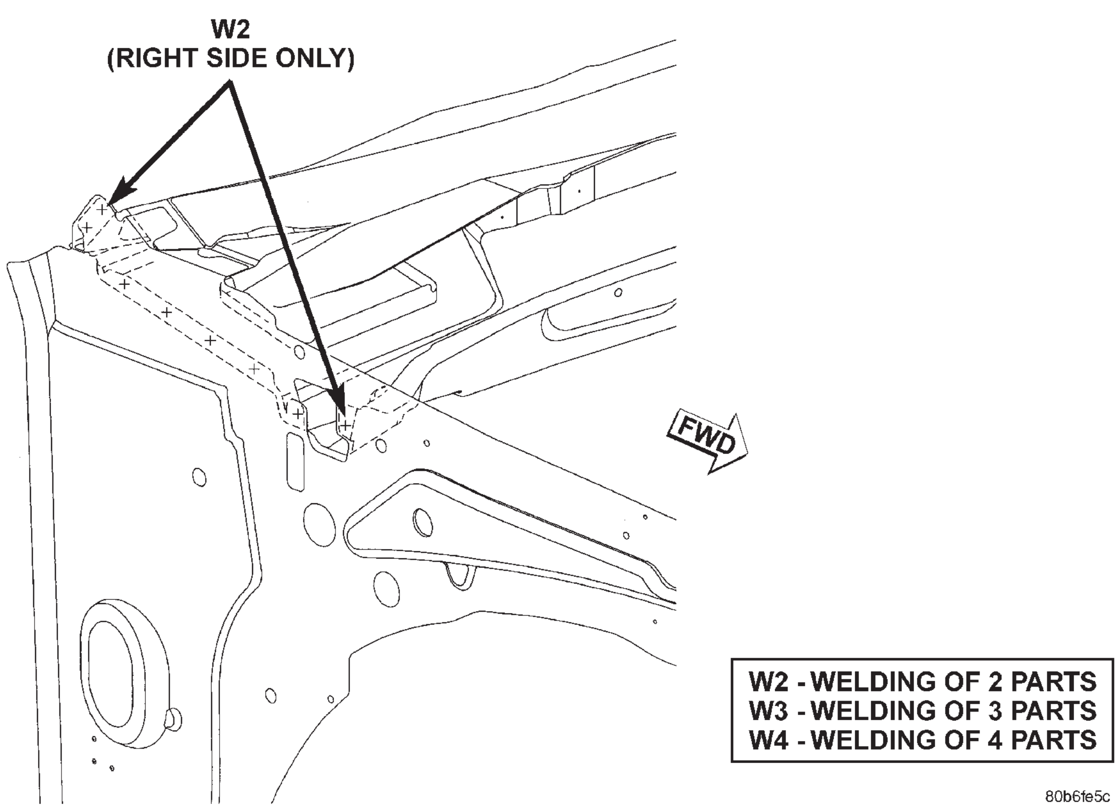


Fig. 58 PLENUM ASSEMBLY TO COWL SIDE PANEL

WELD LOCATIONS (Continued)

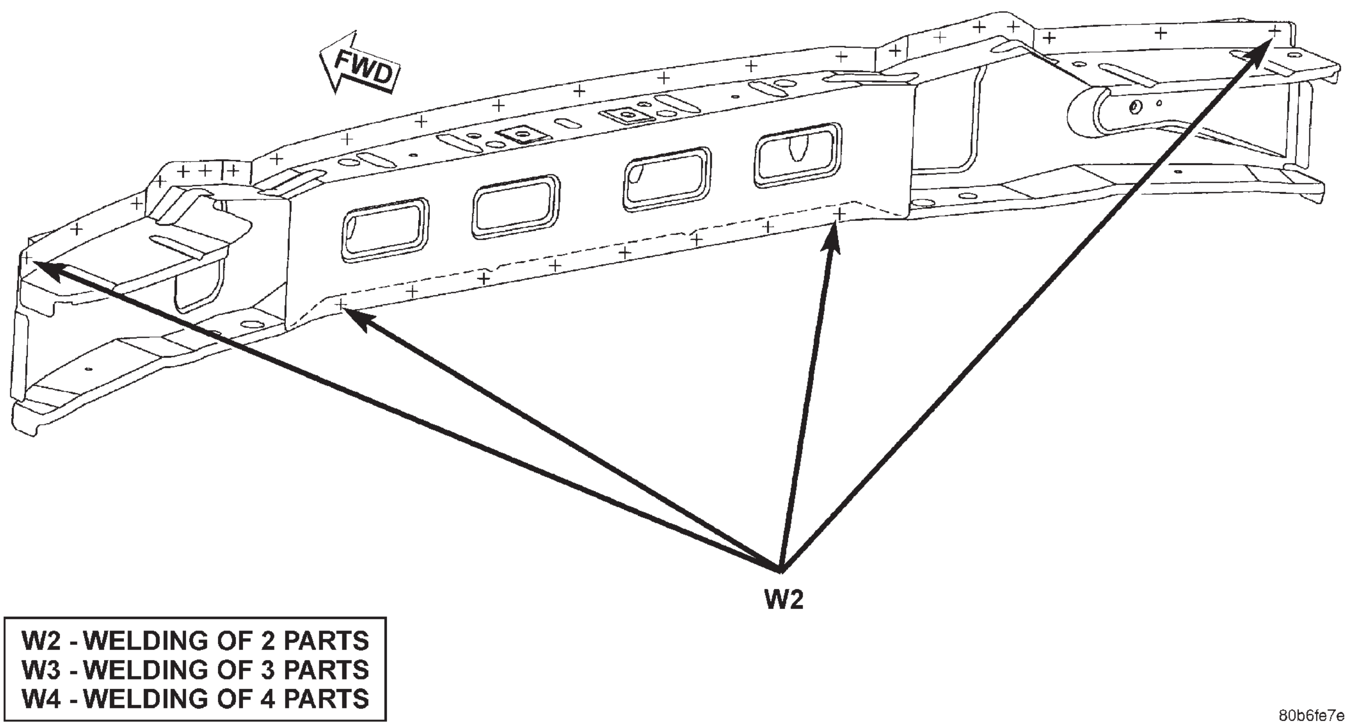


Fig. 59 FRONT LOWER CROSSMEMBER

WELD LOCATIONS (Continued)

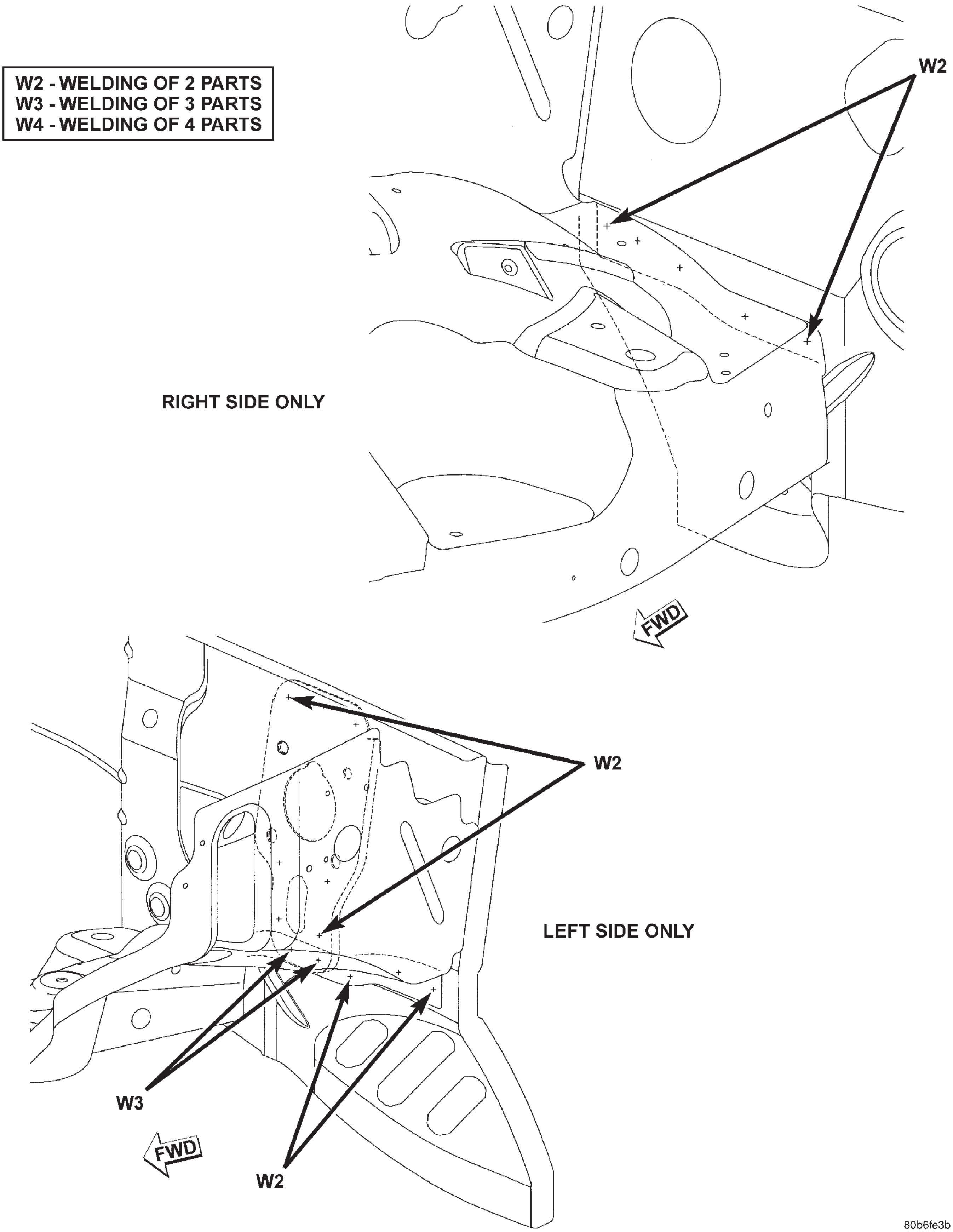


Fig. 60 FRONT SUSPENSION SUPPORT TO DASH

WELD LOCATIONS (Continued)

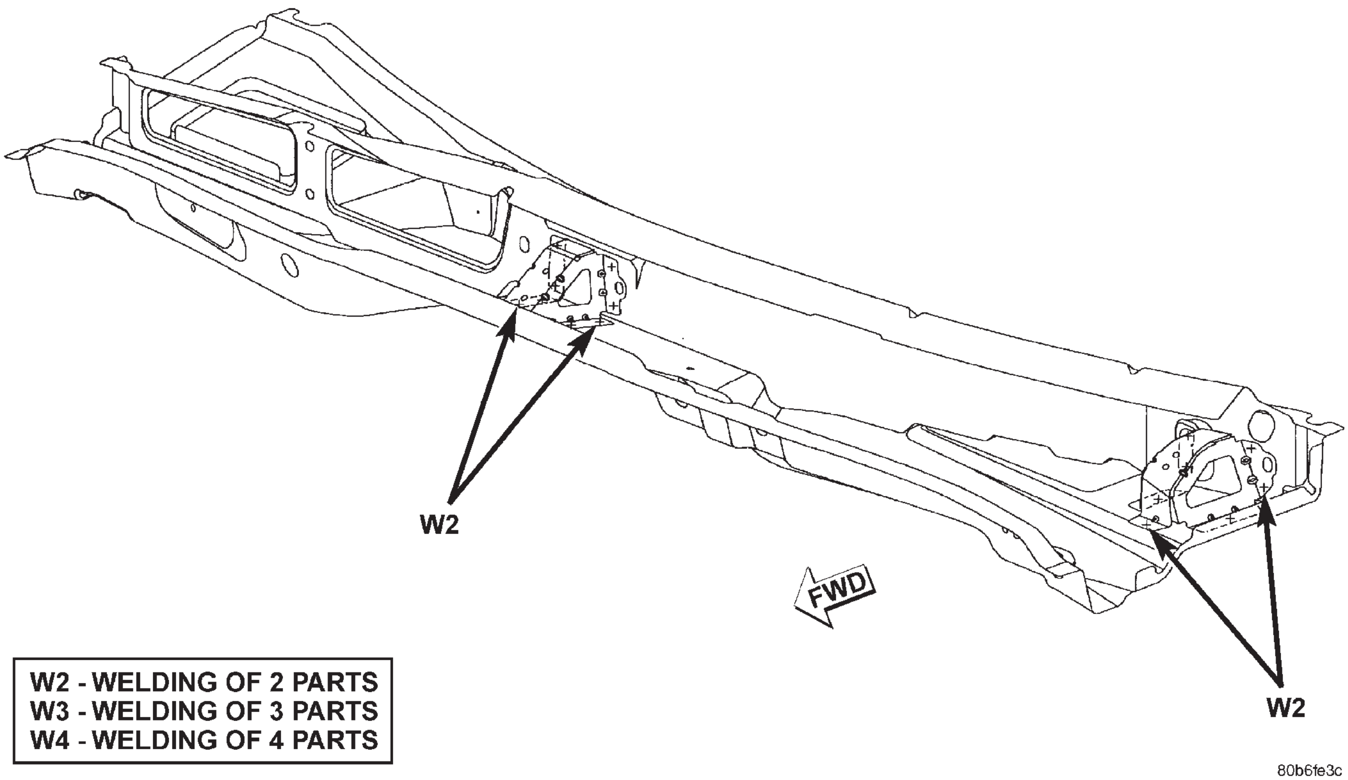


Fig. 61 WIPER MOUNTING BRACKETS TO PLENUM ASSEMBLY

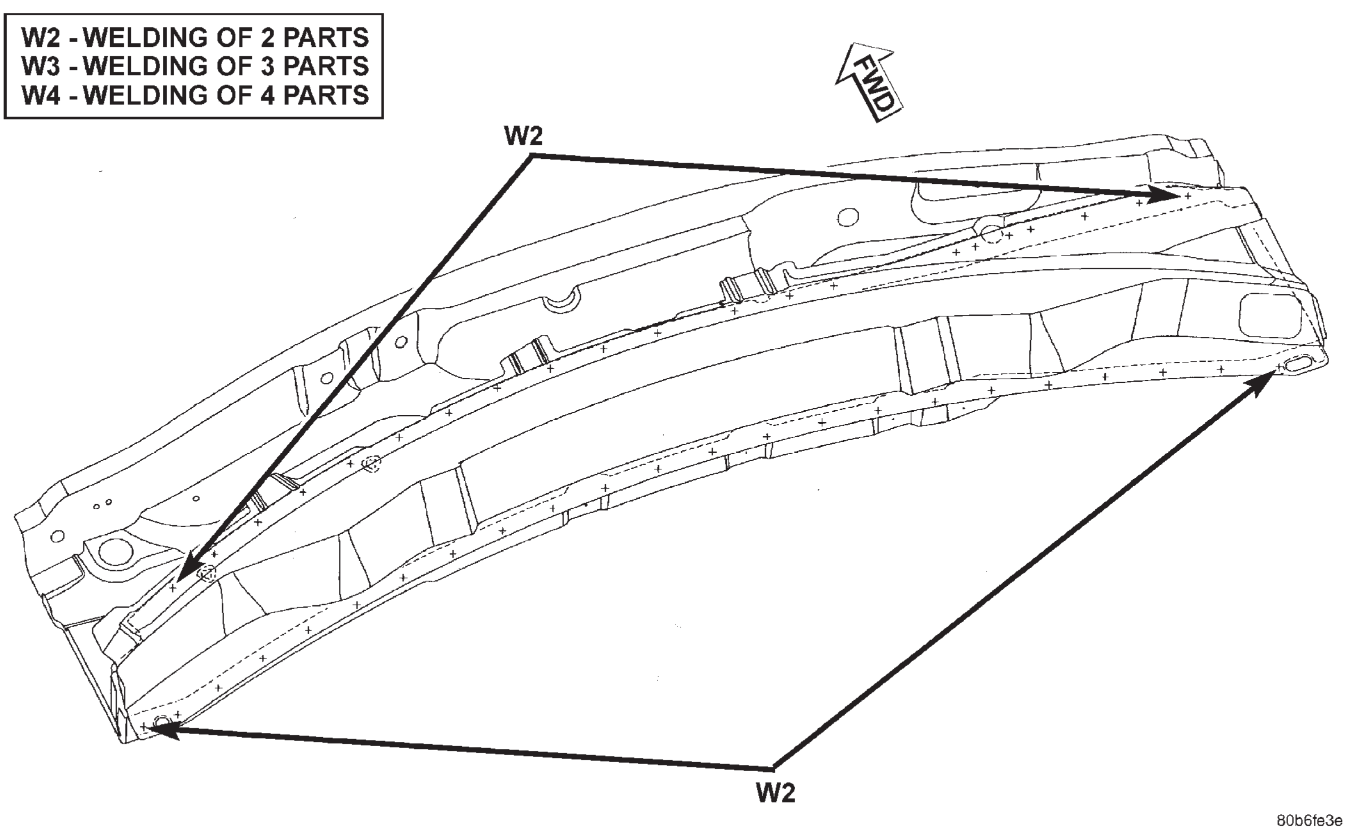


Fig. 62 COWL TOP AND PLENUM ASSEMBLY

WELD LOCATIONS (Continued)

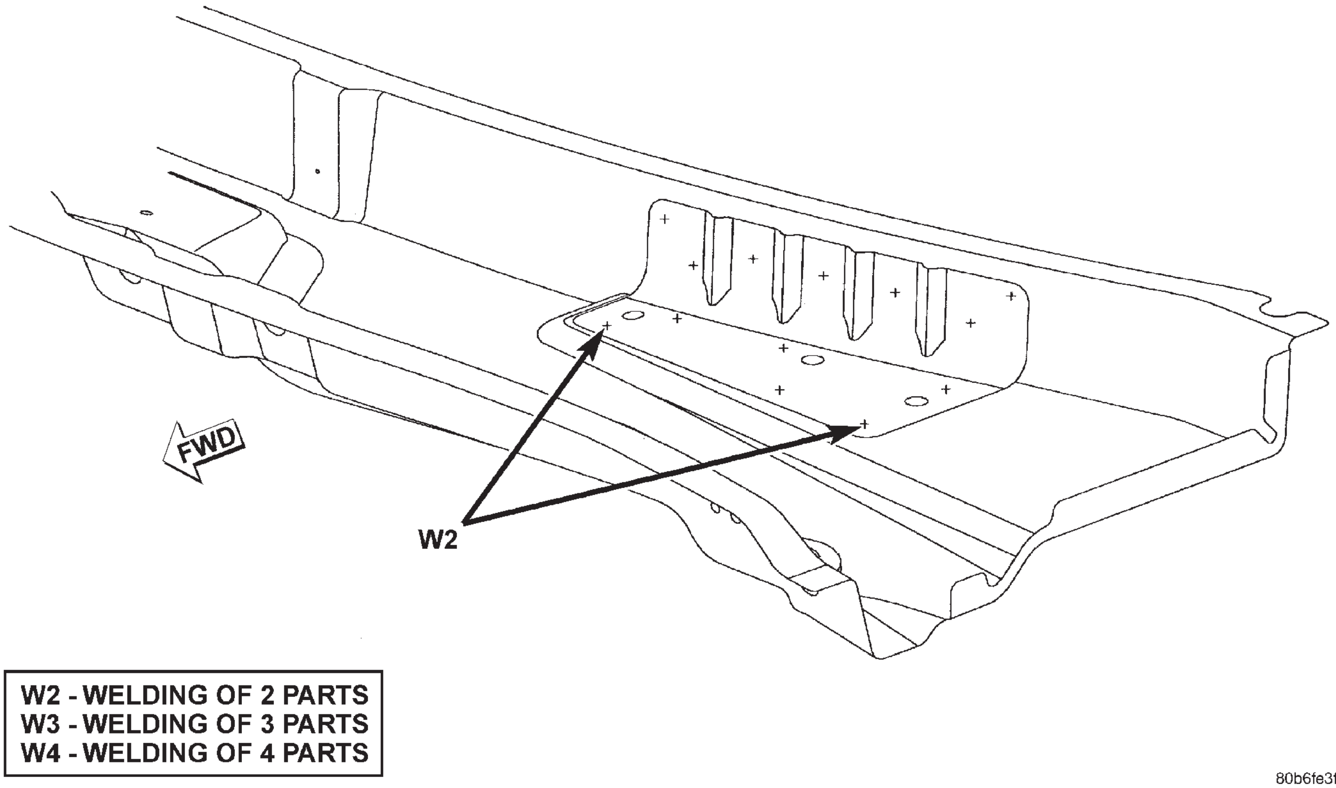


Fig. 63 LOWER PLENUM REINFORCEMENT TO LOWER PLENUM PANEL

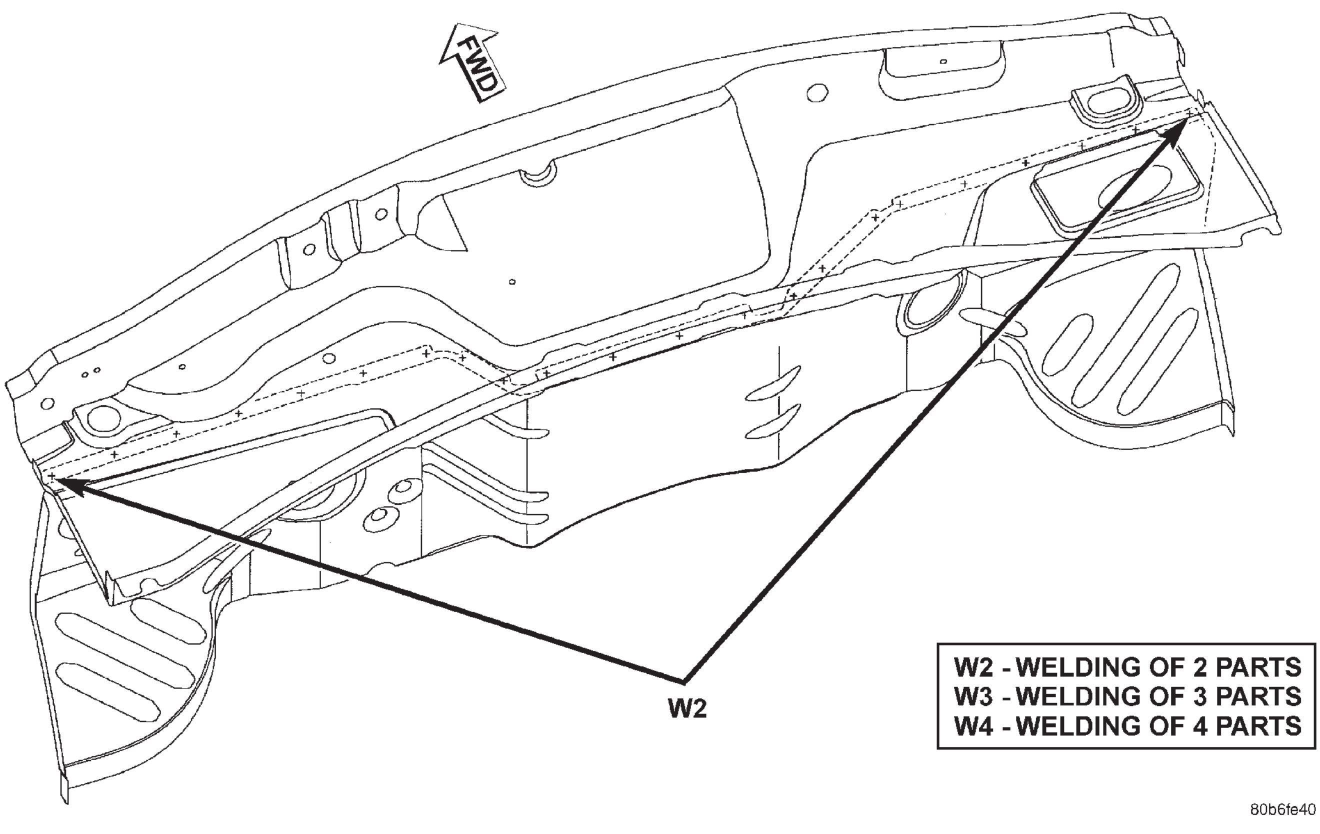


Fig. 64 DASH PANEL TO LOWER PLENUM PANEL

WELD LOCATIONS (Continued)

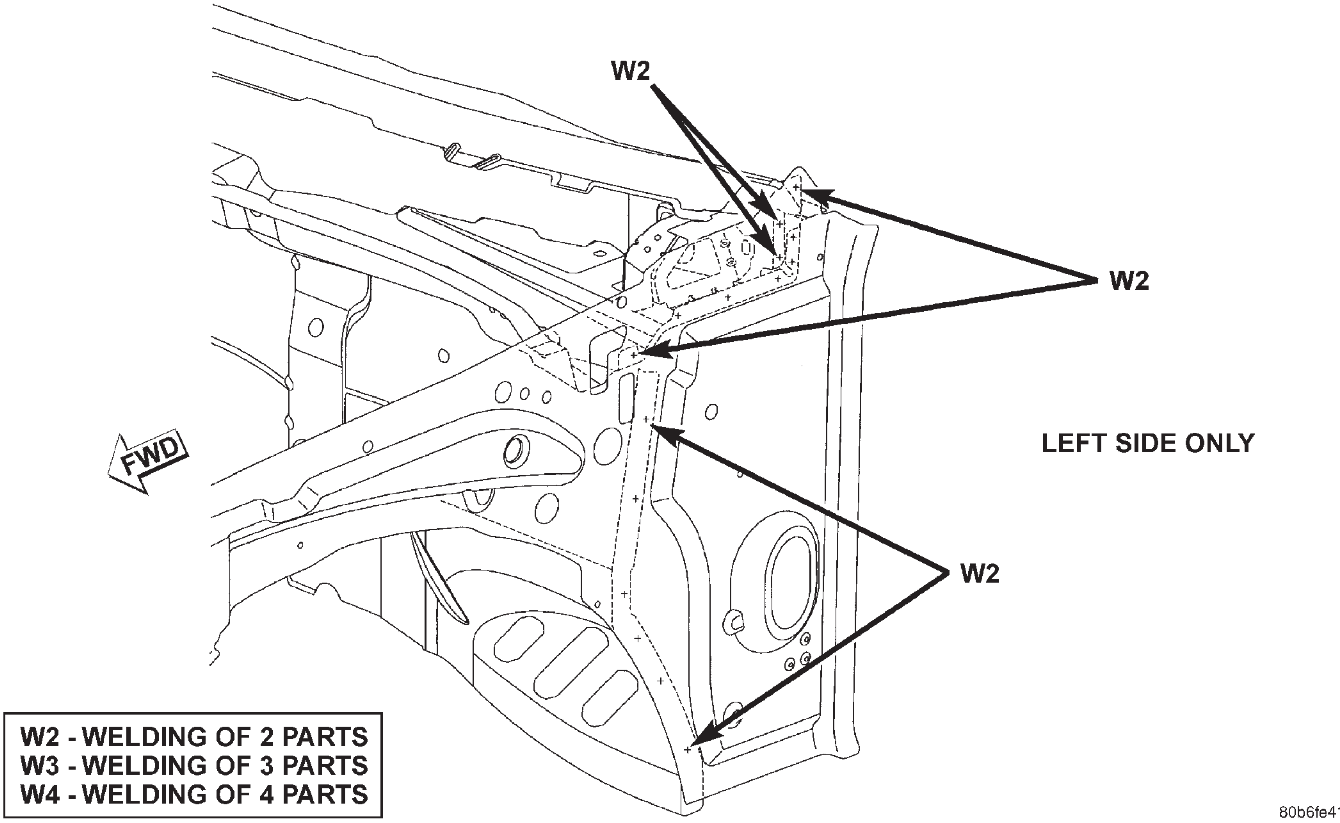


Fig. 65 PLENUM ASSEMBLY TO COWL

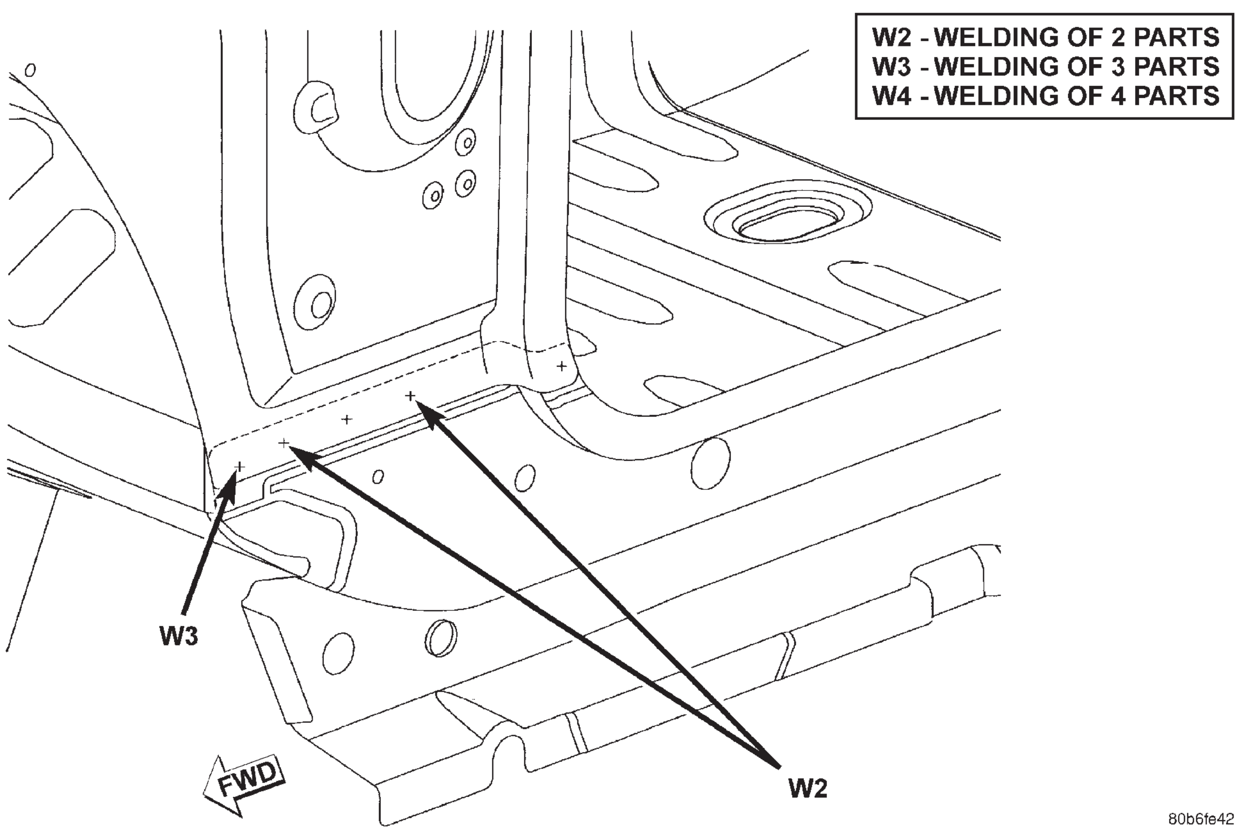


Fig. 66 COWL PANEL TO BODYSIDE SILL

WELD LOCATIONS (Continued)

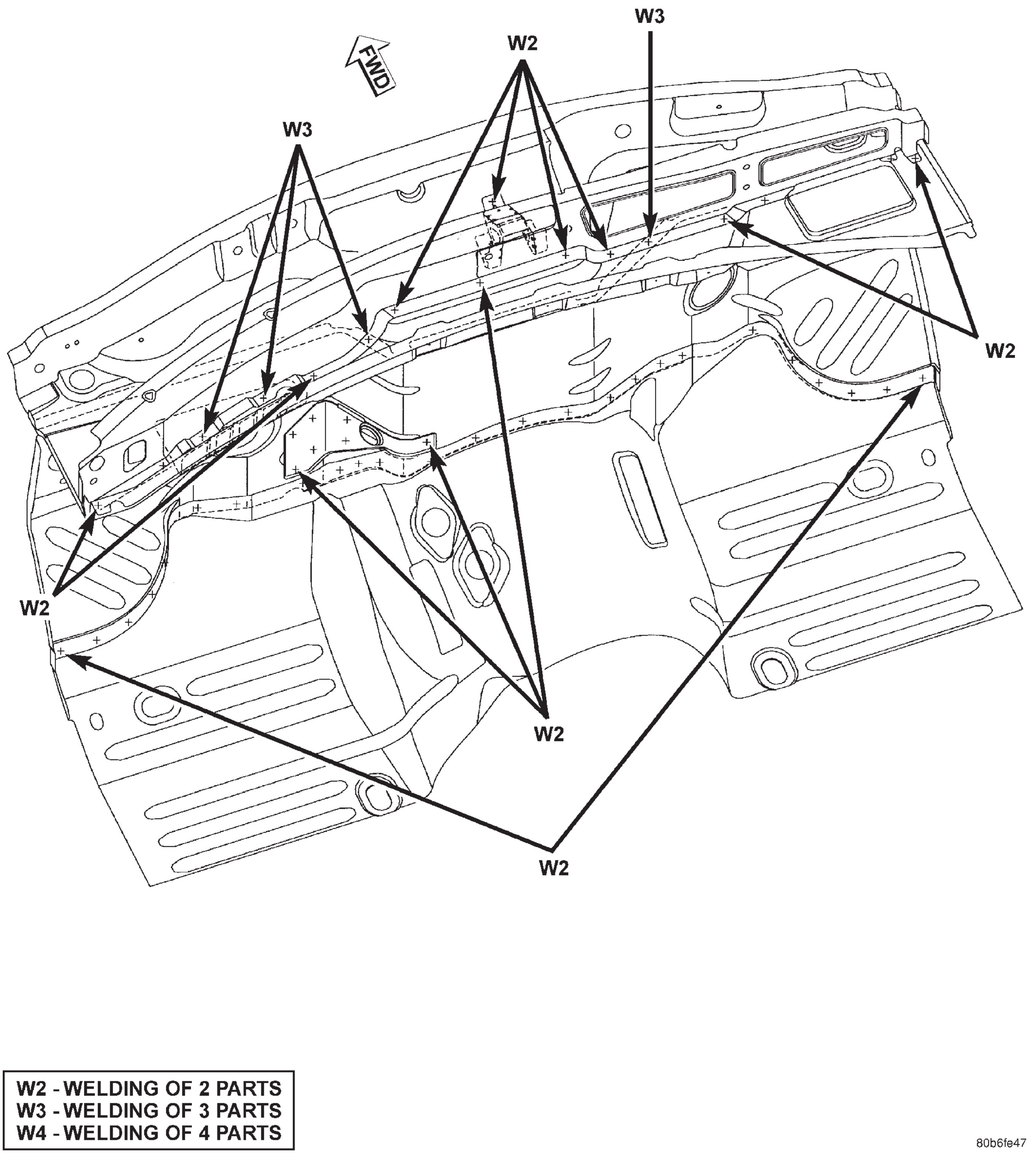


Fig. 67 COWL PANEL TO FRONT FLOOR PAN

WELD LOCATIONS (Continued)

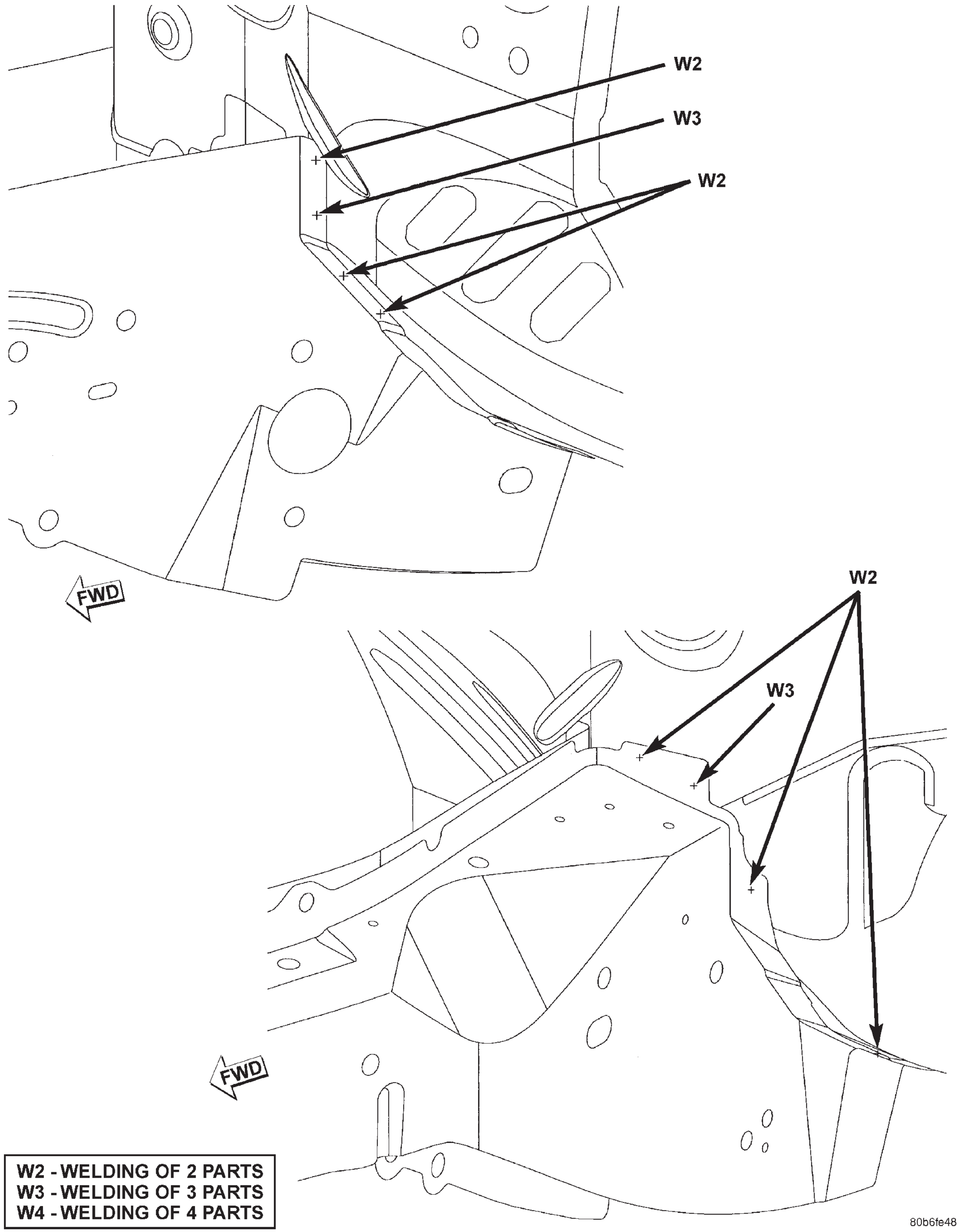


Fig. 68 FRONT SILLS TO DASH AND FRONT FLOOR PAN

WELD LOCATIONS (Continued)

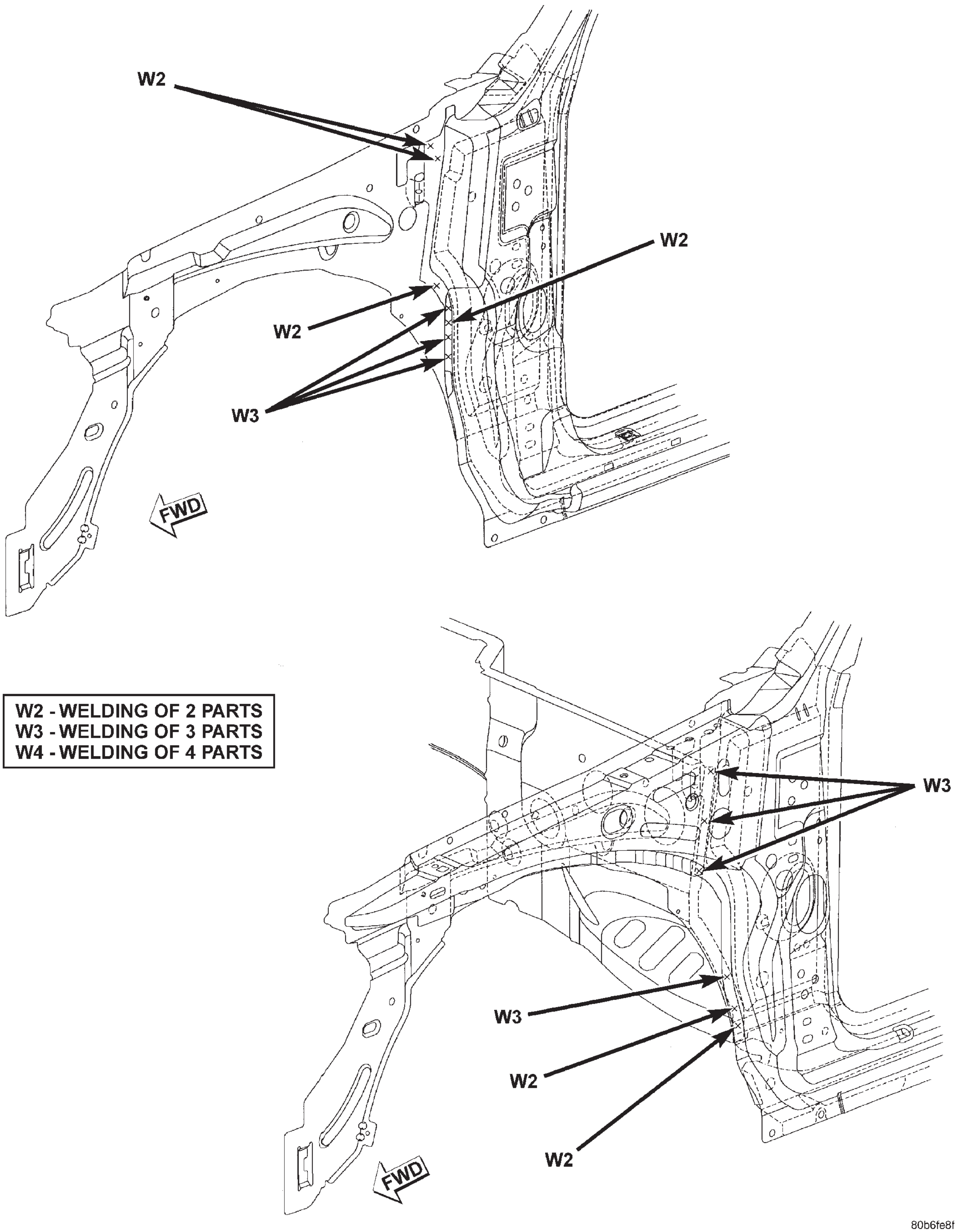


Fig. 69 COWL SIDE PANEL DASH INNER BODYSIDE AND OUTER BODYSIDE PANELS

WELD LOCATIONS (Continued)

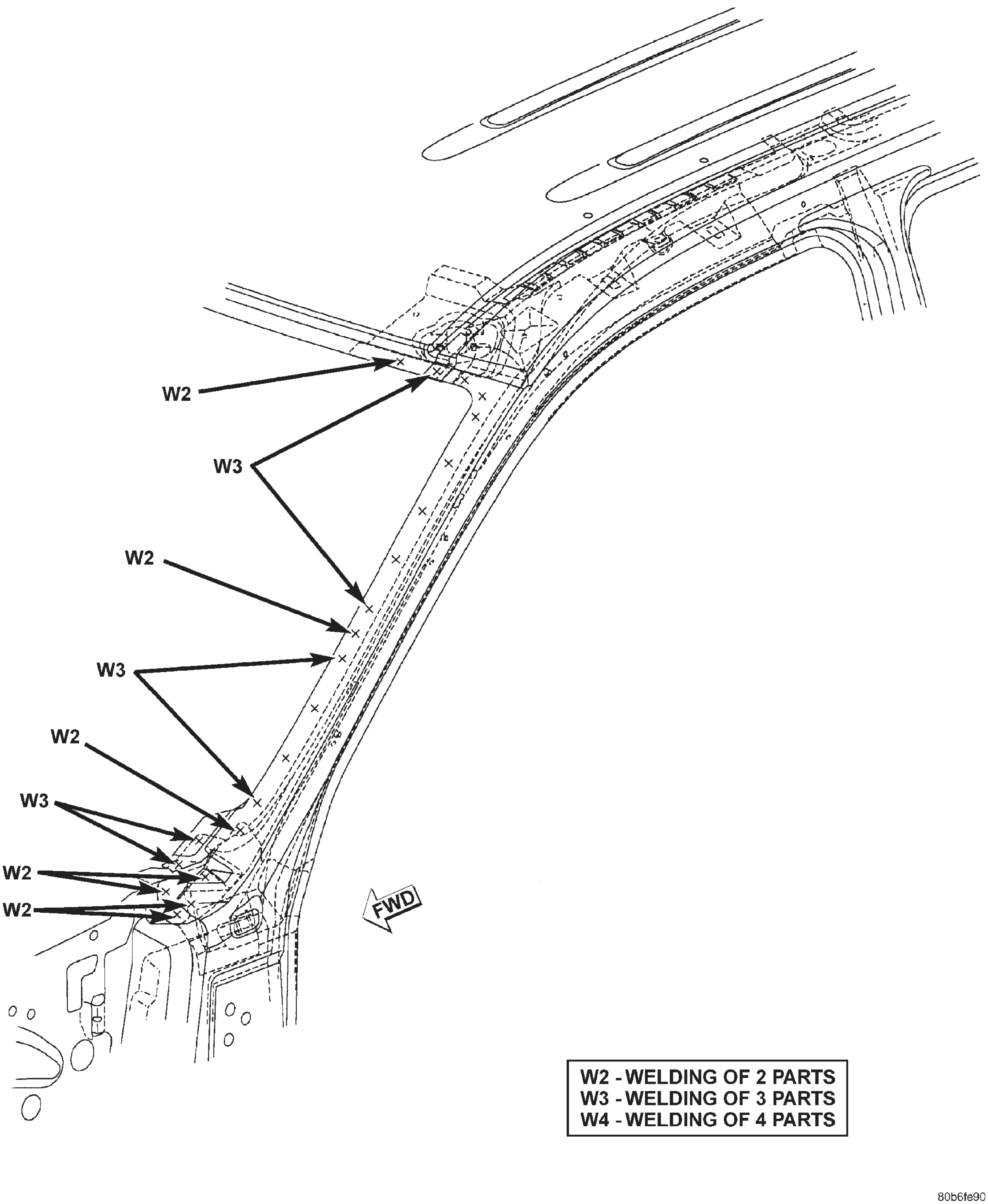


Fig. 70 UPPER FRONT INNER PILLAR TO ROOF AND COWL

WELD LOCATIONS (Continued)

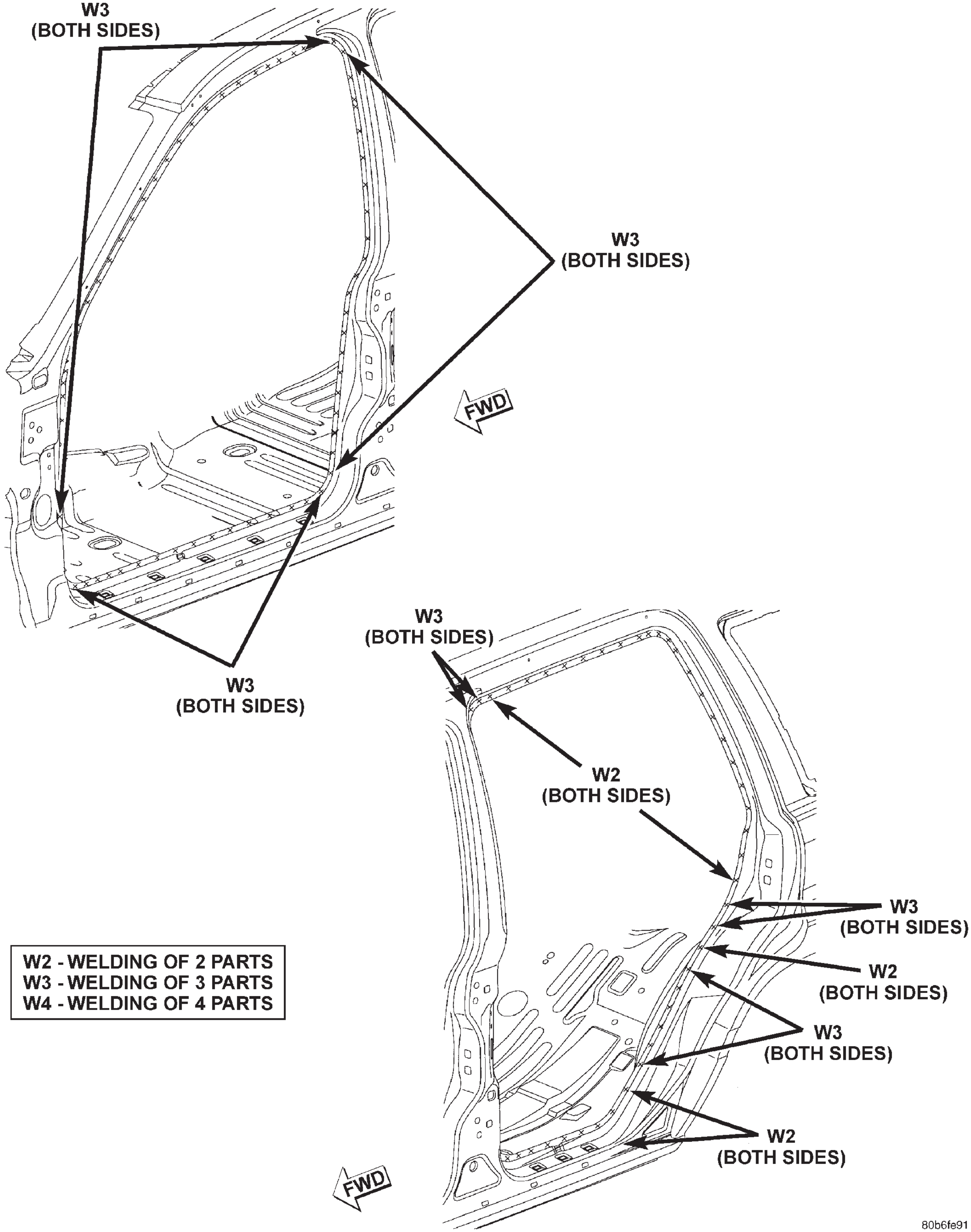


Fig. 71 DOOR OPENINGS

WELD LOCATIONS (Continued)

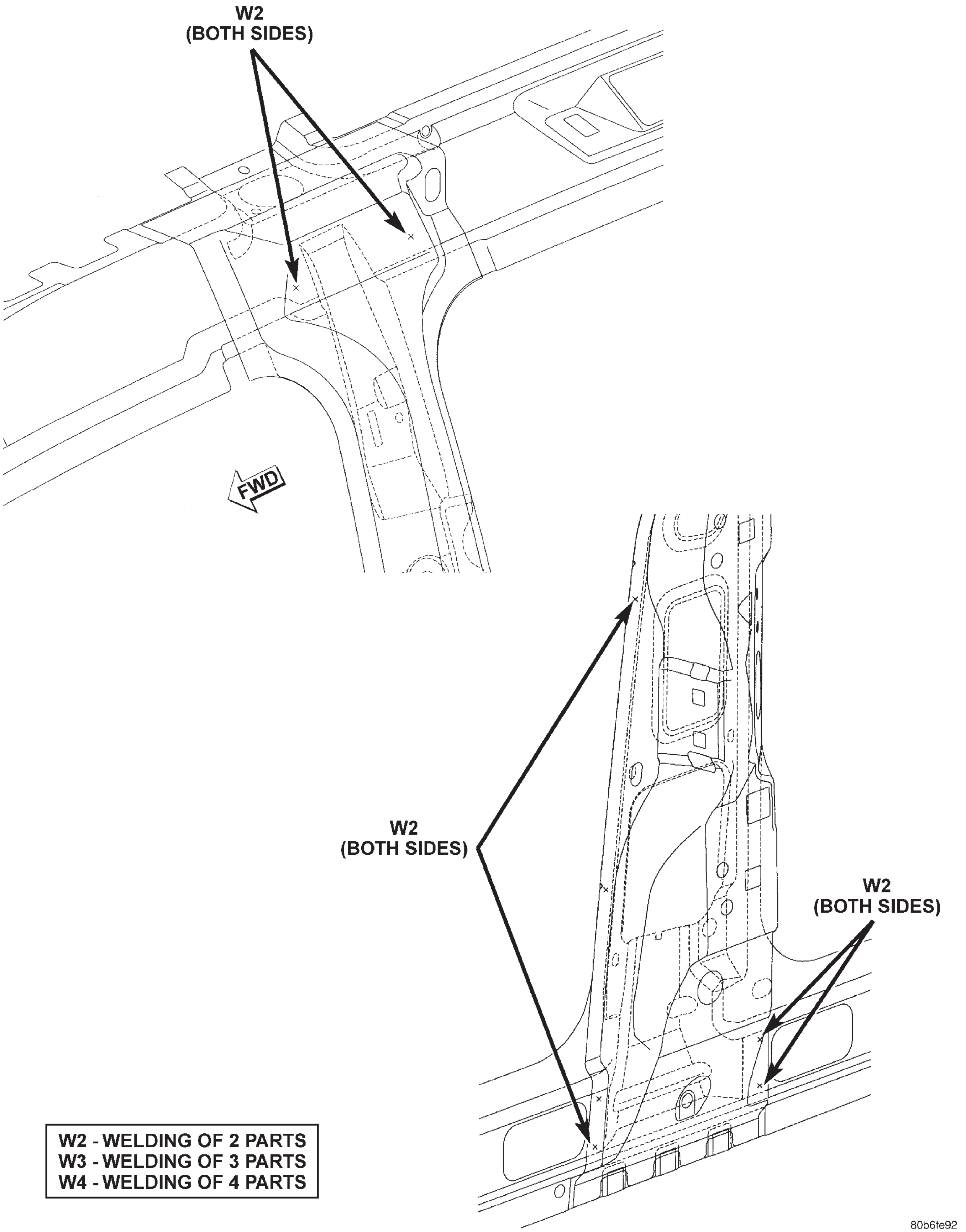


Fig. 72 B-PILLAR REINFORCEMENT TO INNER BODYSIDE APERTURE

WELD LOCATIONS (Continued)

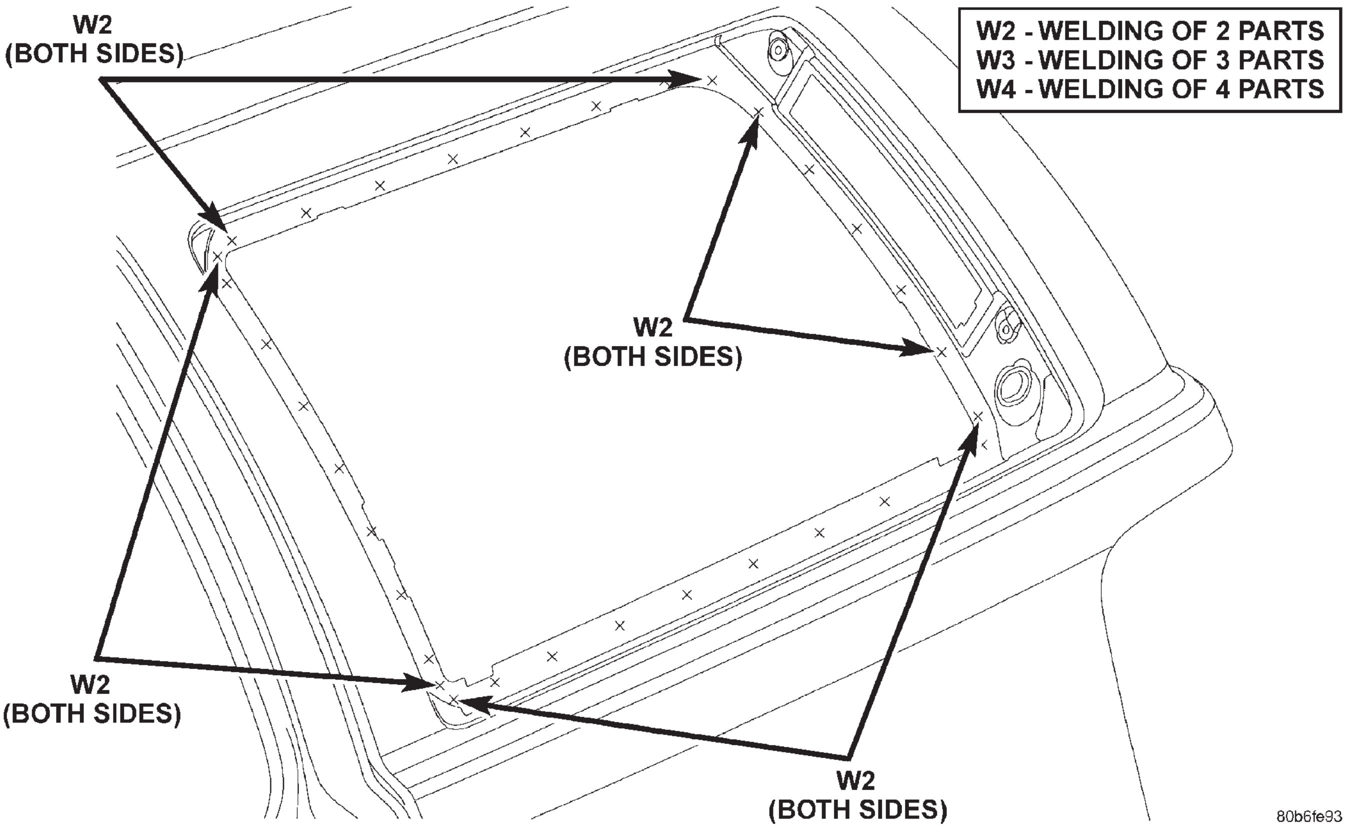


Fig. 73 REAR QUARTER WINDOW TO BODYSIDE APERTURE INNER AND OUTER

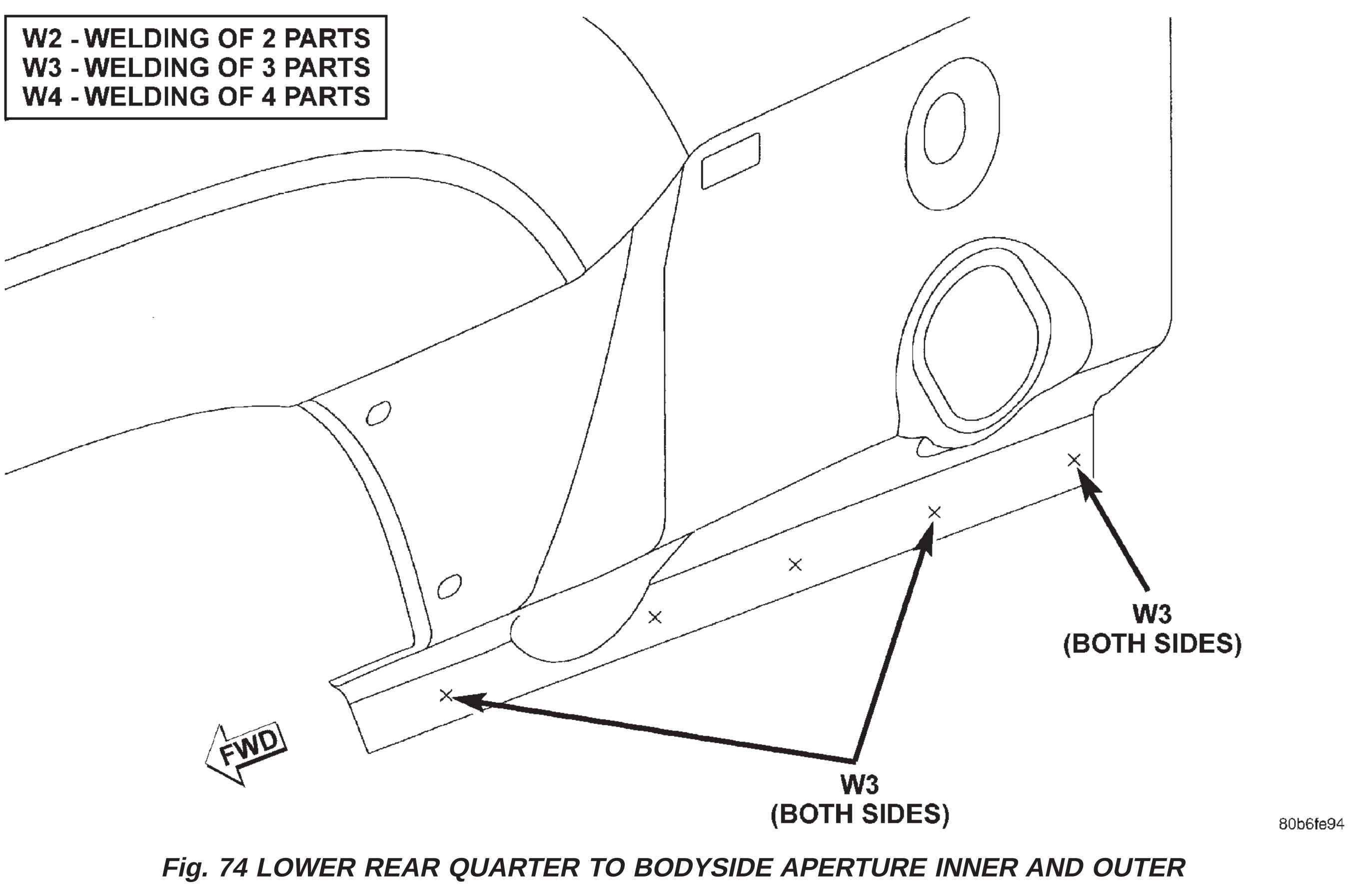


Fig. 74 LOWER REAR QUARTER TO BODYSIDE APERTURE INNER AND OUTER

WELD LOCATIONS (Continued)

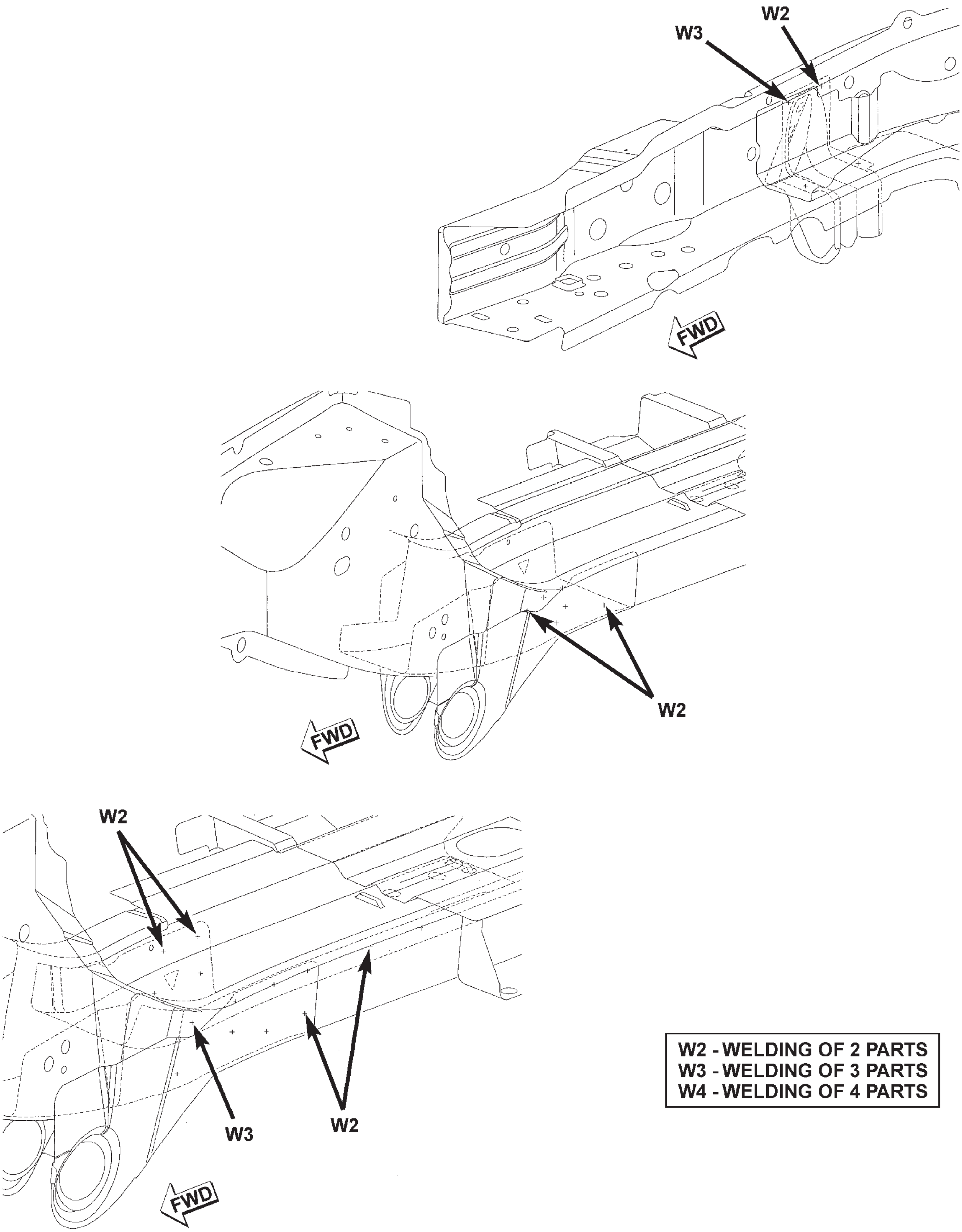


Fig. 75 INNER TRACK BAR, LOWER CONTROL ARM AND TRANSMISSION CROSSMEMBER BRACKETS TO FRONT SILLS

WELD LOCATIONS (Continued)

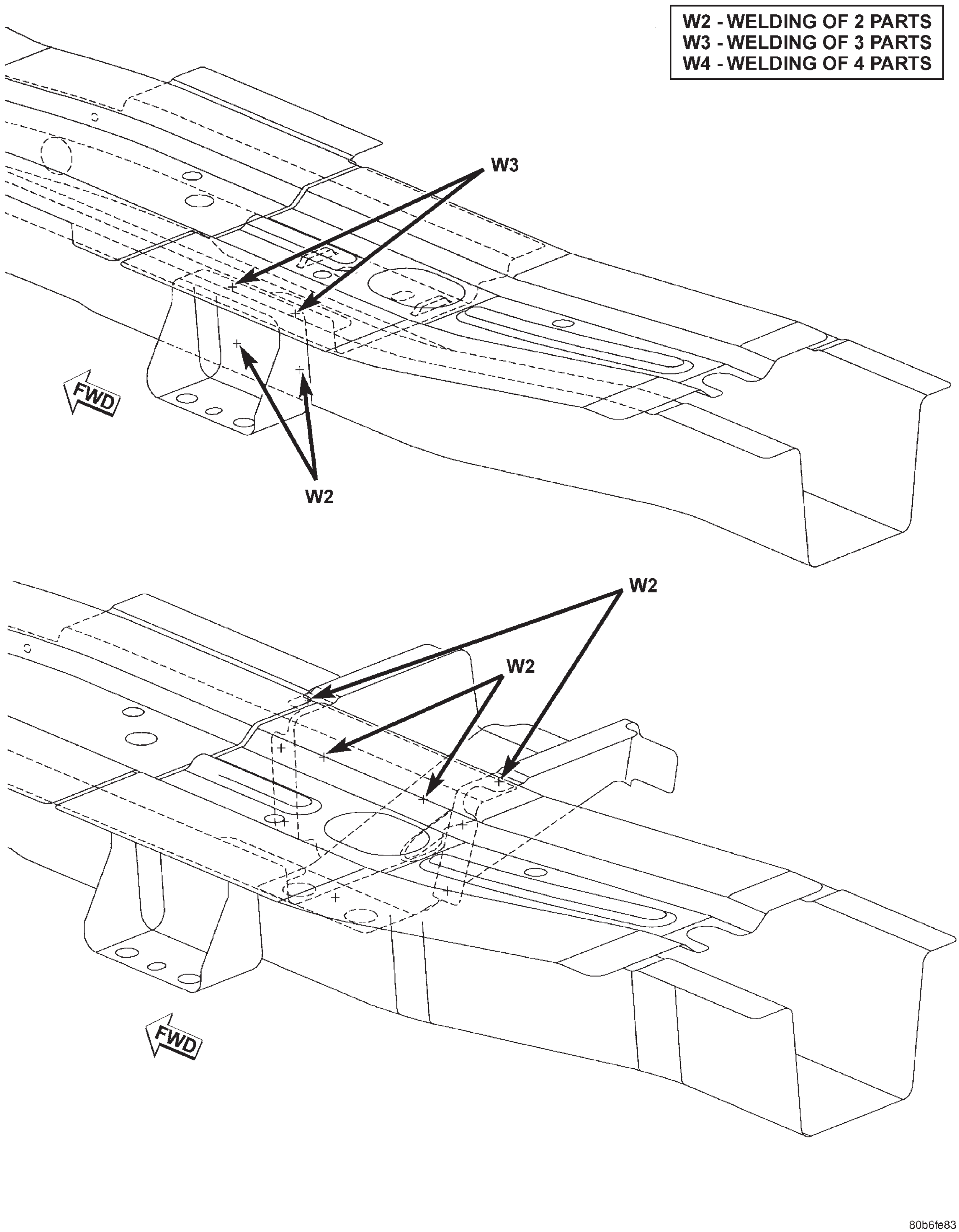
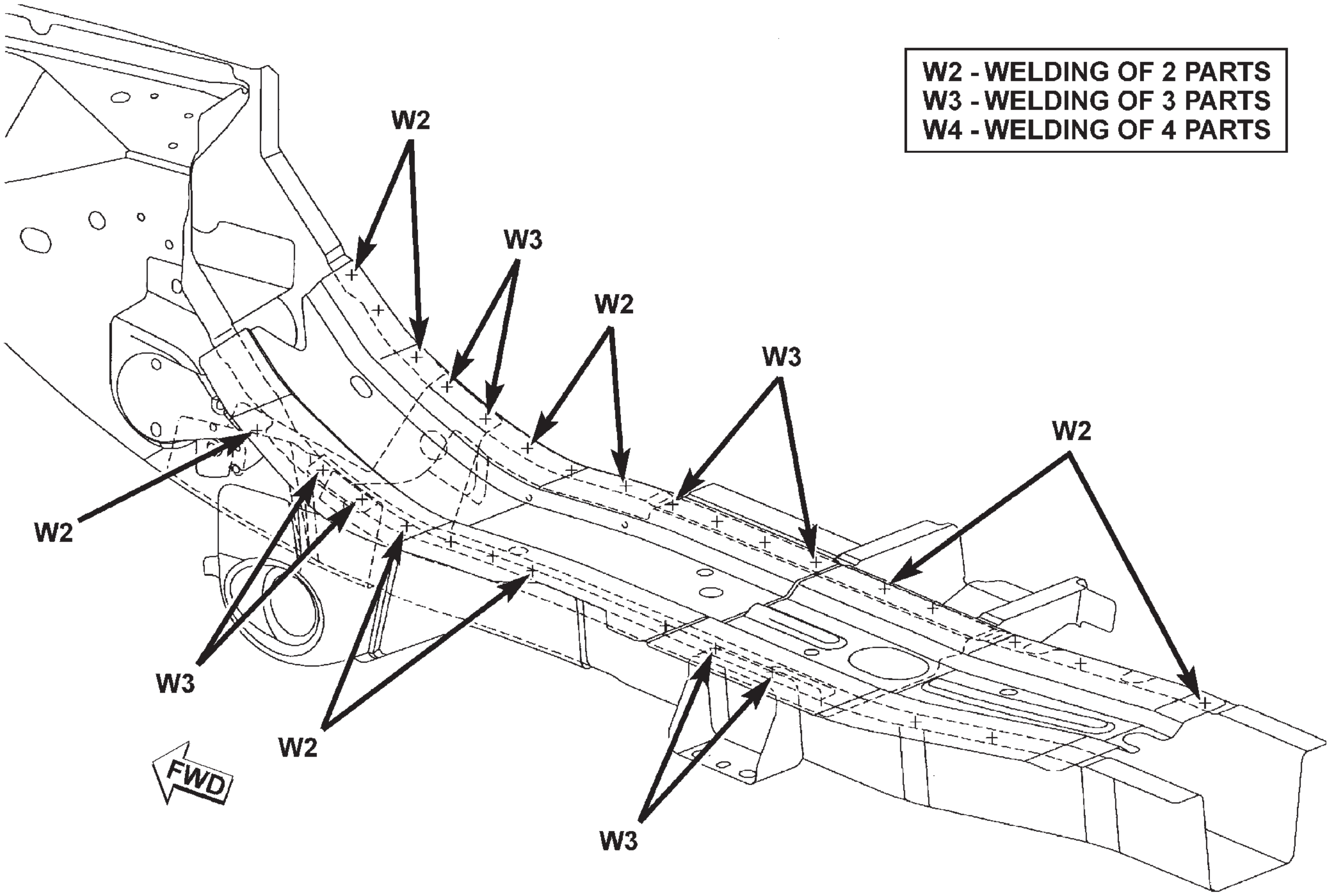


Fig. 76 TRANSMISSION CROSSMEMBER BRACKET AND REINFORCEMENT TO FRONT SILLS

WELD LOCATIONS (Continued)



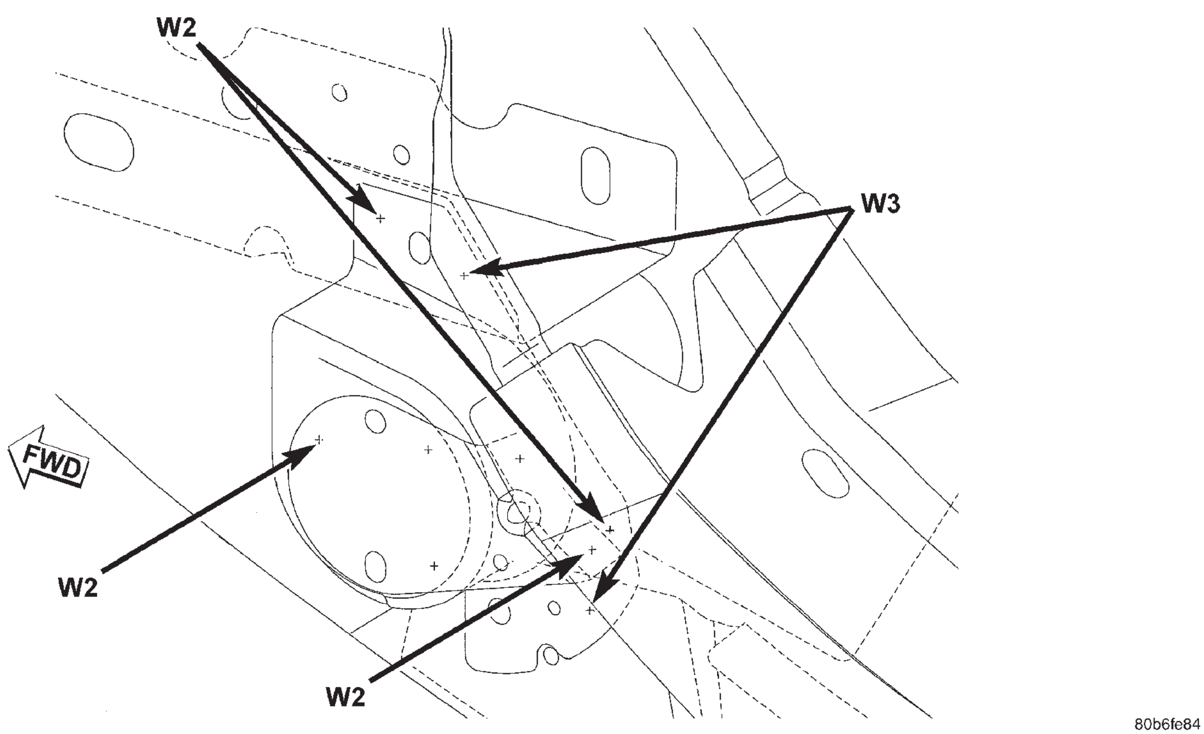


Fig. 77 UPPER SILLS AND UPPER CONTROL ARM REINFORCEMENT AND BRACKETS TO FRONT SILLS

WELD LOCATIONS (Continued)

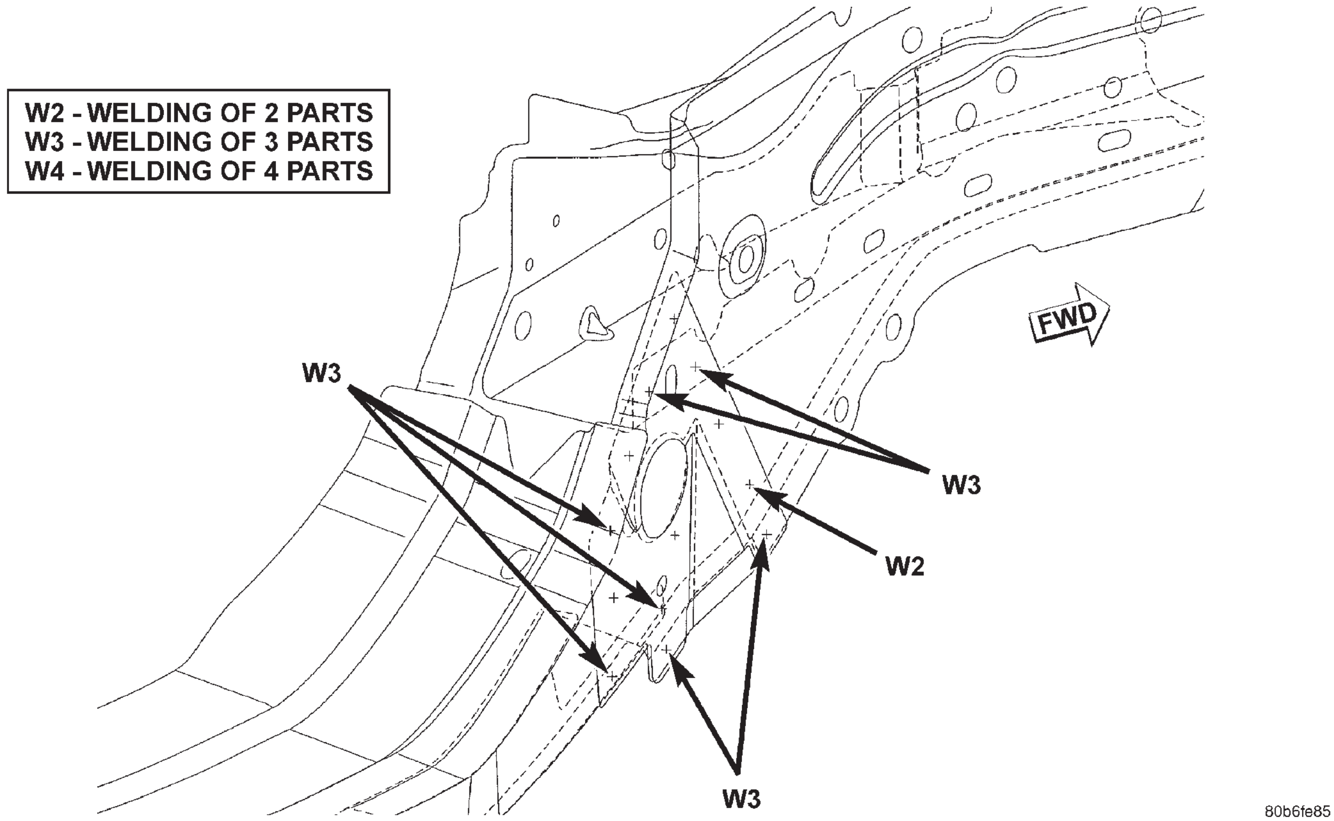


Fig. 78 REINFORCEMENT TO FRONT OUTER SILLS

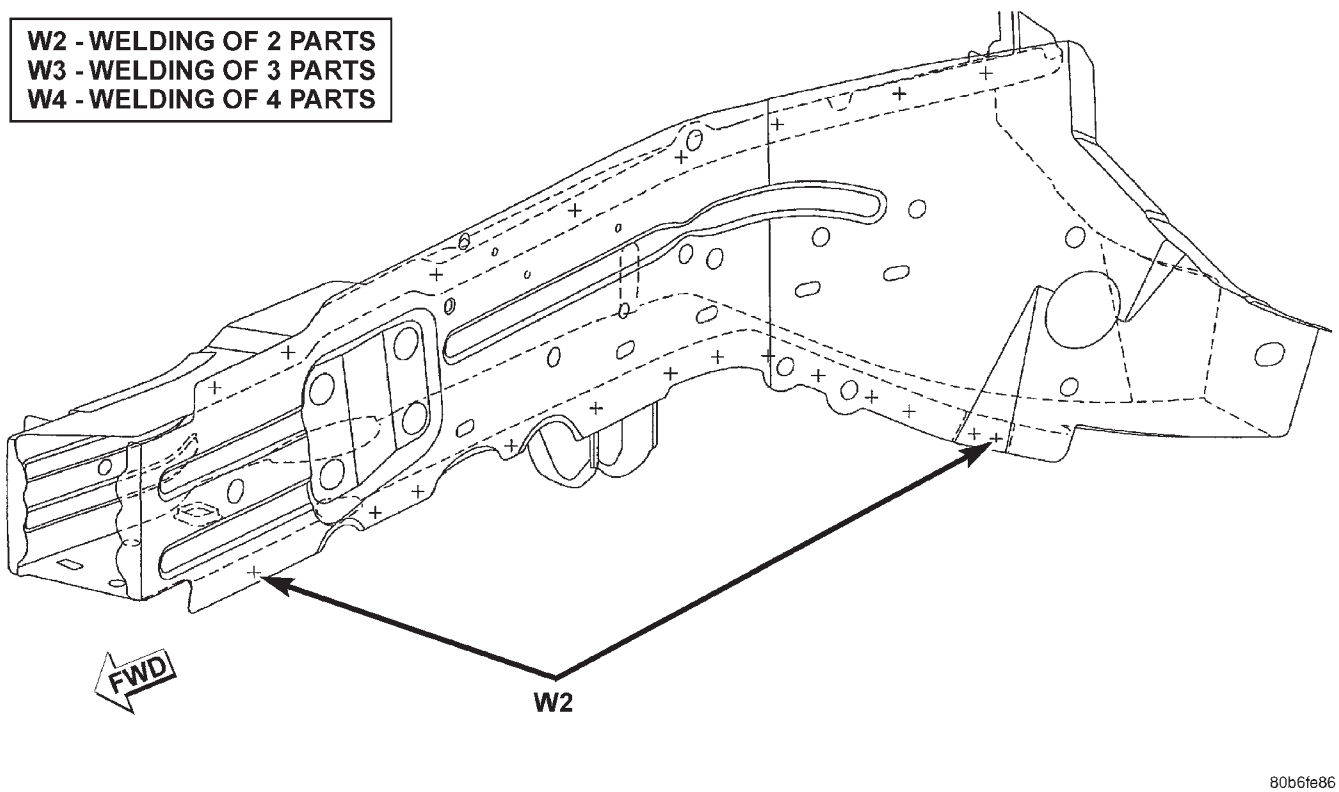


Fig. 79 FRONT INNER SILL TO FRONT OUTER SILL

WELD LOCATIONS (Continued)

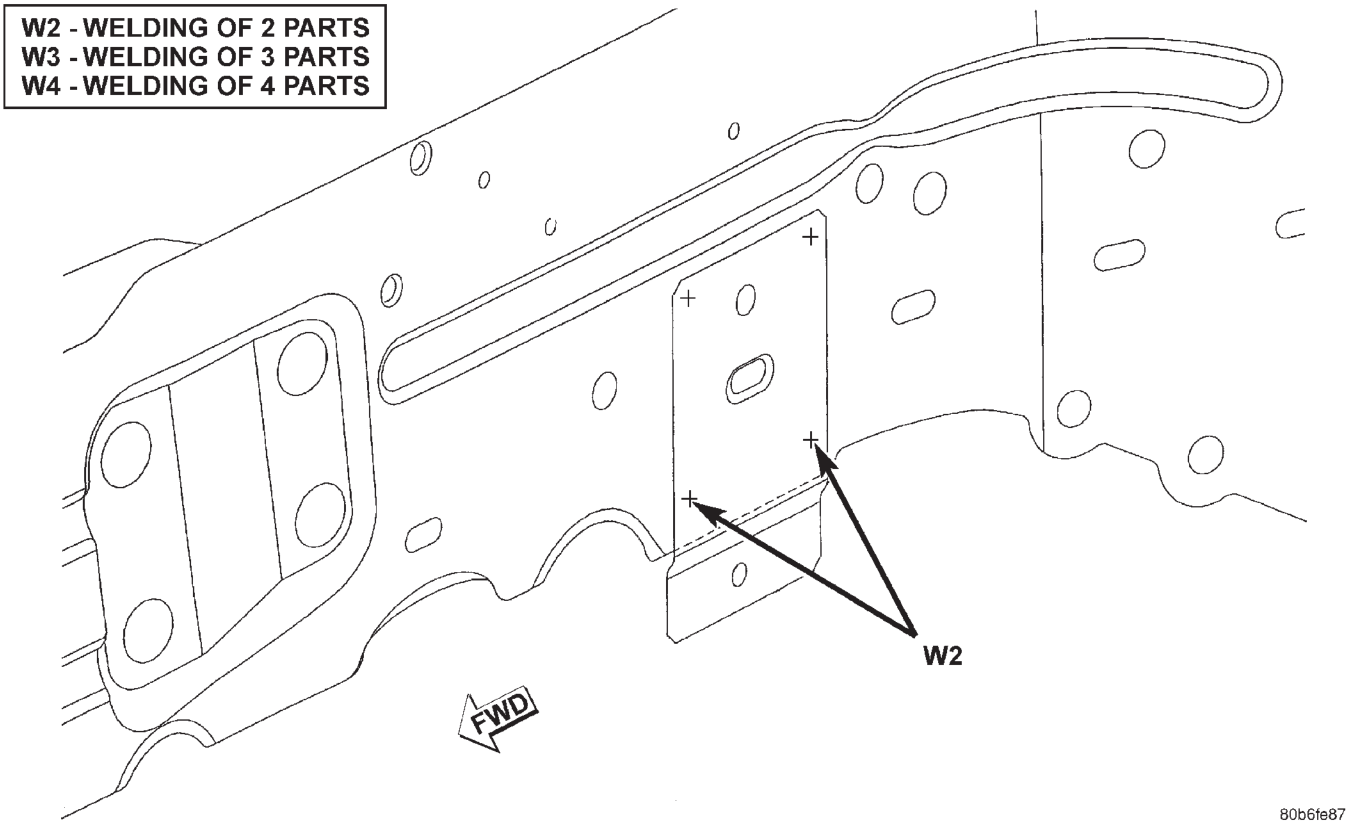


Fig. 80 OUTER TRACK BAR BRACKET TO FRONT OUTER SILL

WELD LOCATIONS (Continued)

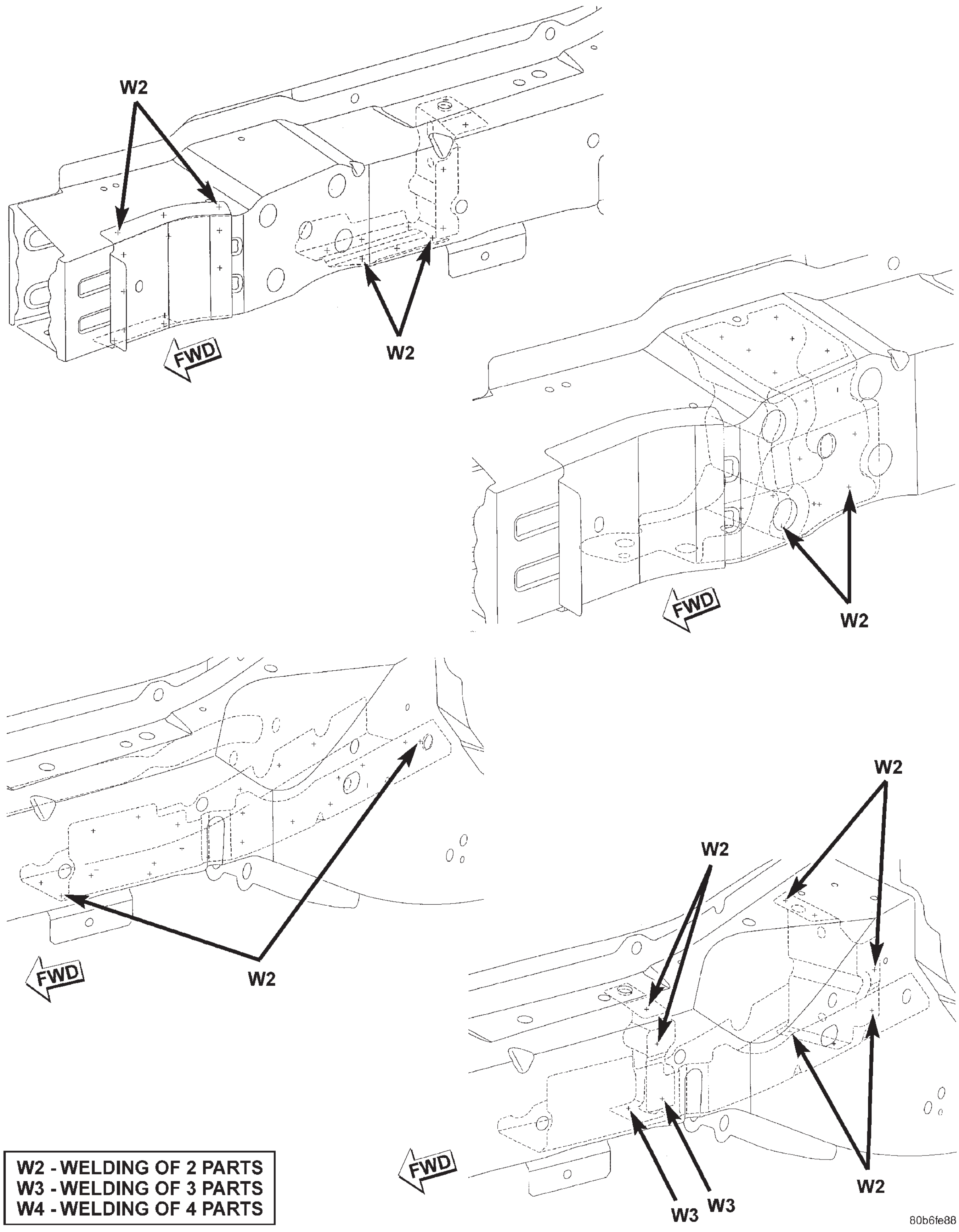


Fig. 81 REINFORCEMENT FOR FRONT ENGINE MOUNTING AND STEERING GEAR TO FRONT INNER SILL

WELD LOCATIONS (Continued)

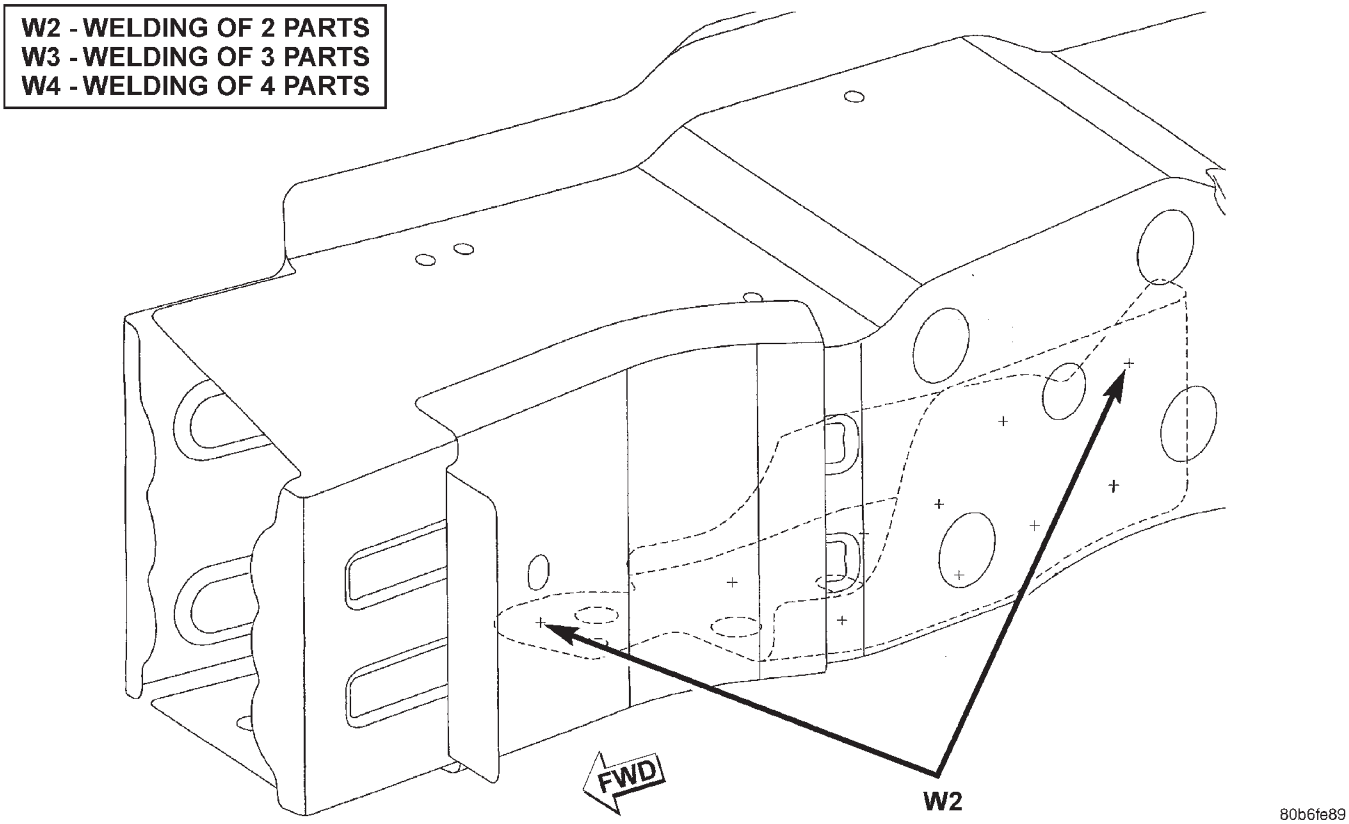


Fig. 82 LARGE AND SMALL SWAY BAR TAPPING PLATES TO FRONT INNER SILLS

WELD LOCATIONS (Continued)

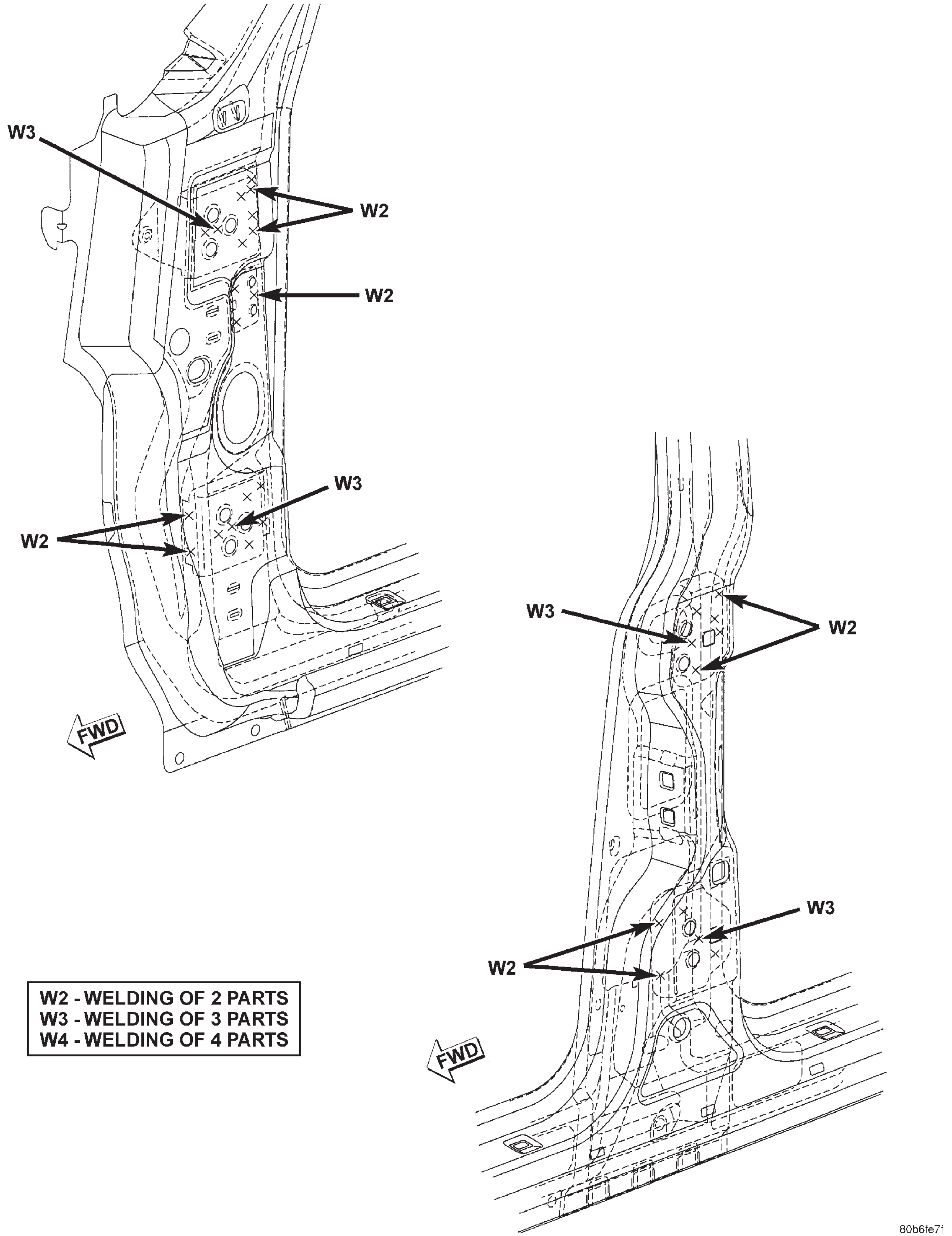


Fig. 83 FRONT AND REAR DOOR HINGE TAPPING PLATES

WELD LOCATIONS (Continued)

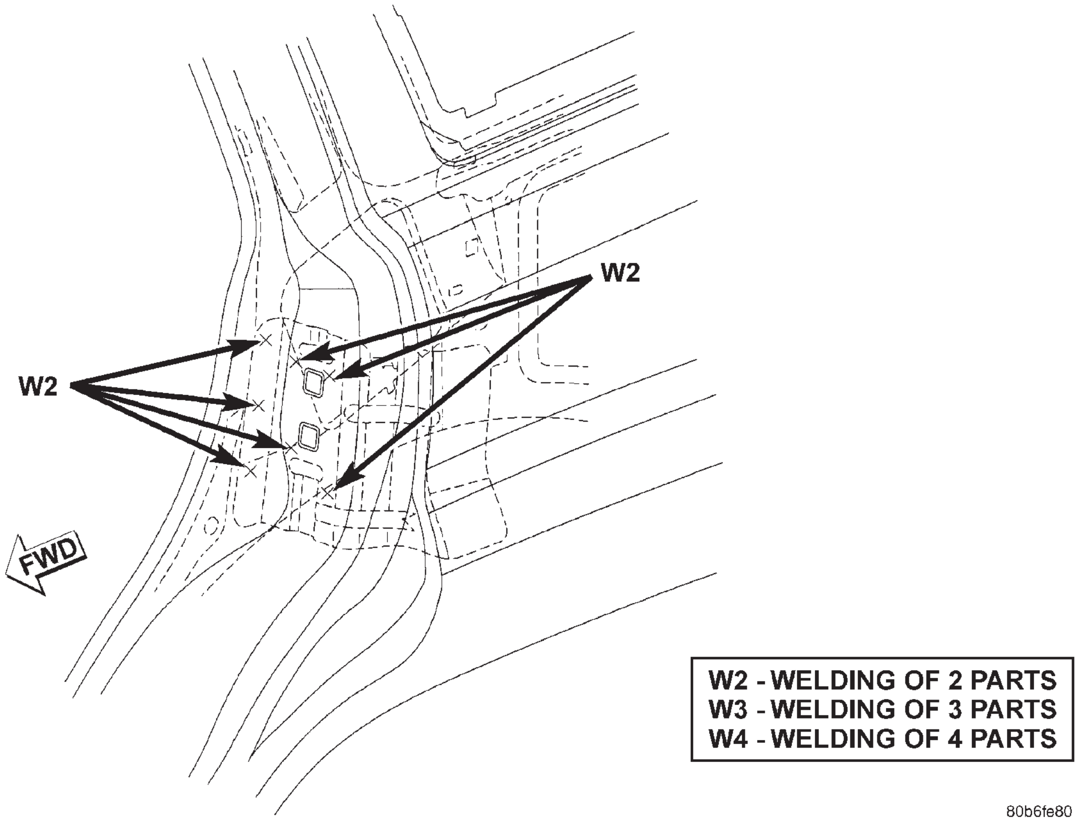


Fig. 84 REAR DOOR STRIKER REINFORCEMENT

WELD LOCATIONS (Continued)

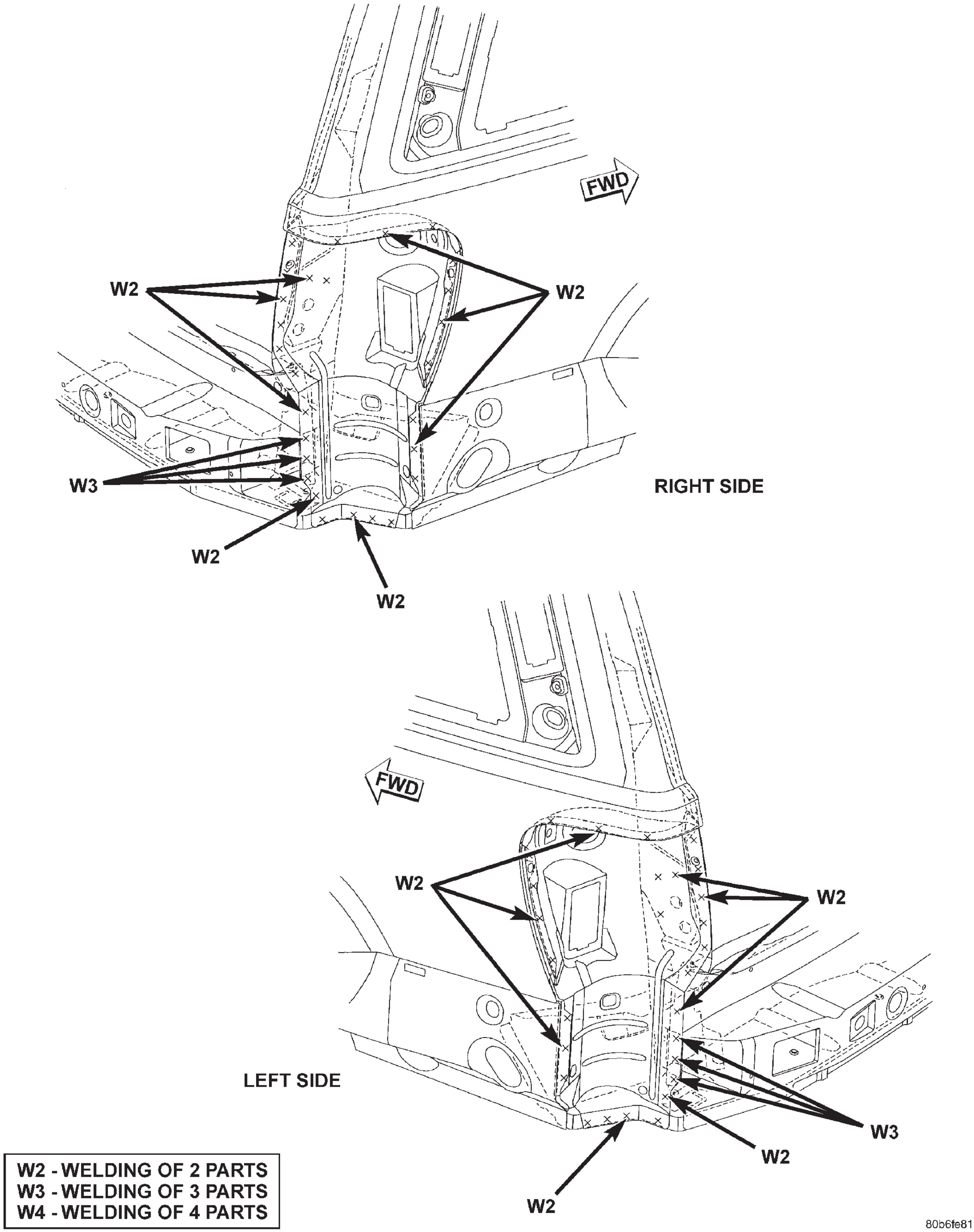


Fig. 85 TAIL LAMP MOUNTING PANELS

WELD LOCATIONS (Continued)

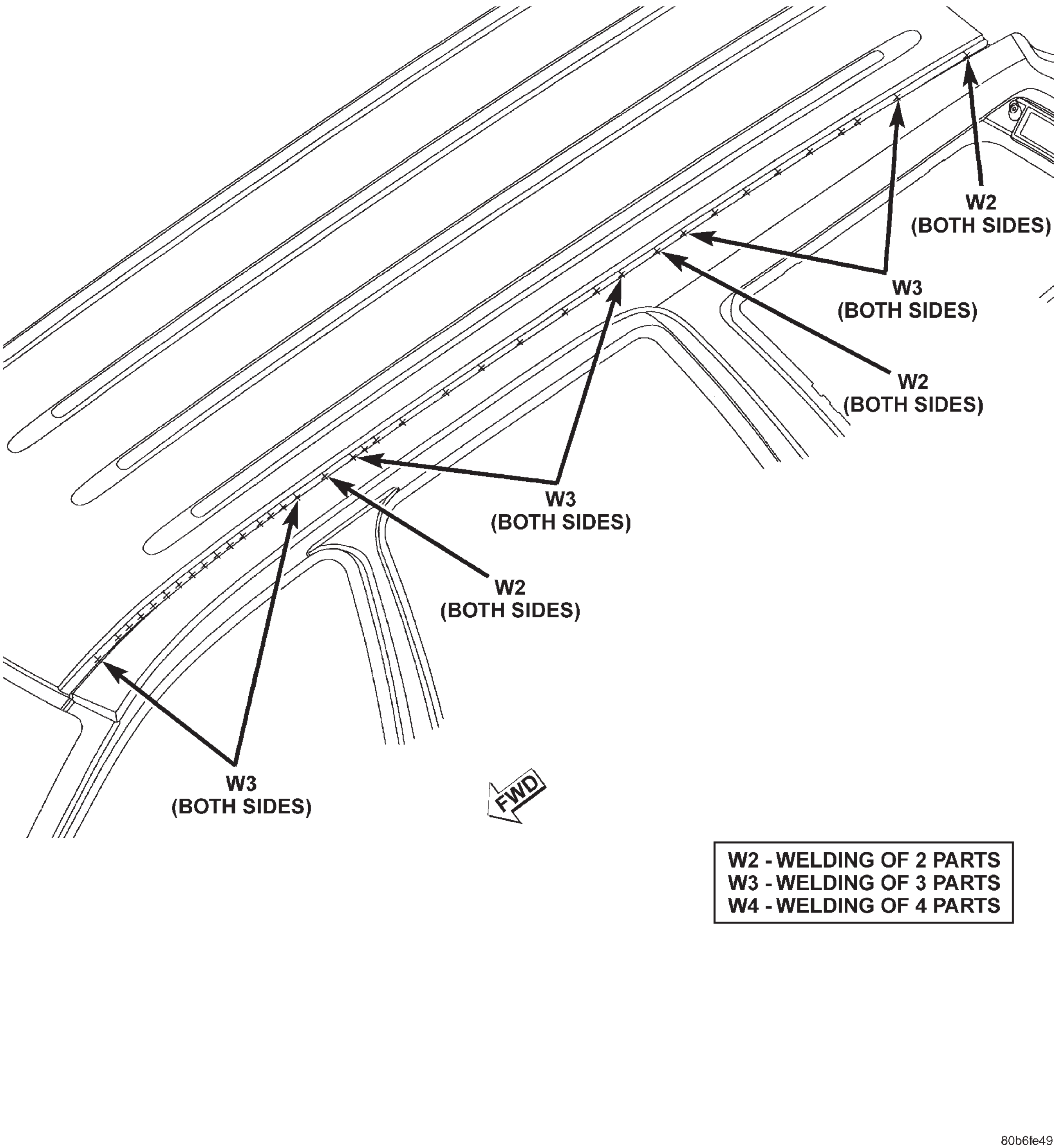


Fig. 86 ROOF PANEL TO BODYSIDE APERTURE

WELD LOCATIONS (Continued)

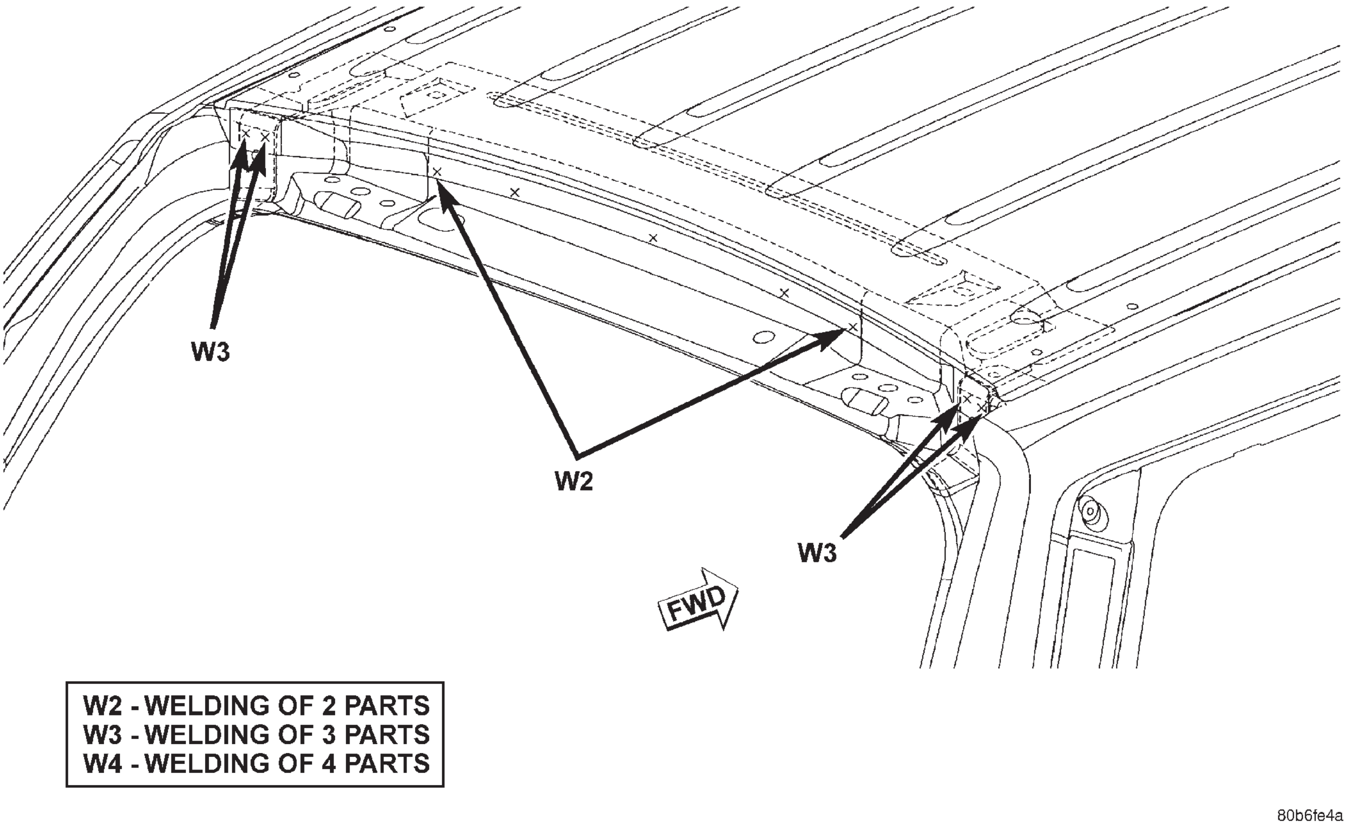


Fig. 87 ROOF PANEL TO REAR HEADER

WELD LOCATIONS (Continued)

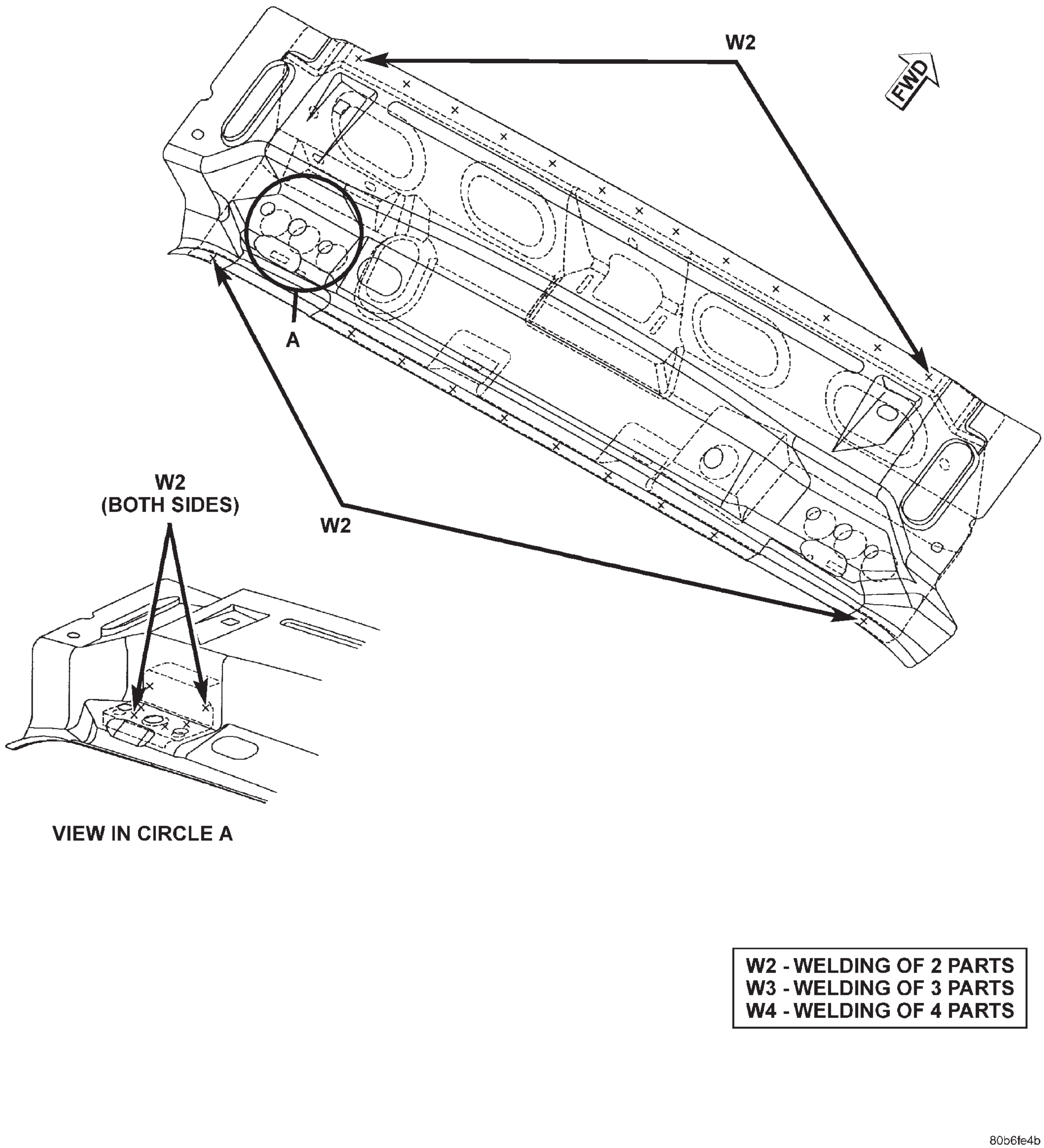


Fig. 88 UPPER REAR HEADER TO LOWER HEADER

WELD LOCATIONS (Continued)

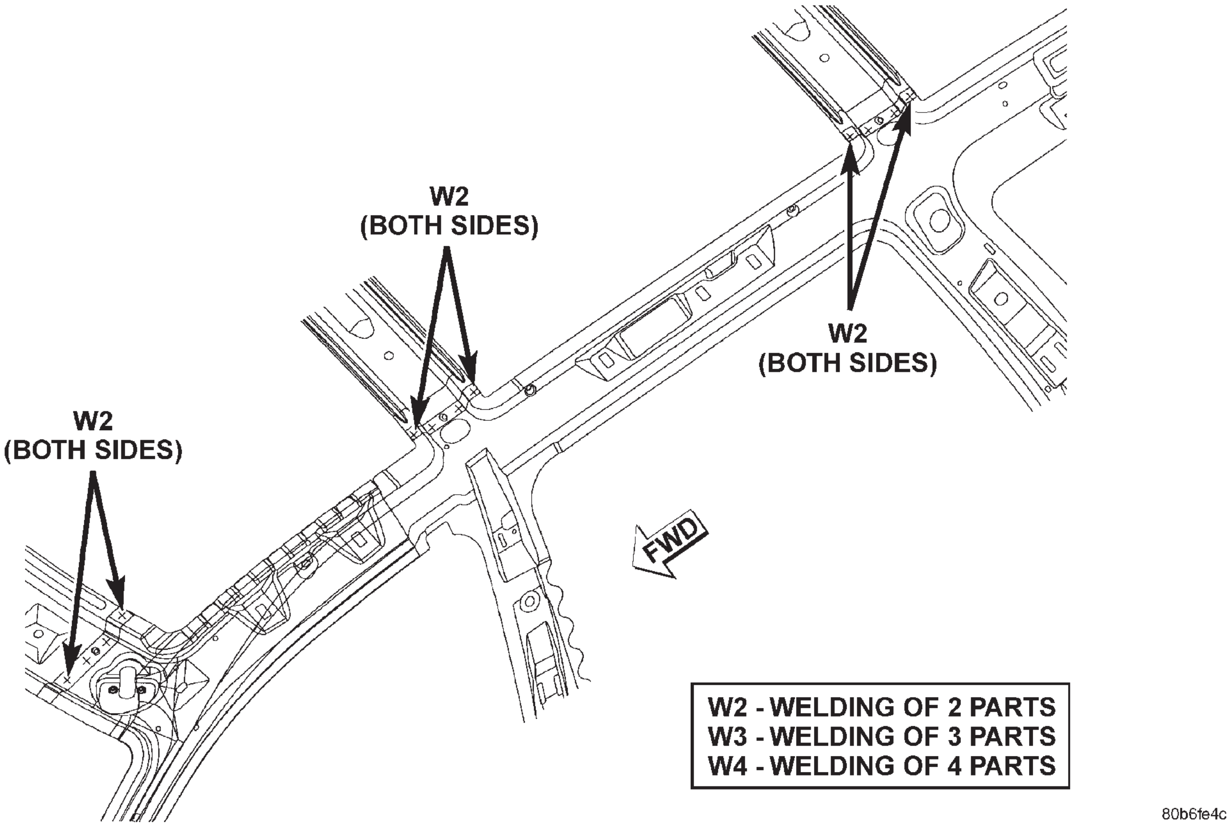


Fig. 89 FRONT HEADER AND ROOF BOWS TO INNER PANEL

WELD LOCATIONS (Continued)

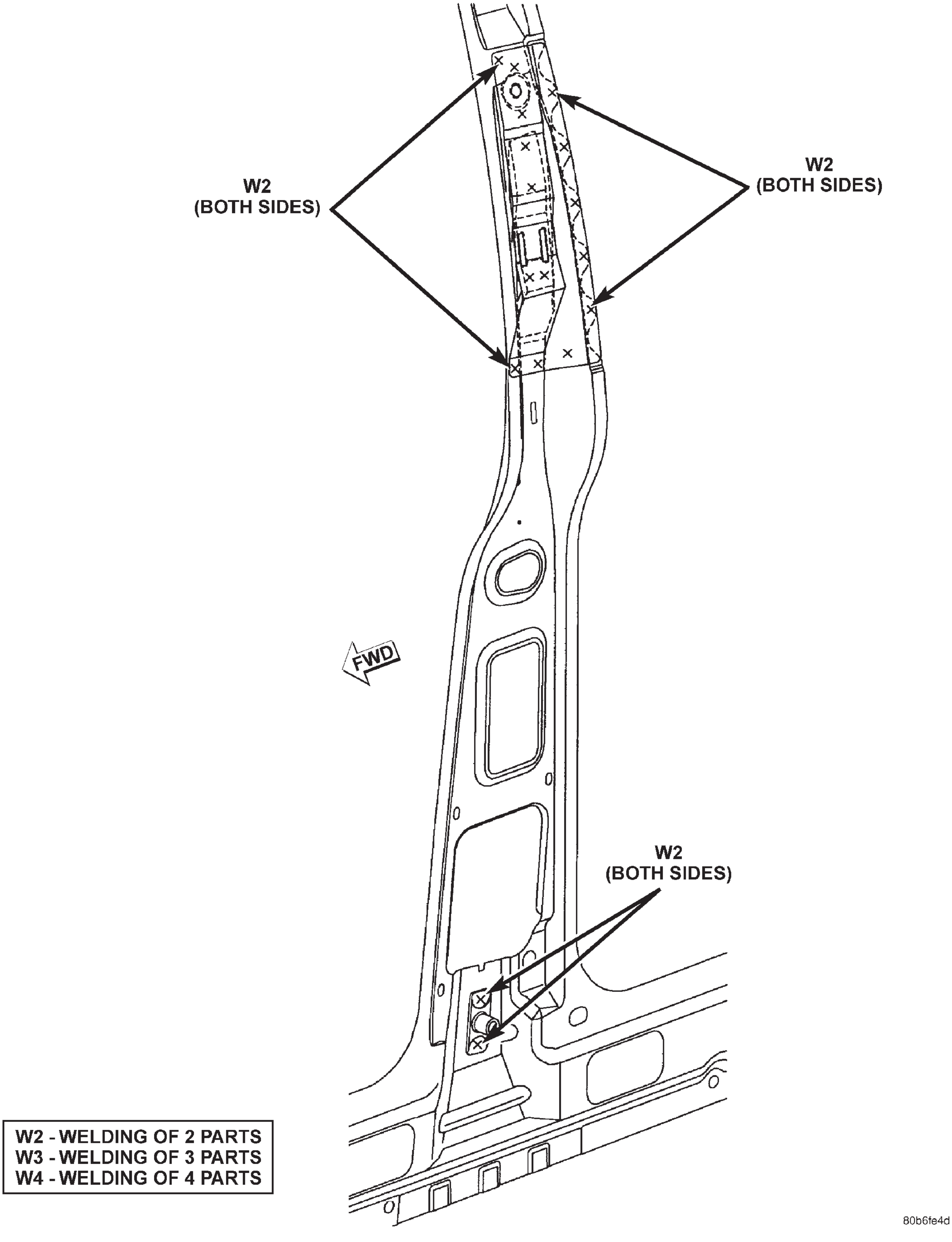


Fig. 90 FRONT SEAT/SHOULDER BELT TO INNER PANEL REINFORCEMENT

WELD LOCATIONS (Continued)

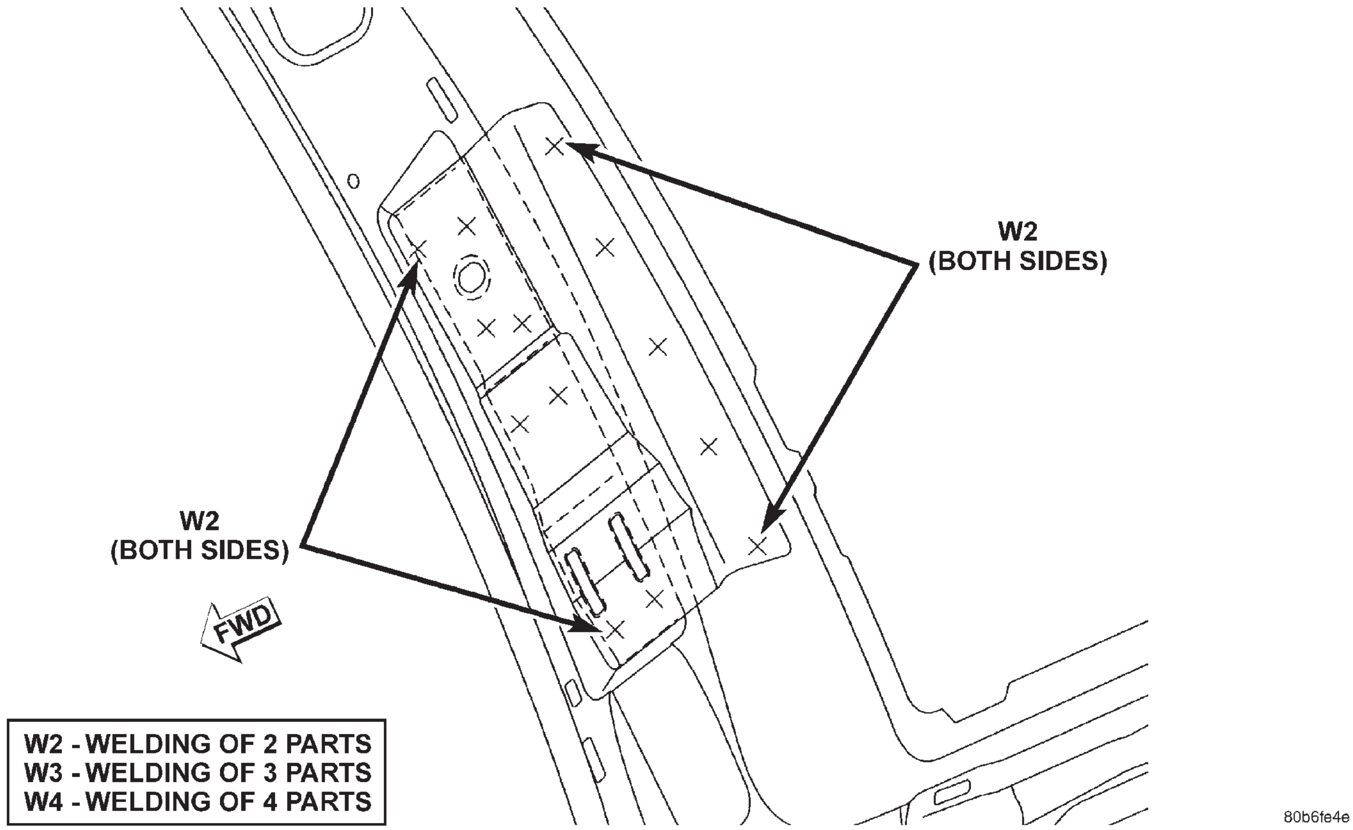


Fig. 91 REAR SEAT/SHOULDER BELT TO INNER PANEL REINFORCEMENT

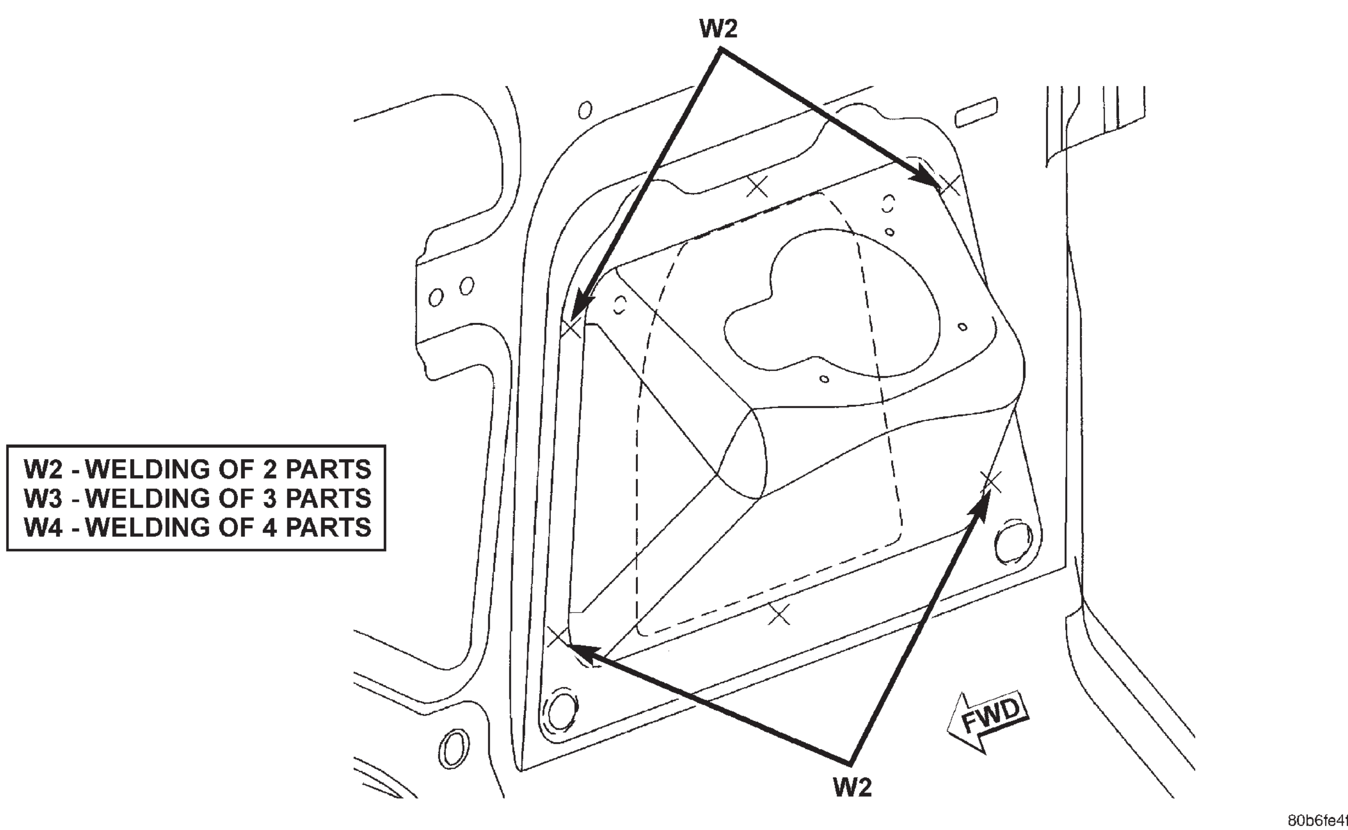


Fig. 92 FUEL FILLER GUSSET TO INNER QUARTER PANEL

WELD LOCATIONS (Continued)

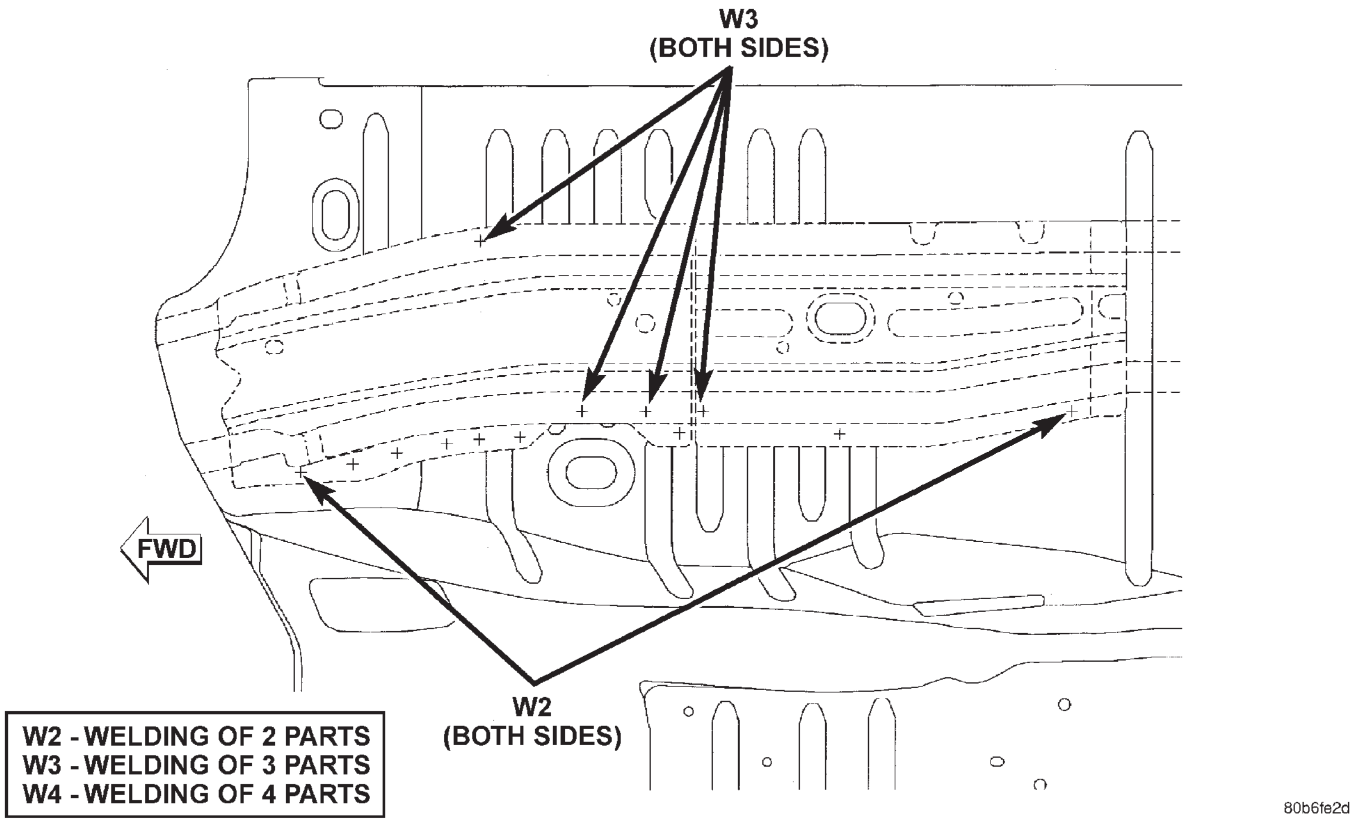


Fig. 93 FRONT FLOOR PAN TO SILL REINFORCEMENT

WELD LOCATIONS (Continued)

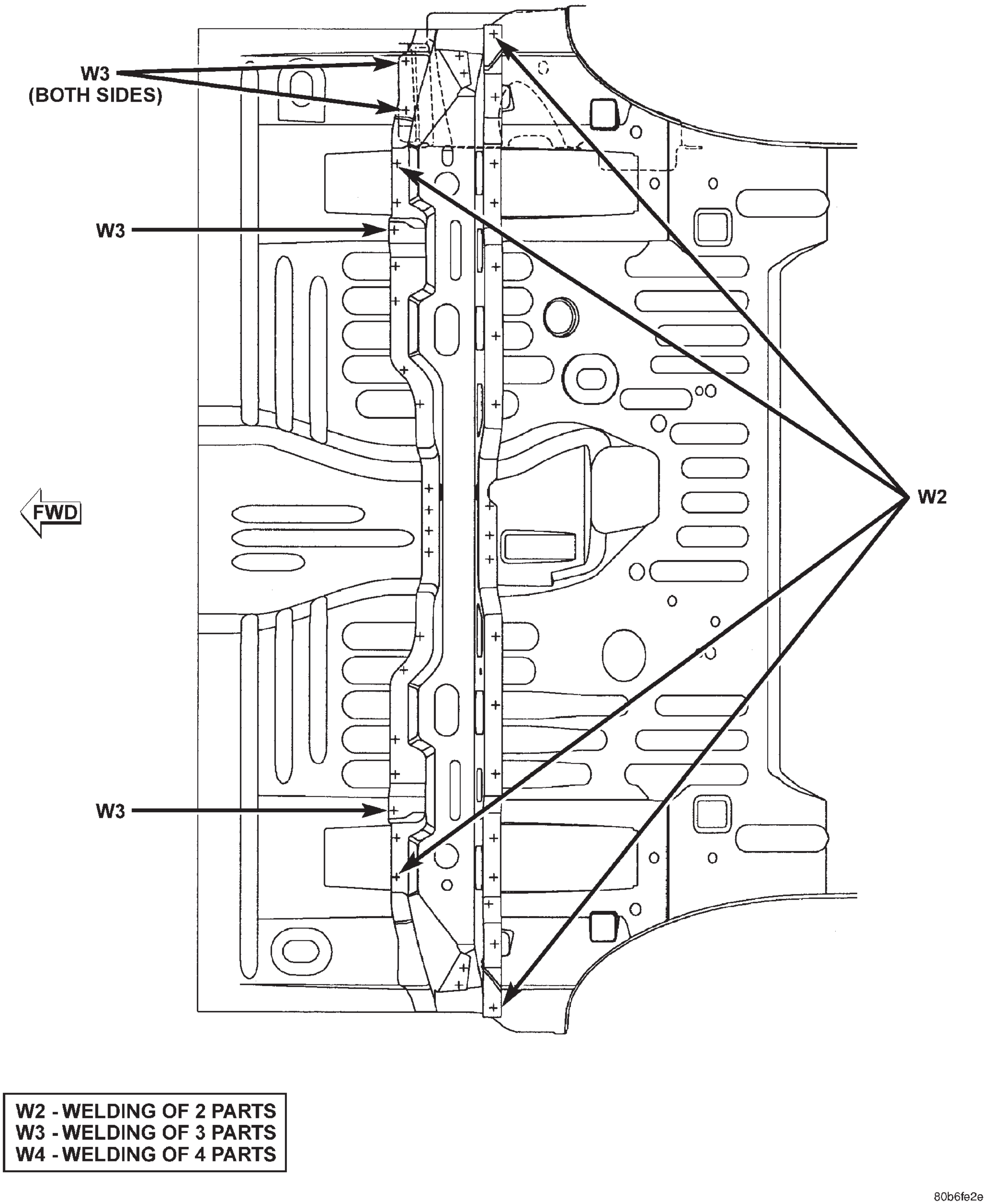


Fig. 94 CENTER FLOOR PAN TO REAR SEAT CROSSMEMBER

WELD LOCATIONS (Continued)

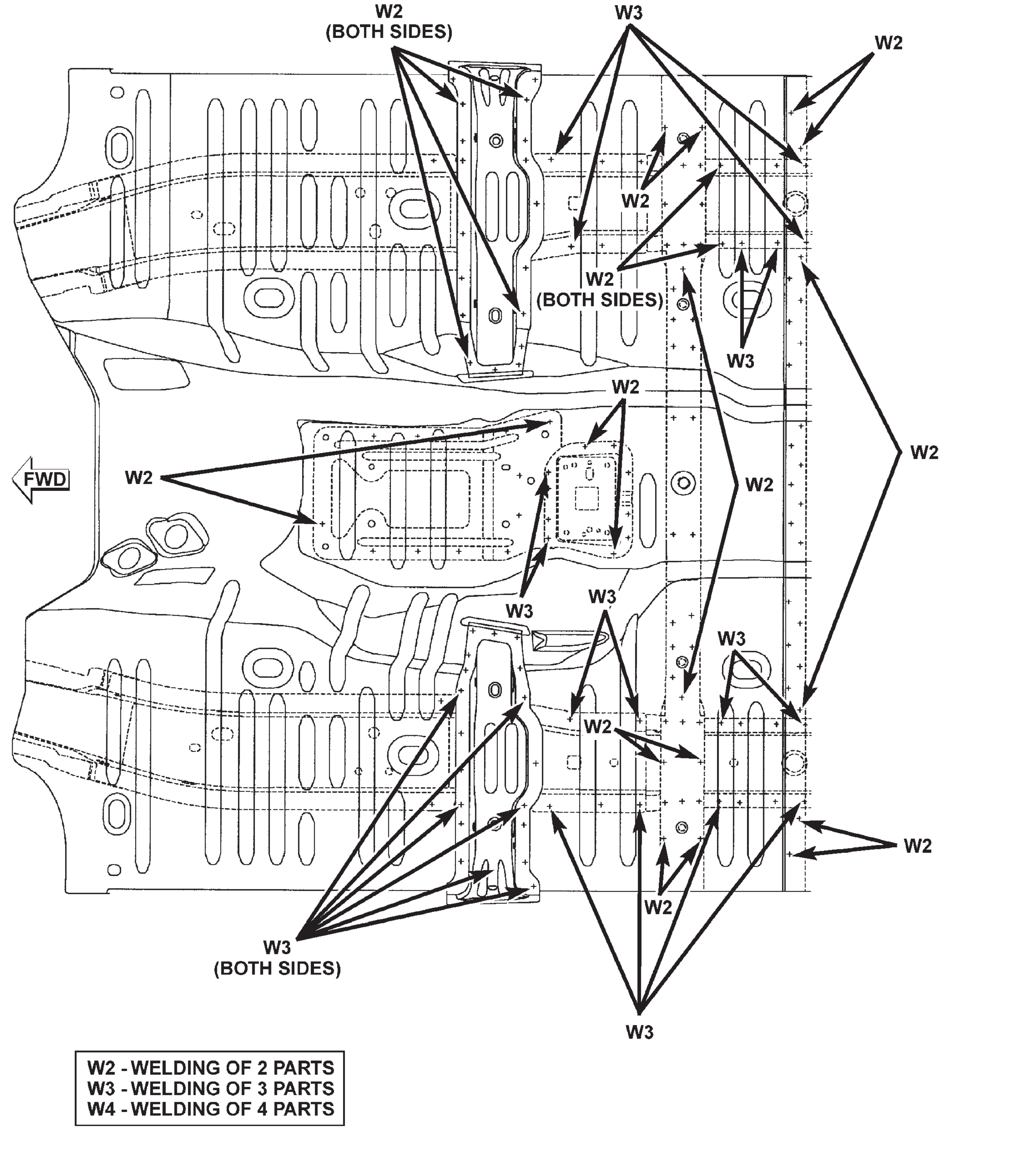


Fig. 95 FRONT FLOOR PAN TO FRONT SEAT REINFORCEMENT AND RAILS

WELD LOCATIONS (Continued)

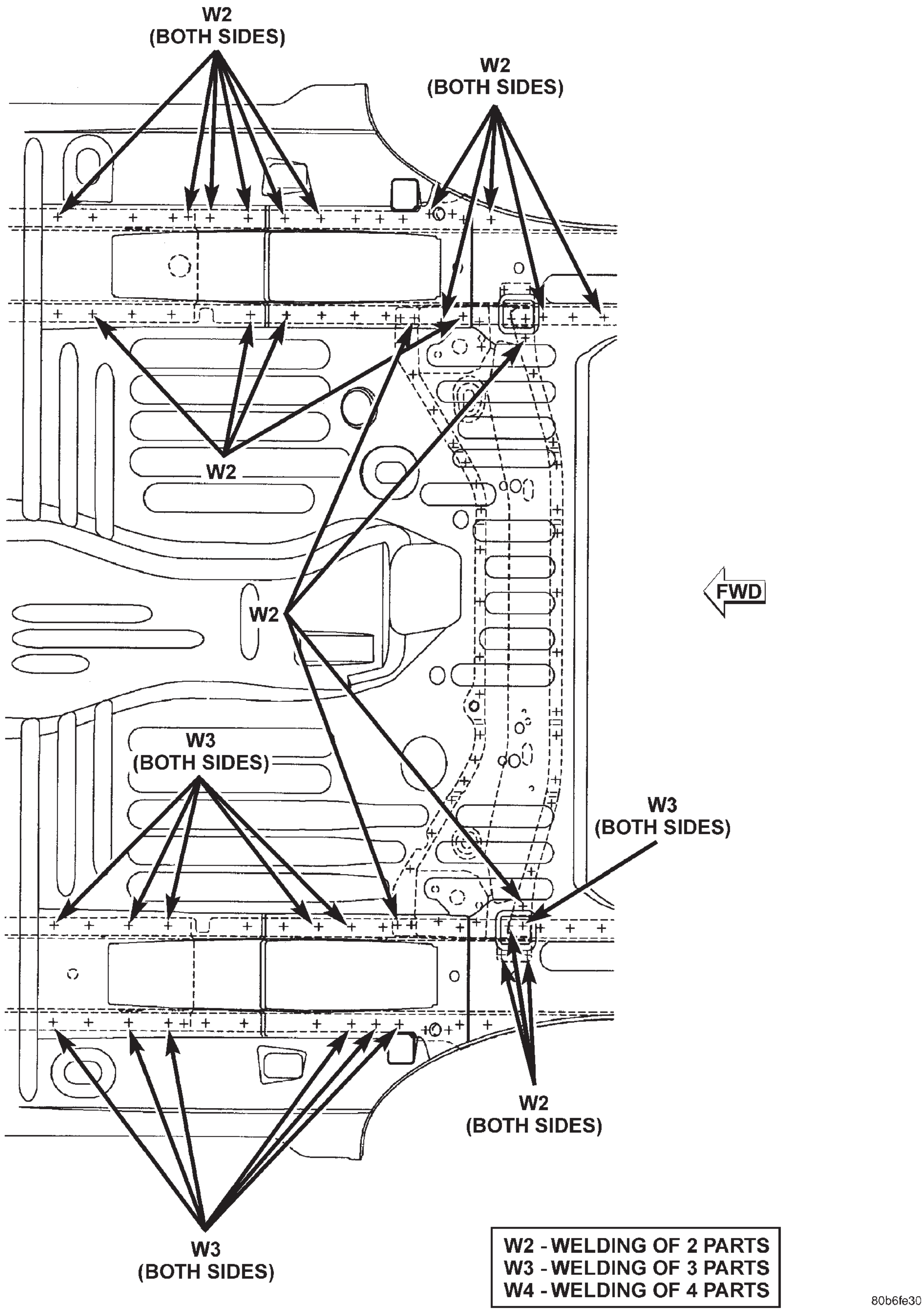


Fig. 96 CENTER FLOOR PAN TO UPPER CONTROL ARM CROSSMEMBER AND RAILS

WELD LOCATIONS (Continued)

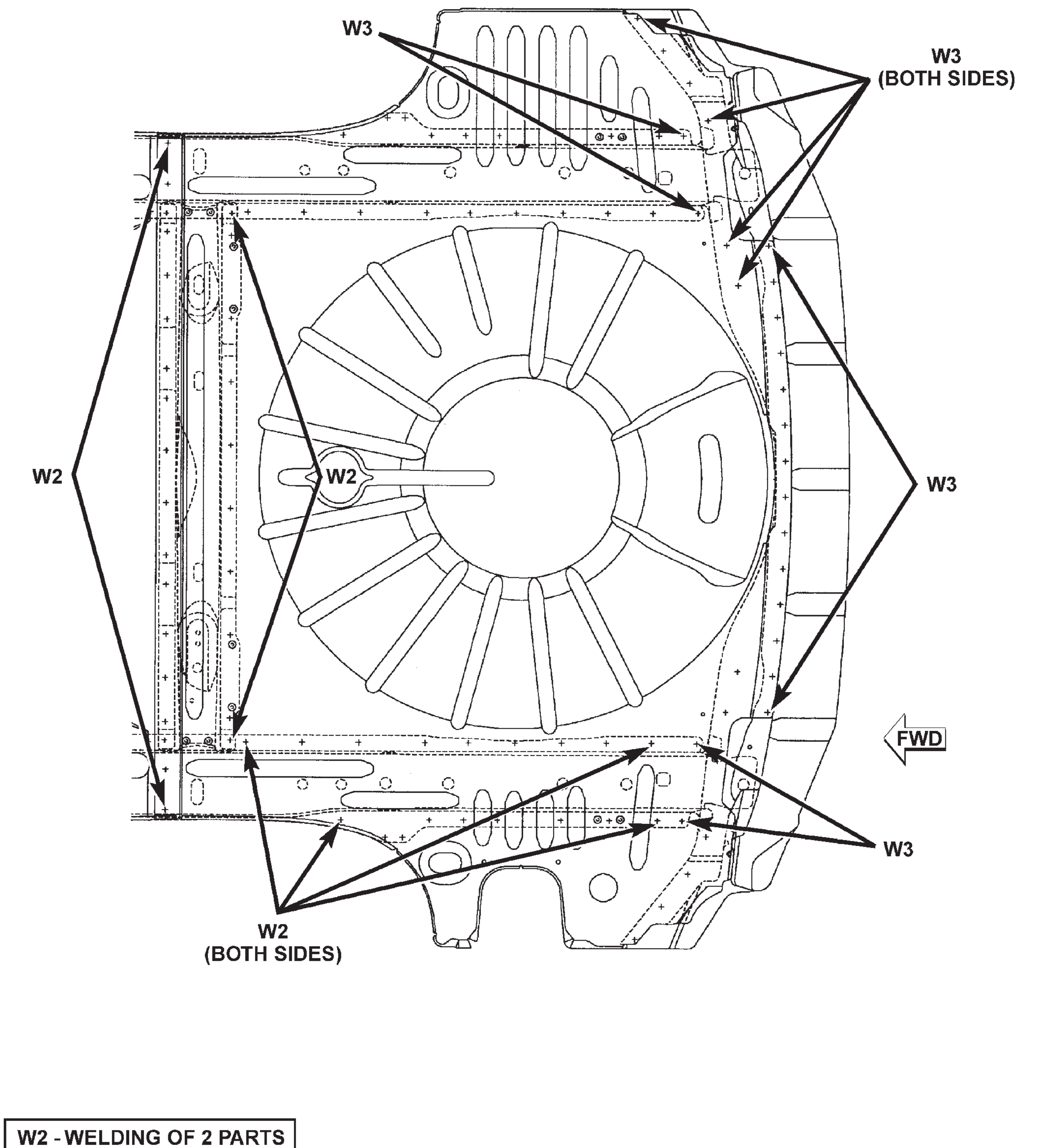


Fig. 97 REAR FLOOR PAN TO RAILS AND SPRING GUIDE CROSSMEMBER

WELD LOCATIONS (Continued)

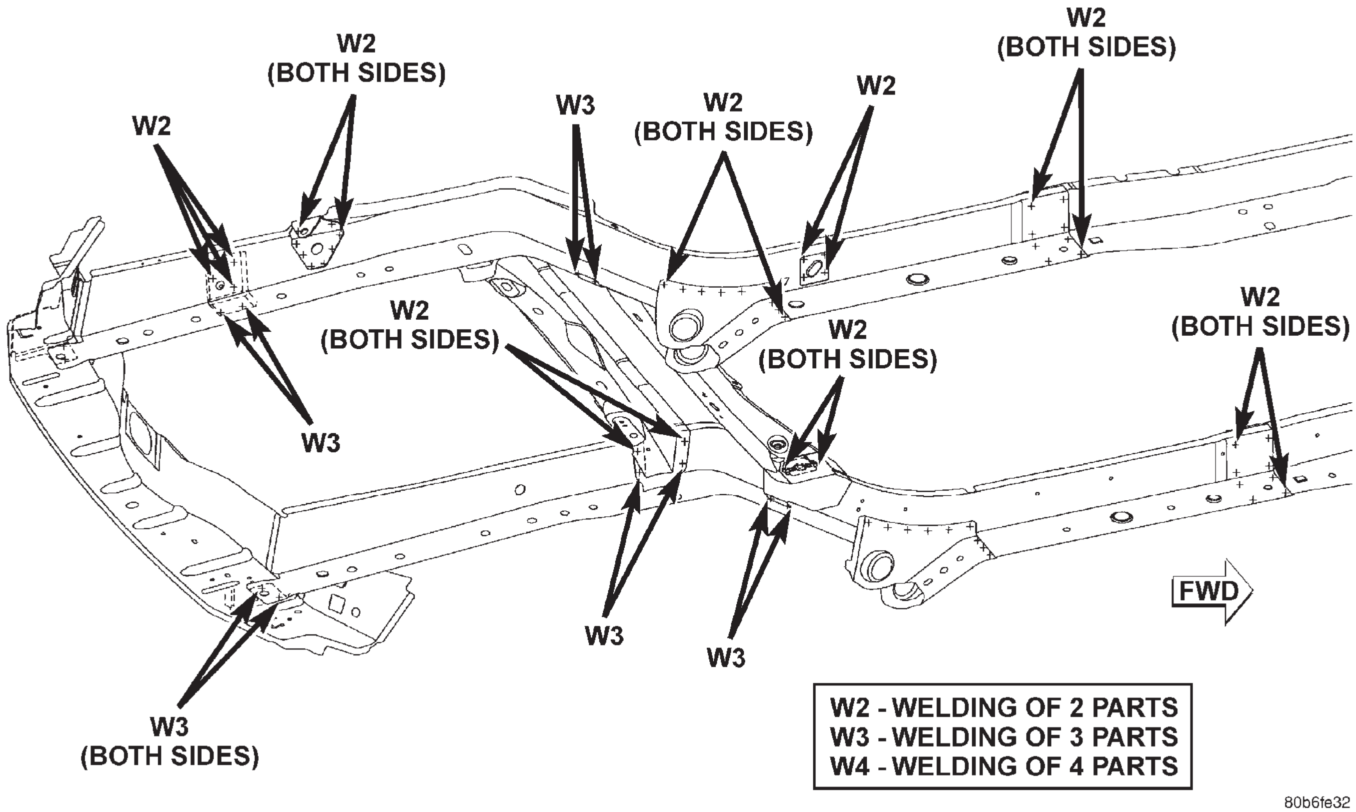


Fig. 98 REAR RAILS

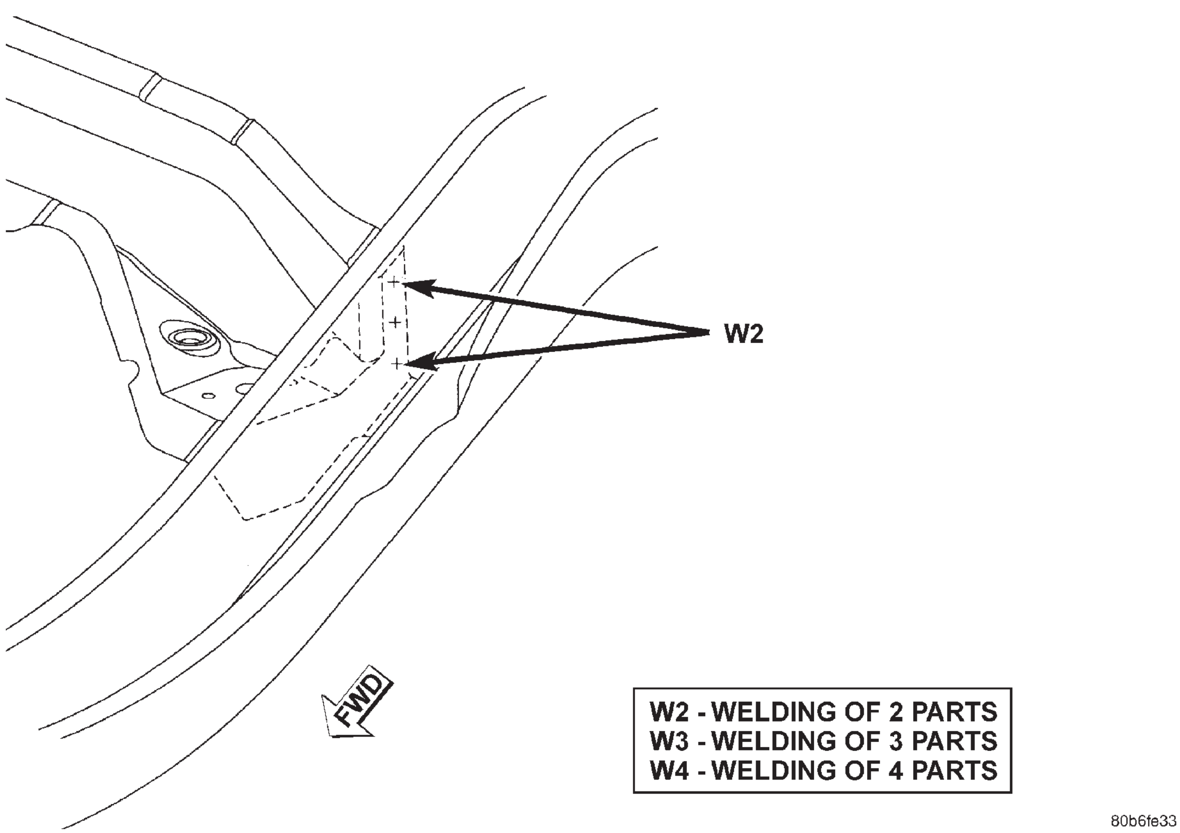


Fig. 99 UPPER CONTROL ARM CROSSMEMBER TO REAR RAIL

WELD LOCATIONS (Continued)

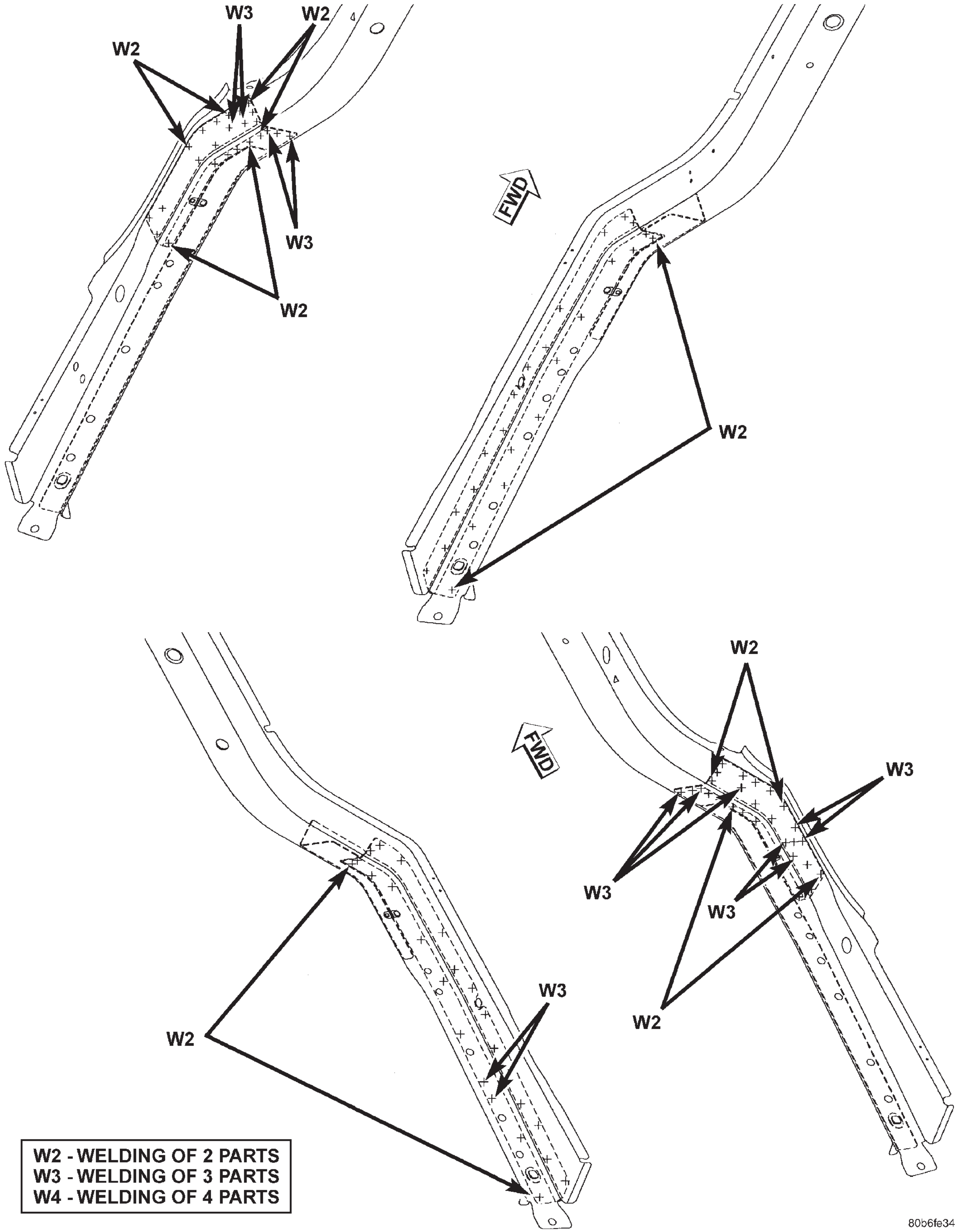


Fig. 100 REAR RAIL REINFORCEMENT TO REAR RAILS

WELD LOCATIONS (Continued)

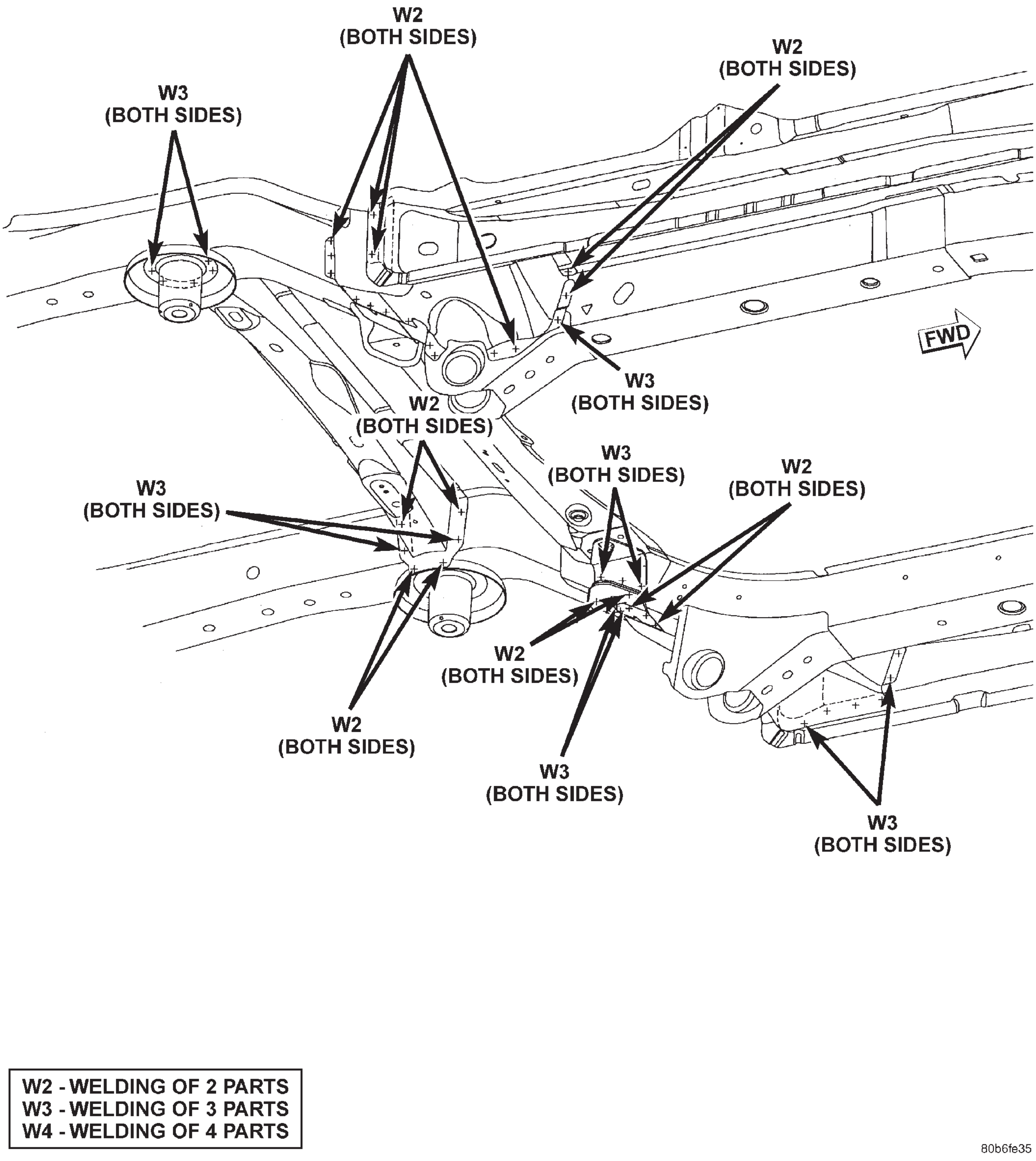


Fig. 101 UPPER CONTROL ARM REINFORCEMENTS TO REAR RAIL

WELD LOCATIONS (Continued)

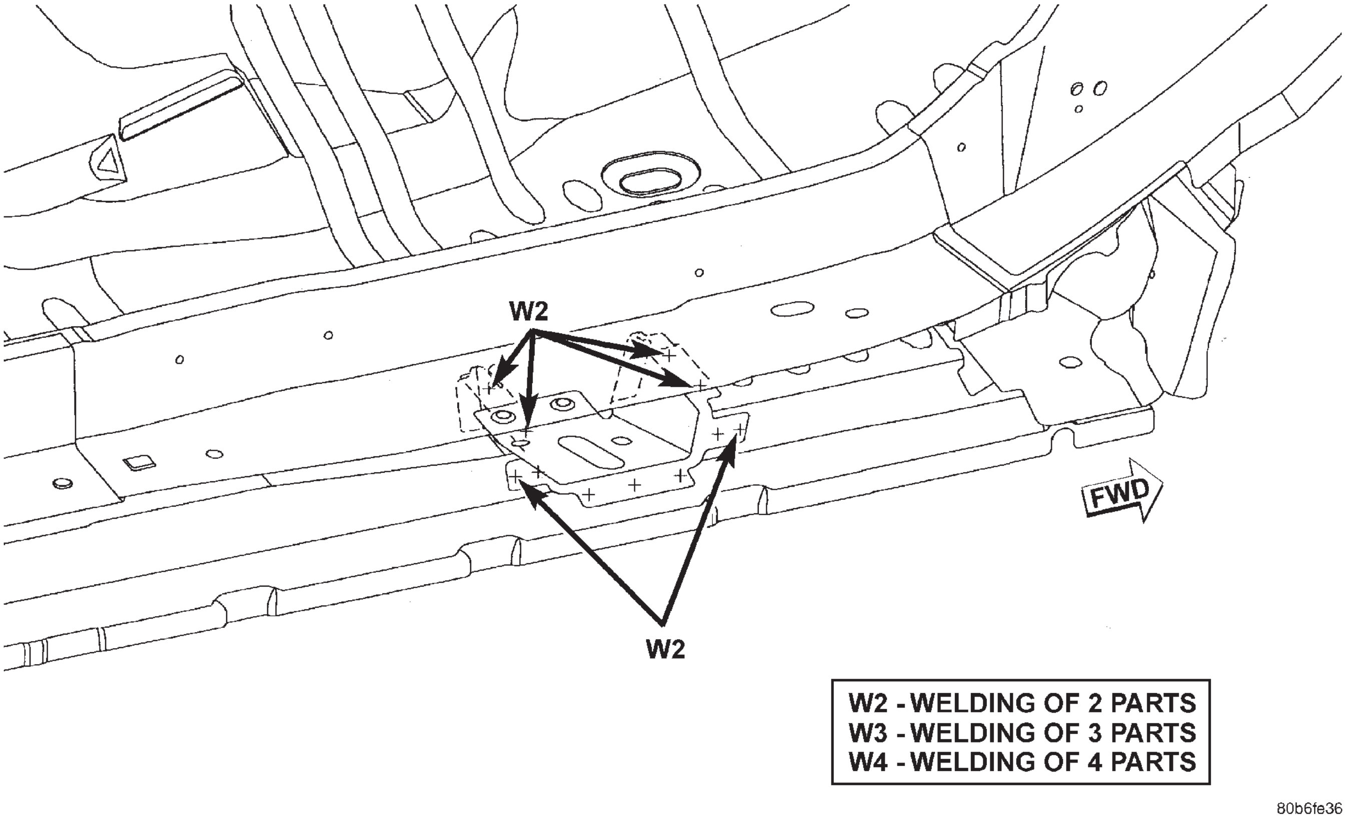


Fig. 102 OUTER TRANSMISSION CROSSMEMBER REINFORCEMENT TO RAIL AND BODYSIDE SILL

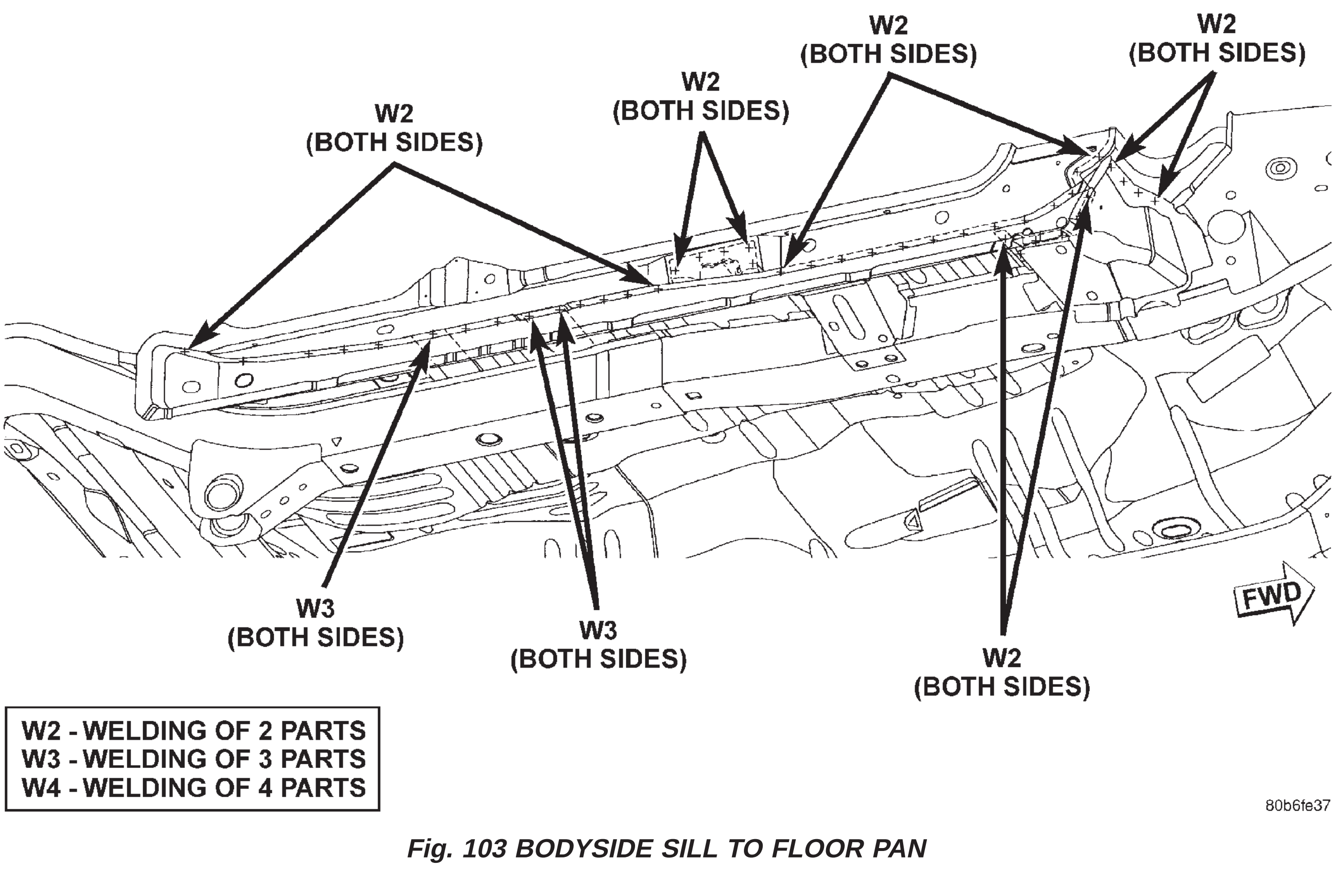


Fig. 103 BODYSIDE SILL TO FLOOR PAN

WELD LOCATIONS (Continued)

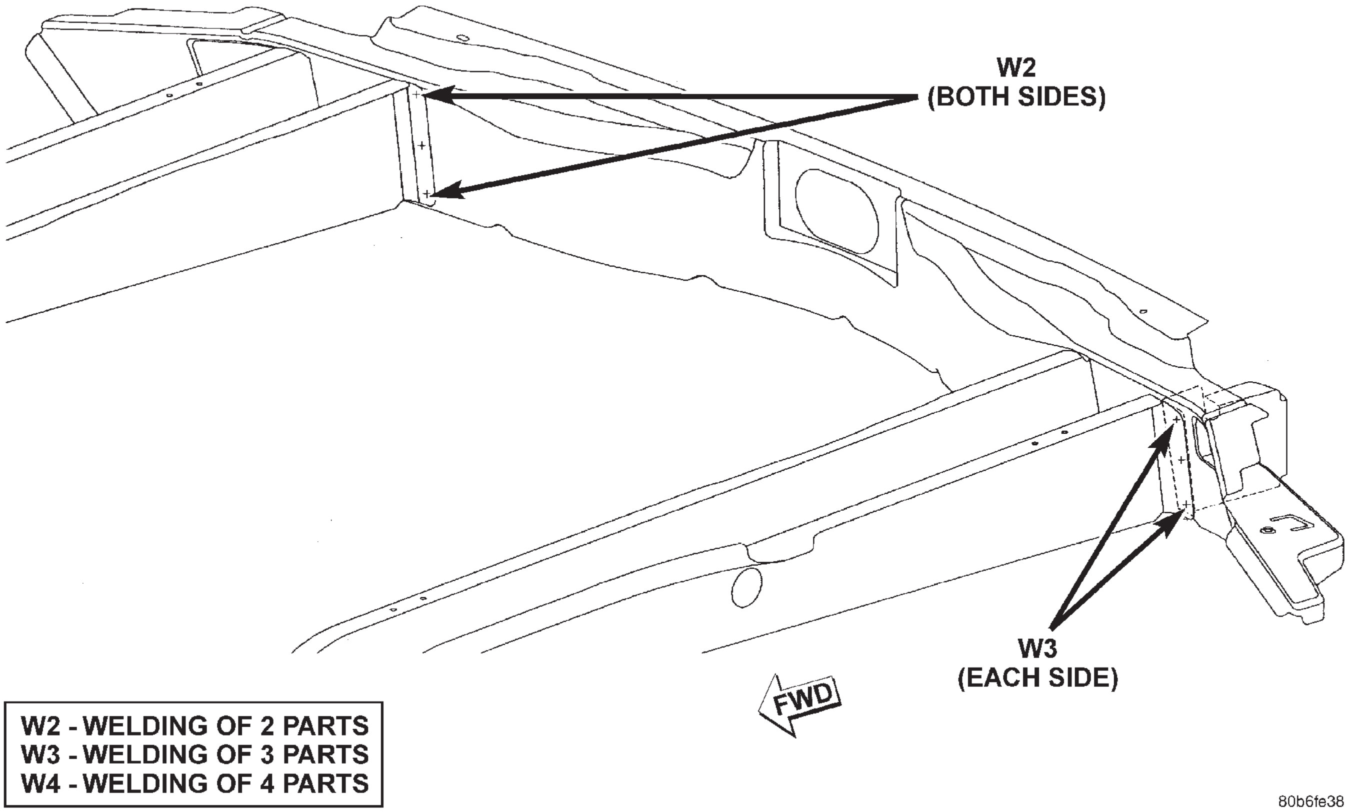


Fig. 104 REAR RAILS TO REAR CROSSMEMBER

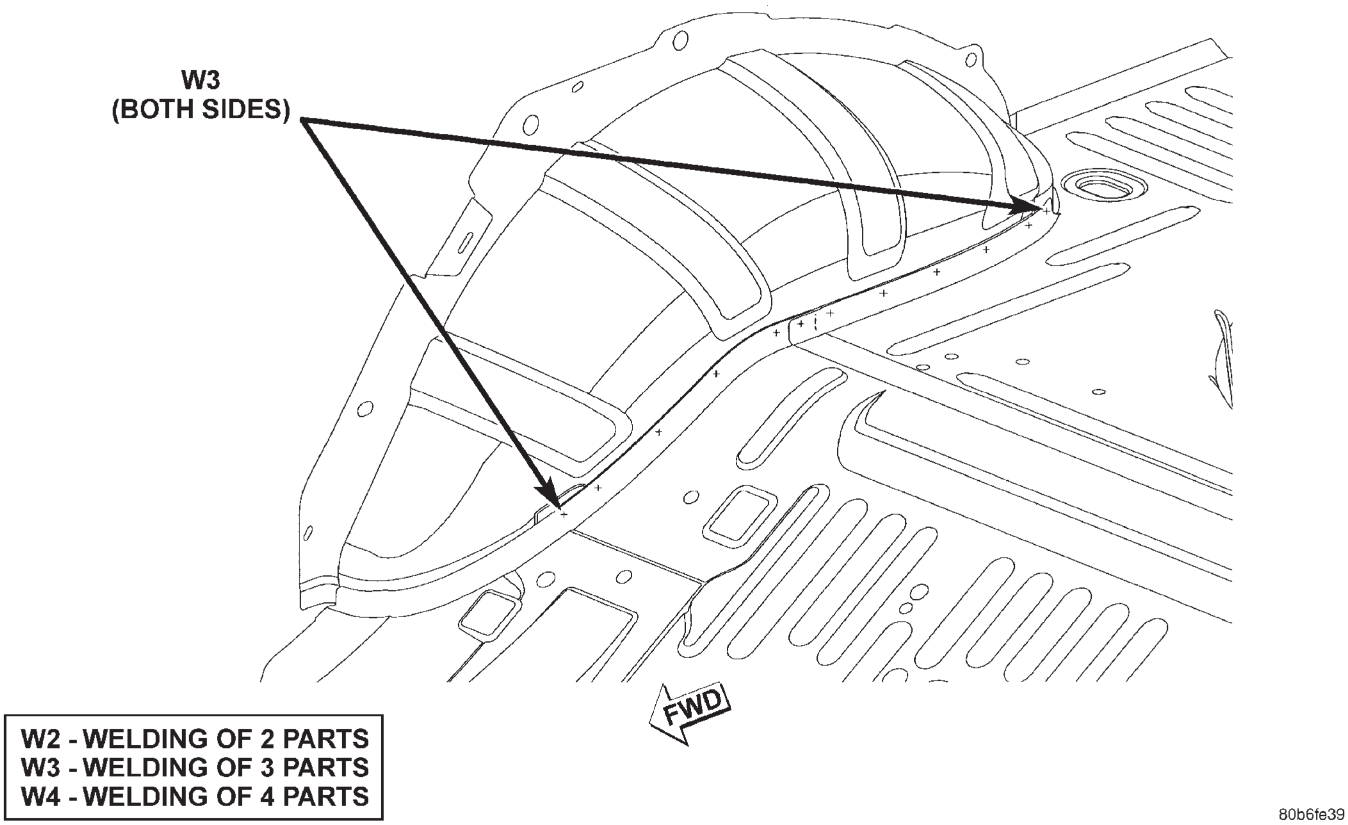


Fig. 105 INNER WHEELHOUSE TO FLOOR PAN

WELD LOCATIONS (Continued)

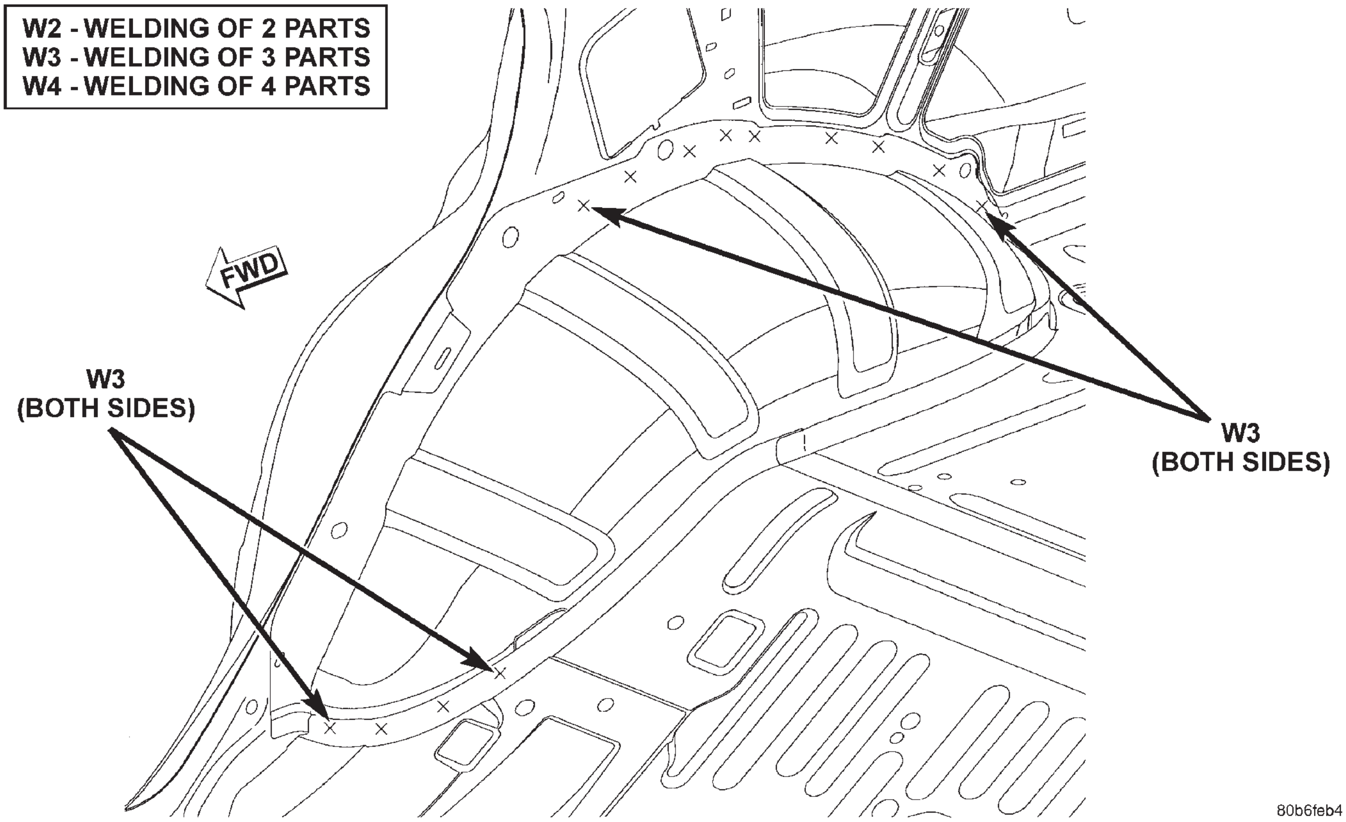


Fig. 106 INNER WHEELHOUSE TO INNER BODYSIDE APERTURE AND FLOOR PAN

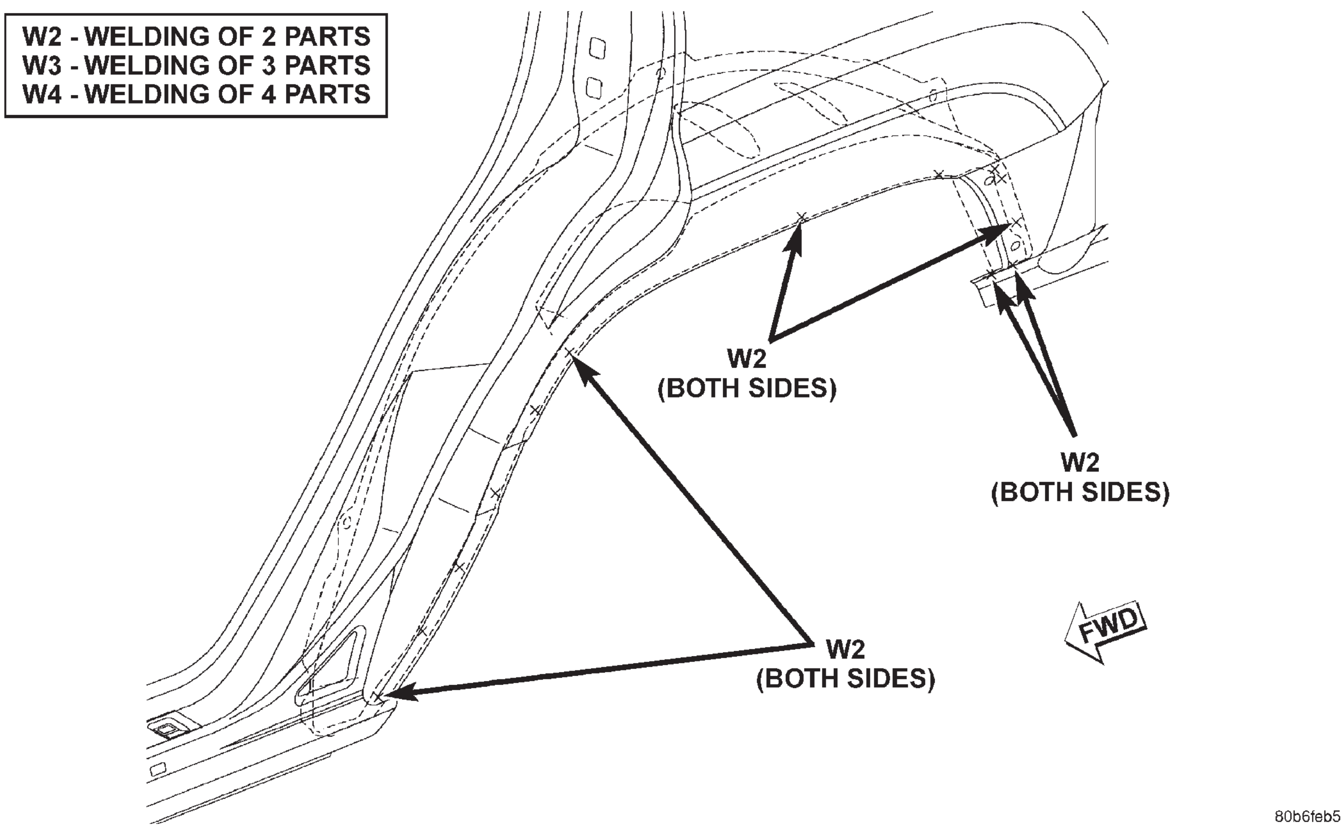


Fig. 107 OUTER WHEELHOUSE TO OUTER BODYSIDE APERTURE

WELD LOCATIONS (Continued)

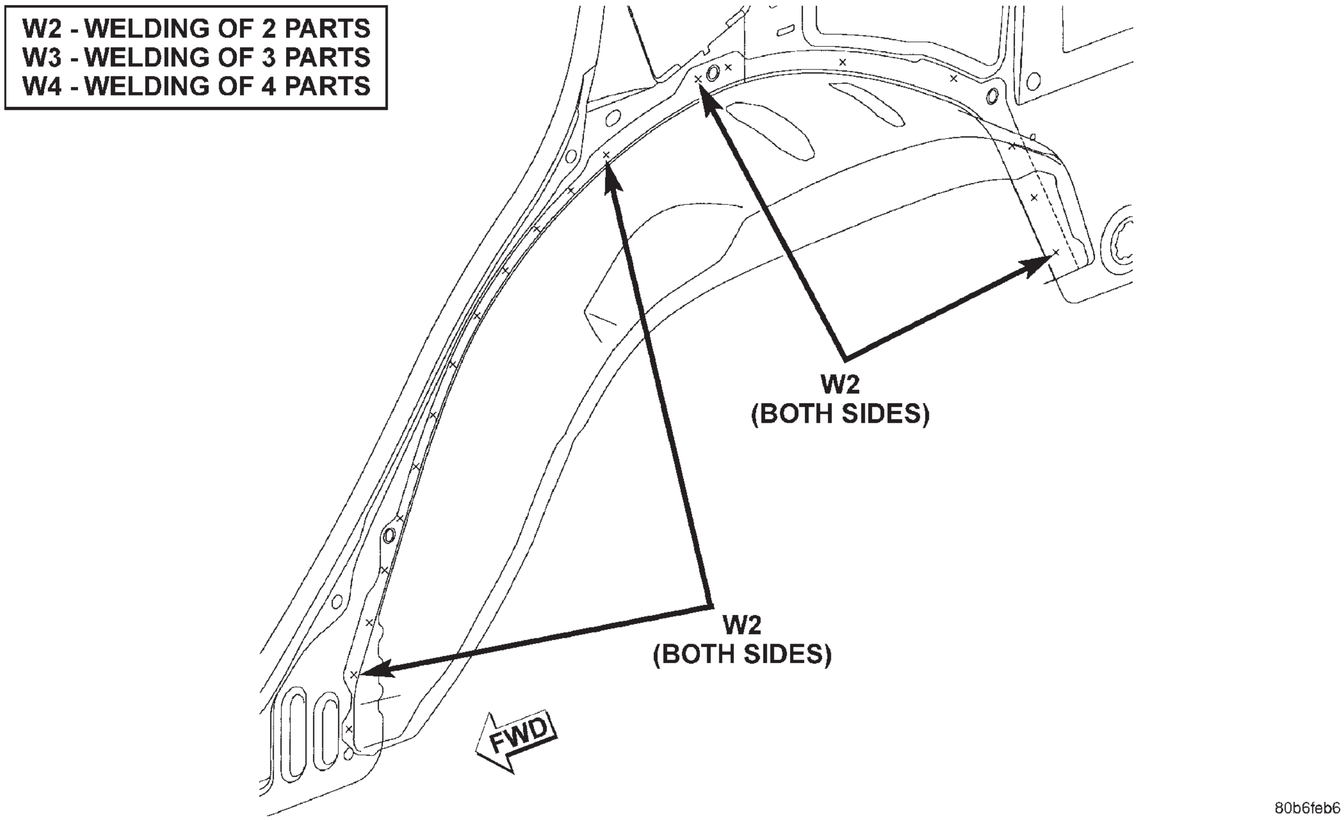


Fig. 108 OUTER WHEELHOUSE TO INNER BODYSIDE APERTURE

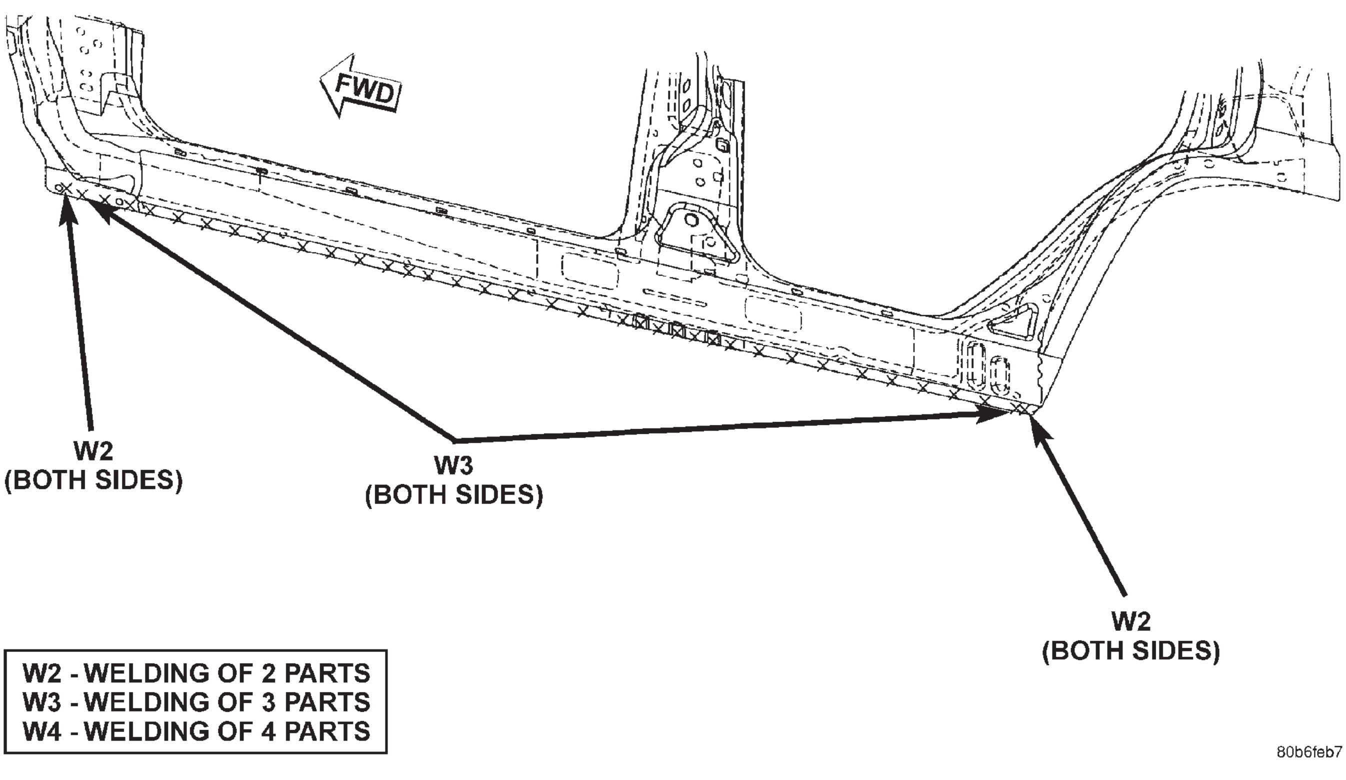


Fig. 109 INNER BODYSIDE APERTURE TO OUTER BODYSIDE APERTURE

WELD LOCATIONS (Continued)

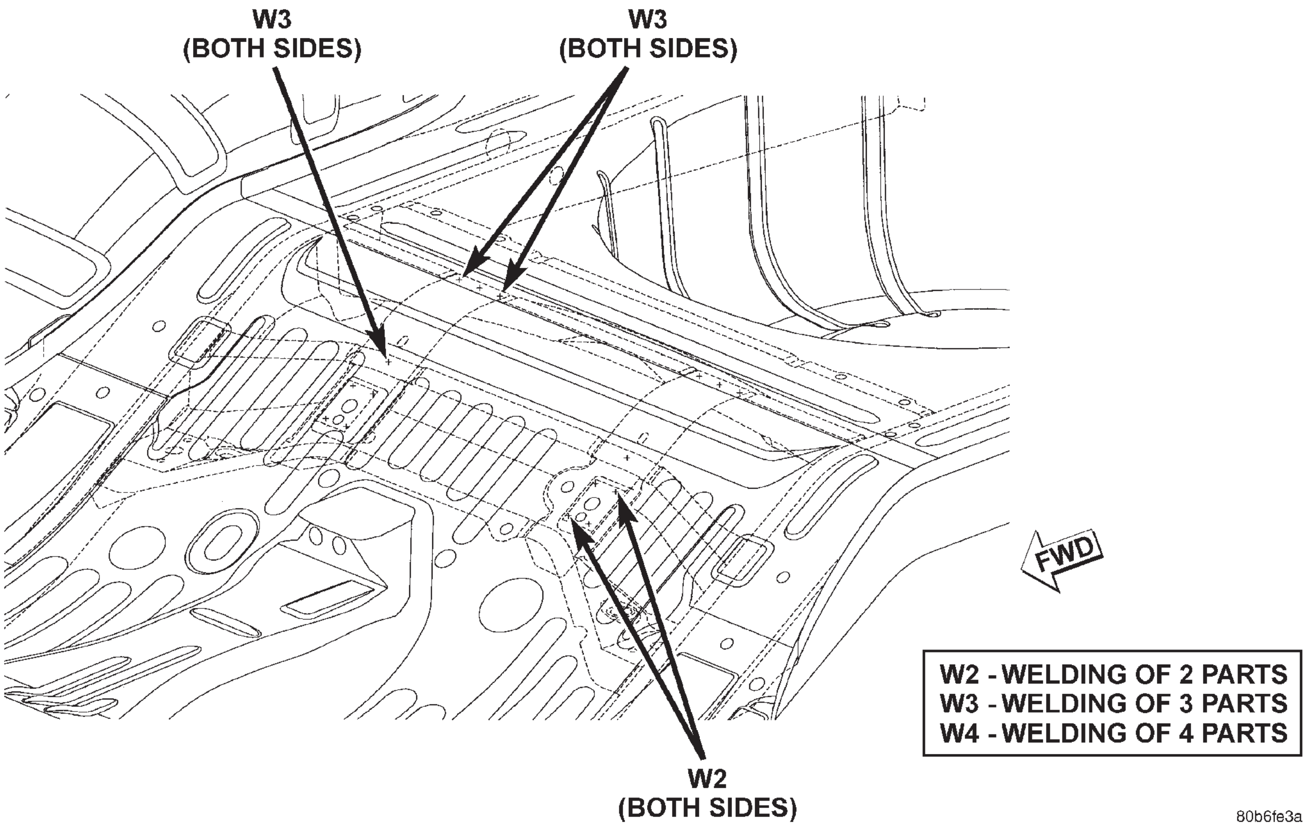


Fig. 110 REAR INBOARD SEAT BELT REINFORCEMENT TO FLOOR PAN

HEATING & AIR CONDITIONING

TABLE OF CONTENTS

HEATING & AIR CONDITIONING

DESCRIPTION

DESCRIPTION - COOLING SYSTEM REQUIREMENTS

To maintain the performance level of the heating-air conditioning system, the engine cooling system must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or condenser will reduce the performance of the air conditioning and engine cooling systems.

The engine cooling system includes the heater core and the heater hoses. Refer to Cooling for more information before opening, or attempting any service to the engine cooling system.

DESCRIPTION - HEATER AND AIR CONDITIONER

A manual temperature control type heating-air conditioning system is standard factory-installed equipment on this model. An electronically controlled Automatic Zone Control (AZC) type heating-air conditioning system is an available factory-installed option.

All vehicles are equipped with a common HVAC housing assembly (Fig. 1). The system combines air conditioning, heating, and ventilating capabilities in a single unit housing mounted under the instrument panel.

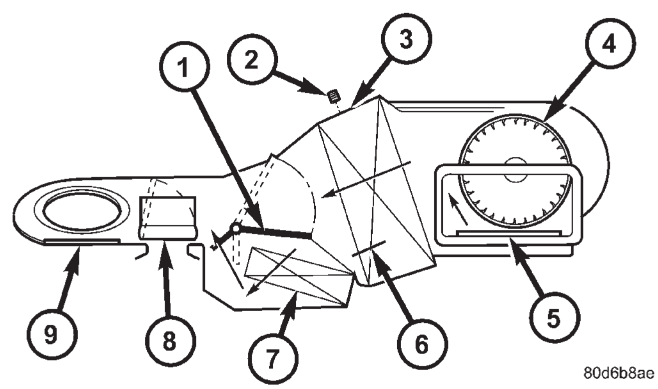


Fig. 1 Blend-Air HVAC System - (typical)

1 - Blend Door
2 - Expansion Valve
3 - Evaporator Core
4 - Blower Assembly
5 - Recirculation Door
6 - Evaporator Probe
7 - Heater Core
8 - Heat/Defrost Door
9 - Panel/Defrost Door

DESCRIPTION - REFRIGERANT SYSTEM SERVICE PORT

The two refrigerant system service ports are used to charge, recover/recycle, evacuate, and test the air conditioning refrigerant system. Unique service port coupler sizes are used on the R-134a system to ensure that the refrigerant system is not accidentally contaminated by the use of the wrong refrigerant (R-12), or refrigerant system service equipment.

HEATING & AIR CONDITIONING (Continued)

OPERATION

OPERATION - HEATER AND AIR CONDITIONER

Outside fresh air enters the vehicle through the cowl top opening at the base of the windshield, and passes through a plenum chamber to the HVAC system blower housing. Air flow velocity can then be adjusted with the blower motor speed selector switch on the a/c heater control panel. The air intake openings must be kept free of snow, ice, leaves, and other obstructions for the HVAC system to receive a sufficient volume of outside air.

It is also important to keep the air intake openings clear of debris because leaf particles and other debris that is small enough to pass through the cowl plenum screen can accumulate within the HVAC housing. The closed, warm, damp and dark environment created within the HVAC housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during HVAC system operation.

Both the manual and AZC heater and air conditioner are blend-air type systems. In a blend-air system, a blend door controls the amount of unconditioned air (or cooled air from the evaporator) that is allowed to flow through, or around, the heater core. A temperature control knob on the a/c heater control panel determines the discharge air temperature by energizing the blend door actuator, which operates the blend door. This allows an almost immediate control of the output air temperature of the system. The AZC system will have separate blend doors and temperature controls for each front seat occupant.

The mode control knob on the a/c heater control panel is used to direct the conditioned air to the selected system outlets. On manual temperature control systems, the mode control knob switches engine vacuum to control the mode doors, which are operated by vacuum actuators. On AZC systems, the mode control knob switches electrical current to control the mode doors, which are operated by electronic actuators.

The outside air intake can be shut off on manual temperature control systems by selecting the Recirculation Mode with the mode control knob. The outside air intake can be shut off on Automatic Zone Control (AZC) type system by pushing the Recirculation Mode button. This will operate the recirculation door that closes off the outside fresh air intake and recirculates the air that is already inside the vehicle.

The air conditioner for all models is designed for the use of non-CFC, R-134a refrigerant. The air conditioning system has an evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. This air conditioning system uses a thermal expansion valve to meter refrigerant flow to the evaporator coil. To maintain minimum evaporator temperature and prevent evaporator freezing, the system utilizes an evaporator thermister probe with the appropriate operating logic located in the body control module (BCM).

OPERATION - REFRIGERANT SYSTEM SERVICE PORT

The high pressure service port is located on the liquid line near the receiver/drier. The low pressure service port is located on the suction line near the evaporator at the rear of the engine compartment.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - A/C PERFORMANCE

The air conditioning system is designed to provide the passenger compartment with low temperature and low specific humidity air. The evaporator, located in the HVAC housing on the dash panel below the instrument panel, is cooled to temperatures near the freezing point. As warm damp air passes through the cooled evaporator, the air transfers its heat to the refrigerant in the evaporator and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an air conditioning system will be more effective in the Recirculation Mode. With the system in the Recirculation Mode, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, the air conditioning system performance levels improve.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the air conditioning system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. High humidity greatly reduces the ability of the evaporator to lower the temperature of the air.

HEATING & AIR CONDITIONING (Continued)

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their air conditioning system on humid days. A performance test is the best way to determine whether the system is performing up to standard. This test also provides valuable clues as to the possible cause of trouble with the air conditioning system.

If the vehicle has the optional Automatic Zone Control (AZC) system, and has intermittent operational problems or fault codes, be certain that the wire harness connectors on the HVAC housing are properly seated (Fig. 2). To check this condition, unplug the two wire harness connector halves, then plug them in again.

Before performing the following procedure, (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING). The air temperature in the test room and in the vehicle must be a minimum of 21° C (70° F) for this test.

(1) Connect a tachometer and a manifold gauge set.

(2) If the vehicle has the standard manual temperature control, set the A/C Heater mode control switch knob in the Panel position, the temperature control knob in the full cool (Fresh Air Mode) position, the A/C button in the On position, and the blower motor switch knob in the highest speed position. If the vehicle has the optional AZC, set the A/C Heater mode control switch knob in the Panel position, the temperature control knob in the full cool position, the A/C button in the On position, and the blower motor switch knob in the highest (manual) speed position.

(3) Start the engine and hold the idle at 1,300 rpm with the compressor clutch engaged.

(4) The engine should be at operating temperature. The doors and windows must be open.

(5) Insert a thermometer in the driver side center A/C (panel) outlet. Operate the engine for five minutes.

(6) The compressor clutch may cycle, depending upon the ambient temperature and humidity.

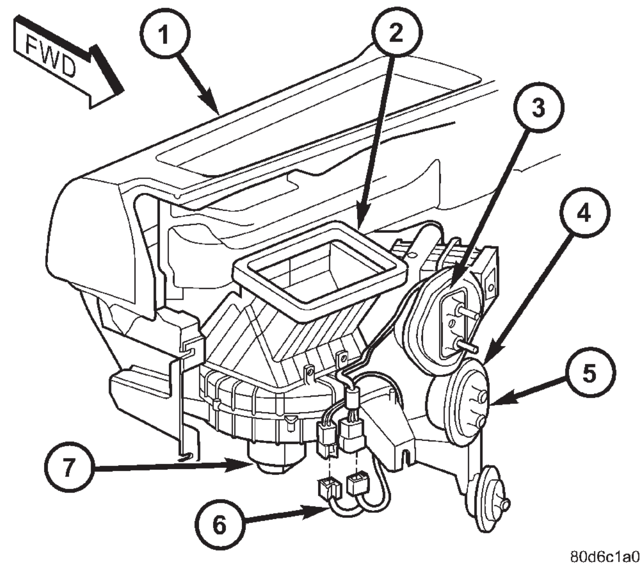


Fig. 2 HVAC Housing - (rear view)

1 - Instrument Panel
2 - Air Intake
3 - Expansion Valve
4 - HVAC Housing
5 - Heater Core Input/Output Ports
6 - Instrument Panel Wiring Harness
7 - Blower Motor

(7) With the compressor clutch engaged, record the discharge air temperature and the compressor discharge pressure.

(8) Compare the discharge air temperature to the Performance Temperature and Pressure chart. If the discharge air temperature is high, (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

Performance Temperature and Pressure					
Ambient Air Temperature and Humidity	21° C (70° F @ 80% humidity)	27° C (80° F @ 80% humidity)	32° C (90° F @ 80% humidity)	38° C (100° F @ 50% humidity)	43° C 110° F @ 20% humidity)
Air Temperature at Center Panel Outlet	10 to 13° C (50 to 55° F)	14 to 17° C (58 to 63° F)	15 to 18° C (60 to 65° F)	17 to 20° C (63 to 68° F)	14 to 17° C (58 to 63° F)
Evaporator Inlet Pressure at Charge Port	241 to 276 kPa (35 to 40 psi)	262 to 290 kPa (38 to 42 psi)	269 to 296 kPa (39 to 43 psi)	275 to 303 kPa (40 to 44 psi)	262 to 290 kPa (38 to 42 psi)
Compressor Discharge Pressure	1241 to 1792 kPa (180 to 260 psi)	1380 to 1930 kPa (200 to 280 psi)	1380 to 1930 kPa (200 to 280 psi)	1655 to 2206 kPa (240 to 320 psi)	1567 to 2068 kPa (220 to 300 psi)
Note: The discharge air temperatures will be lower if the humidity is less than the percentages shown.					

HEATING & AIR CONDITIONING (Continued)

(9) Compare the compressor discharge pressure to the Performance Temperature and Pressure chart. If the compressor discharge pressure is high, see the Pressure Diagnosis chart.

Pressure Diagnosis		
Condition	Possible Causes	Correction
Rapid compressor clutch cycling (ten or more cycles per minute).	1. Low refrigerant system charge.	1. See Plumbing/Diagnosis and Testing - Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system.	1. See Plumbing/Diagnosis and Testing - Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	2. Faulty fuse.	2. Check the fuses in the Power Distribution Center and the junction block. Repair the shorted circuit or component and replace the fuses, if required.
	3. Faulty a/c compressor clutch coil.	3. See A/C Compressor/Diagnosis and Testing - Compressor Clutch Coil in this group. Test the compressor clutch coil and replace, if required.
	4. Faulty compressor clutch relay.	4. See A/C Compressor Clutch Relay/Diagnosis and Testing - Compressor Clutch Relay in this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required.
	6. Faulty a/c high pressure transducer.	6. See A/C High Pressure Transducer/Diagnosis and Testing in this group. Test the a/c high pressure transducer and replace, if required.
	7. Faulty Fin Probe.	7. Check for open circuit.
	8. Faulty Powertrain Control Module (PCM).	8. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required.
Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system.	1. See Refrigerant Oil/Standard Procedure - Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required.
	2. Blend door inoperative or sealing improperly.	2. See Blend Door in this group. Inspect the blend door for proper operation and sealing and correct, if required.
	3. Blend door actuator faulty or inoperative.	3. Perform blend door actuator diagnosis, replace if faulty.

HEATING & AIR CONDITIONING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge.	1. See Plumbing/Diagnosis and Testing - Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	2. Refrigerant flow through the accumulator is restricted.	2. See Accumulator in this group. Replace the restricted accumulator, if required.
	3. Refrigerant flow through the evaporator coil is restricted.	3. See A/C Evaporator in this group. Replace the restricted evaporator coil, if required.
	4. Faulty compressor.	4. See A/C Compressor in this group. Replace the compressor, if required.
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. Condenser air flow restricted.	1. Check the condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Refer to Cooling for more information on air seals. Clean, repair, or replace components as required.
	2. Inoperative cooling fan.	2. Refer to Cooling for more information. Test the cooling fan and replace, if required.
	3. Refrigerant system overcharged.	3. See Plumbing/Standard Procedure - Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required.
	4. Air in the refrigerant system.	4. See Plumbing/Diagnosis and Testing - Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	5. Engine overheating.	5. Refer to Cooling for more information. Test the cooling system and repair, if required.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping.	1. Refer to Cooling for more information. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required.
	2. Faulty compressor.	2. See A/C Compressor in this group. Replace the compressor, if required.
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines.	1. See Liquid, Suction, and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required.
	2. Restricted refrigerant flow through the a/c expansion valve.	2. See A/C Expansion Valve in this group. Replace the Expansion Valve if restricted.
	3. Restricted refrigerant flow through the condenser.	3. See A/C Condenser in this group. Replace the restricted condenser, if required.

HEATING & AIR CONDITIONING (Continued)

DIAGNOSIS AND TESTING - HEATER PERFORMANCE

Before performing the following tests, refer to Cooling for the procedures to check the radiator coolant level, serpentine drive belt tension, radiator air flow and the radiator fan operation. Also be certain that the accessory vacuum supply line is connected at the engine intake manifold for the manual temperature control system.

MAXIMUM HEATER OUTPUT

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control knob in the full hot position, the mode control switch knob in the floor heat position, and the blower motor switch knob in the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the HVAC housing floor outlets. Compare the test thermometer reading to the Temperature Reference chart.

Temperature Reference				
Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Air Temperature at Floor Outlet	62.2° C (144° F)	63.8° C (147° F)	65.5° C (150° F)	67.2° C (153° F)

If the floor outlet air temperature is too low, refer to Cooling to check the engine coolant temperature specifications. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Cooling for the procedures.

OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow:

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- A plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is still low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible locations or causes of insufficient heat:

- An obstructed cowl air intake.
- Obstructed heater system outlets.
- A blend door not functioning properly.

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control knob(s) on the A/C Heater control panel, the following could require service:

- The A/C heater control.
- The blend door actuator(s).
- The wire harness circuits for the A/C heater control or the blend door actuator(s).
- The blend door(s).
- Improper engine coolant temperature.

STANDARD PROCEDURE - DIODE REPLACEMENT

(1) Disconnect and isolate the negative battery cable.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 3).

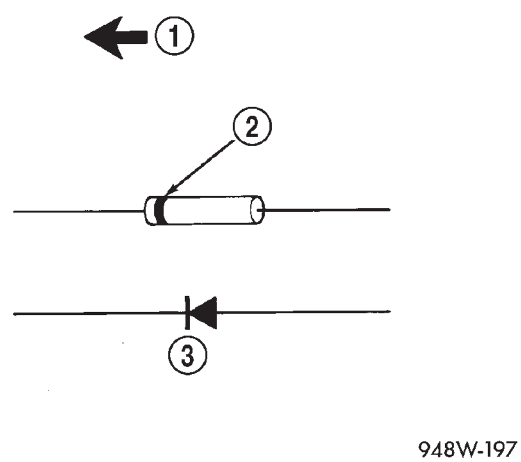


Fig. 3 DIODE IDENTIFICATION

1 - CURRENT FLOW
2 - BAND AROUND DIODE INDICATES CURRENT FLOW
3 - DIODE AS SHOWN IN THE DIAGRAMS

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

HEATING & AIR CONDITIONING (Continued)

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

(8) Re-connect the battery, and test affected systems.

SPECIFICATIONS

A/C APPLICATION TABLE

Item	Description	Notes
VEHICLE	WJ - Grand Cherokee	
SYSTEM	R134a w/ expansion valve	
COMPRESSOR	Nippondenso 10PA17	ND-8 PAG oil
Freeze–up Control	Evaporator Probe	Evaporator mounted
Low psi Control	opens < 22 psi - resets > 34-38 psi	
High psi Control	opens > 450-490 psi - resets < 270-330 psi	line mounted
CONTROL HEAD	Manual type	manual controls
	Automatic Zone Control (AZC)	Automatic Zone Control (AZC) with dual infrared sensing
Mode Doors	Vacuum actuators (manual)	electric actuator (AZC)
Blend Door	Electric actuator	(manual and AZC)
Blend Door (passenger)	Electric actuator	(AZC only)
Recirculation Door	Vacuum actuator (manual)	electric actuator (AZC)
Blower Motor	Hardwired to control head	resistor block (manual), blower controller (AZC)
COOLING FAN	Hybrid - viscous clutch/electric	PCM output
CLUTCH		
Control	Relay	PCM controlled
Draw	2.0-3.9 amps @ 12 V	± 0.5V@ 70° F
Gap	0.016″-0.031″	
DRB III®		
Reads	TPS, RPM, A/C switch	
Actuators	Clutch relay	

HEATING & AIR CONDITIONING (Continued)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
A/C COMPRESSOR SHAFT BOLT	13	9.6	115
A/C COMPRESOR LINE MANIFOLD FASTENERS 4.0L/4.7L	25.4	18.75	225
A/C COMPRESOR LINE MANIFOLD FASTENERS 2.7L DIESEL	22	16.2	195
A/C COMPRESSOR TO ENGINE BLOCK BOLTS - 4.0L/4.7L	45-65	33-48	398-575
A/C COMPRESSOR TO ENGINE BLOCK BOLTS - 2.7L DIESEL	30	22	266
A/C COMPRESSOR REAR BRACE BOLTS - 4.0L	40-55	30-41	354-487
A/C COMPRESSOR REAR BRACE BOLTS - 4.7L	35-45	26-33	310-398
A/C CONDENSER TO REFRIG. LINE FASTENERS	28	21	248
A/C EVAPORATOR LINE to TXV FASTENERS	28	21	247
ACCUMULATOR RETAINING BAND (4.0L/4.7L)	12	9.0	106
ACCUMULATOR RETAINING BAND (3.1L DIESEL)	5	3.7	44
BLOWER MOTOR SCREWS	2.2	1.7	20
DOOR ACTUATOR SCREWS	2.2	1.7	20
HVAC HOUSING SCREWS	2.2	1.7	20
HVAC HOUSING TO DASH PANEL NUTS (ENGINE COMP. SIDE)	7	5	62
HVAC HOUSING TO DASH PANEL NUTS (PASSENGER COMP. SIDE)	4.5	3.3	40
EXPANSION VALVE TO HVAC FASTENERS	20	15	177
SUCTION LINE TO ACCUMULATOR FITTING	28	20.7	248

CONTROLS

TABLE OF CONTENTS

CONTROLS

DIAGNOSIS AND TESTING - VACUUM SYSTEM

Vacuum control is used to operate the mode doors in the standard equipment manual temperature control system HVAC housing. Testing of the A/C Heater mode control switch operation will determine if the vacuum and electrical controls are functioning. However, it is possible that a vacuum control system that operates perfectly at engine idle (high engine vacuum) may not function properly at high engine speeds or loads (low engine vacuum). This can be caused by leaks in the vacuum system, or a faulty vacuum check valve.

A vacuum system test will help to identify the source of poor vacuum system performance or vacuum system leaks. Before starting this test, stop the engine and make certain that the problem isn't a disconnected vacuum supply tube at the engine intake manifold vacuum tap or the vacuum reservoir.

Use an adjustable vacuum test set (Special Tool C-3707-B) and a suitable vacuum pump to test the HVAC vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 1), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.). Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

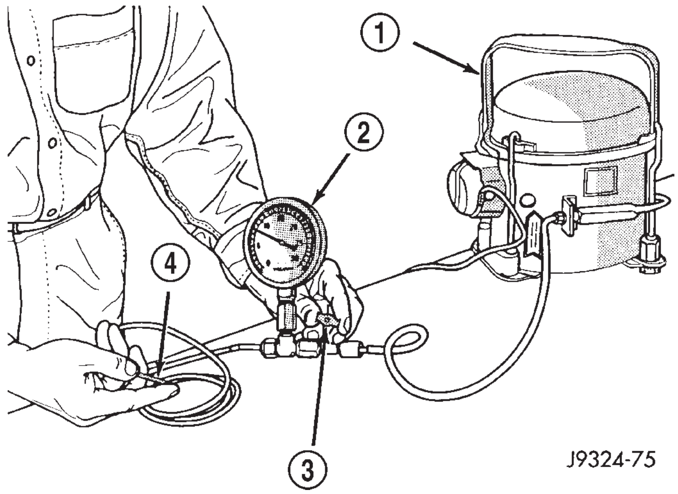


Fig. 1 ADJUST VACUUM TEST BLEED VALVE - TYPICAL

1 - VACUUM PUMP TOOL C-4289
2 - VACUUM TEST SET C-3707
3 - BLEED VALVE
4 - PROBE

VACUUM CHECK VALVES

(1) Remove the vacuum check valve to be tested. The valves are located in the (black) vacuum supply tubes at either the engine intake manifold vacuum tap, or on the bottom of the HVAC unit behind the passenger front floor duct.

(2) Connect the test set vacuum supply hose to the A/C Heater control side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to Step 3. If not OK, replace the faulty valve.

(3) Connect the test set vacuum supply hose to the engine vacuum side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

A/C HEATER CONTROL

(1) Connect the test set vacuum probe to the HVAC vacuum supply (black) tube in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Place the A/C Heater mode control switch knob in each mode position, one position at a time, and pause after each selection. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each selection is made. If not OK, a component or vacuum line in the vacuum circuit of the selected mode has a leak. See the procedure in Locating Vacuum Leaks.

CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector plug holes will help the connector slide onto the switch ports.

CONTROLS (Continued)

LOCATING VACUUM LEAKS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the vacuum harness connector from the back of the A/C Heater mode control switch on the control panel.

(2) Connect the test set vacuum hose probe to each port in the vacuum harness connector, one at a time, and pause after each connection (Fig. 2). The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty mode control switch. If not OK, go to Step 3.

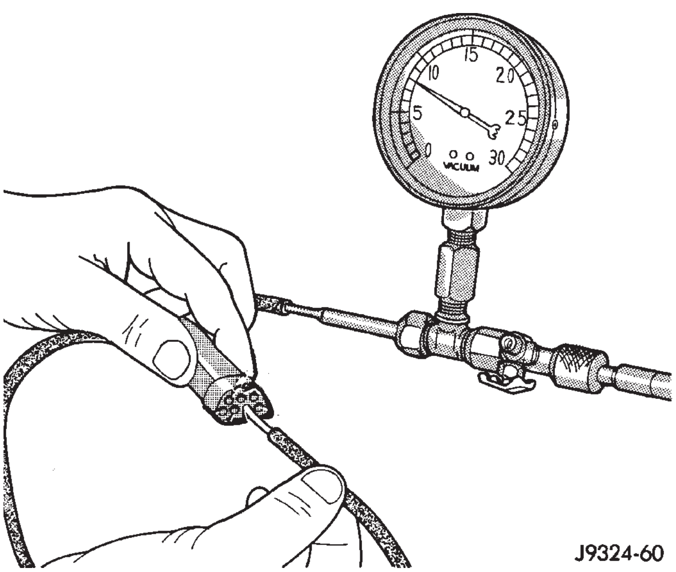


Fig. 2 VACUUM CIRCUIT TEST

(3) Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, refer to the Vacuum Circuits chart (Fig. 3).

(4) Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components.

(5) Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.

(6) To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 millimeter (1/8-inch) inside diameter rubber hose.

CONTROLS (Continued)

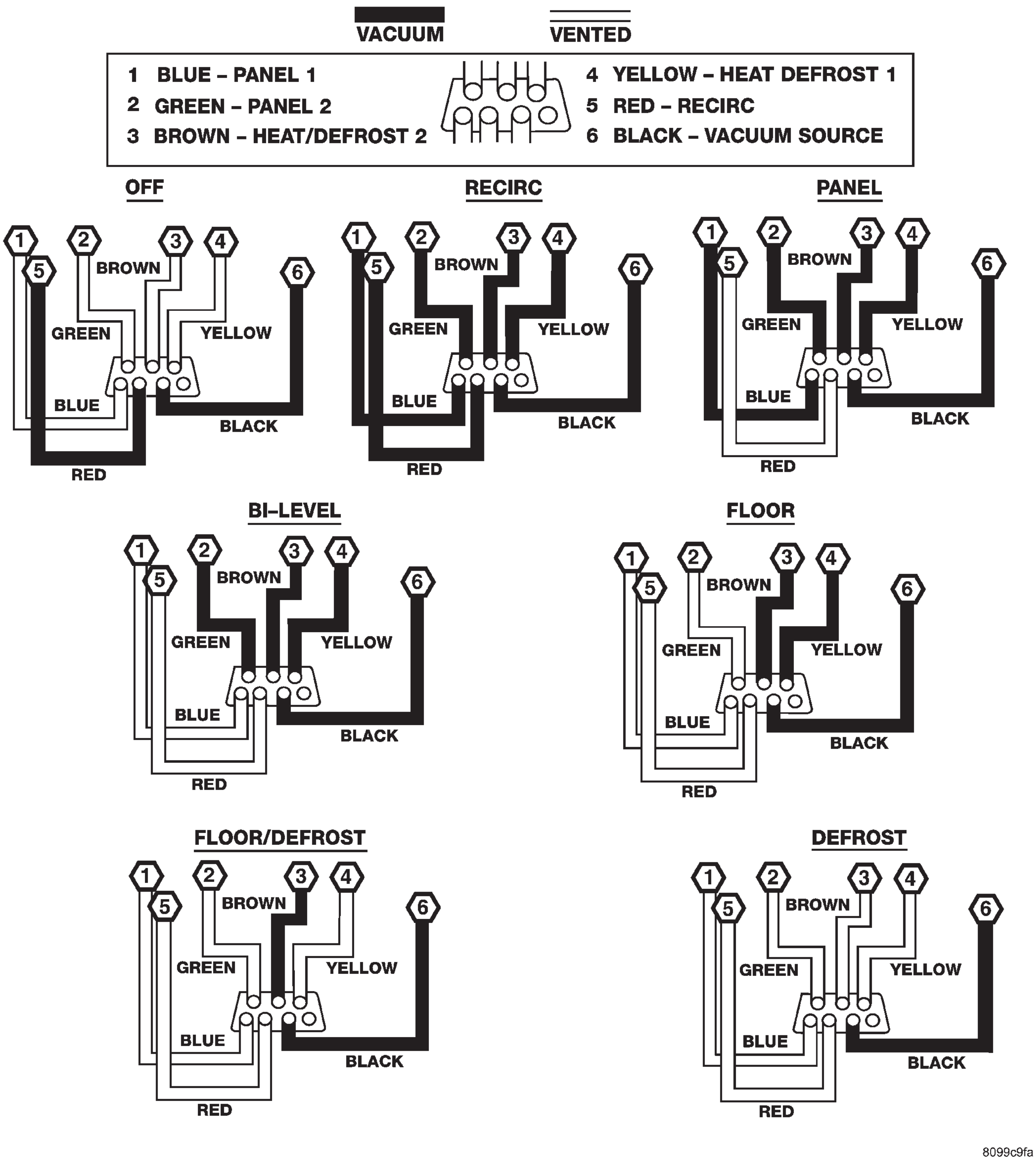


Fig. 3 VACUUM CIRCUITS

A/C COMPRESSOR CLUTCH

DESCRIPTION

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 4). The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is keyed to the compressor shaft and secured with a bolt.

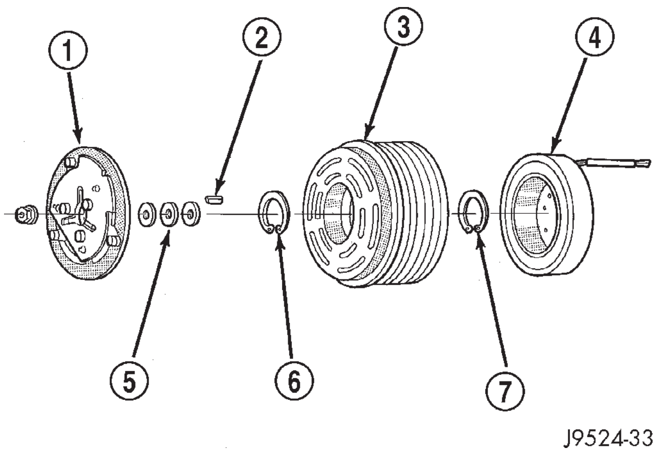


Fig. 4 COMPRESSOR CLUTCH - TYPICAL

1 - CLUTCH PLATE
2 - SHAFT KEY
3 - PULLEY
4 - COIL
5 - CLUTCH SHIMS
6 - SNAP RING
7 - SNAP RING

OPERATION

The compressor clutch components provide the means to engage and disengage the compressor from the engine serpentine accessory drive belt. When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

The compressor clutch engagement is controlled by several components: the a/c switch on the a/c heater control panel, the Automatic Zone Control (AZC) control module (if the vehicle is so equipped), the evaporator probe, the a/c high pressure transducer, the a/c compressor clutch relay, the body control module (BCM) and the Powertrain Control Module (PCM). The PCM may delay compressor clutch engagement for up to thirty seconds. Refer to Electronic Control Modules for more information on the PCM controls.

DIAGNOSIS AND TESTING - COMPRESSOR CLUTCH COIL

For circuit descriptions and diagrams, refer to the appropriate wiring diagrams. The battery must be fully-charged before performing the following tests. Refer to Battery for more information.

(1) Connect an ammeter (0 to 10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0 to 20 volt scale) with clip-type leads for measuring the voltage across the battery and the compressor clutch coil.

(2) With the a/c heater mode control switch in any a/c mode, the a/c heater control a/c switch in the ON position, and the blower motor switch in the lowest speed position, start the engine and run it at normal idle.

(3) The compressor clutch coil voltage should read within 0.2 volts of the battery voltage. If there is voltage at the clutch coil, but the reading is not within 0.2 volts of the battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as required. If there is no voltage reading at the clutch coil, use a DRBIII® scan tool and the appropriate diagnostic information for testing of the compressor clutch circuit. The following components must be checked and repaired as required before you can complete testing of the clutch coil:

- Fuses in the junction block and the Power Distribution Center (PDC)
- A/C heater mode control switch
- A/C compressor clutch relay
- A/C high pressure transducer
- A/C evaporator probe
- Powertrain Control Module (PCM)
- Body Control Module (BCM)

(4) The compressor clutch coil is acceptable if the current draw measured at the clutch coil is 2.0 to 3.9 amperes with the electrical system voltage at 11.5 to 12.5 volts. This should only be checked with the work area temperature at 21° C (70° F). If system voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until the system voltage drops below 12.5 volts.

(a) If the clutch coil current reading is four amperes or more, the coil is shorted and should be replaced.

(b) If the clutch coil current reading is zero, the coil is open and should be replaced.

STANDARD PROCEDURE - COMPRESSOR CLUTCH BREAK-IN

After a new compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the A/C Heater control in the Recirculation Mode, the A/C button in the on position, the blower motor switch in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

REMOVAL

The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement. The compressor clutch can be serviced in the vehicle.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the serpentine drive belt. Refer to Cooling for the procedures.

(3) Remove the bolt that secures the compressor clutch to the compressor shaft (Fig. 5). A band-type oil filter wrench may be used to secure the clutch during bolt removal.

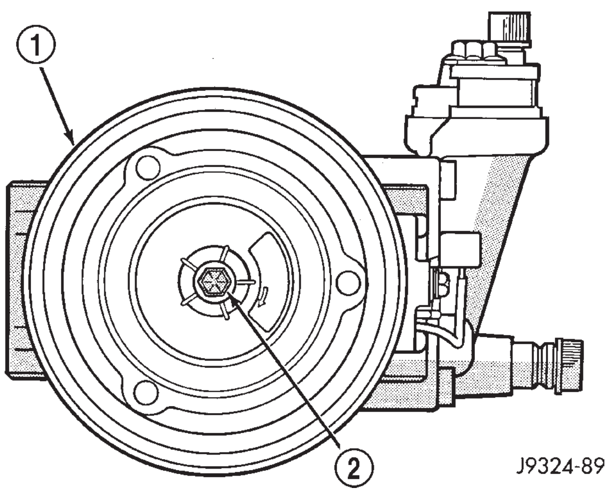


Fig. 5 COMPRESSOR SHAFT BOLT

1 - COMPRESSOR CLUTCH PLATE
2 - COMPRESSOR SHAFT BOLT

(4) Tap the clutch plate with a plastic mallet to release it from the splines on the compressor shaft. Remove the clutch plate and shim(s) from the compressor shaft (Fig. 6).

CAUTION: Do not pry between the clutch plate assembly and the pulley to remove it from the compressor shaft. Prying may damage the clutch plate assembly.

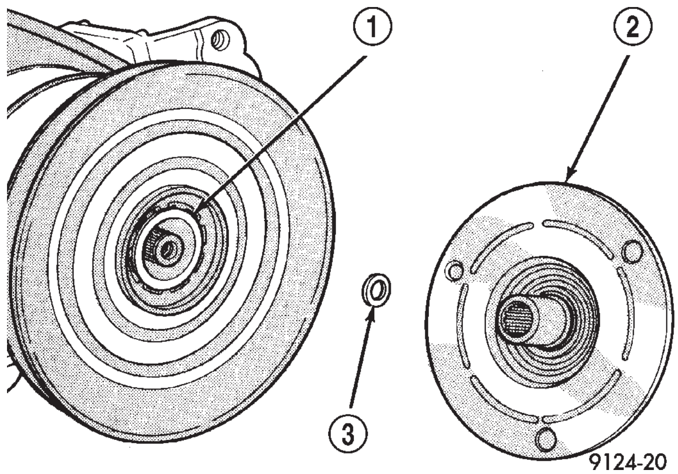


Fig. 6 CLUTCH PLATE AND SHIM(S)

1 - COMPRESSOR SHAFT
2 - CLUTCH PLATE
3 - CLUTCH PLATE SHIM

(5) Remove the external snap ring that secures the compressor clutch pulley to the nose of the compressor front housing with snap ring pliers (Special Tool C-4574) and slide the pulley assembly off of the compressor (Fig. 7).

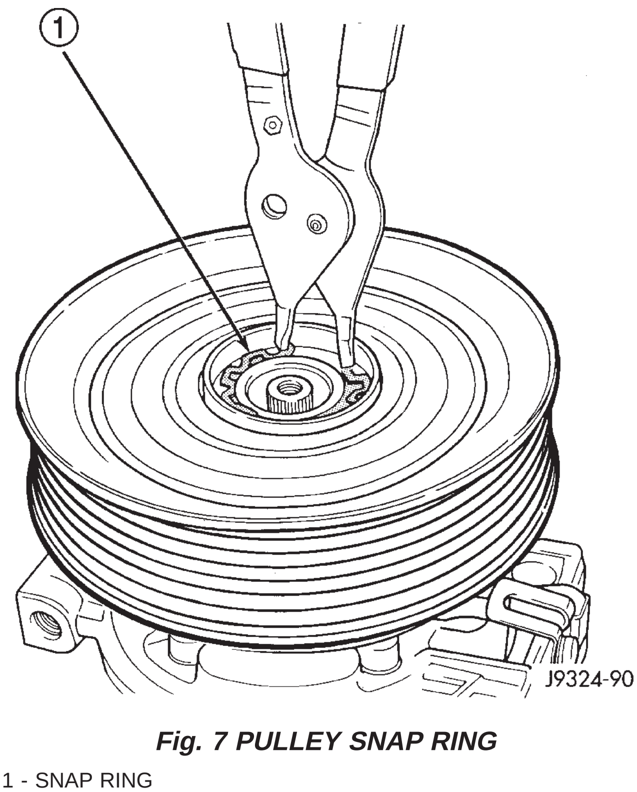


Fig. 7 PULLEY SNAP RING

1 - SNAP RING

(6) Remove the screw and retainer from the clutch coil lead wire harness on the compressor front housing.

A/C COMPRESSOR CLUTCH (Continued)

(7) Remove the external snap ring that secures the compressor clutch coil to the nose of the compressor front housing with snap ring pliers and slide the coil assembly off of the compressor (Fig. 8).

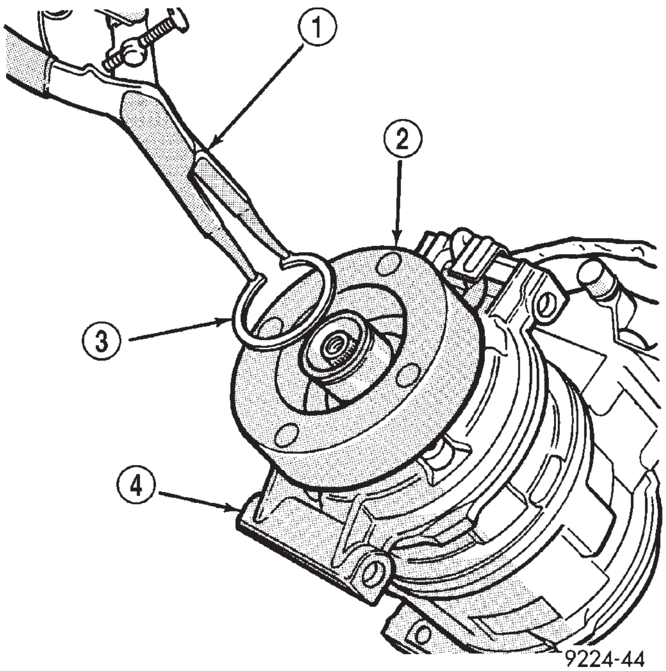


Fig. 8 CLUTCH COIL SNAP RING

1 - SNAP RING PLIERS
2 - CLUTCH COIL
3 - SNAP RING
4 - COMPRESSOR

INSPECTION

Examine the friction surfaces of the clutch pulley and the clutch plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the compressor for refrigerant oil. Remove the felt wick from around the shaft inside the nose of the compressor front housing. If the felt is saturated with refrigerant oil, the compressor shaft seal is leaking and the compressor must be replaced.

Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the bearing, if required.

INSTALLATION

(1) Align the dowel pin on the back of the clutch field coil with the hole in the compressor front housing and press the field coil into place over the nose of the compressor.

(2) Install the clutch coil lead wire harness retaining clip on the compressor front housing and tighten the retaining screw.

(3) Install the clutch field coil and snap ring with snap ring pliers (Special Tool C-4574). The bevel side of the snap ring must be facing outward. Also, both eyelets of the snap ring must be to the right or left of the pin on the compressor. Press in on the snap ring to be certain that it is properly seated in the groove.

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(4) Install the pulley assembly onto the compressor. If necessary, place a block of wood on the friction surface and tap gently with a hammer (Fig. 9).

CAUTION: Do not mar the pulley friction surface.

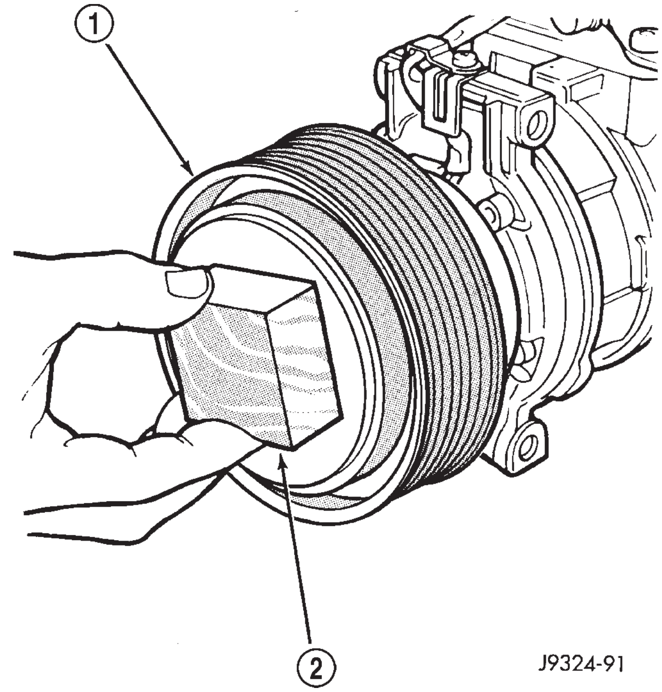


Fig. 9 PULLEY ASSEMBLY INSTALL

1 - PULLEY ASSEMBLY
2 - WOOD BLOCK

(5) Install the pulley assembly retaining snap ring (bevel side outward) with snap ring pliers (Special Tool C-4574). Press in on the snap ring to be certain that it is properly seated in the groove.

(6) If the original clutch plate assembly and pulley assembly are to be reused, the old shim(s) can be used. If not, place a stack of shim(s) equal to the old shim(s) on the shaft against the shoulder.

(7) Install the clutch plate assembly onto the shaft.

(8) With the clutch plate assembly tight against the shim(s), measure the air gap between the clutch plate and the pulley face with feeler gauges. The air

A/C COMPRESSOR CLUTCH (Continued)

gap should be between 0.35 to 0.65 millimeter (0.014 to 0.026 inch). If the proper air gap is not obtained, add or subtract shims as needed until the desired air gap is obtained.

(9) Install the compressor shaft bolt. Tighten the bolt to 13 N·m (115 in. lbs.).

NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is still correct. Spin the pulley before performing a final check of the air gap.

(10) To complete the installation, (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION)

A/C COMPRESSOR CLUTCH RELAY

DESCRIPTION

The compressor clutch relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (footprint) is different, the current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

OPERATION

The compressor clutch relay is a electromechanical device that switches battery current to the compressor clutch coil when the Powertrain Control Module (PCM) grounds the coil side of the relay. The PCM responds to inputs from the a/c compressor switch on the a/c heater control panel, the Automatic Zone Control (AZC) control module (if the vehicle is so equipped), the a/c fin probe, and the a/c high pressure transducer. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH RELAY - DIAGNOSIS AND TESTING)

The compressor clutch relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

The compressor clutch relay cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING - A/C COMPRESSOR CLUTCH RELAY

For circuit descriptions and diagrams, refer to the appropriate wiring information.

The compressor clutch relay (Fig. 10) is located in the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location. Remove the relay from the PDC to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, see the Relay Circuit Test procedure in this group. If not OK, replace the faulty relay.

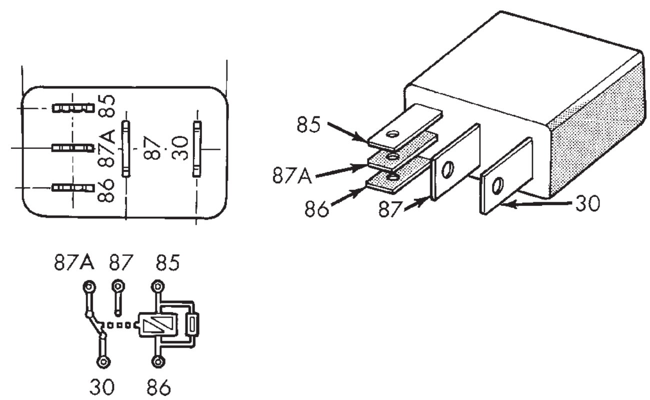


Fig. 10 A/C COMPRESSOR CLUTCH RELAY

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

RELAY CIRCUIT TEST

For circuit descriptions and diagrams, refer to the appropriate wiring information..

(1) The relay common feed terminal cavity (30) is connected to fused battery feed. There should be battery voltage at the cavity for relay terminal 30 at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is not used in this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the compressor clutch coil. There should be continuity between this cavity and the A/C compressor clutch relay output circuit cavity of the compressor clutch coil wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit as required.

(4) The relay coil battery terminal (86) is connected to the fused ignition switch output (run/start) circuit. There should be battery voltage at the cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the

A/C COMPRESSOR CLUTCH RELAY (Continued)

open circuit to the fuse in the junction block as required.

(5) The coil ground terminal cavity (85) is switched to ground through the Powertrain Control Module (PCM). There should be continuity between this cavity and the A/C compressor clutch relay control circuit cavity of the PCM wire harness connector C (gray) at all times. If not OK, repair the open circuit as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 11).

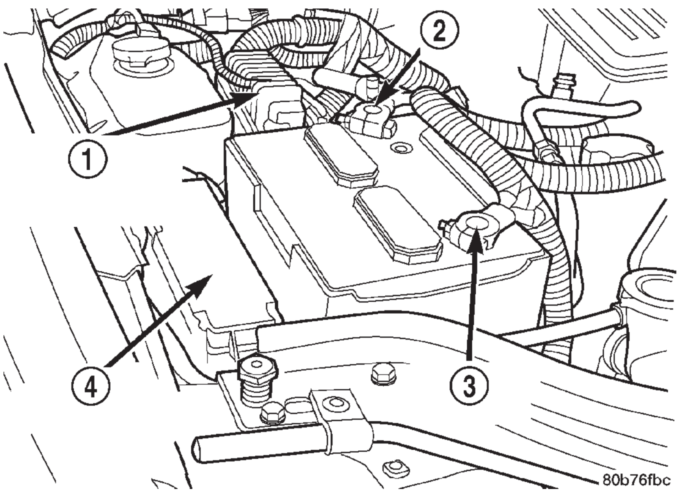


Fig. 11 POWER DISTRIBUTION CENTER (PDC)

1 - TRANSMISSION CONTROL MODULE (TCM)
2 - NEGATIVE CABLE
3 - POSITIVE CABLE
4 - POWER DISTRIBUTION CENTER (PDC)

(3) Refer to the label on the PDC for compressor clutch relay identification and location.

(4) Unplug the compressor clutch relay from the PDC.

INSTALLATION

(1) Install the compressor clutch relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(2) Install the PDC cover.

(3) Connect the battery negative cable.

(4) Test the relay operation.

A/C HEATER CONTROL

DESCRIPTION

The manual temperature control HVAC system uses a combination of electrical, and vacuum controls. The Automatic Zone Control (AZC) HVAC system uses only electrical controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle. Refer to the owner's manual in the vehicle glove box for more information on the suggested operation and use of these controls.

Both a/c heater control panels are located on the instrument panel inboard of the steering column and below the radio (Fig. 12). Both control panels contain rotary-type temperature control knob(s), a rotary-type mode control switch knob, a rotary-type blower motor speed switch knob and an air conditioning compressor push button switch. The rear window defogger push button switch is also located on a/c heater control panel. The AZC control panel also features a recirculation push button switch and a vacuum fluorescent display area.

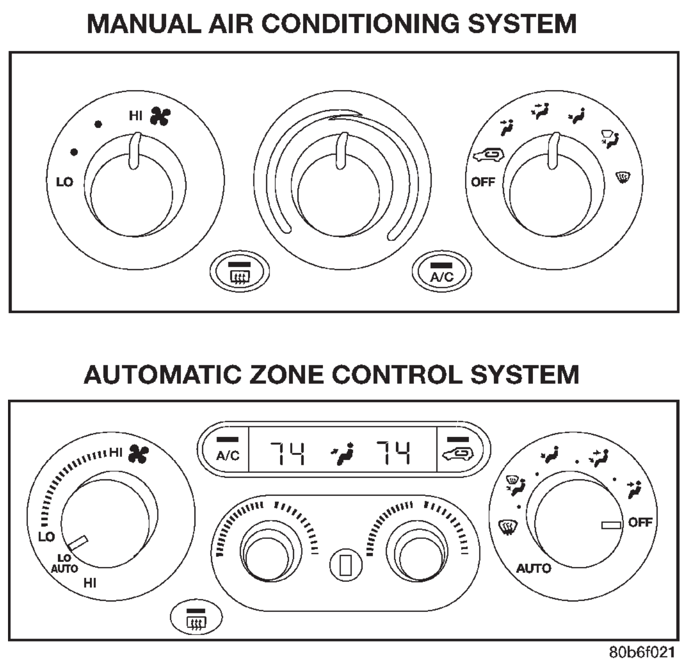


Fig. 12 A/C HEATER CONTROL PANELS

OPERATION

The AZC control module uses infrared sensing technology to control occupant comfort levels, not the actual passenger compartment air temperature. Dual infrared sensors mounted in the face of the control unit independently measure the surface temperature to maintain customer-perceived comfort temperature under changing conditions. Dual Zone temperature control provides wide side-to-side variation in comfort temperature to exceed the needs of either front seat occupant. This sensing system replaces interior air temperature and solar sensors used to approximate direct sensing control through complex control programs.

A/C HEATER CONTROL (Continued)

Both the manual A/C Heater control panel and the AZC control panel are serviced only as complete units and cannot be repaired. If faulty or damaged, the entire control panel unit must be replaced.

DIAGNOSIS AND TESTING - AUTOMATIC ZONE CONTROL SYSTEM

The Automatic Zone Control (AZC) control module has a system self-diagnostic mode which continuously monitors various parameters during normal system operation. If a system fault is detected, a current and historical fault is recorded. When the current fault is cleared, the historical fault remains until reset (manually or automatically). Both the current and historical fault codes can be accessed through either the front panel, or over the Programmable Communications Interface (PCI) bus using a DRBIII® scan tool, and the appropriate diagnostic information.

The AZC control module is capable of three different types of self-diagnostic tests, as follows:

- Fault Code Tests
- Input Circuit Tests
- Output Circuit/Actuator Tests

The information that follows describes:

- How to read the self-diagnostic display
- How to enter the AZC control module self-diagnostic test mode
- How to select the self-diagnostic test types
- How to perform the different tests

ENTERING THE AZC SELF-DIAGNOSTIC MODE

To enter the AZC self-diagnostic mode, perform the following:

(1) Depress the a/c and recirc buttons at the same time and hold. Rotate the left temperature control knob clockwise (CW) one detent.

(2) If you continue to keep the a/c and recirc buttons depressed, the AZC control module will perform a Segment Test of the Vacuum Fluorescent (VF) display. In the Segment Test you should see all of the display segments illuminate as long as both buttons are held. If a display segment fails to illuminate, the vacuum fluorescent display is faulty and the a/c heater control must be replaced.

(3) After viewing the Segment Test, release the A/C and Recirc buttons and the display will clear momentarily. **If a 0 is displayed, then no faults are set in the system.** Should there be any faults, either ″current″ or ″historical″, all fault codes will be displayed in ascending numerical sequence (note no effort is made to display fault codes in chronological order). Each fault code is displayed for one second before the next code is displayed. Once all fault codes have been displayed, the system will then repeat the fault code numbers. This will continue until the left side set temperature control is moved at least one detent position in the CW direction or the ignition is turned ″OFF″.

FAULT CODE TESTS

Fault codes are two-digit numbers that identify a circuit that is malfunctioning. There are two different kinds of fault codes.

1. **Current Fault Codes** - Current means the fault is present right now. There are two types of current faults: input faults, and system faults.

2. **Historical Fault Codes** - Historical or stored means that the fault occurred previously, but is not present right now. A majority of historical fault codes are caused by intermittent wire harness or wire harness connector problems.

CURRENT FAULT CODES	
Input faults	01 = IR thermister circuit open
	02 = IR thermister circuit shorted
	03 = Fan pot shorted
	04 = Fan pot open
	05 = Mode pot shorted
	06 = Mode pot open
	07 = IR sensor delta too large
	08 = Reserved
	09 = Reserved
	10 = One of four motor drivers has drive ″A″ shorted to ground
	11 = Engine air intake temperature Buss message missing
	12 = Country code Buss message missing

A/C HEATER CONTROL (Continued)

CURRENT FAULT CODES	
System Faults	13 = Mode motor not responding
	14 = AI (Recirc) motor not responding
	15 = Left temperature door not responding
	16 = Right temperature door not responding
	17 = Mode door travel range too small
	18 = Mode door travel range too large
	19 = AI (Recirc) door travel too small
	20 = AI (Recirc) door travel too large
	21 = Left temperature door travel too small
	22 = Left temperature door travel too large
	23 = Right temperature door travel too small
	24 = Right temperature door travel too large
	25 = Calibration check sum error
	26 = Engine coolant temp bus message missing
	27 = Vehicle speed bus message missing
	28 = Engine RPM bus message missing
	29 = OAT bus message missing
	30 = Display intensity bus message missing
	31 = VIN number bus message missing
	32 = Raw OAT bus message missing

A/C HEATER CONTROL (Continued)

HISTORICAL FAULT CODES	
Input faults	33 = IR thermister circuit was open
	34 = IR thermister circuit was shorted
	35 = Fan pot was shorted
	36 = Fan pot was open
	37 = Mode pot was shorted
	38 = Mode pot was open
	39 = IR sensor delta was too large
	40 = Reserved
	41 = Reserved
	42 = One of four motor drivers had drive ″A″ shorted to ground
	43 = Engine air intake temperature Buss message missing
	44 = Country code Buss message missing
System Faults	45 = Mode motor was not responding
	46 = AI (Recirc) motor was not responding
	47 = Left temperature door was not responding
	48 = Right temperature door was not responding
	49 = Mode door travel range too small
	50 = Mode door travel range too large
	51 = AI (Recirc) door travel range too small
	52 = AI (Recirc) door travel range too large
	53 = Left temperature door travel too small
	54 = Left temperature door travel too large
	55 = Right temperature door travel too small
	56 = Right temperature door travel too large
	57 = Calibration check sum error
	58 = Engine coolant temp bus message missing
	59 = Vehicle speed bus message missing
	60 = Engine RPM bus message missing
	61 = OAT bus message missing
	62 = Display intensity bus message missing
	63 = VIN number bus message missing
	64 = Raw OAT bus message was missing
	65 = Reserved
	66 = Reserved
	67 = Reserved

NOTE: A battery disconnect will erase all faults stored in Random Access Memory (RAM) of the AZC control module. It is recommended that all faults be recorded before they are erased.

RETRIEVING FAULT CODES

(1) To begin the fault code tests, depress the A/C and Recirc buttons at the same time and rotate the left temperature control knob clockwise (CW) one detent, then release the push-button.

A/C HEATER CONTROL (Continued)

(2) **If there are no fault codes, the “00” display value will remain in the VF window.** Should there be any codes, each will be displayed for one second in ascending numerical sequence (note: no effort is made to display faults in the order they occurred). The left side set temperature display will be blanked and the right side set temperature display will indicate current and historical codes (8 historical max) presently active. Once all codes have been displayed, the system will repeat the fault code numbers. This will continue until the left side set temperature control is moved at least one detent position in either direction, by pressing both the A/C and Recirc buttons at the same time, or the ignition is turned off. Record all of the fault codes, then see the Current and Historical Fault Code charts for the descriptions.

CLEARING FAULT CODES

Current faults cannot be electronically cleared. Repair must be made to the system to eliminate the fault causing code. Historical fault codes can be cleared manually, or automatically. To clear a historical fault manually, depress and hold either the A/C or Recirc button for at least three seconds while the display is in the fault code mode of operation. Historical fault codes are cleared automatically when the corresponding current fault code has been cleared, and has remained cleared for a number of ignition cycles. The faults have been cleared when two horizontal bars appear in the Test Selector display.

EXITING SELF-DIAGNOSTIC MODE

The self-diagnostic mode can be exited by pressing both the A/C and Recirc buttons at the same time, or turning off the ignition.

MONITOR CURRENT PARAMETERS

While in the display fault code mode of operation, current system parameters can also be monitored and/or forced. Rotating the left side set temperature control clockwise will increase the pointer number while rotating the control counter clockwise will decrease the pointer number. Rotating the right set temperature control will have no impact on pointer value or the value of the parameter being monitored. Once the desired pointer number has been selected, pressing either the AC or Recirc buttons will display the current value of the selected parameter. **The right side set temperature display is only capable of displaying only values ranging from 0 to 99, the left side set temperature display is used for values greater than 99. If the value is less than 99, the left side set temperature display remains blanked.** While a parameter is being overridden, the system will continue to function normally except for the parameter which is being manually controlled.

For values < 0, the ″G″ segment in the left side set temperature Most Significant Digit (MSD)(or leftmost number in the pair) will be used to indicate a negative number. For values between -01 to -99 the Least Significant Digit (LSD)(or right-most number of the pair) in the left side set temperature will remain blank. System control of parameter being displayed can be overridden by rotating the right set temperature control in either direction. Rotating the right temperature control in the CW direction, the selected parameter value is overridden and incremented beginning at the value which was being displayed. Rotating the right temperature control in the CCW direction, the selected parameter value is overridden and decremented beginning at the value which was being displayed. The rate at which incrementing and decrement occurs is one unit value per set temperature detent position.

HVAC SYSTEM POINTER		
Pointer Number	DESCRIPTION	Value Displayed
01	A/C Enable	0 or 1
		0 = disabled 1 = enabled
02	Final fan PWM duty cycle	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
03	Left NPRG *	0 to 255
* NPRG equals a calculated number based on outside and in-vehicle conditions. This value is used by the AZC to position the Mode motor, Air Inlet motor, and control blower motor speed.		
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
04	Right NPRG	0 to 255

A/C HEATER CONTROL (Continued)

HVAC SYSTEM POINTER		
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
05	Avg NPRG	0 TO 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
06	Primary control side	0 or 1
		0 = left 1 = right
07	EE Check sum (calculated)	0 to 255
08	Target intensity (in % ON time)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
09	Not Used	0 to 0
10	Not Used	0 to 0
11	Right NINC *	0 to 255
* NINC equals a calculated number based on the IR sensor and IR thermistor values used to calculate the NPRG.		
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
12	Left NINC	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
13	Right NMIX *	0 to 255
* NMIX equals a calculated number based on outside and in-vehicle conditions used by the AZC to position the Temperature motors.		

HVAC SYSTEM POINTER		
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
14	Left NMIX	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CW = decrease	
15	Not Used	0 to 0
16	Not Used	0 to 0
17	Reserved	
18	Reserved	
19	Reserved	

MODE VALUE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
20	mode range in delta counts	0 to 9999
21	Current mode position (in counts)	0 to 9999
22	mode target position in ratio	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
23	mode target position in counts	0 to 9999
24	Not Used	0 to 0
25	number of valve moves since last index	0 to 9999
26	Not Used	0 to 0
27	Not Used	0 to 0
28	Not Used	0 to 0
29	mode motor state	0 to 5
	0 = in position, 1 = moving toward panel, 2 = moving toward defrost, 3 = searching range, 4 = stalled moving toward panel, 5 = stalled moving toward defrost	

A/C HEATER CONTROL (Continued)

LEFT SIDE TEMPERATURE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
30	Left side temp range in delta counts	0 to 9999
31	Current left side temp position (in counts)	0 to 9999
32	Left side temp target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
33	Left side temp target in counts	0 to 9999
34	Not used	0 to 0
35	number of valve moves since last index	0 to 9999
36	Not used	0 to 0
37	Not used	0 to 0
38	Not used	0 to 0
39	Left side temp motor state	0 to 5
	0 = in position, 1 = moving toward panel, 2 = moving toward defrost, 3 = searching range, 4 = stalled moving toward panel, 5 = stalled moving toward defrost	

RIGHT SIDE TEMPERATURE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
40	Right side temp range in delta counts	0 to 9999
41	Current right side temp position (in counts)	0 to 9999
42	Right side temp target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
43	Right side temp target in counts	0 to 9999
44	Not used	0 to 0

RIGHT SIDE TEMPERATURE POINTER		
45	number of valve moves since last index	0 to 9999
46	Not used	0 to 0
47	Not used	0 to 0
48	Not used	0 to 0
49	Right side temp motor state	0 to 5
	0 = in position, 1 = moving toward panel, 2 = moving toward defrost, 3 = searching range, 4 = stalled moving toward panel, 5 = stalled moving toward defrost	

AIR INLET POINTER		
Pointer Number	DESCRIPTION	Value Displayed
50	Air inlet range (in counts)	0 to 9999
51	Current air inlet position (in counts)	0 to 9999
52	Air inlet target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
53	Air inlet target in counts	0 to 9999
54	Not used	0 to 0
55	number of motor moves since last index	0 to 9999
56	Not used	0 to 0
57	Not used	0 to 0
58	Not used	0 to 0
59	Air inlet motor state	0 to 5
	0 = in position, 1 = moving toward panel, 2 = moving toward defrost, 3 = searching range, 4 = stalled moving toward panel, 5 = stalled moving toward defrost	
60	Reserved	
61	Actual Outside Air Temp (in degrees F)	-40 to 215
62	Not used	0 to 0

A/C HEATER CONTROL (Continued)

AIR INLET POINTER		
63	Engine Intake Air Temperature (in degrees F)	-40 to 215
64	Vehicle speed in MPH	0 to 255
65	Engine RPM/100	-0 to 82
66	Engine Coolant Temp - 40 (in degrees F)	-40 to 215
67	Country Code	0 to 255
68	Not used	0 to 0
69	Not used	0 to 0

IR SENSOR POINTER		
Pointer Number	DESCRIPTION	Value Displayed
70	Thermistor temp (in degrees)	-40 to 215
71	Left side sensor A/D (filtered)	0 to 255
72	Right side sensor A/D (filtered)	0 to 255
73	Left side temp (in degrees F)	-40 to 140
74	Right side temp (in degrees F)	-40 to 140
75	Not used	0 to 0
76	Not used	0 to 0
77	Not used	0 to 0
78	Not used	0 to 0
79	Not used	0 to 0

IDENTIFICATION POINTER		
Pointer Number	DESCRIPTION	Value Displayed
80	ROM bit pattern number (digits 1,2,3 & 4)	0 to 9999
81	ROM bit pattern number (digits 5,6,7 & 8)	0 to 9999
82	CAL bit pattern number (digits 1,2,3 & 4)	0 to 9999
83	CAL bit pattern number (digits 5,6,7 & 8)	0 to 9999
84	Not used	0 to 0
85	Not used	0 to 0
86	Not used	0 to 0
87	Not used	0 to 0
88	Not used	0 to 0
89	Not used	0 to 0

OUTPUT CIRCUIT/ACTUATOR TESTS

In the Output Circuit/Actuator Test mode, the output circuits can be viewed, monitored, overridden, and tested. If a failure occurs in an output circuit, test the circuit by overriding the system. Test the actuator through its full range of operation.

(1) To begin the Output Circuit/Actuator Tests you must be in the Select Test mode.

(2) With a “00” value displayed in the Test Selector and no stick man, turn the rotary temperature control knob until the test number you are looking for appears in the Test Selector display. See the Circuit Testing charts for a listing of the test numbers, test items, test types, system tested, and displayed values.

(3) To see the output value, depress the a/c or recirc button. The values displayed will represent the output from the AZC control module.

(4) To enter the actuator test, depress the a/c or recirc button. Then, rotate the right temperature set knob to the desired position.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center upper, and center lower bezels from the instrument panel. Refer to Instrument Panel System for the procedures.

(3) Remove the 4 screws that secure the a/c heater control to the instrument panel (Fig. 13).

(4) Pull the a/c heater control assembly away from the instrument panel far enough to access the connections on the back of the control.

(5) Unplug the wire and/or vacuum harness connectors from the back of the a/c heater control (Fig. 14).

(6) Remove the a/c heater control from the instrument panel.

A/C HEATER CONTROL (Continued)

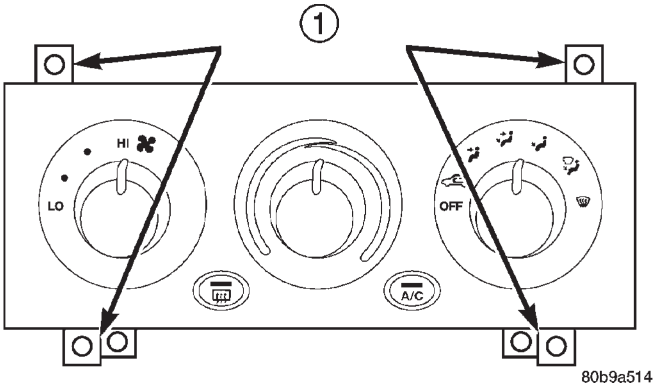


Fig. 13 A/C HEATER CONTROL REMOVE/INSTALL

1 - MOUNTING SCREW TABS

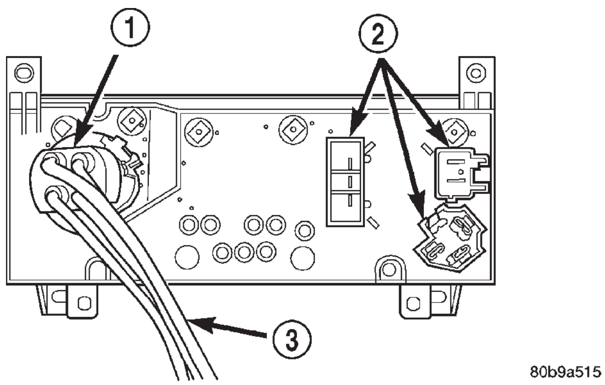


Fig. 14 A/C HEATER CONTROL CONNECTIONS

1 - MODE SWITCH
2 - ELECTRICAL CONNECTIONS
3 - VACUUM HARNESS

INSTALLATION

(1) Plug the wire harness and/or vacuum harness connectors into the back of the a/c heater control.

(2) Position the a/c heater control in the instrument panel and secure it with 4 screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reinstall the center upper, and center lower bezels onto the instrument panel. Refer to Instrument Panel System for the procedures.

(4) Connect the battery negative cable.

A/C PRESSURE TRANSDUCER

DESCRIPTION

The A/C pressure transducer is installed on a fitting located on the refrigerant discharge line near the condenser. An internally threaded hex fitting on the transducer connects it to the externally threaded Schrader-type fitting on the discharge line. A rubber O-ring seals the connection between the transducer and the discharge line fitting. Three terminals within a molded plastic connector receptacle on the top of the transducer connect it to the vehicle electrical system through a take out and connector of the headlamp and dash wire harness.

The A/C pressure transducer cannot be adjusted or repaired and if faulty or damaged, it must be replaced.

OPERATION

The A/C pressure transducer monitors the pressures in the high side of the refrigerant system through its connection to a fitting on the discharge line. The transducer will change its internal resistance in response to the pressures it monitors. The Powertrain Control Module (PCM) provides a five volt reference signal and a sensor ground to the transducer, then monitors the output voltage of the transducer on a sensor return circuit to determine refrigerant pressure. The PCM is preporgrammed to respond to this and other sensor inputs by controlling the operation of the air conditioning compressor clutch and the radiator cooling fan to help optimize air conditioning system performance and to protect the system components from damage. The A/C pressure transducer input to the PCM will also prevent the air conditioning compressor clutch from engaging when the ambient temperatures are below about 0.556° C (33° F) due to the pressure/temperature relationship of the refrigerant. The Schrader-type valve in the liquid line fitting permits the A/C pressure transducer to be removed or installed without distrubing the refrigerant in the system. The A/C pressure transducer is diagnosed using the DRBIII® scan tool. Refer to the appropriate diagnostic information.

A/C PRESSURE TRANSDUCER (Continued)

DIAGNOSIS AND TESTING - A/C PRESSURE TRANSDUCER

The A/C pressure transducer is tested using a DRBIII® scan tool. Refer to the appropriate diagnostic information. Before testing the A/C pressure transducer, be certain that the transducer wire harness connection is clean of corrosion and properly connected. For the air conditioning system to operate, an A/C pressure transducer voltage reading between 0.7 and 4.56 volts is required. Voltage outside this range indicate a low or high refrigerant system pressure condition to the Powertrain Control Module (PCM). The PCM is programmed to respond to a low or high refrigerant system pressure by suppressing operation of the compressor. Refer to the A/C Pressure Transducer Voltage table for the possible condition indicated by the transducer voltage readings.

A/C PRESSURE TRANSDUCER VOLTAGE	
VOLTAGE	POSSIBLE INDICATION
0.0	1. NO SENSOR SUPPLY VOLTAGE FROM PCM. 2. SHORTED SENSOR CIRCUIT. 3. FAULTY TRANSDUCER
0.150 TO 0.450	1. AMBIENT TEMPERATURE BELOW 10° c (50° F). 2. LOW REFRIGERANT SYSTEM PRESSURE.
0.451 TO 4.519	1. NORMAL REFRIGERANT SYSTEM PRESSURE.
4.520 TO 4.850	1. HIGH REFRIGERANT SYSTEM PRESSURE.
5.0	1. OPEN SENSOR CIRCUIT. 2. FAULTY TRANSDUCER.

REMOVAL

WARNING: Transducer can be removed without recoverying the system, but some loss of refrigerant can be expected(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the headlamp and dash wire harness connector for the A/C pressure transducer from the transducer connector receptacle.

(3) Using an open end wrench, unscrew the A/C pressure transducer from the fitting on the discharge line.

(4) Remove the seal from the A/C pressure transducer fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the A/C pressure transducer fitting.

(2) Using an open end wrench, install and tighten the A/C pressure transducer onto the fitting on the discharge line.

(3) Reconnect the headlamp and dash wire harness connector for the A/C pressure transducer to the transducer connector receptacle.

(4) Reconnect the battery negative cable.

BLOWER MOTOR CONTROLLER

DESCRIPTION

Models equipped with the optional Automatic Zone Control (AZC) system have a blower motor controller. The controller allows the selection of almost infinitely variable blower motor speeds. The controller is mounted to the HVAC housing, under the instrument panel and just inboard of the blower motor, in the same location used for the blower motor resistor on manual temperature control systems. It can be accessed without removing any other components.

OPERATION

The blower motor controller output to the blower motor can be adjusted by the blower motor speed switch knob on the AZC A/C Heater control panel, or it can be adjusted automatically by the logic circuitry and programming of the AZC control module. In either case, the AZC control module sends the correct pulse width modulated signal to the blower motor controller to obtain the selected or programmed blower motor speed.

The blower motor controller cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR CONTROLLER (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Depress locking tab and unplug the wire harness connector from the blower motor controller.

(3) Depress locking tab and unplug the controller connector from the blower motor.

(4) Remove the 2 screws that secure the blower motor controller to the HVAC housing.

(5) Remove the blower motor controller from the HVAC housing (Fig. 15).

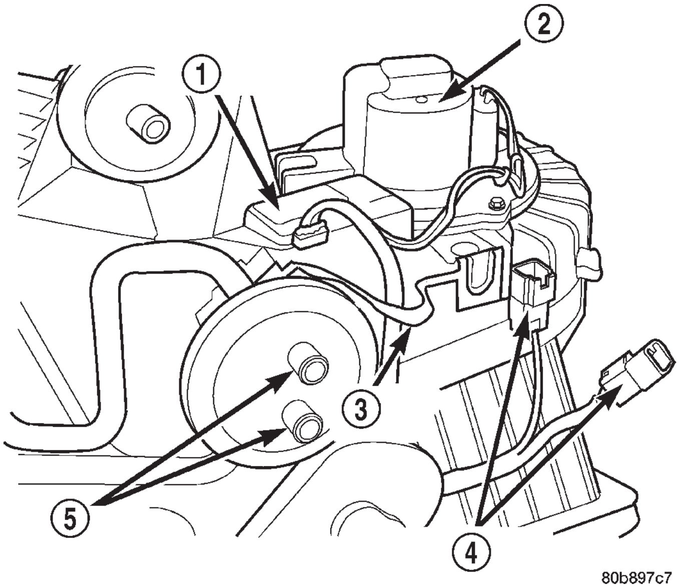


Fig. 15 BLOWER MOTOR CONTROLLER REMOVE/ INSTALL

1 - BLOWER MOTOR CONTROLLER
2 - BLOWER MOTOR
3 - GROUND STRAP
4 - ELECTRICAL CONNECTORS
5 - HEATER CORE TUBES

INSTALLATION

(1) Install the blower motor controller in the HVAC housing. The housing is indexed to allow controller mounting in only one position. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug in the wire harness connector to the blower motor controller.

(3) Plug in the connector from the blower motor controller to the blower motor.

(4) Connect the battery negative cable.

BLOWER MOTOR RESISTOR BLOCK

DESCRIPTION

Models with the standard manual temperature control system have a blower motor resistor. The blower motor resistor is mounted to the bottom of the HVAC housing, under the instrument panel and just inboard of the blower motor. It can be accessed for service without removing any other components.

OPERATION

The resistor has multiple resistor wires, each of which will reduce the current flow to the blower motor to change the blower motor speed by changing the resistance in the blower motor ground path. The blower motor switch directs the ground path through the correct resistor wire to obtain the selected speed.

With the blower motor switch in the lowest speed position, the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING - BLOWER MOTOR RESISTOR BLOCK

For circuit descriptions and diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the blower motor resistor.

BLOWER MOTOR RESISTOR BLOCK (Continued)

(3) Check for continuity between each of the blower motor switch input terminals of the resistor and the resistor output terminal. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Depress locking tab and unplug the wire harness connector from the blower motor resistor.

(3) Depress locking tab and unplug the resistor connector from the blower motor.

(4) Remove the 2 screws that secure the blower motor resistor to the HVAC housing.

(5) Remove the blower motor resistor from the HVAC housing (Fig. 16).

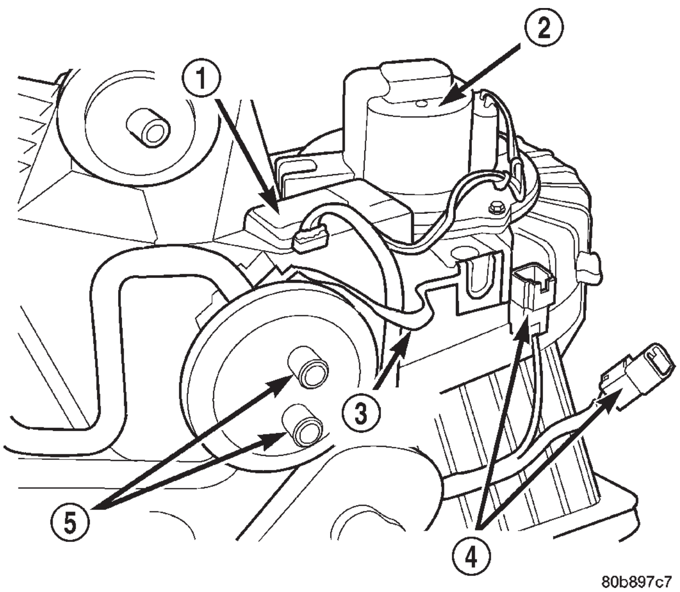


Fig. 16 BLOWER MOTOR RESISTOR REMOVE/ INSTALL

1 - BLOWER MOTOR RESISTOR
2 - BLOWER MOTOR
3 - GROUND STRAP
4 - ELECTRICAL CONNECTORS
5 - HEATER CORE TUBES

INSTALLATION

(1) Install the blower motor resistor in the HVAC housing. The housing is indexed to allow mounting in only one position. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug in the wire harness connector to the blower motor resistor.

(3) Plug in the connector from the blower motor resistor to the blower motor.

(4) Connect the battery negative cable.

BLOWER MOTOR SWITCH

DESCRIPTION

The A/C Heater blower motor is controlled by a rotary-type blower motor switch, mounted in the A/C Heater control panel. On vehicles with manual temperature control systems, the switch allows the selection of four blower motor speeds, but will only operate with the ignition switch in the On position and the A/C Heater mode control switch in any position, except Off. On vehicles with the Automatic Zone Control (AZC) systems, the switch allows the selection of Lo Auto, Hi Auto, and ten speed settings between Lo and Hi.

OPERATION

On manual temperature control systems, the blower motor switch is connected in series with the blower motor ground path through the a/c heater mode control switch. The blower motor switch directs this ground path to the blower motor through the blower motor resistor wires, or directly to the blower motor, as required to achieve the selected blower motor speed.

On AZC systems, the blower motor switch is just one of many inputs to the AZC control module. In the manual blower modes, the AZC control module adjusts the blower motor speed through the blower motor controller as required to achieve the selected blower switch position. In the auto blower modes, the AZC control assembly is programmed to select and adjust the blower motor speed through the blower motor controller as required to achieve and maintain the selected comfort level.

The blower motor switch cannot be repaired and, if faulty or damaged, it must be replaced. The switch is serviced only as a part of the a/c heater control assembly.

DIAGNOSIS AND TESTING - BLOWER MOTOR SWITCH-MANUAL TEMPERATURE CONTROL SYSTEM

For circuit descriptions and diagrams, refer to the appropriate wiring information.

BLOWER MOTOR SWITCH (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check for battery voltage at the fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the a/c heater control from the instrument panel. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL) Check for continuity between the ground circuit cavity of the a/c heater control wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) With the a/c heater control wire harness connector unplugged, place the a/c heater mode control switch knob in any position except the Off position. Check for continuity between the ground circuit terminal and each of the blower motor driver circuit terminals of the a/c heater control as you move the blower motor switch knob to each of the four speed positions. There should be continuity at each driver circuit terminal in only one blower motor switch speed position. If OK, test and repair the blower driver circuits between the a/c heater control connector and the blower motor resistor as required. If not OK, replace the faulty a/c heater control unit.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The blower motor switch cannot be adjusted or repaired, and if faulty or damaged, the a/c heater control must be replaced. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL)

IN-CAR TEMPERATURE SENSOR

DESCRIPTION

Models equipped with the optional Automatic Zone Control (AZC) system use automatic dual zone temperature control with infrared sensing technology. The temperature sensor is located in the center instrument panel, between the dual temperature knobs of the AZC.

OPERATION

The Automatic Zone Control uses infrared sensing technology to control occupant comfort levels, not the actual passenger compartment air temperature. Dual infrared sensors mounted in the face of the control unit independently measure the surface temperature to maintain customer-perceived comfort temperature under changing conditions. Dual Zone temperature control provides wide side-to-side variation in comfort temperature to exceed the needs of either front seat occupant. This sensing system replaces interior air temperature and solar sensors used to approximate direct sensing control through complex control programs.

The infrared temperature sensor cannot be adjusted or repaired and, if faulty or damaged, the AZC head must be replaced.

NOTE: The infrared sensor window may be permanently damaged if any type of cosmetic vinyl dressings are allowed to contact the lens. Avoid spraying or wiping this area with any cleaner or conditioner. This may result in impaired temperature sensing and control.

REMOVAL

The infrared temperature sensor cannot be adjusted or repaired and, if faulty or damaged, the AZC head must be replaced. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL)

BLEND DOOR ACTUATOR

DESCRIPTION

The blend door for all models is actuated by an electric actuator, while the AZC system uses 2 separate actuators to allow the driver and passenger to select individual comfort levels. In the following procedures, service for both types of actuators is covered.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The blend door actuator is used on all models, whether equipped with manual or Automatic Zone Control (AZC). This actuator is located on the front of the HVAC housing to the right of the floor panel transmission tunnel, and can be removed from the passenger compartment without instrument panel or HVAC housing removal.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box door. Refer to Instrument Panel System for the procedures.

(3) Remove the lower I/P glove box door surround panel. Refer to Instrument Panel System for the procedures.

(4) Unplug the wire harness connector from the blend door actuator (Fig. 17).

(5) Remove the 2 screws that secure the blend door actuator to the HVAC housing.

(6) Remove the blend door actuator from the HVAC housing.

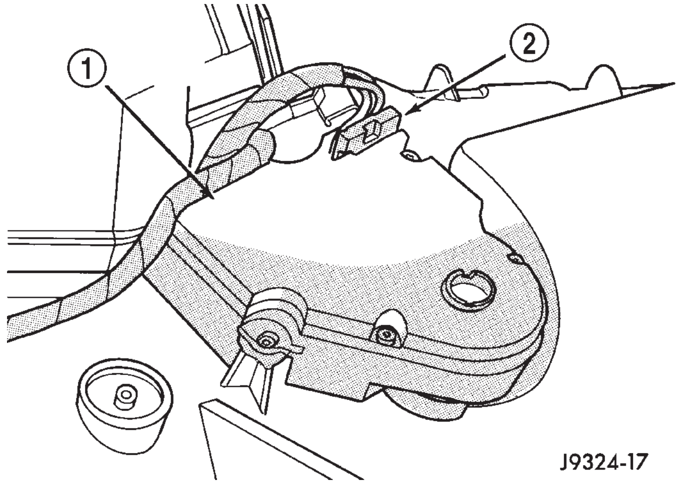


Fig. 17 BLEND DOOR ACTUATOR

1 - BLEND DOOR ACTUATOR
2 - ELECTRICAL CONNECTOR

INSTALLATION

(1) Install the blend door actuator on the HVAC housing and tighten the two mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug in the wire harness connector to the blend door actuator.

(3) Install the glove box door. Refer to Instrument Panel System for the procedures.

(4) Install the lower I/P glove box door surround panel. Refer to Instrument Panel System for the procedures.

(5) Connect and the battery negative cable.

MODE DOOR ACTUATOR

DESCRIPTION

The mode door actuators for vehicles equipped with the standard equipment manual temperature control system are vacuum controlled. The optional Automatic Zone Control (AZC) system uses electric motors to actuate all mode doors. The service procedures for both types of actuators are covered by the following procedures.

MODE DOOR ACTUATOR (Continued)

REMOVAL

REMOVAL - HEAT/DEFROST - PANEL/DEFROST DOOR ELECTRIC ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

These actuators are used only on models equipped with the optional Automatic Zone Control (AZC) system.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two bolts that secure the center instrument panel support bracket to the left side of the floor panel transmission tunnel.

(3) Remove the two bolts that secure the center instrument panel support bracket to the instrument panel.

(4) Remove the center instrument panel support bracket from the vehicle.

(5) Unplug the wire harness connector from the heat/defrost - panel/defrost door actuator (Fig. 18).

(6) Remove the three screws that secure the heat/defrost-panel/defrost door motor to the HVAC housing.

(7) Remove the heat/defrost-panel/defrost door motor from the HVAC housing.

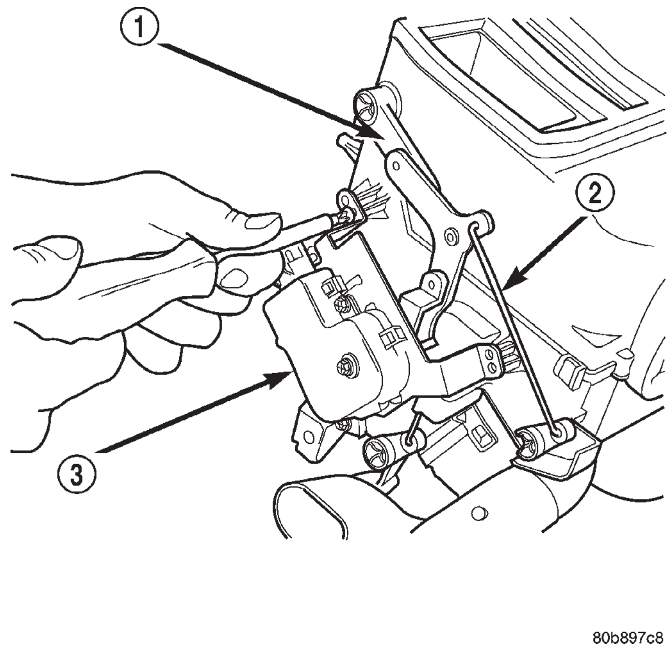


Fig. 18 HEAT/DEFROST - PANEL/DEFROST DOOR ACTUATOR

1 - LEVER ASSEMBLY
2 - LINKAGE
3 - ELECTRIC ACTUATOR

REMOVAL - HEAT/DEFROST DOOR VACUUM ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the HVAC housing from the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL)

(2) Unplug the vacuum harness connector from the heat/defrost door vacuum actuator (Fig. 19).

(3) Disengage the heat/defrost door pivot connection from the heat/defrost door pivot pin.

(4) Remove the screws that secure the heat/defrost door vacuum actuator to the HVAC housing.

(5) Remove the heat/defrost door vacuum actuator from the HVAC housing.

MODE DOOR ACTUATOR (Continued)

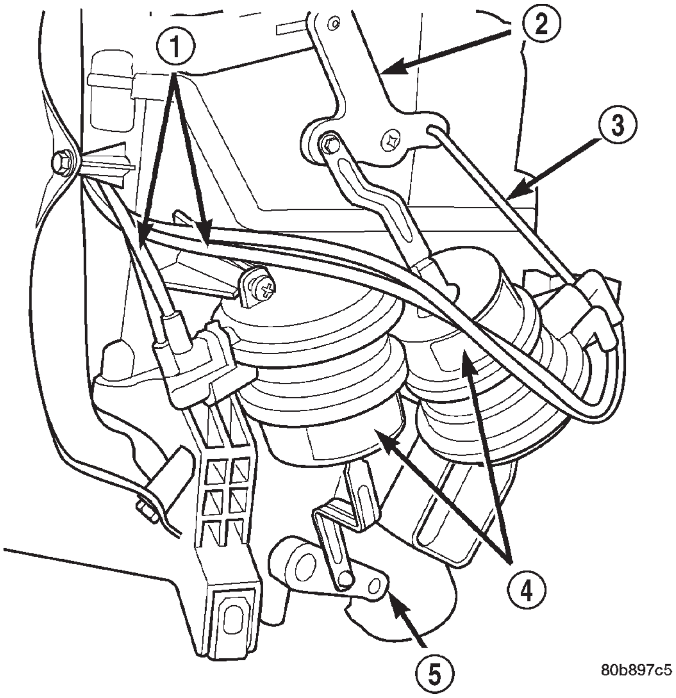


Fig. 19 MODE DOOR ACTUATORS-MANUAL SYSTEM

1 - VACUUM LINES
2 - ACTUATING LEVERS
3 - LINKAGE
4 - VACUUM ACTUATORS
5 - ACTUATING LEVER

REMOVAL - PANEL/DEFROST DOOR VACUUM ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the HVAC housing from the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - REMOVAL)

(2) Unplug the vacuum harness connector from the heat/defrost door vacuum actuator (Fig. 20).

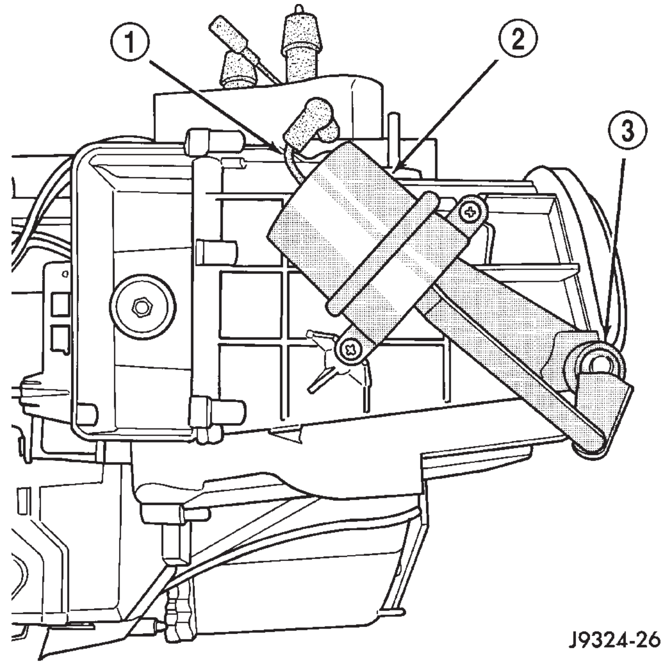


Fig. 20 PANEL/DEFROST DOOR ACTUATOR

1 - VACUUM LINE
2 - PANEL/DEFROST DOOR ACTUATOR
3 - SHAFT RETAINER

(3) Disengage the panel/defrost door pivot connection from the panel/defrost door pivot pin.

(4) Remove the screws that secure the panel/defrost door vacuum actuator to the HVAC housing.

(5) Remove the panel/defrost door vacuum actuator from the HVAC housing.

INSTALLATION

INSTALLATION - HEAT/DEFROST - PANEL/ DEFROST DOOR ELECTRIC ACTUATOR

(1) Install the heat/defrost-panel/defrost door actuator on the HVAC housing, and tighten the three mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug in the wire harness connector to the heat/ defrost - panel/defrost door actuator.

(3) Install the center instrument panel support bracket on the vehicle.

(4) Install the two bolts that secure the center instrument panel support bracket to the instrument panel.

(5) Install the two bolts that secure the center instrument panel support bracket to the left side of the floor panel transmission tunnel.

(6) Connect the battery negative cable.

MODE DOOR ACTUATOR (Continued)

INSTALLATION - HEAT/DEFROST DOOR VACUUM ACTUATOR

(1) Install the heat/defrost door vacuum actuator on the HVAC housing and tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Engage the heat/defrost door pivot connection with the heat/defrost door pivot pin.

(3) Plug in the vacuum harness connector to the heat/defrost door vacuum actuator.

(4) Install the HVAC housing in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

INSTALLATION - PANEL/DEFROST DOOR VACUUM ACTUATOR

(1) Install the panel/defrost door vacuum actuator on the HVAC housing and tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Engage the panel/defrost door pivot connection with the panel/defrost door pivot pin.

(3) Plug in the vacuum harness connector to the heat/defrost door vacuum actuator.

(4) Install the HVAC housing in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

RECIRCULATION DOOR ACTUATOR

DESCRIPTION

The recirculation door actuator for vehicles equipped with the standard equipment manual temperature control system is vacuum controlled. The optional Automatic Zone Control (AZC) system uses an electric recirculation door actuator. In the following procedures, service for both types of actuators is covered.

REMOVAL

REMOVAL - RECIRCULATION DOOR VACUUM ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the instrument panel from the vehicle. Refer to Instrument Panel System for the procedures.

(2) Unplug the vacuum harness connector from the recirculation door vacuum actuator.

(3) Disengage the recirculation door pivot connection from the door pivot pin.

(4) Disengage the recirculation door actuating rod from the recirculation door lever.

(5) Remove the screws that secure the recirculation door vacuum actuator to the HVAC housing.

(6) Remove the recirculation door vacuum actuator from the HVAC housing.

REMOVAL - RECIRCULATION DOOR ELECTRIC ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

This actuator is used only on models equipped with the optional Automatic Zone Control (AZC) system.

(1) Remove the instrument panel from the vehicle. Refer to Instrument Panel System for the procedures.

(2) Unplug the wire harness connector from the recirculation door actuator.

(3) Remove the 2 screws securing the recirculation door housing to the HVAC unit (Fig. 21). Tilt the front of the housing up while reaching around the back releasing 2 tangs holding the rear of the housing down.

(4) Remove the recirculation door housing from the HVAC unit.

(5) Remove the screws that secure the recirculation door actuator to the HVAC housing.

(6) Remove the recirculation door actuator from the HVAC housing.

RECIRCULATION DOOR ACTUATOR (Continued)

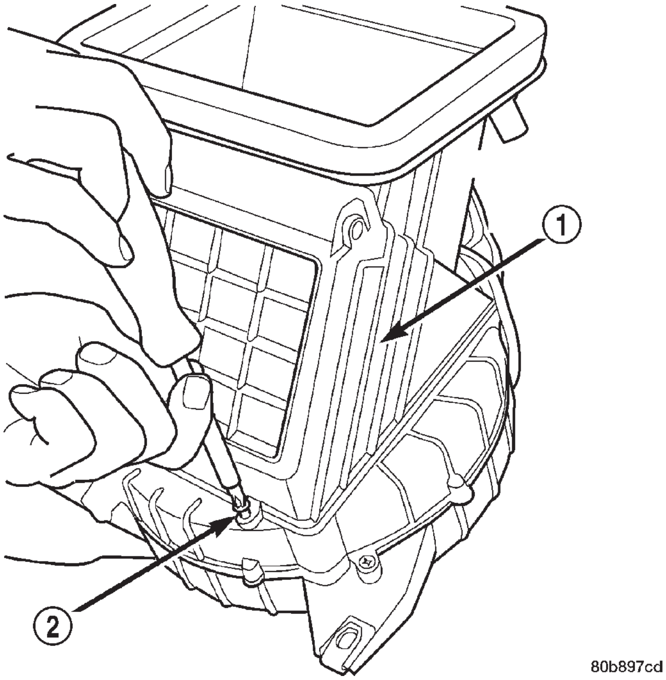


Fig. 21 RECIRCULATION DOOR HOUSING

1 - RECIRCULATION DOOR HOUSING
2 - ATTACHING SCREWS

INSTALLATION

INSTALLATION - RECIRCULATION DOOR VACUUM ACTUATOR

(1) Install the recirculation door vacuum actuator on the HVAC housing and tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Engage the recirculation door actuating rod with the recirculation door lever.

(3) Engage the recirculation door pivot connection with the door pivot pin.

(4) Plug in the vacuum harness connector to the recirculation door vacuum actuator.

(5) Install the instrument panel in the vehicle. Refer to Instrument Panel System for the procedures.

INSTALLATION - RECIRCULATION DOOR ELECTRIC ACTUATOR

(1) Install the recirculation door actuator on the recirculation door housing and tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Install the recirculation door housing on the HVAC unit and tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(3) Plug in the wire harness connector to the recirculation door actuator.

(4) Install the instrument panel in the vehicle. Refer to Instrument Panel System for the procedures.

VACUUM CHECK VALVE

DESCRIPTION

Two vacuum check valves (non AZC only) are installed on the vacuum supply system. One is on the accessory vacuum supply line in the engine compartment, near the vacuum tap on the engine intake manifold. A second vacuum check valve is located on the bottom of the HVAC unit behind the passenger front floor duct on the black vacuum line. The vacuum check valves are designed to allow vacuum to flow in only one direction through the accessory vacuum supply circuits.

OPERATION

The use of a vacuum check valve helps to maintain the system vacuum needed to retain the selected A/C Heater mode settings. The check valve will prevent the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation.

The vacuum check valve cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

(1) Unplug the HVAC vacuum supply line connector at the vacuum check valve near the engine intake manifold vacuum adapter fitting.

(2) Note the orientation of the check valve in the vacuum supply line for correct installation.

(3) Unplug the vacuum check valve from the vacuum supply line fittings.

INSTALLATION

(1) Plug in the vacuum check valve at the vacuum supply line fittings, noting the orientation of the check valve in the vacuum supply line for correct installation.

(2) Plug in the HVAC vacuum supply line connector at the vacuum check valve near the engine intake manifold vacuum adapter fitting.

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is mounted in the right front of the vehicle behind the headlamp mounting module (Fig. 22). The headlamp mounting module and headlamp assembly must be removed from the vehicle to access the vacuum reservoir for service. Refer to Lamps/Lighting for the procedures.

OPERATION

Engine vacuum is stored in the vacuum reservoir. The stored vacuum is used to operate the vacuum-

VACUUM RESERVOIR (Continued)

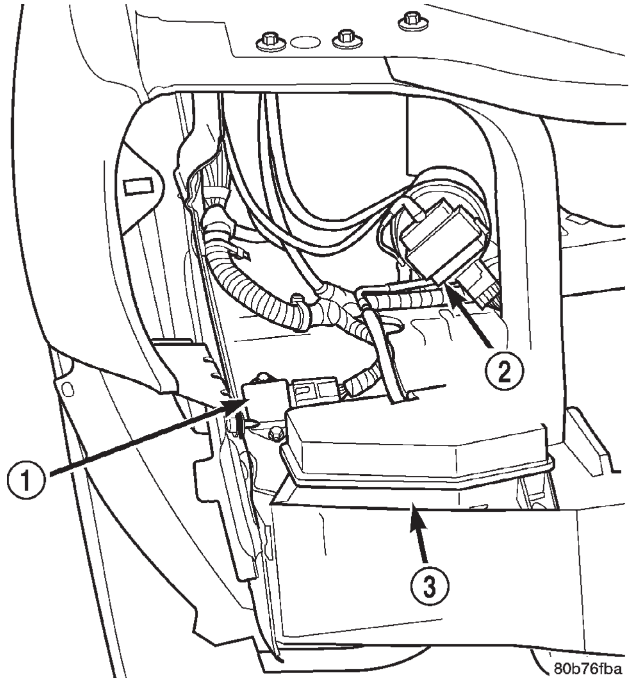


Fig. 22 VACUUM RESERVOIR

1 - FAN RELAY
2 - SPEED CONTROL SERVO
3 - VACUUM RESERVOIR

controlled vehicle accessories during periods of low engine vacuum such as when the vehicle is climbing a steep grade, or under other high engine load operating conditions.

The vacuum reservoir cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

(1) Remove the right side headlamp mounting module and headlamp assembly. Refer to Lamps/ Lighting for the procedures.

(2) Remove the two screws that secure the vacuum reservoir to the base of the radiator closure panel.

(3) Remove the vacuum reservoir.

INSTALLATION

(1) Install the vacuum reservoir in the vehicle and tighten the two screws to 3.4 N·m (30 in. lbs.).

(2) Install the right side headlamp mounting module and headlamp assembly. Refer to Lamps/Lighting for the procedures.

EVAPORATOR TEMPERATURE SENSOR

DESCRIPTION

The evaporator probe is a 2 wire temperature sensing element located at the coldest point on the face of the evaporator. The switch is attached to the evaporator coil fins. The evaporator temperature probe prevents condensate water on the evaporator coil from freezing and obstructing A/C system air flow.

OPERATION

The probe is used to switch the clutch OFF before evaporator freeze-up occurs. Output from the probe is sampled by the Body Control Module (BCM). The clutch is switched OFF when the probe temperature reaches 1.1° C (34° F). It is allowed to switch ON when the probe temperature reaches 2.2° C (36° F).

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the HVAC housing from the vehicle(Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - REMOVAL).

(3) Disassemble the HVAC housing(Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - DISASSEMBLY).

(4) Carefully pull the probe out of the evaporator core.

INSTALLATION

(1) Install the new probe into the evaporator.

NOTE: The new probe must not go into the same hole (in the evaporator core) that the old probe was removed from.

(2) Reassemble the HVAC housing(Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - ASSEMBLY).

(3) Reinstall the HVAC assembly in the vehicle(Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

(4) Reconnect the battery negative cable.

DISTRIBUTION

TABLE OF CONTENTS

AIR OUTLETS

REMOVAL

The driver side, and passenger side panel outlets are available for service. The center outlets are only serviced as part of the instrument cluster center bezel unit.

(1) Remove the instrument panel top pad from the instrument panel. Refer to Instrument Panel System for the procedures.

(2) Remove the two screws that secure each outlet to the backside of the instrument panel top pad (Fig. 1).

(3) Remove the outlet from the top pad.

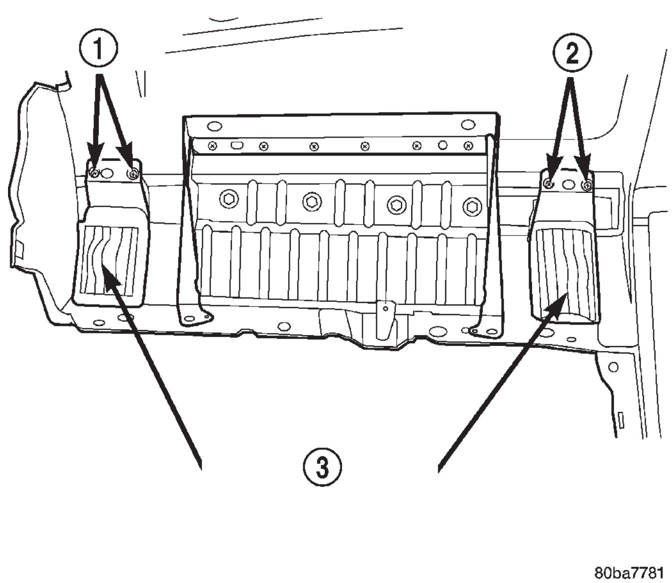


Fig. 1 PANEL OUTLETS (PASSENGER SIDE)

1 - MOUNTING SCREWS
2 - MOUNTING SCREWS
3 - PANEL OUTLETS

INSTALLATION

(1) Fasten the outlet to the top pad. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Install the instrument panel top pad on the instrument panel. Refer to Instrument Panel System for the procedures.

BLOWER MOTOR

DESCRIPTION

The blower motor and blower wheel are located in the passenger side end of the HVAC housing, below the glove box module. The blower motor controls the velocity of the air flowing through the HVAC housing by spinning a squirrel cage-type blower wheel within the housing at the selected speed. The blower motor and blower wheel can be serviced from the passenger compartment side of the housing.

OPERATION

The blower motor will only operate when the ignition switch is in the On position, and the a/c heater mode control switch is in any position, except off. The blower motor circuit is protected by a fuse in the junction block. On models with the standard manual temperature control system, the blower motor speed is controlled by regulating the battery feed through the blower motor switch and the blower motor resistor. On models with the optional Automatic Zone Control (AZC) system, the blower motor speed is controlled by using Pulse Width Modulation (PWM). The blower motor controller adjusts the battery feed voltage to the blower motor, based upon an input from the blower motor switch, through the AZC control module. Pulse width modulation of blower power allows the blower to operate at any speed from stationary, to full speed.

The blower motor and blower motor wheel cannot be repaired, and if faulty or damaged, they must be replaced. The blower motor and blower wheel are each serviced separately.

DIAGNOSIS AND TESTING - BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For circuit descriptions and diagrams, refer to the appropriate wiring information. Possible causes of an inoperative blower motor include:
- Faulty fuse
- Faulty blower motor circuit wiring or wire harness connections
- Faulty blower motor resistor (if the vehicle is so equipped)
- Faulty blower motor controller (if the vehicle is so equipped)
- Faulty blower motor switch
- Faulty a/c heater mode control switch
- Faulty blower motor.

Possible causes of the blower motor not operating in all speeds include:
- Faulty fuse
- Faulty blower motor switch
- Faulty blower motor resistor (if the vehicle is so equipped)
- Faulty blower motor controller (if the vehicle is so equipped)
- Faulty AZC module (if the vehicle is so equipped)
- Faulty blower motor circuit wiring or wire harness connections.

VIBRATION

Possible causes of blower motor vibration include:
- Improper blower motor mounting
- Improper blower wheel mounting
- Blower wheel out of balance or bent
- Blower motor faulty.

NOISE

To verify that the blower is the source of the noise, unplug the blower motor wire harness connector and operate the HVAC system. If the noise goes away, possible causes include:
- Foreign material in the HVAC housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Blower motor faulty.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

BLOWER MOTOR (Continued)

(1) Disconnect and isolate the battery negative cable.

(2) Pinch the connector retainer and unplug the blower motor wire harness from the blower motor (Fig. 2).

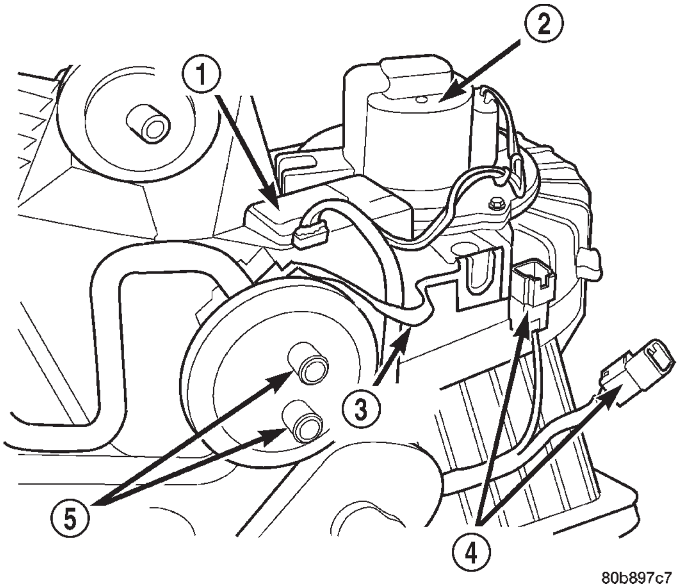


Fig. 2 BLOWER MOTOR (HOUSING REMOVED FROM VEHICLE)

1 - BLOWER MOTOR RESISTOR
2 - BLOWER MOTOR
3 - GROUND STRAP
4 - ELECTRICAL CONNECTORS
5 - HEATER CORE TUBES

(3) Remove the three screws that secure the blower motor and blower wheel assembly to the HVAC housing, using either a T-25 Torx® head or flat-bladed screwdriver.

(4) Lower the blower motor and wheel from the HVAC housing.

(5) Remove the blower wheel retainer clip (Fig. 3).

(6) Remove the wheel from the blower motor shaft.

INSTALLATION

(1) Press the blower wheel hub onto the blower motor shaft. Be sure the flat on the blower motor shaft is indexed to the flat on the inside of the blower wheel hub.

(2) Install the retainer clip over the blower wheel hub.

(3) Install the blower motor in the HVAC housing with three mounting screws. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(4) Plug the blower motor wire harness connector into the blower motor socket.

(5) Connect the battery negative cable.

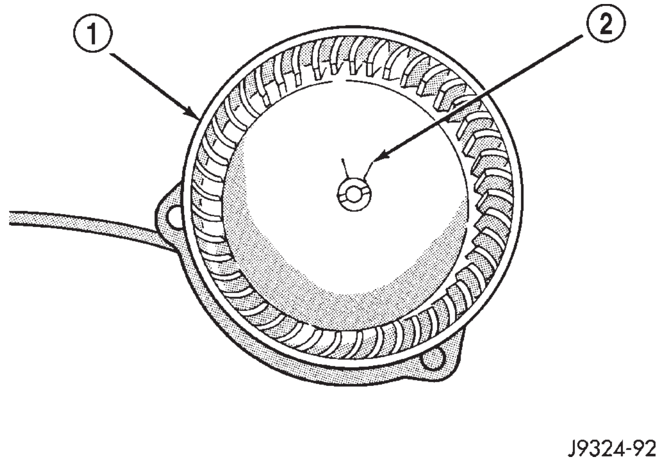


Fig. 3 BLOWER MOTOR WHEEL REMOVE/INSTALL

1 - BLOWER MOTOR WHEEL
2 - RETAINER CLIP

DEFROSTER DUCTS

REMOVAL

(1) Remove the instrument panel assembly from the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(2) Remove the three screws that secure the defroster duct to the HVAC unit housing (Fig. 4).

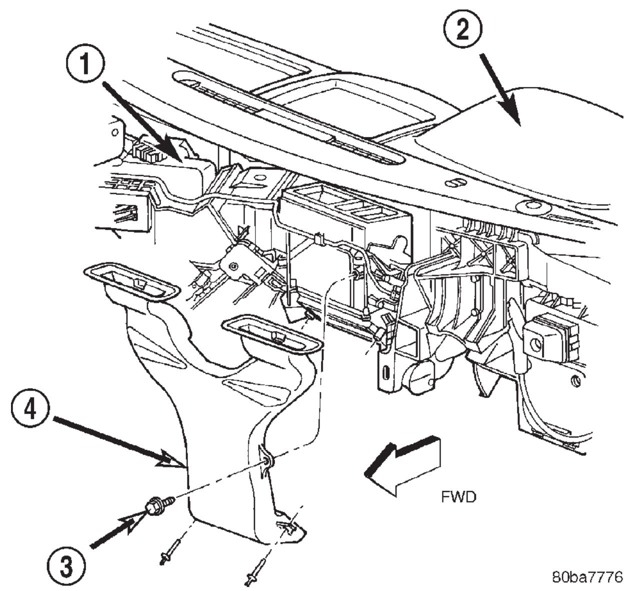


Fig. 4 HVAC DEFROSTER DUCT

1 - HVAC UNIT HOUSING
2 - INSTRUMENT PANEL
3 - SCREWS
4 - DEFROSTER DUCT

(3) Remove the defroster duct from the HVAC unit housing.

DEFROSTER DUCTS (Continued)

INSTALLATION

(1) Install the defroster duct on the HVAC unit housing.

(2) Install the three screws that secure the defroster duct to the HVAC unit housing. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(3) Install the instrument panel assembly in the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

FLOOR DISTRIBUTION DUCTS

REMOVAL

(1) To remove the driver side floor duct from the vehicle, remove the knee blocker panel for access to attaching screw. See Instrument Panel System for the procedures.

(2) The passenger side floor duct fastener can be accessed under the right-center instrument panel.

(3) Remove the screw that secures the floor duct(s) to the HVAC housing (Fig. 5).

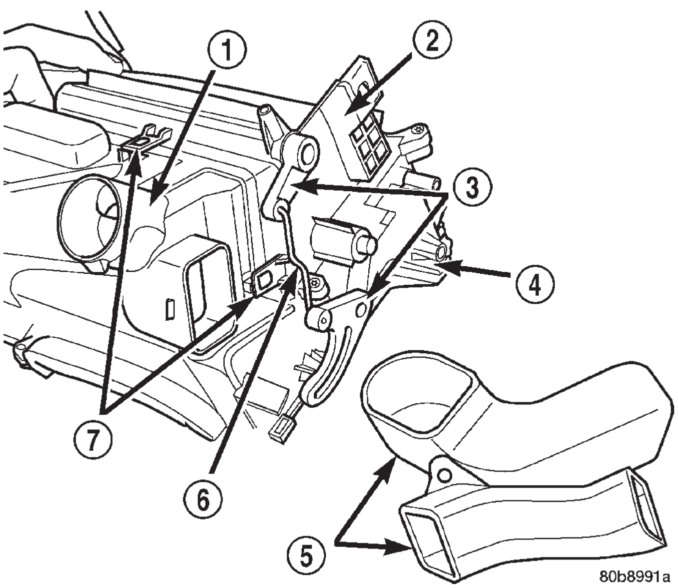


Fig. 5 FLOOR DUCTS (HOUSING REMOVED)

1 - FLOOR DUCT ADAPTER
2 - HEAT/DEFROST DOOR SUB-ASSEMBLY
3 - DOOR LEVERS
4 - LOWER HOUSING
5 - FLOOR DUCTS
6 - LINKAGE
7 - RETAINING TABS

INSTALLATION

(1) Attach the floor duct(s) to the HVAC housing.

(2) Install the screw that secures the floor duct(s) to the HVAC housing. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(3) Install the knee blocker panel. See Instrument Panel System for the procedures.

INSTRUMENT PANEL DUCTS

REMOVAL

(1) Remove the instrument panel top pad from the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL TOP COVER - REMOVAL).

(2) Unsnap the duct extension(s) from the instrument panel structural duct assembly (Fig. 6).

(3) Remove the duct extension(s) from the instrument panel (Fig. 7).

INSTALLATION

(1) Connect the duct extension(s) to the instrument panel.

(2) Snap the duct extension(s) to the instrument panel structural duct assembly.

(3) Install the instrument panel top pad in the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL TOP COVER - INSTALLATION).

REAR FLOOR HEAT DUCT

REMOVAL

(1) To remove the rear floor ducts from the vehicle, remove the knee blocker panels for access, and pull carpeting back.

(2) Pull the floor ducts from the HVAC housing (Fig. 8).

NOTE: The ductwork running from the HVAC housing rearward through the passenger compartment is molded into the carpeting, and must be replaced as a unit if damaged.

INSTALLATION

(1) Attach the floor ducts to the HVAC housing.

(2) Install the knee blocker panels.

(3) Install the carpeting back in its original position.

REAR FLOOR HEAT DUCT (Continued)

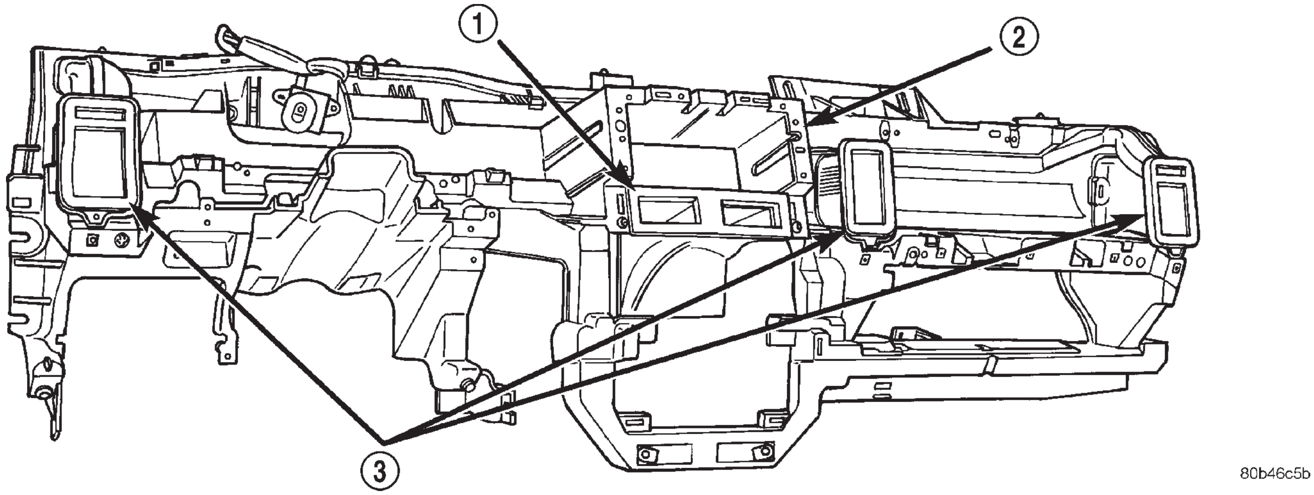


Fig. 6 INSTRUMENT PANEL STRUCTURAL DUCT ASSEMBLY

1 - CENTER DUCT
2 - INSTRUMENT PANEL STRUCTURAL DUCT ASSEMBLY
3 - PANEL DUCT EXTENSIONS

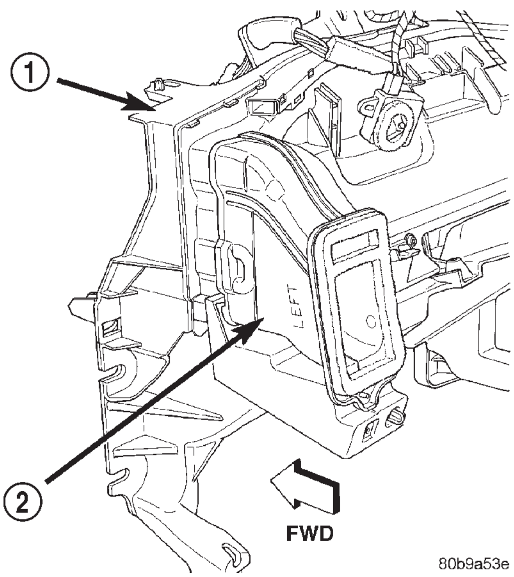


Fig. 7 INSTRUMENT PANEL DUCT EXTENSION

1 - INSTRUMENT PANEL STRUCTURAL DUCT ASSEMBLY
2 - PANEL DUCT EXTENSION

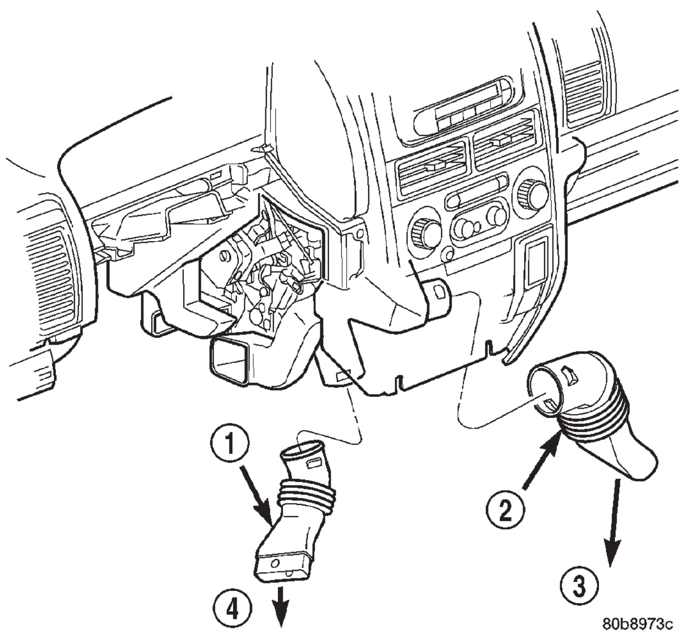


Fig. 8 REAR FLOOR DUCTS

1 - LEFT REAR PASSENGER FLOOR AIR DUCT
2 - RIGHT REAR PASSENGER FLOOR AIR DUCT
3 - TO CARPET DUCT
4 - TO CARPET DUCT

HVAC HOUSING

REMOVAL

The HVAC housing assembly must be removed from the vehicle and the two halves of the housing separated for service access of the heater core, evaporator coil, blend door(s), and each of the various mode doors.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN PLUMBING BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(3) Recover the refrigerant from the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(4) Disconnect the liquid line refrigerant line from the evaporator inlet tube(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - REMOVAL) or (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - REMOVAL). Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Disconnect the suction line refrigerant line from the evaporator outlet tube(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SUCTION LINE - REMOVAL), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SUCTION LINE - REMOVAL) or (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SUCTION LINE - REMOVAL). Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Disconnect the heater hoses from the heater core tubes. Clamp off the heater hoses to prevent loss of coolant. Refer to Cooling for the procedures. Install plugs in, or tape over the opened heater core tubes.

(7) If the vehicle is equipped with the manual temperature control system, unplug the HVAC system vacuum supply line connector from the tee fitting near the heater core tubes.

(8) Remove the coolant reserve/overflow bottle from the passenger side inner fender shield. Refer to Cooling for the procedures.

(9) Remove the Powertrain Control Module (PCM) from the passenger side dash panel in the engine compartment and set it aside. Do not unplug the PCM wire harness connectors. Refer to Electronic Control Modules for the procedures.

(10) Remove the nuts from the HVAC housing mounting studs on the engine compartment side of the dash panel (Fig. 9).

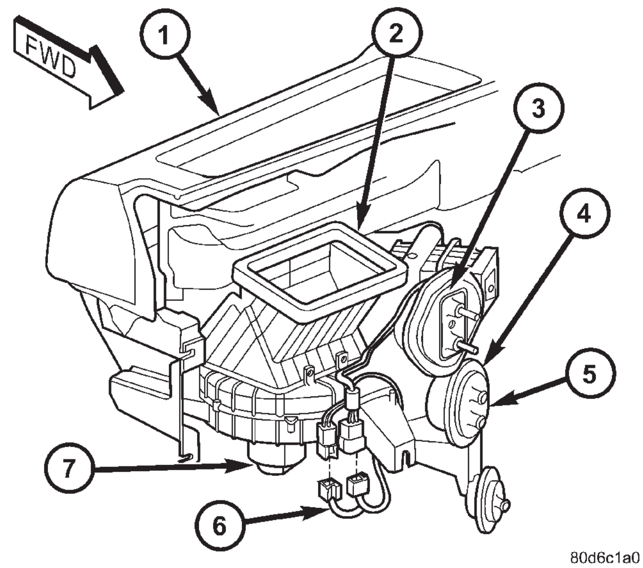


Fig. 9 HVAC Housing - (rear view)

1 - Instrument Panel
2 - Air Intake
3 - Expansion Valve
4 - HVAC Housing
5 - Heater Core Input/Output Ports
6 - Instrument Panel Wiring Harness
7 - Blower Motor

(11) Remove the rear floor heat ducts from the floor heat duct outlets (Fig. 10).

(12) Unplug the HVAC housing wire harness connectors.

(13) Remove the HVAC housing mounting nuts from the studs on the passenger compartment side of the dash panel (Fig. 11).

HVAC HOUSING (Continued)

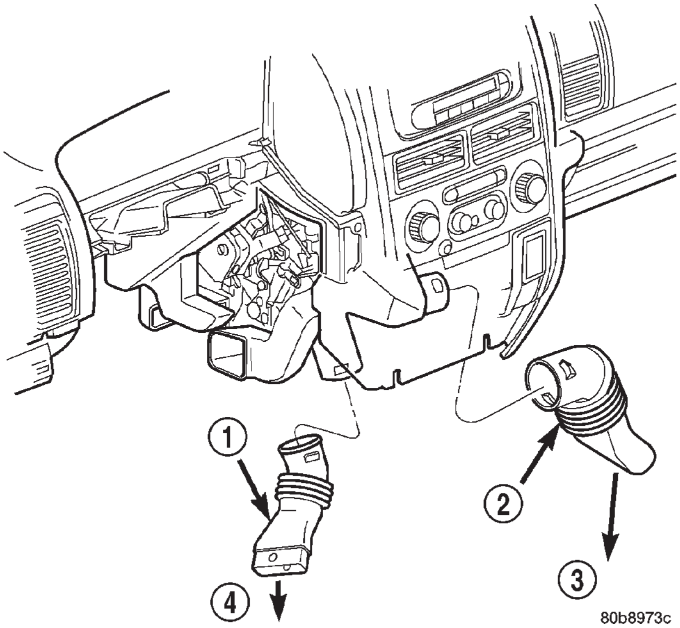


Fig. 10 REAR FLOOR DUCTS

1 - LEFT REAR PASSENGER FLOOR AIR DUCT
2 - RIGHT REAR PASSENGER FLOOR AIR DUCT
3 - TO CARPET DUCT
4 - TO CARPET DUCT

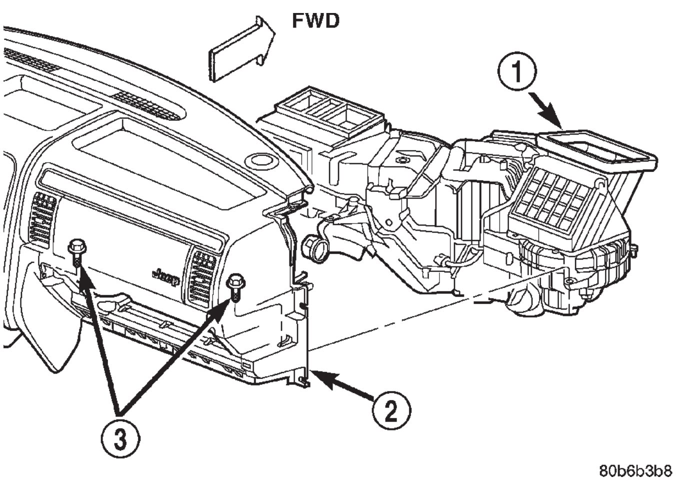


Fig. 11 Passenger Side Instrument Panel to Heater-A/C Housing Mounting

1 - HEATER AND AIR CONDITIONER HOUSING
2 - INSTRUMENT PANEL STRUCTURAL DUCT
3 - SCREW (2)

(14) Remove the HVAC housing from the vehicle, ensuring that the interior is covered in case of loss of fluids.

DISASSEMBLY

(1) Remove the HVAC housing from the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - REMOVAL)

(2) Place the HVAC housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 12).

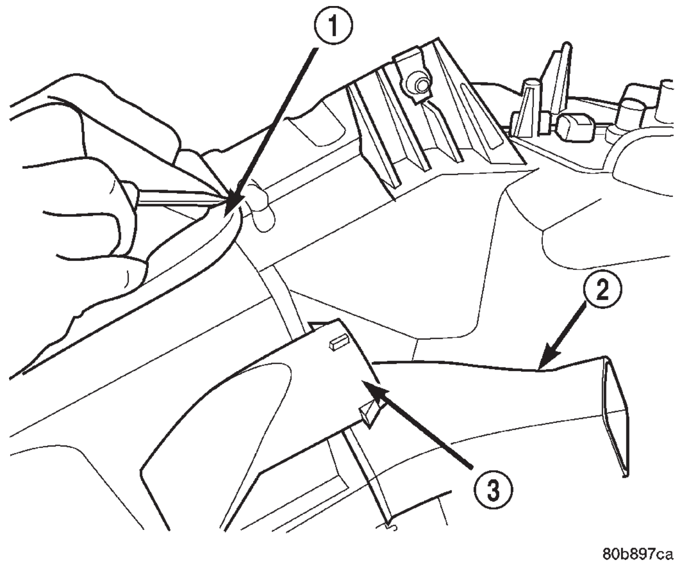


Fig. 12 SPLIT FOAM SEAL AT PANEL OUTLET

1 - ONE PIECE FOAM SEAL
2 - FLOOR DUCT
3 - TO REAR PASSENGER FLOOR AIR DUCT

(4) Place the HVAC housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, which controls the mode door in the top of the case (Fig. 13) (Fig. 14).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 15).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 16).

HVAC HOUSING (Continued)

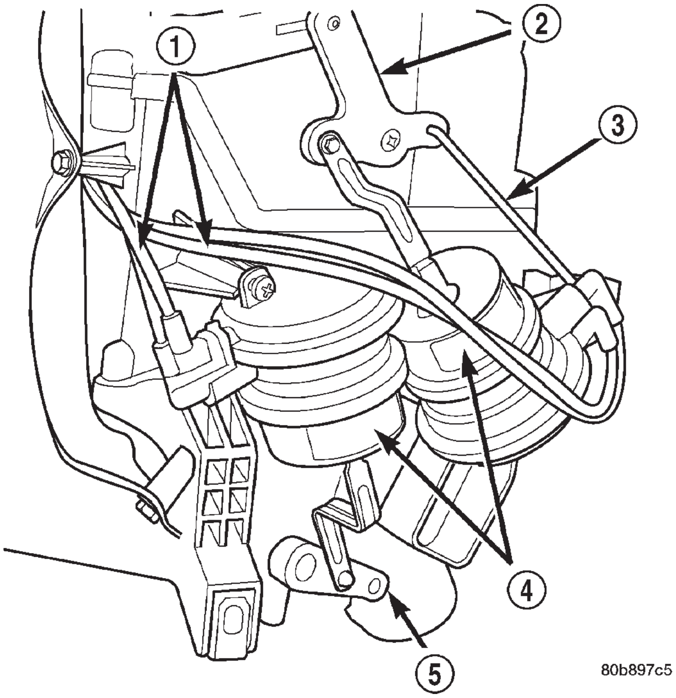


Fig. 13 MODE DOOR ACTUATORS - MANUAL SYSTEM

1 - VACUUM LINES
2 - ACTUATING LEVERS
3 - LINKAGE
4 - VACUUM ACTUATORS
5 - ACTUATING LEVER

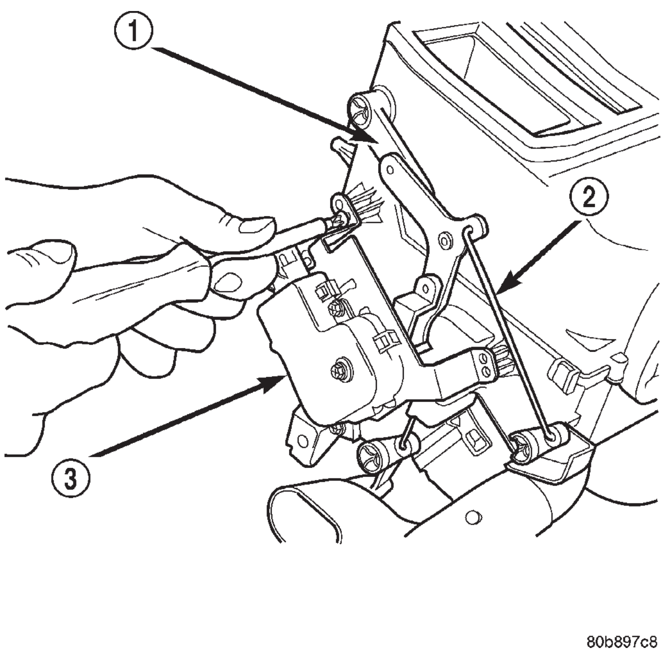


Fig. 14 MODE DOOR ACTUATOR - AZC SYSTEM

1 - LEVER ASSEMBLY
2 - LINKAGE
3 - ELECTRIC ACTUATOR

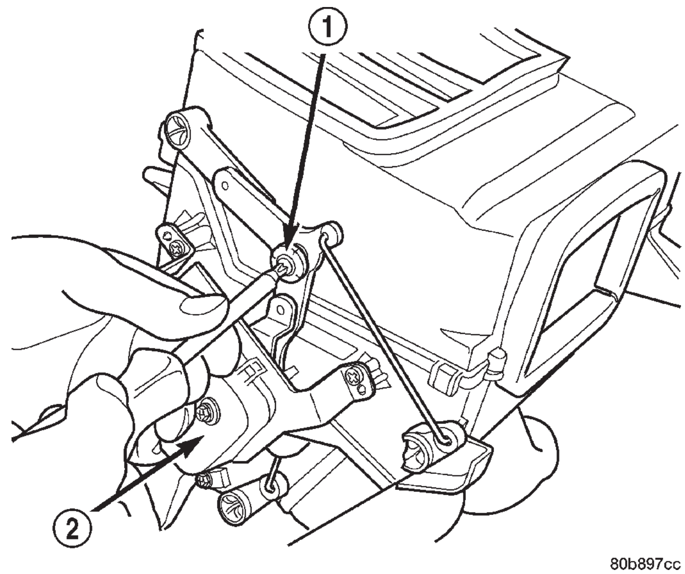


Fig. 15 REMOVE SCREW WITH PLASTIC WASHER

1 - SCREW WITH PLASTIC WASHER
2 - ELECTRIC ACTUATOR

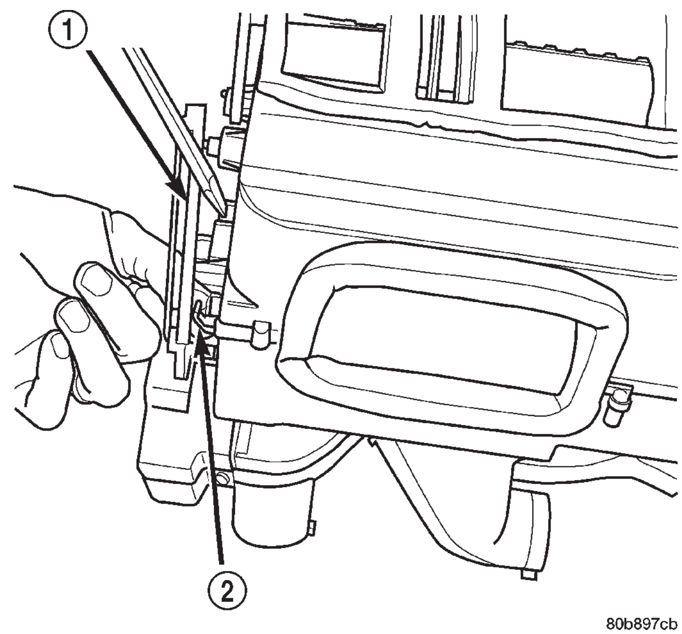


Fig. 16 HVAC HOUSING CLIPS

1 - ACTUATING LEVERS AND LINKAGE
2 - HOUSING CLIP

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 17).

HVAC HOUSING (Continued)

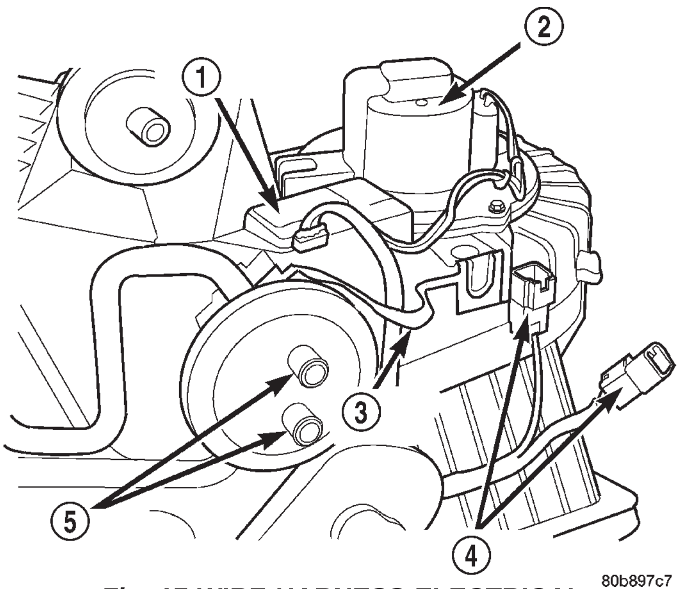


Fig. 17 WIRE HARNESS ELECTRICAL CONNECTOR(S)

1 - BLOWER MOTOR RESISTOR
2 - BLOWER MOTOR
3 - GROUND STRAP
4 - ELECTRICAL CONNECTORS
5 - HEATER CORE TUBES

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the HVAC housing from the bottom half (Fig. 18).

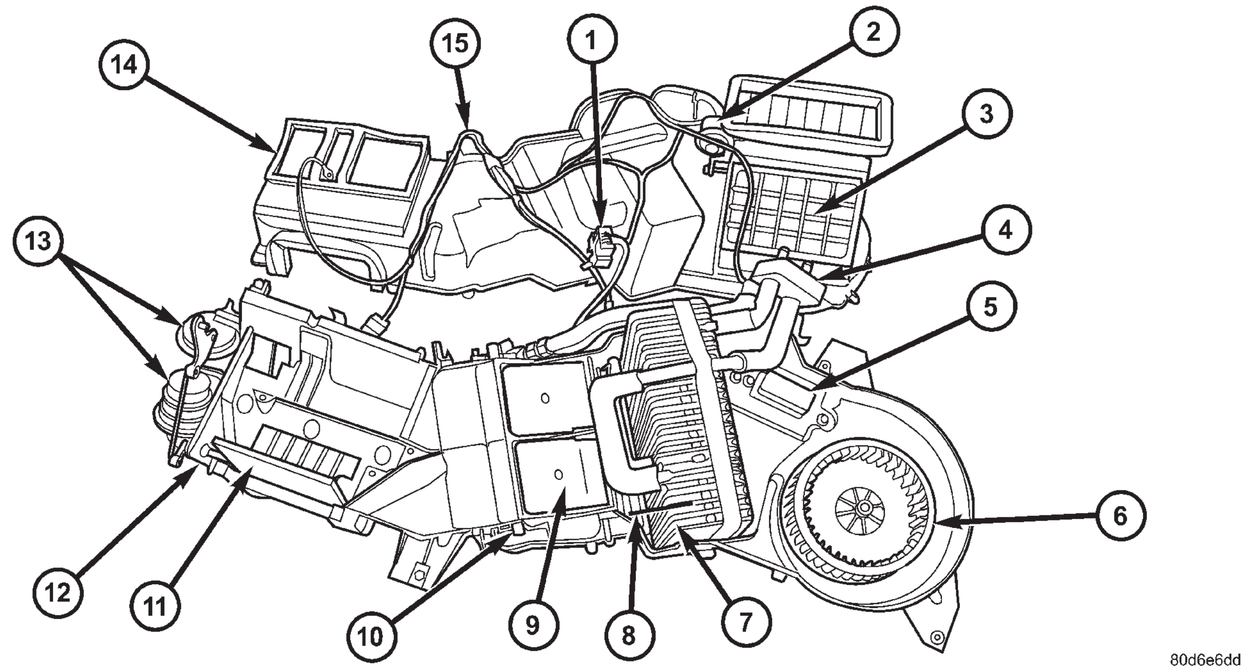


Fig. 18 HVAC HOUSING- CASE SEPARATED

1 - ELECTRICIAL CONNECTORS
2 - VACUUM ACTUATOR
3 - RECIRCULATION DOOR
4 - THERMAL EXPANSION VALVE
5 - BLOWER MOTOR RESISTOR/CONTROLLER
6 - BLOWER WHEEL
7 - EVAPORATOR AND TUBES
8 - FIN SENSOR PROBE
9 - BLEND DOOR
10 - PIVOT SHAFT (MOTOR REMOVED)
11 - PANEL/OUTLET DOOR
12 - LOWER HOUSING
13 - VACUUM ACTUATORS
14 - UPPER HOUSING
15 - VACUUM HARNESS

HVAC HOUSING (Continued)

NOTE: The blend door sub-assembly is attached to the housing with 2 screws, and may be removed for service (Fig. 19).

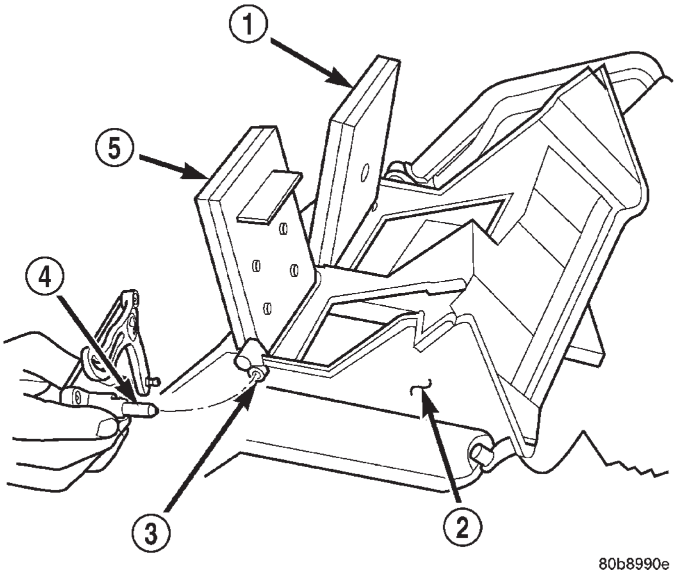


Fig. 19 BLEND DOOR SUB-ASSEMBLY (AZC)

1 - PASSENGER SIDE BLEND DOOR
2 - BLEND DOOR SUB-ASSEMBLY
3 - DOOR PIVOT SHAFT BUSHING
4 - DOOR SHAFT LEVER
5 - DRIVER SIDE BLEND DOOR

ASSEMBLY

(1) Place the top half of the HVAC housing on the bottom half. Be certain that each of the door pivot pins align with the pivot holes in the HVAC housing.

(2) Install the 10 screws that secure the two housing halves to each other. Tighten the HVAC housing screws to 2.2 N·m (20 in. lbs.).

(3) Attach the wire harness electrical connector(s) to the mounts on the lower case at the blower motor end of the unit.

(4) Install the 5 clips that secure the two housing halves to each other. Check doors for binding after replacement, and after assembly of housing.

(5) Install the screw with plastic washer holding the lever assembly to the upper case section.

(6) Install the mode door actuator on the left side of the housing.

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN PLUMBING BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Position the HVAC housing to the dash panel. Be certain that the evaporator condensate drain tube and the housing mounting studs are inserted into their correct mounting holes.

(2) Install the HVAC housing mounting nuts to the studs on the passenger compartment side of the dash panel. Tighten the nuts to 4.5 N·m (40 in. lbs.).

(3) Connect the HVAC housing wire harness connectors.

(4) Reinstall the rear floor heat ducts to the center floor heat duct outlets.

(5) Install and tighten the nuts onto the HVAC housing mounting studs on the engine compartment side of the dash panel. Tighten the nuts to 7 N·m (60 in. lbs.).

(6) Reinstall the PCM to the passenger side dash panel in the engine compartment. Refer to Electronic Control Modules for the procedures.

(7) Reinstall the coolant reserve/overflow bottle to the passenger side inner fender shield. Refer to Cooling for the procedures.

(8) If the vehicle is equipped with the manual temperature control system, connect the HVAC system vacuum supply line connector to the tee fitting near the heater core tubes.

(9) Unclamp/unplug the heater core hoses and tubes. Connect the heater hoses to the heater core tubes and fill the engine cooling system. Refer to Cooling for the procedures.

(10) Unplug or remove the tape from the suction line and the evaporator outlet tube fittings. Connect the suction line to the evaporator outlet tube. Tighten retaining nut to 28 N·m (250 in. lbs.).

(11) Unplug or remove the tape from the liquid line and the evaporator inlet tube fittings. Connect the liquid line to the evaporator inlet tube. Tighten retaining nut to 28 N·m (250 in. lbs.).

(12) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING -

HVAC HOUSING (Continued)

STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(13) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(14) Install the instrument panel in the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

(15) Connect the battery negative cable.

(16) Start the engine and check for proper operation of the heating and air conditioning systems.

BLEND DOOR

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove and disassemble the HVAC housing. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY)

(2) Remove evaporator from lower case to ease access to plastic door shaft bushing.

(3) Pinch the retention tabs holding the blend door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(4) Remove door(s).

INSTALLATION

(1) Install the blend door(s) by snapping the pivot shaft into the HVAC case.

(2) Install the evaporator in the lower case.

(3) Reassemble the HVAC housing and install in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

NOTE: The blend door sub-assembly is attached to the housing with 2 screws, and may be removed for service (Fig. 20).

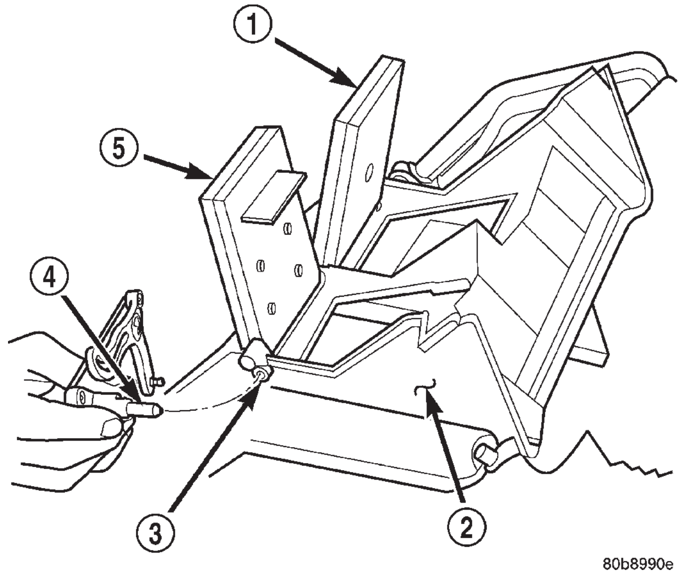


Fig. 20 BLEND DOOR SUB-ASSEMBLY

1 - PASSENGER SIDE BLEND DOOR
2 - BLEND DOOR SUB-ASSEMBLY
3 - DOOR PIVOT SHAFT BUSHING
4 - DOOR SHAFT LEVER
5 - DRIVER SIDE BLEND DOOR

MODE DOOR

REMOVAL

REMOVAL - PANEL OUTLET DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove and disassemble the HVAC housing. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY)

MODE DOOR (Continued)

(2) Pinch the retention tabs holding the panel outlet door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer (Fig. 21).

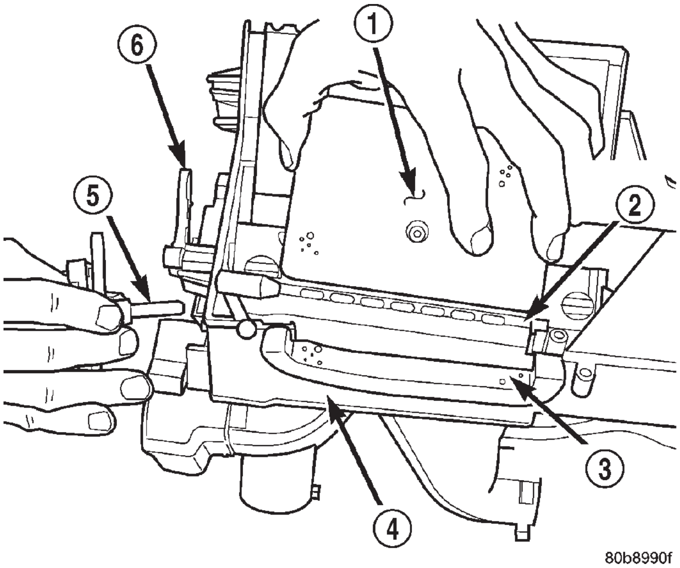


Fig. 21 PANEL OUTLET DOOR

1 - PANEL/OUTLET DOOR
2 - DOOR SHAFT
3 - FOAM SEAL (SPLIT)
4 - LOWER HOUSING
5 - PANEL OUTLET DOOR LEVER
6 - LEVER

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel outlet door pivot shaft retainer from the pivot shaft.

(4) Remove the panel outlet door from the HVAC housing.

REMOVAL - HEAT/DEFROST DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove and disassemble the HVAC housing. (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - REMOVAL) (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - DISASSEMBLY)

(2) Remove the evaporator, and styrofoam tray from the lower case.

(3) Place the HVAC housing upside down on a work bench.

(4) Unscrew and remove the 2 floor heat ducts.

(5) Unsnap and remove the duct adapter from the bottom of the heat/defrost door sub-assembly (Fig. 22).

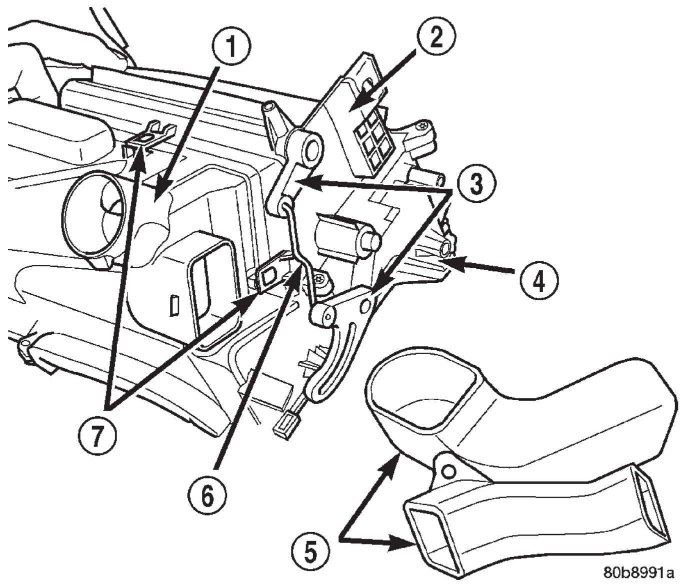


Fig. 22 HEAT/DEFROST DOOR DUCTS, AND ADAPTER

1 - FLOOR DUCT ADAPTER
2 - HEAT/DEFROST DOOR SUB-ASSEMBLY
3 - DOOR LEVERS
4 - LOWER HOUSING
5 - FLOOR DUCTS
6 - LINKAGE
7 - RETAINING TABS

(6) Gently pry the metal linkage from the heat/defrost door lever.

(7) Remove the heat/defrost door sub-assembly, which is attached to the housing with 4 screws (Fig. 23).

(8) Pinch the retention tabs holding the heat/defrost door pivot shaft lever to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(9) Remove the heat/defrost door (Fig. 24).

MODE DOOR (Continued)

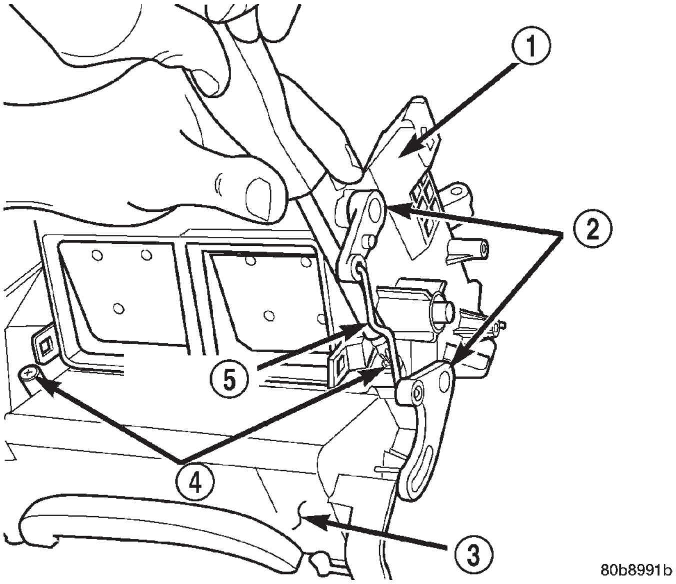


Fig. 23 HEAT/DEFROST DOOR SUB-ASSEMBLY REMOVAL

1 - HEAT/DEFROST DOOR SUB-ASSEMBLY
2 - LEVERS
3 - LOWER HOUSING
4 - SCREWS
5 - LINKAGE

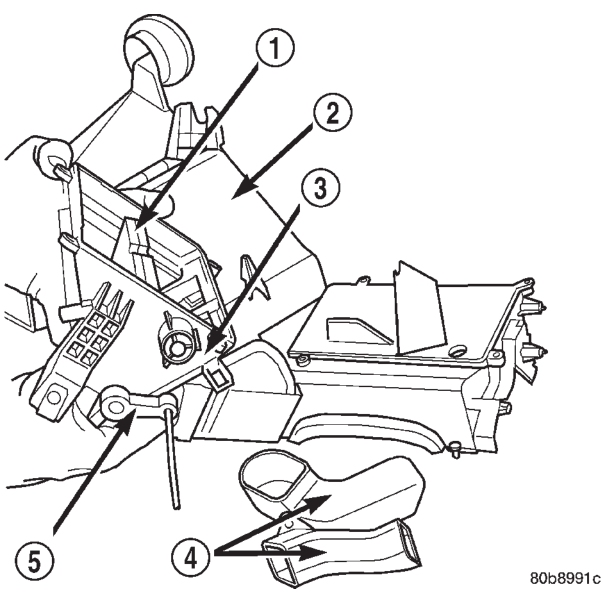


Fig. 24 HEAT/DEFROST DOOR REMOVAL

1 - HEAT/DEFROST DOOR
2 - LOWER HOUSING
3 - HEAT/DEFROST DOOR SUB-ASSEMBLY
4 - FLOOR DUCTS
5 - DOOR LEVER

REMOVAL - PANEL/DEFROST DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove and disassemble the HVAC housing. See HVAC Housing in this group for the procedures.

(2) Pinch the retention tabs holding the panel/defrost door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer (Fig. 25).

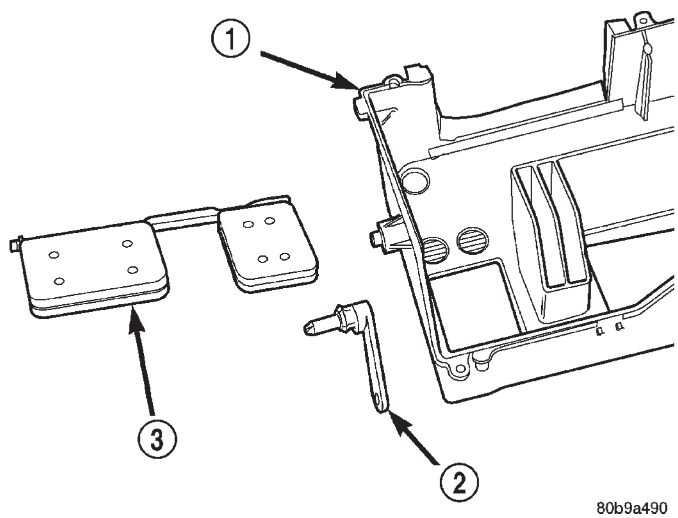


Fig. 25 PANEL/DEFROST DOOR

1 - UPPER HOUSING
2 - LEVER
3 - PANEL/DEFROST MODE DOOR

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel/defrost door pivot shaft retainer from the pivot shaft.

(4) Remove the panel/defrost door from the HVAC housing.

MODE DOOR (Continued)

INSTALLATION

INSTALLATION - PANEL OUTLET DOOR

(1) Snap the panel outlet door pivot shaft retainer on the pivot shaft.

(2) Attach the panel outlet door pivot shaft to the HVAC case.

(3) Reassemble the HVAC housing and install in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

INSTALLATION - HEAT/DEFROST DOOR

(1) Install the heat/defrost door by snapping the heat/defrost door pivot shaft into the HVAC case.

(2) Install the heat/defrost door sub-assembly and tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(3) Attach the metal linkage to the heat/defrost door lever.

(4) Snap the duct adapter to the bottom of the heat/defrost door sub-assembly.

(5) Install the 2 floor heat ducts and tighten the mounting screws to 2.2 N·m (20 in. lbs.)..

(6) Install the evaporator, and styrofoam tray in the lower case.

(7) Reassemble the HVAC housing and install in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

INSTALLATION - PANEL/DEFROST DOOR

(1) Snap the panel/defrost door pivot shaft retainer on the pivot shaft.

(2) Attach the panel/defrost door pivot shaft to the HVAC case.

(3) Reassemble the HVAC housing and install in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

RECIRCULATION DOOR

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the HVAC housing from the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL)

(2) Place the HVAC housing right side up on the work bench.

(3) Unplug the wire/vacuum connector from the recirculation door actuator.

(4) Remove the 2 screws fastening the recirculation door sub-assembly to the main housing (Fig. 26).

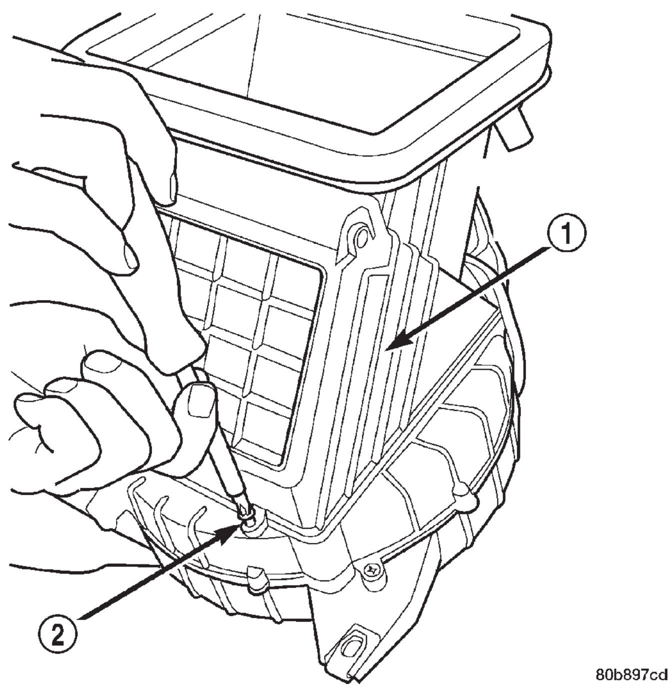


Fig. 26 RECIRCULATION DOOR HOUSING

1 - RECIRCULATION DOOR HOUSING
2 - ATTACHING SCREWS

RECIRCULATION DOOR (Continued)

(5) Raise the front of the door sub-assembly while releasing the 2 tabs holding the rear to the main housing, and remove the recirculation door housing.

(6) Remove the electric/vacuum actuator from the recirculation door sub-assembly and set aside.

(7) Pinch the retention tabs holding the recirculation door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(8) Remove the recirculation door from the recirculation air door housing.

INSTALLATION

(1) Install the recirculation door in the recirculation air door housing by snapping the pivot shaft retention tabs into the case.

(2) Install the electric/vacuum actuator on the recirculation door sub-assembly. Check door for binding after replacement.

(3) Install the recirculation door housing on the HVAC case and tighten the 2 screws to 2.2 N·m (20 in. lbs.).

(4) Plug in the wire/vacuum connector to the recirculation door actuator.

(5) Install the HVAC housing in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

PLUMBING

TABLE OF CONTENTS

PLUMBING

DESCRIPTION - REFRIGERANT LINE

The refrigerant lines and hoses are used to carry the refrigerant between the various air conditioning system components. A barrier hose design with a nylon tube, which is sandwiched between rubber layers, is used for the R-134a air conditioning system on this vehicle. This nylon tube helps to further contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant hoses are made from lightweight aluminum or steel, and commonly use braze-less fittings.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

OPERATION - REFRIGERANT LINE

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

WARNING

WARNING: THE AIR CONDITIONING SYSTEM CONTAINS REFRIGERANT UNDER HIGH PRESSURE. SEVERE PERSONAL INJURY MAY RESULT FROM IMPROPER SERVICE PROCEDURES. REPAIRS SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

AVOID BREATHING THE REFRIGERANT AND REFRIGERANT OIL VAPOR OR MIST. EXPOSURE MAY IRRITATE THE EYES, NOSE, AND/OR THROAT. WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM DIRECT CONTACT WITH THE REFRIGERANT. IF EYE CONTACT OCCURS, SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE THE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC LEAK DETECTOR IS RECOMMENDED.

IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE THE WORK AREA BEFORE RESUMING SERVICE. LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

THE EVAPORATION RATE OF R-134a REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT THE SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH THE REFRIGERANT.

THE R-134a SERVICE EQUIPMENT OR THE VEHICLE REFRIGERANT SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR AND R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS, AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

PLUMBING (Continued)

CAUTION

CAUTION

CAUTION: Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.

Never add R-12 to a refrigerant system designed to use R-134a. Damage to the system will result.

R-12 refrigerant oil must not be mixed with R-134a refrigerant oil. They are not compatible.

Do not use R-12 equipment or parts on the R-134a system. Damage to the system will result.

Do not overcharge the refrigerant system. This will cause excessive compressor head pressure and can cause noise and system failure.

Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

The refrigerant system must always be evacuated before charging.

Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. This will prevent contamination in the system.

Before disconnecting a component, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system.

Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug.

Before connecting an open refrigerant fitting, always install a new seal or gasket. Coat the fitting and seal with clean refrigerant oil before connecting.

Do not remove the sealing caps from a replacement component until it is to be installed.

When installing a refrigerant line, avoid sharp bends that may restrict refrigerant flow. Position the refrigerant lines away from exhaust system components or any sharp edges, which may damage the line.

Tighten refrigerant fittings only to the specified torque. The aluminum fittings used in the refrigerant system will not tolerate overtightening.

When disconnecting a refrigerant fitting, use a wrench on both halves of the fitting. This will prevent twisting of the refrigerant lines or tubes.

Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.

Keep service tools and the work area clean. Contamination of the refrigerant system through careless work habits must be avoided.

REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS

Kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all refrigerant system connections are pressure tight.

A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. Sharp bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold. It is a good practice to inspect all flexible refrigerant system hose lines at least once a year to make sure they are in good condition and properly routed.

There are two types of refrigerant fittings:

- All fittings with O-rings need to be coated with refrigerant oil before installation. Use only O-rings that are the correct size and approved for use with R-134a refrigerant. Failure to do so may result in a leak.
- Unified plumbing connections with gaskets cannot be serviced with O-rings. The gaskets are not reusable and new gaskets do not require lubrication before installing.

Using the proper tools when making a refrigerant plumbing connection is very important. Improper tools or improper use of the tools can damage the refrigerant fittings. Always use two wrenches when loosening or tightening tube fittings. Use one wrench to hold one side of the connection stationary, while loosening or tightening the other side of the connection with a second wrench.

The refrigerant must be recovered completely from the system before opening any fitting or connection. Open the fittings with caution, even after the refrigerant has been recovered. If any pressure is noticed as a fitting is loosened, tighten the fitting and recover the refrigerant from the system again.

Do not discharge refrigerant into the atmosphere. Use an R-134a refrigerant recovery/recycling device that meets SAE Standard J2210.

The refrigerant system will remain chemically stable as long as pure, moisture-free R-134a refrigerant and refrigerant oil is used. Dirt, moisture, or air can upset this chemical stability. Operational troubles or serious damage can occur if foreign material is present in the refrigerant system.

When it is necessary to open the refrigerant system, have everything needed to service the system

PLUMBING (Continued)

ready. The refrigerant system should not be left open to the atmosphere any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture. All lines and components in parts stock should be capped or sealed until they are to be installed.

All tools, including the refrigerant recycling equipment, the manifold gauge set, and test hoses should be kept clean and dry. All tools and equipment must be designed for R-134a refrigerant.

DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

If the air conditioning system is not cooling properly, determine if the refrigerant system is fully-charged. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - A/C PERFORMANCE)

An electronic leak detector designed for R-134a refrigerant is recommended for locating and confirming refrigerant system leaks. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

An oily residue on or near refrigerant system lines, connector fittings, components, or component seals can indicate the general location of a possible refrigerant leak. However, the exact leak location should be confirmed with an electronic leak detector prior to component repair or replacement.

To detect a leak in the refrigerant system, perform one of the following procedures:

SYSTEM EMPTY

(1) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(2) Connect and dispense 0.283 kilograms (0.625 pounds or 10 ounces) of R-134a refrigerant into the evacuated refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(3) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(4) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(5) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet. Set the blower motor switch to the lowest speed position, the A/C button in the On position, and select the Recirculation Mode.

SYSTEM LOW

(1) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(2) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run with the air conditioning system turned on for five minutes.

(3) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(4) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet. Set the blower motor switch to the lowest speed position, the A/C button in the On position, and select the Recirculation Mode.

STANDARD PROCEDURE

STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: EYE PROTECTION MUST BE WORN WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED, BEFORE CONNECTING TO OR DISCONNECTING FROM THE REFRIGERANT SYSTEM. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

When servicing the air conditioning system, a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used. Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the

PLUMBING (Continued)

equipment manufacturer for proper care and use of this equipment.

A manifold gauge set may be needed with some recovery/recycling/charging equipment (Fig. 1). The service hoses on the gauge set being used should have manual (turn wheel), or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

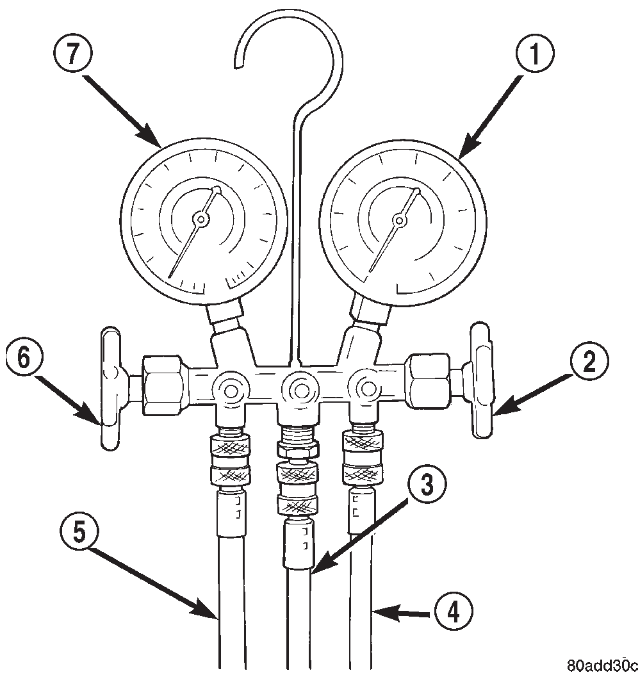


Fig. 1 MANIFOLD GAUGE SET - TYPICAL

1 - HIGH PRESSURE GAUGE
2 - VALVE
3 - VACUUM/REFRIGERANT HOSE (YELLOW W/ BLACK STRIPE)
4 - HIGH PRESSURE HOSE (RED W/ BLACK STRIPE)
5 - LOW PRESSURE HOSE (BLUE W/ BLACK STRIPE)
6 - VALVE
7 - LOW PRESSURE GAUGE

MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

LOW PRESSURE GAUGE HOSE The low pressure hose (Blue with Black stripe) attaches to the suction service port. This port is located on the suction line near the dash panel.

HIGH PRESSURE GAUGE HOSE The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the discharge line between the compressor and the condenser inlet.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE The center manifold hose (Yellow, or White, with Black stripe) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

STANDARD PROCEDURE - REFRIGERANT RECOVERY

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to recover the refrigerant from an R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be charged. If moisture and air enters the system and becomes mixed with the refrigerant, the compressor head pressure will rise above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Evacuating the refrigerant system will remove the air and boil the moisture out of the system at near room temperature. To evacuate the refrigerant system, use the following procedure:

(1) Connect a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 and a manifold gauge set to the refrigerant system of the vehicle.

(2) Open the low and high side valves and start the charging station vacuum pump. When the suction gauge reads 88 kPa (26 in. Hg.) vacuum or greater, close all of the valves and turn off the vacuum pump.

PLUMBING (Continued)

(a) If the refrigerant system fails to reach the specified vacuum, the system has a leak that must be corrected. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS)

(b) If the refrigerant system maintains the specified vacuum for five minutes, restart the vacuum pump, open the suction and discharge valves and evacuate the system for an additional ten minutes.

(3) Close all of the valves, and turn off the charging station vacuum pump.

(4) The refrigerant system is now ready to be charged with R-134a refrigerant. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

After the refrigerant system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - SPECIFICATIONS - CHARGE CAPACITY)

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

PARTIAL CHARGE METHOD

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

The partial charge method is used to add a partial charge to a refrigerant system that is low on refrigerant. To perform this procedure the evaporator inlet and outlet tube temperatures are measured. The temperature difference is measured with a temperature meter with one or two clamp-on thermocouple probes. The difference between the evaporator inlet and outlet tube temperatures will determine the amount of refrigerant needed.

Before adding a partial refrigerant charge, check for refrigerant system leaks. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS) If a leak is found, make the necessary repairs before attempting a full or partial refrigerant charge.

(1) Attach a manifold gauge set to the refrigerant system service ports.

(2) Attach the two clamp-on thermocouple probes to the inlet and outlet tubes of the evaporator coil.

- If a single thermocouple probe is used, attach the probe to the evaporator inlet tube just before the collar of the refrigerant line connector fitting. The probe must make contact with the bottom surface of the evaporator inlet tube.
- If dual thermocouple probes are used, attach probe 1 to the evaporator inlet tube, and probe 2 to the evaporator outlet tube. Attach both probes to the evaporator tubes just before the collar of the refrigerant line connector fittings. The probes must make contact with the bottom surfaces of the evaporator inlet and outlet tubes.

(3) Open all of the windows or doors of the passenger compartment.

(4) Set the A/C button on the A/C Heater controls to the on position, the temperature control knob in the full cool position, select Recirculation Mode, and place the blower motor switch in the highest speed position.

(5) Start the engine and hold the engine idle speed at 1,000 rpm. Allow the engine to warm up to normal operating temperature.

(6) The compressor clutch may cycle, depending upon ambient temperature, humidity, and the refrigerant system charge level.

(7) Hold the engine idle speed at 1,000 rpm.

(8) Allow three to five minutes for the refrigerant system to stabilize, then record the temperatures of the evaporator inlet and outlet tubes.

- If a single probe is used, record the temperature of the evaporator inlet tube. Then remove the probe from the inlet tube and attach it to the evaporator outlet tube just before the collar of the refrigerant line connector fitting. The probe must make contact with the bottom surface of the evaporator outlet tube. Allow the thermocouple and meter time to stabilize, then record the temperature of the evaporator outlet tube. Subtract the inlet tube temperature reading from the outlet tube temperature reading.
- If dual probes are used, record the temperatures of both the evaporator inlet and outlet tubes. Then subtract the inlet tube temperature reading from the outlet tube temperature reading.

(9) If the measured temperature differential is higher than 22° C to 26° C (40° F to 47° F), add 0.4 kilograms (14 ounces) of refrigerant.

PLUMBING (Continued)

(10) Allow three to five minutes for the refrigerant system to stabilize, then take a second set of thermocouple measurements. Record the temperature difference to determine if an additional charge is required.

(11) Record the compressor discharge pressure. If the reading is higher than the pressure shown in the Compressor Discharge Pressure Chart, the system could be overcharged. If the reading is equal to, or lower, than the pressure shown in the chart, continue with this procedure.

Compressor Discharge Pressure Chart						
Ambient Temperature	16°C (60°F)	21°C (70°F)	27°C (80°F)	32°C (90°F)	38°C (100°F)	43°C (110°F)
Compressor Discharge Pressure	1378 kPa (200 psi)	1516 kPa (220 psi)	1723 kPa (250psi)	1930 kPa (280 psi)	2206 kPa (320 psi)	2413 kPa (350 psi)

(12) **EXAMPLE:** The ambient temperature is 21° C (70° F). The evaporator inlet tube temperature is 12° C (54° F) and the evaporator outlet tube temperature is 10° C (50° F). Subtract the inlet tube temperature from the outlet tube temperature. The difference is -2° C (-4° F). With a -2° C (-4° F) temperature differential at 21° C (70° F) ambient temperature, the system is fully charged.

(13) Add enough refrigerant to bring the refrigerant system up to a full charge.

(14) Remove the jumper wire from the low pressure cycling clutch switch wire harness connector and plug the connector back into the switch.

SPECIFICATIONS

CHARGE CAPACITY

The R-134a refrigerant system charge capacity for this vehicle is 0.765 kilograms (1.687 pounds/27 ounces).

A/C COMPRESSOR

DESCRIPTION

DESCRIPTION - A/C COMPRESSOR

The air conditioning system uses a Nippondenso 10PA17 ten cylinder, double-acting swash plate-type compressor on all models. This compressor has a fixed displacement of 170 cubic centimeters (10.374 cubic inches), and has both the suction and discharge ports located on the cylinder head. A label identifying the use of R-134a refrigerant is located on the compressor.

DESCRIPTION - HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor manifold, which is on the side of the compressor. This mechanical valve is designed to vent refrigerant from the system to protect against damage to the compressor and other system components, caused by condenser air flow restriction or an overcharge of refrigerant.

OPERATION

OPERATION - A/C COMPRESSOR

The compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The compressor draws in low-pressure refrigerant vapor from the evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the condenser through the compressor discharge port.

The compressor cannot be repaired. If faulty or damaged, the entire compressor assembly must be replaced. The compressor clutch, pulley, and coil, are available for service.

OPERATION - HIGH PRESSURE RELIEF VALVE

The high pressure relief valve vents the system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The valve closes when a minimum discharge pressure of 2756 kPa (400 psi) is reached.

A/C COMPRESSOR (Continued)

The high pressure relief valve vents only enough refrigerant to reduce the system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the system. If the valve vents refrigerant, it does not mean that the valve is faulty.

The high pressure relief valve is a factory-calibrated unit. The valve cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the compressor assembly.

DIAGNOSIS AND TESTING - COMPRESSOR NOISE

When investigating an air conditioning related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: What sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon belt tension, belts can develop noises that are mistaken for a compressor noise. Improper belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the serpentine drive belt condition and tension as described in Cooling before beginning this procedure.

(1) Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Switch the compressor on and off several times to clearly identify the compressor noise. Listen to the compressor while the clutch is engaged and disengaged. Probe the compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.

(2) Loosen all of the compressor mounting hardware and retighten. Tighten the compressor clutch mounting nut. Be certain that the clutch coil is mounted securely to the compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH - INSTALLATION)

(3) To duplicate a high-ambient temperature condition (high head pressure), restrict the air flow through the condenser. Install a manifold gauge set to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).

(4) Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines for kinks or sharp bends that will restrict refrigerant flow, which can cause noises. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION - REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS)

(5) If the noise is from opening and closing of the high pressure relief valve, reclaim, evacuate, and recharge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)If the high pressure relief valve still does not seat properly, replace the a/c compressor. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL)

(6) If the noise is from liquid slugging on the suction line, check the refrigerant oil level and the refrigerant system charge. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - SPECIFICATIONS - CHARGE CAPACITY).

(7) If the noise continues, replace the compressor and repeat Step 1.

REMOVAL

REMOVAL

The compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the compressor clutch or clutch coil, the engine, the cylinder head, or the generator.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Recover the refrigerant from the system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(2) Disconnect and isolate the battery negative cable.

(3) Remove the serpentine drive belt. Refer to Cooling for the procedures.

(4) Unplug the compressor clutch coil wire harness connector.

A/C COMPRESSOR (Continued)

(5) Remove the (2) refrigerant line retaining bolts that secure the suction line and discharge line to the compressor. Install plugs in, or tape over all of the opened refrigerant fittings.

(6) Remove the bolts that secure the compressor (Fig. 2) or (Fig. 3) and (Fig. 4).

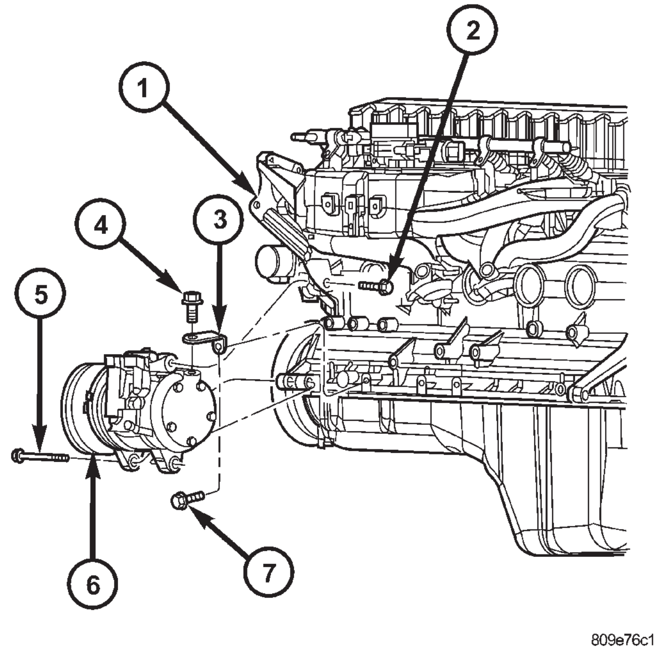


Fig. 2 COMPRESSOR REMOVE/INSTALL - 4.0L ENGINE

1 - POWER STEERING PUMP MOUNTING BRACKET
2 - BOLT
3 - BRACE
4 - BOLT
5 - BOLT
6 - A/C COMPRESSOR
7 - BOLT

(7) Remove the compressor.

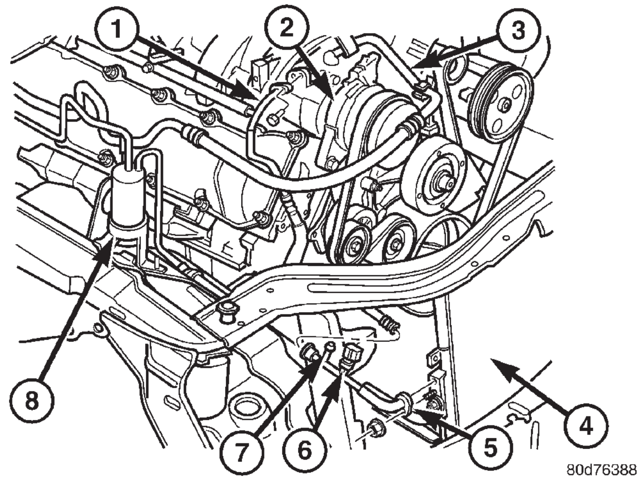


Fig. 3 COMPRESSOR AND A/C LINES - V8

1 - DISCHARGE LINE
2 - A/C COMPRESSOR
3 - SUCTION LINE
4 - A/C/ CONDENSOR
5 - DISCHARGE LINE TO CONDENSOR
6 - A/C PRESSURE TRANSDUCER SWITCH
7 - A/C/ SERVICE PORT
8 - RECEIVER DRIER

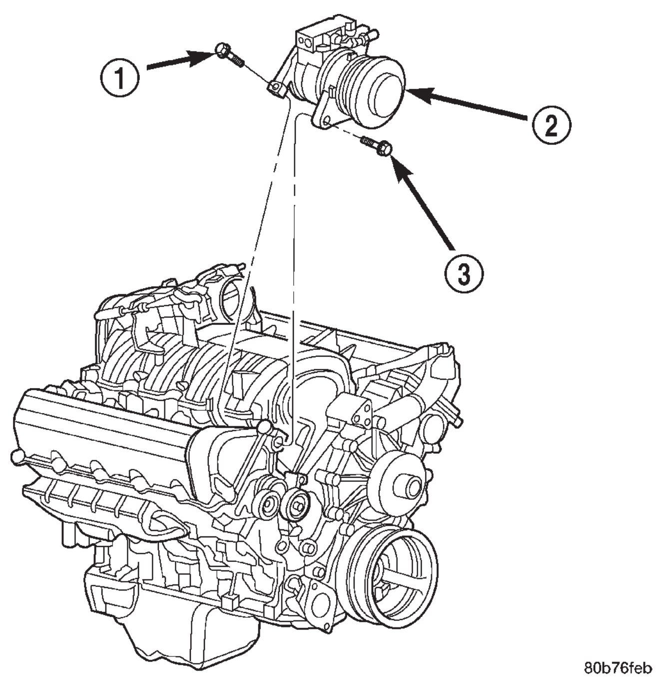


Fig. 4 COMPRESSOR REMOVE/INSTALL - V8 ENGINE - RIGHT VIEW

1 - BOLT
2 - A/C COMPRESSOR
3 - BOLT

A/C COMPRESSOR (Continued)

REMOVAL - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant from the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(3) Remove the accessory drive belt from the compressor clutch. Refer to Cooling for the procedure (Fig. 5).

(4) Raise the vehicle on a hoist.

(5) Remove the front splash shield (if equipped).

(6) Remove the (2) refrigerant line retaining bolts from the compressor. Remove both lines from the compressor and cover all openings.

(7) Disconnect the compressor clutch electrical connector.

(8) Remove the compressor mounting bolts and remove the compressor from the vehicle.

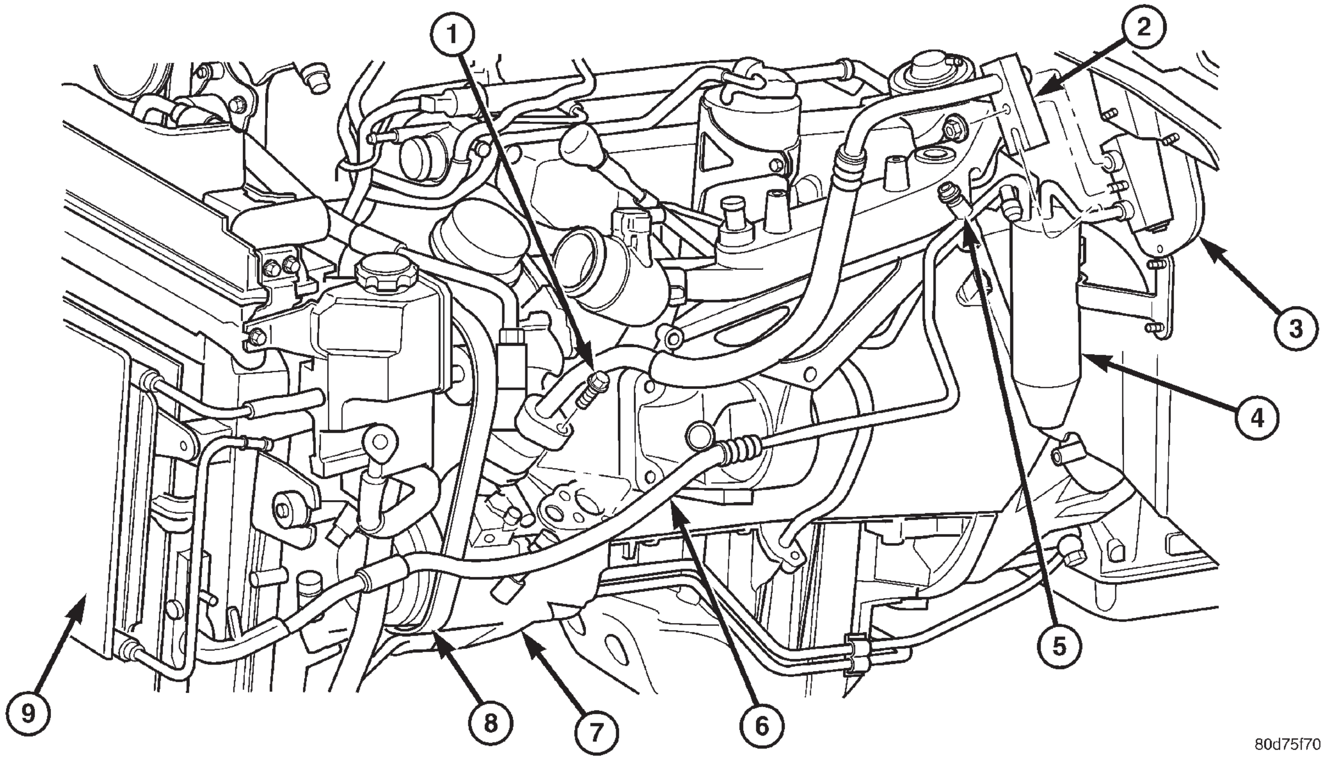


Fig. 5 2.7L Diesel Compressor-RHD (LHD typical)

1 - SUCTION LINE MOUNTING SCREW
2 - SUCTION LINE TO H-BLOCK
3 - H-BLOCK
4 - RECEIVER DRIER
5 - LIQUID LINE SERVICE PORT
6 - LIQUID LINE AND RECEIVER DRIER
7 - A/C COMPRESSOR
8 - A/C COMPRESSOR DRIVE BELT
9 - RADIATOR - CONDENSOR ASSEMBLY

A/C COMPRESSOR (Continued)

INSTALLATION

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

NOTE: If a replacement compressor is being installed, be certain to check the refrigerant oil level. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE) Use only refrigerant oil of the type recommended for the compressor in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - DESCRIPTION)

(1) Install the compressor. Tighten the 4.0L mounting bolts fastening the compressor to the block to 45-65 N·m (35-50 ft. lbs.). Tighten the mounting bolts holding the rear brace to the compressor and block to 40-55 N·m (30-40 ft. lbs.). Tighten the 4.7L compressor front mounting screws to 45-65 N·m (35-50 ft. lbs.), and the rear mounting screws to 35-45 N·m (25-35 ft. lbs.).

(2) Remove the tape or plugs from all of the opened refrigerant line fittings. Install the suction line and discharge line fittings to the manifold on the compressor. Tighten the mounting bolts to 25.4 N·m (225 in. lbs.).

(3) Install the serpentine drive belt. Refer to Cooling for the procedures.

(4) Plug in the compressor clutch coil wire harness connector.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(7) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

INSTALLATION - 2.7L TURBO DIESEL

CAUTION: Check the oil level before installing the new compressor. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE)

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Lift the compressor into position and install the (4) mounting bolts. Torque the bolts to 41 N·m (30 ft. lbs.).

(2) Connect the compressor clutch electrical connector.

(3) Install both refrigerant lines on the compressor. Make certain the sealing 0-rings are free of tears and well lubricated with R-134a refrigerant oil. Torque the line retaining bolts to 22 N·m (200 in. lbs.).

(4) Install the front splash shield (if equipped).

(5) Lower the vehicle from the hoist.

(6) Install the accessory drive belt on the compressor clutch. Refer to Cooling for the procedure.

(7) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING -

A/C COMPRESSOR (Continued)

STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(8) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(9) Connect the negative battery cable.

A/C CONDENSER

DESCRIPTION

The condenser is located in the air flow in front of the engine cooling radiator. The condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the compressor to give up its heat to the air passing over the condenser fins.

OPERATION

When the refrigerant gas gives up its heat, it condenses. When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

CAUTION: Before removing the condenser, note the location of each of the radiator and condenser air seals. These seals are used to direct air through the condenser and radiator. The air seals must be reinstalled in their proper locations in order for the air conditioning and engine cooling systems to perform as designed.

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(3) Remove the screws attaching the grille and headlamp mounting module to the upper crossmember of the vehicle. Refer to Body for this and further steps in the procedure.

(4) Remove the headlamps from their mounts.

(5) Remove the nuts that secure the hood latch and brace to the upper crossmember.

(6) The radiator upper crossmember can be adjusted left or right through the use of its slotted mounting holes. Before removal, mark the original position of the crossmember.

(7) Remove the bolts that secure the radiator to the upper crossmember and set it aside (Fig. 6).

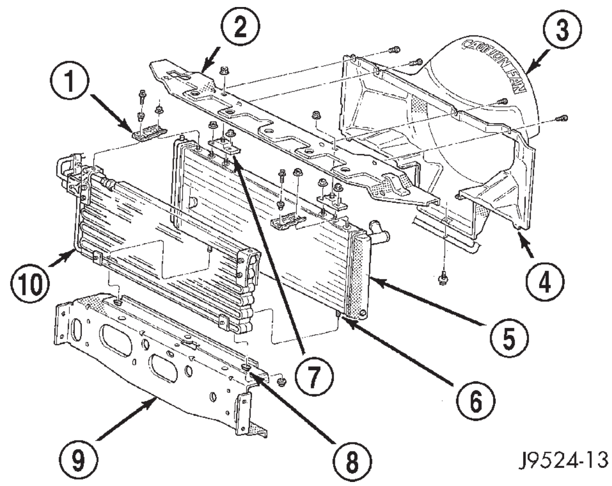


Fig. 6 CONDENSER MOUNTING - TYPICAL

1 - CONDENSER-TO-RADIATOR MOUNTING BRACKETS (2)
2 - UPPER CROSSMEMBER
3 - FAN SHROUD
4 - ALIGNMENT TABS
5 - RADIATOR
6 - ALIGNMENT DOWELS (2)
7 - RUBBER ISOLATORS (2)
8 - RUBBER GROMMETS (2)
9 - LOWER CROSSMEMBER
10 - CONDENSER

(8) Remove the engine air filter inlet duct secured at the headlamp mounting module.

(9) Remove the headlamp mounting module and front fascia for access to the condenser and fittings.

(10) Disconnect the discharge line and liquid line refrigerant line fittings from the condenser. Install plugs in, or tape over all of the opened refrigerant line fittings.

A/C CONDENSER (Continued)

(11) Remove the bolts that secure the upper condenser and transmission cooler.

(12) Carefully lift the condenser out of the vehicle.

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

CAUTION: Before removing the condenser, note the location of each of the radiator and condenser air seals. These seals are used to direct air through the condenser and radiator. The air seals must be reinstalled in their proper locations in order for the air conditioning and engine cooling systems to perform as designed.

(1) Carefully position the condenser in the vehicle.

(2) Install the bolts that secure the upper condenser and transmission cooler.

(3) Remove the tape or plugs from the refrigerant line fittings on the condenser inlet and the discharge line. Connect the discharge line to the condenser inlet. Tighten the retaining nut to 28 N·m (250 in. lbs.).

(4) Remove the tape or plugs from the refrigerant line fittings on the condenser outlet and the liquid line. Connect the liquid line to the condenser outlet. Tighten the retaining nut to 28 N·m (250 in. lbs.).

(5) Install the headlamp mounting module and front fascia. Refer to Body for the procedure.

(6) Install the engine air filter inlet duct.

(7) Install the bolts that secure the radiator to the upper crossmember.

(8) Install the nuts that secure the hood latch and brace to the upper crossmember.

(9) Install the headlamps in their mounts.

(10) Install the screws attaching the grille and headlamp mounting module to the upper crossmember of the vehicle. Refer to Body for this and further steps in the procedure.

(11) Evacuate and Recharge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(12) Connect the battery negative cable.

NOTE: If the condenser is replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/REFRIGERANT OIL - DESCRIPTION)

A/C DISCHARGE LINE

REMOVAL

REMOVAL - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Disconnect and isolate the negative battery cable.

(2) Recover the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(3) Remove both headlamps from the vehicle. Refer to Lamps/Lighting for the procedure.

(4) Remove the a/c high pressure transducer(Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C PRESSURE TRANSDUCER - REMOVAL).

(5) Remove the front fascia from the vehicle. Refer to Front Fascia for the procedure (Fig. 7).

(6) Remove the refrigerant line retaining fastener from the condenser inlet fitting. Remove the line and cap the condenser inlet tube to prevent contamination of the system.

A/C DISCHARGE LINE (Continued)

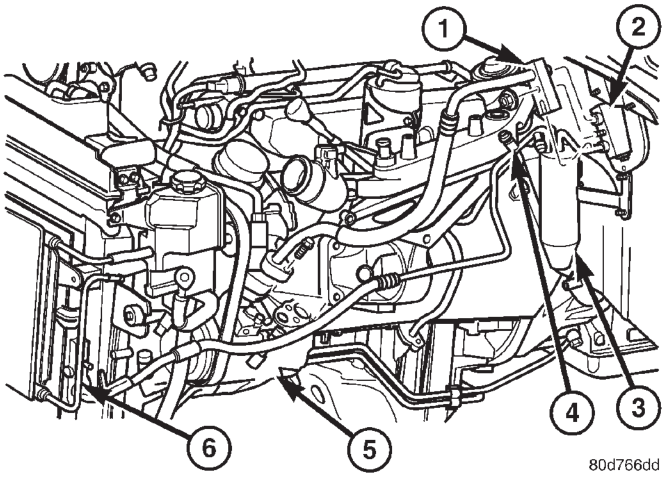


Fig. 7 Suction-Discharge Lines- RHD (LHD-typical)

1 - SUCTION LINE
2 - H-BLOCK
3 - RECEIVER DRIER
4 - DISCHARGE LINE & SERVICE PORT
5 - A/C COMPRESSOR
6 - DISCHARGE LINE & CONDENSOR CONNECTION

(7) Raise the vehicle on a hoist.

(8) Remove the front splash shield (if equipped).

(9) Remove the refrigerant line retaining fastener from the compressor outlet fitting. Remove the line and cap the compressor outlet opening to prevent contamination of the system.

(10) Unclip and remove the discharge line from the vehicle.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(3) Remove the a/c high pressure transducer(Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C PRESSURE TRANSDUCER - REMOVAL).

(4) Disconnect the discharge line from the condenser inlet. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Remove the bolt that secures the discharge line fitting to compressor. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Remove the discharge line assembly from the vehicle.

INSTALLATION

INSTALLATION - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Carefully position the discharge line in the vehicle.

(2) Remove the cap and install the discharge line on the compressor. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 22 N·m (200 in. lbs.).

(3) Install the front splash shield (if equipped).

(4) Lower the vehicle from the hoist.

(5) Remove the cap and install the discharge line on the condenser. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).

(6) Install the front fascia on the vehicle. Refer to Front Fascia for the procedure.

(7) Install both headlamps in the vehicle. Refer to Lamps/Lighting for the procedure.

(8) Install the a/c high pressure transducer, and connect the electrical connector(Refer to 24 - HEAT-

A/C DISCHARGE LINE (Continued)

ING & AIR CONDITIONING/CONTROLS/A/C PRESSURE TRANSDUCER - INSTALLATION).

(9) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(10) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(11) Connect the negative battery cable.

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Remove the tape or plugs from the discharge line block fitting and the manifold on the compressor. Install the discharge line block fitting to the manifold on the compressor. Tighten the mounting bolt to 25.4 N·m (225 in. lbs.).

(2) Remove the tape or plugs from the refrigerant line fittings on the condenser inlet and the discharge line. Connect the discharge line to the condenser inlet. Tighten the retaining nut to 28 N·m (250 in. lbs.).

(3) Install the a/c high pressure transducer(Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C PRESSURE TRANSDUCER - INSTALLATION).

(4) Connect the battery negative cable.

(5) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(6) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

A/C EXPANSION VALVE

DESCRIPTION

The “H” valve type thermal expansion valve (TXV) is located at the front of the heater-A/C housing between the liquid and suction lines and the evaporator coil.

The expansion valve is a factory calibrated unit and cannot be adjusted or repaired. If faulty or damaged, the expansion valve must be replaced.

OPERATION

High-pressure, high temperature liquid refrigerant from the liquid line passes through the expansion valve orifice, converting it inot a low-pressure, low-temperature mixture of liquid and gas before it enters the evaporator coil. A temperature sensor in the expansion valve control head monitors the temperature of the refrigerant leaving the evaporator coil throught the suction line, and adjusts the orifice size at the liquid line to let the proper amoount of refrigerant into the evaporator coil to meet the vehicle cooling requirements. Controlling the refrigerant flow through the evaporator ensures that none of the refrigerant leaving the evaporator is still in a liquid state, which could damage the compressor.

DIAGNOSIS AND TESTING - A/C EXPANSION VALVE

The expansion valve is located on the engine side of the dash panel near the shock tower.

The expansion valve can fail in three different positions (open, closed or restricted).

In an Open Position: this will result in a noisy compressor or no cooling. The cause can be broken spring, broken ball or excessive moisture in the A/C system. If the spring or ball are found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system, recycle the refrigerant.

In a Closed Position: There will be low suction pressure and no cooling. This may be caused by a failed power dome or excessive moisture in the A/C system. If the power dome on the expansion valve is found to be defective replace the expansion valve. If excessive moisture is found recycle the refrigerant.

A Restricted Orifice: There will be low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be the cause, recycle the refrigerant and replace the expansion valve and the receiver/drier.

A/C EXPANSION VALVE (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the A/C system-(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(3) Disconnect the the A/C lines from the expansion valve. Cap or tape over the open A/C lines.

(4) Remove the lines from the expansion valve(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - REMOVAL), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - REMOVAL), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C DISCHARGE LINE - REMOVAL) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C DISCHARGE LINE - REMOVAL).

(5) Remove the expansion valve retainer screw from the expansion valve.

(6) Remove the expansion valve.

(7) Remove the expansion valve gasket.

INSTALLATION

(1) Install a NEW gasket and install the eapansion valve to the evaporator.

(2) Install the expansion valve bolts and tighten to 11 N·m (100 in. lbs.).

(3) Install NEW seals on the A/C lines and install the lines to the expansion valve(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C DISCHARGE LINE - INSTALLATION), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C DISCHARGE LINE - INSTALLATION), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - INSTALLATION) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - INSTALLATION).

(4) Evacuate the A/C system(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(5) Recharge the A/C system(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(6) Connect the battery negative cable.

LIQUID LINE

REMOVAL

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) The liquid line is serviced as an integral part of the receiver/drier assembly(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER / DRIER - REMOVAL) or (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER / DRIER - REMOVAL).

REMOVAL - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) The liquid line is service as an integral part of the receiver/drier assembly(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER / DRIER - REMOVAL).

INSTALLATION

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) The liquid line is serviced as an integral part of the receiver/drier assembly(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER / DRIER - INSTALLATION) or (Refer to 24 - HEAT-

LIQUID LINE (Continued)

ING & AIR CONDITIONING/PLUMBING/RECEIVER / DRIER - INSTALLATION).

INSTALLATION - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) The liquid line is serviced as an integral part of the receiver/drier bottle assembly(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER / DRIER - INSTALLATION).

SUCTION LINE

REMOVAL

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(3) Remove the retainer nut from the evaporator connection (Fig. 8) or (Fig. 9).

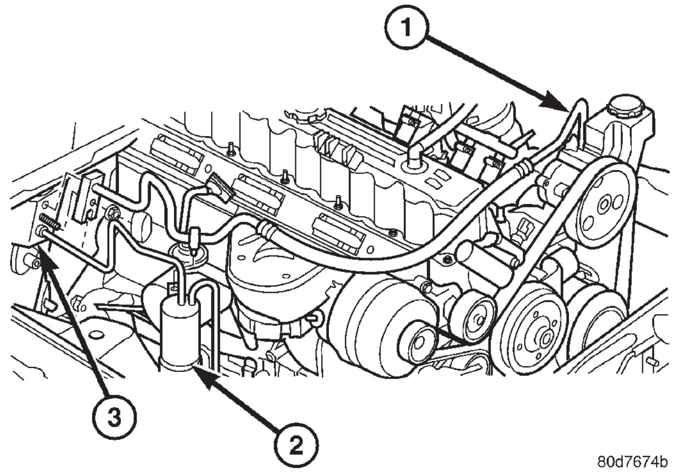


Fig. 8 SUCTION LINE - I-6

1 - SUCTION LINE
2 - RECEIVER DRIER- LIQUID LINE
3 - H-BLOCK

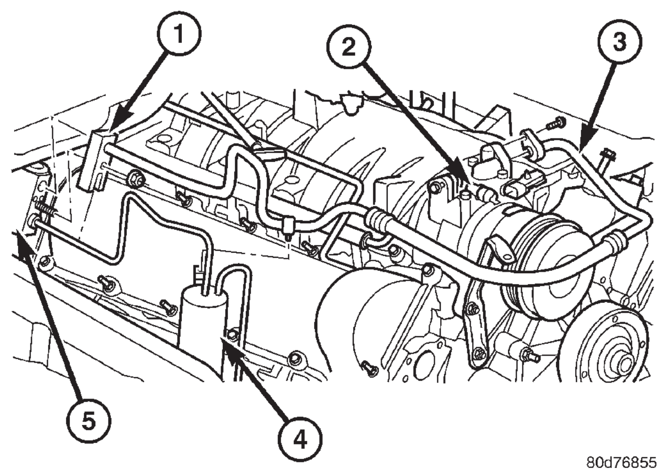


Fig. 9 V-8 Suction Line

1 - SUCTION LINE TO H-BLOCK
2 - A/C COMPRESSOR
3 - SUCTION LINE TO COMPRESSOR
4 - RECEIVER DRIER ASSEMBLY
5 - H-BLOCK

(4) Slide the suction line off the stud and liquid line. Install plugs in, or tape over all the opened refrigerant line fittings. Remove from clip.

(5) Remove the bolt that secures the suction line fitting to compressor. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Remove the suction line assembly from the vehicle.

SUCTION LINE (Continued)

REMOVAL - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

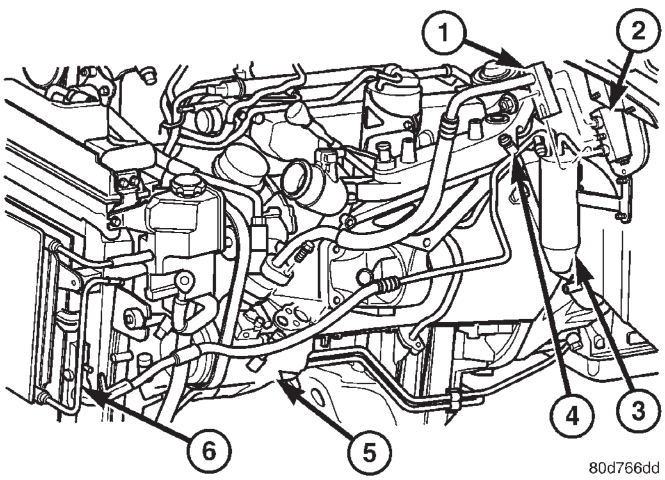


Fig. 10 Suction-Discharge Lines- RHD (LHD-typical)

1 - SUCTION LINE
2 - H-BLOCK
3 - RECEIVER DRIER
4 - DISCHARGE LINE & SERVICE PORT
5 - A/C COMPRESSOR
6 - DISCHARGE LINE & CONDENSOR CONNECTION

(3) Remove the refrigerant line retaining fastener from the H-Valve Block (Fig. 10). Remove the line and gasket from the H-Valve block and cap or tape over both ends.

(4) Remove the refrigerant line support bracket bolt from the cylinder head cap.

(5) Remove the refrigerant line retaining fastener from the compressor inlet fitting. Remove the line and cap the compressor outlet tube to prevent contamination of the system.

(6) Unclip and remove the suction line from the vehicle.

INSTALLATION

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Remove the tape or plugs from the suction line block fitting and the manifold on the compressor. Install the suction line block fitting to the manifold on the compressor. Tighten the mounting bolt to 25.4 N·m (225 in. lbs.).

(2) Remove the tape or plugs from the refrigerant line fittings on the evaporator outlet and the suction line. Slide the suction line copnnection block over the liquid line and evaporator stud. Tighten the retaining nut to 28 N·m (250 in. lbs.).

(3) Connect the battery negative cable.

(4) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(5) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

SUCTION LINE (Continued)

INSTALLATION - 2.7L TURBO DIESEL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Carefully position the suction line in the vehicle.

(2) Remove the cap or tape and install the suction line on the compressor. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 22 N·m (200 in. lbs.).

(3) Position and install the refrigerant line support bracket bolt on the cylinder head cap. Torque the bolt to 20 N·m (177 in. lbs.).

(4) Remove the cap or tape and install the suction line on the H-Valve Block. Be certain the sealing O-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).

(5) Install the tie-straps retaining the wire harness on the suction line.

(6) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(7) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(8) Connect the negative battery cable.

A/C EVAPORATOR

DESCRIPTION

The evaporator coil is located in the HVAC housing, under the instrument panel. The evaporator coil is positioned in the HVAC housing so that all air that enters the housing must pass over the fins of the evaporator before it is distributed through the system ducts and outlets. However, air passing over the evaporator coil fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator coil tubes.

OPERATION

Refrigerant enters the evaporator from the orifice tube as a low-temperature, low-pressure liquid. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas before it leaves the evaporator.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Remove and disassemble the HVAC housing. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY)

(2) Lift the evaporator coil unit out of the lower half of the HVAC housing (Fig. 11).

A/C EVAPORATOR (Continued)

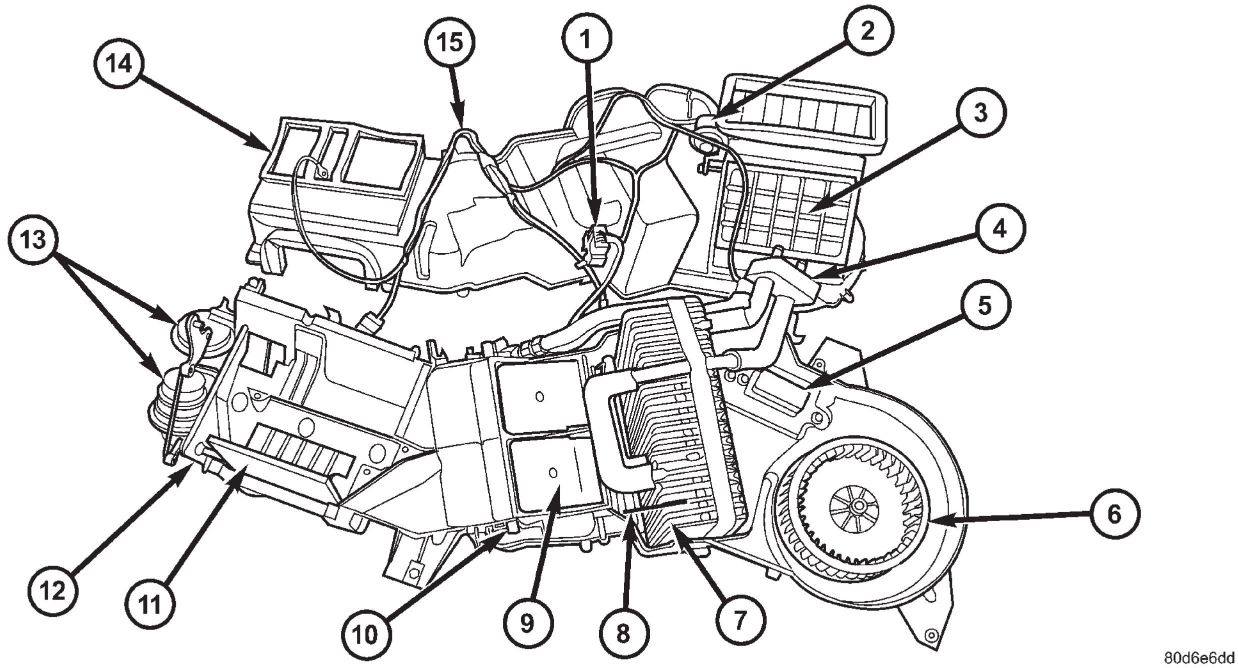


Fig. 11 HVAC HOUSING- CASE SEPARATED

1 - ELECTRICIAL CONNECTORS
2 - VACUUM ACTUATOR
3 - RECIRCULATION DOOR
4 - THERMAL EXPANSION VALVE
5 - BLOWER MOTOR RESISTOR/CONTROLLER
6 - BLOWER WHEEL
7 - EVAPORATOR AND TUBES
8 - FIN SENSOR PROBE
9 - BLEND DOOR
10 - PIVOT SHAFT (MOTOR REMOVED)
11 - PANEL/OUTLET DOOR
12 - LOWER HOUSING
13 - VACUUM ACTUATORS
14 - UPPER HOUSING
15 - VACUUM HARNESS

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Install the evaporator coil in the bottom half of the HVAC housing. Be certain that the evaporator foam insulator wrap is reinstalled.

(2) Reassemble the HVAC housing and install in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY) (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION)

NOTE: If the evaporator is replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system.

HEATER CORE

DESCRIPTION

The heater core is located in the HVAC housing, under the instrument panel. It is a heat exchanger made of rows of tubes and fins.

OPERATION

Engine coolant is circulated through heater hoses to the heater core at all times. As the coolant flows through the heater core, heat removed from the engine is transferred to the heater core fins and tubes. Air directed through the heater core picks up the heat from the heater core fins. The temperature control door allows control of the heater output air temperature by controlling how much of the air flowing through the HVAC housing is directed through the heater core. The blower motor speed controls the volume of air flowing through the HVAC housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced. Refer to Cooling for more information on the engine cooling system, the engine coolant and the heater hoses.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Remove the HVAC housing from the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - REMOVAL)

(2) Remove the foam gasket surrounding the core tubes.

NOTE: Notice the orientation of the irregularly shaped gasket on the tubes. The gasket must be placed correctly to ensure proper sealing against the body during reinstallation.

(3) Remove the screws and retainers that secure the heater core and tubes to the HVAC housing (Fig. 12).

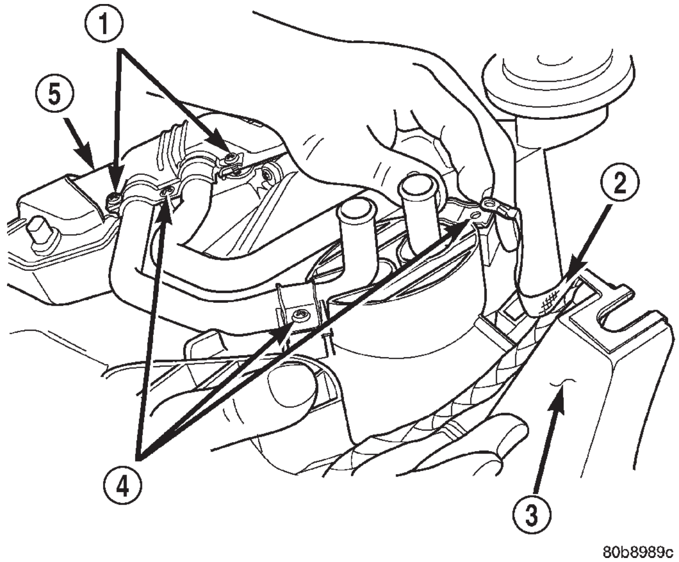


Fig. 12 HEATER CORE, TUBES, AND RETAINERS

1 - TUBE-TO-CORE CLAMPS
2 - GROUND STRAP
3 - HVAC HOUSING
4 - TUBE RETAINERS AND SCREWS
5 - HEATER CORE

(4) Remove the mode door actuator if necessary, for clearance to remove the core.

(5) Lift the heater core straight up and out of the HVAC housing (Fig. 13).

(6) When replacing individual tubes, loosen and remove the round tube-to-core clamp, and pull tube from core.

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is

HEATER CORE (Continued)

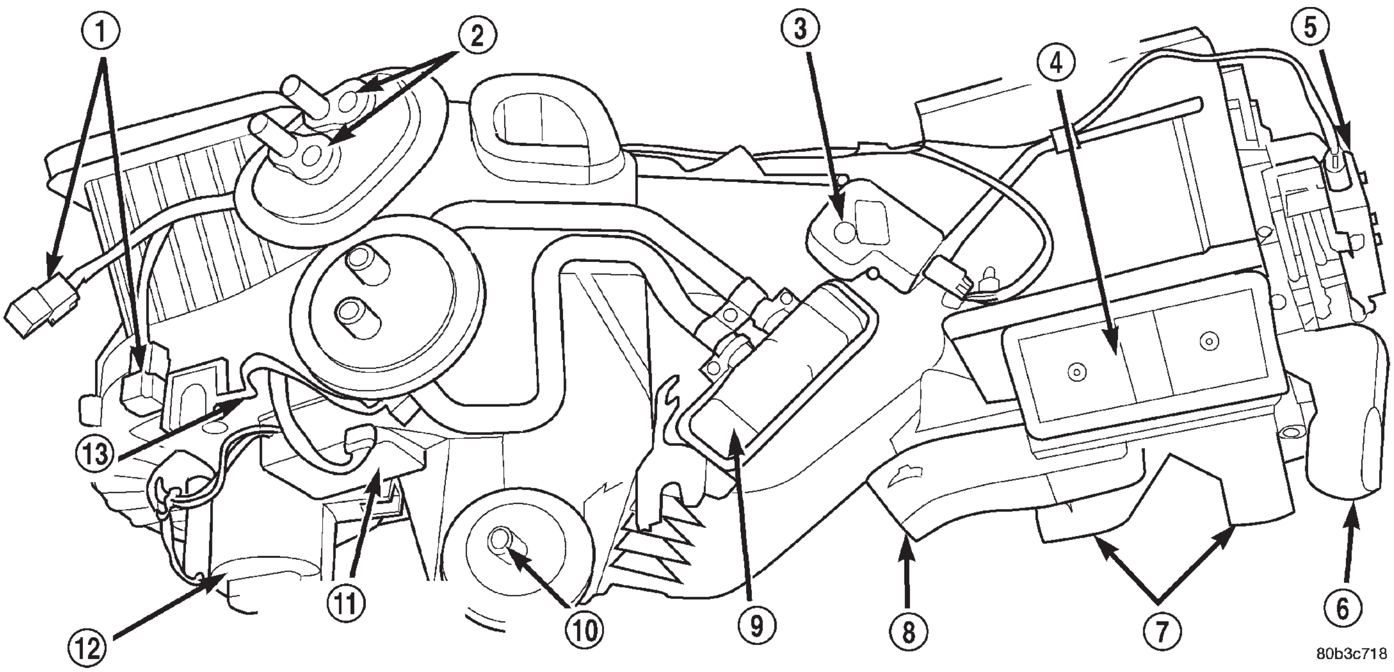


Fig. 13 HEATER CORE AND TUBES - (Typical)

1 - ELECTRICAL CONNECTORS
2 - EXPANSION VALVE
3 - ELECTRIC ACTUATOR
4 - OUTLET TO DEFROSTER DUCTS
5 - ELECTRIC ACTUATOR
6 - FLOOR DUCT
7 - TO REAR PASSENGER FLOOR AIR DUCTS
8 - FLOOR DUCT
9 - HEATER CORE AND TUBES
10 - HOUSING DRAIN
11 - BLOWER MOTOR RESISTOR/CONTROLLER
12 - BLOWER MOTOR
13 - GROUND STRAP

pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) When installing individual tubes, insert tube into core ensuring that tube O-ring is seated in core and not pinched. Hold tube in seated position while installing the round tube-to-core clamp (Fig. 14).

NOTE: The round tube-to-heater-core clamp should be left loose enough to turn the tube in the core. Position the core in the housing, and then tighten the tube-to-heater-core clamp after orienting the tubes to the molded HVAC housing.

(2) Lower the heater core into the HVAC housing.

(3) Install the mode door actuator, if removed from housing for core removal.

(4) Position the retainers over the heater core tubes. Install and tighten the screws that secure the heater core and retainers to the HVAC housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

NOTE: The grounding strap is to be attached to the lower heater core tube retainer.

(5) Reinstall the HVAC housing to the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/ DISTRIBUTION/HVAC HOUSING - INSTALLATION)

RECEIVER / DRIER

DESCRIPTION

The receiver/drier is mounted in the engine compartment between the condenser and is part of the liquid line assembly. The filter/drier cannot be repaired, if the filter/drier is faulty, damaged, left open to the atmosphere or contaminated the line assembly must be replaced.

OPERATION

The filter-drier performs a filtering action to prevent foreign material in the refrigerant from contaminating the expansion valve. A desiccant bag is mounted inside the filter-drier canister to absorb any

RECEIVER / DRIER (Continued)

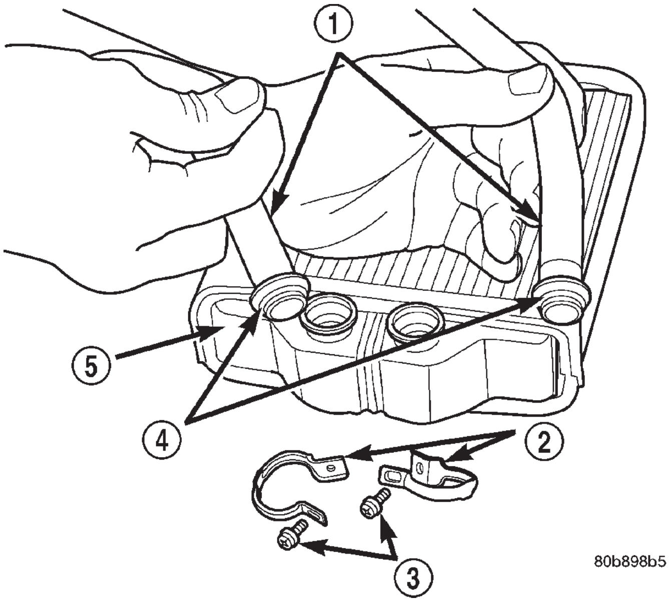


Fig. 14 HEATER CORE, TUBES, AND O-RINGS

1 - HEATER CORE TUBES
2 - TUBE-TO-CORE CLAMPS
3 - SCREWS
4 - O-RINGS
5 - HEATER CORE

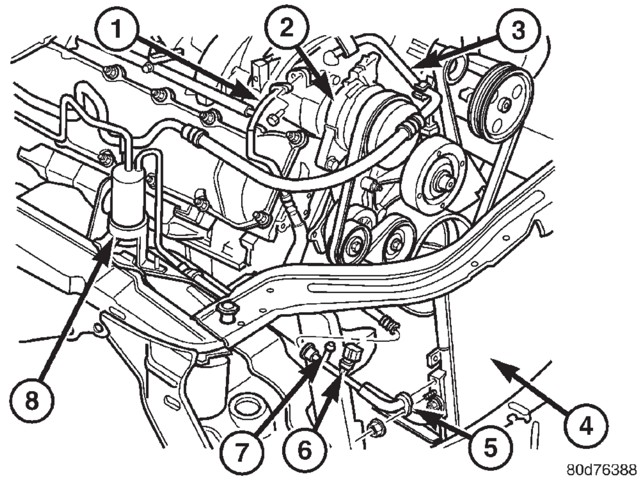


Fig. 15 COMPRESSOR AND A/C LINES - V8

1 - DISCHARGE LINE
2 - A/C COMPRESSOR
3 - SUCTION LINE
4 - A/C/ CONDENSOR
5 - DISCHARGE LINE TO CONDENSOR
6 - A/C PRESSURE TRANSDUCER SWITCH
7 - A/C/ SERVICE PORT
8 - RECEIVER DRIER

moisture which may have netered and become trapped within the refrigerant system. In addition, during periods of high demand air conditioner operation, the filter-drier acts as a reservoir to store surplus refrigerant. Refrigerant enters the filter-drier as a high-pressure, low-temperature liquid.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Recover the refrigerant from the refrigerant system(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Remove the battery and the battery tray(Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL) and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).

(3) Remove the screw from the receiver/drier bracket (Fig. 15) or (Fig. 16).

(4) Remove the retaining nut from the evaporator connection and then slide the suction line off the stud and liquid line.

(5) Remove the receiver/drier bracket from the stud and disconnect the liquid line from the evaporator inlet. Install plugs in or tape over all of the evaporator connection openings and opened refrigerant line fittings.

(6) Disconnect the liquid line from the condenser outlet. Install plugs in, or tape over all of the opened refrigerant line fittings.

(7) Remove liquid line assembly.

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to

RECEIVER / DRIER (Continued)

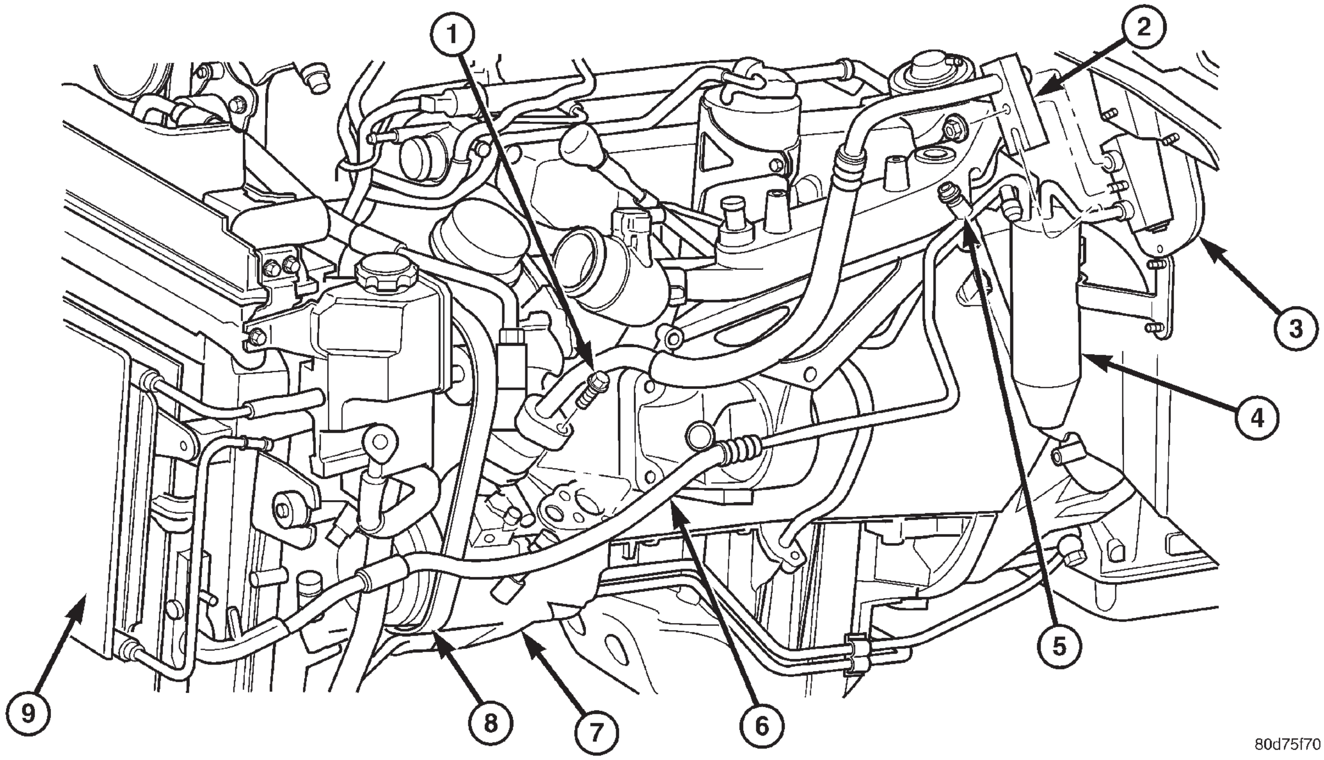


Fig. 16 2.7L Diesel Compressor-RHD (LHD typical)

1 - SUCTION LINE MOUNTING SCREW
2 - SUCTION LINE TO H-BLOCK
3 - H-BLOCK
4 - RECEIVER DRIER
5 - LIQUID LINE SERVICE PORT
6 - LIQUID LINE AND RECEIVER DRIER
7 - A/C COMPRESSOR
8 - A/C COMPRESSOR DRIVE BELT
9 - RADIATOR - CONDENSOR ASSEMBLY

inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

(1) Remove the tape or plugs from the refrigerant line fittings on the condenser outlet and the condenser end of the liquid line. Connect the liquid line to the condenser outlet. Tighten the retaining nut to 20.16 N·m (180 in. lbs.).

(2) Remove the tape or plugs from the refrigerant line fittings on the evaporator end of the liquid line and the evaporator inlet. Place the receiver/drier bracket on the stud and connect the liquid line to the evaporator inlet.

(3) Remove the tape or plugs from the suction line and evaporator outlet. Slide the suction line connection block on the liquid line on the evaporator connection stud. Tighten the retaining nut to 20.16 N·m (180 in. lbs.).

(4) Insert a screw for the receiver/drier bracket and hand turn three turns. Tighten the screw to 10.64 N·m (95 in. lbs.).

(5) Install the battery tray and the battery(Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION) and (Refer to 8 - ELECTRICAL/ BATTERY SYSTEM/BATTERY - INSTALLATION).

(6) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(7) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

NOTE: If the receiver/drier is replaced, add 120 milliliters (4 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/REFRIGERANT OIL - DESCRIPTION)

REFRIGERANT

DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

OPERATION

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service technicians that the air conditioning system is equipped with R-134a.

REFRIGERANT OIL

DESCRIPTION

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The 10PA17 compressor used in this vehicle is designed to use an ND8 PAG refrigerant oil. Use only refrigerant oil of this same type to service the refrigerant system.

OPERATION

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause compressor damage, and too much can reduce air conditioning system performance.

PAG refrigerant oil is much more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

STANDARD PROCEDURE - REFRIGERANT OIL LEVEL

When an air conditioning system is assembled at the factory, all components except the compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the compressor is dispersed throughout the refrigerant system. The accumulator, evaporator, condenser, and compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of oil in the refrigerant system. This ensures proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling capacity of the air conditioning system.

It will not be necessary to check the oil level in the compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when a accumulator, evaporator coil, or condenser are replaced. See the Refrigerant Oil Capacities chart. When a compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

Refrigerant Oil Capacities		
Component	ml	fl oz
A/C System	130	4.40
Receiver Drier	70	2.37
Condenser	10	0.34
Evaporator	50	1.69
Compressor	drain and measure the oil from the old compressor - see text.	

VISCOUS HEATER

DESCRIPTION

DESCRIPTION

The diesel engine has an engine mounted mechanical device called a Viscous Heater that is used to heat the coolant coming from the engine to the heater core. The Viscous Heater is driven by the engine fan belt and has a electro-mechanical clutch which is controlled by the HVAC control unit.

DESCRIPTION - VISCOUS HEATER CLUTCH

The basic viscous heater clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly and a clutch plate. The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings (Fig. 17). The clutch plate is keyed to the viscous heater shaft and secured with a nut. These components provide the means to engage and disengage the viscous heater from the engine accessory drive belt.

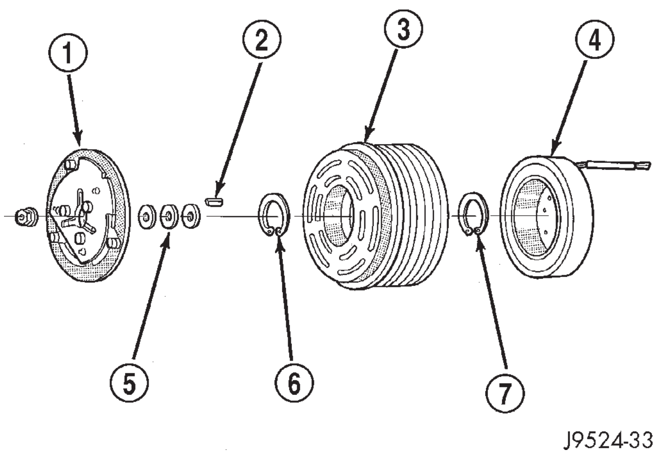


Fig. 17 CLUTCH ASSEMBLY- typical

1 - CLUTCH PLATE
2 - SHAFT KEY
3 - PULLEY
4 - COIL
5 - CLUTCH SHIMS
6 - SNAP RING
7 - SNAP RING

OPERATION

OPERATION - VISCOUS HEATER

The Viscous Heater is driven by the engine fan belt. The Viscous Heater has an electro-mechanical clutch that receives a signal from the HVAC control head and the Viscous Heater controller that energizes and engages the clutch. Once engaged the clutch allows the Viscous Heater to increase the temperature of the coolant flowing to the heater core, which provides heat the passenger compartment quicker than normal engines without the Viscous Heater. The Viscous Heater generates heat by means of friction which heats a special Silicon Oil within its housing which is then transferred to the engine coolant when the coolant passes over fins within the pump. Please note that the coolant is isolated from the silicon oil within the pump housing. When demand for passenger compartment heat decreases the Viscous Heater clutch will receive an input from the Viscous heater controller to disengage.

OPERATION - VISCOUS HEATER CLUTCH

When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the viscous heater shaft. When the coil is not energized the pulley freewheels on the clutch hub bearing, which is part of the pulley. The viscous heater clutch and coil are the only serviced parts on the viscous heater assembly. If the viscous heater is inoperative or damaged the entire assembly must be replaced. The viscous heater clutch engagement is controlled by several components: the viscous heater controller, the engine powertrain control module and the HVAC control head.

REMOVAL

REMOVAL - VISCOUS HEATER

(1) Drain the engine coolant(Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

(2) Remove the engine accessory drive belt(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove the heater hose clamps at the Viscous Heater.

(4) Remove the heater hoses from the Viscous Heater.

(5) Unplug the Viscous Heater clutch electrical connector.

(6) Remove the bolts holding the Viscous Heater to the mounting bracket.

(7) Remove the Viscous Heater from the vehicle.

REMOVAL - VISCOUS HEATER CLUTCH

(1) The viscous heater clutch can be serviced in the vehicle and the cooling system does not have to be drained.

(2) Disconnect and isolate the battery negative cable.

(3) Remove the serpentine drive belt(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

VISCOUS HEATER (Continued)

(4) Unplug the clutch coil wire harness connector.

(5) Remove the bolts that secure the viscous heater to the mounting bracket.

(6) Remove the viscous heater from the mounting bracket. Support the viscous heater in the engine compartment while servicing the clutch.

(7) Insert the two pins of the spanner wrench (special Tool C-4489 or equivalent) into the holes of the clutch plate. Hold the clutch plate stationary and remove the hex nut (Fig. 18).

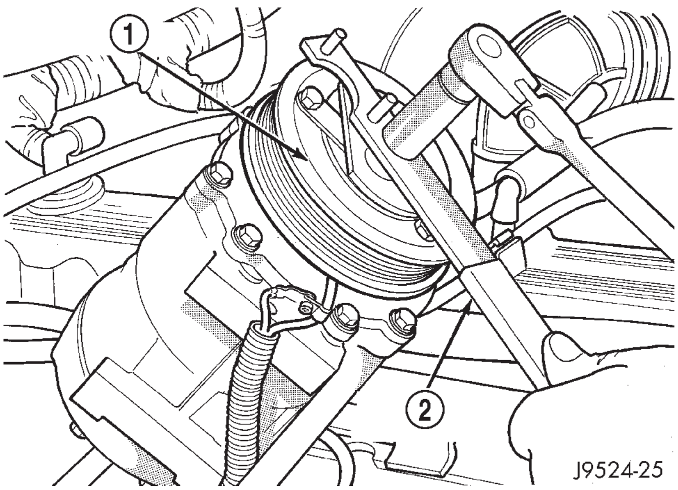


Fig. 18 CLUTCH NUT REMOVE-typical

1 - CLUTCH PLATE
2 - SPANNER

(8) Remove the clutch plate.

(9) Remove the clutch shims.

(10) Remove the external front housing snap ring with snap ring pliers (Fig. 19).

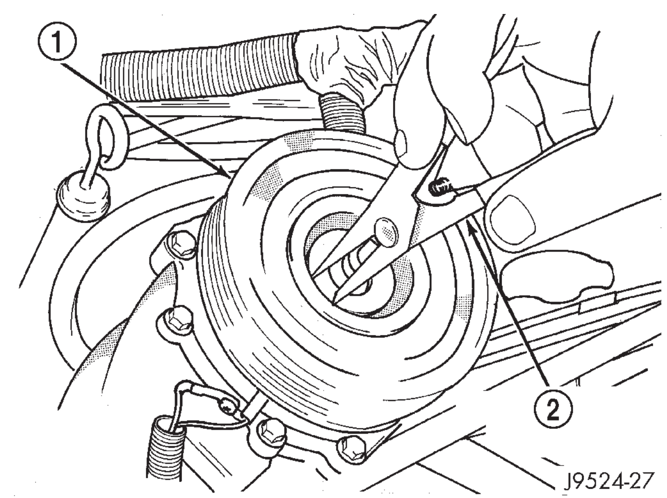


Fig. 19 EXTERNAL SNAP RING REMOVE- typical

1 - PULLEY
2 - SNAP RING PLIERS

(11) Install the lip of the rotor puller (Special Tool C-6141–1 or equivalent) into the snap ring groove exposed in the previous step, and install the shaft protector (Special Tool C-6141–2 or equivalent) (Fig. 20).

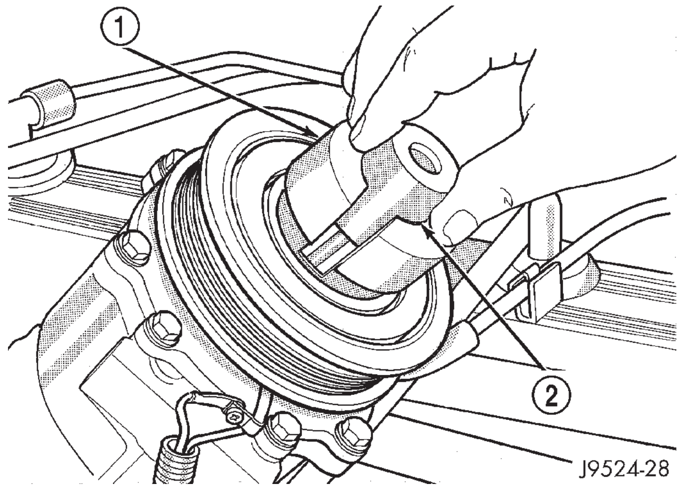


Fig. 20 SHAFT PROTECTOR AND PULLER- typical

1 - PULLER JAW
2 - SHAFT PROTECTOR

(12) Install the puller through bolts (Special Tool C-6461 or equivalent) through the puller flange and into the jaws of the rotor puller and tighten. Turn the puller center bolt clockwise until the rotor is free (Fig. 21).

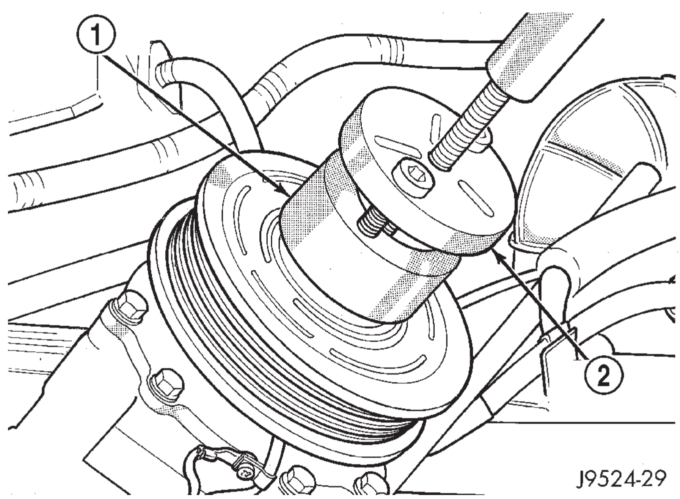


Fig. 21 INSTALL PULLER PLATE- typical

1 - PULLER JAW
2 - PULLER

(13) Remove the screw and retainer from the clutch coil lead wire harness on the viscous heater housing.

VISCOUS HEATER (Continued)

(14) Remove the snap ring from the hub and remove the clutch field coil (Fig. 22). Slide the clutch field coil off of the hub.

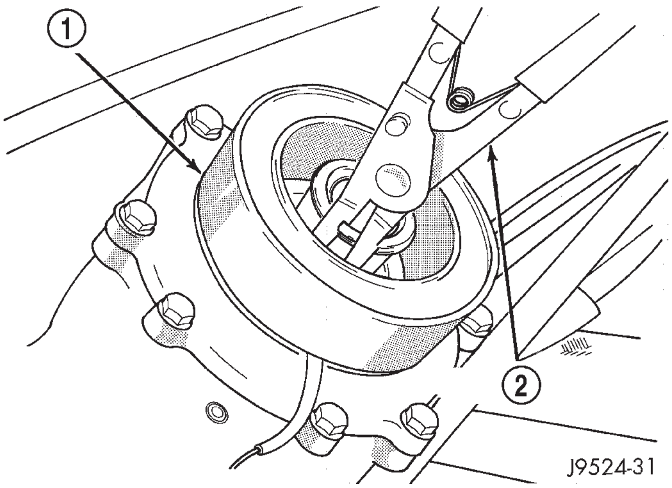


Fig. 22 CLUTCH FIELD COIL SNAP RING REMOVE-typical

1 - COIL
2 - SNAP RING PLIERS

INSTALLATION

INSTALLATION

(1) Install Viscous Heater to engine mounting bracket.
(2) Install the Viscous Heater mounting bolts and tighten to 33 N·m (25 ft. lbs.).
(3) Plug the wiring harness electrical connector to the Viscous Heater clutch.
(4) Install heater hoses to the Viscous Heater connections.
(5) Install heater hose clamps to Viscous Heater connections.
(6) Install the engine accessory drive belt(Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(7) Refill the engine cooling system(Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
(8) Reconnect the battery negative cable.
(9) Operate vehicle and check for any coolant leaks, repair as required.

INSTALLATION - VISCOUS HEATER CLUTCH

(1) Install the clutch field coil and snap ring.
(2) Install the screw and retainer on the clutch coil lead wire harness on the viscous heater housing. Tighten the screw to 2.2 N·m (20 in. lbs.)
(3) Align the rotor assembly squarely on the front housing hub.
(4) Install the rotor bearing asembly with the installer (Special Tool C-6871 or equalivent). Thread the installer on the shaft, then turn the nut until the rotor asembly is seated.
(5) Install the external front housing snap ring with snap ring pliers. The bevel side of the snap ring must be facing outward. Press the snap ring to make sure it is properly seated in the groove.

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(6) Install the original clutch shims on the shaft.
(7) Install the clutch plate. Install the shaft hex nut and tighten to 15–20 N·m (11–15 ft. lbs.).

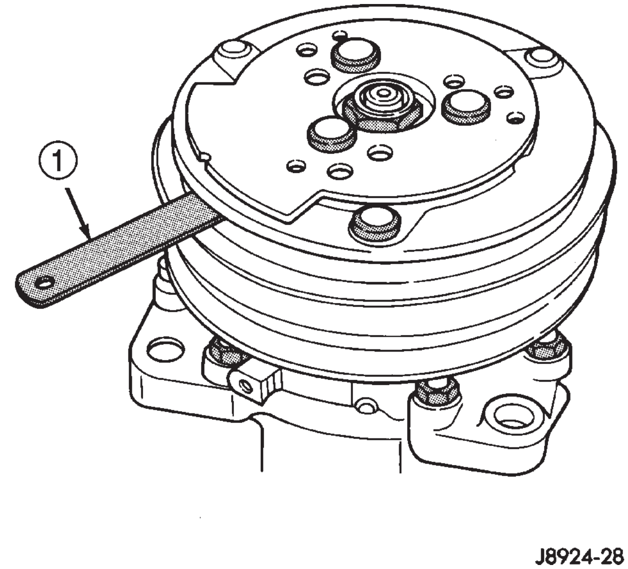


Fig. 23 CHECK CLUTCH AIR GAP-typical

1 - FEELER GAUGE

(8) Check the clutch air gap with a feeler gauge (Fig. 23). If the gap does not meet specification, add or substract shims as required. The air gap specification if 0.41 to 0.79 millimeters (0.016 to 0.031 inches).

NOTE: The air gap is determined by the spacer shims. When installing an original, or a new clutch assembly, try the original shims first. When installing a new clutch (and not having the old shims available) use a 1.0, 0.50 and 0.13 millimeter (0.040, 0.020 and 0.005 inch) shim from the new clutch hardware package that is provided with the new clutch.

(9) Reinstall the viscous heater to the mounting bracket. Tighten the mounting screws to 33 N·m (25 ft. lbs.).
(10) Reinstall the battery negative cable.

EMISSIONS CONTROL

TABLE OF CONTENTS

EMISSIONS CONTROL

DESCRIPTION

DESCRIPTION - EMISSION CONTROL SYSTEM

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator (check engine) Lamp. Refer to Malfunction Indicator Lamp in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting the DRB scan tool (or an equivalent scan tool) to the 16–way data link connector (Fig. 1).

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, connect the DRB scan tool to the 16–way data link connector to erase all DTC's and extinguish the MIL (check engine lamp).

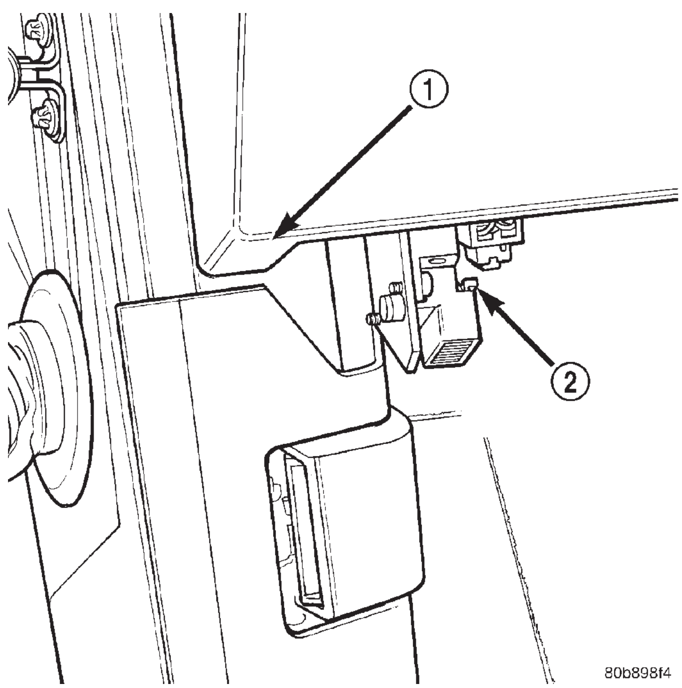


Fig. 1 Data Link (Diagnostic) Connector Location

1 - INSTRUMENT PANEL LOWER/LEFT EDGE
2 - DATA LINK CONNECTOR

EMISSIONS CONTROL (Continued)

DESCRIPTION - STATE DISPLAY TEST MODE

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. Connect the DRB scan tool to the data link connector and access the state display screen. Then access either State Display Inputs and Outputs or State Display Sensors.

DESCRIPTION - CIRCUIT ACTUATION TEST MODE

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly. Connect the DRB scan tool to the data link connector and access the Actuators screen.

DESCRIPTION - DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

NOTE: For a list of DTC's, refer to the charts in this section.

BULB CHECK

Each time the ignition key is turned to the ON position, the malfunction indicator (check engine) lamp on the instrument panel should illuminate for approximately 2 seconds then go out. This is done for a bulb check.

OBTAINING DTC'S USING DRB SCAN TOOL

(1) Connect the DRB scan tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel; near the steering column.

(2) Turn the ignition switch on and access the "Read Fault" screen.

(3) Record all the DTC's and "freeze frame" information shown on the DRB scan tool.

(4) To erase DTC's, use the "Erase Trouble Code" data screen on the DRB scan tool. **Do not erase any DTC's until problems have been investigated and repairs have been performed.**

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0030 (M)	1/1 O2 Sensor Heater Circuit Malfunction	Problem detected in oxygen sensor heater relay circuit.
P0031 (M)	1/1 O2 Sensor Heater Circuit Low	Problem detected in oxygen sensor heater relay circuit.
P0032 (M)	1/1 O2 Sensor Heater Circuit High	Problem detected in oxygen sensor heater relay circuit.
P0036 (M)	1/2 O2 Sensor Heater Circuit Malfunction	Problem detected in oxygen sensor heater relay circuit.
P0037 (M)	1/2 O2 Sensor Heater Circuit Low	Problem detected in oxygen sensor heater relay circuit.
P0038 (M)	1/2 O2 Sensor Heater Circuit High	Problem detected in oxygen sensor heater relay circuit.
P0043 (M)	1/3 O2 Sensor Heater Circuit Low	Problem detected in oxygen sensor heater relay circuit.
P0044 (M)	1/3 O2 Sensor Heater Circuit High	Problem detected in oxygen sensor heater relay circuit.
P0051 (M)	2/1 O2 Sensor Heater Circuit Low	Problem detected in oxygen sensor heater relay circuit.
P0052 (M)	2/1 O2 Sensor Heater Circuit High	Problem detected in oxygen sensor heater relay circuit.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0057 (M)	2/2 O2 Sensor Heater Circuit Low	Problem detected in oxygen sensor heater relay circuit.
P0058 (M)	2/2 O2 Sensor Heater Circuit High	Problem detected in oxygen sensor heater relay circuit.
P0071 (M)	Amb/Bat Temp Sensor Performance	
P0106	Barometric Pressure Out of Range	MAP sensor input voltage out of an acceptable range detected during reading of barometric pressure at key-on.
P0107 (M)	Map Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
P0108 (M)	Map Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
PO111 (M)	Intake Air Temp Sensor Performance	
P0112 (M)	Intake Air Temp Sensor Voltage Low	Intake air (charge) temperature sensor input below the minimum acceptable voltage.
P0113 (M)	Intake Air Temp Sensor Voltage High	Intake air (charge) temperature sensor input above the maximum acceptable voltage.
P0116	Coolant Temp Sensor Performance	A rationatilty error has been detected in the coolant temp sensor.
P0117 (M)	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below the minimum acceptable voltage.
P0118 (M)	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above the maximum acceptable voltage.
P0121 (M)	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor signal.
P0121 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage.
P0122 (M)	Throttle Position Sensor Voltage Low	Throttle position sensor input below the acceptable voltage range.
P0122 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage.
P0123 (M)	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
P0123 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too High	APPS voltage input above the maximum acceptable voltage.
P0125 (M)	Closed Loop Temp Not Reached	Time to enter Closed Loop Operation (Fuel Control) is excessive.
P0125 (M)	Engine is Cold Too Long	Engine does not reach operating temperature.
P0130 (M)	1/1 O2 Sensor Heater Circuit Malfunction	Oxygen sensor heater element malfunction.
P0131 (M)	1/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0132 (M)	1/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0133 (M)	1/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0134 (M)	1/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor input.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0135 (M)	1/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0136 (M)	1/2 O2 Sensor Heater Circuit Malfunction	Oxygen sensor heater element malfunction.
P0137 (M)	1/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0138 (M)	1/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0139 (M)	1/2 O2 Sensor Slow Response	Oxygen sensor response not as expected.
P0140 (M)	1/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0141 (M)	1/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0143 (M)	1/3 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0144 (M)	1/3 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0145 (M)	1/3 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0146 (M)	1/3 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0147 (M)	1/3 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0151 (M)	2/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0152 (M)	2/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage sustained above normal operating range.
P0153 (M)	2/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0154 (M)	2/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0155 (M)	2/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0157 (M)	2/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0158 (M)	2/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0159	2/2 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0160 (M)	2/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0161 (M)	2/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
PO165	Starter Relay Circuit	Problem detected in starter relay circuit.
P0168	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P0171 (M)	1/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0172 (M)	1/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0174 (M)	2/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0175 (M)	2/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0176	Loss of Flex Fuel Calibration Signal	No calibration voltage present from flex fuel sensor.
P0177	Water In Fuel	Excess water found in fuel by water-in-fuel sensor.
P0178	Flex Fuel Sensor Volts Too Low	Flex fuel sensor input below minimum acceptable voltage.
P0178	Water In Fuel Sensor Voltage Too Low	Loss of water-in-fuel circuit or sensor.
P0179	Flex Fuel Sensor Volts Too High	Flex fuel sensor input above maximum acceptable voltage.
P0181	Fuel Injection Pump Failure	Low power, engine derated, or engine stops.
P0182 (M)	CNG Temp Sensor Voltage Too Low	Compressed natural gas temperature sensor voltage below acceptable voltage.
P0183 (M)	CNG Temp Sensor Voltage Too High	Compressed natural gas temperature sensor voltage above acceptable voltage.
P0201 (M)	Injector #1 Control Circuit	An open or shorted condition detected in control circuit for injector #1 or the INJ 1 injector bank.
P0202 (M)	Injector #2 Control Circuit	An open or shorted condition detected in control circuit for injector #2 or the INJ 2 injector bank.
P0203 (M)	Injector #3 Control Circuit	An open or shorted condition detected in control circuit for injector #3 or the INJ 3 injector bank.
P0204 (M)	Injector #4 Control Circuit	Injector #4 or INJ 4 injector bank output driver stage does not respond properly to the control signal.
P0205 (M)	Injector #5 Control Circuit	Injector #5 output driver stage does not respond properly to the control signal.
P0206 (M)	Injector #6 Control Circuit	Injector #6 output driver stage does not respond properly to the control signal.
P0207 (M)	Injector #7 Control Circuit	Injector #7 output driver stage does not respond properly to the control signal.
P0208 (M)	Injector #8 Control Circuit	Injector #8 output driver stage does not respond properly to the control signal.
P0209 (M)	Injector #9 Control Circuit	Injector #9 output driver stage does not respond properly to the control signal.
P0210 (M)	Injector #10 Control Circuit	Injector #10 output driver stage does not respond properly to the control signal.
P0215	Fuel Injection Pump Control Circuit	Failure in fuel pump relay control circuit.
P0216 (M)	Fuel Injection Pump Timing Failure	High fuel supply restriction, low fuel pressure or possible wrong or incorrectly installed pump keyway.
P0217	Decreased Engine Performance Due To Engine Overheat Condition	Engine overheating. ECM will derate engine performance.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0219	Crankshaft Position Sensor Overspeed Signal	Engine has exceeded rpm limits.
P0222 (M)	Idle Validation Signals Both Low	Problem detected with idle validation circuits within APPS.
P0223 (M)	Idle Validation Signals Both High (Above 5 Volts)	Problem detected with idle validation circuits within APPS.
P0230	Transfer Pump (Lift Pump) Circuit Out of Range	Problem detected in fuel transfer pump circuits.
P0232	Fuel Shutoff Signal Voltage Too High	Fuel shut-off signal voltage too high from ECM to fuel injection pump.
P0234 (M)	Turbo Boost Limit Exceeded	Problem detected in turbocharger wastegate.
P0236 (M)	Map Sensor Too High Too Long	Problem detected in turbocharger wastegate.
P0237 (M)	Map Sensor Voltage Too Low	MAP sensor voltage input below the minimum acceptable voltage.
P0238 (M)	Map Sensor Voltage Too High	MAP sensor voltage input above the maximum acceptable voltage.
PO243	Wastegate Solenoid Circuit	
P0251 (M)	Fuel Inj. Pump Mech. Failure Fuel Valve Feedback Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0253 (M)	Fuel Injection Pump Fuel Valve Open Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0254	Fuel Injection Pump Fuel Valve Current Too High	Problem caused by internal fuel injection pump failure.
P0300 (M)	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
P0301 (M)	CYLINDER #1 MISFIRE	Misfire detected in cylinder #1.
P0302 (M)	CYLINDER #2 MISFIRE	Misfire detected in cylinder #2.
P0303 (M)	CYLINDER #3 MISFIRE	Misfire detected in cylinder #3.
P0304 (M)	CYLINDER #4 MISFIRE	Misfire detected in cylinder #4.
P0305 (M)	CYLINDER #5 MISFIRE	Misfire detected in cylinder #5.
P0306 (M)	CYLINDER #6 MISFIRE	Misfire detected in cylinder #6.
P0307 (M)	CYLINDER #7 MISFIRE	Misfire detected in cylinder #7
P0308 (M)	CYLINDER #8 MISFIRE	Misfire detected in cylinder #8.
P0309 (M)	CYLINDER #9 MISFIRE	Misfire detected in cylinder #9.
P0310 (M)	CYLINDER #10 MISFIRE	Misfire detected in cylinder #10.
P0320 (M)	No Crank Referance Signal at PCM	No reference signal (crankshaft position sensor) detected during engine cranking.
P0320 (M)	No RPM Signal to PCM (Crankshaft Position Sensor Signal to JTEC)	A CKP signal has not been detected at the PCM.
P0325	Knock Sensor #1 Circuit	Knock sensor (#1) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0330	Knock Sensor #2 Circuit	Knock sensor (#2) signal above or below minimum acceptable threshold voltage at particular engine speeds.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0336 (M)	Crankshaft Position (CKP) Sensor Signal	Problem with voltage signal from CKP.
P0340 (M)	No Cam Signal At PCM	No fuel sync
P0341 (M)	Camshaft Position (CMP) Sensor Signal	Problem with voltage signal from CMP.
P0350	Ignition Coil Draws Too Much Current	A coil (1-5) is drawing too much current.
P0351 (M)	Ignition Coil # 1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0352 (M)	Ignition Coil # 2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0353 (M)	Ignition Coil # 3 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0354 (M)	Ignition Coil # 4 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0355 (M)	Ignition Coil # 5 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0356 (M)	Ignition Coil # 6 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0357 (M)	Ignition Coil # 7 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0358 (M)	Ignition Coil # 8 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0370	Fuel Injection Pump Speed/Position Sensor Sig Lost	Problem caused by internal fuel injection pump failure.
P0380 (M)	Intake Air Heater Relay #1 Control Circuit	Problem detected in #1 air heater solenoid/relay circuit (not heater element)
P0381 (M)	Wait To Start Lamp Inoperative	Problem detected in wait-to-start bulb circuit.
P0382 (M)	Intake Air Heater Relay #2 Control Circuit	Problem detected in #2 air heater solenoid/relay circuit (not heater element)
P0387	Crankshaft Position Sensor Supply Voltage Too Low	CKP sensor voltage input below the minimum acceptable voltage.
P0388	Crankshaft Position Sensor Supply Voltage Too High	CKP sensor voltage input above the maximum acceptable voltage.
PO0400	Diesel EGR System Failure	
P0401	EGR System Failure	Required change in air/fuel ration not detected during diagnostic test.
P0403	EGR Solenoid Circuit	An open or shorted condition detected in the EGR solenoid control circuit.
P0404	EGR Position Sensor Rationality	EGR position sensor signal does not correlate to EGR duty cycle.
P0405	EGR Position Sensor Volts Too Low	EGR position sensor input below the acceptable voltage range.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0406	EGR Position Sensor Volts Too High	EGR position sensor input above the acceptable voltage range.
P0412	Secondary Air Solenoid Circuit	An open or shorted condition detected in the secondary air (air switching/aspirator) solenoid control circuit.
P0420 (M)	1/1 Catalytic Converter Efficiency	Catalyst 1/1 efficiency below required level.
P0432 (M)	1/2 Catalytic Converter Efficiency	Catalyst 2/1 efficiency below required level.
P0441 (M)	Evap Purge Flow Monitor	Insufficient or excessive vapor flow detected during evaporative emission system operation.
P0442 (M)	Evap Leak Monitor Medium Leak Detected	A small leak has been detected in the evaporative system.
P0443 (M)	Evap Purge Solenoid Circuit	An open or shorted condition detected in the EVAP purge solenoid control circuit.
P0455 (M)	Evap Leak Monitor Large Leak Detected	A large leak has been detected in the evaporative system.
P0456 (M)	Evap Leak Monitor Small Leak Detected	Leak has been detected in the evaporative system.
P0460	Fuel Level Unit No Change Over Miles	During low fuel
P0460	Fuel Level Unit No Change Over Miles	Fuel level sending unit voltage does not change for more than 40 miles.
PO061	Fuel Level Unit No Change Over Time	
P0462	Fuel Level Sending Unit Volts Too Low	Fuel level sensor input below acceptable voltage.
P0462 (M)	Fuel Level Sending Unit Volts Too Low	Open circuit between PCM and fuel gauge sending unit.
P0463	Fuel Level Sending Unit Volts Too High	Fuel level sensor input above acceptable voltage.
P0463 (M)	Fuel Level Sending Unit Volts Too High	Circuit shorted to voltage between PCM and fuel gauge sending unit.
P0500 (M)	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
P0500 (M)	No Vehicle Speed Sensor Signal	A vehicle speed signal was not detected.
P0505 (M)	Idle Air Control Motor Circuits	
P0508 (M)	IAC Motor Sense Circuit Low	
P0509 (M)	IAC Motor Sense Circuit High	
P0521	Oil Pressure Switch Rationality	
P0522	Oil Pressure Voltage Too Low	Oil pressure sending unit (sensor) voltage input below the minimum acceptable voltage.
P0523	Oil Pressure Voltage Too High	Oil pressure sending unit (sensor) voltage input above the maximum acceptable voltage.
P0524	Oil Pressure Too Low	Engine oil pressure is low. Engine power derated.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0545	A/C Clutch Relay Circuit	Problem detected in air conditioning clutch relay control circuit.
P0551	Power Steering Switch Failure	Incorrect input state detected for the power steering switch circuit. PL: High pressure seen at high speed.
P0562	Charging System Voltage Too Low	Supply voltage sensed at ECM too low.
P0563	Charging System Voltage Too High	Supply voltage sensed at ECM too high.
P0572	Brake Switch Input #1 Signal Missing	
P0573	Brake Switch Input #2 Signal Missing	
P0575	Cruise Control Switch Voltage Low	
P0576	Cruise Control Switch Voltage High	
P0577	Cruise Control Switch Voltage High	
P0600	PCM Failure SPI Communications	No communication detected between co-processors in the control module.
P0601 (M)	Internal Controller Failure	Internal control module fault condition (check sum) detected.
P0602 (M)	ECM Fueling Calibration Error	ECM Internal fault condition detected.
P0604	RAM Check Failure	Transmission control module RAM self test fault detected. -Aisin transmission
P0605	ROM Check Falure	Transmission control module ROM self test fault detected -Aisin transmission
P0606 (M)	ECM Failure	ECM Internal fault condition detected.
P0615	Starter Relay Control Circuit	An open or shorted condition detected in the starter relay control circuit.
P0622 (G)	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
P0645	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay control circuit.
P0700	EATX Controller DTC Present	This SBEC III or JTEC DTC indicates that the EATX or Aisin controller has an active fault and has illuminated the MIL via a CCD (EATX) or SCI (Aisin) message. The specific fault must be acquired from the EATX via CCD or from the Aisin via ISO-9141.
P0703	Brake Switch Stuck Pressed or Released	Incorrect input state detected in the brake switch circuit. (Changed from P1595)
P0703	Brake Switch Sense Circuit	
P0711 (M)	Trans Temp Sensor, No Temp Rise After Start	Relationship between the transmission temperature and overdrive operation and/or TCC operation indicates a failure of the Transmission Temperature Sensor. OBD II Rationality. Was MIL code 37.
P0712	Trans Temp Sensor Voltage Too Low	Transmission fluid temperature sensor input below acceptable voltage. Was MIL code 37.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0712 (M)	Trans Temp Sensor Voltage Too Low	Voltage less than 1.55 volts (4-speed auto. trans. only).
P0713	Trans Temp Sensor Voltage Too High	Transmission fluid temperature sensor input above acceptable voltage. Was MIL code 37.
P0713 (M)	Trans Temp Sensor Voltage Too High	Voltage greater than 3.76 volts (4-speed auto. trans. only).
P0720 (M)	Low Output SPD Sensor RPM, Above 15 MPH	The relationship between the Output Shaft Speed Sensor and vehicle speed is not within acceptable limits.
P0720 (M)	Low Output Spd Sensor RPM Above 15 mph	Output shaft speed is less than 60 rpm with vehicle speed above 15 mph (4-speed auto. trans. only).
P0740 (M)	Torq Con Clu, No RPM Drop at Lockup	Relationship between engine and vehicle speeds indicated failure of torque convertor clutch lock-up system (TCC/PTU solenoid)
P0743 (M)	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter clutch (part throttle unlock) solenoid control circuit. Shift solenoid C electrical fault - Aisin transmission
P0743 (M)	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter part throttle unlock solenoid control circuit (3 or 4-speed auto. trans. only).
P0748 (M)	Governor Pressur Sol Control/Trans Relay Circuits	An open or shorted condition detected in the Governor Pressure Solenoid circuit or Trans Relay Circuit in JTEC RE transmissions.
P0748 (M)	Governor Pressure Sol Control/Trans Relay Circuits	An open or shorted condition detected in the governor pressure solenoid or relay circuits (4-speed auto. trans. only).
P0751 (M)	O/D Switch Pressed (Lo) More Than 5 Minutes	Overdrive override switch input is in a prolonged depressed state.
P0751 (M)	O/D Switch Pressed (LO) More Than 5 Min	Overdrive Off switch input too low for more than 5 minutes (4-speed auto. trans. only).
P0753 (M)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the overdrive solenoid control circuit or Trans Relay Circuit in JTEC RE transmissions. Was MIL code 45.
P0753 (M)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the transmission 2-4 shift solenoid circuit (4-speed auto. trans. only).
P0756	AW4 Shift Sol B (2-3) Functional Failure	Shift solenoid B (2-3) functional fault - Aisin transmission
P0783 (M)	3-4 Shift Sol, No RPM Drop at Lockup	The overdrive solenoid is unable to engage the gear change from 3rd gear to the overdrive gear.
P0801	Reverse Gear Lockout Circuit Open or Short	An open or shorted condition detected in the transmission reverse gear lock-out solenoid control circuit.
P0830	Clutch Depressed Switch Circuit	Problem detected in clutch switch circuit.
P0833	Clutch Released Switch Circuit	Problem detected in clutch switch circuit.
P0836	4WD Mux Switch Circuit	
P0837	4WD Mux Switch Performance	

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P1110	Decrease Engine Performance Due To High Intake Air Temperature	Intake manifold air temperature is above the engine protection limit. Engine power will be derated.
P1180	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P1192	Intake Air Temp Sensor Voltage Low	
P1193	Intake Air Temp Sensor Voltage High	
P1194	O2 Heater Performance	
P1195 (M)	1/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/1 during catalyst monitor test. (Also see SCI DTC $66) (was P0133)
P1196 (M)	2/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 2/1 during catalyst monitor test. (Also see SCI DTC $7A) (was P0153)
P1197	1/2 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/2 during catalyst monitor test. (Also see SCI DTC $68) (was P0139)
P1198	Radiator Temperature Sensor Volts Too High	Radiator coolant temperature sensor input above the maximum acceptable voltage.
P1199	Radiator Temperature Sensor Volts Too Low	Radiator coolant temperature sensor input below the minimum acceptable voltage.
P1280	Fuel System Relay Circuit	
P1281	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (Thermostat).
P1282	Fuel Pump/System Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
P1283	Idle Select Signal Invalid	ECM or fuel injection pump module internal fault condition detected.
P1284 (M)	Fuel Injection Pump Battery Voltage Out-Of-Range	Fuel injection pump module internal fault condition detected. Engine power will be derated.
P1285 (M)	Fuel Injection Pump Controller Always On	Fuel injection pump module relay circuit failure detected. Engine power will be derated.
P1286	Accelerator Position Sensor (APPS) Supply Voltage Too High	High voltage detected at APPS.
P1287	Fuel Injection Pump Controller Supply Voltage Low	ECM or fuel injection pump module internal fault condition detected. Engine power will be derated.
P1288	Intake Manifold Short Runner Solenoid Circuit	An open or shorted condition detected in the short runner tuning valve circuit.
P1289	Manifold Tune Valve Solenoid Circuit	An open or shorted condition detected in the manifold tuning valve solenoid control circuit.
P1290	High Pressure Solenoid Relay Ckt.	CNG Fuel System Pressure Too High–Compressed natural gas system pressure above normal operating range.
P1291	No Temp Rise Seen From Intake Heaters	Energizing Heated Air Intake does not change intake air temperature sensor an acceptable amount.

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P1291 (M)	No Temperature Rise Seen From Intake Air Heaters	Problem detected in intake manifold air heating system.
P1292	CNG Pressure Sensor Voltage Too High	Compressed natural gas pressure sensor reading above acceptable voltage.
P1293	CNG Pressure Sensor Voltage Too Low	Compressed natural gas pressure sensor reading below acceptable voltage.
P1294 (M)	Target Idle Not Reached	Target RPM not achieved during drive idle condition. Possible vacuum leak or IAC (AIS) lost steps.
P1295 (M)	No 5 Volts to TP Sensor	Loss of a 5 volt feed to the Throttle Position Sensor has been detected.
P1295 (M)	Accelerator Position Sensor (APPS) Supply Voltage Too Low	APPS supply voltage input below the minimum acceptable voltage.
P1296	No 5 Volts to MAP Sensor	Loss of a 5 volt feed to the MAP Sensor has been detected.
P1297 (M)	No Change in MAP From Start To Run	No difference is recognized between the MAP reading at engine idle and the stored barometric pressure reading.
P1298	Lean Operation at Wide Open Throttle	A prolonged lean condition is detected during Wide Open Throttle
P1299	Vacuum Leak Found (IAC Fully Seated)	MAP Sensor signal does not correlate to Throttle Position Sensor signal. Possible vacuum leak.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
P1389	No ASD Relay Output Voltage At PCM	No Z1 or Z2 voltage sensed when the auto shutdown relay is energized.
P1389 (M)	No ASD Relay Output Voltage at PCM	An open condition detected In the ASD relay output circuit.
P1390	Timing Belt Skipped 1 Tooth or More	Relationship between Cam and Crank signals not correct
P1391 (M)	Intermittent Loss of CMP or CKP	Loss of the Cam Position Sensor or Crank Position sensor has occurred. For PL 2.0L
P1398 (M)	Mis-Fire Adaptive Numerator at Limit	PCM is unable to learn the Crank Sensor's signal in preparation for Misfire Diagnostics. Probable defective Crank Sensor
P1399	Wait To Start Lamp Cicuit	An open or shorted condition detected in the Wait to Start Lamp circuit.
P1403	No 5V to EGR Sensor	Loss of 5v feed to the EGR position sensor.
P01475	Aux 5 Volt Supply Voltage High	Sensor supply voltage for ECM sensors is too high.
P1476	Too Little Secondary Air	Insufficient flow of secondary air injection detected during aspirator test (was P0411)
P1477	Too Much Secondary Air	Excessive flow of secondary air injection detected during aspirator test (was P0411).

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P1478	Battery Temp Sensor Volts Out of Limit	Internal temperature sensor input voltage out of an acceptable range.
P1479	Transmission Fan Relay Circuit	An open or shorted condition detected in the transmission fan relay circuit.
P1480	PCV Solenoid Circuit	An open or shorted condition detected in the PCV solenoid circuit.
P1481	EATX RPM Pulse Perf	EATX RPM pulse generator signal for misfire detection does not correlate with expected value.
P1482	Catalyst Temperature Sensor Circuit Shorted Low	Catalyst temperature sensor circuit shorted low.
P1483	Catalyst Temperature Sensor Circuit Shorted High.	Catalyst temperature sensor circuit shorted high.
P1484	Catalytic Converter Overheat Detected	A catalyst overheat condition has been detected by the catalyst temperature sensor.
P1485	Air Injection Solenoid Circuit	An open or shorted condition detected in the air assist solenoid circuit.
P1486	Evap Leak Monitor Pinched Hose Found	LDP has detected a pinched hose in the evaporative hose system.
P1487	Hi Speed Rad Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the #2 high speed radiator fan control relay.
P1488	Auxiliary 5 Volt Supply Output Too Low	Auxiliary 5 volt sensor feed is sensed to be below an acceptable limit.
P1488	5 Volt Supply Voltage Low	Sensor supply voltage for ECM sensors is too low.
P1489	High Speed Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the high speed radiator fan control relay.
P1490	Low Speed Fan CTRL Relay Circuit	An open or shorted condition detected in control circuit of the low speed radiator fan control relay.
P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the radiator fan control relay control circuit. This includes PWM solid state relays.
P1492	Ambient/Batt Temp Sen Volts Too High	External temperature sensor input above acceptable voltage.
P1492 (M)	Ambient/Batt Temp Sensor Volts Too High	Battery temperature sensor input voltage above an acceptable range.
P1493 (M)	Ambient/Batt Temp Sen Volts Too Low	External temperature sensor input below acceptable voltage.
P1493 (M)	Ambient/Batt Temp Sen Volts Too Low	Battery temperature sensor input voltage below an acceptable range.
P1494 (M)	Leak Detection Pump Sw or Mechanical Fault	Incorrect input state detected for the Leak Detection Pump (LDP) pressure switch.
P1495	Leak Detection Pump Solenoid Circuit	An open or shorted condition detected in the Leak Detection Pump (LDP) solenoid circuit.
P1496	5 Volt Supply, Output Too Low	5 volt sensor feed is sensed to be below an acceptable limit. (less than 4v for 4 sec)

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P1498	High Speed Rad Fan Ground CTRL Rly Circuit	An open or shorted condition detected in the control circuit of the #3 high speed radiator fan control relay.
P1499	Hydraulic cooling fan solenoid circuit	An open or shorted condition detected in the cooling fan control solenoid circuit.
P1594 (G)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1594	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in either of the speed control vacuum or vent solenoid control circuits.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
P1596	Speed Control Switch Always High	Speed control switch input above maximum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below minimum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below the minimum acceptable voltage.
P1598	A/C Pressure Sensor Volts Too High	A/C pressure sensor input above maximum acceptable voltage.
P1598	A/C Sensor Input Hi	Problem detected in air conditioning electrical circuit.
P1599	A/C Pressure Sensor Volts Too Low	A/C pressure sensor input below minimum acceptable voltage.
P1599	A/C Sensor Input Lo	Problem detected in air conditioning electrical circuit.
P1602	PCM not programmed	
P1680	Clutch Released Switch Circuit	Problem detected in clutch switch electrical circuit.
P1681	No I/P Cluster CCD/J1850 Messages Received	No CCD/J1850 messages received from the cluster control module.
P1682 (G)	Charging System Voltage Too Low	Battery voltage sense input below target charging voltage during engine operation and no significant change in voltage detected during active test of generator output circuit.
P1682	Charging System Voltage Too Low	Charging system output voltage low.
P1683	SPD CTRL PWR Relay; or S/C 12v Driver CKT	An open or shorted condition detected in the speed control servo power control circuit.
P1683	Spd ctrl pwr rly, or s/c 12v driver circuit	An open or shorted condition detected in the speed control servo power control circuit.
P1684	Batt Loss (disconnected) in last 50 Starts	The battery has been disconnected within the last 50 starts
P1685	SKIM Invalid Key - (Wrong or Invalid Key MSG Received From SKIM)	The engine controler has received an invalid key from the SKIM.
P1686	No SKIM BUS Messages Received	No CCD/J1850 messages received from the Smart Key Immobilizer Module (SKIM).

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P1687	No MIC BUS Message (No Cluster BUS Message)	No CCD/J1850 messages received from the Mechanical Instrument Cluster (MIC) module.
P1688 (M)	Internal Fuel Injection Pump Controller Failure	Internal problem within the fuel injection pump. Low power, engine derated, or engine stops.
P1689 (M)	No Communication Between ECM and Injection Pump Module	Data link circuit failure between ECM and fuel injection pump. Low power, engine derated, or engine stops.
P1690 (M)	Fuel Injection Pump CKP Sensor Does Not Agree With ECM CKP Sensor	Problem in fuel sync signal. Possible injection pump timing problem. Low power, engine derated, or engine stops.
P1691	Fuel Injection Pump Controller Calibration Error	Internal fuel injection pump failure. Low power, engine derated, or engine stops.
P1692	DTC Set In ECM	A ″Companion DTC″ was set in both the ECM and PCM.
P1693 (M)	DTC Detected in Companion Module	A fault has been generated in the companion engine control module.
P1693 (M)	DTC Detected in PCM/ECM or DTC Detected in ECM	A ″Companion DTC″ was set in both the ECM and PCM.
P1694	Fault In Companion Module	No CCD/J1850 messages received from the powertrain control module-Aisin transmission
P1694 (M)	No BUS (CCD) Messages received from ECM	Bus communication failure to PCM.
P1695	No CCD/J1850 Message From Body Control Module	No CCD/J1850 messages received from the body control module.
P1696	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the control module.
P1697	PCM Failure SRI Mile Not Stored	Unsuccessful attempt to update Service Reminder Indicator (SRI or EMR) mileage in the control module EEPROM.
P1698	No CCD/J1850 Message From TCM	No CCD/J1850 messages received from the electronic transmission control module (EATX) or the Aisin transmission controller.
P1698	No CCD Messages received from PCM	Bus communication failure to PCM. A ″Companion DTC″ was set in both the ECM and PCM.
P1699	No Climate Control Bus Messages	
P1719	Skip Shift Solenoid Circuit	An open or shorted condition detected in the transmission 2-3 gear lock-out solenoid control circuit.
P1740	TCC or OD Sol Perf	A rationality error has been detected in either the TCC solenoid or overdrive solenoid systems.
P1740 (M)	TCC OR O/D Solenoid Performance	Problem detected in transmission convertor clutch and/or overdrive circuits (diesel engine with 4-speed auto. trans. only).

EMISSIONS CONTROL (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P1756 (M)	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear. (Mid Pressure Malfunction)
P1756 (M)	Governor Pressure Not Equal to Target @ 15-20 PSI	Governor sensor input not between 10 and 25 psi when requested (4-speed auto. trans. only).
P1757	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear (Zero Pressure Malfunction)
P1757 (M)	Governor Pressure Above 3 PSI In Gear With 0 MPH	Governor pressure greater than 3 psi when requested to be 0 psi (4-speed auto. trans. only).
P1762 (M)	Gov Press Sen Offset Volts Too Lo or High	The Governor Pressure Sensor input is greater than a calibration limit or is less than a calibration limit for 3 consecutive park/neutral calibrations.
P1762 (M)	Governor Press Sen Offset Volts Too Low or High	Sensor input greater or less than calibration for 3 consecutive Neutral/Park occurrences (4-speed auto. trans. only).
P1763	Governor Pressure Sensor Volts Too Hi	The Governor Pressure Sensor input is above an acceptable voltage level.
P1763 (M)	Governor Pressure Sensor Volts Too HI	Voltage greater than 4.89 volts (4-speed auto. trans. only).
P1764 (M)	Governor Pressure Sensor Volts Too Low	The Governor Pressure Sensor input is below an acceptable voltage level.
P1764 (M)	Governor Pressure Sensor Volts Too Low	Voltage less than .10 volts (4-speed auto. trans. only).
P1765 (M)	Trans 12 Volt Supply Relay CTRL Circuit	An open or shorted condition is detected in the Transmission Relay control circuit. This relay supplies power to the TCC
P1765 (M)	Trans 12 Volt Supply Relay Ctrl Circuit	Current state of solenoid output port is different than expected (4-speed auto. trans. only).
P1830	Clutch Override Relay Circuit	Problem detected in clutch pedal switch override relay circuit.
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch.
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch (3 or 4-speed auto. trans. only).

EMISSIONS CONTROL (Continued)

DESCRIPTION - TASK MANAGER

The PCM is responsible for efficiently coordinating the operation of all the emissions-related components. The PCM is also responsible for determining if the diagnostic systems are operating properly. The software designed to carry out these responsibilities is referred to as the 'Task Manager'.

DESCRIPTION - MONITORED SYSTEMS

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator Lamp (MIL) will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the MIL or a scan tool.

The following is a list of the system monitors:

- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Leak Detection Pump Monitor (if equipped)

All these system monitors require two consecutive trips with the malfunction present to set a fault.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

The following is an operation and description of each system monitor:

OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the Catalyst and Fuel Monitors.

The O2S can fail in any or all of the following manners:

- slow response rate
- reduced output voltage
- dynamic shift
- shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) shorted to voltage DTC, as well as a O2S heater DTC, the O2S fault MUST be repaired first. Before checking the O2S fault, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 ° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S sensor are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S sensor is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S sensor must be tested to ensure that it is heating the sensor properly.

The O2S sensor circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S sensor output voltage from the other effects.

LEAK DETECTION PUMP MONITOR (IF EQUIPPED)

The leak detection assembly incorporates two primary functions: it must detect a leak in the evapora-

EMISSIONS CONTROL (Continued)

tive system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5” water. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at .040” orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP’s solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the Air Fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S sensor output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual fuel-air ratio with the O2S sensor (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. This can increase vehicle emissions

EMISSIONS CONTROL (Continued)

and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S's sensor strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL will be illuminated.

DESCRIPTION - TRIP DEFINITION

The term “Trip” has different meanings depending on what the circumstances are. If the MIL (Malfunction Indicator Lamp) is OFF, a Trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

When any Emission DTC is set, the MIL on the dash is turned ON. When the MIL is ON, it takes 3 good trips to turn the MIL OFF. In this case, it depends on what type of DTC is set to know what a “Trip” is.

For the Fuel Monitor or Mis-Fire Monitor (continuous monitor), the vehicle must be operated in the “Similar Condition Window” for a specified amount of time to be considered a Good Trip.

If a Non-Contiuous OBDII Monitor fails twice in a row and turns ON the MIL, re-running that monitor which previously failed, on the next start-up and passing the monitor, is considered to be a Good Trip. These will include the following:

- Oxygen Sensor
- Catalyst Monitor
- Purge Flow Monitor
- Leak Detection Pump Monitor (if equipped)
- EGR Monitor (if equipped)
- Oxygen Sensor Heater Monitor

If any other Emission DTC is set (not an OBDII Monitor), a Good Trip is considered to be when the Oxygen Sensor Monitor and Catalyst Monitor have been completed; or 2 Minutes of engine run time if the Oxygen Sensor Monitor or Catalyst Monitor have been stopped from running.

It can take up to 2 Failures in a row to turn on the MIL. After the MIL is ON, it takes 3 Good Trips to turn the MIL OFF. After the MIL is OFF, the PCM will self-erase the DTC after 40 Warm-up cycles. A Warm-up cycle is counted when the ECT (Engine Coolant Temperature Sensor) has crossed 160°F and has risen by at least 40°F since the engine has been started.

DESCRIPTION - COMPONENT MONITORS

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (MIL) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum if the TPS indicates a small throttle opening.

All open/short circuit checks or any component that has an associated limp in will set a fault after 1 trip with the malfunction present. Components without an associated limp in will take two trips to illuminate the MIL.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

DESCRIPTION - NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system, although it may set a fuel system fault.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

THROTTLE BODY AIRFLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

DESCRIPTION - HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

DESCRIPTION - LOAD VALUE

ENGINE	IDLE/NEUTRAL	2500 RPM/NEUTRAL
All Engines	2% to 8% of Maximum Load	9% to 17% of Maximum Load

EMISSIONS CONTROL (Continued)

OPERATION - TASK MANAGER

The Task Manager determines which tests happen when and which functions occur when. Many of the diagnostic steps required by OBD II must be performed under specific operating conditions. The Task Manager software organizes and prioritizes the diagnostic procedures. The job of the Task Manager is to determine if conditions are appropriate for tests to be run, monitor the parameters for a trip for each test, and record the results of the test. Following are the responsibilities of the Task Manager software:

- Test Sequence
- MIL Illumination
- Diagnostic Trouble Codes (DTCs)
- Trip Indicator
- Freeze Frame Data Storage
- Similar Conditions Window

Test Sequence

In many instances, emissions systems must fail diagnostic tests more than once before the PCM illuminates the MIL. These tests are know as 'two trip monitors.' Other tests that turn the MIL lamp on after a single failure are known as 'one trip monitors.' A trip is defined as 'start the vehicle and operate it to meet the criteria necessary to run the given monitor.'

Many of the diagnostic tests must be performed under certain operating conditions. However, there are times when tests cannot be run because another test is in progress (conflict), another test has failed (pending) or the Task Manager has set a fault that may cause a failure of the test (suspend).

- Pending

Under some situations the Task Manager will not run a monitor if the MIL is illuminated and a fault is stored from another monitor. In these situations, the Task Manager postpones monitors **pending** resolution of the original fault. The Task Manager does not run the test until the problem is remedied.

For example, when the MIL is illuminated for an Oxygen Sensor fault, the Task Manager does not run the Catalyst Monitor until the Oxygen Sensor fault is remedied. Since the Catalyst Monitor is based on signals from the Oxygen Sensor, running the test would produce inaccurate results.

- Conflict

There are situations when the Task Manager does not run a test if another monitor is in progress. In these situations, the effects of another monitor running could result in an erroneous failure. If this **conflict** is present, the monitor is not run until the conflicting condition passes. Most likely the monitor will run later after the conflicting monitor has passed.

For example, if the Fuel System Monitor is in progress, the Task Manager does not run the EGR Monitor. Since both tests monitor changes in air/fuel ratio and adaptive fuel compensation, the monitors will conflict with each other.

- Suspend

Occasionally the Task Manager may not allow a two trip fault to mature. The Task Manager will **suspend** the maturing of a fault if a condition exists that may induce an erroneous failure. This prevents illuminating the MIL for the wrong fault and allows more precis diagnosis.

For example, if the PCM is storing a one trip fault for the Oxygen Sensor and the EGR monitor, the Task Manager may still run the EGR Monitor but will suspend the results until the Oxygen Sensor Monitor either passes or fails. At that point the Task Manager can determine if the EGR system is actually failing or if an Oxygen Sensor is failing.

MIL Illumination

The PCM Task Manager carries out the illumination of the MIL. The Task Manager triggers MIL illumination upon test failure, depending on monitor failure criteria.

The Task Manager Screen shows both a Requested MIL state and an Actual MIL state. When the MIL is illuminated upon completion of a test for a third trip, the Requested MIL state changes to OFF. However, the MIL remains illuminated until the next key cycle. (On some vehicles, the MIL will actually turn OFF during the third key cycle) During the key cycle for the third good trip, the Requested MIL state is OFF, while the Actual MIL state is ON. After the next key cycle, the MIL is not illuminated and both MIL states read OFF.

Diagnostic Trouble Codes (DTCs)

With OBD II, different DTC faults have different priorities according to regulations. As a result, the priorities determine MIL illumination and DTC erasure. DTCs are entered according to individual priority. DTCs with a higher priority overwrite lower priority DTCs.

Priorities

- Priority 0 —Non-emissions related trouble codes
- Priority 1 — One trip failure of a two trip fault for non-fuel system and non-misfire.
- Priority 2 — One trip failure of a two trip fault for fuel system (rich/lean) or misfire.
- Priority 3 — Two trip failure for a non-fuel system and non-misfire or matured one trip comprehensive component fault.
- Priority 4 — Two trip failure or matured fault for fuel system (rich/lean) and misfire or one trip catalyst damaging misfire.

EMISSIONS CONTROL (Continued)

Non-emissions related failures have no priority. One trip failures of two trip faults have low priority. Two trip failures or matured faults have higher priority. One and two trip failures of fuel system and misfire monitor take precedence over non-fuel system and non-misfire failures.

DTC Self Erasure

With one trip components or systems, the MIL is illuminated upon test failure and DTCs are stored.

Two trip monitors are components requiring failure in two consecutive trips for MIL illumination. Upon failure of the first test, the Task Manager enters a maturing code. If the component fails the test for a second time the code matures and a DTC is set.

After three good trips the MIL is extinguished and the Task Manager automatically switches the trip counter to a warm-up cycle counter. DTCs are automatically erased following 40 warm-up cycles if the component does not fail again.

For misfire and fuel system monitors, the component must pass the test under a Similar Conditions Window in order to record a good trip. A Similar Conditions Window is when engine RPM is within ±375 RPM and load is within ±10% of when the fault occurred.

NOTE: It is important to understand that a component does not have to fail under a similar window of operation to mature. It must pass the test under a Similar Conditions Window when it failed to record a Good Trip for DTC erasure for misfire and fuel system monitors.

DTCs can be erased anytime with a DRB III. Erasing the DTC with the DRB III erases all OBD II information. The DRB III automatically displays a warning that erasing the DTC will also erase all OBD II monitor data. This includes all counter information for warm-up cycles, trips and Freeze Frame.

Trip Indicator

The **Trip** is essential for running monitors and extinguishing the MIL. In OBD II terms, a trip is a set of vehicle operating conditions that must be met for a specific monitor to run. All trips begin with a key cycle.

Good Trip

The Good Trip counters are as follows:

- Specific Good Trip
- Fuel System Good Trip
- Misfire Good Trip
- Alternate Good Trip (appears as a Global Good Trip on DRB III)
- Comprehensive Components
- Major Monitor
- Warm-Up Cycles

Specific Good Trip

The term Good Trip has different meanings depending on the circumstances:

- If the MIL is OFF, a trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.
- If the MIL is ON and a DTC was set by the Fuel Monitor or Misfire Monitor (both continuous monitors), the vehicle must be operated in the Similar Condition Window for a specified amount of time.
- If the MIL is ON and a DTC was set by a Task Manager commanded once-per-trip monitor (such as the Oxygen Sensor Monitor, Catalyst Monitor, Purge Flow Monitor, Leak Detection Pump Monitor, EGR Monitor or Oxygen Sensor Heater Monitor), a good trip is when the monitor is passed on the next start-up.
- If the MIL is ON and any other emissions DTC was set (not an OBD II monitor), a good trip occurs when the Oxygen Sensor Monitor and Catalyst Monitor have been completed, or two minutes of engine run time if the Oxygen Sensor Monitor and Catalyst Monitor have been stopped from running.

Fuel System Good Trip

To count a good trip (three required) and turn off the MIL, the following conditions must occur:

- Engine in closed loop
- Operating in Similar Conditions Window
- Short Term multiplied by Long Term less than threshold
- Less than threshold for a predetermined time

If all of the previous criteria are met, the PCM will count a good trip (three required) and turn off the MIL.

Misfire Good Trip

If the following conditions are met the PCM will count one good trip (three required) in order to turn off the MIL:

- Operating in Similar Condition Window
- 1000 engine revolutions with no misfire

Warm-Up Cycles

Once the MIL has been extinguished by the Good Trip Counter, the PCM automatically switches to a Warm-Up Cycle Counter that can be viewed on the DRB III. Warm-Up Cycles are used to erase DTCs and Freeze Frames. Forty Warm-Up cycles must occur in order for the PCM to self-erase a DTC and Freeze Frame. A Warm-Up Cycle is defined as follows:

- Engine coolant temperature must start below and rise above 160° F
- Engine coolant temperature must rise by 40° F
- No further faults occur

EMISSIONS CONTROL (Continued)

Freeze Frame Data Storage

Once a failure occurs, the Task Manager records several engine operating conditions and stores it in a Freeze Frame. The Freeze Frame is considered one frame of information taken by an on-board data recorder. When a fault occurs, the PCM stores the input data from various sensors so that technicians can determine under what vehicle operating conditions the failure occurred.

The data stored in Freeze Frame is usually recorded when a system fails the first time for two trip faults. Freeze Frame data will only be overwritten by a different fault with a higher priority.

CAUTION: Erasing DTCs, either with the DRB III or by disconnecting the battery, also clears all Freeze Frame data.

Similar Conditions Window

The Similar Conditions Window displays information about engine operation during a monitor. Absolute MAP (engine load) and Engine RPM are stored in this window when a failure occurs. There are two different Similar conditions Windows: Fuel System and Misfire.

FUEL SYSTEM

- **Fuel System Similar Conditions Window** — An indicator that 'Absolute MAP When Fuel Sys Fail' and 'RPM When Fuel Sys Failed' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Fuel Sys Fail** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Fuel Sys Fail** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **Upstream O2S Volts** — A live reading of the Oxygen Sensor to indicate its performance. For example, stuck lean, stuck rich, etc.
- **SCW Time in Window (Similar Conditions Window Time in Window)** — A timer used by the PCM that indicates that, after all Similar Conditions have been met, if there has been enough good engine running time in the SCW without failure detected. This timer is used to increment a Good Trip.
- **Fuel System Good Trip Counter** — A Trip Counter used to turn OFF the MIL for Fuel System DTCs. To increment a Fuel System Good Trip, the engine must be in the Similar Conditions Window, Adaptive Memory Factor must be less than calibrated threshold and the Adaptive Memory Factor must stay below that threshold for a calibrated amount of time.
- **Test Done This Trip** — Indicates that the monitor has already been run and completed during the current trip.

MISFIRE

- **Same Misfire Warm-Up State** — Indicates if the misfire occurred when the engine was warmed up (above 160° F).
- **In Similar Misfire Window** — An indicator that 'Absolute MAP When Misfire Occurred' and 'RPM When Misfire Occurred' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Misfire Occurred** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Misfire Occurred** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **200 Rev Counter** — Counts 0–100 720 degree cycles.
- **SCW Cat 200 Rev Counter** — Counts when in similar conditions.
- **SCW FTP 1000 Rev Counter** — Counts 0–4 when in similar conditions.
- **Misfire Good Trip Counter** — Counts up to three to turn OFF the MIL.
- **Misfire Data**— Data collected during test.
- **Test Done This Trip**— Indicates YES when the test is done.

EVAPORATIVE EMISSIONS

TABLE OF CONTENTS

EVAPORATIVE EMISSIONS

DESCRIPTION

DESCRIPTION - EVAPORATION CONTROL SYSTEM

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through the control valve, through the fuel management valve, and through vent hoses and tubes to a charcoal filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

Gas powered engines use a duty cycle purge system. The PCM controls vapor flow by operating the duty cycle EVAP purge solenoid. Refer to Duty Cycle EVAP Canister Purge Solenoid.

When equipped with certain emissions packages, a Leak Detection Pump (LDP) will be used as part of the evaporative system for OBD II requirements. Also refer to Leak Detection Pump.

Vehicles powered with gasoline engines are also equipped with ORVR (On-Board Refueling Vapor Recovery). Refer to ORVR for additional information.

EVAPORATIVE EMISSIONS (Continued)

NOTE: The evaporative system uses specially manufactured lines/hoses. If replacement becomes necessary, only use fuel resistant, low permeation hose.

Certain components can be found in (Fig. 1).

DESCRIPTION - CCV SYSTEM

The 4.0L 6–cylinder engine is equipped with a Crankcase Ventilation (CCV) system. The system consists of:

- A fixed orifice fitting of a calibrated size. This fitting is pressed into a rubber grommet located on the top/rear of cylinder head (valve) cover (Fig. 2).
- a pair of breather tubes (lines) to connect the system components.
- the air cleaner housing.
- an air inlet fitting (Fig. 2).

DESCRIPTION - PCV SYSTEM

The 4.7L V-8 engine is equipped with a closed crankcase ventilation system and a Positive Crankcase Ventilation (PCV) valve.

This system consists of:

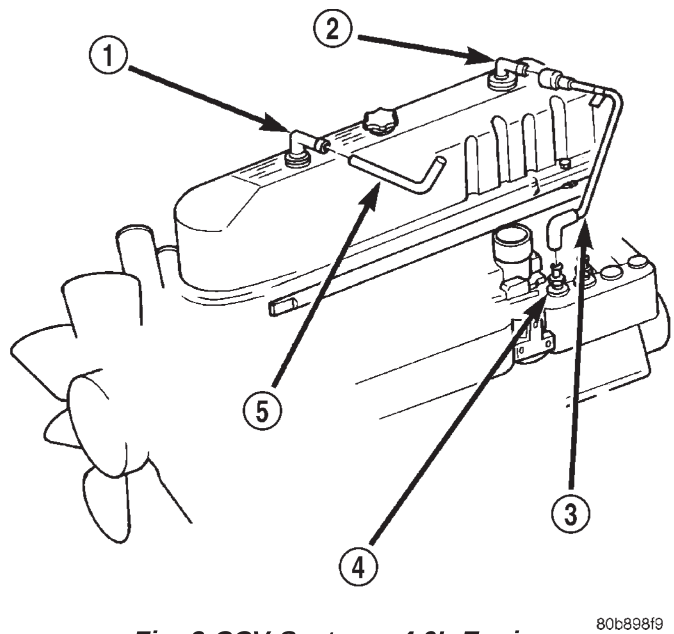


Fig. 2 CCV System—4.0L Engine

1 - AIR INLET FITTING
2 - FIXED ORIFICE FITTING
3 - CCV BREATHER TUBE (REAR)
4 - INT. MAN. FITTING
5 - CCV BREATHER TUBE (FRONT)

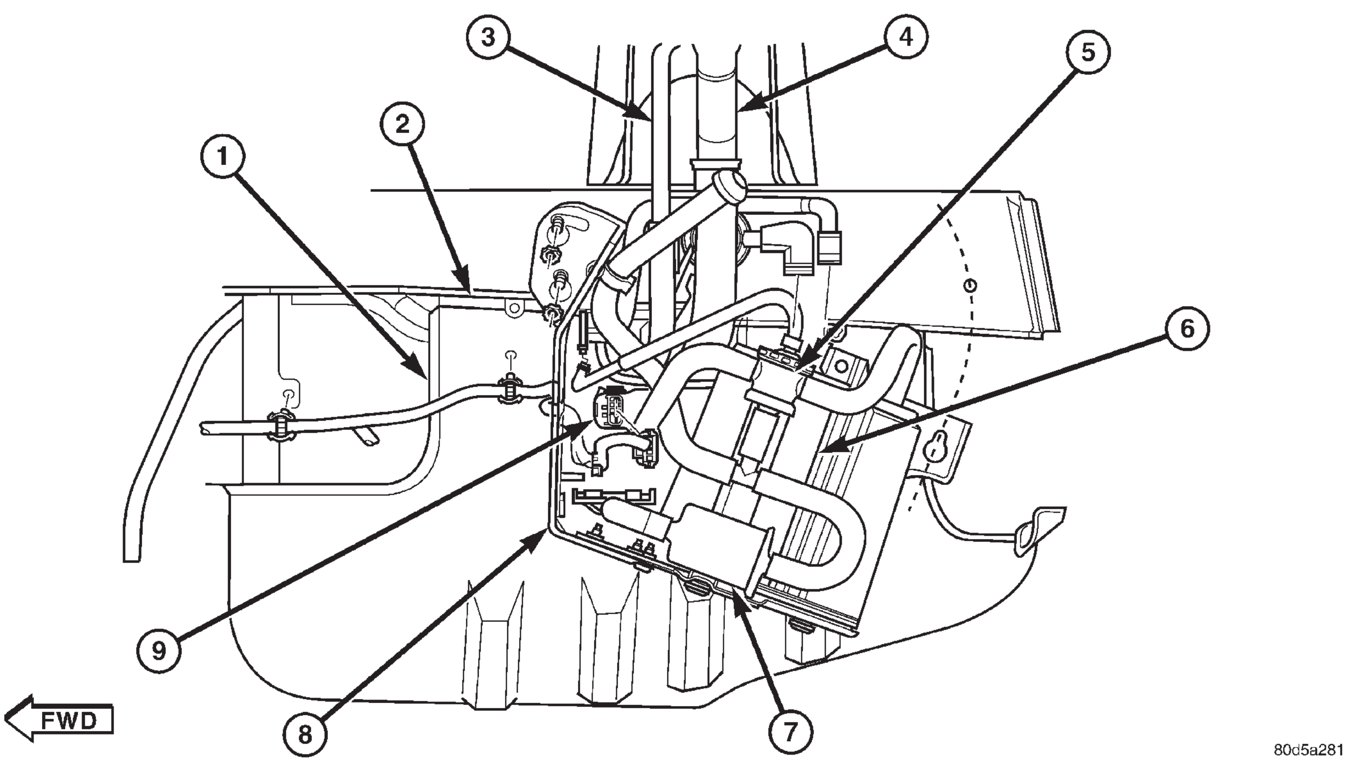


Fig. 1 ORVR / LDP COMPONENTS

1 - FUEL TANK (LEFT SIDE)
2 - FRAME RAIL (LEFT-REAR OUTSIDE)
3 - FUEL VENT TUBE
4 - FUEL FILL TUBE
5 - CONTROL VALVE
6 - EVAP CANISTER
7 - LDP FILTER
8 - TWO-PIECE SUPPORT BRACKET
9 - LEAK DETECTION PUMP (LDP)

EVAPORATIVE EMISSIONS (Continued)

• a PCV valve mounted to the oil filler housing (Fig. 3). The PCV valve is sealed to the oil filler housing with an o-ring.
• the air cleaner housing
• two interconnected breathers threaded into the rear of each cylinder head (Fig. 4).
• tubes and hose to connect the system components.

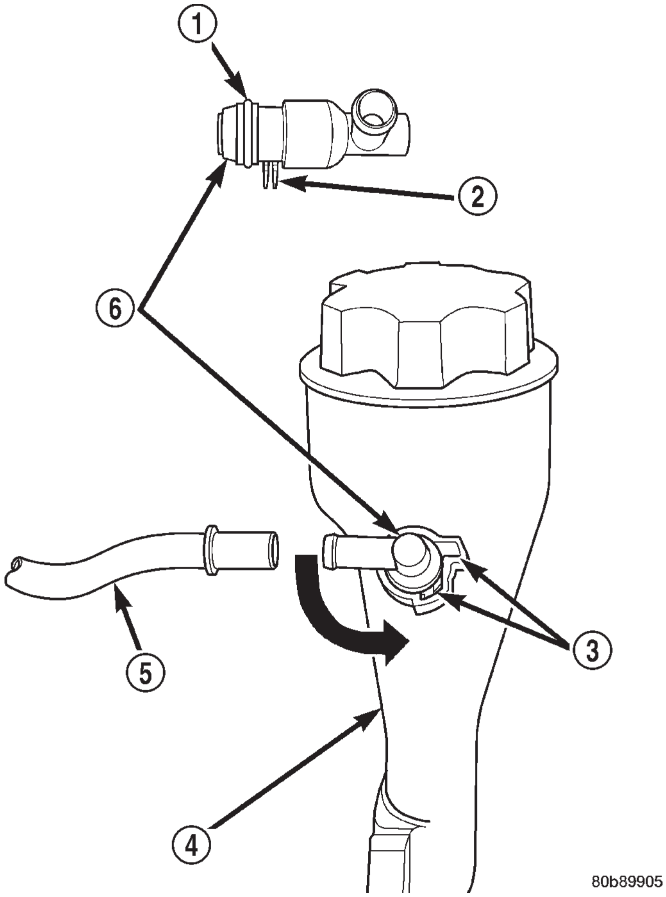


Fig. 3 PCV Valve/Oil Filler Tube (Housing)—4.7L Engine

1 - O-RING
2 - LOCATING TABS
3 - CAM LOCK
4 - OIL FILLER TUBE
5 - PCV LINE/HOSE
6 - PCV VALVE

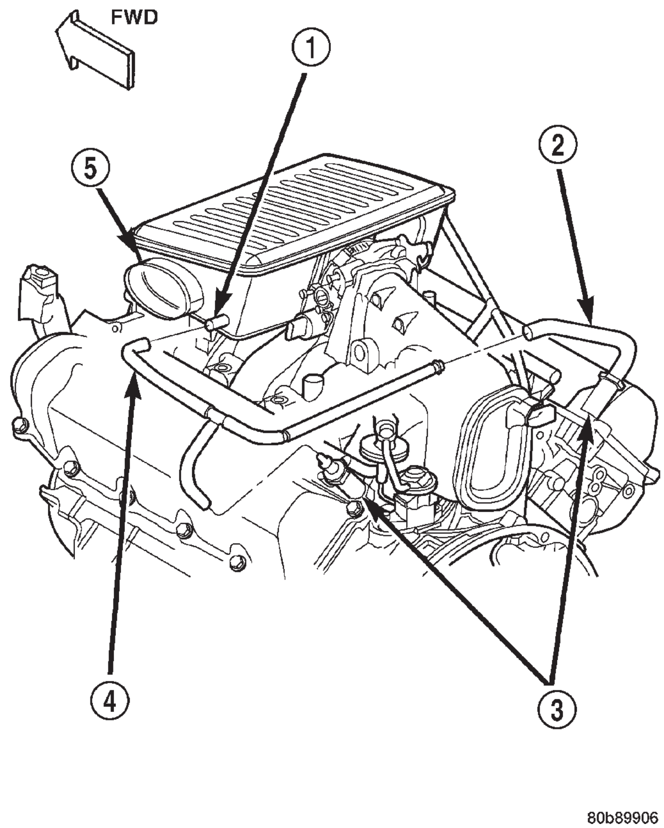


Fig. 4 PCV System Hoses/Tubes—4.7L Engine

1 - FRESH AIR FITTING
2 - CONNECTING TUBES/HOSES
3 - CRANKCASE BREATHERS (2)
4 - RUBBER HOSE
5 - AIR CLEANER RESONATOR

OPERATION

OPERATION - 4.0L CCV SYSTEM

The CCV system performs the same function as a conventional PCV system, but does not use a vacuum controlled PCV valve.

The fixed orifice fitting meters the amount of crankcase vapors drawn out of the engine.

When the engine is operating, fresh air enters the engine and mixes with crankcase vapors. Engine vacuum draws the vapor/air mixture through the fixed orifice and into the intake manifold. The vapors are then consumed during engine combustion.

OPERATION - 4.7L PCV SYSTEM

The PCV system operates by engine intake manifold vacuum. Filtered air is routed into the crankcase through the air cleaner hose and crankcase breathers. The metered air, along with crankcase vapors, are drawn through the PCV valve and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow-by gases to the intake system, reducing engine sludge formation.

The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

TYPICAL PCV valves are shown in (Fig. 5), (Fig. 6) and (Fig. 7).

When the engine is not operating, or during an engine pop-back, the spring forces the plunger back against the seat (Fig. 5). This will prevent vapors from flowing through the valve.

EVAPORATIVE EMISSIONS (Continued)

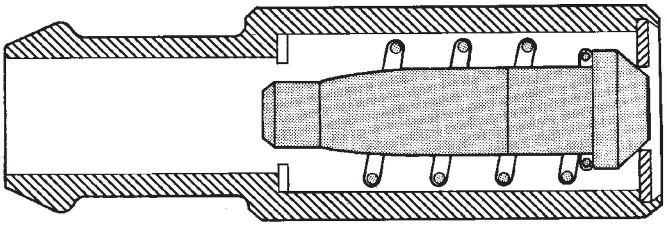


Fig. 5 Engine Off or Engine Pop-Back—No Vapor Flow

During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve (Fig. 6). In this position there is minimal vapor flow through the valve.

During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve (Fig. 7).

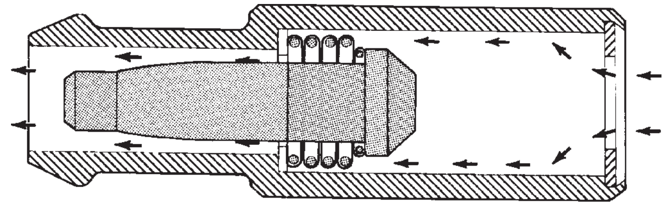


Fig. 6 High Intake Manifold Vacuum—Minimal Vapor Flow

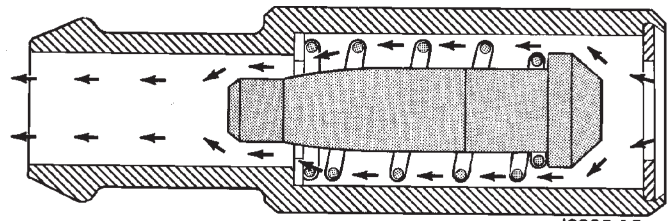


Fig. 7 Moderate Intake Manifold Vacuum—Maximum Vapor Flow

SPECIFICATIONS

TORQUE - EVAPORATION SYSTEM

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Crankcase Breathers - 3.7L / 4.7L	12	-	106
EVAP Canister Mounting	11	-	100
EVAP Canister Purge Solenoid Mounting Nuts	9	-	80
LDP Pump-to-Support Bracket	2	-	20
LDP Pump Support Bracket-to-Frame	28	-	250

CCV HOSE

DIAGNOSIS AND TESTING - CCV SYSTEM - 4.0L

Before attempting diagnosis, be sure locations of fixed orifice fitting and air inlet fitting (Fig. 8) have not been inadvertently exchanged. The fixed orifice fitting is light grey in color and is located at **rear** of valve cover. The air inlet fitting is black in color and is located at **front** of valve cover.

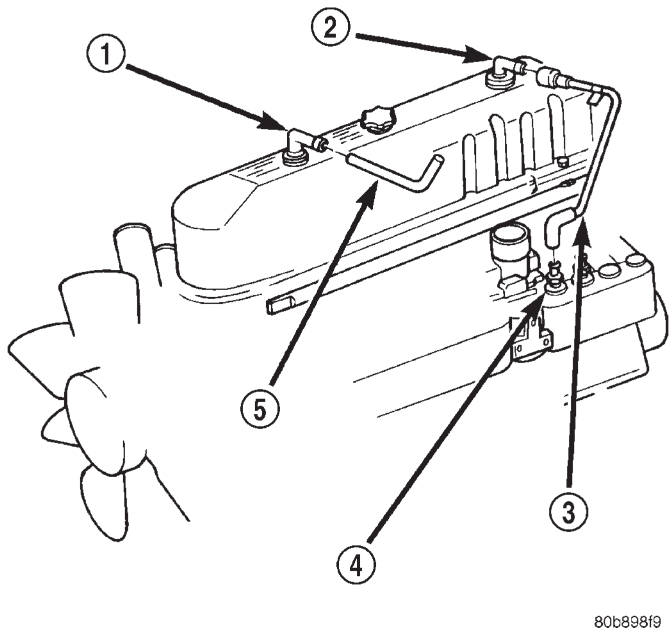


Fig. 8 Fixed Orifice Fitting and CCV System—4.0L Engine

1 - AIR INLET FITTING
2 - FIXED ORIFICE FITTING
3 - CCV BREATHER TUBE (REAR)
4 - INT. MAN. FITTING
5 - CCV BREATHER TUBE (FRONT)

(1) Pull fixed orifice fitting (Fig. 8) from valve cover and leave tube attached.

(2) Start engine and bring to idle speed.

(3) If fitting is not plugged, a hissing noise will be heard as air passes through fitting orifice. Also, a strong vacuum should be felt with a finger placed at fitting inlet.

(4) If vacuum is not present, remove fitting orifice fitting from tube. Start engine. If vacuum can now be felt, replace fixed orifice fitting. Do not attempt to clean plastic fitting.

(5) If vacuum is still not felt at hose, check line/hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at intake manifold. Do this by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

(6) Return fixed orifice fitting to valve cover and leave tube attached.

(7) Disconnect air inlet fitting and its attached hose at front of valve cover (Fig. 8). Start engine and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the rubber grommet (opening) of the disconnected air inlet fitting.

(8) The paper should be drawn against the rubber grommet with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.

(9) If vacuum is not present, check breather hoses/tubes/lines for obstructions or restrictions.

(10) After testing, reconnect all system hoses/tubes/lines.

REMOVAL - FIXED ORIFICE FITTING

When installing fixed orifice fitting, be sure locations of fixed orifice fitting and air inlet fitting (Fig. 9) have not been inadvertently exchanged. The fixed orifice fitting is light grey in color and is located at **rear** of valve cover. The air inlet fitting is black in color and is located at **front** of valve cover.

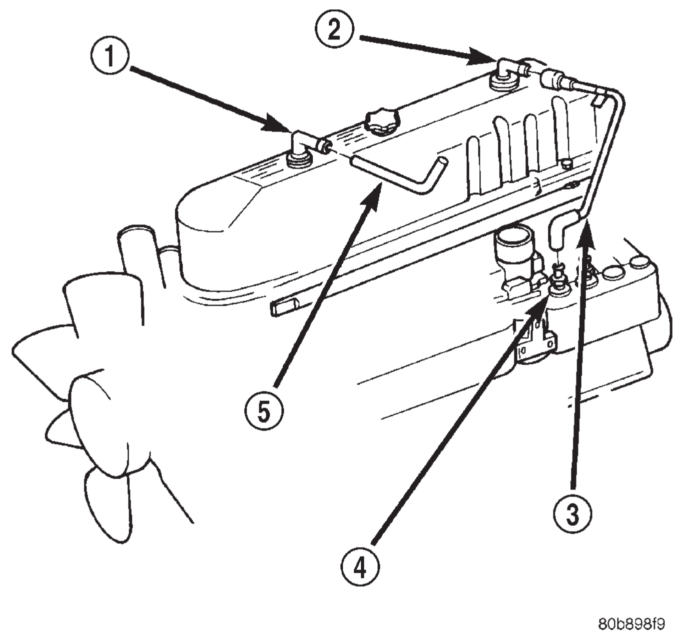


Fig. 9 FIXED ORIFICE FITTING - 4.0L

1 - AIR INLET FITTING
2 - FIXED ORIFICE FITTING
3 - CCV BREATHER TUBE (REAR)
4 - INT. MAN. FITTING
5 - CCV BREATHER TUBE (FRONT)

(1) Pull fixed orifice fitting (Fig. 9) from valve cover grommet.

(2) Separate fitting from CCV breather tube.

CCV HOSE (Continued)

INSTALLATION - FIXED ORIFICE FITTING

When installing fixed orifice fitting, be sure locations of fixed orifice fitting and air inlet fitting (Fig. 9) have not been inadvertently exchanged. The fixed orifice fitting is light grey in color and is located at **rear** of valve cover. The air inlet fitting is black in color and is located at **front** of valve cover.

(1) Connect fitting to CCV breather tube.

(2) Return fixed orifice fitting to valve cover grommet.

EVAP/PURGE SOLENOID

DESCRIPTION

The duty cycle EVAP canister purge solenoid (DCP) regulates the rate of vapor flow from the EVAP canister to the intake manifold. The Powertrain Control Module (PCM) operates the solenoid.

OPERATION

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM cycles (energizes and de-energizes) the solenoid 5 or 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time that the solenoid is energized. The PCM adjusts solenoid pulse width based on engine operating condition.

REMOVAL

The duty cycle evaporative (EVAP) canister purge solenoid is located in the engine compartment near the brake master cylinder (Fig. 10).

(1) Disconnect electrical connector at solenoid.

(2) Disconnect vacuum lines at solenoid.

(3) Lift solenoid slot (Fig. 10) from mounting bracket for removal.

INSTALLATION

(1) Position solenoid slot to mounting bracket.

(2) Connect vacuum lines to solenoid. Be sure vacuum lines are firmly connected and not leaking or damaged. If leaking, a Diagnostic Trouble Code (DTC) may be set with certain emission packages.

(3) Connect electrical connector to solenoid.

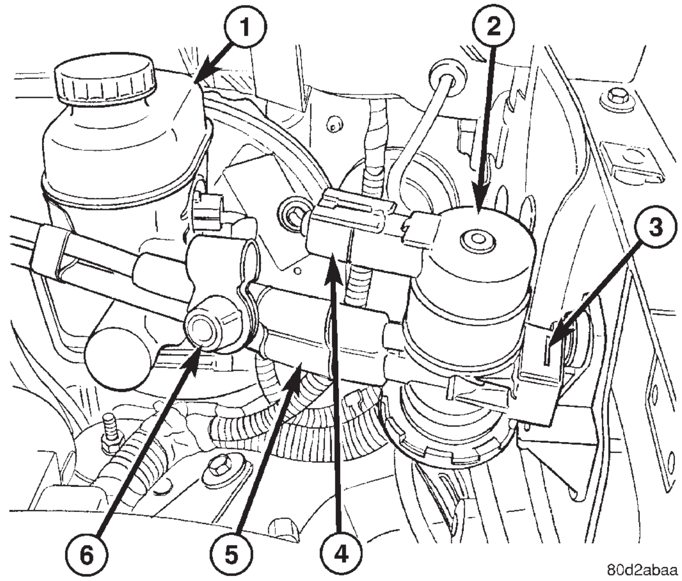


Fig. 10 EVAP/PURGE SOLENOID LOCATION

1 - BRAKE MASTER CYLINDER
2 - EVAP SOLENOID
3 - SLOT
4 - ELEC. CONNEC.
5 - VACUUM LINE CONNEC.
6 - TEST PORT

FUEL FILLER CAP

DESCRIPTION

The plastic fuel tank filler tube cap is threaded onto the end of the fuel fill tube. Certain models are equipped with a 1/4 turn cap.

OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If equipped with a California emissions package and a Leak Detection Pump (LDP), the cap must be tightened securely. If cap is left loose, a Diagnostic Trouble Code (DTC) may be set.

REMOVAL

If replacement of the 1/4 turn fuel tank filler tube cap is necessary, it must be replaced with an identical cap to be sure of correct system operation.

FUEL FILLER CAP (Continued)

CAUTION: Remove the fuel tank filler tube cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or before draining the fuel tank.

LEAK DETECTION PUMP

DESCRIPTION

The evaporative emission system is designed to prevent the escape of fuel vapors from the fuel system (Fig. 11). Leaks in the system, even small ones, can allow fuel vapors to escape into the atmosphere. Government regulations require onboard testing to make sure that the evaporative (EVAP) system is functioning properly. The leak detection system tests for EVAP system leaks and blockage. It also performs self-diagnostics. During self-diagnostics, the Powertrain Control Module (PCM) first checks the Leak Detection Pump (LDP) for electrical and mechanical faults. If the first checks pass, the PCM then uses the LDP to seal the vent valve and pump air into the system to pressurize it. If a leak is present, the PCM will continue pumping the LDP to replace the air that leaks out. The PCM determines the size of the leak based on how fast/long it must pump the LDP as it tries to maintain pressure in the system.

EVAP LEAK DETECTION SYSTEM COMPONENTS

Service Port: Used with special tools like the Miller Evaporative Emissions Leak Detector (EELD) to test for leaks in the system.

EVAP Purge Solenoid: The PCM uses the EVAP purge solenoid to control purging of excess fuel vapors stored in the EVAP canister. It remains closed during leak testing to prevent loss of pressure.

EVAP Canister: The EVAP canister stores fuel vapors from the fuel tank for purging.

EVAP Purge Orifice: Limits purge volume.

EVAP System Air Filter: Provides air to the LDP for pressurizing the system. It filters out dirt while allowing a vent to atmosphere for the EVAP system.

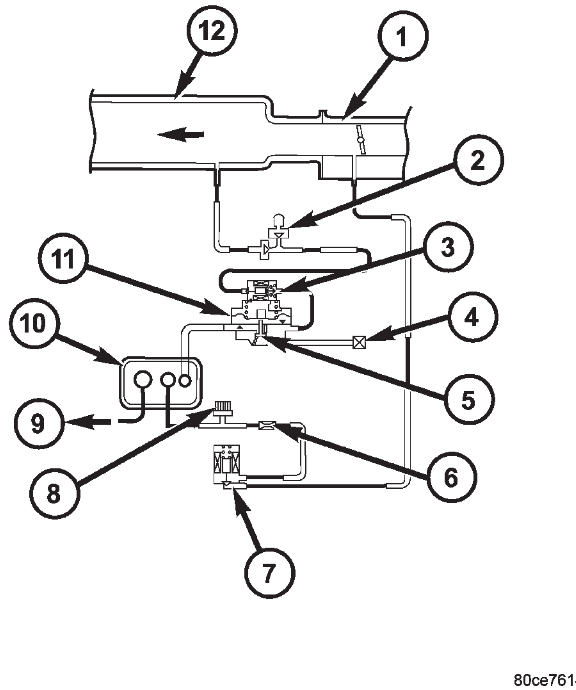


Fig. 11 TYPICAL SYSTEM COMPONENTS

1 - Throttle Body
2 - Service Vacuum Supply Tee (SVST)
3 - LDP Solenoid
4 - EVAP System Air Filter
5 - LDP Vent Valve
6 - EVAP Purge Orifice
7 - EVAP Purge Solenoid
8 - Service Port
9 - To Fuel Tank
10 - EVAP Canister
11 - LDP
12 - Intake Air Plenum

LEAK DETECTION PUMP (Continued)

OPERATION

The main purpose of the LDP is to pressurize the fuel system for leak checking. It closes the EVAP system vent to atmospheric pressure so the system can be pressurized for leak testing. The diaphragm is powered by engine vacuum. It pumps air into the EVAP system to develop a pressure of about 7.5″ H2O (1/4) psi. A reed switch in the LDP allows the PCM to monitor the position of the LDP diaphragm. The PCM uses the reed switch input to monitor how fast the LDP is pumping air into the EVAP system. This allows detection of leaks and blockage. The LDP assembly consists of several parts (Fig. 12). The solenoid is controlled by the PCM, and it connects the upper pump cavity to either engine vacuum or atmospheric pressure. A vent valve closes the EVAP system to atmosphere, sealing the system during leak testing. The pump section of the LDP consists of a diaphragm that moves up and down to bring air in through the air filter and inlet check valve, and pump it out through an outlet check valve into the EVAP system. The diaphragm is pulled up by engine vacuum, and pushed down by spring pressure, as the LDP solenoid turns on and off. The LDP also has a magnetic reed switch to signal diaphragm position to the PCM. When the diaphragm is down, the switch is closed, which sends a 12 V (system voltage) signal to the PCM. When the diaphragm is up, the switch is open, and there is no voltage sent to the PCM. This allows the PCM to monitor LDP pumping action as it turns the LDP solenoid on and off.

LDP AT REST (NOT POWERED)

When the LDP is at rest (no electrical/vacuum) the diaphragm is allowed to drop down if the internal (EVAP system) pressure is not greater than the return spring. The LDP solenoid blocks the engine vacuum port and opens the atmospheric pressure port connected through the EVAP system air filter. The vent valve is held open by the diaphragm. This allows the canister to see atmospheric pressure (Fig. 13).

DIAPHRAGM UPWARD MOVEMENT

When the PCM energizes the LDP solenoid, the solenoid blocks the atmospheric port leading through the EVAP air filter and at the same time opens the engine vacuum port to the pump cavity above the diaphragm. The diaphragm moves upward when vacuum above the diaphragm exceeds spring force. This upward movement closes the vent valve. It also causes low pressure below the diaphragm, unseating the inlet check valve and allowing air in from the EVAP air filter. When the diaphragm completes its upward movement, the LDP reed switch turns from closed to open (Fig. 14).

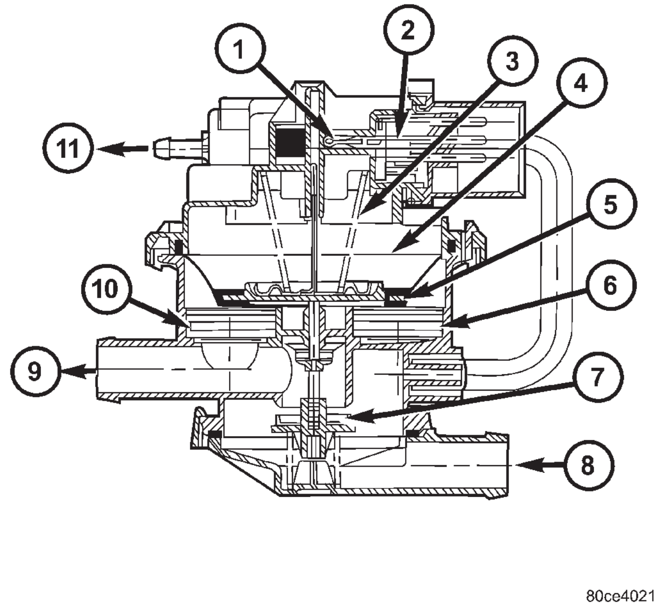


Fig. 12 EVAP LEAK DETECTION SYSTEM COMPONENTS

1 - Reed Switch
2 - Solenoid
3 - Spring
4 - Pump Cavity
5 - Diaphragm
6 - Inlet Check Valve
7 - Vent Valve
8 - From Air Filter
9 - To Canister
10 - Outlet Check Valve
11 - Engine Vacuum

DIAPHRAGM DOWNWARD MOVEMENT

Based on reed switch input, the PCM de-energizes the LDP solenoid, causing it to block the vacuum port, and open the atmospheric port. This connects the upper pump cavity to atmosphere through the EVAP air filter. The spring is now able to push the diaphragm down. The downward movement of the diaphragm closes the inlet check valve and opens the outlet check valve pumping air into the evaporative system. The LDP reed switch turns from open to closed, allowing the PCM to monitor LDP pumping (diaphragm up/down) activity (Fig. 15). During the pumping mode, the diaphragm will not move down far enough to open the vent valve. The pumping cycle is repeated as the solenoid is turned on and off. When the evaporative system begins to pressurize, the pressure on the bottom of the diaphragm will begin to oppose the spring pressure, slowing the pumping action. The PCM watches the time from when the solenoid is de-energized, until the diaphragm drops down far enough for the reed switch to

LEAK DETECTION PUMP (Continued)

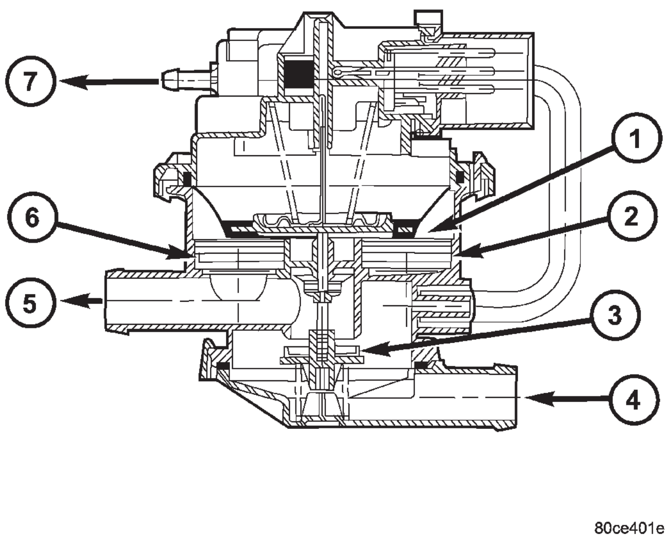


Fig. 13 LDP AT REST

1 - Diaphragm
2 - Inlet Check Valve (Closed)
3 - Vent Valve (Open)
4 - From Air Filter
5 - To Canister
6 - Outlet Check Valve (Closed)
7 - Engine Vacuum (Closed)

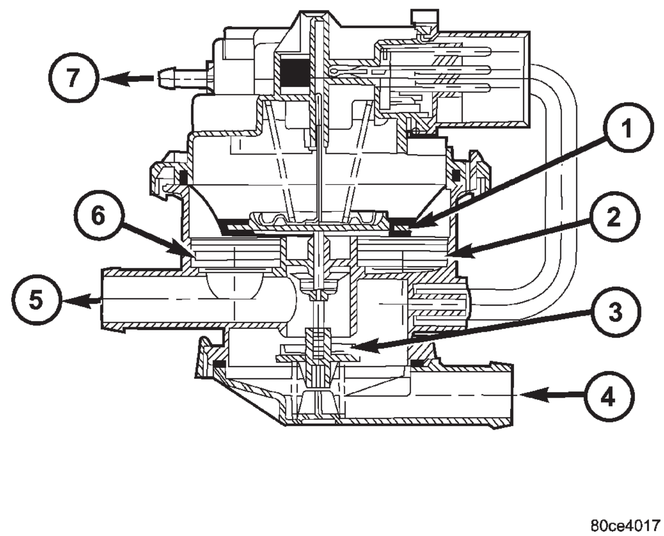


Fig. 14 DIAPHRAGM UPWARD MOVEMENT

1 - Diaphragm
2 - Inlet Check Valve (Open)
3 - Vent Valve (Closed)
4 - From Air Filter
5 - To Canister
6 - Outlet Check Valve (Closed)
7 - Engine Vacuum (Open)

change from opened to closed. If the reed switch changes too quickly, a leak may be indicated. The longer it takes the reed switch to change state, the tighter the evaporative system is sealed. If the system pressurizes too quickly, a restriction somewhere in the EVAP system may be indicated.

PUMPING ACTION

Action : During portions of this test, the PCM uses the reed switch to monitor diaphragm movement. The solenoid is only turned on by the PCM after the reed switch changes from open to closed, indicating that the diaphragm has moved down. At other times during the test, the PCM will rapidly cycle the LDP solenoid on and off to quickly pressurize the system. During rapid cycling, the diaphragm will not move enough to change the reed switch state. In the state of rapid cycling, the PCM will use a fixed time interval to cycle the solenoid. If the system does not pass the EVAP Leak Detection Test, the following DTCs may be set:

- P0442 - EVAP LEAK MONITOR 0.040″ LEAK DETECTED
- P0455 - EVAP LEAK MONITOR LARGE LEAK DETECTED
- P0456 - EVAP LEAK MONITOR 0.020″ LEAK DETECTED
- P1486 - EVAP LEAK MON PINCHED HOSE FOUND
- P1494 - LEAK DETECTION PUMP SW OR MECH FAULT
- P1495 - LEAK DETECTION PUMP SOLENOID CIRCUIT

DIAGNOSIS AND TESTING - ENABLING CONDITIONS TO RUN EVAP LEAK DETECTION TEST

- Cold start: with ambient temperature (obtained from modeling the inlet air temperature sensor on passenger vehicles and the battery temperature sensor on Jeep & Dodge Truck vehicles) between 4° C (40° F) and 32° C (90° F) for 0.040 leak. Between 4° C (40° F) and 29° C (85° F) for 0.020 leak.
- Engine coolant temperature within:-12° to -8° C (10° to 18° F) of battery/ambient.
- Battery voltage between 10 and 15 volts.
- Low fuel warning light off (fuel level must be between 15% and 85%.
- MAP sensor reading 22 in Hg or above (This is the manifold absolute pressure, not vacuum).

LEAK DETECTION PUMP (Continued)

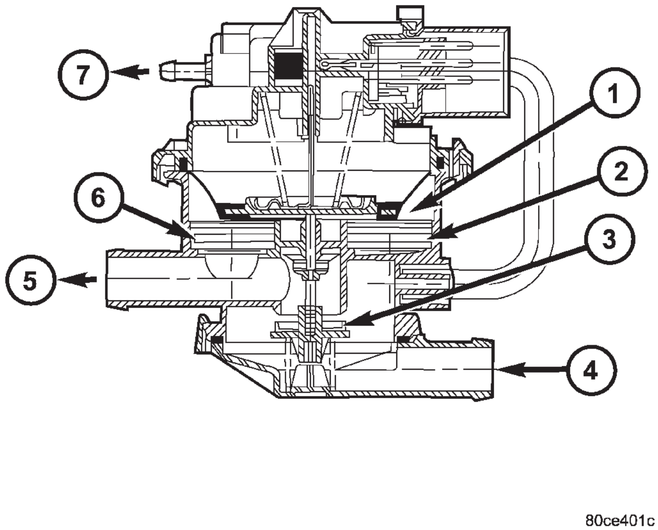


Fig. 15 DIAPHRAGM DOWNWARD MOVEMENT

1 - Diaphragm
2 - Inlet Check Valve (Closed)
3 - Vent Valve (Closed)
4 - From Air Filter
5 - To Canister
6 - Outlet Check Valve (Open)
7 - Engine Vacuum (Closed)

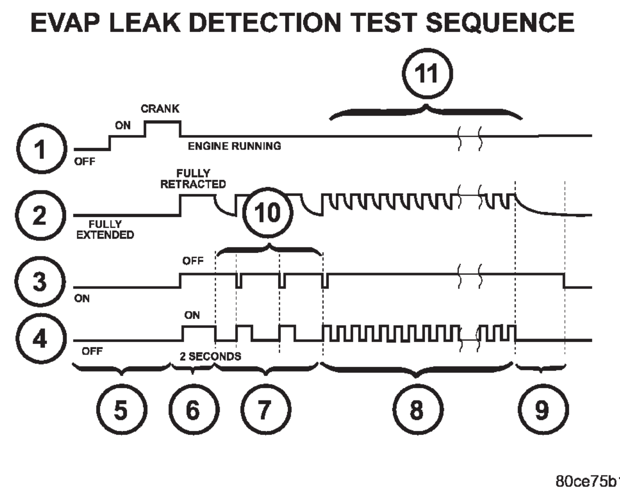
- No engine stall during test.

NOTE: IF BATTERY VOLTAGE DROPS BELOW 10 VOLTS FOR MORE THAN 5 SECONDS DURING ENGINE CRANKING, THE EVAP LEAK DETECTION TEST WILL NOT RUN.

NOTE: THE FOLLOWING VALUES ARE APPROXIMATE AND VEHICLE SPECIFIC. USE THE VALUES SEEN IN PRE TEST/MONITOR TEST SCREEN ON THE DRB III®. SEE TSB 25-02-98 FOR MORE DETAIL.

A DTC will not be set if a one-trip fault is set or if the MIL is illuminated for any of the following:

- Purge Solenoid Electrical Fault
- All TPS Faults
- All Engine Controller Self Test Faults
- LDP Pressure Switch Fault
- All Cam and/or Crank Sensor Fault
- EGR Solenoid Electrical Fault
- All MAP Sensor Faults
- All Injector Faults
- Ambient/Battery Temperature Sensor Electrical Faults
- Baro Out of Range
- Vehicle Speed Faults
- All Coolant Sensor Faults
- LDP Solenoid Circuit



EVAP LDP TEST SEQUENCE

1 - IGNITION SWITCH
2 - LDP DIAPHRAM
3 - LDP SWITCH
4 - LDP SOLENOID
5 - SECTION 1
6 - SECTION 2
7 - SECTION 3
8 - SECTION 4
9 - SECTION 5
10 - 3 TEST CYCLES TO TEST FOR BLOCKAGE
11- RAPID PUMP CYCLING FOR 70 CYCLES

NOTE: IF BATTERY TEMPERATURE IS NOT WITHIN RANGE, OR IF THE ENGINE COOLANT TEMPERATURE IS NOT WITHIN A SPECIFIED RANGE OF THE BATTERY TEMPERATURE, THE PCM WILL NOT RUN TESTS FOR DTC P1494, P1486, P0442, P0455 AND P0441. THESE TEMPERATURE CALIBRATIONS MAY BE DIFFERENT BETWEEN MODELS.

SECTION 1 - P1495 Leak Detection Pump Solenoid Circuit- When the ignition key is turned to ″ON″, the LDP diaphragm should be in the down position and the LDP reed switch should be closed. If the EVAP system has residual pressure, the LDP diaphragm may be up. This could result in the LDP reed switch being open when the key is turned to ″ON″ and a P1494 fault could be set because the PCM is expecting the reed switch to be closed.

After the key is turned ″ON″, the PCM immediately tests the LDP solenoid circuit for electrical faults. If a fault is detected, DTC P1495 will set, the

LEAK DETECTION PUMP (Continued)

MIL will illuminate, and the remaining EVAP Leak Detection Test is canceled.

SECTION 2 - P1494 Leak Detection Pump Switch or Mechanical Fault- If DTC P1495 is not set, the PCM will check for DTC P1494. If the LDP reed switch was closed when the key was turned to ″ON″, the PCM energizes the LDP solenoid for up to 8 seconds and monitors the LDP switch. As the LDP diaphragm is pulled up by engine vacuum, the LDP reed switch should change from closed to open. If it does not, the PCM sets a temporary fault (P1494) in memory, and waits until the next time the Enabling Conditions are met to run the test again. If this is again detected, P1494 is stored and the MIL is illuminated. If the problem is not detected during the next enabling cycle, the temporary fault will be cleared.

However, if the PCM detects the reed switch open when the key is turned to ″ON″, the PCM must determine if this condition is due to residual pressure in the EVAP system, or an actual fault. The PCM stores information in memory on EVAP system purging from previous engine run or drive cycles.

If little or no purging took place, residual pressure could be holding the LDP diaphragm up, causing the LDP switch to be open. Since this is not a malfunction, the PCM cancels the EVAP Leak Detection Test without setting the temporary fault.

If there was sufficient purging during the previous cycle to eliminate EVAP system pressure, the PCM judges that this is a malfunction and sets a temporary fault in memory. The next time that the Enabling Conditions are met, the test will run again. If the fault is again detected, the MIL will illuminate and DTC P1494 will be stored. If the fault is not detected, the temporary fault will be cleared.

SECTION 3 - P1486 EVAP Leak Monitor Pinched Hose Found- If no fault has been detected so far, the PCM begins testing for possible blockage in the EVAP system between the LDP and the fuel tank. This is done by monitoring the time required for the LDP to pump air into the EVAP system during two to three pump cycles. If no blockage is present, the LDP diaphragm is able to quickly pump air out of the LDP each time the PCM turns off the LDP solenoid. If a blockage is present, the PCM detects that the LDP takes longer to complete each pump cycle. If the pump cycles take longer than expected (approximately 6 to 10 seconds) the PCM will suspect a blockage. On the next drive when Enabling Conditions are met, the test will run again. If blockage is again detected, P1486 is stored, and the MIL is illuminated.

SECTION 4 - No DTC Can Be Set During This Time- After the LDP blockage tests are completed, the PCM then tests for EVAP system leakage. First, the PCM commands the LDP to rapidly pump for 20 to 50 seconds (depending on fuel level) to build pressure in the EVAP system. This evaluates the system J18-24-0 to see if it can be sufficiently pressurized. This evaluation (rapid pump cycling) may occur several times prior to leak checking. The LDP reed switch does not close and open during rapid pumping because the diaphragm does not travel through its full range during this part of the test.

SECTION 5 - P0456, P0442, P0455 EVAP Leak Monitor and Leak Detected- Next, the PCM performs one or more test cycles by monitoring the time required for the LDP reed switch to close (diaphragm to drop) after the LDP solenoid is turned off.

If the switch does not close, or closes after a long delay, it means that the system does not have any significant leakage and the EVAP Leak Detection Test is complete.

However, if the LDP reed switch closes quickly, there may be a leak or the fuel level may be low enough that the LDP must pump more to finish pressurizing the EVAP system. In this case, the PCM will rapidly pump the LDP again to build pressure in the EVAP system, and follow that by monitoring the time needed for several LDP test cycles. This process of rapid pumping followed by several LDP test cycles may repeat several times before the PCM judges that a leak is present.

When leaks are present, the LDP test cycle time will be inversely proportional to the size of the leak. The larger the leak, the shorter the test cycle time. The smaller the leak, the longer the test cycle time. DTC's may be set when a leak as small as 0.5 mm (0.020″) diameter is present.

If the system detects a leak, a temporary fault will be stored in PCM memory. The time it takes to detect a .020, .040, or Large leak is based on calibrations that vary from model to model. The important point to remember is if a leak is again detected on the next EVAP Leak Detection Test, the MIL will illuminate and a DTC will be stored based on the size of leak detected. If no leak is detected during the next test, the temporary fault will be cleared.

DIAGNOSTIC TIPS During diagnosis, you can compare the LDP solenoid activity with the monitor sequence in Figure 6. If the PCM detects a problem that could set a DTC, the testing is halted and LDP solenoid activity will stop. As each section of the test begins, it indicates that the previous section passed successfully. By watching to see which tests complete, you can see if any conditions are present that the PCM considers abnormal.

For example, if the LDP solenoid is energized for the test cycles to test for blockage (P1486), it means that the LDP has already passed its test for P1494. Then, if the PCM detects a possible blockage, it will

LEAK DETECTION PUMP (Continued)

set a temporary fault without turning on the MIL and continue the leak portion of the test. However, the PCM will assume that the system is already pressurized and skip the rapid pump cycles.

Always diagnose leaks, if possible, before disconnecting connections. Disconnecting connections may mask a leak condition.

Keep in mind that if the purge solenoid seat is leaking, it could go undetected since the leak would end up in the intake manifold. Disconnect the purge solenoid at the manifold when leak checking. In addition, a pinched hose fault (P1486) could set if the purge solenoid does not purge the fuel system properly (blocked seat). The purge solenoid must vent the fuel system prior to the LDP system test. If the purge solenoid cannot properly vent the system the LDP cannot properly complete the test for P1486 and this fault can set due to pressure being in the EVAP system during the test sequence.

Multiple actuation's of the DRB III® Leak Detection Pump (LDP) Monitor Test can hide a 0.020 leak because of excess vapor generation. Additionally, any source for additional vapor generation can hide a small leak in the EVAP system. Excess vapor generation can delay the fall of the LDP diaphragm thus hiding the small leak. An example of this condition could be bringing a cold vehicle into a warm shop for testing or high ambient temperatures.

Fully plugged and partially plugged underhood vacuum lines have been known to set MIL conditions. P1494 and P0456 can be set for this reason. Always, thoroughly, check plumbing for pinches or blockage before condemning components.

TEST EQUIPMENT The Evaporative Emission Leak Detector (EELD) Miller Special Tool 8404 is capable of visually detecting leaks in the evaporative system and will take the place of the ultrasonic leak detector 6917A. The EELD utilizes shop air and a smoke generator to visually detect leaks down to 0.020 or smaller. The food grade oil used to make the smoke includes an UV trace dye that will leave telltale signs of the leak under a black light. This is helpful when components have to be removed to determine the exact leak location. For detailed test instructions, follow the operators manual packaged with the EELD.

NOTE: Be sure that the PCM has the latest software update. Reprogram as indicated by any applicable Technical Service Bulletin. After LDP repairs are completed, verify the repair by running the DRB III® Leak Detection Pump (LDP) Monitor Test as described in Technical Service Bulletin 18-12-99.

REMOVAL

The Leak Detection Pump (LDP) is located under the left quarter panel behind the left/rear wheel (Fig. 16). It is attached to a two-piece support bracket (Fig. 17). The LDP and LDP filter are replaced (serviced) as one unit.

(1) Remove stone shield behind left/rear wheel (Fig. 18). Drill out plastic rivets for removal.

(2) Remove 3 LDP mounting bolts (Fig. 19).

(3) Remove support bracket brace bolt (Fig. 17).

(4) Loosen, but do not remove 2 support bracket nuts at frame rail (Fig. 19).

(5) To separate and lower front section of two-piece support bracket, remove 3 attaching bolts on bottom of support bracket (Fig. 17). While lowering support bracket, disconnect LDP wiring clip (Fig. 20).

(6) Disconnect electrical connector at LDP (Fig. 20).

(7) Carefully remove vapor/vacuum lines at LDP (Fig. 20).

(8) Remove LDP.

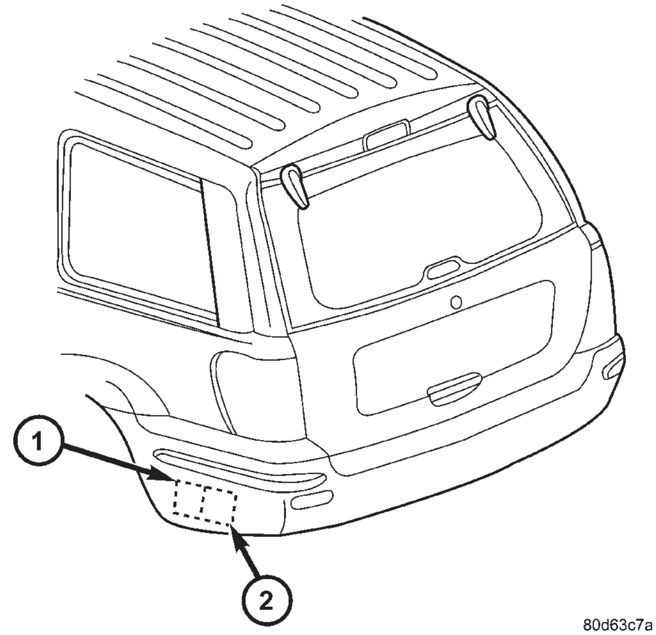


Fig. 16 LOCATION, LDP / EVAP CANISTER

1 - LEAK DETECTION PUMP
2 - EVAP CANISTER

INSTALLATION

The LDP is located in the left quarter panel behind the left/rear wheel. It is attached to a two-piece support bracket (Fig. 17). The LDP and LDP filter are replaced (serviced) as one unit.

(1) Position LDP and carefully install vapor/vacuum lines to LDP and LDP filter. **The vapor/vacuum lines and hoses must be firmly connected.**

LEAK DETECTION PUMP (Continued)

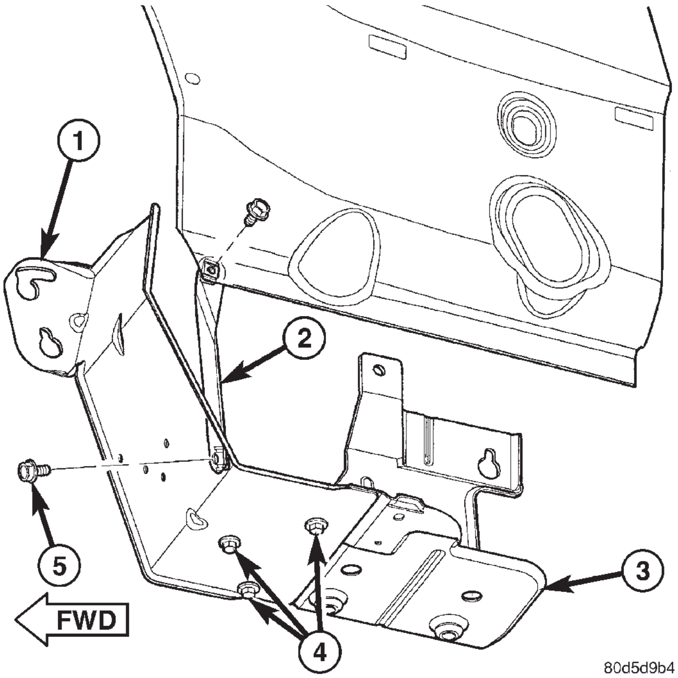


Fig. 17 TWO-PIECE SUPPORT BRACKET

1 - TWO-PIECE SUPPORT BRACKET (FRONT)
2 - SUPPORT BRACKET BRACE
3 - TWO-PIECE SUPPORT BRACKET (REAR)
4 - SUPPORT BRACKET ATTACHING BOLTS (3)
5 - SUPPORT BRACKET BRACE BOLT

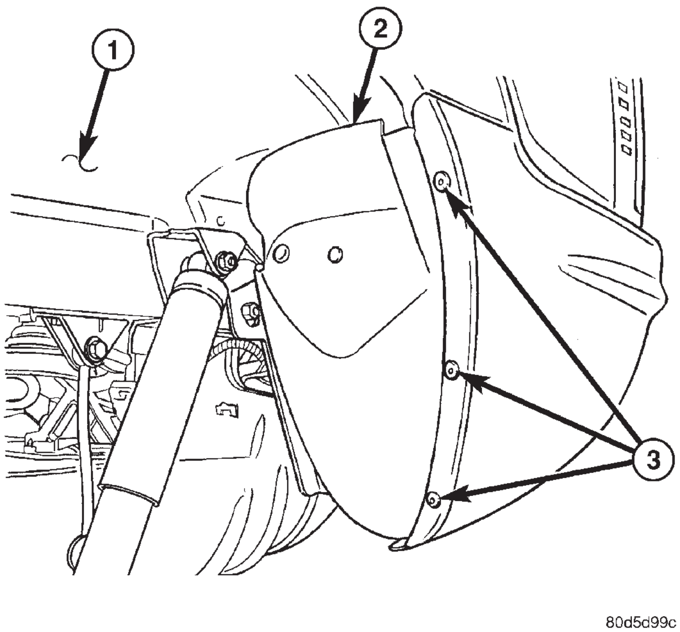


Fig. 18 STONE SHIELD

1 - LEFT-REAR WHEELHOUSE
2 - STONE SHIELD
3 - PLASTIC RIVETS

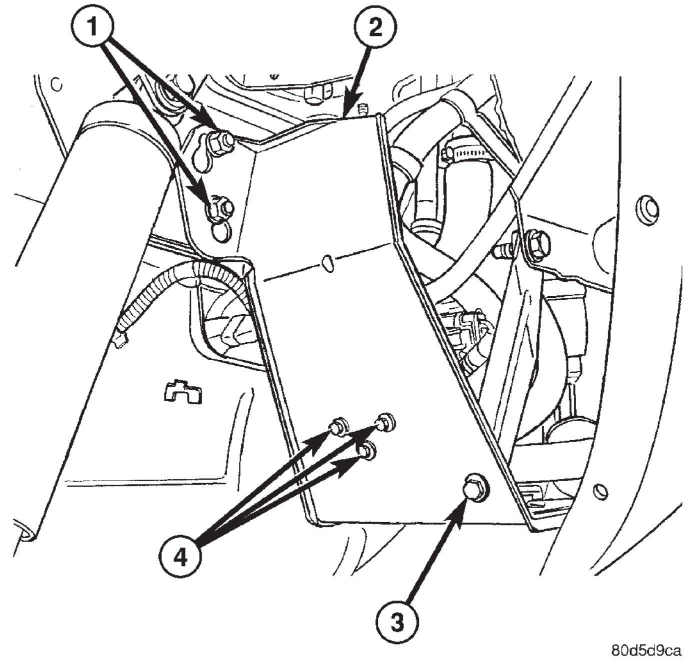


Fig. 19 LDP MOUNTING BOLTS

1 - SUPPORT BRACKET NUTS (2)
2 - SUPPORT BRACKET (FRONT)
3 - SUPPORT BRACKET BRACE BOLT
4 - LDP MOUNTING BOLTS (3)

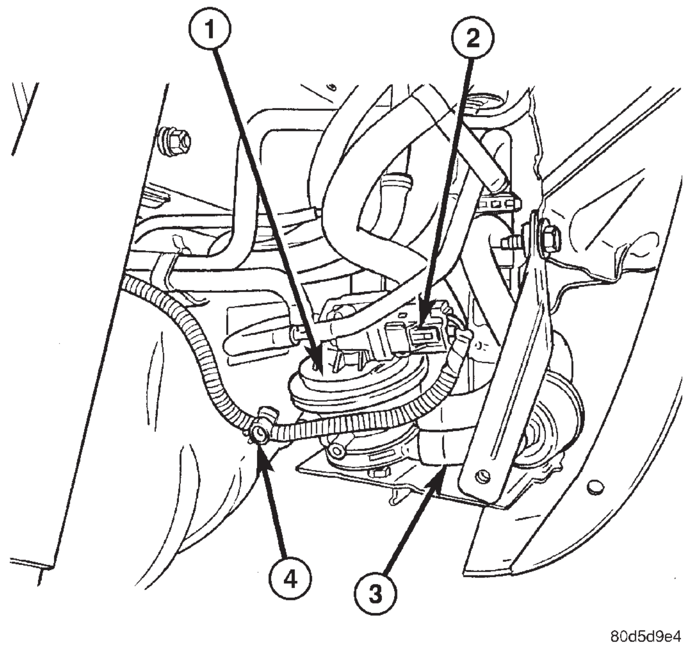


Fig. 20 LDP REMOVAL / INSTALLATION

1 - LDP
2 - ELEC. CONNECT.
3 - VAPOR / VACUUM LINES
4 - WIRING CLIP

LEAK DETECTION PUMP (Continued)

Check the vapor/vacuum lines at the LDP, LDP filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.

(2) Connect electrical connector to LDP.

(3) While raising front section of support bracket, connect LDP wiring clip (Fig. 20).

(4) Install 3 LDP mounting bolts (Fig. 19). Refer to Torque Specifications.

(5) Join front and rear sections of two-piece support bracket by installing 3 bolts on bottom of support bracket (Fig. 17). Do not tighten bolts at this time.

(6) Install support bracket brace bolt (Fig. 17). Do not tighten bolt at this time.

(7) Tighten 2 support bracket nuts at frame rail (Fig. 19). Refer to Torque Specifications.

(8) Tighten 3 support bracket bolts and brace bolt. Refer to Torque Specifications.

(9) Position stone shield behind left/rear wheel (Fig. 18). Install new plastic rivets.

ORVR

DESCRIPTION

The ORVR (On-Board Refueling Vapor Recovery) system consists of a unique fuel tank, flow management valve, fluid control valve, one-way check valve and vapor canister. Certain ORVR components can be found in (Fig. 1).

OPERATION

The ORVR (On-Board Refueling Vapor Recovery) system is used to remove excess fuel tank vapors. This is done while the vehicle is being refueled. Certain ORVR components can be found in (Fig. 1).

Fuel flowing into the fuel filler tube (approx. 1” I.D.) creates an aspiration effect drawing air into the fuel fill tube. During refueling, the fuel tank is vented to the EVAP canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the EVAP canister, the vehicle’s computer controlled purge system draws vapor out of the canister for the engine to burn. The vapor flow is metered by the purge solenoid so that there is no, or minimal impact on driveability or tailpipe emissions.

As fuel starts to flow through the fuel fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve and on to the vapor canister. Vapor is absorbed in the EVAP canister until vapor flow in the lines stops. This stoppage occurs following fuel shut-off, or by having the fuel level in the tank rise high enough to close the control valve. This control valve contains a float that rises to seal the large diameter vent path to the EVAP canister. At this point in the refueling process, fuel tank pressure increases, the check valve closes (preventing liquid fuel from spiting back at the operator), and fuel then rises up the fuel filler tube to shut off the dispensing nozzle.

PCV VALVE

DIAGNOSIS AND TESTING - PCV VALVE/PCV SYSTEM - 4.7L

(1) Disconnect PCV line/hose (Fig. 21) by disconnecting rubber connecting hose at PCV valve fitting.

(2) Remove PCV valve at oil filler tube by rotating PCV valve downward until locating tabs have been freed at cam lock (Fig. 21). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**

(3) After valve is removed, check condition of valve o-ring (Fig. 21). Also, PCV valve should rattle when shaken.

(4) Reconnect PCV valve to its connecting line/hose.

(5) Start engine and bring to idle speed.

(6) If valve is not plugged, a hissing noise will be heard as air passes through valve. Also, a strong vacuum should be felt with a finger placed at valve inlet.

(7) If vacuum is not felt at valve inlet, check line/hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at rear of manifold. Do this by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

PCV VALVE (Continued)

(8) **Do not attempt to clean the old PCV valve.**

(9) Return PCV valve back to oil filler tube by placing valve locating tabs (Fig. 21) into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.

(10) Connect PCV line/hose and connecting rubber hose to PCV valve.

(11) Disconnect rubber hose from fresh air fitting at left side of air cleaner resonator box (Fig. 22). Start engine and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the opening of the disconnected rubber hose.

(12) The paper should be drawn against the hose opening with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.

(13) If vacuum is not present, disconnect each PCV system hose at top of each breather (Fig. 22). Check for obstructions or restrictions.

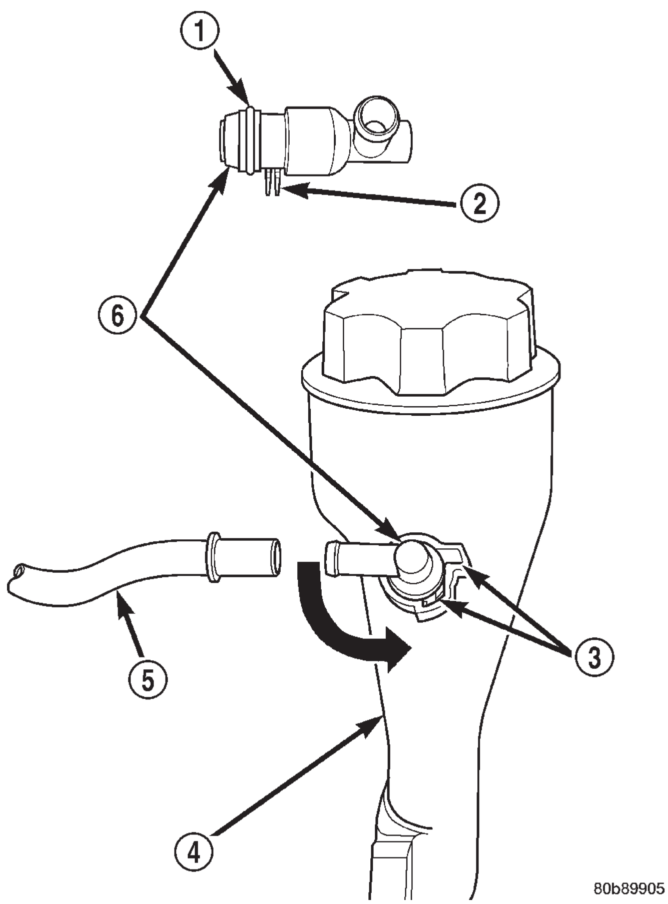


Fig. 21 PCV Valve/Oil Filler Tube—4.7L V-8 Engine

1 - O-RING
2 - LOCATING TABS
3 - CAM LOCK
4 - OIL FILLER TUBE
5 - PCV LINE/HOSE
6 - PCV VALVE

(14) If vacuum is still not present, remove each PCV system breather (Fig. 22) from each cylinder head. Check for obstructions or restrictions. If plugged, replace breather. Tighten breather to 12 N·m (106 in. lbs.) torque. Do not attempt to clean breather

(15) If vacuum is still not present, disconnect each PCV system hose at each fitting and check for obstructions or restrictions.

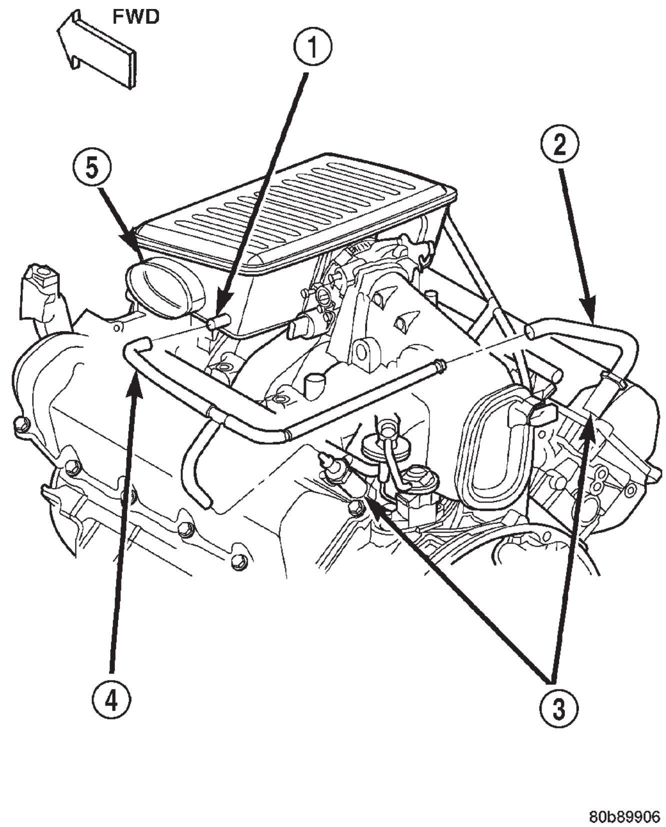


Fig. 22 PCV Breathers/Tubes/Hoses—4.7L V-8 Engine

1 - FRESH AIR FITTING
2 - CONNECTING TUBES/HOSES
3 - CRANKCASE BREATHERS (2)
4 - RUBBER HOSE
5 - AIR CLEANER RESONATOR

PCV VALVE (Continued)

REMOVAL - PCV VALVE - 4.7L

The PCV valve is located on the oil filler tube (Fig. 23). Two locating tabs are located on the side of the valve (Fig. 23). These 2 tabs fit into a cam lock in the oil filler tube. An o-ring seals the valve to the filler tube.

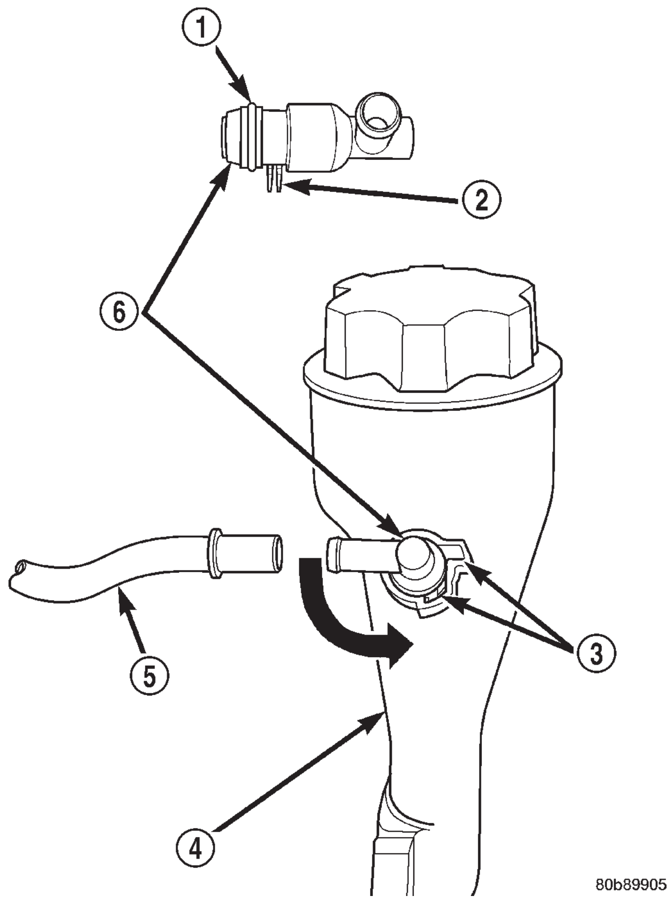


Fig. 23 PCV Valve/Oil Filler Tube Location

1 - O-RING
2 - LOCATING TABS
3 - CAM LOCK
4 - OIL FILLER TUBE
5 - PCV LINE/HOSE
6 - PCV VALVE

(1) Disconnect PCV line/hose (Fig. 23) by disconnecting rubber hose at PCV valve fitting.

(2) Remove PCV valve at oil filler tube by rotating PCV valve downward (counter-clockwise) until locating tabs have been freed at cam lock (Fig. 23). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**

(3) After valve is removed, check condition of valve o-ring (Fig. 23).

INSTALLATION - PCV VALVE - 4.7L

The PCV valve is located on the oil filler tube (Fig. 23). Two locating tabs are located on the side of the valve (Fig. 23). These 2 tabs fit into a cam lock in the oil filler tube. An o-ring seals the valve to the filler tube.

(1) Return PCV valve back to oil filler tube by placing valve locating tabs (Fig. 23) into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.

(2) Connect PCV line/hose and rubber hose to PCV valve.

VACUUM LINES

DESCRIPTION

A vacuum schematic for emission related items can be found on the VECI label. Refer to Vehicle Emission Control Information (VECI) Label for label location.

VAPOR CANISTER

DESCRIPTION

A maintenance free, EVAP canister is used on all gasoline powered models. The canister is attached to a two-piece support bracket located behind the left-rear wheel.

OPERATION

The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

The canister serves two functions: as a temporary fuel vapor storage point while refueling the vehicle for the ORVR system, as a temporary vapor storage point while the engine is running.

Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

Refer to ORVR for additional information.

VAPOR CANISTER (Continued)

REMOVAL

The EVAP canister is located behind the left-rear wheel (Fig. 24). It is attached to a two-piece support bracket (Fig. 25).

(1) Remove rear bumper facia. Refer to Rear Facia Removal / Installation in Frame & Bumpers section.

(2) Remove 1 support bracket brace bolt (Fig. 25).

(3) Loosen, but do not remove 2 support bracket nuts (Fig. 26).

(4) Remove upper/rear support bracket mounting bolt (Fig. 27).

(5) Carefully lower support bracket assembly to gain access to vapor / vacuum lines. To prevent damage to lines, suspend bracket assembly with rope or string.

(6) Disconnect necessary vacuum / vapor lines at EVAP canister.

(7) Remove EVAP canister mounting bolt (Fig. 28).

(8) Lift canister from support bracket (2 pins are used to align canister into support bracket)

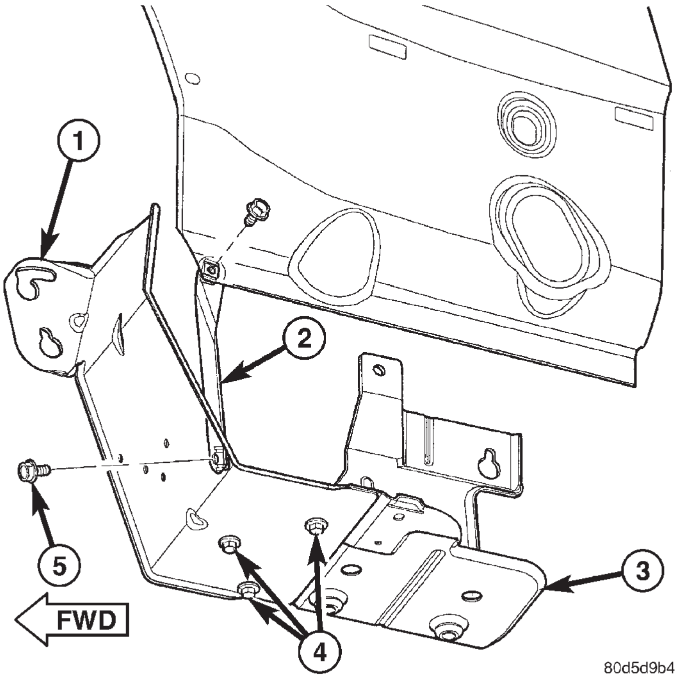


Fig. 25 TWO-PIECE SUPPORT BRACKET

1 - TWO-PIECE SUPPORT BRACKET (FRONT)
2 - SUPPORT BRACKET BRACE
3 - TWO-PIECE SUPPORT BRACKET (REAR)
4 - SUPPORT BRACKET ATTACHING BOLTS (3)
5 - SUPPORT BRACKET BRACE BOLT

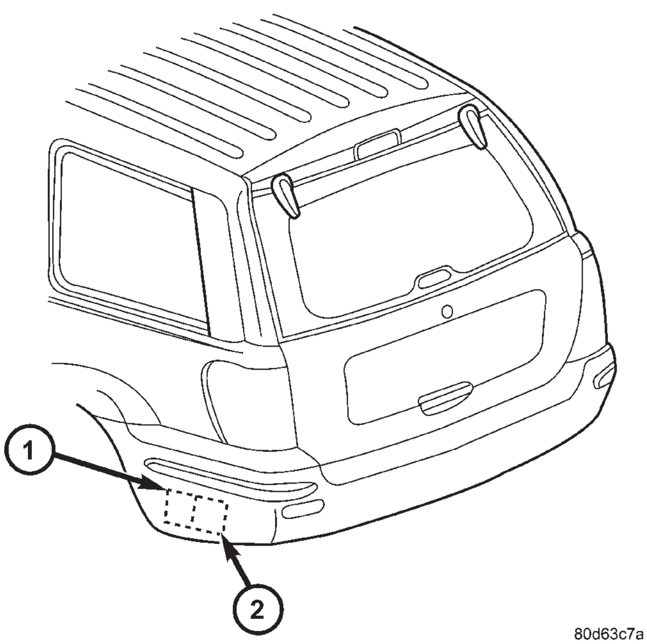


Fig. 24 LOCATION, LDP / EVAP CANISTER

1 - LEAK DETECTION PUMP
2 - EVAP CANISTER

INSTALLATION

The EVAP canister is located behind the left-rear wheel (Fig. 24). It is attached to a two-piece support bracket (Fig. 25).

(1) Position canister to support bracket. Guide 2 alignment pins into support bracket.

(2) Install EVAP canister mounting bolt (Fig. 28). Refer to Torque Specifications.

(3) Carefully install vapor / vacuum lines to canister. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the LDP, LDP filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**

VAPOR CANISTER (Continued)

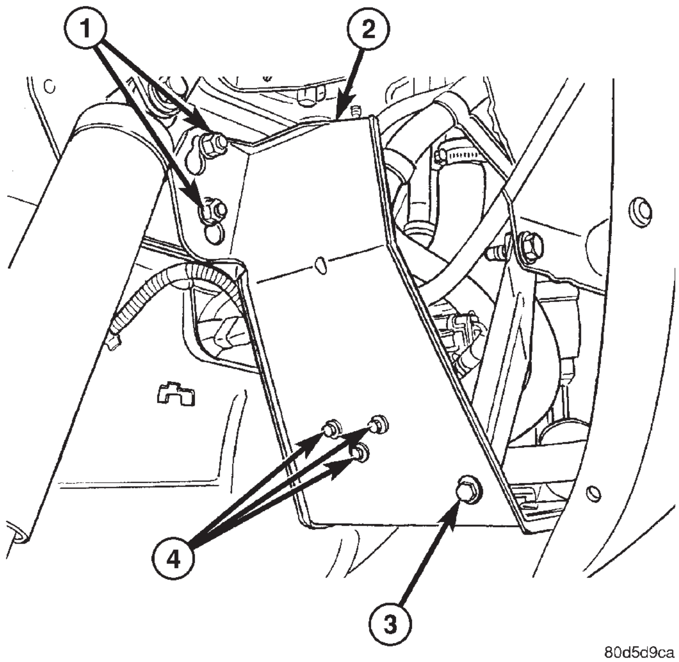


Fig. 26 SUPPORT BRACKET NUTS

1 - SUPPORT BRACKET NUTS (2)
2 - SUPPORT BRACKET (FRONT)
3 - SUPPORT BRACKET BRACE BOLT
4 - LDP MOUNTING BOLTS (3)

(4) Carefully raise support bracket assembly to frame rail. Install 1 support bracket brace bolt (Fig. 25) and 2 support bracket nuts (Fig. 26).

(5) Install upper/rear support bracket mounting bolt (Fig. 27). Refer to Torque Specifications.

(6) Install rear bumper facia. Refer to Rear Facia Removal / Installation in Frame & Bumpers section.

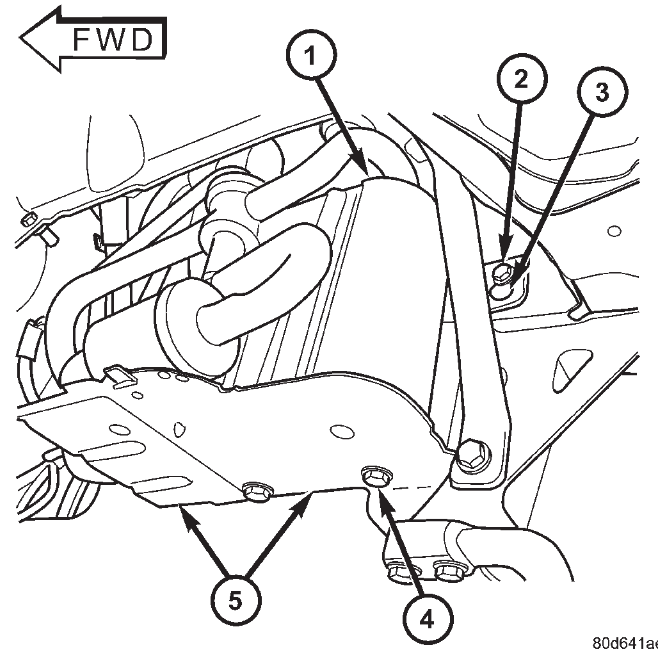


Fig. 27 SUPPORT BRACKET BOLT

1 - EVAP CANISTER
2 - UPPER / REAR SUPPORT BRACKET BOLT
3 - SLOTTED HOLE
4 - ALIGNMENT PINS (2)
5 - TWO-PIECE SUPPORT BRACKET

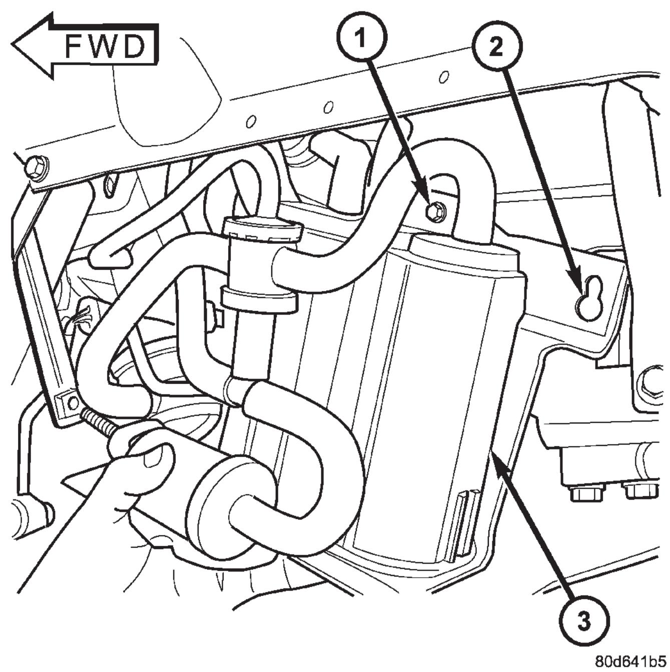


Fig. 28 EVAP CANISTER REMOVE / INSTALL

1 - EVAP CANISTER MOUNTING BOLT
2 - SLOTTED HOLE
3 - EVAP CANISTER (LOWERED)

SERVICE MANUAL COMMENTS

What errors(s) have you found?

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In order for us to assist you, please include as much details as possible when reporting an error

Comments / Suggestions

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☐ **Dealership Technician** **Dealer Code:** ____________	**Retail Customer** ☐

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JEEP®

2002 WG
GRAND CHEROKEE
2.7L DIESEL ENGINE

SERVICE MANUAL
SUPPLEMENT

DaimlerChrysler Corporation reserves the right to make changes in design or to make additions to or improvements in its products without imposing any obligations upon itself to install them on its products previously manufactured.

FOREWORD

This manual is designed as a supplement to be used along with the 2002 Grand Cherokee Service Manual. It includes information related to the 2.7L diesel engine installed in this vehicle by DaimlerChrysler Corporation. For diagnosis or service procedures relating to other components or systems, refer to the 2002 Grand Cherokee Service Manual.

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information describing the operation and use of standard and optional equipment is included in the Owner's Manual provided with the vehicle.

Information in this manual is divided into groups. These groups contain description, operation, diagnosis, testing, adjustments, removal, installation, disassembly, and assembly procedures for the systems and components. To assist in locating a group title page, use the Group Tab Locator on the following page. The solid bar after the group title is aligned to a solid tab on the first page of each group. The first page of the group has a contents section that lists major topics within the group. If you are not sure which Group contains the information you need, look up the Component/System in the alphabetical index located in the rear of this manual.

A Service Manual Comment form is included at the rear of this manual. Use the form to provide DaimlerChrysler Corporation with your comments and suggestions.

Tightening torques are provided as a specific value throughout this manual. This value represents the midpoint of the acceptable engineering torque range for a given fastener application. These torque values are intended for use in service assembly and installation procedures using the correct OEM fasteners. When replacing fasteners, always use the same type (part number) fastener as removed.

DaimlerChrysler Corporation reserves the right to change testing procedures, specifications, diagnosis, repair methods, or vehicle wiring at any time without prior notice or incurring obligation.

GROUP TAB LOCATOR

LUBRICATION & MAINTENANCE

TABLE OF CONTENTS

LUBRICATION & MAINTENANCE

SPECIFICATIONS - FLUID CAPACITIES

DESCRIPTION	SPECIFICATION
FUEL TANK	20 U.S. Gallons (76 Liters)****
Engine Oil - with Filter - 2.7L Diesel	6.5L (6.9 qts.)
Engine Oil - with Filter - 4.0L	5.7 L (6.0 qts.)
Engine Oil - with Filter - 4.7L	5.7 L (6.0 qts.)
Cooling System - 2.7L Diesel	14.2L (15 qts.)***
Cooling System - 4.0L	14.1 L (15 qts.)***
Cooling System - 4.7L	13.7 L (14.5 qts.)***
AUTOMATIC TRANSMISSION	
Service Fill - 42RE	3.8 L (4.0 qts.)
Service Fill - 545RFE	2WD - 5.2 L (11 pts.) 4WD - 6.2 L (13 pts.)

DESCRIPTION	SPECIFICATION
Service Fill - W5J400	5.0 L (10.6 pts.)
O-haul Fill - 42RE	9.1-9.5 L (19-20 pts.)
O-haul Fill - 545RFE	13.33 L (28.0 pts.)
O-haul Fill - W5J400	7.7 L (16.3 pts)
Dry fill capacity Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. (Refer to appropriate 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/FLUID - STANDARD PROCEDURE).	
TRANSFER CASE	
NV242	1.35L (2.85 pts.)
NV247	1.6L (3.4 pts.)
FRONT AXLE ± 0.3 L (1 oz.)	
186 FBI (Model 30)	1.18 L (2.5 pts.)*
* With Vari-Lok add 0.07 L (2.5 oz.) of Friction Modifier.	

LUBRICATION & MAINTENANCE (Continued)

DESCRIPTION	SPECIFICATION
REAR AXLE ± 0.3 L (1 oz.)	
198 RBI (Model 35)	1.66 L (3.5 pts.)*
226 RBA (Model 44)	2.24 L (4.75 pts.)**
* With Trac-lok add 0.07 L (2.5 oz.) of Friction Modifier.	
** With Trac-lok or Vari-Lok, add 0.07 L (2.5 oz.) of Friction Modifier.	
*** Includes 0.9L (1.0 qts.) for coolant reservoir.	
****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.	

INTERNATIONAL SYMBOLS

DESCRIPTION

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations (Fig. 1).

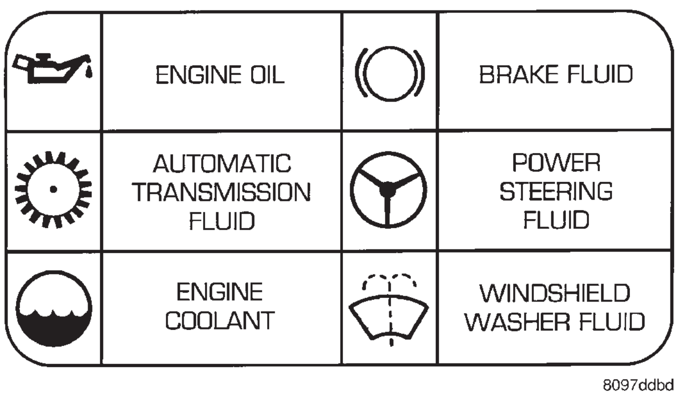

Fig. 1 INTERNATIONAL SYMBOLS

PARTS & LUBRICANT RECOMMENDATION

STANDARD PROCEDURE - PARTS & LUBRICANT RECOMMENDATIONS

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 2) on the label. At the bottom NLGI symbol is the usage and quality identification letters. Wheel bearing lubricant is identified by the letter “G”. Chassis lubricant is identified by the latter “L”. The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.

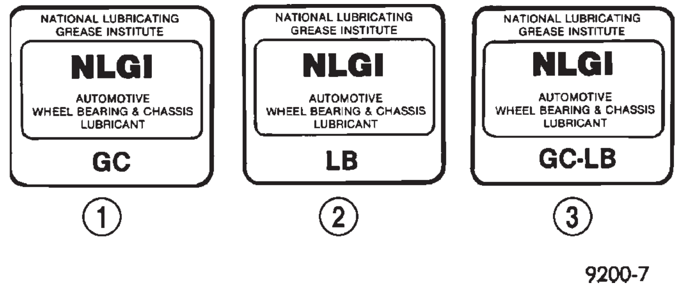

Fig. 2 NLGI Symbol

1 - WHEEL BEARINGS
2 - CHASSIS LUBRICATION
3 - CHASSIS AND WHEEL BEARINGS

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

FLUID TYPES

DESCRIPTION

DESCRIPTION - ENGINE COOLANT

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

FLUID TYPES (Continued)

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300) deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

DESCRIPTION - HOAT COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified (non-HOAT or other HOAT), may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.

COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

Pure Water-Water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

100 percent Ethylene-Glycol-The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22°C (-8°F).

50/50 Ethylene-Glycol and Water-Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protec-

FLUID TYPES (Continued)

tion against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

COOLANT SELECTION AND ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 3).

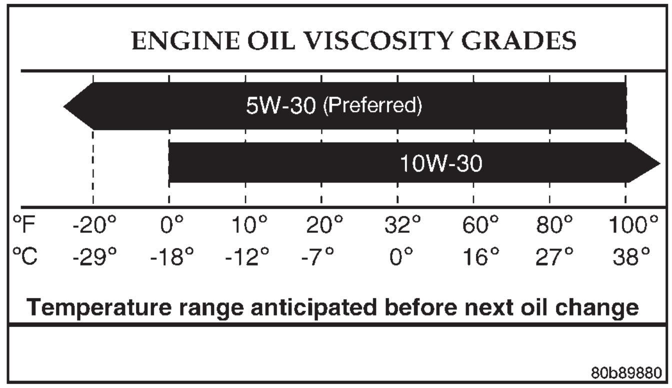

Fig. 3 Temperature/Engine Oil Viscosity - 4.7L

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 4).

Fig. 4 API SYMBOL

FLUID TYPES (Continued)

DESCRIPTION - ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

API SERVICE GRADE CERTIFIED

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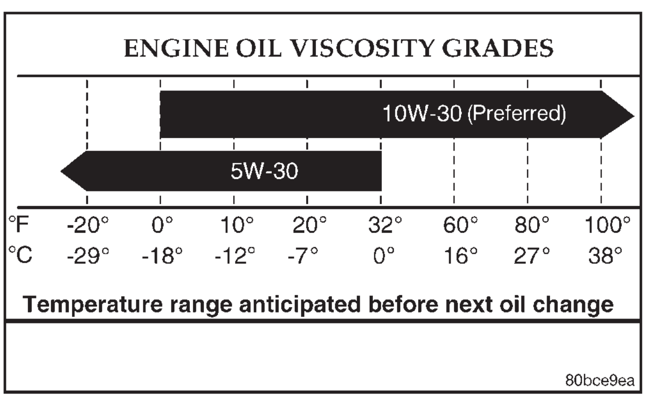

Fig. 5 Temperature/Engine Oil Viscosity - 4.0L

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 6).

9400-9

Fig. 6 API Symbol

DESCRIPTION

A multi-purpose, hypoid gear lubricant which conforms to MIL-L-2105C and API GL 5 quality specifications should be used. Mopar Hypoid Gear Lubricant conforms to these specifications.

FRONT AXLE

• Lubricant is SAE 75W-140 SYNTHETIC.

REAR AXLE

• Lubricant is a thermally stable SAE 80W-90 gear lubricant.

• Lubricant for heavy-duty or trailer tow use is SAE 75W-140 SYNTHETIC.

NOTE: Trac-lok® and Vari-lok® equipped axles require a friction modifier be added to the lubricant.

DESCRIPTION - TRANSFER CASE - NV242

Recommended lubricant for the NV242 transfer case is Mopar® ATF+4, type 9602 Automatic Transmission Fluid.

DESCRIPTION - TRANSFER CASE - NV247

Mopar® Transfer Case Lubricant (P/N 05016796) is the only lubricant recommended for the NV247 transfer case.

DESCRIPTION - AUTOMATIC TRANSMISSION FLUID

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

Mopar® ATF +4, type 9602, Automatic Transmission Fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF +4, type 9602, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid

FLUID TYPES (Continued)

condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

DESCRIPTION - AUTOMATIC TRANSMISSION FLUID - W5J400

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

Shell® 3403 Automatic Transmission Fluid is the recommended fluid for the W5J400 DaimlerChrysler automatic transmission.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Shell® 3403 Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.**

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

DESCRIPTION - ENGINE OIL - DIESEL ENGINES

Use only Diesel Engine Oil meeting standard **MIL-2104C** or API Classification **CD or higher** or **CCML D4, D5**.

SAE VISCOSITY GRADE

CAUTION: Low viscosity oils must have the proper API quality or the CCMC G5 designation.

To assure of properly formulated engine oils, it is recommended that SAE Grade 10W-40 engine oils that meet Chrysler material standard MS-6395, be used. European Grade 10W-40 oils are also acceptable.

Oils of the SAE 5W-40 or 8W-80 grade number are preferred when minimum temperatures consistently fall below -12°C.

OPERATION - AUTOMATIC TRANSMISSION FLUID

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

FLUID FILL/CHECK LOCATIONS

INSPECTION - FLUID FILL/CHECK LOCATIONS

The fluid fill/check locations and lubrication points are located in each applicable group.

MAINTENANCE SCHEDULES

DESCRIPTION

″Maintenance Schedule Information not included in this section, is located in the appropriate Owner’s Manual.″

LIFT POINTS

STANDARD PROCEDURE - HOISTING AND JACKING RECOMMENDATIONS

FLOOR JACK

When properly positioned, a floor jack can be used to lift a WJ vehicle (Fig. 7). Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

CAUTION: Do not attempt to lift a vehicle with a floor jack positioned under:
- **An axle tube.**
- **Aluminum differential.**
- **A body side sill.**
- **A steering linkage component.**
- **A drive shaft.**
- **The engine or transmission oil pan.**
- **The fuel tank.**
- **A front suspension arm.**

HOIST

A vehicle can be lifted with:
- A single-post, frame-contact hoist.
- A twin-post, chassis hoist.
- A ramp-type, drive-on hoist.

NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly (Fig. 7).

WARNING: THE HOISTING AND JACK LIFTING POINTS PROVIDED ARE FOR A COMPLETE VEHICLE. WHEN A CHASSIS OR DRIVETRAIN COMPONENT IS REMOVED FROM A VEHICLE, THE CENTER OF GRAVITY IS ALTERED MAKING SOME HOISTING CONDITIONS UNSTABLE. PROPERLY SUPPORT OR SECURE VEHICLE TO HOISTING DEVICE WHEN THESE CONDITIONS EXIST.

JUMP STARTING

STANDARD PROCEDURE - JUMP STARTING

WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN GROUP 8A, BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS. DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT. DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR. DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS

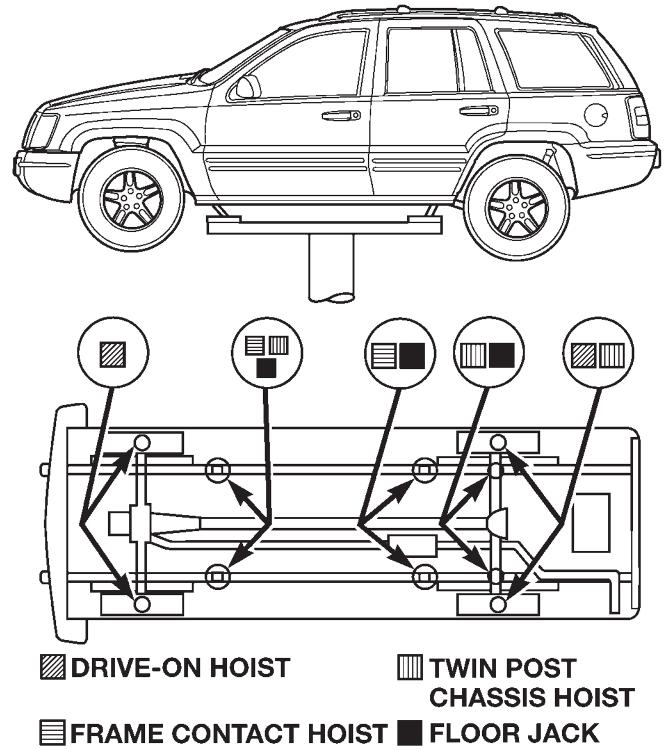

Fig. 7 Correct Vehicle Lifting Locations

BELOW THE TOP OF LEAD PLATES. DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE. DO NOT USE OPEN FLAME NEAR BATTERY. REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT. WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.

CAUTION: When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.

TO JUMP START A DISABLED VEHICLE:

(1) Raise hood on disabled vehicle and visually inspect engine compartment for:
- Battery cable clamp condition, clean if necessary.
- Frozen battery.
- Yellow or bright color test indicator, if equipped.
- Low battery fluid level.
- Generator drive belt condition and tension.
- Fuel fumes or leakage, correct if necessary.

CAUTION: If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.

JUMP STARTING (Continued)

(2) When using another vehicle as a booster source, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.

(3) On disabled vehicle, place gear selector in park or neutral and set park brake. Turn off all accessories.

(4) Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result. Review all warnings in this procedure.

(5) On disabled vehicle, connect RED jumper cable clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground as close to the ground cable attaching point as possible (Fig. 8).

(6) Start the engine in the vehicle which has the booster battery, let the engine idle a few minutes, then start the engine in the vehicle with the discharged battery.

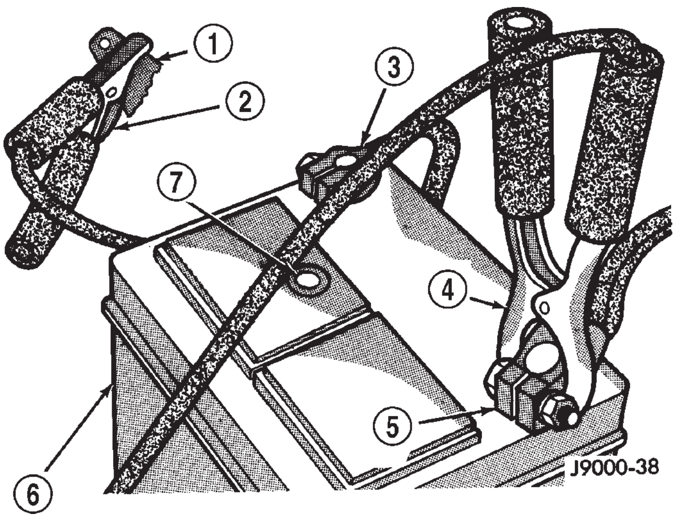

Fig. 8 Jumper Cable Clamp Connections

1 - ENGINE GROUND
2 - NEGATIVE JUMPER CABLE
3 - BATTERY NEGATIVE CABLE
4 - POSITIVE JUMPER CABLE
5 - BATTERY POSITIVE CABLE
6 - BATTERY
7 - TEST INDICATOR

CAUTION: Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will overheat and could fail.

(7) Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 min.), before cranking again.

DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp from engine ground on disabled vehicle.
- When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal. Disconnect RED cable clamp from battery positive terminal.
- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

EMERGENCY TOW HOOKS

DESCRIPTION

WARNING: REMAIN AT A SAFE DISTANCE FROM A VEHICLE THAT IS BEING TOWED VIA ITS TOW HOOKS. THE TOW STRAPS/CHAINS COULD BREAK AND CAUSE SERIOUS INJURY.

Some Jeep vehicles are equipped with front emergency tow hooks (Fig. 9). The tow hooks should be used for **EMERGENCY**purposes only.

CAUTION: DO NOT use emergency tow hooks for tow truck hook-up or highway towing.

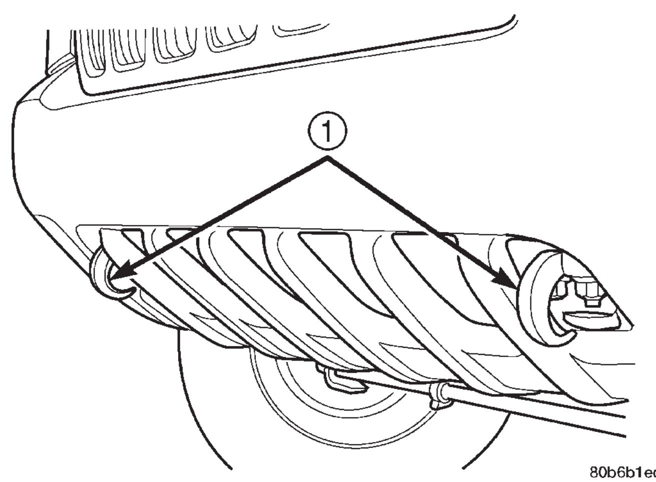

Fig. 9 Emergency Tow Hooks

1 - TOW HOOK

TOWING

STANDARD PROCEDURE - TOWING RECOMMENDATIONS

A vehicle equipped with SAE approved wheel lift-type towing equipment can be used to tow WJ vehicles. When towing a 4WD vehicle using a wheel-lift towing device, use tow dollies under the opposite end of the vehicle. A vehicle with flatbed device can also be used to transport a disabled vehicle (Fig. 10).

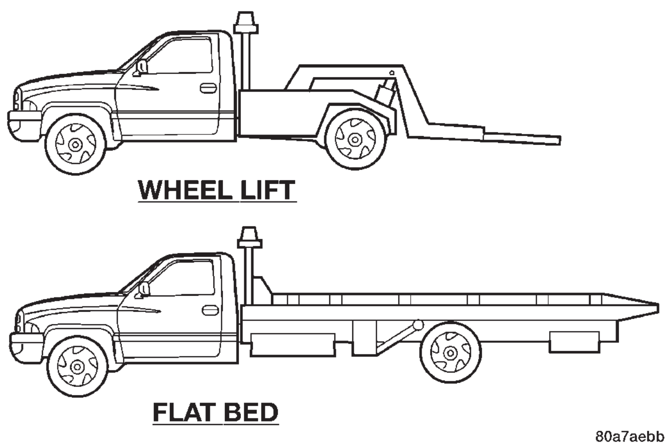

Fig. 10 Tow Vehicles With Approved Equipment

SAFETY PRECAUTIONS

CAUTION: The following safety precautions must be observed when towing a vehicle:

- Secure loose and protruding parts.
- Always use a safety chain system that is independent of the lifting and towing equipment.
- Do not allow towing equipment to contact the disabled vehicle's fuel tank.
- Do not allow anyone under the disabled vehicle while it is lifted by the towing device.
- Do not allow passengers to ride in a vehicle being towed.
- Always observe state and local laws regarding towing regulations.
- Do not tow a vehicle in a manner that could jeopardize the safety of the operator, pedestrians or other motorists.
- Do not attach tow chains, T-hooks, or J-hooks to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.
- Do not tow a heavily loaded vehicle. Use a flatbed device to transport a loaded vehicle.

TWO-WHEEL-DRIVE VEHICLE TOWING

DaimlerChrysler Corporation recommends that a vehicle be towed with the rear end lifted, whenever possible.

WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION (AUTOMATIC TRANSMISSION) OR A FORWARD DRIVE GEAR (MANUAL TRANSMISSION).

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

TWO WHEEL DRIVE TOWING-REAR END LIFTED

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

2WD vehicles can be towed with the front wheels on the surface for extended distances at speeds not exceeding 48 km/h (30 mph).

(1) Attach wheel lift device to rear wheels.
(2) Place the transmission in neutral.
(3) Raise vehicle to towing position.
(4) Attach safety chains. Route chains so not to interfere with tail pipe when vehicle is lifted.
(5) Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(6) Secure steering wheel in straight ahead position with a clamp device designed for towing.
(7) Place transmission in park.

TWO WHEEL DRIVE TOWING-FRONT END LIFTED

CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.

(1) Attach wheel lift device to rear wheels.
(2) Place the transmission in neutral.
(3) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
(4) Attach wheel lift device to front wheels and raise vehicle to towing position.
(5) Attach the safety chains.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

TOWING (Continued)

(6) Turn the ignition switch to the OFF position to unlock the steering wheel.

(7) Secure steering wheel in straight ahead position with a clamp device designed for towing.

(8) Place transmission in park.

FOUR-WHEEL-DRIVE VEHICLE TOWING

DaimlerChrysler Corporation recommends that a 4WD vehicle be transported on a flat-bed device. A Wheel-lift device can be used provided **the trailing wheels are off the ground and positioned in tow dollies.**

WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION.

CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.

FOUR WHEEL DRIVE TOWING—REAR END LIFTED

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

(1) Attach wheel lift device to front wheels.

(2) Place the transmission in neutral.

(3) Raise the front of the vehicle off the ground and install tow dollies under front wheels.

(4) Attach wheel lift device to rear wheels and raise vehicle to towing position.

(5) Attach safety chains. Route chains so not to interfere with tail pipe when vehicle is lifted.

(6) Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(7) Secure steering wheel in straight ahead position with a clamp device designed for towing.

(8) Place transmission in park.

FOUR WHEEL DRIVE TOWING—FRONT END LIFTED

WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.

(1) Attach wheel lift device to rear wheels.

(2) Place the transmission in neutral.

(3) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.

(4) Attach wheel lift device to front wheels and raise vehicle to towing position.

(5) Attach the safety chains.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(6) Turn the ignition switch to the OFF position to unlock the steering wheel.

(7) Secure steering wheel in straight ahead position with a clamp device designed for towing.

(8) Place transmission in park.

COOLING - 2.7L DIESEL

TABLE OF CONTENTS

COOLING - 2.7L DIESEL

OPERATION—COOLING SYSTEM

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

- PROLONGED IDLE
- VERY HIGH AMBIENT TEMPERATURE
- SLIGHT TAIL WIND AT IDLE
- SLOW TRAFFIC
- TRAFFIC JAMS
- HIGH SPEED OR STEEP GRADES

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- Increasing engine speed for more air flow is recommended.

TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, (Refer to 7 - COOLING - DIAGNOSIS AND TESTING)

COOLING - 2.7L DIESEL (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM

COOLING SYSTEM DIAGNOSIS—DIESEL ENGINE

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATUREGAUGE READS LOW	1. Vehicle is equipped with a heavy duty cooling system.	1. None. System operating normaly.
	2. Temperature gauge not connected	2. Connect gauge.
	3. Temperature gauge connected but not operating.	3. Check gauge. Refer (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	4. Coolant level low.	4. Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
TEMPERATURE GAUGE READS HIGH. COOLANT MAY OR MAY NOT BE LEAKING FROM SYSTEM	1. Vehicle overloaded, high ambient (outside) temperatures with A/C turned on, stop and go driving or prolonged operation at idle speeds.	1. Temporary condition, repair not required. Notify customer of vehicle operation instructions located in Owners Manual.
	2. Temperature gauge not functioning correctly.	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	3. Air traped in cooling	3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) and refill (Refer to 7 - COOLING - STANDARD PROCEDURE)
	4. Radiator cap faulty.	4. Replace radiator cap.
	5. Plugged A/C or radiator cooling fins.	5. Clean all debre away from A/C and radiator cooling fins.
	6. Coolant mixture incorrect.	6. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) refill with correct mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).
	7. Thermostat stuck shut.	7. Replace thermostat.
	8. Bug screen or winter front being used.	8. Remove bug screen or winter front.
	9. Viscous fan drive not operating properly.	9. Check viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)
	10. Cylinder head gasket leaking.	10. Check for leaking head gaskets (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	11. Heater core leaking.	11. Replace heater core.
	12. cooling system hoses leaking.	12. Tighten clamps or Replace hoses.
	13. Brakes dragging.	13. Check brakes. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL - DIAGNOSIS AND TESTING)

COOLING - 2.7L DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING INCONSISTENT (ERRATIC, CYCLES OR FLUCTUATES)	1. Heavy duty cooling system, extream cold ambient (outside) temperature or heater blower motor in high position.	1. None. System operating normaly.
	2. Temperature gauge or gauge sensor defective.	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	3. Temporary heavy usage or load.	3. None. Normal condition.
	4. Air traped in cooling system.	4. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
	5. Water pump	5. Replace water pump.
	6. Air leak on suction side of water pump.	6. Check for leak. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING)
RADIATOR CAP LEAKING STEAM AND /OR COOLANT INTO RESERVOIR BOTTLE. (TEMPERATURE GAUGE MAY READ HIGH)	1. Radiator cap defective.	1. Replace radiator cap.
	2. Radiator neck surface damaged.	2. Replace radiator.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING.	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reservior/overflow system.	1. Replace radiator cap, check vent hose between radiator and reservoir bottle for blockage also check reservoir bottle vent for blockage.
NOISY FAN	1. Fan blade(s) loose, damaged.	1. Replace fan blade assembly.
	2. Thermal viscous fan drive.	2. None. Normal condition.
	3. Fan blades striking surrounding objects.	3. Locate contact point and repair as necessary.
	4. Thermal viscous fan drive bearing.	4. Replace viscous fan drive assembly.
	5. Obstructed air flow through radiator.	5. Remove obstruction.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or A/C condenser air flow obstructed.	1. Remove obstruction and/or clean.
	2. Thermal viscous fan drive not working.	2. Check fan drive. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)
	3. Air seals around radiator damaged or missing.	3. Inspect air seals, repair or replace as necessary.

COOLING - 2.7L DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE HEATER PERFORMANCE. GUAGE MAY OR MAY NOT READ LOW.	1. Heavy duty cooling system, and cooler ambient temperatures.	1. None. Normal condition.
	2. Obstruction in heater hoses.	2. Remove hoses, remove obstruction.
	3. Water pump damaged.	3. Replace water pump.
HEAT ODOR	1. Damaged or missing drive line heat shields.	1. Repair or replace damaged or missing heat shields.
	2. Thermal viscous fan drive damaged.	2. Check thermal viscous fan drive. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)

ACCESSORY DRIVE

TABLE OF CONTENTS

DRIVE BELTS

DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 1), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 1). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to ACCESSORY DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for contamination, alignment, glazing, or excessive end play.

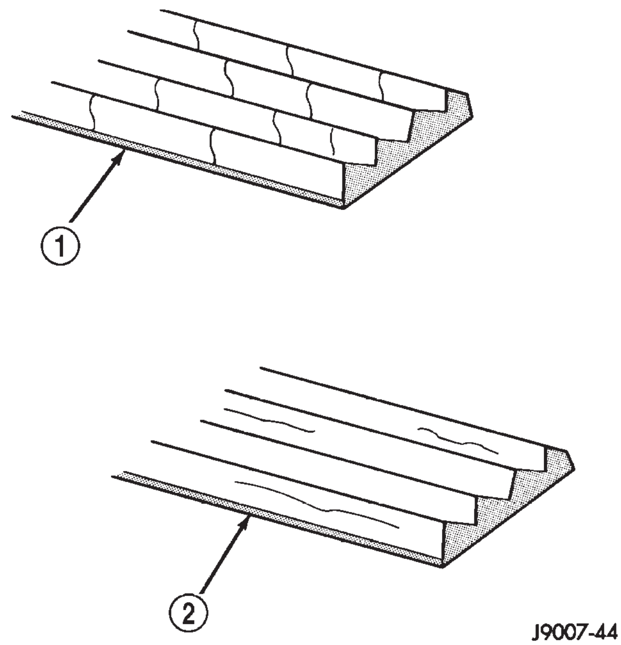

Fig. 1 Belt Wear Patterns

1 - NORMAL CRACKS BELT OK
2 - NOT NORMAL CRACKS REPLACE BELT

DRIVE BELTS (Continued)

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary
	3. Rusted pulley(s)	3. Clean rust from pulley(s)
	4. Sharp or jagged pulley groove tips	4. Replace pulley. Inspect belt.
	5. Belt rubber deteriorated	5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Inspect/Replace tensioner if necessary
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace faulty component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
″GROOVE JUMPING″ (Belt does not maintain correct position on pulley)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension	1. Replace Inspect/Replace tensioner if necessary
	2. Tensile member damaged during belt installation	2. Replace belt
	3. Severe misalignment	3. Align pulley(s)
	4. Bracket, pulley, or bearing failure	4. Replace defective component and belt

DRIVE BELTS (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISE (Objectional squeal, squeek, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Bearing noise	2. Locate and repair
	3. Belt misalignment	3. Align belt/pulley(s)
	4. Belt to pulley mismatch	4. Install correct belt
	5. Driven component induced vibration	5. Locate defective driven component and repair
	6. System resonent frequency induced vibration	6. Vary belt tension within specifications
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object	1. Correct rubbing condition
	2. Excessive heat causing woven fabric to age	2. Replace belt
	3. Tension sheeting splice has fractured	3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Belt contacting stationary object	2. Replace belt
	3. Pulley(s) out of tolerance	3. Replace pulley
	4. Insufficient adhesion between tensile member and rubber matrix	4. Replace belt

REMOVAL

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner.

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label.This label is located in the engine compartment.

(1) A 3/8 inch square hole is provided in the automatic belt tensioner. Attach a 3/8 inch drive-long handle ratchet to this hole.

(2) Rotate ratchet and tensioner assembly counterclockwise (as viewed from front) until tension has been relieved from belt.

(3) Remove belt from water pump pulley first.

(4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing the accessory drive belt, the belt must be the correct length and routed correctly. If not, engine may overheat due to water pump rotating in wrong direction.

(1) Position drive belt over all pulleys **except** water pump pulley (Fig. 2).

(2) Attach a 3/8 inch ratchet to tensioner.

(3) Rotate ratchet and belt tensioner counterclockwise. Place belt over water pump pulley. Let tensioner rotate back into place. Remove ratchet. Be sure belt is properly seated on all pulleys.

DRIVE BELTS (Continued)

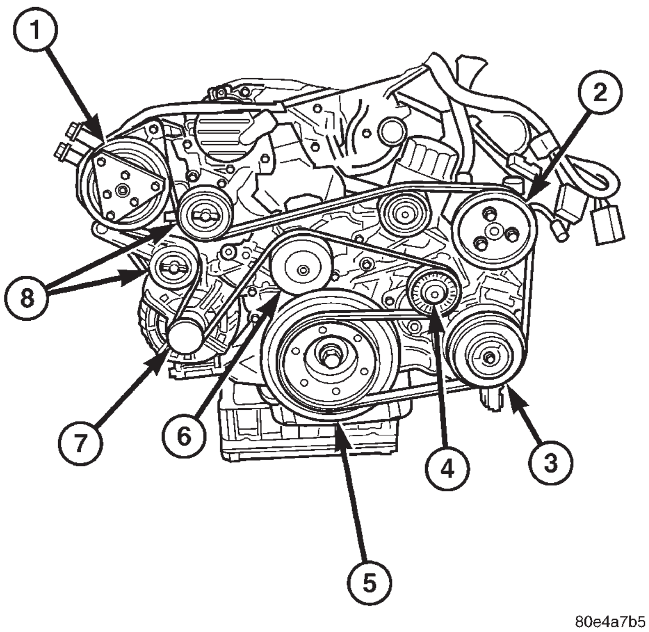

Fig. 2 ACCESSORY BELT ROUTING

1 - VISCOUS HEATER
2 - POWER STEERING PUMP
3 - AC COMPRESSOR
4 - AUTOMATIC BELT TENSIONER
5 - VIBRATION DAMPER/CRANKSHAFT PULLEY
6 - WATER PUMP PULLEY
7 - GENERATOR
8 - IDLER PULLEYS

BELT TENSIONERS

DESCRIPTION

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner.

Drive belts on all engines are equipped with a spring loaded automatic belt tensioner. This tensioner maintains constant belt tension at all times and requires no maintenance or adjustment.

OPERATION

WARNING: THE AUTOMATIC BELT TENSIONER ASSEMBLY IS SPRING LOADED. DO NOT ATTEMPT TO DISASSEMBLE THE TENSIONER ASSEMBLY.

The automatic belt tensioner maintains correct belt tension using a coiled spring within the tensioner housing. The spring applies pressure to the tensioner arm pressing the arm into the belt, tensioning the belt.

If a new belt is being installed, the arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

ENGINE

TABLE OF CONTENTS

COOLANT

DESCRIPTION

Coolant flows through the engine water jackets and cylinder heads absorbing heat produced by the engine during operation. The coolant carries heat to the radiator and heater core. Here it is transferred to ambient air passing through the radiator and heater core fins.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

100 Percent Ethylene-Glycol—Should Not Be Used in Chrysler Vehicles

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300 deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22 deg. C (-8 deg. F).

Propylene-glycol Formulations—Should Not Be Used in Chrysler Vehicles

Propylene-glycol formulations do not meet Chrysler coolant specifications. It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-

COOLANT (Continued)

glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up in Chrysler vehicles, which are designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/Ethylene-glycol Mixtures—Should Not Be Used in Chrysler Vehicles

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

DIAGNOSIS AND TESTING - COOLING SYSTEM LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist (Fig. 1).

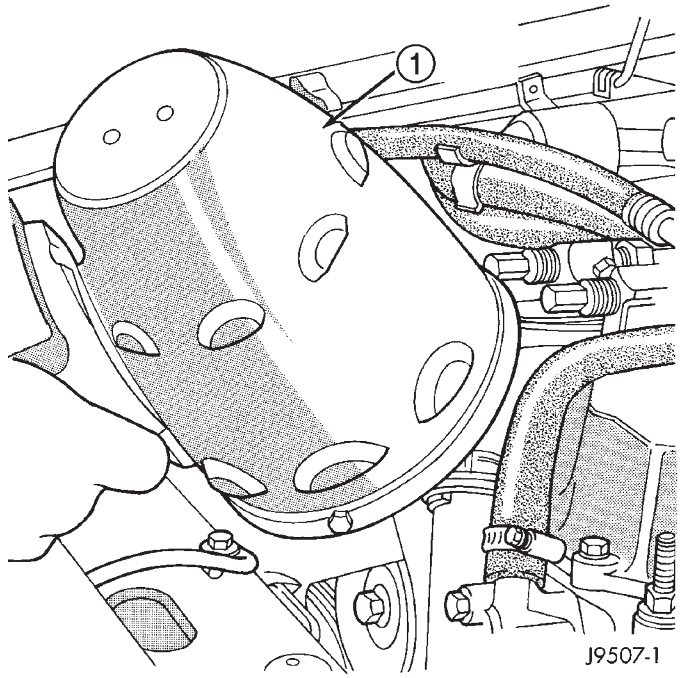

Fig. 1 Leak Detection Using Black Light—Typical

1 - TYPICAL BLACK LIGHT TOOL

PRESSURE TESTER METHOD

The engine should be at normal operating temperature. Recheck the system cold if cause of coolant loss is not located during the warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove coolant recovery pressure container cap and check coolant level. Push down on cap to disengage it from stop tabs. Wipe inside of container and examine lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect radiator-to- pressure container hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

Inspect cams on outside of pressure container. If cams are damaged, seating of pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to coolant pressure container (Fig. 2).

Operate tester pump to apply 103.4 kPa (15 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

Holds Steady: If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If

COOLANT (Continued)

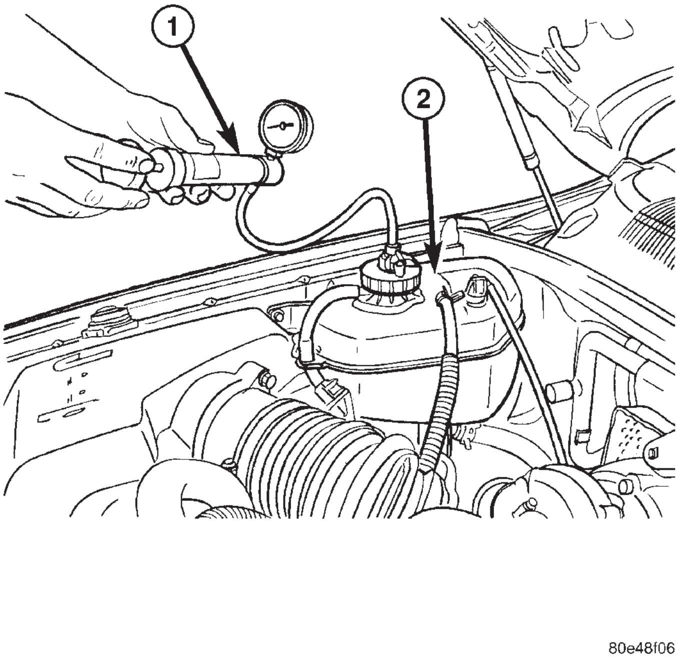

Fig. 2 PRESSURE TESTING COOLING SYSTEM

1 - COOLANT PRESSURE TESTER
2 - COOLANT PRESSURE CONTAINER

leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 110 KPA (20 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate engine without pressure cap on coolant container until thermostat opens. Attach a Pressure Tester to container. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST - WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean and suitably marked container for reuse.

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAIN WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow thermostat removal.

Remove accessory drive belt.

Add coolant to pressure container to bring level to within 6.3 mm (1/4 in) of top of thermostat housing.

CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open draincock immediately after test to eliminate boil over.

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

STANDARD PROCEDURE

STANDARD PROCEDURE - ADDING ADDITIONAL COOLANT

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5

COOLANT (Continued)

Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

STANDARD PROCEDURE - DRAINING COOLING SYSTEM

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) DO NOT remove coolant recovery pressure container cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

NOTE: Radiator draincock is located on the right/ lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant recovery pressure container first. The coolant does not have to be removed from the container unless the system is being refilled with a fresh mixture. When container is empty, remove cap and continue draining cooling system.

To drain the engine of coolant, remove the cylinder block drain plug located on the side of cylinder block.

STANDARD PROCEDURE - REFILLING COOLING SYSTEM

(1) Tighten the radiator drain and the cylinder block drain plug(s) (if removed).

(2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Fill radiator to top and add sufficient coolant to the coolant recovery pressure container to raise level to FULL mark.

(3) With heater control unit in the HEAT position, operate engine with container cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the pressure container.

(5) Add coolant to pressure container as necessary. **Only add coolant to the container when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** To purge the cooling system of all air, this heat up/cool down cycle (adding coolant to cold engine) must be performed three times. Add necessary coolant to raise container level to the FULL mark after each cool down period.

COOLANT RECOVERY PRESSURE CONTAINER

DESCRIPTION

A pressurized, plastic coolant container is used with this cooling system (Fig. 3). The container is located at the right-rear side of the engine compartment and is mounted as the highest point of the cooling system.

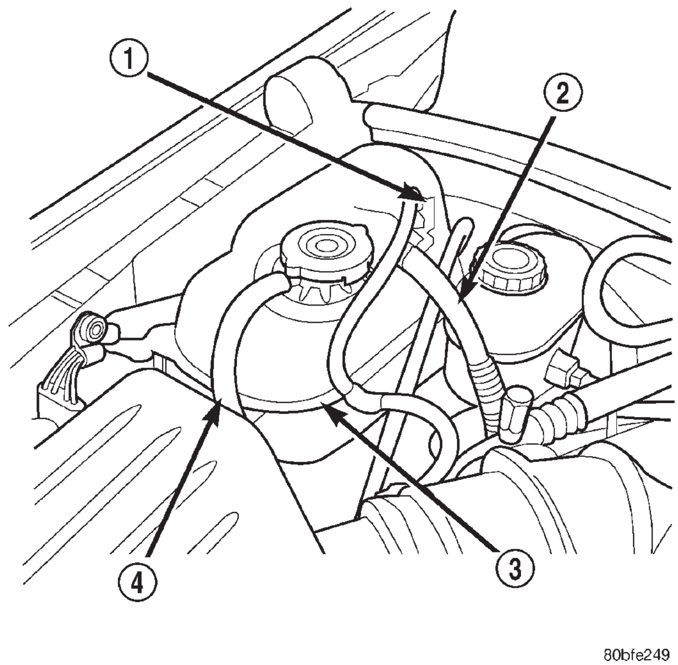

Fig. 3 COOLANT RECOVERY PRESSURE CONTAINER

1 - LOW COOLANT LEVEL SENSOR
2 - COOLANT RECOVERY HOSE
3 - COOLANT RECOVERY PRESSURE CONTAINER
4 - OVERFLOW HOSE

OPERATION

The location of the container allows any air or vapor exceeding the pressure/vent cap rating to escape through the cap. Coolant flows through the container at all times during engine operation whether the engine is cold or at normal operating temperature. The coolant container is equipped with a pressure/vent cap. For more information (Refer to 7

COOLANT RECOVERY PRESSURE CONTAINER (Continued)

- COOLING/ENGINE/RADIATOR PRESSURE CAP - DESCRIPTION)

REMOVAL

WARNING: DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90C (194°F). OPEN CONTAINER SLOWLY AND RELEASE PRESSURE. STORE COOLANT IN PROPER CONTAINERS ONLY. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR. RISK OF INJURY TO SKIN AND EYES WITH HOT COOLANT WHICH SPLASHES OUT. RISK OF POISONING FROM SWALLOWING COOLANT.

NOTE: Turn container cap carefully as far as first detent, release pressure, then unscrew cap.

(1) Release cooling system pressure.
(2) Disconnect sensor electrical connector (Fig. 3).
(3) Remove radiator over flow hose (Fig. 3).
(4) Remove cooling system recovery hose (Fig. 3).
(5) Remove container retaining bolts.

INSTALLATION

(1) Position coolant container and install retaining bolts (Fig. 3).
(2) Properly route and install coolant recovery hose (Fig. 3).
(3) Properly route and install radiator overflow hose (Fig. 3).
(4) Connect sensor electrical connector (Fig. 3).
(5) Refill system with proper coolant mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(6) Start engine and inspect for leaks.

ENGINE COOLANT TEMP SENSOR

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C. OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Partailly drain coolant system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Unplug coolant temperature sensor electrical connector.

NOTE: Capture any residual coolant that may flow.

(5) Remove coolant temperature sensor (Fig. 4).

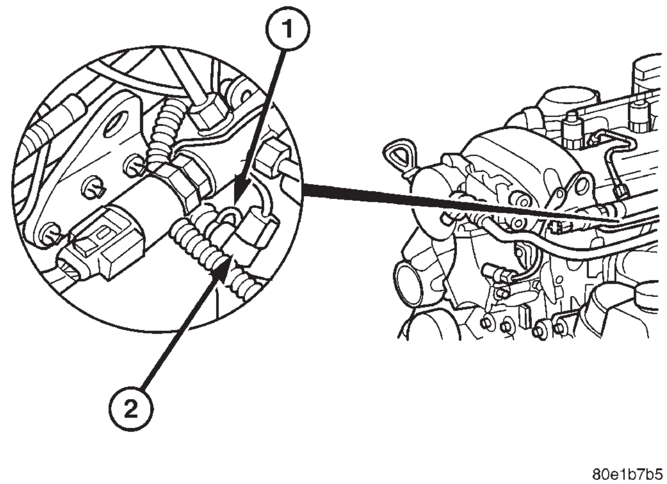

Fig. 4 ENGINE COOLANT TEMPERATURE SENSOR

1 - RETAINING CLAMP
2 - ENGINE COOLANT TEMPERATURE SENSOR

INSTALLATION

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

(1) Position and install coolant temperature sensor (Fig. 4).
(2) Connect coolant temperature sensor electrical connector (Fig. 4).
(3) Refill coolant system to proper level with proper mixture of coolant (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(5) Connect negative battery cable.

ENGINE COOLANT TEMP SENSOR (Continued)

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

ENGINE COOLANT THERMOSTAT

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

NOTE: Inspect condition of all clamps and hoses, replace as necessary.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Drain engine coolant (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Remove bracket for fuel line.
(5) Remove coolant hoses and vent hose from thermostat housing.
(6) Remove thermostat housing (Fig. 5).
(7) Remove thermostat from housing.
(8) Clean all sealing surfaces.

INSTALLATION

(1) Clean all sealing surfaces.
(2) Position thermostat in housing and install thermostat housing (Fig. 5). Tighten bolts to 9N·m (80 lbs.in.).

NOTE: Inspect condition of all clamps and hoses, replace as necessary.

(3) Connect coolant hoses and vent hose (Fig. 5).
(4) Install bracket for fuel line (Fig. 5).
(5) Close coolant drain.
(6) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(7) Connect negative battery cable.

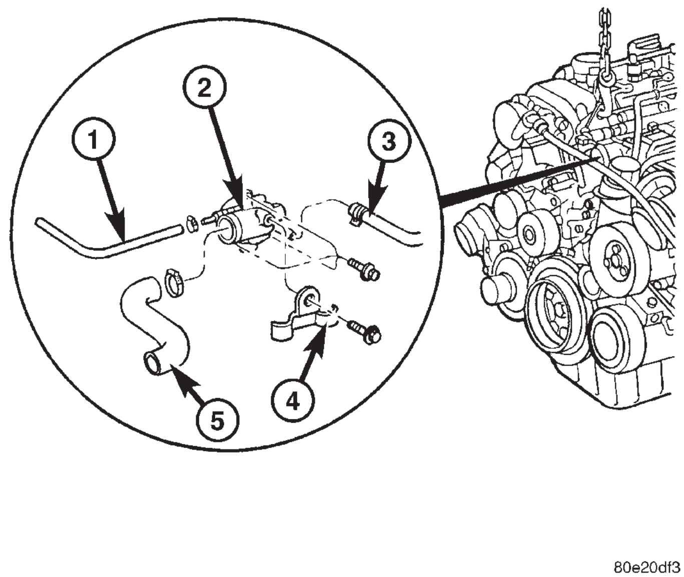

Fig. 5 THERMOSTAT ASSEMBLY

1 - VENT HOSE
2 - THERMOSTAT HOUSING
3 - COOLANT HOSE
4 - FUEL LINE BRACKET
5 - UPPER RADIATOR HOSE

(8) Fill coolant system to proper level with appropriate coolant mixture (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(9) Start engine and inspect for leaks.

WATER PUMP

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

(1) Disconnect negative battery cable.

WATER PUMP (Continued)

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Drain engine coolant (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(5) Disconnect coolant hoses at water pump.

(6) Remove idler pulley.

(7) Remove water pump and clean sealing surfaces (Fig. 6).

INSTALLATION

(1) Clean all sealing surfaces.

(2) Position and install waterpump (Fig. 6). Tighten M6 bolts to 14N·m (124 lbs. in.) and M8 bolts to 20N·m (177 lbs. in.).

(3) Install idler pulley. Tighten bolt to 35N·m (26 lbs. ft.).

(4) Install coolant hoses.

(5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Close coolant drain.

(7) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(8) Connect negative battery cable.

(9) Fill coolant system to proper level with the appropriate coolant mixture (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(10) Start engine and inspect for leaks.

RADIATOR FAN

DESCRIPTION

The hydraulic fan (Fig. 7) replaces both the electric fan and the engine driven mechanical fan. The hydraulic cooling fan is integral to the fan shroud and is located between the radiator and the engine.

The power steering pump supplies the hydraulic fluid and pressure to rotate the cooling fan blade, while the electrical portain of the fan is controlled by the electronic control module (ECM).

The hydraulic fan drive (motor) consists of the three major following components:

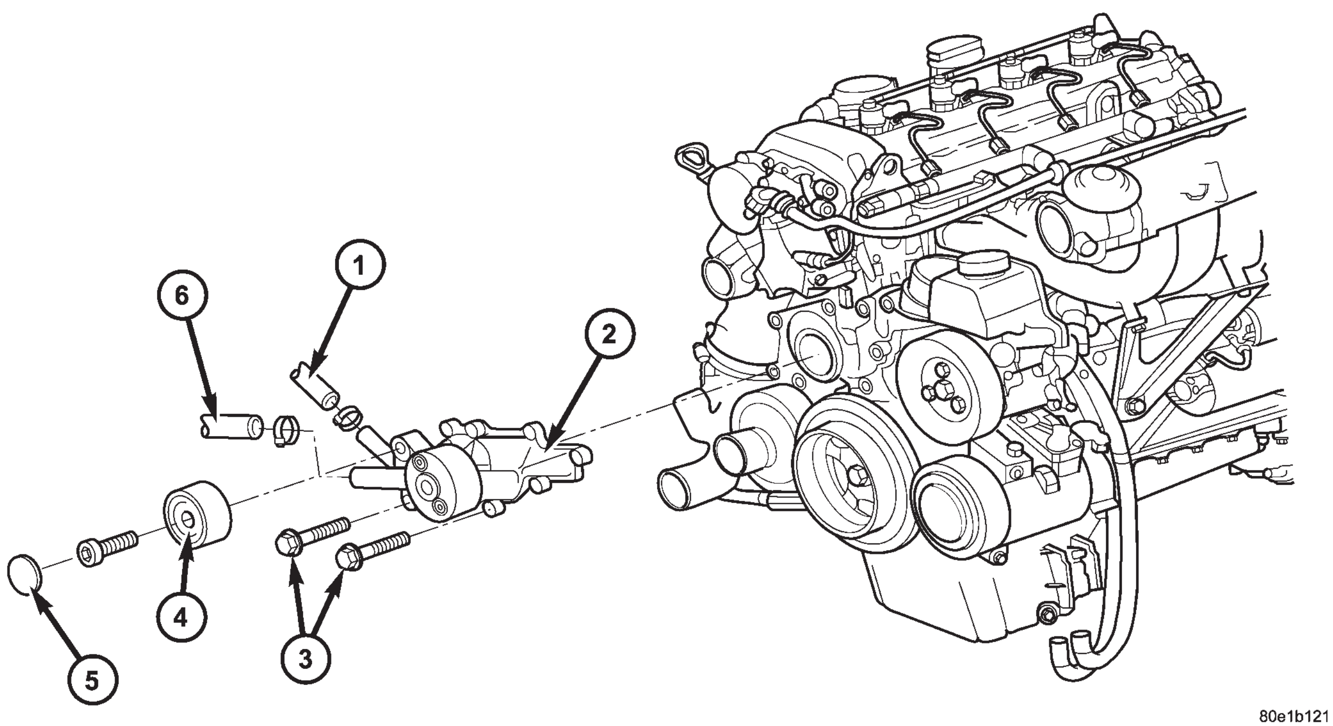

Fig. 6 WATER PUMP - TYPICAL

1 - COOLANT HOSE
2 - WATER PUMP
3 - WATER PUMP BOLTS
4 - IDLER PULLEY
5 - IDLER PULLEY CAP
6 - COOLANT HOSE

RADIATOR FAN (Continued)

- Steering flow control valve
- Fan control valve
- Two stage G-rotor hydraulic drive

The hydraulic fan and drive are not serviceable. Any failure of the fan blade, hydraulic fan drive or fan shroud requires replacement of the fan module. The fan blade and hydraulic fan drive are matched and balanced as a system and servicing either separately would disrupt this balance.

For hydraulic fluid routing information refer to (Fig. 8).

CAUTION: Do not attempt to service the hydraulic cooling fan or fan drive separately replace the cooling module as an assembly. Failure to do so may cause severe damage to the hydraulic cooling fan assembly.

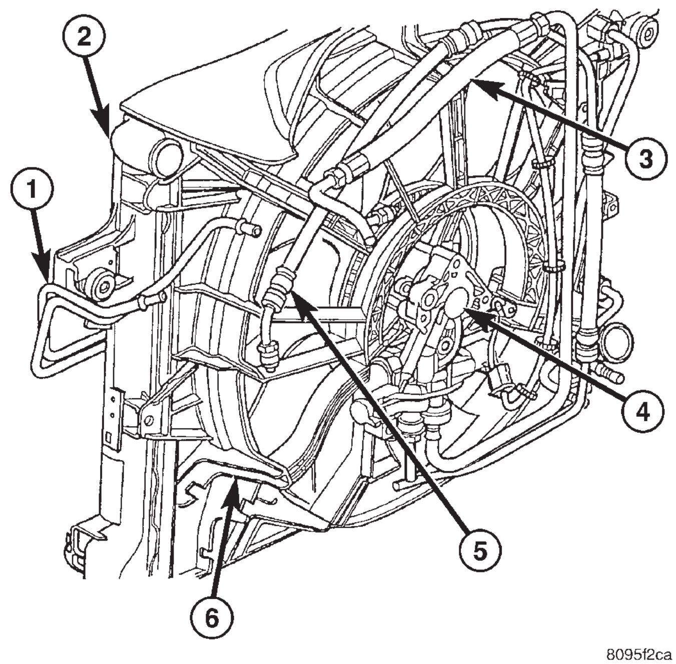

Fig. 7 HYDRAULIC RADIATOR COOLING FAN AND FAN DRIVE

1 - POWER STEERING FLUID COOLER
2 - RADIATOR
3 - HIGH PRESSURE LINE FROM STEERING GEAR PUMP TO HYDRAULIC FAN MOTOR
4 - HYDRAULIC FAN MOTOR
5 - HIGH PRESSURE LINE FROM HYDRAULIC FAN MOTOR TO STEERING GEAR
6 - FAN SHROUD

OPERATION

The hydraulic radiator cooling fan replaces both the electric fan and the engine driven mechanical fan. The use of this hydraulic fan provides heavy trailer tow capability while at the same time reducing unnecessary power drain on both the engine and the vehicles electrical system.

HYDRAULIC FAN STRATEGY

The hydraulic radiator cooling fan is controlled by the Electronic Control Module (ECM). A PWM (Pulse Width Modulated) signal from the ECM controls the fan from 0 to 100% of the available fan speed. There are four inputs to the ECM that determine what speed percentage of fan is required by the vehicle. These inputs are:

- Engine Coolant Temperature
- Transmission Oil Temperature
- Battery Temperature
- A/C System Pressure

By monitoring these four parameters, the ECM can determine if cooling airflow is required. If airflow is required, the ECM will slowly ramp up (speed up) the fan speed until the operating parameter(s) are met for the driving condition. Once the temperature or pressure is reduced to within operating parameters, the fan will adjust or hold its speed to maintain the temperature / pressure requirements.

NOTE: If the ECM is not requesting fan on operation, the fan blade will spin between 100 and 500 RPM when the vehicle is at idle. This is due to a controlled minimum oil flow requirement through the fan drive motor.

ACTIVATING THE HYDRAULIC FAN WITH THE DRBIII®

Under the Engine Systems test heading, there is a subheading. “Hydraulic fan solenoid test”, that has the selections, on /off. Activating the fan with the DRBIII® will run the fan at 100% duty cycle, which will help troubleshoot any system problems, and also help with the deaeration procedure.

NOTE: Engine must be running to activate the fan with the DRBIII®.

RADIATOR COOLING FAN HYDRAULIC FLUID PATH

Hydraulic fluid is pumped from the power steering pump, though a high pressure delivery line, to the fan drive motor. As fluid is diverted through the G-rotors, rotational motion moves fluid from the high-pressure (inlet) side of the motor to the low-pressure (outlet) side. Fluid exiting the drive motor is divided into two paths. Path one continues through a high pressure delivery line to the steering gear, and path two sends fluid back to the power steering pump through a low pressure line. Fluid exits the steering gear under low pressure and travels through a low pressure line to the power steering fluid cooler before being returned back the power steering fluid reservoir (Fig. 7).

RADIATOR FAN (Continued)

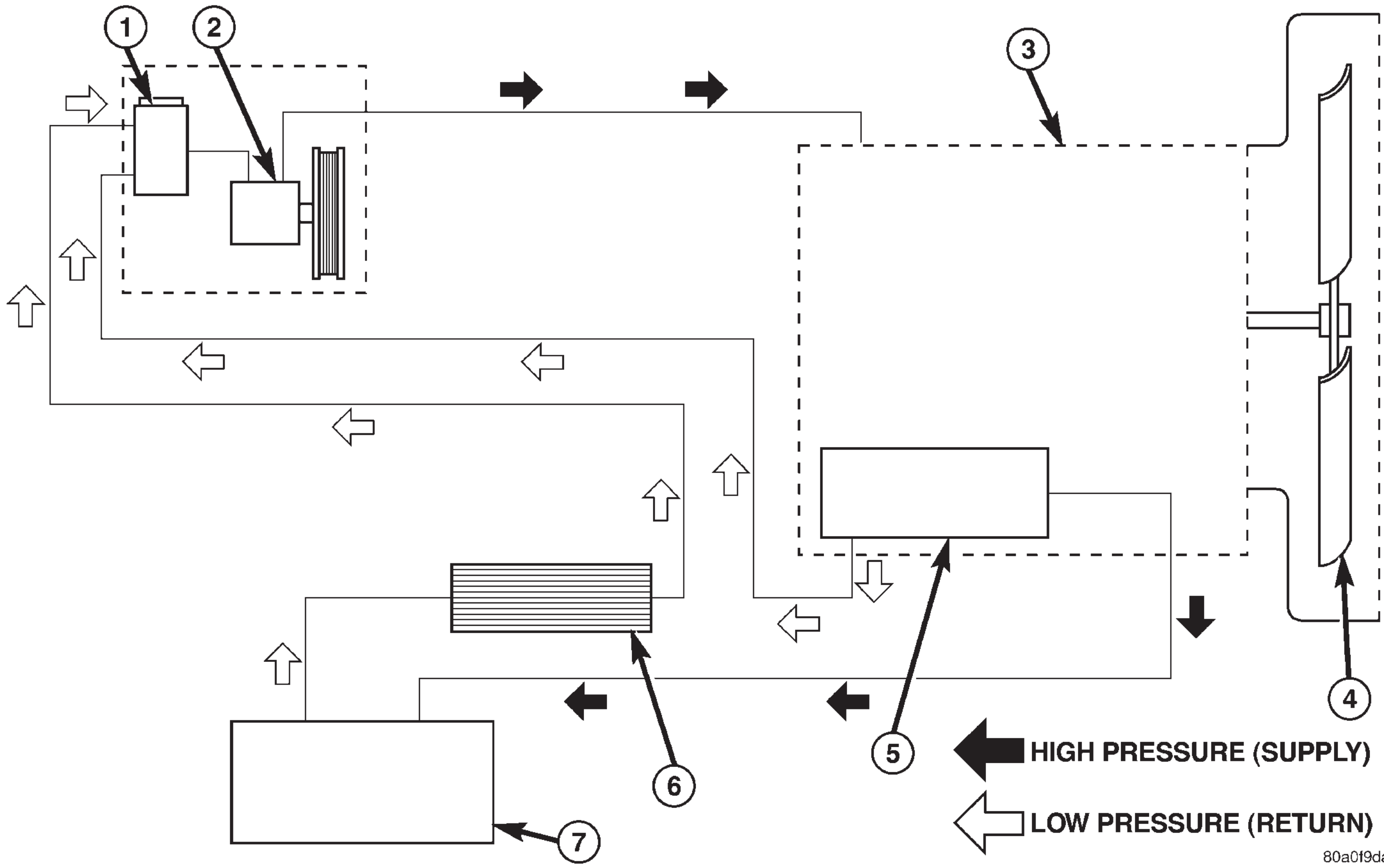

Fig. 8 HYDRAULIC FAN FLUID FLOW CIRCUIT

1 - POWER STEERING RESERVOIR
2 - POWER STEERING PUMP
3 - HYDRAULIC FAN DRIVE ASSEMBLY
4 - FAN BLADE
5 - HYDRAULIC FAN CONTROL SOLENOID
6 - POWER STEERING OIL COOLER
7 - STEERING GEAR

NOTE: There is a steering flow control valve located in the fan drive motor. Because of the design of the valve, steering assist can not be effected by the radiator cooling fan even during fan drive failure.

REMOVAL

(1) Raise vehicle on hoist.

(2) Drain cooling system.(Refer to 7 - COOLING - STANDARD PROCEDURE)

NOTE: The hydraulic fan drive is driven by the power steering pump. When removing lines or hoses from fan drive assembly use a drain pan to catch any power steering fluid that may exit the fan drive or the lines and hoses.

NOTE: When ever the high pressure line fittings are removed from the hydraulic fan drive the O-rings must be replaced.

(3) Disconnect two high pressure lines at hydraulic fan drive (Fig. 9). Remove and discard o-rings from line fittings.

(4) Disconnect low pressure return hose at hydraulic fan drive (Fig. 9).

NOTE: The lower mounting bolts can only be accessed from under vehicle.

(5) Remove two lower mounting bolts from the shroud (Fig. 11).

(6) Lower vehicle.

(7) Disconnect the electrical connector for the fan control solenoid.

(8) Disconnect the radiator upper hose at the radiator and position out of the way.

(9) Disconnect the power steering gear outlet hose and fluid return hose at the cooler (Fig. 10).

(10) Remove two upper mounting bolts from the shroud (Fig. 11).

(11) Remove the shroud and fan drive from vehicle.

RADIATOR FAN (Continued)

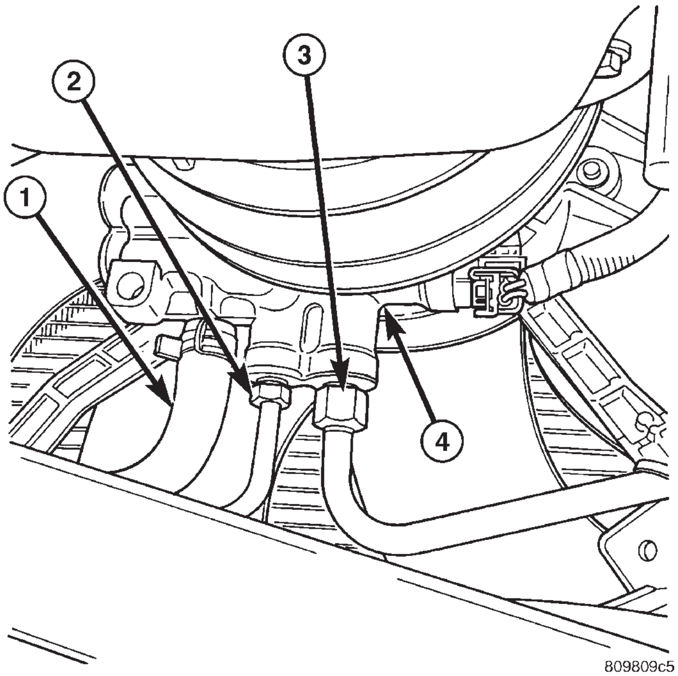

Fig. 9 HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

1 - LOW PRESSURE RETURN HOSE
2 - HIGH PRESSURE LINE (OUTLET)
3 - HIGH PRESSURE LINE (INLET)
4 - HYDRAULIC FAN DRIVE

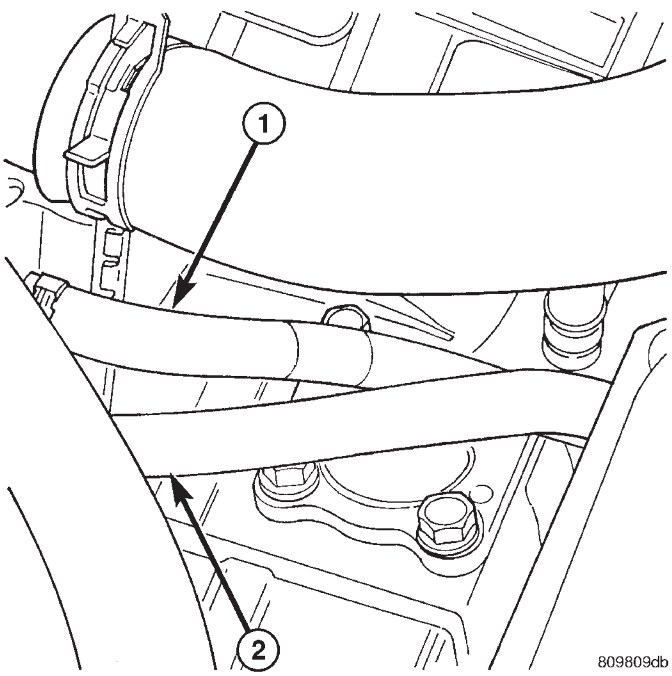

Fig. 10 POWER STEERING GEAR OUTLET AND RETURN HOSES

1 - POWER STEERING COOLER RETURN HOSE
2 - POWER STEERING COOLER SUPPLY HOSE

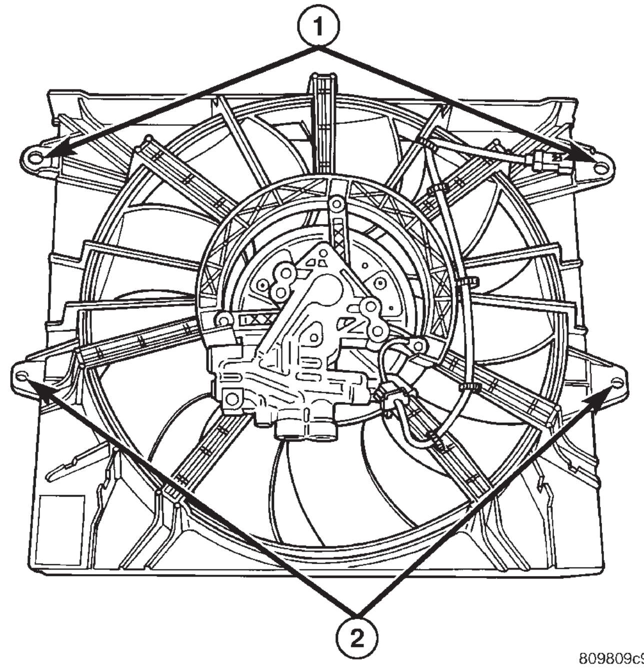

Fig. 11 FAN SHROUD MOUNTING BOLT LOCATIONS

1 - FAN SHROUD UPPER MOUNTING BOLT LOCATIONS
2 - FAN SHROUD LOWER MOUNTING BOLT LOCATIONS

INSTALLATION

CAUTION: There is an external ground wire connected to the hydraulic fan drive located at the electrical connector on the fan assembly. This ground MUST remain connected at all times. Failure to ensure ground before engine is operating can cause severe damage to the ECM.

(1) Position fan drive and shroud in vehicle.
(2) Install fan shroud upper mounting bolts. Do not tighten at this time.
(3) Install radiator upper hose onto radiator.
(4) Connect power steering cooler hoses.
(5) Raise vehicle on hoist.
(6) Install fan shroud lower mounting bolts. Tighten to 6 N·m (50 in. lbs.).

NOTE: When ever the high pressure line fittings are removed from the hydraulic fan drive the o-rings located on the fittings must be replaced.

(7) Lubricate the o-rings on the fittings with power steering fluid then connect inlet and outlet high pressure lines to fan drive (Fig. 12). Tighten inlet line to 49 N·m (36 ft. lbs.) tighten outlet line to 29 N·m (21.5 ft. lbs.).
(8) Connect low pressure return hose to fan drive (Fig. 12).
(9) Lower vehicle.

RADIATOR FAN (Continued)

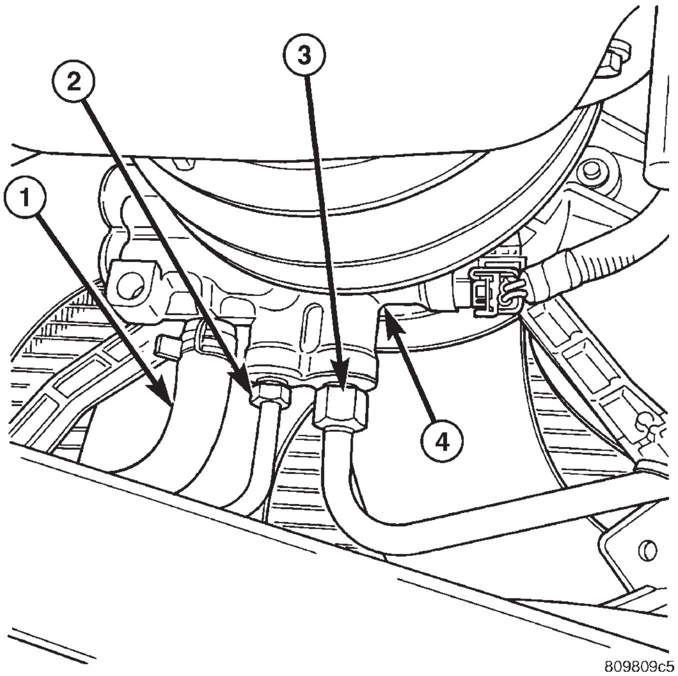

Fig. 12 HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

1 - LOW PRESSURE RETURN HOSE
2 - HIGH PRESSURE LINE (OUTLET)
3 - HIGH PRESSURE LINE (INLET)
4 - HYDRAULIC FAN DRIVE

(10) Install radiator upper hose.

(11) Connect electrical connector for hydraulic fan control solenoid and assure ECM ground to fan assembly.

(12) Tighten fan shroud upper mounting bolts to 6 N·m (50 in. lbs.).

(13) Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

CAUTION: Do not run engine with power steering fluid below the full mark in the reservoir. Sever damage to the hydraulic cooling fan or the engine can occur.

(14) Refill power steering fluid reservoir and bleed air from steering system (Refer to 19 - STEERING/ PUMP - STANDARD PROCEDURE).

(15) Run engine and check for leaks.

RADIATOR PRESSURE CAP

DESCRIPTION

all vehicle are equipped with a pressure cap (Fig. 13). This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

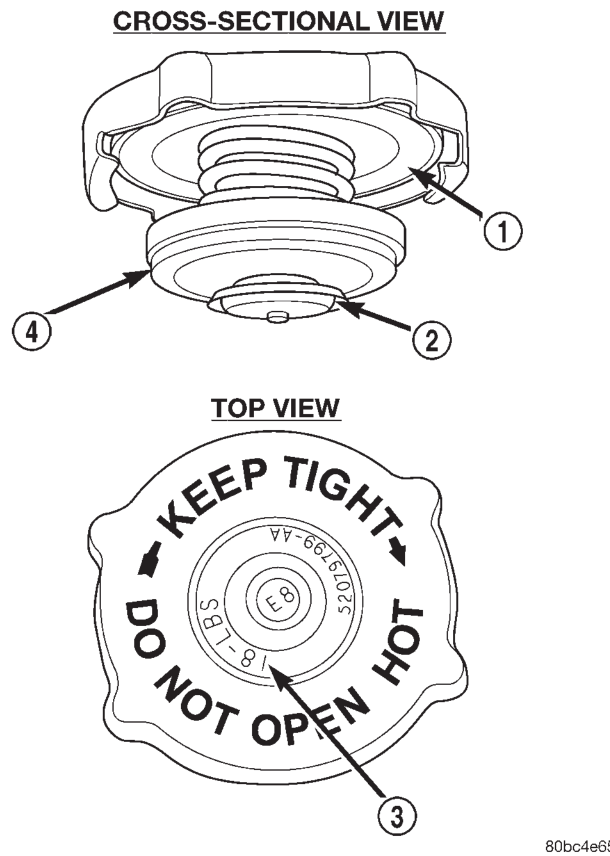

Fig. 13 Radiator Pressure Cap - Typical

1 - FILLER NECK SEAL
2 - VACUUM VENT VALVE
3 - PRESSURE RATING
4 - PRESSURE VALVE

RADIATOR PRESSURE CAP (Continued)

OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

DIAGNOSIS AND TESTING - RADIATOR PRESSURE CAP

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install the cap on pressure tester (tool 7700 or an equivalent) (Fig. 14).

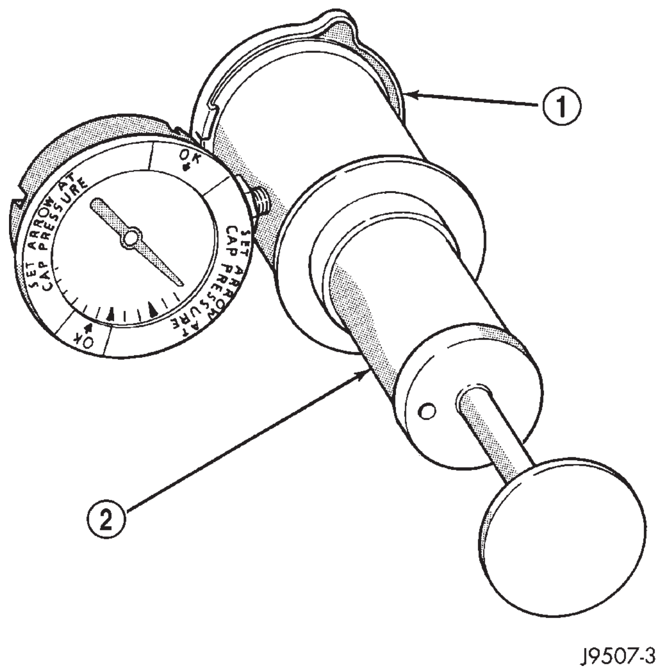

Fig. 14 Pressure Testing Radiator Pressure Cap—Typical

1 - PRESSURE CAP
2 - TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 124 to 145 kPa (18 to 21 psi). The cap is satisfactory when the pressure holds steady. It is also good if it holds pressure within the 124 to 145 kPa (18 to 21 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

CLEANING

Clean the radiator pressure cap using a mild soap and water only.

INSPECTION

Visually inspect the pressure valve gasket on the cap. Replace cap if the gasket is swollen, torn or worn. Inspect the area around radiator filler neck for white deposits that indicate a leaking cap.

RADIATOR

DESCRIPTION

The radiator used with the 2.7L diesel is constructed of a horizontal down-flow aluminum core with plastic side tanks.

CAUTION: Plastic tanks, while stronger than brass, are subject to damage by impact, such as wrenches.

COOLING MODULE

The cooling module assembly includes the radiatorand hydraulic fan assembly. To replace either one of these components, the entire assembly must be removed from the vehicle and then disassembled. (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL)

DIAGNOSIS AND TESTING - RADIATOR FLOW TEST

There is coolant flow through the coolant recovery container before and after the thermostat opens. If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If the hose is hot, the thermostat is open and water is circulating through the cooling system.

CAUTION: Do not remove the vent valve to insert a temperature gauge thought the opening , coolant will spill out of the system and the engine will not be filled with coolant up to the heads. Major damage could happen if you run the engine in this condition.

RADIATOR (Continued)

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN APPROVED AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

NOTE: Constant tension hose clamps are used on most vehicles. When removing or installing clamps use tools designed for servicing these types of clamps. A number or letter is stamped on the clamp. If replacement is required use only original equipment clamps with a matching letter or number.

NOTE: When removing the radiator, note the location of the rubber radiator-to-body air seals. These seals are used to prevent overheating and must remain in there original positions.

Do Not waste usable coolant. If solution is clean, drain into a clean container for reuse.

(1) Disconnect negative battery cable.

(2) Drain coolant from radiator (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

NOTE: When ever the high pressure line fittings are removed from the hydraulic fan drive the O-rings must be replaced.

(3) Disconnect both pressure lines at hydraulic fan drive (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(4) Disconnect low pressure return hose at hydraulic fan drive(Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(5) Disconnect fan electrical connector and set aside.

(6) Remove lower, upper radiator, and coolant pressure container hoses from radiator.

NOTE: The lower portion of the radiator is equipped with two alignment dowel pins that are seated in rubber grommets. These grommets are pressed into the lower cross member and must remain present to prevent radiator tank damage.

(7) Remove radiator retaining bolts, and carefully remove coolant module assembly from vehicle (Fig. 15).

(8) Separate coolant fan from radiator.

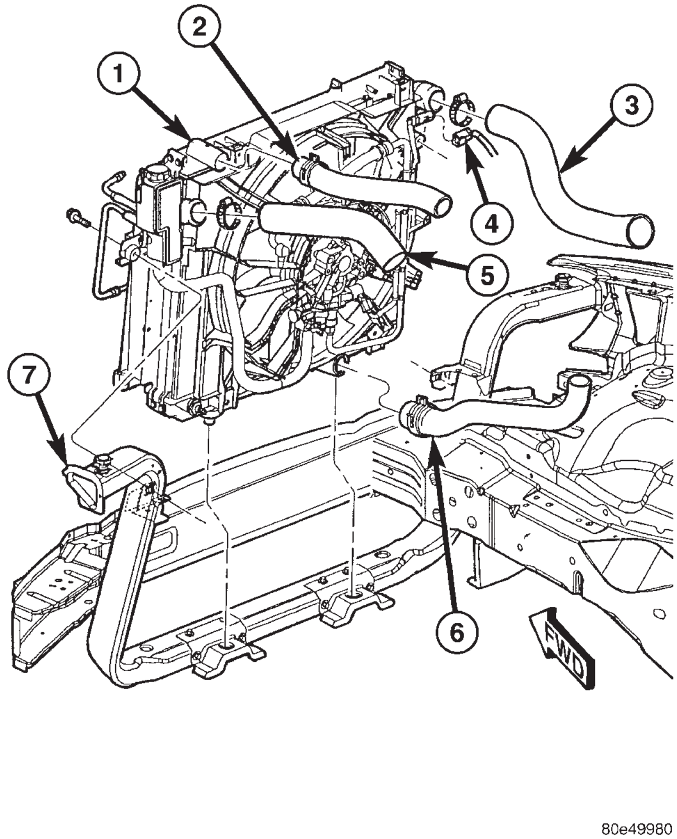

Fig. 15 COOLING MODULE

1 - RADIATOR
2 - UPPER RADIATOR HOSE
3 - CHARGE AIR COOLER INLET HOSE
4 - COOLING FAN ELECTRICAL CONNECTOR
5 - CHARGE AIR COOLER OUTLET HOSE
6 - LOWER RADIATOR HOSE
7 - RADIATOR SUPPORT

CLEANING

The radiator and air conditioning fins should be cleaned when an accumulation of bugs, leaves etc. has occurred. Clean radiator fins are necessary for good heat transfer. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

RADIATOR (Continued)

INSTALLATION

CAUTION: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEMS HOSES. USE ONLY THE TOOLS THAT ARE DESIGNED FOR THIS TYPE OF SERVICE. A NUMBER OR LETTER IS STAMPED ON THE CLAMP. IF REPLACEMENT IS REQUIRED, USE ONLY AN ORIGINAL EQUIPMENT CLAMP WITH THE MATCHING NUMBER OR LETTER.

NOTE: Care must be taken when installing the radiator not to damage the fins of the radiator or other ancillary components. Note the location and proper installation of the radiator to charge air cooler and radiator to body rubber air seals. These must be installed correctly to prevent engine over heating and provide proper A/C efficiency.

(1) Position the coolant module assembly.

(2) Carefully lower the radiator tank alignment dowels into the rubber grommets in the lower cross-member and secure coolant module.

(3) Connect upper, lower radiator and coolant pressure container hoses then secure.

(4) Connect coolant fan electrical connector and assure good ECM ground to fan assembly.

NOTE: When ever the pressure line fittings are installed at the hydraulic fan drive, the O-rings must be replaced.

(5) Connect low pressure return hose at hydraulic fan.

(6) Connect both high pressure hoses at hydraulic fan.

NOTE: Do Not waste usable coolant. If the solution is clean and the mixture is correct, reuse original coolant.

(7) Refill cooling system with correct mixture with the proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(8) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(9) Start engine and inspect for leaks.

ELECTRONIC CONTROL MODULES

TABLE OF CONTENTS

ENGINE CONTROL MODULE

DESCRIPTION

The ECM is located in the left side of engine compartment attached to the left inner fender behind the battery (Fig. 1).

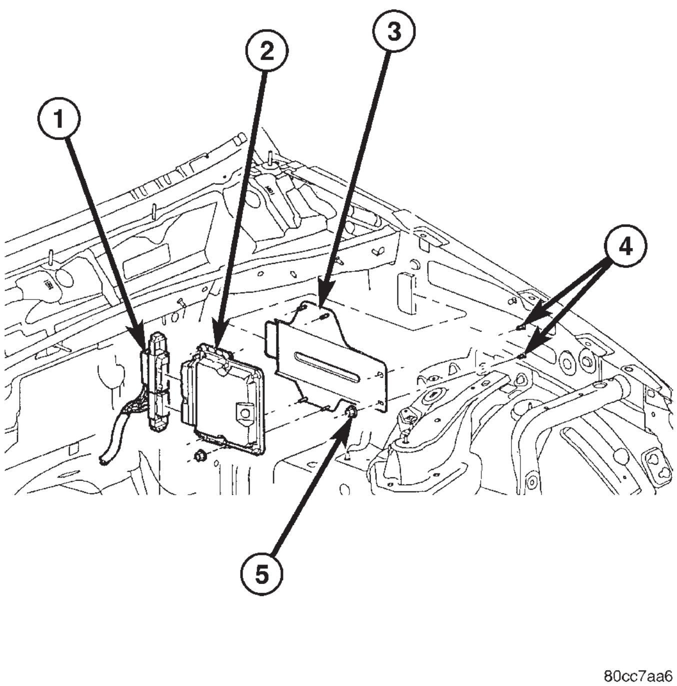

Fig. 1 ENGINE CONTROL MODULE (ECM) REMOVAL/INSTALL

1 - ECM ELECTRICAL CONNECTORS
2 - ENGINE CONTROL MODULE (ECM)
3 - ECM MOUNTING BRACKET
4 - ECM MOUNTING BRACKET MOUNTING STUDS
5 - MOUNTING BRACKET RETAINING NUTS

OPERATION

The ECM has been programmed to monitor different circuits of the diesel fuel injection system. This monitoring is called on-board diagnostics. Certain criteria must be met for a diagnostic trouble code to be entered into the ECM memory. The criteria may be a range of: engine rpm, engine temperature, time or other input signals to the ECM. If all of the criteria for monitoring a system or circuit are met, and a problem is sensed, then a DTC will be stored in the ECM memory. It is possible that a DTC for a monitored circuit may not be entered into the ECM memory, even though a malfunction has occurred. This may happen when the monitoring criteria have not been met. The ECM compares input signal voltages from each input device with specifications (the established high and low limits of the input range) that are programmed into it for that device. If the input voltage is not within the specifications and other trouble code criteria are met, a DTC will be stored in the ECM memory.

ECM OPERATING MODES

As input signals to the ECM change, the ECM adjusts its response to the output devices. For example, the ECM must calculate a different fuel quantity and fuel timing for engine idle condition than it would for a wide open throttle condition. There are several different modes of operation that determine how the ECM responds to the various input signals.

Ignition Switch On (Engine Off)

When the ignition is turned on, the ECM activates the glow plug relay for a time period that is determined by engine coolant temperature, atmospheric temperature and battery voltage.

Engine Start-Up Mode

The ECM uses the engine temperature sensor and the crankshaft position sensor (engine speed) inputs to determine fuel injection quantity.

ENGINE CONTROL MODULE (Continued)

Normal Driving Modes

Engine idle, warm-up, acceleration, deceleration and wide open throttle modes are controlled based on all of the sensor inputs to the ECM. The ECM uses these sensor inputs to adjust fuel quantity and fuel injector timing.

Limp-In Mode

If there is a fault detected with the accelerator pedal position sensor, the ECM will set the engine speed at 1100 RPM.

Overspeed Detection Mode

If the ECM detects engine RPM that exceeds 5200 RPM, the ECM will set a DTC in memory and illuminate the MIL until the DTC is cleared.

After-Run Mode

The ECM transfers RAM information to ROM and performs an Input/Output state check.

MONITORED CIRCUITS

The ECM is able to monitor and identify most driveability related trouble conditions. Some circuits are directly monitored through ECM feedback circuitry. In addition, the ECM monitors the voltage state of some circuits and compares those states with expected values. Other systems are monitored indirectly when the ECM conducts a rationality test to identify problems. Although most subsytems of the engine control module are either directly or indirectly monitored, there may be occasions when diagnostic trouble codes are not immediately identified. For a trouble code to set, a specific set of conditions must occur and unless these conditions occur, a DTC will not set.

DIAGNOSTIC TROUBLE CODES

Each diagnostic trouble code (DTC) is diagnosed by following a specific procedure. The diagnostic test procedure contains step-by-step instruction for determining the cause of the DTC as well as no trouble code problems. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

HARD CODE

A DTC that comes back within one cycle of the ignition key is a hard code. This means that the problem is current every time the ECM/SKIM checks that circuit or function. Procedures in this manual verify if the DTC is a hard code at the beginning of each test. When the fault is not a hard code, an intermittent test must be performed. NOTE: If the DRBIII® displays faults for multiple components (i.e. ECT, VSS, IAT sensors) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate schematic to identify shared circuits. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

INTERMITTENT CODE

A DTC that is not current every time the ECM/SKIM checks the circuit or function is an intermittent code. Most intermittent DTCs are caused by wiring or connector problems. Problems that come and go like this are the most difficult to diagnose; they must be looked for under specific conditions that cause them. **NOTE: Electromagnetic (radio) interference can cause an intermittent system malfunction.** This interference can interrupt communication between the ignition key transponder and the SKIM. The following checks may assist you in identifying a possible intermittent problem:

- Visually inspect the related wire harness connectors. Look for broken, bent, pushed out or corroded terminals.
- Visually inspect the related wire harness. Look for chafed, pierced or partially broken wire.
- Refer to hotlines or technical service bulletins that may apply. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

ECM DIAGNOSTIC TROUBLE CODES

IMPORTANT NOTE: Before replacing the ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most ECM driver/control circuit failures are caused by internal failures to components (i.e. relays and solenoids) and shorted circuits (i.e. sensor pull-ups, drivers and ground circuits). These faults are difficult to detect when a double fault has occurred and only one DTC has set. If the DRBIII® displays faults for multiple components (i.e.VSS, ECT, Batt Temp, etc.) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate wiring diagrams to identify shared circuits. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

ENGINE CONTROL MODULE (Continued)

STANDARD PROCEDURE - ECM/SKIM PROGRAMMING - DIESEL

NOTE: Before replacing the ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most ECM driver/control circuit failures are caused by internal component failures (i.e. relay and solenoids) and shorted circuits (i.e. pull-ups, drivers and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has set.

ECM/SKIM PROGRAMMING

When a ECM and the SKIM are replaced at the same time perform the following steps in order:

(1) Program the new ECM

(2) Program the new SKIM

(3) Replace all ignition keys and program them to the new SKIM.

ECM/SKIM PROGRAMMING

When an ECM (Bosch) and the SKIM are replaced at the same time perform the following steps in order:

(1) Program the new SKIM

(2) Program the new ECM (Bosch)

PROGRAMMING THE ECM (Bosch)

(1) To program the VIN, connect the DRB III® and turn the ignition on.

(2) Select Engine from the main menu. The DRB III® will require the VIN to be entered before continuing.

(3) Select ENTER to update the VIN. The DRB III® will display the updated VIN.

(4) If the engine is equipped with air conditioning, the ECM A/C function must be enabled. Enable the ECM A/C function as follows:

- Using the DRB III® select ENGINE, MISCELLANEOUS, then ENABLE/DISABLE A/C
- Push 1 to enable A/C. DRB III® screen should display A/C Activated.

PROGRAMMING THE SKIM

(1) Turn the ignition switch on (transmission in park/neutral).

(2) Use the DRB III® and select THEFT ALARM, SKIM then MISCELLANEOUS.

(3) Select ECM REPLACED (DIESEL ENGINE).

(4) Program the vehicle four-digit PIN into SKIM.

(5) Select COUNTRY CODE and enter the correct country.

NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, the SKIM must be replaced.

(6) Select YES to update VIN (the SKIM will learn the VIN from the PCM).

(7) Press ENTER to transfer the secret key (the PCM will send the secret key to the SKIM).

(8) Program ignition keys to SKIM.

NOTE: If the ECM and the SKIM are replaced at the same time, all vehicle keys will need to be replaced and programmed to the new SKIM.

PROGRAMMING IGNITION KEYS TO THE SKIM

(1) Turn the ignition switch on (transmission in park/neutral).

(2) Use the DRB III® and select THEFT ALARM, SKIM then MISCELLANEOUS.

(3) Select PROGRAM IGNITION KEY'S.

(4) Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM it (the key) cannot be transferred to another vehicle.

If ignition key programming is unsuccessful, the DRB III® will display one of the following messages:

Programming Not Attempted - The DRB III® attempts to read the programmed key status and there are no keys programmed into SKIM memory.

Programming Key Failed (Possible Used Key From Wrong Vehicle) - SKIM is unable to program key due to one of the following:

- faulty ignition key transponder
- ignition key is programmed to another vehicle.

8 Keys Already Learned, Programming Not Done - SKIM transponder ID memory is full.

(5) Obtain ignition keys to be programmed from customer (8 keys maximum).

(6) Using the DRB III®, erase all ignition keys by selecting MISCELLANEOUS and ERASE ALL CURRENT IGN. KEYS.

(7) Program all ignition keys.

Learned Key In Ignition - Ignition key transponder ID is currently programmed in SKIM memory.

REMOVAL

(1) Disconnect negative battery cable.

(2) Disconnect ECM electrical connectors (Fig. 2).

(3) Remove ECM bracket to inner fender retaining nuts (Fig. 2).

(4) Remove ECM and bracket assembly from vehicle (Fig. 2).

(5) Separate ECM from bracket.

ENGINE CONTROL MODULE (Continued)

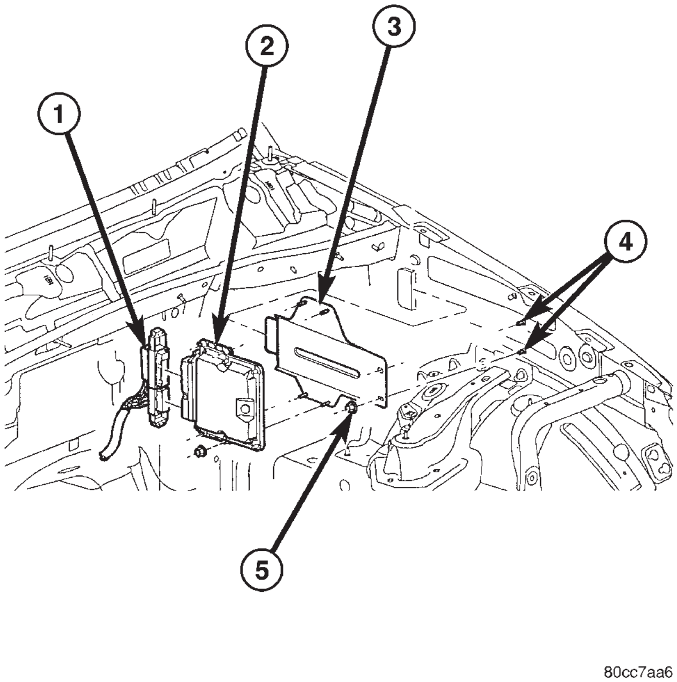

Fig. 2 ENGINE CONTROL MODULE (ECM) REMOVAL/INSTALL

1 - ECM ELECTRICAL CONNECTORS
2 - ENGINE CONTROL MODULE (ECM)
3 - ECM MOUNTING BRACKET
4 - ECM MOUNTING BRACKET MOUNTING STUDS
5 - MOUNTING BRACKET RETAINING NUTS

INSTALLATION

(1) Install ECM on bracket (Fig. 2).

(2) Position ECM and bracket assembly in vehicle (Fig. 2).

(3) Install ECM bracket to inner fender retaining nuts (Fig. 2).

(4) Connect ECM electrical connectors (Fig. 2).

(5) Connect negative battery cable.

TRANSMISSION CONTROL MODULE

DESCRIPTION

The electronic control system consists of various components providing inputs to the TCM. The TCM monitors transmission sensors, shifter assembly switches, and bus messages to determine transmission shift strategy. After shift strategies are determined, the TCM controls the actuation of transmission solenoids, which controls the routing of hydraulic fluid within the transmission, by moving a sequence of four valves to make a shift occur.

The W5J400 electronic transmission has a fully adaptive control system. The system performs its functions based on continuous real-time sensor feedback information. In addition the TCM receives information from the PCM/ECM (engine management) and ABS (chassis systems) controllers over the CAN C bus. The CAN C bus is a high-speed communication bus that allows real time control capability between various controllers. Most messages are sent every 20 milliseconds. This means critical information can be shared between the transmission, engine, and ABS controllers. The CAN C bus is a two wire bus with a CAN C Bus (+) circuit and a CAN C Bus (-) circuit. These circuits are twisted pairs in the harness to reduce the potential of radio and noise interference.

The transmission control system automatically adapts to changes in engine performance, vehicle speed, and transmission temperature variations to provide consistent shift quality. The control system ensures that clutch operation during up-shifting and downshifting is more responsive without increased harshness. The TCM activates the solenoid valves and moves valves in the valve body to achieve the necessary gear changes. The required pressure level is calculated from the load condition, engine speed. Vehicle speed (from ABS module) and transmission oil temperature, matched to the torque to be transmitted. Power for the transmission system is supplied through the shifter mechanism (no transmission control relay). The TCM (Fig. 3) is located in the center console, on the right side of the transmission tunnel.

OPERATION

The transmission control module (TCM) determines the current operating conditions of the vehicle and controls the shifting process for shift comfort and driving situations. It receives this operating data from sensors and broadcast messages from other modules.

The TCM uses inputs from several sensors that are directly hardwired to the controller and it uses several indirect inputs that are used to control shifts. This information is used to actuate the proper solenoids in the valve body to achieve the desired gear. The TCM continuously checks for electrical, mechanical, and some hydraulic problems. When the TCM detects a problem, it stores a Diagnostic Trouble Code (DTC).

The shift lever sensor assembly (SLSA) has sensors that are monitored by the TCM to calculate shift lever position. The reverse light switch, an integral part of the SLSA, controls the reverse light relay con-

TRANSMISSION CONTROL MODULE (Continued)

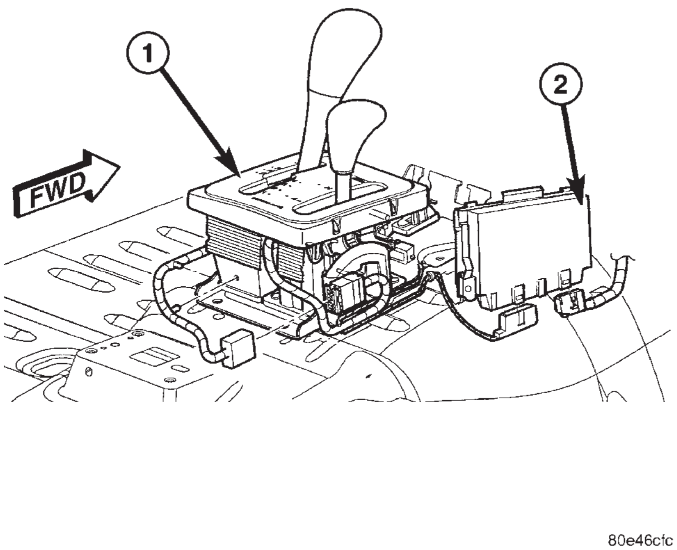

Fig. 3 Shifter Assembly and Transmission Control Module

1 - SHIFTER ASSEMBLY
2 - TRANSMISSION CONTROL MODULE

trol circuit. The Brake/Transmission Shift Interlock (BTSI) solenoid and the park lockout solenoid (also part of the SLSA) are controlled by the TCM.

The PCM and ABS broadcast messages over the controller area network (CAN C) bus for use by the TCM. The TCM uses this information, with other inputs, to determine the transmission operating conditions.

The TCM:

- determines the momentary operating conditions of the vehicle.
- controls all shift processes.
- considers shift comfort and the driving situation.

The TCM controls the solenoid valves for modulating shift pressures and gear changes. Relative to the torque being transmitted, the required pressures are calculated from load conditions, engine rpm, vehicle speed, and ATF temperature.

The following functions are contained in the TCM:

- Shift Program
- Downshift Safety
- Engine Management Intervention
- Torque Converter Lock-Up Clutch.
- Adaptation.

This transmission does not have a TCM relay. Power is supplied to the Shift module and the TCM directly from the ignition.

The TCM continuously checks for electrical problems, mechanical problems, and some hydraulic problems. When a problem is sensed, the TCM stores a diagnostic trouble code (DTC). Some of these codes cause the transmission to go into ″Limp-In″ or ″default″ mode. Some faults cause permanent Limp-In and others cause temporary Limp-In. The W5J400 defaults in the current gear position if a DTC is detected, then after a key cycle the transmission will go into Limp-in, which is mechanical 2nd gear. Some DTCs may allow the transmission to resume normal operation (recover) if the detected problem goes away. A permanent Limp-In DTC will recover when the key is cycled, but if the same DTC is detected for three key cycles the system will not recover and the DTC must be cleared from the TCM with the DRBIII® scan tool.

TCM SIGNALS

The TCM registers one part of the input signals by direct inputs, the other part by CAN C bus. In addition to the direct control of the actuators, the TCM sends various output signals by CAN C bus to other control modules.

Selector Lever Position

A series of 12 Hall-effect switches in the SLSA inform the TCM of the position of the selector lever.

The TCM monitors the SLSA for all shift lever positions through five position circuits. The SLSA provides a low-current 12-volt signal to the TCM. The TCM compares the on/off signals to programmed combinations to determine the exact position of the shift lever.

ATF Temperature Sensor

The ATF temperature sensor is a PTC thermistor. It measures the temperature of the transmission fluid and is an input signal for the TCM. The temperature of the ATF has an influence on the shift time and resulting shift quality. As the temperature rises, resistance rises. Therefore the probing voltage is decreasing. Because of its registration, the shifting process can be optimized in all temperature ranges.

The ATF temperature sensor is connected in series with the park/neutral contact. The temperature signal is transmitted to the TCM only when the reed contact of the park/neutral contact is closed because the TCM only reads ATF temperature while in a forward gear.

Starter Interlock

The TCM monitors a contact switch wired in series with the transmission temperature sensor to determine PARK and NEUTRAL positions. The contact switch is open in PARK and NEUTRAL. The TCM senses transmission temperature as high (switch supply voltage), confirming switch status as open. The TCM then broadcasts a message over CAN bus

TRANSMISSION CONTROL MODULE (Continued)

to confirm switch status. The PCM receives this information and allows operation of the starter circuit.

N2 and N3 Speed Sensors

The N2 and N3 Input Speed Sensors are two Hall-effect speed sensors that are used by the TCM to calculate the transmissions input speed. Since the input speed cannot be measured directly, two of the drive elements are measured. Two input speed sensors were required because both drive elements are not active in all gears.

CAN C Bus Indirect Input Signals

A 2.5-volt bias (operating voltage) is present on the CAN C bus any time the ignition switch is in the RUN position. Both the TCM and the ABS apply this bias. On this vehicle, the CAN C bus is used for module data exchange only. The indirect inputs used on the W5J400 electronic control system are:

- Wheel Speed Sensors.
- Transfer Case Switch Status.
- Brake Switch.
- Engine RPM.
- Engine Temperature.
- Cruise Control Status.
- Gear Limit Request.
- Throttle Position - 0% at idle, 100% at WOT. If open, TCM assumes idle (0% throttle opening).
- Odometer Mileage
- Maximum Effective Torque.
- Engine in Limp-In Mode/Mileage Where DTC Was Set.
- Engine Torque Reduction Request.

BRAKE TRANSMISSION SHIFT INTERLOCK (BTSI)

The BTSI solenoid prevents shifting out of the PARK position until the ignition key is in the RUN position and the brake pedal is pressed. The TCM controls the ground while the ignition switch supplies power to the BTSI solenoid. The PCM monitors the brake switch and broadcasts brake switch status messages over the CAN C bus. If the park brake is depressed and there is power (Run/Start) to SLSA, the BTSI solenoid deactivates. The TCM monitors this for the SLSA because the SLSA does not communicate on the CAN C bus.

SHIFT SCHEDULES

The basic shift schedule includes up and downshifts for all five gears. The TCM adapts the shift program according to driving style, accelerator pedal position and deviation of vehicle speed. Influencing factors are:

- Road Conditions.
- Incline, Decline and Altitude.
- Trailer Operation, Loading.
- Engine Coolant Temperature.
- Cruise Control Operation.
- Sporty Driving Style.
- Low and High ATF Temperature.

Upshift To:	1-2	2-3	3-4	4-5
Activated By Solenoid:	1-2/4-5	2-3	3-4	1-2/4-5
Shift Point (at 35.2% of throttle)	17.8 km/h (11.6 mph)	32.1 km/h (19.95 mph)	67.5 km/h (41.94 mph)	73.8 km/h (45.86 mph)
Downshift From:	5-4	4-3	3-2	2-1
Activated By Solenoid:	1-2/4-5	3-4	2-3	1-2/4-5
Shift Point	55.7 km/h (34.61 mph)	40.5 km/h (25.17 mph)	24.4 km/h (15.16 mph)	15.1 km/h (9.38 mph)

DOWNSHIFT SAFETY

Selector lever downshifts are not performed if inadmissible high engine rpm is sensed.

ENGINE MANAGEMENT INTERVENTION

By briefly retarding the ignition timing during the shifting process, engine torque is reduced and therefore, shift quality is optimized.

ADAPTATION

To equalize tolerances and wear, an automatic adaptation takes place for:

- Shift Time.
- Clutch Filling Time.
- Clutch Filling Pressure.
- Torque Converter Lock-Up Control.

Adaptation data may be stored permanently and to some extent, can be diagnosed.

Driving Style Adaptation

The shift point is modified in steps based on the information from the inputs. The control module looks at inputs such as:

- vehicle acceleration and deceleration (calculated by the TCM).
- rate of change as well as the position of the throttle pedal (fuel injection information from the PCM).

TRANSMISSION CONTROL MODULE (Continued)

• lateral acceleration (calculated by the TCM).

• gear change frequency (how often the shift occurs).

Based on how aggressive the driver is, the TCM moves up the shift so that the present gear is held a little longer before the next upshift. If the driving style is still aggressive, the shift point is modified up to ten steps. If the driving returns to normal, then the shift point modification also returns to the base position.

This adaptation has no memory. The adaptation to driving style is nothing more than a shift point modification meant to assist an aggressive driver. The shift points are adjusted for the moment and return to base position as soon as the inputs are controlled in a more rational manner.

Shift Time Adaptation (Shift Overlap Adaptation, Working Pressure)

Shift time adaptation is the ability of the TCM to electronically alter the time it takes to go from one gear to another. Shift time is defined as the time it takes to disengage one shift member while another is being applied. Shift time adaptation is divided into four categories:

36. Accelerating upshift, which is an upshift under a load. For shift time adaptation for the 1-2 upshift to take place, the transmission must shift from 1st to 2nd in six different engine load ranges vs. transmission output speed ranges.

37. Decelerating upshift, which is an upshift under no load. This shift is a rolling upshift and is accomplished by letting the vehicle roll into the next gear.

38. Accelerating downshift, which is a downshift under load. This shift can be initiated by the throttle, with or without kickdown. The shift selector can also be used.

39. Decelerating downshift, which is accomplished by coasting down. As the speed of the vehicle decreases, the transmission downshifts.

Fill Pressure Adaptation (Apply Pressure Adaptation, Modulating Pressure)

Fill pressure adaptation is the ability of the TCM to modify the pressure used to engage a shift member. The value of this pressure determines how firm the shift will be.

• If too much pressure is used, the shift will be hard.

• If too little pressure is used, the transmission may slip.

The pressure adjustment is needed to compensate for the tolerances of the shift pressure solenoid valve. The amount the solenoid valve opens as well as how quickly the valve can move, has an effect on the pressure. The return spring for the shift member provides a resistance that must be overcome by the pressure in order for shift member to apply. These return springs have slightly different values. This also affects the application pressure and is compensated for by fill pressure adaptation.

Fill Time Adaptation (Engagement Time Adaptation)

Fill time is the time it takes to fill the piston cavity and take up any clearances for a friction element (clutch or brake). Fill time adaptation is the ability of the TCM to modify the time it takes to fill the shift member by applying a preload pressure.

CONTROLLER MODES OF OPERATION

Permanent Limp-In Mode

When the TCM determines there is a non-recoverable condition present that does not allow proper transmission operation, it places the transmission in permanent Limp-In Mode. When the condition occurs the TCM turns off all solenoids as well as the solenoid supply output circuit. If this occurs while the vehicle is moving, the transmission remains in the current gear position until the ignition is turned off or the shifter is placed in the ″P″ position. When the shifter has been placed in ″P,″ the transmission only allows 2nd gear operation. If this occurs while the vehicle is not moving, the transmission only allows operation in 2nd gear.

Temporary Limp-In Mode

This mode is the same as the permanent Limp-In Mode except if the condition is no longer present, the system resumes normal operation.

Under Voltage Limp-In Mode

When the TCM detects that system voltage has dropped below 8.5 volts, it disables voltage-dependant diagnostics and places the transmission in the temporary Limp-In Mode. When the TCM senses that the voltage has risen above 9.0 volts, normal transmission operation is resumed.

Hardware Error Mode

When the TCM detects a major internal error, the transmission is placed in the permanent Limp-In Mode and ceases all communication over the CAN bus. When the TCM has entered this mode normal transmission operation does not resume until all DTCs are cleared from the TCM.

Loss of Drive

If the TCM detects a situation that has resulted or may result in a catastrophic engine or transmission problem, the transmission is placed in the neutral position. Improper Ratio, Input Sensor Overspeed or Engine Overspeed DTCs cause the loss of drive.

TRANSMISSION CONTROL MODULE (Continued)

Controlled Limp-in Mode

When a failure does not require the TCM to shut down the solenoid supply, but the failure is severe enough that the TCM places the transmission into a predefined gear, there are several shift performance concerns. For instance, if the transmission is slipping, the controller tries to place the transmission into 3rd gear and maintain 3rd gear for all forward drive conditions.

STANDARD PROCEDURE - TCM QUICK LEARN

The quick learn procedure requires the use of the DRBIII® scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper baseline transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRB® indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

ENGINE SYSTEMS

TABLE OF CONTENTS

CHARGING

TABLE OF CONTENTS

CHARGING

DESCRIPTION

The charging system used on diesel engines consists of:

- Bosch Generator / field internally controlled
- Ignition switch (Refer to Group 8D, Ignition System for information)
- Battery (Refer to Group 8A, Battery for information)
- Wiring harness and connections (Refer to Group 8W, Wiring for information)

The charging system is turned on and off with the ignition switch. The generator is driven by the engine through a serpentine belt and pulley arrangement.

All vehicles are equipped with On-Board Diagnostics (OBD). Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. See the Powertrain Diagnostic Manual for more information.

SPECIFICATIONS

TORQUE - DIESEL

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Generator Decoupler	110	81	-
Generator-to-Mounting Bracket Bolts (2)	40	30	-
B+ Generator Output Wire	9	-	75

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced. On certain generators, a decoupler is used. Refer to Generator Decoupler for additional information.

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicles electrical system through the generator, battery, and ground terminals.

Noise emitting from the generator may be caused by:

- Worn, loose or defective bearings
- Loose or defective drive pulley
- Incorrect, worn or damaged drive belt
- Loose mounting bolts
- Misaligned drive pulley
- Defective stator or diode
- Damaged internal fins

REMOVAL

WARNING: DISCONNECT NEGATIVE BATTERY CABLE BEFORE REMOVING GENERATOR B+ OUTPUT WIRE FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY OR DAMAGE TO VEHICLE ELECTRICAL SYSTEM.

(1) Disconnect negative battery cable.

(2) Remove accessory drive belt from generator pulley by relieving tension on belt tensioner. Refer to Cooling System for procedure.

(3) Remove turbo intercooler hose (Fig. 1).

(4) Loosen (but do not remove) mounting bolt for idler pulley (Fig. 1).

(5) The generator uses 4 horizontally mounted bolts (Fig. 2). Remove 2 upper generator mounting bolts.

(6) Raise vehicle.

(7) Lower oil pan splash shield at right frame rail by disconnecting 2 clips (Fig. 3).

(8) Remove bolt at air conditioning line support bracket (Fig. 4).

(9) Remove B+ output cable nut and cable at rear of generator.

(10) Disconnect generator field wire connector from rear of generator.

(11) Remove 2 lower generator mounting bolts (Fig. 2). Note lower bolts are slightly shorter than upper bolts.

(12) Lower generator for removal.

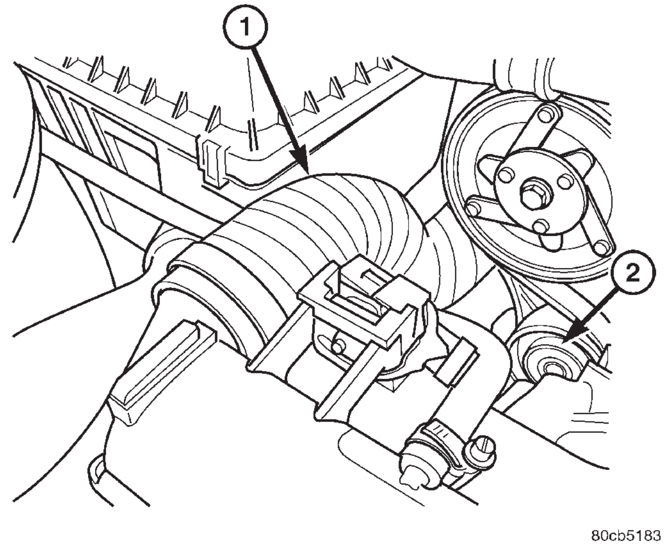

Fig. 1 TURBO INTERCOOLER HOSE

1 - INTERCOOLER HOSE
2 - IDLER PULLEY

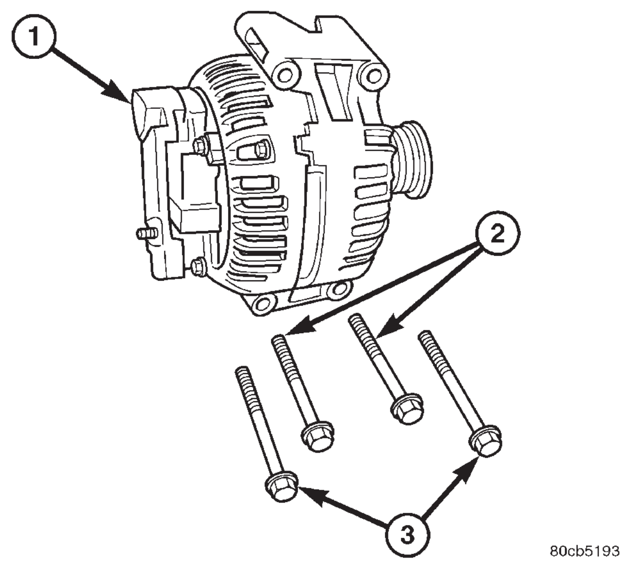

Fig. 2 GENERATOR - 2.7L DIESEL

1 - GENERATOR
2 - LOWER MOUNTING BOLTS
3- UPPER MOUNTING BOLTS

INSTALLATION

(1) Raise generator into position from bottom of vehicle.

GENERATOR (Continued)

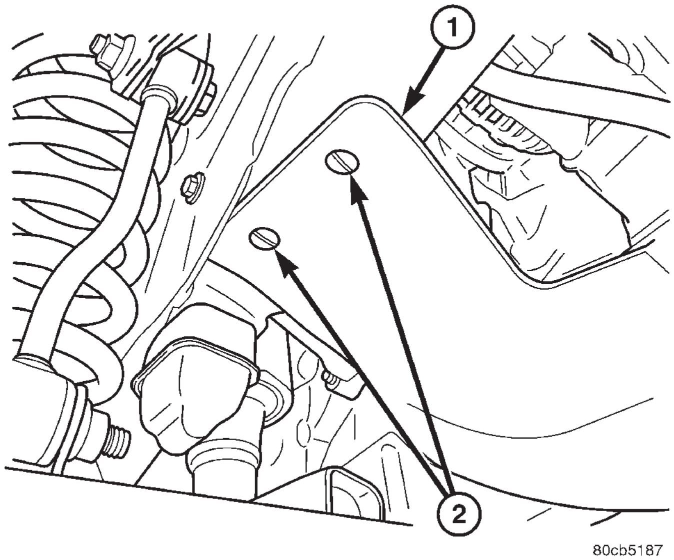

Fig. 3 OIL PAN SPLASH SHIELD

1 - OIL PAN SPLASH SHIELD
2 - SPLASH SHIELD CLIPS

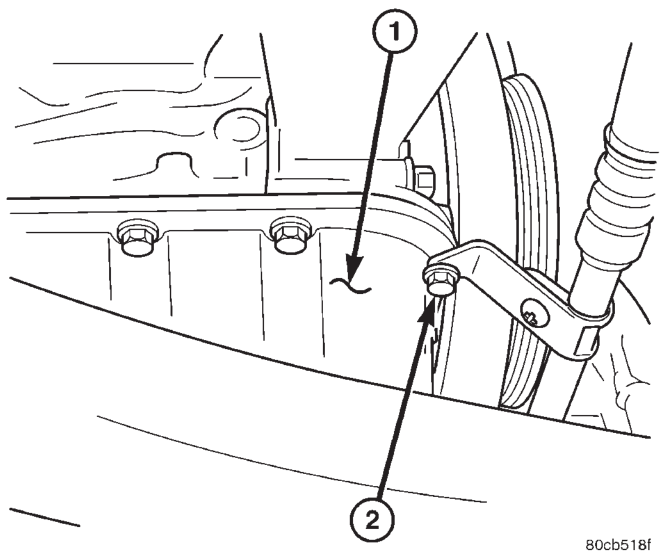

Fig. 4 AC LINE AT OIL PAN

1 - OIL PAN (RIGHT/FRONT)
2 - MOUNTING BOLT

(2) Install 2 lower generator mounting bolts finger tight (Fig. 2). Note lower bolts are slightly shorter than upper bolts.

(3) Connect generator field wire connector to rear of generator.

(4) Install B+ output cable nut and cable to rear of generator.

(5) Install bolt at air conditioning line support bracket (Fig. 4).

(6) Install oil pan splash shield. Press in 2 clips (Fig. 3).

(7) Lower vehicle.

(8) Install 2 upper generator mounting bolts. Tighten all 4 mounting bolts

(9) Tighten idler pulley bolt.

(10) Install turbo intercooler hose (Fig. 1).

(11) Install accessory drive belt by relieving tension on belt tensioner. Refer to Cooling System for procedure.

(12) Connect negative battery cable.

GENERATOR DECOUPLER PULLEY

DESCRIPTION

The generator decoupler is used only with certain engines. The decoupler is used in place of the standard generator drive pulley (Fig. 5).

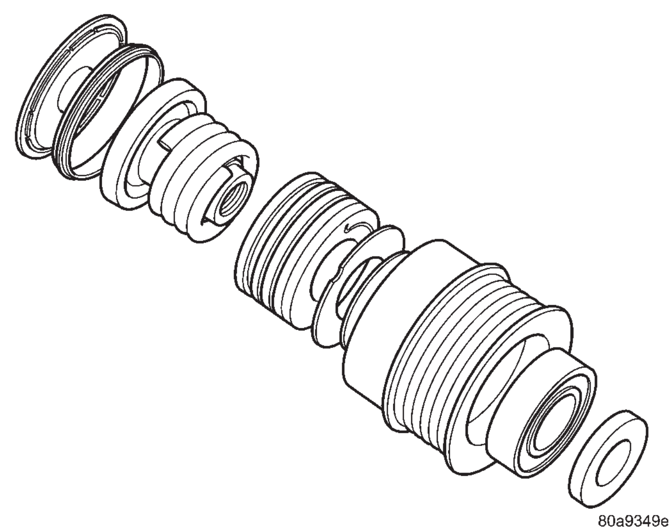

Fig. 5 GENERATOR DECOUPLER PULLEY (TYPICAL)

OPERATION

The generator decoupler is used only with certain engines. The decoupler (Fig. 5). is a one-way clutch designed to help reduce belt tension fluctuation, vibration, reduce fatigue loads, improve belt life, reduce hubloads on components, and reduce noise. Dry operation is used (no grease or lubricants). The decoupler is not temperature sensitive and also has a low sensitivity to electrical load. The decoupler is a non-serviceable item and is to be replaced as an assembly.

GENERATOR DECOUPLER PULLEY (Continued)

DIAGNOSIS AND TESTING - GENERATOR DECOUPLER

CONDITION	POSSIBLE CAUSES	CORRECTION
Does not drive generator (generator not charging)	Internal failure	Replace decoupler
Noise coming from decoupler	Internal failure	Replace decoupler

REMOVAL

The generator decoupler is used only with certain engines.

Two different type generator decoupler pulleys are used. One can be identified by the use of machined splines (Fig. 6). The other can be identified by a hex opening (Fig. 7) and will not use splines.

Different special tools are required to service each different decoupler. Refer to following procedure.

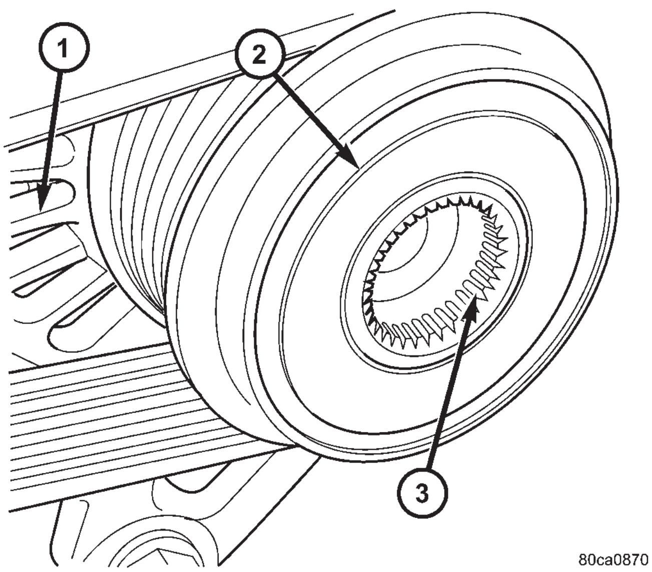

Fig. 6 GENERATOR DECOUPLER PULLEY (INA)

1 - GENERATOR
2 - DECOUPLER (INA)
3 - MACHINED SPLINES

INA Decoupler

(1) Disconnect negative battery cable.

(2) Remove generator and accessory drive belt. Refer to Generator Removal.

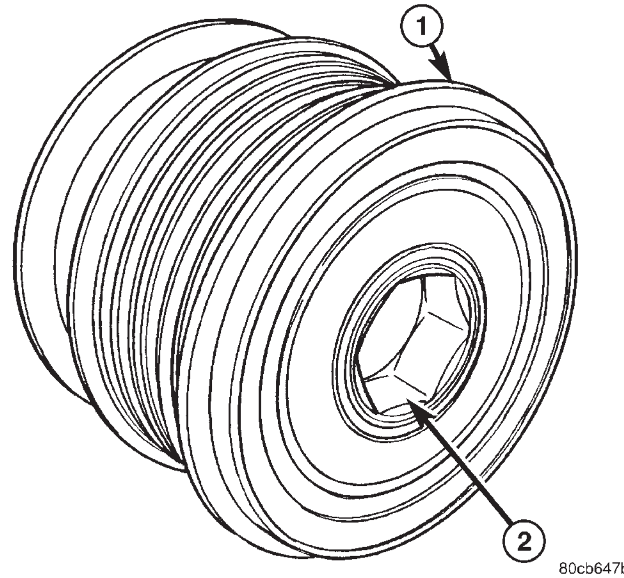

Fig. 7 GENERATOR DECOUPLER PULLEY (LITENS)

1 - DECOUPLER (LITENS)
2 - HEX OPENING

(3) Position Special Tool #8823 (VM.1048) into decoupler (Fig. 8).

(4) Determine if end of generator shaft is hex shaped (Fig. 9) or is splined (Fig. 10). If hex is used, insert a 10MM deep socket into tool #8823 (VM.1048) (Fig. 11). If splined, insert a 5/16” 6-point hex driver, or a 10MM 12-point triple square driver into tool #8823 (VM.1048) (Fig. 12).

(5) The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise (Fig. 11) or, (Fig. 12).

(6) After breaking loose with tool, unthread decoupler by hand from generator.

GENERATOR DECOUPLER PULLEY (Continued)

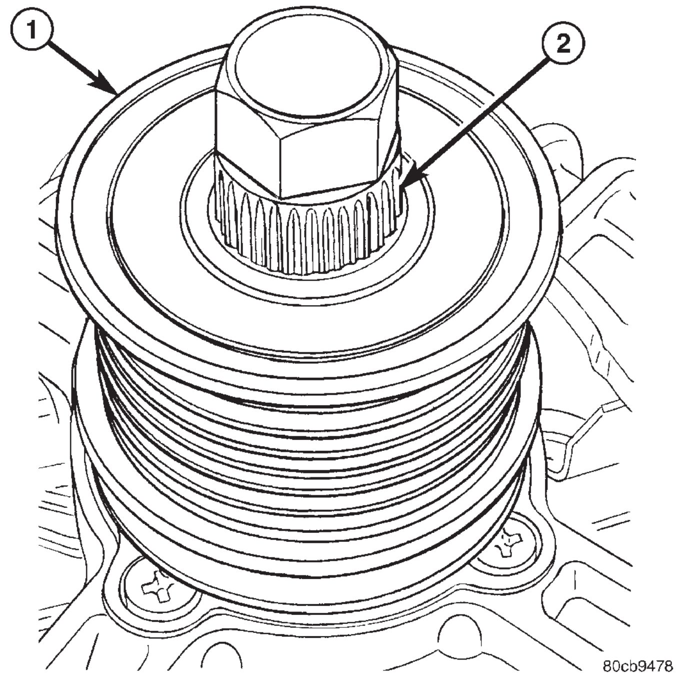

Fig. 8 #8823 (VM.1048) TOOL AND INA DECOUPLER

1 - INA DECOUPLER
2 - TOOL #8823 (VM.1048)

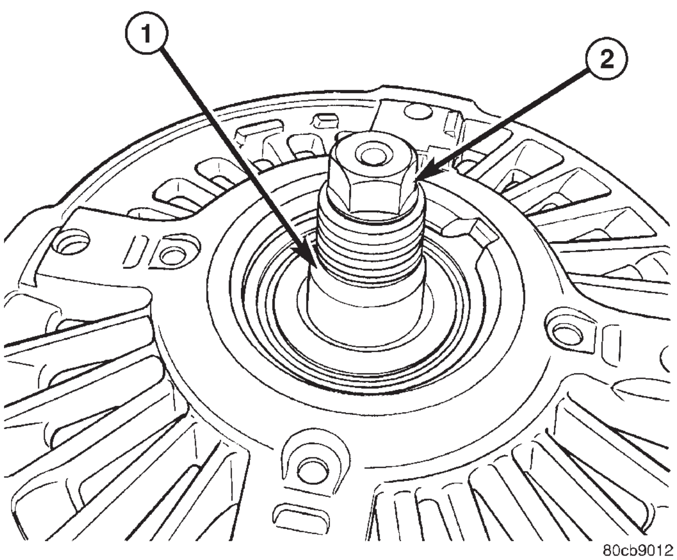

Fig. 9 END OF GENERATOR SHAFT (HEX)

1 - GENERATOR SHAFT
2 - HEX

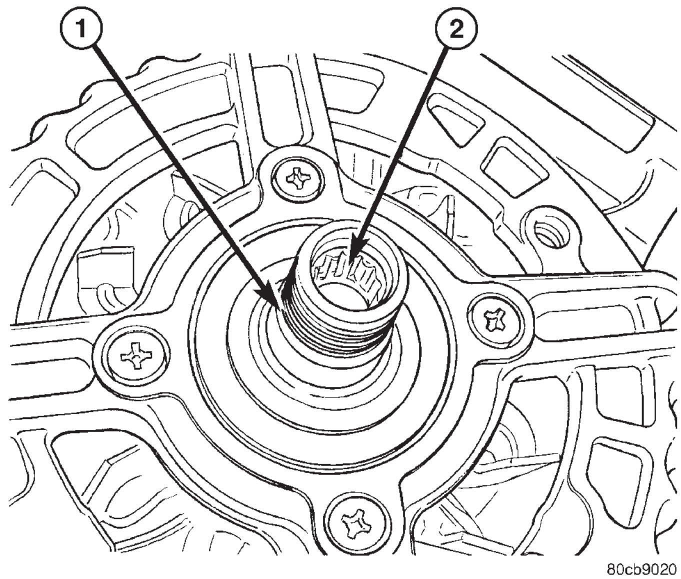

Fig. 10 END OF GENERATOR SHAFT (SPLINED)

1 - GENERATOR SHAFT
2 - SPLINES

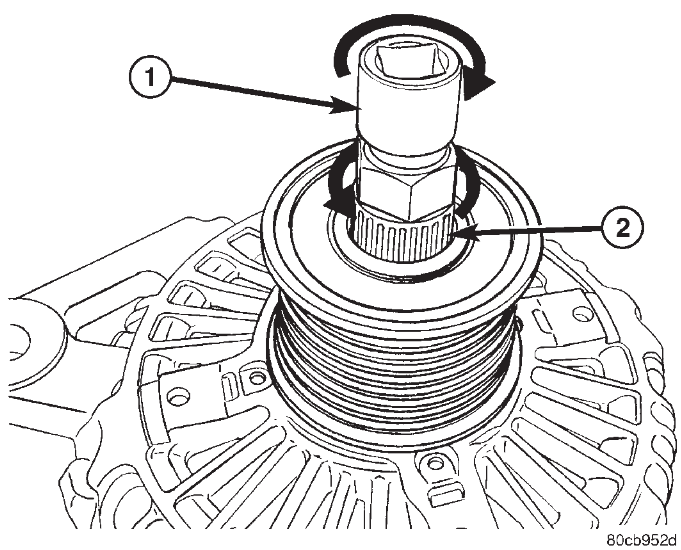

Fig. 11 DECOUPLER REMOVAL (INA-HEX)

1 - DEEP 10 MM SOCKET
2 - TOOL #8823 (VM.1048)

GENERATOR DECOUPLER PULLEY (Continued)

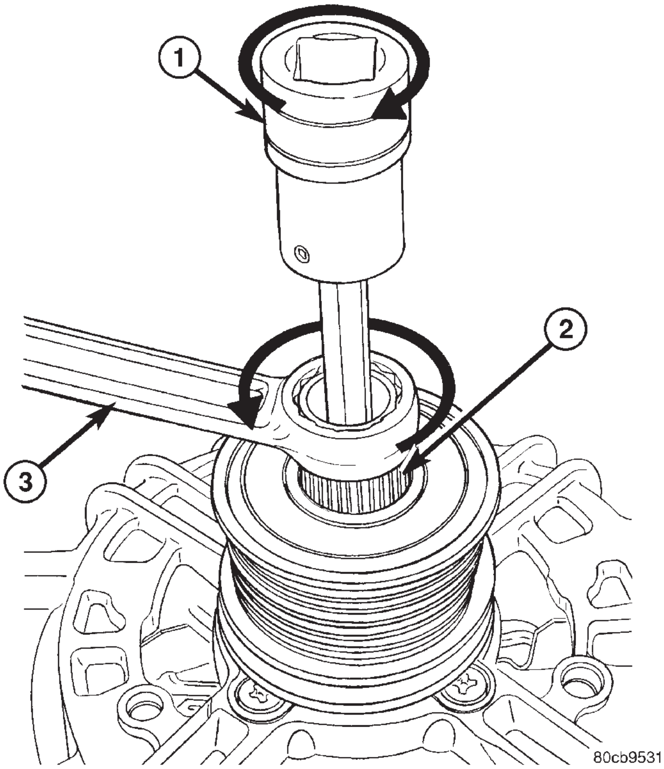

Fig. 12 DECOUPLER REMOVAL (INA-SPLINED)

1 - DRIVER
2 - TOOL #8823 (VM.1048)
3 - 17 MM WRENCH

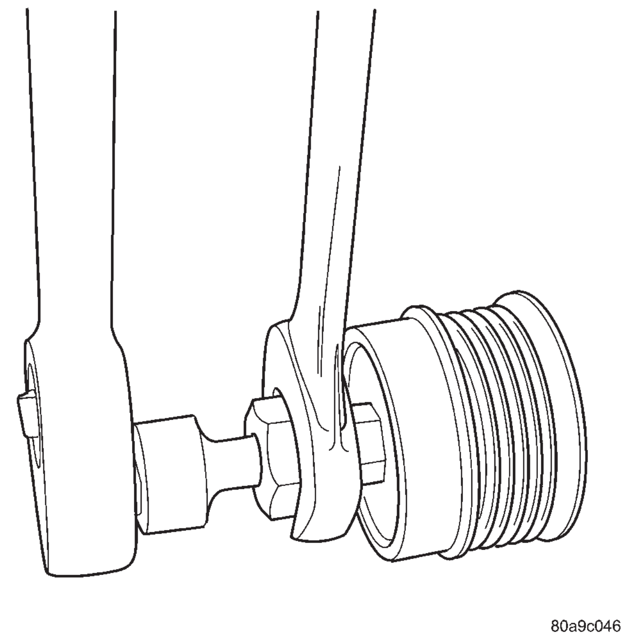

Fig. 13 # 8433 TOOL AND LITENS DECOUPLER

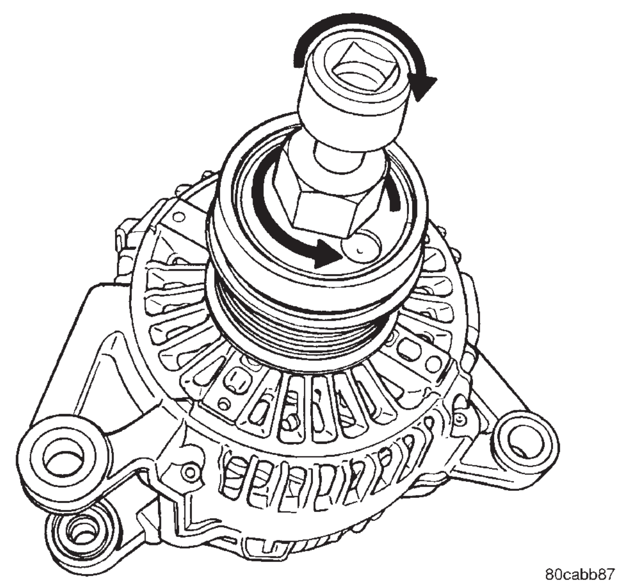

Fig. 14 DECOUPLER REMOVAL (LITENS)

Litens Decoupler

(1) Disconnect negative battery cable.

(2) Remove generator and accessory drive belt. Refer to Generator Removal.

(3) Position Special Tool #8433 (Fig. 13) into decoupler. Align to hex end of generator shaft.

(4) The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise (Fig. 14).

(5) After breaking loose with tool, unthread decoupler by hand from generator.

INSTALLATION

INA Decoupler

(1) Thread decoupler pulley onto generator shaft by hand (right-hand threads).

(2) Position Special Tool #8823 (VM.1048) into decoupler (Fig. 8).

(3) Determine if end of generator shaft is hex shaped (Fig. 9) or is splined (Fig. 10). If hex is used, insert a 10MM deep socket into tool #8823 (VM.1048) (Fig. 15). If splined, insert a 5/16” 6-point hex driver, or a 10MM 12-point triple square driver into tool #8823 (VM.1048) (Fig. 16).

GENERATOR DECOUPLER PULLEY (Continued)

(4) **Do not use an adjustable, ratcheting "click type" torque wrench. Most "click type" wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counter-clockwise rotation (Fig. 15) or, (Fig. 16). Refer to torque specifications.

(5) Install accessory drive belt, and generator. Refer to Generator Installation.

(6) Connect negative battery cable.

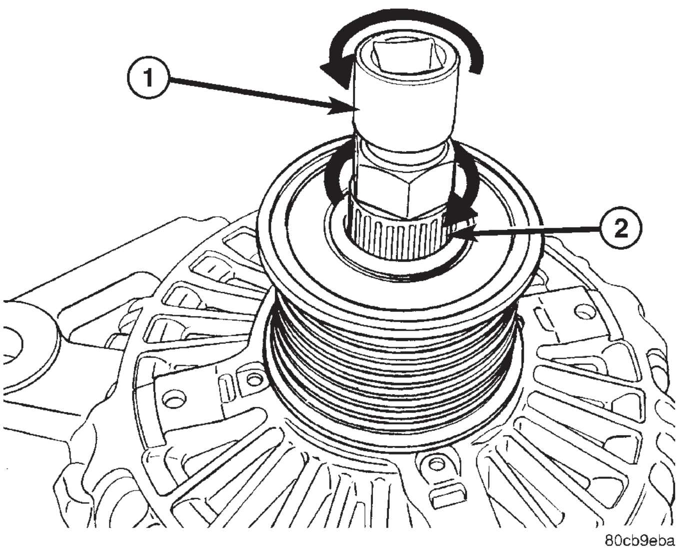

Fig. 15 DECOUPLER INSTALLATION (INA-HEX)

1 - 10MM DEEP SOCKET
2 - TOOL # 8823 (VM.1048)

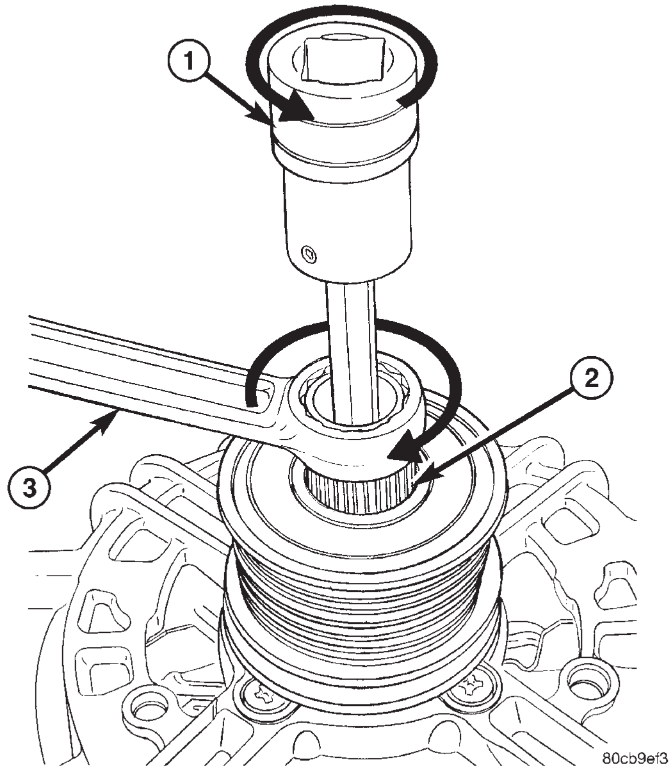

Fig. 16 DECOUPLER INSTALLATION (INA SPLINED)

1 - DRIVER
2 - TOOL # 8823 (VM.1048)

Litens Decoupler

(1) Thread decoupler pulley onto generator shaft by hand (right-hand threads).

(2) Position Special Tool 8433 (Fig. 13) into decoupler. Align tool to hex end of generator shaft.

(3) **Do not use an adjustable, ratcheting "click type" torque wrench. Most "click type" wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counter-clockwise rotation (Fig. 17). Refer to torque specifications.

(4) Install accessory drive belt, and generator. Refer to Generator Installation.

(5) Connect negative battery cable.

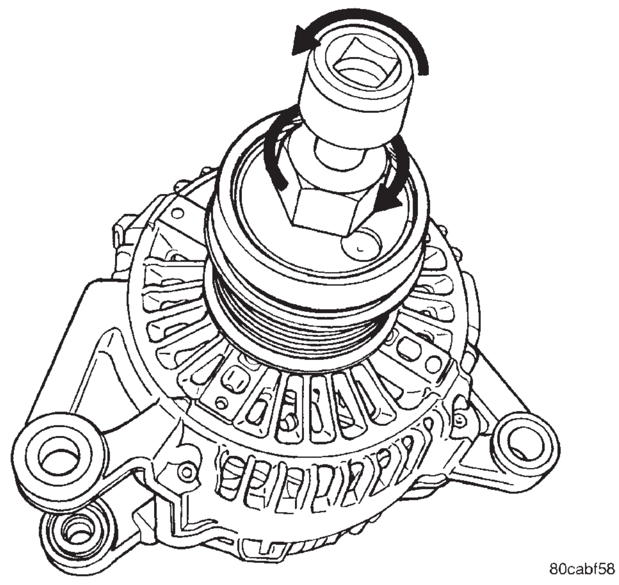

Fig. 17 DECOUPLER INSTALLATION (Litens)

STARTING

TABLE OF CONTENTS

STARTING

SPECIFICATIONS

STARTER MOTOR - DIESEL

Starter and Solenoid	
Engine Application	Diesel
Power Rating	2.2 Kilowatt
Voltage	12 Volts
Number of Fields	4
Number of Poles	4
Number of Brushes	4
Drive Type	Planetary Gear Reduction
Free Running Test Voltage	11.5 Volts
Free Running Test Maximum Amperage Draw	160 Amperes
Free Running Test Minimum Speed	5500 rpm
Solenoid Closing Maximum Voltage	7.8 Volts
*Cranking Amperage Draw test	350 Amperes
*Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.	

STARTER MOTOR

REMOVAL - 2.7L DIESEL

(1) Disconnect and isolate negative battery cable.
(2) Raise and support vehicle.
(3) Remove battery cable mounting nut and cable eyelet at starter solenoid battery terminal.
(4) Remove 2 starter mounting bolts (Fig. 1).
(5) Partially lower starter to gain access to solenoid wire connector. Do not allow starter motor to hang from the wire harness.
(6) Disconnect solenoid wire at starter: slide red colored tab to unlock; push down on black colored tab while pulling connector from solenoid.
(7) Remove starter from vehicle.

INSTALLATION - 2.7L DIESEL

(1) Position starter motor to transmission.
(2) Install and tighten 2 mounting bolts. Refer to torque specifications.
(3) Connect solenoid wire to starter solenoid. Slide red colored tab to lock connector.
(4) Install battery cable and nut to solenoid stud. Refer to torque specifications.
(5) Lower vehicle.

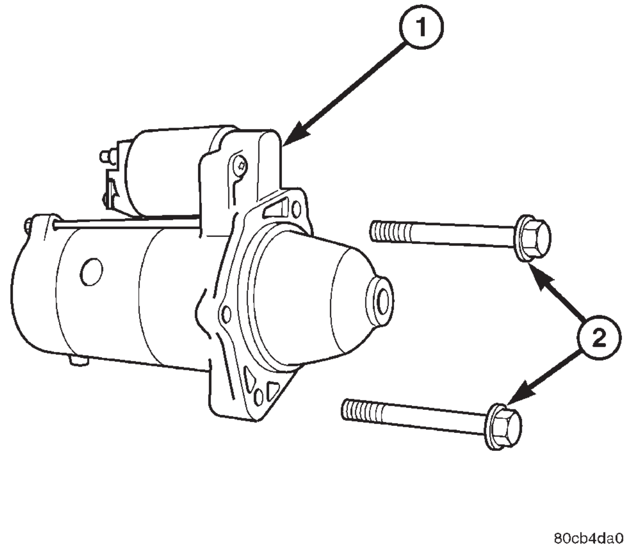

Fig. 1 STARTER MOTOR - 2.7L DIESEL

1 - STARTER MOTOR
2 - MOUNTING BOLTS (2)

(6) Connect negative battery cable.

IGNITION CONTROL

TABLE OF CONTENTS

GLOW PLUG

DESCRIPTION

Glow plugs are used to help start a cold or cool engine (Fig. 1). The glow plugs will heat up and glow to heat the combustion chamber of each cylinder. An individual glow plug is used for each cylinder. Each glow plug is threaded into the left side of the cylinder head below the cylinder head cover/intake manifold.

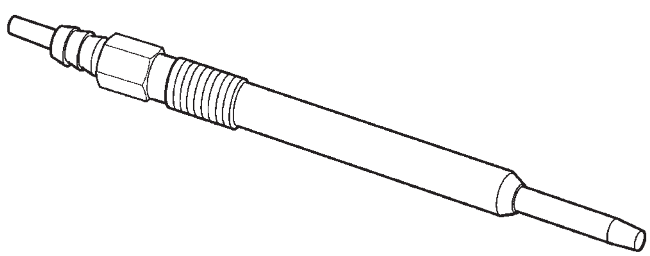

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Fig. 1 GLOW PLUG

OPERATION

The glow plugs are used to preheat the combustion chambers in order to achieve the ignition temperature required for the fuel-air mixture.

The glow plug consists of a housing with a female thread and an interference-fit rod. The heating element is integrated in the glow rod. It consists of a heating winding and a control winding connected in series.

When the glow plug system is switched “ON”, a current of about 30 ampere flows to each glow plug. The heating winding heats the glow plug. The control winding increases its resistance as the temperature rises and limits the current to approximately 15-25 ampere. The glow plug is protected this way from overloads.

REMOVAL

CAUTION: Engine temperature must be at least 90°C (194°F) before removing glow plugs. If cylinder head is already removed, warm cylinder head to 90°C (194°F) before removing glow plugs.

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO SKIN AND EYES EXPOSED TO FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Press in on fuel line locking tab to release fuel line. Pull back on locking tab to return to lock position.

(3) Remove fuel return flow line to high pressure pump.

(4) Disconnect glow plug electrical connector (Fig. 2).

WARNING: RISK OF INJURY TO SKIN AND EYES FROM HANDLING HOT OR GLOWING OBJECTS. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

(5) Remove glow plugs and clean glow plug bay (Fig. 2).

INSTALLATION

(1) Clean glow plug bay and install glow plug. Tighten glow plugs to 12N·m (106 lbs. in.).

(2) Connect glow plug electrical connector. (Fig. 2).

GLOW PLUG (Continued)

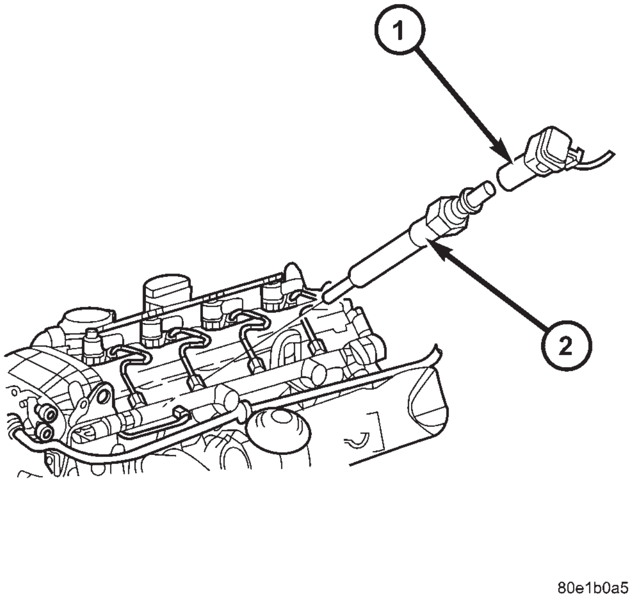

Fig. 2 GLOW PLUG LOCATION - TYPICAL

1 - GLOW PLUG ELECTRICAL CONNECTOR
2 - GLOW PLUG

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO SKIN AND EYES EXPOSED TO FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Press in on fuel line locking tab to release fuel line. Pull back on locking tab to return to lock position.

(3) Install fuel return flow line to high pressure pump.

(4) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(5) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

GLOW PLUG RELAY

DESCRIPTION

There are two glow plug relays. These relays are located in the Power Distribution Center (PDC) in the engine compartment.

OPERATION

When the ignition (key) switch is place in the ON position, a signal is sent to the ECM relating current engine coolant temperature. This signal is sent from the engine coolant temperature sensor.

After receiving this signal, the ECM will determine if, when and for how long of a period the glow plug relays should be activated. This is done before, during and after the engine is started. Whenever the glow plug relays are activated, it will control the 12 volt 100 amp circuit for the operation of the four glow plugs. Each relay control two glow plugs.

The Glow Plug lamp is tied to this circuit. Lamp operation is also controlled by the ECM.

With a cold engine, the glow plug relays and glow plugs may be activated for a maximum time of 200 seconds. Refer to the following Glow Plug Control chart for a temperature/time comparison of the glow plug relay operation.

In this chart, Pre-Heat and Post-Heat times are mentioned. Pre-Heat is the amount of time the glow plug relay control circuit is activated when the ignition (key) is switched ON, without the engine running. Post-Heat is the amount of time the glow plug relay control circuit is activated after the engine is operated. The Glow Plug lamp will not be activated during the post-heat cycle.

Engine Coolant Temperature ″Key ON″	Wait-To Start Lamp ″ON″ (Seconds)	Pre-Heat Cycle (Glow Plugs On Seconds)	Post-Heat Cycle (Seconds)
-30C	20 SEC.	35 SEC.	200 SEC.
-10C	8 SEC.	23 SEC.	180 SEC.
+10C	6 SEC.	21 SEC.	160 SEC.
+30C	5 SEC.	20 SEC.	140 SEC.
+40C	4 SEC.	19 SEC.	70 SEC.
+70C	1 SEC.	16 SEC.	20 SEC.

DIAGNOSIS AND TESTING - GLOW PLUG RELAYS

Refer to the appropriate Diesel Powertrain Diagnosis Manual for information on diagnosing the glow plug relays.

ENGINE

TABLE OF CONTENTS

ENGINE - 2.7L DIESEL

DESCRIPTION

DESCRIPTION

This 2.7 Liter five-cylinder Common Rail Diesel Injection (CDI) engine is an in-line overhead valve diesel engine. This engine utilizes a cast iron cylinder block and an aluminum cylinder head. The engine is turbocharged and intercooled. This engine also has for valve per cylinder and dual overhead camshafts (Fig. 1).

DESCRIPTION	SPECIFICATION
Engine	2.7L CDI
Engine Description	5 Cylinder In-Line Engine With 4-Valve Technology
Fuel Injection System	Common Rail Diesel Injection (CDI)
Fuel	Diesel
Rated Output	125/4200 kW at RPM
Torque	400/1600-2400 Nm at RPM
Maximum Speed	4800 RPM
Compression Ratio	19:1
Bore/Stroke	88.0/88.4 mm
Eff. Displacement	2688 cm3

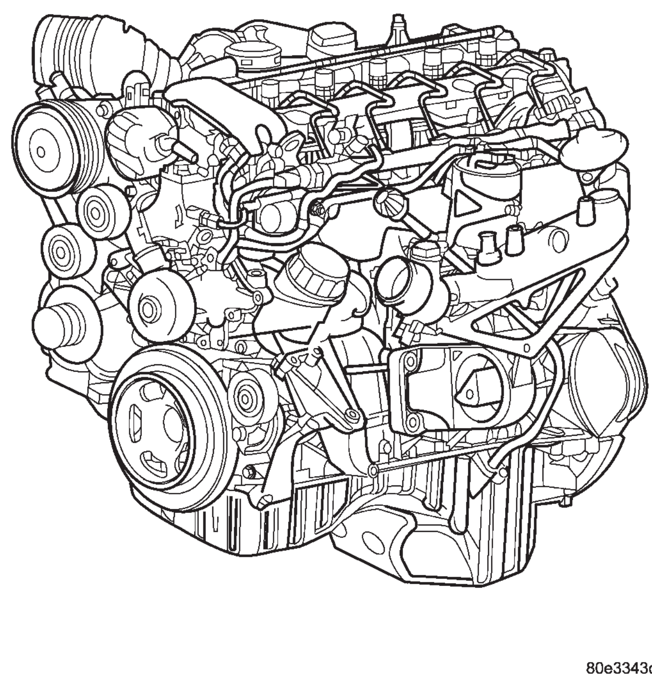

Fig. 1 2.7L DIESEL ENGINE

ENGINE - 2.7L DIESEL (Continued)

DESCRIPTION - ENGINE COVER

The engine cover is a black plastic cover used to cover the top of the engine (Fig. 2).

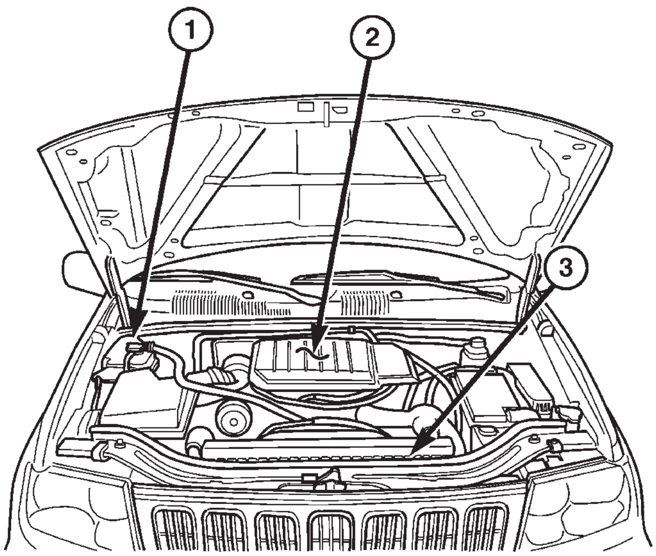

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Fig. 2 ENGINE COMPARTMENT

1 - COOLANT PRESSURE CONTAINER
2 - ENGINE COVER
3 - RADIATOR

STANDARD PROCEDURE

STANDARD PROCEDURE - COMPRESSION TESTING ENGINE

(1) Warm up engine to operating temperature (approx. 80 °C).

(2) Shut off engine.

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Remove glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - REMOVAL).

(5) Crank engine several times with the starter to eliminate combustion residues in the cylinders.

(6) Insert compression tester adapter with check valve installed into glow plug hole of cylinder to be tested.

(7) Test compression pressure by cranking engine with starter for at least 8 revolutions.

(8) Carry out test procedure at the remaining cylinders in the same way.

(9) Compare pressure readings obtained with the specified pressures. If the pressure reading is below the minimum compression pressure or if the permissible difference between the individual cylinders is exceeded. Refer to cylinder leak down test.

(10) Remove compression tester and adapter from cylinder head.

(11) Install glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - INSTALLATION).

(12) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

INSPECTING

NOTE: If crankshaft rotates, install retaining lock for crankshaft/ring gear.

(1) Pressurize cylinder with compressed air and read off pressure loss at cylinder leak tester. If excessive pressure loss exists, determine cause. Refer to (DETERMINING PRESSURE LOSS OF CYLINDERS).

NOTE: If the retaining lock is installed, remove it, rotate engine and install lock once again.

(2) Carry out test of other cylinders in the firing order of engine.

STANDARD PROCEDURE - CHECKING OIL PRESSURE

(1) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(2) Remove oil galley plug together with seal at timing case cover.

(3) Screw oil pressure gauge adaptor fitting together with seal onto timing case cover.

(4) Connect oil pressure gauge to adaptor fitting.

(5) Check oil level, adjust with correct engine oil if necessary.

(6) Insert temperature of remote thermometer into oil level indicator tube.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

CAUTION: Ensure that fan and accessory drive belt DO NOT damage oil pressure gauge hose.

(7) Start engine and bring to operating temperature 90°C (194°F).

(8) Record engine oil pressure at idle.

(9) Raise engine speed to 3000 rpm and record oil pressure.

ENGINE - 2.7L DIESEL (Continued)

(10) At normal operating temperature the oil pressure must not drop below 3 bar (44 psi.). When engine speed is raised, oil pressure must rise with out delay and be no less than 3 bar (44 psi.) at 3000 rpm.

(11) If oil pressure is out of range, determine cause.

REMOVAL

REMOVAL - 2.7L DIESEL ENGINE

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES, AND EYE WEAR.

CAUTION: STORE OR DISCARD ALL FULIDS IN SUITABLE AND APPROPRIATELY MARKED CONTAINERS.

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Evacuate and recover air conditioning system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(5) Remove front grill and fascia assembly (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(6) Remove headlamp assemblies (Refer to 23 - BODY/EXTERIOR/GRILLE FRAME - REMOVAL).

(7) Remove headlamp support.

(8) Remove upper radiator support.

(9) Remove upper radiator hose.

(10) Raise and suitably support vehicle.

(11) Disconnect supply and return lines at viscus fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(12) Disconnect lower radiator hose at radiator.

(13) Disconnect transmission cooler hoses at cooler.

(14) Disconnect fan electrical connector.

(15) Lower vehicle.

(16) Disconnect both power steering cooler hoses at cooler.

(17) Remove power steering resivior retaining bolts.

(18) Lift coolant module from vehicle (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).

(19) Remove air cleaner housing assembly.

(20) Remove air tube at turbocharger.

(21) Remove air conditioning lines from compressor.

(22) Remove junction block bracket from compressor.

(23) Remove turbocharger outlet to charge air cooler.

(24) Disconnect coolant resivior lines from engine.

(25) Disconnect signal line at turbocharger.

(26) Disconnect generator B+ at generator.

(27) Disconnect fuel supply and return lines at fuel filter (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL) .

(28) Remove battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

(29) Remove battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).

(30) Disconnect B+ wiring at power distribution center (PDC).

(31) Disconnect pedal position sensor electrical connectors.

(32) Disconnect 3 engine wiring harness connectors.

(33) Remove connector bracket from left sill plate.

(34) Remove exhaust flange retainer at turbocharger.

(35) Disconnect heater hoses.

(36) Raise and suitably support vehicle.

(37) Remove torque converter bolts.

(38) Remove starter (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

(39) Remove transmission bell housing bolts from engine.

(40) Disconnect transmission electrical connectors.

(41) Lower vehicle.

(42) Suitably support transmission.

(43) Connect a suitable engine hoist.

(44) Raise engine approximately 76mm (3 in.).

(45) Remove left engine mount sill plate.

CAUTION: When removing engine care must be taken not to damage crankshaft sensor or other ancellary components.

(46) Remove engine from vehicle.

ENGINE - 2.7L DIESEL (Continued)

REMOVAL - ENGINE COVER

(1) Firmly grasp front of cover and lift straight up to release cover from mounting ball studs (Fig. 3).

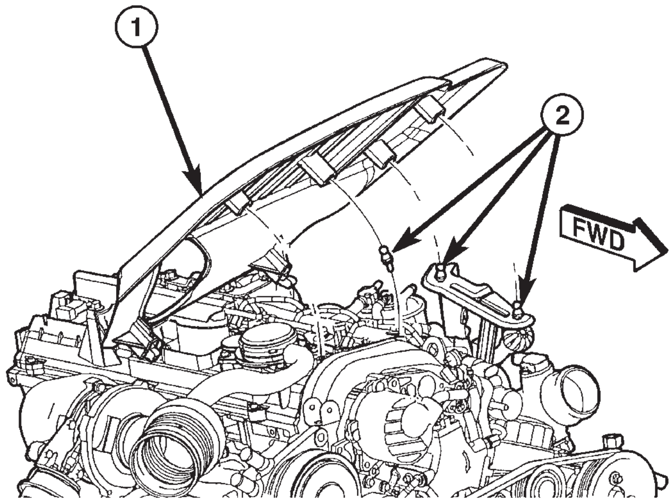

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Fig. 3 ENGINE COVER FRONT MOUNTS

1 - ENGINE COVER
2 - MOUNTING BALL STUDS

(2) Pull cover out of rear mounts and remove from vehicle (Fig. 4).

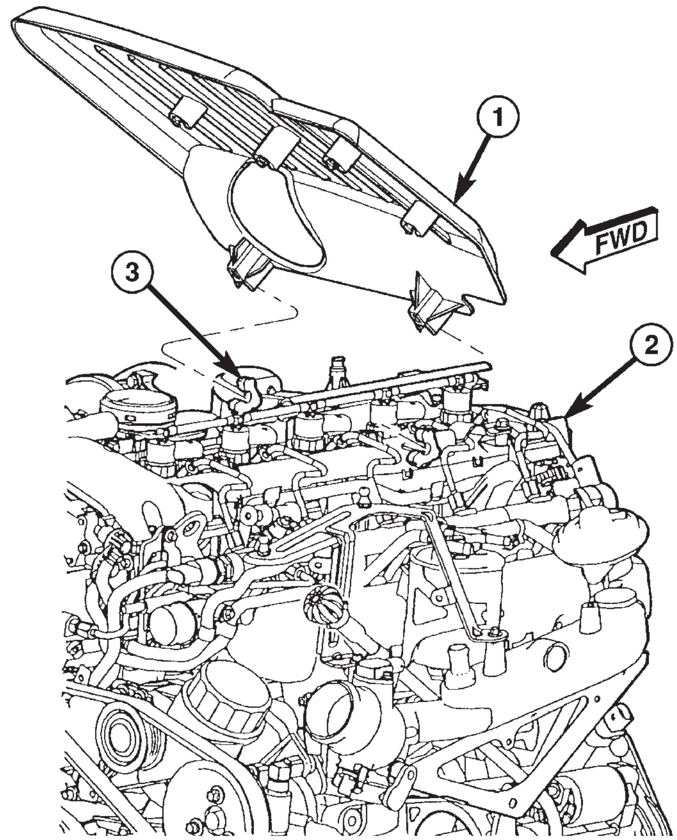

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Fig. 4 ENGINE COVER REAR MOUNTS

1 - ENGINE COVER
2 - CYLINDER HEAD COVER
3 - REAR MOUNT

INSTALLATION

INSTALLATION - 2.7L DIESEL ENGINE

CAUTION: When installing engine, care must be taken not to damage crankshaft sensor or other ancillary components.

(1) Suitably support transmission.
(2) Position engine in bay area approximately 76MM (3 in.) above.
(3) Install left engine mount through bolt into sill plate, Do Not tighten.
(4) Lower engine until sill plate meets frame rail.
(5) Slide engine back toward transmission until engine meets bell housing.
(6) Raise and suitably support vehicle.
(7) Install and tighten transmission bell housing bolts
(8) Install and tighten transfer case bolts.
(9) Install starter (Refer to 8 - ELECTRICAL/ STARTING/STARTER MOTOR - INSTALLATION).
(10) Connect transmission and transfer case electrical connectors.
(11) Install and tighten torque converter bolts.
(12) Lower vehicle.
(13) Connect heater hoses.
(14) Connect exhaust flange retainer at turbocharger.
(15) Install connector bracket to left sill plate.
(16) Connect engine wiring harnesses.
(17) Connect pedal position sensor electrical harness connectors.
(18) Connect B+ wiring at power distribution center (PDC).
(19) Install battery tray.
(20) Install battery.
(21) Connect fuel supply and return lines.
(22) Connect generator B+ at generator.
(23) Connect signal line at turbocharger.
(24) Connect coolant pressure container lines.

ENGINE - 2.7L DIESEL (Continued)

(25) Install turbocharger outlet to charge air cooler.

(26) Install junction block bracket to compressor.

(27) Install air conditioning lines to compressor.

(28) Install air tube at turbocharger.

(29) Install air cleaner housing.

(30) Install coolant module (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(31) Position and install power steering reservoir.

(32) Connect both power steering cooler lines to cooler.

(33) Connect transmission cooler lines at cooler.

(34) Connect lower radiator hose to radiator.

(35) Connect supply and return lines at viscous fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(36) Install upper radiator hose.

(37) Install upper radiator support (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION)..

(38) Install headlamp support.

(39) Install headlamp assemblies.

(40) Install front grill and fascia assembly.

(41) Fill coolant system with proper mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(42) Fill engine oil to proper level. Refer to owners manual for specifications.

(43) Connect negative battery cable.

(44) Evacuate and recharge air conditioning (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(45) Bleed air from fuel injection system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(46) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(47) Start engine and inspect for leaks.

(48) Check transmission and transfer case oil levels. Refer to owners manual for specifications.

INSTALLATION - ENGINE COVER

(1) Align cover and push into rear mounts (Fig. 4).

(2) Push down front of cover slowly to align mounting ball studs (Fig. 3).

(3) Push down firmly on front of cover to lock cover in place.

ENGINE - 2.7L DIESEL (Continued)

SPECIFICATIONS - TORQUE SPECIFICATIONS

2.7L DIESEL

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Crankcase Ventilation			
Screw-Air Charge Distribution Pipe to Air Charge Distribution Panel	11	-	97
Cylinder Head			
8m-Bolt- Cylinder Head to Timing Case Cover	20	15	-
Bolt-Front Cover to Cylinder Head	14	-	124
12m-Bolt-Cylinder Head to Crankcase (3 stages, torque, torque angle, torque angle)	60, 90°, 90°	44	-
Crankcase, Timing Case Cover, End Cover			
Bolt-Crankshaft Bearing Cap to Crankcase (2 stages, torque, torque angle)	55, 90°	40	-
Bolt-End Cover to Crankcase	9	-	80
Bolt-Timing Case Cover to Crankcase	20	15	-
Plug-Coolant Drain to Crankcase	30	22	-
Oil Pan			
6m-Bolt-Oil Pan to Crankcase	9	-	80
8m-Bolt-Oil Pan to Crankcase	20	15	-
Bolt-Oil Pan to End Cover	9	-	80
Bolt-Oil Pan to Timing Case Cover	9	-	80
Bolt-Oil Pan to Transmission Bell Housing	40	30	-
Plug-Pil Pan to Oil Drain	47	35	-
Connecting Rod			
Bolt-Connecting Rod Cap to Connecting Rod (3 stage, 1&2 torque, 3 torque angle)	5,25,90°	-	44,221
Crankshaft			
Bolt-Crankshaft Bearing Cap (2 stage, 1 torque, 2 torque angle	55,90°	40.5	-
Flywheel, Driven Plate, Vibration Damper, Starter Ring Gear			
8.8m-Bolt-Central Bolt of Vibration Damper (2 stage, 1 torque, 2 torque angle)	200,90°	147.5	-
10.9m-Bolt-Central Bolt of Vibration Damper (2 stage, 1 torque, 2 torque angle)	325,90°	240	-
Bolt-Stretch Shank for Flywheel or 2 Mass Flywheel to Crankshaft (2 stage, 1 torque, 2 torque angle)	45,90°	33	
Turbo Charger			
Bolt-Oil Feed Line to Cylinder Head	9/22	-	80-194
Bolt-Oil Feed Line to Turbo Charger	30	22	-
Bolt-Turbo Charger Support	30	22	-
Bolt-Turbo Charger Support to Crankcase	20	-	177
Bolt-Oil Outlet Line to Turbo Charger	9	-	80

ENGINE - 2.7L DIESEL (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Connection-Flange of Exhaust Manifold to Turbo Charger	30	22	-
Connection-Turbo Charger to Front Catalytic Converter	30	22	-
Charge Air Pipe/Charge Air Cooling			
Bolt-Charge Air Distribution Pipe	16	-	141
Bolt-Inlet Port Shut Off Positioning Motor to Air Charge Distribution Pipe	9	-	80
Bolt-Support to Charge Air Distribution Pipe	20	-	177
Bolt-Support to Engine Bracket	40	30	-
Clamp-Charge Air Pipes/Hoses	3	-	27
Belt Tensioning Device			
Bolt-Guide Pully to Coolant Pump	35	26	-
Bolt-Guide Pully to Timimg Case Cover	35	26	-
Bolt-V-Belt Tensioning Device to Tensioning Pully	36	26.5	-
Bolt-V-Belt Tensioning Device to Timing Case Cover	30	22	-
Exhaust Manifold			
Nut-Exhaust Manifold at Cylinder Head	30	22	-
Position Sensor			
Nut/Bolt-Camshaft Position Sensor to Cylinder Head Cover	11	-	97
Nut/Bolt-Crankshaft Position Sensor to Engine Block	8	-	70
Pre-Glow System			
Cylinder Head to Glow Plug	12	-	106
Starter			
Bolt-Starter to Crankcase	42	31	-
Nut-Connection of Circuit 30	14	-	124
Nut-Connection of Circuit 50	6	-	53
Alternator			
Bolt-Generator to Timing Case Cover	20	15	-
Bolt-Generator to Cooler Housing	6	-	53
Bolt-Cooler Housing of Generator to Crankcase	20	-	177
Nut-B+ Circuit to Generator	13-18	-	115-159
Nut-D+ Circuit to Generator	5	-	44
Nut-Collar to V-Belt Pully	80	59	-
Oil Pump			
Bolt-Oil Pump to Crankcase	18	-	133
Bolt-Oil Pipe to Crankshaft Bearing Cap	8	-	70
Oil Filter			
Screw Cap to Oil Filter	25	18.5	-
Oil Cooling System			

ENGINE - 2.7L DIESEL (Continued)

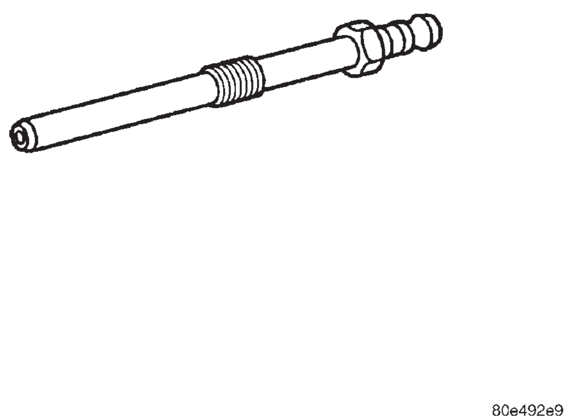
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt-Oil-Water Heat Exchanger to Timing Cover Case	15	-	133
Oil Level Pressure			
Bolt-Dip Stick Guide Tube to Cylinder Head	14	-	123
Bolt-Oil Level Sensor to Oil Pan	14	-	123
Coolant Pre- Heater			
Coolant Pre-Heater in Engine Block	35	26	-
Engine Cooling General			
Bolt-Belt Pully to Coolant Pump	8-35	6 - 26	-
Bolt-Coolant Pump to Timing Case Cover 6m/8m	14/20	10 - 15	-
Bolt-Thremostat Housing to Cylinder Head	9	-	80
Coolant Drain Plug to Crankcase	30	22	-
Engine Suspension, Engine Mount, Engine Bracket			
Bolt-Engine Bracket to Crankcase (2 stage, torque, torque angle)	20/90°	15	-
Bolt-Engine Mount to Engine Bracket	55	40.5	-
Bolt-Front Engine Mount to Front Axle Carrier	35	26	-
Bolt-Rear Engine Cross Member to Body	40	30	-
Bolt-Rear Engine Mount to Rear Engine Cross Member	35	26	-
Bolt/Nut- Rear Engine Mount to Transmission	40	26	-
Bolt-Shrowd to Engine Bracket	10	-	88.5
Nut-Front Engine Mount to Engine Bracket	65	48	-
Nut-Engine Mount to Vehicle Frame	35	26	-
Fuel Filter			
Bolt-Clip to Fuel Filter	8	-	70
Bolt- Fuel Filter to Charge Air Distribution Pipe	14	-	124
Exhaust System			
Bolt- Catalytic Converter Bracket to Crankcase	20	-	177
Clamp-Connection Between Front Exhaust Pipe and Rear Exhaust System	55	41	-
Clip-Front Catalytic Converter to Engine Mount	20	-	177
Nut-Bracket to Tail Pipe	55	40.5	-
Nut-Exhaust Bracket to Threaded Plate of Center Exhaust Pipe	20	-	177
Support-Exhaust Bracket on Transmission	20	-	177
Refrigerant Compressor			
Bolt-Refrigerant Compressor to Timing Case Cover	20	-	177
Bolt-Refrigerant Compressor to Bracket	20	-	177
Bolt-Refrigerant Lines to Refrigerant Compressor	20	-	177
Timing Chain, Chain Tensioner			
Bolt-Camshaft Sprocket to Exhaust Camshaft	18	-	159
Bolt-Intermediate Gear of High Pressure Pump to Cylinder Head	40	29.5	-

ENGINE - 2.7L DIESEL (Continued)

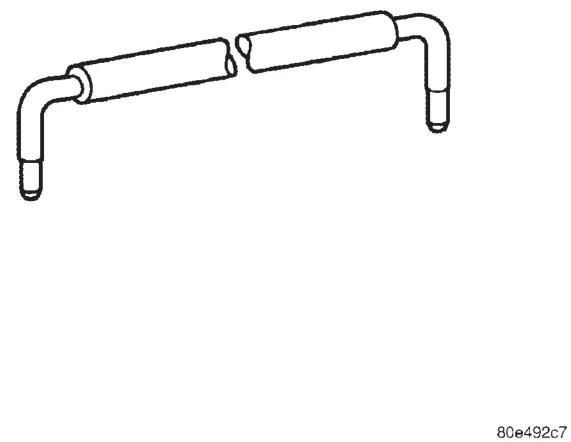
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Timing Chain Tensioner to Timing Case Cover	80	59	-
Camshaft			
Bolt-Camshaft Bearing Cap to Cylinder Head	9	-	80
Bolt-Driver to Inlet Camshaft	50	37	-
Common Rail Diesel Injection			
Bolt-Bango Bolt of Leak Oil Line to Rail	20	-	177
Bolt-Bracket to High Pressure Pump	9	-	80
Bolt-High Pressure Pump to Cylinder Head	14	-	124
Bolt-Pre-delivery Pump to Top Cover of Cylinder Head	9	-	80
Bolt-Pressure Control Valve to Rail (2 stage, torque)	3/5	-	26/44
Bolt-Rail to Cylinder Head	14	-	124
Bolt-Shutoff Valve to Cylinder Head	8	-	70
Nut-Pressure Line to Rail/Injector (New,Reused)	22/25	16/18.5	-
Nut-Pressure Line to High Pressure Pump/Rail	22	16	-
Screw-Tensioning Claw to Injector (2 stage, 1 torque, 2 torque angle)	7/90°	-	62
Rail- Pressure Sensor to Rail	22	16	-
Pressure Pipe Connection to Injector	42	31	-
Threaded Rail to Rail	22	16	-
Fuel Cooling System			
Bolt-Fuel Cooler to Charge Air Distribution Pipe	14	-	124
Heater Booster, Heater Unit			
Bolt- Temperature Controlled Cut Out to Heater Booster control Module	12	-	106
Nut-Threaded Stud to Electronic Heater Booster	18	-	159

ENGINE - 2.7L DIESEL (Continued)

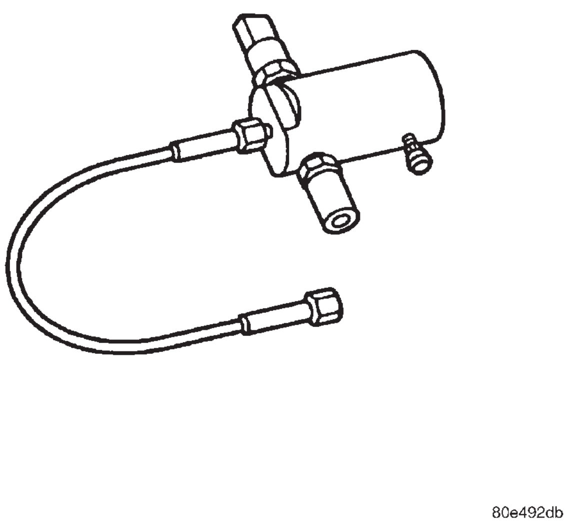
SPECIAL TOOLS



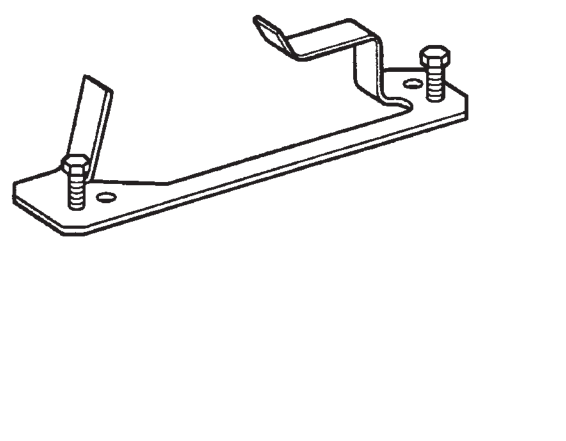
#8927 COMPRESSION TESTER ADAPTER



#8929 CAMSHAFT LOCKING PIN

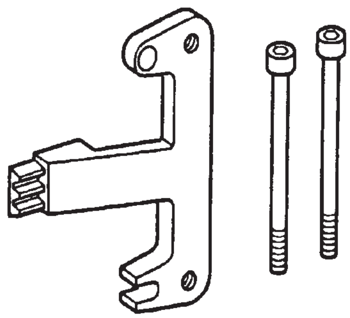


#8928 FUEL PRESSURE TESTER



#8931 TIMING CHAIN RETAINER

ENGINE - 2.7L DIESEL (Continued)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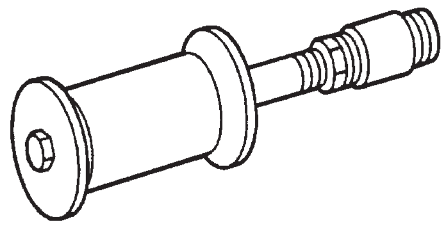
#8932 CRANKSHAFT LOCK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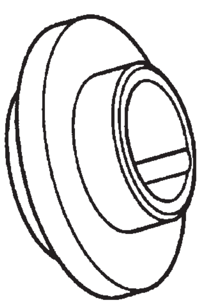
#8937 SLIDE HAMMER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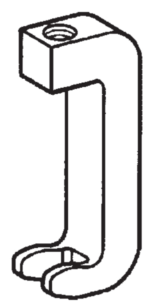
#8936 FRONT CRANKSHAFT SEAL INSTALLER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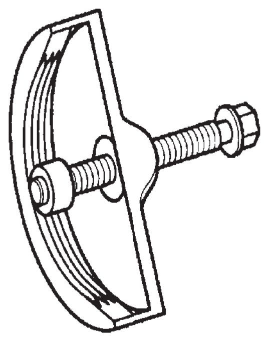
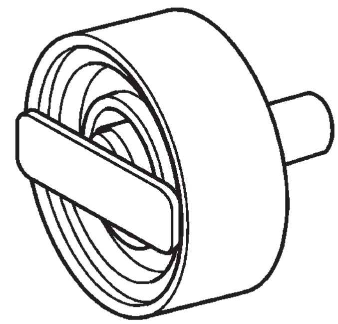
#8938 INJECTOR REMOVER

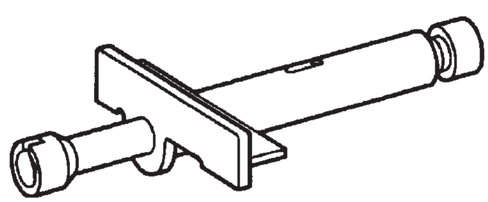
ENGINE - 2.7L DIESEL (Continued)



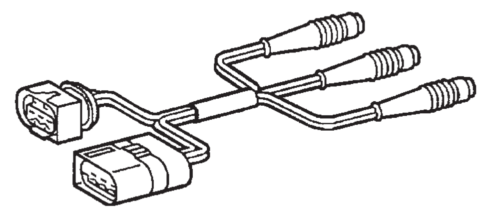
#8940 VIBRATION DAMPER REMOVER



#8944 REAR MAIN SEAL INSTALLER

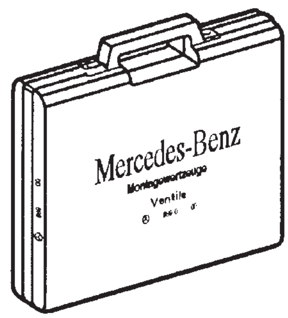


#8942 OIL JET INSTALLER



#8945 ADAPTER CABLE

ENGINE - 2.7L DIESEL (Continued)



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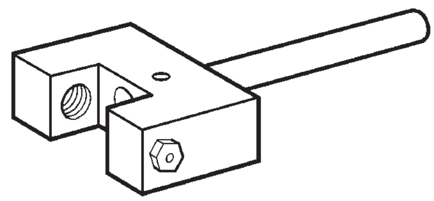
#8946 VALVE SERVICE TOOLS



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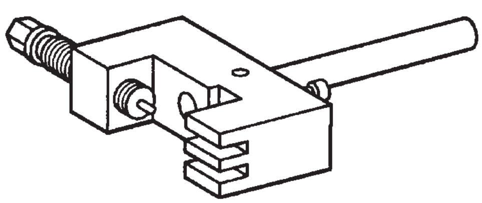
#8948 CHAIN SEPARATOR TOOL



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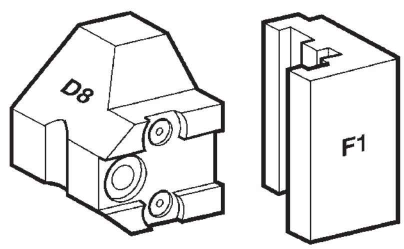
#8947 RIVET OPENER



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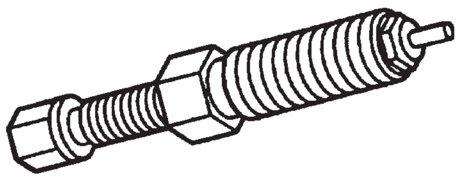
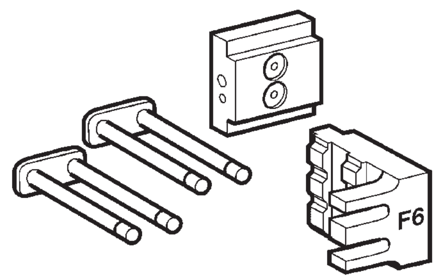
#8949 THRUST PIECE

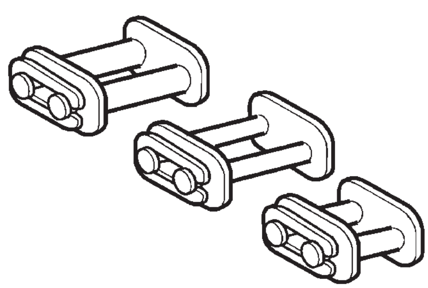
ENGINE - 2.7L DIESEL (Continued)



#8950 PRESSING SCREW



#8952 ASSEMBLY INSERTS



#8951 ASSEMBLY LINKS

CYLINDER HEAD

STANDARD PROCEDURE

STANDARD PROCEDURE - CYLINDER HEAD BOLT INSPECTION

(1) Measure cylinder head bolts between points shown (Fig. 5).

Cylinder Head Bolts	Thread Diameter	12 M
	Length When New	102 mm
	Maximum Length	104 mm

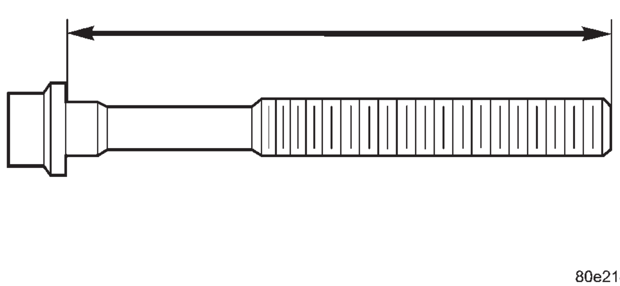


Fig. 5 MEASURING CYLINDER HEAD BOLTS

(2) If the cylinder head bolt length is greater than the maximum allowable measurement, replace the cylinder head bolts.

STANDARD PROCEDURE - MEASURE CYLINDER HEAD SURFACE

NOTE: Only resurface cylinder head contact surface if porous or damaged. IT IS NOT necessary to rework minor variations in flatness in the longitudinal direction.

(1) Disconnect negative battery cable.
(2) Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(3) Remove valves.
(4) Inspect cylinder head contact surface for flatness, porous and damage.
(5) Using a straight edge, measure cylinder head and cylinder block flatness.
(6) Measure cylinder head height at point (1) indicated and retain reading (Fig. 6).

NOTE: The camshaft housing Must Not be machined. Basic bore of the camshaft bearings will be altered.

(7) Machine cylinder head contact surface, if necessary.
(8) Measure cylinder head height (1) at point indicated, record stock removal (Fig. 6) CYLINDER HEAD SPECIFICATIONS .
(9) Measure valve setback at points (2) indicated (Fig. 6) CYLINDER HEAD SPECIFICATIONS .

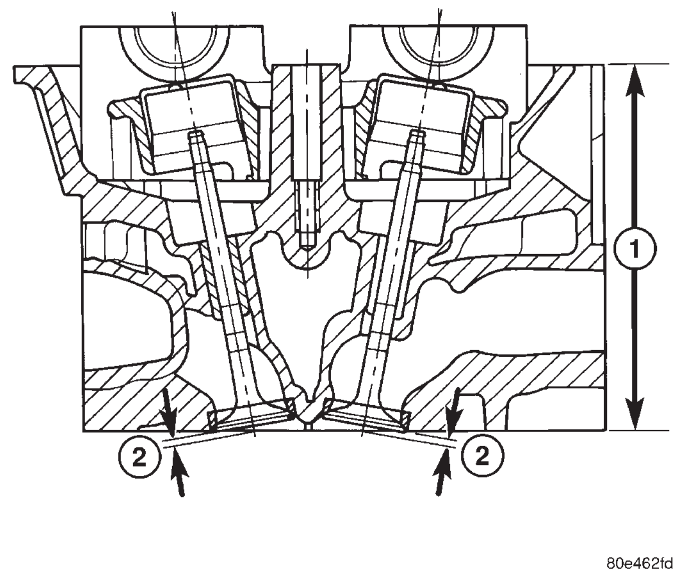


Fig. 6 CYLINDER HEAD MEASURMENTS

NOTE: If measurement is less than dimension "2" no further correct valve clearance compensation is possible; replace valve seat ring or cylinder head if measurement is greater than specification.

CYLINDER HEAD SPECIFICATIONS

Description	Specification
Height of Cylinder Head (1), With Out Camshaft Housing	126.85mm to 127.15mm
Valve Set Back (2) With New Valves and New Valve Seat Rings	Exhaust Valve: 1.0mm - 1.4mm Intake Valve: 1.1mm - 1.5mm

CYLINDER HEAD (Continued)

REMOVAL

REMOVAL - CYLINDER HEAD

(1) Disconnect negative battery cable.
(2) Raise and support vehicle.

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN APPROVED CONTAINER ONLY. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

(3) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Lower vehicle.
(5) Remove engine cover. (Refer to 9 - ENGINE COVER- REMOVAL).
(6) Remove air cleaner housing.
(7) Remove air intake tube at turbocharger.
(8) Disconnect vacuum hose at turbocharger waste gate solenoid.
(9) Disconnect heater hoses and remove coolant pipe.

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL.

(10) Remove fuel high pressure pipes and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

NOTE: Refer to the appropriate injector servicing procedures for cleaning of the injectors and recesses.

(11) Clean injectors(Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).
(12) Unbolt fuel air bleed at intake manifold and set aside.
(13) Disconnect fuel injector and glow plug wiring harness and set aside.
(14) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(15) Position piston of cylinder #1 to ignition TDC.
(16) Install retaining lock for crankshaft/starter ring gear.
(17) Remove timing chain tensioner(Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(18) Remove cylinder head front cover(Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(19) Remove top guide rail (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(20) Remove camshafts(Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).
(21) Remove idler gear (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(22) Remove pressure line at high pressure pump.
(23) Remove fuel return flow line between rail and high pressure pump.
(24) Remove high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).
(25) Remove fuel return hose at fuel filter.
(26) Remove charge air distribution pipe (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - REMOVAL).
(27) Unbolt oil dip stick tube.
(28) Disconnect viscous heater and set aside.
(29) Disconnect precatalytic converter at turbocharger.
(30) Detach charge air pipe at turbocharger.
(31) Remove oil return flow line at turbocharger.
(32) Remove turbocharger support bracket.
(33) Remove upper timing case to cylinder head bolts.

NOTE: Loosen cylinder head bolts in the reverse order of the tightening sequence.

(34) Remove cylinder head bolts and inspect (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).
(35) Remove cylinder head.

NOTE: Carefully clean all mating surfaces and bolt thread holes. Assure that no oil or grease is present during reassembly.

(36) Clean all mating surfaces and blow out bolt thread holes.

REMOVAL - CYLINDER HEAD FRONT COVER

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Partially drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Disconnect viscous heater pipe and set aside.

CYLINDER HEAD (Continued)

(5) Disconnect cooling fan power steering hose at power steering pump and set aside.

(6) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(7) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - REMOVAL).

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. SERVICE VEHICLE IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL.

(8) Remove low pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).

(9) Remove vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - REMOVAL).

(10) Remove bolts attaching front cover.

NOTE: Lower portion of front cover is sealed with RTV sealant. Carefully tug at front cover until it loosens from cylinder head.

(11) Raise locking pawl of top guide rail and remove cylinder head front cover (Fig. 7).

NOTE: Dowel pins are use as a guide during assembly and must remain in the proper position to assure a good sealing surface.

REMOVAL - CYLINDER HEAD GUIDE RAIL

(1) Disconnect negative battery cable.

CAUTION: Rotate engine at crankshaft only. DO NOT rotate the engine with the bolt of the camshaft sprocket. DO NOT rotate the engine back.

NOTE: Markings on the camshaft and camshaft bearing cap must be aligned.

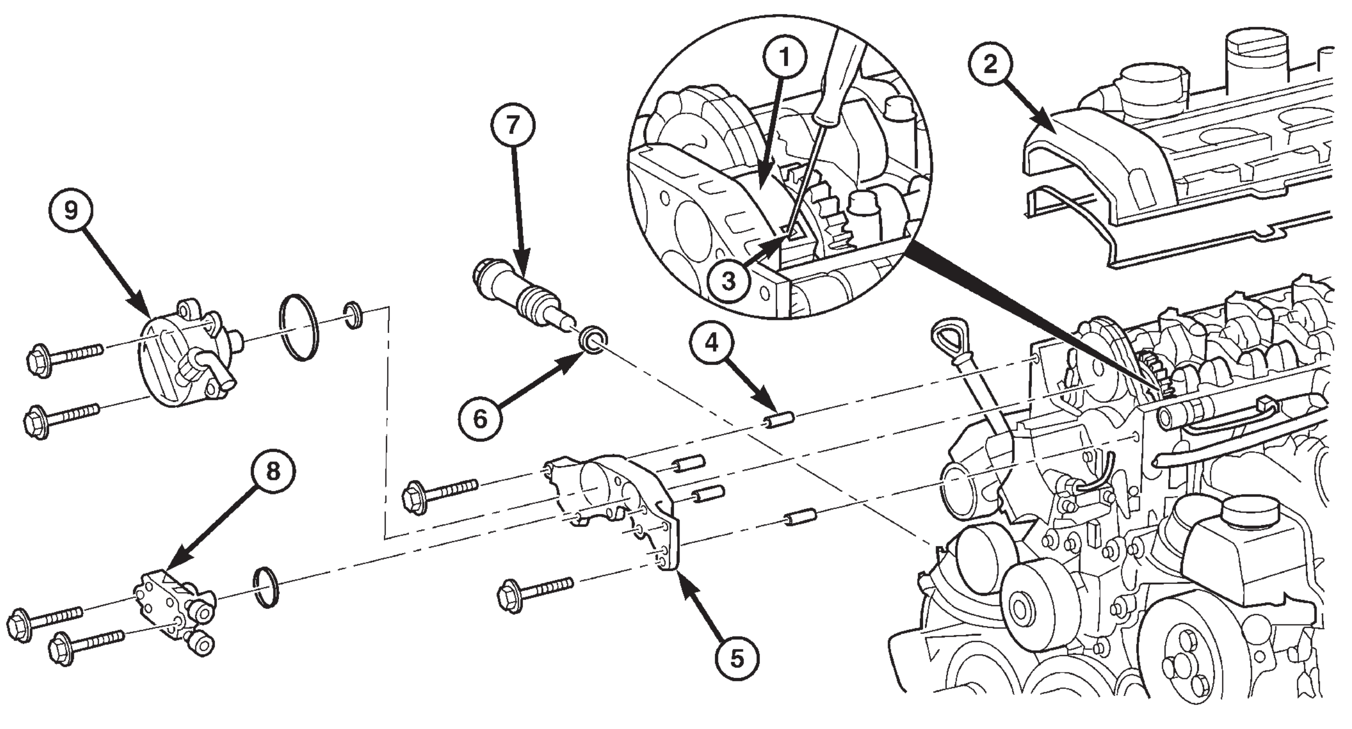


Fig. 7 CYLINDER HEAD FRONT COVER

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER
8 - LOW PRESSURE PUMP
9 - VACUUM PUMP

CYLINDER HEAD (Continued)

(2) Position piston of number 1 cylinder to ignition TDC.

(3) Remove engine cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(4) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(5) Carefully raise locking pawl of top slide rail and remove front cover at cylinder head (Fig. 7).

(6) Insert a locking pin through 1st camshaft bearing cap into the hole in the inlet camshaft sprocket.

(7) Counter hold the camshaft with an open end wrench to avoid damage and unbolt driver of inlet camshaft sprocket.

(8) Remove top guide rail.

INSTALLATION

INSTALLATION - CYLINDER HEAD

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. SERVICE VEHICLES IN WELL VENTILATED AREAS. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. WEAR PROTECTIVE CLOTHING.

NOTE: Thoroughly clean all mating surfaces with appropriate solvents and blow out bolt holes, to assure that no grease or oil is present during reassembly.

NOTE: If piston or connecting rods have been replaced, measure piston projection.

NOTE: Check facing cylinder head contact surface.

(1) Position the cylinder head and gasket properly on engine using the dowel pins as guide.

NOTE: Inspect all cylinder head bolts for defects and stretching before installation (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).

CYLINDER HEAD BOLT TORQUE SEQUENCE

The M12 cylinder head bolts must be torqued in 3 stages.

(1) Install M12 cylinder head bolts finger tight.

(2) Torque bolts in numeric order starting with number 1 to 60 N·m (44 lbs.in.) (Fig. 8).

(3) Install M8 timing chain cover to cylinder head bolts (1A) (Fig. 8). Tighten to 20N·m (177 lbs.in.).

(4) Tighten M12 cylinder head bolts in numeric order starting with number 1 an additional 90° (Fig. 8).

(5) Tighten M12 cylinder head bolts in numeric order starting with number 1 an additional 90° (Fig. 8).

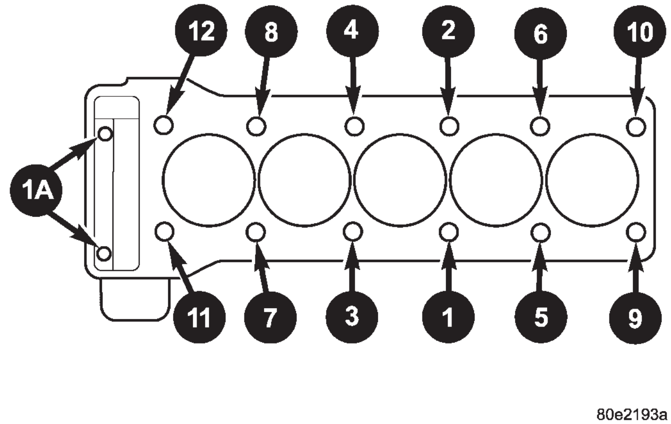


Fig. 8 CYLINDER HEAD BOLT TORQUE SEQUENCE

(2) Install turbocharger support bracket. Tighten bolts to 30N·m (22 lbs.ft.).

(3) Install oil return flow line at turbocharger.

(4) Attach charge air pipe at turbocharger.

(5) Reconnect the precatlytic converter to turbocharger. Tighten to 30N·m (22 lbs.ft.).

(6) Install viscous heater.

(7) Reconnect oil dip stick tube. Tighten to 14 N·m (124 lbs. in.).

(8) Install charge air distribution pipe (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).

(9) Install fuel return hose at fuel filter.

(10) Install high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(11) Install fuel return flow line between rail and high pressure pump.

(12) Install pressure line at high pressure pump.

(13) Install idler gear (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(14) Install camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

(15) Install top guide rail (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(16) Install front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(17) Install timing chain tensioner with new gasket. (Refer to 9 - ENGINE/VALVE TIMING/TIMING

CYLINDER HEAD (Continued)

BELT/CHAIN AND SPROCKETS - INSTALLATION) Tighten to 80N·m (59 lbs.ft.).

(18) Remove retaining lock for crankshaft/starter ring gear.

(19) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(20) Install and properly route fuel injector and glow plug wiring harness, making appropriate connections.

(21) Install fuel high pressure pipes and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - INSTALLATION).

(22) Secure fuel air bleed at intake manifold.

(23) Connect vacuum hose at turbocharger waste gate solenoid.

(24) Install air intake tube at turbocharger (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).

(25) Install air cleaner housing.

(26) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

NOTE: DO NOT pressure test cooling system until engine has reached operating temperature.

(27) Refill cooling system with proper coolant mixture to proper level (Refer to 7 - COOLING/ENGINE/ COOLANT - STANDARD PROCEDURE).

(28) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(29) Start engine and inspect for leaks.

INSTALLATION - CYLINDER HEAD FRONT COVER

NOTE: Thoroughly clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Dowel pins are used as a guide during assembly and must remain in the proper position to assure a good sealing surface.

(1) Apply sealant to lower portion and position cylinder head front cover.

(2) Raise locking pawl of top guide rail and guide front cover onto guide pins.

(3) Install bolts attaching front cover (Fig. 7) Tighten bolts to 14N·m (124 lbs. in.).

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. REMOVE SOURCES OF IGNITION FROM THE AREA. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS.

(4) Instal low pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(5) Install vacuum pump (Refer to 9 - ENGINE/ ENGINE BLOCK/INTERNAL VACUUM PUMP - INSTALLATION).

NOTE: Timing chain tensioner must be installed with a new gasket.

(6) Install timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(7) Connect power steering hose.

(8) Connect viscous heater pipe.

(9) Refill cooling system with proper mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(10) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(11) Start the engine and inspect for leaks.

INSTALLATION - CYLINDER HEAD GUIDE RAIL

(1) Carefully position the top guide rail onto the guide pins.

(2) Counter hold the camshaft with an open end wrench and install driver of inlet camshaft sprocket. Tight bolt to 50N·m (37 lbs. ft.).

(3) Remove camshaft sprocket locking pin.

(4) Carefully raise locking pawl of top guide rail and install front cover at cylinder head (Fig. 7).

(5) Install timing chain tensioner with new gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(6) Install engine cover (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(7) Reconnect negative battery cable.

CYLINDER HEAD (Continued)

WARNING: US EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(8) Start engine and inspect for leaks.

CYLINDER HEAD COVER(S)

REMOVAL

(1) Disconnect negative battery cable.
(2) Detach hose from oil separator.
(3) Disconnect fuel injector and glow plug harness and set aside.
(4) Remove fuel high pressure pipes and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - REMOVAL).
(5) Remove cylinder head cover retaining bolts and remove cover.

INSTALLATION

(1) Position cylinder head cover with new gasket and install bolts. Tighten bolts to 20 N·m (177 lbs. in.).
(2) Install and properly route fuel injector and glow plug wiring harness, making appropriate connections.
(3) Install injectors and high pressure pipes (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
(4) Attach oil seperator hose.
(5) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

VALVE SPRINGS

REMOVAL

REMOVAL - VALVE SPRINGS

(1) Disconnect negative battery cable.
(2) Remove glow plugs (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/GLOW PLUG - REMOVAL).
(3) Remove injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
(4) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(5) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(6) Remove front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(7) Remove top guide rail (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).
(8) Remove camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).

NOTE: The timing chain must be held in up position so as not to jam during procedure.

(9) Position piston of cylinder to be processed to DTC by rotating the crankshaft clockwise.**DO NOT crank engine.DO NOT rotate engine backward.**
(10) Install crankshaft lock, special tool #8932.
(11) Seal injector hole with connection piece and retain with orginal tensioning claw.
(12) Connect cylinder leak tester with adaptors and pressurize the cylinder to 5 bar (73 psi.).

WARNING: Valve springs and retainers must be kept in order of the cylinder they were removed.

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at top of valve spring retainer.

(13) Compress valve spring.
(14) Remove valve keepers.
(15) Remove top valve spring retainer and valve spring.
(16) Remove valve stem seals.
(17) Remove bottom valve spring retainer.

NOTE: Inspect all cylinder head components for wear or damage.

(18) Repeat procedure for each cylinder as necessary.

REMOVAL - VALVES

(1) Remove cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).
(2) Place insertion plate into the assembly board in direction of arrows on assembly board.
(3) Mount cylinder head onto assembly board with its front side pointing in direction of arrow on assembly board.
(4) Attach valve assembly tool to cylinder head.

VALVE SPRINGS (Continued)

WARNING: Suitably mark the valve and the position in the cylinder head before removal. Failure to do so will result in improperly seated valves and possible engine damage after reassembly.

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at top of valve spring retainer.

(5) Compress valve spring.
(6) Remove valve keepers.
(7) Remove top valve spring retainer and valve spring.
(8) Remove valve stem seals.
(9) Remove bottom valve spring retainer.
(10) Repeat steps 5 through 9 as necessary.
(11) Remove cylinder head from assembly board.

WARNING: Valves, springs and retainers must be kept in order of the cylinder they were removed.

(12) Remove valves.

INSTALLATION

INSTALLATION - VALVE SPRINGS

NOTE: Inspect all valve springs and retainers for wear or damage. Replace as necessary.

(1) Position piston of cylinder to be processed to TDC by rotating the crankshaft clockwise. **NO NOT crank engine or rotate engine counter clockwise.**
(2) Connect cylinder leak tester with adaptors and pressurize the cylinder to 5 bar (73 psi).
(3) Install lower valve spring retainer.
(4) Install valve stem seal.
(5) Install valve spring.
(6) Install valve spring retainer.

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at the top of each valve spring retainer.

NOTE: Ensure that the valve keepers are seated properly.

(7) Compress valve and install valve keepers.
(8) Repeat procedure for each cylinder as necessary.
(9) Remove special tooling from cylinder head.
(10) Position piston of #1 cylinder to ignition TDC.
(11) Install camshafts and check basic position (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).
(12) Install top guide rail (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(13) Install front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(14) Install timing chain tensioner with new gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)
(15) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
(16) Install glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - INSTALLATION).

WARNING: SERVICE VEHICLES IN A WELL VENTILATED AREA AND AVOID IGNITION SORCES. RISK OF INJURY TO SKIN AND EYES FROM FUEL JET FLOWING OUT.

(17) Install injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
(18) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(19) Start the engine and inspect for leaks.

INSTALLATION - VALVES

WARNING: Valves must be kept in their original positions in cylinder head. Failure to do so will result in engine damage.

NOTE: Inspect all valves, springs and retainers for wear or damage. Replace as necessary.

(1) Install valves in their original position in the cylinder head.
(2) Mount cylinder head onto assembly board with its front side pointing in the direction of arrow on assembly board.
(3) Install lower valve spring retainer.
(4) Install valve stem seal.
(5) Install valve spring.
(6) Install valve spring retainer.

VALVE SPRINGS (Continued)

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at the top of each valve spring retainer.

NOTE: Ensure that the valve collets are seated properly.

(7) Compress valve and install valve keepers.
(8) Repeat steps 3 through 7 as necessary.
(9) Remove valve assembly from cylinder head.
(10) Remove cylinder head from assembly board.
(11) Install cylinder head on engine block (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(12) Install glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - INSTALLATION).
(13) Connect negative battery cable.

WARNING: US EXTREME CAUTION WHEN THE ENGINE IS IN OPERATION. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(14) Start engine and check for leaks.

CAMSHAFT(S)

STANDARD PROCEDURE - CHECKING CAMSHAFT POSITION

WARNING: NO FIRE, SPARKS, OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL AS WELL AS RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUEL ONLY INTO SUITABLE AND MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL.

(1) Remove injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
(2) Clean injectors and recesses(Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).
(3) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

NOTE: Rotate engine at crankshaft only. DO NOT crank engine at the camshaft and DO NOT rotate the engine backward.

(4) Position piston of cylinder #1 to ignition TDC.
(5) Insert the locking pin through first camshaft bearing cap into the hole in the left inlet camshaft sprocket (Fig. 9).

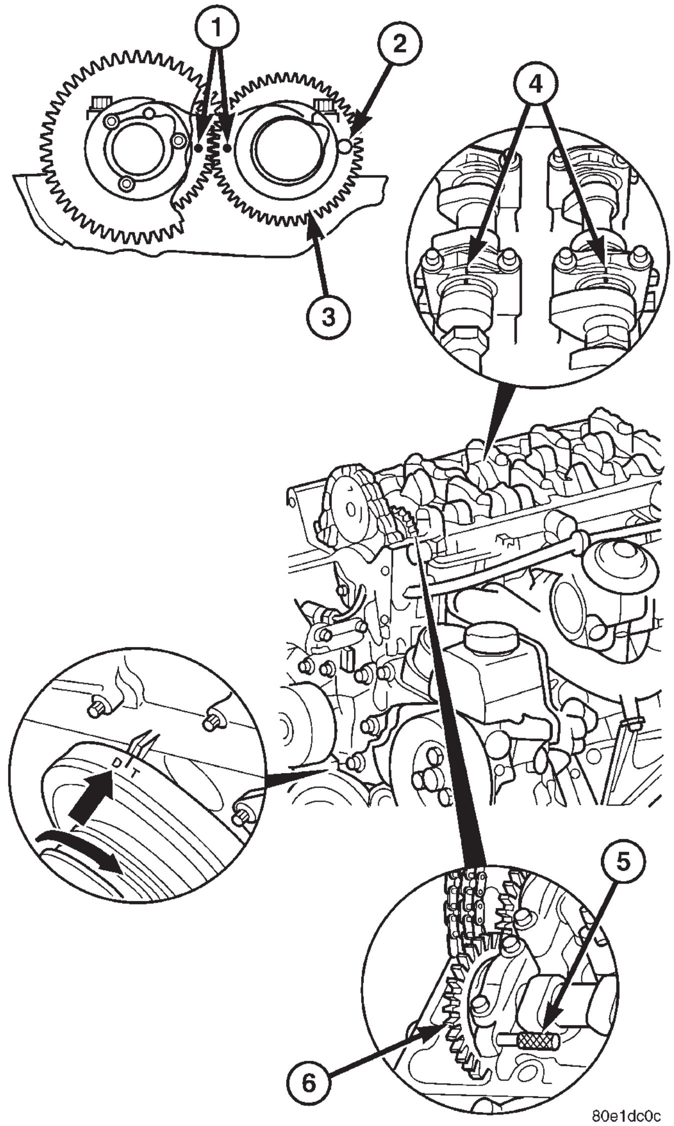


Fig. 9 CHECKING CAMSHAFT POSITION

1 - CAMSHAFT SPROCKET ALIGNMENT DOTS
2 - CAMSHAFT LOCK POSITION
3 - INTAKE CAMSHAFT SPROCKET
4 - CAMSHAFT AND BEARING CAP ALIGNMENT MARKS
5 - CAMSHAFT LOCKING PIN (SPECIAL TOOL #8929)
6 - INTAKE CAMSHAFT SPROCKET

NOTE: The two markings in the inlet camshaft sprockets must be positioned opposite and markings of camshaft and camshaft bearing cap must be aligned. If not, perform basic position of camshafts.

(6) Remove locking pin from camshaft bearing cap hole.

CAMSHAFT(S) (Continued)

(7) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(8) Install injectors (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NO WEAR LOOSE CLOTHING.

(9) Start the engine and inspect for leaks.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover.(Refer to 9 - ENGINE - REMOVAL).

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. WEAR PROTECTIVE CLOTHING. STORE FUEL ONLY IN SUITABLE AND APPROPRIATELY MARKED CONTAINERS.

(3) Remove high pressure lines and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - REMOVAL).

(4) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(5) Position piston of cylinder #1 to ignition TDC.

(6) Lock inlet camshaft (Fig. 10).

(7) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: The lower portain of the cylinder head front cover is sealed with RTV sealant. Carefully tug front cover after bolt removal to loosen from cylinder head.

(8) Remove cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(9) Remove top side rail (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

CAUTION: For all work in which the crankshaft should not rotate, secure camshaft gear to timing chain.

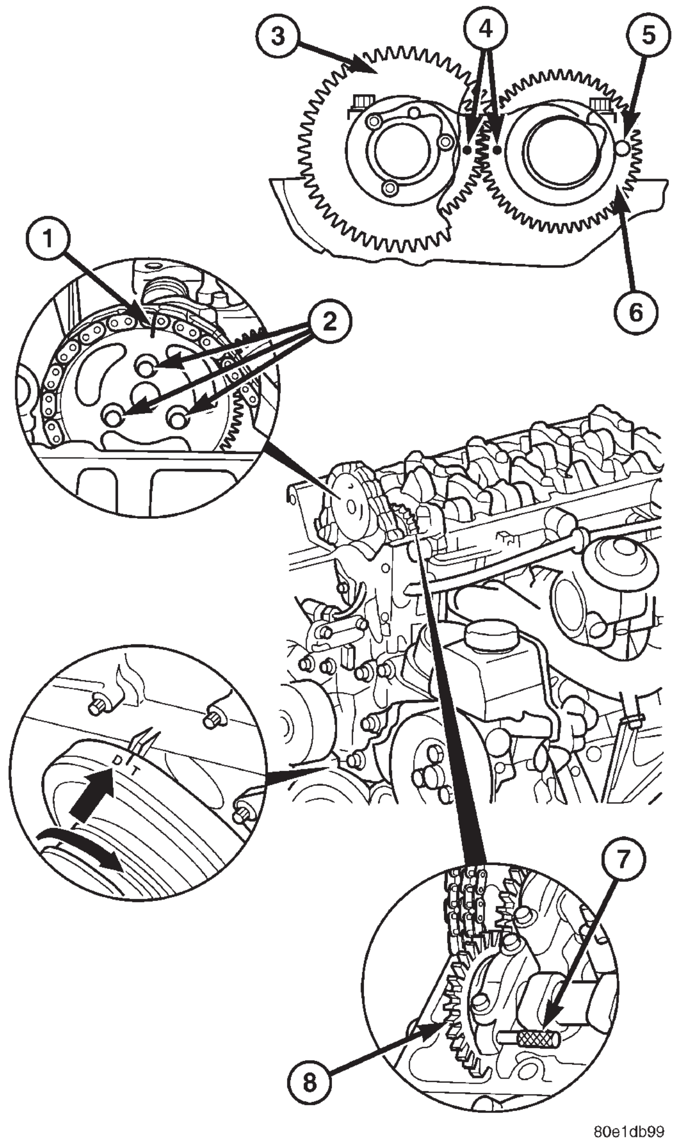


Fig. 10 CAMSHAFT ALIGNMENT

1 - EXHAUST CAMSHAFT SPROCKET AND CHAIN MARKING
2 - EXHAUST CAMSHAFT SPROCKET BOLTS
3 - EXHAUST CAMSHAFT SPROCKET
4 - CAMSHAFT ALIGNMENT DOTS
5 - INTAKE CAMSHAFT LOCK POSITION
6 - INTAKE CAMSHAFT SPROCKET
7 - INTAKE CAMSHAFT LOCK (SPECIAL TOOL #8929)
8 - INTAKE CAMSHAFT SPROCKET

CAMSHAFT(S) (Continued)

(10) Mark camshaft sprocket relative to timing chain.

(11) Unbolt camshaft sprocket from exhaust camshaft.

NOTE: Note the position of dowel pin for camshaft sprocket alignment during reassembly.

(12) Remove camshaft sprocket.

CAUTION: Camshaft bearing caps must remain in proper order and position.

(13) Mark and remove camshaft bearing caps.

(14) Remove the inlet and exhaust camshafts (Fig. 11).

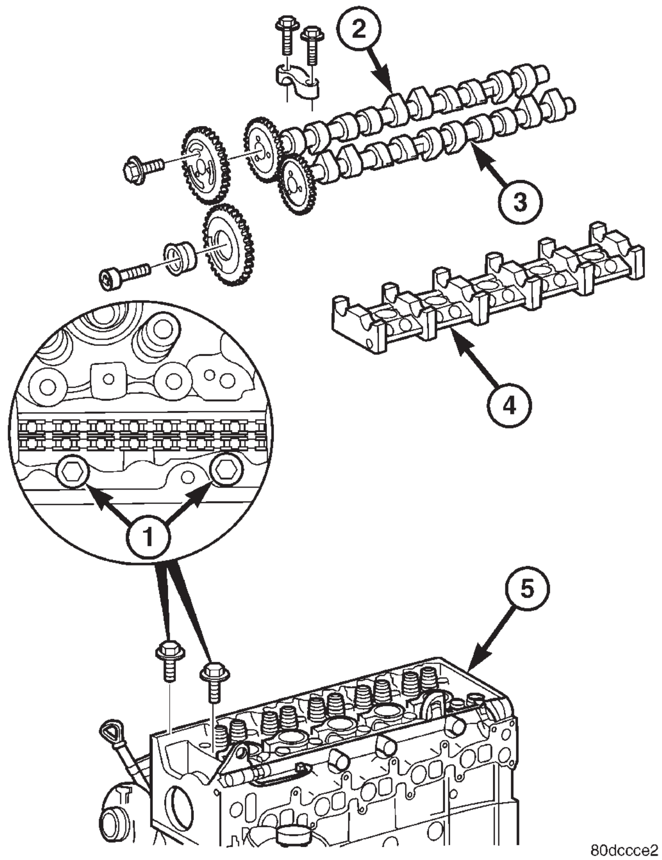


Fig. 11 CAMSHAFTS AND HOUSING ASSEMBLY

1 - CYLINDER HEAD BOLTS
2 - EXHAUST CAMSHAFT
3 - INTAKE CAMSHAFT
4 - CAMSHAFT HOUSING
5 - CYLINDER HEAD

INSTALLATION

CAUTION: The camshafts are sensitive to fracturing. Ensure they are installed free of stress.

CAUTION: Pay attention to assignment of camshafts. Camshaft code numbers are visible on the thrust collar of the axial bearing.

CAUTION: Oil bucket tappets and camshaft bearing points. Inspect ease of operation of bucket tappets.

(1) Install inlet and exhaust camshafts.

CAUTION: Install camshafts so that the two holes in camshaft sprockets are positioned opposite and the markings of the camshaft and camshaft bearing cap are aligned.

(2) Align inlet and exhaust camshafts at axial bearing (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - STANDARD PROCEDURE).

(3) Position piston of cylinder #1 to 30° TDC.

NOTE: Pay attention to markings on camshaft bearing caps.

(4) Install camshaft bearing caps in the proper order. Tighten bolts to 9N·m (80 lbs. in.).

CAUTION: Do not rotate engine counter clockwise.

(5) Position the piston of cylinder #1 to ignition TDC.

NOTE: Pay attention to markings on camshaft bearing caps.

(6) Install the bearing caps in reverse order at the same point. Tighten bearing cap bolts evenly in steps each of 1 turn.

NOTE: The piston of cylinder #1 must be positioned at ignition TDC when the inlet camshaft is locked.

(7) Insert locking pin through the first camshaft bearing cap into the whole in the camshaft sprocket.

NOTE: Do Not use old camshaft sprocket bolts.

(8) Fit camshaft sprocket with timing chain fitted on, onto exhaust camshaft paying attention to position of dowel pin. Tighten bolt to 18N·m (159 lbs.in.).

(9) Install timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

CAMSHAFT(S) (Continued)

(10) Inspect/Set basic position of camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - STANDARD PROCEDURE).

(11) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

NOTE: Refer to the appropriate injector servicing procedures for cleaning of injectors and recesses.

(12) Clean and install injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE), (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(13) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(14) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(15) Start engine and inspect for leaks.

ENGINE BLOCK

STANDARD PROCEDURE

STANDARD PROCEDURE - REPLACING ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 12).

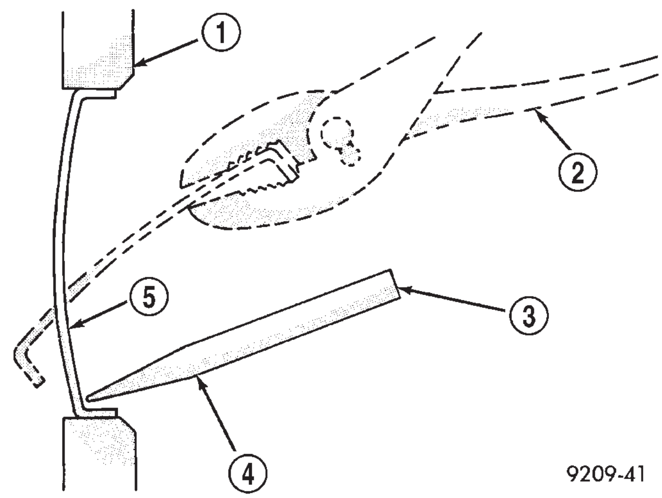


Fig. 12 Core Hole Plug Removal

1 - CYLINDER BLOCK
2 - REMOVE PLUG WITH PLIERS
3 - STRIKE HERE WITH HAMMER
4 - DRIFT PUNCH
5 - CUP PLUG

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

ENGINE BLOCK (Continued)

STANDARD PROCEDURE - MEASURING CYLINDER BORES

NOTE: This must be done with engine completely disassembled.

(1) Thoroughly clean all cylinder bores with appropriate cleaning solvent.

(2) Measure each cylinder at the three measuring points shown (Fig. 13).

(3) Using the three measurment point, measure cylinder in the longitudinal and in the transverse direction (Fig. 13).

(4) Use the measurment and table below to group cylinder bores:

Standard size	88.0 mm
Group code letter A	88.000-88.006 mm
Group code letter X	88.006-88.012 mm
Group code letter B	88.012-88.018 mm
Wear limit in longitudinal in transverse direction	0.020 mm
Permissible variation of cylinder shape (when new)	0.000-0.014 mm

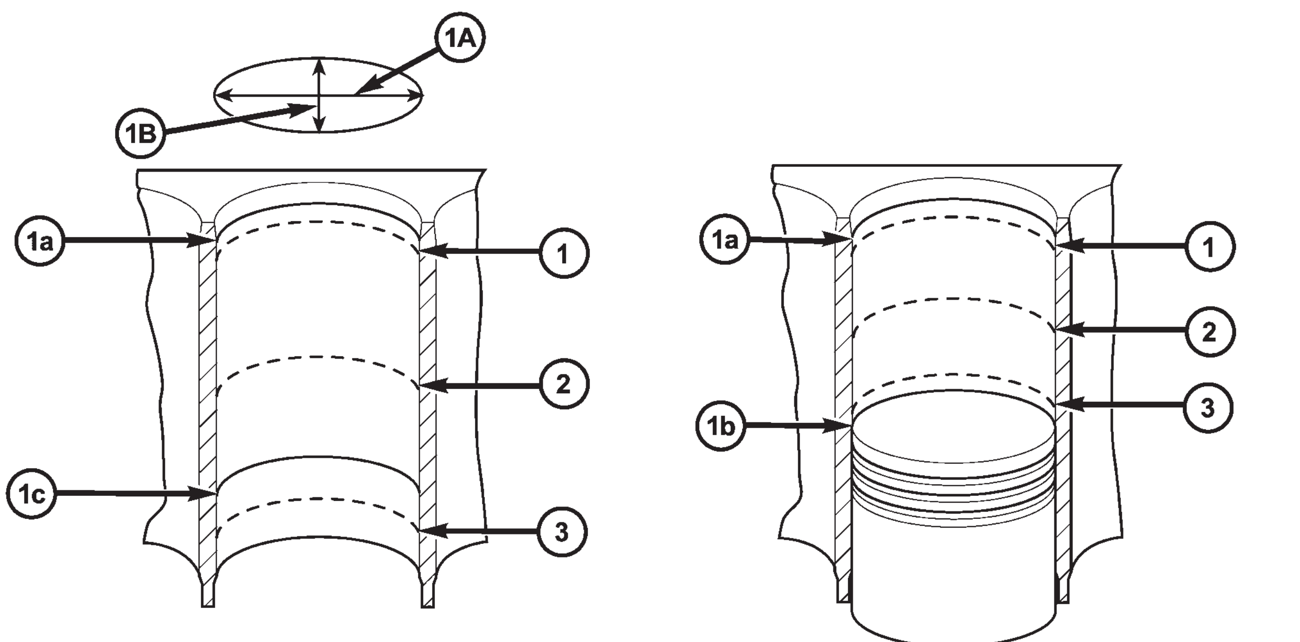


Fig. 13 MEASURING CYLINDER BORES

1 - MEASURING POINT OF CYLINDER BORE
2 - MEASURING POINT OF CYLINDER BORE
3 - MEASURING POINT OF CYLINDER BORE
1a - UPPER REVERSAL POINT OF #1 PISTON RING
1b - BOTTOM DEAD CENTER OF PISTON
1c - BOTTOM REVERSAL POINT OF OIL SCRAPER RING
1A - LONGITUDINAL DIRECTION
1B - TRANSVERSE PDIRECTION

CRANKSHAFT

STANDARD PROCEDURE - MEASURE CRANKSHAFT AND BLOCK JOURNALS

NOTE: After any bearing damage occurred, remove all debris which is present in the main oil gallery, connecting rod bores, and in the crankshaft and oil galleries. Include removal of the inserting steel ball of the main oil gallery before cleaning.

(1) Remove crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - REMOVAL).
(2) Clean all engine parts thoroughly.

CAUTION: After bearing has damage has occurred, replace connecting rods which have suffered overheating because of bearing damage. The connecting rod must not have any cross scores and notches.

(3) Inspect connecting rod. If damage is present, inspect crankshaft, replace as necessary.
(4) Inspect crankcase.
(5) Inspect standard size of crankshaft bearing shells.
(6) Inspect crankshaft bearing cap.
(7) Mount crankshaft radially.
(8) Inspect crankshaft bearing play.

NOTE: Radial mounting of the main bearings of standard size crankshaft is possible by assigning the color-coded bearing shells.

ASSIGN CRANKSHAFT BEARING SHELLS

The oil pan rail of the cylinder block is marked with chisel punches indicating what bearing shell are used.
(9) Assign crankshaft bearing shells.
(10) Mount crankshaft axially.
(11) Inspect crankshaft bearing play.

REMOVAL

(1) Remove engine (Refer to 9 - ENGINE - REMOVAL).
(2) Remove timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)
(3) Remove end cover.(Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).
(4) Remove pistons (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - REMOVAL).

CAUTION: The crankshaft bearing caps are numbered consecutively, beginning with the first crankshaft bearing cap at the front of the engine. Attention must be paid to the way crankshaft bearing caps fit.

(5) Unbolt crankshaft bearing caps (Fig. 14).

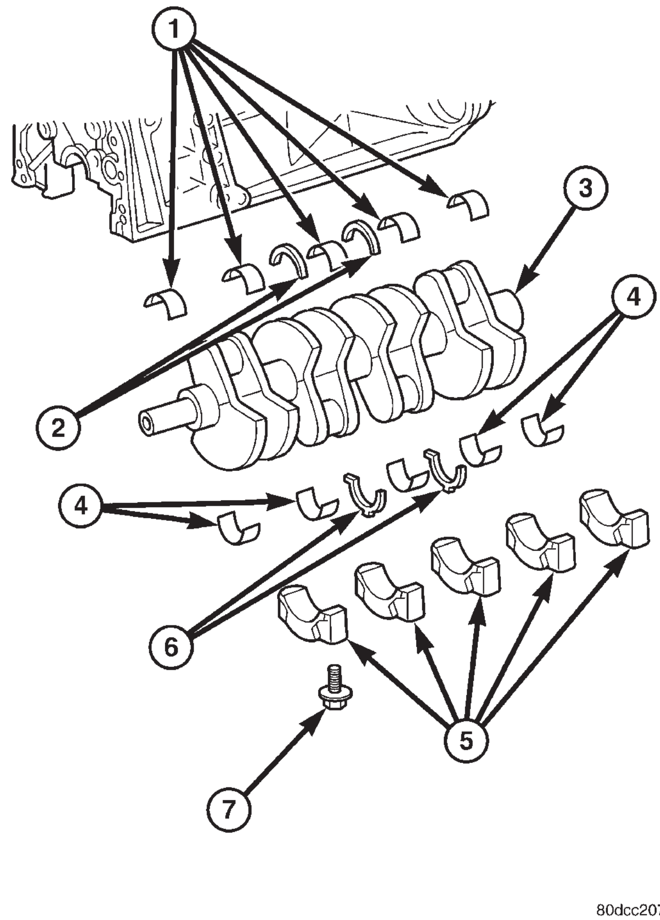


Fig. 14 CRANKSHAFT ASSEMBLY

1 - BEARING HALVES IN ENGINE BLOCK
2 - THRUST WASHERS IN ENGINE BLOCK
3 - CRANKSHAFT
4 - BEARING HALVES IN MAIN BEARING CAPS
5 - MAIN BEARING CAPS
6 - THRUST WASHERS IN MAIN BEARING CAPS
7 - MAIN BEARING BOLTS

(6) Inspect crankshaft bearing caps and bolts for wear and stretching.
(7) Remove crankshaft.

INSTALLATION

CAUTION: Oil the bearing shells before inserting crankshaft.

CRANKSHAFT (Continued)

CAUTION: Oil grooves in the thrust washers must point toward the thrust collars of the crankshaft.

CAUTION: Thrust washers in the bearing cap each have two retaining lugs as a anti-twist lock.

CAUTION: Oil thread and head contact surfaces of bolts that retain the crankshaft bearing caps; tighten bolts from inside to outside, beginning at the fit bearing. Rotate crankshaft to check clearance.

(1) Install crankshaft.

CAUTION: The crankshaft bearing caps are numbered consecutively, beginning with the first crankshaft bearing cap at the front of the engine. Attention must be paid to the way the crankshaft bearing caps fit.

(2) Install the crankshaft bearing caps.Tighten bolts in two stages. 55N·m (40.5 lbs ft), then 90°.
(3) Install the pistons (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION).
(4) Install the end cover (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - INSTALLATION).
(5) Install the timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
(6) Install the engine (Refer to 9 - ENGINE - INSTALLATION).
(7) Fill the crankcase with the correct engine oil, to the proper level. Refer to the owners manual for specifications.
(8) Fill the cooling system with the proper coolant, to the proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(9) Connect the negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS, OR FAN. DO NOT WEAR LOOSE CLOTHES.

(10) Start engine and inspect for leaks.

CRANKSHAFT OIL SEAL - REAR

REMOVAL

This must be done with the transmission removed from the vehicle.
(1) Disconnect the negative battery cable.
(2) Raise and support the vehicle.
(3) Drain the engine oil.

NOTE: Loosen all of the oil pan bolts to assure that the oil pan gasket is not damaged when removing the rear main oil seal and end cover assembly.

NOTE: Inspect the oil pan gasket for damage. If the oil pan gasket is damaged, remove the oil pan and replace the oil pan gasket.

(4) Loosen the oil pan bolts.
(5) Remove the flywheel.

CAUTION: Care must be taken when removing the rear main seal and adaptor assembly. Failure to do so will result in damage to the oil pan gasket.

(6) Remove the rear main seal/adaptor retaining bolts and carefully pry the adaptor from the crankcase at the adaptor shoulders (Fig. 15).

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Carefully position the rear main seal/adaptor evenly onto the assembly sleeve. The rear main oil seal lip MUST NOT roll over the edge of the tool.

(1) Position the rear main oil seal/adaptor with assembly sleeve onto the crankshaft so that the dowel sleeves fit into the guide holes (Fig. 15). Care must be taken so that the oil pan gasket is not damaged.
(2) Install the rear main seal/adaptor to crankcase bolts and tighten to 9·Nm (80 lbs.in) (Fig. 15).
(3) Tighten the M6 oil pan bolts to 9N·m (80 lbs in) and the M8 bolts to 20 N·m (15 lbs ft).
(4) Install the fly wheel and tighten bolts in two stages (Fig. 15). 45N·m (33 lbs. ft.) then 90°.
(5) Install the oil pan drain plug and tighten to 25N·m (18 lbs ft).
(6) Lower the vehicle.

CRANKSHAFT OIL SEAL - REAR (Continued)

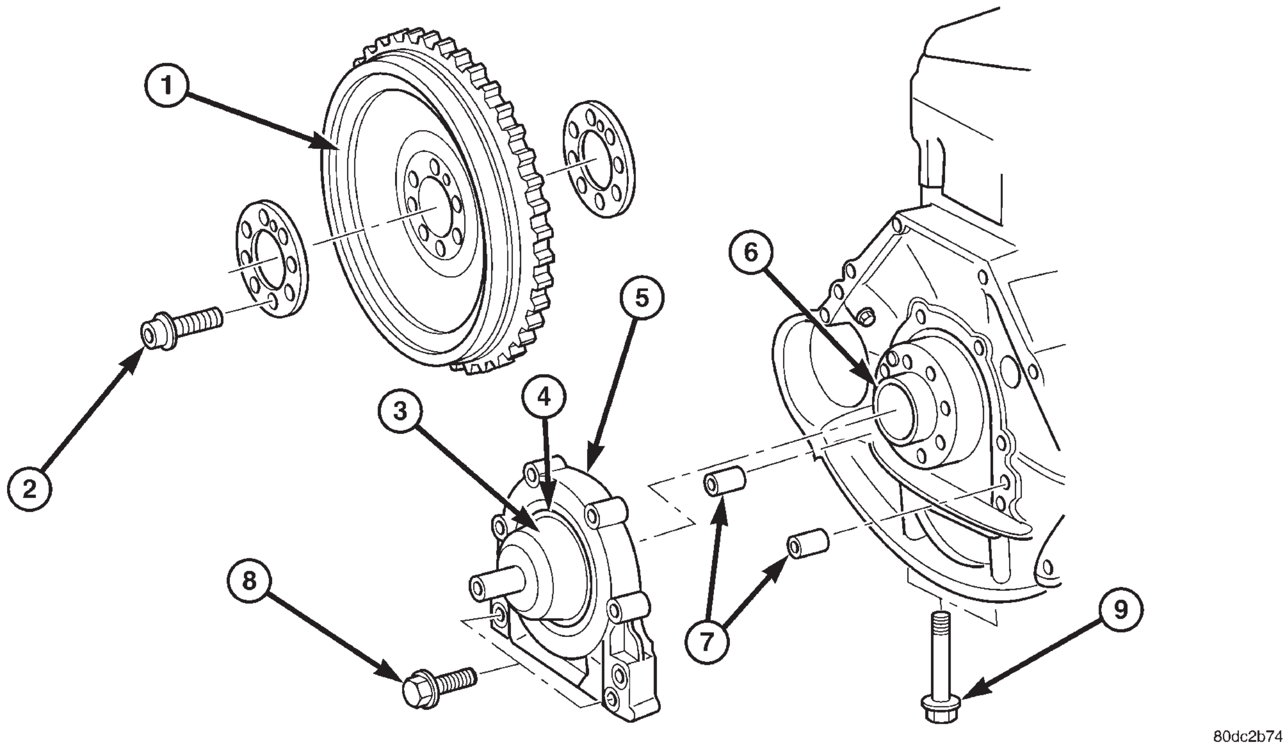


Fig. 15 REAR MAIN SEAL/ADAPTER

1 - FLYWHEEL
2 - FLYWHEEL BOLTS
3 - SPECIAL TOOL 8944
4 - REAR CRANKSHAFT OIL SEAL
5 - REAR CRANKSHAFT SEAL ADAPTER
6 - CRANKSHAFT
7 - ALIGNMENT DOWELS
8 - REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT
9 - OIL PAN TO REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT

(7) Fill the crankcase with the correct engine oil, to the proper level. Refer to owners manual for specifications.

(8) Connect the negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(9) Start the engine and inspect for leaks.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the accessory drive belt.

(3) Install the retaining lock for the crankshaft/ring gear.

NOTE: If the hub of the belt pulley/vibration damper is tight, use a puller to remove it. Do Not tilt the puller. The groves of the puller MUST mesh fully into the slots of the belt pulley.

NOTE: Inspect the running surface of the belt pulley for wear.

(4) Remove the belt pully/vibration damper.

CAUTION: Care must be taken to prevent severe damage to the crankshaft and mounting whole for the front crankshaft seal.

(5) Using a suitable prying tool, remove the front crankshaft seal from the timing cover (Fig. 16).

CRANKSHAFT OIL SEAL - FRONT (Continued)

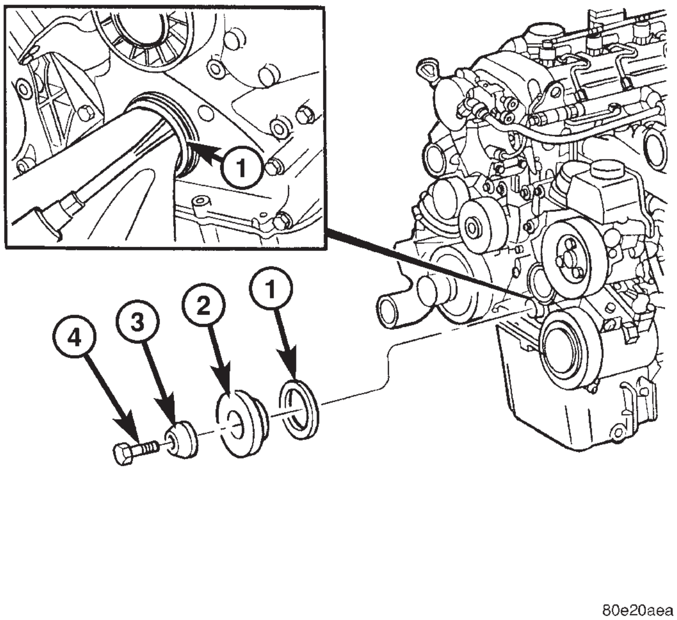


Fig. 16 FRONT SEAL REMOVAL/INSTALLATION

1 - FRONT CRANKSHAFT OIL SEAL
2 - SEAL INSTALLER SPECIAL TOOL #8936
3 - WASHER
4 - RETAINING BOLT

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Carefully position the front crankshaft seal evenly onto the timing cover.

(1) Install the front crankshaft seal.
(2) Install the belt pulley/vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
(3) Remove the retaining lock for the crankshaft/ring gear.
(4) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(5) Reconnect the negative battery cable.
(6) Fill the crankcase with the correct engine oil to the proper level.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.
(7) Start the engine and inspect for leaks.

FLYWHEEL

REMOVAL

(1) Remove transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - W5J400 - REMOVAL).

NOTE: M6x90 bolts must be used with retaining lock to prevent damage to rear end cover.

(2) Install retaining lock for crankshaft/starter ring gear.

NOTE: Flywheel does not need balancing or should it be interchanged.

(3) Remove flywheel with both inner and outer washers (Fig. 17).

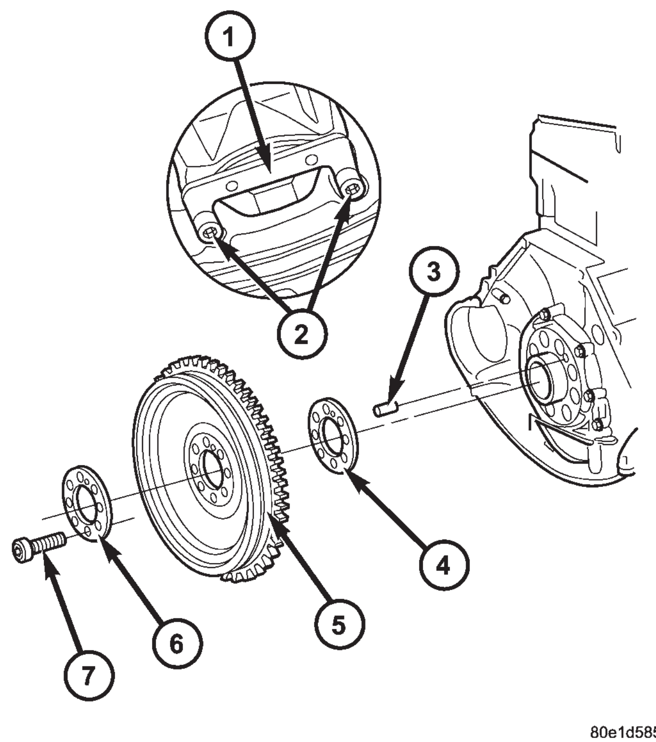


Fig. 17 FLYWHEEL ASSEMBLY

1 - SPECIAL TOOL #8932 CRANKSHAFT LOCK
2 - RETAINING BOLTS
3 - ALIGNMENT PIN
4 - WASHER
5 - FLYWHEEL
6 - FLYWHEEL
7 - FLYWHEEL BOLT

FLYWHEEL (Continued)

INSTALLATION

NOTE: A flex rod torque wrench must not be used in order to avoid angle errors when tightening to degrees.

(1) Align flywheel and inner and outer washers with straight pin. Tighten bolts in two stages. 45N·m (33 lbs. ft.) then 90°.

(2) Remove the retaining lock from the crankshaft/ starter ring gear.

(3) Install clutch.

(4) Install transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - W5J400 - INSTALLATION).

(5) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS IN OPERATION. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start the vehicle.

PISTON & CONNECTING ROD

DESCRIPTION

The pistons are of a free floating design. Oil jets in the engine block lubricate and cool the piston and pin assembly. The connecting rods have a pressed in place wrist pin bushing which is lubricated by the oil jets (Fig. 18).

STANDARD PROCEDURE

STANDARD PROCEDURE - CHECKING AND REPAIRING CONNECTING RODS

NOTE: Connecting rods with blue discoloration, cross scores or notches must be replaced. Compensate for different weights by milling off the balancing weight.

(1) Inspect connecting rod for discoloring, cross scores and notches.

NOTE: Connecting rod and bearing cap are marked in sets and attached with two sleeves.

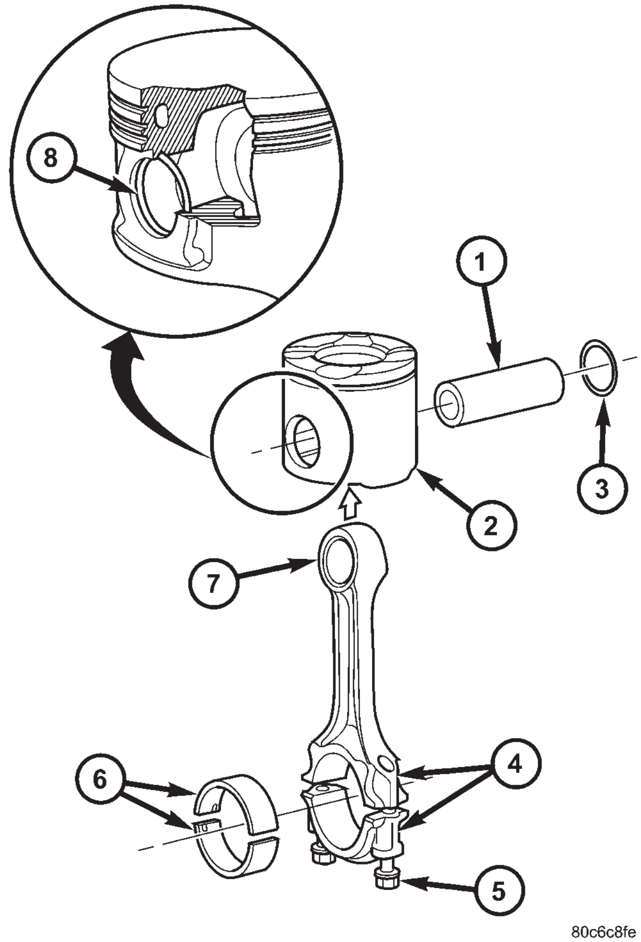


Fig. 18 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN
2 - PISTON
3 - SNAP RING
4 - CONNECTING ROD ALIGNMENT NUMBERS
5 - CONNECTING ROD BOLT
6 - CONNECTING ROD BEARING
7 - CONNECTING ROD
8 - SNAP RING

(2) Bolt connecting rod bearing cap to connecting rod. Tighten connecting rod bearing caps to initial specification (Refer to 9 - ENGINE/ENGINE BLOCK/ PISTON & CONNECTING ROD - INSTALLATION).

PISTON & CONNECTING ROD (Continued)

NOTE: If the maximum permissible diameter is exceeded, grind off contact surface of connecting rod bearing cap by a Maximum of 0.02mm.

(3) Using a dial indicator, measure connecting rod bearing basic bore, repair as necessary (Fig. 19).

NOTE: If excessive wear is present, press in new connecting rod bushings.

(4) Measure connecting rod bushing inner diameter (Fig. 19).

(5) Inspect wristpin bushing.

(6) Measure piston pin end play in connecting rod bushing.

(7) Measure peak to valley height of connecting rod bushing on inside.

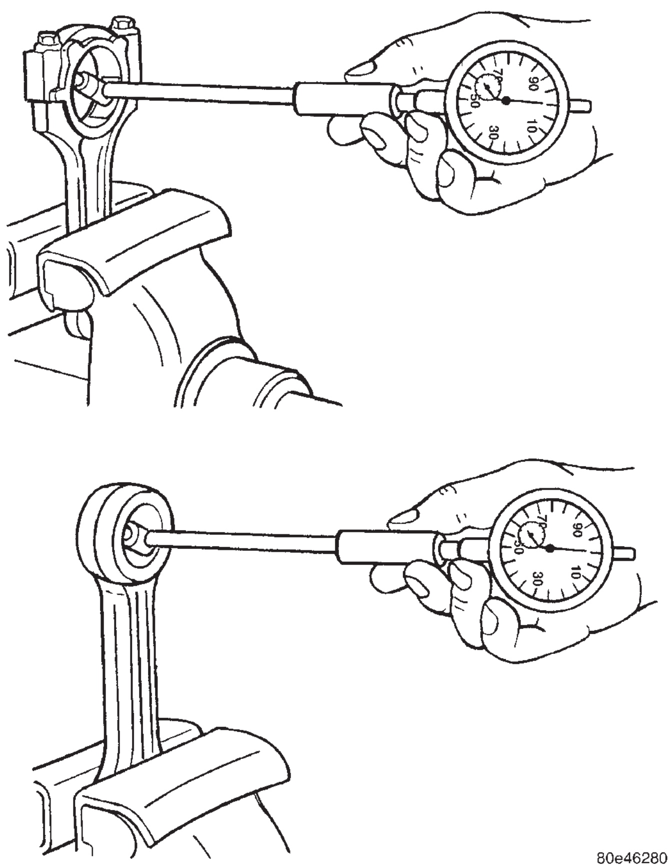


Fig. 19 MEASURING CONNECTING RODS

CONNECTING ROD SPECIFICATIONS

Distance between middle connecting rod bore to connecting rod bushing bore	148.970 mm to 149.030 mm
Width of connecting rod bearing bore at connecting rod bushing bore	21.940 mm to 22 mm
Connecting rod bearing shell basic bore	51.600 mm to 51.614 mm
Allowable out-of-roundness and taper of basic bore	.020 mm
Allowable twist of connecting rod bearing bore to connecting rod bushing bore over a length of 100 mm	.100 mm
Allowable variation of axial parallelism of connecting rod bearing bore to connecting rod bushing bore over a length of 100 mm	.045 mm
Allowable difference in weight of complete connecting rod of an engine	2g
Connecting rod inner bushing	30.018 to 30.024 mm
Connecting rod outer bushing	32.575 mm to 32.600 mm
Connecting rod basic bore	32.500 mm to 32.525 mm
Piston pin play in connecting rod	.018 mm to .024 mm
Peak-to-Valley height (Rz) of connecting rod bushing on inside	5
Connecting rod bolt thread	M8 x 1

PISTON & CONNECTING ROD (Continued)

STANDARD PROCEDURE - MEASURING PISTON PROTRUSION

After replacing the pistons/connecting rods or machining the engine block contact surface, it is then necessary to measure the piston protrusion.

Measure protrusion between piston crown and cylinder head contact surface without the head gasket installed. The measurment must be carried out in the direction of the piston pin in order to eliminate piston rock.

(1) Measure piston protrusion at the two measuring points (arrows) (Fig. 20).

Piston protrusion with new crankcase should be 0.38 - 0.62 mm.

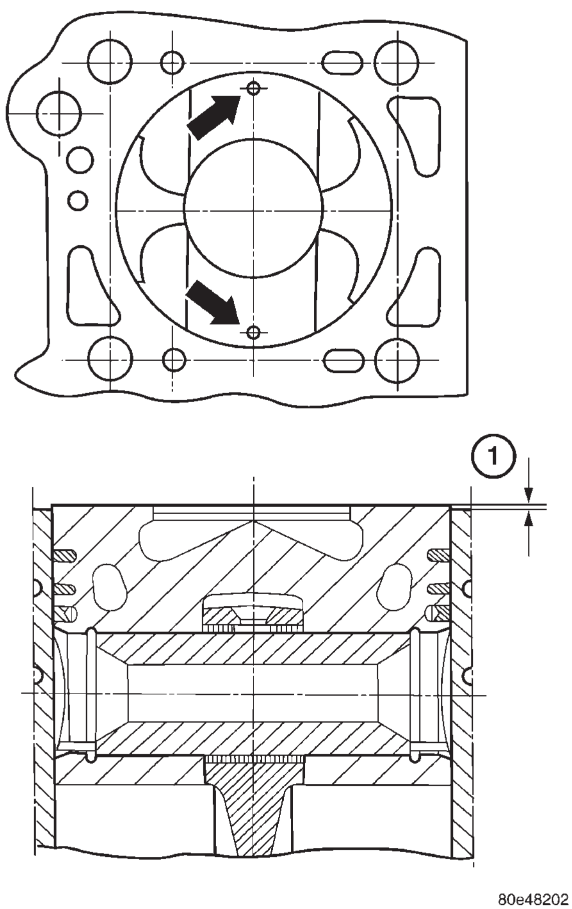


Fig. 20 MEASURING PISTON PROTRUSION

1 - PISTON PROTRUSION MEASUREMENT

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the engine (Refer to 9 - ENGINE - REMOVAL).

(3) Remove the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(4) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(5) Push back on the chain tensioner and remove the oil pump chain from the oil pump.

(6) Remove the oil pump.

NOTE: Mark the connecting rod and connecting rod bearing cap to each other at the inlet side.

(7) Remove the connecting rod bearing cap.

NOTE: Do Not mix up the top and bottom connecting rod bearing shells.

(8) Mark the connecting rod bearing shell and the connecting rod bearing cap to each other.

NOTE: If the pistons are used, the direction of travel arrows and the marking of the pistons may no longer be visible because of carbon deposits. The carbon deposits on the pistons must be removed.

NOTE: If the arrows indicating the driving direction on the piston are no longer visible, they must be marked again.

(9) Remove the connecting rod together with the piston through the top of the engine.

NOTE: DO NOT mix up the top and bottom connecting rod bearing shells.

(10) Mark the connecting rod bearing shell and connecting rod to each other.

CAUTION: Care must be taken not to damage the piston.

PISTON & CONNECTING ROD (Continued)

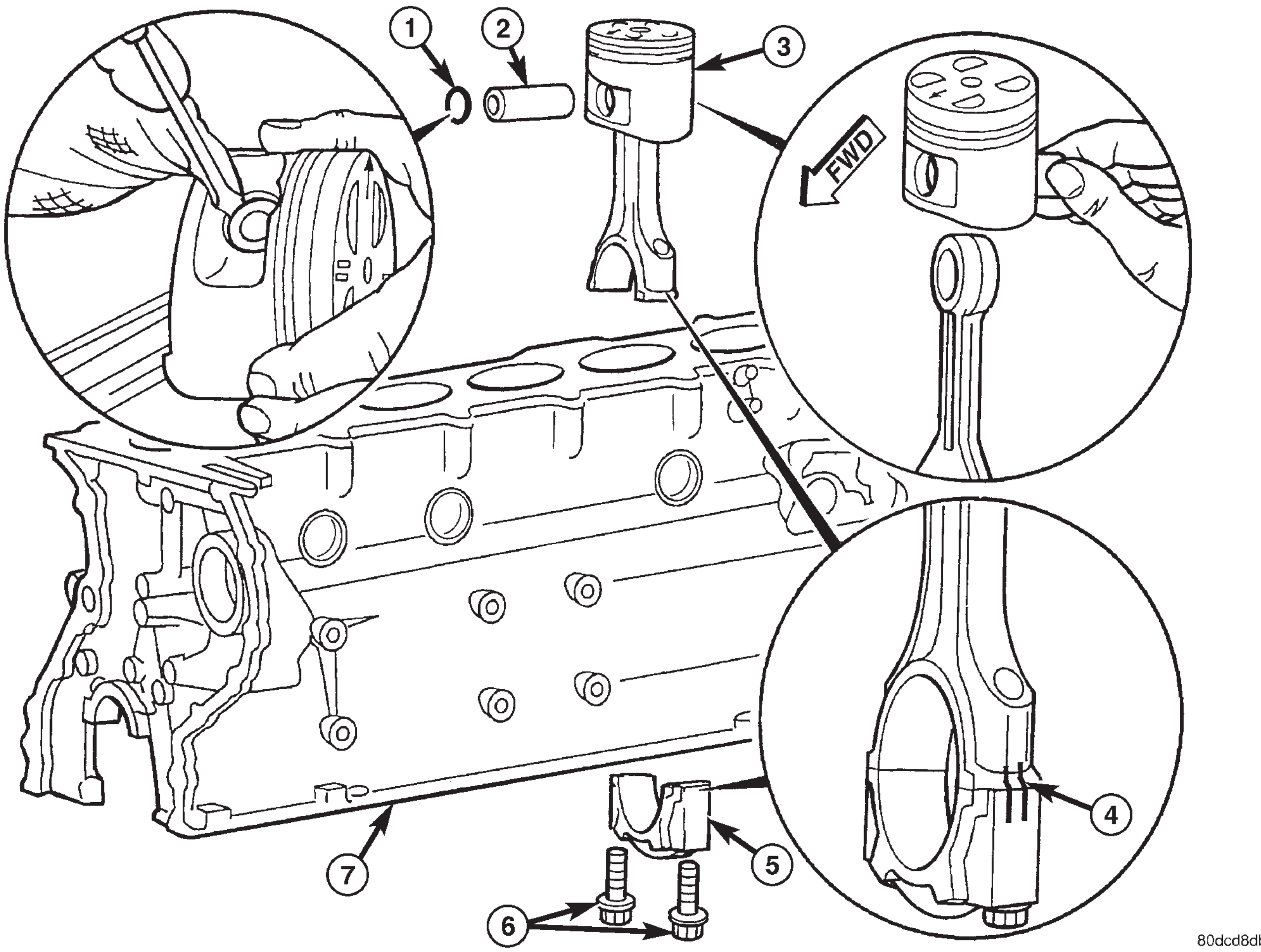


Fig. 21 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN CIRCLIP
2 - PISTON PIN
3 - PISTON ASSEMBLY
4 - CONNECTING ROD AND CAP ALIGNMENT MARKS
5 - CONNECTING ROD CAP
6 - CONNECTING ROD BOLTS
7 - ENGINE BLOCK

(11) Remove the piston pin circle clip. (Fig. 21).

(12) Press the piston pin out of the piston and connecting rod bushing. (Fig. 21).

(13) Inspect the connecting rod for wear and damage.

INSTALLATION

(1) Assign piston to the cylinder bore.

(2) Using the appropriate clean engine oil, oil piston pin and connecting rod bushing.

CAUTION: Assemble the piston and connecting rod so that the arrow is pointing in the direction of travel (in the opposite direction of power flow). The marking on the connecting rod is pointing toward the inlet side.

(3) Assemble piston and connecting rod (Fig. 22).

(4) Insert piston pin by hand (Fig. 22).

CAUTION: Care must be taken not to damage the piston.

(5) Insert circle clip of piston pin into groove on piston (Fig. 22).

(6) Using the appropriate clean engine oil, clean the cylinder bores, connecting rod bearing journals, connecting rod bearing shells and pistons.

CAUTION: Offset the piston ring gaps by 120°.

(7) Position a ring compressor over piston and rings. Tighten ring compressor (Fig. 23).**Ensure that ring position does not change during this operation.**

CAUTION: Rotate the crankshaft sufficiently so that the connecting rod does not touch the connecting rod journal when the piston is pushed onto the cylinder bore.

PISTON & CONNECTING ROD (Continued)

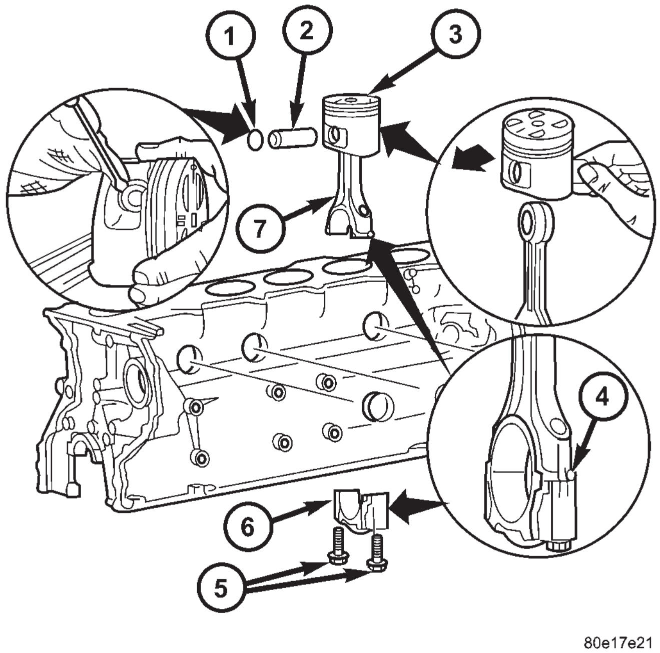


Fig. 22 PISTON AND CONNECTING ROD ASSEMBLY

1 - CIRCLE CLIP
2 - PISTON PIN
3 - PISTON ASSEMBLY
4 - CONNECTING ROD ALIGNMENT MARKINGS
5 - CONNECTING ROD BOLTS
6 - CONNECTING ROD CAP
7 - CONNECTING ROD

(8) Install piston with arrow pointing in the direction of travel (in the opposite direction to power flow) (the marking on the connecting rod should be pointing toward the inlet side). (Fig. 23).

(9) Clean and inspect the connecting rod bolts.

CAUTION: Assure that the correct top and bottom connecting rod bearings shells are used in accordance with the markings.

CAUTION: The anti-twist locks of the connecting rod bearing shells must be located in the slots of the connecting rod bearing caps.

(10) Insert connecting rod bearing shell into connecting rod bearing cap.

CAUTION: The markings on the connecting rod and connecting rod cap must be lined up.

(11) Install connecting rod bearing cap. Tighten bolts in 3 stages, 5N·m (44 lbs in), 25N·m (221 lbs in), 90°.

(12) Rotate crankshaft fully and check the clearance.

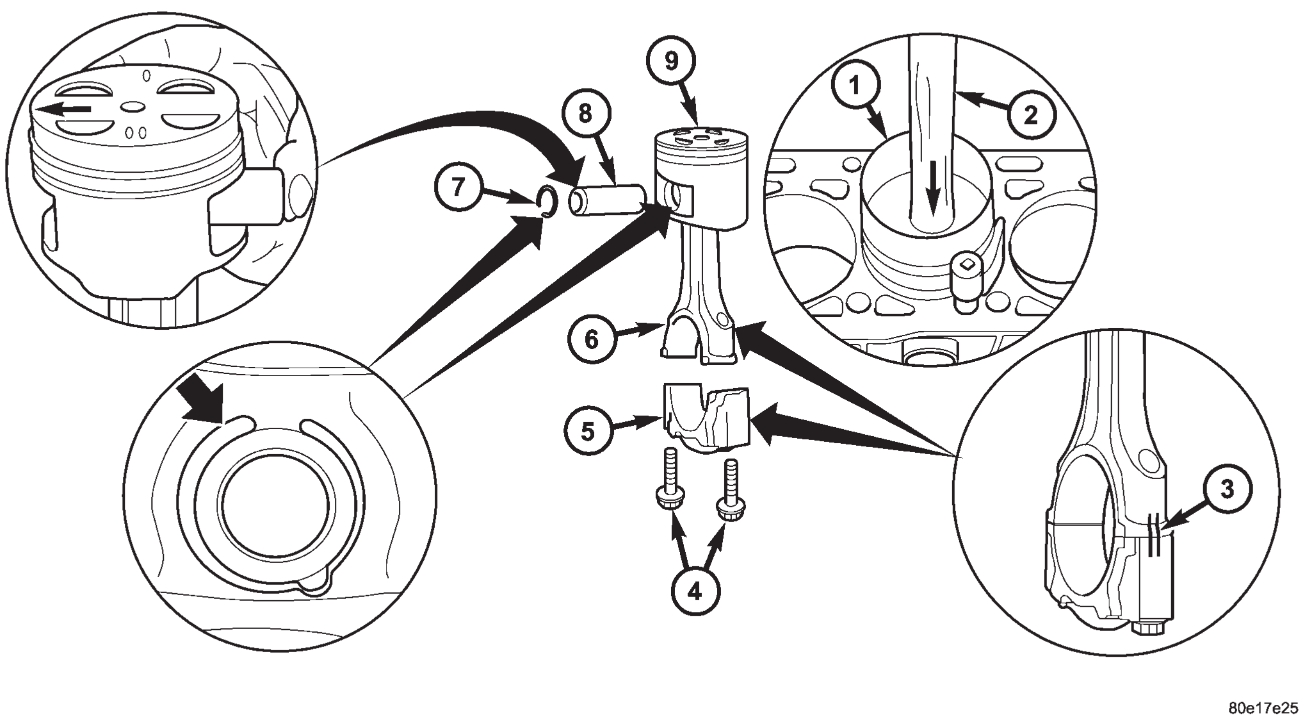


Fig. 23 PISTON AND CONNECTING ROD INSTALLATION

1 - PISTON RING COMPRESSOR
2 - WOOD HAMMER HANDLE
3 - CONNECTING ROD ALIGNMENT MARKINGS
4 - CONNECTING ROD BOLTS
5 - CONNECTING ROD CAP
6 - CONNECTING ROD
7 - CIRCLE CLIP
8 - PISTON PIN
9 - PISTON ASSEMBLY

PISTON & CONNECTING ROD (Continued)

(13) Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(14) Install engine oil pan and oil pan drain plug (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

CAUTION: Install a cylinder head gasket of standard thickness or a cylinder head gasket of repair thickness depending on piston projection.

(15) Measure piston projection (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE).

(16) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(17) Install engine (Refer to 9 - ENGINE - INSTALLATION).

(18) Fill the crankcase with correct engine oil, to proper level. Refer to owners manual for specifications.

(19) Fill the cooing system with proper coolant, to the proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(20) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS, OR FAN. DO NOT WEAR LOOSE CLOTHES.

(21) Start the engine and inspect for leaks.

PISTON RINGS

STANDARD PROCEDURE - PISTON RING FITTING

(1) Carefully clean the carbon from all ring grooves. Oil drain openings in the oil ring groove and pin boss must be clear. DO NOT remove metal from the grooves or lands. This will change ring-to-groove clearances and will damage the ring-to-land seating.

(2) Be sure the piston ring grooves are free of nicks and burrs.

(3) Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring (Fig. 24). Rotate the ring in the groove. It must move freely around circumference of the groove.

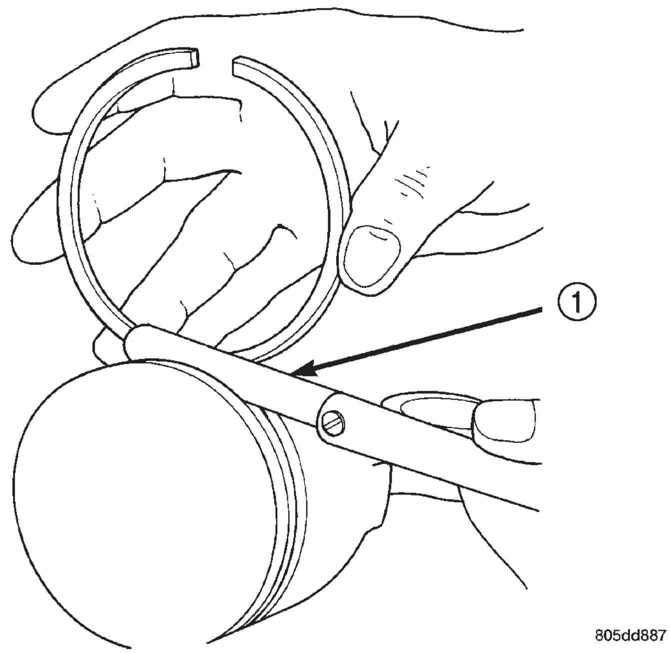


Fig. 24 Ring Side Clearance Measurement

1 - FEELER GAUGE

RING SIDE CLEARANCE CHART

ITEM	SPECIFICATION
Top Compression Ring	0.012 - 0.016 mm (0.0047 - 0.0063 in.)
Second Compression Ring	0.05 - 0.09 mm (0.0019 - 0.0035 in.)
Oil Control Ring	0.03 - 0.07 mm (0.0011 - 0.0027 in.)

PISTON RINGS (Continued)

(4) Place ring in the cylinder bore and push down with inverted piston to position near lower end of the ring travel. Measure ring gap with a feeler gauge fitting snugly between ring ends (Fig. 25).

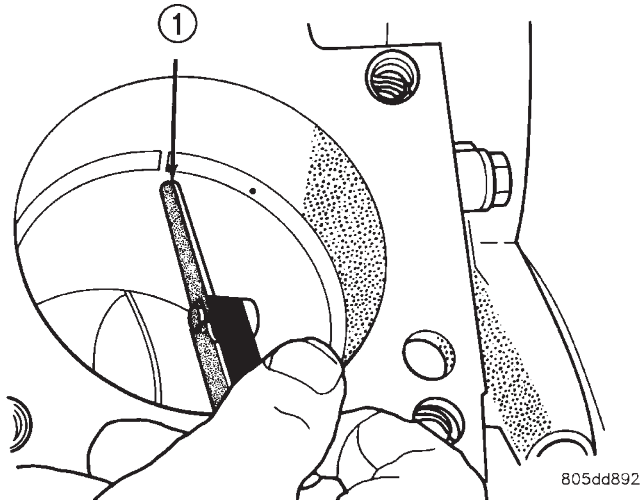


Fig. 25 Gap Measurement

1 - FEELER GAUGE

RING GAP MEASUREMENT CHART

ITEM	SPECIFICATION
Top Compression Ring	0.229 - 0.610 mm (0.0090 - 0.0240 in.)
Second Compression Ring	0.483 - 0.965 mm (0.0190 - 0.080 in.)
Oil Control Ring	0.254 - 1.500 mm (0.010 - 0.060 in.)

(5) The oil control rings are symmetrical, and can be installed with either side up. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

(6) Using a ring expander, install compression rings with manufactures designation pointing toward piston crown (Fig. 26).

Ring Gap Orientation

- Position the gaps on the piston as shown (Fig. 27).
- Oil spacer - Gap on center line of piston skirt.
- Oil rails - gap 180° apart on centerline of piston pin bore.
- No. 2 Compression ring - Gap 120° from top oil rail gap.
- No. 1 Compression ring - Gap 120° from No. 2 compression ring gap.

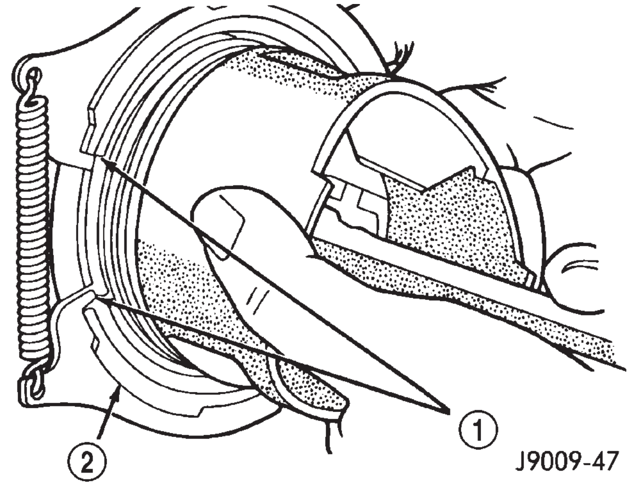


Fig. 26 Compression Ring Installation

1 - COMPRESSION RING
2 - RING EXPANDER RECOMMENDED

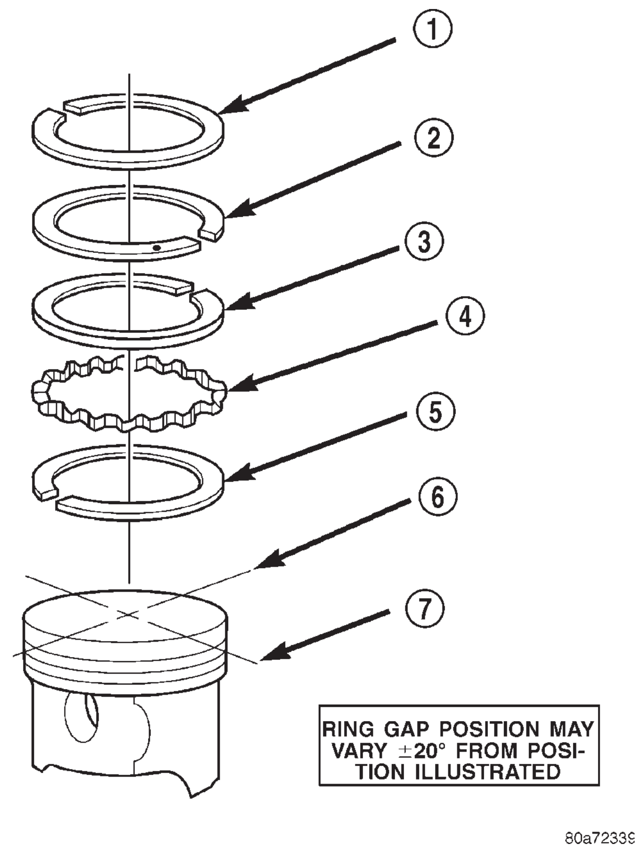


Fig. 27 Ring Gap Orientation

1 - TOP COMPRESSION RING
2 - BOTTOM COMPRESSION RING
3 - TOP OIL CONTROL RAIL
4 - OIL RAIL SPACER
5 - BOTTOM OIL CONTROL RAIL
6 - IMAGINARY LINE PARALLEL TO PISTON PIN
7 - IMAGINARY LINE THROUGH CENTER OF PISTON SKIRT

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(3) Install retaining lock for crankshaft/ring gear (Fig. 28).
(4) Remove crankshaft center bolt and washer (Fig. 28).

NOTE: If hub of belt pulley/vibration damper is tight, use puller to remove. DO NOT tilt puller when in use. Grooves of the puller must mesh fully into the slots of the belt pulley.

(5) Remove the belt pulley/vibration damper (Fig. 28).

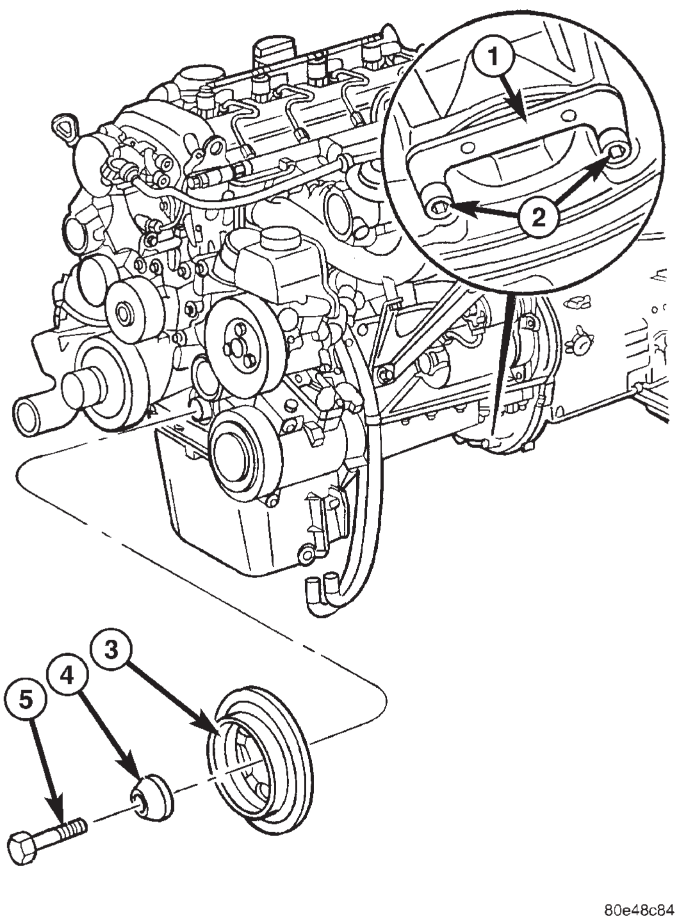


Fig. 28 VIBRATION DAMPER/CRANKSHAFT PULLEY

1 - SPECIAL TOOL #8932
2 - RETAINING BOLTS
3 - VIBRATION DAMPER/CRANKSHAFT PULLEY
4 - WASHER
5 - CRANKSHAFT BOLT

NOTE: If grooves can be felt in the belt pulley/vibration damper during inspection, the pulley/damper must be replaced.

(6) Inspect hub at belt pulley/vibration damper for wear grooves.
(7) Replace front crankshaft seal.

INSTALLATION

NOTE: Align parallel key, fix in place with grease. Turn to ensure the slot is aligned with parallel key in crankshaft.

NOTE: Front crankshaft seal must be replaced before installing the belt pulley/vibration damper.

(1) Position the belt pulley/vibration damper.
(2) Install crankshaft center bolt and washer. Tighten bolt in two stages. M8.8 bolt to 200N·m (148 lbs. ft.) then 90°, M10.9 bolt to 325N·m (240 lbs. ft.) then 90°.

NOTE: Inspect accessory drive belt for wear. Replace as necessary.

(3) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(4) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS IN OPERATION. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(5) Start vehicle and inspect for leaks.

VACUUM PUMP

DESCRIPTION

The vacuum pump is operated by a slotted extension attached to the vacuum pump shaft. The vacuum pump shaft slotted extension fits into, and is driven by, the exhaust camshaft gear.

The vacuum pump is a constant displacement, vane-type pump. Vacuum is generated by vanes mounted in the pump rotor. The rotor is located in the pump housing and is pressed onto the pump shaft.

The vacuum pump rotating components are internally lubricated.

The vacuum pump is not serviceable and must be replaced as a unit. Do not disassemble or attempt to repair the pump.

VACUUM PUMP (Continued)

OPERATION

Vacuum pump output is transmitted to the Heater, Electronic, Vacuum, Air Conditioner (HEVAC) and speed control, systems through a supply hose. The hose is connected to an outlet port on the pump housing and uses an in-line check valve to retain system vacuum when vehicle is not running.

Pump output ranges from a minimum of 8.5 to 25 inches vacuum.

The pump rotor and vanes are rotated by the pump drive gear. The drive gear is operated by the exhaust camshaft gear.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Partailly drain coolant system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Disconnect viscous heater line and set aside.

(5) Disconnect cooling fan, power steering line and set aside.

(6) Remove vacuum line at vacuum pump.

NOTE: Observe position of driver on rear of pump.

(7) Remove vacuum pump and seals (Fig. 29).

(8) Clean all sealing surfaces.

INSTALLATION

(1) Clean all sealing surfaces.

(2) Position driver on rear of pump and install vacuum pump with new seals. Tighten bolts to 14N·m (124 lbs. in.).

(3) Install vacuum line to vacuum pump.

(4) Reconnect cooling fan , power steering hose.

(5) Reconnect viscous heater pipe.

(6) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).Tighten screws to 10 N·m (89 lbs. in.).

(7) Connect negative battery cable.

(8) Refill coolant system with correct mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(9) Start the engine and inspect for leaks.

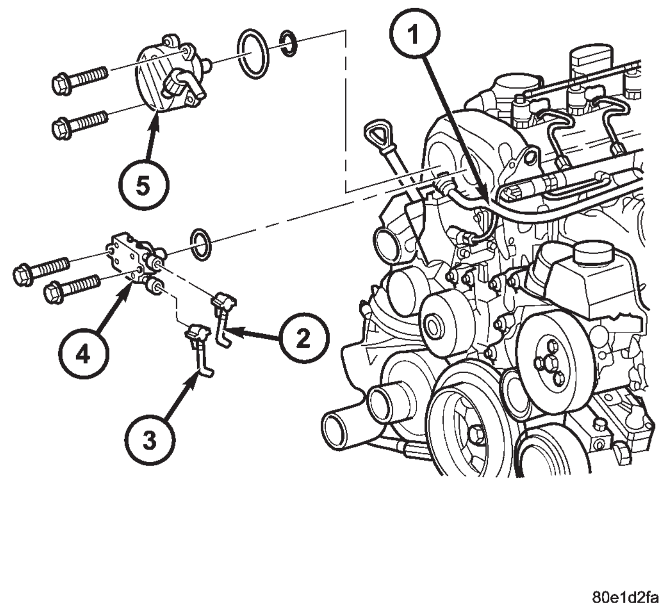


Fig. 29 VACUUM PUMP AND LOW PRESSURE FUEL PUMP ASSEMBLIES

1 - VACUUM LINE
2 - FUEL OUTLET LINE
3 - FUEL FEED LINE
4 - LOW PRESSURE FUEL PUMP
5 - VACUUM PUMP

OIL

REMOVAL - OIL SEPARATOR

(1) Disconnect breather hose.

(2) Remove the separator retaining bolts

(3) Twist to remove oil separator from cover.

INSTALLATION - OIL SEPARATOR

(1) Lubricate the oil separator o - ring with clean engine oil.

(2) Position separator above cover and apply downward pressure to seat.

(3) Install retaining bolts and tighten to 8N·m (70 lbs. in.).

(4) Connect breather hose.

OIL JET

DESCRIPTION

There are five oil jets installed in the engine block (Fig. 30). These oil jets are used to cool and lubricate the piston assemblies.

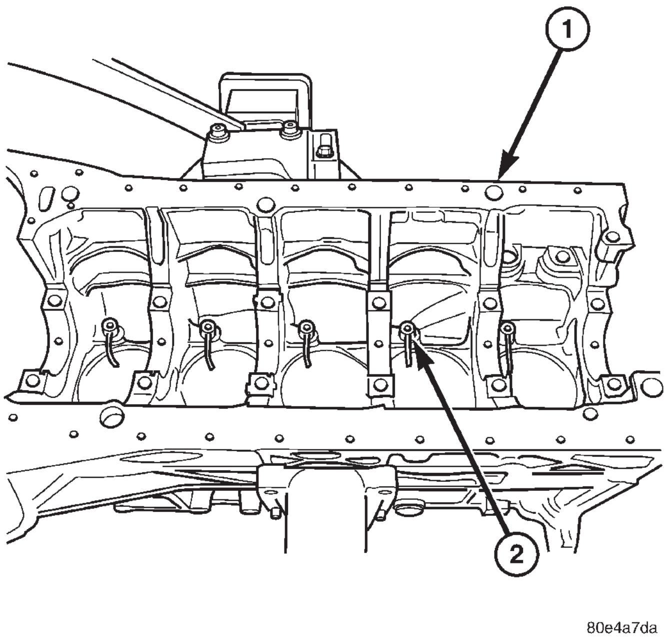


Fig. 30 OIL JET LOCATION

1 - ENGINE BLOCK
2 - OIL JET

REMOVAL

The engine must be removed from the vehicle and completely dissassembled to replace the oil jets.

(1) Remove engine from vehicle.
(2) Completely dissassemble engine.
(3) Using an extraction claw and a slide hammer, remove the oil jets from engine block.

INSTALLATION

(1) Install oil jet into special tool #8924.
(2) Align oil jet in location in engine block.
(3) Drive oil jets into block using special tool #8924 until oil jet is fully seated into engine block (Fig. 31).
(4) Reassemble engine.
(5) Install engine into vehicle.

OIL PAN

REMOVAL

(1) Disconnect negative battery cable.
(2) Raise and support vehicle.
(3) Drain engine oil.

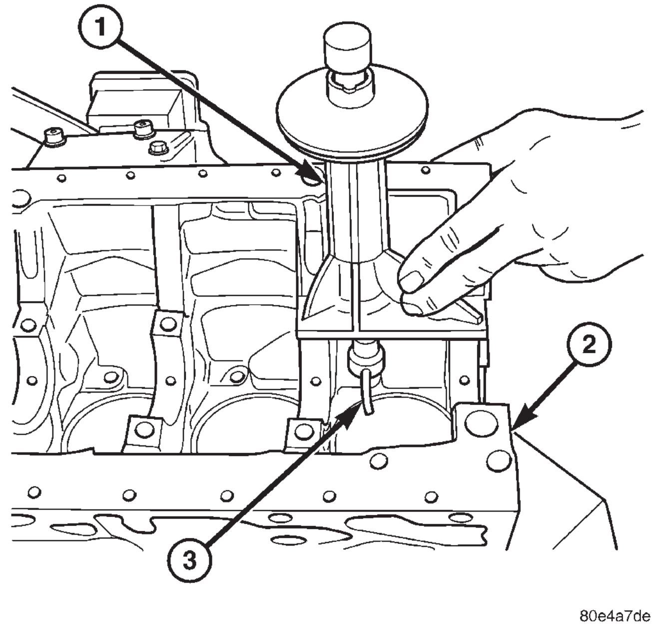


Fig. 31 OIL JET INSTALLATION

1 - OIL JET INSTALLER #8942
2 - ENGINE BLOCK
3 - OIL JET

(4) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

NOTE: Oil pan bolts are different diameters and lengths and must be installed in their proper position.

(5) Remove oil pan bolts, oil pan and gasket.

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Oil pan bolts are different diameters and lengths. They must be installed in the proper position.

(1) Install the oil pan. Tighten M6 bolts to 9N·m (80 lbs. in.) and M8 bolts to 20N·m (15 lbs. ft.).
(2) Refill crankcase with the proper engine oil to the proper level. Refer to owners manual for specification.
(3) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(4) Start the engine and inspect for leaks.

OIL PUMP

REMOVAL

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(3) Unbolt oil pump from crankcase.
(4) Press chain tensioner off oil pump chain and remove oil pump (Fig. 32).

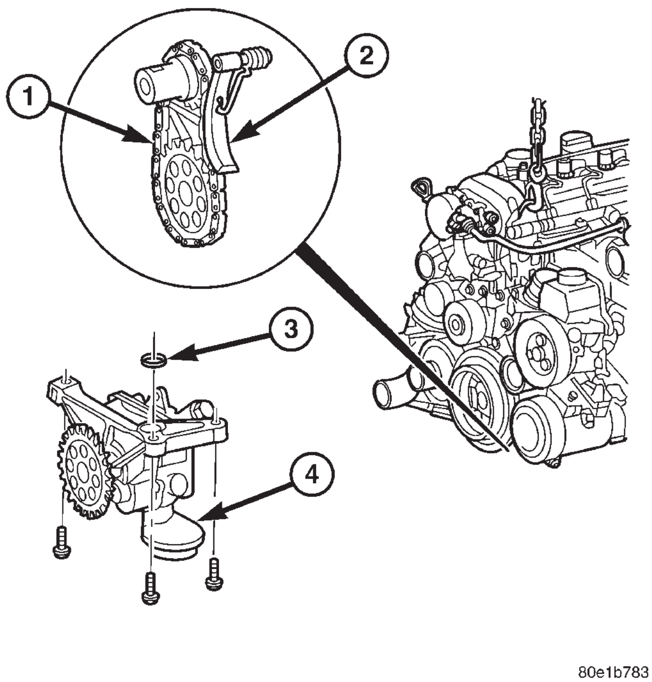


Fig. 32 OIL PUMP ASSEMBLY

1 - OIL PUMP CHAIN
2 - OIL PUMP CHAIN TENSIONER
3 - O-RING
4 - OIL PUMP

REMOVAL- OIL PUMP CHAIN

(1) Disconnect negative battery cable.
(2) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(3) Remove oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
(4) Using special tool #8948, position and fit chain seperating tool and thrust spindle onto a link of the oil pump chain (Fig. 33).
(5) Screw the thrust pin in and seperate the oil pump chain link.
(6) Remove pressed - out oil pump chain pin from chain seperation tool.

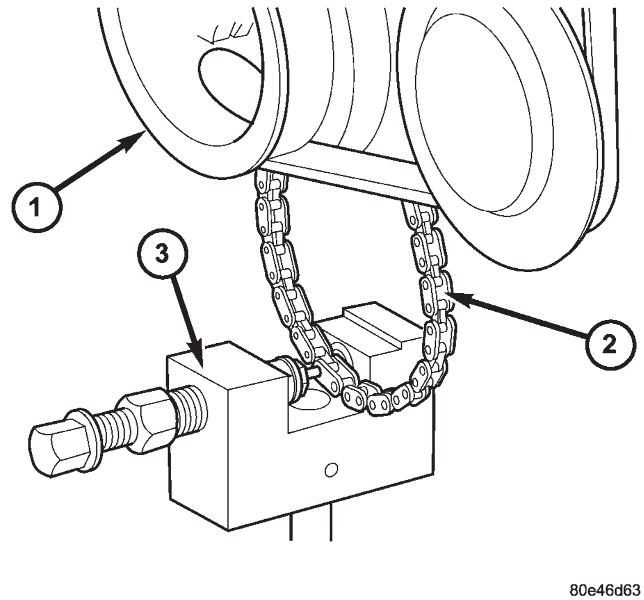


Fig. 33 OIL PUMP CHAIN LINK REMOVAL

1 - VIBRATION DAMPER/PULLEY
2 - OIL PUMP CHAIN
3 - SPECIAL TOOL #8948

CAUTION: IT IS ESSENTIAL that the installation procedure for the oil pump chain is followed exactly. Failure to do so will result in severe engine damage.

INSTALLATION

INSTALLATION

NOTE: Clean strainer of oil pump. If oil pump is dry, fill with appropriate engine oil.

(1) Position oil pump and install oil pump chain.
(2) Install oil pump and seal.Tighten bolts to 18N·m (159 lbs. in.).
(3) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
(4) Fill crankcase to proper level with correct engine oil. Refer to owners manual for specification.
(5) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

OIL PUMP (Continued)

INSTALLATION - OIL PUMP CHAIN

CAUTION: IT IS ESSENTIAL that the installation procedure is followed exactly. Failure to do so will result in severe engine damage.

(1) Connect old oil pump chain and new chain with temporary link, outer plate and locking element (Fig. 34).

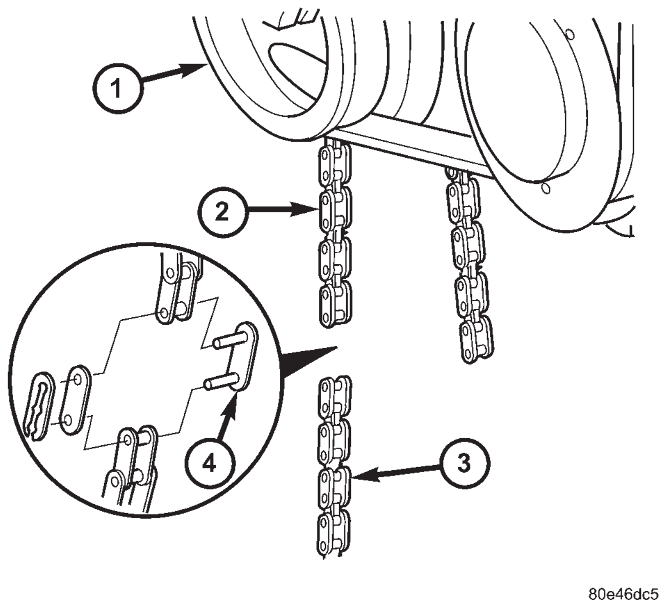


Fig. 34 INSTALLING OIL PUMP CHAIN TEMPORARY LINK

1 - VIBRATION DAMPER/CRANKSHAFT PULLEY
2 - OLD OIL PUMP CHAIN
3 - NEW OIL PUMP CHAIN
4 - TEMPORARY LINK

(2) Slowly rotate crankshaft in a clockwise direction until it is possible to connect the ends of the new and old oil pump chains.

(3) Remove assembly locking element, outer plate and assembly link (Fig. 35).

CAUTION: Insert new riveted link from the rear.

(4) Connect ends of new oil pump chain with new riveted link (Fig. 36).

NOTE: When assembling riveting tool, one piece is secured by a screw and the other can move loosely on the thrust spindle.

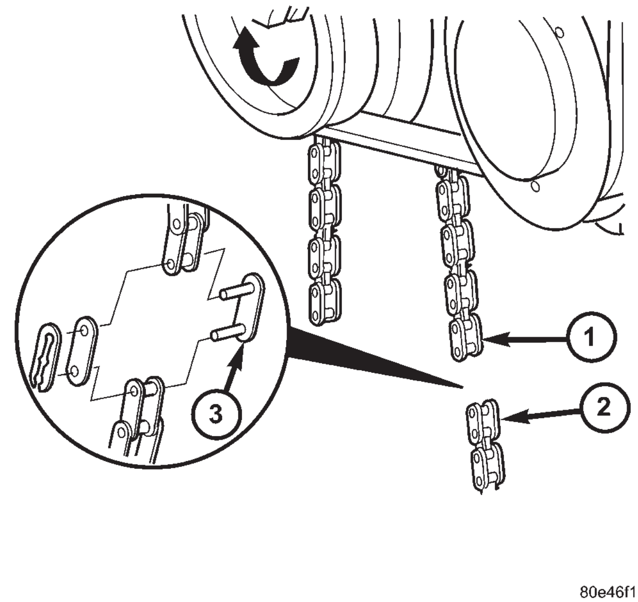


Fig. 35 REMOVING OIL PUMP CHAIN TEMPORARY LINK

1 - NEW OIL PUMP CHAIN
2 - OLD OIL PUMP CHAIN
3 - TEMPORARY LINK

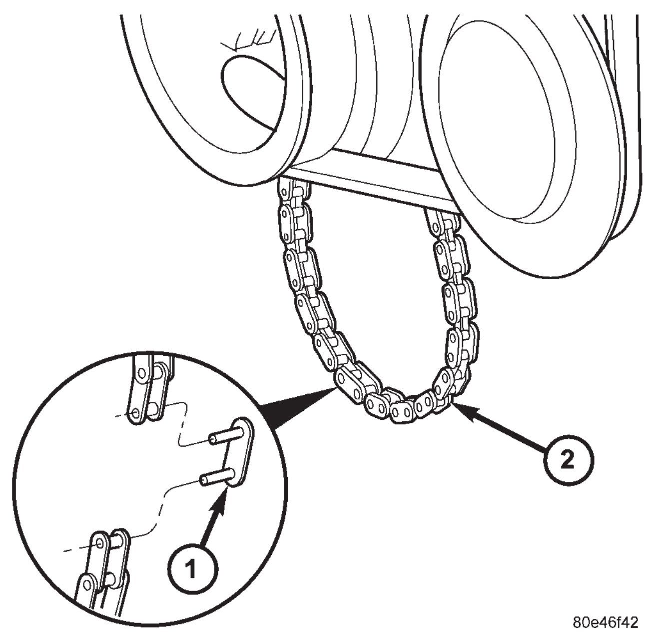


Fig. 36 INSTALLING NEW RIVETED LINK

1 - NEW RIVETED LINK
2 - OIL PUMP CHAIN

OIL PUMP (Continued)

(5) Assemble riveting tool by attaching inserts. (Fig. 37).

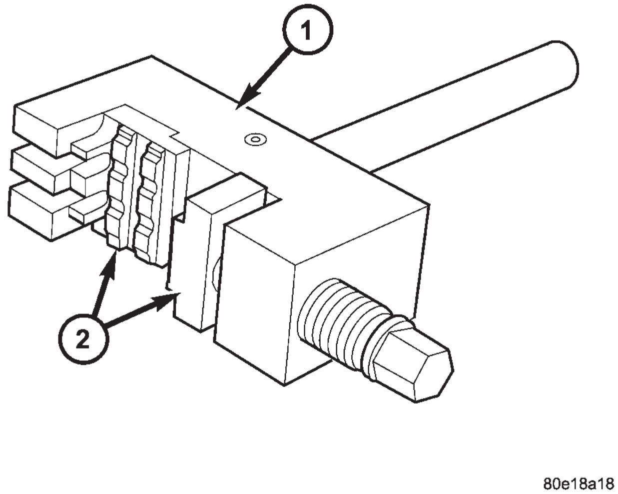


Fig. 37 INSTALLING ASSEMBLY INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8952

NOTE: The outer plate will be held in place by a magnet.

(6) Place new outer plate into tool insert.

NOTE: Ensure that the riveted link and riveting tool are aligned.

(7) Position riveting tool over new link and press in new rivet as far as the tool stop.
(8) Remove riveting tool to change inserts.
(9) Install insert on riveting tool and secure with screw.
(10) Install insert on riveting tool (Fig. 38).

NOTE: The outer plate is held in place magnetically by riveting tool.

(11) Insert new outer plate into the moving assembly insert.
(12) Position riveting tool so that spacer webs of the guide are side by side.
(13) Ensure that riveted link and outer plate are aligned.

NOTE: When turning spindle of riveting tool, be sure that pins of riveted link are inserted into holes of outer plate.

(14) Screw in spindle of riveting tool until firm resistance is felt.
(15) Remove riveting tool.

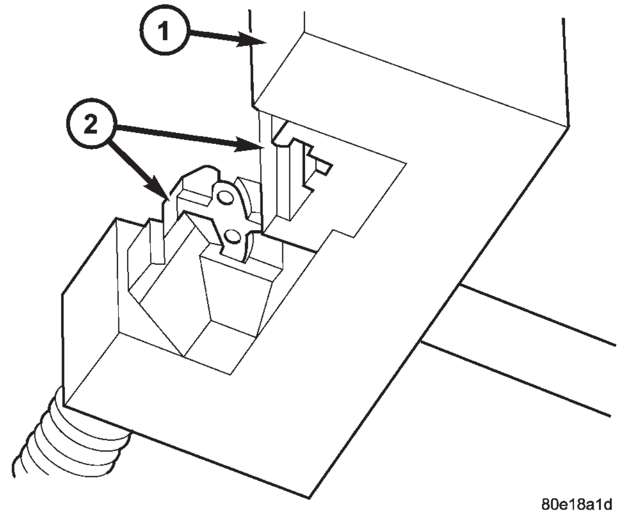


Fig. 38 INSTALLING RIVETING INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

(16) Turn over tool moving assembly insert to the riveting profile.

NOTE: Rivet pins of the riveted link individually.

(17) Position riveting tool exactly over middle of pin (Fig. 39).

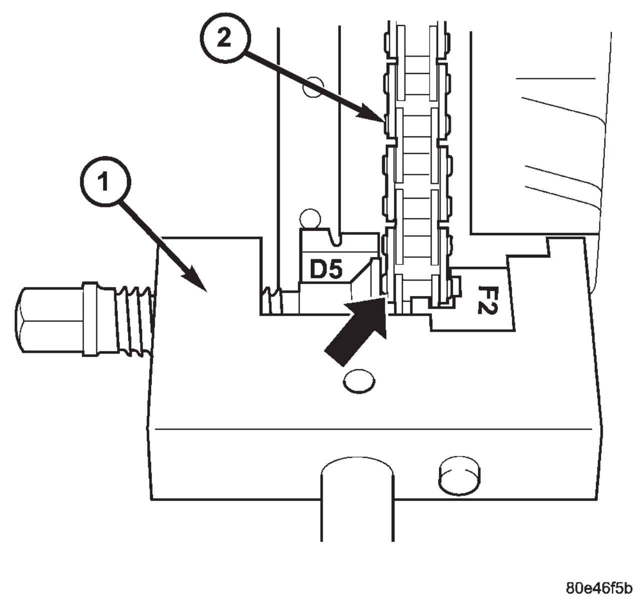


Fig. 39 RIVETING NEW LINK

1 - RIVETING TOOL
2 - OIL PUMP CHAIN

OIL PUMP (Continued)

(18) Tighten riveting tool spindle until it stops.
(19) Remove riveting tool, inspect riveting, rerivet if necessary (Fig. 40).
(20) Repeat procedure for both rivets.

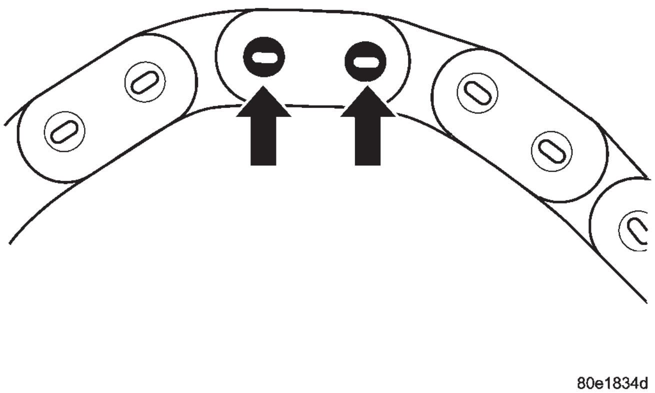


Fig. 40 RIVET INSPECTION

(21) Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
(22) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
(23) Refill engine with proper oil to the correct level.
(24) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELT OR FAN. DO NOT WEAR LOOSE CLOTHES.

(25) Start engine and inspect for leaks.

OIL COOLER & LINES

REMOVAL - OIL COOLER

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Unscrew oil filter housing cap.
(4) Raise and suitably support vehicle.

WARNING: DO NOT OPEN COOLING SYSTEM UNLESS TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN A MARKED AND SUITABLE CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

NOTE: Collect any residual fluids that may flow.

(5) Drain engine coolant.
(6) Remove fuel full-flow filter (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL).
(7) Remove coolant hose from exhaust heat exchanger.
(8) Remove bolts attaching exhaust heat exchanger to cylinder head.
(9) Remove air charge distribution pipe (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - REMOVAL).
(10) Remove coolant hose at oil-water heat exchanger.

NOTE: Collect any residual fluids that may flow.

(11) Remove automatic transmission fluid line at oil-water heat exchanger.
(12) Remove oil-water heat exchanger at timing case cover.

INSTALLATION - OIL COOLER

(1) Install oil cooler to timing case cover. Tighten bolts to 15 N·m (132 lbs. in.).
(2) Install transmission fluid lines to oil cooler.
(3) Install coolant hose to oil cooler.
(4) Install air charge distribution pipe (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).
(5) Install bolts attaching exhaust heat exchanger to cylinder head.
G
(6) Install coolant hose from exhaust heat exchanger.
(7) Install fuel full-flow filter (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - INSTALLATION).
(8) Close engine coolant drains.
(9) Install oil filter housing cap. Tighten to 25N·m (181 lbs. ft.).
(10) Install engine cover (Refer to 9 - ENGINE - INSTALLATION). Tighten screws to 10N·m (89 lbs. in.).
(11) Refill coolant system to proper level with properly mixed coolant (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(12) Check engine oil level, refill with proper engine oil as necessary. Refer to owners manual for specifications.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

OIL COOLER & LINES (Continued)

(13) Start engine and inspect for leaks.

(14) Inspect engine oil level 2 minutes after turning engine off. Refill as necessary.

INTAKE MANIFOLD

DESCRIPTION - INLET PORT SHUT OFF

A swirl and a charge air inlet port each are provided in the intake manifold for each cylinder (Fig. 41). The charge air ports can be closed by means of flaps. The flaps are connected to each other by linkage, which is operated by the inlet port shut off motor. The valves are held in position by means of spring force.

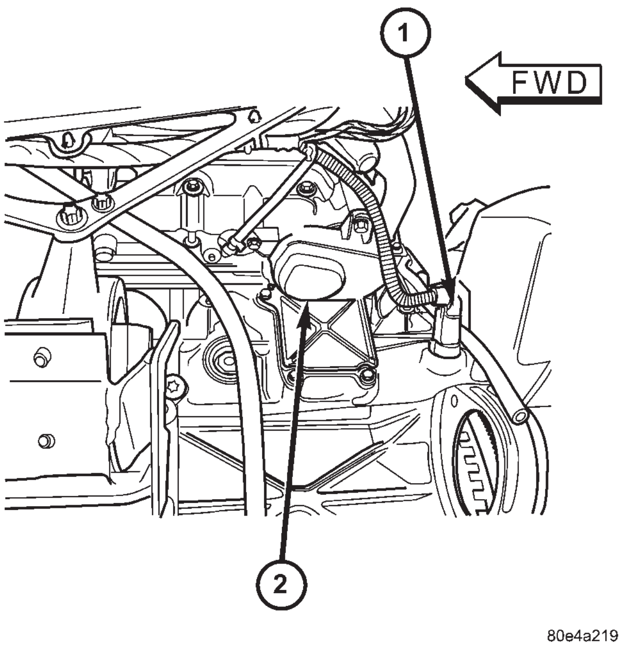


Fig. 41 SENSOR LOCATION

1 - CRANKSHAFT POSITION SENSOR
2 - SWIRL ACTUATOR

OPERATION - INLET PORT SHUT OFF

With lower engine speed and load range, all charge air ports are sealed off by way of flaps. The entire air flow flows in only through the swirl inlet ports. This results in a high air swirling which produces more effective mixing of fuel with air, enhancing combustion.

As engine speed and load rise, the charge inlet ports are continuously opened to obtain the best possible ratio between air swirling and air mass for each operating point. This optimizes engine power, exhaust characteristics, and reduces soot.

The position of the flaps in the charge air ports is determined by input received by the ECM (Engine Control Module). The inlet port shut off motor receives a PWM signal from the ECM for this purpose. A direct current motor pushes the adjusting lever into the correct position. If a fault or an open circuit occurs, the flaps are opened.

TIMING CHAIN COVER

REMOVAL

WARNING: DO NOT OPEN COOLING SYSTEM UNLESS TEMPERATURE IS BELOW 90°c (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN APPROVED CONTAINER ONLY. RISK OF INJURY TO SKIN AND EYES FROM SCALDING COOLANT. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

(1) Disconnect negative battery cable.

(2) Drain coolant (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Drain engine oil.

(4) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

NOTE: Inspect condition of hoses and clamps, replace as necessary.

(5) Detach coolant hoses on thermostat housing.

(6) Remove air intake hose.

(7) Remove air charge pipe together with air charge hose.

(8) Remove hydraulic cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(9) Remove viscous heater hose and set aside.

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. SERVICE VEHICLE IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL.

(10) Remove fuel high pressure lines and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

(11) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

NOTE: Rotate engine on crankshaft. DO NOT crank the engine at the bolt of the camshaft sprocket.

NOTE: DO NOT crank engine back.

TIMING CHAIN COVER (Continued)

(12) Position piston of cylinder 1 to ignition TDC. **Markings on the camshaft bearing cap must be aligned.**

(13) Install retaining lock for crankshaft/starter ring gear.

(14) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(15) Release rail on bracket.

(16) Remove coolant thermostat (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).

(17) Remove cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(18) Remove belt pulley of power steering pump.

NOTE: NO NOT open the air conditioning system.

(19) Unplug AC compressor electrical connector and unbolt AC compressor. Relocate in lower engine compartment **with out** opening the system.

(20) Detach the coolant hose to oil-water heat exchanger at crankcase.

(21) Detach and plug the transmission oil lines to oil-water heat exchanger.

(22) Detach coolant hoses on coolant pump.

(23) Remove water pump (Refer to 7 - COOLING/ENGINE/WATER PUMP - REMOVAL).

(24) Remove air charge pipe.

(25) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(26) Remove belt/pulley vibration damper.(Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

NOTE: Remove the bolts in area of timing case cover. Loosen all other oil pan bolts.

(27) Remove oil pan bolts.

(28) Remove M8 bolts of cylinder head on timing case cover.

(29) Remove timing case cover (Fig. 42).

(30) Remove remaining ancillary components attached to the timing case cover.

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during assembly.

(1) Inspect cylinder head gasket and oil pan gasket. If damaged, replace.

(2) Replace the front crankshaft seal (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - INSTALLATION).

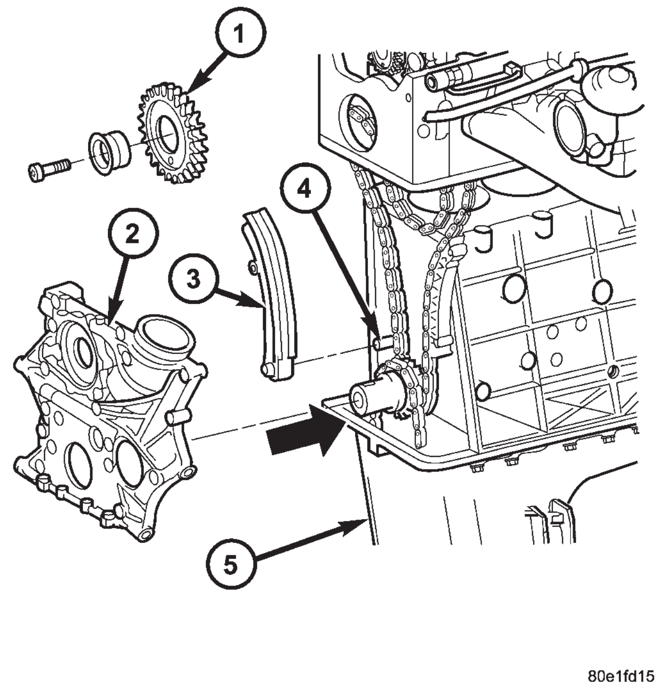


Fig. 42 TIMING CHAIN COVER

1 - INTERMEDIATE GEAR
2 - TIMING CHAIN COVER
3 - TENSIONING RAIL
4 - BEARING PIN
5 - OIL PAN

(3) Install ancillary components to timing case cover.

(4) Position and install timing case cover. Tighten bolts to 20 N·m (177 lbs in).

(5) Install the M8 bolts of cylinder head on timing case cover. Tighten bolts to 20 N·m (177 lbs in).

(6) Position and install the oil pan. Tighten M6 bolts to 9 N·m (80 lbs in) and M8 bolts to 20 N·m (177 lbs in).

(7) Install belt /pulley vibration damper. Tighten M8.8 bolt in two stages, 200N·m (147 lbs ft.) then 90°, M10.9 bolt 325N·m (240 lbs ft) then 90°.

(8) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(9) Install air charge pipe (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).

(10) Install water pump (Refer to 7 - COOLING/ENGINE/WATER PUMP - INSTALLATION).

(11) Connect coolant hoses to water pump.

(12) Connect the transmission oil lines to oil-water heat exchanger.

(13) Connect coolant hose to oil-water heat exchanger.

TIMING CHAIN COVER (Continued)

(14) Install the AC compressor and reconnect electrical connector.

(15) Install belt pulley onto power steering pump.

(16) Apply sealant to lower portain of, and install, front cover to cylinder block. Tighten bolts to 20N·m (177 lbs in) (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(17) Install coolant thermostat (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - INSTALLATION).

(18) Install rail on bracket.

(19) Install timing chain tensioner with new seal (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(20) Install fuel high pressure lines and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(21) Remove retaining lock for crankshaft/starter ring gear.

(22) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(23) Install hydraulic cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(24) Install viscous heater.

(25) Install air charge pipe with air charge hose (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).

(26) Install air intake hose.

(27) Fill coolant to the proper level, with the proper coolant (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(28) Tighten the oil drain plug to 30N·m (265 lbs in).

(29) Fill the crankcase with the correct oil, to the proper level. Refer to owners manual for specifications.

(30) Connect the negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

CAUTION: DO NOT pressure test cooling system until the engine reaches operating temperature.

(31) Start engine and inspect for leaks.

TIMING BELT/CHAIN AND SPROCKETS

REMOVAL

REMOVAL - BOTTOM GUIDE RAIL

(1) Disconnect negative battery cable.

(2) Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

NOTE: Oil pan DOES NOT need to be removed. Remove bolts in the area of timing case cover then loosen the remaining bolts.

NOTE: Remove timing case cover carefully. Care must be taken not to damage oil pan gasket.

(3) Remove timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(4) Remove guide rail from bearing pin (Fig. 43).

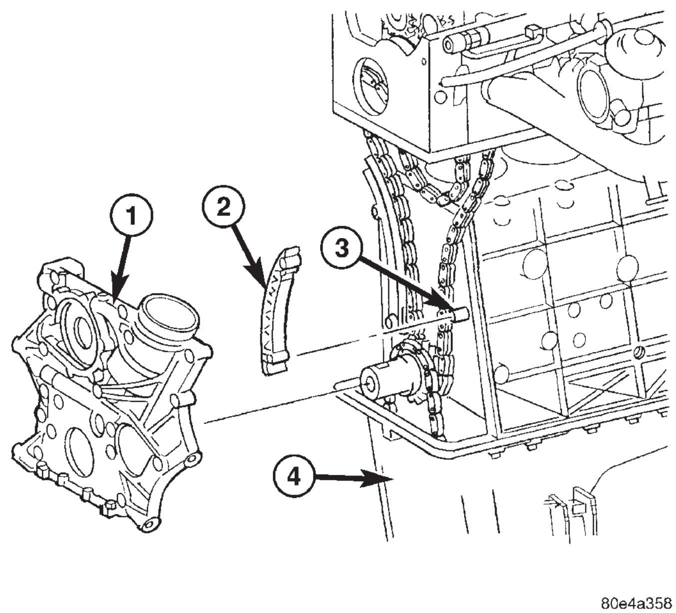


Fig. 43 BOTTOM GUIDE RAIL

1 - TIMING CHAIN COVER
2 - BOTTOM SLIDE RAIL
3 - BEARING PIN
4 - OIL PAN

TIMING BELT/CHAIN AND SPROCKETS (Continued)

REMOVAL - INTERMEDIATE GEAR

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

WARNING: NO FIRE, FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(3) Remove fuel high pressure lines injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
(4) Clean injectors and recesses (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).
(5) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(6) Insert locking pin through first camshaft bearing cap into hole in inlet camshaft sprocket to lock inlet camshaft.
(7) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(8) Remove cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(9) Remove top slide rail (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(10) Remove high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).
(11) Mark camshaft sprocket relative to timing chain.
(12) Unbolt camshaft sprocket from exhaust camshaft.

NOTE: Note position of dowel pin for camshaft sprocket alignment during reassembly.

(13) Secure camshaft sprocket to timing chain with tie strap.
(14) Remove camshaft sprocket.
(15) Remove intermediate gear and bushing (Fig. 44).

REMOVAL - TIMING CHAIN TENSIONING RAIL

(1) Disconnect negative battery cable.
(2) Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

NOTE: Oil pan DOES NOT need to be removed. Remove bolts in the area of timing case cover then loosen the remaining bolts.

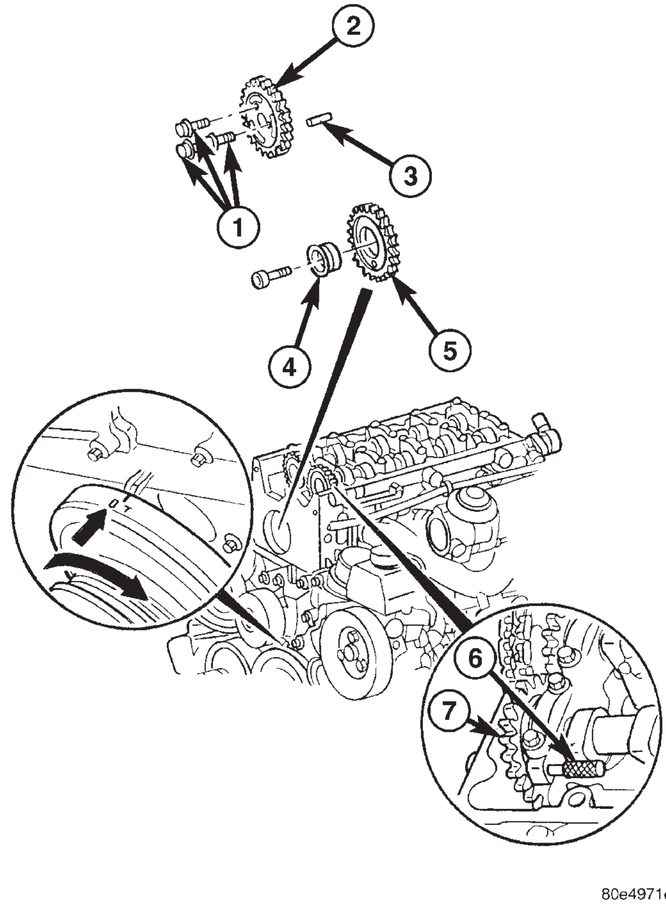


Fig. 44 HIGH RESSURE PUMP INTERMEDIATE GEAR

1 - CAMSHAFT SPROCKET BOLTS
2 - INTAKE CAMSHAFT
3 - DOWEL PIN
4 - INTERMEDIATE GEAR BUSHING
5 - INTERMEDIATE GEAR
6 - CAMSHAFT LOCKING PIN
7 - INTAKE CAMSHAFT SPROCKET

NOTE: Remove timing case cover carefully. Care must be taken not to damage oil pan gasket.

(3) Remove timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
(4) Remove tensioning rail from bearing pin (Fig. 45).

REMOVAL - TIMING CHAIN

(1) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(2) Remove vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - REMOVAL).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

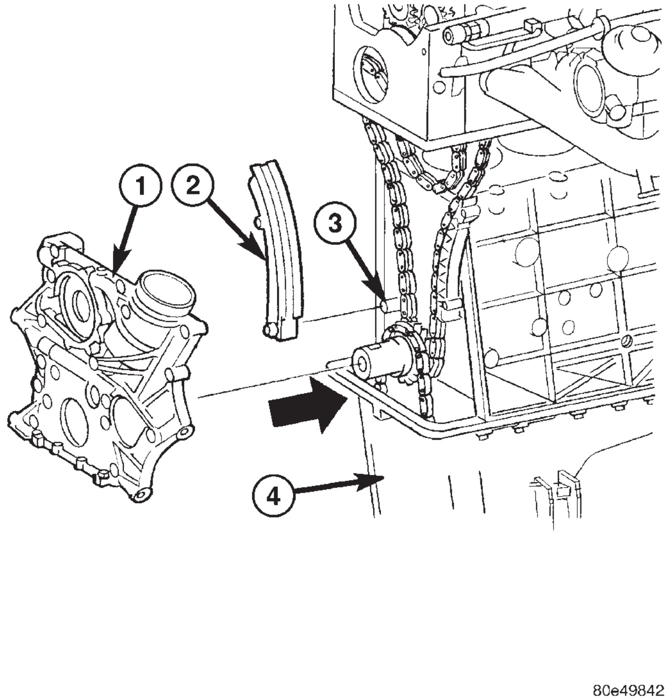


Fig. 45 TIMING CHAIN TENSIONING RAIL

1 - TIMING CHAIN COVER
2 - TENSIONING RAIL
3 - BEARING PIN
4 - OIL PAN

(3) Remove low pressure fuel pump and drive (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ FUEL INJECTION PUMP - REMOVAL).

(4) Remove guide rail in cylinder head (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(5) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

CAUTION: Cover timing case recess to prevent foreign material from entering engine.

(6) Secure timing chain to camshaft sprocket with tie straps (Fig. 46).

(7) Remove camshaft sprocket with timing chain attached, from camshaft.

NOTE: When fitting the thrust spindle, ensure that the thrust pin is positioned at the left timing chain pin of a chain link (Fig. 47).

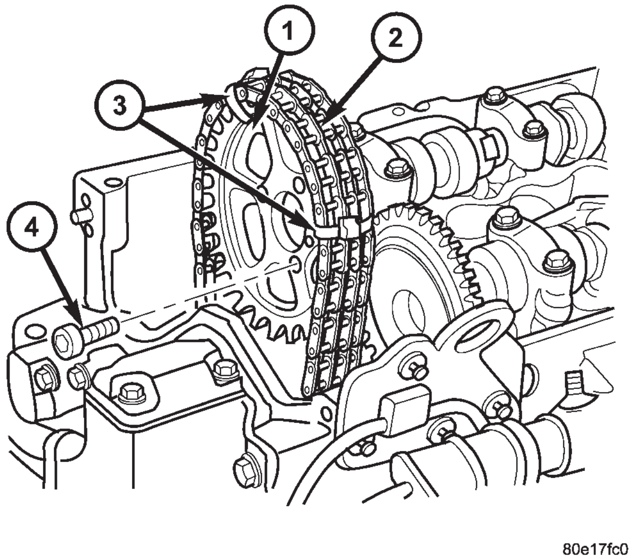


Fig. 46 SECURING TIMING CHAIN TO SPROCKET

1 - CAMSHAFT SPROCKET
2 - TIMING CHAIN
3 - TIE STRAPS
4 - RETAINING BOLTS

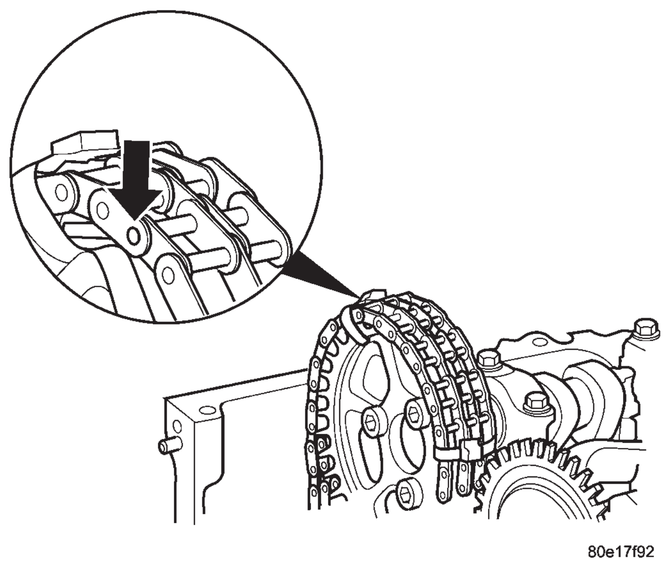


Fig. 47 THRUST PIN POSITION

(8) Using special tool #8948, position timing chain separating tool at the timing chain of the camshaft sprocket (Fig. 48).

(9) Screw the thrust pin in and separate the timing chain.

(10) Unscrew the thrust spindle and remove the tool.

NOTE: DO NOT detach timing chain from camshaft sprocket.

TIMING BELT/CHAIN AND SPROCKETS (Continued)

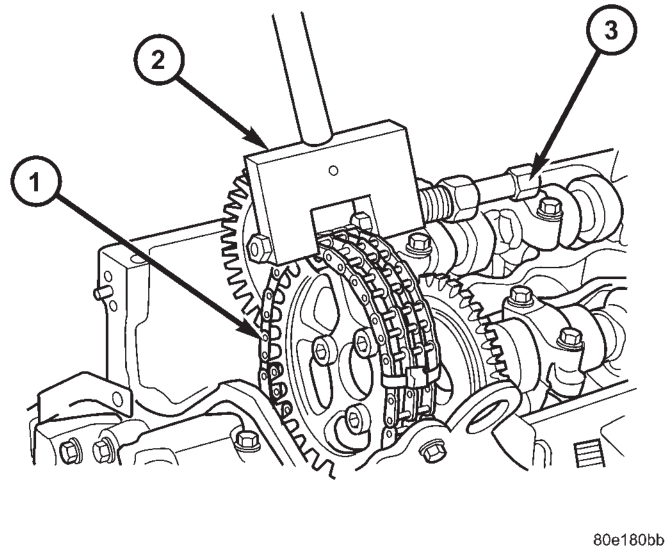


Fig. 48 SEPARATING TIMING CHAIN WITH SPECIAL TOOL #8948

1 - TIMING CHAIN
2 - SPECIAL TOOL #8948
3 - THRUST SPINDLE

(11) Install camshaft sprocket with timing chain, to camshaft.

(12) Remove pressed - out timing chain pin from chain separation tool.

(13) Attach special tool 8931, timing chain retainer, to cylinder head with bolts supplied (Fig. 49).

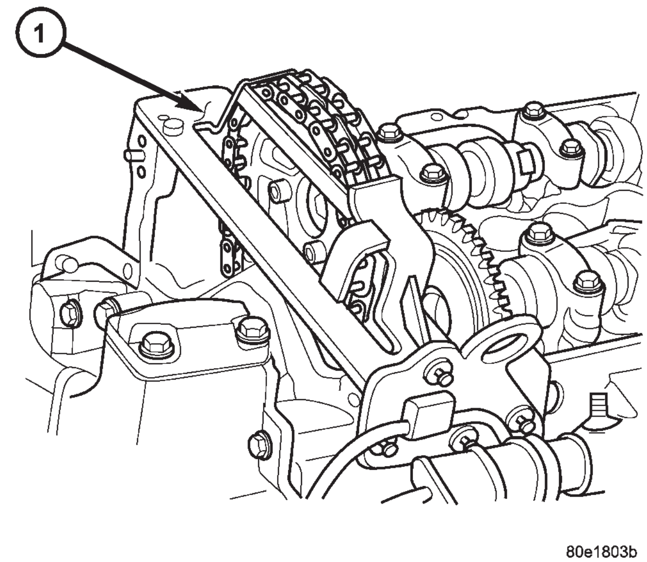


Fig. 49 SPECIAL TOOL # 8931

1 - SPECIAL TOOL #8931

(14) Remove timing chain to camshaft sprocket tie straps.

(15) Connect new timing chain and old timing chain with assembly link, assembly plate and locking element, and secure (Fig. 50) (Fig. 51).

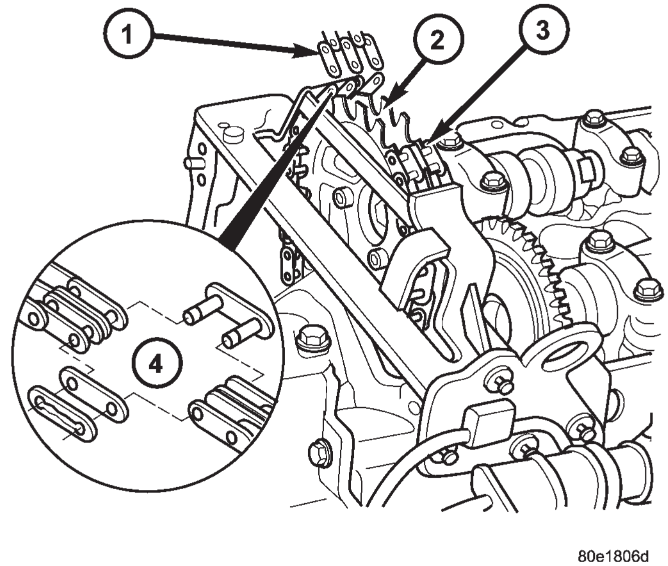


Fig. 50 INSTALLING TEMPORARY LINK

1 - NEW TIMING CHAIN
2 - CAMSHAFT SPROCKET
3 - OLD TIMING CHAIN
4 - TEMPORARY LINK

CAUTION: IT IS ESSENTIAL that the installation procedure for the timing chain is followed exactly. Failure to do so will result in severe engine damage.

INSTALLATION

INSTALLATION - BOTTOM GUIDE RAIL

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

(1) Install slide rail on bearing pin.

(2) Install timing cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(3) Install oil pan bolts. Tighten M6 bolts to 9N·m (80 lbs.in.) and M8 bolts to 20N·m (15 lbs. ft.).

(4) Install cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION).

(5) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start the engine and inspect for leaks.

TIMING BELT/CHAIN AND SPROCKETS (Continued)

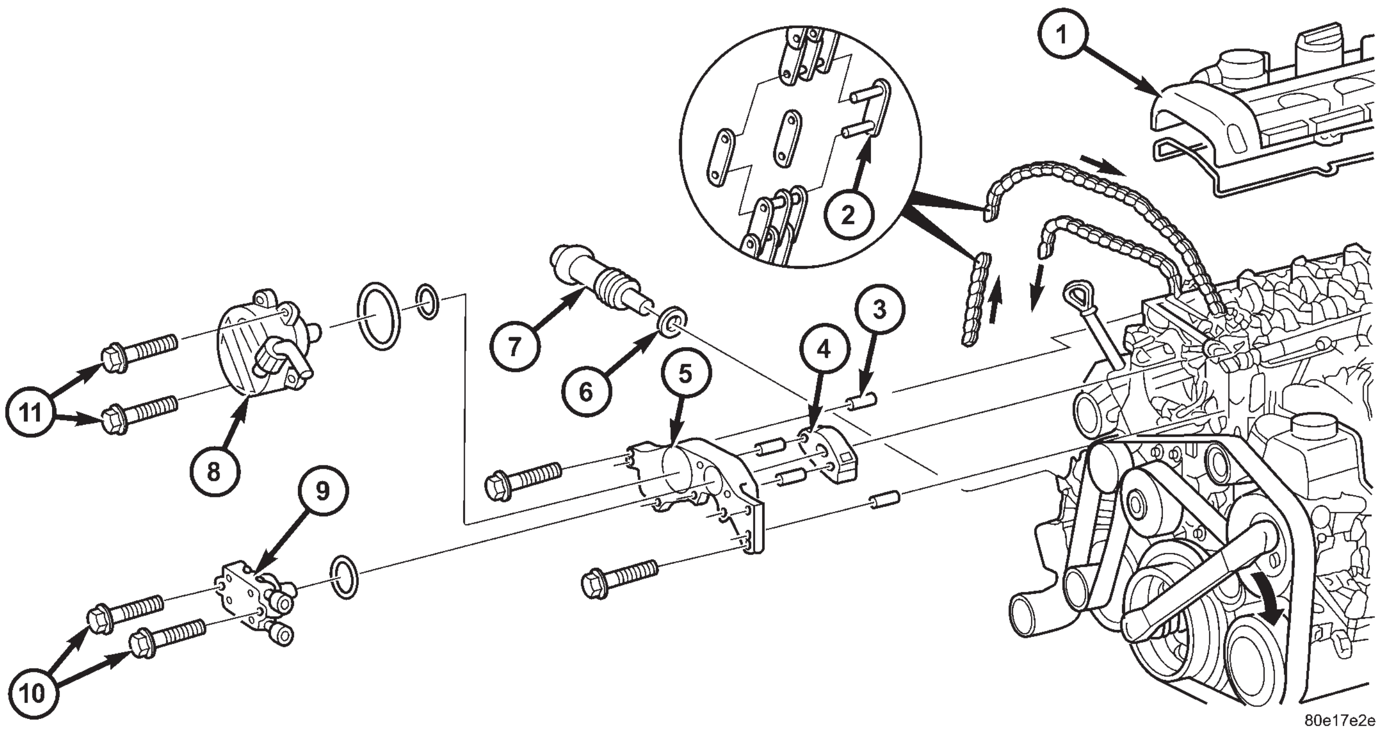


Fig. 51 TIMING CHAIN TEMPORARY LINK

1 - CYLINDER HEAD COVER
2 - TIMING CHAIN TEMPORARY LINK
3 - ALIGNMENT PINS
4 - TOP GUIDE RAIL
5 - CYLINDER HEAD FRONT COVER
6 - TIMING CHAIN TENSIONER SEAL
7 - TIMING CHAIN TENSIONER
8 - VACUUM PUMP
9 - LOW PRESSURE FUEL PUMP
10 - LOW PRESSURE PUMP MOUNTING BOLTS
11 - VACUUM PUMP MOUNTING BOLTS

INSTALLATION - INTERMEDIATE GEAR

NOTE: Refer to appropriate injector servicing procedures for cleaning of injectors and recesses.

(1) Install intermediate gear and bushing. Tighten bolt to 40N·m (30 lbs.ft.)

(2) Install camshaft sprocket, noting dowel pin alignment. Tighten bolt to 18 N·m (159 lbs. in.).

(3) Remove tie strap retaining timing chain to sprocket.

WARNING: NO FIRE, FLAMES OR SMOKING. SERVIVE VEHICLE IN WELL VENTILATED AREA. RISK OF INJURY FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. WEAR PROTECTIVE CLOTHING.

(4) Install high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(5) Install top slide rail (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(6) Install cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(7) Install timing chain tensioner with new gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

NOTE: Inspect basic position of camshaft and reset if necessary.

(8) Remove camshaft locking pin.

(9) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

WARNING: NO FIRE, FLAMES OR SMOKING. SERVIVE VEHICLE IN WELL VENTILATED AREA. RISK OF INJURY FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. WEAR PROTECTIVE CLOTHING.

(10) Install fuel high pressure lines and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(11) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

(12) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(13) Start engine and inspect for leaks.

INSTALLATION - TIMING CHAIN TENSIONING RAIL

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

(1) Install tensioning rail on bearing pin
(2) Install timing cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
(3) Install oil pan bolts. Tighten M6 bolts to 9N·m (80 lbs.in.) and M8 bolts to 20N·m (15 lbs. ft.).
(4) Install cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION).
(5) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start the engine and inspect for leaks.

ADJUSTMENTS

INSTALLATION - TIMING CHAIN

CAUTION: IT IS ESSENTIAL that the installation procedure is followed exactly. Failure to do so will result in severe engine damage.

CAUTION: Cover timing case recesses to prevent foreign material from entering engine.

(1) Connect new timing chain and old timing chain with the assembly link, the assembly plate and the assembly locking element, and secure (Fig. 52).

NOTE: Always keep new timing chain meshed with camshaft sprocket.

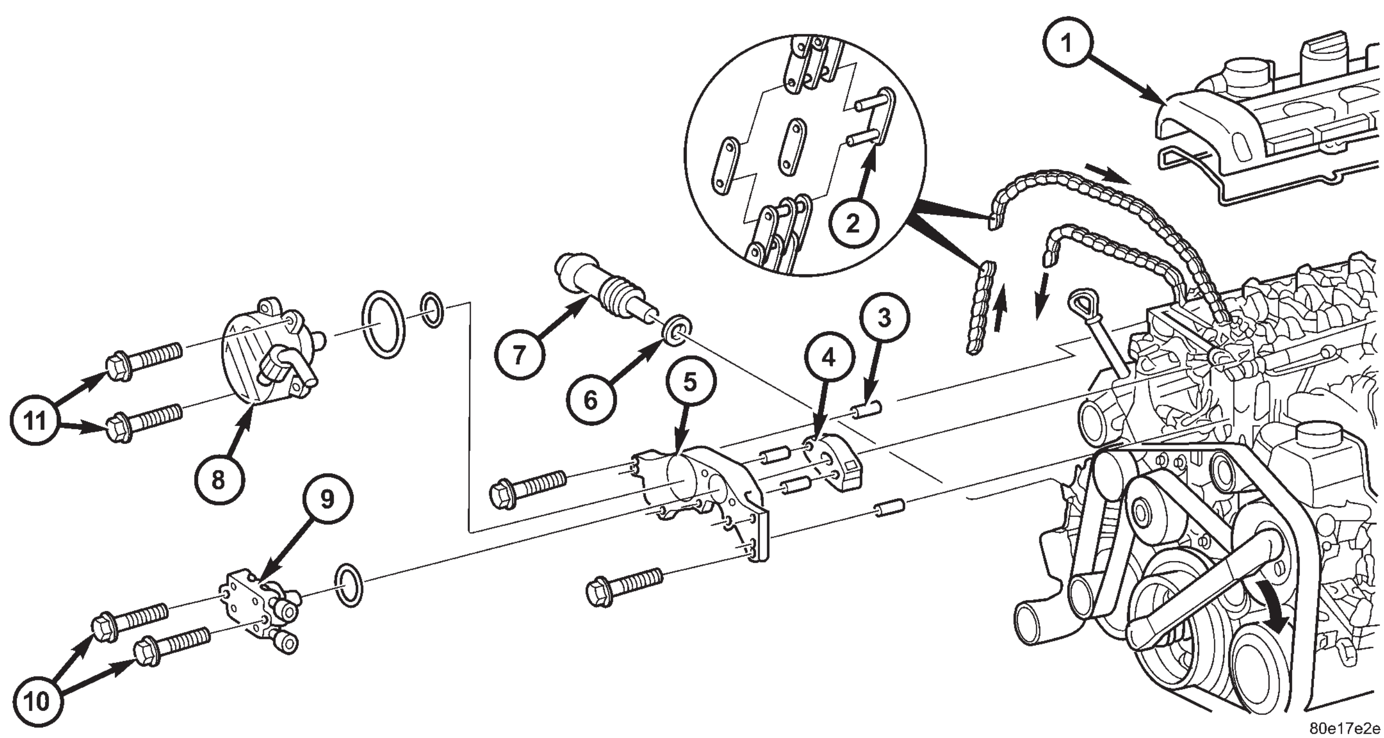


Fig. 52 TIMING CHAIN TEMPORARY LINK

1 - CYLINDER HEAD COVER
2 - TIMING CHAIN TEMPORARY LINK
3 - ALIGNMENT PINS
4 - TOP GUIDE RAIL
5 - CYLINDER HEAD FRONT COVER
6 - TIMING CHAIN TENSIONER SEAL
7 - TIMING CHAIN TENSIONER
8 - VACUUM PUMP
9 - LOW PRESSURE FUEL PUMP
10 - LOW PRESSURE PUMP MOUNTING BOLTS
11 - VACUUM PUMP MOUNTING BOLTS

TIMING BELT/CHAIN AND SPROCKETS (Continued)

NOTE: Rotate engine at crankshaft only. DO NOT crank engine and DO NOT rotate engine backward (Fig. 52).

NOTE: Draw out the end of old timing chain evenly as it becomes free, to the same extent that new timing chain is drawn in (Fig. 52).

(2) Draw in new timing chain by rotating the crankshaft slowly in direction of rotation of engine until the ends of the new timing chain meet and can be connected (Fig. 52).

NOTE: Assembly link is only an assembly aid and NOT designed for engine running.

(3) Remove assembly locking element, assembly outer plate and assembly link (Fig. 53).

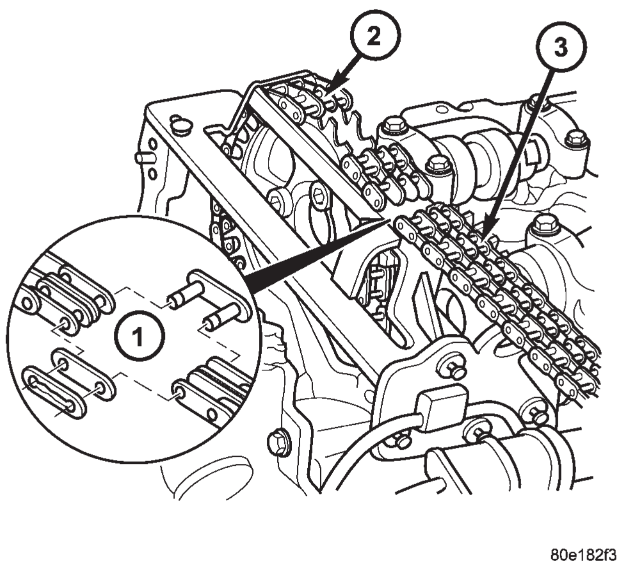


Fig. 53 REMOVING TEMPORARY LINK

1 - TEMPORARY LINK
2 - NEW TIMING CHAIN
3 - OLD TIMING CHAIN

(4) Attach new timing chain to camshaft sprocket and retain.
(5) Insert new riveted link and new middle plate into ends of timing chain (Fig. 54).
(6) Take off retaining devise at cylinder head.
(7) Remove camshaft sprocket from camshaft with timing chain secured.

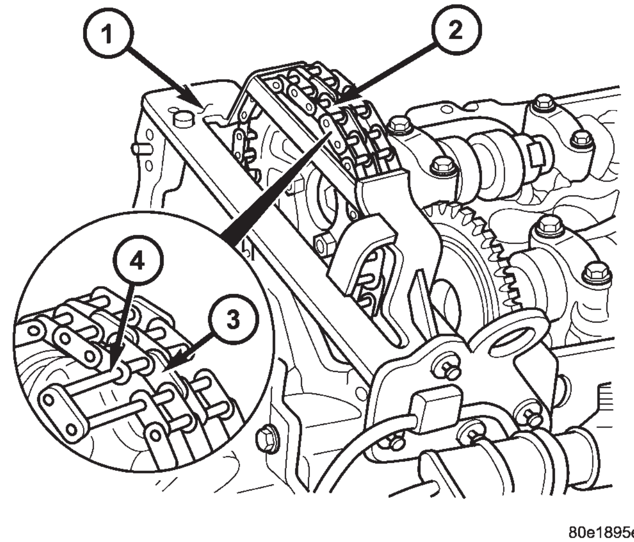


Fig. 54 INSERT NEW RIVETED LINK

1 - SPECIAL TOOL #8931
2 - NEW TIMING CHAIN ENDS
3 - NEW MIDDLE PLATE
4 - NEW RIVETED LINK

NOTE: When assembling riveting tool, piece F5 is secured by a screw and D9 can move loosely on thrust spindle

(8) Assemble riveting tool by inserting pieces F5 and D9 (Fig. 55).

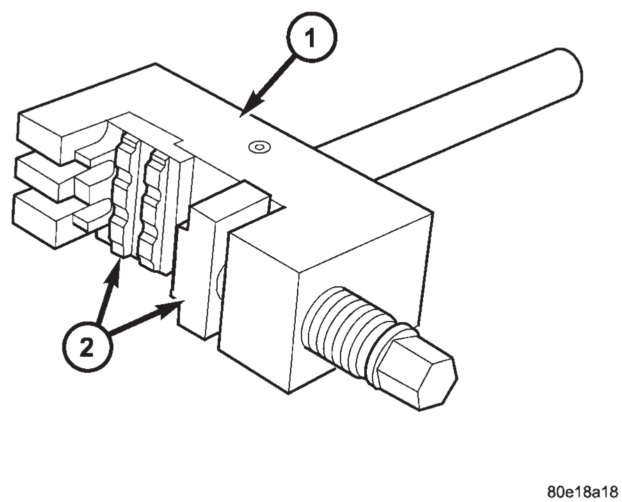


Fig. 55 INSTALLING ASSEMBLY INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8952

TIMING BELT/CHAIN AND SPROCKETS (Continued)

NOTE: Ensure that the riveted link and riveting tool are aligned.

(9) Press in new riveted link as far as the stop (Fig. 56).

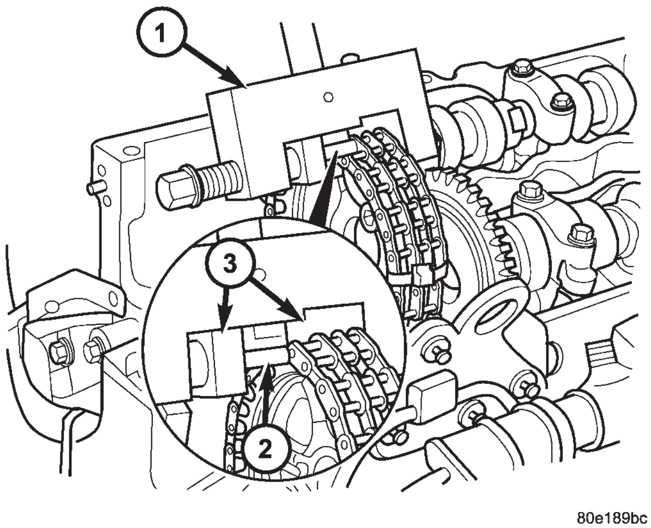


Fig. 56 PRESSING IN NEW RIVETED LINK

1 - SPECIAL TOOL #8947
2 - NEW RIVETED LINK
3 - SPECIAL TOOL #8952

(10) Remove riveting tool to change inserts.

(11) Install insert F1 on riveting tool and secure with screw (Fig. 57).

(12) Install insert D8 on riveting tool (Fig. 57).

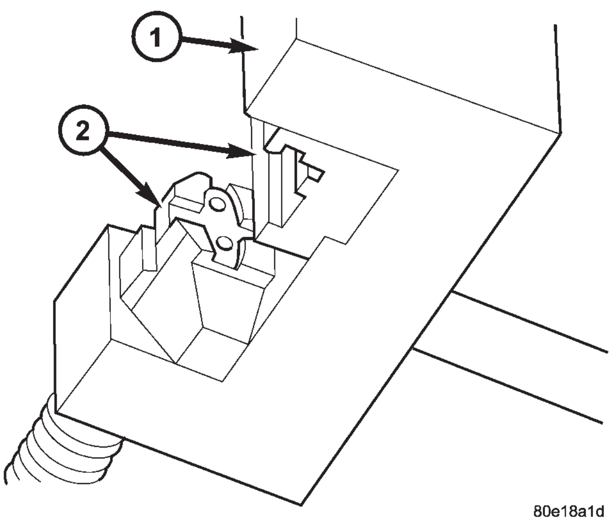


Fig. 57 INSTALLING RIVETING INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

NOTE: The outer plate is held magnetically by riveting tool.

(13) Insert new outer plate into the moving assembly insert.

(14) Position riveting tool so that spacer webs of the guide are side by side.

(15) Ensure that riveted link and outer plate are aligned (Fig. 58).

NOTE: When turning spindle of riveting tool, be sure that pins of riveted link are inserted into holes of outer plate (Fig. 58).

(16) Screw in spindle of riveting tool until firm resistance is felt (Fig. 58).

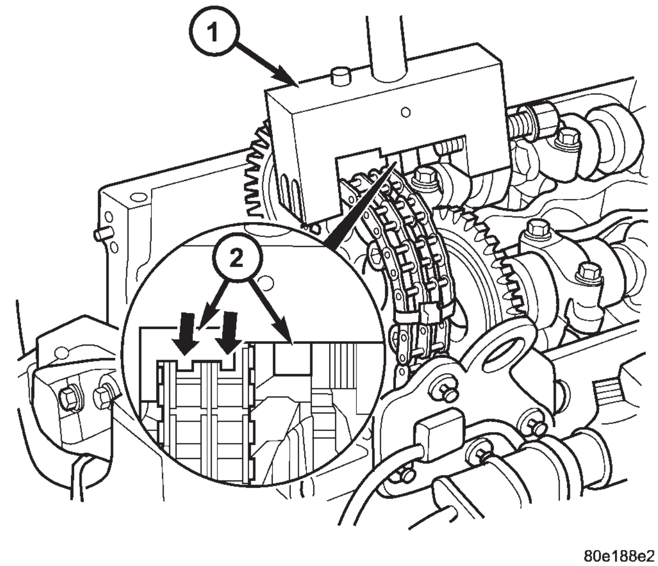


Fig. 58 INSTALLING LINK OUTER PLATE

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

TIMING BELT/CHAIN AND SPROCKETS (Continued)

(17) Remove riveting tool.

(18) Turn over moving assembly insert (D8) to the riveting profile.

(19) Position riveting tool exactly over middle of pin.

(20) Tighten riveting tool spindle to end of travel.

(21) Repeat procedure for both riveting pins (Fig. 59).

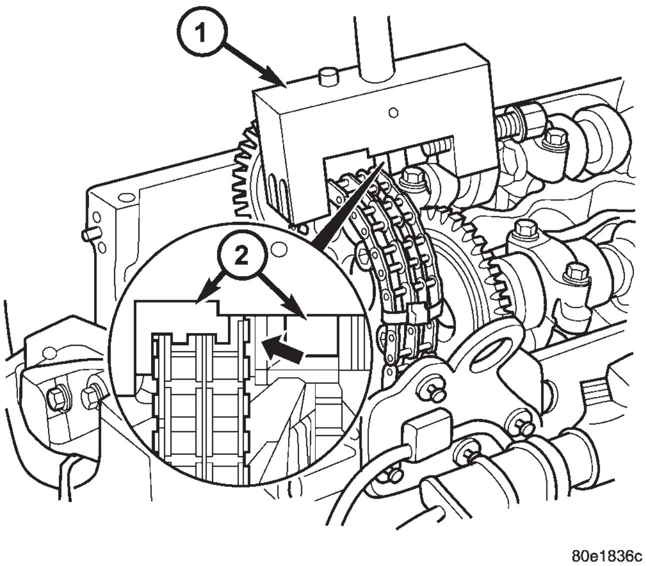


Fig. 59 RIVETING LINKS OF THE RIVETED LINK

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

(22) Inspect riveting, rerivet if required (Fig. 60).

(23) Install camshaft sprocket with timing chain retained onto camshaft. Tighten camshaft bolts to 18N·m (159 lbs.in.).

(24) Remove camshaft sprocket to timing chain tie straps.

(25) Install guide rail and tighten low pressure fuel pump drive to 50N·m (37 lbs. ft.).

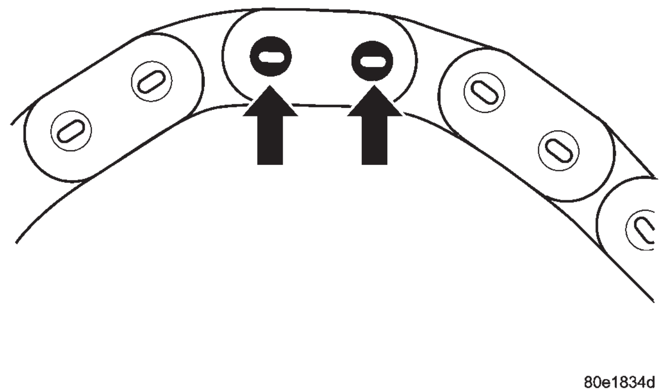


Fig. 60 RIVET INSPECTION

(26) Install low pressure fuel pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(27) Install timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(28) Install vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - INSTALLATION).

(29) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(30) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(31) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(32) Start engine and inspect for leaks.

TIMING CHAIN TENSIONER

REMOVAL

(1) Disconnect negative battery cable.

CAUTION: Rotate engine at crankshaft only. DO NOT rotate the engine with the bolt of the camshaft sprocket. DO NOT rotate the engine counter clockwise.

NOTE: Markings on the camshaft and camshaft bearing cap must be aligned.

(2) Position piston of number 1 cylinder to ignition TDC.
(3) Partially drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Remove viscous heater.
(5) Remove intake air scoop.
(6) Remove accessory drive belt and idler pulley above generator (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(7) Remove timing chain tensioner (Fig. 61).

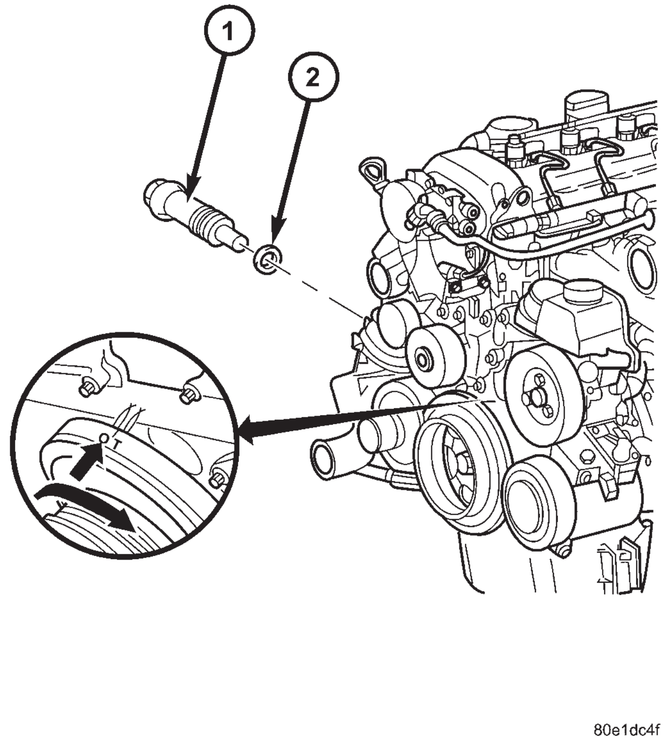


Fig. 61 TIMING CHAIN TENSIONER

1 - TIMING CHAIN TENSIONER
2 - TIMING CHAIN TENSIONER SEAL

INSTALLATION

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

(1) Install timing chain tensioner with new gasket. Tighten to 80N·m (59 lbs.ft.).
(2) Install viscous heater.
(3) Install idler pulley and accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(4) Install intake air scoop.
(5) Reconnect negative battery cable.
(6) Refill coolant system with correct mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(7) Start the engine and inspect for leaks.

EXHAUST SYSTEM AND TURBOCHARGER - 2.7L DIESEL

TABLE OF CONTENTS

EXHAUST SYSTEM AND TURBOCHARGER - 2.7L DIESEL

DESCRIPTION - 2.7L DIESEL

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The diesel engine exhaust system consists of an engine exhaust manifold, turbocharger, exhaust pipe, resonator, extension pipe (if needed), muffler and exhaust tailpipe.

The exhaust system must be properly aligned and secured to prevent stress, leakage and body contact. The exhaust components should be kept a minimum of 25.4 mm (1.0 in.) away from the body and frame. If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

DIAGNOSIS AND TESTING - DIESEL ENGINE

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten/replace clamps/bolts at leaking joints.
	2. Rusted or expanded muffler.	2. Replace muffler. Inspect exhaust system.
	3. Broken or rusted exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten/replace flange attaching nuts/bolts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten/replace exhaust manifold to cylinder head bolts.
	7. Turbocharger mounting flange cracked.	7. Remove turbocharger and inspect.
	8. Restriction in exhaust system.	8. Remove restriction, if possible. Replace restricted part if necessary.

TURBOCHARGER SYSTEM

DESCRIPTION

CAUTION: The turbocharger is a performance part and must not be tampered with. The wastegate bracket is an integral part of the turbocharger. Tampering with the wastegate components can reduce durability by increasing cylinder pressure and thermal loading due to incorrect inlet and exhaust manifold pressure. Poor fuel economy and failure to meet regulatory emissions laws may result. Increasing the turbocharger boost WILL NOT increase engine power.

The turbocharger used on this vehicle is of the variable turbine type (Fig. 1). These turbochargers use the entire exhaust energy to boost efficiency of the turbocharger and the engine.

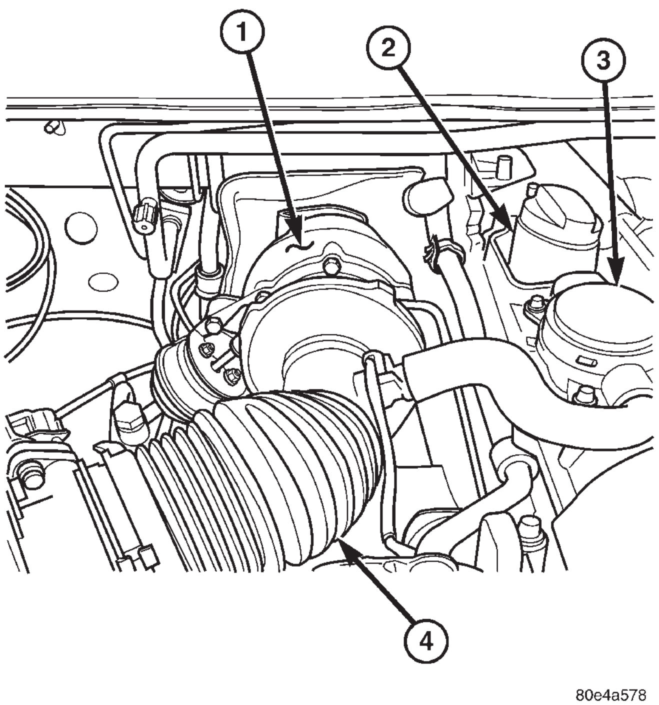


Fig. 1 TURBOCHARGER LOCATION

1 - TURBOCHARGER
2 - CYLINDER HEAD COVER
3 - OIL SEPARATOR
4 - AIR INLET TUBE
5 - WASTEGATE ACTUATOR

The advantages of a turbocharger with variable turbine geometry are:

- Higher charge pressure already in the lower and in upper engine speed ranges.
- Higher torque as a result of improved cylinder charge.
- Reduction in exhaust emissions as a result of an improvement in the air supply of the engine.
- Increased power output as a result of the higher charge pressure combined with a reduced exhaust backpressure and thus improved charge cycle.

OPERATION

The exhaust gases of the engine are directed through the exhaust manifold into the turbine housing onto the turbine wheel (Fig. 2). The flow energy of the exhaust gases cause the turbine wheel to rotate. Consequently, the compressor wheel, which is connected through the turbine shaft with the turbine wheel, is driven at the same speed. The fresh air inducted by the compressor wheel is compressed and passed to the engine (Fig. 2).

The charge pressure is controlled by varying the position of the guide vanes (Fig. 2). The guide stud of the control linkage of the boost pressure actuator turns the adjusting ring in the turbine housing (Fig. 2). As a result, all the guide vanes whose guide studs likewise mesh into the adjusting ring, are also turned (Fig. 2).

At low speeds, the flow cross-section is reduced by closing the guide vanes (Fig. 2). Consequently the speed at which the exhaust gas impacts on the turbine wheel is increased, as a result of which the speed of the turbocharger and thus the charge pressure rises.

At high engine speeds the guide vanes are increasingly opened and the flow cross-section is thus enlarged, as a result of which the speed of the turbocharger reduces and the charge pressure drops.

REMOVAL - TURBOCHARGER

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOL. CARE SHOULD BE TAKEN WHEN WORKING NEAR THE TURBOCHARGER. THE TEMPERATURE OF THE TURBOCHARGER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

NOTE: THERE IS NO PROCEDURE FOR REPAIRING THE TURBOCHARGER. IF DAMAGE IS FOUND DURING INSPECTION, THE TURBOCHARGER MUST BE REPLACED.

(1) Disconnect negative battery cable.

(2) Disconnect oil separator hose from turbocharger air inlet hose.

TURBOCHARGER SYSTEM (Continued)

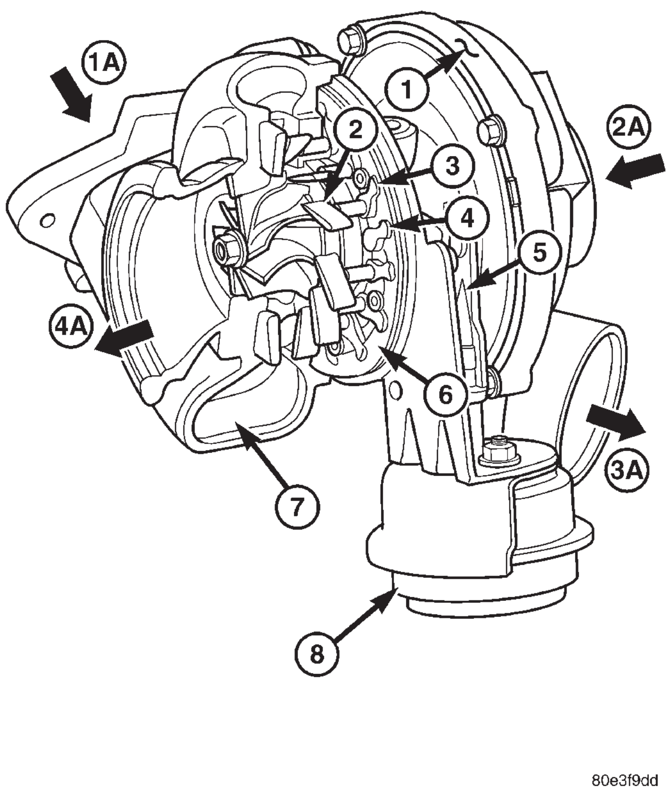


Fig. 2 TURBOCHARGER COMPONENTS

1 - COMPRESSOR HOUSING
2 - GUIDE VANE
3 - GUIDE STUD OF GUIDE VANE
4 - GUIDE STUD OF CONTROL LINKAGE
5 - CONTROL LINKAGE
6 - ADJUSTING RING
7 - TURBINE HOUSING
8 - CHARGE PRESSURE CONTROL UNIT
1A - EXHAUST GASES TO TURBINE WHEEL
2A - TURBO INLET (FRESH AIR)
3A - TURBO OUTLET (COMPRESSED AIR)
4A - EXHAUST OUTLET

(3) Disconnect MAF inlet tube from turbocharger.
(4) Disconnect charge air inlet tube at turbocharger.
(5) Disconnect charge air inlet tube to turbocharger housing support bracket.
(6) Disconnect wastegate motor vacuum hose.
(7) Disconnect turbocharger to charge air lower support bracket.
(8) Disconnect turbocharger upper and lower oil lines and capture lost fluid.
(9) Remove the exhaust down pipe to turbocharger spring clamp and separate.
(10) Remove turbocharger from support bracket.

INSTALLATION

(1) Position and install the turbocharger on the lower support bracket.
(2) Position exhaust down pipe to turbocharger and secure with clamp.
(3) Reconnect turbocharger oil lines with new seals.
(4) Connect waste gate solenoid vacuum hose.
(5) Connect charge air inlet tube to turbocharger housing support bracket.
(6) Connect charger air inlet tube.
(7) Connect MAF intake tube.
(8) Connect oil separator tube to MAF intake tube.
(9) Connect negative battery cable.

WASTEGATE

REMOVAL - WASTE GATE SOLENOID

(1) Disconnect negative battery cable.
(2) Disconnect waste gate solenoid electrical connector.
(3) Disconnect engine vacuum harness from waste gate solenoid (Fig. 3).
(4) Remove waste gate solenoid from bracket (Fig. 3).

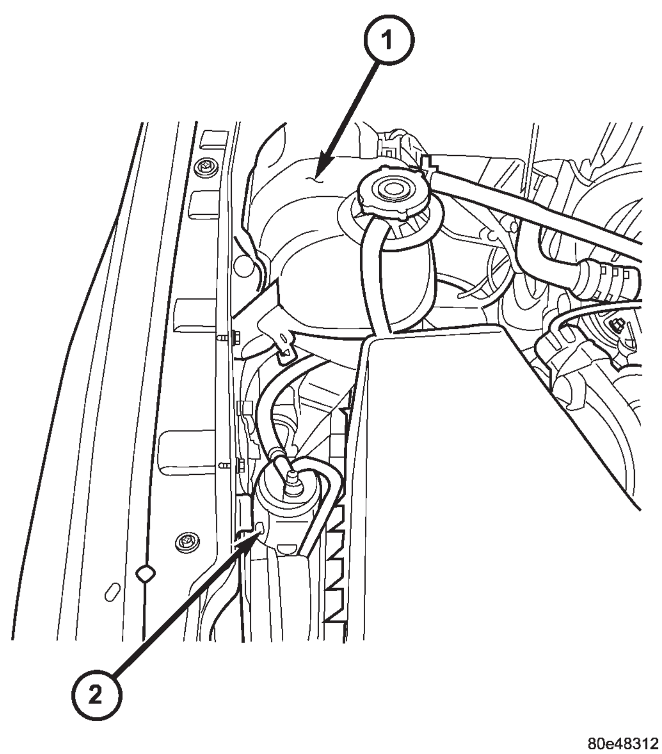


Fig. 3 WASTEGATE SOLENOID LOCATION

1 - COOLANT PRESSURE CONTAINER
2 - WASTEGATE SOLENOID

WASTEGATE (Continued)

INSTALLATION

(1) Position and install waste gate solenoid onto bracket.

(2) Connect engine vacuum harness to waste gate solenoid

(3) Connect waste gate solenoid electrical connector.

(4) Connect negative battery cable.

CHARGE AIR COOLER AND PLUMBING

DESCRIPTION

The charge air system consists of the charge air cooler and charge air cooler piping.

The charge air cooler is a heat exchanger that uses air flow from vehicle motion to dissipate heat from the intake air. As the turbocharger increases air pressure, the air temperature increases. Lowering the intake air temperature increases engine efficiency and power.

OPERATION

Intake air is drawn through the air cleaner and into the turbocharger compressor housing. Pressurized air from the turbocharger then flows forward through the charge air cooler located in front of the radiator. From the charge air cooler the air flows back into the intake manifold.

DIAGNOSIS AND TESTING - CHARGE AIR COOLER SYSTEM - LEAKS

Low turbocharger boost pressure and low engine preformance can be caused by leaks in the charge air cooler or it's plumbing. The following procedure outlines how to check for leaks in the charge air cooler system.

(1) Loosen clamp and remove turbocharger to air inlet duct rubber sleeve from turbocharger.

(2) Insert Special Tool 8442 Adapter into the rubber sleeve. Tighten existing clamp to 8 N·m (72 in.lbs.).

CAUTION: Do not apply more than 138 kpa (20 psi) air pressure to the charge air cooler system, sever damage to the charge air cooler system may occur.

(3) Connect regulated air supply to air fitting on Special Tool 8442 Adapter. Set air pressure to a Maximum of 138 kpa (20 psi).

(4) Using soapy water check the air inlet ducts, rubber sleeves, charge air cooler and intake manifold for leaks.

REMOVAL - CHARGE AIR COOLER

WARNING: IF THE ENGINE WAS JUST TURNED OFF, THE AIR INTAKE SYSTEM TUBES MAY BE HOT.

NOTE: Note the location of the rubber air charge cooler to A/C condenser and air charger cooler to radiator air seals. The seals are use to prevent overheating and improve charge air and A/C efficiency.

(1) Disconnect the battery negative cables.

(2) Remove cooling module (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).

(3) Remove the front grill.

(4) Mark the position of the radiator upper cross member and remove cross member.

(5) Unbolt the transmission auxiliary cooler and power steering cooler from the charge air cooler and set aside.

(6) Remove the boost tubes from the charge air cooler.

(7) Remove power steering reservoir retaining bolt, and set reservoir aside.

(8) Remove the charge air cooler bolts.

NOTE: Care must be taken not to damage the charge air cooler fins and the fins of other ancillary cooler components.

(9) Pivot the charge air cooler rearward and up to remove.

CLEANING

CAUTION: Do not use caustic cleaners to clean the charge air cooler. Damage to the charge air cooler will result.

NOTE: If internal debris cannot be removed from the cooler, the charge air cooler MUST be replaced.

(1) If the engine experiences a turbocharger failure or any other situation where oil or debris get into the charge air cooler, the charge air cooler must be cleaned internally.

(2) Position the charge air cooler so the inlet and outlet tubes are vertical.

(3) Flush the cooler internally with solvent in the direction opposite of normal air flow.

(4) Shake the cooler and lightly tap on the end tanks with a rubber mallet to dislodge trapped debris.

(5) Continue flushing until all debris or oil are removed.

CHARGE AIR COOLER AND PLUMBING (Continued)

(6) Rinse the cooler with hot soapy water to remove any remaining solvent.

(7) Rinse thoroughly with clean water and blow dry with compressed air.

INSPECTION

Visually inspect the charge air cooler for cracks, holes, or damage. Inspect the tubes, fins, and welds for tears, breaks, or other damage. Replace the charge air cooler if damage is found.

Pressure test the charge air cooler, using Charge Air Cooler Tester Kit.

INSTALLATION - CHARGE AIR COOLER

(1) Position the power steering reservoir along with charge air cooler. Install the bolts and tighten to 2 N·m (17 in. lbs.).

(2) Install cooling module (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION) (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(3) Install the transmission auxiliary cooler (if equipped) (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - INSTALLATION).

(4) Install the power steering cooler.

(5) Install the boost tubes to the charge air cooler. With the clamps in position, tighten the clamps to 11 N·m (95 in. lbs.)

(6) Align and install upper cross member.

(7) Install the front grill (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(8) Connect the battery negative cable.

(9) Start engine and check for leaks.

FUEL SYSTEM

TABLE OF CONTENTS

FUEL INJECTION

TABLE OF CONTENTS

CAMSHAFT POSITION SENSOR

DESCRIPTION

The camshaft position sensor is mounted on the cylinder head cover (Fig. 1). The sensor detects the camshaft position contactlessly (hall effect) by means of a segment at the camshaft. The electronic control module (ECM) detects TDC position of cylinder 1 by means of the signal supplied by the camshaft sensor. Injection timing is synchronized by means of the camshaft signal and the crankshaft signal.

OPERATION

The signal circuit of the camshaft sensor has a voltage of approximately 5V. If the segment machined into the exhaust camshaft sprocket is positioned opposite the camshaft sensor, the camshaft signal is approximately 0V. This 0V to 5V signal is used by the engine control module (ECM) for detecting ignition TDC of cylinder 1 as the engine rotates. If no signal is supplied by the camshaft position sensor, the vehicle will not start.

REMOVAL

(1) Disconnect negative battery cable.

CAMSHAFT POSITION SENSOR (Continued)

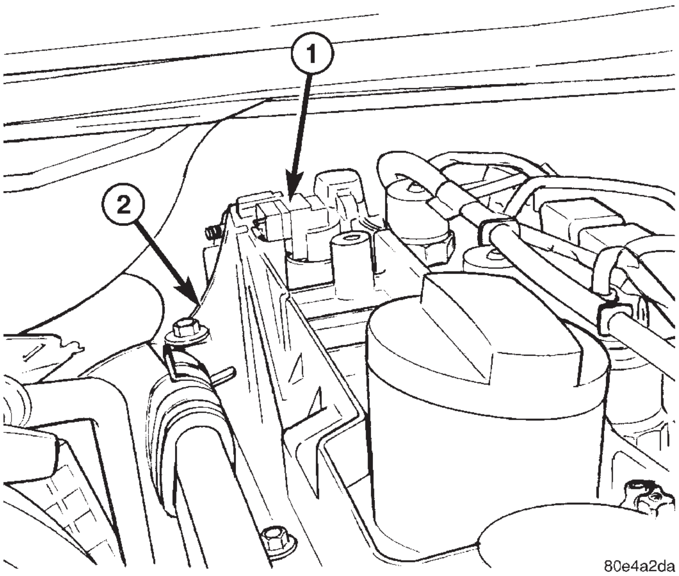


Fig. 1 CAMSHAFT POSITION SENSOR LOCATION

1 - CAMSHAFT POSITION (CMP) SENSOR
2 - CYLINDER HEAD COVER

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Disconnect camshaft position sensor electrical connector.

(4) Remove retaining bolt and remove sensor.

INSTALLATION

(1) Install camshaft position sensor and tighten bolt.

(2) Reconnect electrical connector.

(3) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(4) Reconnect negative battery cable.

CRANKSHAFT POSITION SENSOR

DESCRIPTION

The crankshaft position sensor is located at the left rear of the engine just above the starter motor (Fig. 2). This sensor is used to detect engine speed.

OPERATION

The crankshaft position and engine speed are detected contactlessly. The distance between the crankshaft position sensor and the teeth of the driven plate is fixed by the installation position.

When the crankshaft rotates, an alternating voltage is generated in the crankshaft position sensor by the teeth of the driven plate.

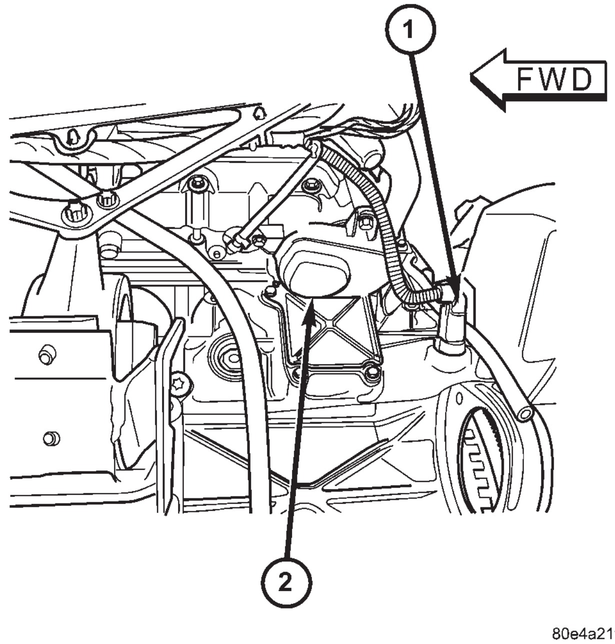


Fig. 2 SENSOR LOCATION

1 - CRANKSHAFT POSITION SENSOR
2 - SWIRL ACTUATOR

In this case, the front edge of a tooth generates a positive voltage pulse and the rear edge a negative voltage pulse. The distance from the positive to the negative voltage peak equals the length of a tooth.

The gap created by 2 missing teeth (arrow) has the effect that no voltage is generated in the crankshaft position sensor. This is analyzed in order to detect the TDC position of cylinder 1

FUEL PRESSURE SENSOR

DESCRIPTION

The rail sensor monitors and passes on the current rail pressure to the control module (Fig. 3). The non-constant system pressure influences the position of the sensor diaphragm which alters the sensors electrical resistance.

OPERATION

The rail pressure sensor measures the current rail pressure and supplies an appropriate voltage signal to the Engine Control Module (ECM). The pressure control valve is then actuated by the ECM through a control loop until the desired rail pressure is reached.

FUEL PRESSURE SENSOR (Continued)

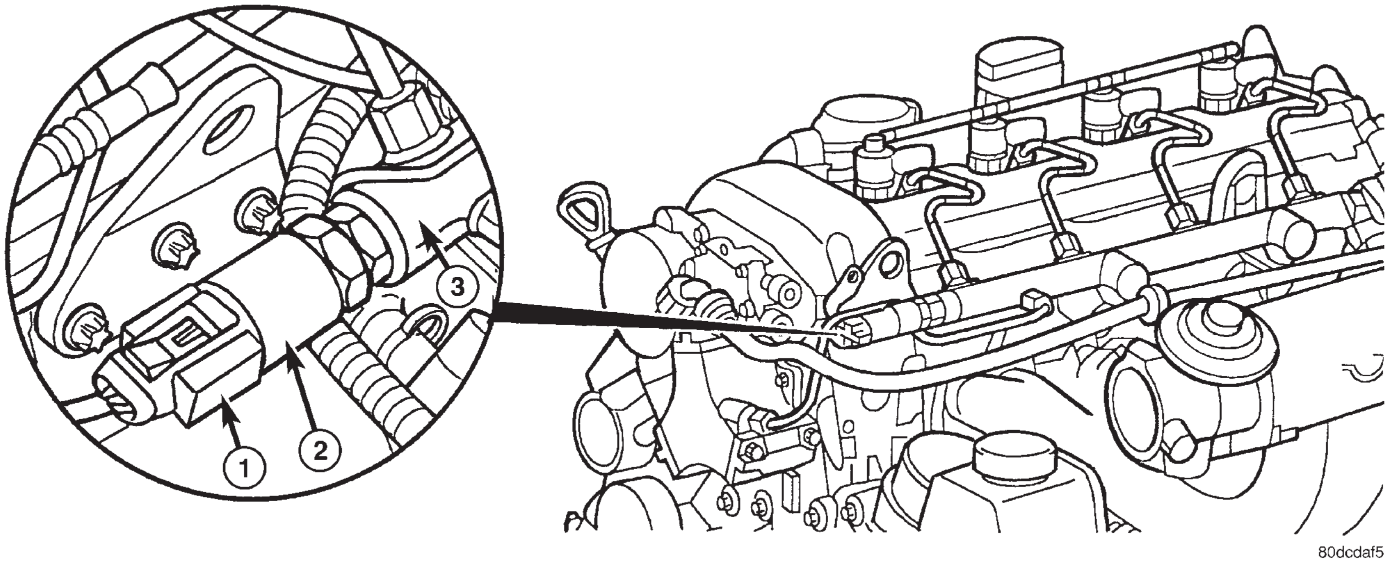


Fig. 3 FUEL PRESSURE SENSOR

1 - FUEL PRESSURE ELECTRICAL CONNECTOR
2 - FUEL PRESSURE SENSOR
3 - FUEL RAIL

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: To avoid leakage problems, the rail pressure sensor should not be removed unless it is to be replaced.

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Unplug electrical connector at rail pressure sensor (Fig. 3).

(4) Counterhold at the threaded connection of rail and remove rail pressure sensor.

INSTALLATION

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Coat sealing surface of fuel rail with lubricating varnish and replace seal.

(2) Counterhold at the threaded connection of the fuel rail and install the rail pressure sensor (Fig. 3). Tighten to 22N·m (194 lbs. in.).

(3) Connect rail sensor electrical connector (Fig. 3).

(4) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(5) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOU HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

FUEL INJECTOR

DESCRIPTION

FUEL INJECTOR

There are individual fuel injectors for all five cylinders. These fuel injectors are used to spray fuel into the combustion chamber (Fig. 4).

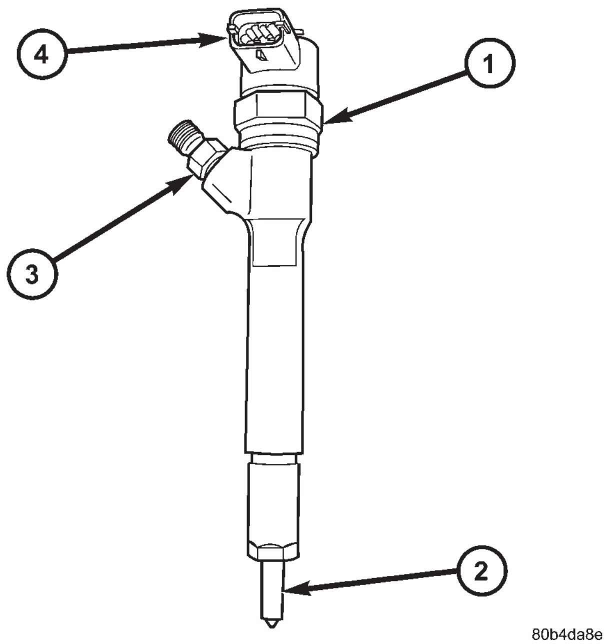


Fig. 4 FUEL INJECTOR

1 - FUEL INJECTOR
2 - NOZZLE
3 - FUEL INLET FITTING
4 - ELECTRICAL CONNECTION

OPERATION

The injector operation can be subdivided into four operating states with the engine running and the high-pressure pump generating pressure:

- Injector closed (with high pressure applied)
- Injector opens (start of injection)
- Injector opened fully
- Injector closes (end of injection)

Injector closed (with high pressure applied)

With the injector closed (at-rest state), the solenoid valve is not energized and is therefore closed. With the bleed orifice closed, the valve spring forces the armature's ball onto the bleed-orifice seat. The rail's high pressure build up in the valve control chamber, and the same pressure is also present in the nozzle's chamber volume. The rail pressure applied at the control plunger's end face, together with the force of the nozzle spring, maintain the nozzle in the closed position against the opening forces applied to its pressure stage (Fig. 5).

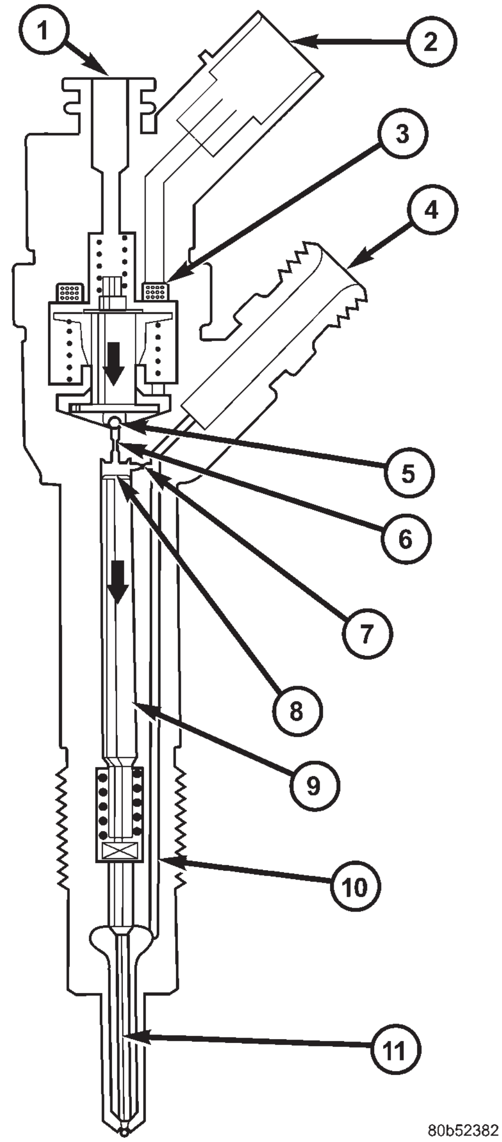


Fig. 5 INJECTOR COMPONENTS

1 - INJECTOR CLOSED (AT-REST STATUS)
2 - ELECTRICAL CONNECTION
3 - TRIGGERING ELEMENT (SOLENOID VALVE)
4 - FUEL INLET (HIGH PRESSURE) FROM THE RAIL
5 - VALVE BALL
6 - BLEED ORIFICE
7 - FEED ORIFICE
8 - VALVE CONTROL CHAMBER
9 - VALVE CONTROL PLUNGER
10 - FEED PASSAGE TO THE NOZZLE
11 - NOZZLE NEEDLE

Injector opens (start of injection)

The solenoid valve is energized with the pickup current which serves to ensure that it open quickly.

FUEL INJECTOR (Continued)

The force exerted by the triggered solenoid now exceeds that of the valve spring and the armature opens the bleed orifice. Almost immediately, the high-level pick-up current is reduced to the lower holding current required for the electromagnet. This is possible due to the magnetic circuit's air gap now being smaller. When the bleed orifice opens, fuel can flow from the valve control chamber into the cavity situated above it, and from there via the fuel return to the tank. The bleed orifice prevents complete pressure balance, and the pressure in the valve control chamber sinks as a result. This leads to the pressure in the valve-control chamber being lower than that in the nozzle's chamber volume which is still at the same pressure level as the rail. The reduced pressure in the valve-control chamber causes a reduction in the force exerted on the control plunger, the nozzle needle open as a result, and injection starts (Fig. 5).

Injector opens fully

The control plunger reaches its upper stop where it remains supported by a cushion of fuel which is generated by the flow of fuel between the bleed and feed orifices. The injector nozzle has now opened fully, and the fuel is injected into the combustion chamber at a pressure almost equal to that in the fuel rail (Fig. 5).

Injector closes (end of injection)

As soon as the solenoid valve is no longer triggered, the valve spring forces the armature downwards and the ball closes the bleed orifice. The armature is a 2–piece design. Here, although the armature plate is guided by a driver shoulder in its downward movement, it can "overspring" with the return spring so that it exerts no downwards-acting forces on the armature and the ball. The closing of the bleed orifice lead to pressure build up in the control chamber via the input from the feed orifice. This pressure is the same as that in the rail and exerts an increased force on the control plunger through its end face. This force, together with that of the spring, now exceeds the force exerted by the chamber volume and the nozzle needle closes. Injection ceases as soon as the nozzle needle comes up against its bottom stop again (Fig. 5).

STANDARD PROCEDURE - CLEANING FUEL INJECTORS

NOTE: Before cleaning the injector recesses, seal the injector holes in the injector recesses with the appropriate pin to prevent debris from falling into the recesses and entering the motor.

(1) Seal the injector holes inside the cylinder head recesses.
(2) Wipe out injector recesses with a non - woven cloth, then clean with a cylinder brush.
(3) Clean the bottom of the cylinder recess with a round brush.
(4) Blow out the recess and clean again with a non - woven cloth and cover over.
(5) Perform these steps for each injector recess.

NOTE: DO NOT clean the tip of the injector with a wire brush. Use a non - woven cloth.

(6) Clean injector body with a wire brush.
(7) Clean injector tips with a non -woven cloth.
(8) Grease injector body with anti seize lubricant.

NOTE: Always replace the seals that seal off the injectors at the cylinder head to the combustion chamber and replace the retaining screws.

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: The engine must be lowered in the vehicle to remove the fourth and fifth cylinders fuel injectors.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) **If the fourth or fifth injectors are being replaced the engine must be supported and the engine mount through bolts removed. Lower engine down in engine compartment until injectors can be removed.**
(4) Unplug injector electrical connectors.

NOTE: Counterhold injection lines with wrench socket at threaded connections of injectors.

(5) Remove injector high pressure lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - REMOVAL).
(6) Press in locking clamps and detach injector return lines.
(7) Remove tension claw at injectors.

FUEL INJECTOR (Continued)

NOTE: If injectors are tight, remove with extraction claw in place of tensioning claw. If extraction claw contacts cylinder head cover, remove cylinder head cover. If necessary, remove injectors with threaded adaptor and discard injector.

(8) Remove injectors (Fig. 6).

(9) Clean injectors and recesses (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

INSTALLATION

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Clean injectors and recesses (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

(2) Coat injector body with anti seize lubricant then install injectors with new seals.

(3) Install tensioning claws with new screws at injectors. Tighten screws in two stages, 7 N·m (62 lbs. in.) then 90°.

NOTE: If locking clamp has been pulled off at injector, the locking clamp must be replaced.

(4) Position fuel return line at injectors and secure locking clamps.

NOTE: Counterhold injection lines with wrench socket at threaded connections of injectors.

(5) Install high pressure injection lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - INSTALLATION).

(6) Reconnect injector electrical connectors.

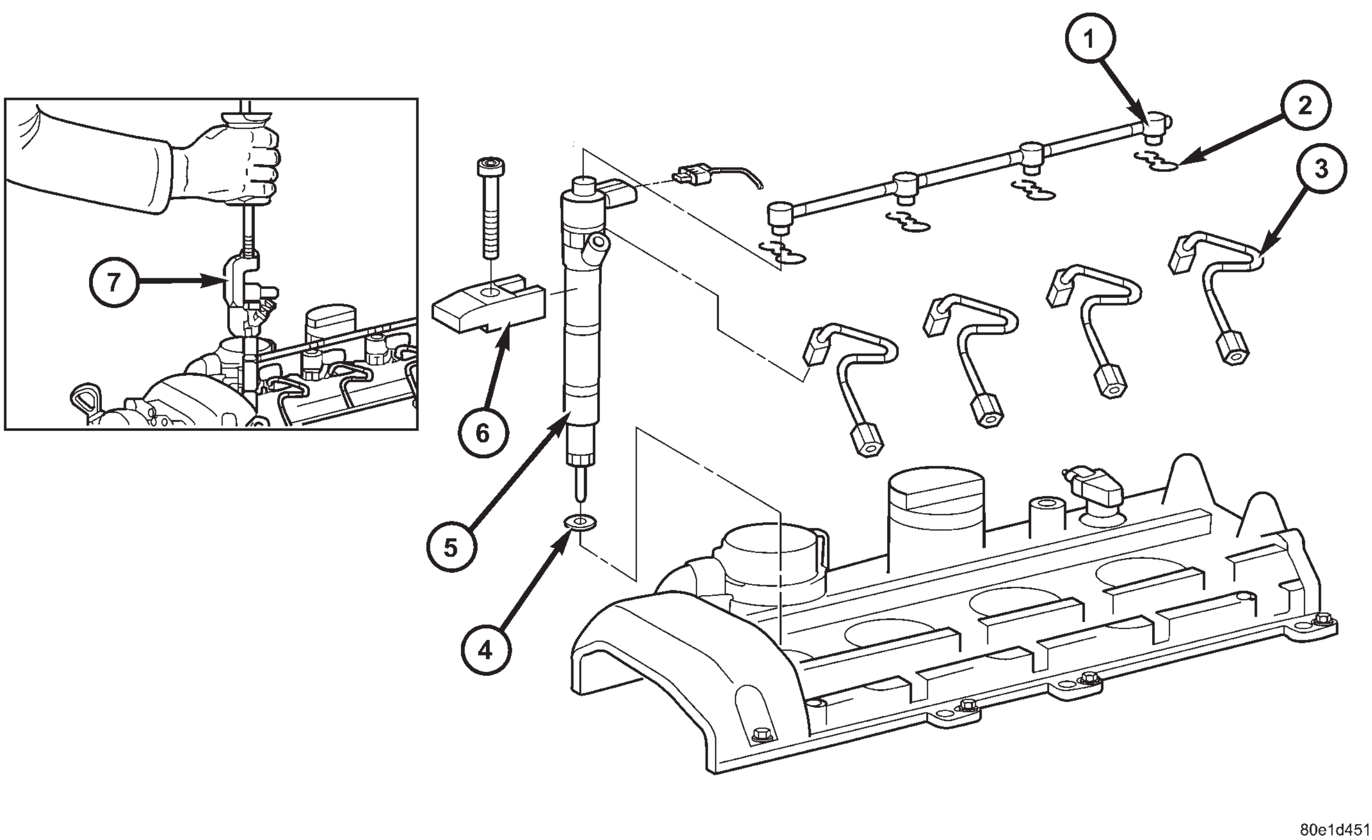


Fig. 6 FUEL INJECTOR REMOVAL/INSTALLATION

1 - INJECTOR RETURN LINES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

FUEL INJECTOR (Continued)

(7) **If injectors four and five were replaced raise engine back in position and install engine mount through bolts.**

(8) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(9) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(10) Start engine and inspect for leaks.

FUEL RAIL

DESCRIPTION

The fuel rail acts like a high pressure store. It is available to all injectors for drawing fuel which has been compressed by the injection pump. The rail pressure sensor, rail pressure solenoid, high pressure line, and the return flow line are attached to the fuel rail (Fig. 7).

OPERATION

The stored fuel volume inside the rail acts as a damper for pressure fluctuations which result because of pulsating supply and brief large extractions of fuel during injector firing. The rail primarily influences the atomization of fuel at the injector nozzle, and the accuracy of injected quantity during injection.

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Disconnect fuel rail pressure sensor and pressure control valve electrical connectors (Fig. 7).

(4)

CAUTION: When slackening and tightening fuel injection line union nuts, counter hold with wrench at threaded connection. ON NO ACCOUNT exceed the tightening torque at any time. Do NOT crimp or bend lines.

NOTE: After removing lines, seal connections and ensure cleanliness.

(5) Remove injector high pressure lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - REMOVAL) (Fig. 7).

(6) Remove pressure line of high pressure pump (Fig. 7).

NOTE: Note attention to the use of locking arm.

(7) Detach fuel return flow line to high pressure pump at rail (Fig. 7).

(8) Detach fuel return flow line to fuel filter at fuel filter (Fig. 7).

(9) Remove fuel rail (Fig. 7).

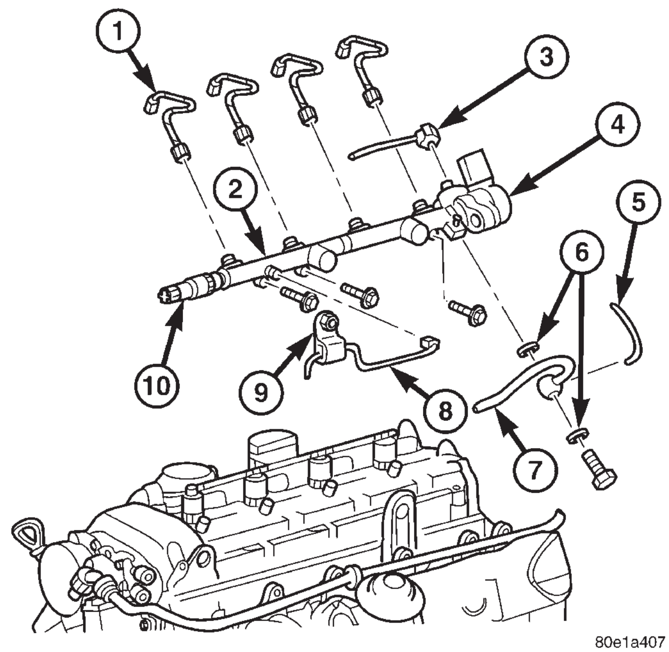


Fig. 7 FUEL PRESSURE SOLENOID

1 - INJECTION LINES
2 - FUEL RAIL
3 - FUEL RETURN LINE
4 - FUEL PRESSURE SOLENOID
5 - OIL LINE
6 - SEALS
7 - FUEL RETURN LINE AT COOLER
8 - HIGH PRESSURE FUEL LINE TO FUEL RAIL
9 - FUEL LINE BRACKET
10 - FUEL PRESSURE SENSOR

FUEL RAIL (Continued)

INSTALLATION

WARNING: NO FIRE, FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Position and loosely install fuel return line from fuel filter, with new seals to rail (Fig. 7).

(2) Position fuel rail to cylinder head, feed in high pressure line with new seals (Fig. 7).

(3) Tighten fuel rail bolts to 14 N·m (124 lbs.in.) (Fig. 7).

(4) Tighten nut of pressure line to high pressure pump/rail to 22N·m (194 lbs.in.).

(5) Tighten banjo bolt of fuel return line to fuel rail to 20N·m (177 lbs.in.).

CAUTION: Inspect sealing cones at the lines. Replace as necessary. Ensure that all fuel pressure lines are exactly located in original position.

(6) Install injector lines (Fig. 7). Tighten nut of pressure line to rail/injector to 22N·m (194 lbs.in.).

(7) Reconnect fuel rail pressure sensor and pressure control valve electrical connectors (Fig. 7).

(8) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(9) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(10) Start engine and inspect for leaks.

MANIFOLD AIR FLOW (MAF) SENSOR

DESCRIPTION

The Mass Air Flow (MAF) Sensor is mounted inline in the air intake between the air filter and the turbocharger (Fig. 8).

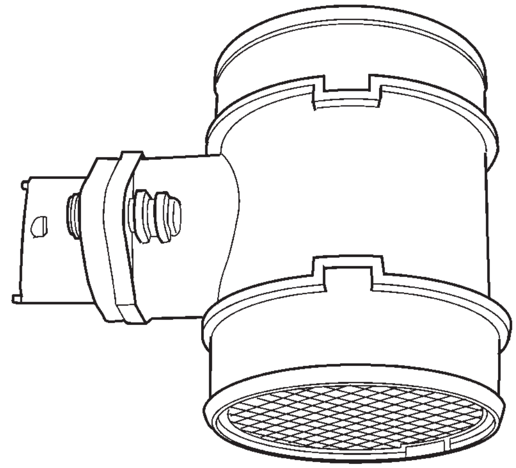


Fig. 8 MASS AIR FLOW (MAF) SENSOR

OPERATION

The ECM uses the mass air flow (MAF) sensor to measure air density. A signal voltage is provided to the MAF sensor that contains a ceramic element. As engine speed increases, air flow across the ceramic element increases. Changes in air flow and air density cause the temperature of the ceramic element to fluxuate. The ceramic element changes resistance respectively to changes in temperature. The change in resistance varies the signal voltage output to the ECM. The signal voltage is used by the ECM as a measure for the air mass supplied. The Diesel Power Relay supplies battery power the to MAF sensor, ground is provided by the ECM. The MAF sensor signal is provided by the ECM.

REMOVAL

(1) Disconnect negative battery cable.

(2) Disconnect mass air flow (MAF) sensor electrical connector (Fig. 9).

(3) Disconnect air inlet tube.

(4) Remove MAF to air cleaner housing retaining bolts and remove sensor (Fig. 9).

INSTALLATION

(1) Position mass air flow (MAF) sensor to air cleaner housing and tighten bolts (Fig. 9).

(2) Connect air inlet tube.

(3) Connect MAF sensor electrical connector (Fig. 9).

(4) Connect negative battery cable.

MANIFOLD AIR FLOW (MAF) SENSOR (Continued)

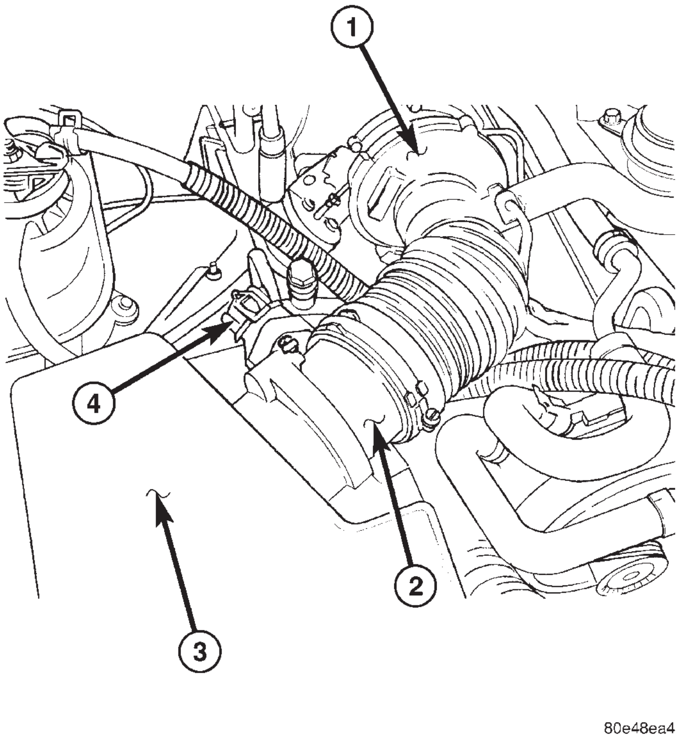


Fig. 9 MAF SENSOR LOCATION

1 - TURBOCHARGER
2 - MAF SENSOR
3 - AIR CLEANER HOUSING
4 - MAF SENSOR ELECTRICAL CONNECTOR

FUEL PRESSURE SOLENOID

DESCRIPTION

The fuel pressure solenoid is attached to the rear of the fuel rail. The solenoid controls and maintains the rail pressure constant along with a control current transmitted by the engine control module (ECM) (Fig. 10).

OPERATION

High pressure which is present in the fuel rail flows to the ball seat of the solenoid (Fig. 11). The specified pressure required by the system is built up in the rail by the fuel pressure solenoid building up a magnetic force which corresponds to this specific pressure by means of a control current from the electronic control module (ECM) (Fig. 11). This magnetic force equals a certain outlet cross section at the ball seat of the solenoid. The rail pressure is altered as a result of the quantity of fuel which flows off (Fig. 11). The current fuel pressure is signaled by the fuel pressure sensor to the engine control module (ECM). The controlled fuel flows back along the return fuel line, into the tank.

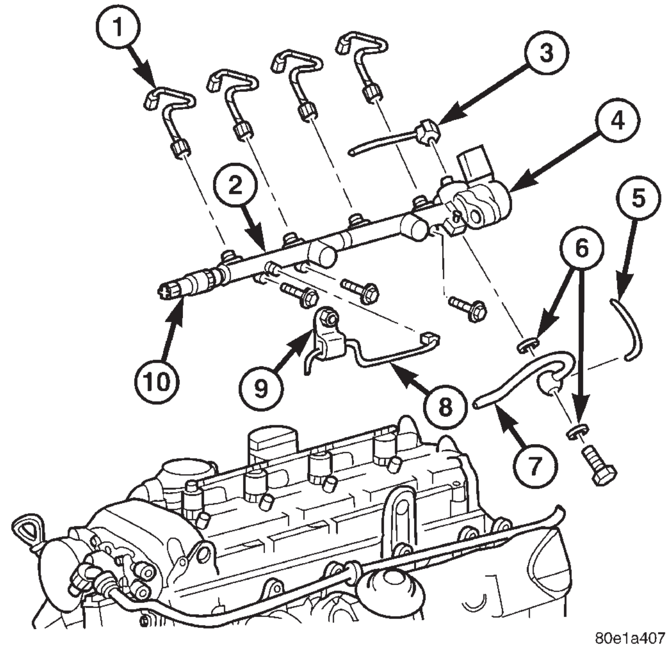


Fig. 10 FUEL PRESSURE SOLENOID

1 - INJECTION LINES
2 - FUEL RAIL
3 - FUEL RETURN LINE
4 - FUEL PRESSURE SOLENOID
5 - OIL LINE
6 - SEALS
7 - FUEL RETURN LINE AT COOLER
8 - HIGH PRESSURE FUEL LINE TO FUEL RAIL
9 - FUEL LINE BRACKET
10 - FUEL PRESSURE SENSOR

In a de-energized state, the fuel pressure solenoid is closed as the spring force presses the ball into the ball seat (Fig. 11). When driving, the fuel pressure solenoid is constantly open (Fig. 11). When engine is started, the fuel pressure solenoid is held closed by magnetic force (Fig. 11). When driving, the pressure of the fluid counteracts the magnetic force of the coil and the slight spring force (Fig. 11).

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

FUEL PRESSURE SOLENOID (Continued)

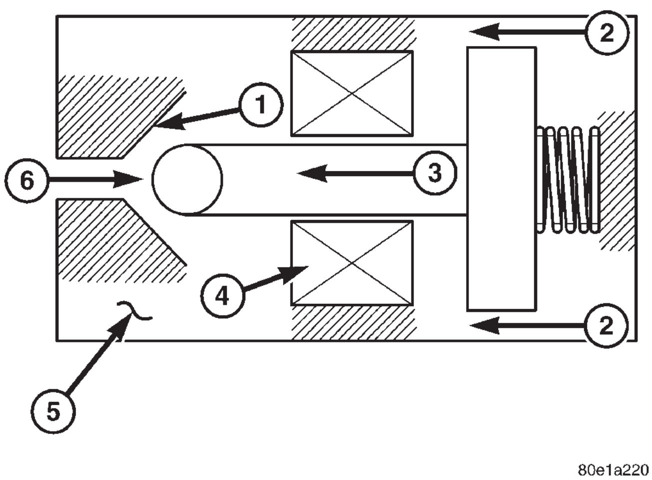


Fig. 11 FUEL PRESSURE SOLENOID OPERATION

1 - BALL SEAT
2 - SPRING FORCE
3 - MAGNETIC FORCE
4 - COIL
5 - FUEL PRESSURE SOLENOID
6 - HIGH PRESSURE FEED

(3) Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

(4) Clamp fuel rail securely in vise with protective jaws.

NOTE: Once removed, the pressure solenoid must always be replaced.

(5) Remove fuel pressure solenoid retaining screws and remove solenoid (Fig. 12).

INSTALLATION - FUEL PRESSURE SOLENOID

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Apply a thin film of special grease to the seals before installing. If the seals are damaged when being installed, an internal leak may occur which can not be recognized externally.

(1) Position fuel pressure solenoid to fuel rail and retain with screws. Tighten in two stages 3N·m (26 lbs. in.), then 5N·m (44 lbs. ft.).

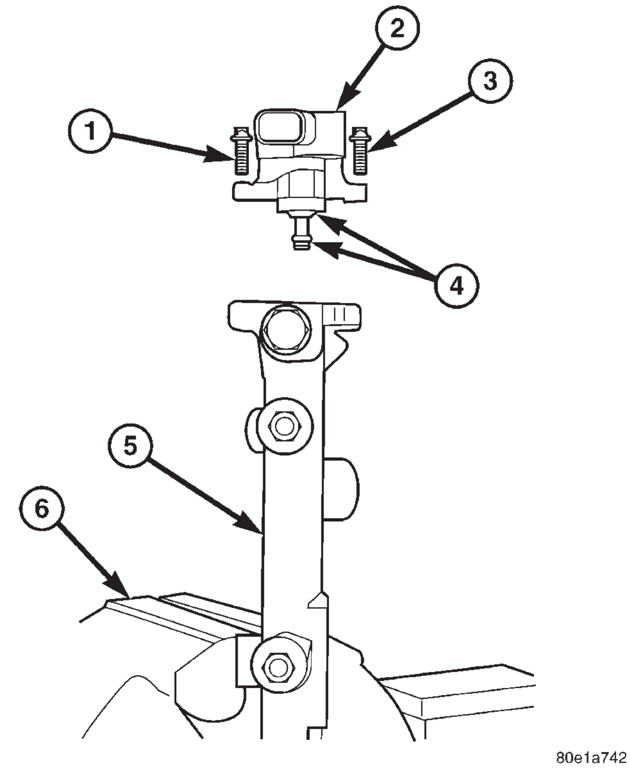


Fig. 12 FUEL PRESSURE SOLENOID ASSEMBLY

1 - RETAINING BOLT
2 - FUEL PRESSURE SOLENOID
3 - RETAINING BOLT
4 - O-RING LOCATION
5 - FUEL RAIL
6 - VISE

(2) Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(3) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(4) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS, OR FAN. DO NOT WEAR LOOSE CLOTHES.

(5) Start engine and inspect for leaks.

BOOST PRESSURE SENSOR

DESCRIPTION

The boost pressure sensor is mounted to the top of the intake manifold just above the intake air inlet (Fig. 13). The sensor allows the ECM to monitor air pressure within the intake manifold.

BOOST PRESSURE SENSOR (Continued)

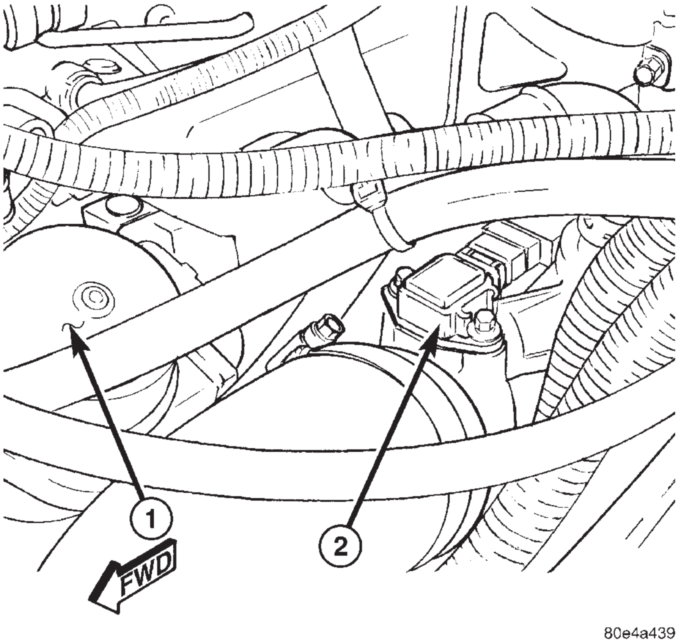


Fig. 13 BOOST PRESSURE SENSOR LOCATION

1 - OIL FILTER CAP
2 - BOOST PRESSURE SENSOR

OPERATION

When the intake manifold pressure is low (high vacuum) sensor voltage output is 0.25-1.8 volts at the ECM. When the intake manifold pressure is high due to turbo boost, sensor voltage output is 2.0-4.7 volts. The sensor receives a 5-volts reference from the ECM. Sensor ground is also provides by the ECM. The ECM uses boost pressure combined with intake air temerature to determine the volume of air entering the engine.

DIAGNOSIS AND TESTING - BOOST PRESSURE SENSOR

If the boost pressure sensor fails, the ECM records a DTC into memory and continues to operate the engine in one of the three limp-in modes. When the ECM is operating in this mode, a loss of power will be present, as if the turbocharger was not operating. The best method for diagnosing faults with the boost pressure sensor is with the DRB III® scan tool. Refer to the Diesel Powertrain Diagnostic Manual for more information.

Refer to On-Board Diagnostics in Emissions Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

INTAKE AIR TEMPERATURE SENSOR

DESCRIPTION

This sensor is also used to monitor the intake air temperature (Fig. 14).

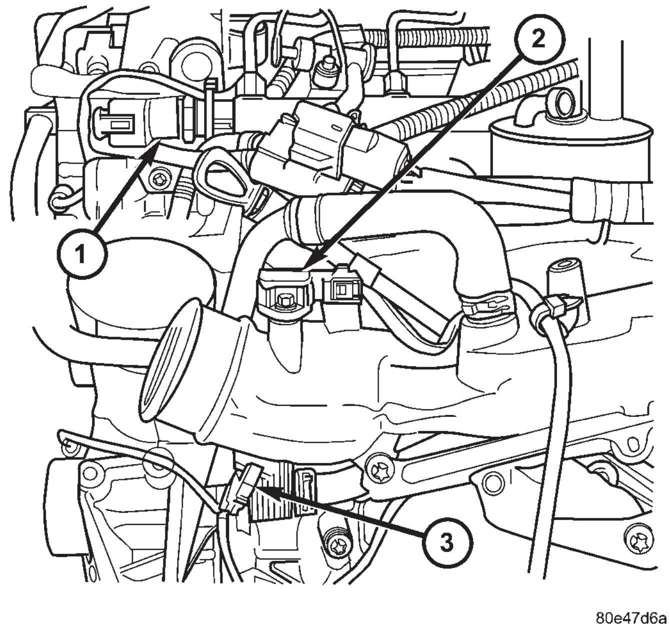


Fig. 14 SENSOR LOCATIONS

1 - FUEL PRESSURE SENSOR
2 - BOOST PRESSURE SENSOR
3 - INTAKE AIR TEMPERATURE SENSOR

OPERATION

The intake air temperature sensor is a negative temperature coefficient (NTC) thermistor (resistance varies inversly with temperature). This means at cold air temperature its resistance is high, sothe voltage signal will be high. As intake air temperature increases, sensor resistance decreases and the signal voltage will be low. This allows the sensor to provide an analog voltage signal (0.2-4.8 volts) to the ECM.

FUEL DELIVERY

TABLE OF CONTENTS

FUEL DELIVERY

STANDARD PROCEDURE - BLEEDING AIR FROM FUEL SYSTEM

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(2) Press locking ring at bleeder valve in direction of arrow and pull off seal.
(3) Press inlet connection into bleeder valve until it locks.
(4) Connect line between inlet connection and reservoir.
(5) Connect hand pump to vacuum side at reservoir.
(6) Operate hand pump until fuel flows through line free of bubbles.
(7) Press locking ring at bleeder valve in direction of arrow and detach inlet connection.
(8) Press seal into bleeder valve until it locks.
(9) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

FUEL FILTER / WATER SEPARATOR

DESCRIPTION

In order to assure trouble free operation with winter grade diesel fuel, a preheater valve is located with in the fuel filter. Depending on the temperature of the heated return flow fuel, fuel flows back through the preheating valve into the fuel filter to heat up or flows directly back into the fuel tank.

OPERATION

PRE - HEATING Up to 45°C (113°F), the thermo bimetal plate of the preheater, shuts off the return fuel flow port to the fuel tank. The fuel from the rail flows into the fuel filter to be warmed. If there is air in the system, a ball seals off a port and the air is directed to the fuel tank.

NON PRE - HEATING From above 45°C (113°F) the thermo bimetal plate of the preheater, shuts off the port to the fuel filter and fuel from the rail flows directly into the return flow line to the fuel tank.

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

FUEL FILTER / WATER SEPARATOR (Continued)

(1) Disconnect negative battery cable.
(2) Insert a suitable hose into the fuel drain port in rear of filter, turn drain port counterclockwise and drain fuel into a suitable and appropriately marked container.
(3) Disconnect fuel feed and return lines at fuel filter and set aside.
(4) Disconnect fuel heater electrical connector at fuel filter.
(5) Remove fuel filter retaining bracket bolt and remove fuel filter.

INSTALLATION

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Assure fuel filter drain port is closed.

(1) Connect fuel heater electrical connector.
(2) Position fuel filter in bracket and tighten retaining bolt.
(3) Connect fuel feed and return lines.
(4) Connect negative battery cable.
(5) Start engine and inspect for leaks.

FUEL PUMP

DESCRIPTION

DESCRIPTION - HIGH PRESSURE PUMP

The high pressure pump is a radial piston pump with three pistons arranged at an angle of 120°. The high pressure pump is driven at about 1.3 times the speed of the camshaft. The high pressure pump is mounted to the front of the cylinder head (Fig. 1).

DESCRIPTION - LOW PRESSURE PUMP

The low pressure pump (Fig. 2)supplies an adequate quantity of filtered fuel in all operating conditions from the fuel tank, at an adequate pressure, to the high pressure pump.

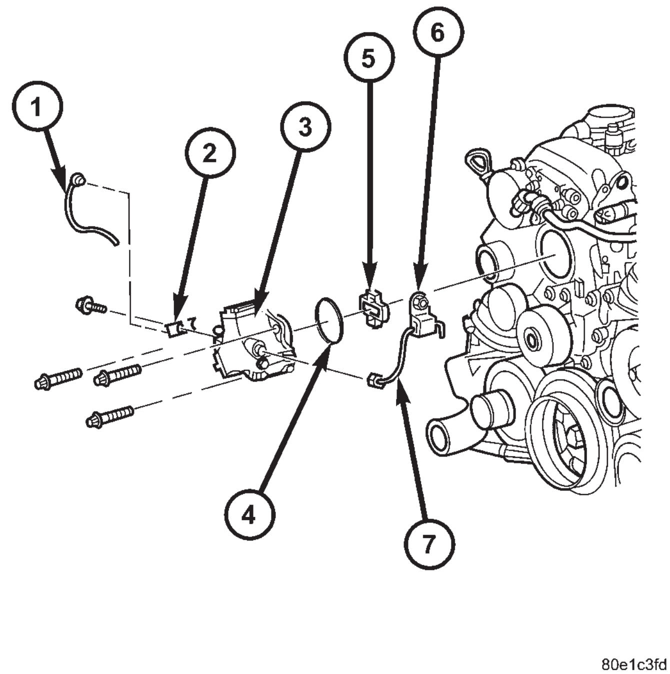


Fig. 1 HIGH PRESSURE PUMP

1 - FUEL RETURN LINE
2 - FUEL LINE BRACKET
3 - HIGH PRESSURE PUMP
4 - O-RING
5 - PUMP DRIVE
6 - FUEL LINE BRACKET
7 - HIGH PRESSURE FUEL LINE FROM PUMP TO FUEL RAIL

OPERATION

OPERATION

LOW PRESSURE SIDE

The fuel supplied by the fuel delivery pump flows through the fuel feed to the throttle valve. Any air entrained by the fuel is directed through the restrictor to the return flow. The throttle valve opens against the force of the spring at a pressure of approx. 0.4 bar and the fuel is able to flow along a ring line to the individual pistons. The eccentric shaft with its eccentric plate moves the pistons up and down against the piston spring of the three pump elements. The leak fuel from the pistons flows along the return flow to the fuel tank. The fuel flowing out of the throttle valve, also flows off along the return flow.

FUEL PUMP (Continued)

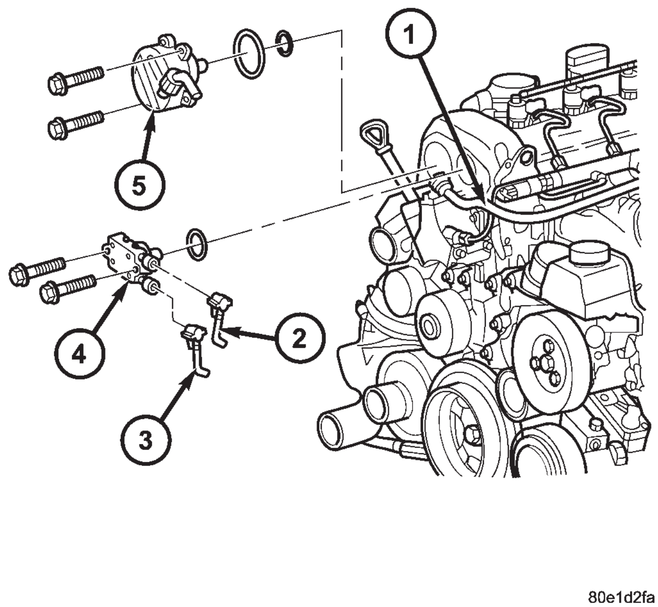


Fig. 2 VACUUM PUMP AND LOW PRESSURE FUEL PUMP ASSEMBLIES

1 - VACUUM LINE
2 - FUEL OUTLET LINE
3 - FUEL FEED LINE
4 - LOW PRESSURE FUEL PUMP
5 - VACUUM PUMP

HIGH PRESSURE SIDE

A. Filling the piston: The piston is moved down as a result of the piston spring. The fuel supplied by the fuel delivery pump flows along the ring passage, the valve disk and the valve spring into the cylinder. The ball valve prevents the fuel from being able to flow back from the high pressure passage.

B. Producting high pressure: The piston is moved up by the rising eccentric shaft and the fuel is thus compressed. The valve disk shuts off the delivery volume to the fuel feed. Once the fuel pressure in the cylinder rises beyond the pressure which exists in the high pressure circuit, the ball valve opens and the fuel is pumped into the high pressure circuit.

OPERATION - LOW PRESSURE PUMP

The low pressure pump draws fuel from tank through fuel filter and supplies the high pressure pump. Fuel pressure at starter speed is 0.4 to 1.5 bar (6 to 22 psi.). A fuel pressure of 2.0 to 2.5 bar (29 to 36 psi.) is reached at idle speed. Fuel pressure is limited to 3.5 bar ± .5 bar (51 psi. ± 7 psi) by the valve in the fuel delivery pump. This valve opens by overcoming a spring force and allows excessive fuel to flow to the intake side of the low pressure pump. This diverted fuel flows into the return flow pipe through the fuel cooler back to the tank. As a result of this circulation, the fuel always remains relatively cool.

REMOVAL

REMOVAL - HIGH PRESSURE PUMP

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(4) Partially drain coolant system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(5) Disconnect viscous heater hose at heater and bracket above idler pulley and set aside.
(6) Disconnect hydraulic fan power steering hose at steering pump and set aside.
(7) Remove bolt for fuel line retainer at lifting eye.

CAUTION: DO NOT slacken the threaded connection. Use a wrench to counterhold at the threaded connection when loosening and tightening the union nut. DO NOT EXCEED tightening torque.

CAUTION: DO NOT crimp or bend fuel line. Capture all fluids that flow out of connections.

(8) Unbolt pressure line at pressure pump.
(9) Detach fuel return flow line at high pressure pump.

NOTE: Detach high pressure pump driver and intermediate piece if pump is being replaced.

(10) Remove bolts attaching high pressure pump and remove pump (Fig. 3).

FUEL PUMP (Continued)

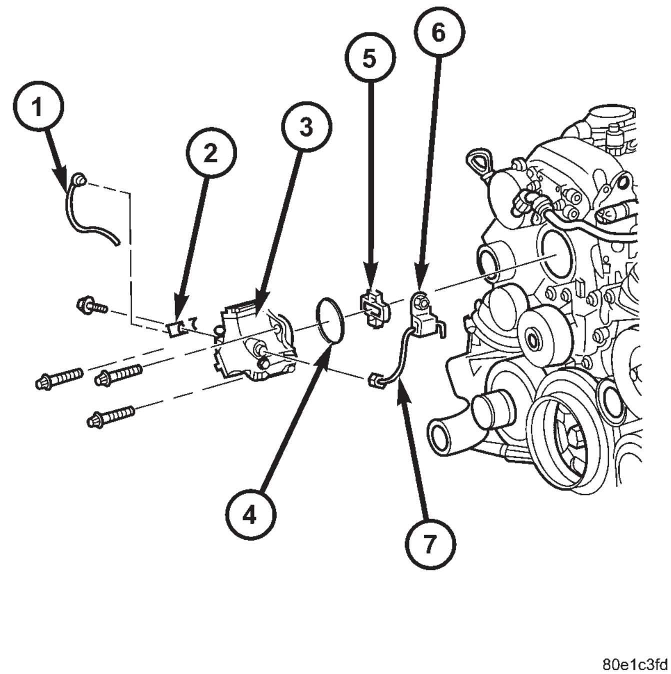


Fig. 3 HIGH PRESSURE PUMP

1 - FUEL RETURN LINE
2 - FUEL LINE BRACKET
3 - HIGH PRESSURE PUMP
4 - O-RING
5 - PUMP DRIVE
6 - FUEL LINE BRACKET
7 - HIGH PRESSURE FUEL LINE FROM PUMP TO FUEL RAIL

REMOVAL - LOW PRESSURE PUMP

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Remove vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - REMOVAL).
(4) Detach fuel lines at low pressure pump (Fig. 4).
(5) Remove low pressure pump (Fig. 4).

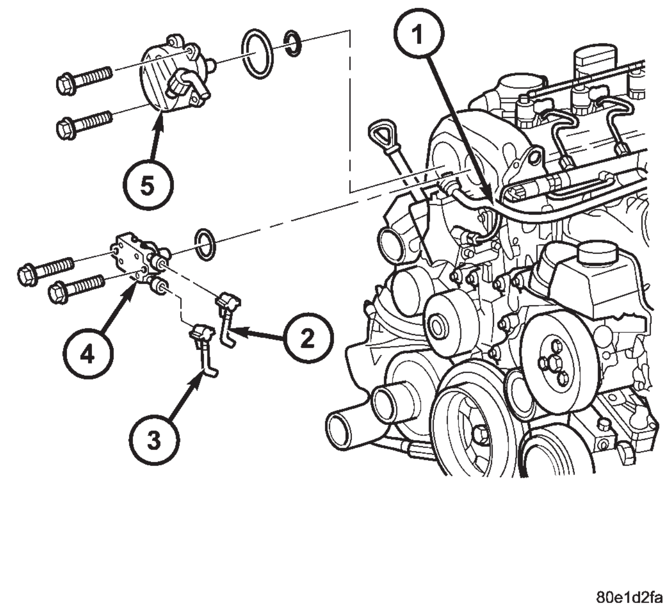


Fig. 4 VACUUM PUMP AND LOW PRESSURE FUEL PUMP ASSEMBLIES

1 - VACUUM LINE
2 - FUEL OUTLET LINE
3 - FUEL FEED LINE
4 - LOW PRESSURE FUEL PUMP
5 - VACUUM PUMP

INSTALLATION

INSTALLATION - HIGH PRESSURE PUMP

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

CAUTION: Clean sealing surfaces with appropriate solvents and replace all seals.

NOTE: Inspect then attach high pressure pump driver and intermediate piece if pump is being replaced. If wear is present at driver, replace the intermediate gear.

FUEL PUMP (Continued)

(1) Position and secure the high pressure pump to cylinder head (Fig. 3). Tighten bolts to 14 N·m (124 lbs. in.).

CAUTION: NEVER slacken the thread connection. Use a wrench to counterhold at threaded connection when slackening and tightening torque in order to avoid also slackening the threaded connection the next time.

CAUTION: DO NOT crimp or bend fuel line. Inspect sealing cone at line; replace line if compression exists.

(2) Attach fuel flow return line (Fig. 3).
(3) Install bracket to high pressure pump (Fig. 3). Tighten nut to 9N·m (80 lbs. in.).

CAUTION: NEVER slacken the thread connection. Use a wrench to counterhold at threaded connection when slackening and tightening torque in order to avoid also slackening the threaded connection the next time.

CAUTION: DO NOT crimp or bend fuel line. Inspect sealing cone at line; replace line if compression exists.

(4) Attach high pressure fuel line to pump (Fig. 3). Tighten to 22N·m (194 lbs.in.).
(5) Connect hydraulic fan power steering hose and viscous heater hose, then secure in bracket above idler pulley.
(6) Install bolt for fuel line retainer at lifting eye.
(7) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(8) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(9) Connect negative battery cable.
(10) Refill coolant system with proper mixture to correct level.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOU HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(11) Start engine and inspect for leaks.

INSTALLATION - LOW PRESSURE PUMP

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Clean sealing surfaces, replace seal if necessary.

(1) Prime the low pressure pump with the appropriate fuel.
(2) Attach low pressure fuel pump to cylinder head front cover. Tighten bolt to 9N·m (80 lbs. in.).
(3) Attach fuel lines to low pressure pump.
(4) Install vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - INSTALLATION).
(5) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(6) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(7) Start engine and inspect for leaks.

FUEL LINES

REMOVAL - HIGH PRESSURE LINES

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

CAUTION: Counterhold with wrench at threaded connections of injectors. DO NOT EXCEED the tightening torque in order to avoid also slackings the threaded connection.

FUEL LINES (Continued)

CAUTION: DO NOT crimp or bend lines.

NOTE: After removing injection lines, seal connections and ensure cleanliness.

(3) Unscrew union nuts of injection lines.
(4) Remove injection lines (Fig. 5).

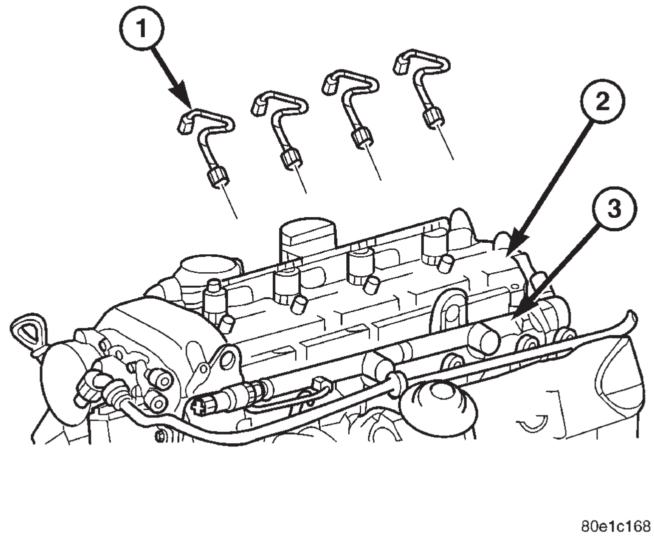


Fig. 5 HIGH PRESSURE LINES AT INJECTORS

1 - HIGH PRESSURE LINE
2 - CYLINDER HEAD COVER
3 - FUEL RAIL

INSTALLATION - HIGH PRESSURE LINES

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Loosen the fuel rail mounting bolts to install lines free of stress.

CAUTION: Inspect sealing cone at lines. Replace if compression points exist. Ensure lines are exactly located.

(2) Position and install fuel lines (Fig. 5). Tighten to 22N·m (195 lbs. in.) using a wrench to counterhold at threaded connection.
(3) Tighten fuel rail to 14N·m (124 lbs. in.).
(4) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(5) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

STEERING - 2.7L - DIESEL

TABLE OF CONTENTS

PUMP

TABLE OF CONTENTS

PUMP

REMOVAL

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the intercooler outlet hose from the vehicle.

(3) Remove the battery. Refer to the electrical section.

(4) Siphon and drain the fluid from the pump.

(5) Remove the accessory drive belt from the power steering pump pulley. Refer to Cooling System for the procedure.

(6) Install a allen wrench in the power steering pump center shaft to hold the pump in position. Remove the (3) power steering pump pulley retaining bolts (Fig. 1).

(7) Remove the power steering pump pulley from the pump.

(8) Remove the power steering fluid supply hose from the pump (Fig. 2).

(9) Remove the power steering fluid pressure line from the pump (Fig. 2).

(10) Remove the power steering pump to the mount and remove the pump from the vehicle.

PUMP (Continued)

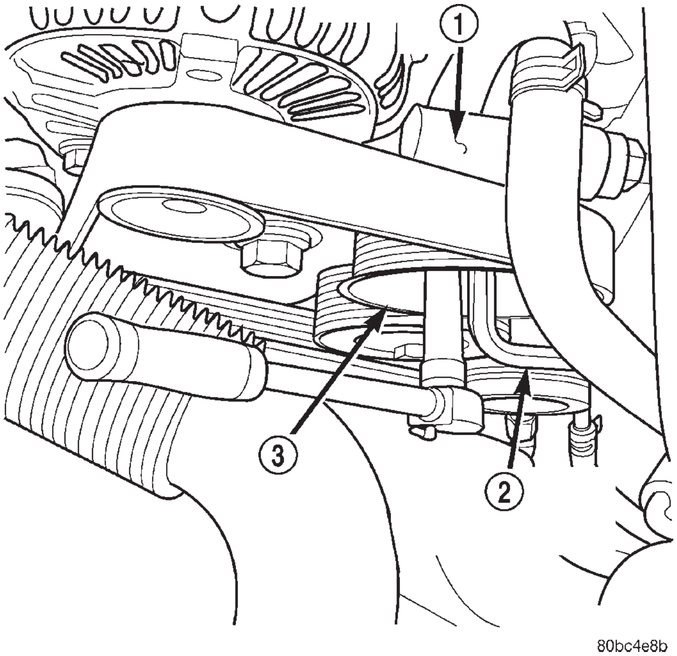


Fig. 1 Installing Power Steering Pump Pulley

1 - POWER STEERING PUMP
2 - ALLEN WRENCH HOLDING PUMP CENTER SHAFT
3 - POWER STEERING PUMP PULLEY

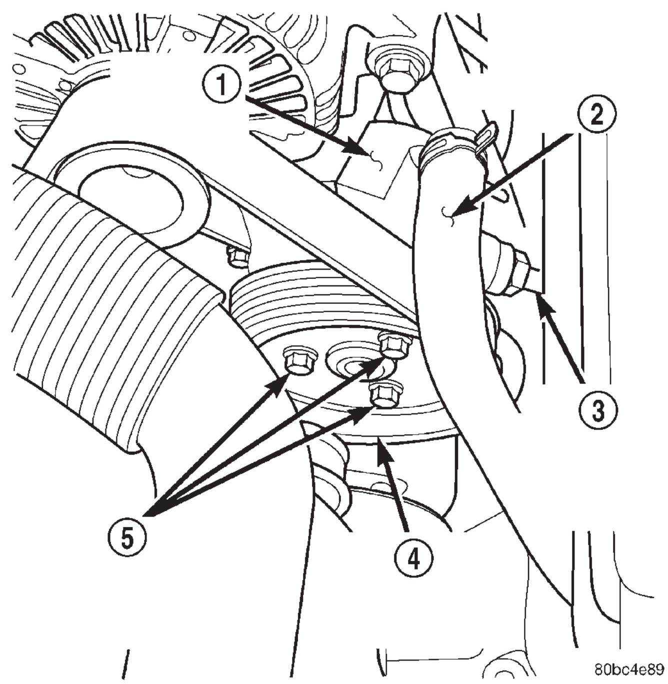


Fig. 2 Diesel Power Steering Pump Position & Orientation

1 - POWER STEERING PUMP
2 - POWER STEERING FLUID SUPPLY HOSE
3 - POWER STEERING FLUID PRESSURE LINE
4 - POWER STEERING PUMP PULLEY
5 - POWER STEERING PUMP PULLEY RETAINING BOLTS

INSTALLATION

CAUTION: Power steering system fluid may be contaminated with metal shavings, overheated or improper fluid. All fluid should be drained from the system. After any component replacement, system should be flushed and filled with Mopar Power Steering fluid, or equivalent.

(1) Position the pump to the pump mount and install the retaining bolts. Torque the bolts to 27 N·m (20 ft. lbs.).

(2) Install the power steering fluid pressure line on the pump. Torque the nut to 24 N·m (18 ft. lbs.). Be certain the sealing o-ring is lubricated and free of tears.

(3) Install the power steering fluid supply hose on the pump.

(4) Install the power steering pump pulley on the pump. Torque the retaining bolts to 27 N·m (20 ft. lbs.). Use the allen wrench to hold the pump from rotating.

(5) Install the accessory drive belt on the power steering pump pulley. Refer to Cooling System for the procedure.

(6) Install the battery.

(7) Install the intercooler outlet hose on the vehicle.

(8) Connect the negative battery cable.

(9) Fill the power steering fluid. Refer to - Power Steering Pump Initial Operation - in this group for the procedure.

RESERVOIR

REMOVAL

(1) Siphon and drain the fluid from the pump.

(2) Remove the intercooler outlet hose from the vehicle.

(3) Remove the front fascia. Refer to the body section.

(4) Remove the cooler hose to the reservoir.

(5) Remove the return hose at the reservoir from the pump.

(6) Remove the supply hose at the reservoir from the fan.

INSTALLATION

(1) Install the supply hose at the reservoir from the fan.

(2) Install the return hose at the reservoir from the pump.

(3) Install the cooler hose to the reservoir.

(4) Install the front fascia. Refer to the body section.

RESERVOIR (Continued)

(5) Install the intercooler outlet hose to the vehicle.

(6) Fill the reservoir and check the power steering system for leaks.

PULLEY

REMOVAL

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the intercooler outlet hose from the vehicle.

(3) Remove the accessory drive belt from the power steering pump pulley. Refer to Cooling System for the procedure.

(4) Install a allen wrench in the power steering pump center shaft to hold the pump in position. Remove the (3) power steering pump pulley retaining bolts (Fig. 3).

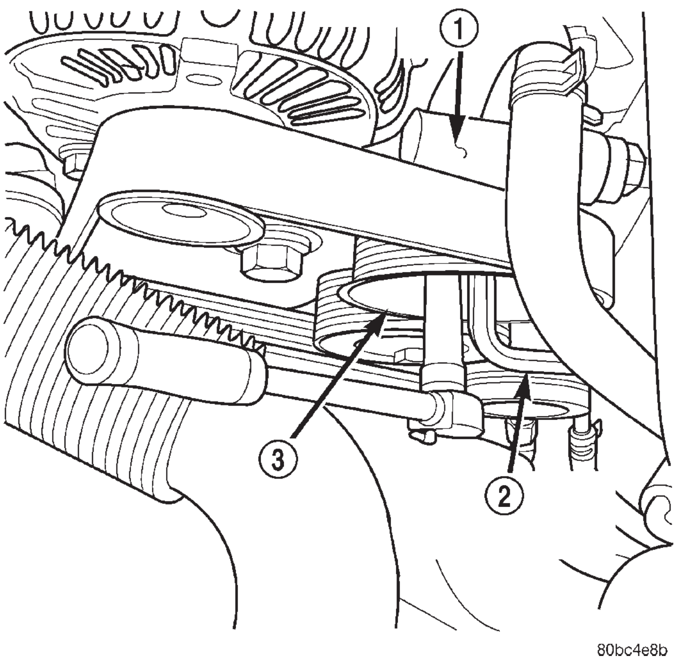


Fig. 3 Installing Power Steering Pump Pulley

1 - POWER STEERING PUMP
2 - ALLEN WRENCH HOLDING PUMP CENTER SHAFT
3 - POWER STEERING PUMP PULLEY

(5) Remove the power steering pulley.

INSTALLATION

(1) Install the power steering pump pulley on the pump. Torque the retaining bolts to 27 N·m (20 ft. lbs.). Use the allen wrench to hold the pump from rotating.

(2) Install the accessory drive belt on the power steering pump pulley. Refer to Cooling System for the procedure.

(3) Install the intercooler outlet hose on the vehicle.

(4) Connect the negative battery cable.

HOSES

REMOVAL

REMOVAL - PRESSURE HOSE - PUMP TO THE HYDRAULIC FAN MODULE

(1) Drain the power steering fluid from the reservoir.

(2) Raise and support the vehicle.

(3) Remove the metal skid plate.

(4) Disconnect the high pressure hose from the hydraulic fan motor.

(5) Lower the vehicle.

(6) Disconnect the high pressure hose from the power steering pump.

(7) Remove the hose from the clipped position on the fan shroud.

(8) Remove the hose from the vehicle.

REMOVAL - RETURN HOSE - RESERVOIR TO THE HYDRAULIC FAN MODULE

(1) Drain the power steering fluid from the reservoir.

(2) Remove the battery.

(3) Remove the front fascia. Refer to the body section.

(4) Remove the power steering reservoir. Refer to reservoir removal in this section.

(5) Disconnect the rubber return hose from the power steering reservoir.

(6) Raise and support the vehicle.

(7) Remove the metal skid plate.

(8) Disconnect the rubber return hose from the hydraulic fan motor.

(9) Remove the hose from the vehicle.

REMOVAL - PRESSURE HOSE - GEAR TO THE HYDRAULIC FAN MODULE

(1) Drain the power steering fluid from the reservoir.

(2) Remove the battery.

(3) Remove the battery tray.

(4) Remove the front fascia. Refer to the body section.

(5) Remove the power steering reservoir. Refer to reservoir removal in this section.

HOSES (Continued)

(6) Disconnect the high pressure hose from the power steering gear.
(7) Remove the hose from the clipped position on the fan shroud.
(8) Raise and support the vehicle.
(9) Remove the metal skid plate.
(10) Disconnect the high pressure hose from the hydraulic fan motor.
(11) Remove the hose from the vehicle.

REMOVAL - RETURN HOSE - RESERVOIR TO THE PUMP

(1) Drain the power steering fluid from the reservoir.
(2) Remove the battery.
(3) Disconnect the rubber hose from the power steering pump.
(4) Disconnect the rubber hose from the power steering reservoir.
(5) Remove the hose from the vehicle.

REMOVAL - 3/8” GEAR OUTLET HOSE

(1) Drain the power steering fluid from the reservoir.
(2) Remove the battery.
(3) Remove the battery tray.
(4) Remove the front fascia. Refer to the body section.
(5) Remove the power steering reservoir. Refer to reservoir removal in this section.
(6) Disconnect the rubber hose from the steering cooler inlet tube.
(7) Disconnect the metal tube from the power steering gear.
(8) Remove the hose from the vehicle.

REMOVAL - INLET COOLER HOSE

(1) Disconnect negative battery cable at battery.
(2) Drain the power steering fluid out of the reservoir.
(3) Remove the front fascia grille assembly,(Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).
(4) Remove the grille opening reinforcement panel
(5) Place a drain pan under the cooler.
(6) Disconnect the lower hose at cooler.
(7) Disconnect the cooler hose at the gear.
(8) Remove the bracket holding the cooler hoses (Fig. 4).
(9) Remove the cooler hose from the vehicle.

REMOVAL - OUTLET COOLER HOSE

(1) Disconnect negative battery cable at battery.
(2) Drain the power steering fluid out of the reservoir.

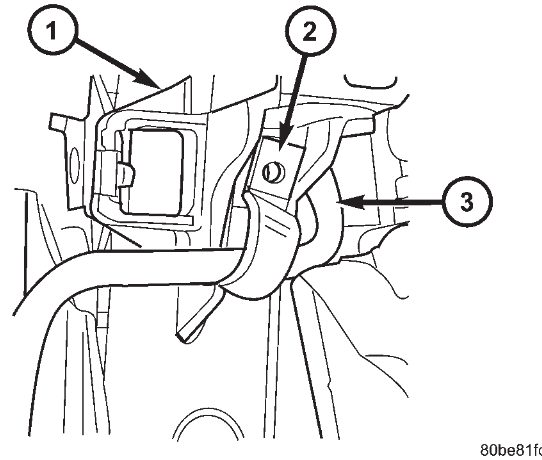


Fig. 4 COOLER HOSES MOUNTING BRACKET

1 - RADIATOR
2 - COOLER HOSES MOUNTING BRACKET
2 - COOLER HOSE

(3) Remove the front fascia grille assembly,(Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).
(4) Remove the grille opening reinforcement panel
(5) Place a drain pan under the cooler.
(6) Disconnect the upper hose at cooler.
(7) Disconnect the cooler hose at the reservoir.
(8) Remove the bracket holding the cooler hoses (Fig. 4).
(9) Remove the cooler hose from the vehicle.

INSTALLATION

INSTALLATION - PRESSURE HOSE PUMP TO THE HYDRAULIC FAN MODULE

NOTE: Lubrication and a new o-ring must be used when reinstalling.

(1) Install the hose to the vehicle.
(2) Reconnect the high pressure hose to the power steering pump. Tighten the hose to 22.5 N·m (17 ft.lbs.).
(3) Install the hose to the clipped position on the fan shroud.
(4) Raise and support the vehicle.
(5) Reconnect the high pressure hose to the hydraulic fan motor. Tighten the hose to 22.5 N·m (17 ft.lbs.).
(6) Install the metal skid plate.
(7) Remove the support and lower the vehicle.
(8) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

HOSES (Continued)

INSTALLATION - RETURN HOSE - RESERVOIR TO THE HYDRAULIC FAN MODULE

(1) Install the hose to the vehicle.
(2) Reconnect the rubber return hose to the hydraulic fan motor. Tighten the hose.
(3) Install the metal skid plate.
(4) Reconnect the rubber return hose to the power steering reservoir. Tighten the hose clamp.
(5) Remove the support and lower the vehicle.
(6) Install the power steering reservoir. Refer to the reservoir installation in this section.
(7) Install the front fascia. Refer to the body section.
(8) Install the battery
(9) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - PRESSURE HOSE - GEAR TO HYDRAULIC FAN MODULE

NOTE: Lubrication and a new o-ring must be used when reinstalling.

(1) Install the hose to the vehicle.
(2) Reconnect the high pressure hose to the hydraulic fan motor. Tighten the hose to 22.5 N·m (17 ft.lbs.).
(3) Install the metal skid plate.
(4) Remove the support and lower the vehicle.
(5) Reconnect the high pressure hose to the power steering gear. Tighten the hose to 22.5 N·m (17 ft.lbs.).
(6) Install the hose to the clipped position on the fan shroud.
(7) Install the battery tray.
(8) Install the power steering reservoir. Refer to the reservoir installation in this section.
(9) Install the front fascia. Refer to the body section.
(10) Install the battery
(11) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - RETURN HOSE - RESERVOIR TO THE PUMP

(1) Install the hose to the vehicle.
(2) Reconnect the rubber hose to the power steering pump. Tighten the hose clamp.
(3) Reconnect the rubber hose to the power steering reservoir. Tighten the hose clamp.
(4) Install thebattery.
(5) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 3/8″ GEAR OUTLET HOSE

NOTE: Lubrication and a new o-ring must be used when reinstalling.

(1) Install the hose to the vehicle.
(2) Reconnect the rubber hose to the steering cooler inlet tube. Tighten the hose clamp.
(3) Reconnect the metal tube to the power steering gear. Tighten the hose to 22.5 N·m (17 ft.lbs.).
(4) Install the battery tray.
(5) Install the power steering reservoir. Refer to the reservoir installation in this section.
(6) Install the front fascia. Refer to the body section.
(7) Install the battery
(8) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - INLET COOLER HOSE

(1) Install the cooler hose to the vehicle.
(2) Reconnect the cooler hose at the gear.
(3) Reconnect the lower hose at cooler. Tighten the hose to 22.5 N·m (17 ft.lbs.)
(4) Install the bracket holding the cooler hoses (Fig. 4).
(5) Install the grille opening reinforcement panel
(6) Install the front fascia grille assembly, (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).
(7) Reconnect negative battery cable at battery.
(8) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - OUTLET COOLER HOSE

(1) Install the cooler hose to the vehicle.
(2) Reconnect the cooler hose at the reservoir.
(3) Reconnect the upper hose at the cooler. Tighten the hose to 22.5 N·m (17 ft. lbs.)
(4) Install the bracket holding the cooler hoses (Fig. 4). Tighten the bracket to 22.5 N·m (17 ft. lbs.)
(5) Install the grille opening reinforcement panel
(6) Install the front fascia grille assembly, (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).
(7) Reconnect negative battery cable at battery.
(8) Refill the power steering fluid and bleed the system,(Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

TRANSMISSION AND TRANSFER CASE

TABLE OF CONTENTS

AUTOMATIC TRANSMISSION - W5J400

DESCRIPTION

The W5J400 automatic transmission (Fig. 1) is an electronically controlled 5-speed transmission with a lock-up clutch in the torque converter. The ratios for the gear stages are obtained by 3 planetary gear sets. Fifth gear is designed as an overdrive with a high-speed ratio.

The gears are actuated electronically/hydraulically. The gears are shifted by means of an appropriate combination of three multi-disc holding clutches, three multi-disc driving clutches, and two freewheeling clutches.

Electronic transmission control enables precise adaptation of pressures to the respective operating conditions and to the engine output during the shift phase which results in a significant improvement in shift quality.

Furthermore, it offers the advantage of a flexible adaptation to various vehicle and engines.

Basically, the automatic transmission with electronic control offers the following advantages:

- Reduces fuel consumption.
- Improved shift comfort.
- More favourable step-up through the five gears.
- Increased service life and reliability.
- Lower maintenance costs.

TRANSMISSION IDENTIFICATION

The transmission name, W5J400, can be decoded to describe the transmission as follows:

- W = A transmission using a hydraulic torque converter.
- 5 = 5 forward gears.
- J = A transmission first used in a Jeep® vehicle.
- 400 = A 4X4 transmission.

The transmission can be generically identified visually by the presence of a round 13-way connector located near the front corner of the transmission oil pan, on the right side. Specific transmission information can be found stamped into a pad on the left side of the transmission, above the oil pan rail.

TRANSMISSION GEAR RATIOS

The gear ratios for the W5J400 automatic transmission are as follows:

1st Gear	3.59:1
2nd Gear	2.19:1
3rd Gear	1.41:1
4th Gear	1.00:1
5th Gear	0.83:1
Reverse	3.16:1
Reverse (In 4WD Low range)	1.93:1

TRANSMISSION HOUSING

The converter housing and transmission are made from a light alloy. These are bolted together and centered via the outer multi-disc carrier of multi-disc holding clutch, B1. A coated intermediate plate provides the sealing. The oil pump and the outer multi-disc carrier of the multi-disc holding clutch, B1, are bolted to the converter housing. The stator shaft is pressed into it and prevented from rotating by splines. The electrohydraulic unit is bolted to the transmission housing from underneath. A sheet metal steel oil pan forms the closure.

MECHANICAL SECTION

The mechanical section consists of a drive shaft, output shaft, a sun gear shaft, and three planetary

AUTOMATIC TRANSMISSION - W5J400 (Continued)

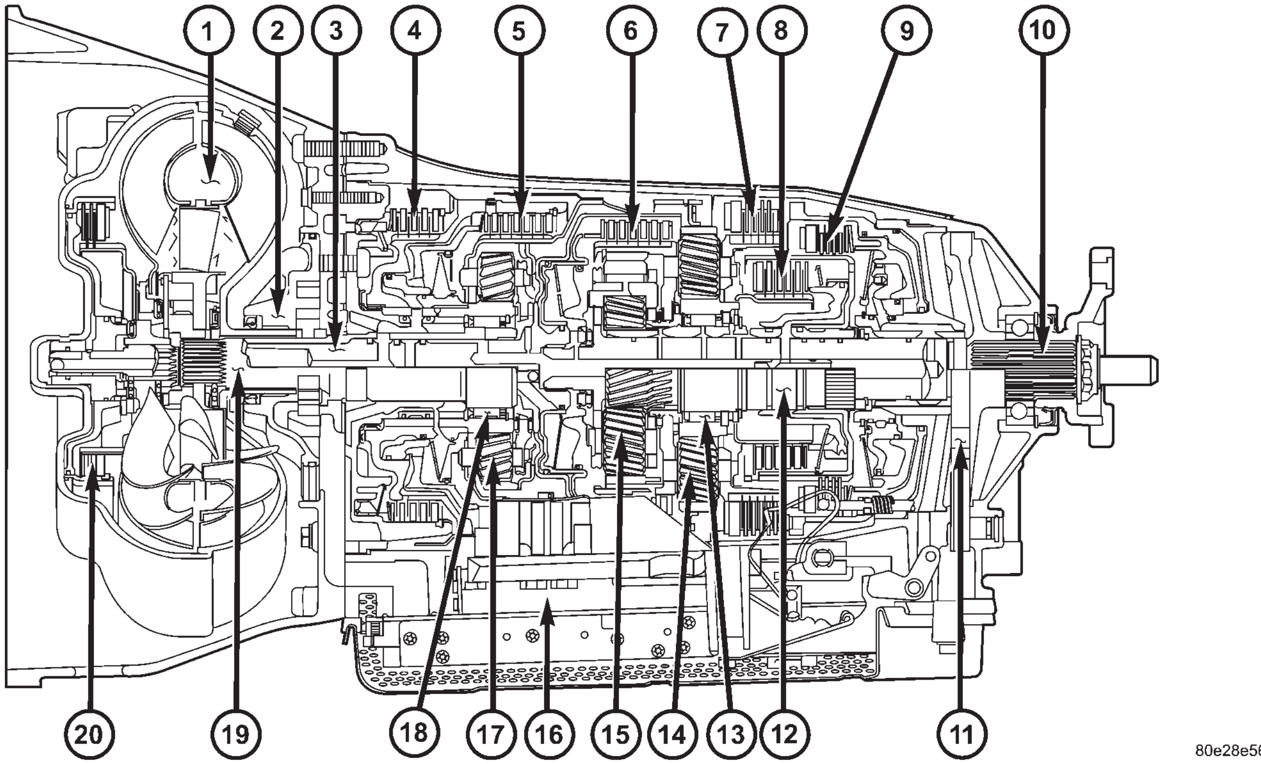


Fig. 1 W5J400 Automatic Transmission

1 - TORQUE CONVERTER	11 - PARKING LOCK GEAR
2 - OIL PUMP	12 - INTERMEDIATE SHAFT
3 - DRIVESHAFT	13 - FREEWHEEL F2
4 - MULTI-DISC HOLDING CLUTCH B1	14 - REAR PLANETARY GEAR SET
5 - DRIVING CLUTCH K1	15 - CENTER PLANETARY GEAR SET
6 - DRIVING CLUTCH K2	16 - ELECTROHYDRAULIC CONTROL UNIT
7 - MULTI-DISC HOLDING CLUTCH B3	17 - FRONT PLANETARY GEAR SET
8 - DRIVING CLUTCH K3	18 - FREEWHEEL F1
9 - MULTI-DISC HOLDING CLUTCH B2	19 - STATOR SHAFT
10 - OUTPUT SHAFT	20 - TORQUE CONVERTER LOCK-UP CLUTCH

gear sets which are coupled to each other. The planetary gear sets each have four planetary pinion gears. The oil pressure for the torque converter lock-up clutch and clutch K2 is supplied through bores in the drive shaft. The oil pressure to clutch K3 is transmitted through the output shaft. The lubricating oil is distributed through additional bores in both shafts. All the bearing points of the gear sets, as well as the freewheeling clutches and actuators, are supplied with lubricating oil. The parking lock gear is connected to the output shaft via splines.

Freewheeling clutches F1 and F2 are used to optimize the shifts. The front freewheel, F1, is supported on the extension of the stator shaft on the transmission side and, in the locking direction, connects the sun gear of the front planetary gear set to the transmission housing. In the locking direction, the rear freewheeling clutch, F2, connects the sun gear of the center planetary gear set to the sun gear of the rear planetary gear set.

ELECTROHYDRAULIC CONTROL UNIT

The electrohydraulic control unit comprises the shift plate made from light alloy for the hydraulic control and an electrical control unit. The electrical control unit comprises of a supporting body made of plastic, into which the electrical components are assembled. The supporting body is mounted on the shift plate and screwed to it.

Strip conductors inserted into the supporting body make the connection between the electrical components and a plug connector. The connection to the wiring harness on the vehicle and the transmission control module (TCM) is produced via this 13-pin plug connector with a bayonet lock.

SHIFT GROUPS

The hydraulic control components (including actuators) which are responsible for the pressure distribution before, during, and after a gear change are described as a shift group. Each shift group contains a command valve, a holding pressure shift valve, a shift pressure shift valve, overlap regulating valve, and a solenoid.

The hydraulic system contains three shift groups: 1-2/4-5, 2-3, and 3-4. Each shift group can also be described as being in one of two possible states. The active shift group is described as being in the shift phase when it is actively engaging/disengaging a clutch combination. The 1-2/4-5 shift group control the B1 and K1 clutches. The 2-3 shift group controls the K2 and K3 clutches. The 3-4 shift group controls the K3 and B2 clutches.

OPERATION

The transmission control is divided into the electronic and hydraulic transmission control functions. While the electronic transmission control is responsible for gear selection and for matching the pressures to the torque to be transmitted, the transmission's power supply control occurs via hydraulic elements in the electrohydraulic control module. The oil supply to the hydraulic elements, such as the hydrodynamic torque converter, the shift elements and the hydraulic transmission control, is provided by way of an oil pump connected with the torque converter.

The Transmission Control Module (TCM) allows for the precise adaptation of pressures to the corresponding operating conditions and to the engine output during the gearshift phase, resulting in a noticeable improvement in shift quality. The engine speed limit can be reached in the individual gears at full throttle and kickdown. The shift range can be changed in the forward gears while driving, but the TCM employs a downshift safeguard to prevent over-revving the engine. The system offers the additional advantage of flexible adaptation to different vehicle and engine variants.

EMERGENCY RUNNING FUNCTION

In order to ensure a safe driving state and to prevent damage to the automatic transmission, the TCM control module switches to limp-home mode in the event of critical faults. A DTC assigned to the fault is stored in memory. All solenoid and regulating valves are thus de-energized.

The net effect is:

- The last engaged gear remains engaged.
- The modulating pressure and shift pressures rise to the maximum levels.
- The torque converter lockup clutch is deactivated.

In order to preserve the operability of the vehicle to some extent, the hydraulic control can be used to engage 2nd gear or reverse using the following procedure:

- Stop the vehicle.
- Switch off engine.
- Move selector lever to ″P″.
- Wait at least 10 seconds.
- Start engine.
- Move selector lever to D: 2nd gear.
- Move selector lever to R: Reverse gear.

The limp-home function remains active until the DTC is rectified or the stored DTC is erased with the DRB® tool. Sporadic faults can be reset via ignition OFF/ON.

CLUTCH APPLICATION

Refer to CLUTCH APPLICATION for which shift elements are applied in each gear position.

CLUTCH APPLICATION

GEAR	RATIO	B1	B2	B3	K1	K2	K3	F1	F2
1	3.59	X*	X				X*	X	X
2	2.19		X		X		X*		X
3	1.41		X		X	X			
4	1.00				X	X	X		
5	0.83	X				X	X	X*	
N	X						X		
R	3.16	X*		X			X	X	
R (4WD Low)	1.93			X	X		X		
* = The shift components required during coast.									

FIRST GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred to the output shaft (26) (Fig. 2) and (Fig. 3).

Front Planetary Gear Set

The annulus gear (8) is driven by the drive shaft (25). The sun gear (21) is held against the housing by the locked freewheel F1 (20) during acceleration and via the engaged multiple-disc holding clutch B1 (4) during deceleration. The planetary pinion gears (17) turn on the fixed sun gear (21) and increase the torque from the annulus gear (8) to the planetary carrier (13). The planetary carrier (13) moves at a reduced speed in the running direction of the engine.

Rear Planetary Gear Set

The annulus gear (11) turns at a reduced speed due to the mechanical connection to the front planetary carrier (15). The sun gear (23) is held against the housing by the engaged multiple-disc holding clutch B2 (6), by the locked freewheel F2 (24) during acceleration and by the engaged multiple-disc clutch K3 (12) during deceleration. The planetary gears (19) turn on the fixed sun gear (23) and increase the torque from the annulus gear (11) to the planetary carrier (15). The planetary carrier (15) moves at a reduced speed in the running direction of the engine.

Center Planetary Gear Set

The annulus gear (10) is driven at the same speed as the rear planetary carrier (15) as a result of a mechanical connection. The sun gear (22) is held against the housing by the multiple-disc holding clutch B2 (6). The planetary pinion gears (18) turn on the fixed sun gear (22) and increase the torque from the annulus gear (10) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the running direction of the engine.

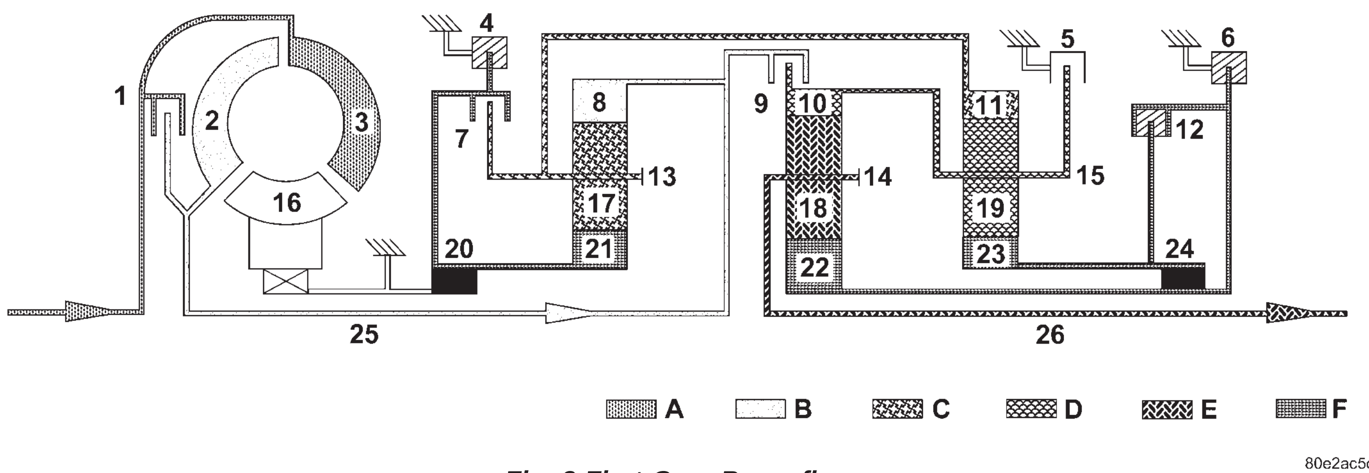


Fig. 2 First Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

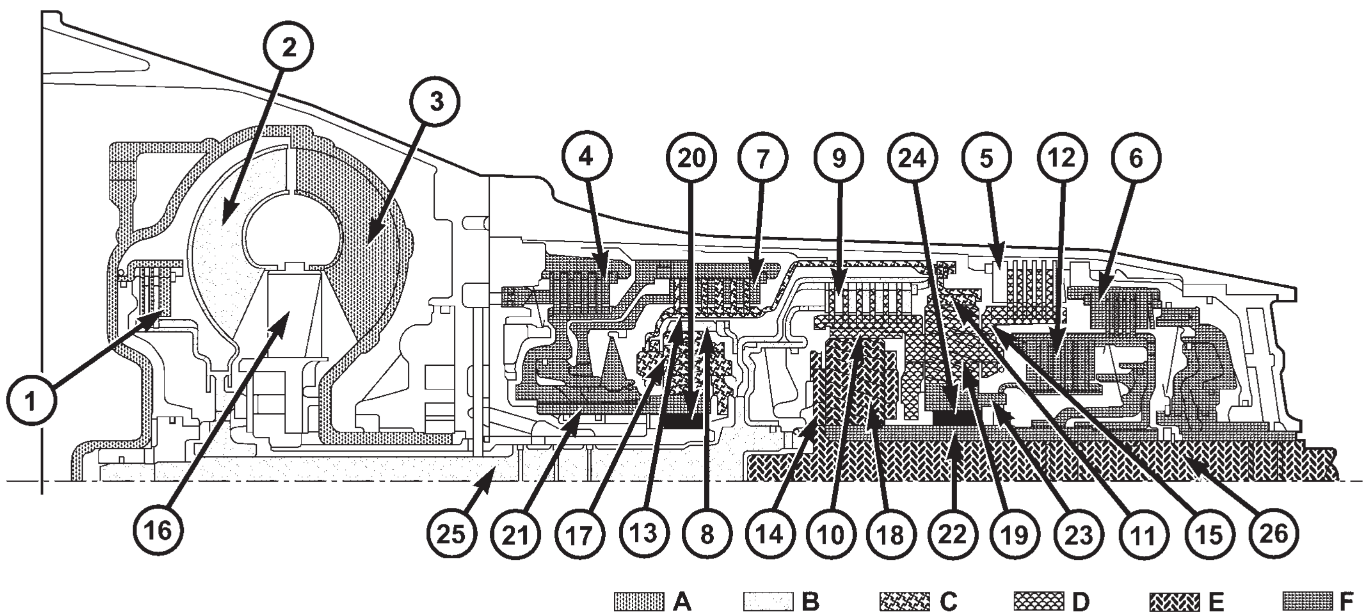


Fig. 3 First Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

SECOND GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and the center and rear planetary gearset and transferred to the output shaft (26) (Fig. 4) and (Fig. 5).

Front Planetary Gear Set

The planetary carrier (13) and sun gear (21) are connected via the engaged multiple-disc clutch K1 (7). The planetary gearset is therefore blocked and turns as a closed unit at the input speed due to the mechanical connection of the annulus gear (8) and drive shaft.

Rear Planetary Gear Set

The annulus gear (11) turns at the input speed as a result of the mechanical connection to the front planetary carrier (13). The sun gear (23) is held against the housing by the engaged multiple-disc holding clutch B2 (6), by the locked freewheel F2 (24) during acceleration and by the engaged multiple-disc clutch K3 (12) during deceleration. The planetary pinion gears (19) turn on the fixed sun gear (23) and increase the torque from the annulus gear (11) to the planetary carrier (15). The planetary carrier (15) moves at a reduced speed in the running direction of the engine.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

Center Planetary Gear Set

The annulus gear (10) is driven at the same speed as the rear planetary carrier (15) as a result of a mechanical connection. The sun gear (22) is held against the housing by the multiple-disc holding clutch B2 (6). The planetary pinion gears (18) turn on the fixed sun gear (22) and increase the torque from the annulus gear (10) to the planetary carrier (14). The output shaft (5) connected to the planetary carrier (14) turns at a reduced speed in the running direction of the engine.

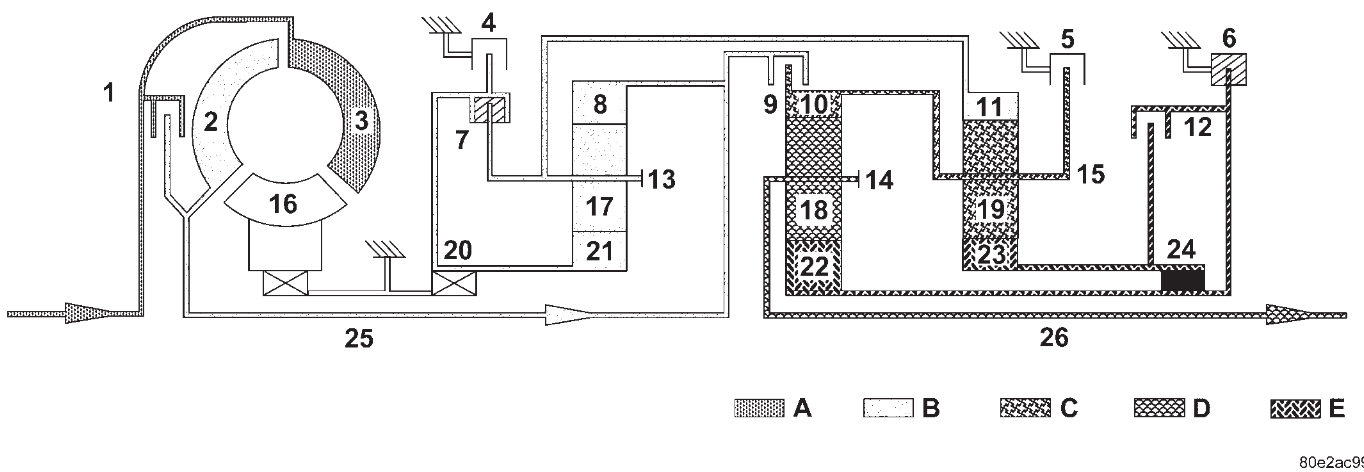


Fig. 4 Second Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - FIXED PARTS

AUTOMATIC TRANSMISSION - W5J400 (Continued)

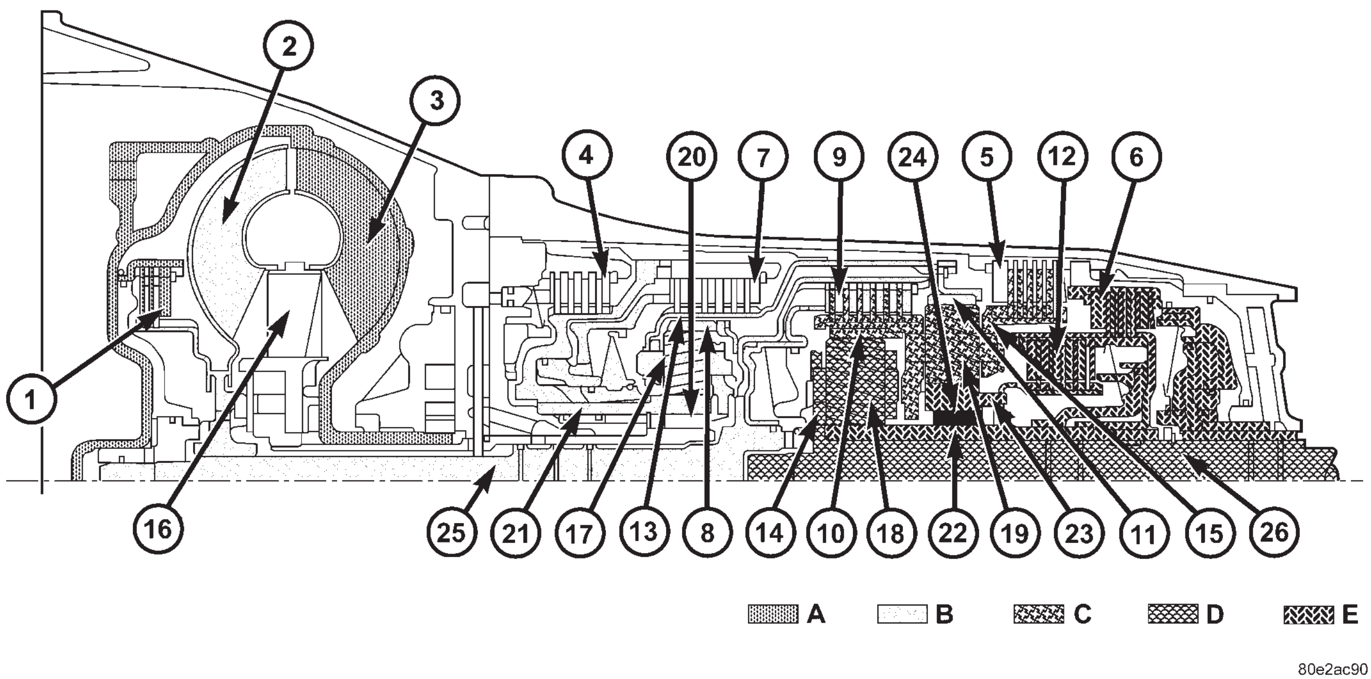


Fig. 5 Second Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
D - SECOND GEAR RATIO
E - FIXED PARTS

THIRD GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and the center planetary gearset and transferred to the output shaft (26) (Fig. 6) and (Fig. 7).

Front Planetary Gear Set

The planetary carrier (13) and sun gear (21) are connected via the engaged multiple-disc clutch K1 (7). The planetary gearset is therefore locked and turns as a closed unit at the input speed due to the mechanical connection of the annulus gear (8) and drive shaft (25).

Rear Planetary Gear Set

The multiple-disc clutch K2 (9) is engaged and transfers the input speed of the drive shaft (25) to the planetary carrier (15) via the annulus gear (10). The annulus gear (11) turns in the same way as the planetary carrier (15) due to the mechanical connection with the locked front planetary gearset. This planetary gearset is therefore locked and turns as a closed unit.

Center Planetary Gear Set

The annulus gear (10) turns at the input speed as a result of the engaged multiple-disc clutch K2 (9). The sun gear (22) is held against the housing by the

AUTOMATIC TRANSMISSION - W5J400 (Continued)

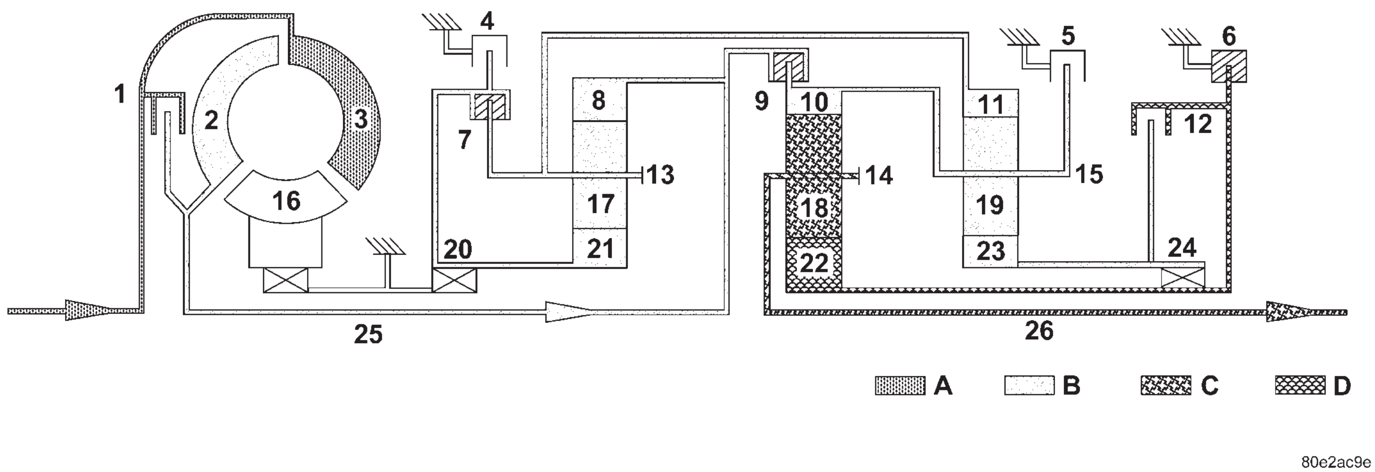


Fig. 6 Third Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
C - FIRST GEAR RATIO
D - FIXED PARTS

multiple-disc holding clutch B2 (6). The planetary pinion gears (18) turn on the fixed sun gear (22) and increase the torque from the annulus gear (10) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the running direction of the engine.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

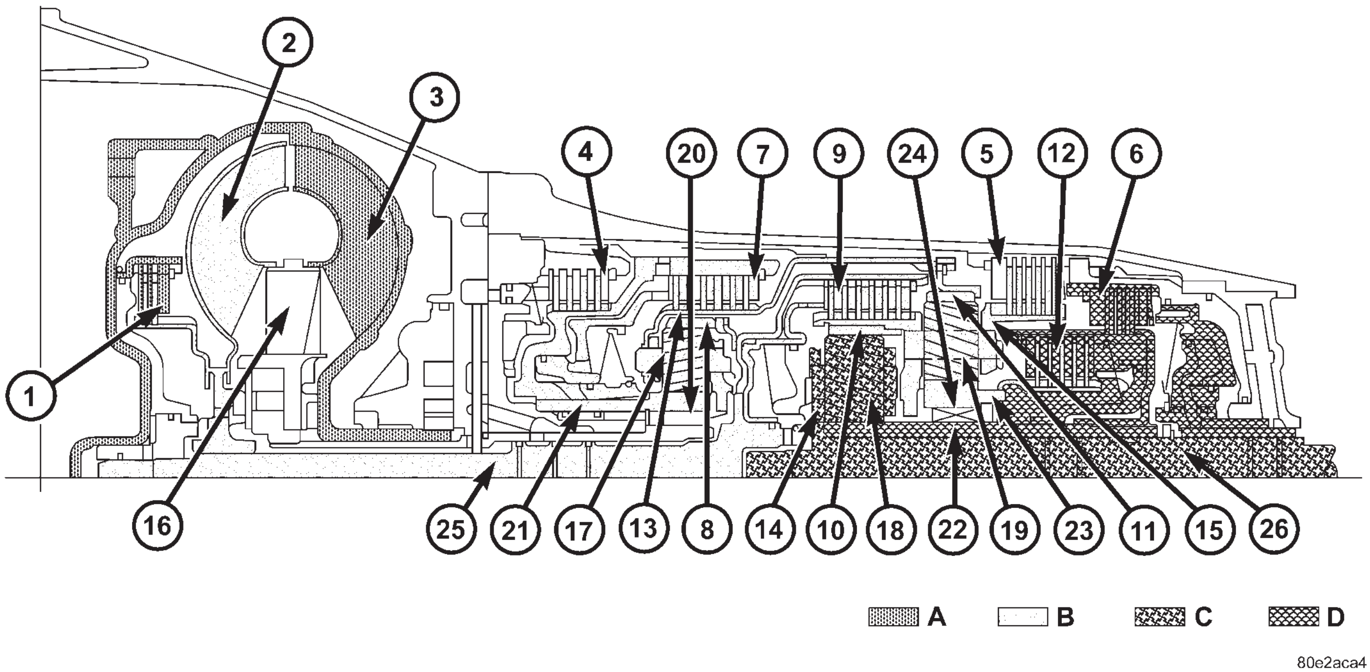


Fig. 7 Third Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
C - FIRST GEAR RATIO
D - FIXED PARTS

AUTOMATIC TRANSMISSION - W5J400 (Continued)

FOURTH GEAR POWERFLOW

Speed and torque are not converted by the direct gear ratio of the 4th gear. Power is transferred from the drive shaft (25) to the output shaft (26) via three locked planetary gearsets (Fig. 8) and (Fig. 9).

Front Planetary Gear Set

The planetary carrier (13) and sun gear (21) are connected via the engaged multiple-disc clutch K1 (7). The planetary gearset is therefore locked and turns as a closed unit at the input speed due to the mechanical connection of the annulus gear (8) and the drive shaft (25).

Rear Planetary Gear Set

The multiple-disc clutch K2 (9) is engaged and transfers the input speed of the drive shaft (25) to the planetary carrier (15) via the annulus gear (10). The annulus gear (11) turns in the same way as the planetary carrier (15) due to the mechanical connection with the locked front planetary gearset. The planetary gearset is therefore locked and turns as a closed unit.

Center Planetary Gear Set

The annulus gear (10) turns at the input speed as a result of the engaged multiple-disc clutch K2 (9). The multiple-disc clutch K3 (12) connects the sun gears (22) and (23) of the rear and center planetary gearset. The planetary gearset is locked by the same speeds of the annulus gear (10) and the sun gear (22) and it turns as a closed unit.

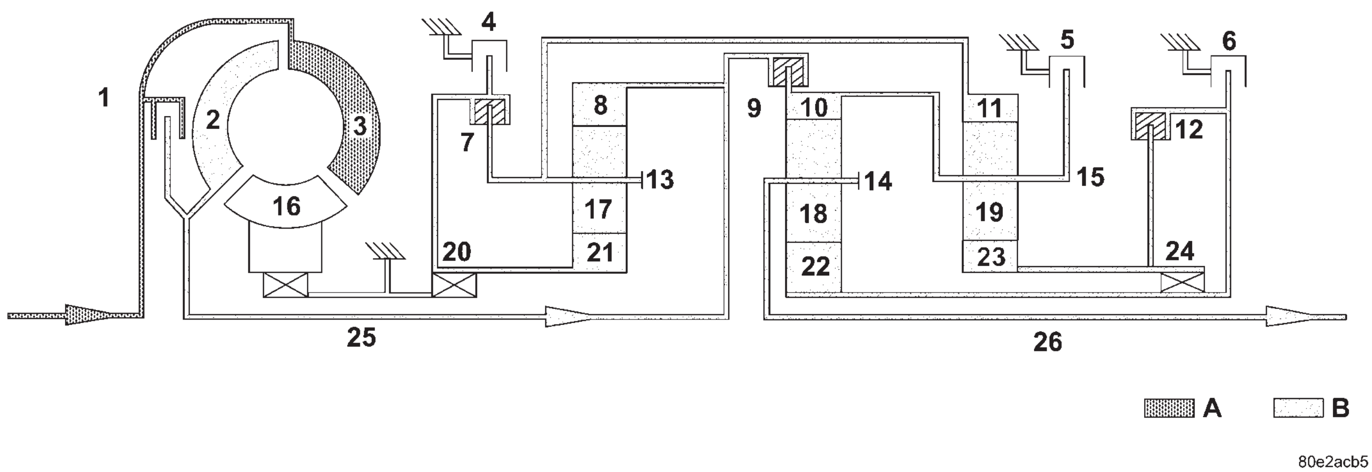


Fig. 8 Fourth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH	14 - CENTER PLANETARY CARRIER
2 - TORQUE CONVERTER TURBINE	15 - REAR PLANETARY CARRIER
3 - TORQUE CONVERTER IMPELLER	16 - TORQUE CONVERTER STATOR
4 - HOLDING CLUTCH B1	17 - FRONT PLANETARY PINION GEARS
5 - HOLDING CLUTCH B3	18 - CENTER PLANETARY PINION GEARS
6 - HOLDING CLUTCH B2	19 - REAR PLANETARY PINION GEARS
7 - DRIVING CLUTCH K1	20 - FREEWHEELING CLUTCH F1
8 - FRONT PLANETARY ANNULUS GEAR	21 - FRONT PLANETARY SUN GEAR
9 - DRIVING CLUTCH K2	22 - CENTER PLANETARY SUN GEAR
10 - CENTER PLANETARY ANNULUS GEAR	23 - REAR PLANETARY SUN GEAR
11 - REAR PLANETARY ANNULUS GEAR	24 - FREEWHEELING CLUTCH F2
12 - DRIVING CLUTCH K3	25 - DRIVE SHAFT
13 - FRONT PLANETARY CARRIER	26 - OUTPUT SHAFT
A - ENGINE SPEED	B - TRANSMISSION INPUT SPEED

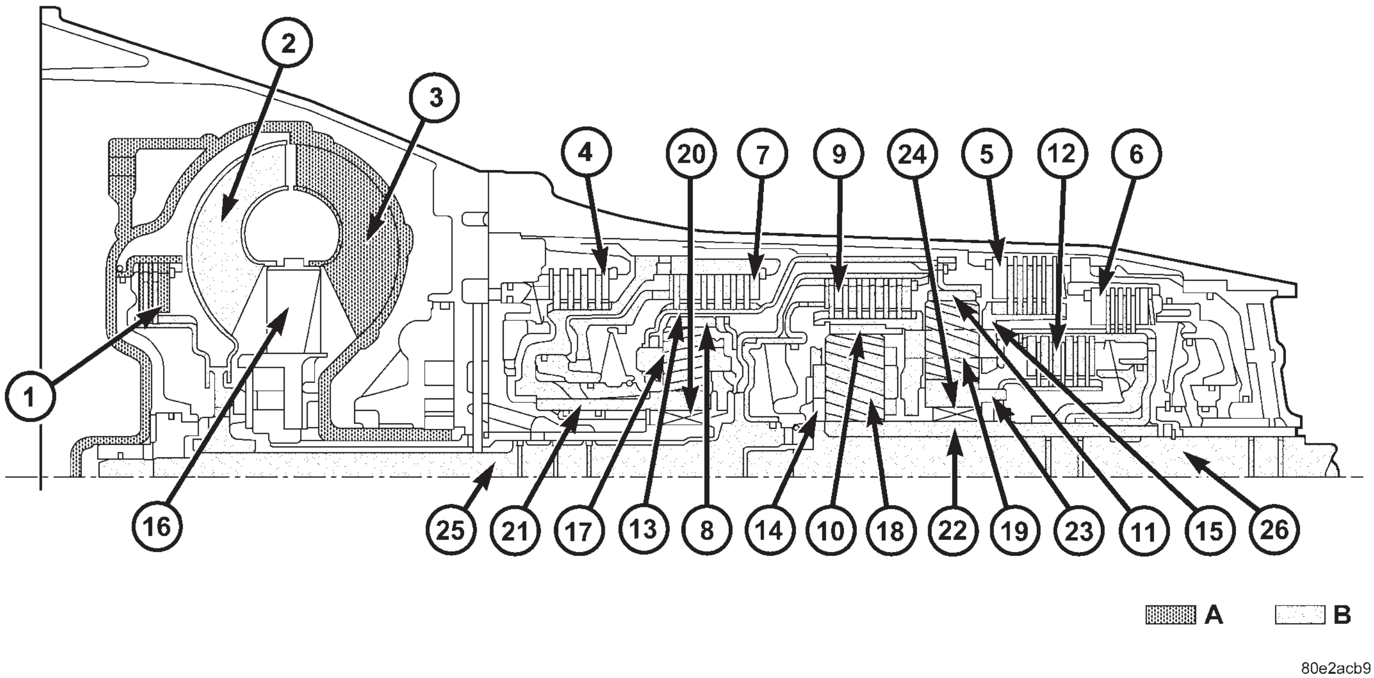


Fig. 9 Fourth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
B - TRANSMISSION INPUT SPEED

AUTOMATIC TRANSMISSION - W5J400 (Continued)

FIFTH GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred to the output shaft (26) (Fig. 10) and (Fig. 11).

Front Planetary Gear Set

The annulus gear (8) is driven by the drive shaft (25). The sun gear (21) is held against the housing by the locked freewheel F1 (20) during acceleration and via the engaged multiple-disc holding clutch B1 (4) during deceleration. The planetary pinion gears (17) turn on the fixed sun gear (21) and increase the torque from the annulus gear (8) to the planetary carrier (13). The planetary carrier (13) moves at a reduced speed in the running direction of the engine.

Rear Planetary Gear Set

The multiple-disc clutch K2 (9) is engaged and transfers the input speed of the drive shaft (25) to the planetary carrier (15) via the annulus gear (10). The annulus gear (11) turns at a reduced speed due to the mechanical connection with the front planetary carrier (13). The planetary pinion gears (19) turn between the annulus gear (11) and the sun gear (23). The sun gear (23) moves at an increased speed in the running direction of the engine.

Center Planetary Gear Set

The annulus gear (10) turns at the input speed as a result of the engaged multiple-disc clutch K2 (9). The multiple-disc clutch K3 (12) transfers an increased speed to the sun gear (22) due to the connection with the sun gear (23). The planetary pinion gears (18) turn between the annulus gear (10) and the sun gear (22). The speed of the planetary carrier (14) and the output shaft connected to the planetary carrier (5) lies between that of the annulus gear (10) and the sun gear (22). This provides a step-up ratio.

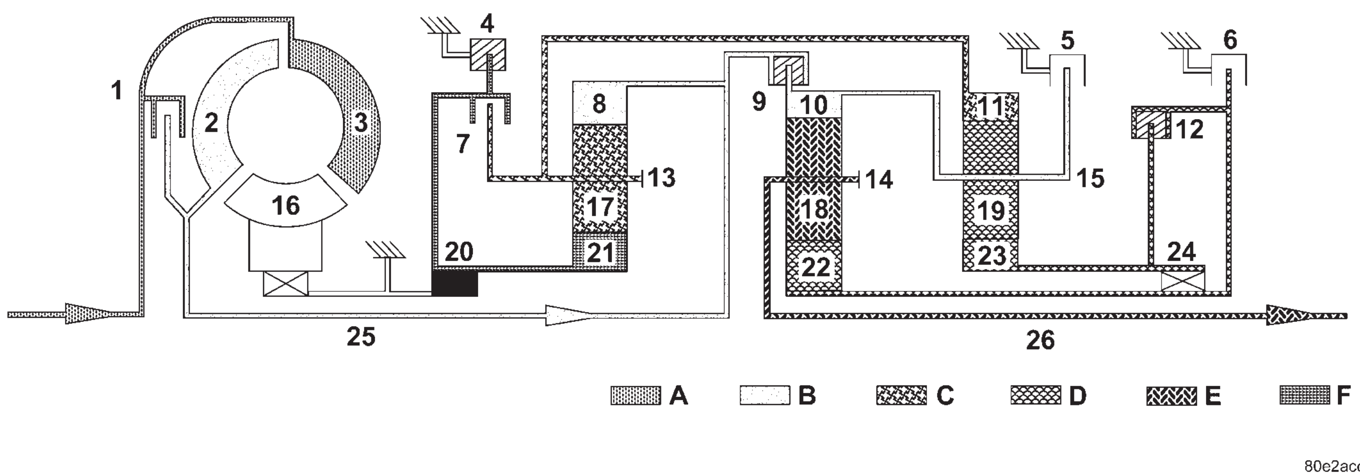


Fig. 10 Fifth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

AUTOMATIC TRANSMISSION - W5J400 (Continued)

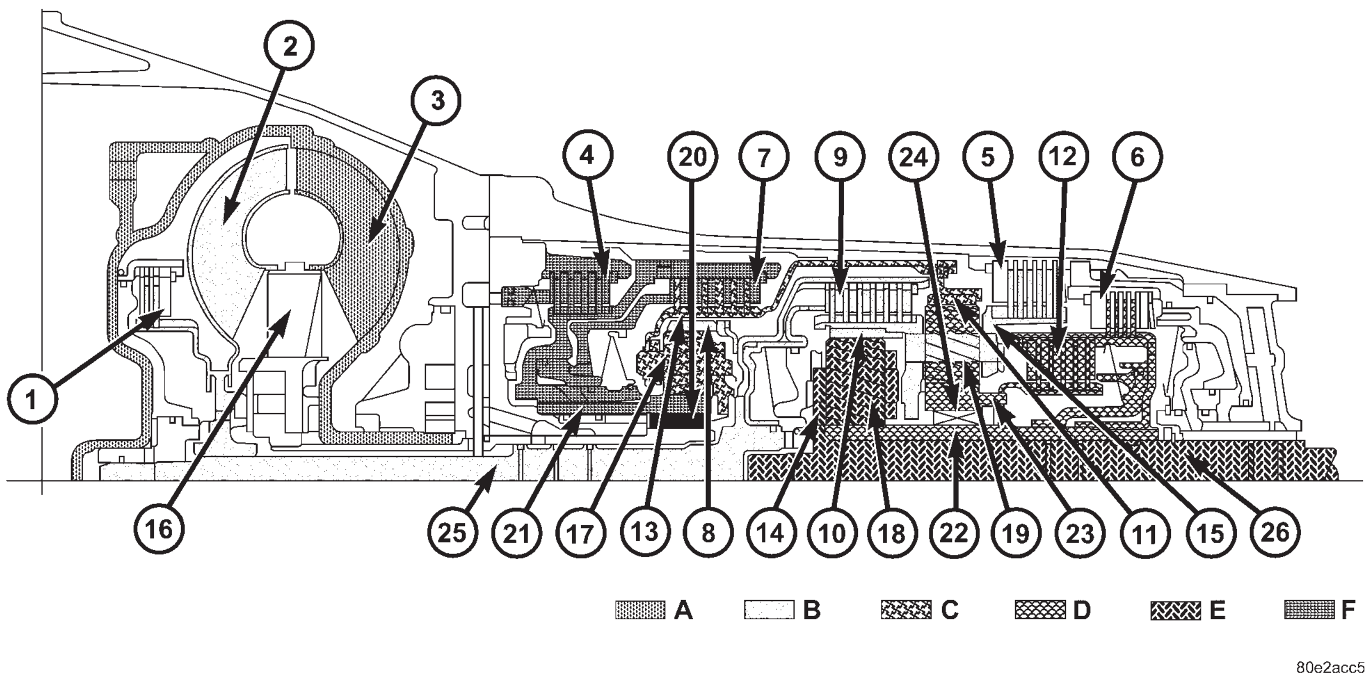


Fig. 11 Fifth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

REVERSE GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred with reversed direction of rotation to the output shaft (26) (Fig. 12) and (Fig. 13).

Front Planetary Gear Set

The annulus gear (8) is driven by the drive shaft (25). The sun gear (21) is held against the housing by the locked freewheel F1 (20) during acceleration and via the engaged multiple-disc holding clutch B1 (4) during deceleration. The planetary pinion gears (17) turn on the fixed sun gear (21) and increase the torque from the annulus gear (8) to the planetary carrier (13). The planetary carrier (13) moves at a reduced speed in the running direction of the engine.

Rear Planetary Gear Set

The planetary carrier (15) is held against the housing by the engaged multiple-disc holding clutch B3 (5). The annulus gear (11) turns at a reduced speed due to the mechanical connection to the front planetary carrier (13). The planetary gears (19) turn between the annulus gear (11) and the sun gear (23). The direction is reversed by the held planetary carrier (15) so that the sun gear (23) turns in the opposite direction to the running direction of the engine.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

Center Planetary Gear Set

The annulus gear (10) is held against the housing by the multiple-disc holding clutch B3 (5) via the mechanical connection to the planetary carrier (15). The sun gear (22) turns backwards due to the engaged multiple-disc clutch K3 (12). The planetary gears (18) turn on the fixed annulus gear (10) and increase the torque from the sun gear (22) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the opposite direction to the running direction of the engine.

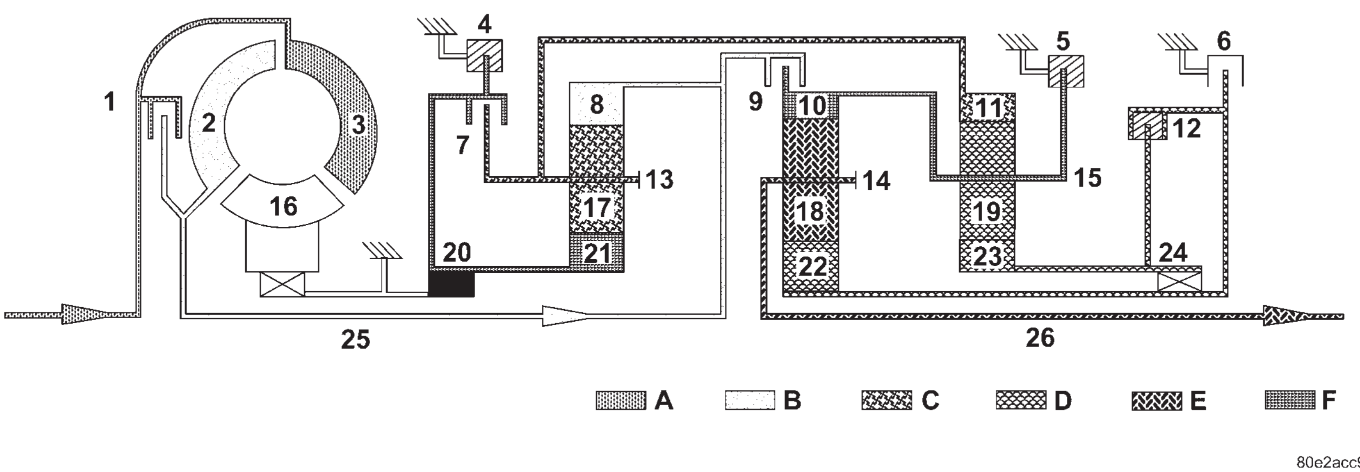


Fig. 12 Reverse Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

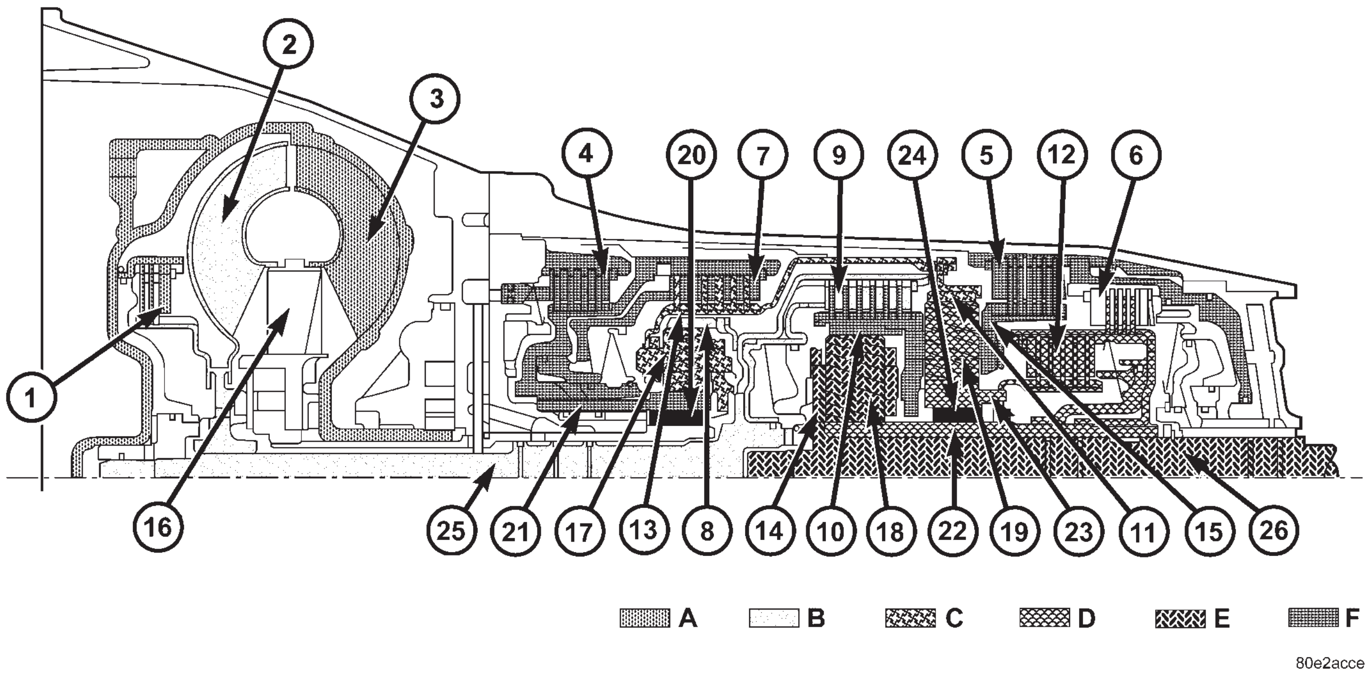


Fig. 13 Reverse Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

REVERSE GEAR POWERFLOW (4WD Low)

Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred with reversed direction of rotation to the output shaft (26) (Fig. 14) and (Fig. 15).

Front Planetary Gear Set

The clutch K1 (7) is shifted. The planetary carrier (13) and sun gear (21) are connected to each other as a result. The annulus gear (8) is driven via the drive shaft (25). The planetary gear set is locked and turns as a unit.

Rear Planetary Gear Set

The planetary carrier (15) is held against the housing by the engaged multiple-disc holding clutch B3 (5). The annulus gear (11) turns at a reduced speed due to the mechanical connection to the front planetary carrier (13). The planetary pinion gears (19) turn between the annulus gear (11) and the sun gear (23). The direction is reversed by the held planetary carrier (15) so that the sun gear (23) turns in the opposite direction to the running direction of the engine.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

Center Planetary Gear Set

The annulus gear (10) is held against the housing by the multiple-disc holding clutch B3 (5) via the mechanical connection to the planetary carrier (15). The sun gear (22) turns backwards due to the engaged multiple-disc clutch K3 (12). The planetary gears (18) turn on the fixed annulus gear (10) and increase the torque from the sun gear (22) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the opposite direction to the running direction of the engine.

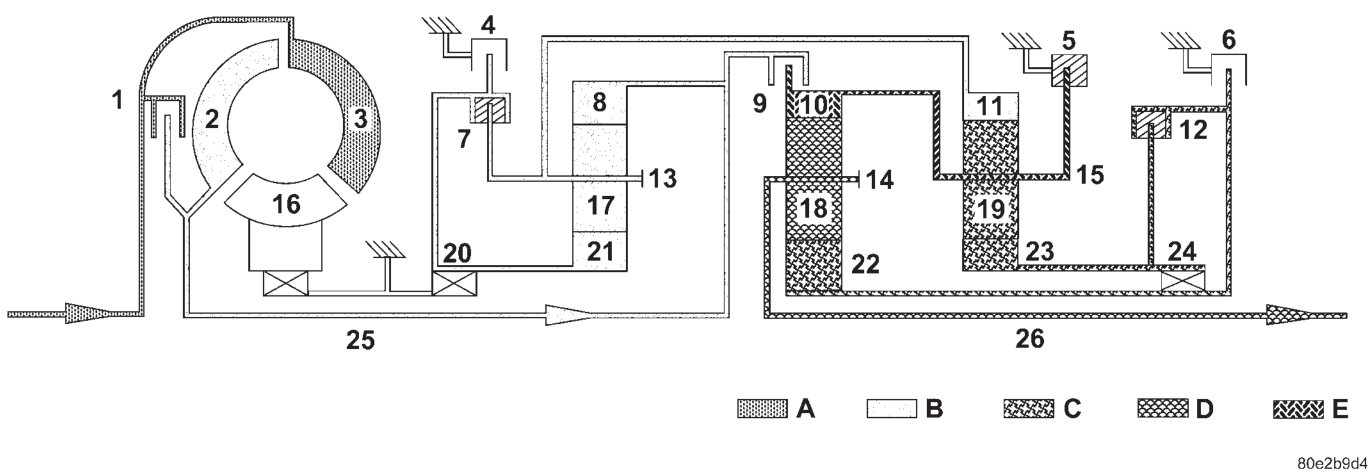


Fig. 14 Reverse Gear Powerflow - 4WD Low

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - FIXED PARTS

AUTOMATIC TRANSMISSION - W5J400 (Continued)

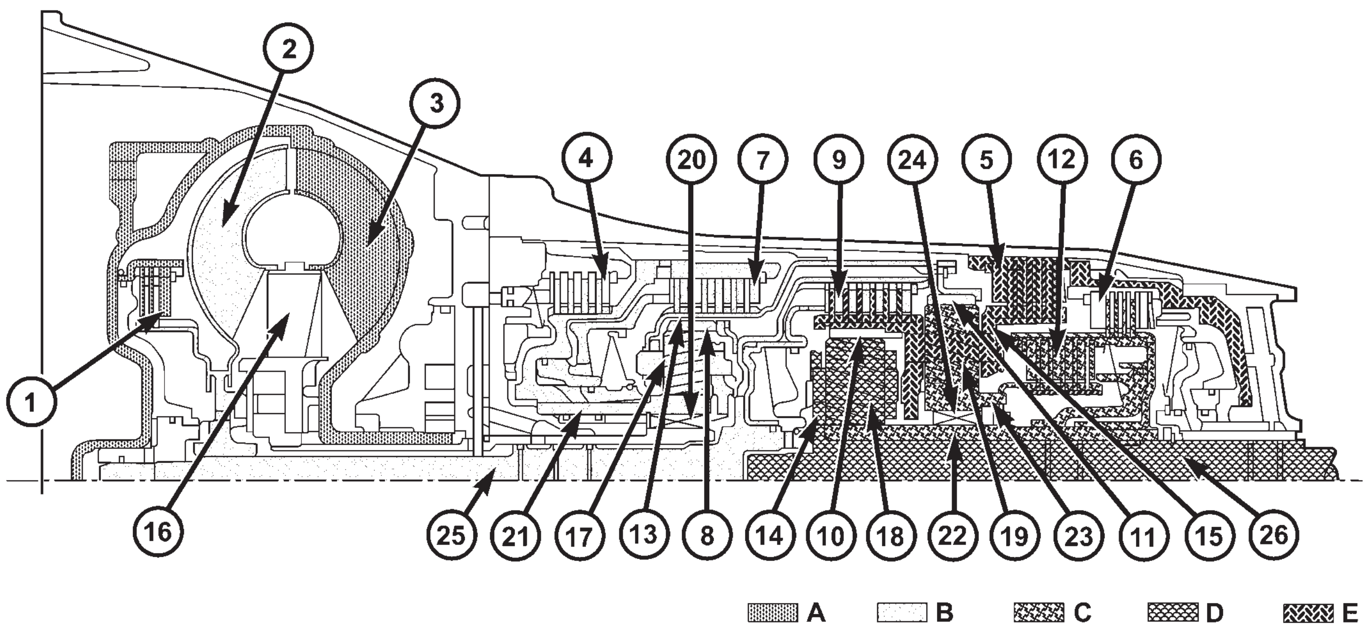


Fig. 15 Reverse Gear Powerflow - 4WD Low

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
D - SECOND GEAR RATIO
E - FIXED PARTS

SHIFT GROUPS/ SHIFT SEQUENCE

1-2 Shift - First Gear Engaged

The end face of the command valve (5) (Fig. 16) is kept unpressurized via the solenoid valve for 1-2 and 4-5 shift (1). Via the holding pressure shift valve (4), the working pressure (p-A) is present at the multiple-disc holding clutch B1 (7). Clutch K1 (6) is unpressurized.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

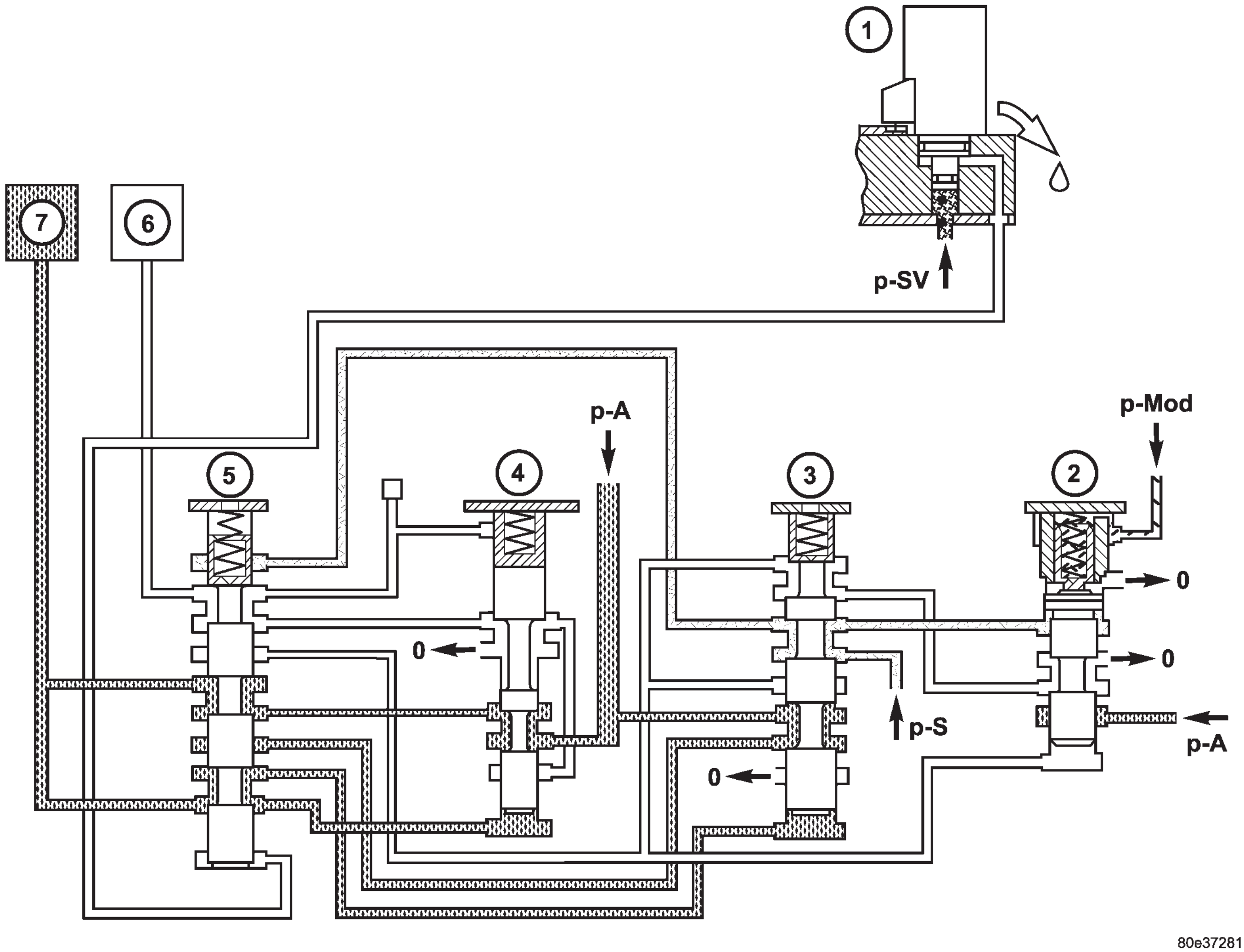


Fig. 16 First Gear Engaged

1 - 1-2/4-5 SHIFT SOLENOID
2 - 1-2/4-5 OVERLAP VALVE
3 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
4 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
5 - 1-2/4-5 COMMAND VALVE
6 - DRIVING CLUTCH K1
7 - HOLDING CLUTCH B1

Shift Phase

Via the 1-2 and 4-5 shift solenoid valve (1) (Fig. 17), the shift valve pressure (p-SV) is directed onto the end face of the command valve (5). The command valve is moved and the shift pressure (p-S) coming from the shift pressure shift valve (3) is directed via the command valve (5) onto clutch K1 (6). Simultaneously the clutch B1 (7) is subjected to overlap pressure by the overlap regulating valve (2).

The B1 (7) pressure acting on the end face of the shift pressure shift valve (3) is replaced by the working pressure (p-A). The rising shift pressure (p-S) at clutch K1 (6) acts on the annular face of the overlap regulating valve (2) and reduces the overlap pressure regulated by the overlap regulating valve (2). When a corresponding pressure level is reached at the holding pressure shift valve (4), this valve switches over.

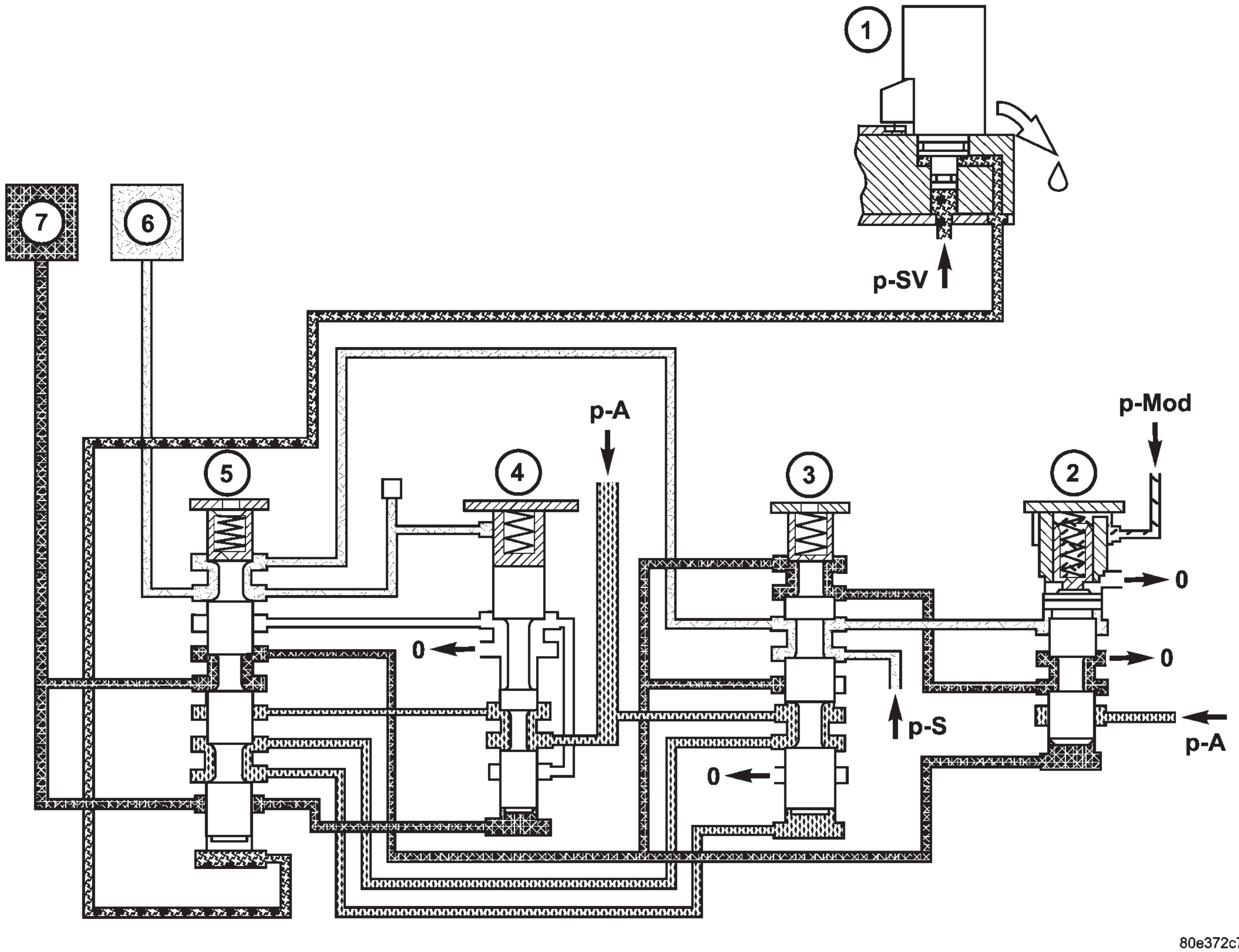


Fig. 17 Shift Phase

1 - 1-2/4-5 SHIFT SOLENOID
2 - 1-2/4-5 OVERLAP VALVE
3 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
4 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
5 - 1-2/4-5 COMMAND VALVE
6 - DRIVING CLUTCH K1
7 - HOLDING CLUTCH B1

Second Gear Engaged

After the gearchange is complete, the pressure on the end face of the command valve (5) (Fig. 18) is reduced via the 1-2 and 4-5 shift solenoid valve (1), and the command valve (5) is pushed back to its basic position. Via the holding pressure shift valve (4) the working pressure (p-A) now passes via the command valve (5) to clutch K1 (6). The multiple-disc holding clutch B1 (7) is deactivated (unpressurized). The spring of the shift pressure shift valve (3) pushes the valve back to its basic position.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

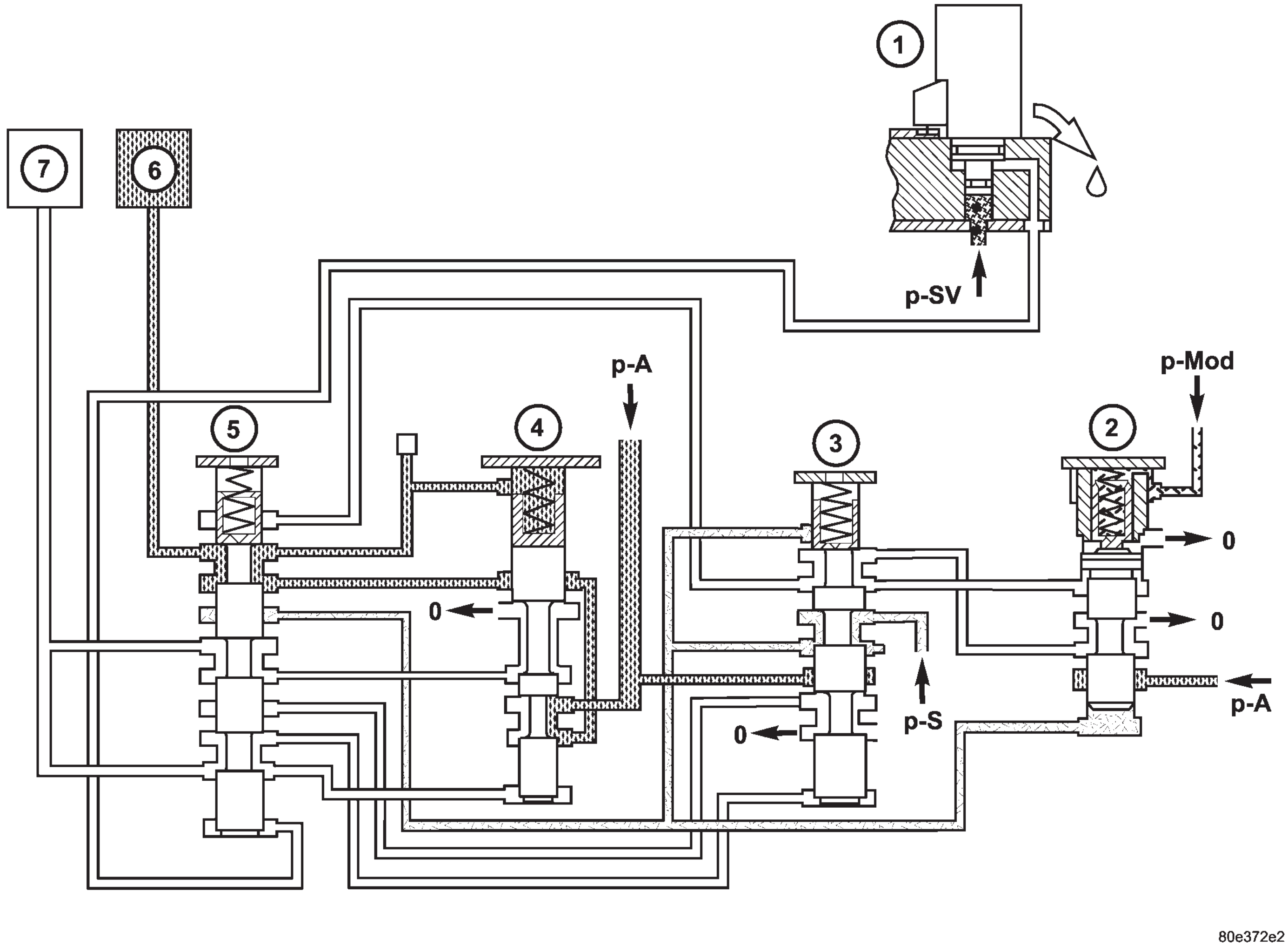


Fig. 18 Second Gear Engaged

1 - 1-2/4-5 SHIFT SOLENOID
2 - 1-2/4-5 OVERLAP VALVE
3 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
4 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
5 - 1-2/4-5 COMMAND VALVE
6 - DRIVING CLUTCH K1
7 - HOLDING CLUTCH B1

Gear Shift N to D (1st gear) - Engine Started

With the engine started (Fig. 19) and the gearshift lever in the NEUTRAL or PARK positions, holding clutch B1 (1) and driving clutch K3 (4) are applied and the various valves in the 1-2/4-5 shift group are positioned to apply pressure to the holding clutch B2.

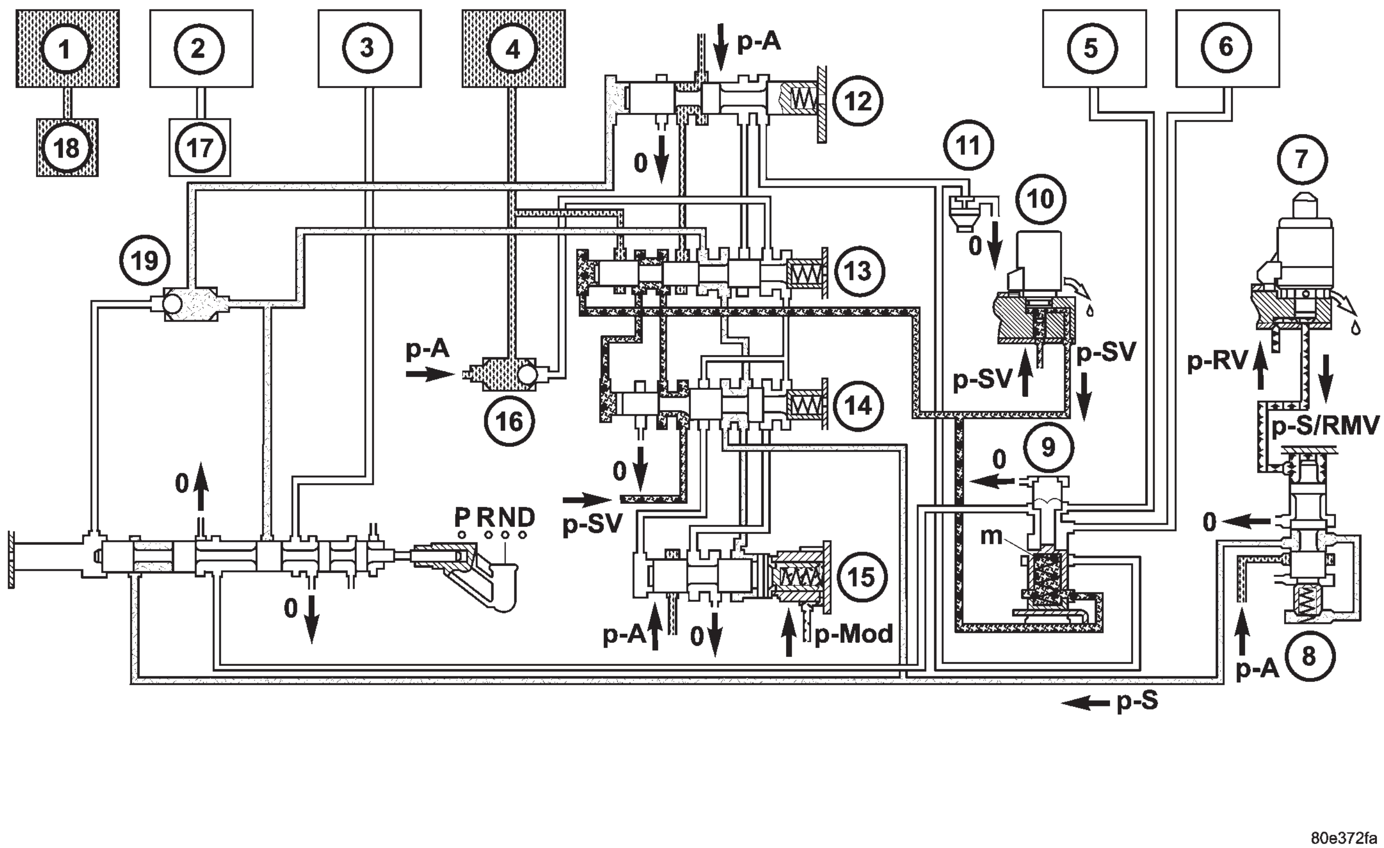


Fig. 19 Engine Started

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B3
4 - DRIVING CLUTCH K3
5 - HOLDING CLUTCH B2 PISTON
6 - HOLDING CLUTCH B2 PISTON OPPOSING FACE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - SHIFT PRESSURE REGULATING VALVE
9 - SHIFT VALVE B2
10 - 3-4 SHIFT SOLENOID
11 - PRESSURE HOLDING VALVE
12 - 3-4 HOLDING PRESSURE SHIFT VALVE
13 - 3-4 COMMAND VALVE
14 - 3-4 SHIFT PRESSURE SHIFT VALVE
15 - 3-4 OVERLAP REGULATING VALVE
16 - BALL VALVE
17 - 1-2/4-5 COMMAND VALVE
18 - 1-2/4-5 COMMAND VALVE
19 - BALL VALVE

Activation Sequence

The selector valve (Fig. 20) opens the shift pressure (p-S) feed connection from the ball valve (19) with the shift valve B2 (9). With the shift valve B2 (9) in the upper position, shift pressure (p-S) travels behind the piston B2 (5) and simultaneously to the opposing face of the piston B2 (6). The multiple-disc holding clutch B2 begins to close.

The pressure on the opposing face of the piston B2 (6) ensures a soft activation of the multiple-disc holding clutch B2.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

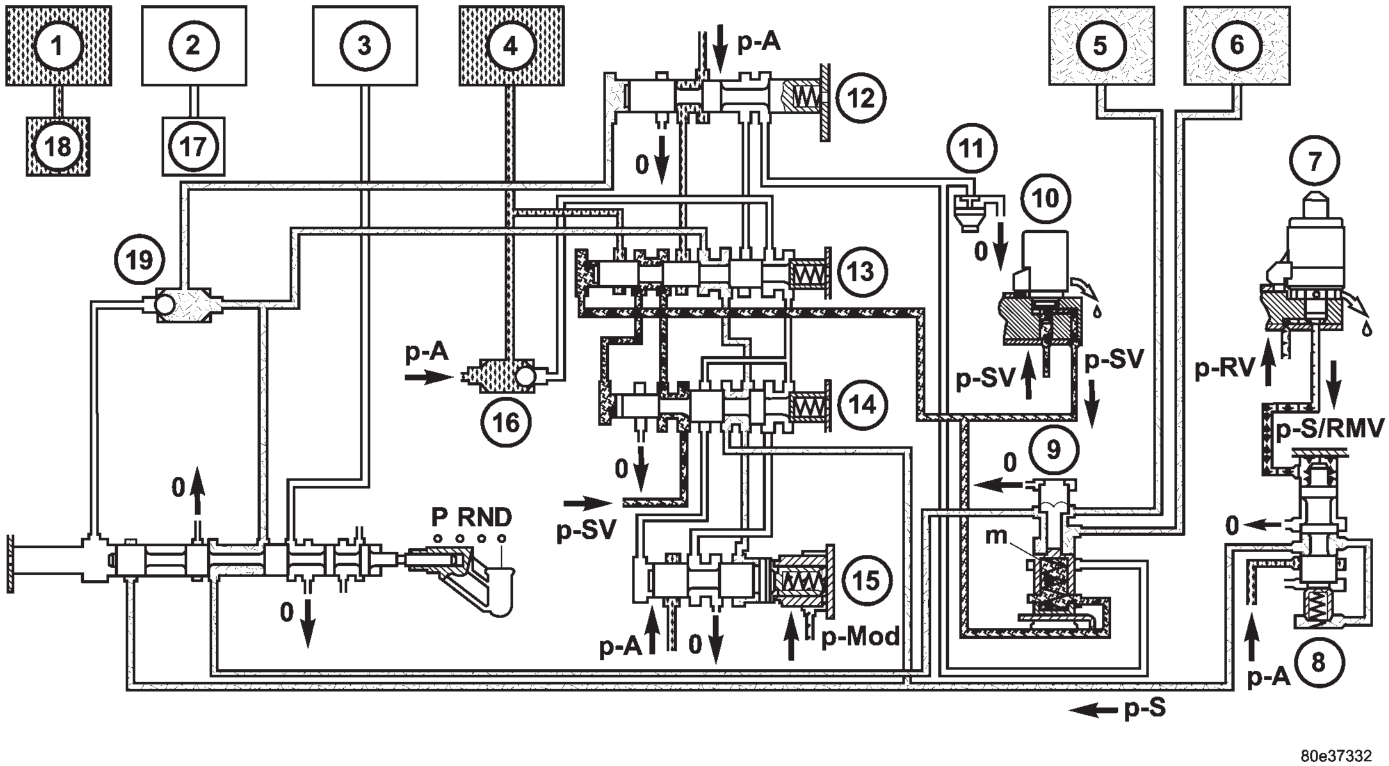


Fig. 20 Activation Sequence

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B3
4 - DRIVING CLUTCH K3
5 - HOLDING CLUTCH B2 PISTON
6 - HOLDING CLUTCH B2 PISTON OPPOSING FACE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - SHIFT PRESSURE REGULATING VALVE
9 - SHIFT VALVE B2
10 - 3-4 SHIFT SOLENOID
11 - PRESSURE HOLDING VALVE
12 - 3-4 HOLDING PRESSURE SHIFT VALVE
13 - 3-4 COMMAND VALVE
14 - 3-4 SHIFT PRESSURE SHIFT VALVE
15 - 3-4 OVERLAP REGULATING VALVE
16 - BALL VALVE
17 - 1-2/4-5 COMMAND VALVE
18 - 1-2/4-5 COMMAND VALVE
19 - BALL VALVE

First Gear Engaged

The TCM control module monitors the activation sequence via the speed of the input shaft, which slows down as the frictional connection in the multiple-disc holding clutch increases. When the speed drops to the specified level, the TCM shuts off the power to the 3-4 shift solenoid valve (10) (Fig. 21). The spring chamber of the shift valve B2 (9) is depressurized and switches downwards. This connects the line to the opposing face of the piston B2 (6) with the pressure holding valve (11). The pressure on the opposing face of the piston B2 (6) drops to a residual pressure.

The working pressure (p-A) is formed and travels via the 2-3 holding pressure shift valve, the 2-3 command valve and the ball valve (16) to multi-plate clutch K3 (4) and via the 3-4 command valve (13) to the end face of the 3-4 shift pressure shift valve (14). The 3-4 shift pressure shift valve (14) is moved against the force of the spring towards the right. At the same time the 3-4 solenoid valve (10) is energized. This allows shift valve pressure (p-SV) to enter the spring chamber of the shift valve B2 (9) and to reach the end face of the 3-4 command valve (13). The shift valve B2 (9) is held in the upper position and the 3-4 command valve (13) switches towards the right. At the end face of the 3-4 shift pressure shift valve (14) the working pressure (p-A) is replaced by shift valve pressure (p-SV).

The 3-4 command valve (13) moves to the left. Working pressure (p-A) travels via the holding pressure shift valve (12) and the 3-4 command valve (13) to the piston of multiple-disc holding clutch B2 (5).

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on a W5J400 automatic transmission, check for Diagnostic Trouble Codes with the DRB® scan tool.

Transmission malfunctions may be caused by these general conditions:
- Poor engine performance.
- Improper adjustments.
- Hydraulic malfunctions.
- Mechanical malfunctions.
- Electronic malfunctions.
- Transfer case performance.

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary.

DIAGNOSIS AND TESTING - PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

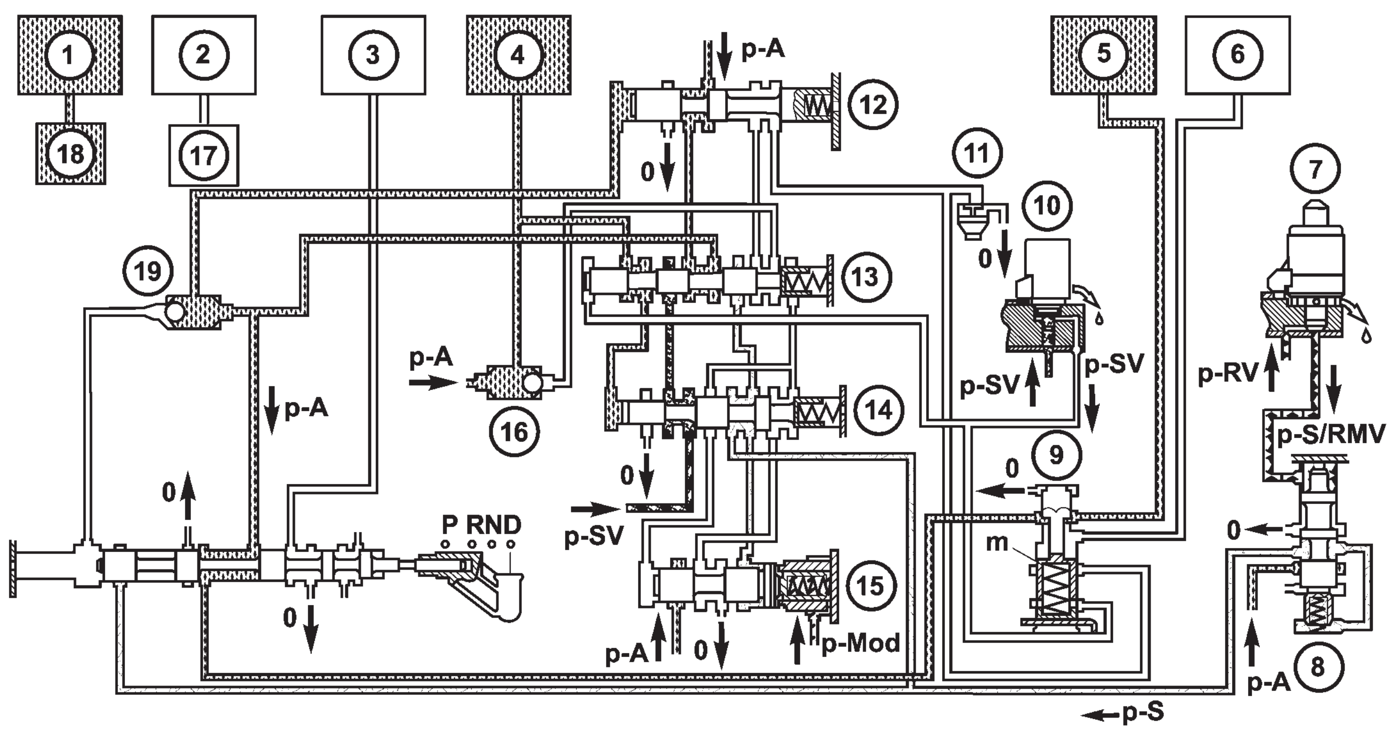


Fig. 21 First Gear Engaged

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B3
4 - DRIVING CLUTCH K3
5 - HOLDING CLUTCH B2 PISTON
6 - HOLDING CLUTCH B2 PISTON OPPOSING FACE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - SHIFT PRESSURE REGULATING VALVE
9 - SHIFT VALVE B2
10 - 3-4 SHIFT SOLENOID
11 - PRESSURE HOLDING VALVE
12 - 3-4 HOLDING PRESSURE SHIFT VALVE
13 - 3-4 COMMAND VALVE
14 - 3-4 SHIFT PRESSURE SHIFT VALVE
15 - 3-4 OVERLAP REGULATING VALVE
16 - BALL VALVE
17 - 1-2/4-5 COMMAND VALVE
18 - 1-2/4-5 COMMAND VALVE
19 - BALL VALVE

AUTOMATIC TRANSMISSION - W5J400 (Continued)

VEHICLE IS DRIVABLE

(1) Check for transmission fault codes using DRB® scan tool.

(2) Check fluid level and condition.

(3) Adjust gearshift cable if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts, and engages.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift cable.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged driveplate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

DIAGNOSIS AND TESTING - ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line pressure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart CLUTCH APPLICATION provides a basis for analyzing road test results.

CLUTCH APPLICATION

GEAR	RATIO	B1	B2	B3	K1	K2	K3	F1	F2
1	3.59	X*	X				X*	X	X
2	2.19		X		X		X*		X
3	1.41		X		X	X			
4	1.00				X	X	X		
5	0.83	X				X	X	X*	
N	X						X		
R	3.16	X*		X			X	X	
R (4WD Low)	1.93			X	X		X		
* = The shift components required during coast.									

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CONDITION	POSSIBLE CAUSES	CORRECTION
MAXIMUM SPEED 30 km/h	1. Speed Control 30 Actuated.	1. Instruct Customer.
ENGINE DIES WHEN TRANSMISSION IS SHIFTED INTO GEAR, ALSO NOISES IN N AND/OR P	1. PWM Valve Blocked.	1. Replace Valve.
	2. Torque Converter Lock Up Control Valve Locked.	2. Enable Movement of Valve, Remove Particle.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
LEVER IN ″P″ POSITION BLOCKED (BRAKE ACTIVATED)	1. No Vacuum Brake Booster After Long Immobilization, Brake Pedal Not Fully Applied/Hard Pedal.	1. Check Vacuum/ Tightness of Brake Booster.
	2. No Stoplamp Switch Signal (no DTC IN ECM).	2. Check Contact to Stoplamp Switch. Replace Switch if Necessary.
GRUMBLING, DRONING, JERKING WHEN TCC IS ENGAGED	1. Slip Speed TCC to Low.	1. Switch Off Torque Converter Lock Up Using DRB®. If Complaint Is Not Reproduced Afterwards, Replace PWM Valve, Set Adaption Values to Zero.
HOWLING, HUMMING ABOVE 4000 RPM IN EACH GEAR	1. Oil Filter Blocked.	1. Replace Oil Filter.
	2. Oil Pump.	2. Replace Oil Pump.
WHINING, SINGING	1. Gear Set Noises in 1st, 2nd, 5th Gear.	1. Replace transmission..
	2. Intermediate Bearing Of The Drive Shaft At 0 km/h, Only When Cold.	2. Replace Intermediate Bearing of the Drive Shaft.
″CLACK″ NOISE FROM CENTER SHIFT AREA WHEN STOPPING OR STARTING	1. Park Lock Solenoid.	1. Replace Shifter Assembly.
CRACKING NOISE WHEN LOAD CYCLE	1. Stick - Slip Between Joint Flange and Collar Nut.	1. Install Zinc Coated Collar Nut Together With Washer.
CHATTERING IN CENTER CONSOLE SHIFT WHILE ACCELERATING	1. Bushing Shift Shaft Has Too Much Clearance.	1. Replace Shifter Lever and Cover Plate.
HARD 2-3 UPSHIFT WHEN STEPPING OFF THE ACCELERATOR PEDAL	1. Response Characteristic Control Loop.	1. Install K2 Disc Spring.
UPSHIFT 2-3, 3-4 SLIPPING	1. Spring of Regulating Valve Pressure control Valve Broken.	1. Replace spring.
HARD 2-1 DOWNSHIFT WHEN COMING TO A STOP	1. Transmission (2-1 downshift) Not Adapted.	1. Readapt Transmission.
	2. TCM Software Data.	2. Flash TCM.
	3. Free Wheeling Clutch F1 Defective.	Replace Free Wheeling Clutch F1.
HARD 3-2 DOWNSHIFT WHEN DECELERATION EVEN AFTER READAPTION	1. K3 Idles.	1. Install TCM And/Or Electrohydraulic Control Unit.
NO RESP. DELAYED UPSHIFT, NO DTC	1. Different Tire Sizes Are Mounted On The Front Axle.	1. Mount Uniform Tire Sizes On The Front Axle.
NO UPSHIFT 3-4, 4-5 AFTER FAST OFF (ACCELERATOR)	1. Upshift Prevention To Realize Dynamical Drivestyle.	1. Instruct Customer.
NO UPSHIFT OF 1ST GEAR BELOW 5000 RPM	1. Gear Recognition Switch.	1. Replace Gear Recognition Switch.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO UPSHIFT INTO 5TH GEAR WHEN FULL THROTTLE OR KICK DOWN ACTIVATION	1. The Upshift 4-5 At Full Throttle or Kick Down Never Occurs Until Reaching Cut Off Speed. Under These Conditions, The High Powered Vehicle Will Never Shift Into 5th Gear Below 250 km/h.	1. Instruct Customer.
NO KICK DOWN SHIFTING	1. Accelerator Pedal Value < 95%.	1. Check Engine Control. Adjust As Necessary.
Engine Turns Up While 2-3 Upshift and/or Hard 3-2 Downshift	1. Oil Level Too Low.	1. Check Oil At 80°C. Add if Necessary.
	2. Oil Filter Not Installed.	2. Install Oil Filter.
	3. Free Wheeling Clutch F2 Defective.	3. Replace Free Wheeling Clutch F2, Hollow Shaft, and Rear Sun Gear/Inner Disc Carrier K3.
GRABBING 2-3 COASTING UPSHIFT AND/OR BRAKE DOWNSHIFT	1. Oil Level Too Low.	1. Check Oil At 80°C. Add if Necessary.
	2. Oil Filter Not Installed.	2. Install Oil Filter.
	3. Control shift or Command Valve Blocked.	3. Check Each Slide Valve For Base Position and Ease Of Movement, Remove Particle.
	4. K3 Disc Burnt, Hot Spots or Rubbed Down.	4. Replace Inner and Outer Disc Carrier K3 And Control Valve.
DELAYED ENGAGEMENT, NO TRANSFER OF POWER IN R AND/OR D, ALSO AT TIMES	1. Oil Level Too Low.	1. Check Oil At 80°C. Add if Necessary.
	2. Recognition Switch - Selector Lever Position.	2. Replace Recognition Switch Only When Intermediate Position or Fault is Indicated.
	3. Oil Filter Not Installed.	3. Install Oil Filter.
	4. AEV, Delayed Pressure Build Up On Piston B2/B3.	4. Install New Shifting Procedure (TCM, electrohydraulic control unit or repair set).
	5. Wrong Combination TCM/ Electrohydraulic Control Unit.	5. Check Combination TCM/Electrohydraulic Control Unit. Replace TCM Resp. Electrohydraulic Control Unit, if necessary.
NO UPSHIFT OF 1ST GEAR AT TIMES	1. Connector Ballast Unit. Output Speed Sensor Loose, Incorrectly Contacted.	1. Check Connectors, Replace Output Speed sensor If Necessary.
	2. Output Speed Sensor Defective	2. Replace Output Speed Sensor.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
LEAKAGE AT THE AREA OF THE ELECTRICAL PLUG TO THE CONDUCTOR PLATE	1. Deformation O-Rings.	1. Replace O-Rings.
	2. Deformation Adapter.	2.Replace Adaptor.
	3. The Conductor Plate Is Not Fitted Surface To Surface On The Valve Body In One Corner, The Plug Is Not Centered In The Socket And The O-ring Will Not Seal.	3. Remove Nose Of Conductor Plate.
	4. Contacting At The Conductor Plate Leaky. Oil In Harness, Sometimes In The Control Module.	4. Replace Conductor Plate.
LEAKAGE AT THE AREA OF BELL HOUSING/ TORQUE CONVERTER	1. Bolts (Torx M6) Outer Disc Carrier B1.	1. Clean Thread and Install the Bolts Using Sealer.
OIL LEAKS	1. 6 Lower Bolts (TorxM8) Converter Housing.	1. Clean Thread and Install the Bolts Using Sealer.
	2. Oil Drain Plug Converter Loose Resp. No Seal Ring Installed.	2. Install Drain Plug Correctly.
	3. Weld Seam Of Torque Converter Leaky.	3. Replace Torque Converter.
	4. Radial Sealing Ring Oil Pump Defective.	4. Replace Sealing Ring.
	5. O-Ring Oil Pump Defective Or Not Installed.	5. Install O-Ring.
	6. Bushing Of Oil Pump Loose, caused By Missing Fit Bolt At Transmission/Engine Flange.	6. Install Fit Bolt If Necessary.

STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL

(1) Disconnect the negative battery cable.

(2) Raise and support the vehicle.

(3) Remove any necessary skid plates (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL).

(4) Mark propeller shaft and axle yokes for assembly alignment.

(5) Remove the rear propeller shaft.

(6) Remove the front propeller shaft.

(7) Disconnect and lower or remove any necessary exhaust components.

(8) Remove the starter motor.

(9) Remove the torque converter access plug from the diesel engine adapter.

(10) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(11) Disconnect gearshift cable from transmission manual valve lever.

(12) Remove bolt (3) (Fig. 22) and screw (1) holding the heat shield (2) to the transmission.

(13) Disconnect 13-pin plug connector (1) (Fig. 23). Turn bayonet lock of guide bushing (2) anti-clockwise.

(14) Drain transmission oil by unscrewing oil drain plug (8).

(15) Disconnect transfer case shift cable from the transfer case shift lever.

(16) Remove the clip securing the transfer case shift cable into the cable support bracket.

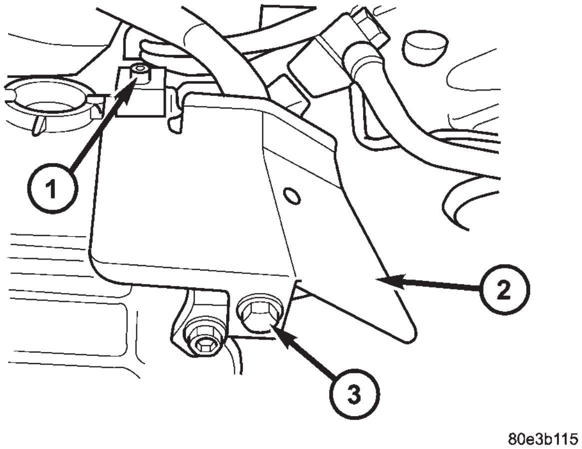


Fig. 22 Remove Heat Shield

1 - SCREW
2 - HEAT SHIELD
3 - BOLT

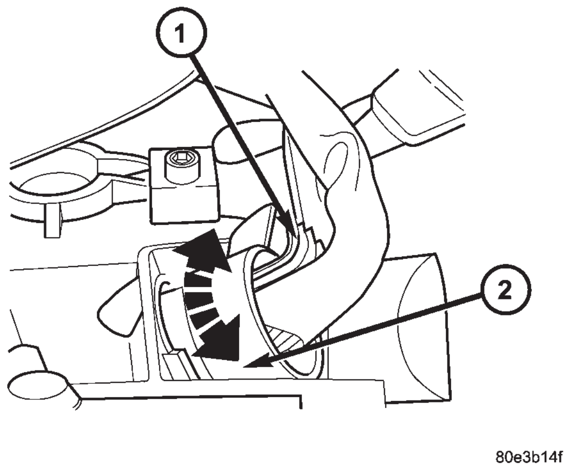


Fig. 23 Remove Wiring Connector Plug

1 - PLUG CONNECTOR
2 - GUIDE BUSHING

(17) Disconnect transmission fluid cooler lines at transmission fittings and clips.

(18) Disconnect the transmission vent hose from the transmission.

(19) Support rear of engine with safety stand or jack.

(20) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(21) Remove bolts securing rear support and cushion to transmission and crossmember.

(22) Remove bolts attaching crossmember to frame and remove crossmember.

(23) Remove transfer case.

(24) Remove all remaining converter housing bolts.

(25) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(26) Hold torque converter in place during transmission removal.

(27) Lower transmission and remove assembly from under the vehicle.

(28) To remove torque converter, carefully slide torque converter out of the transmission.

DISASSEMBLY

(1) Remove the torque converter (1) (Fig. 24).

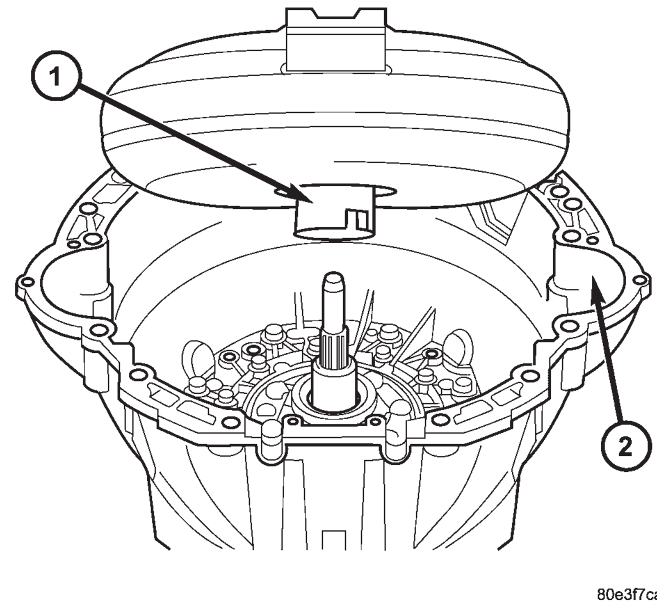


Fig. 24 Remove Torque Converter

1 - TORQUE CONVERTER
2 - CONVERTER HOUSING

(2) Loosen guide bushing (12) (Fig. 25) and remove from transmission housing.

(3) Detach oil pan (5) (Fig. 25).

(4) Remove oil filter (4) (Fig. 25).

(5) Unscrew Torx socket bolts (3) and remove electrohydraulic unit (2).

(6) Remove the bolts holding the transfer case adapter housing onto the transmission case.

(7) Remove the transfer case adapter housing from the transmission case.

(8) Remove the bolt holding the output shaft extension to the output shaft.

(9) Remove the output shaft extension from the output shaft.

(10) Remove the transmission rear oil seal.

(11) Remove the transmission rear output shaft shim.

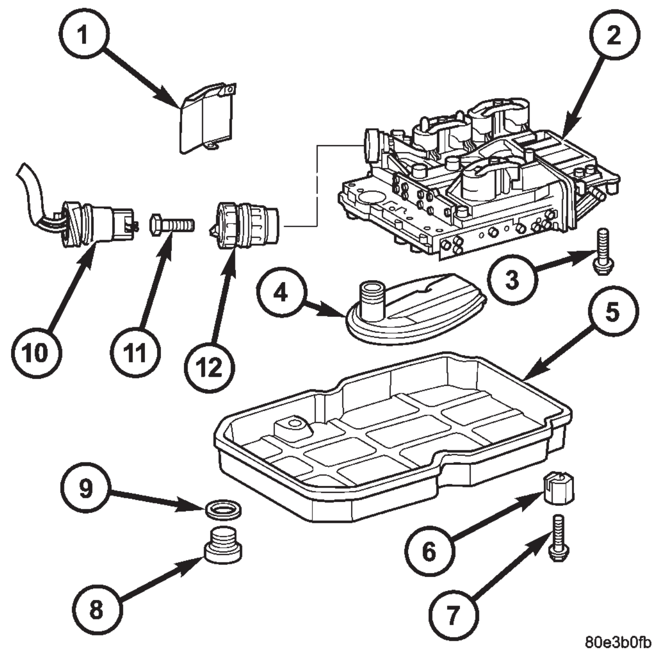


Fig. 25 Remove Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

(12) Remove the transmission rear output shaft bearing retaining ring (1) (Fig. 26).

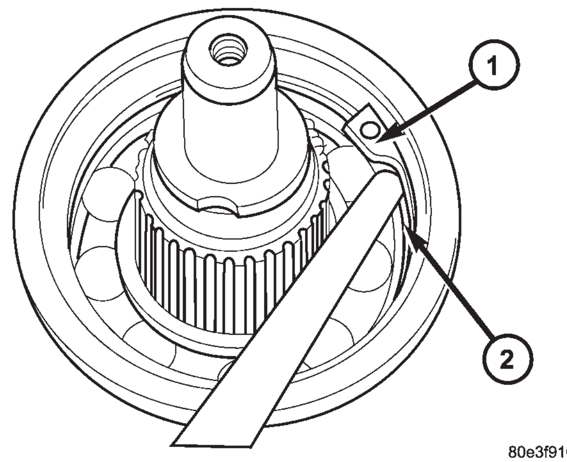


Fig. 26 Remove Rear Output Shaft Retaining Ring - Typical

1 - RETAINING RING
2 - OUTPUT SHAFT BEARING

AUTOMATIC TRANSMISSION - W5J400 (Continued)

(13) Assemble Puller, Size 5, 8903 (Fig. 27) and Bearing Puller Adapter 8904 onto the output shaft and output shaft bearing.

(14) Remove the output shaft bearing (Fig. 28).

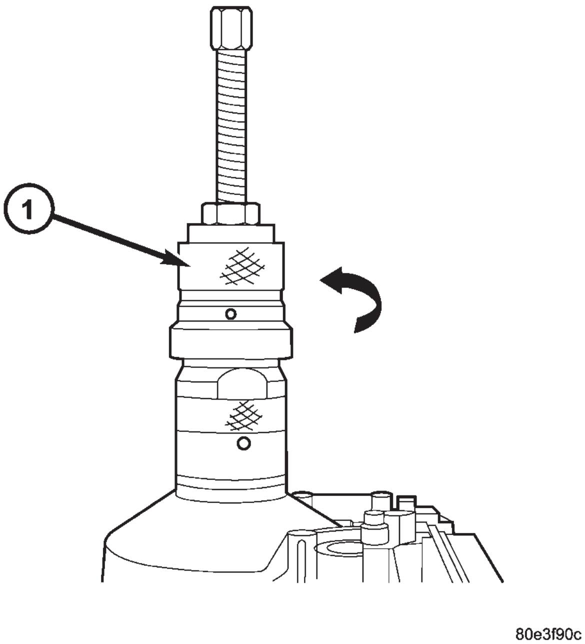


Fig. 27 Assemble Special Tool To Remove Output Shaft Rear Bearing

1 - PULLER, SIZE 5, 8903 AND BEARING PULLER ADAPTER 8904

(15) Remove the output shaft end-play shim from the output shaft.

(16) Remove the bolts holding the transmission housing to the converter housing from inside the converter housing.

(17) Stand the transmission upright on the converter housing. Be sure to use suitable spacers between the bench surface and the converter housing since the input shaft protrudes past the front surface of the housing.

(18) Remove the remaining bolts holding the transmission housing to the converter housing.

(19) Remove the transmission housing from the converter housing.

(20) Remove output shaft with center and rear gear set and clutch K3 (3) (Fig. 29).

(21) Remove thrust needle bearing (4) and thrust washer (5) (Fig. 29).

(22) Remove drive shaft with clutch K2 and front gear set (6).

(23) Remove clutch K1 (1).

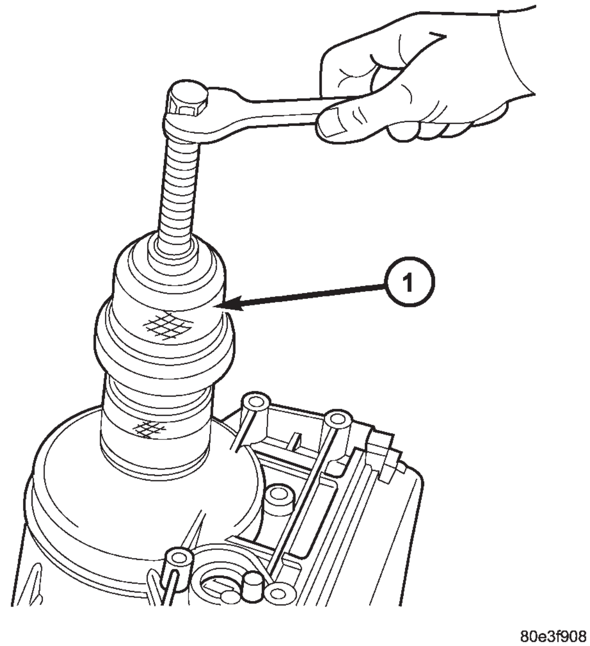


Fig. 28 Remove Output Shaft Rear Bearing

1 - PULLER, SIZE 5, 8903 AND BEARING PULLER ADAPTER 8904

(24) Unscrew Torx socket bolts (4) (Fig. 30) and remove oil pump (6). Screw two opposed bolts into the oil pump housing and press the oil pump out of the converter housing by applying light blows with a plastic hammer.

(25) Unscrew Torx socket bolts (1) (Fig. 30) and remove multiple-disc brake B1 (5) from converter housing. Screw two opposed bolts into the multiple-disc brake B1 (5) and separate from the converter housing by applying light blows with a plastic hammer.

(26) Detach intermediate plate (3) (Fig. 30) from converter housing (2).

(27) Remove multiple-disc pack B3 (2) (Fig. 31) and spring washer (3) by removing snap-ring (1) in transmission housing. To facilitate removal of the snap-ring (1), compress the multiple-disc pack B3 (2).

(28) Unscrew Torx socket bolts (7) (Fig. 31).

(29) Remove multiple-disc brake B2 (4) (Fig. 31) from transmission housing. The externally toothed disc carrier for multiple-disc holding clutch B2 is also the piston for multiple-disc holding clutch B3.

(30) Remove parking lock gear (5) (Fig. 31).

AUTOMATIC TRANSMISSION - W5J400 (Continued)

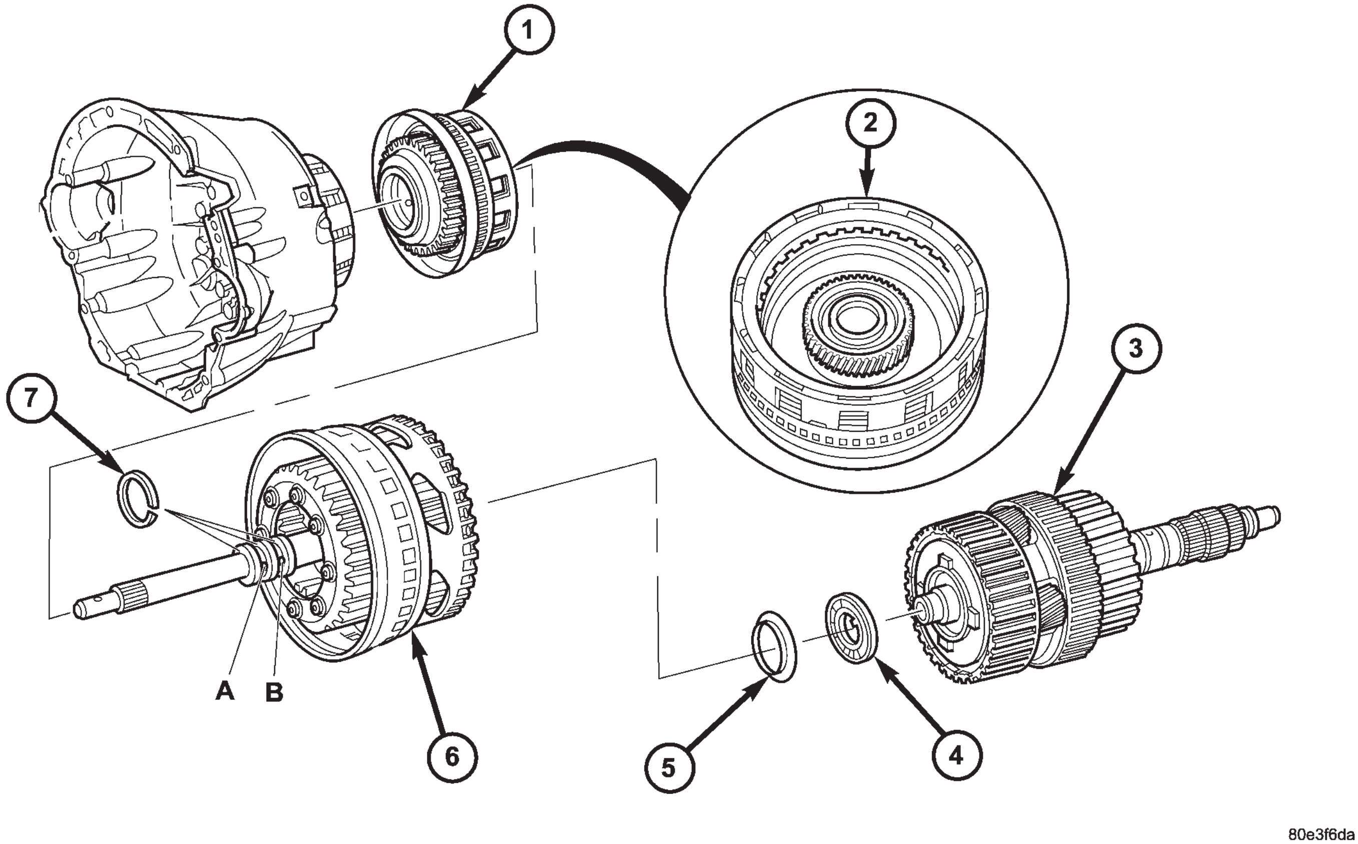


Fig. 29 Remove K1, K2, and K3 Clutches

1 - DRIVING CLUTCH K1
2 - SUN GEAR OF FRONT PLANETARY GEAR SET
3 - DRIVING CLUTCH K3, OUTPUT SHAFT , AND CENTER AND REAR PLANETARY GEAR SETS
4 - THRUST NEEDLE BEARING
5 - THRUST WASHER
6 - FRONT PLANETARY GEAR SET, DRIVING CLUTCH K2, AND DRIVE SHAFT
7 - TEFLON RINGS

AUTOMATIC TRANSMISSION - W5J400 (Continued)

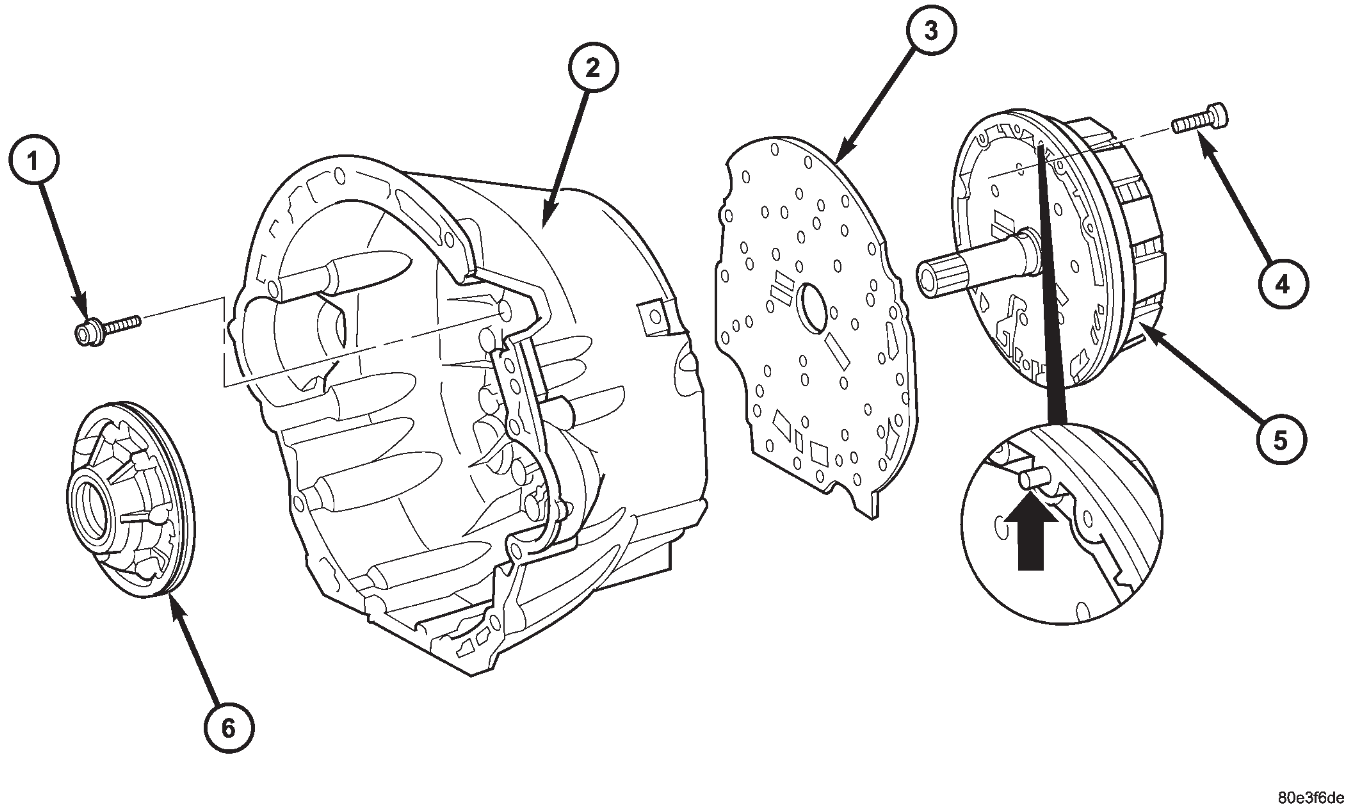


Fig. 30 Remove Holding Clutch B1 and Oil Pump

1 - BOLTS - M6X32
2 - CONVERTER HOUSING
3 - INTERMEDIATE PLATE
4 - BOLTS - M8X35
5 - HOLDING CLUTCH B1
6 - OIL PUMP

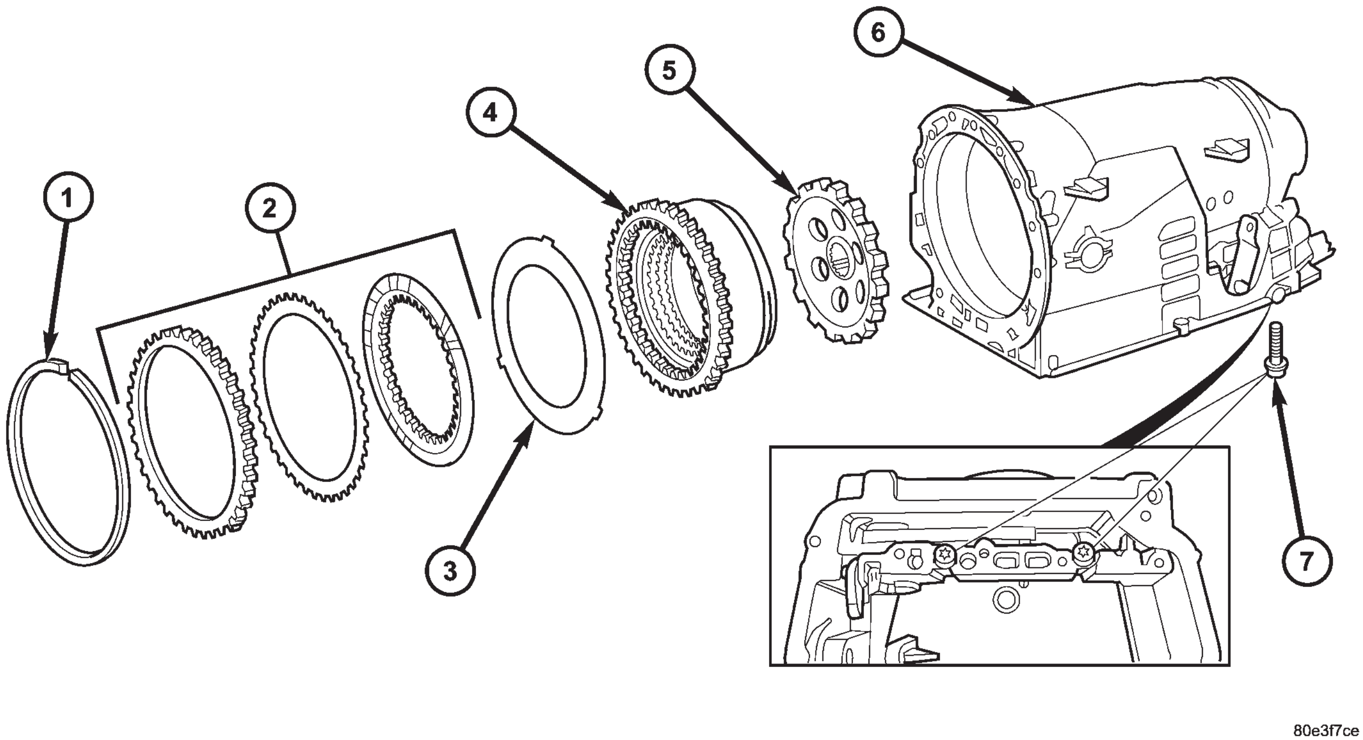


Fig. 31 Remove B2, B3, and Parking Gear

1 - SNAP-RING
2 - HOLDING CLUTCH B3 DISCS
3 - SPRING WASHER
4 - HOLDING CLUTCH B2
5 - PARK GEAR
6 - TRANSMISSION HOUSING
7 - BOLTS - M8X60

ASSEMBLY

(1) Insert parking lock gear (5) (Fig. 32).

(2) Install multiple-disc holding clutch B2 (4) in transmission housing (6) (Fig. 32).

(3) Screw in Torx socket bolts (7). Tighten the bolts to 16 N·m.

NOTE: During the measurement the snap ring (7) (Fig. 33) must contact the upper bearing surface of the groove in the outer multiple-disc carrier (8).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(4) Insert and measure spring washer (4) (Fig. 33) and multiple-disc pack B3 (2, 6).

(a) Put multiple-discs for multiple-disc brake B3 together in the sequence shown in the illustration and insert individually.

(b) Using a feeler gauge, determine the play ″L″ at three points between the snap ring (7) and outer multiple-disc (1). B3 clutch clearance should be 1.0-1.4 mm. Adjust the clearance as necessary.

(c) Adjust with snap-ring (7), if necessary. Snap rings are available in thicknesses of 3.2, 3.5, 3.8, 4.1 4.4 and 4.7 mm..

(5) Place intermediate plate (3) on converter housing (2) and align.

NOTE: The intermediate panel can generally be used several times. The panel must not be coated with sealant

(6) Check that the K1 clutch feed hole (Fig. 34) in the inner hub of clutch B1 is free before installing clutch B1.

(7) Install the holding clutch B1 (5) (Fig. 35) onto the converter housing and intermediate plate. Installed position of clutch B1 in relation to converter housing is specified by a plain dowel pin in clutch B1 (arrow).

(8) Install the bolts to hold clutch B1 (5) (Fig. 35) to the converter housing.

(9) Securely tighten multiple-disc brake B1 (5) on converter housing (2) to 10 N·m.

(10) Install new seals on the oil pump (Fig. 36).

(11) Install oil pump (6) and securely tighten. Tighten the oil pump bolts to 20 N·m.

AUTOMATIC TRANSMISSION - W5J400 (Continued)

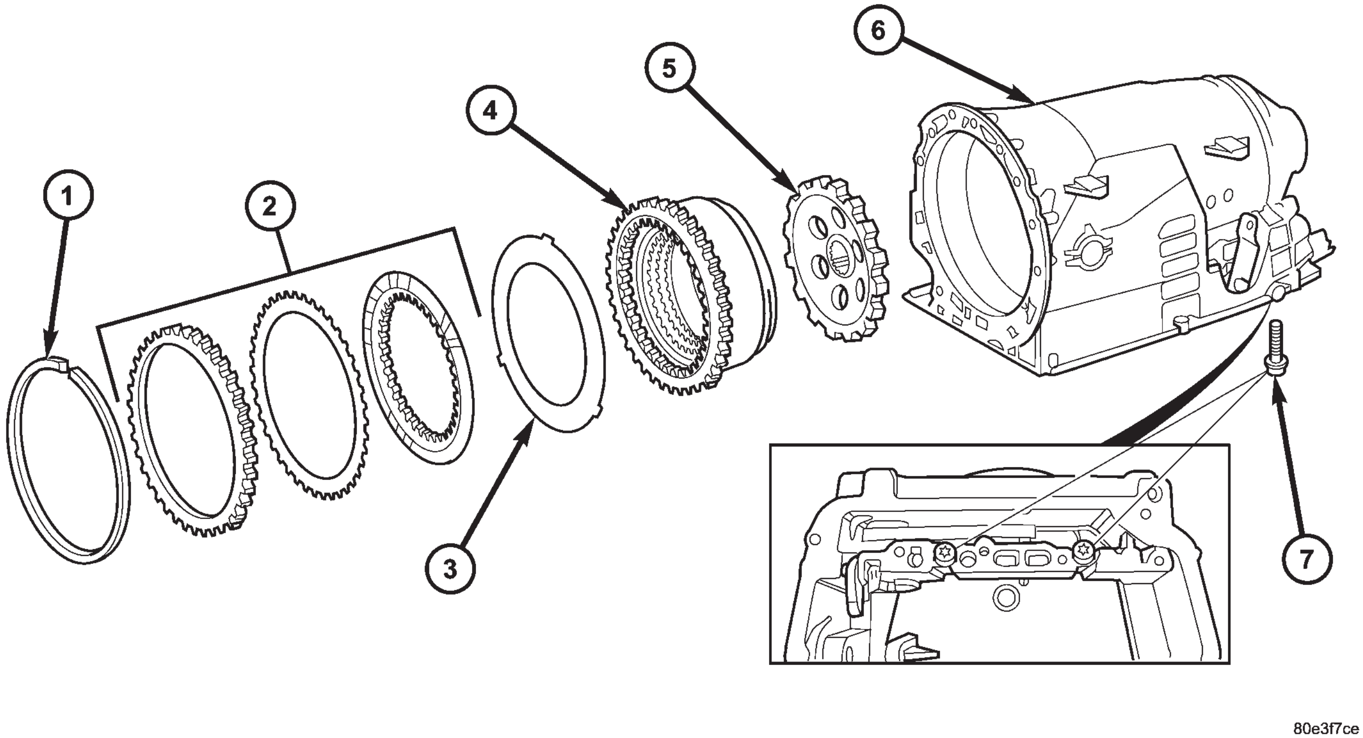


Fig. 32 Install B2, B3, and Parking Gear

1 - SNAP-RING
2 - HOLDING CLUTCH B3 DISCS
3 - SPRING WASHER
4 - HOLDING CLUTCH B2
5 - PARK GEAR
6 - TRANSMISSION HOUSING
7 - BOLTS - M8X60

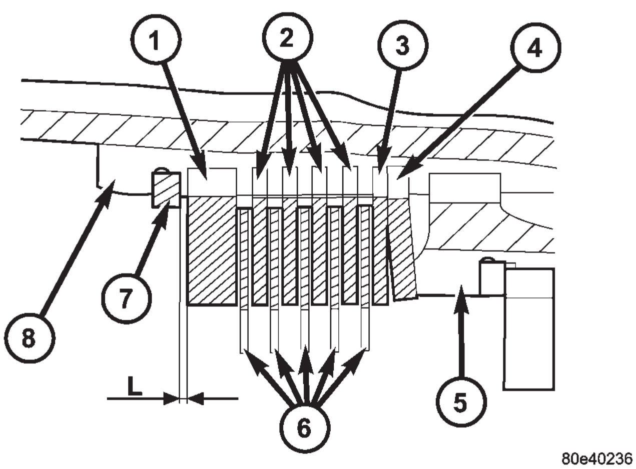


Fig. 33 Measure B3 Clutch Clearance

1 - OUTER DISC - 6.5 MM
2 - OUTER DISCS - 1.8 MM
3 - OUTER DISCS - 1.8 MM
4 - SPRING WASHER
5 - PISTON
6 - FRICTION DISCS
7 - SNAP-RING
8 - B3 DISC CARRIER

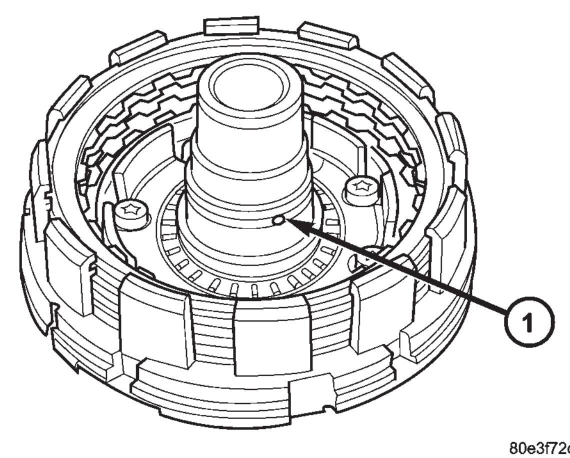


Fig. 34 Check K1 Feed Hole

1 - K1 CLUTCH FEED HOLE

AUTOMATIC TRANSMISSION - W5J400 (Continued)

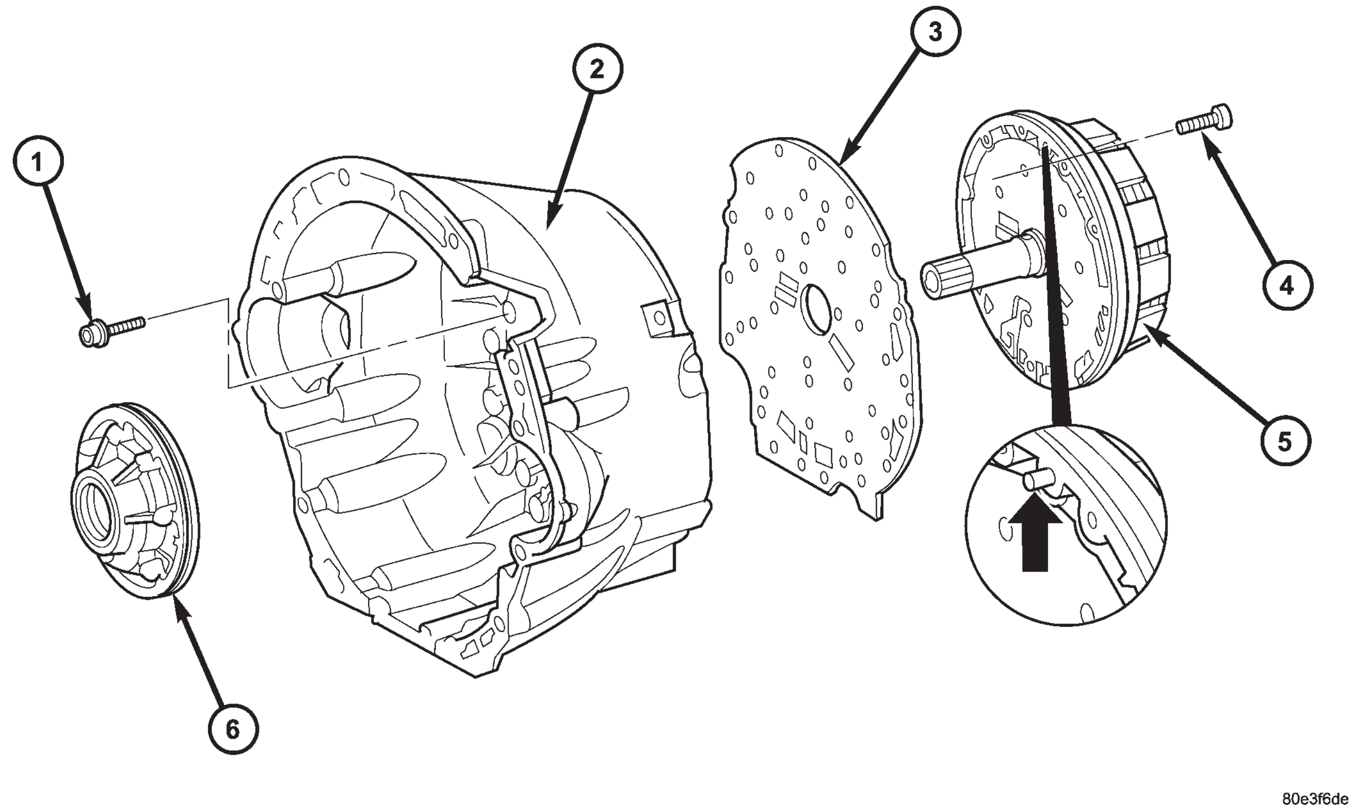


Fig. 35 Install Holding Clutch B1 and Oil Pump

1 - BOLTS - M6X32
2 - CONVERTER HOUSING
3 - INTERMEDIATE PLATE
4 - BOLTS - M8X35
5 - HOLDING CLUTCH B1
6 - OIL PUMP

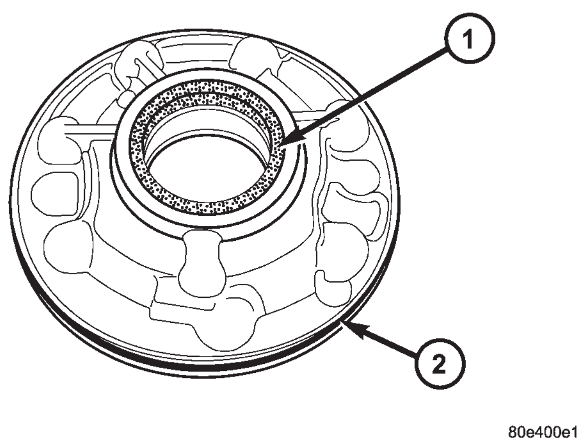


Fig. 36 Install New Oil Pump Seals

1 - INNER OIL SEAL
2 - OUTER OIL SEAL

(12) Using grease, insert Teflon rings (7) (Fig. 37) in the groove so that the joint remains together

(13) Mount clutch K1 (1) (Fig. 37).

(14) Install drive shaft with clutch K2 (6) and front gear set (1) (Fig. 37).

(15) Install front washer (5) and thrust needle bearing (4) (Fig. 37).

(16) Install output shaft with center and rear gear set and clutch K3 (3) (Fig. 37).

(17) Using grease, install both Teflon rings in the groove at the rear of the output shaft so that the joint stays together.

(18) Mount transmission housing on converter housing.

(19) Screw in Torx socket bolts through the transmission housing into the converter housing. Tighten the bolts to 20 N·m.

(20) Measure end play between park pawl gear and grooved ball bearing.

(a) Place Parallel Rest 8906 (1) on transmission housing. Using the depth gauge, measure from the parallel rest (1) to the parking lock gear (2) (Fig. 38).

AUTOMATIC TRANSMISSION - W5J400 (Continued)

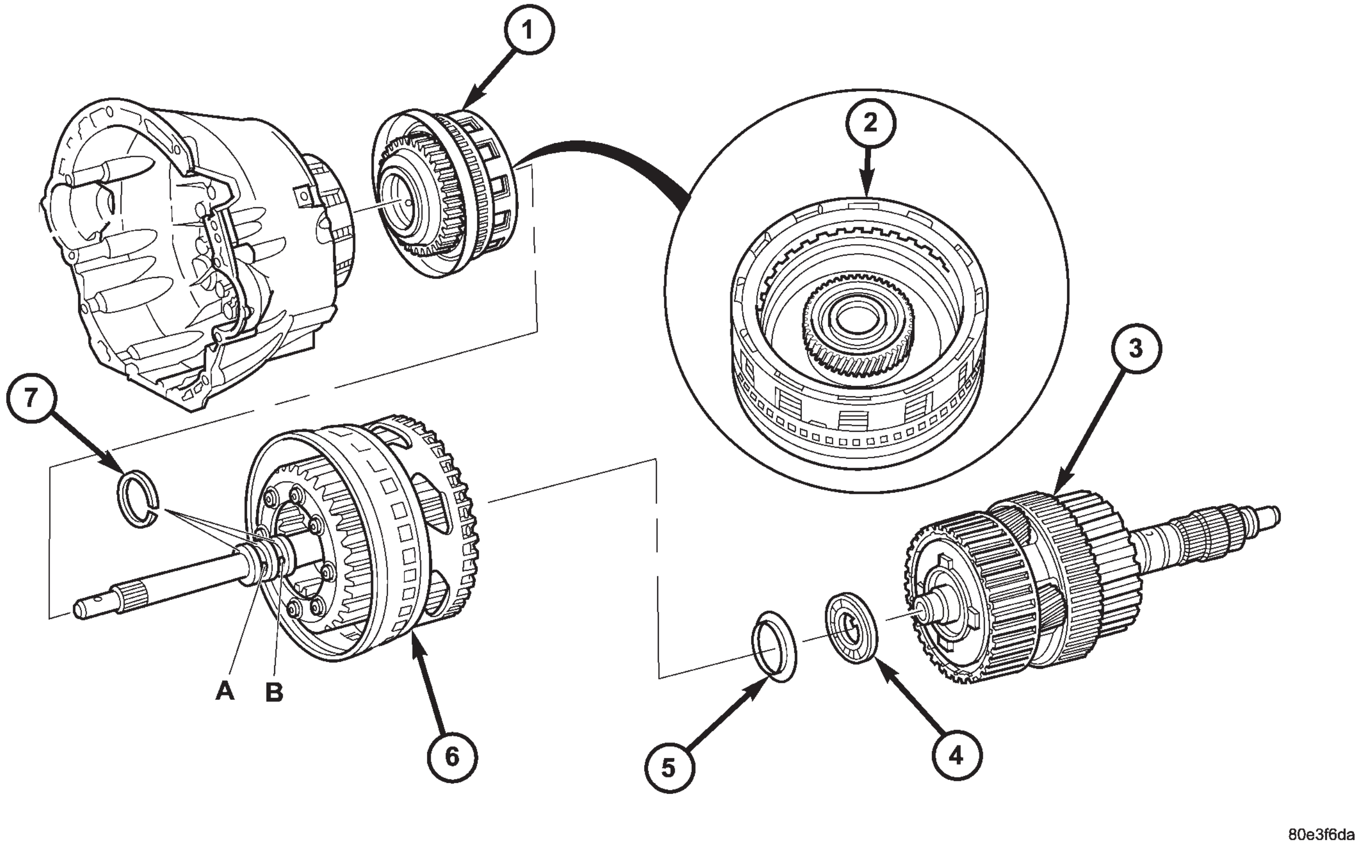


Fig. 37 Install K1, K2, and K3 Clutches

1 - DRIVING CLUTCH K1
2 - SUN GEAR OF FRONT PLANETARY GEAR SET
3 - DRIVING CLUTCH K3, OUTPUT SHAFT , AND CENTER AND REAR PLANETARY GEAR SETS
4 - THRUST NEEDLE BEARING
5 - THRUST WASHER
6 - FRONT PLANETARY GEAR SET, DRIVING CLUTCH K2, AND DRIVE SHAFT
7 - TEFLON RINGS

(b) Using the depth gauge, measure from the Parallel Rest 8906 (1) to the contact surface of the output shaft bearing (2) in the transmission housing (Fig. 39).

(c) Subtract the first figure from the second figure to determine the current end-play of the transmission. Select a shim such that the end-play will be 0.3-0.5 mm. Shims are available in thicknesses of 0.2, 0.3, 0.4 and 0.5 mm.

(d) Install the selected shim.

(21) Screw in Torx socket bolts through the converter housing into the transmission housing. Tighten the bolts to 20 N·m.

(22) Install output shaft bearing in rear transmission housing.

(a) Using a suitable alignment tool, press the output shaft bearing into the transmission housing. The closed side of the plastic cage must point towards the parking lock gear.

(b) Install the retaining ring (Fig. 40). Ensure that the retaining ring is seated correctly in the groove.

(c) Check that there is no play between the bearing and the retaining ring using feeler gauge.

(d) There must be no play between the retaining ring and the bearing. If the ring cannot be installed, a thinner ring must be used. If there is play between the ring and the bearing, a thicker ring must be installed. Retaining rings are available in thicknesses of 2.0, 2.1 and 2.2 mm.

(23) Install the rear output shaft shim onto the output shaft.

(24) Install a new transmission rear seal into the transmission case with Drift Punch 8902.

(25) Install the output shaft extension onto the output shaft.

(26) Install the bolt to hold the output shaft extension to the output shaft. Torque the bolt to 120 N·m (88 ft.lbs.).

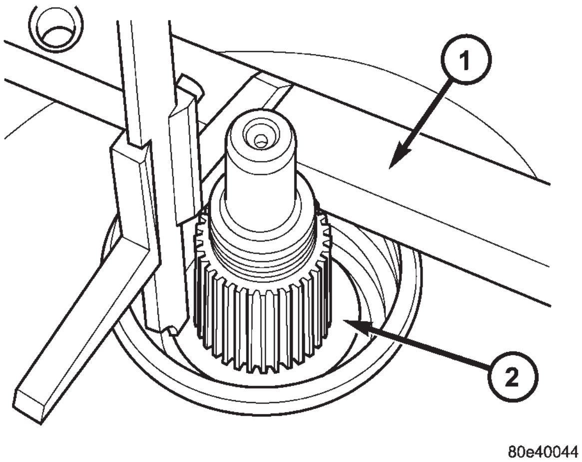


Fig. 38 Measure From Transmission Housing to Park Gear

1 - PARALLEL REST 8906
2 - PARK GEAR

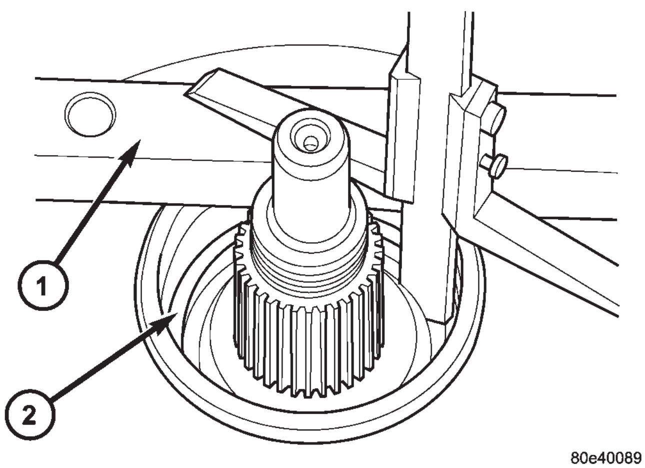


Fig. 39 Measure From Transmission Housing To Rear Bearing Contact Surface

1 - PARALLEL REST 8906
2 - OUTPUT SHAFT BEARING CONTACT SURFACE

(27) Install the transfer case adapter housing onto the transmission case.

(28) Install the bolts to hold the transfer case adapter housing onto the transmission case. Torque the bolt to 20 N·m (177 in.lbs.).

(29) Install electrohydraulic unit (2). Tighten the bolts to 8 N·m.

(30) Install oil filter (4) (Fig. 41).

(31) Install oil pan (5) (Fig. 41). Tighten the bolts to 8 N·m.

(32) Install guide bushing (12) (Fig. 41).

(33) Install the torque converter (Fig. 42).

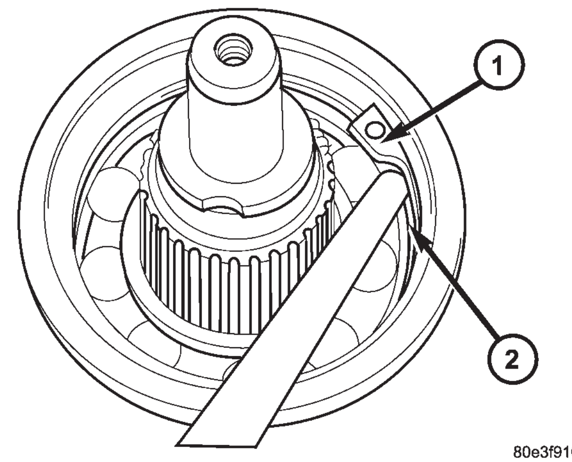


Fig. 40 Install Rear Output Shaft Retaining Ring - Typical

1 - RETAINING RING
2 - OUTPUT SHAFT BEARING

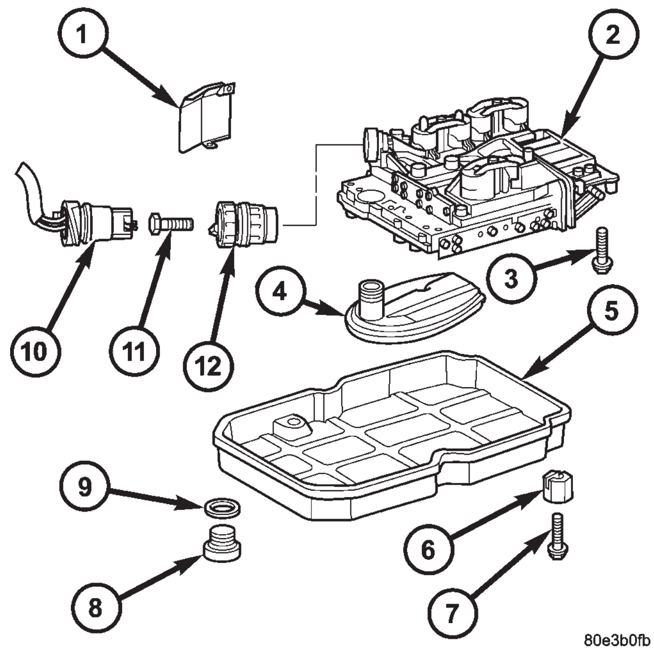


Fig. 41 Install Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

AUTOMATIC TRANSMISSION - W5J400 (Continued)

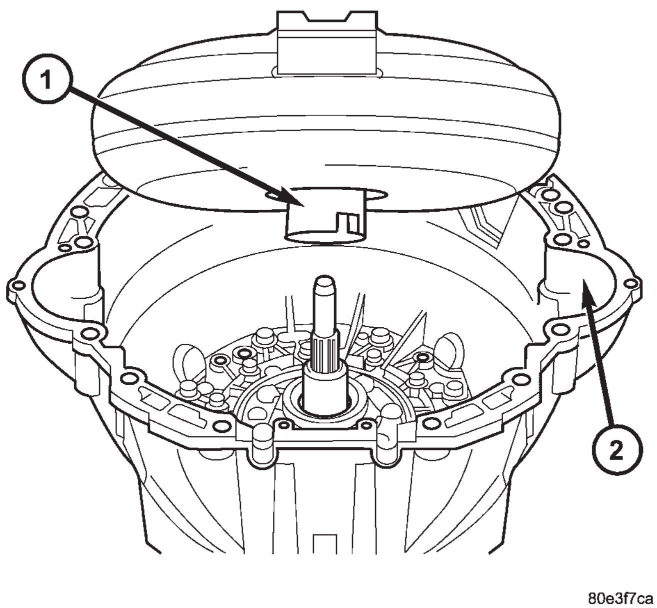


Fig. 42 Install Torque Converter

1 - TORQUE CONVERTER
2 - CONVERTER HOUSING

INSTALLATION

(1) Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.

(3) Lubricate oil pump seal lip with transmission fluid.

(4) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or converter hub while inserting torque converter into the front of the transmission.

(5) Align torque converter to oil pump seal opening.

(6) Insert torque converter hub into oil pump.

(7) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(8) Check converter seating with a scale and straightedge (Fig. 43). Surface of converter lugs should be at least 19 mm (3/4 in.) to rear of straightedge when converter is fully seated.

(9) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

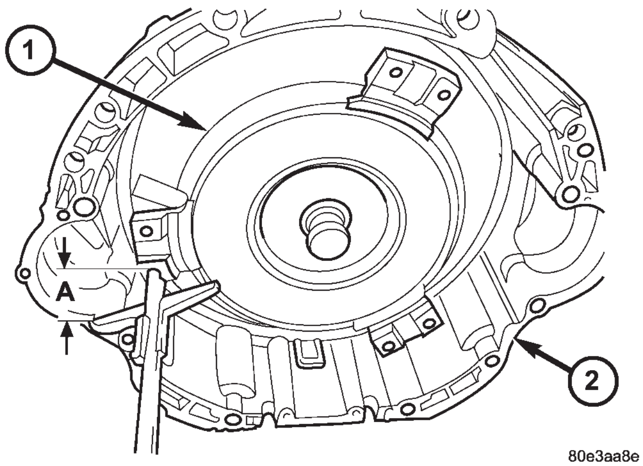


Fig. 43 Torque Converter Installation Depth

1 - TORQUE CONVERTER
2 - TRANSMISSION HOUSING

(10) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

(11) Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.

(12) Raise transmission and align the torque converter with the drive plate and the transmission converter housing with the engine block.

(13) Move transmission forward. Then raise, lower, or tilt transmission to align the converter housing with the engine block dowels.

(14) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.

(15) Install two bolts to attach the transmission to the engine.

(16) Install remaining torque converter housing to engine bolts. Tighten to 39 N·m (29 ft.lbs.).

(17) Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).

(18) Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).

(19) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (39 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).

(20) Remove engine support fixture.

(21) Connect gearshift cable to transmission.

(22) Check O-ring on plug connector (1) (Fig. 44), and replace if necessary.

(23) Install the plug connector (1) into the guide bushing (2). Turn bayonet lock of guide bushing (2) clockwise to connect plug connector (1).

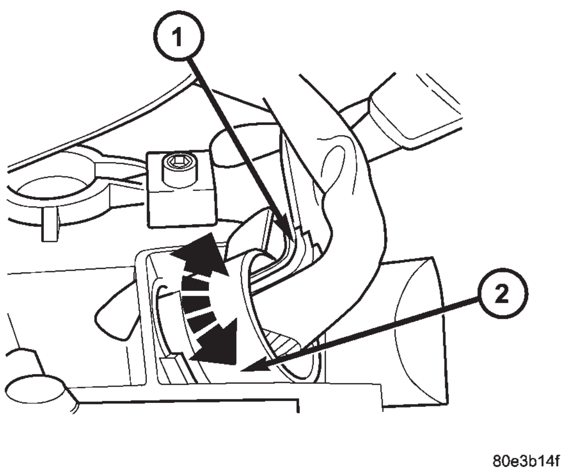


Fig. 44 Install Wiring Connector Plug

1 - PLUG CONNECTOR
2 - GUIDE BUSHING

(24) Position the heat shield (2) (Fig. 45) onto the transmission housing and install the screw (1) and bolt (3) to hold the shield in place.

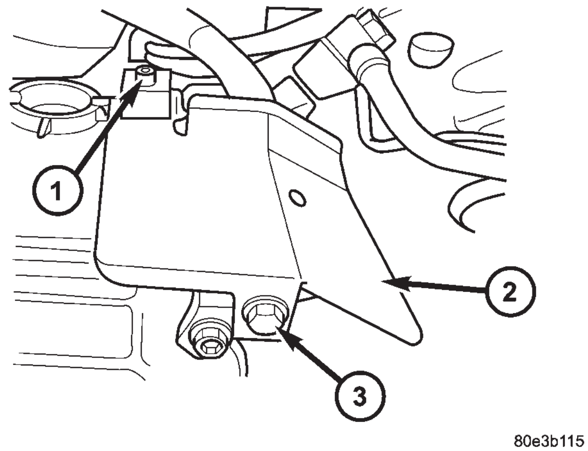


Fig. 45 Install Heat Shield

1 - SCREW
2 - HEAT SHIELD
3 - BOLT

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(25) Install all torque converter-to-driveplate bolts by hand.

(26) Verify that the torque converter is pulled flush to the driveplate. Tighten bolts to 42 N·m (30.5 ft. lbs.).

(27) Install the torque converter bolt access plug into the engine adapter.

(28) Install starter motor.

(29) Connect cooler lines to transmission.

(30) Install transmission fill tube.

(31) Install exhaust components.

(32) Install transfer case. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).

(33) Install the transfer case shift cable to the cable support bracket and the transfer case shift lever.

(34) Align and connect propeller shafts.

(35) Adjust gearshift cable if necessary.

(36) Lower vehicle.

(37) Connect negative battery cable.

(38) Fill transmission with Shell® 3403 Automatic Transmission fluid (Refer to 21 - TRANSMISSION/AUTOMATIC - W5J400/FLUID - STANDARD PROCEDURE).

(39) Verify proper operation.

SPECIFICATIONS - W5J400 AUTOMATIC TRANSMISSION

GEAR RATIOS

1ST	3.59:1
2ND	2.19:1
3RD	1.41:1
4TH	1.00:1
5TH	0.83:1
REVERSE	3.16:1
REVERSE (4WD Low)	1.93:1

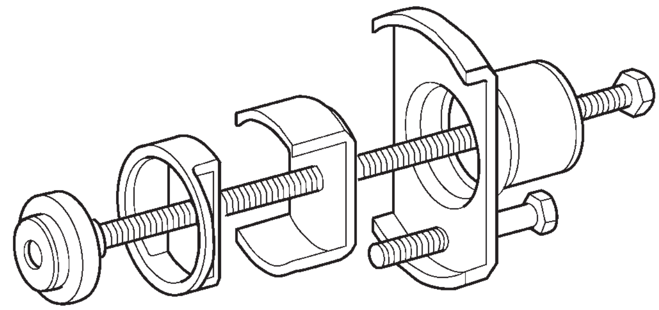
SPECIFICATIONS

COMPONENT		METRIC (mm)
Output Shaft End-play		0.3-0.5
Output Shaft End-play Snap-rings		0.2, 0.3, 0.4, and 0.5
Rear Planetary Gear Set End-play		0.15-0.6
Rear Planetary Gear Set Snap-rings		3.0, 3.4, and 3.7
B1 Clutch Clearance	2 Disc	2.3-2.7
	3 Disc	2.7-3.1
	4 Disc	3.0-3.4
B1 Clutch Snap-rings		2.6, 2.9, 3.2, 3.5, 3.8, and 4.1
B2 Clutch Clearance	4 Disc	1.9-2.3
	5 Disc	2.0-2.4
B2 Clutch Snap-rings		2.9, 3.2, 3.5, 3.8, and 4.1
B3 Clutch Clearance		1.0-1.4
B3 Clutch Snap-rings		3.2, 3.5, 4.1, 4.4, and 4.7
K1 Clutch Clearance	3 Disc	2.7-3.1
	4 Disc	3.0-3.4
	5 Disc	3.3-3.7
	6 Disc	3.6-4.0
K1 Clutch Snap-rings		2.6, 2.9, 3.2, 3.5, 3.8, and 4.1
K2 Clutch Clearance	3 Disc	2.3-2.7
	4 Disc	2.4-2.8
	5 Disc	2.5-2.9
	6 Disc	2.7-3.1
K2 Clutch Snap-rings		2.3, 2.6, 2.9, 3.2, 3.5, and 3.8
K3 Clutch Clearance	3 Disc	2.3-2.7
	4 Disc	2.4-2.8
	5 Disc	2.5-2.9
K3 Clutch Snap-rings		2.0, 2.3, 2.6, 2.9, 3.2, and 3.5

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, B2 Clutch Carrier	16	12.5	-
Bolt, B1 Carrier to Converter Housing	10	7.5	-
Bolt, Output Shaft Extension	120	88	-
Bolt, Transfer Case Adapter Housing	20	-	177
Bolt, Electrohydraulic Unit	8	-	70
Bolt, Transmission Housing to Converter Housing	20	15	-
Bolts, Oil Pan	8	-	70
Screws, Valve Body/Housing Side Cover	4	-	35
Bolt, Shift Plate	8	-	70
Bolt, Solenoid Leaf Spring	8	-	70
Plug, Oil Pan Drain	20	15	-
Nut, Shifter Mechanism to Floor Pan	7	-	65
Screw, Gearshift Cable Adjustment	7	-	65

SPECIAL TOOLS - W5J400 AUTOMATIC TRANSMISSION



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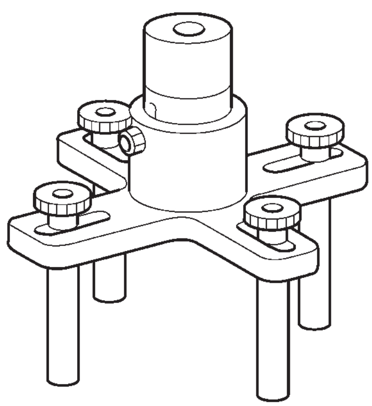
Compressor, Multi-use Spring - 8900



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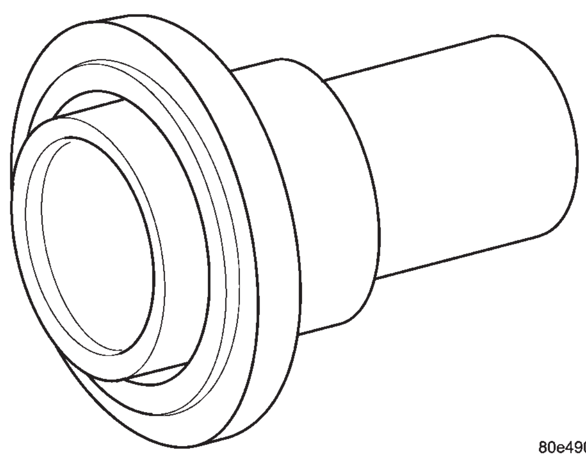
Tool, Pressing - 8901



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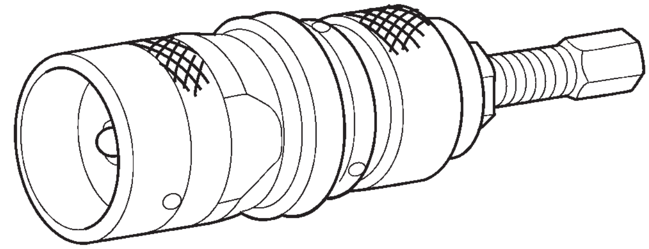
Punch, Drift - 8902



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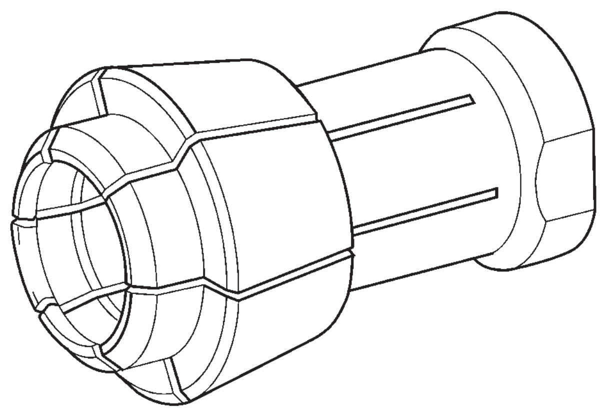
Puller, Size 5 - 8903



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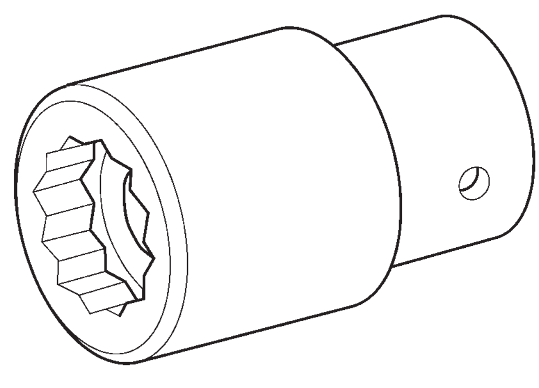
Adapter, Bearing Puller - 8904



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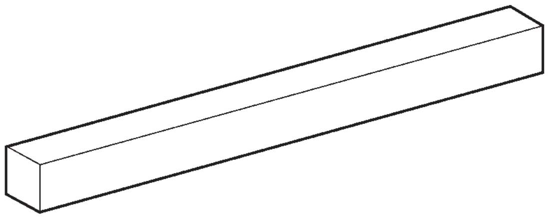
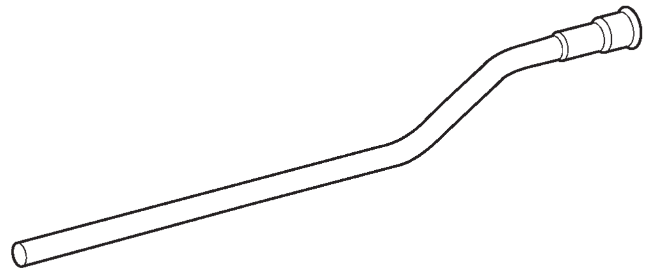
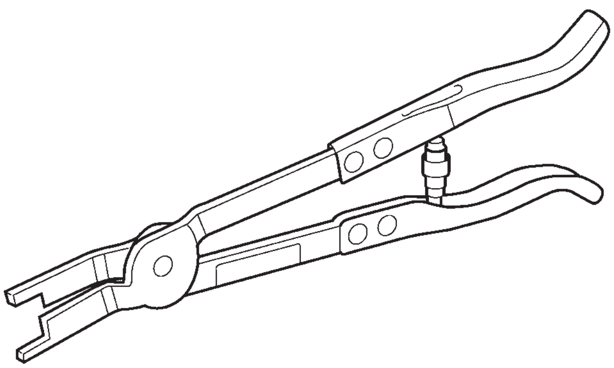
Socket - 8905



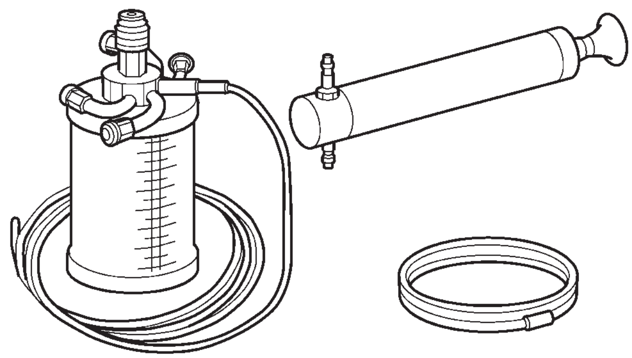
Parallel Rest - 8906



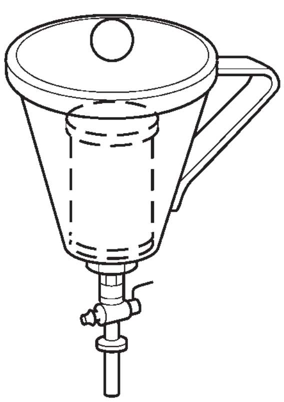
Tube, Filler - 8909



Pliers - 8907



Pump - 8910



Funnel - 8908

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

DESCRIPTION

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 46).

OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shifter assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any gear position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK

SYSTEM VERIFICATION

(1) Verify that the key can only be removed in the PARK position

(2) When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.

(3) Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.

(4) Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.

(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

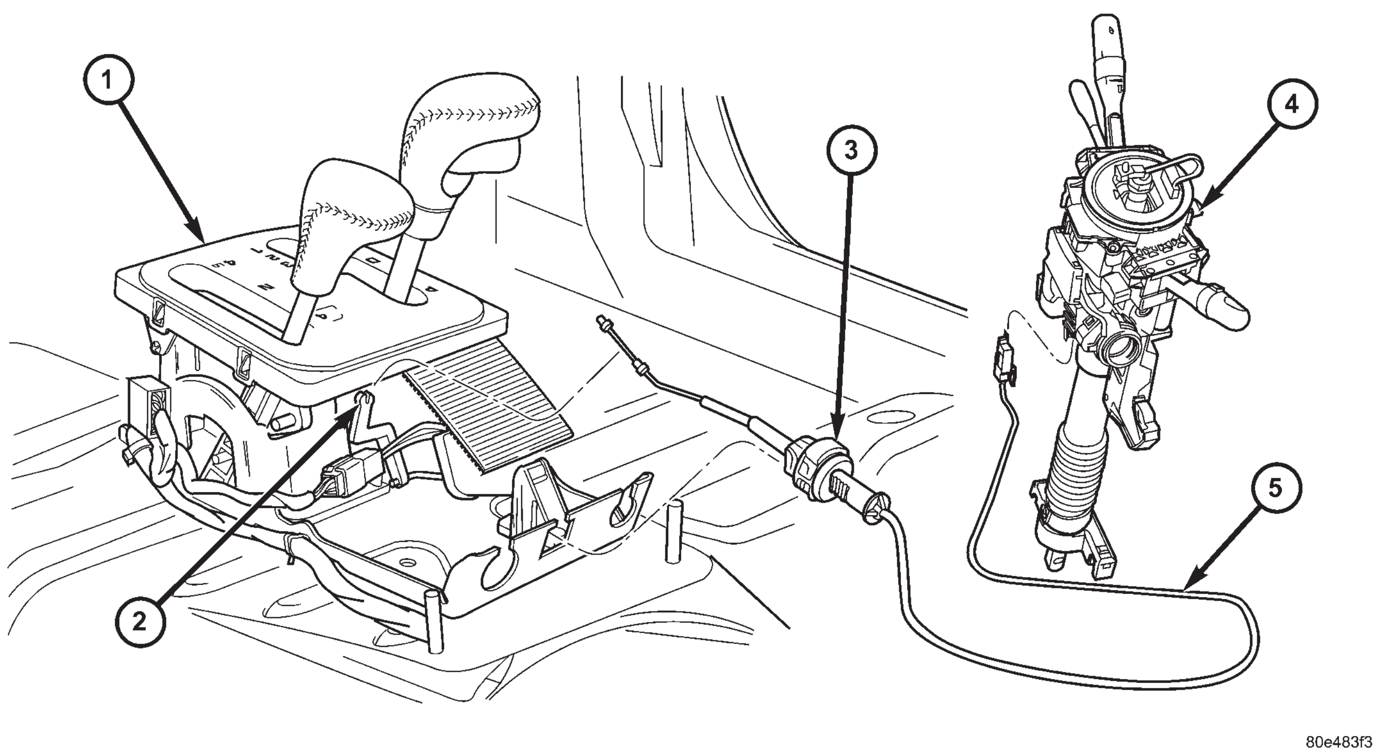


Fig. 46 Ignition Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

DIAGNOSTIC CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
KEY WILL NOT ROTATE TO THE OFF/LOCK POSITION.	1. Misadjusted Park Lock cable.	1. Adjust Park Lock cable. (Refer to 21 - TRANSMISSION AND TRANSFER CASE/AUTOMATIC TRANSMISSION/BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM - ADJUSTMENTS)
	2. Misadjusted gearshift cable.	2. Adjust gearshift cable. (Refer to 21 - TRANSMISSION AND TRANSFER CASE/AUTOMATIC TRANSMISSION/GEAR SHIFT CABLE - ADJUSTMENTS)
	3. Burrs on ignition key.	3. Remove burrs and cycle key several times to verify operation.
	4. Binding or broken components.	4. Inspect system components and repair/replace components as necessary.
VEHICLE WILL NOT START UNLESS SHIFTER IS HELD FORWARD OF THE PARK POSITION.	1. Misadjusted gearshift cable.	1. Adjsut gearshift cable. (Refer to 21 - TRANSMISSION AND TRANSFER CASE/AUTOMATIC TRANSMISSION/GEAR SHIFT CABLE - ADJUSTMENTS)

ADJUSTMENTS - BRAKE TRANSMISSION SHIFT INTERLOCK

The park interlock cable is part of the brake/shift lever interlock system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of PARK.

ADJUSTMENT PROCEDURE

(1) Remove floor console coin tray for access to the brake transmission shift interlock cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(2) Shift the transmission into the PARK position.

(3) Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**

(4) Pull cable lock button up to release cable (Fig. 47).

(5) Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.

(6) Push lock button down until it snaps in place.

BTSI FUNCTION CHECK

(1) Verify removal of ignition key allowed in PARK position only.

(2) When the shift lever is in PARK, and the shift handle push-button is in the out position, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the off position.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

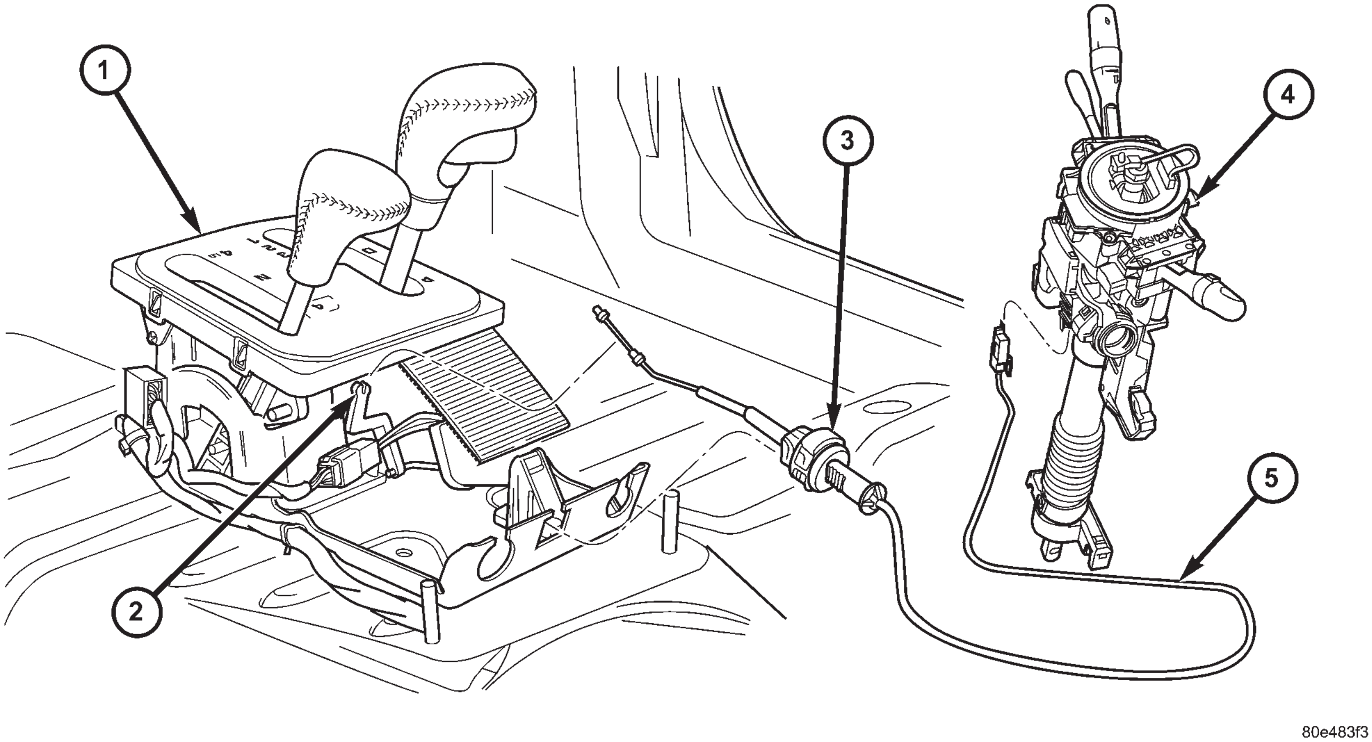


Fig. 47 Ignition Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

(4) Shifting out of PARK should not be possible while applying normal push-button force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gear and NEUTRAL, or PARK, may be done without depressing foot brake with ignition switch in run or start positions.

(7) The floor shifter lever and gate positions should be in alignment with all transmission detent positions.

(8) Engine starts must be possible with shifter lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gate positions other than PARK or NEUTRAL.

(9) With shifter lever handle push-button not depressed and lever detent in:

- PARK position- apply forward force on center of handle and remove pressure. Engine start must be possible.
- PARK position- apply rearward force on center of handle and remove pressure. Engine start must be possible.
- NEUTRAL position- engine start must be possible.
- NEUTRAL position, engine running and brakes applied- Apply forward force on center of shift handle. Transmission should not be able to shift into REVERSE detent.

DRIVING CLUTCHES

DESCRIPTION

Three multi-plate driving clutches (Fig. 48), the front, middle and rear multi-plate clutches K1, K2 and K3, are located in the planetary gear sets in the transmission housing.

A multi-plate driving clutch consists of a number of internally toothed discs (4) on an internally toothed disc carrier and externally toothed discs (3) on an externally toothed disc carrier.

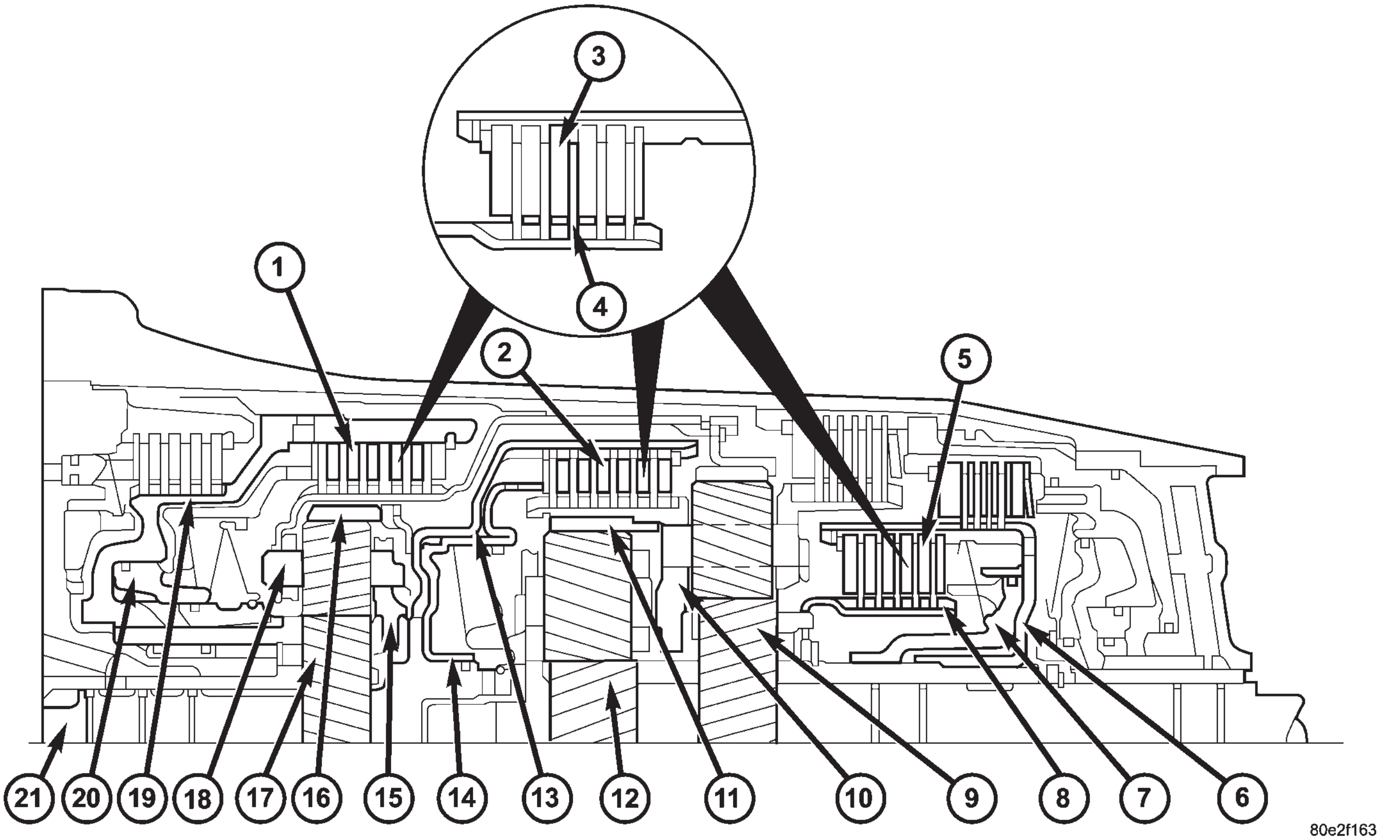


Fig. 48 Driving Clutches

1 - K1 CLUTCH
2 - K2 CLUTCH
3 - EXTERNALLY TOOTHED DISC
4 - INTERNALLY TOOTHED DISC
5 - K3 CLUTCH
6 - K3 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
7 - K3 CLUTCH PISTON
8 - K3 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET SUN GEAR
10 - CENTER PLANETARY GEARSET PLANETARY CARRIER
11 - CENTER PLANETARY GEARSET ANNULUS GEAR
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - K2 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
14 - K2 CLUTCH PISTON
15 - FRONT PLANETARY GEARSET PLANETARY CARRIER
16 - FRONT PLANETARY GEARSET ANNULUS GEAR
17 - FRONT PLANETARY GEARSET SUN GEAR
18 - K1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
19 - K1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
20 - K1 CLUTCH PISTON
21 - DRIVE SHAFT

DRIVING CLUTCHES (Continued)

OPERATION

The driving clutches (Fig. 49) produce a non-positive locking connection between two elements of a planetary gear set or between one element from each of two planetary gear sets in order to transmit the drive torque.

If the piston (20) on multi-plate clutch K1 (1) is subjected to oil pressure, it presses the internal and external discs of the disc set together. The sun gear (17) is locked with the planetary carrier (15) via the externally toothed disc carrier (19) and the internally toothed disc carrier (18). The front planetary gear set is thus locked and turns as a closed unit.

If the multi-plate clutch K2 (2) is actuated via the piston (14), the piston compresses the disc set. The annulus gear (16) of the front planetary gear set is locked with the annulus gear (11) of the center planetary gear set via the externally toothed disc carrier (13) and the center planetary carrier (10) on which the internally toothed discs are seated. Annulus gear (16) and annulus gear (11) turn at the same speed as the input shaft (21)

If the multi-plate clutch K3 (5) is actuated via the piston (7), the piston compresses the disc set. The sun gear (12) of the center planetary gear set is locked with the sun gear (9) of the rear planetary gear set via the externally toothed disc carrier (6) and the internally toothed disc carrier (8). Sun gear (12) and sun gear (9) turn at the same speed.

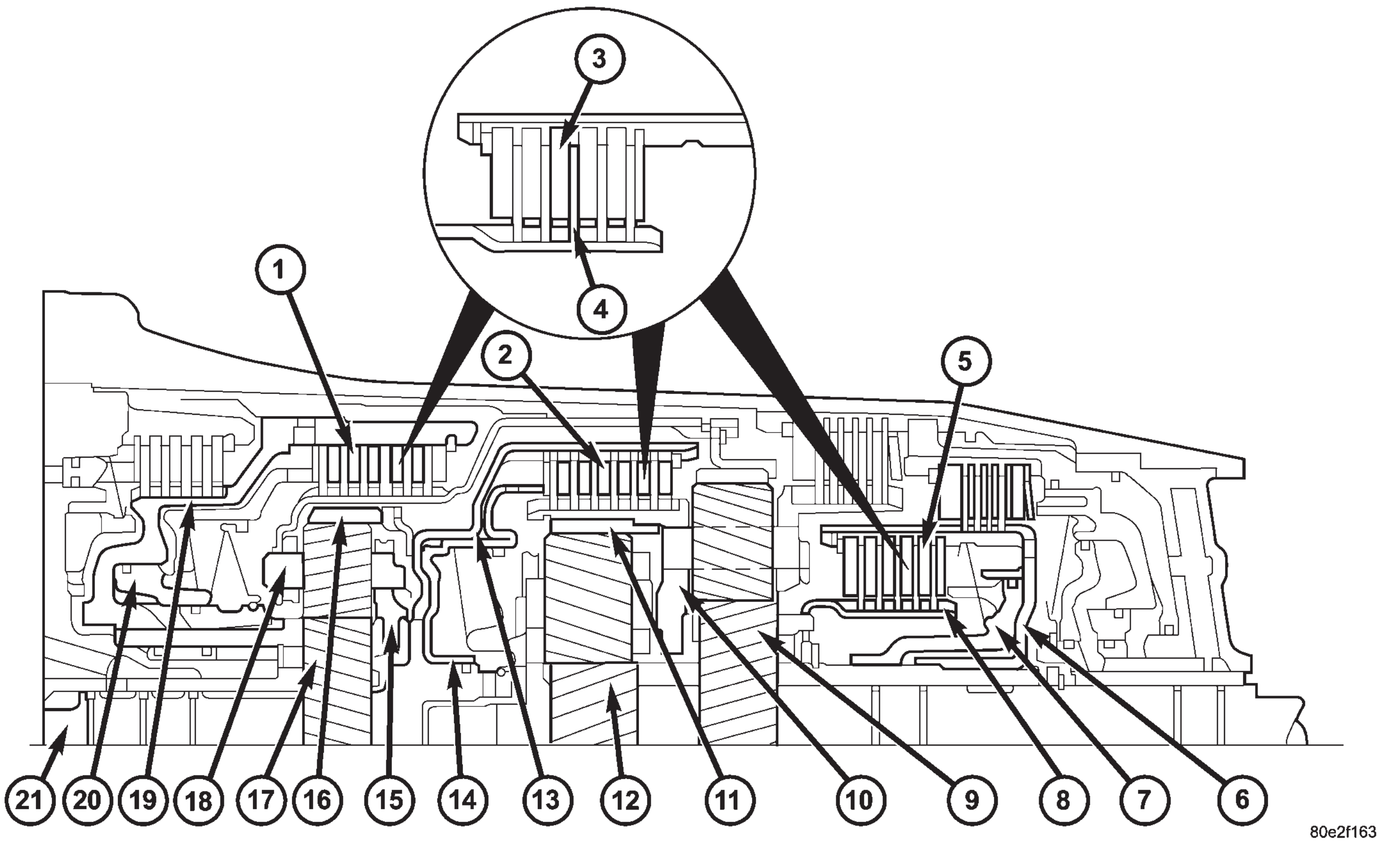


Fig. 49 Driving Clutches

1 - K1 CLUTCH
2 - K2 CLUTCH
3 - EXTERNALLY TOOTHED DISC
4 - INTERNALLY TOOTHED DISC
5 - K3 CLUTCH
6 - K3 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
7 - K3 CLUTCH PISTON
8 - K3 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET SUN GEAR
10 - CENTER PLANETARY GEARSET PLANETARY CARRIER
11 - CENTER PLANETARY GEARSET ANNULUS GEAR
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - K2 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
14 - K2 CLUTCH PISTON
15 - FRONT PLANETARY GEARSET PLANETARY CARRIER
16 - FRONT PLANETARY GEARSET ANNULUS GEAR
17 - FRONT PLANETARY GEARSET SUN GEAR
18 - K1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
19 - K1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
20 - K1 CLUTCH PISTON
21 - DRIVE SHAFT

DRIVING CLUTCH K1

DISASSEMBLY

(1) Remove snap-ring (11) (Fig. 50) from outer multiple-disc carrier (6).

(2) Take multiple-disc pack (12) out of outer multiple-disc carrier (6).

(3) Place Multi-use Spring Compressor 8900 on the spring plate (8) and compress the spring until the snap-ring (10) is exposed.

(4) Remove snap-ring (10) (Fig. 50).

(5) Take out disc spring (7) and remove piston (6) by carefully blowing compressed air into the bore (A).

(6) Remove snap-ring (3) and take out front freewheeling clutch F1 (2).

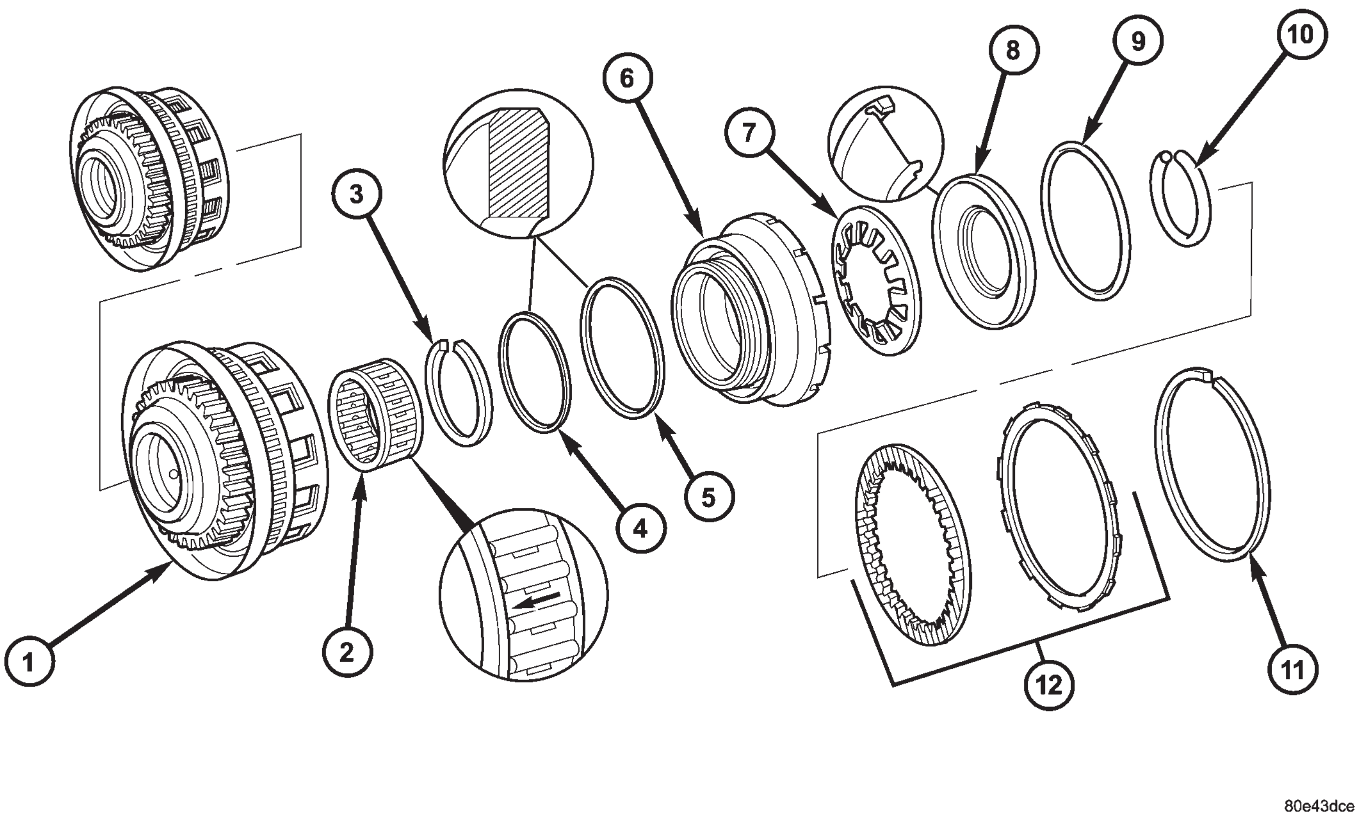


Fig. 50 Driving Clutch K1 Components

1 - K1 OUTER DISC CARRIER	7 - DISC SPRING
2 - FREEWHEELING CLUTCH F1	8 - SPRING PLATE
3 - SNAP-RING	9 - SPRING PLATE SEALING RING
4 - OUTER DISC CARRIER SEALING RING	10 - SNAP-RING
5 - PISTON SEALING RING	11 - SNAP-RING
6 - PISTON	12 - MULTIPLE DISC PACK

DRIVING CLUTCH K1 (Continued)

ASSEMBLY

(1) Install piston (6) (Fig. 51) in the outer multiple-disc carrier (1). Check sealing rings (4 and 5), replace if necessary. The rounded off edges of the sealing rings must point outwards.

(2) Insert disc spring (7) (Fig. 51). Insert disc spring with the curvature towards the piston.

(3) Insert spring plate (8). Insert spring plate with the curvature towards the sun gear. Check sealing ring (9), replace if necessary.

(4) Place Multi-use Spring Compressor 8900 on spring plate (8) and compress the spring until the groove of the snap-ring is exposed.

(5) Insert snap-ring (10) (Fig. 51). After installing, check snap-ring for correct seat

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(6) Insert multiple-disc pack (12) in the outer multiple-disc carrier.

(7) Insert snap-ring (11).

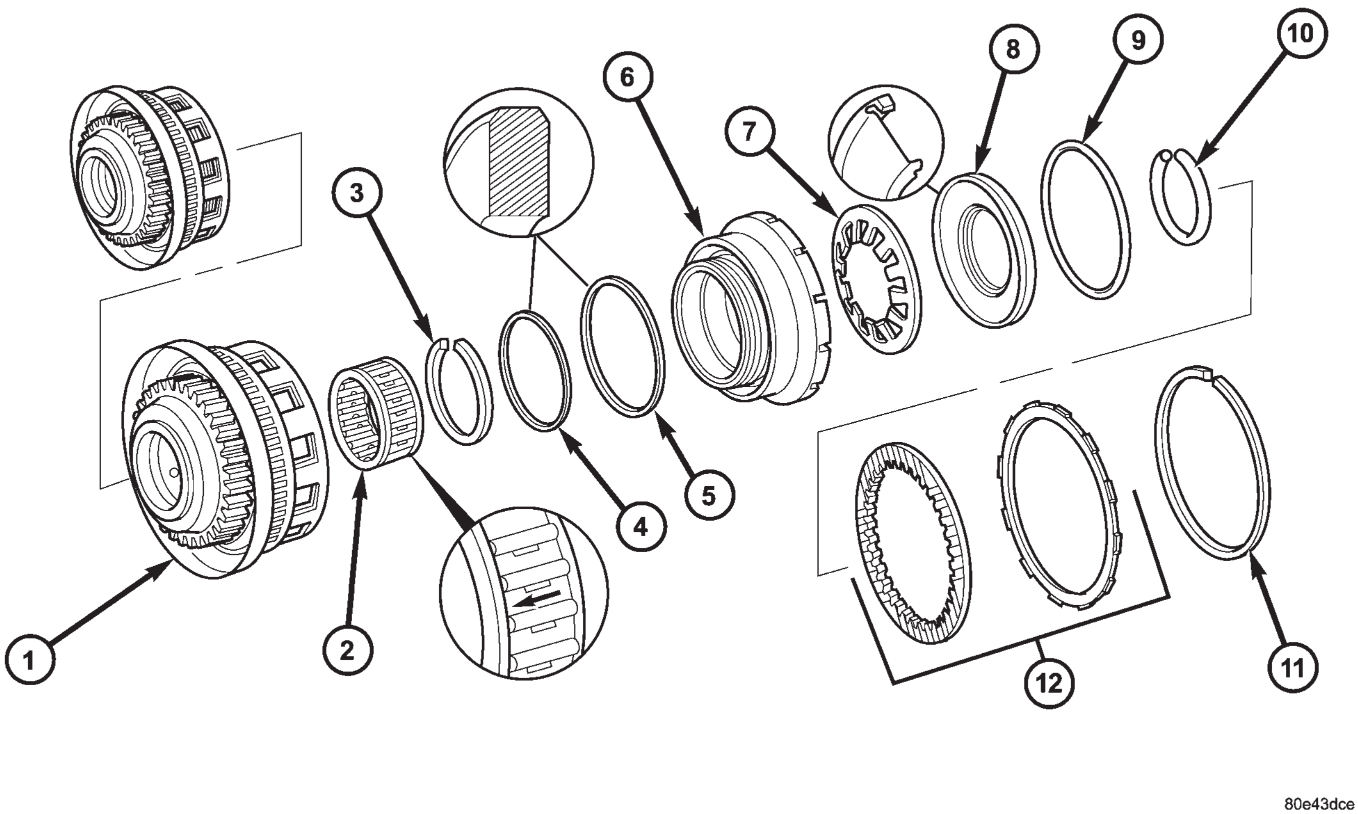


Fig. 51 Driving Clutch K1 Components

1 - K1 OUTER DISC CARRIER
2 - FREEWHEELING CLUTCH F1
3 - SNAP-RING
4 - OUTER DISC CARRIER SEALING RING
5 - PISTON SEALING RING
6 - PISTON
7 - DISC SPRING
8 - SPRING PLATE
9 - SPRING PLATE SEALING RING
10 - SNAP-RING
11 - SNAP-RING
12 - MULTIPLE DISC PACK

DRIVING CLUTCH K1 (Continued)

(8) Measure the K1 clutch pack clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 52) on outer multiple disc.

(b) Using a lever press, compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 53) at three points between the snap-ring (5) and outer multiple-disc (3).

(d) During the measurement the snap-ring (5) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(e) The correct clutch clearance is 2.7-3.1 mm for three friction disc versions, 3.0-3.4 mm for four disc versions, 3.3-3.7 mm for five disc versions, and 3.6-4.0 mm for six disc versions.

(f) Adjust with snap-ring (5), if necessary. Snap-rings are available in thicknesses of 2.6, 2.9, 3.2, 3.5 3.8 and 4.1 mm.

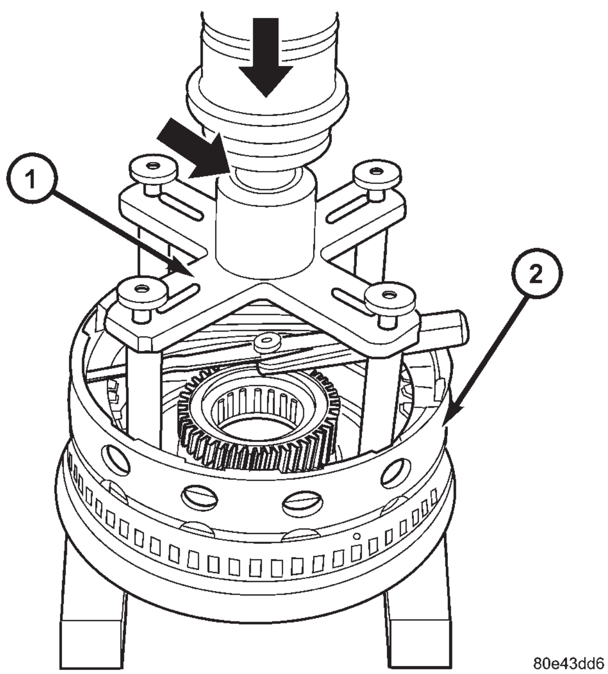


Fig. 52 Measure K1 Clutch Clearance

1 - PRESSING TOOL 8901
2 - K1 OUTER DISC CARRIER

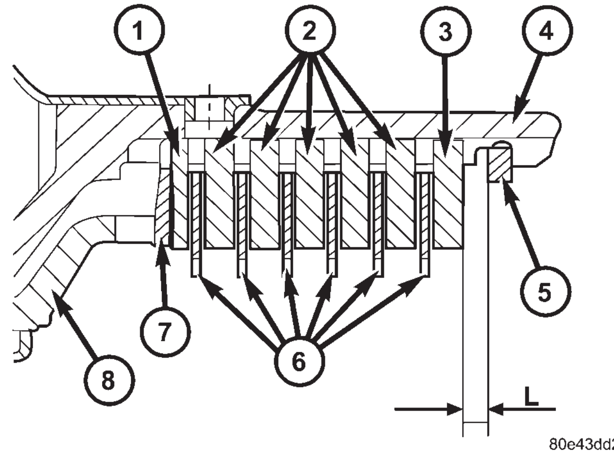


Fig. 53 Driving Clutch K1 Stack-up

1 - OUTER MULTIPLE DISC - 1.8MM
2 - OUTER MULTIPLE DISC - 2.8MM
3 - OUTER MULTIPLE DISC - 4.0MM
4 - K1 OUTER DISC CARRIER
5 - SNAP-RING
6 - FRICTION DISCS
7 - DISC SPRING
8 - PISTON

(9) Insert front freewheeling clutch F1 (2) and fit snap-ring (3). The freewheeling clutch F1 (2) must be installed in the direction of the arrow.

DRIVING CLUTCH K2

DISASSEMBLY

(1) Remove snap-ring (15) from the K1 inner multiple-disc carrier with integrated front gear set (1) and take off hollow gear (14).

(2) Remove drive shaft with clutch K2 (3) (Fig. 54).

(3) Remove needle thrust bearing (2).

(4) Remove snap-ring (13) (Fig. 54) from K2 outer multiple-disc carrier.

(5) Take out multiple-disc pack (12).

(6) Take out disk spring (11) (Fig. 54).

DRIVING CLUTCH K2 (Continued)

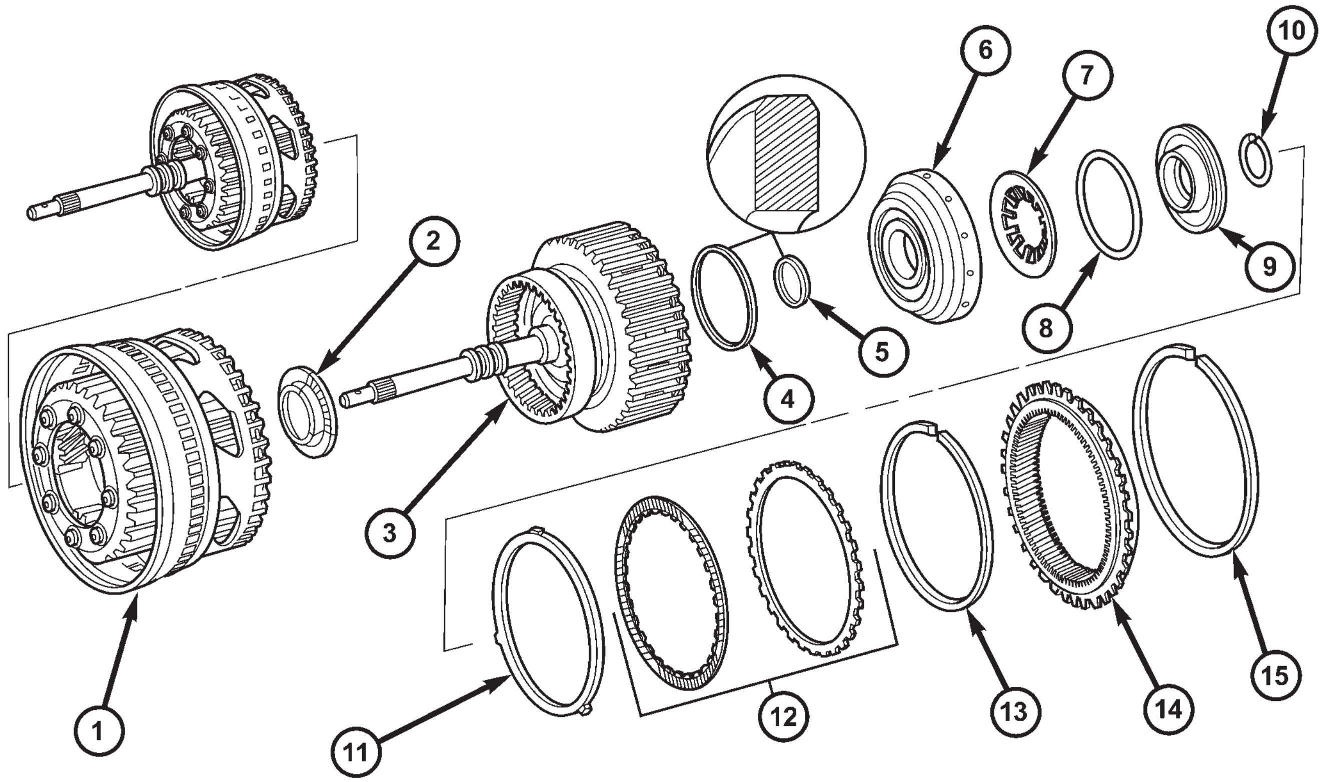


Fig. 54 Driving Clutch K2 Components

1 - K1 INNER DISC CARRIER WITH INTEGRATED FRONT GEAR SET
2 - THRUST BEARING
3 - INPUT SHAFT AND K2 CLUTCH
4 - PISTON OUTER SEAL RING
5 - PISTON INNER SEAL RING
6 - PISTON
7 - DISC SPRING
8 - SPRING RETAINER SEAL
9 - SPRING RETAINER
10 - SNAP-RING
11 - DISC SPRING
12 - MULTIPLE DISC PACK
13 - SNAP-RING
14 - HOLLOW GEAR
15 - SNAP-RING

(7) Fit Multi-use Spring Compressor 8900 (Fig. 55) onto spring retainer (9) and press until snap-ring (10) is released.

(8) Remove snap-ring (10) (Fig. 54).

(9) Take out disc spring (7) and pull piston (6) out of outer multiple-disc carrier.

DRIVING CLUTCH K2 (Continued)

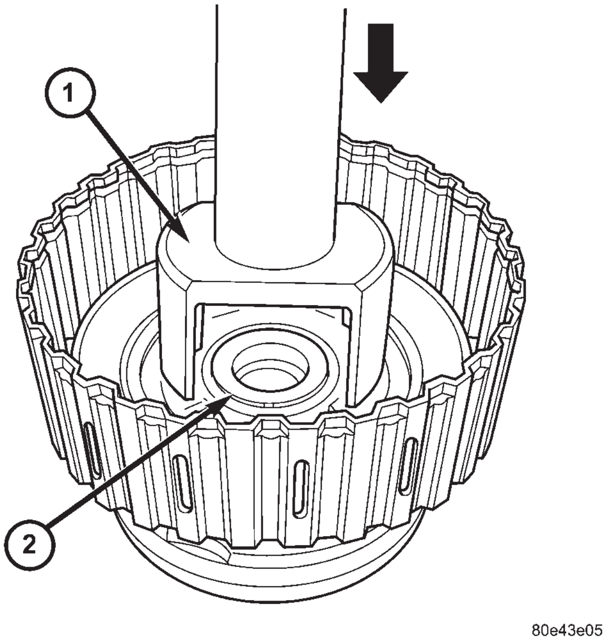


Fig. 55 Compress K2 Clutch Spring

1 - MULTI-USE SPRING COMPRESSOR 8900
2 - SNAP-RING

ASSEMBLY

(1) Install piston (6) (Fig. 56) in outer multiple-disc carrier. Inspect seals (4 and 5), replace if necessary. The rounded edges of the seals must point to the outside.

(2) Insert disk spring (7) and spring retainer (9). Insert disk spring (7) with curved side pointing toward spring retainer (9). Inspect seal 8 (Fig. 56), replace if necessary.

(3) Place Multi-use Spring Compressor 8900 (Fig. 57) on spring plate (9) and press until the groove of the snap-ring is exposed.

(4) Insert snap-ring (10).

(5) Insert disk spring (11).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(6) Insert multiple-disk set (12) into outer multiple-disk carrier.

(7) Fit snap-ring (13).

(8) Measure K2 clutch clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 58) on outer multiple disc.

(b) Using a lever press, compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 59) at three points between the snap-ring (6) and outer multiple-disc (4).

(d) During the measurement the snap-ring (6) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(e) The correct clutch clearance is 2.3-2.7 mm for three friction disc versions, 2.4-2.8 mm for four disc versions, 2.5-2.9 mm for five disc versions, and 2.7-3.1 mm for six disc versions.

(f) Adjust with snap-ring (6), if necessary. Snap-rings are available in thicknesses of 2.3, 2.6, 2.9, 3.2, 3.5 and 3.8 mm.

DRIVING CLUTCH K2 (Continued)

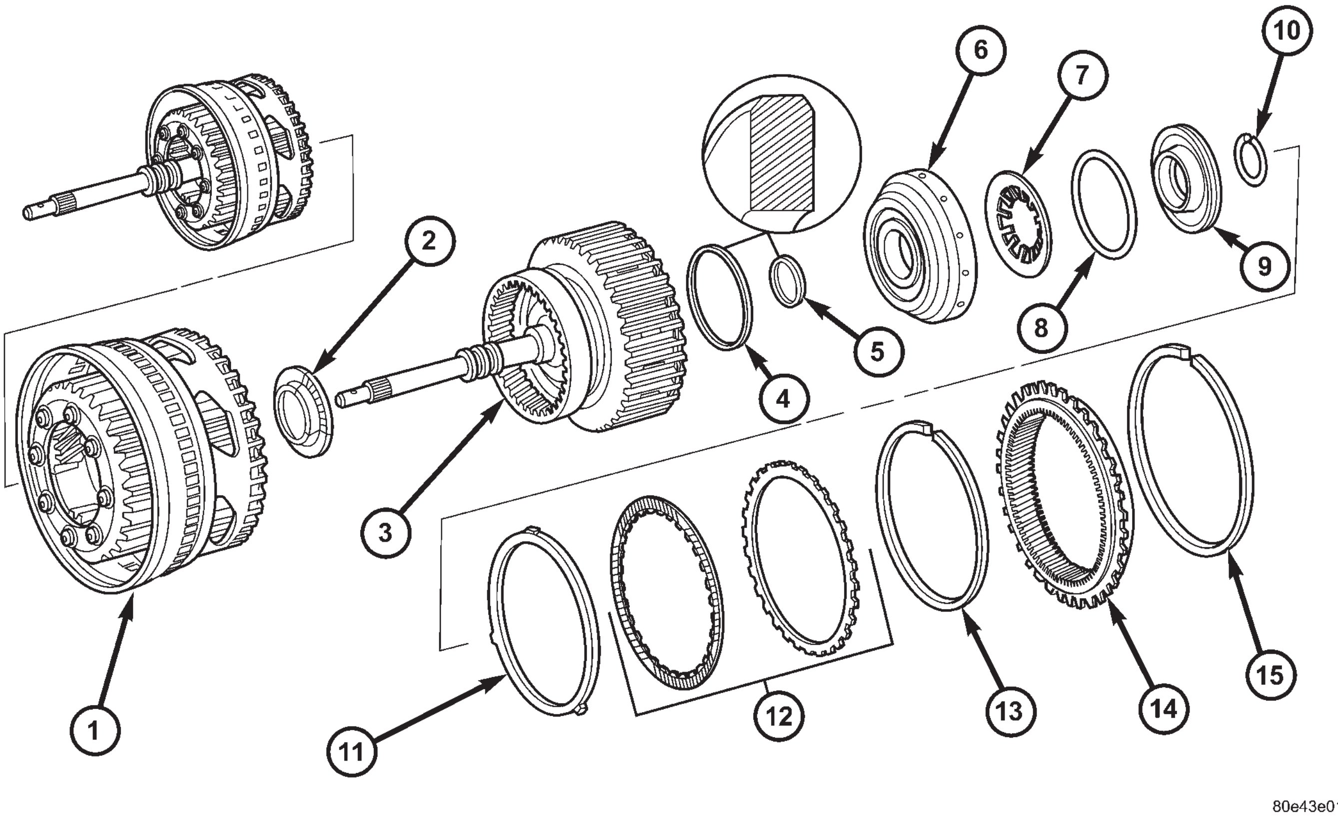


Fig. 56 Driving Clutch K2 Components

1 - K1 INNER DISC CARRIER WITH INTEGRATED FRONT GEAR SET
2 - THRUST BEARING
3 - INPUT SHAFT AND K2 CLUTCH
4 - PISTON OUTER SEAL RING
5 - PISTON INNER SEAL RING
6 - PISTON
7 - DISC SPRING
8 - SPRING RETAINER SEAL
9 - SPRING RETAINER
10 - SNAP-RING
11 - DISC SPRING
12 - MULTIPLE DISC PACK
13 - SNAP-RING
14 - HOLLOW GEAR
15 - SNAP-RING

(9) Insert axial needle bearing (2) into K1 inner multiple-disk carrier. Insert axial needle bearing (2) with a little grease to prevent it slipping.

(10) Install drive shaft in K1 inner multiple-disc carrier with integrated front gear set (3).

DRIVING CLUTCH K2 (Continued)

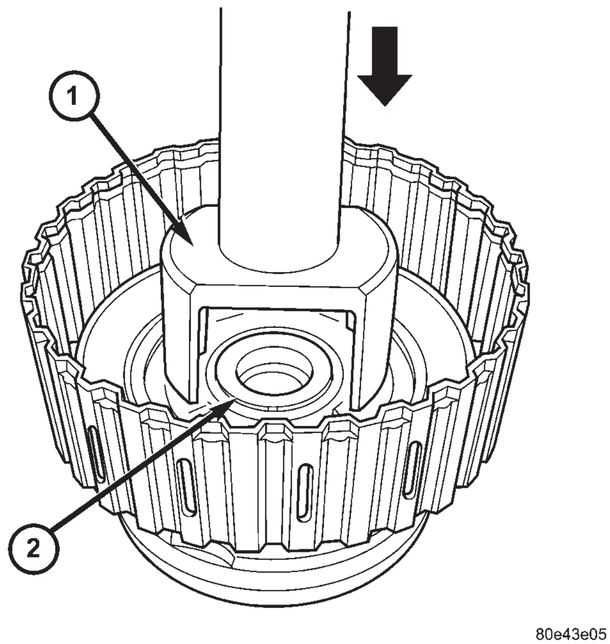


Fig. 57 Compress K2 Clutch Spring

1 - MULTI-USE SPRING COMPRESSOR 8900
2 - SNAP-RING

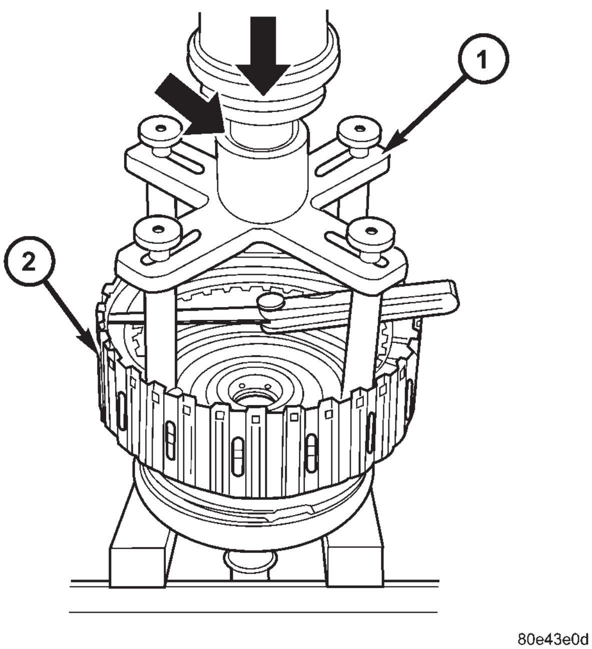


Fig. 58 Measure K2 Clutch Clearance

1 - PRESSING TOOL 8901
2 - K1 INNER DISC CARRIER

(11) Fit internally-geared wheel (14). Pay attention to installation position.

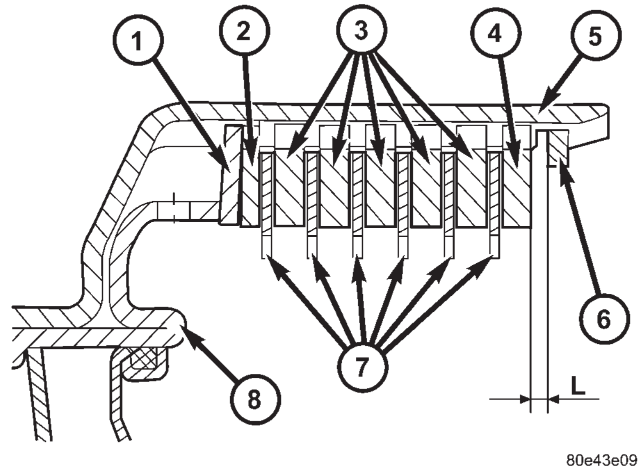


Fig. 59 Driving Clutch K2 Stack-up

1 - DISC SPRING
2 - OUTER MULTIPLE DISC - 1.8 MM
3 - OUTER MULTIPLE DISC - 2.8 MM
4 - OUTER MULTIPLE DISC - 4.0 MM
5 - K2 OUTER DISC CARRIER
6 - SNAP-RING
7 - FRICTION DISCS
8 - PISTON

DRIVING CLUTCH K3

DISASSEMBLY

(1) Remove snap-ring (1) (Fig. 60) from outer multiple-disc carrier.

(2) Remove multiple-disc pack (2) and disk spring (3) from outer multiple-disc carrier.

(3) Place Multi-use Spring Compressor 8900 (9) (Fig. 60) on disc spring (5) and compress the spring until the snap-ring (4) is exposed.

(4) Remove snap-ring (4).

(5) Remove spring plate (5) and piston (6) from outer multiple-disc carrier.

ASSEMBLY

(1) Install piston (6) in the outer multiple-disc carrier (8). Check sealing ring (7), replace if necessary. The rounded off edges of the sealing ring must point outwards.

(2) Insert disc spring (5). Insert disc spring with the curvature towards the piston.

(3) Mount the Multi-use Spring Compressor 8900 (9) on the spring plate and clamp until the snap-ring groove is exposed.

(4) Insert snap-ring (4). The collar of the snap-ring must point towards the multiple-disc pack.

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

DRIVING CLUTCH K3 (Continued)

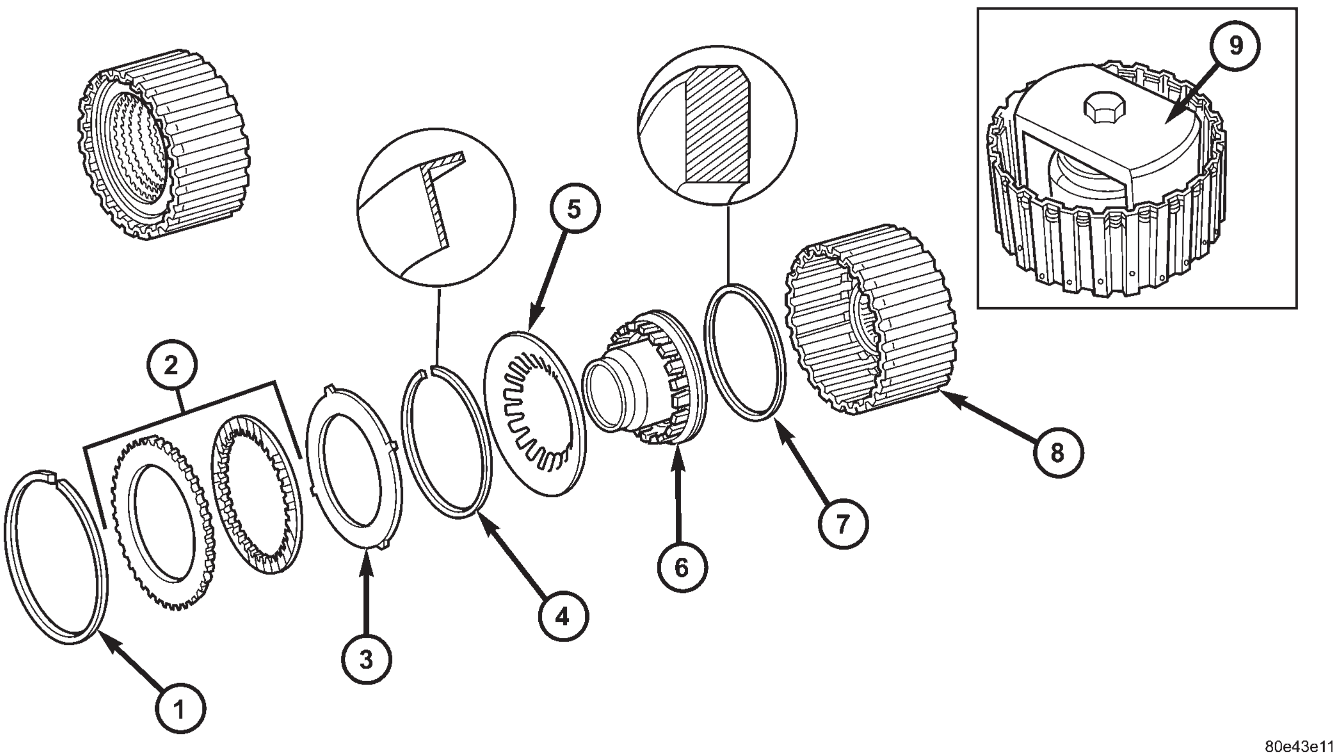


Fig. 60 Driving Clutch K3 Components

1 - SNAP-RING
2 - MULTIPLE DISC PACK
3 - DISC SPRING
4 - SNAP-RING
5 - SPRING PLATE
6 - PISTON
7 - SEALING RING
8 - OUTER DISC CARRIER
9 - MULTI-USE SPRING COMPRESSOR 8900

(5) Install disk spring (3) and multiple-disc pack (2) in outer multiple-disc carrier (8).

(6) Insert snap-ring (1).

(7) Measure the K3 clutch clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 61) on outer multiple disc.

(b) Using a lever press, compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 62) at three points between the snap-ring (8) and outer multiple-disc (2).

(d) During the measurement the snap-ring (8) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(e) The correct clutch clearance is 2.3-2.7 mm for three friction disc versions, 2.4-2.8 mm for four disc versions, and 2.5-2.9 mm for five disc versions.

(f) Adjust with snap-ring (8), if necessary. Snap-rings are available in thicknesses of 2.0, 2.3, 2.6, 2.9, 3.2 and 3.5 mm.

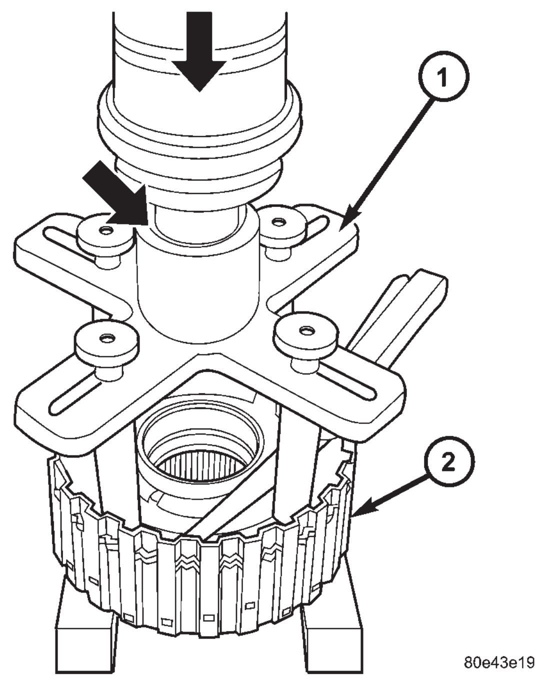


Fig. 61 Measure K3 Clutch Clearance

1 - PRESSING TOOL 8901
2 - OUTER DISC CARRIER

DRIVING CLUTCH K3 (Continued)

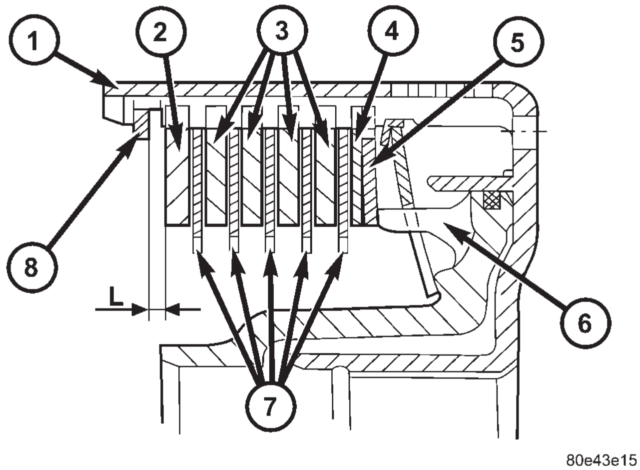


Fig. 62 Driving Clutch K3 Stack-up

1 - OUTER DISC CARRIER
2 - OUTER MULTIPLE DISC - 4.0 MM
3 - OUTER MULTIPLE DISC - 2.8 MM
4 - OUTER MULTIPLE DISC - 1.8 MM
5 - DISC SPRING
6 - PISTON
7 - FRICTION DISCS - 2.1 MM
8 - SNAP-RING

ELECTROHYDRAULIC UNIT

DESCRIPTION

The electrohydraulic control unit comprises the shift plate made from light alloy for the hydraulic control and an electrical control unit. The electrical control unit comprises of a supporting body made of plastic, into which the electrical components are assembled. The supporting body is mounted on the shift plate and screwed to it.

Strip conductors inserted into the supporting body make the connection between the electrical components and a plug connector. The connection to the wiring harness on the vehicle and the transmission control module (TCM) is produced via this 13-pin plug connector with a bayonet lock.

ELECTRICAL CONTROL UNIT

The electric valve control unit (7) (Fig. 63) consists of a plastic shell which houses the RPM sensors (1,12), regulating solenoid valves (3, 4), solenoid valves (5, 6, 10), the TCC solenoid valve (11), the park/neutral contact (9), and the transmission oil temperature sensor (8). Conductor tracks integrated into the shell connect the electric components to a plug connection (2). This 13-pin plug connection (2) establishes the connection to the vehicle-side cable harness and to the transmission control module (TCM). With the exception of the solenoid valves, all other electric components are fixed to the conductor tracks.

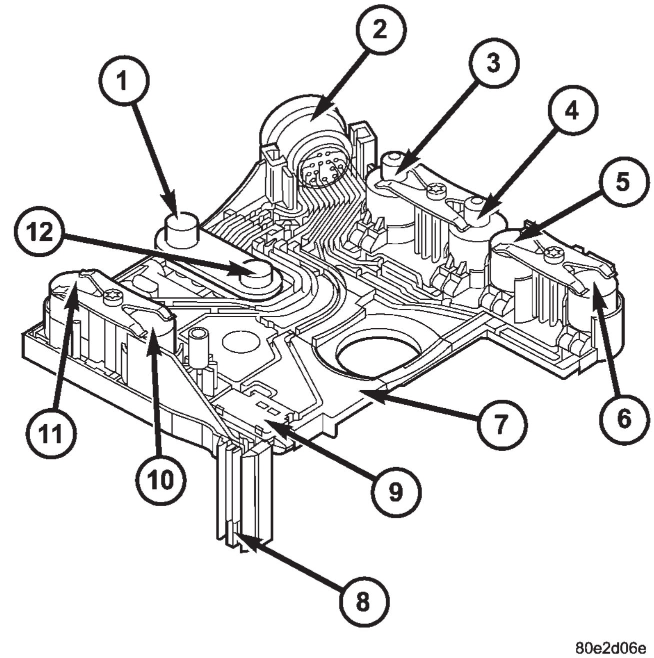


Fig. 63 Electrical Control Unit

1 - N3 SPEED SENSOR
2 - PLUG CONNECTOR
3 - MODULATING PRESSURE REGULATING SOLENOID
4 - SHIFT PRESSURE REGULATING SOLENOID
5 - 1-2/4-5 SHIFT SOLENOID
6 - 3-4 SHIFT SOLENOID
7 - ELECTRICAL CONTROL UNIT
8 - TRANSMISSION TEMPERATURE SENSOR
9 - STARTER INTERLOCK CONTACT
10 - 2-3 SHIFT SOLENOID
11 - TORQUE CONVERTER LOCK-UP SOLENOID
12 - N2 SPEED SENSOR

HYDRAULIC CONTROL UNIT

Working Pressure (Operating Pressure) (p-A)

The working pressure provides the pressure supply to the hydraulic control and the transmission shift elements. It is the highest hydraulic pressure in the entire hydraulic system. The working pressure is regulated at the working pressure regulating valve in relation to the load and gear. All other pressures required for the transmission control are derived from the working pressure.

Lubrication Pressure (p-Sm)

At the working pressure regulating valve surplus oil is diverted to the lubrication pressure regulating valve, from where it is used in regulated amounts to lubricate and cool the mechanical transmission components and the torque converter. Furthermore, the lubrication pressure (p-Sm) is also used to limit the pressure in the torque converter.

ELECTROHYDRAULIC UNIT (Continued)

Shift Pressure (p-S)

The shift pressure is determined by the shift pressure regulating solenoid valve and the shift pressure regulating valve. The shift pressure:

- Regulates the pressure in the activating shift element during the shift phase.
- Determines together with the modulating pressure the pressure reduction at the deactivating shift element as regulated by the overlap regulating valve.
- Initializes 2nd gear in limp-home mode.

Modulating Pressure (p-Mod)

The modulating pressure influences the size of the working pressure and determines together with the shift pressure the pressure regulated at the overlap regulating valve. The modulating pressure is regulated at the modulating pressure regulating solenoid valve, which is under regulating valve pressure. The modulating pressure is variable and relative to the engine load.

Regulating Valve Pressure (p-RV)

The regulating valve pressure is regulated at the regulating valve pressure regulating valve in relation to the working pressure (p-A) up to a maximum pressure of 8 bar. It supplies the modulating pressure regulating solenoid valve, the shift pressure regulating solenoid valve and the shift valve pressure regulating valve.

Shift Valve Pressure (p-SV)

The shift valve pressure (p-SV) is derived from the regulating valve pressure (p-RV), is regulated at the shift valve pressure regulating valve and is then present at the:

- 1-2 and 4-5 shift solenoid valve.
- 3-4 shift solenoid valve.
- 2-3 shift solenoid valve.
- Torque converter lockup solenoid valve.
- 3-4 and 2-3 shift pressure shift valve.

The shift valve pressure (p-SV) controls the command valves via the upshift/downshift solenoid valves.

Overlap Pressure (p-Ü)

The overlap pressure controls the shift component pressure reduction during a shift phase. The pressure in a shift element as it disengages is controlled during the shift phase depending on engine load (modulating pressure) and the pressure in the shift element as it engages. The adjusted pressure is inversely proportional to the transmission capability of the shift element being engaged (controlled overlap).

Working Pressure Regulating Valve (Operating Pressure)

The working pressure regulating valve (Fig. 64) is located in the valve housing of the shift plate. It regulates the primary pressure of the hydraulic system.

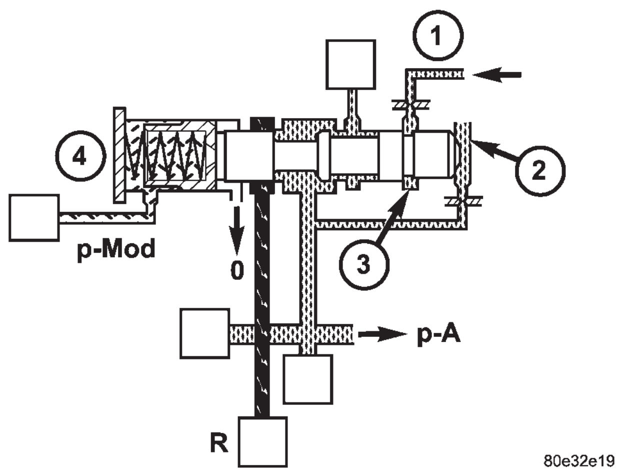


Fig. 64 Working Pressure Regulating Valve

1 - PRESSURE FROM K1/K2
2 - END FACE
3 - ANNULAR SURFACE
4 - WORKING PRESSURE REGULATING VALVE

ELECTROHYDRAULIC UNIT (Continued)

Torque Converter Lockup Clutch Regulating Valve

The torque converter lock-up clutch regulating valve (Fig. 65) is located in the valve housing of the electrohydraulic control module. The valve is responsible for the hydraulic control of the torque converter lockup clutch and distribution of the lubricating oil.

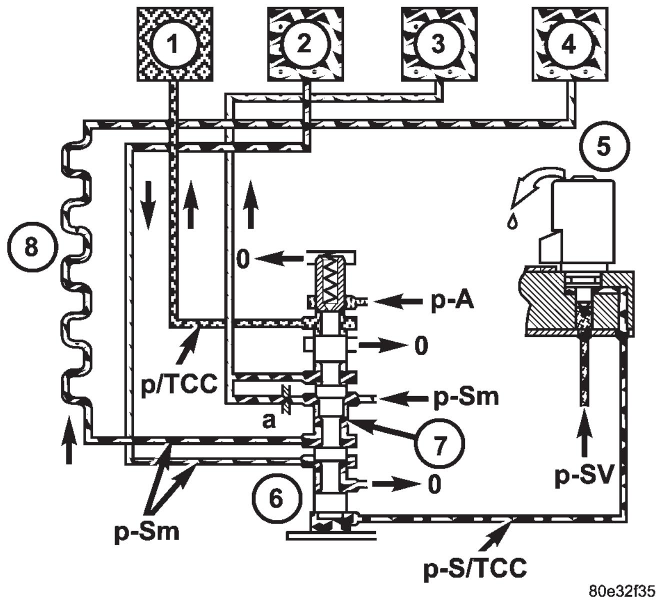


Fig. 65 Torque Converter Lockup Clutch Regulating Valve

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER OUTPUT
3 - TORQUE CONVERTER INPUT
4 - TORQUE CONVERTER LUBRICATION POINTS
5 - TORQUE CONVERTER LOCK-UP SOLENOID
6 - TORQUE CONVERTER LOCK-UP CLUTCH REGULATING VALVE
7 - ANNULAR PASSAGE THROTTLE
8 - OIL COOLER

Overlap Regulating Valve

Each shift group is assigned one overlap regulating valve (Fig. 66). The 1-2 / 4-5 overlap regulating valve is installed in the shift valve housing; the 2-3 and 3-4 overlap regulating valves are installed in the valve housing. The overlap regulating valve regulates the pressure reduction during a shift phase.

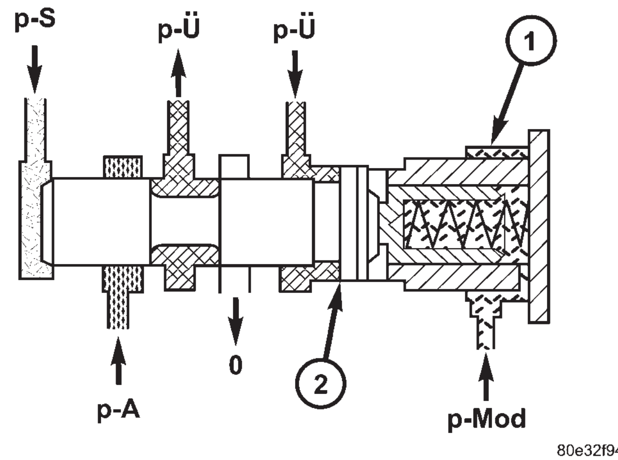


Fig. 66 Overlap Regulating Valve

1 - OVERLAP REGULATING VALVE
2 - ANNULAR SURFACE ON OVERLAP REGULATING VALVE

Command Valve

Each shift group possesses one command valve (Fig. 67). The 1-2 / 4-5 and 2-3 command valves are installed in the shift valve housing; the 3-4 command valve is installed in the valve housing. The command valve switches the shift group from the stationary phase to the shift phase and back again.

Holding Pressure Shift Valve

Each shift group possesses one holding pressure shift valve (Fig. 68). The 1-2 / 4-5 and 2-3 holding pressure shift valves are installed in the shift valve housing; the 3-4 holding pressure shift valve is installed in the valve housing. The holding pressure shift valve allocates the working pressure to one actuator of a shift group.

ELECTROHYDRAULIC UNIT (Continued)

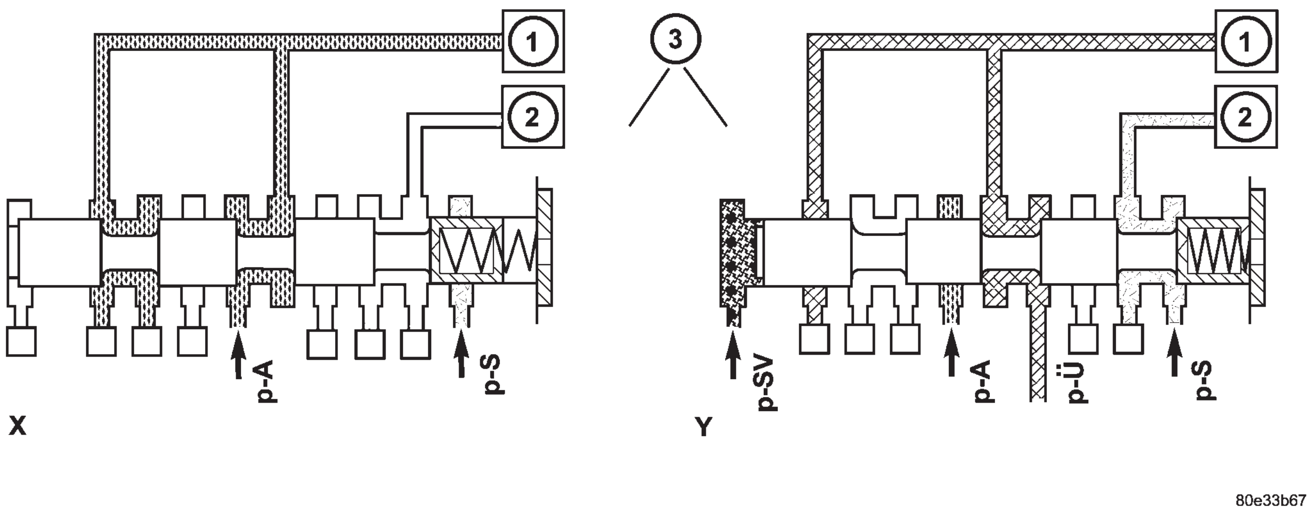


Fig. 67 Command Valve

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - 1-2/4-5 COMMAND VALVE

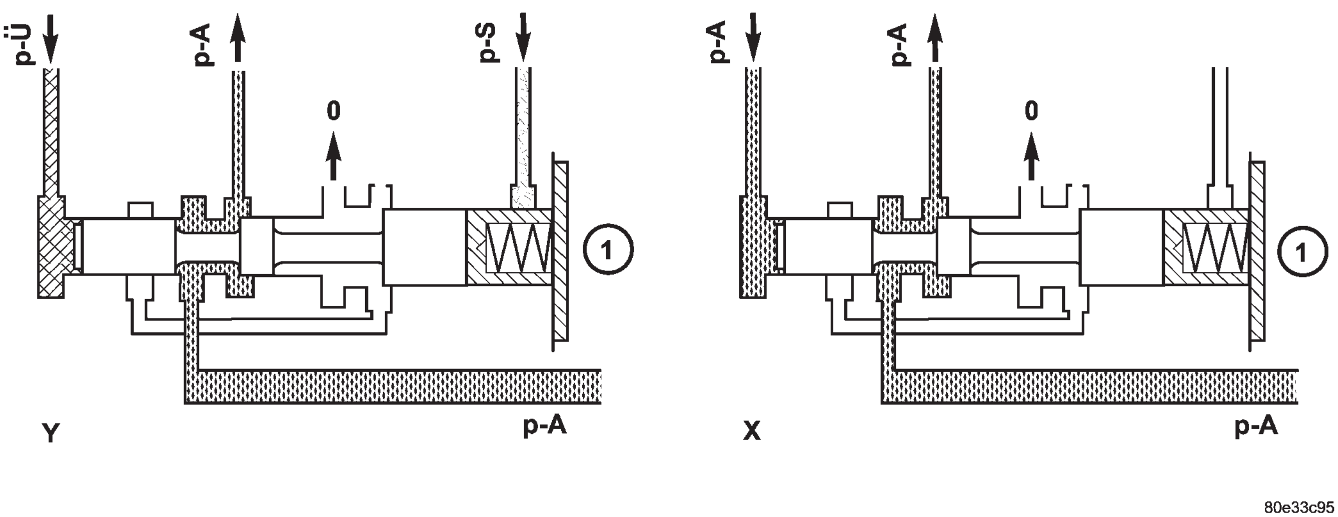


Fig. 68 Holding Pressure Shift Valve

1 - HOLDING PRESSURE SHIFT VALVE

Shift Pressure Shift Valve

Each shift group possesses one shift pressure shift valve (Fig. 69). The 1-2 / 4-5 and 2-3 shift pressure shift valves are installed in the shift valve housing; the 3-4 shift pressure shift valve is installed in the valve housing. It assigns the shift pressure (p-S) to the activating actuator and the overlap pressure (p-Ü) regulated by the overlap regulating valve to the deactivating actuator.

Lubrication Pressure Regulating Valve

The lubrication pressure regulating valve (Fig. 70) is located in the valve housing of the electrohydraulic control module. The valve controls the fluid to lubricate and cool the mechanical part of the transmission, and limits the pressure in the torque converter.

ELECTROHYDRAULIC UNIT (Continued)

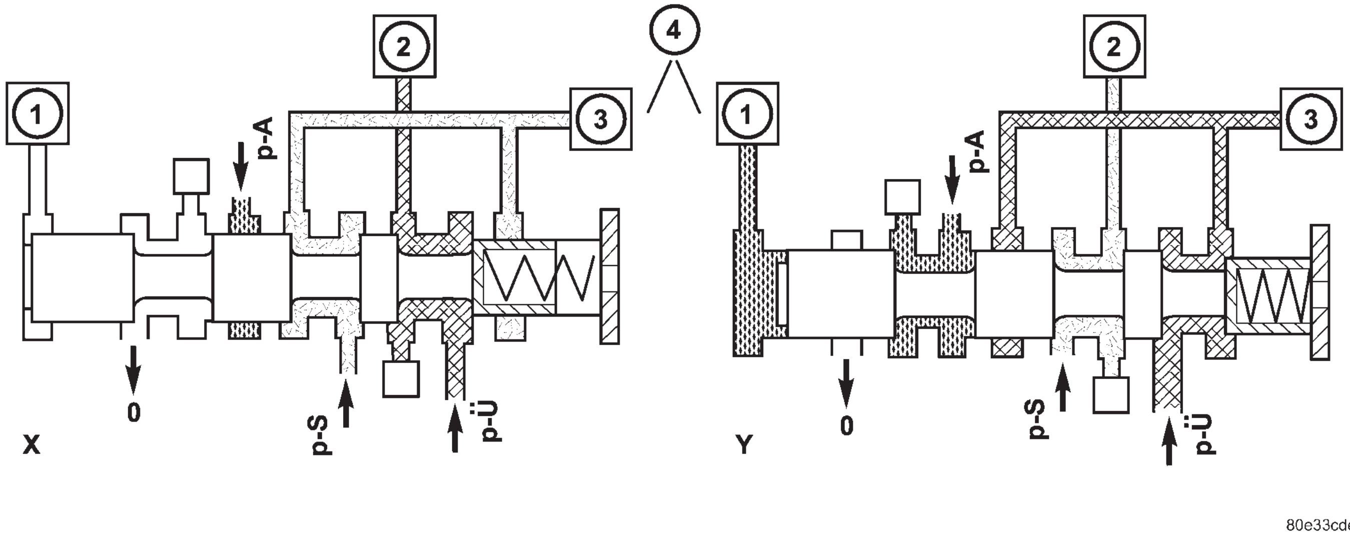


Fig. 69 Shift Pressure Shift Valve

1 - 1-2/4-5 COMMAND VALVE
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B1
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE

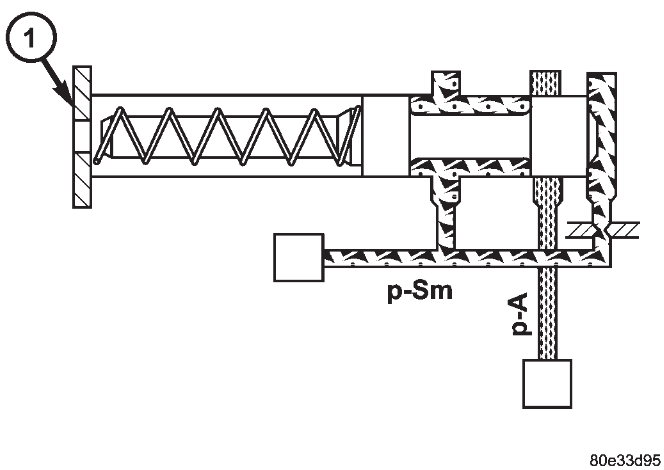


Fig. 70 Lubrication Pressure Regulating Valve

1 - LUBRICATION PRESSURE REGULATING VALVE

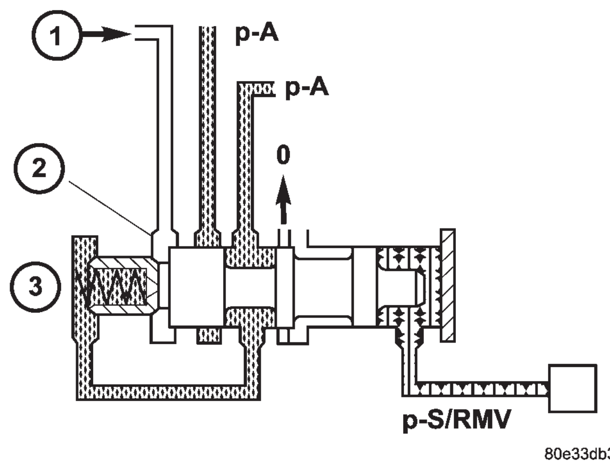


Fig. 71 Shift Pressure Regulating Valve

1 - PRESSURE FROM CLUTCH K2
2 - ANNULAR SURFACE
3 - SHIFT PRESSURE REGULATING VALVE

Shift Pressure Regulating Valve

The shift pressure regulating valve (Fig. 71) is located in the valve housing of the shift plate. It regulates the shift pressure (p-S).

ELECTROHYDRAULIC UNIT (Continued)

Regulating Valve Pressure Regulating Valve

The regulating valve pressure regulating valve (Fig. 72) is located in the valve housing of the electrohydraulic control module. It regulates the regulating valve pressure (p-RV).

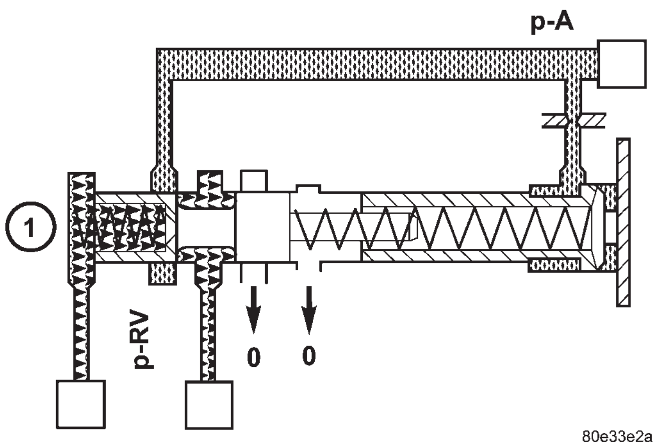


Fig. 72 Regulating Valve Pressure Regulating Valve

1 - REGULATING VALVE PRESSURE REGULATING VALVE

Shift Valve Pressure Regulating Valve

The shift valve pressure regulating valve (Fig. 73) is located in the valve housing of the electrohydraulic control module. It regulates the shift valve pressure (p-SV).

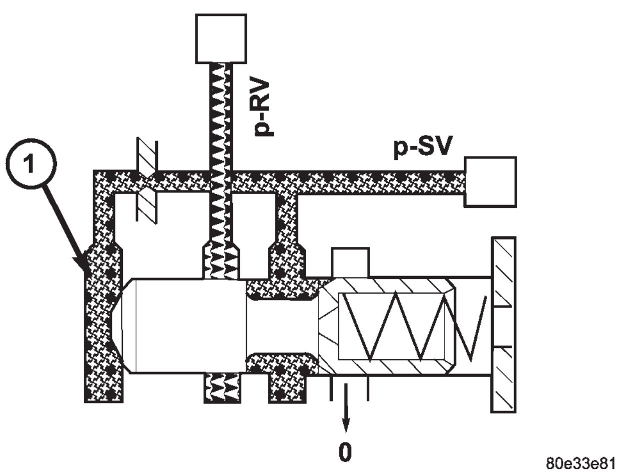


Fig. 73 Shift Valve Pressure Regulating Valve

1 - SHIFT VALVE PRESSURE REGULATING VALVE

OPERATION

ELECTRICAL CONTROL UNIT

Signals from the transmission control module (TCM) are converted into hydraulic functions in the electric valve control unit (7) (Fig. 74). The RPM sensors (1, 12), starter interlock contact (9), and transmission oil temperature sensor (8) of the electric valve control unit (7) supply the TCM with input signals. The solenoid valves are controlled by the TCM and trigger the hydraulic functions.

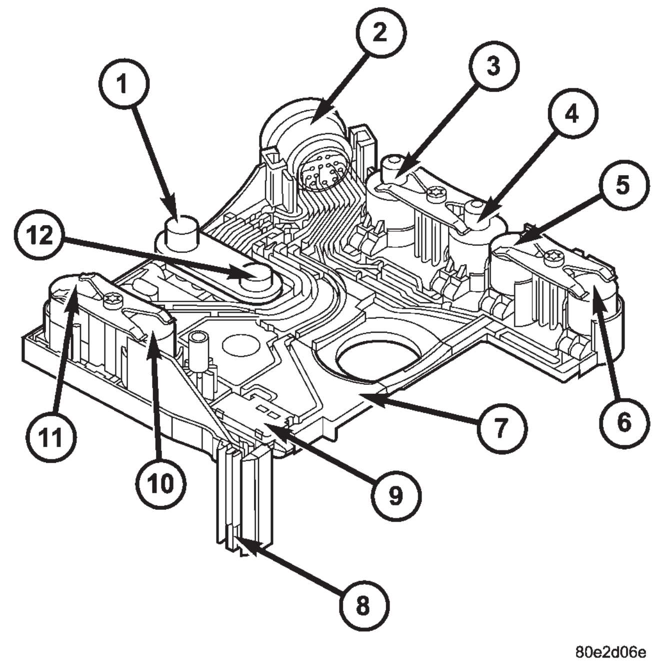


Fig. 74 Electrical Control Unit

1 - N3 SPEED SENSOR
2 - PLUG CONNECTOR
3 - MODULATING PRESSURE REGULATING SOLENOID
4 - SHIFT PRESSURE REGULATING SOLENOID
5 - 1-2/4-5 SHIFT SOLENOID
6 - 3-4 SHIFT SOLENOID
7 - ELECTRICAL CONTROL UNIT
8 - TRANSMISSION TEMPERATURE SENSOR
9 - STARTER INTERLOCK CONTACT
10 - 2-3 SHIFT SOLENOID
11 - TORQUE CONVERTER LOCK-UP SOLENOID
12 - N2 SPEED SENSOR

ELECTROHYDRAULIC UNIT (Continued)

HYDRAULIC CONTROL UNIT

Working Pressure Regulating Valve (Operating Pressure)

The working pressure (p-A) is regulated at the working pressure regulating valve (22) (Fig. 75) in relation to load (modulating pressure) and gear (K1 or K2 pressure). The spring in the working pressure regulating valve sets a minimum pressure level (basic pressure).

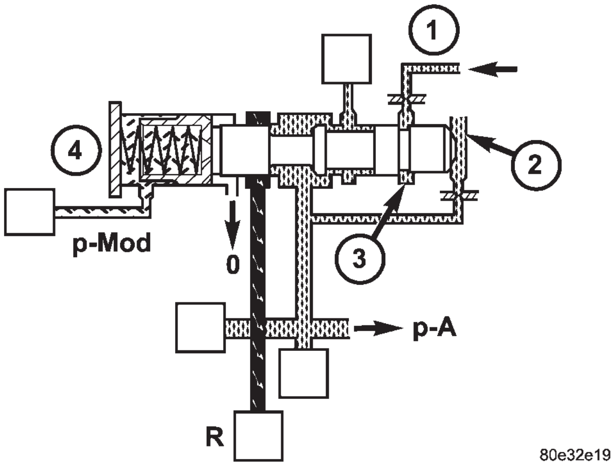


Fig. 75 Working Pressure Regulating Valve

1 - PRESSURE FROM K1/K2
2 - END FACE
3 - ANNULAR SURFACE
4 - WORKING PRESSURE REGULATING VALVE

Torque Converter Lockup Clutch Regulating Valve

The torque converter lockup clutch regulating valve (6) (Fig. 76) regulates the torque converter lock-up clutch working pressure in relation to the torque converter clutch control pressure. According to the size of the working pressure, the torque converter lockup clutch is either Engaged, Disengaged, or Slipping. When the regulating valve (6) is in the lower position, lubricating oil flows through the torque converter and oil cooler (8) into the transmission (torque converter lockup clutch unpressurized). In its regulating position (slipping, torque converter lockup clutch pressurized), a reduced volume of lubricating oil flows through the annular passage (7) bypassing the torque converter and passing direct through the oil cooler into the transmission. The rest of the lubricating oil is directed via the throttle ″a″ into the torque converter in order to cool the torque converter lockup clutch.

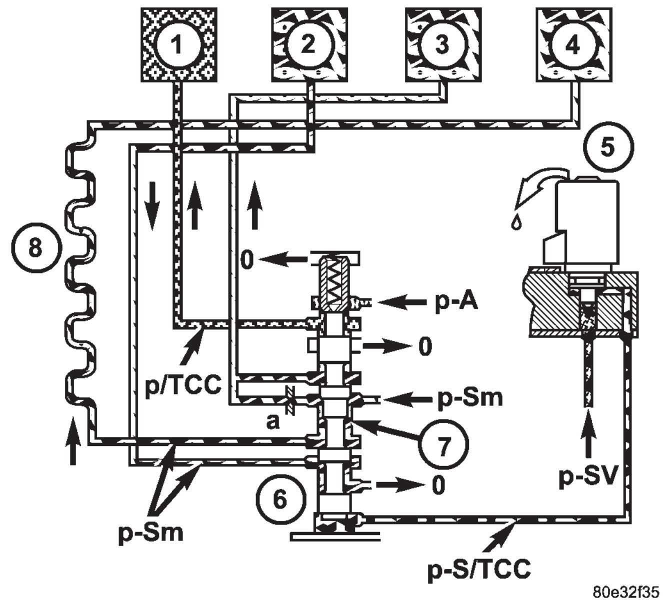


Fig. 76 Torque Converter Lockup Clutch Regulating Valve

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER OUTPUT
3 - TORQUE CONVERTER INPUT
4 - TORQUE CONVERTER LUBRICATION POINTS
5 - TORQUE CONVERTER LOCK-UP SOLENOID
6 - TORQUE CONVERTER LOCK-UP CLUTCH REGULATING VALVE
7 - ANNULAR PASSAGE THROTTLE
8 - OIL COOLER

Overlap Regulating Valve

During the shift phase the pressure (Fig. 77) in the deactivating shift actuator is regulated in relation to the engine load (modulating pressure) and the pressure in the activating actuator. The regulated pressure is inversely proportional to the transfer capacity of the activating shift actuator (regulated overlap).

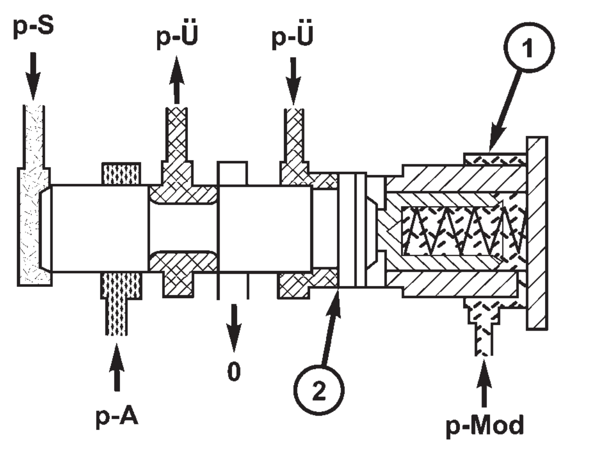


Fig. 77 Overlap Regulating Valve

1 - OVERLAP REGULATING VALVE
2 - ANNULAR SURFACE ON OVERLAP REGULATING VALVE

ELECTROHYDRAULIC UNIT (Continued)

Command Valve

When the end face is unpressurized (stationary phase), the working pressure is directed to the actuated shift element. If the end face of the command valve (Fig. 78) is subjected to the shift valve pressure (p-SV) (shift phase), then the shift pressure is switched to the activating element and the overlap pressure is switched to the deactivating element.

Shift Valve Holding Pressure

The holding pressure shift valve (Fig. 79) is actuated by the pressures present at the end face in the actuators and a spring. It assigns the working pressure to the actuator with the higher pressure (taking into account the spring force and the effective surface area). The other element of the shift group is then unpressurized. The valve switches over only during the shift phase and only at a certain pressure ratio between the overlap pressure (p-Ü) and the shift pressure (p-S).

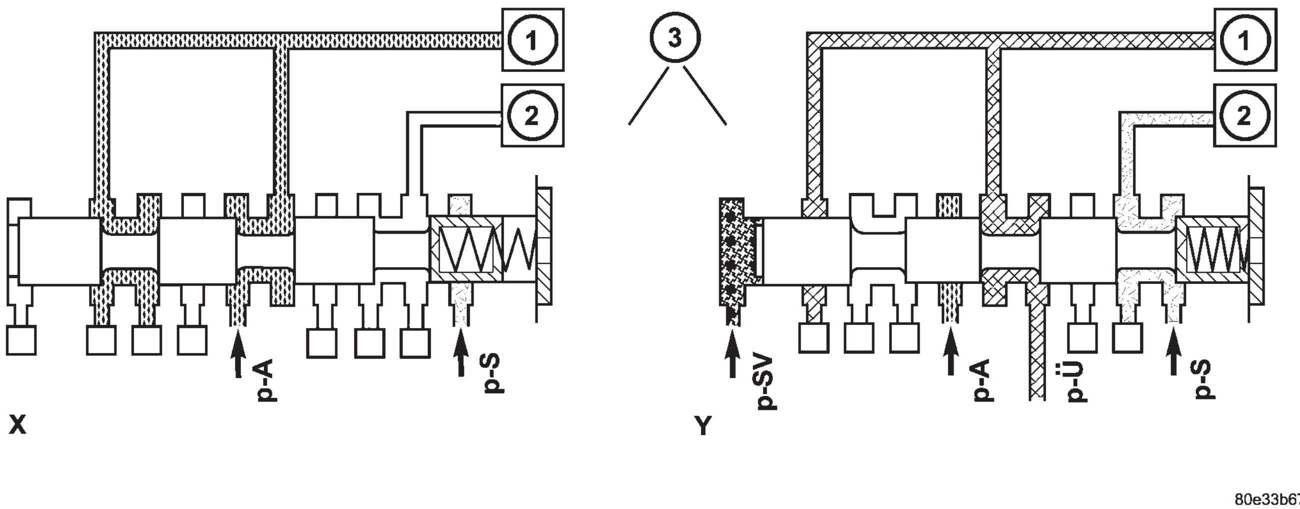


Fig. 78 Command Valve

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - 1-2/4-5 COMMAND VALVE

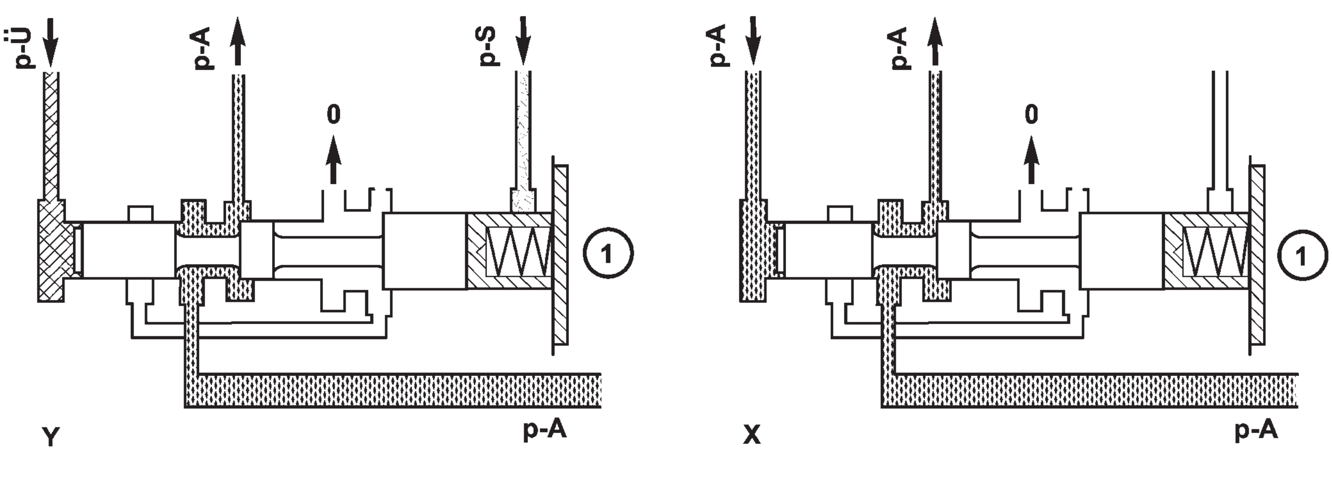


Fig. 79 Shift Valve Holding Pressure

1 - HOLDING PRESSURE SHIFT VALVE

ELECTROHYDRAULIC UNIT (Continued)

Shift Pressure Shift Valve

When the multiple-disc brake B1 (3) is activated, the working pressure (pa) is applied to the end face of the 1-2 / 4-5 shift pressure shift valve (4) (Fig. 80) via the command valve (1). Its shift state is maintained during the shift phase by substituting the shift element pressure acting on its end face (and which is variable during the shift phase) with a corresponding constant pressure. When the multi-plate clutch K1 (2) is activated, the end face of the shift valve is unpressurized during the stationary and shift phases, so the shift state is maintained during the shift phase in this case too.

Lubrication Pressure Regulating Valve

At the working pressure regulating valve surplus oil is diverted to the lubrication pressure regulating valve (1) (Fig. 81), from where the lubrication pressure (p-Sm) is used in regulated amounts to supply the transmission lubrication system including the torque converter.

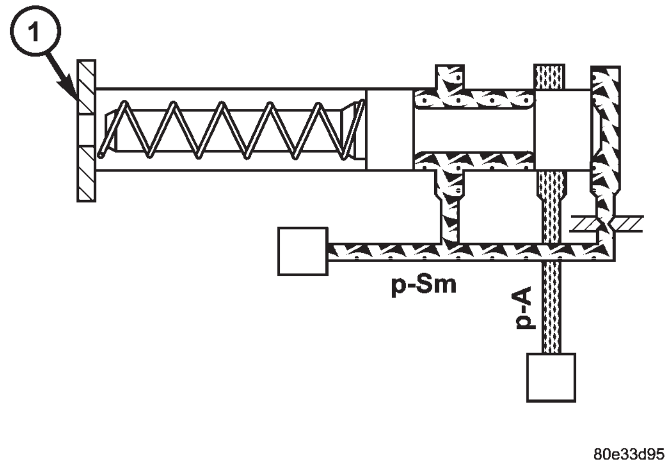


Fig. 81 Lubrication Pressure Regulating Valve

1 - LUBRICATION PRESSURE REGULATING VALVE

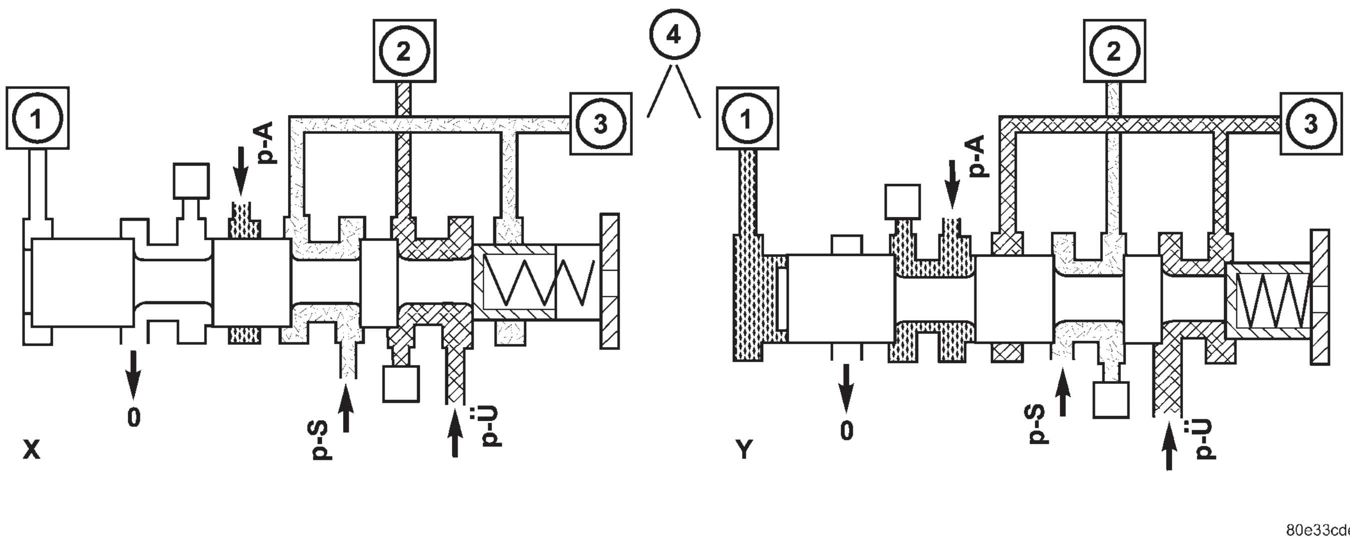


Fig. 80 Shift Pressure Shift Valve

1 - 1-2/4-5 COMMAND VALVE
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B1
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE

ELECTROHYDRAULIC UNIT (Continued)

Shift Pressure Regulating Valve

The shift pressure is determined by the shift pressure regulating solenoid valve and the shift pressure regulating valve (3) (Fig. 82). In addition, pressure from the clutch K2 (1) is also present at the annular surface (2) of the shift pressure regulating valve (3). This reduces the shift pressure in 2nd gear.

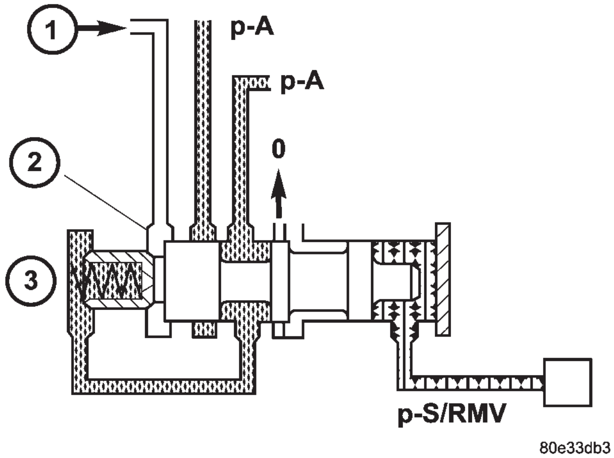


Fig. 82 Shift Pressure Regulating Valve

1 - PRESSURE FROM CLUTCH K2
2 - ANNULAR SURFACE
3 - SHIFT PRESSURE REGULATING VALVE

Regulating Valve Pressure Regulating Valve

The regulating valve pressure (p-RV) is set at the regulating valve pressure regulating valve (1) (Fig. 83) in relation to the working pressure (p-A) as far as the maximum pressure.

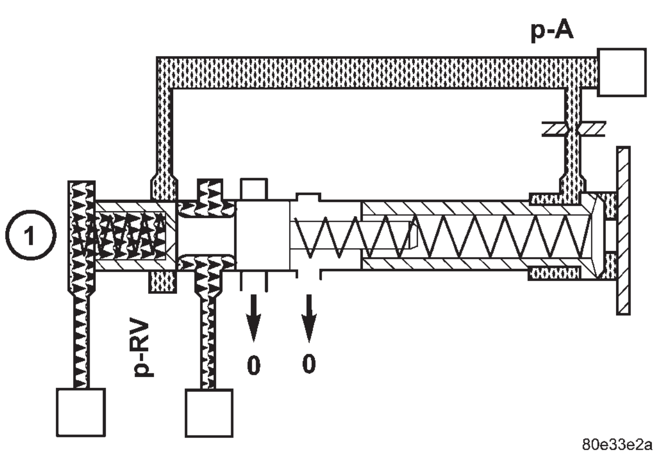


Fig. 83 Regulating Valve Pressure Regulating Valve

1 - REGULATING VALVE PRESSURE REGULATING VALVE

Shift Valve Pressure Regulating Valve

The non-constant regulating valve pressure (p-RV) is regulated to a constant shift valve pressure (p-SV) at the shift valve pressure regulating valve (1) (Fig. 84) and is used to supply the 1-2 and 4-5 / 3-4 / 2-3 solenoid valves and the torque converter lockup clutch PWM solenoid valve.

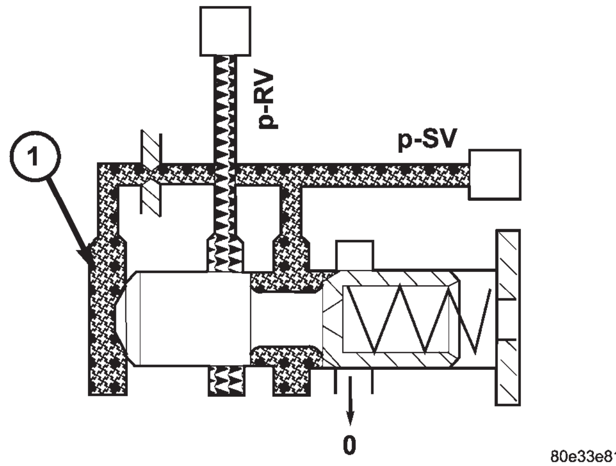


Fig. 84 Shift Valve Pressure Regulating Valve

1 - SHIFT VALVE PRESSURE REGULATING VALVE

REMOVAL

(1) Move selector lever to position ″P″.

(2) Raise vehicle.

(3) Remove bolt (3) (Fig. 85) and screw (1) holding the heat shield (2) to the transmission.

(4) Loosen guide bushing (2) (Fig. 85) and remove from transmission housing.

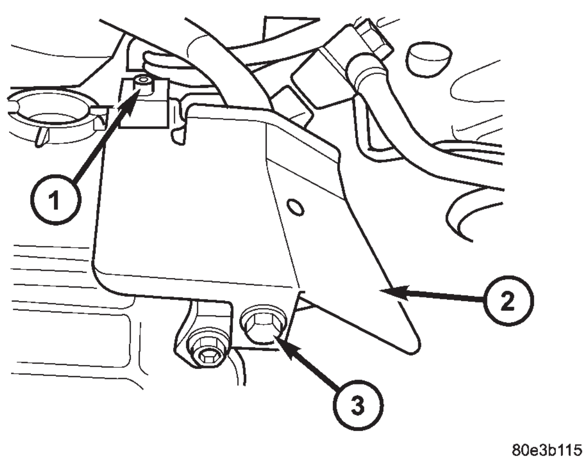


Fig. 85 Remove Heat Shield

1 - SCREW
2 - HEAT SHIELD
3 - BOLT

ELECTROHYDRAULIC UNIT (Continued)

(5) Disconnect 13-pin plug connector (1) (Fig. 86). Turn bayonet lock of guide bushing (2) anti-clockwise.

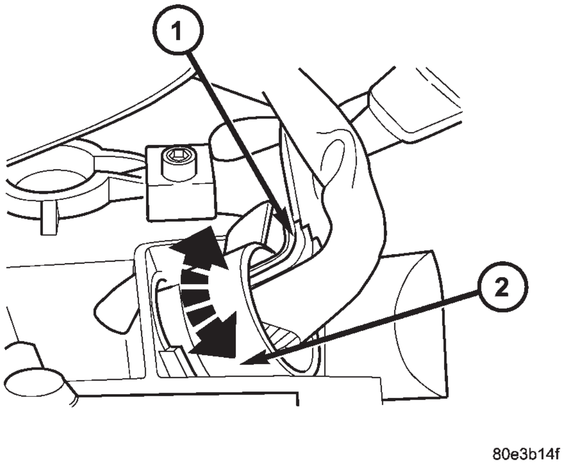


Fig. 86 Remove Wiring Connector Plug

1 - PLUG CONNECTOR
2 - GUIDE BUSHING

(6) Drain transmission oil by unscrewing oil drain plug (8) (Fig. 87).

NOTE: If the transmission fluid is burnt or contains abraded particles, the oil cooler lines and oil cooler must be flushed out.

(7) Detach oil pan (5).
(8) Remove oil filter (4).
(9) Unscrew Torx socket bolts (3) and remove electrohydraulic control module (2).

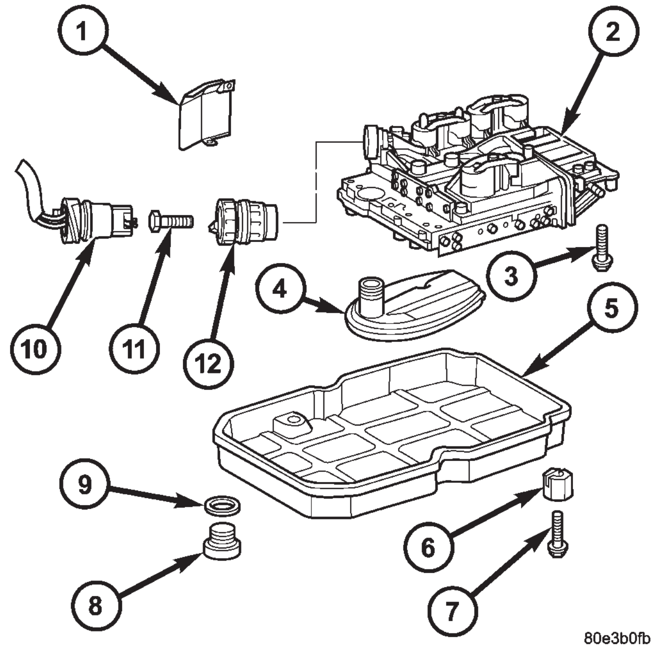


Fig. 87 Remove Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

DISASSEMBLY

(1) Remove electrohydraulic unit from the vehicle.
(2) Remove solenoid caps (1, 2) (Fig. 88).
(3) Unscrew Torx socket bolts (3, 4) (Fig. 88).

NOTE: Pay attention to the different lengths of the Torx socket bolts.

(4) Remove leaf springs (5).
(5) Withdraw solenoid valves (6 - 11) from shift plate (13).

NOTE: Check O-rings on solenoid valves for damage and replace if necessary.

(6) Bend away retaining lug on stiffening rib on transmission oil temperature sensor.
(7) Remove electrohydraulic control module (12) from the shift plate (13).
(8) Note the locations of the major shift valve group components for assembly reference (Fig. 89).

NOTE: Pay great attention to cleanliness for all work on the shift plate. Fluffy cloths must not be used. Leather cloths are particularly good. After dismantling, all parts must be washed and blown out with compressed-air, noting that parts may be blown away.

ELECTROHYDRAULIC UNIT (Continued)

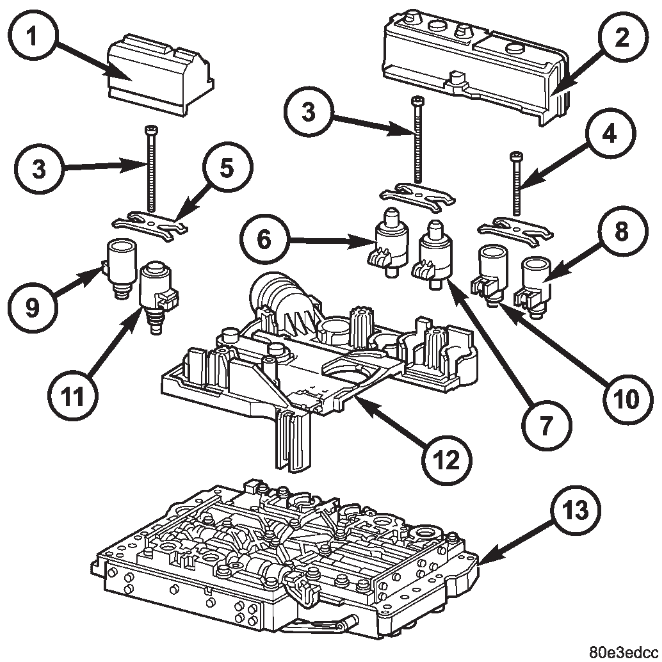


Fig. 88 Electrical Unit Components

1 - SOLENOID CAP
2 - SOLENOID CAP
3 - BOLT - M6X32
4 - BOLT - M6X30
5 - LEAF SPRING
6 - MODULATING PRESSURE REGULATING SOLENOID VALVE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - 3-4 SHIFT SOLENOID
9 - TORQUE CONVERTER LOCK-UP SOLENOID
10 - 1-2/4-5 SHIFT SOLENOID
11 - 2-3 SHIFT SOLENOID
12 - ELECTRICHYDRAULIC CONTROL MODULE
13 - SHIFT PLATE

(9) Unbolt leaf spring (5) (Fig. 90).

(10) Unscrew Torx bolts (1) (Fig. 90).

(11) Remove valve housing (2) from valve body (4) (Fig. 90).

(12) Remove the strainers for the modulating pressure and shift pressure control solenoid valves (Fig. 91) from the valve housing.

(13) Remove the strainer (1) (Fig. 92) in the inlet to torque converter lock-up control solenoid valve.

(14) Remove sealing plate (3).

NOTE: A total of 12 valve balls are located in the valve body, four made from plastic (4) and eight from steel (1, 3).

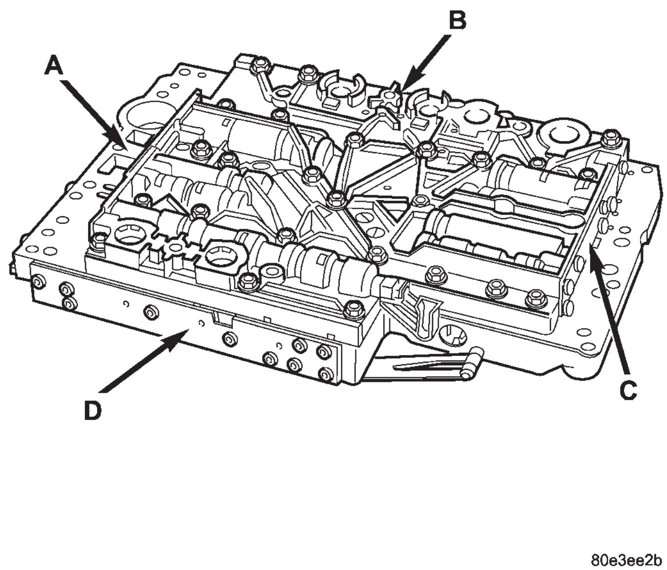


Fig. 89 Shift Valve Group Locations

A - OPERATING AND LUBRICATING PRESSURE REGULATING VALVES AND 2-3 OVERLAP VALVE
B - 1-2/4-5 SHIFT GROUP AND SHIFT, SHIFT VALVE, AND REGULATING VALVE PRESSURE REGULATING VALVES
C - 3-4 SHIFT GROUP
D - 2-3 SHIFT GROUP, TCC LOCK-UP AND B2 REGULATING VALVES

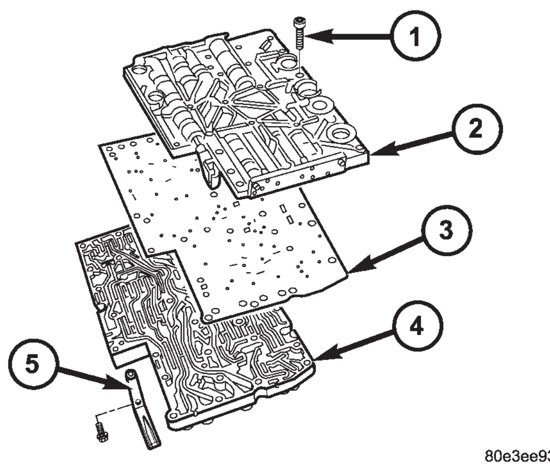


Fig. 90 Shift Plate Components

1 - BOLTS - 29
2 - VALVE HOUSING
3 - SEALING PLATE
4 - VALVE BODY
5 - LEAF SPRING

ELECTROHYDRAULIC UNIT (Continued)

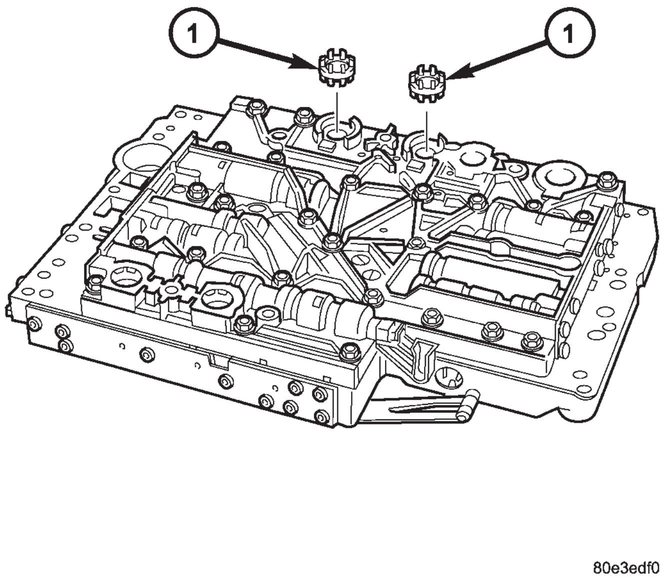


Fig. 91 Solenoid Valve Strainer Locations

1 - SOLENOID VALVE STRAINERS

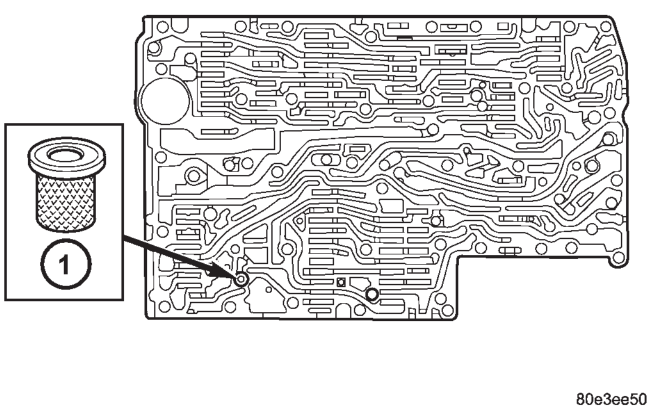


Fig. 92 Converter Lock-up Solenoid Valve Strainer Location

1 - CONVERTER LOCK-UP SOLENOID STRAINER

(15) Note the location of all check balls (1, 3, 4) (Fig. 93) and the central strainer (2) for re-installation. Remove all check balls (1, 3, 4) and the central strainer (2).

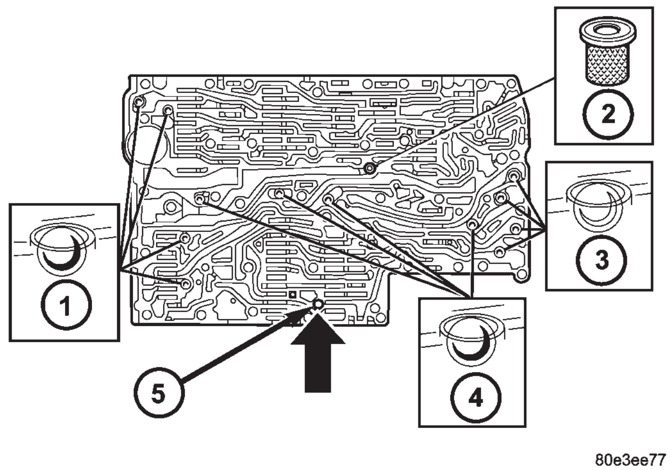


Fig. 93 Check Balls and Strainer Location

1 - STEEL CHECK BALLS
2 - CENTRAL STRAINER
3 - STEEL CHECK BALLS
4 - PLASTIC CHECK BALLS
5 - PLAIN DOWEL PIN

(16) Remove the screws holding the side covers to the valve body and valve housing.

(17) Remove all valves and springs from the valve body (1) (Fig. 94). Check all valves for ease of movement and shavings.

NOTE: The sleeves and pistons of the overlap regulating valves must not be mixed up.

ELECTROHYDRAULIC UNIT (Continued)

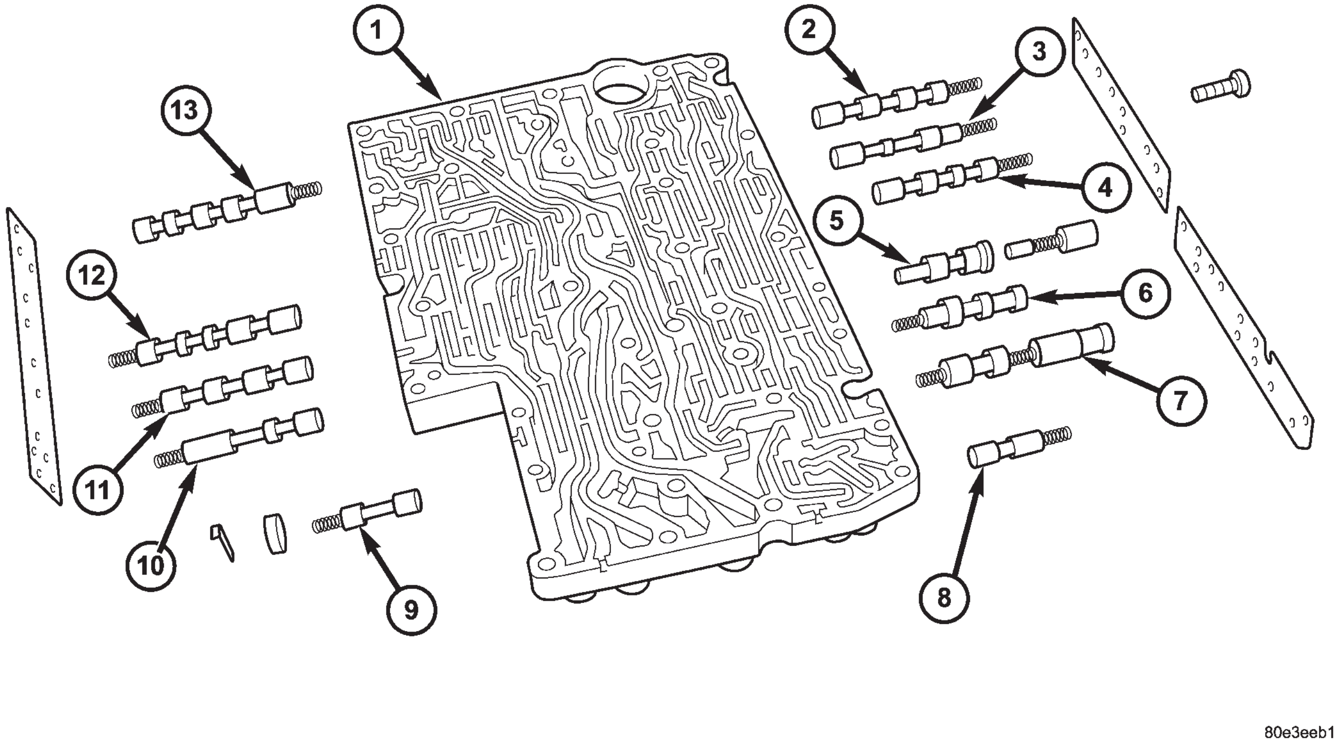


Fig. 94 Valve Body Components

1 - VALVE BODY
2 - 1-2/4-5 COMMAND VALVE
3 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
5 - 1-2/4-5 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
6 - SHIFT PRESSURE REGULATING VALVE
7 - REGULATING VALVE PRESSURE REGULATING VALVE
8 - SHIFT VALVE PRESSURE REGULATING VALVE
9 - B2 SHIFT VALVE
10 - 2-3 HOLDING PRESSURE SHIFT VALVE
11 - 2-3 COMMAND VALVE
12 - 2-3 SHIFT PRESSURE SHIFT VALVE
13 - TCC LOCK-UP REGULATING VALVE

(18) Remove all valves and springs from the valve housing (2) (Fig. 95). Check all valves for ease of movement and shavings.

(19) Remove the pressure supply valve (1) (Fig. 96) from the valve body.

ASSEMBLY

NOTE: Pay great attention to cleanliness for all work on the shift plate. Fluffy cloths must not be used. Leather cloths are particularly good. After dismantling, all parts must be washed and blown out with compressed-air, noting that parts may be blown away.

(1) Install the pressure supply valve (1) (Fig. 97) into the valve body.

ELECTROHYDRAULIC UNIT (Continued)

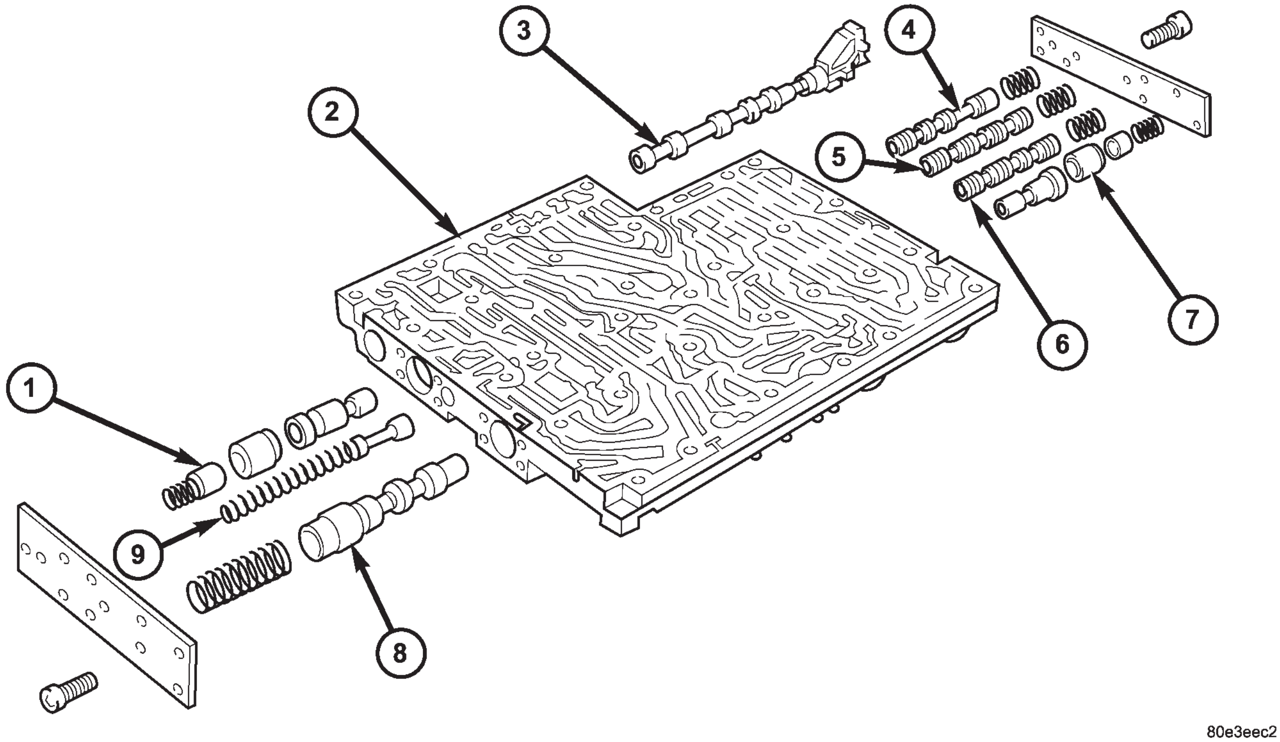


Fig. 95 Valve Housing Components

1 - 2-3 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
2 - VALVE HOUSING
3 - SELECTOR VALVE
4 - 3-4 HOLDING PRESSURE SHIFT VALVE
5 - 3-4 COMMAND VALVE
6 - 3-4 SHIFT PRESSURE SHIFT VALVE
7 - 3-4 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
8 - OPERATING PRESSURE REGULATING VALVE
9 - LUBRICATING PRESSURE REGULATING VALVE

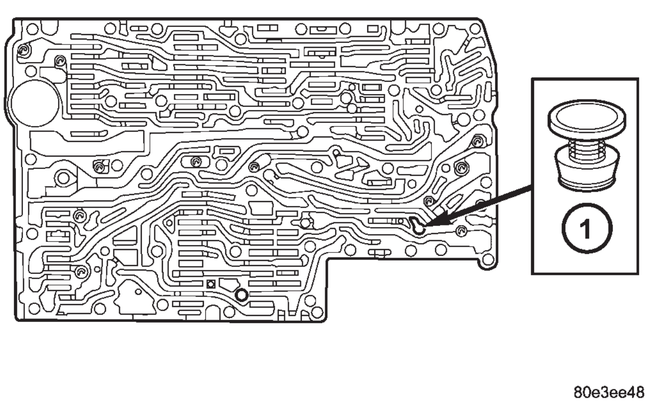


Fig. 96 Pressure Feed Valve Location

1 - PRESSURE FEED VALVE

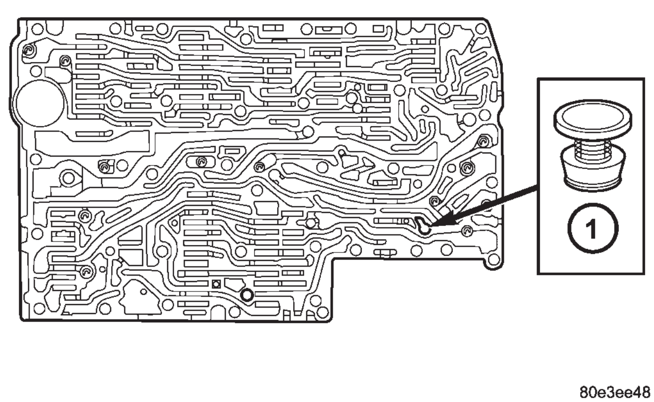


Fig. 97 Pressure Feed Valve Location

1 - PRESSURE FEED VALVE

ELECTROHYDRAULIC UNIT (Continued)

(2) Install all valves and springs from the valve body (1) (Fig. 98). Check all valves for ease of movement and shavings.

NOTE: The sleeves and pistons of the overlap regulating valves must not be mixed up.

(3) Install all valves and springs into the valve housing (2) (Fig. 99). Check all valves for ease of movement and shavings.

(4) Install the screws to hold the side covers to the valve body and valve housing. Tighten the screws to 4 N·m.

NOTE: A total of 12 valve balls are located in the valve body, four made from plastic (4) and eight from steel (1, 3).

(5) Install all check balls (1, 3, 4) (Fig. 100) and the central strainer (2).

(6) Install the strainer (1) (Fig. 101) in the inlet to torque converter lock-up control solenoid valve.

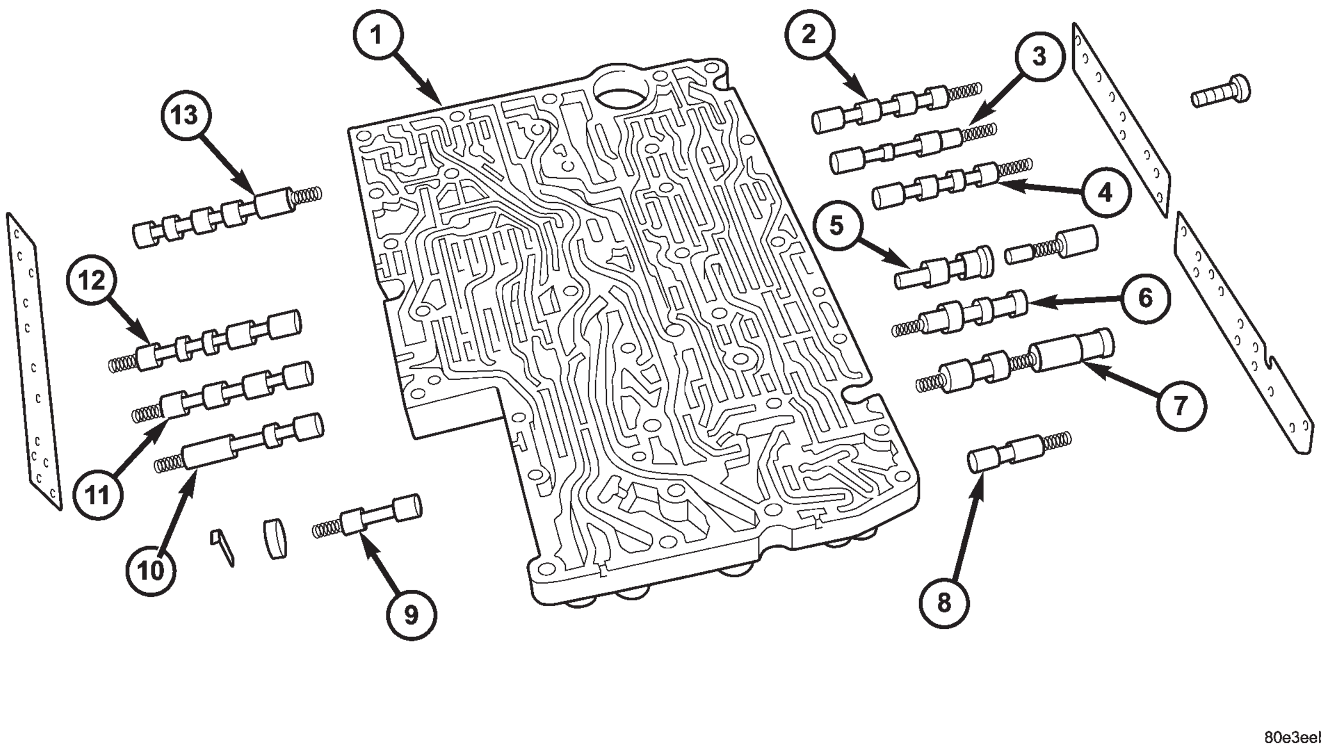


Fig. 98 Valve Body Components

1 - VALVE BODY
2 - 1-2/4-5 COMMAND VALVE
3 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
5 - 1-2/4-5 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
6 - SHIFT PRESSURE REGULATING VALVE
7 - REGULATING VALVE PRESSURE REGULATING VALVE
8 - SHIFT VALVE PRESSURE REGULATING VALVE
9 - B2 SHIFT VALVE
10 - 2-3 HOLDING PRESSURE SHIFT VALVE
11 - 2-3 COMMAND VALVE
12 - 2-3 SHIFT PRESSURE SHIFT VALVE
13 - TCC LOCK-UP REGULATING VALVE

ELECTROHYDRAULIC UNIT (Continued)

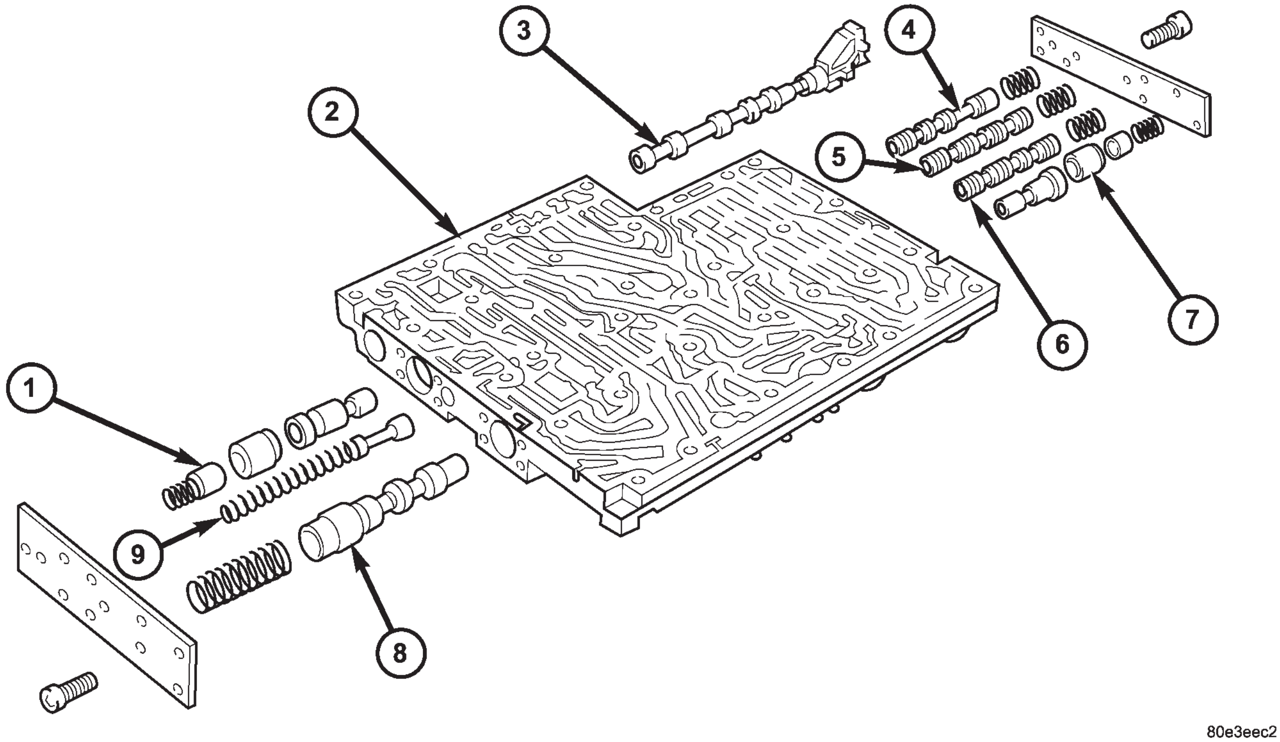


Fig. 99 Valve Housing Components

1 - 2-3 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
2 - VALVE HOUSING
3 - SELECTOR VALVE
4 - 3-4 HOLDING PRESSURE SHIFT VALVE
5 - 3-4 COMMAND VALVE
6 - 3-4 SHIFT PRESSURE SHIFT VALVE
7 - 3-4 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
8 - OPERATING PRESSURE REGULATING VALVE
9 - LUBRICATING PRESSURE REGULATING VALVE

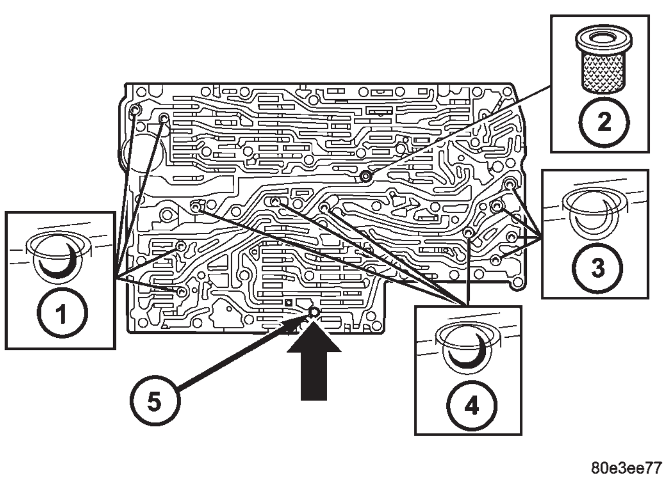


Fig. 100 Check Balls and Strainer Location

1 - STEEL CHECK BALLS
2 - CENTRAL STRAINER
3 - STEEL CHECK BALLS
4 - PLASTIC CHECK BALLS
5 - PLAIN DOWEL PIN

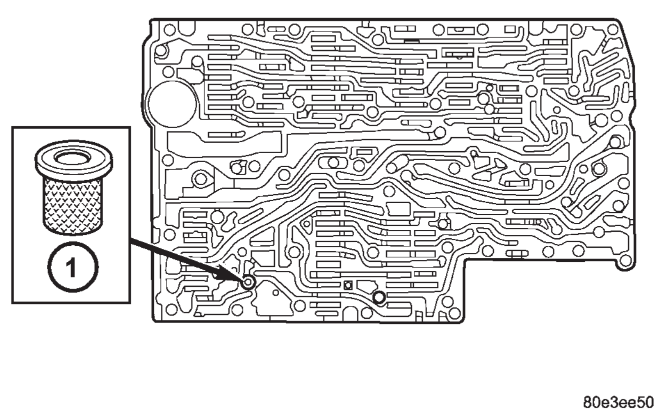


Fig. 101 Converter Lock-up Solenoid Valve Strainer Location

1 - CONVERTER LOCK-UP SOLENOID STRAINER

(7) Position the sealing plate (3) onto the valve body (4) (Fig. 102).

ELECTROHYDRAULIC UNIT (Continued)

(8) Install the valve housing (2) onto the valve body (4) and sealing plate (3).

(9) Install the shift plate Torx bolts (1) (Fig. 102). Tighten the bolts to 8 N·m.

(10) Install leaf spring (5) (Fig. 102).

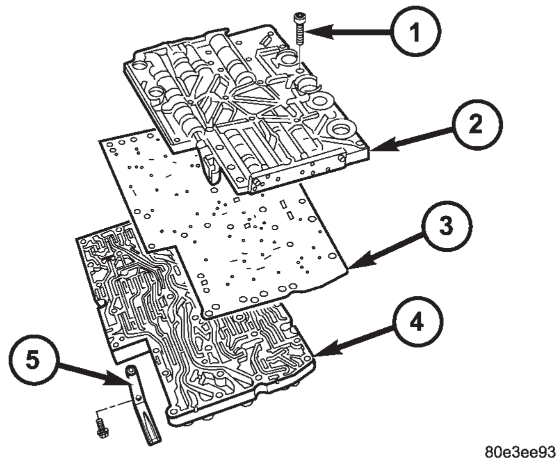


Fig. 102 Shift Plate Components

1 - BOLTS - 29
2 - VALVE HOUSING
3 - SEALING PLATE
4 - VALVE BODY
5 - LEAF SPRING

(11) Install the strainers for the modulating pressure and shift pressure control solenoid valves (Fig. 103) into the valve housing.

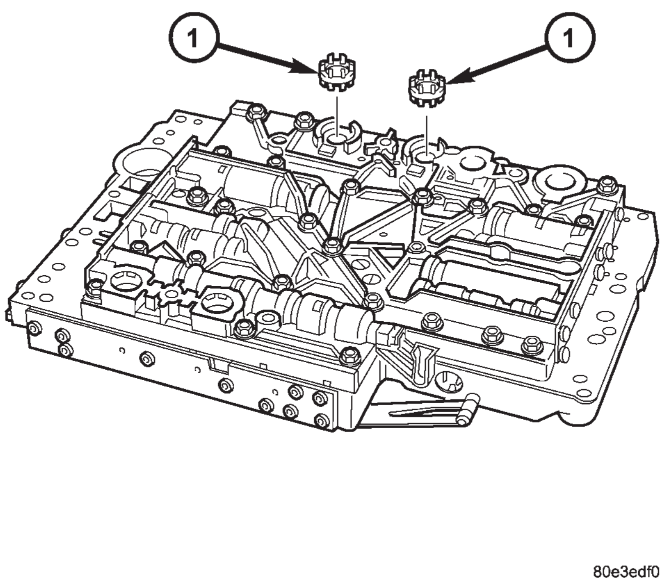


Fig. 103 Solenoid Valve Strainer Locations

1 - SOLENOID VALVE STRAINERS

(12) Install the electrohydraulic control module (12) onto the shift plate (13) (Fig. 104).

(13) Bend the retaining lug on stiffening rib on transmission oil temperature sensor to retain the electrohydraulic control module.

(14) Install the solenoid valves (6 - 11) into shift plate (13).

NOTE: Check O-rings on solenoid valves for damage and replace if necessary.

(15) Install the leaf springs (5).

(16) Install the Torx socket bolts (3, 4) (Fig. 104). Tighten the bolts to 8 N·m.

NOTE: Pay attention to the different lengths of the Torx socket bolts.

(17) Install the solenoid caps (1, 2).

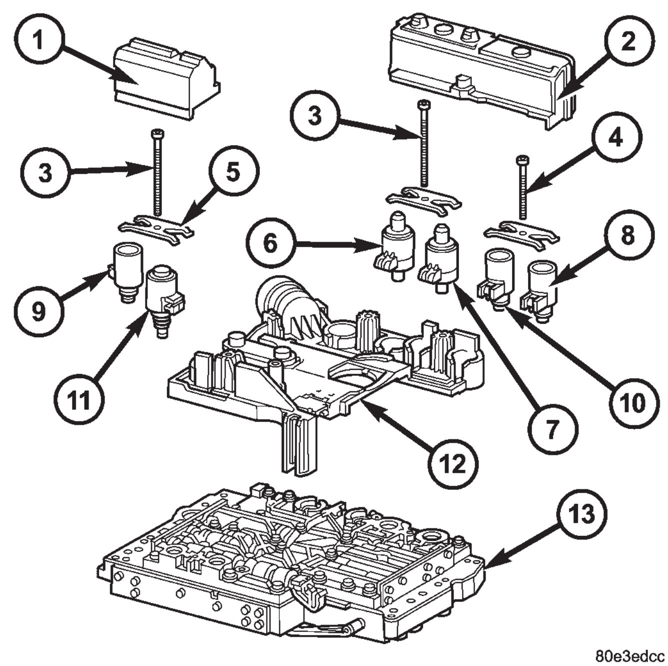


Fig. 104 Electrical Unit Components

1 - SOLENOID CAP
2 - SOLENOID CAP
3 - BOLT - M6X32
4 - BOLT - M6X30
5 - LEAF SPRING
6 - MODULATING PRESSURE REGULATING SOLENOID VALVE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - 3-4 SHIFT SOLENOID
9 - TORQUE CONVERTER LOCK-UP SOLENOID
10 - 1-2/4-5 SHIFT SOLENOID
11 - 2-3 SHIFT SOLENOID
12 - ELECTRICHYDRAULIC CONTROL MODULE
13 - SHIFT PLATE

(18) Install the electrohydraulic unit into the vehicle.

ELECTROHYDRAULIC UNIT (Continued)

INSTALLATION

(1) Position the electrohydraulic unit in the transmission housing.

(2) Insert selector valve (1) (Fig. 105) in driver of detent plate (2). When installing the electrohydraulic control module in the transmission housing, the plastic part of the selector valve (1) must engage in the driver of the detent plate (2).

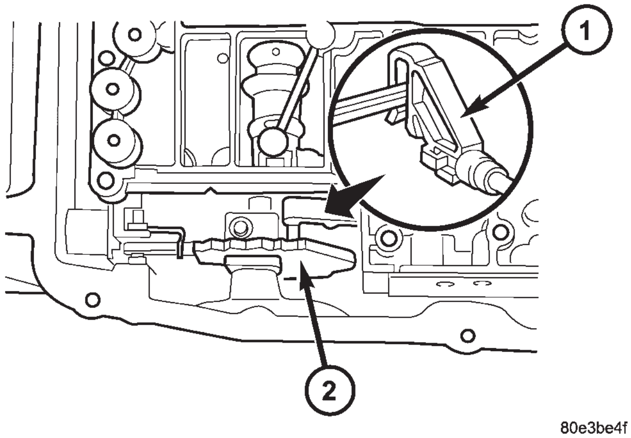


Fig. 105 Connect The Selector Valve To The Detent Plate

1 - SELECTOR VALVE
2 - DETENT PLATE

(3) Install the Torx socket bolts (3) (Fig. 106) and torque to 8 N·m.

(4) Install a new oil filter (4) (Fig. 106).

(5) Install oil pan (5) (Fig. 106).

(6) Install the oil drain plug (8) (Fig. 106) with a new drain plug gasket (9). Torque the drain plug to 20 N·m.

(7) Install the guide bushing (2) (Fig. 106) into the transmission housing and install the bolt to hold the guide bushing in place.

(8) Check O-ring on plug connector (1) (Fig. 107), and replace if necessary.

(9) Install the plug connector (1) into the guide bushing (2). Turn bayonet lock of guide bushing (2) clockwise to connect plug connector (1).

(10) Position the heat shield (2) (Fig. 108) onto the transmission housing and install the screw (1) and bolt (3) to hold the shield in place.

(11) Check oil level in automatic transmission, or add oil.

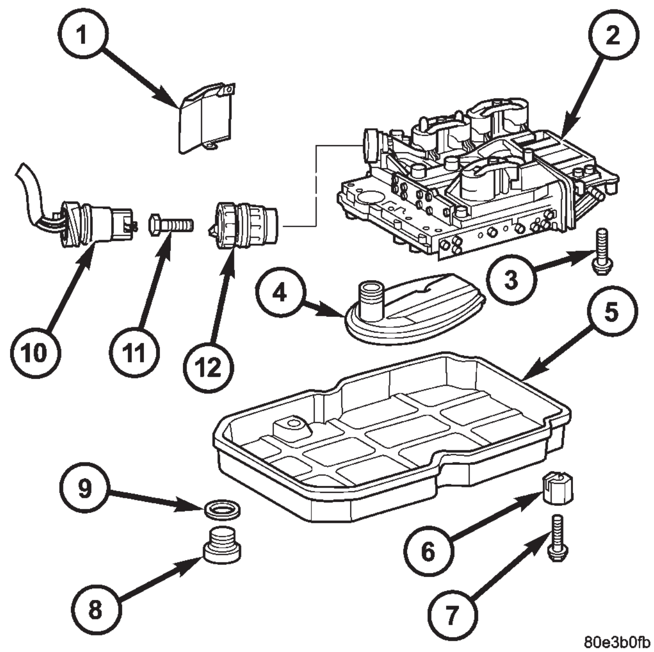


Fig. 106 Remove Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

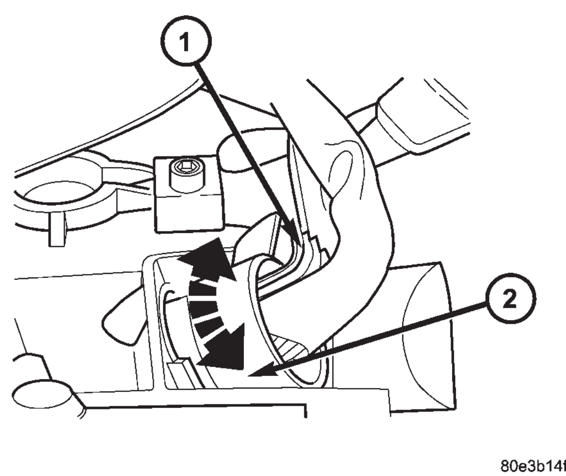


Fig. 107 Install Wiring Connector Plug

1 - PLUG CONNECTOR
2 - GUIDE BUSHING

ELECTROHYDRAULIC UNIT (Continued)

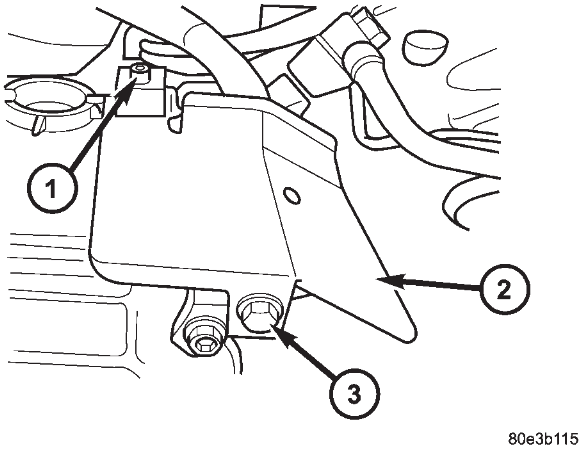


Fig. 108 Install Heat Shield

1 - SCREW
2 - HEAT SHIELD
3 - BOLT

FLUID AND FILTER

DESCRIPTION

The oil level control (Fig. 109) is located on the electrohydraulic unit and consists of the float (5) which is integrated into the electrohydraulic unit. The float is positioned to plug the opening between the oil gallery and gearset chamber so that the rotating gearsets do not splash about in oil as the oil level rises. The oil level control reduces power loss and prevents oil from being thrown out of the transmission housing at high oil temperatures.

OPERATION

With low oil levels (Fig. 110), the lubricating oil which flows constantly out of the gearset, flows back to oil gallery (2) though the opening (6). If the oil level rises, the oil presses the float (5) against the housing opening (6). The float (5) therefore separates the oil gallery (2) from the gearset chamber (1). The lubricating oil which continues to flow out of the gearsets is thrown against the housing wall, incorporated by the rotating parts and flows back into the oil gallery (2) through the upper opening (arrow).

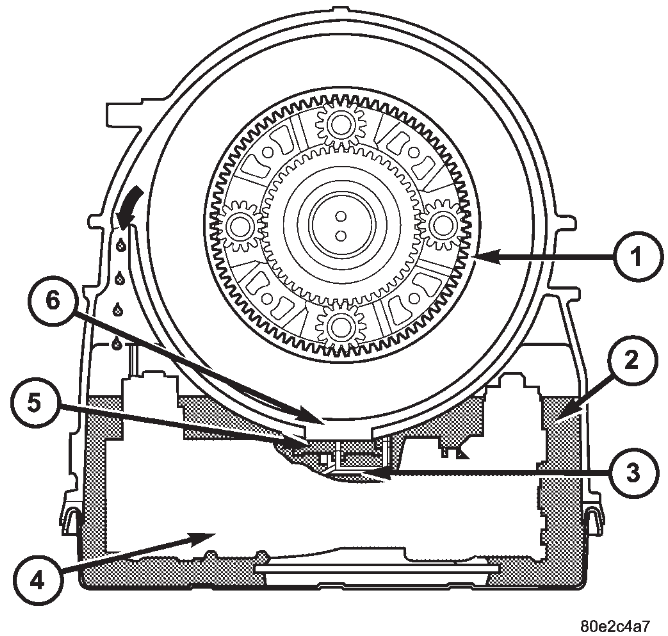


Fig. 109 Fluid Level Control

1 - GEARSET CHAMBER
2 - OIL GALLERY
3 - SHELL OF ELECTROHYDRAULIC UNIT
4 - ELECTROHYDRAULIC UNIT
5 - FLOAT
6 - OPENING

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

FLUID AND FILTER (Continued)

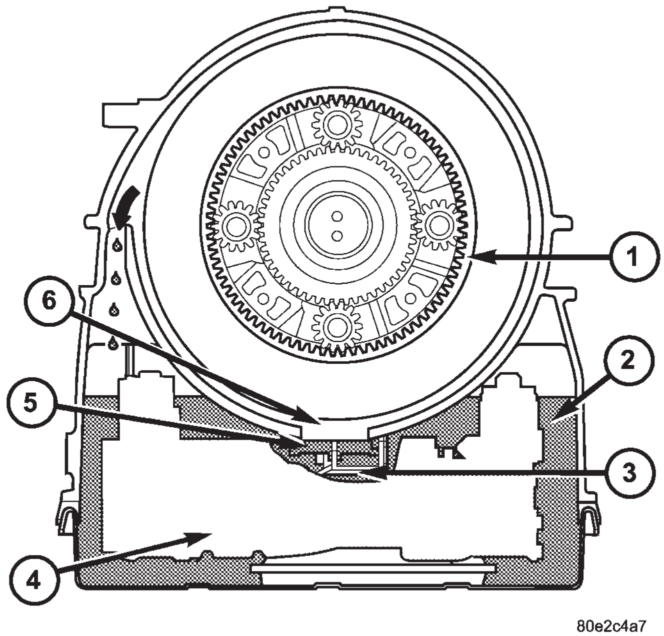


Fig. 110 Fluid Level Control

1 - GEARSET CHAMBER
2 - OIL GALLERY
3 - SHELL OF ELECTROHYDRAULIC UNIT
4 - ELECTROHYDRAULIC UNIT
5 - FLOAT
6 - OPENING

DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has three primary causes.

(1) Internal clutch slippage, usually caused by low line pressure, inadequate clutch apply pressure, or clutch seal failure.

(2) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(3) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

DIAGNOSIS AND TESTING - FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

FLUID AND FILTER (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - CHECK OIL LEVEL

(1) Verify that the vehicle is parked on a level surface.

(2) Remove locking pin (1) (Fig. 111). Remove the plate of the locking pin with a suitable tool and press out the pin remaining in the cap downwards.

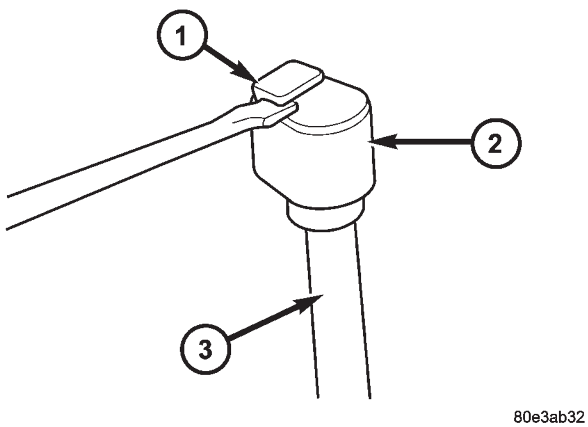


Fig. 111 Remove Dipstick Tube Cap Lock

1 - LOCKING PIN
2 - TUBE CAP
3 - DIPSTICK TUBE

(3) Remove cap (2).

WARNING: Risk of accident from vehicle starting off by itself when engine running. Risk of injury from contusions and burns if you insert your hands into the engine when it is started or when it is running. Secure vehicle to prevent it from moving off by itself. Wear properly fastened and close-fitting work clothes. Do not touch hot or rotating parts.

(4) Actuate the service brake. Start engine and let it run at idle speed in selector lever position ″P″.

(5) Shift through the transmission modes several times with the vehicle stationary and the engine idling

(6) Warm up the transmission, wait at least 2 minutes and check the oil level with the engine running. Push the Oil Dipstick 8863 in up to the stop and pull out again, read off oil level, repeat if necessary.

(7) Check transmission oil temperature.

(8) The transmission Oil Dipstick 8863 has indicator marks every 10mm. Determine the height of the oil level on the dipstick and using the height, the transmission temperature, and the Transmission Fluid Graph (Fig. 112), determine if the transmission oil level is correct.

(9) Add additional oil if necessary. Use Funnel 8908 to add oil.

(10) If the oil level is above the correct height, use Pump 8910 to remove the excess oil

(11) Re-check oil level as necessary.

(12) Once the oil level is correct, install a new dipstick tube cap (2) (Fig. 113) and lock pin (1).

STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Verify that the vehicle is parked on a level surface.

(2) Remove locking pin (1) (Fig. 114). Remove the plate of the locking pin with a suitable tool and press out the pin remaining in the cap downwards.

(3) Remove cap (2).

(4) Insert clean Funnel 8908 in transmission fill tube.

(5) Add following initial quantity of Shell® 3403 to transmission:

(a) If only fluid and filter were changed, add **5.0 L (10.6 pts.)** of transmission fluid to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **7.7 L (16.3 pts.)** of transmission fluid to transmission.

(6) Check the transmission fluid (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - W5J400/FLUID - STANDARD PROCEDURE) and adjust as required.

FLUID AND FILTER (Continued)

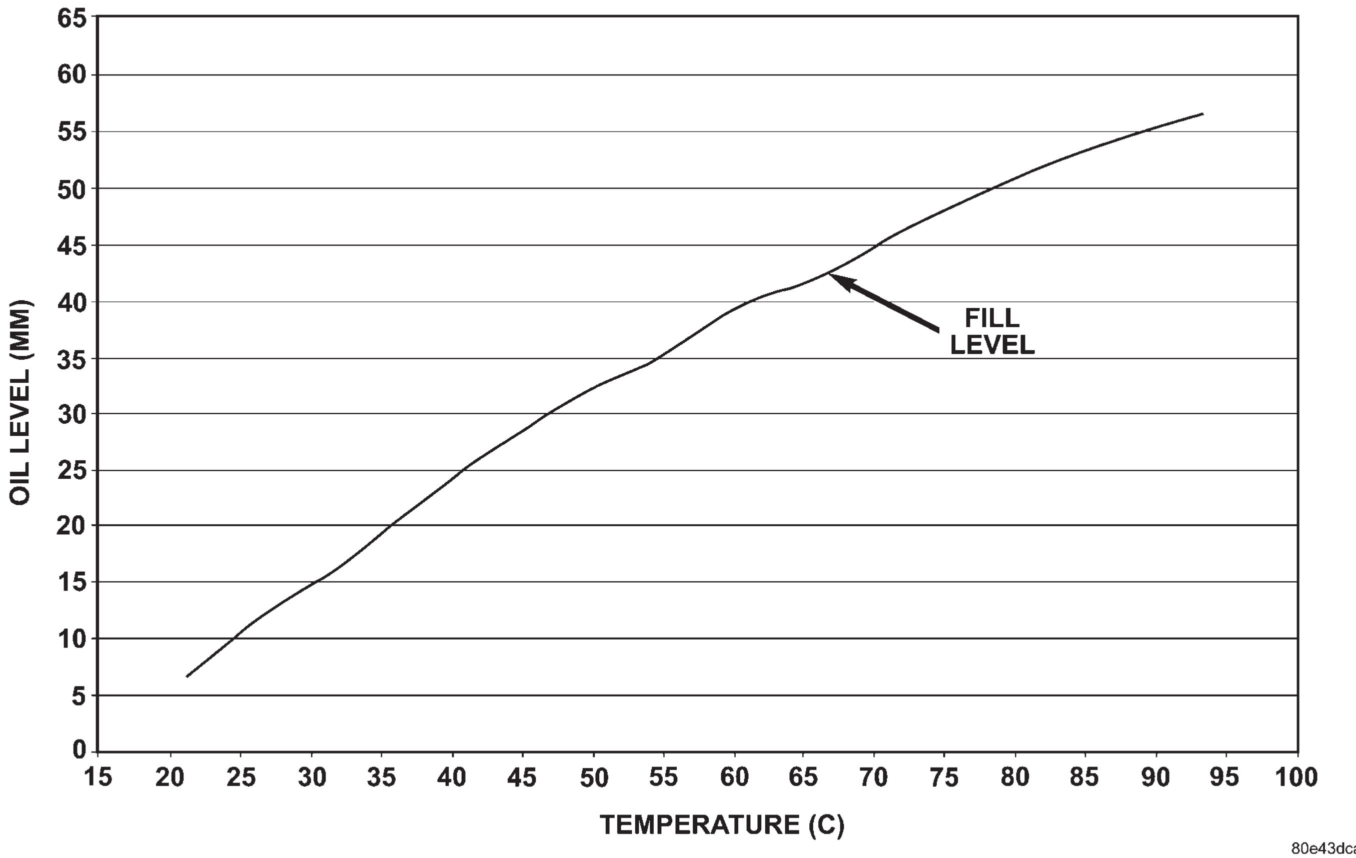


Fig. 112 W5J400 Fill Level Chart

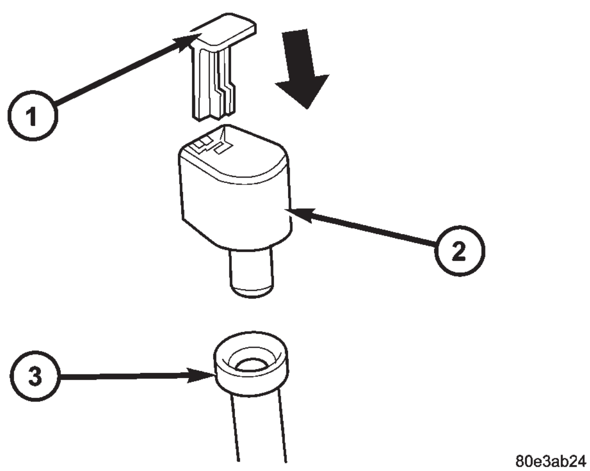


Fig. 113 Dipstick Tube Cap Components

1 - LOCKING PIN
2 - TUBE CAP
3 - DIPSTICK TUBE

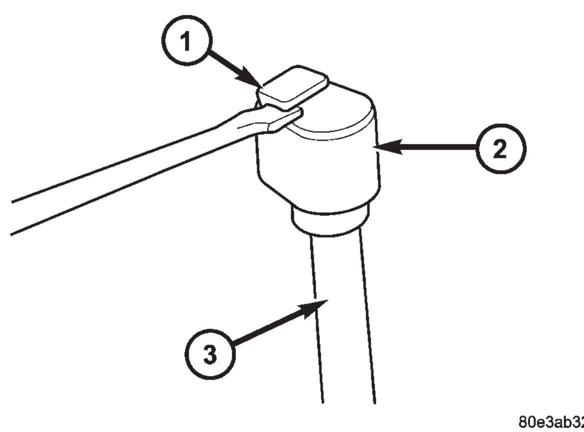


Fig. 114 Remove Dipstick Tube Cap Lock

1 - LOCKING PIN
2 - TUBE CAP
3 - DIPSTICK TUBE

FREEWHEELING CLUTCH

DESCRIPTION

Freewheeling clutches (Fig. 115) are installed in the front planetary gear set between the sun gear and the stator shaft, and in the rear planetary gear set between the sun gear and the intermediate shaft.

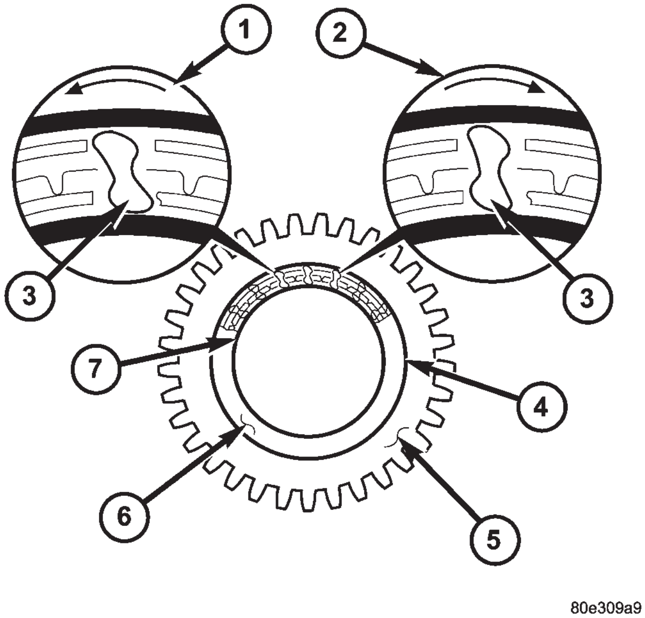


Fig. 115 Freewheeling Clutch

1 - ROTATION DIRECTION ″A″
2 - ROTATION DIRECTION ″B″
3 - LOCKING ELEMENTS
4 - OUTER RACE
5 - FRONT OR REAR SUN GEAR
6 - LOCKING ELEMENT CAGE
7 - INNER RACE

The freewheel consists of an outer race (4), an inner race (7), a number of locking elements (3) and a cage (6) for these locking elements.

OPERATION

The freewheeling clutch (Fig. 116) optimizes individual gearshifts. They lock individual elements of a planetary gear set together or against the transmission housing in one direction of rotation to allow the torque to be transmitted.

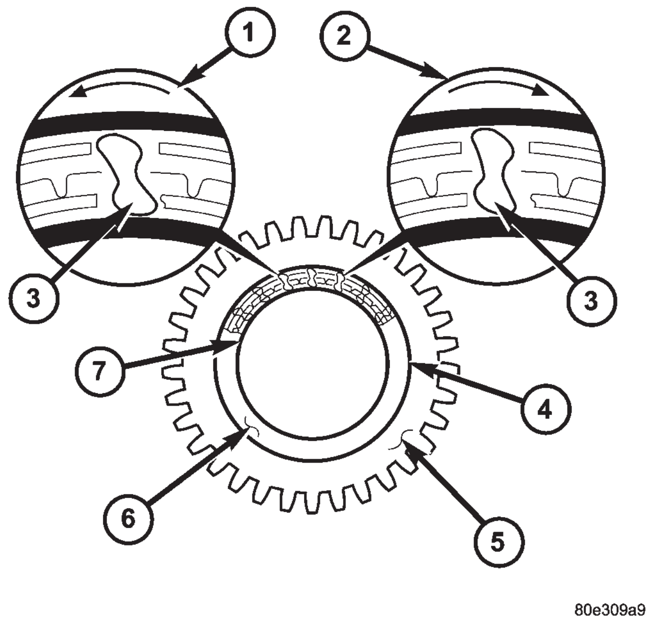


Fig. 116 Freewheeling Clutch

1 - ROTATION DIRECTION ″A″
2 - ROTATION DIRECTION ″B″
3 - LOCKING ELEMENTS
4 - OUTER RACE
5 - FRONT OR REAR SUN GEAR
6 - LOCKING ELEMENT CAGE
7 - INNER RACE

If the inner race (7) of the freewheeling clutch is locked and the outer race (4) turns in direction ″A″ (1), the locking elements (3) adopt a diagonal position on account of their special contours, allowing the freewheel function. The outer race (4) slides over the locking elements (3) with negligible friction. If the rotation of the outer race (4) changes to direction ″B″ (2), the locking elements (3) stand up and lock the outer and inner races (4, 7) together.

FREEWHEELING CLUTCH (Continued)

DISASSEMBLY

(1) Remove retaining ring (5) (Fig. 117) from hollow shaft (1).

(2) Remove rear sun gear (4) with the K3 internally toothed disk carrier and rear freewheeling clutch F2 (3).

(3) Remove snap-ring (2) (Fig. 117) for freewheel.

(4) Press freewheeling clutch out of sun gear.

(5) Check O-rings (6), replace if necessary.

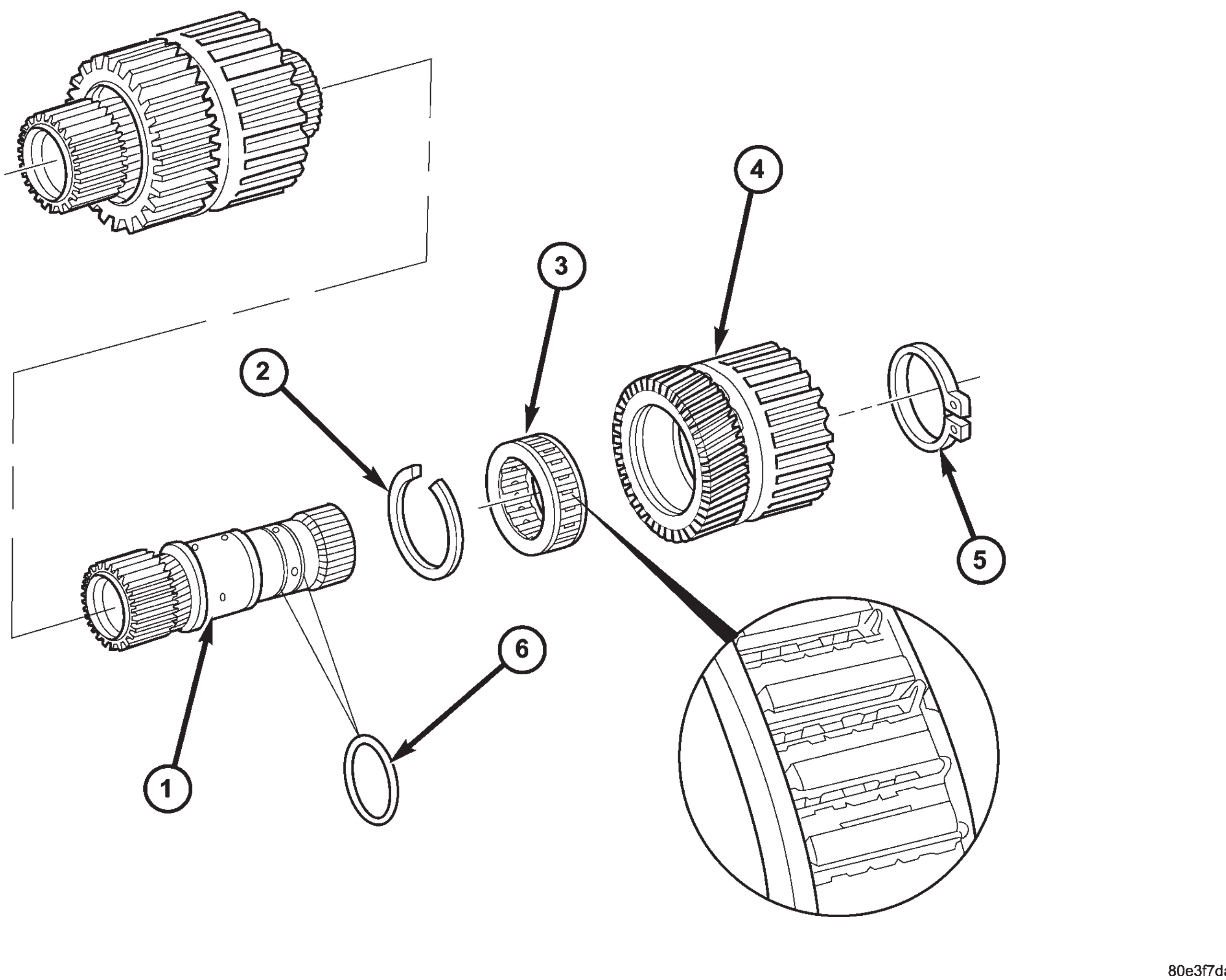


Fig. 117 Freewheeling Clutch F2

1 - HOLLOW SHAFT
2 - SNAP-RING
3 - FREEWHEELING CLUTCH F2
4 - K3 INNER DISC CARRIER AND REAR PLANETARY SUN GEAR
5 - RETAINING RING
6 - O-RINGS

FREEWHEELING CLUTCH (Continued)

(6) Check the anti-friction bearing (Fig. 118) in the rear planetary sun gear for damage. Replace as necessary.

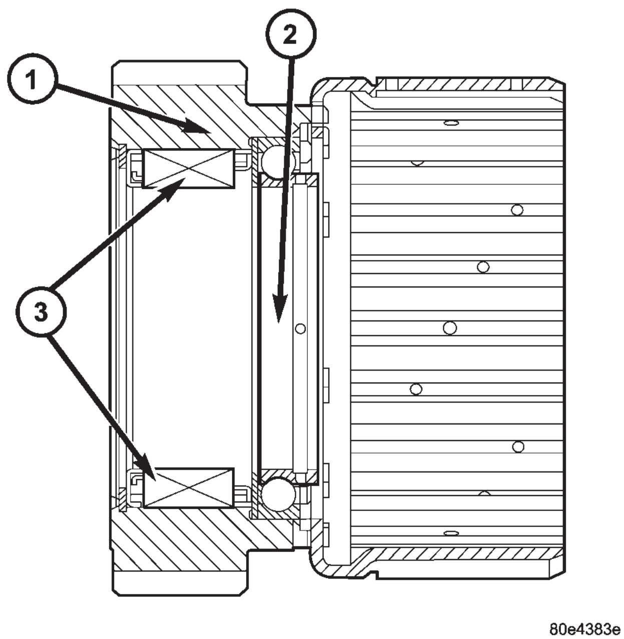


Fig. 118 Freewheeling Clutch F2 Anti-Friction Bearing

1 - K3 INNER DISC CARRIER AND REAR PLANETARY SUN GEAR
2 - ANTI-FRICTION BEARING
3 - FREEWHEELING CLUTCH F2

ASSEMBLY

(1) Press freewheeling clutch F2 (3) (Fig. 119) into sun gear (4).

(2) Install snap-ring (2) for freewheeling clutch.

(3) Check O-rings (6) (Fig. 119) on hollow shaft, replace if necessary.

(4) Install rear sun gear (4) with K3 internally toothed disc carrier and rear freewheeling clutch (3) onto the hollow shaft.

(5) Install retaining ring (5) onto hollow shaft (1).

FREEWHEELING CLUTCH (Continued)

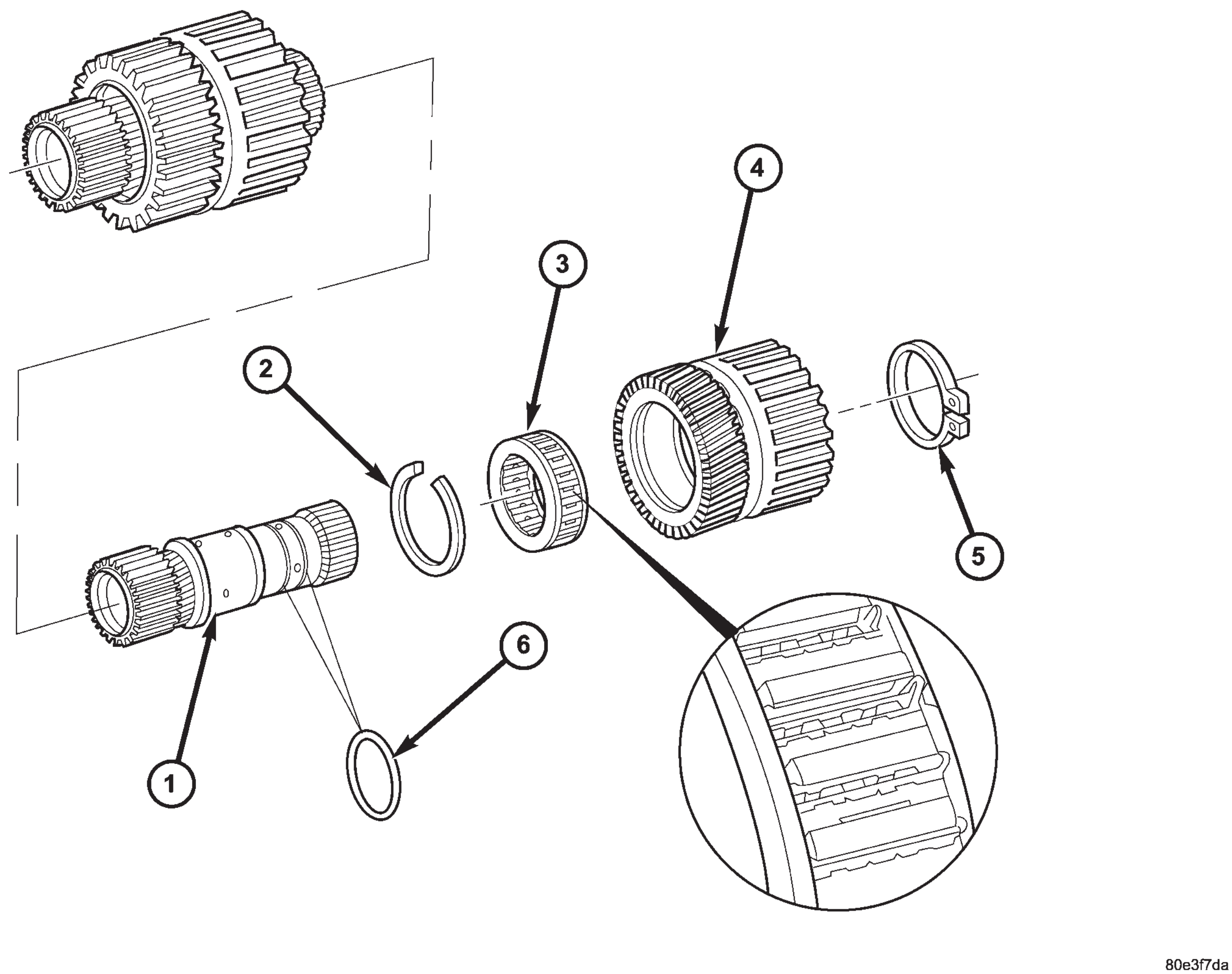


Fig. 119 Freewheeling Clutch F2

1 - HOLLOW SHAFT
2 - SNAP-RING
3 - FREEWHEELING CLUTCH F2
4 - K3 INNER DISC CARRIER AND REAR PLANETARY SUN GEAR
5 - RETAINING RING
6 - O-RINGS

GEARSHIFT CABLE

DIAGNOSIS AND TESTING - GEARSHIFT CABLE

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

(a) PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.

(b) PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.

(c) NEUTRAL position - Normal position. Engine starts must be possible.

(d) NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

GEARSHIFT CABLE (Continued)

REMOVAL

(1) Shift transmission into PARK.
(2) Raise vehicle.
(3) Remove the shift cable eyelet from the transmission manual shift lever.
(4) Remove shift cable from the cable support bracket.
(5) Lower vehicle.
(6) Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 120).
(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 121).
(9) Pull cable through floor panel opening.

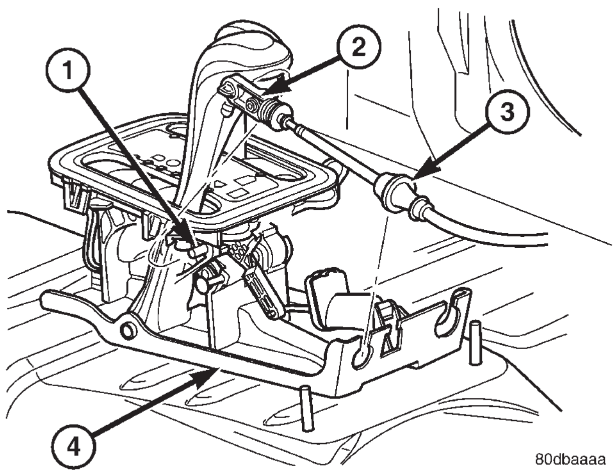


Fig. 120 Transmission Shift Cable at Shifter - Typical

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

(10) Remove shift cable from vehicle.

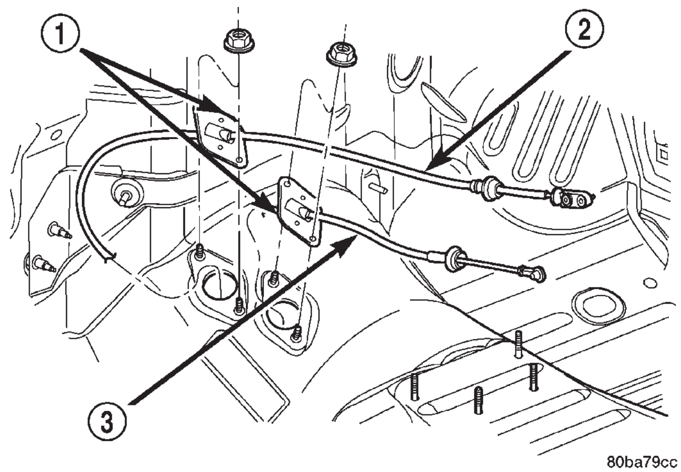


Fig. 121 Shift Cables at Floor Pan

1 - SEAL PLATES
2 - TRANSMISSION SHIFT CABLE
3 - TRANSFER CASE SHIFT CABLE

INSTALLATION

(1) Route cable through hole in floor pan.
(2) Install seal plate to studs in floor pan.
(3) Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).
(4) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.
(5) Place the floor shifter lever in PARK position.
(6) Loosen the adjustment screw on the shift cable.
(7) Snap the shift cable onto the shift lever pin.
(8) Raise the vehicle.
(9) Install the shift cable to the shift cable support bracket.
(10) Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.
(11) Snap the shift cable onto the transmission manual shift lever.
(12) Lower vehicle.

GEARSHIFT CABLE (Continued)

(13) Verify that the shift lever is in the PARK position.

(14) Push and hold forward on the shifter handle with at least 10-15 N·m of force to take up any movement of the shifter and gearshift cable adjuster.

(15) Tighten the adjustment screw to 7 N·m (65 in.lbs.).

(16) Verify correct shifter operation.

(17) Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

ADJUSTMENTS - GEARSHIFT CABLE

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the park/neutral position contact may be faulty.

(1) Shift transmission into PARK.

(2) Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(3) Loosen the shift cable adjustment screw (Fig. 122).

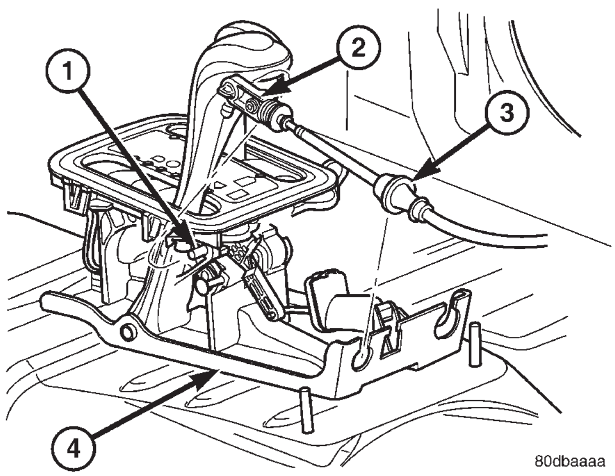


Fig. 122 Shift Cable at the Shifter - Typical

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

(4) Raise vehicle.

(5) Unsnap cable eyelet from transmission shift lever.

(6) Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(8) Snap cable eyelet onto transmission shift lever.

(9) Lower vehicle

(10) Push and hold forward on the shifter handle with at least 10-15 N·m of force to take up any movement of the shifter and gearshift cable adjuster.

(11) Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).

(12) Verify correct operation.

(13) Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

HOLDING CLUTCHES

DESCRIPTION

Three multiple-disc holding clutches (Fig. 123), the front, middle and rear multiple disc clutches B1, B3 and B2, are located in the planetary gear sets in the transmission housing.

A multiple-disc holding clutch consists of a number of internally toothed discs (10) on an internally toothed disc carrier and externally toothed discs (9) on an externally toothed disc carrier, which is rigidly connected to the transmission housing.

OPERATION

The holding clutches (Fig. 124) connect the annulus gear, sun gear, or planetary carrier of a planetary gear set against the transmission housing in order to transmit the drive torque.

If the piston (16) on multiple-disc holding clutch B1 (1) is subjected to oil pressure, it presses the internal (3) and external discs (2) of the disc set together. The internally toothed disc carrier (15) locks the sun gear (14) against the housing. The planetary pinion gears (13) turn on the sun gear (14).

If the multiple-disc holding clutch B2 (5) is actuated via the piston (7), the piston compresses the disc set. The internally toothed disc carrier (8) locks the sun gear (12) against the housing. The planetary pinion gears (11) turn on the sun gear (12).

If the multiple-disc holding clutch B3 (4) is actuated via the piston (6), the planetary carrier (9) and the annulus gear (10) are locked. When the multiple-disc brake B3 (4) is actuated, the direction of rotation is reversed.

HOLDING CLUTCHES (Continued)

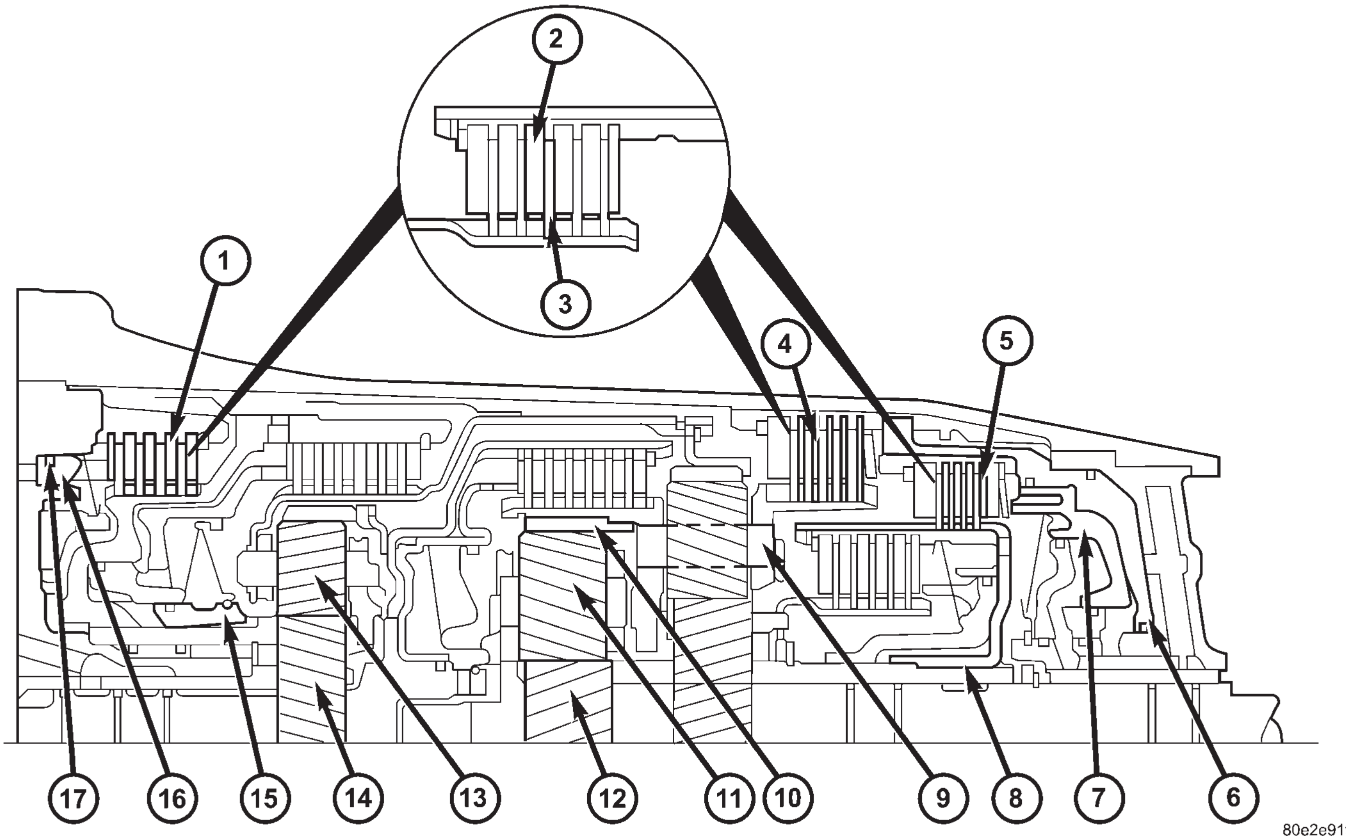


Fig. 123 Holding Clutches

1 - B1 CLUTCH
2 - EXTERNALLY TOOTHED DISC
3 - INTERNALLY TOOTHED DISC
4 - B3 CLUTCH
5 - B2 CLUTCH
6 - B3 CLUTCH PISTON
7 - B2 CLUTCH PISTON
8 - B2 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET PLANETARY CARRIER
10 - CENTER PLANETARY GEARSET ANNULUS GEAR
11 - CENTER PLANETARY GEARSET PINION GEARS
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - FRONT PLANETARY GEARSET PINION GEARS
14 - FRONT PLANETARY GEARSET SUN GEAR
15 - B1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
16 - B1 CLUTCH PISTON
17 - B1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER

HOLDING CLUTCHES (Continued)

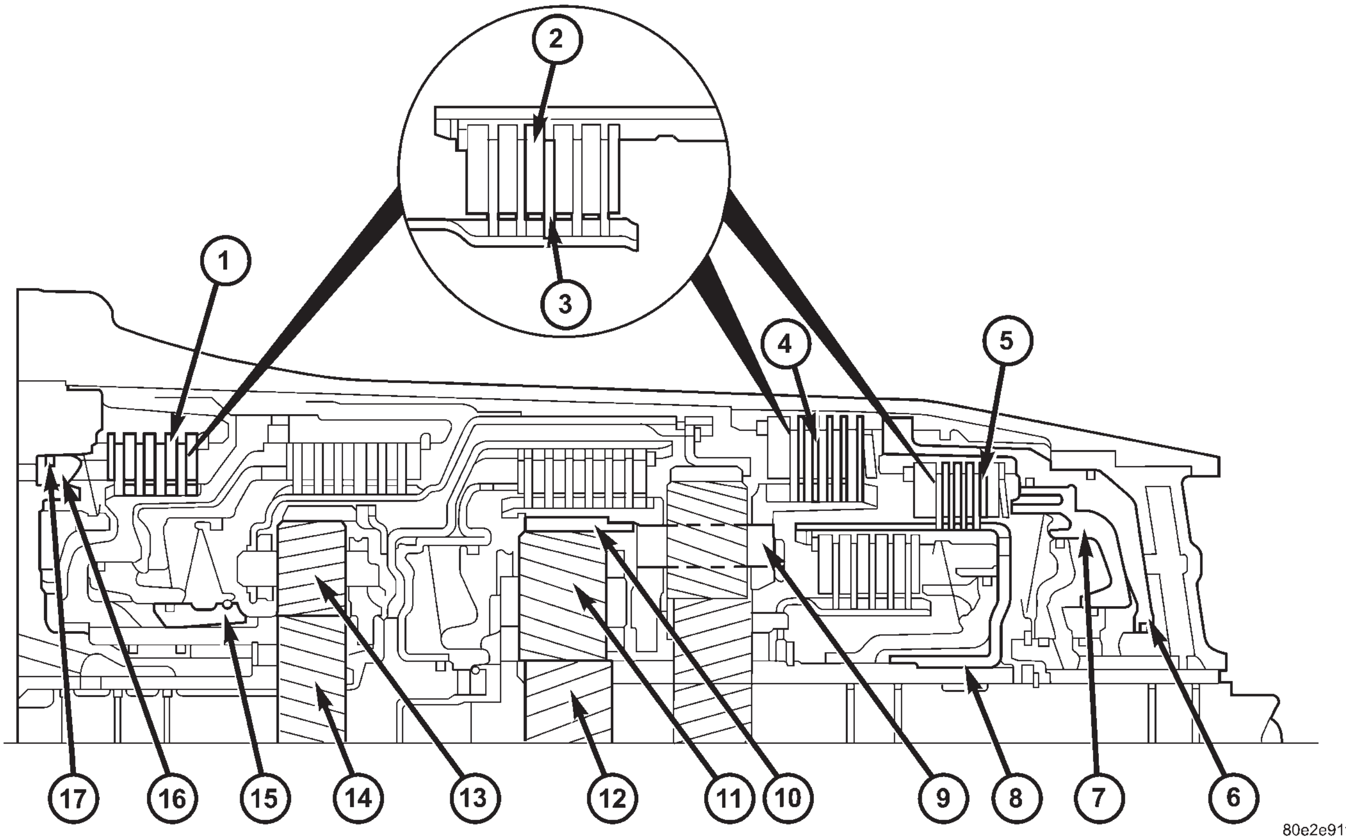


Fig. 124 Holding Clutches

1 - B1 CLUTCH
2 - EXTERNALLY TOOTHED DISC
3 - INTERNALLY TOOTHED DISC
4 - B3 CLUTCH
5 - B2 CLUTCH
6 - B3 CLUTCH PISTON
7 - B2 CLUTCH PISTON
8 - B2 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET PLANETARY CARRIER
10 - CENTER PLANETARY GEARSET ANNULUS GEAR
11 - CENTER PLANETARY GEARSET PINION GEARS
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - FRONT PLANETARY GEARSET PINION GEARS
14 - FRONT PLANETARY GEARSET SUN GEAR
15 - B1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
16 - B1 CLUTCH PISTON
17 - B1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER

HOLDING CLUTCH B1

DISASSEMBLY

(1) Remove snap-ring (7) (Fig. 125).

(2) Remove multiple-disc pack (6) and disc spring (5) from outer multiple-disc carrier.

(3) Place the Multi-use Spring Compressor 8900 (8) (Fig. 125) on disc spring (3) and compress the spring until the snap-ring (4) is exposed.

(4) Remove snap-ring (4).

(5) Remove piston (2) from the outer multiple-disc carrier by carefully blowing compressed air into the bore (A).

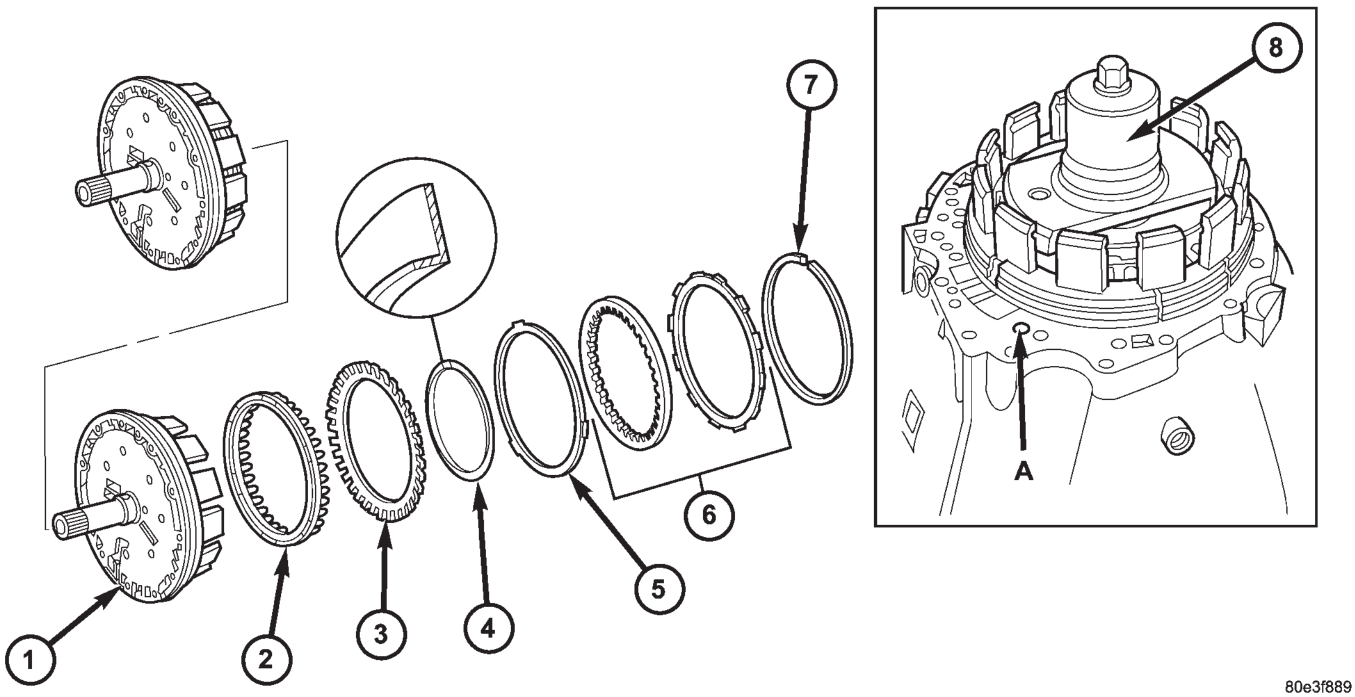


Fig. 125 Holding Clutch B1

1 - HOLDING CLUTCH B1 OUTER CARRIER
2 - PISTON
3 - DISC SPRING
4 - SNAP-RING
5 - DISC SPRING
6 - MULTIPLE DISC PACK
7 - SNAP-RING
8 - MULTI-USE SPRING COMPRESSOR 8900

HOLDING CLUTCH B1 (Continued)

ASSEMBLY

(1) Install piston (2) (Fig. 126) in outer multiple-disc carrier (1). Press in piston using the disc spring (3) and Multi-use Spring Compressor 8900 (8). Place compressor (8) on disc spring (3) and compress until the groove of the snap-ring is exposed

NOTE: Check vulcanized gasket, replace if necessary.

(2) Insert snap-ring (4) (Fig. 126).

NOTE: The collar of the snap-ring must point towards the multiple-disc pack. After installing, check snap-ring for correct seat.

(3) Insert disc spring (5) and multiple-disc pack (6) in the outer multiple-disc carrier.

(4) Insert snap-ring (7).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

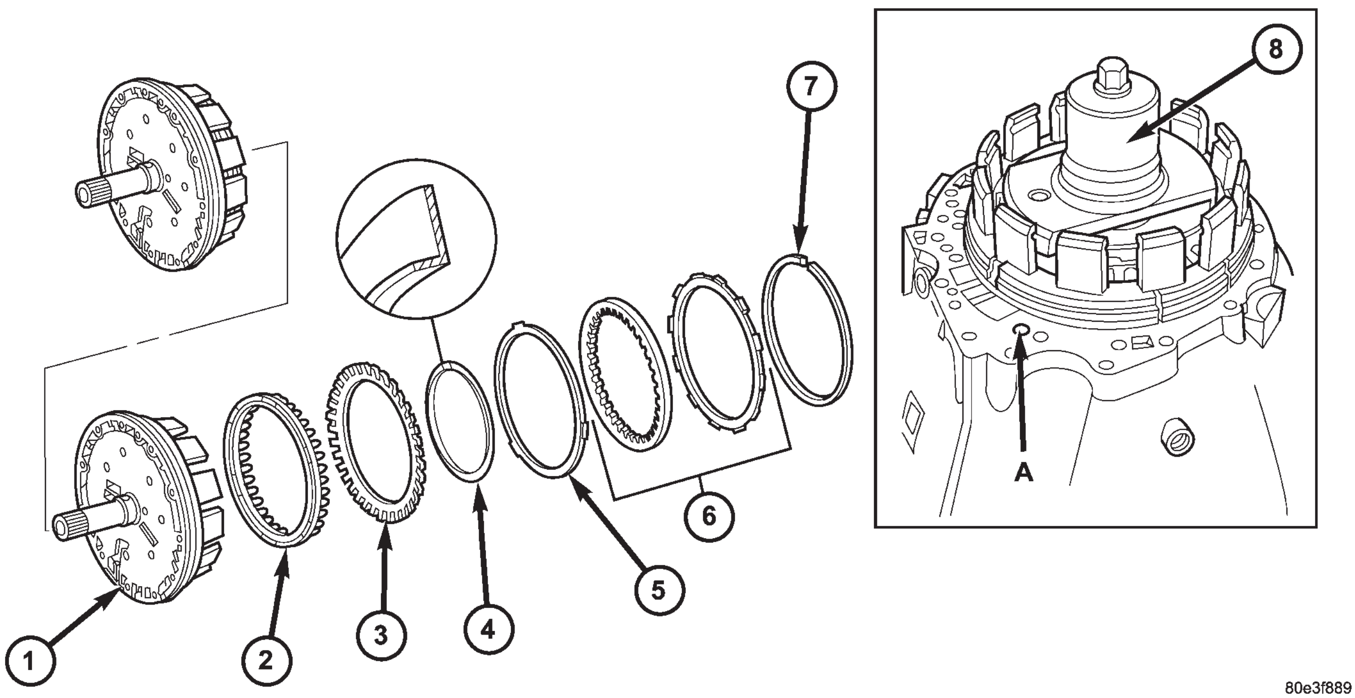


Fig. 126 Holding Clutch B1

1 - HOLDING CLUTCH B1 OUTER CARRIER
2 - PISTON
3 - DISC SPRING
4 - SNAP-RING
5 - DISC SPRING
6 - MULTIPLE DISC PACK
7 - SNAP-RING
8 - MULTI-USE SPRING COMPRESSOR 8900

HOLDING CLUTCH B1 (Continued)

(5) Measure B1 clutch clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 127) on outer multiple disc.

(b) Using a lever press (Fig. 127), compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 128) at three points between the snap-ring (6) and outer multiple-disc (4). During the measurement, the snap-ring (6) must contact the upper bearing surface of the groove in the outer multiple-disc carrier (5). The correct clearance is 2.3-2.7 mm for 2 friction disc versions, 2.7-3.1 mm for 3 disc versions, and 3.0-3.4 mm for 4 disc versions.

(d) Adjust with snap-ring (6), if necessary. Snap-rings are available in thicknesses of 2.6, 2.9, 3.2, 3.5, 3.8 and 4.1 mm.

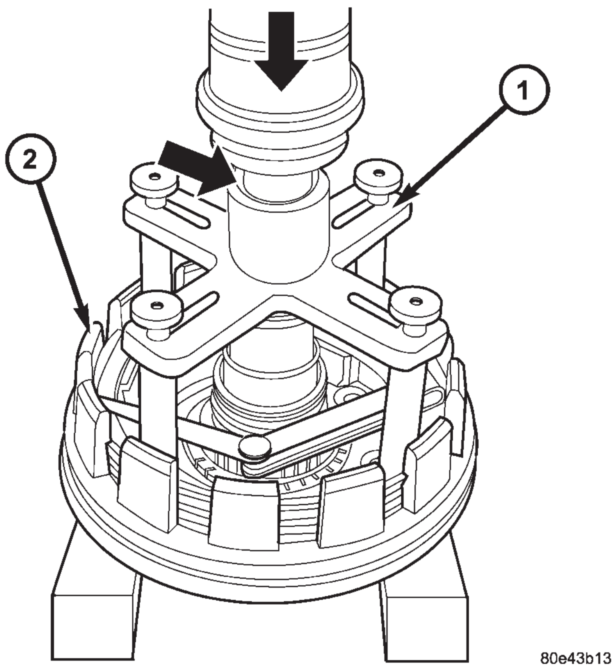


Fig. 127 Measure B1 Clutch Clearance

1 - PRESSING TOOL 8901
2 - B1 CLUTCH OUTER CARRIER

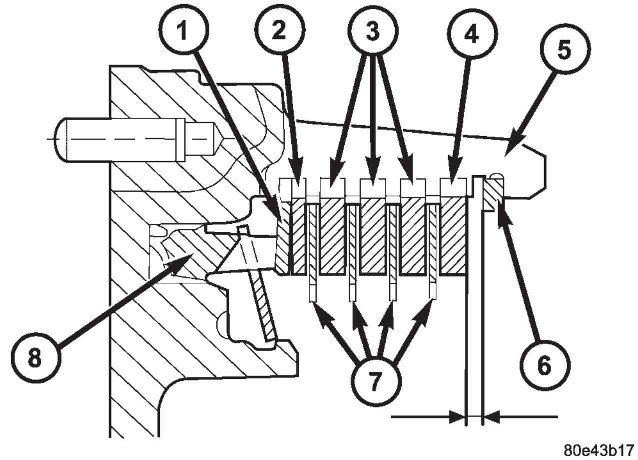


Fig. 128 B1 Clutch Stack-up

1 - DISC SPRING
2 - OUTER MULTIPLE DISC - 1.8 mm
3 - OUTER MULTIPLE DISC - 2.8 mm
4 - OUTER MULTIPLE DISC - 4.0 mm
5 - B1 OUTER CARRIER
6 - SNAP-RING
7 - FRICTION DISCS
8 - PISTON

HOLDING CLUTCH B2

DISASSEMBLY

(1) Remove snap ring (1) (Fig. 129).

(2) Take multiple-disc pack B2 (2) and disc spring (3) out of the outer multiple-disc carrier B2 (8). The outer multiple-disc carrier for the multi-disc holding clutch B2 is the piston for the multiple-disc holding clutch B3 at the same time.

(3) Place the Multi-use Spring Compressor 8900 on the spring disc (14) and compress the spring until the groove for the snap-ring is exposed.

(4) Remove snap-ring (16) (Fig. 129).

(5) Remove spring plate (15) and disc spring (14).

HOLDING CLUTCH B2 (Continued)

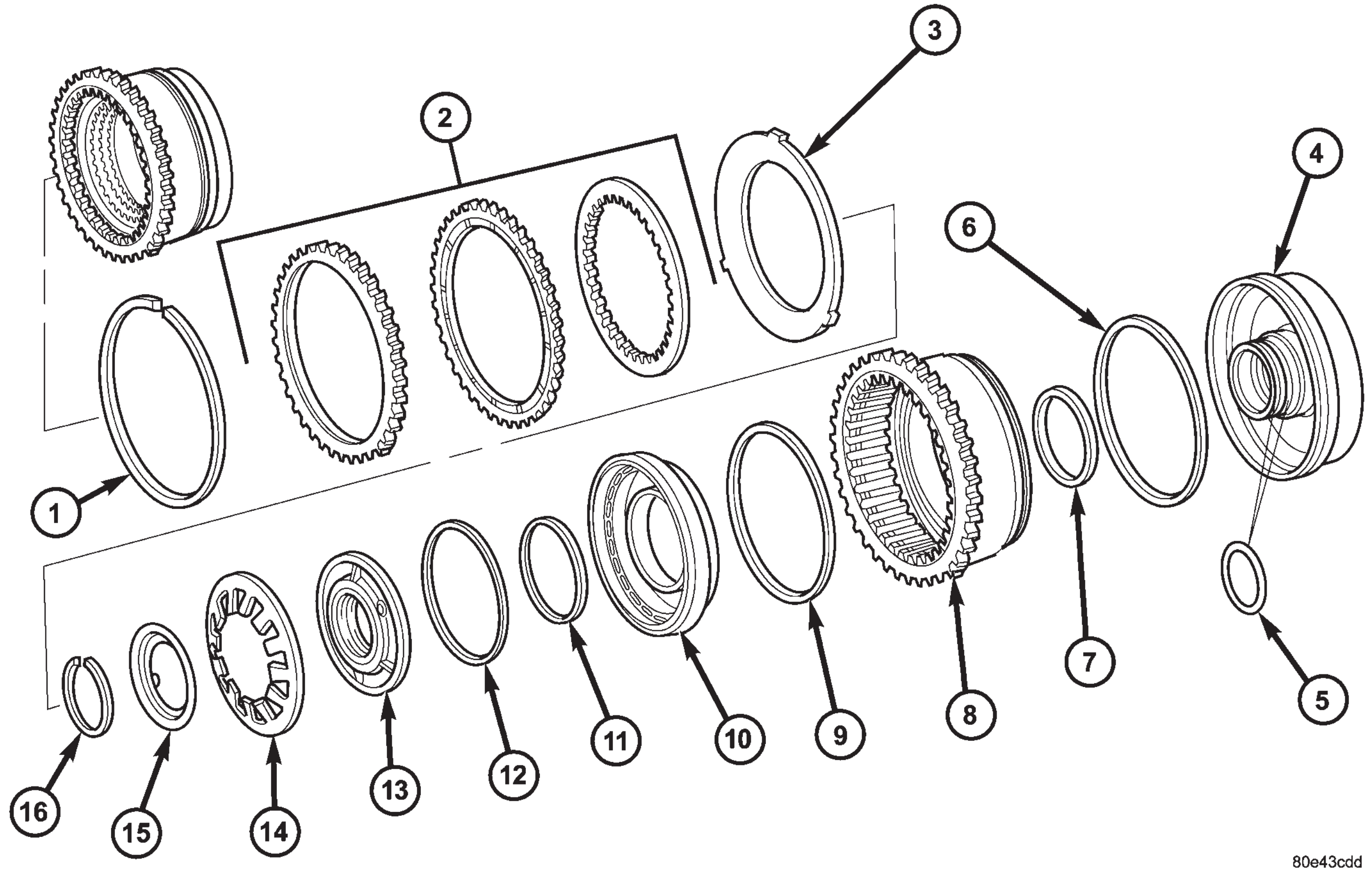


Fig. 129 Holding Clutch B2

1 - SNAP-RING
2 - MULTIPLE DISC PACK
3 - DISC SPRING
4 - B2 AND B3 PISTON GUIDE
5 - O-RING
6 - B3 PISTON SEALING RING
7 - B3 PISTON SEALING RING
8 - B3 PISTON/B2 OUTER DISC CARRIER
9 - B3 PISTON SEALING RING
10 - B2 PISTON
11 - PISTON GUIDE SEALING RING
12 - PISTON GUIDE SEALING RING
13 - PISTON GUIDE RING
14 - PISTON BACK PRESSURE DISC SPRING
15 - SPRING PLATE
16 - SNAP-RING

HOLDING CLUTCH B2 (Continued)

(6) Separate piston guide ring (13) and the B2 piston (10) from the B3 piston (8) by blowing compressed air into the bore (**D**) (Fig. 130).

(7) Press piston guide ring (13) out of the B2 piston (10).

(8) Separate piston guide (4) from the B3 piston (8) by blowing compressed air into the bore (**A**) (Fig. 130).

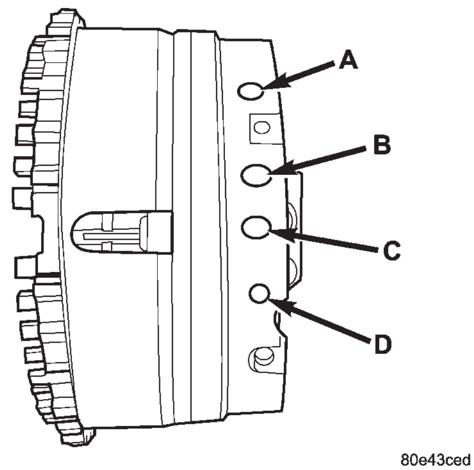


Fig. 130 B2 Clutch Oil Supply Locations

A - B3 PISTON
B - B2 PISTON GUIDE RING SIDE
C - K3 CLUTCH FEED
D - B2 PISTON SHIFT SIDE

ASSEMBLY

(1) Assemble piston guide (4) (Fig. 131) and B3 piston (8) in the correct position.

(2) Check all sealing rings (Fig. 132), replace if necessary. The rounded off edges on the sealing rings (6), (3) and (2) must point outwards. The rounded off edges on the sealing ring (4) must point inwards.

(3) Insert B2 piston (10) (Fig. 131) in B3 piston (8).

(4) Insert piston guide ring (2) (Fig. 133). The valve (1) in the piston guide ring must be on top.

(5) Insert disc spring (14) (Fig. 131) and spring plate (15). Insert disc spring with the curvature towards the spring plate

(6) Place Multi-use Spring Compressor 8900 on the disc spring (14) and compress the spring until the groove for the snap-ring is exposed.

(7) Insert snap-ring (16).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(8) Insert disc spring (3) and multiple-disc pack (2) in the B2 outer multiple-disc carrier.

(9) Insert snap-ring (1).

NOTE: During the measurement the snap-ring (8) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(10) Measure the B2 clutch pack clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 134) on outer multiple disc.

(b) Using a lever press, compress the pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 135) at three points between the snap-ring (8) and outer multiple-disc (7).

(d) The correct clutch clearance is 1.9-2.3 mm for the four friction disc versions and 2.0-2.4 mm for the five disc versions.

(e) Adjust with snap-ring (8), if necessary. Snap-rings are available in thicknesses of 2.9, 3.2, 3.5, 3.8 and 4.1 mm.

HOLDING CLUTCH B2 (Continued)

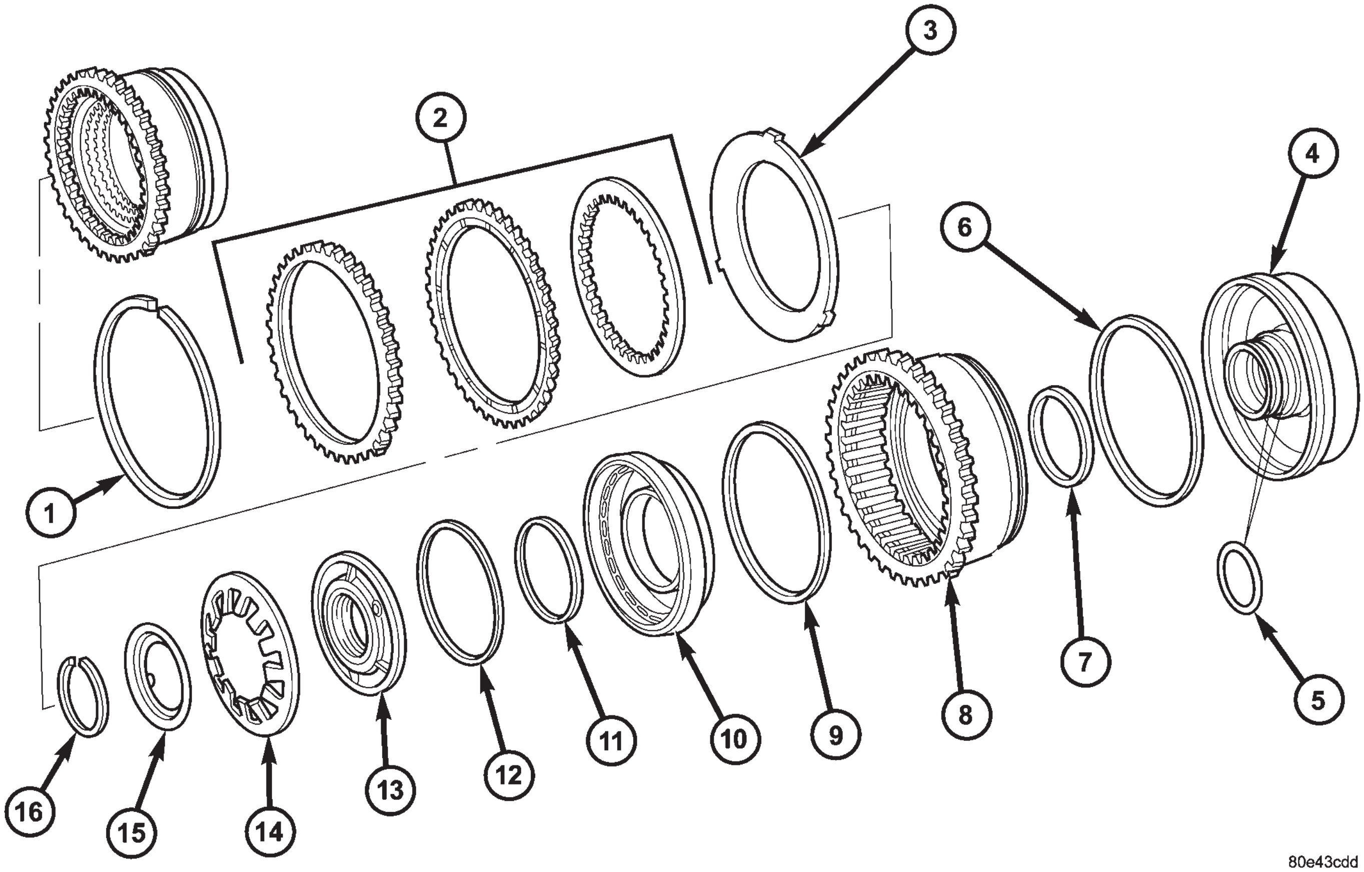


Fig. 131 Holding Clutch B2

1 - SNAP-RING
2 - MULTIPLE DISC PACK
3 - DISC SPRING
4 - B2 AND B3 PISTON GUIDE
5 - O-RING
6 - B3 PISTON SEALING RING
7 - B3 PISTON SEALING RING
8 - B3 PISTON/B2 OUTER DISC CARRIER
9 - B3 PISTON SEALING RING
10 - B2 PISTON
11 - PISTON GUIDE SEALING RING
12 - PISTON GUIDE SEALING RING
13 - PISTON GUIDE RING
14 - PISTON BACK PRESSURE DISC SPRING
15 - SPRING PLATE
16 - SNAP-RING

HOLDING CLUTCH B2 (Continued)

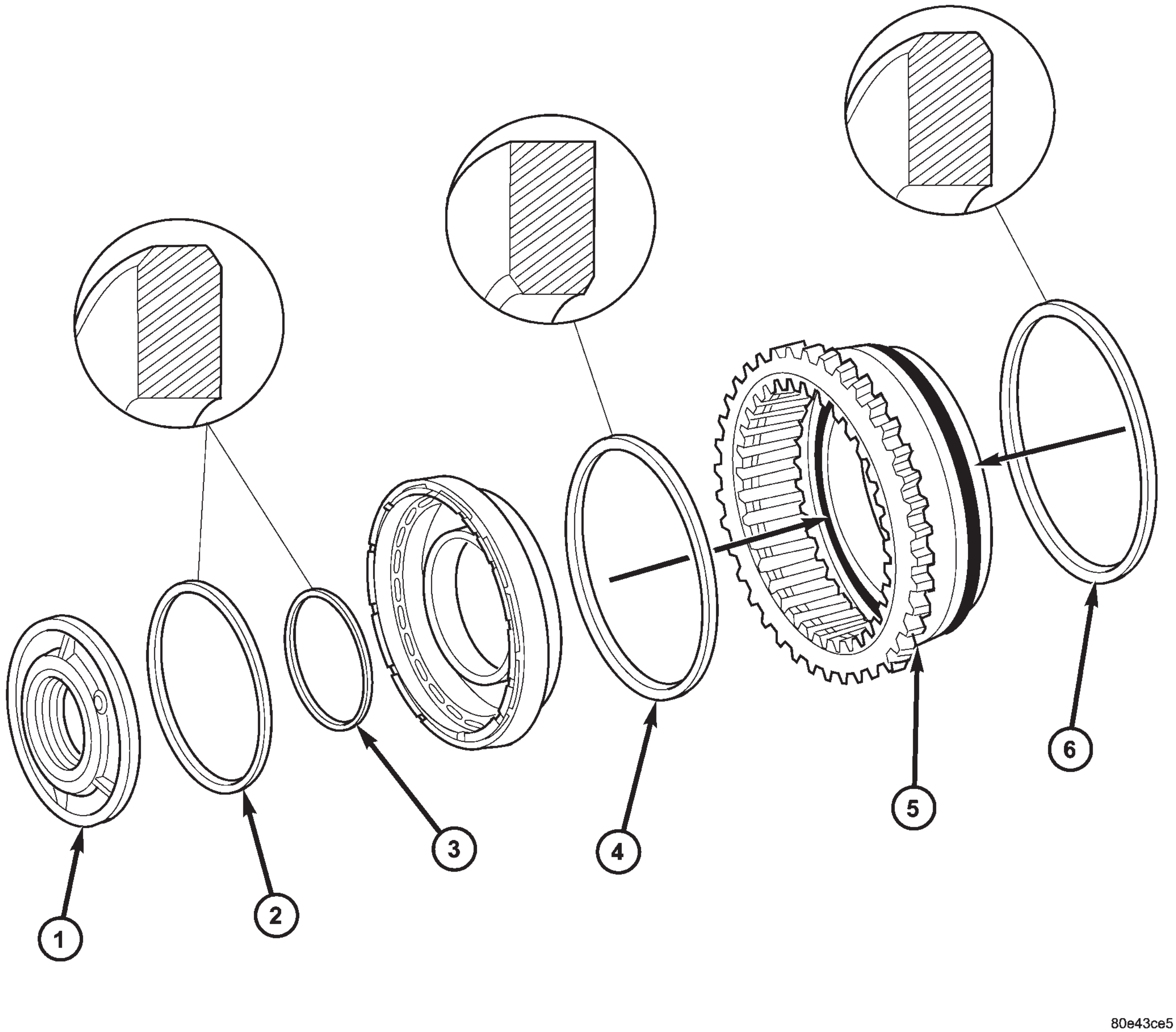


Fig. 132 Holding Clutch B2/B3 Seals

1 - PISTON GUIDE RING
2 - PISTON GUIDE RING SEALING RING
3 - PISTON GUIDE RING SEALING RING
4 - B3 PISTON SEALING RING
5 - B3 PISTON/B2 OUTER DISC CARRIER
6 - B3 PISTON SEALING RING

HOLDING CLUTCH B2 (Continued)

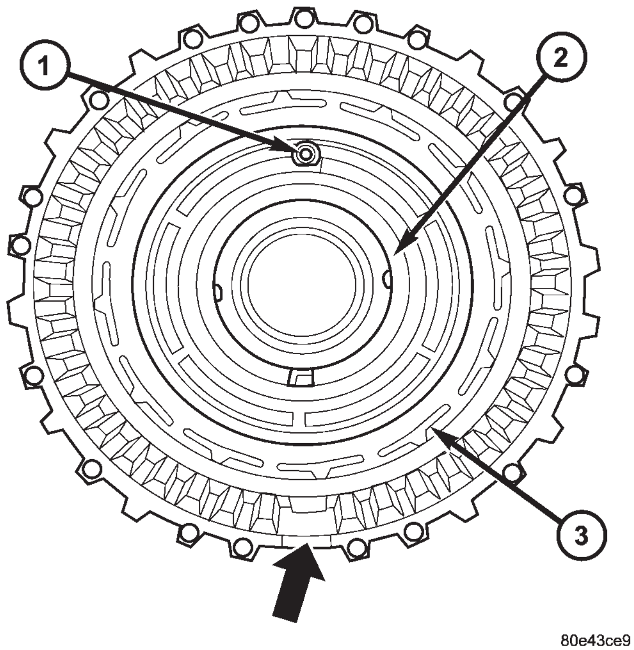


Fig. 133 B2 Piston and Piston Guide Ring

1 - VALVE
2 - PISTON GUIDE RING
3 - B2 PISTON

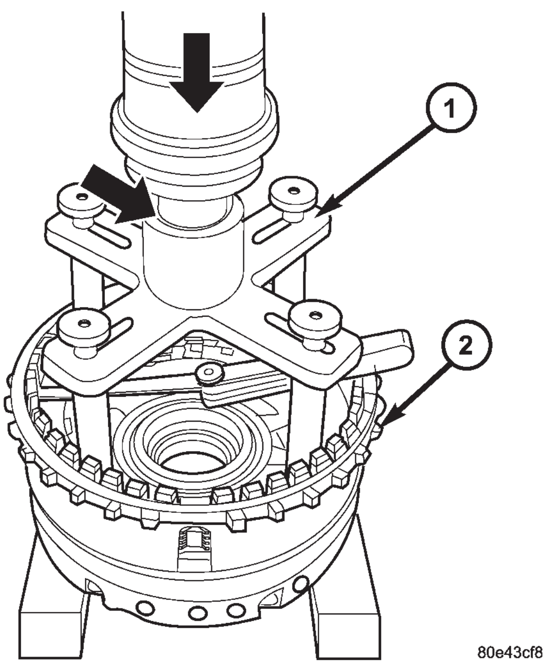


Fig. 134 Measure B2 Clutch Clearance

1 - PRESSING TOOL 8901
2 - B3 PISTON/B2 OUTER DISC CARRIER

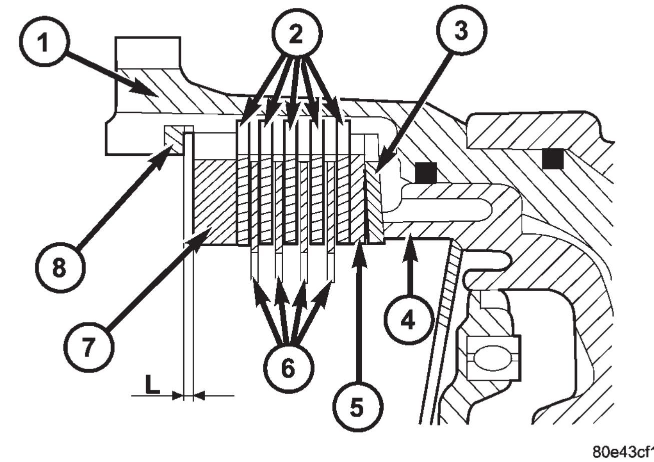


Fig. 135 B2 Clutch Stack-up

1 - B2 OUTER DISC CARRIER
2 - FRICTION DISCS
3 - DISC SPRING
4 - B2 PISTON
5 - OUTER MULTIPLE DISC - 1.8 MM
6 - OUTER MULTIPLE DISC - 1.8 MM
7 - OUTER MULTIPLE DISC - 6.5 MM
8 - SNAP-RING

INPUT SPEED SENSORS

DESCRIPTION

The input speed sensors (6, 8) (Fig. 136) are fixed to the shell of the control unit via contact blades. The speed sensors are pressed against the transmission housing (2) by a spring (7) which is held against the valve housing of the shift plate (5). This ensures a defined distance between the speed sensors and the exciter ring (4).

OPERATION

Signals from the input speed sensors (6, 8) (Fig. 137) are recorded in the transmission control module (TCM) together with the wheel and engine speeds and other information and are processed into an input signal for electronic control.

Input speed sensor N2 (6) records the speed of the front sun gear via the externally toothed disc carrier of the multiple-disc clutch K1 (10) and input speed sensor N3 (8) records the speed of the front planet carrier via the internally toothed disc carrier of multiple-disc clutch K1 (3).

INPUT SPEED SENSORS (Continued)

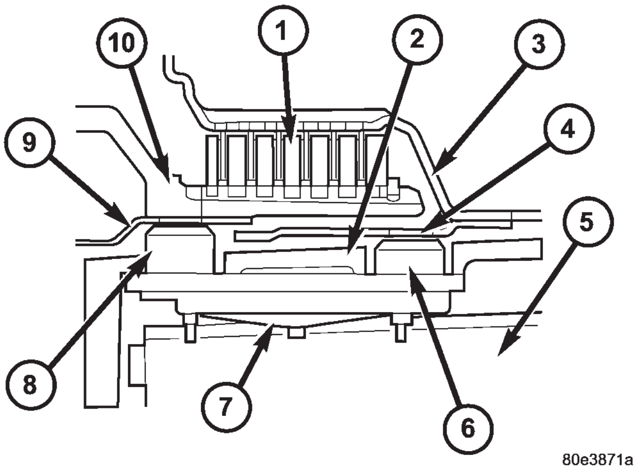


Fig. 136 Speed Sensors

1 - DRIVING CLUTCH K1
2 - TRANSMISSION HOUSING
3 - DRIVING CLUTCH K1 INTERNALLY TOOTHED DISC
4 - EXCITER RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - N2 INPUT SPEED SENSOR
7 - SPRING
8 - N3 INPUT SPEED SENSOR
9 - EXCITER RING
10 - DRIVING CLUTCH K1 EXTERNALLY TOOTHED DISC

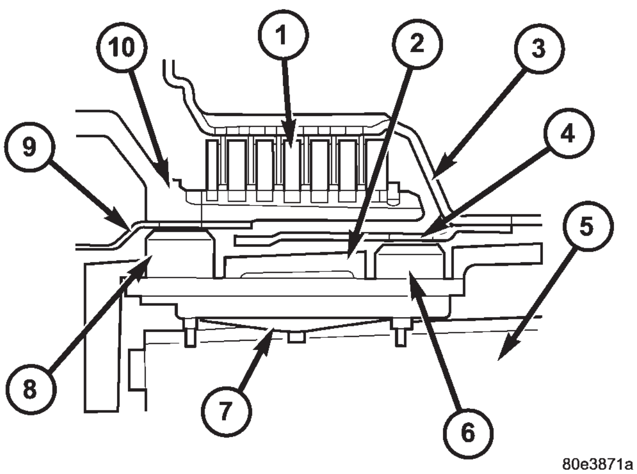


Fig. 137 Input Speed Sensors

1 - DRIVING CLUTCH K1
2 - TRANSMISSION HOUSING
3 - DRIVING CLUTCH K1 INTERNALLY TOOTHED DISC
4 - EXCITER RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - N2 INPUT SPEED SENSOR
7 - SPRING
8 - N3 INPUT SPEED SENSOR
9 - EXCITER RING
10 - DRIVING CLUTCH K1 EXTERNALLY TOOTHED DISC

OIL PUMP

DESCRIPTION

The oil pump (Fig. 138) (crescent-type pump) is installed in the torque converter casing behind the torque converter and is driven by the drive flange of the torque converter. The pump creates the oil pressure required for the hydraulic procedures.

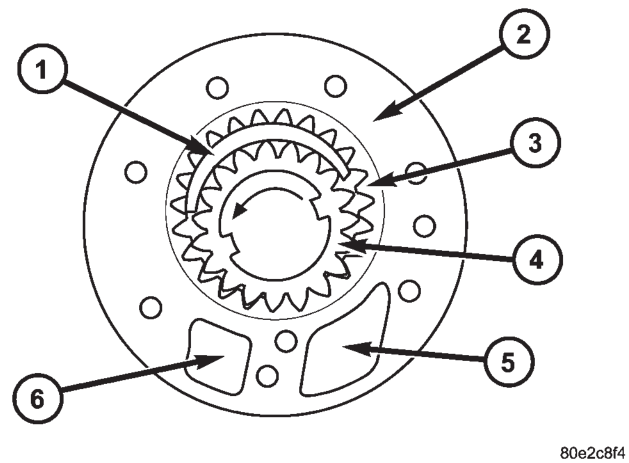


Fig. 138 Oil Pump

1 - CRESCENT
2 - OIL PUMP
3 - EXTERNAL GEAR
4 - INTERNAL GEAR
5 - INLET CHAMBER
6 - PRESSURE CHAMBER

OPERATION

When the engine is running, the oil (Fig. 139) is pumped through the inlet chamber (5) along the upper and lower side of the crescent to the pressure chamber (6) of the housing. The meshing of the teeth prevents oil flowing from the delivery side to the intake side. An external gear (3), eccentrically mounted in the pump housing, is located on the internal gear (4) which is connected to the drive flange. The crescent (1) drives the external wheel.

OIL PUMP (Continued)

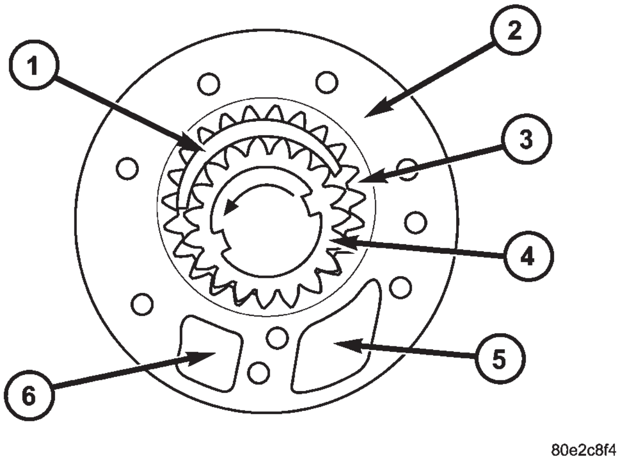


Fig. 139 Oil Pump

1 - CRESCENT
2 - OIL PUMP
3 - EXTERNAL GEAR
4 - INTERNAL GEAR
5 - INLET CHAMBER
6 - PRESSURE CHAMBER

DISASSEMBLY

(1) Remove pump gears (1 and 2) (Fig. 140) from pump housing.

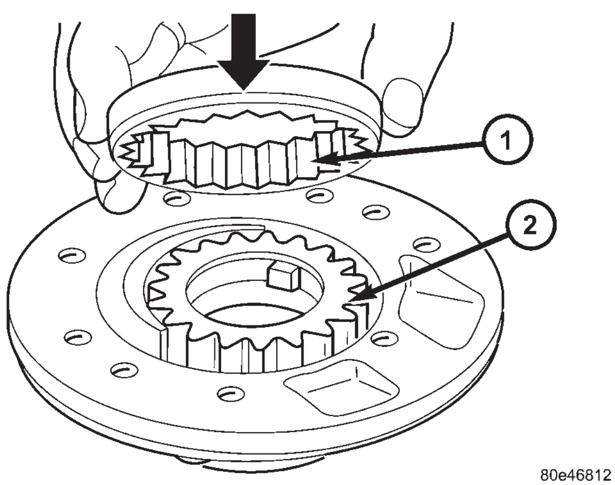


Fig. 140 Oil Pump Gears

1 - OUTER PUMP ROTOR
2 - INNER PUMP ROTOR

(2) Remove the inner oil pump seal (1) (Fig. 141).
(3) Replace the outer oil pump O-ring (2) (Fig. 141).

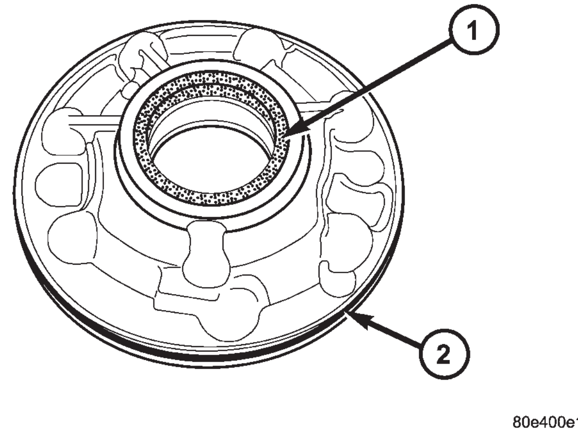


Fig. 141 Remove Oil Pump Seals

1 - INNER OIL SEAL
2 - OUTER OIL SEAL

ASSEMBLY

(1) Install new inner oil pump seal (1) (Fig. 142).
(2) Replace O-ring (2) (Fig. 142).

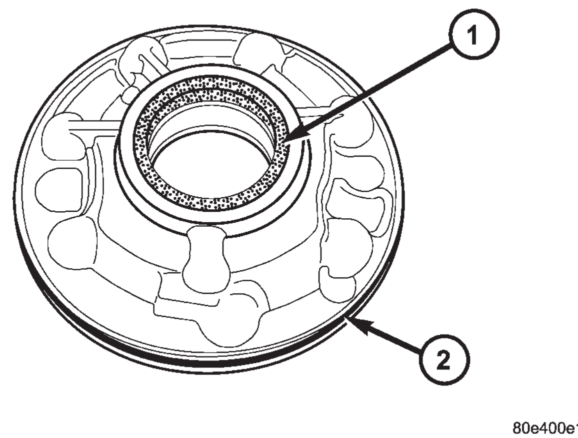


Fig. 142 Install New Oil Pump Seals

1 - INNER OIL SEAL
2 - OUTER OIL SEAL

OIL PUMP (Continued)

(3) Lubricate pump gears and place in the pump housing. Insert pump gear (1) (Fig. 143) so that the chamfer (arrow) points towards the pump housing.

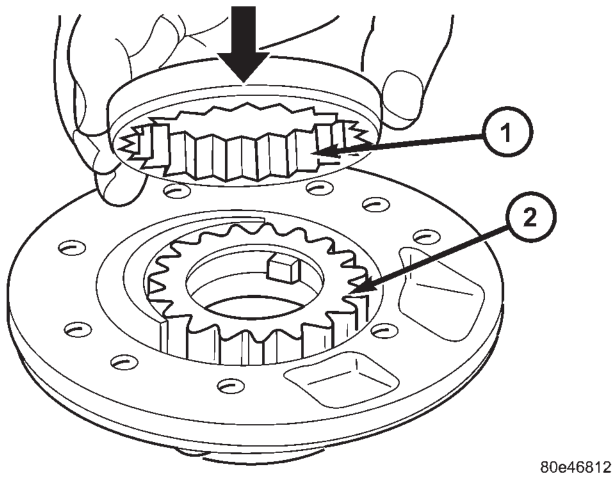


Fig. 143 Oil Pump Gears

1 - OUTER PUMP ROTOR
2 - INNER PUMP ROTOR

PARK LOCK CABLE

REMOVAL

(1) Place the shifter in the PARK position.
(2) Lower the steering column cover.
(3) With the ignition switch in the “RUN” position depress the park lock cable locking tab, located on top of the cable connector at the steering column and pull the park lock cable straight out.
(4) Remove the park lock cable from steering column (Fig. 144).
(5) Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
(6) Disconnect the park lock cable from the shift BTSI lever and remove the cable from the shifter assembly bracket.
(7) Release the park lock cable from any remaining clips.
(8) Remove park lock cable from the vehicle.

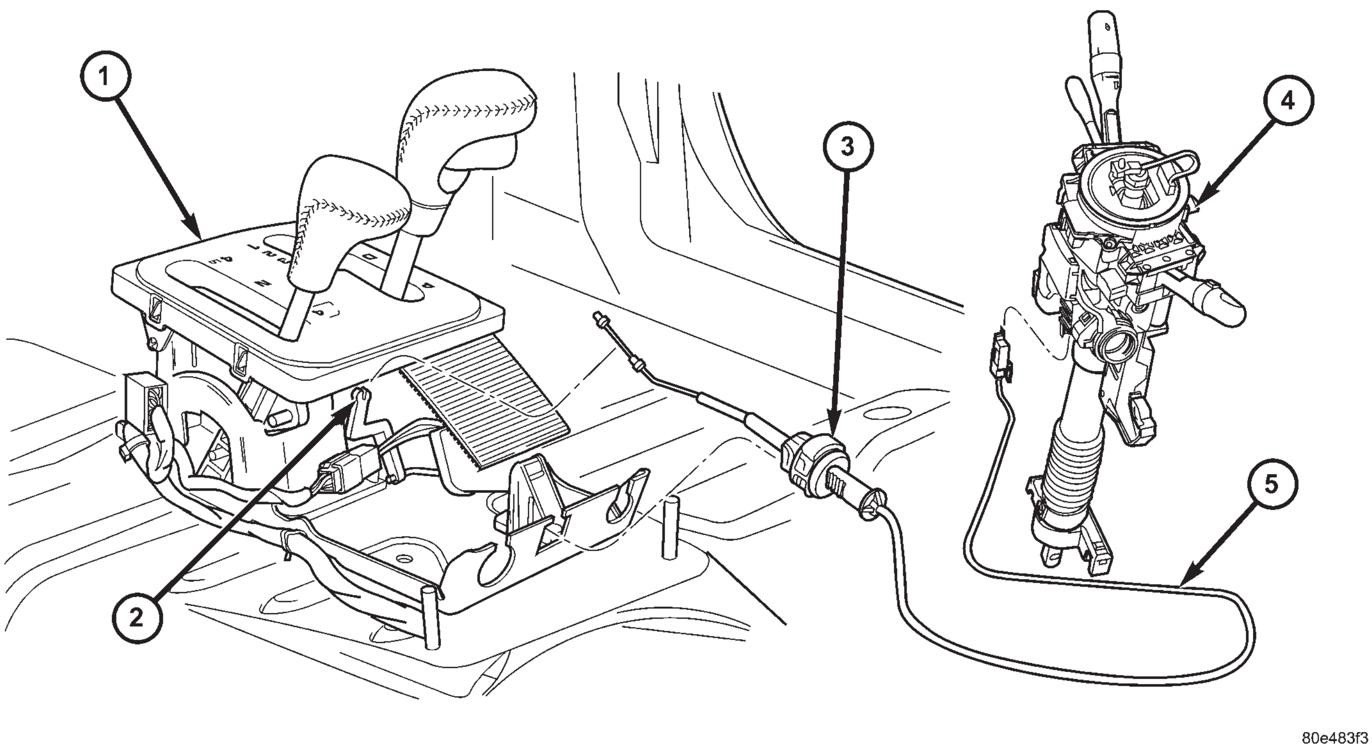


Fig. 144 Ignition Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

PARK LOCK CABLE (Continued)

INSTALLATION

NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Park Lock Cable.

(1) Verify that the shifter is in the PARK position.

(2) Push the park lock cable straight into the square mounting hole in the steering column until cable snaps in place.

(3) Route park lock cable to the shifter mechanism.

(4) Install the park lock cable end fitting into shifter BTSI lever.

(5) Pull rearward on the cable housing to snap park lock cable adjuster ears into floor shifter bracket.

(6) Place the ignition key cylinder in the ACCESSORY position.

(7) Push the cable adjuster lock clamp downward to lock it.

(8) Test the park lock cable operation.

(9) Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 145) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

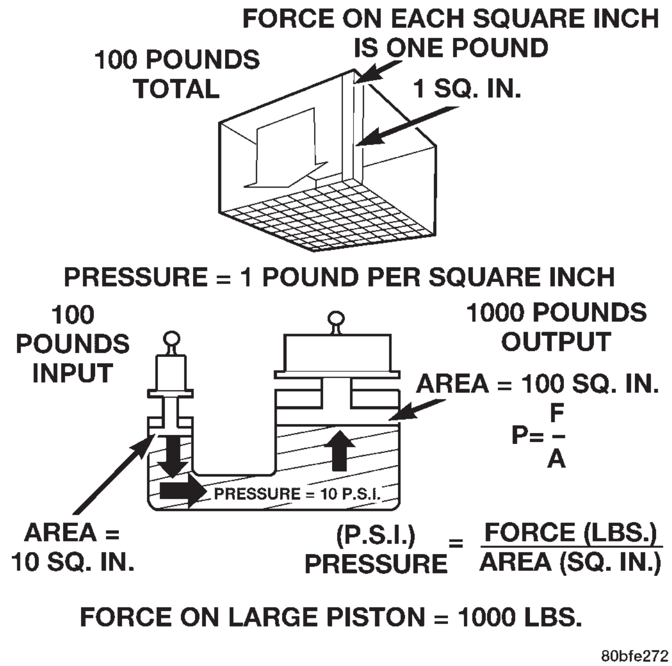


Fig. 145 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 146) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O-rings, D-rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

PISTONS (Continued)

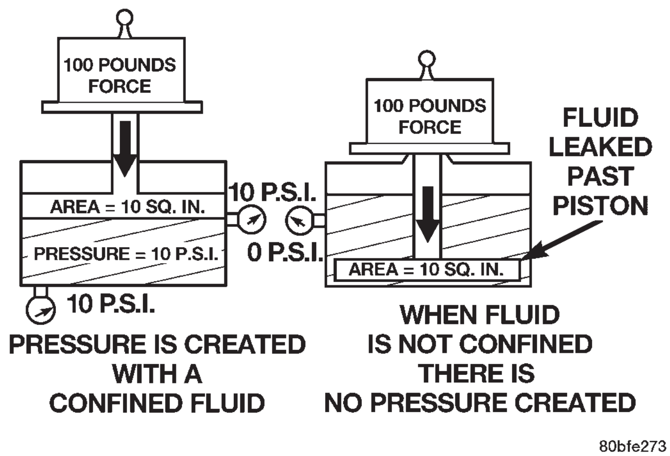


Fig. 146 Pressure on a Confined Fluid

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 147), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 147), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

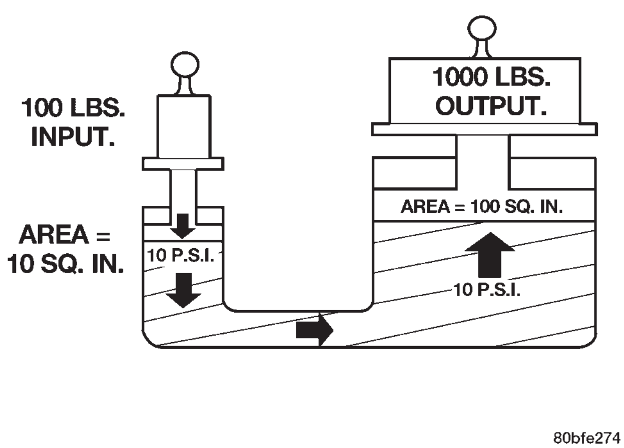


Fig. 147 Force Multiplication

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight-to-distance output rather than a pressure-to-area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 148) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

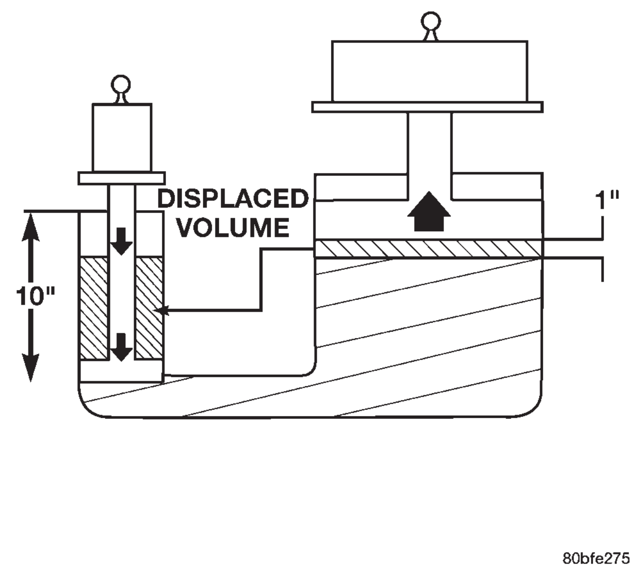


Fig. 148 Piston Travel

PLANETARY GEARTRAIN

DESCRIPTION

Three planetary gear sets (Fig. 149) are used to produce the different gear ratios. These are located in the mechanical part of the transmission as the front, middle and rear planetary gear sets.

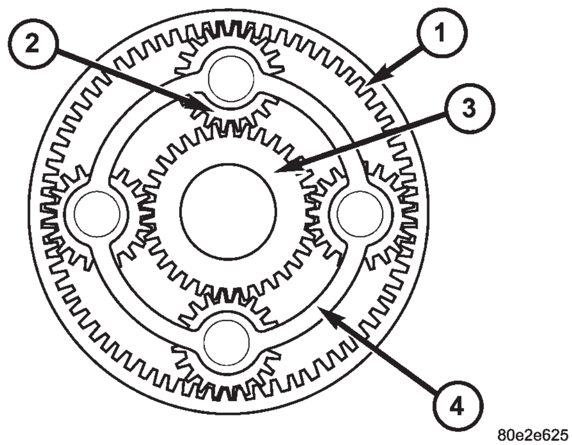


Fig. 149 Planetary Geartrain

1 - ANNULUS GEAR
2 - PLANETARY PINION GEARS
3 - SUN GEAR
4 - PLANETARY CARRIER

OPERATION

The annulus gear (1) (Fig. 150) and sun gear (3) elements of a planetary gear system are alternately driven and braked by the actuating elements of the multi-plate clutch and multiple-disc brake. The planetary pinion gears (2) can turn on the internal gearing of the annulus gear (1) and on the external gearing of the sun gear (3). This allows for a variety of gear ratios and the reversal of the rotation direction without the need for moving gear wheels or shift collars. When two components of the planetary gear set are locked together, the planetary gear set is locked and turns as a closed unit.

The torque and engine speed are converted according to the lever ratios and the ratio of the number of teeth on the driven gears to that on the drive gears, and is referred to as the gear ratio. The overall ratio of a number of planetary gear sets connected in series is obtained by multiplying the partial ratios.

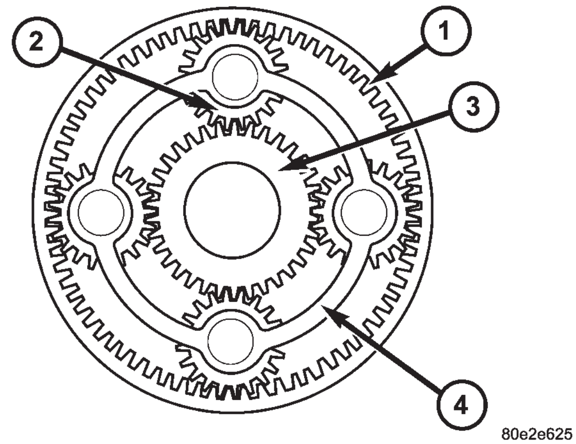


Fig. 150 Planetary Geartrain

1 - ANNULUS GEAR
2 - PLANETARY PINION GEARS
3 - SUN GEAR
4 - PLANETARY CARRIER

DISASSEMBLY

(1) Remove upper two visible Teflon rings (1) (Fig. 151) from output shaft.

(2) Remove retaining ring (11), shim (10), thrust needle bearing (9) and thrust washer (8) from output shaft.

(3) Remove clutch K3 (7).

(4) Remove rear tubular shaft/freewheeling clutch F2 (6) (Fig. 151) from output shaft.

(5) Remove rear gear set (5) with integrated tubular shaft of center gear set from output shaft.

(6) Remove thrust washer (4).

ASSEMBLY

(1) Mount thrust washer (4) (Fig. 152) with the collar pointing towards the planet carrier.

(2) Mount rear gear set (5) with integrated tubular shaft of the center gear set on output shaft.

(3) Using grease, install lower three Teflon rings (1) (Fig. 152) in the groove so that the joint stays together

(4) Put rear tubular shaft/freewheeling clutch F2 (6) onto output shaft.

(5) Install clutch K3 (7).

(6) Mount retaining ring, shim, thrust needle bearing and thrust washer (8 - 11) (Fig. 152).

(7) Using grease, insert the upper two Teflon rings (1) in the groove so that the joint remains together.

PLANETARY GEARTRAIN (Continued)

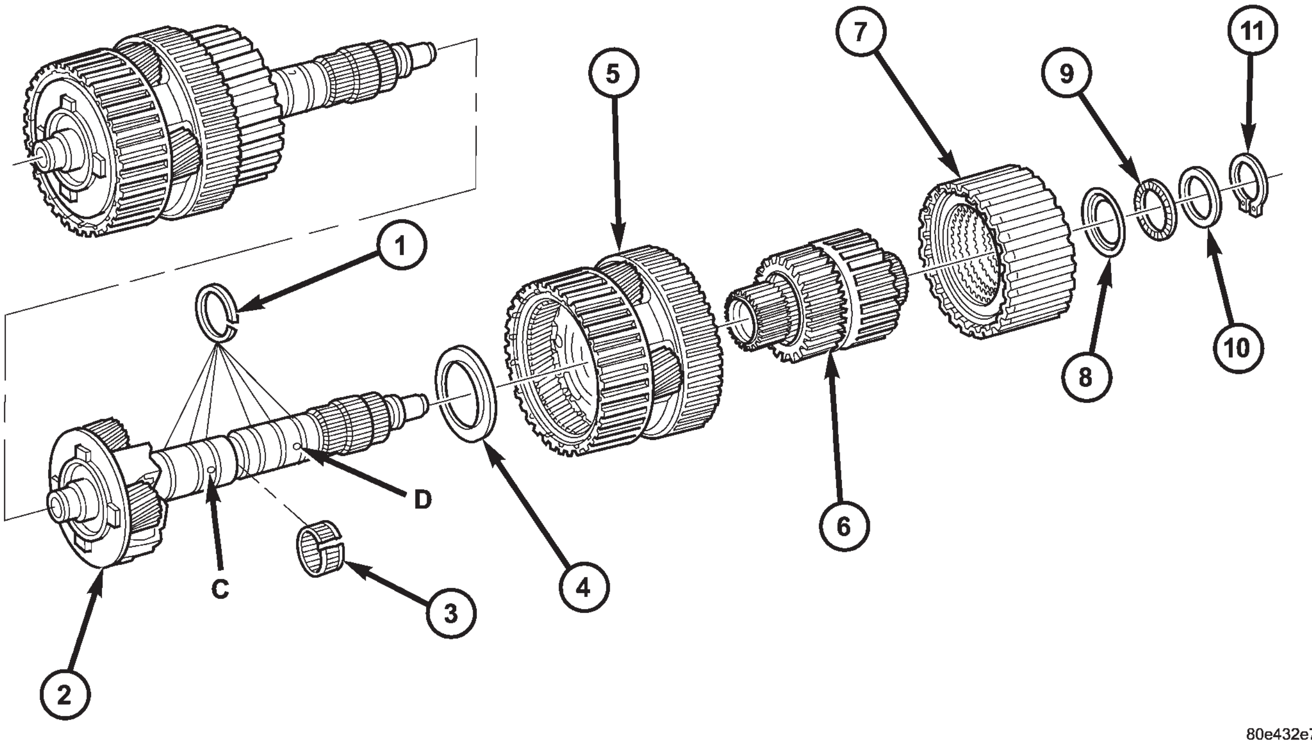


Fig. 151 Output Shaft with Center and Rear Planetary Geartrain

1 - TEFLON RINGS
2 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER
3 - NEEDLE BEARING
4 - THRUST WASHER
5 - REAR PLANETARY GEAR SET
6 - REAR HOLLOW SHAFT/FREEWHEELING CLUTCH F2
7 - DRIVING CLUTCH K3
8 - THRUST WASHER
9 - AXIAL NEEDLE BEARING
10 - SHIM
11 - RETAINING RING

PLANETARY GEARTRAIN (Continued)

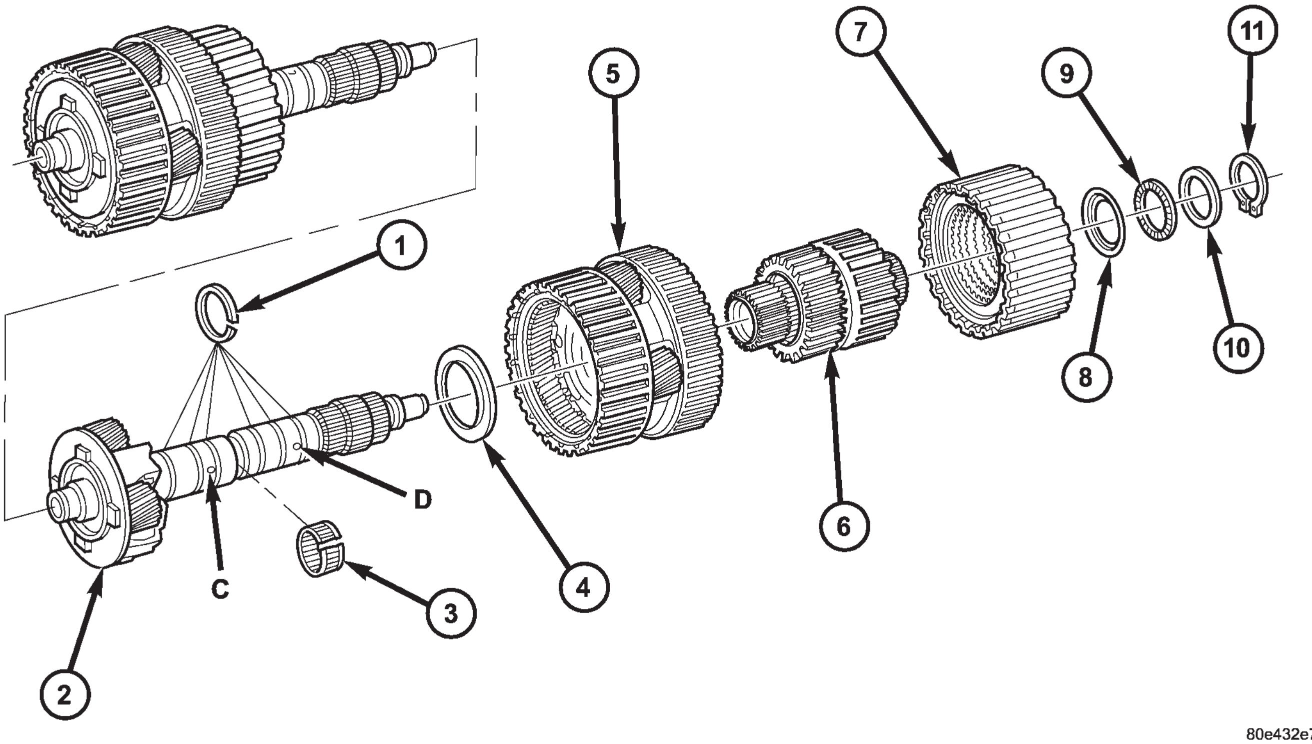


Fig. 152 Output Shaft with Center and Rear Planetary Geartrain

1 - TEFLON RINGS
2 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER
3 - NEEDLE BEARING
4 - THRUST WASHER
5 - REAR PLANETARY GEAR SET
6 - REAR HOLLOW SHAFT/FREEWHEELING CLUTCH F2
7 - DRIVING CLUTCH K3
8 - THRUST WASHER
9 - AXIAL NEEDLE BEARING
10 - SHIM
11 - RETAINING RING

PLANETARY GEARTRAIN (Continued)

(8) Inspect axial play (Fig. 153) between shim (10) and retaining ring (11). Check axial play ″S″ between shim (10) and retaining ring (1) using a feeler gauge. Clearance should be 0.15-0.6 mm. Shims are available in thicknesses of 3.0, 3.4, and 3.7 mm. Adjust as necessary

NOTE: During the test, apply a contact force by hand to K3 in the direction of the arrow.

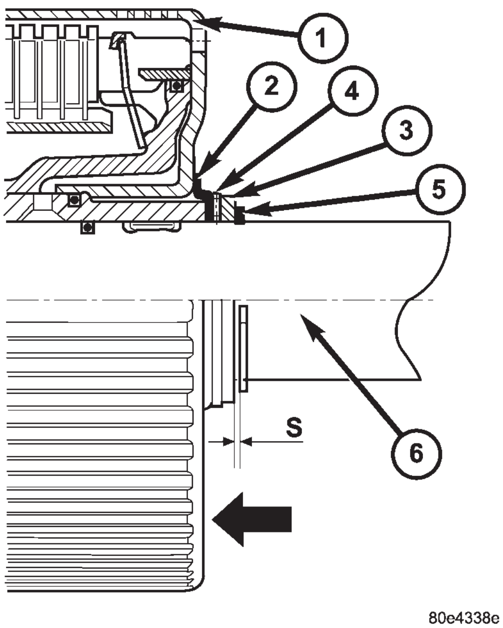


Fig. 153 Check Center and Rear Planetary End-Play

1 - DRIVING CLUTCH K3
2 - THRUST WASHER
3 - SHIM
4 - AXIAL NEEDLE BEARING
5 - RETAINING RING
6 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER

SHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides eight shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual fourth (4)
- Manual third (3)
- Manual second (2)
- Manual low (1)

The Selector Lever Sensor Assembly (SLSA) is a microprocessor-equipped module that detects transmission shift lever position and reports that position to the TCM. The SLSA contains a Hall-effect sensor array that is connected to the microprocessor. The microprocessor controls a set of circuits that are connected to the TCM. The TCM applies a sensing voltage to these circuits, and the SLSA grounds these circuits in a programmed pattern indicating shift lever position.

The reverse light switch, an integral part of the SLSA, controls the reverse light relay control circuit. The Brake/Transmission Shift Interlock (BTSI) solenoid and the park lockout solenoid (also part of the SLSA) are controlled by the TCM.

OPERATION

The transmission control module (TCM) monitors the shift lever and sensor assembly (SLSA) for all shift lever positions through five position circuits. The SLSA provides a low-current 12-volt signal to the TCM. The TCM compares the on/off signals to programmed combinations to determine the exact position of the shift lever.

Each circuit can be either HI or LO, depending on the shift lever position. The TCM can decode this information and determine the position of the shift lever. Each shift lever position has a certain combination of HI and LO circuits that are called a Grey Code.

This transmission does not have an internal range sensor. The requested gear must be communicated to the TCM by the shifter module. There are 12 Hall-effect sensors. Five circuits send a grey code (PRNDL Code) to the transmission controller to accomplish this. The grey code is a valid signal that reports the status of each Hall-effect sensor for each switch position to determine gear position and gear shift movement (fore and aft direction). If this grey code is incorrect, a DTC is set. The shifter sense circuits communicate the position of the shift lever to the TCM. Each circuit is terminated at the shifter.

The SLSA grey code can be viewed with the DRB® scan tool and compared to the Grey Code table SLSA Grey Code Table to verify proper operation.

SHIFT MECHANISM (Continued)

SLSA GREY CODE TABLE

	C1	C2	C3	C4	C5
PARK	H	H	H	L	L
T1	L	H	H	L	H
REVERSE	L	H	H	H	L
T2	L	L	H	H	H
NEUTRAL	H	L	H	H	L
T3	H	L	L	H	H
D	L	L	H	L	L
4	L	L	L	H	L
3	L	H	L	L	L
2	H	L	L	L	L
1	H	H	L	H	L

PARK LOCKOUT SOLENOID

The SLSA contains a park lockout solenoid. The park lockout solenoid is energized by the TCM whenever the shift position is not PARK and vehicle speed is above 10 kph (6 mph).

REMOVAL

(1) Remove any necessary console parts for access to shift lever assembly and shifter cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(2) Shift transmission into PARK.

(3) Disconnect the transmission shift cable at shift lever and shifter assembly bracket (Fig. 154).

(4) Disconnect the park lock cable from the shifter BTSI lever and the shifter assembly bracket. (Fig. 155)

(5) Disconnect the transfer case shift cable from the transfer case shift lever pin (Fig. 156), if equipped.

(6) Remove the clip holding the transfer case shift cable to the shifter assembly bracket, if equipped.

(7) Remove the transfer case shift cable from the shifter assembly bracket, if equipped.

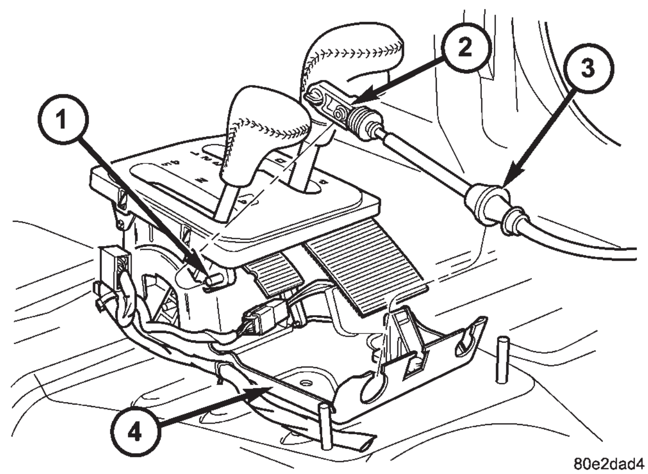


Fig. 154 Transmission Shift Cable

1 - SHIFT LEVER PIN
2 - ADJUSTMENT SCREW
3 - SHIFT CABLE
4 - SHIFTER ASSEMBLY BRACKET

(8) Disengage all wiring connectors from the shifter assembly.

(9) Remove all nuts holding the shifter assembly to the floor pan (Fig. 157).

(10) Remove the shifter assembly from the vehicle.

SHIFT MECHANISM (Continued)

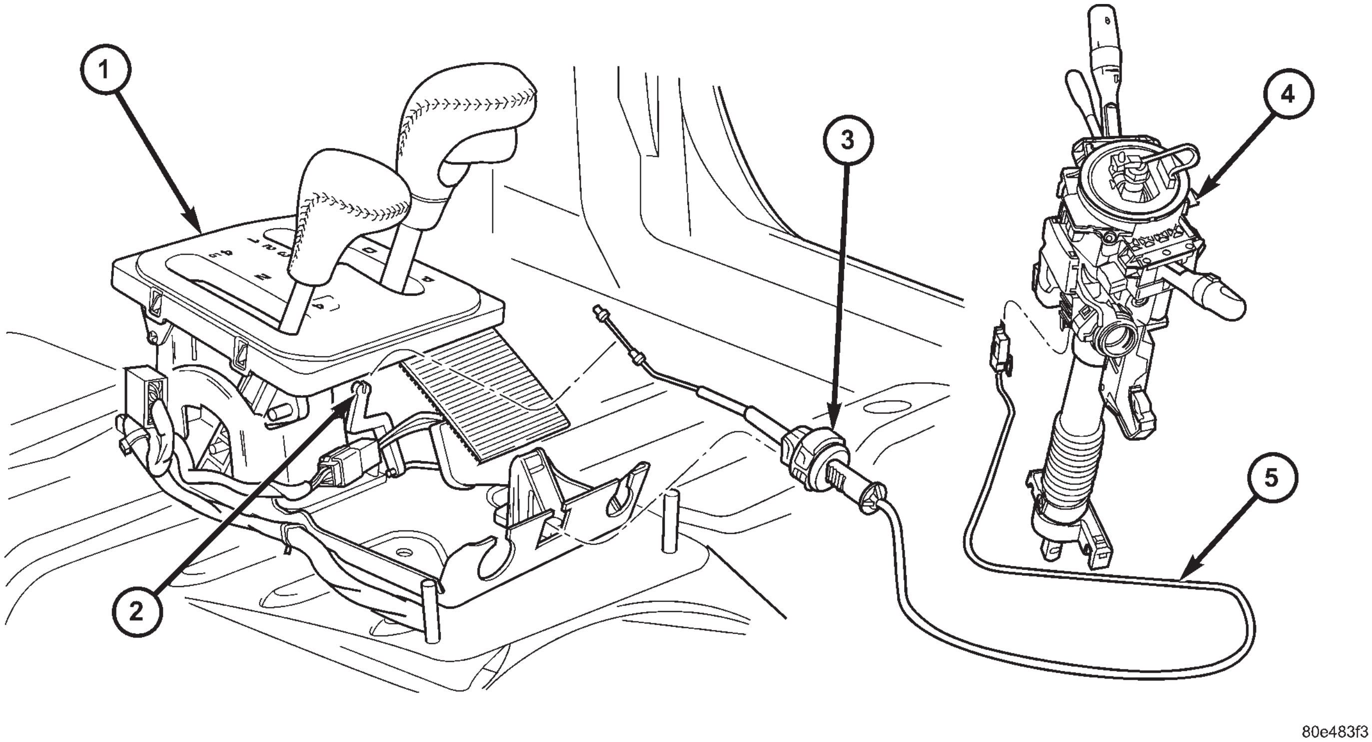


Fig. 155 Ignition Interlock Cable

1 - SHIFT MECHANISM
2 - SHIFTER BTSI LEVER
3 - ADJUSTMENT CLIP
4 - STEERING COLUMN ASSEMBLY
5 - INTERLOCK CABLE

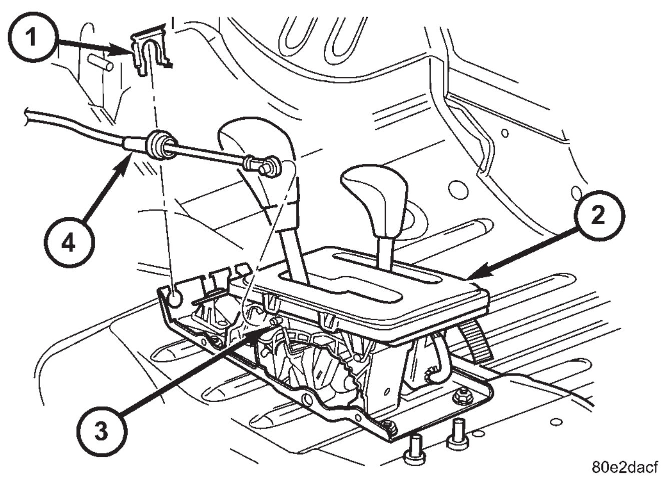


Fig. 156 Transfer Case Shift Cable

1 - CLIP
2 - SHIFTER
3 - TRANSFER CASE SHIFT LEVER PIN
4 - TRANSFER CASE SHIFT CABLE

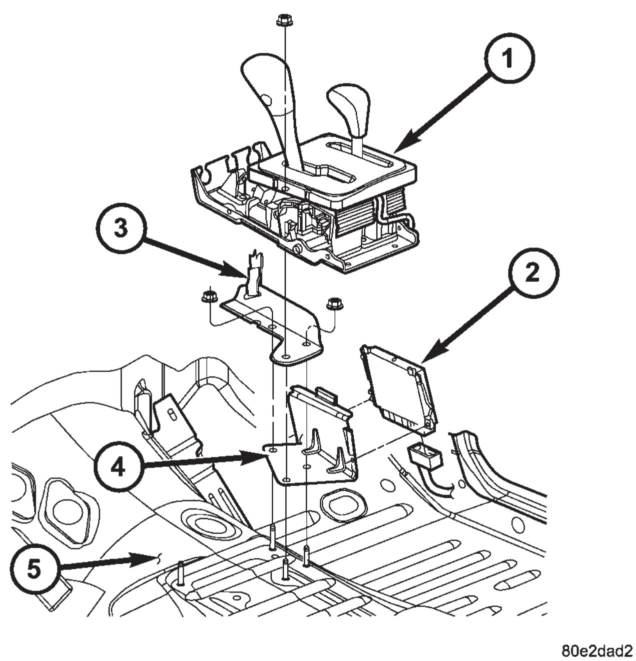


Fig. 157 Shifter Assembly

1 - SHIFTER ASSEMBLY
2 - TRANSMISSION CONTROL MODULE
3 - STRAP
4 - BRACKET
5 - FLOOR PAN

SHIFT MECHANISM (Continued)

INSTALLATION

(1) Install shifter assembly onto the shifter assembly studs on the floor pan.

(2) Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in.lbs.).

(3) Place the floor shifter lever in PARK position.

(4) Loosen the adjustment screw on the shift cable.

(5) Verify that the park lock cable adjustment tab is pulled upward to the unlocked position.

(6) Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.

(7) Install the transfer case shift cable to the shifter assembly bracket. Install clip to hold cable to the bracket.

(8) Snap the transfer case shift cable, if equipped, onto the transfer case shift lever pin.

(9) Install the park lock cable into the shifter assembly bracket and into the shifter BTSI lever.(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC/SHIFT INTERLOCK MECHANISM - ADJUSTMENTS)

(10) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(11) Snap the shift cable onto the shift lever pin.

(12) Verify that the shift lever is in the PARK position.

(13) Tighten the adjustment screw to 7 N·m (65 in.lbs.).

(14) Place the key in the accessory position.

(15) Push downward on the park lock cable adjustment tab to lock the adjustment.

(16) Verify correct shifter, park lock, and BTSI operation.

(17) Install any console parts removed for access to shift lever assembly and shift cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed**. The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or
2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

SOLENOID (Continued)

UPSHIFT/DOWNSHIFT SOLENOID VALVES

The solenoid valves for upshifts and downshifts (Fig. 158) are located in the shell of the electric control unit and pressed against the shift plate with a spring.

The solenoid valves (1) initiate the upshift and downshift procedures in the shift plate.

The solenoid valves (1) are sealed off from the valve housing of the shift plate (5) by two O-rings (4, 6). The contact springs (8) at the solenoid valve engage in a slot in the conductor tracks (7). The force of the contact spring (8) ensures safe contacts.

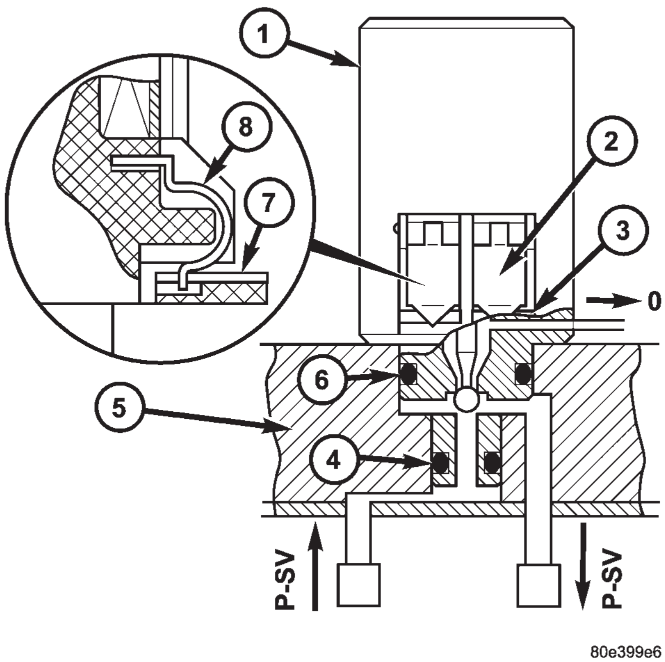


Fig. 158 Upshift/Downshift Solenoid Valves

1 - UPSHIFT/DOWNSHIFT SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - O-RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - O-RING
7 - CONDUCTOR TRACK
8 - CONTACT SPRING

MODULATING PRESSURE CONTROL SOLENOID VALVE

The modulating pressure control solenoid valve (Fig. 159) is located in the shell of the electric valve control unit and pressed against the shift plate by a spring.

Its purpose is control the modulating pressure depending on the continuously changing operating conditions, such as load and gear change.

The modulating pressure regulating solenoid valve (1) has an interference fit and is sealed off to the valve body of the shift plate (4) by a seal (arrow). The contact springs (2) at the solenoid valve engage in a slot in the conductor tracks (3). The force of the contact springs (2) ensures secure contacts.

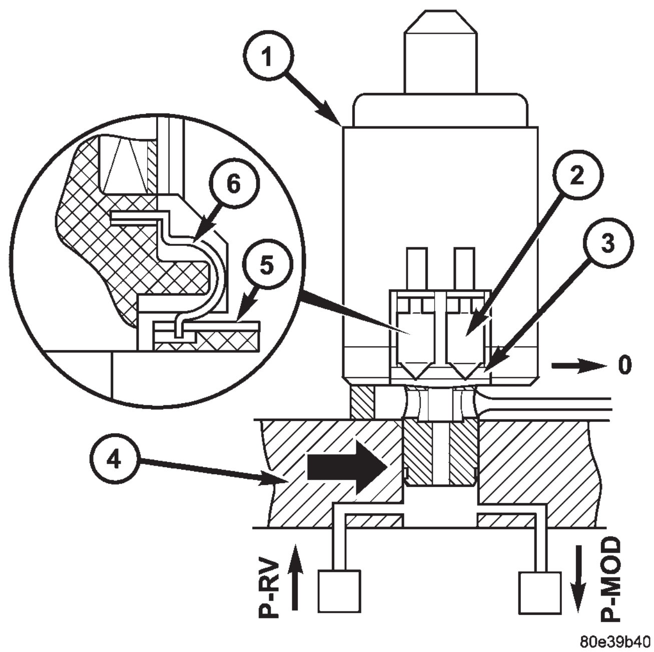


Fig. 159 Modulating Pressure Control Solenoid Valve

1 - MODULATING PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

SOLENOID (Continued)

TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE

The torque converter lockup clutch PWM solenoid valve (1) (Fig. 160) is located in the shell of the electric valve control unit and pressed against the shift plate by a spring.

The PWM solenoid valve (1) for the torque converter lockup controls the pressure for the torque converter lockup clutch.

The torque converter lockup PWM solenoid valve (1) is sealed off to the valve body of the shift plate (4) by an O-ring (5) and a seal (arrow). The contact springs (2) at the solenoid valve engage in a slot in the conductor tracks (3). The force of the contact springs (2) ensures secure contacts.

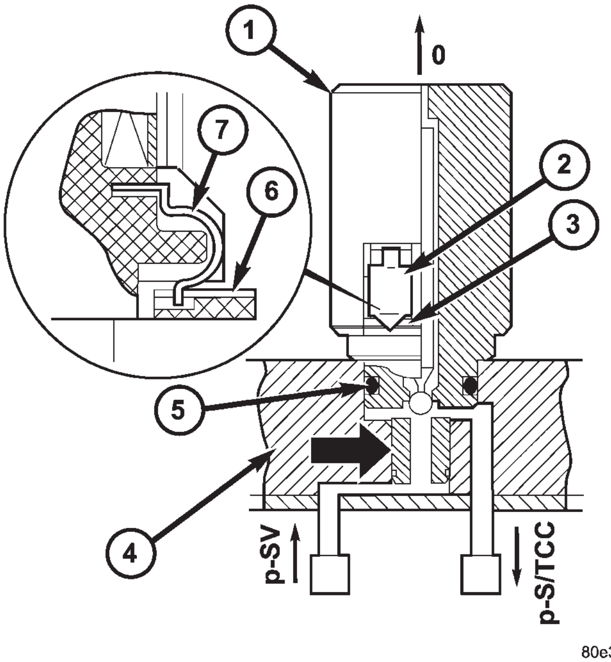


Fig. 160 Torque Converter Lockup Clutch PWM Solenoid Valve

1 - TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING OF SHIFT PLATE
5 - O-RING
6 - CONDUCTOR TRACK
7 - CONTACT SPRING

SHIFT PRESSURE CONTROL SOLENOID VALVE

The shift pressure control solenoid valve (1) (Fig. 161) is located in the shell of the electric valve control unit and pressed against the shift plate by a spring.

Its purpose is to control the shift pressure depending on the continuously changing operating conditions, such as load and gear change.

The shift pressure regulating solenoid valve (1) has an interference fit and is sealed off to the valve body of the shift plate (4) by a seal (arrow). The contact springs (2) at the solenoid valve engage in a slot in the conductor tracks (3). The force of the contact springs (2) ensures secure contacts

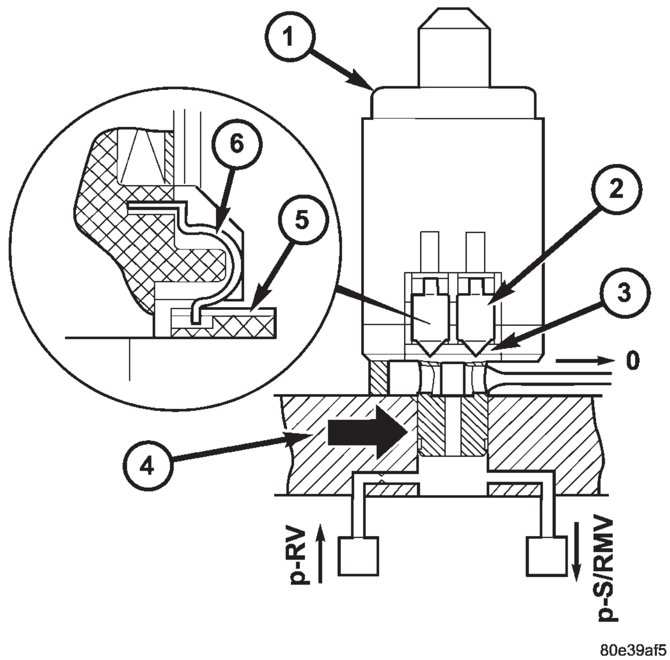


Fig. 161 Shift Pressure Control Solenoid Valve

1 - SHIFT PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

SOLENOID (Continued)

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

UPSHIFT/DOWNSHIFT SOLENOID VALVES

If a solenoid valve (Fig. 162) is actuated by the TCM, it opens and guides the control pressure (p-SV) to the assigned command valve. The solenoid valve remains actuated and therefore open until the shifting process is complete. The shift pressure (p-SV) to the command valve is reduced to zero as soon as the power supply to the solenoid valve is interrupted.

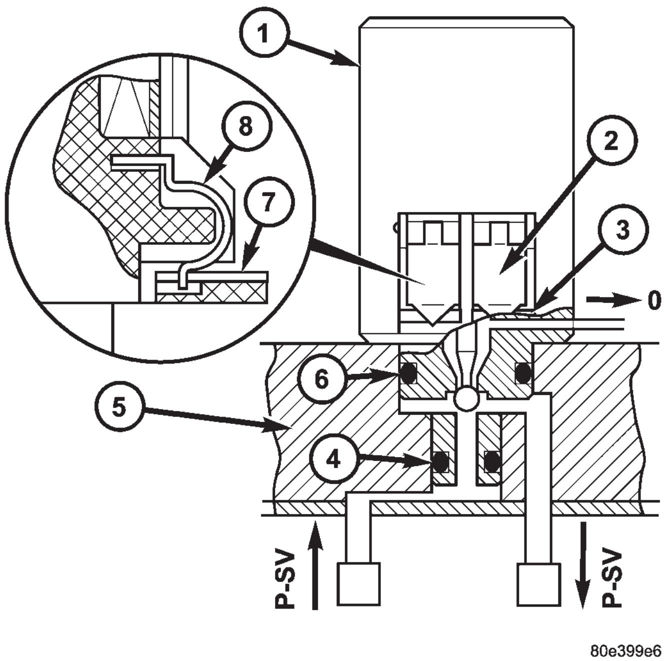


Fig. 162 Upshift/Downshift Solenoid Valves

1 - UPSHIFT/DOWNSHIFT SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - O-RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - O-RING
7 - CONDUCTOR TRACK
8 - CONTACT SPRING

MODULATING PRESSURE CONTROL SOLENOID VALVE

The modulating pressure regulating solenoid valve (1) (Fig. 163)assigns a proportional pressure to the current which is controlled by the TCM according to the load.

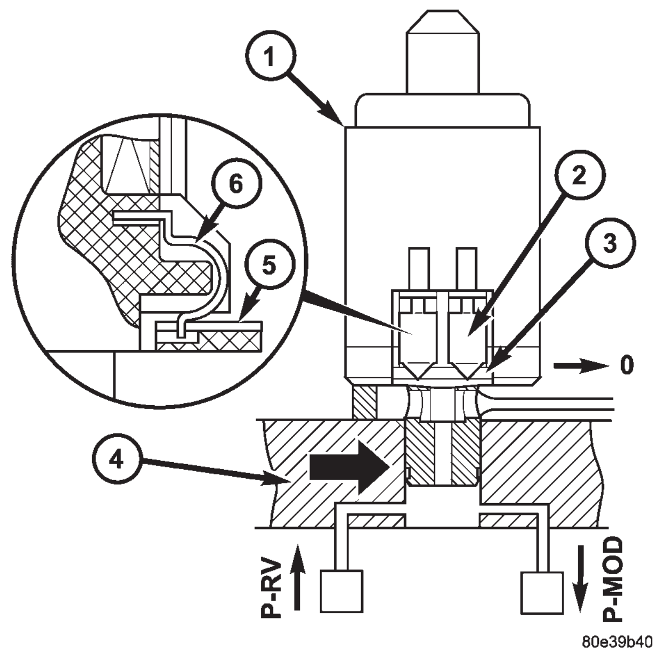


Fig. 163 Modulating Pressure Control Solenoid Valve

1 - MODULATING PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

SOLENOID (Continued)

TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE

The torque converter lockup PWM solenoid (1) (Fig. 164) valve converts pulse-wave-modulated current controlled by the TCM into the appropriate hydraulic control pressure (p-S/TCC).

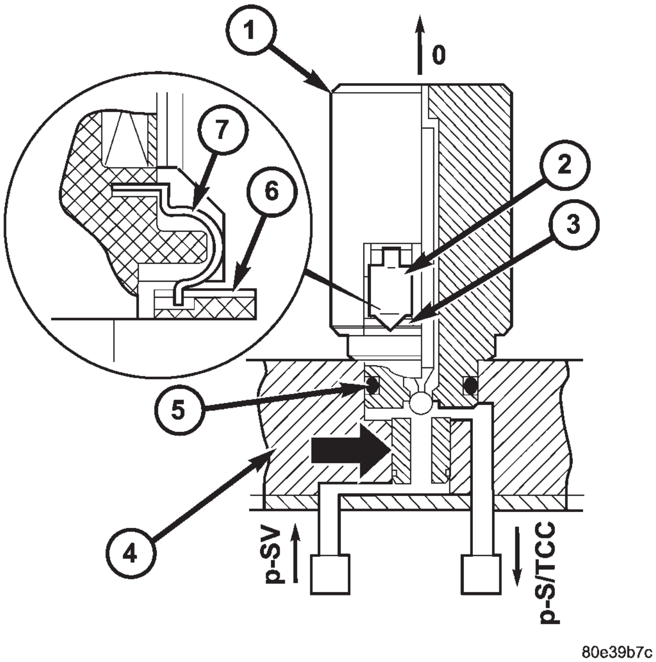


Fig. 164 Torque Converter Lockup Clutch PWM Solenoid Valve

1 - TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING OF SHIFT PLATE
5 - O-RING
6 - CONDUCTOR TRACK
7 - CONTACT SPRING

SHIFT PRESSURE CONTROL SOLENOID VALVE

The shift pressure regulating solenoid valve (1) (Fig. 165) assigns a proportional pressure to the current which is controlled by the TCM according to the load.

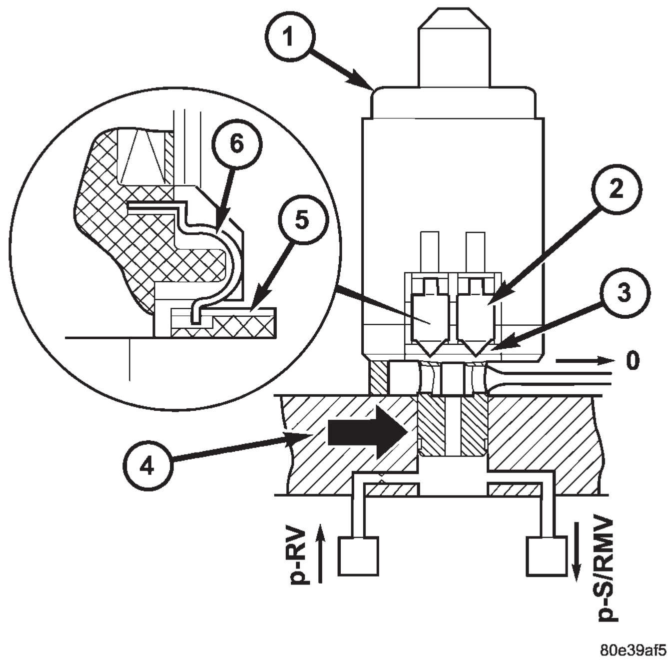


Fig. 165 Shift Pressure Control Solenoid Valve

1 - SHIFT PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

TEMPERATURE SENSOR/ PARK-NEUTRAL CONTACT

DESCRIPTION

DESCRIPTION - PARK/NEUTRAL CONTACT

The park/neutral contact (4) (Fig. 166) is located in the shell of the electric control unit and is fixed to the conductor tracks.

Its purpose is to recognize selector valve and selector lever positions ″P″ and ″N″. The park/neutral contact consists of:

- the plunger (2).
- the permanent magnet (3).
- the dry-reed contact (4).

TEMPERATURE SENSOR/PARK-NEUTRAL CONTACT (Continued)

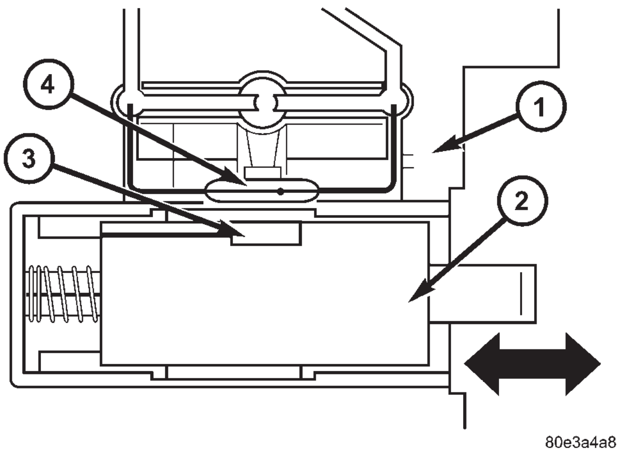


Fig. 166 Park/Neutral Contact

1 - SHELL OF ELECTRIC CONTROL MODULE
2 - PLUNGER
3 - PERMANENT MAGNET
4 - DRY-REED CONTACT

DESCRIPTION

The transmission oil temperature sensor (1) (Fig. 167) is located in the shell of the electric valve control unit and is fixed to the conductor tracks.

Its purpose is to measure the temperature of the transmission oil and pass the temperature to the TCM as an input signal. It is a temperature-dependent resistor (PTC).

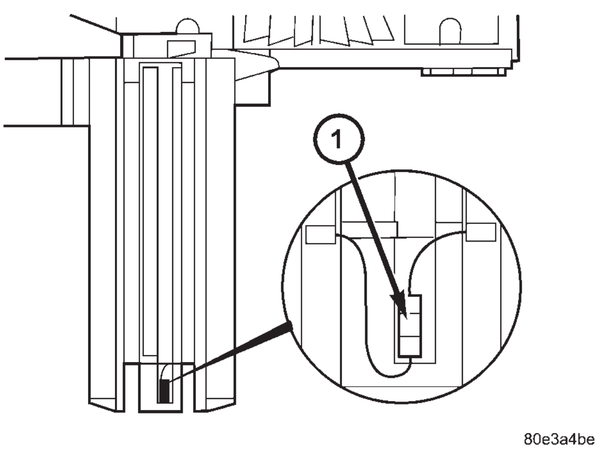


Fig. 167 Transmission Temperature Sensor

1 - TRANSMISSION TEMPERATURE SENSOR

OPERATION

OPERATION

In selector lever positions ″P″ and ″N″ the park/neutral contact (4) (Fig. 168) is actuated by a cam track which is located on the detent plate. The permanent magnet (3) is moved away from the dry-reed contact (4). The dry-reed contact (4) is opened. The TCM receives an electric signal. The circuit to the starter in the selector lever positions ″P″ and ″N″ is closed.

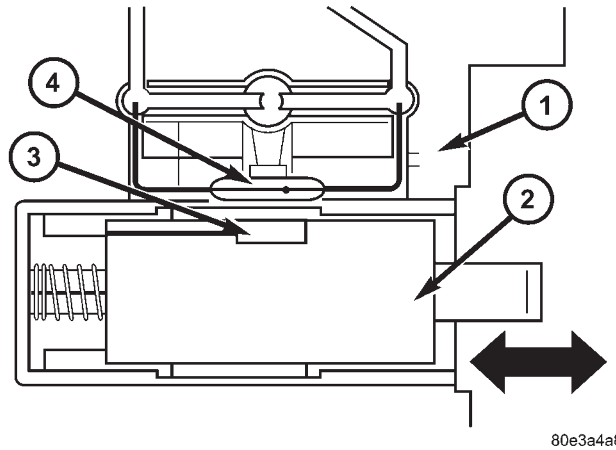


Fig. 168 Park/Neutral Contact

1 - SHELL OF ELECTRIC CONTROL MODULE
2 - PLUNGER
3 - PERMANENT MAGNET
4 - DRY-REED CONTACT

OPERATION

The temperature of the transmission oil has a considerable effect on the shifting time and therefore the shift quality. By measuring the oil temperature, shift operations can be optimized in all temperature ranges. The transmission oil temperature sensor (1) (Fig. 169) is switched in series with the park/neutral contact. The temperature signal is transferred to the TCM only when the dry-reed contact of the park/neutral contact is closed in a forward gear position.

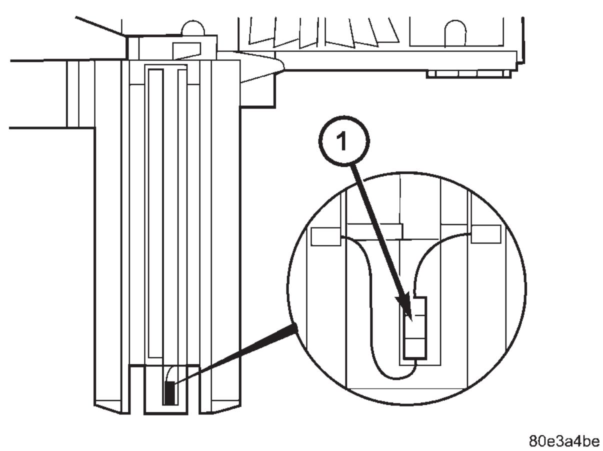


Fig. 169 Transmission Temperature Sensor

1 - TRANSMISSION TEMPERATURE SENSOR

TEMPERATURE SENSOR/PARK-NEUTRAL CONTACT (Continued)

Refer to the Transmission Temperature Sensor Specifications table (Fig. 170) for the relationship between transmission temperature, sensor voltage, and sensor resistance.

TRANSMISSION TEMP SENSOR SPECIFICATIONS

TEMPERATURE/VOLTAGE/RESISTANCE CHART

TEMPERATURE (C)	TEMPERATURE (F)	VOLTAGE	RESISTANCE
-50	-58	0.73	506.0
-45	-49	0.77	534.0
-40	-40	0.80	564.0
-35	-31	0.84	593.0
-30	-22	0.88	624.0
-25	-13	0.91	654.0
-20	-4	0.95	686.0
-15	5	0.98	718.0
-10	14	1.02	750.0
-5	23	1.05	783.0
0	32	1.09	817.0
5	41	1.12	851.0
10	50	1.16	886.0
15	59	1.19	921.0
20	68	1.23	957.0
25	77	1.26	994.0
30	86	1.30	1032.0
35	95	1.33	1070.0
40	104	1.37	1109.0
45	113	1.40	1149.0
50	122	1.44	1189.0
55	131	1.48	1231.0
60	140	1.51	1273.0
65	149	1.55	1316.0
70	158	1.58	1360.0
75	167	1.62	1405.0
80	176	1.65	1450.0
85	185	1.69	1497.0
90	194	1.72	1545.0
95	203	1.76	1594.0
100	212	1.79	1644.0
105	221	1.83	1695.0
110	230	1.86	1747.0
115	239	1.90	1800.0
120	248	1.93	1855.0
125	257	1.97	1911.0
130	266	2.00	1968.0
135	275	2.04	2027.0
140	284	2.08	2087.0
145	293	2.11	2148.0
150	302	2.15	2211.0
155	311	2.18	2276.0
160	320	2.22	2342.0
165	329	2.25	2410.0
170	338	2.29	2479.0
175	347	2.32	2551.0

80e3afbe

Fig. 170 Transmission Temperature Sensor Specifications

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 171) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The converter clutch engages in third gear. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.

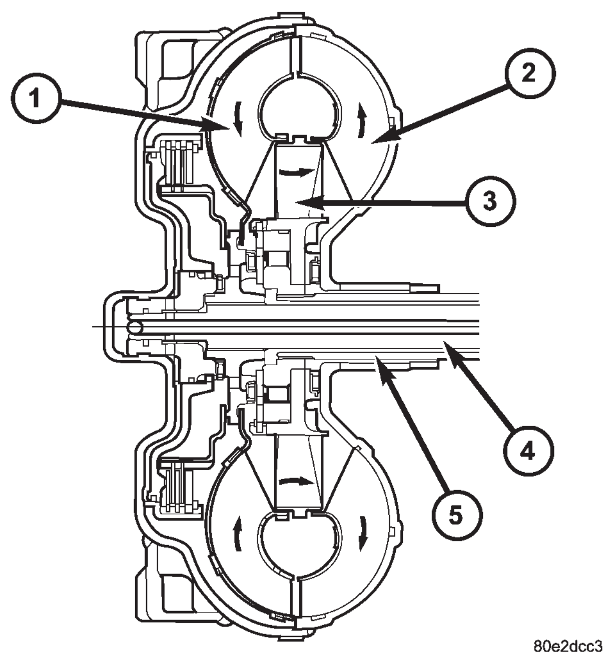


Fig. 171 Torque Converter

1 - TURBINE
2 - IMPELLER
3 - STATOR
4 - INPUT SHAFT
5 - STATOR SHAFT

TORQUE CONVERTER (Continued)

IMPELLER

The impeller (Fig. 172) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

TURBINE

The turbine (Fig. 173) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

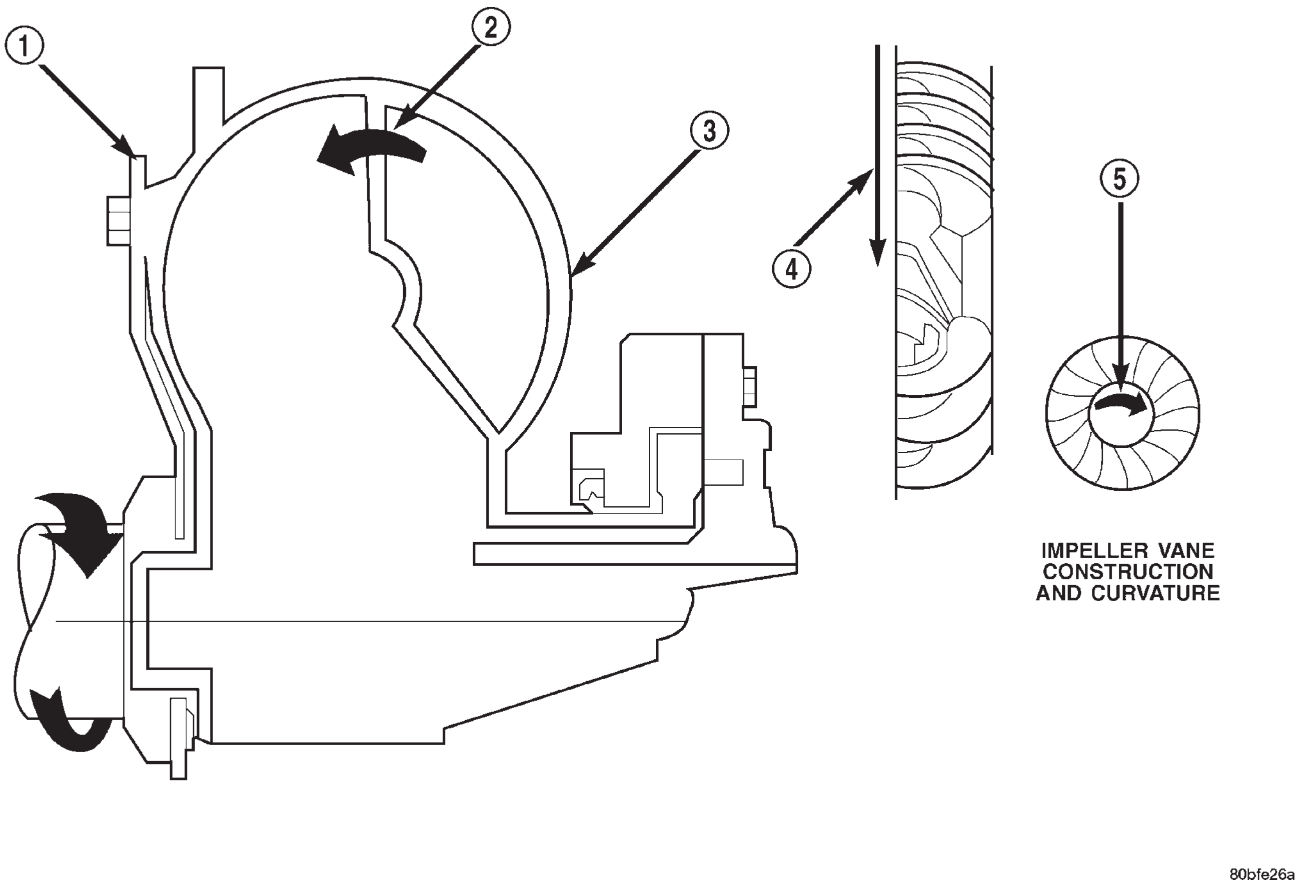


Fig. 172 Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

TORQUE CONVERTER (Continued)

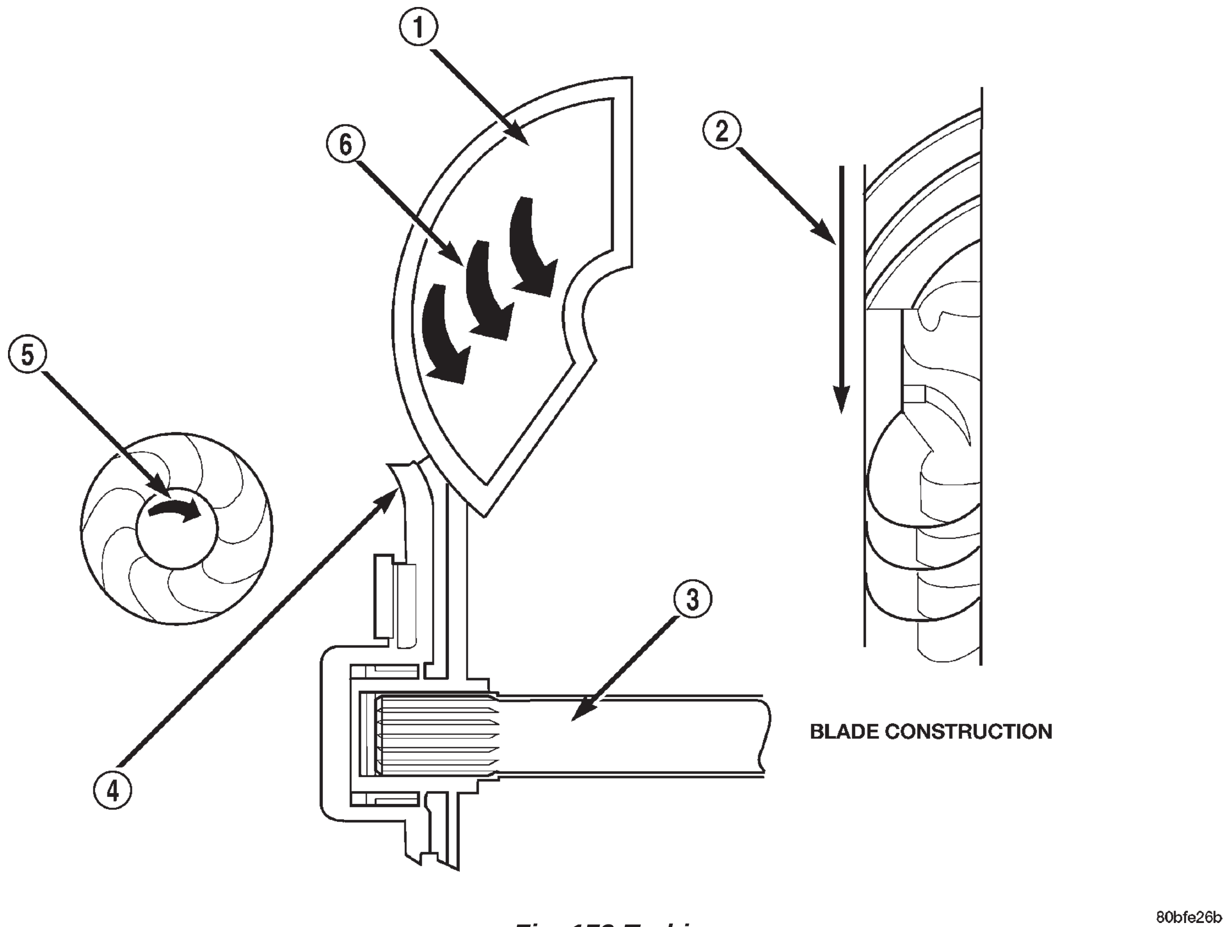


Fig. 173 Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

STATOR

The stator assembly (Fig. 174) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 175). The stator contains a freewheeling clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the freewheeling clutch, the torque multiplication feature of the torque converter is operational.

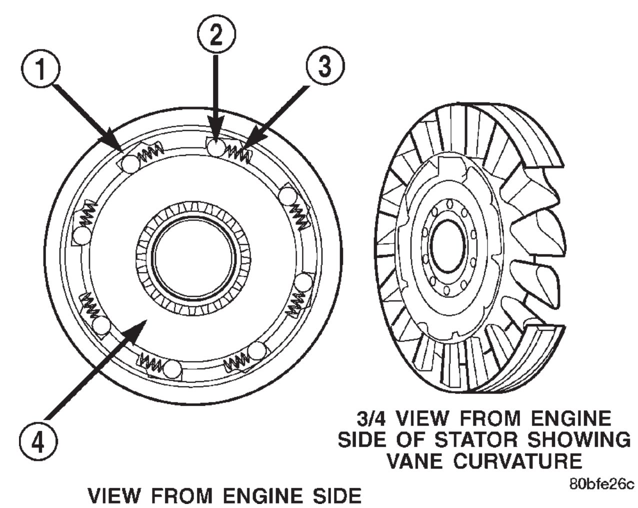


Fig. 174 Stator Components

1 - CAM (OUTER RACE)
2 - ROLLER
3 - SPRING
4 - INNER RACE

TORQUE CONVERTER (Continued)

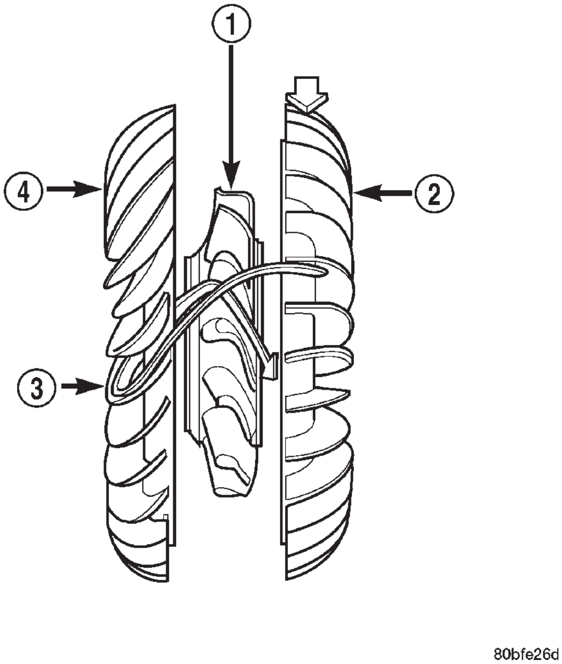


Fig. 175 Stator Location

1 - STATOR
2 - IMPELLER
3 - FLUID FLOW
4 - TURBINE

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 176) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston with friction material was added to the turbine assembly to provide this mechanical lock-up.

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the torque converter lock-up solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

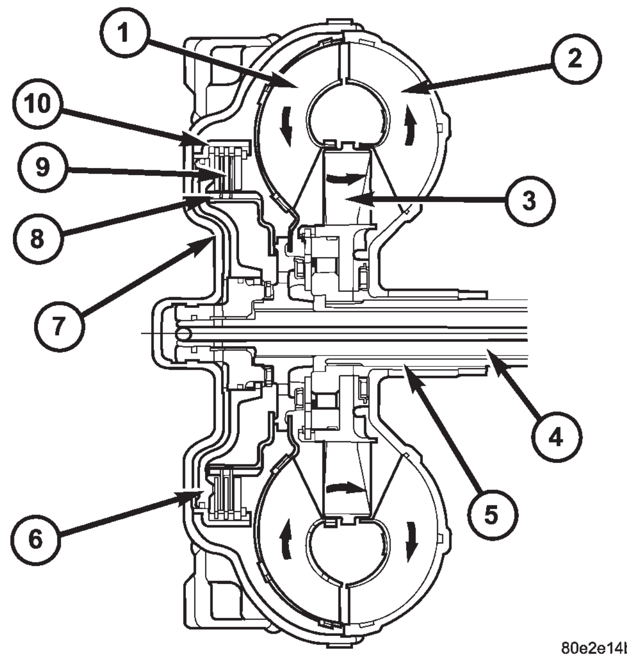


Fig. 176 Torque Converter Lock-up Clutch

1 - TURBINE
2 - IMPELLER
3 - STATOR
4 - INPUT SHAFT
5 - STATOR SHAFT
6 - PISTON
7 - COVER SHELL
8 - INTERNALLY TOOTHED DISC CARRIER
9 - CLUTCH PLATE SET
10 - EXTERNALLY TOOTHED DISC CARRIER

OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a “hindering” direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

TORQUE CONVERTER (Continued)

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 177). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counter-clockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.0:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

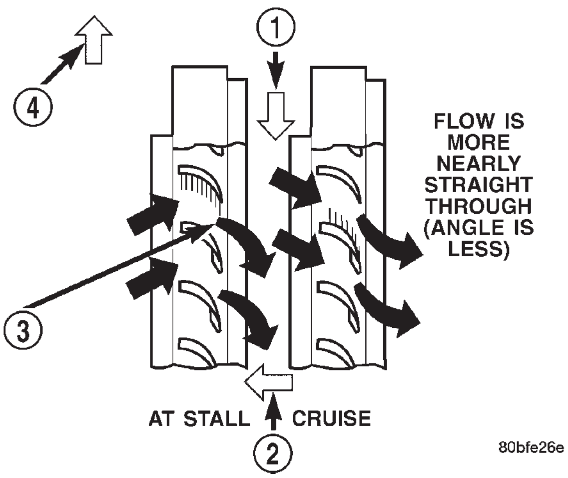


Fig. 177 Stator Operation

1 - DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 - FRONT OF ENGINE
3 - INCREASED ANGLE AS OIL STRIKES VANES
4 - DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material (Fig. 178) to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

The clutch can be engaged in second, third, fourth, and fifth gear ranges.

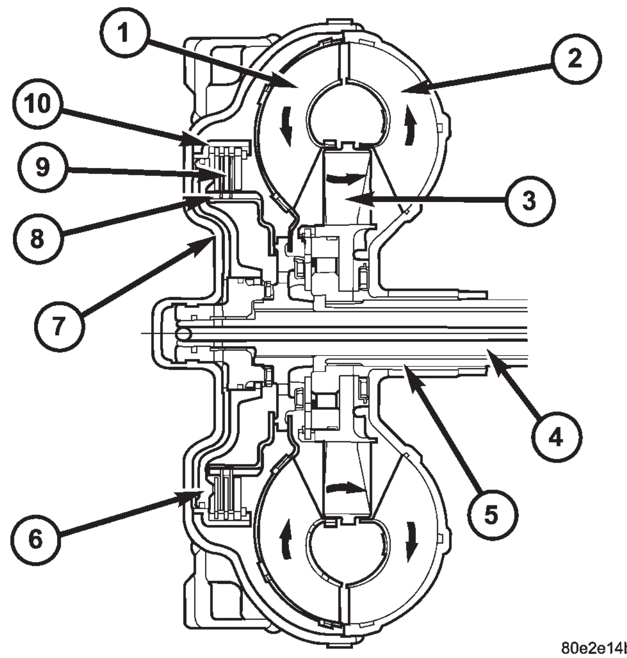


Fig. 178 Torque Converter Lock-up Clutch

1 - TURBINE
2 - IMPELLER
3 - STATOR
4 - INPUT SHAFT
5 - STATOR SHAFT
6 - PISTON
7 - COVER SHELL
8 - INTERNALLY TOOTHED DISC CARRIER
9 - CLUTCH PLATE SET
10 - EXTERNALLY TOOTHED DISC CARRIER

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the torque converter solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the TCC Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

TORQUE CONVERTER (Continued)

PARTIAL EMCC

Partial EMCC operation modulates the TCC Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the TCC Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the TCC Solenoid duty cycle.

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive flats for sharp edges, burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or converter hub while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 179). Surface of converter lugs should be at least 19 mm (3/4 in.) to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

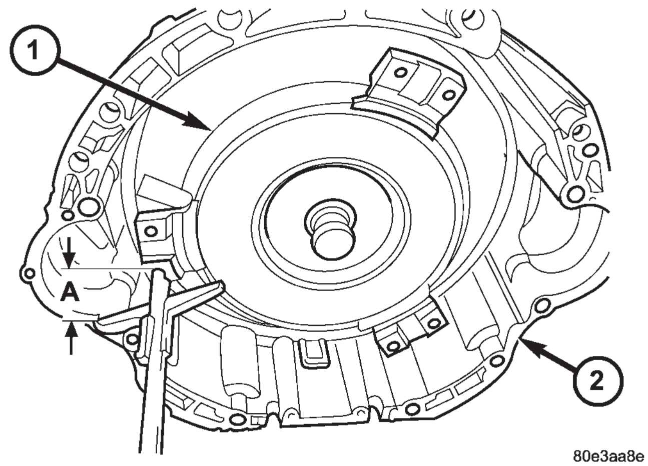


Fig. 179 Torque Converter Installation Depth

1 - TORQUE CONVERTER
2 - TRANSMISSION HOUSING

TRANSFER CASE - NV247

REMOVAL

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the (2) upper fan shroud retaining bolts.

(3) Raise the vehicle on a hoist.

(4) Remove the (2) lower fan shroud retaining bolts.

CAUTION: Mark the position of the driveshaft in relation to its companion flange prior to disassembly. Driveshaft must be reinstalled in the same position it was in prior to disassembly.

(5) Remove the front driveshaft retaining bolts (Fig. 180) and remove the driveshaft from the transfer case companion flange. Support the driveshaft with mechanics wire.

TRANSFER CASE - NV247 (Continued)

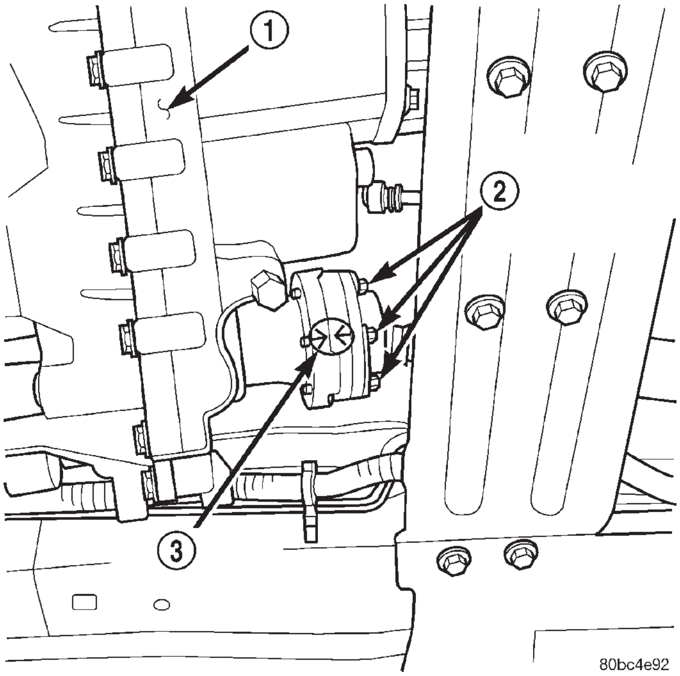


Fig. 180 Front Driveshaft Retaining Bolts

1 - TRANSFER CASE
2 - FRONT DRIVESHAFT RETAINING BOLTS
3 - REFERENCE MARK

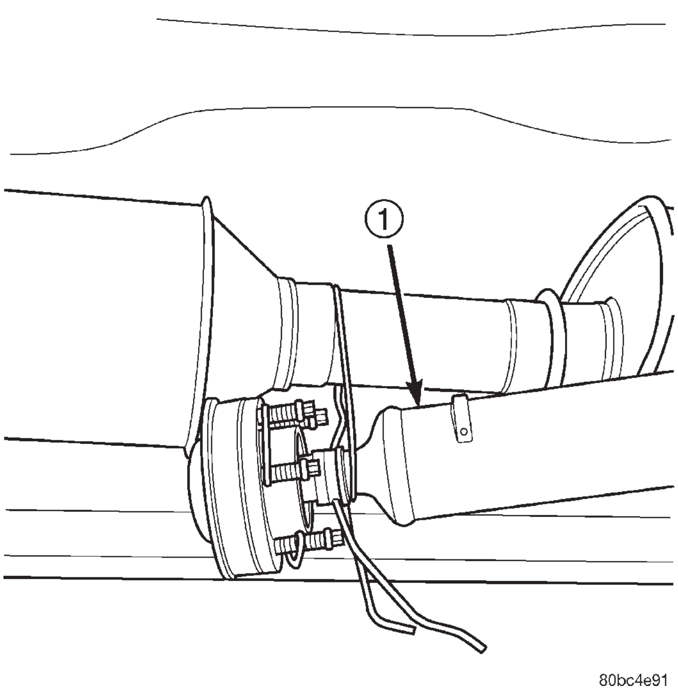


Fig. 181 Rear Driveshaft - Supported

1 - REAR DRIVESHAFT

(6) Remove the rear driveshaft retaining bolts and remove the driveshaft from the transfer case companion flange. Support the driveshaft with mechanics wire (Fig. 181).

(7) Disconnect the transfer case shift cable from the shifter arm (Fig. 182).

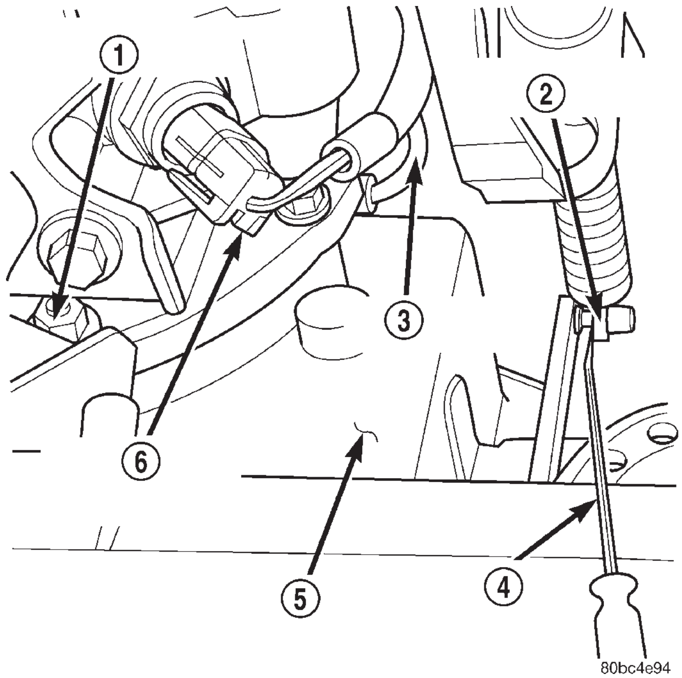


Fig. 182 Transfer Case Position and Orientation

1 - TRANSFER CASE RETAINING NUTS
2 - TRANSFER CASE SHIFTER CABLE
3 - TRANSFER CASE VENT HOSE
4 - FLAT BLADED TOOL
5 - TRANSFER CASE
6 - TRANSMISSION ELECTRICAL CONNECTOR

(8) Disconnect the vent tube from the transfer case (Fig. 182).

(9) Remove the transmission oil pan and drain the transmission fluid. Reinstall the transmission oil pan.

(10) Position a jack under the transmission support crossmember and support the transmission and transfer case assembly.

(11) Remove the (8) transmission support crossmember retaining bolts (Fig. 183).

(12) Position a transmission jack under the transfer case.

(13) Lower the transmission assembly enough to gain access and remove the transfer case to transmission retaining nuts.

(14) Remove the transfer case from the vehicle.

DISASSEMBLY

Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

TRANSFER CASE - NV247 (Continued)

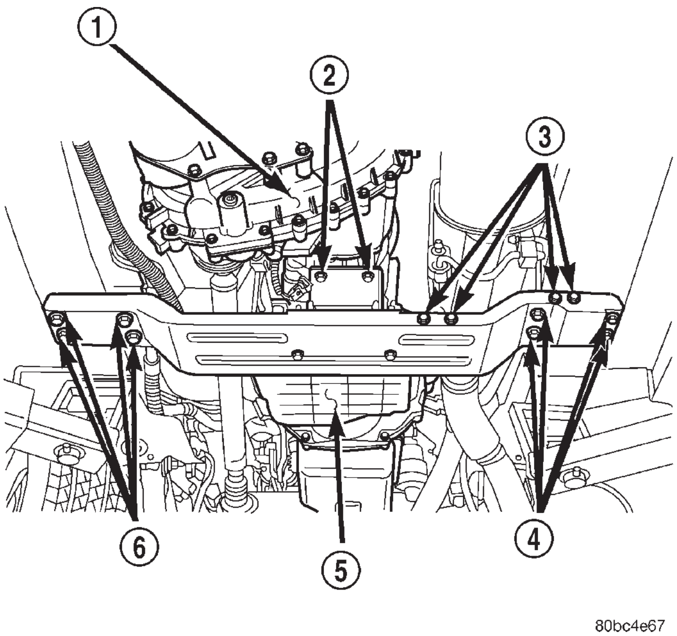


Fig. 183 Transmission Support Crossmember Position and Orientation

1 - TRANSFER CASE
2 - TRANSMISSION MOUNT RETAINING BOLTS (2 OF 4)
3 - EXHAUST SYSTEM SUPPORT BRACKET RETAINING BOLTS
4 - CROSSMEMBER RETAINING BOLTS
5 - TRANSMISSION
6 - CROSSMEMBER RETAINING BOLTS

REAR CASE AND OIL PUMP

(1) Remove the bolts (Fig. 184) holding the transfer case damper to the transfer case.

(2) Remove the damper (Fig. 185) from the transfer case.

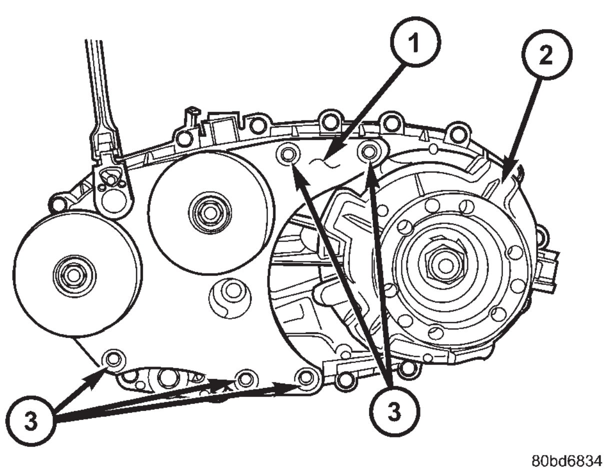


Fig. 184 Remove Damper Bolts

1 - DAMPER
2 - TRANSFER CASE
3 - BOLTS

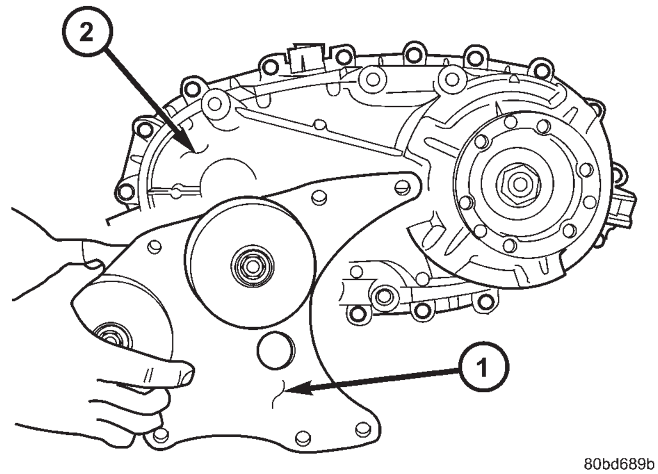


Fig. 185 Remove Damper

1 - DAMPER
2 - TRANSFER CASE

(3) Install two bolts (Fig. 186) partially into the rear propellor shaft companion flange, 180° from each other.

(4) Install the rectangular end of the Flange Holder C-3281 over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the rear output shaft.

(5) Use Remover C-452 (Fig. 187) to remove the rear companion flange.

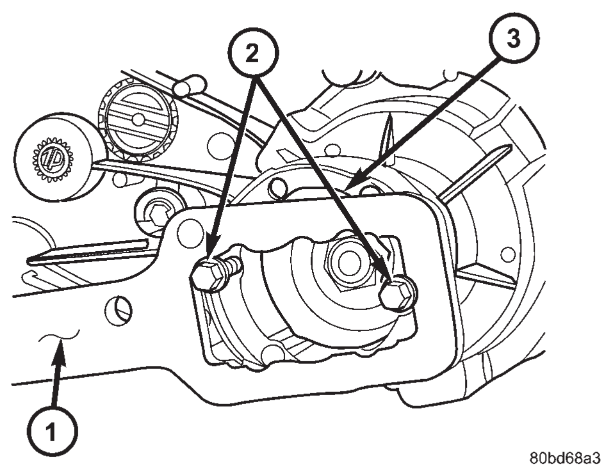


Fig. 186 Hold Companion Flange

1 - HOLDER C-3281
2 - BOLTS
3 - COMPANION FLANGE

(6) Support transfer case so rear case is facing upward.

(7) Remove bolts holding front case to rear case. The case alignment bolt require flat washers (Fig. 188).

TRANSFER CASE - NV247 (Continued)

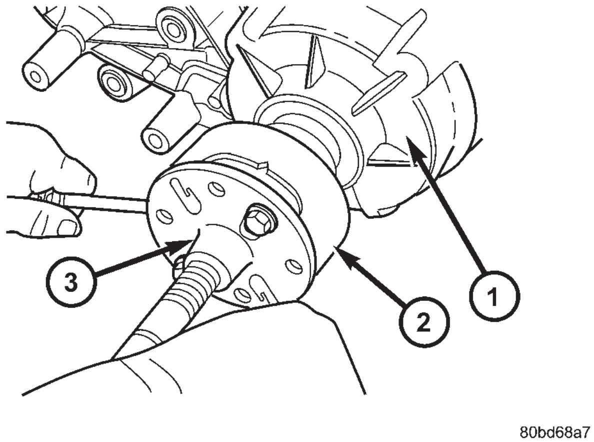


Fig. 187 Remove Companion Flange

1 - TRANSFER CASE
2 - COMPANION FLANGE
3 - REMOVER C-452

(8) Loosen rear case with flat blade screwdriver to break sealer bead. Insert screwdriver blade only into notches provided at each end of case (Fig. 189).

(9) Remove rear case.

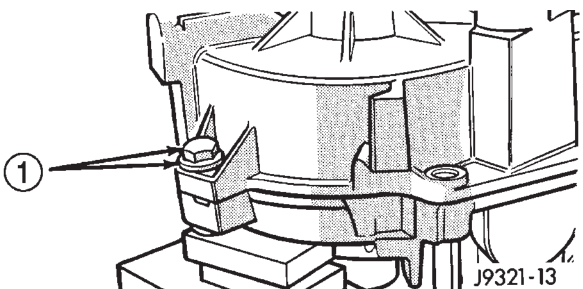


Fig. 188 Rear Case Alignment Bolt Locations

1 - ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

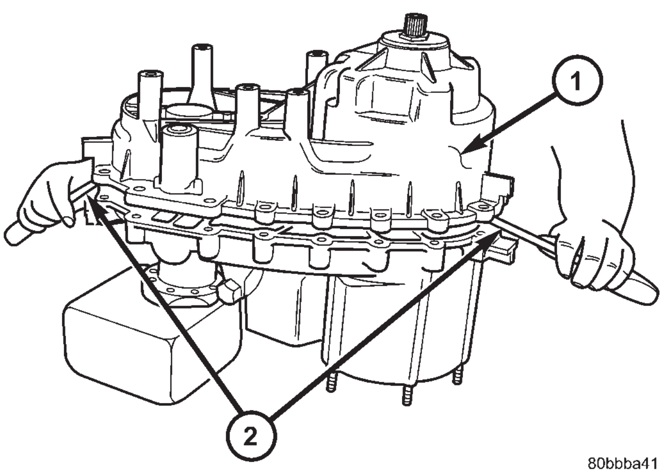


Fig. 189 Rear Case Removal

1 - REAR TRANSFER CASE HALF
2 - SCREWDRIVER SLOTS

(10) Remove the screws holding the transfer case chain snubber (Fig. 190) to the rear transfer case half.

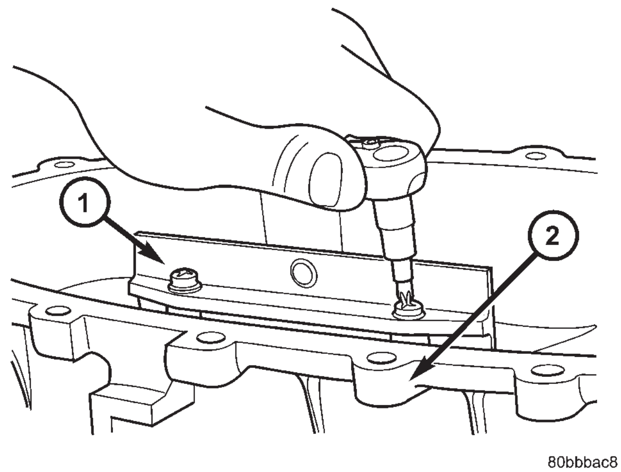


Fig. 190 Remove Transfer Case Chain Snubber

1 - TRANSFER CASE CHAIN SNUBBER
2 - REAR CASE HALF

(11) Remove the oil pump retaining snap-ring (Fig. 191).

(12) Disengage oil pickup tube from oil pump (Fig. 192).

(13) Remove oil pump assembly (Fig. 193).

(14) Remove pick-up tube o-ring from oil pump (Fig. 194), if necessary. Do not disassemble the oil pump, it is not serviceable.

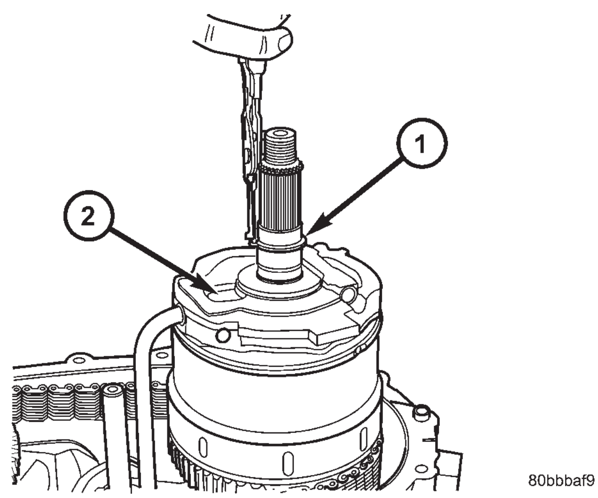


Fig. 191 Remove Oil Pump Snap-ring

1 - OIL PUMP SNAP-RING
2 - OIL PUMP

TRANSFER CASE - NV247 (Continued)

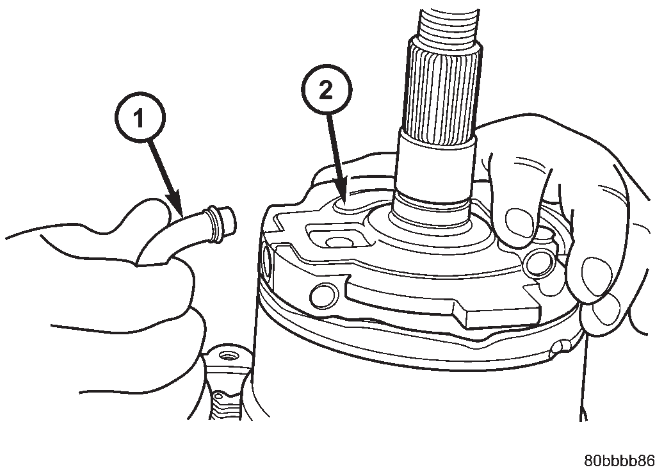


Fig. 192 Disengage Oil Pump Tube From Oil Pump

1 - OIL PUMP PICKUP TUBE
2 - OIL PUMP

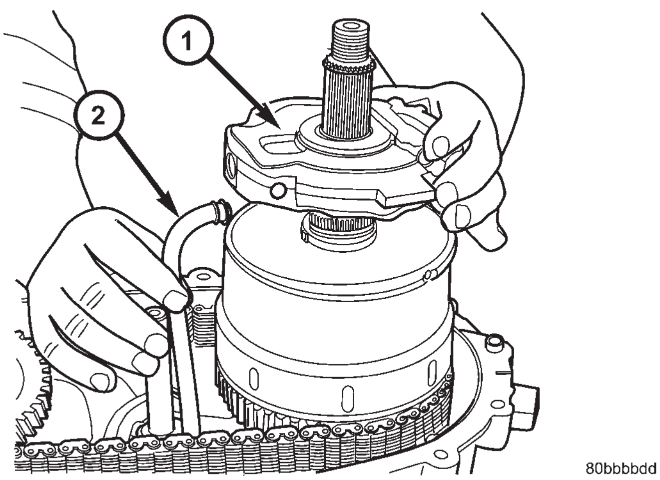


Fig. 193 Remove Oil Pump

1 - OIL PUMP
2 - OIL PUMP PICKUP TUBE

COMPANION FLANGE AND RANGE LEVER

(1) Remove front companion flange nut as follows:
(a) Move range lever to 4L position.
(b) Remove nut with socket and impact wrench.

(2) Remove companion flange. If flange is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller. Be sure puller tool is positioned on flange and not on slinger as slinger will be damaged.

(3) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(4) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft.

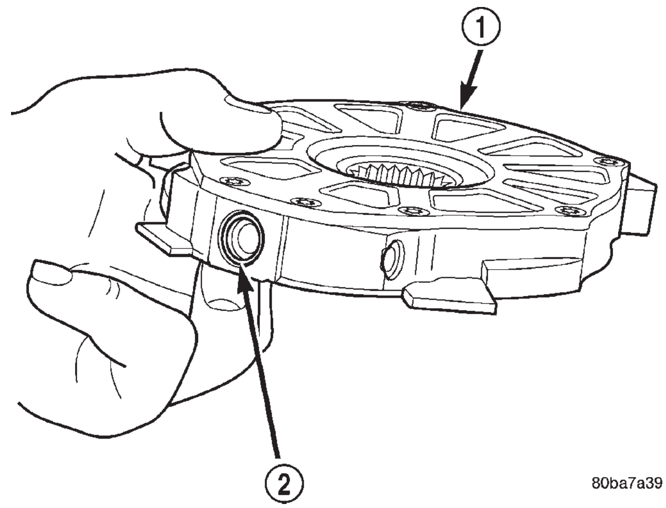


Fig. 194 Pick-up Tube O-ring Location

1 - OIL PUMP
2 - O-RING

NOTE: Note position of range lever so it can be re-installed correctly.

PROGRESSIVE COUPLING

(1) Remove progressive coupling locating snap-ring (Fig. 195) and progressive coupling thrust washer (Fig. 196) from the mainshaft.

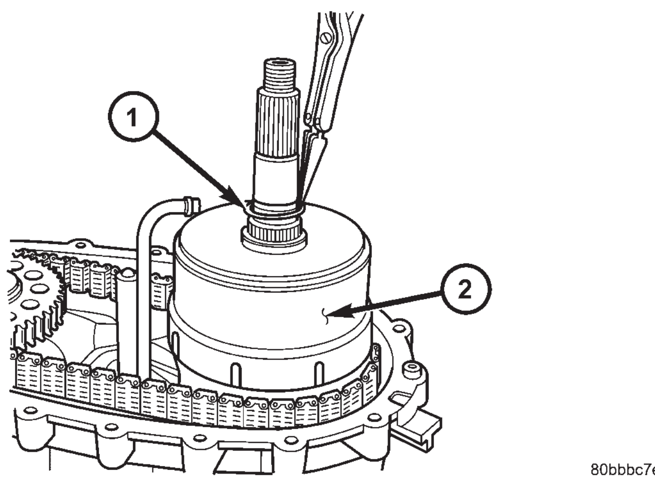


Fig. 195 Remove Progressive Coupler Snap-ring

1 - PROGRESSIVE COUPLING SNAP-RING
2 - PROGRESSIVE COUPLING

TRANSFER CASE - NV247 (Continued)

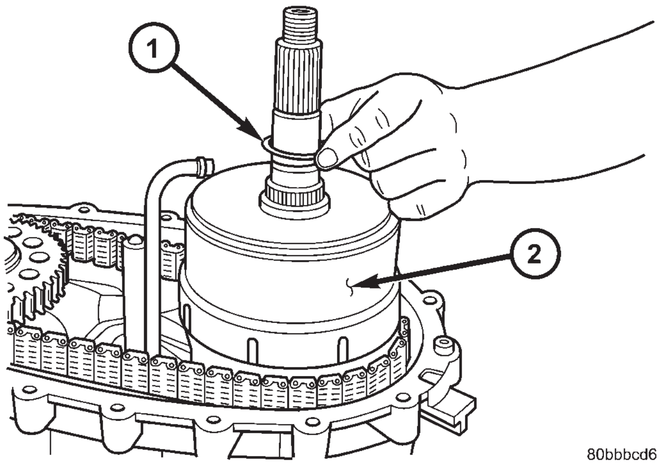


Fig. 196 Remove Progressive Coupler Thrust Washer

1 - PROGRESSIVE COUPLING THRUST WASHER
2 - PROGRESSIVE COUPLING

(2) Remove progressive coupling from mainshaft (Fig. 197).

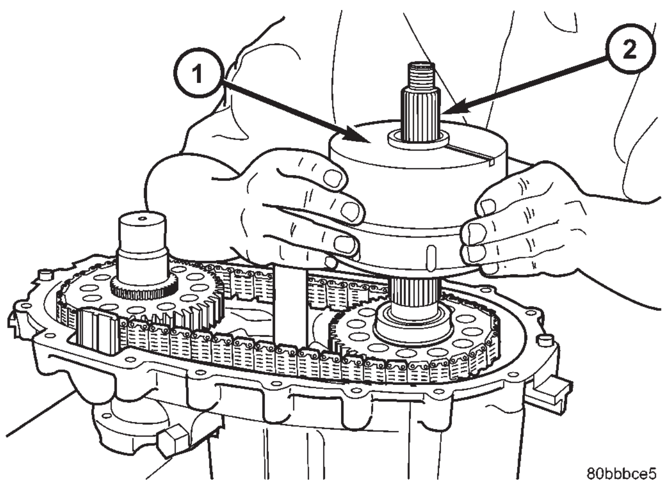


Fig. 197 Remove Progressive Coupler

1 - PROGRESSIVE COUPLING
2 - MAINSHAFT

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Remove rear output shaft drive gear snap-ring (Fig. 198).

(2) Disengage drive gear (Fig. 199). Pry gear upward and off mainshaft as shown.

(3) Remove front output shaft, drive chain and drive gear as assembly (Fig. 199).

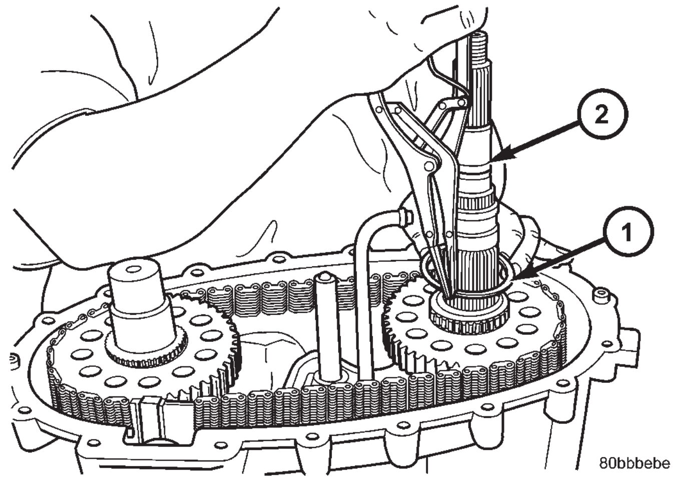


Fig. 198 Remove Output Shaft Drive Gear Snap-ring

1 - REAR OUTPUT SHAFT DRIVE GEAR SNAP-RING
2 - REAR OUTPUT SHAFT

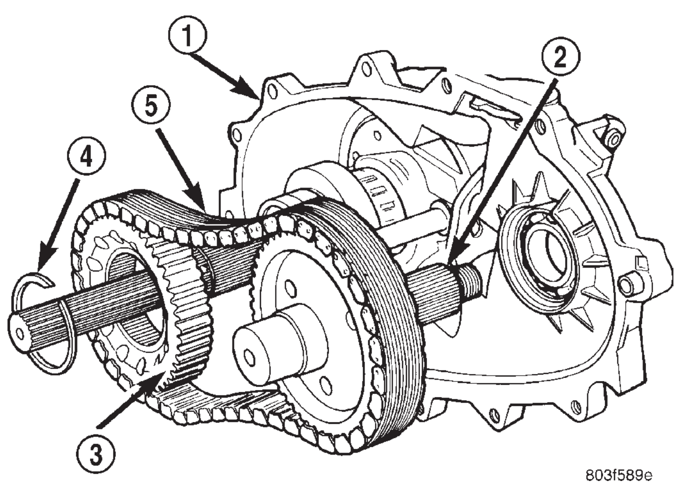


Fig. 199 Front Output Shaft, Drive Gear And Chain Removal

1 - REAR HOUSING
2 - OUTPUT SHAFT AND SPROCKET
3 - MAINSHAFT SPROCKET
4 - SNAP-RING
5 - DRIVE CHAIN

TRANSFER CASE - NV247 (Continued)

(4) Remove front output shaft drive gear snap-ring. (Fig. 200)

(5) Remove output shaft drive gear from front output shaft. (Fig. 201)

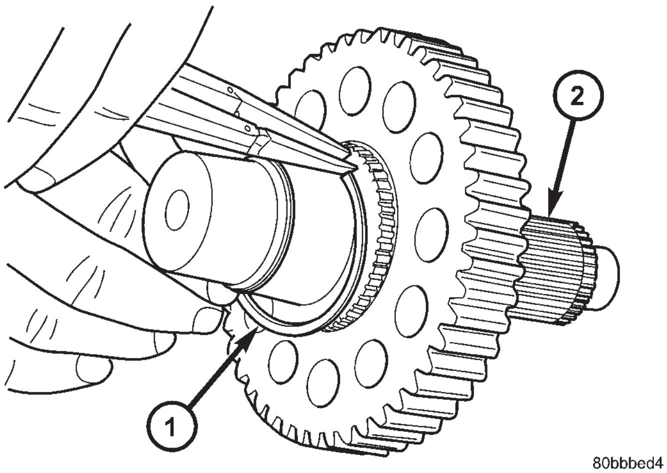


Fig. 200 Remove Front Output Shaft Drive Gear Snap-ring

1 - FRONT OUTPUT SHAFT DRIVE GEAR SNAP-RING
2 - FRONT OUTPUT SHAFT

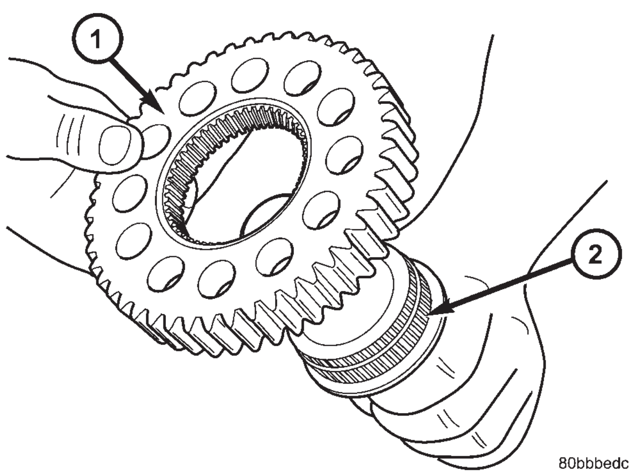


Fig. 201 Remove Front Output Shaft Drive Gear

1 - FRONT OUTPUT SHAFT DRIVE GEAR
2 - FRONT OUTPUT SHAFT

(6) Remove the oil pump pickup tube from the front case half. (Fig. 202)

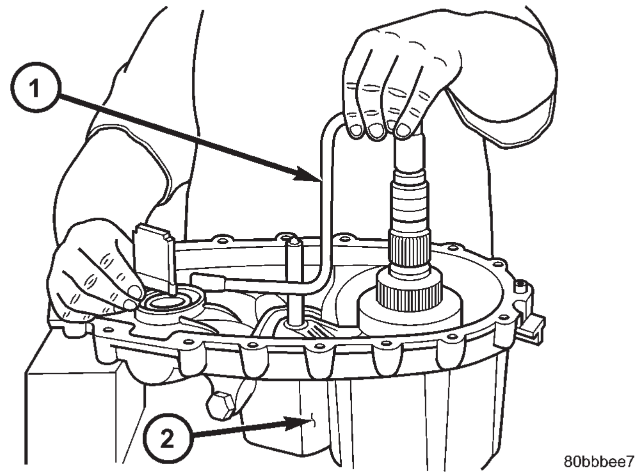


Fig. 202 Remove Oil Pump Pickup Tube

1 - OIL PUMP PICKUP TUBE
2 - FRONT CASE HALF

SHIFT FORKS AND MAINSHAFT

(1) Remove detent plug, O-ring, detent spring and detent plunger (Fig. 203).

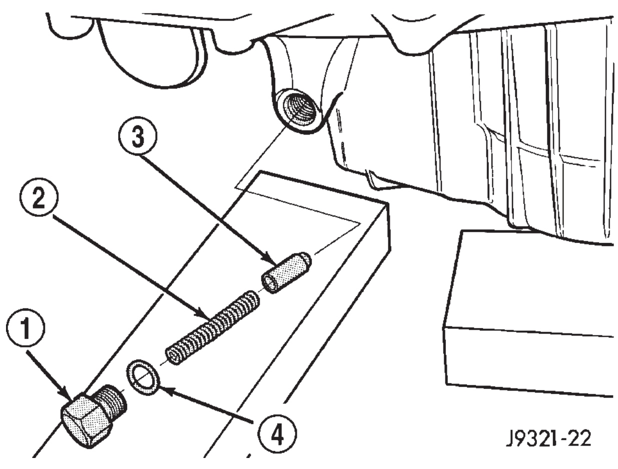


Fig. 203 Detent Plug, Spring And Plunger Removal

1 - DETENT PLUG
2 - DETENT SPRING
3 - DETENT PLUNGER
4 - PLUG O-RING

TRANSFER CASE - NV247 (Continued)

(2) Remove shift rail from shift fork and transfer case housing.

(3) Rotate range shift fork until it disengages from shift sector.

(4) Remove mainshaft and shift fork from input gear pilot bearing.

NOTE: Loose needle bearings are used to support the drive sprocket hub on the mainshaft. Do not lift mainshaft by drive sprocket hub or needle bearings will become dislodged.

(5) Wrap rag around mainshaft underneath drive sprocket hub and remove drive sprocket hub from mainshaft. Be sure to retrieve all the drive sprocket hub needle bearings.

(6) Remove snap ring holding clutch sleeve onto mainshaft.

(7) Remove range clutch sleeve, blockout spring, locking clutch, and locking clutch spring from mainshaft (Fig. 204).

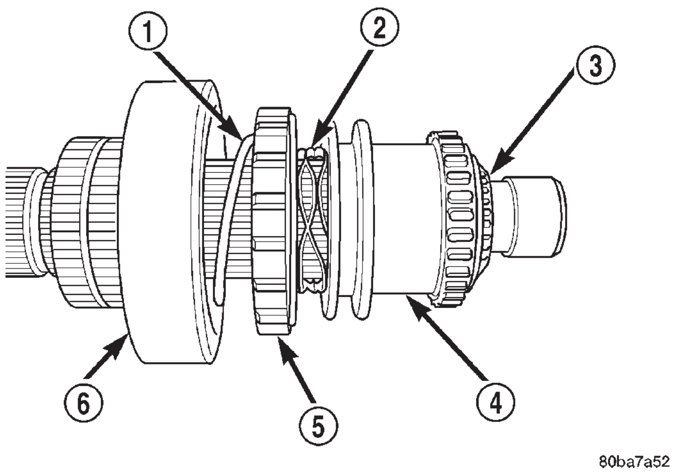


Fig. 204 Range Clutch Sleeve, Blockout Spring, Locking Clutch and Spring

1 - LOCKING CLUTCH SPRING
2 - BLOCKOUT SPRING
3 - SNAP-RING
4 - RANGE CLUTCH SLEEVE
5 - LOCKING CLUTCH
6 - DRIVE SPROCKET HUB

(8) Remove shift sector. Rotate and tilt sector as needed to remove it.

(9) Remove shift sector bushing and O-ring (Fig. 205).

INPUT GEAR/LOW RANGE ASSEMBLY

(1) Turn front case on side so that the input shaft is facing upward.

(2) Remove the input shaft seal with a suitable screw mounted in a slide hammer.

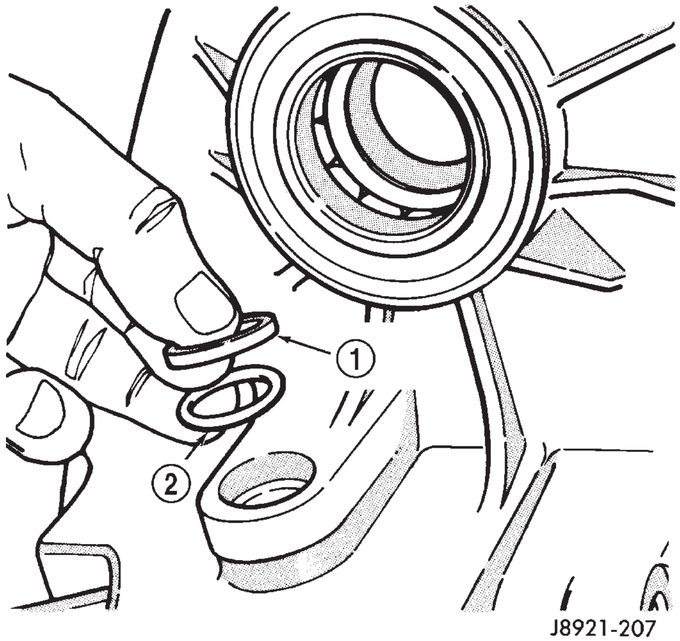


Fig. 205 Sector Bushing And O-Ring Removal

1 - SHIFT SECTOR BUSHING
2 - O-RING

(3) Remove snap-ring that retains input gear shaft in front bearing.

(4) Remove input and low range gear assembly (Fig. 206).

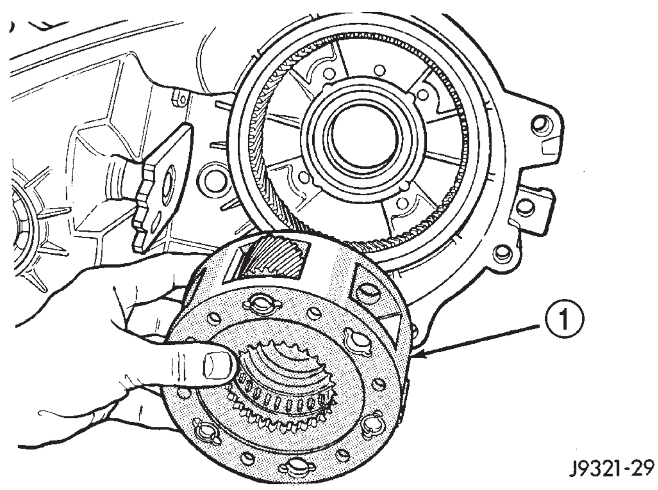


Fig. 206 Input And Low Range Gear Assembly Removal

1 - INPUT AND LOW RANGE GEAR ASSEMBLY

TRANSFER CASE - NV247 (Continued)

INPUT AND LOW RANGE GEAR

(1) Remove snap-ring that retains input gear in low range gear (Fig. 207).
(2) Remove retainer (Fig. 208).
(3) Remove front tabbed thrust washer (Fig. 209).
(4) Remove input gear (Fig. 210).
(5) Remove rear tabbed thrust washer from low range gear (Fig. 211).

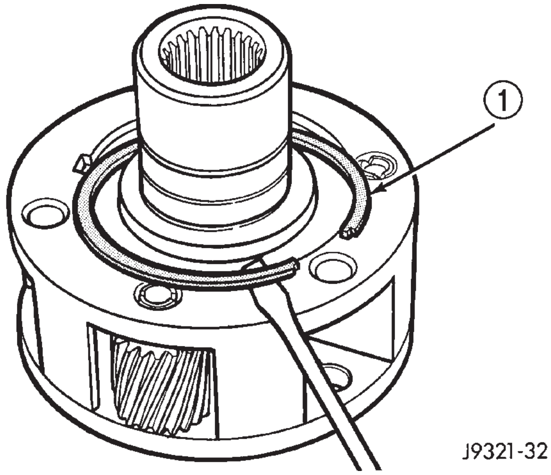


Fig. 207 Input Gear Snap-Ring Removal

1 - INPUT GEAR SNAP-RING

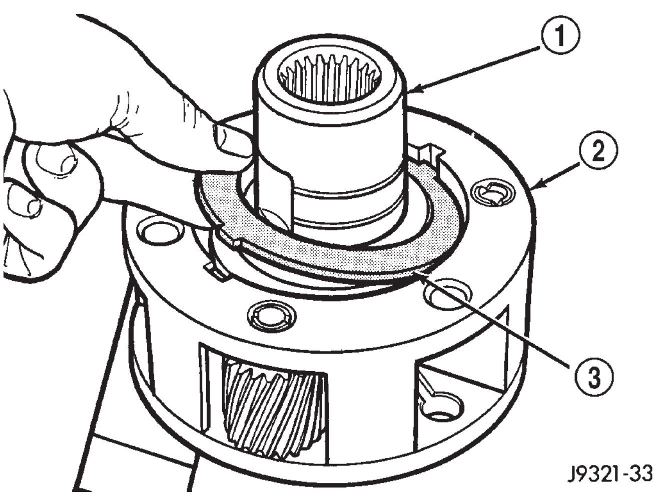


Fig. 208 Input Gear Retainer

1 - INPUT GEAR
2 - LOW RANGE GEAR
3 - RETAINER

INSPECTION

MAINSHAFT

Examine the mainshaft components carefully for evidence of wear or damage.

Replace the thrust washers if worn or damaged.

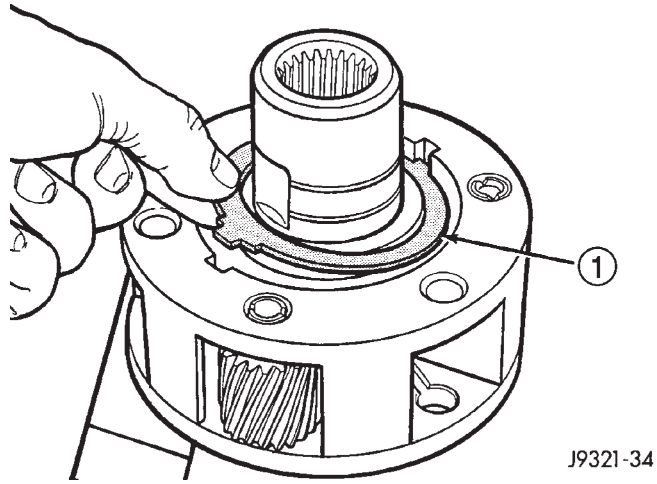


Fig. 209 Front Tabbed Thrust Washer

1 - FRONT TABBED THRUST WASHER

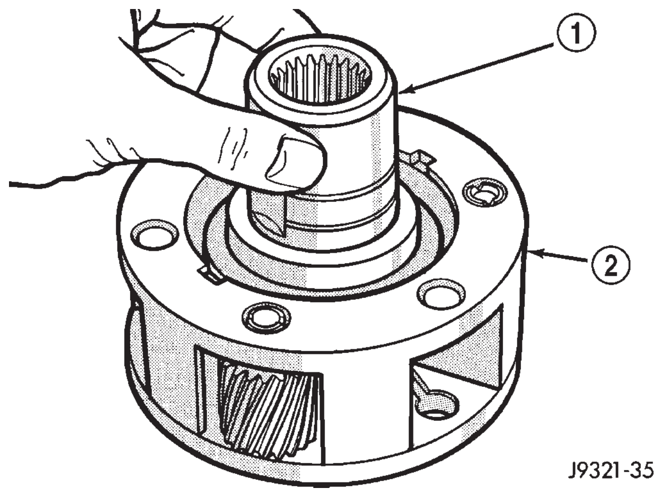


Fig. 210 Input Gear Removal

1 - INPUT GEAR
2 - LOW RANGE GEAR

Replace the mainshaft and sprocket gears if the teeth or gear bores are worn or damaged.

Replace the mainshaft bearings if worn, flat spotted, brinelled, or damaged in any way.

Replace the mainshaft if it is bent, exhibits wear or damage to the bearing surfaces, splines or gear teeth.

INPUT AND LOW RANGE GEARS

Inspect the low range gear pinions and pinion pins. Replace the low range gear if any of the pins or pinions are worn or damaged.

Inspect the thrust washers, retainer, and snap-ring. Replace the snap-ring if bent, or distorted. Replace the thrust washers and retainer if worn, cracked or damaged in any way.

TRANSFER CASE - NV247 (Continued)

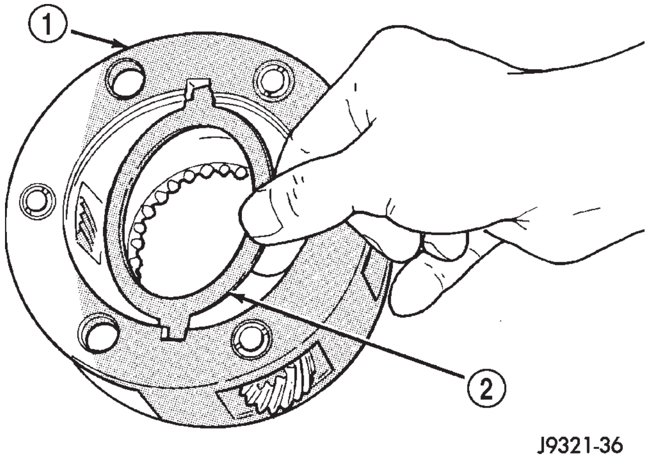


Fig. 211 Rear Tabbed Thrust Washer Removal

1 - LOW RANGE GEAR
2 - REAR TABBED THRUST WASHER

Examine the input gear carefully. Be sure the gear teeth and bearing surfaces are in good condition. Replace the gear if wear or damage is evident.

Check the input gear pilot bearing. Rotate the bearing and check for roughness or noise. Also check bearing position in the bore. The bearing should be recessed approximately 2.5 mm (0.100 in.) below the top edge of the bore. The bearing should not be seated at the bottom of the bore. Replace the bearing if worn, or roughness is evident. Replace both the gear and bearing if the bearing is a loose fit in the bore.

GEAR CASE AND RETAINERS

Examine both case halves carefully. Replace any case half if wear, cracks, or other damage is evident.

Check condition of the low range annulus gear and the shift rail bushing in the front case (Fig. 212). The low range annulus gear is not a serviceable part. Replace the gear and case as an assembly if the gear is loose, worn, or damaged. The shift rail bushing is a serviceable part and can be replaced if necessary.

Examine the sealing surfaces of both case halves. Small burrs, or scratches on these surfaces can be reduced with crocus cloth or a fine tooth file.

Examine condition of the shift rail bushing in the front case. If the bushing is worn or damaged, it can be removed with a blind hole type puller. A replacement bushing can be installed with a suitable size driver. Recess the bushing slightly below the edge of the bore but do not seat it all the into the case.

GEARTRAIN

Inspect the mainshaft splines, gear teeth and bearing surfaces carefully for evidence of wear, or damage. Replace the shaft if necessary. do not attempt to salvage it if damaged.

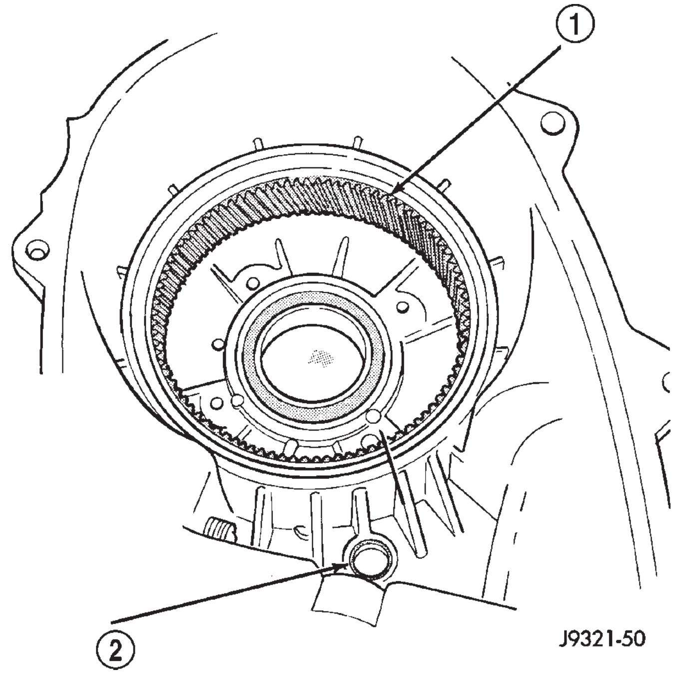


Fig. 212 Low Range Annulus Gear Location

1 - LOW RANGE ANNULUS GEAR
2 - SHIFT RAIL BUSHING

The shift rail and range fork are an assembly. Replace both parts if either is damaged. However, the nylon pads in the fork can be replaced if worn, or cracked.

Inspect the transfer case snap-rings closely. Do not attempt to salvage a distorted snap-ring by straightening or reshaping it. Replace any snap-ring that is distorted, or worn.

Inspect the low range gear, input gear and the gear thrust washers retainer, and snap-ring. The low range gear is serviced as an assembly only. Replace the gear if the case or pinions are damaged.

During inspection, also make sure the seal surface of the input gear is in good condition. Minor nicks on this surface can be reduced with crocus cloth. However, replace the gear if the seal surface is severely scored or worn.

OIL PUMP AND PROGRESSIVE COUPLING

The oil pump and progressive coupling are not serviceable components. Replace the coupling as an assembly if it is damaged. Replace the oil pump as an assembly if the gear teeth are worn, or if the pump has become damaged.

BEARINGS AND SEALS

The transfer case seals should be replaced during overhaul. Use new seals in the front and rear cases. Also replace the yoke seal washer and the detent plug O-ring.

Check condition of each transfer case bearing. Replace any bearing exhibiting signs of roughness, wear, or damage.

ASSEMBLY

Lubricate transfer case components with Mopar® Transfer Case Lubricant or petroleum jelly (where indicated) during assembly.

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

BEARINGS AND SEALS

(1) Remove front output shaft seal from front case with pry tool (Fig. 213).

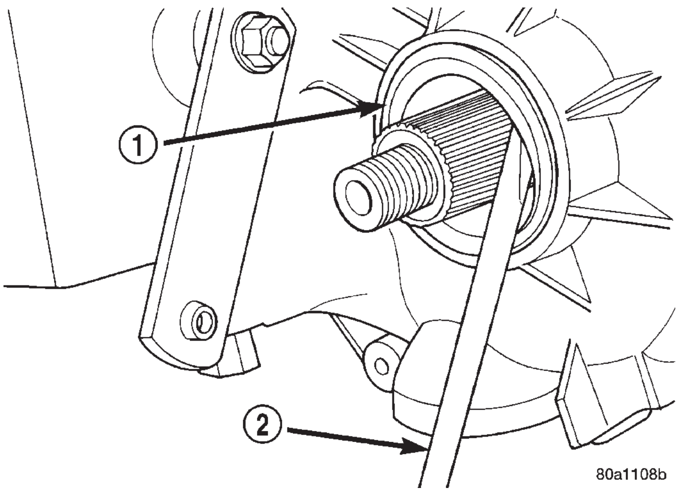


Fig. 213 Remove Front Output Shaft Seal - Typical

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

(2) Remove snap-ring that retains front output shaft bearing in front case (Fig. 214).

(3) Using tool 6953, remove bearing from front case (Fig. 215).

(4) Using tool 6953, install new bearing.

(5) Install snap-ring to hold bearing into case.

(6) Install new front output seal in front case with Installer Tool 6952-A as follows:

(a) Place new seal on tool. **Garter spring on seal goes toward interior of case.**

(b) Start seal in bore with light taps from hammer (Fig. 216). Once seal is started, continue tapping seal into bore until installer tool bottoms against case.

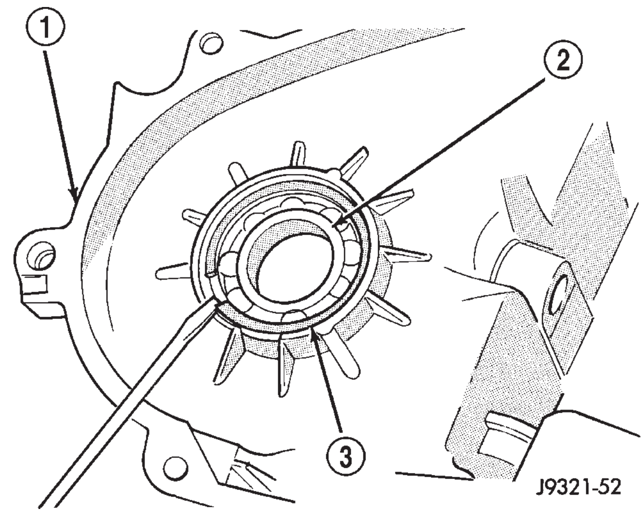


Fig. 214 Output Shaft Front Bearing Snap-Ring Removal

1 - FRONT CASE
2 - OUTPUT SHAFT FRONT BEARING
3 - BEARING SNAP-RING

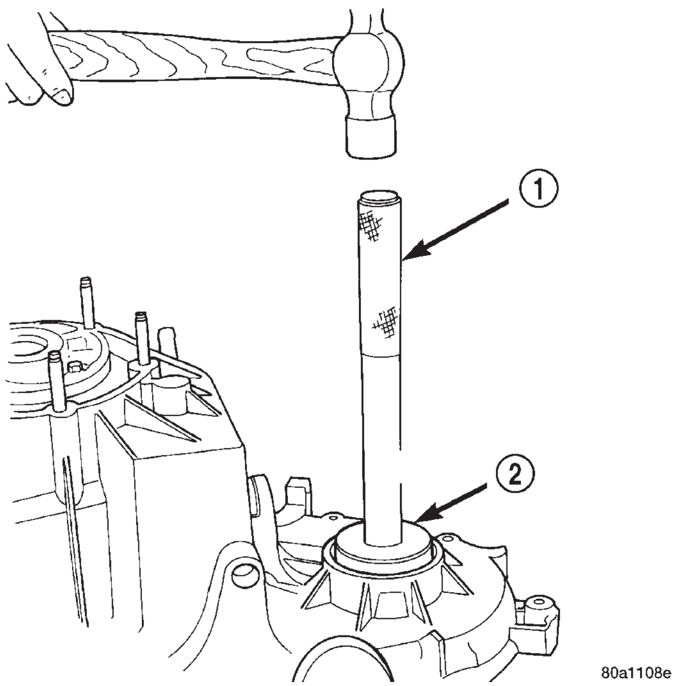


Fig. 215 Remove Output Shaft Front Bearing

1 - HANDLE C-4171
2 - REMOVER/INSTALLER 6953

TRANSFER CASE - NV247 (Continued)

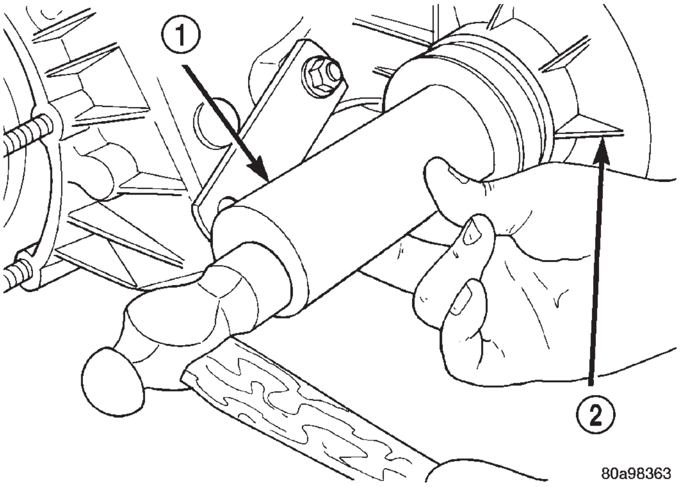


Fig. 216 Front Output Seal Installation

1 - INSTALLER 6952-A
2 - TRANSFER CASE

(7) Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 217).

(8) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 218). **The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 219).**

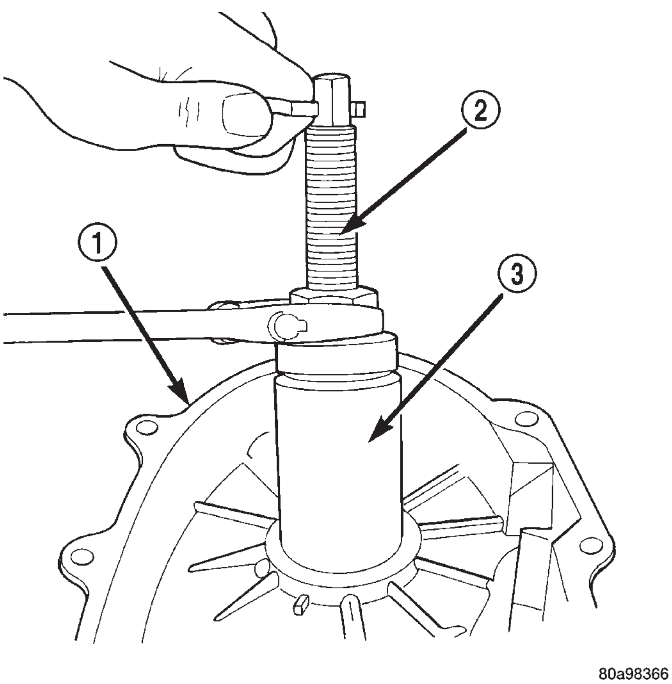


Fig. 217 Output Shaft Rear Bearing Removal

1 - REAR CASE
2 - SPECIAL TOOL L-4454-1 AND L-4454-3
3 - SPECIAL TOOL 8148

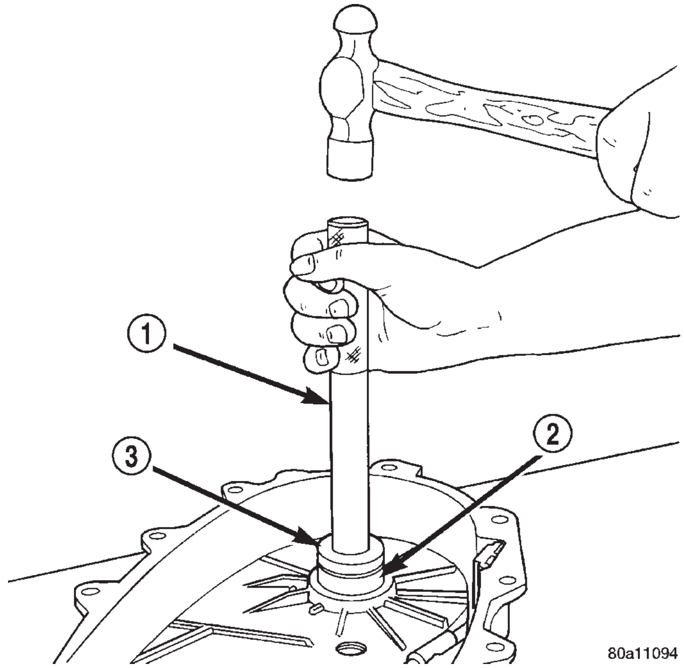


Fig. 218 Output Shaft Rear Bearing Installation

1 - HANDLE C-4171
2 - OUTPUT SHAFT INNER BEARING
3 - INSTALLER 5066

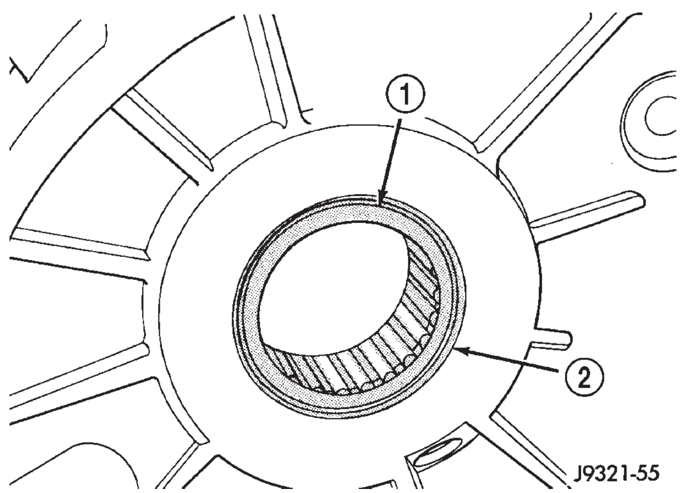


Fig. 219 Output Shaft Rear Bearing Installation Depth

1 - BEARING (SEATED) AT LOWER EDGE OF CHAMFER
2 - CHAMFER

(9) Using Remover C-4210 and Handle C-4171, drive input shaft bearing from inside the annulus gear opening in the case. (Fig. 220).

(10) Install locating ring on new bearing.

(11) Position case so forward end is facing upward.

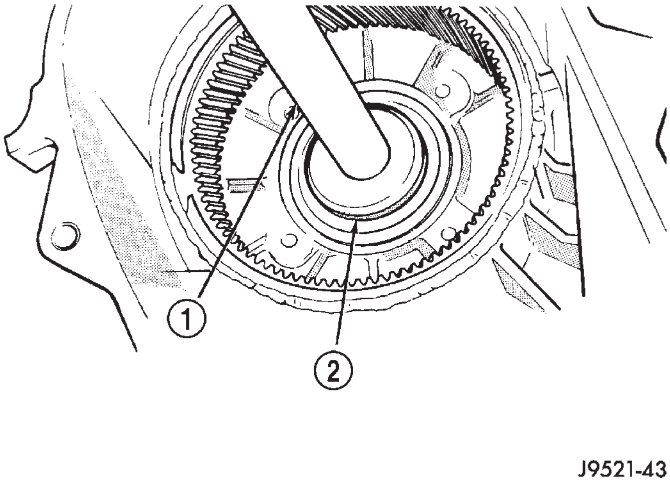


Fig. 220 Input Shaft Bearing Removal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL C-4210

(12) Using Remover C-4210 and Handle C-4171, drive input shaft bearing into case. The bearing locating ring must be fully seated against case surface.

(13) Remove input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 221).

(14) Install new pilot bearing with Installer 8128 and Handle C-4171 (Fig. 222).

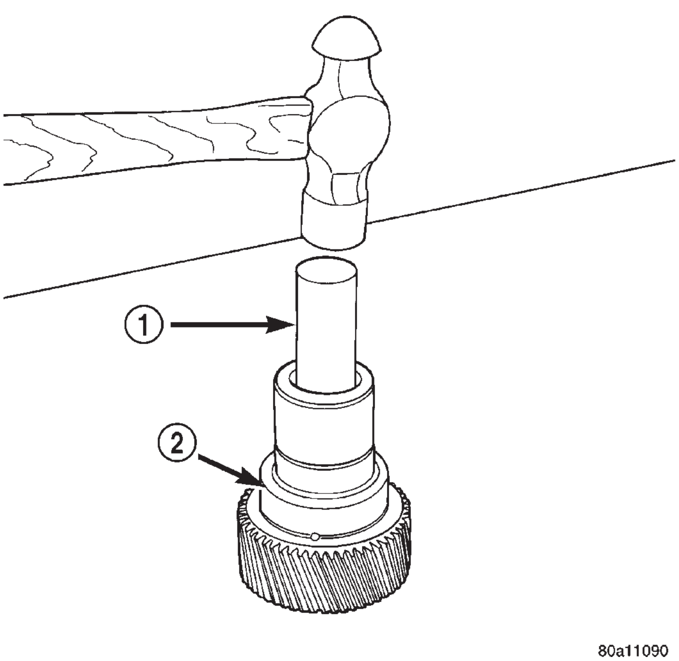


Fig. 221 Remove Input Gear Pilot Bearing

1 - DRIFT
2 - INPUT GEAR

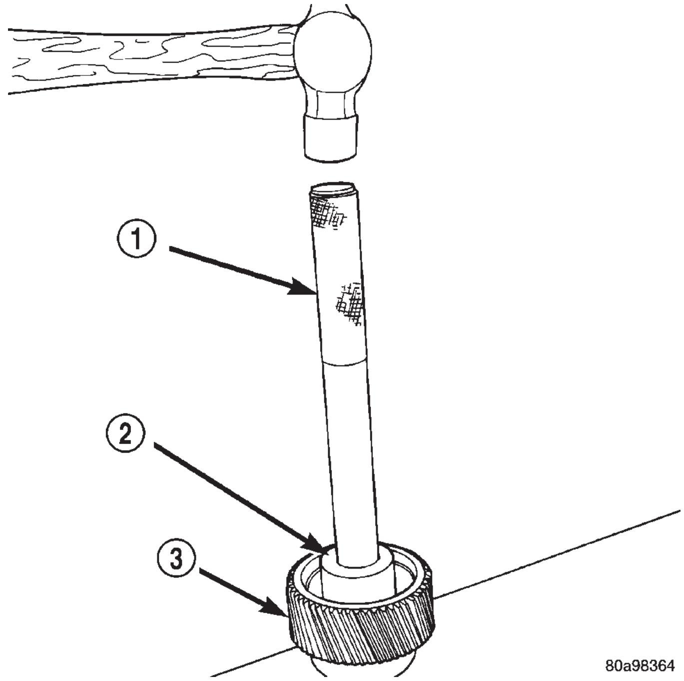


Fig. 222 Install Input Gear Pilot Bearing

1 - HANDLE C-4171
2 - INSTALLER 8128
3 - INPUT GEAR

INPUT AND LOW RANGE GEAR

(1) Lubricate gears and thrust washers (Fig. 223) with transfer case lubricant.

(2) Install first thrust washer in low range gear (Fig. 223). Be sure washer tabs are properly aligned in gear notches.

(3) Install input gear in low range gear. Be sure input gear is fully seated.

(4) Install remaining thrust washer in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.

(5) Install retainer on input gear and install snap-ring.

(6) Align and install low range/input gear assembly in front case (Fig. 224). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

(7) Install snap-ring to hold input/low range gear into front bearing.

(8) Install a new input shaft seal with Installer C-3995-A and Universal Handle C-4171.

TRANSFER CASE - NV247 (Continued)

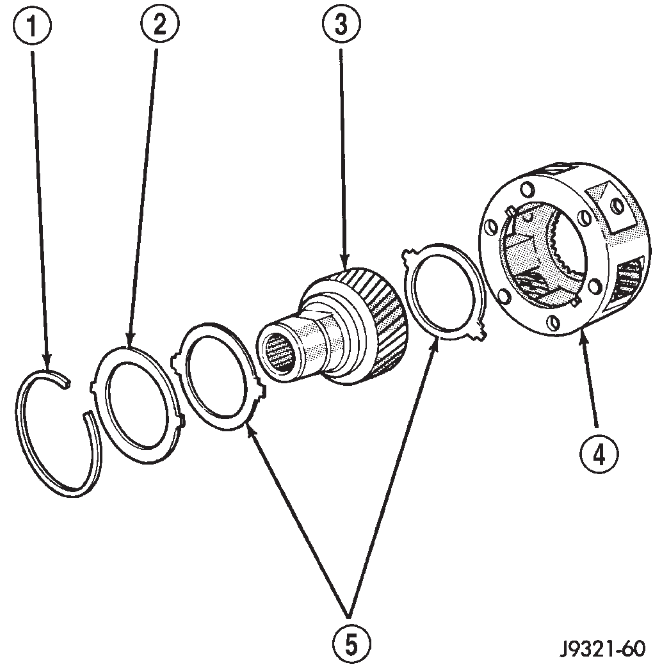


Fig. 223 Input/Low Range Gear Components

1 - SNAP-RING
2 - RETAINER PLATE
3 - INPUT GEAR
4 - LOW RANGE GEAR
5 - THRUST WASHERS

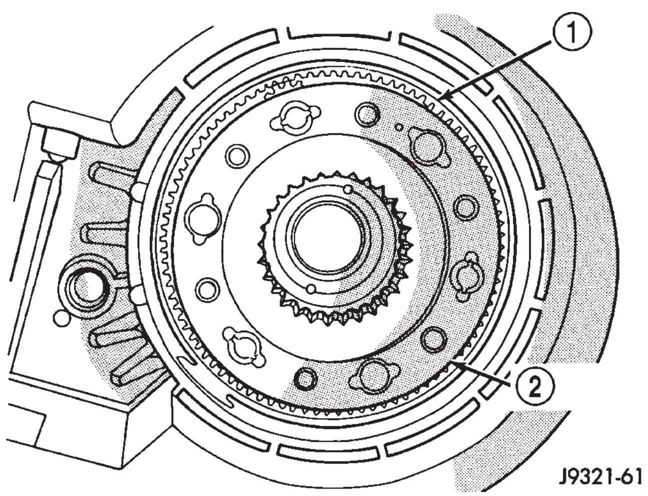


Fig. 224 Input/Low Range Gear Installation

1 - ANNULUS GEAR
2 - INPUT/LOW RANGE GEAR

SHIFT FORKS AND MAINSHAFT

(1) Install new sector shaft O-ring and bushing (Fig. 225).

(2) Install shift sector.

(3) Install locking clutch spring, locking clutch, blockout spring, and range clutch sleeve, to mainshaft as shown in (Fig. 226). Install snap ring.

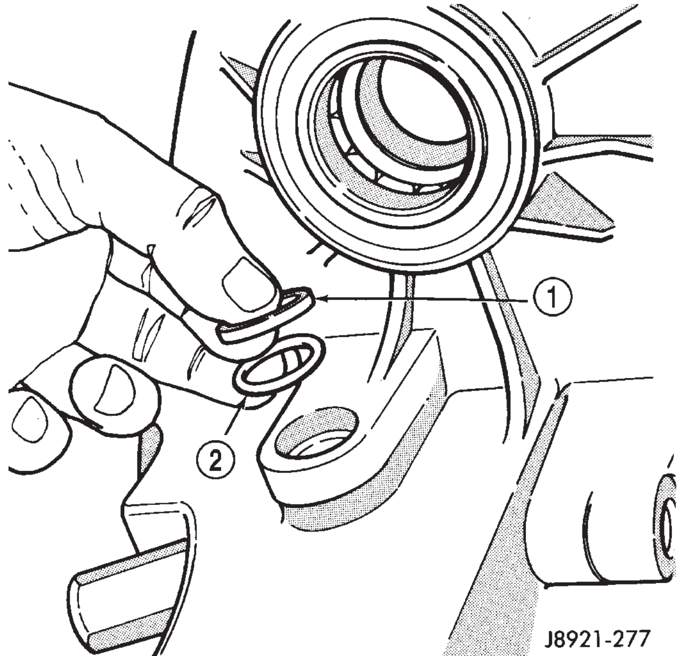


Fig. 225 Sector O-Ring And Bushing Installation

1 - SECTOR BUSHING
2 - O-RING

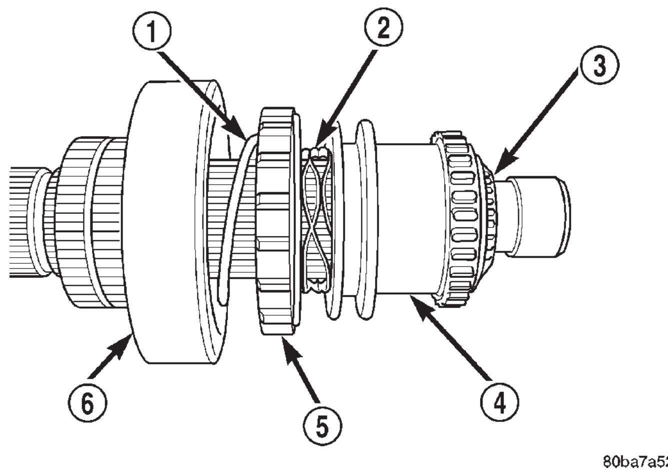


Fig. 226 Range Clutch Sleeve, Blockout Spring, Locking Clutch and Spring

1 - LOCKING CLUTCH SPRING
2 - BLOCKOUT SPRING
3 - SNAP-RING
4 - RANGE CLUTCH SLEEVE
5 - LOCKING CLUTCH
6 - DRIVE SPROCKET HUB

(4) Install drive sprocket hub to mainshaft and manually load the needle bearings.

(5) Install new pads on range fork, if necessary.

(6) Install range shift fork to range clutch sleeve. Install mainshaft/range shift fork assembly into transfer case and input planetary assembly. Rotate fork until it engages with slot in shift sector.

TRANSFER CASE - NV247 (Continued)

(7) Install shift rail to shift range fork and transfer case housing.

(8) Rotate shift sector to NEUTRAL position.

(9) Install new O-ring on detent plug (Fig. 227).

(10) Lubricate detent plunger with transfer case lubricant or light coat of petroleum jelly.

(11) Install detent plunger, spring and plug (Fig. 227).

(12) Verify that plunger is properly engaged in sector.

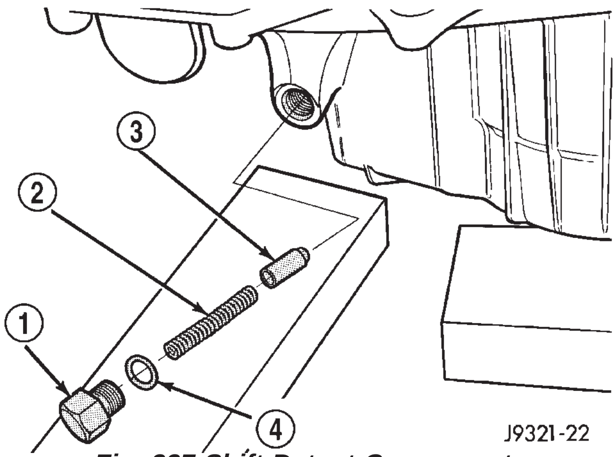


Fig. 227 Shift Detent Components

1 - DETENT PLUG
2 - DETENT SPRING
3 - DETENT PLUNGER
4 - PLUG O-RING

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Install the front output shaft drive gear (Fig. 228) onto the front output shaft.

(2) Install the front output shaft drive gear snap-ring (Fig. 229) onto the output shaft.

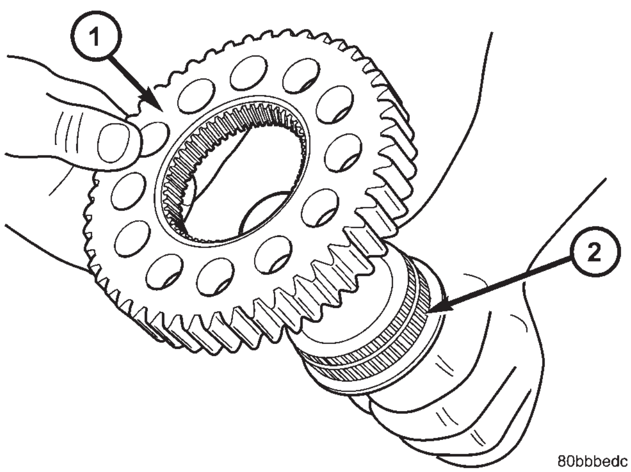


Fig. 228 Install Front Output Shaft Drive Gear

1 - FRONT OUTPUT SHAFT DRIVE GEAR
2 - FRONT OUTPUT SHAFT

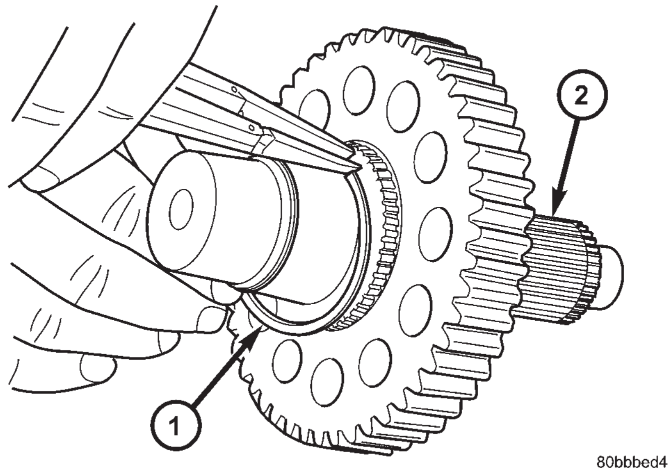


Fig. 229 Install Front Output Shaft Drive Gear Snap-ring

1 - FRONT OUTPUT SHAFT DRIVE GEAR SNAP-RING
2 - FRONT OUTPUT SHAFT

(3) Install the oil pump pickup tube (Fig. 230) into the front transfer case half.

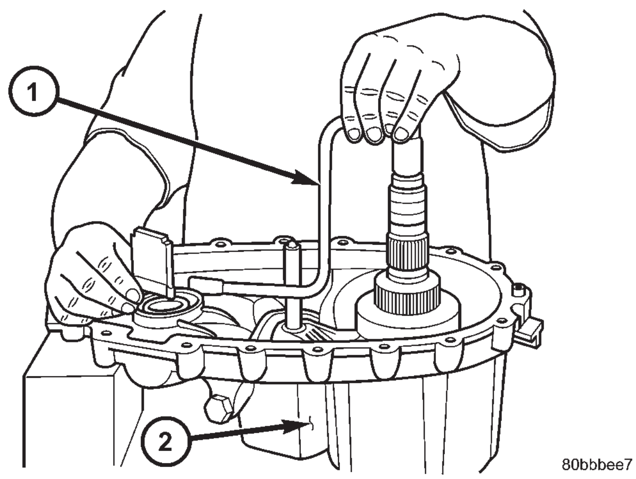


Fig. 230 Install Oil Pump Pickup Tube

1 - OIL PUMP PICKUP TUBE
2 - FRONT CASE HALF

(4) Lubricate front output shaft assembly, drive chain and drive gear with transfer case lubricant.

(5) Assemble drive chain, drive gear and front output shaft (Fig. 231).

(6) Start drive gear on mainshaft.

(7) Guide front output shaft into bearing and drive gear onto mainshaft drive gear (Fig. 231).

(8) Install drive gear snap-ring (Fig. 232).

TRANSFER CASE - NV247 (Continued)

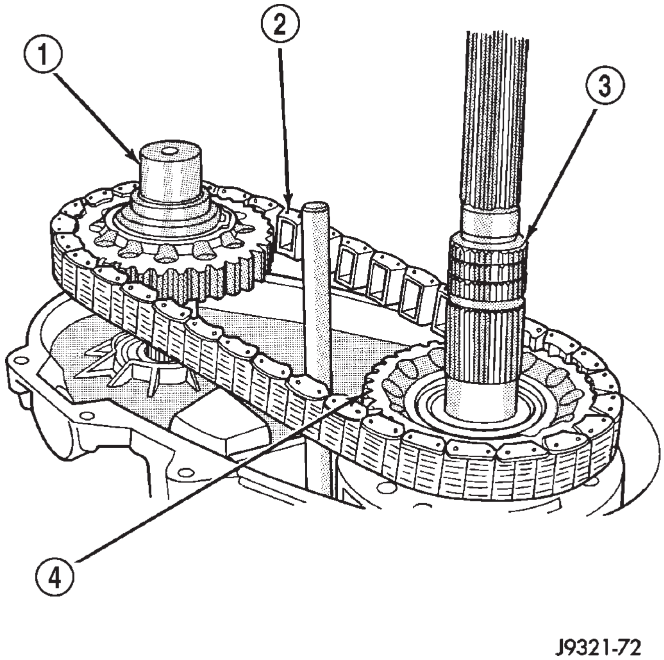


Fig. 231 Installing Drive Chain, Front Output Shaft And Drive Gear

1 - FRONT OUTPUT SHAFT
2 - DRIVE CHAIN
3 - MAINSHAFT
4 - DRIVE GEAR

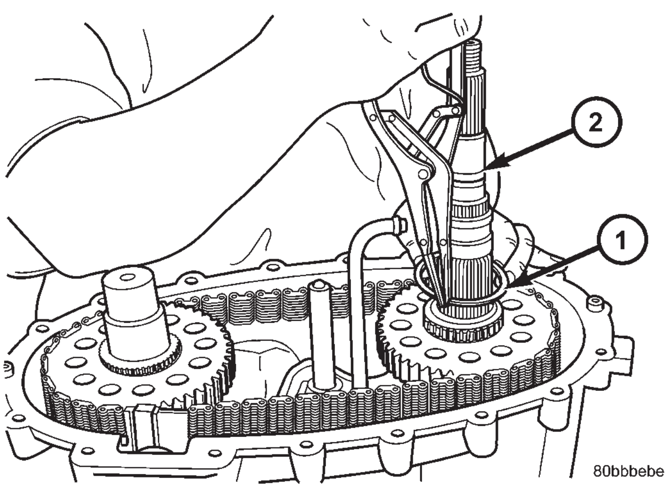


Fig. 232 Install Output Shaft Drive Gear Snap-ring

1 - REAR OUTPUT SHAFT DRIVE GEAR SNAP-RING
2 - REAR OUTPUT SHAFT

PROGRESSIVE COUPLING

(1) Install progressive coupling (Fig. 233).

(2) Install the progressive coupling thrust washer (Fig. 234) over the output shaft and against the coupling.

(3) Install the progressive coupling snap-ring (Fig. 235) onto the output shaft.

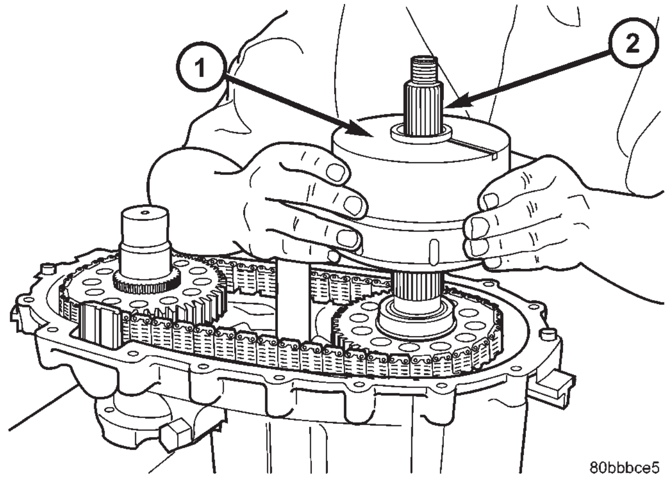


Fig. 233 Install Progressive Coupler

1 - PROGRESSIVE COUPLING
2 - MAINSHAFT

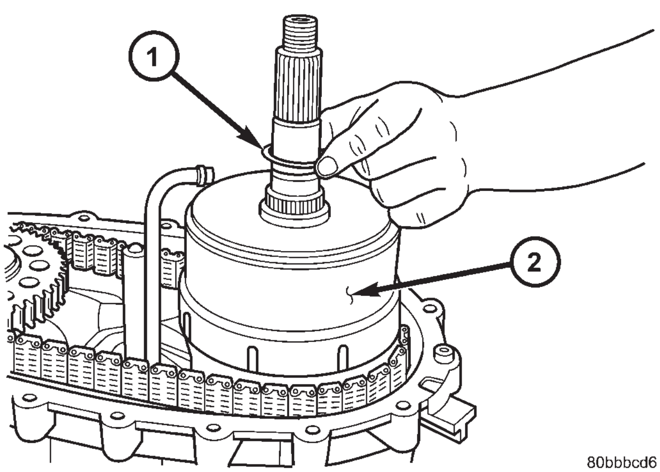


Fig. 234 Install Progressive Coupler Thrust Washer

1 - PROGRESSIVE COUPLING THRUST WASHER
2 - PROGRESSIVE COUPLING

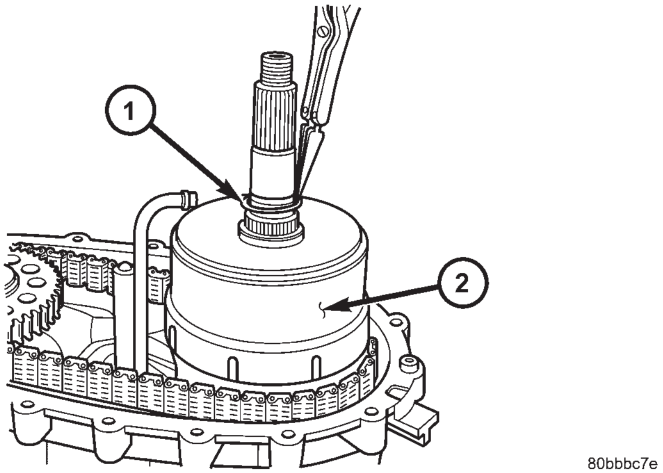


Fig. 235 Install Progressive Coupler Snap-ring

1 - PROGRESSIVE COUPLING SNAP-RING
2 - PROGRESSIVE COUPLING

OIL PUMP

(1) Install new O-ring on flanged end of oil pickup tube.

(2) Install oil pump (Fig. 236).

(3) Install oil pump retaining snap-ring (Fig. 237).

(4) Insert oil pickup tube in pump (Fig. 238).

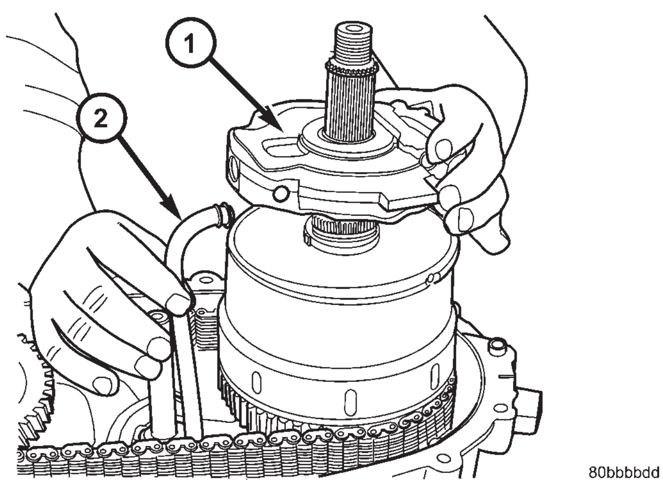


Fig. 236 Install Oil Pump

1 - OIL PUMP
2 - OIL PUMP PICKUP TUBE

REAR CASE

(1) Install magnet in front case pocket (Fig. 239).

(2) Clean sealing flanges of front case and rear case with a wax and grease remover.

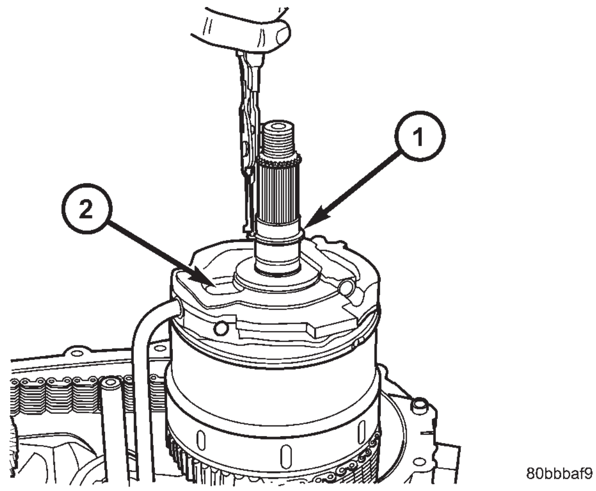


Fig. 237 Install Oil Pump Snap-ring

1 - OIL PUMP SNAP-RING
2 - OIL PUMP

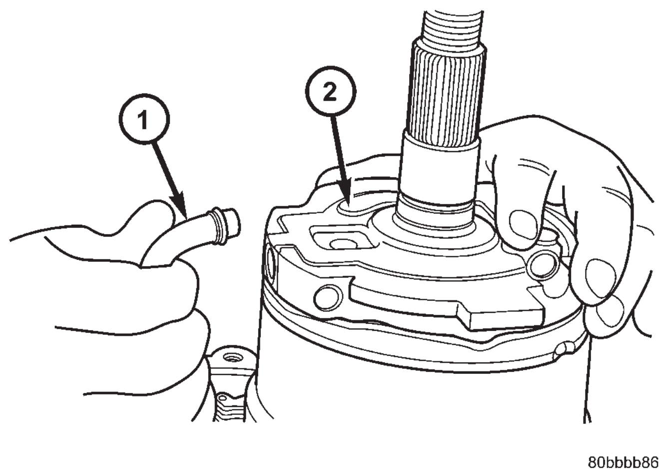


Fig. 238 Engage Oil Pump Tube to Oil Pump

1 - OIL PUMP PICKUP TUBE
2 - OIL PUMP

(3) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting flange of front case. Work sealer bead around bolt holes as shown (Fig. 240).

(4) Align and install rear case on front case.

(5) Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (Fig. 241).

(6) Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

TRANSFER CASE - NV247 (Continued)

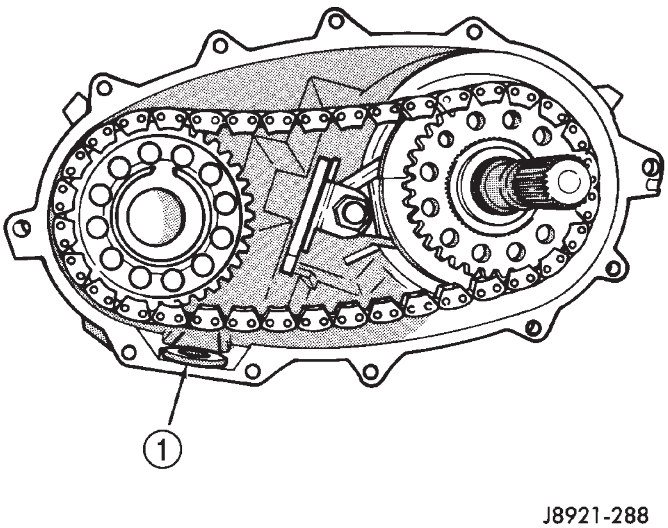


Fig. 239 Installing Case Magnet

1 - MAGNET

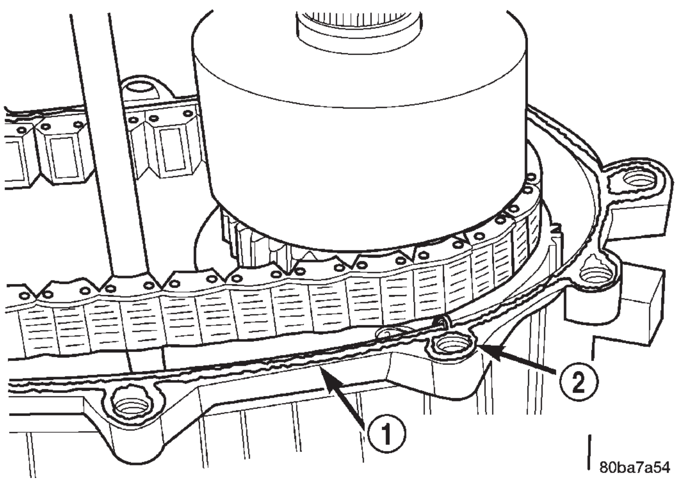


Fig. 240 Applying Sealer To Front Case Flange

1 - FRONT CASE FLANGE
2 - SEALER BEAD

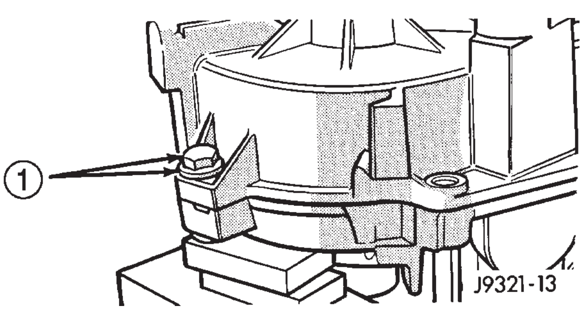


Fig. 241 Alignment Bolt

1 - ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

COMPANION FLANGE AND RANGE LEVER

(1) Install range lever, washer and locknut on sector shaft (Fig. 242). Tighten locknut to 27-34 N·m (20-25 ft. lbs.) torque.

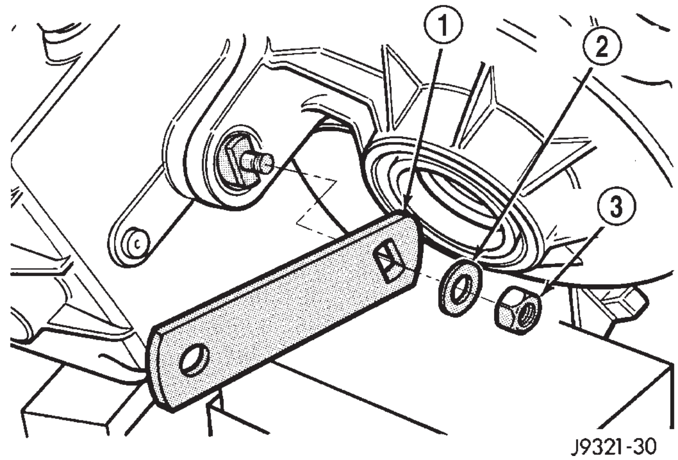


Fig. 242 Range Lever Installation - Typical

1 - RANGE LEVER
2 - WASHER
3 - LOCKNUT

(2) Install new seal washer on front output shaft (Fig. 243).

(3) Lubricate flange hub with transfer case lubricant and install flange on front shaft.

(4) Install new seal washer on front shaft.

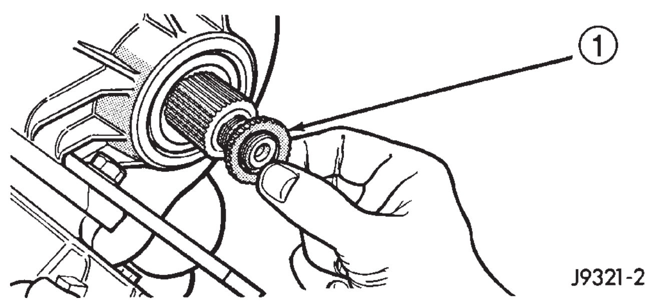


Fig. 243 Flange Seal Washer Installation

1 - YOKE SEAL WASHER

(5) Install companion flange and new nut on front output shaft.

(6) Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281 (Fig. 244), or similar tool to hold flange while tightening flange nut.

(7) Install companion flange and new nut on rear output shaft.

(8) Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281, or similar tool to hold flange while tightening flange nut.

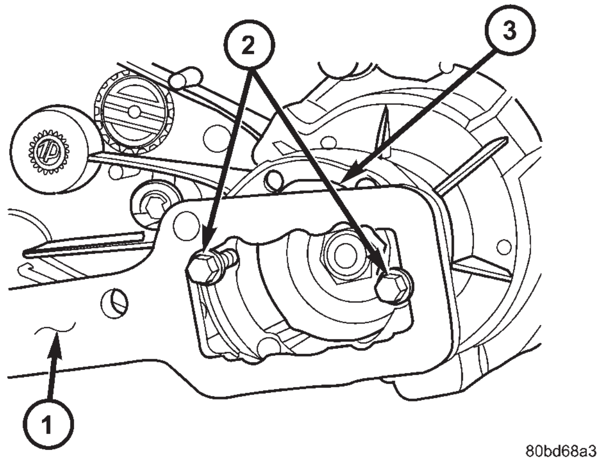


Fig. 244 Hold Companion Flange

1 - HOLDER C-3281
2 - BOLTS
3 - COMPANION FLANGE

FINAL ASSEMBLY

(1) Position transfer case damper onto the transfer case.

(2) Install the damper bolts (Fig. 245). Tighten bolts to 41-54 N·m (30-40 ft. lbs.) torque.

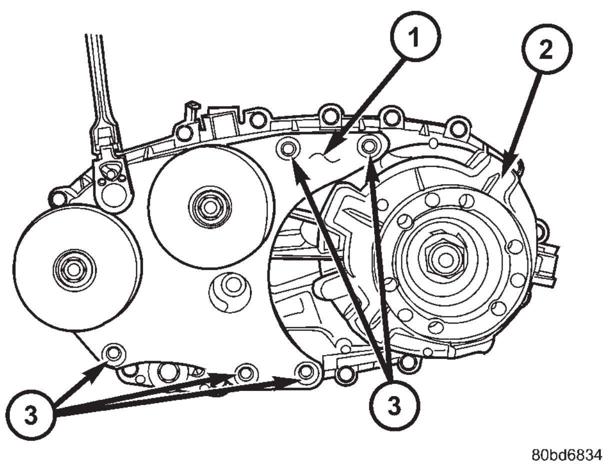


Fig. 245 Install Damper Bolts

1 - DAMPER
2 - TRANSFER CASE
3 - BOLTS

(3) Install drain plug. Tighten plug to 41-54 N·m (30-40 ft. lbs.) torque.

(4) Level transfer case and fill it with Mopar® Transfer Case Lubricant. Correct fill level is to bottom edge of fill plug hole.

(5) Install and tighten fill plug to 41-54 N·m (30-40 ft. lbs.) torque.

INSTALLATION

NOTE: If a replacement transfer case is being installed, be certain the counter weight is installed on the transfer case housing prior to installation.

(1) Install the transfer case on the transmission. Torque the transfer case retaining nuts to 75 N·m (55 ft. lbs.).

(2) Install the vent tube on the transfer case.

(3) Connect the transfer case shift cable on the shifter arm.

(4) Using the jack, raise the transmission assembly into position and install the (8) transmission support crossmember retaining bolts (Fig. 246). Torque the bolts to 41 N·m (30 ft. lbs.).

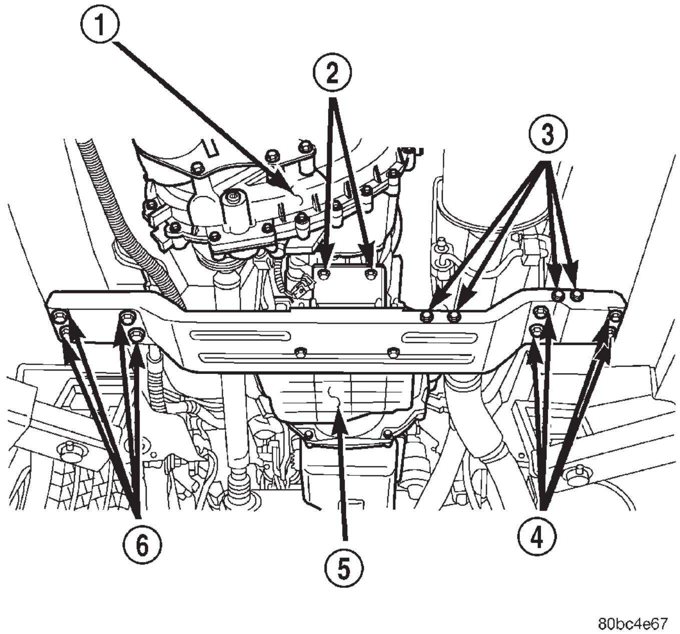


Fig. 246 Transmission Support Crossmember Position and Orientation

1 - TRANSFER CASE
2 - TRANSMISSION MOUNT RETAINING BOLTS (2 OF 4)
3 - EXHAUST SYSTEM SUPPORT BRACKET RETAINING BOLTS
4 - CROSSMEMBER RETAINING BOLTS
5 - TRANSMISSION
6 - CROSSMEMBER RETAINING BOLTS

TRANSFER CASE - NV247 (Continued)

(5) Install the rear driveshaft. Torque the bolts to 32 N·m (24 ft. lbs.). Be certain to install the driveshaft in the same position as before removal.

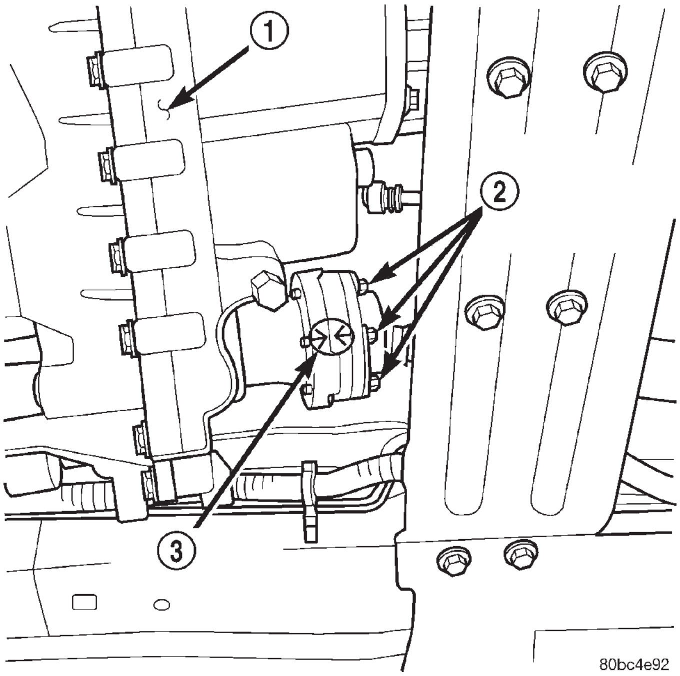


Fig. 247 Front Driveshaft Retaining Bolts

1 - TRANSFER CASE
2 - FRONT DRIVESHAFT RETAINING BOLTS
3 - REFERENCE MARK

(6) Install the front driveshaft. Torque the bolts to 32 N·m (24 ft. lbs.) (Fig. 247). Be certain to install the driveshaft in the same position as before removal.

(7) Install the (2) lower fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(8) Lower the vehicle on the hoist.

(9) Install the (2) upper fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(10) Fill the transmission fluid to specification.

(11) Connect the negative battery cable.

SPECIFICATIONS

TRANSFER CASE - NV247

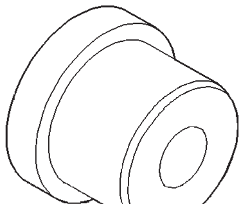
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, crossmember	41-47	30.2-34.7	-
Plug, Detent	16-24	11.8-17.7	-
Plugs, drain/fill	41-54	30.2-39.8	-
Bolts, case half	27-34	19.9-25	-
Nut, companion flange	122-176	90-130	-
Lock-nut, shift	27-34	19.9-25	-
Nuts, T-case mount stud	33-41	24.3-30.2	-

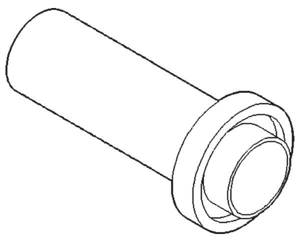
TRANSFER CASE - NV247 (Continued)

SPECIAL TOOLS

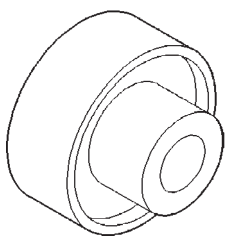
TRANSFER CASE - NV247



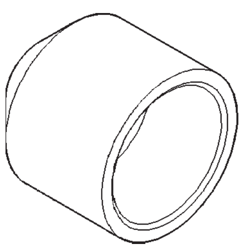
Installer, Bearing - 5066



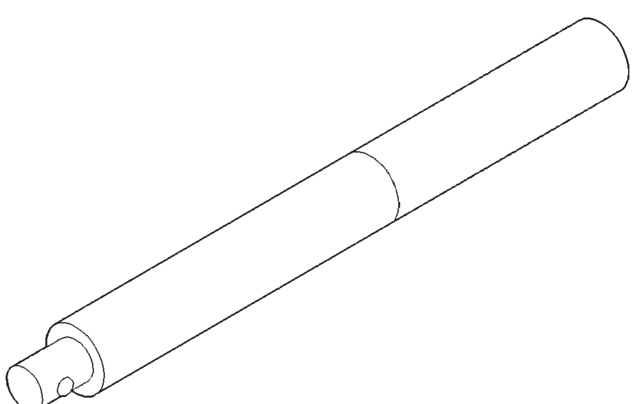
Installer, Seal - 6952-A



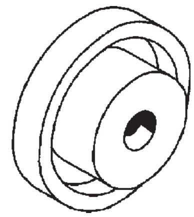
Installer, Bearing - 6953



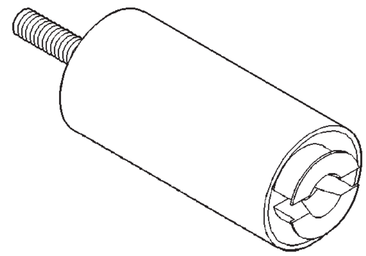
Installer, Seal - C-3995-A



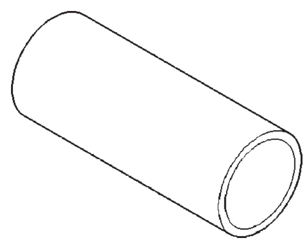
Handle - C-4171



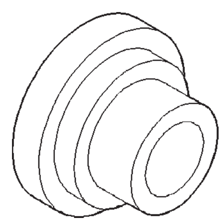
Remover, Bearing - C-4210



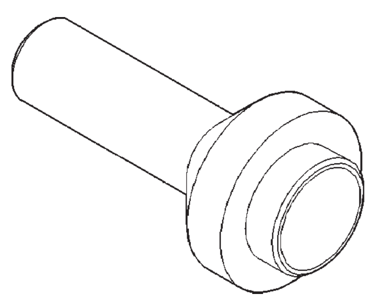
Remover, Bearing - L-4454



Cup, Installer - 8148



Installer, Bearing - 8128



Installer, Seal - 7884

EMISSIONS CONTROL - 2.7L DIESEL

TABLE OF CONTENTS

EMISSIONS CONTROL - 2.7L DIESEL

DESCRIPTION

The 2.7L diesel Engine Control Module (ECM) controls many different circuits in the fuel injection and engine systems. If the ECM senses a problem with a monitored circuit that indicates an actual problem, a Diagnostic Trouble Code (DTC) will be stored in the ECM's memory, and eventually may illuminate the MIL (Malfunction Indicator Lamp) constantly while the key is on. If the problem is repaired, or is intermittent, the ECM will erase the DTC after 40 warm-up cycles without the the fault detected. A warm-up cycle consists of starting the vehicle when the engine is cold, then the engine is warmed up to a certain temperature, and finally, the engine temperature falls to a normal operating temperature, then the key is turned off.

Certain criteria must be met for a DTC to be entered into ECM memory. The criteria may be a specific range of engine rpm, engine or fuel temperature and/or input voltage to the ECM. A DTC indicates that the ECM has identified an abnormal signal in a circuit or the system.

There are several operating conditions that the ECM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non–Monitored Circuits in this section.

ECM MONITORED SYSTEMS

The ECM can detect certain problems in the electrical system.

Open or Shorted Circuit – The ECM will not distinguish between an open or a short to ground, however the ECM can determine if there is excessive current on a circuit, such as a short to voltage or a decrease in component resistance.

Output Device Current Flow – The ECM senses whether the output devices are electrically connected.

If there is a problem with the circuit, the ECM senses whether the circuit is open, shorted to ground (–), or shorted to (+) voltage.

Fuel Pressure: Fuel pressure is controlled by the fuel injection pump and fuel pressure solenoid. The ECM uses a fuel pressure sensor to determine if a fuel pressure problem exists.

Fuel Injector Malfunctions: The ECM can determine if a fuel injector has an electrical problem. The fuel injectors on the diesel engine are **controlled** by the ECM.

ECM NON–MONITORED SYSTEMS

The ECM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A DTC will not be displayed for these conditions.

Cylinder Compression: The ECM cannot detect uneven, low, or high engine cylinder compression.

Exhaust System: The ECM cannot detect a plugged, restricted or leaking exhaust system.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of the Exhaust Gas Recirculation System (EGR) are not monitored by the ECM.

ECM System Ground: The ECM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

ECM/PCM Connector Engagement: The ECM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The ECM compares input signals from each input device. It has high and low limits that are programmed into it for that device. If the inputs are not within specifications and other DTC criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the ECM when it senses a high or low input voltage from the control system device in question.

EXHAUST GAS RECIRCULATION

TABLE OF CONTENTS

EXHAUST GAS RECIRCULATION

DESCRIPTION

The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming fuel/air mixture.

A malfunctioning EGR system can cause engine stumble, sags, or hesitation, rough idle, engine stalling and poor driveability.

OPERATION

The system consists of:

- An EGR valve assembly, located toward the rear of the engine on the intake manfiold.
- An EGR solenoid, located in the left rear of engine compartment near EGR valve. The EGR solenoid controls the “on time” of the EGR valve.
- The ECM operates the EGR solenoid. The ECM is located inside the vehicle under the instrument panel.
- The vacuum pump supplies vacuum for the EGR solenoid and the EGR valve. This pump also supplies vacuum for operation of the power brake booster and the heating and air conditioning system. The pump is located in the front of the engine block and is driven by the exhaust camshaft.
- Vacuum lines and hoses connect the various components.

When the ECM supplies a variable ground signal to the EGR solenoid, EGR system operation begins. The ECM will monitor and determine when to supply and remove this variable ground signal. This will depend on inputs from the engine coolant temperature, throttle position and engine speed sensors.

When the variable ground signal is supplied to the EGR solenoid, vacuum from the vacuum pump will be allowed to pass through the EGR solenoid and on to the EGR valve with a connecting hose.

Exhaust gas recirculation will begin in this order when:

- The ECM determines that EGR system operation is necessary.
- The engine is running to operate the vacuum pump.
- A variable ground signal is supplied to the EGR solenoid.
- Variable vacuum passes through the EGR solenoid to the EGR valve.
- The inlet seat (poppet valve) at the bottom of the EGR valve opens to dilute and recirculate exhaust gas back into the intake manifold.

The EGR system will be shut down by the ECM after 60 seconds of continuous engine idling to improve idle quality.

VALVE

DESCRIPTION

The egr valve is mounted to the intake manifold at the left rear corner of the engine (Fig. 1).

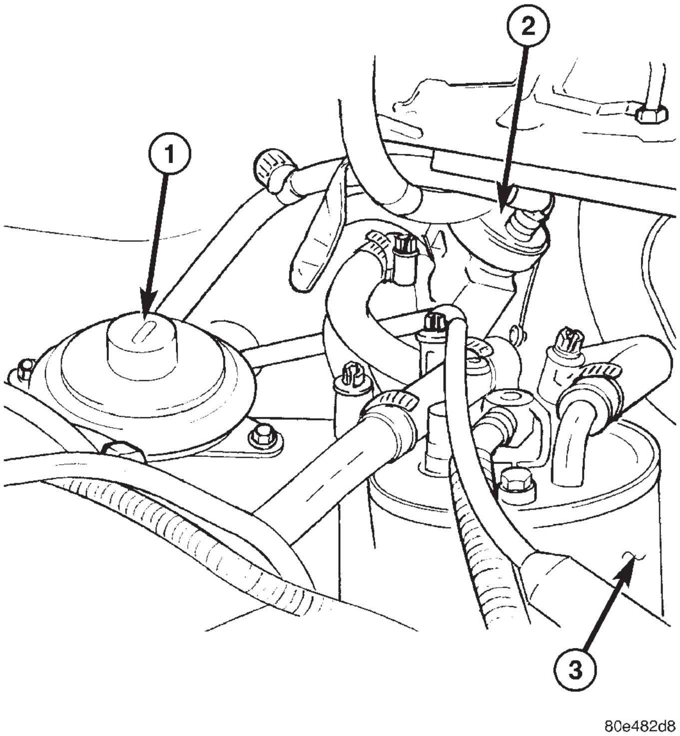


Fig. 1 EGR COMPONENTS

1 - EGR VALVE
2 - EGR SOLENOID
3 - FUEL FILTER

OPERATION

The engines use Exhaust Gas Recirculation (EGR) systems. The EGR system reduces oxides of nitrogen (NOx) in engine exhaust and helps prevent detonation (engine knock). Under normal operating conditions, engine cylinder temperature can reach more than 3000°F. Formation of NOx increases proportionally with combustion temperature. To reduce the emission of these oxides, the cylinder temperature must be lowered. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming air/fuel mixture. The diluted air/fuel mixture reduces peak flame temperature during combustion.

REMOVAL

(1) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(2) Disconnect EGR valve vacuum line (Fig. 2).

(3) Remove EGR valve retaining bolts and EGR valve (Fig. 2).

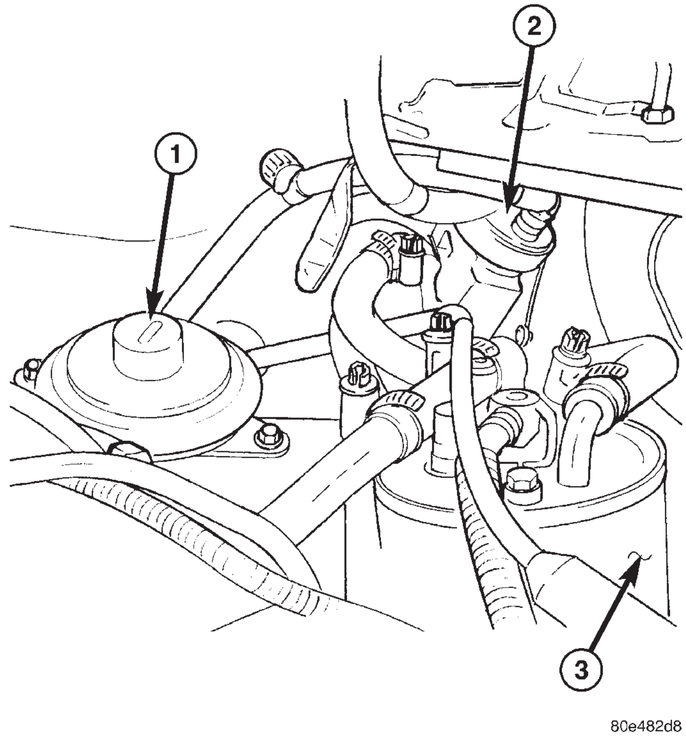


Fig. 2 EGR COMPONENTS

1 - EGR VALVE
2 - EGR SOLENOID
3 - FUEL FILTER

INSTALLATION

(1) Clean EGR valve sealing surfaces.

(2) Lubricate o-ring and install egr valve in intake manifold. Tighten EGR valve retaining bolts (Fig. 2).

(3) Connect vacuum line (Fig. 2).

(4) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

SOLENOID

DESCRIPTION

The EGR solenoid is mounted in the left-rear of the engine compartment (Fig. 3). The EGR solenoid serves two different functions. One is to control vacuum bleed-off of the EGR valve. The other is to control the “on time” of the EGR valve.

REMOVAL

(1) Disconnect negative battery cable.

(2) Disconnect EGR solenoid electrical connector.

(3) Disconnect EGR solenoid from engine vacuum harness (Fig. 3).

(4) Remove EGR solenoid from bracket (Fig. 3).

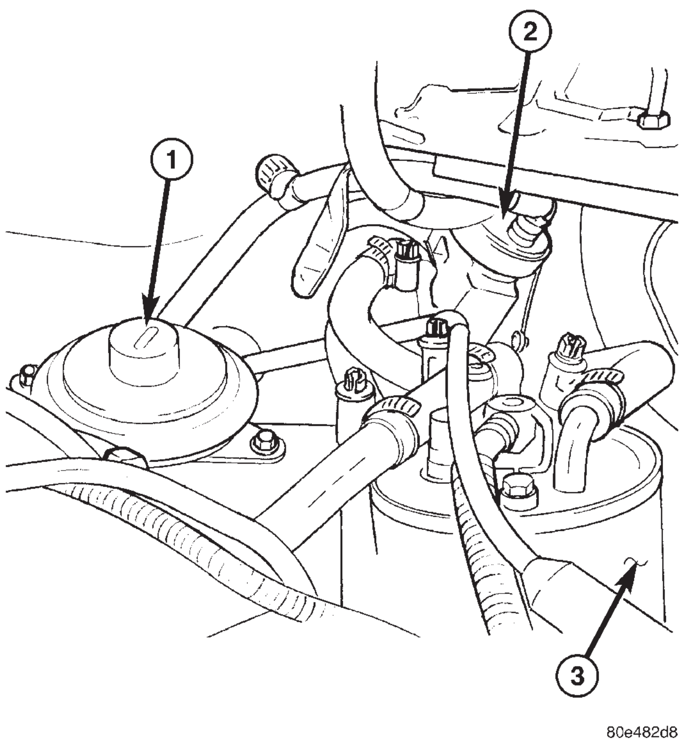


Fig. 3 EGR COMPONENTS

1 - EGR VALVE
2 - EGR SOLENOID
3 - FUEL FILTER

INSTALLATION

(1) Position and install EGR solenoid onto bracket.

(2) Connect engine vacuum harness to EGR solenoid.

(3) Connect EGR solenoid electrical connector.

(4) Connect negative battery cable.

ON-BOARD DIAGNOSTICS

TABLE OF CONTENTS

ON-BOARD DIAGNOSTICS

DESCRIPTION - DIAGNOSTIC TROUBLE CODES

On the following pages, a list of DTC's is provided for the 2.7L diesel engine. A DTC indicates that the ECM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but most likely will not identify the failed component directly. Refer to the appropriate diagnostic manual for more information on diagnosis of trouble codes.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored DTC can be displayed through the use of the DRB III® scan tool. The DRB III® connects to the data link connector. The data link connector is located under the instrument panel near bottom of the steering column (Fig. 1).

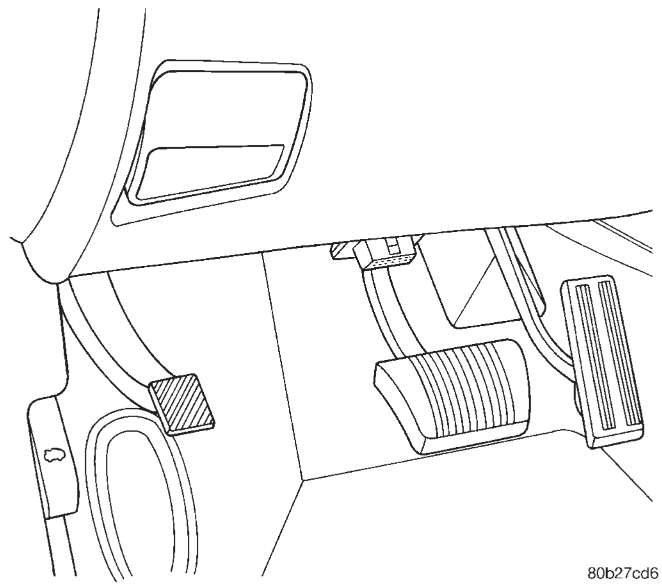


Fig. 1 Data Link Connector - Typical

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB III® scan tool to erase a DTC.

ON-BOARD DIAGNOSTICS (Continued)

ENGINE CONTROL MODULE (ECM) - DRBIII® CODES

Generic Scan Tool Code	DRB III® Scan Tool Display
P0070	Ambient Air Temperature Circuit Signal Voltage Too High Ambient Air Temperature Circuit Signal Voltage Too Low
P0100	Mass Air Flow Sensor Signal Voltage Too High Mass Air Flow Sensor Signal Voltage Too Low Mass Air Flow Sensor Supply Voltage Out of Range
P0105	Barometric Pressure Circuit Signal Voltage To High Barometric Pressure Circuit Signal Voltage To Low
P0110	Charge Air Temperature Sensor Circuit Signal Too High Charge Air Temperature Sensor Circuit Signal Too Low
P0115	Engine Coolant Temperature Sensor Circuit Voltage To Low Engine Coolant Temperature Sensor Circuit Voltage To High
P0190	Fuel Pressure Sensor Signal Voltage Too High Fuel Pressure Sensor Signal Voltage Too Low Fuel Pressure Sensor Signal Voltage Out of Range
P0201	Injector 1 Over Current Low Side Injector 1 Over Current High Side Injector 1 Load Drop Injector 1 SL Error
P0202	Injector 2 Over Current Low Side Injector 2 Over Current High Side Injector 2 Load Drop Injector 2 SL Error
P0203	Injector 3 Over Current Low Side Injector 3 Over Current High Side Injector 3 Load Drop Injector 3 SL Error
P0204	Injector 4 Over Current Low Side Injector 4 Over Current High Side Injector 4 Load Drop Injector 4 SL Error
P0205	Injector 5 Over Current Low Side Injector 5 Over Current High Side Injector 5 Load Drop Injector 5 SL Error

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P0235	Boost Pressure Sensor Plausibility Boost Pressure Sensor Signal Voltage Too Low Boost Pressure Sensor Signal Voltage Too High Boost Pressure Sensor Signal Voltage Too High Or Low
P0243	Boost Pressure EVM Short Circuit Boost Pressure EVM Open Circuit Boost Pressure EVM Positive Governor Deviation Boost Pressure EVM Negative Governor Deviation
P0335	Engine Speed Sensor
P0340	CMP Signal Frequency Too High IAT Failure IAT Dynamically Implausible CMP Signal Static Defect
P0380	Glow Plug Relay 1 Open Circuit Glow Plug Relay 1 Short Circuit
P0382	Glow Plug Relay 2 Open Circuit Glow Plug Relay 2 Short Circuit
P0403	EGR EVM Open Load EGR EVM Short Circuit EGR EVM Negative Governor Deviation
P0460	Fuel Level Sensor Signal Too Low Fuel Level Sensor Signal Too High
P0500 test	Vehicle Speed Sensor Frequency Too High Vehicle Speed Sensor Plausibility Vehicle Speed Sensor Signal Voltage Too High
P0514	Battery Temperature Sensor Signal Too High Battery Temperature Sensor Signal Too Low
P0520	Oil Pressure Sensor Signal Too High Oil Pressure Sensor Signal Too Low Oil Pressure Sensor Supply Out of Range
P0530	A/C Pressure Transducer Out of Range A/C Pressure Transducer Signal Voltage Too High A/C Pressure Transducer Signal Voltage Too Low
P0560	Battery Voltage Signal Too High Battery Voltage Signal Too Low

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P0579	Speed Control Switch Signal Too High Speed Control Switch Signal Too Low Speed Control Switch Plausibility Error
P0606	ECM Recovery Flag ECM Redundant Monitoring ECM Gate Array Monitoring
P0615	Starter Relay Circuit Short Circuit
P0620	Generator Battery Voltage Too Low Generator Battery Voltage Too High Generator Short Circuit Generator Open Load Generator High Current Generator High Battery Voltage Difference Generator Low Battery Voltage Difference
P0641	ECM Sensor Supply Too High ECM Sensor Supply Too Low
P0645	A/C Compressor Relay Control Open Load A/C Compressor Relay Control Short Circuit
P0651	ECM Sensor Supply Too Low ECM Sensor Supply Too High
P0685	ECM (ASD) Relay Control Circuit Shuts Off Too Early ECM (ASD) Relay Control Circuit Shuts Off Too Late
P700	EGS Transmission Faults Shift Solenoid A Electrical Shift Solenoid B Electrical Shift Solenoid C Electrical Torque Converter Clutch Electrical Pressure Control Solenoid Electrical Pressure Control Solenoid B Electrical Transmission Control System Electrical
P702	Input Turbine Speed Circuit Malfunction Selector Lever: Code Invalid or CAN Message Distorted or Position Implausible CAN: Right and Left Rear Wheel Speed Implausible or Inconsistent ABS - Node or ABS Information Distorted Transmission Fault CAN: T - Case Information Implausible or Information Distorted Torque Converter Lock - Up - Clutch Gear Recognition Negative

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P0703	Brake Switch Signal Plausibility Brake Switch Signal Plausibility After Initialization
P0836	4 Wheel Drive Switch Signal Too Low 4 Wheel Drive Switch Signal Too High 4 Wheel Drive Switch Plausibility Error 2 4 Wheel Drive Switch Plausibility Error 1
P0850	Park/Neutral Switch Signal Plausibility
P1130	Fuel Pressure Plausibility, Minimum Pressure at Eng Speed Too Low Fuel Pressure Plausibility, Maximum Exceeded Fuel Pressure Plausibility, Regulator Sticks Fuel Pressure Plausibility, Leakage
P1131	Fuel Pressure Actuator Open Load Fuel Pressure Actuator Short Circuit Fuel Pressure Actuator Power Stage Error
P1205	Injector Classification Checksum Error Injector Classification Invalid Injector Class
P1235	EGS Fuel Quantity Demand, Parity Error EGS Fuel Quantity Demand, Toggle Bit EGS Fuel Quantity Demand, Demand Not Plausible
P1242	CAN BUS Message Missing From EGS CAN BUS Mute CAB BUS
P1270	Swirl Actuator Short Circuit Swirl Actuator Open Load Swirl Actuator Diagnosis Ground Switching
P1499	Hydraulic Fan Solenoid Short Circuit Hydraulic Fan Solenoid Open Load
P1511	Battery Sense 1 Too High Battery Sense 1 Too Low
P1512	Battery Sense 2 Too High Battery Sense 2 Too Low
P1536	Generator Excitation Current Too High
P1601	Injector Boost Capacitor Voltage 1 Too High Injector Boost Capacitor Voltage 1 Too Low
P1605	Ignition Signal Plausibility After Initalization
P1606	After Run Test Failure, Zero Fuel Quantity After Run Test Failure, Injector Power Stage

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P1608	A to D Monitoring, RAM Test Failure A to D Monitoring, Ground Connection to PPS Failure A to D Monitoring, Test Voltage Failure
P1610	5 Voltage Supply Too High 5 Voltage Supply Too Low
P1643	Cabin Heater Relay Short Circuit Cabin Heater Relay Load Open
P1651	J1850: IFR Error J1850: Status Error
P1652	J1850 BUS Short to Plus J1850 BUS Short to Ground J1850 BUS Transmit Buffer Full J1850 BUS Arbitration Error J1850 BUS Internal SPI Transmission Error J1850 BUS Receive Dead/PV Test J1850 BUS Not Permitted Reset
P1680	EEPROM Fault Checksum EEPROM Fault Checksum Error EEPROM Fault Communication Error EEPROM Fault Different Variation Number EEPROM Fault Code Work Incorrect or Missing EEPROM Fault VIN Write Error
P1685	SKIM Write Access to Secret Key in EEPROM Bad SKIM Read Access to Secret Key in EEPROM RAM Mirror Bad SKIM Timed Out During Communication SKIM Received Invalid Key Code
P2120	Acc. Pedal Position Sensor Supply Out of Range Acc. Pedal Position Sensor Plausibility With Brake Switch Acc. Pedal Position Sensor Signal Too High
P2125	Accel Pedal Sensor Signal to High Accel Pedal Sensor Supply Out of Range Accel Pedal Sensor (PGS) Plausibility w/ PWG

SERVICE MANUAL COMMENTS

What errors(s) have you found?

In order for us to assist you, please include as much details as possible when reporting an error

Comments / Suggestions

☐ Dealership Technician
Dealer Code: ____________

Retail Customer ☐

Manual Title, Year, Number and Page: ____________

Your Name: ____________

Address: ____________

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Place
Stamp
Here

DaimlerChrysler Corporation
Attn. Publications Dept.
CIMS 486-02-70
800 Chrysler Drive
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TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

NOTES

1.0 INTRODUCTION

The procedures contained in this manual include specifications, instructions, and graphics needed to diagnose the PCM Powertrain System. The diagnostics in this manual are based on the failure condition or symptom being present at the time of diagnosis.

Please follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the appropriate modules; i.e., if the DRBIII® displays a "No Response" condition, you must diagnose this first before proceeding.
2. Read DTCs (diagnostic trouble codes) with the DRBIII®.
3. If no DTCs are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All system schematic diagrams are in Section 10.0. All charts and graphs are in Section 11.0.

An * placed before the symptom description indicates a customer complaint.

When repairs are required, refer to the appropriate service manual for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added; current systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE DTC. It is recommended that you review the entire manual to become familiar with all new and enhanced diagnostic procedures.

After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.2 SIX-STEP TROUBLE SHOOTING PROCEDURE

Diagnosis of the Powertrain Control Module (PCM) is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

The Powertrain Control Module (PCM) monitors and controls:

- fuel system
- ignition system
- charging system
- speed control system
- automatic transmission ("XXRE/XXRH" transmissions only)

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 GENERAL DESCRIPTION

The on-board OBDII/EUROIII diagnostics incorporated with the PCM controller are intended to assist the field technician in repairing vehicle problems by the quickest means.

3.2 FUNCTION OPERATION

3.2.1 FUEL CONTROL (GAS)

The PCM controls the air/fuel ratio of the engine by varying fuel injector on time. Mass air flow is calculated by the speed density method using engine speed and manifold absolute pressure (IAT is a modifier in Speed Density).

Different fuel calculation strategies are used depending on the operational state of the engine. During crank mode, a prime shot fuel pulse is delivered followed by fuel pulses determined by a crank time strategy. Cold engine operation is determined via an open loop strategy until the O2 sensors have reached operating temperature. At this point, the strategy enters a closed loop mode where fuel requirements are based upon the state of the O2 sensors, engine speed, MAP, throttle position, air temperature, battery voltage, and coolant temperature.

3.2.2 ON-BOARD DIAGNOSTICS

The PCM has been programmed to monitor any circuit or system that has an effect on vehicle emissions, or is used by the PCM to determine the proper functionality of these systems. This monitoring is called “on-board diagnosis.”

Certain criteria or, “arming conditions”, must be met for a trouble code to be entered into the PCM memory. The criteria may be a range of: engine rpm, engine temperature, and/or input voltage to the PCM. If a problem is detected with a monitored circuit, and all of the criteria or arming conditions are met, a trouble code will be stored in the PCM.

It is possible that a trouble code for a monitored circuit may not be entered into the PCM memory even though a malfunction has occurred. This may happen because one of the trouble code criteria (arming conditions) has not been met.

The PCM compares input signal voltages from each input device with specifications (the established high and low limits of the range) that are preprogrammed for that device. If the input voltage is not within specifications and other trouble code criteria (arming conditions) are met, a trouble code will be stored in the PCM memory.

The On Board Diagnostics have evolved to the second Generation of Diagnostics referred to as OBDII/EUROIII. These OBDII/EUROIII Diagnostics control the functions necessary to meet the requirements of California OBDII/EUROIII and Federal OBD regulations. These requirements specify the inclusion of a Malfunction Indicator Light (MIL) located on the instrument panel for all 1994 and subsequent model-year passenger cars, light duty trucks, and medium-duty vehicles. The purpose of the MIL is to inform the vehicle operator in the event of the malfunction of any emission systems and components which can affect emissions and which provide input to, or receive output from, the PCM.

The following table summarizes the various OBDII monitors operation.

OBDII / EUROIII Monitor Operation

Comprehensive Components Monitor	**Major Monitors Non Fuel Control & Non Misfire**	**Major Monitors Fuel Control & Misfire**
Run constantly	Run Once Per Trip	Run constantly
Includes All Engine Hardware • Sensors, Switches, Solenoids, etc.	Monitors Entire Emission System	Monitors Entire System
Most are One Trip Faults – Usually Turns On The MIL and Sets DTC After One Failure	Most are Two Trip Faults – Turns On The MIL and Sets DTC After Two Consecutive Failures	Two Trip Faults – Turns On The MIL and Sets DTC After Two Consecutive Failures
Priority 3	**Priority 1 or 3**	**Priority 2 or 4**
All Checked For Continuity Open Short To Ground Short To Voltage Inputs Checked For Rationality Outputs Checked For Functionality	Done Stop Testing = Yes Oxygen Sensor Heater Oxygen Sensor Response Catalytic Converter Efficiency Except EWMA • up to 6 tests per trip and a one trip fault (SBEC) and a two-trip fault on JTEC EGR System Evaporative Emission System (Purge and Leak) Non-LDP or LDP	**Fuel Control Monitor** Monitors Fuel Control System For: Fuel System Lean Fuel System Rich Requires 3 Consecutive *Fuel System Good Trips* to Extinguish The MIL **Misfire Monitor** Monitors For Engine Misfire at: 4 X 1000 RPM Counter (4000 Revs) (Type B) **200 X 3 (600) RPM Counter (Type A)
Requires 3 Consecutive *Global Good Trips* to Extinguish the MIL*	Requires 3 Consecutive *Global Good Trips* to Extinguish the MIL*	Requires 3 Consecutive *Global Good Trips* To Extinguish the MIL **Type A misfire is a one trip failure on pre-1999, 2 Trip failure on 1999 and later. The MIL will illuminate at the first or second failure, based on MY.

***40 Warm Up Cycles** are required to erase DTC's *after* the MIL has been extinguished.

3.2.3 TRANSMISSION CONTROL

The PCM also controls the 4 speed automatic transmissions utilizing electronic governor pressure control, eliminating the need for a separate transmission controller.

Transmission control is achieved through regulation of governor pressure using a Governor Pressure Solenoid valve. Valve position is controlled by pulse width modulation. Torque converter clutch and overdrive solenoids are also controlled by the PCM, as are the transmission relay and dashboard overdrive off lamp. PCM inputs affecting transmission operation include the throttle position sensor, output shaft speed sensor, vehicle speed, engine speed sensor (CKP), brake switch, ignition, overdrive on/off switch, torque converter clutch solenoid, transmission temperature sensor, and governor pressure sensor.

The PCM continuously checks for internal transmission problems, electrical problems, and some hydraulic problems. When a problem is sensed, the PCM stores a diagnostic trouble code. Any of these codes cause the transmission to go into "default" mode. When the PCM detects a problem, the transmission will default to third gear. When this happens, the only transmission functions are:

- PARK and NEUTRAL
- REVERSE
- THIRD GEAR
- MANUAL SHIFTING of FIRST, SECOND and THIRD GEAR

No upshifts or downshifts are allowed. The position of the manual valve alone allows the ranges that are available. Although engine performance is seriously degraded while in this mode, it allows the owner to drive the vehicle in for service. The transmission can be shifted manually by quickly downshifting into 1st to achieve 1st gear, then shifting to 2nd, then to third. However, default mode will not allow 4th gear or any EMCC operation.

Once the DRBIII® is in the RE transmission portion of the diagnostic program, it constantly monitors the PCM, updating the screens with switch, sensor, and input/output states, as well as displaying diagnostic trouble codes and default status.

TRANSMISSION IDENTIFICATION

The transmission part/identification numbers and codes are stamped on the left side of the case just above the oil pan gasket surface. The first letter/number group is the assembly part number. The next number group is the transmission serial number. Refer to this information when ordering replacement parts.

GOVERNOR PRESSURE SOLENOID VALVE

The solenoid valve generates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device and is located in the governor body on the valve body transfer plate. The inlet side of the solenoid valve is exposed to normal transmission line pressure while in forward gears. The outlet side of the valve leads to the valve body governor circuit. The solenoid valve regulates line pressure to produce governor pressure. The average current supplied to the solenoid valve controls governor pressure. One amp current produces zero psi governor pressure. Zero amps set the maximum governor pressure. Current is regulated by modulation of the pulse width of a 512 Hz driver frequency. The transmission control relay supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC) and is provided through the relay's fused B+ contact. The solenoid is polarity sensitive. The PCM energizes the solenoid by grounding it through the power ground terminal on the PCM.

GOVERNOR PRESSURE SENSOR

The governor pressure sensor measures output pressure of the governor pressure solenoid valve.

The sensor output signal provides the necessary feedback to the PCM. This feedback is needed to accurately control pressure. The unit is an absolute pressure device and the output is calibrated to be 0.35 to 0.65 volts at 14.7 psi (normal barometric pressure). Since this is an absolute pressure device, 0 psi calibration is required often to compensate for changing atmospheric pressure or altitude. This voltage measured at 0 psi is referred to as zero pressure offset.

GOVERNOR SHIFT SCHEDULES

The electronic governor has several governor curves possible as opposed to a conventional governor, which has a single governor curve with two stages. These transmissions are mechanically and hydraulically the same as the ones they replace.

As with all-hydraulic transmissions, the vehicle shift speeds are determined by balancing a hydraulic pressure signal proportional to transmission output speed (called governor pressure) against a pressure signal determined by throttle position (called throttle pressure). The four curves are used during the following operating conditions.

Low Transmission Fluid Temperature — When the transmission fluid is cold at or below 30°F, the conventional governor can delay shifts, resulting in higher than normal shift speeds and harsh shifts. The electronically controlled low temperature governor pressure curve is higher than normal to make the transmission shift at normal speeds and sooner. The PCM uses a temperature sensor in the transmission oil sump to determine when low temperature governor pressure is needed.

Transfer Case Low-Range Operation — On four-wheel drive vehicles operating in low range, the engine can accelerate to its peak more rapidly than in Normal range, resulting in delayed shifts and undesirable engine "flare." The low range governor pressure curve is also higher than normal to initiate upshifts sooner. The PCM compares the electronic vehicle speed signal to the transmission output shaft speed signal to determine when the transfer case is in low range.

Wide-Open Throttle Operation — In wide-open throttle (WOT) mode, adaptive memory in the PCM assures that up-shifts occur at the preprogrammed optimum speed. WOT operation is determined from the throttle position sensor, which is also a part of the emission control system. The initial setting for the WOT upshift is below the optimum engine speed. As WOT shifts are repeated, the PCM learns the time required to complete the shifts by comparing the engine speed when the shifts occur to the optimum speed. After each shift, the PCM adjusts the shift point until the optimum speed is reached. The PCM also considers vehicle loading, grade and engine performance changes due to high altitude in determining when to make WOT shifts. It does this by measuring vehicle and engine acceleration and then factoring in the shift time.

Normal Operation — Normal operation is refined through the increased computing power of the PCM and through access to data on engine operating conditions provided by the PCM. This facilitated the development of a load adaptive shift strategy — the ability to alter the shift schedule in response to vehicle load conditions. One manifestation of this capability is grade "hunting" prevention — the ability of the transmission logic to delay an upshift on a grade if the engine does not have sufficient power to maintain speed in the higher gear. The 3-2 downshift and the potential for hunting between gears occurs with a heavily loaded vehicle or on steep grades. When hunting occurs, it is very objectionable because shifts are frequent and accompanied by large changes in noise and acceleration.

GOVERNOR OPERATION

The electronic governor control system replaces the old centrifugal governor pressure control and is located on the valve body. The control system uses a governor pressure solenoid that can vary pressure, a pressure sensor, and the output shaft speed sensor. The electronic governor control system regulates pressure to control shifts in the first three gears. Output shaft speed and throttle position is used to determine target pressure. Actual governor pressure is read from the sensor and the difference between the target pressure and actual pressure is used to determine duty cycle correction. The duty cycle is the amount of time the governor pressure solenoid needs to be off to meet the target pressure. Output shaft speed, throttle position, controller calculations, and shift lever position, all determine different governor pressure curves. Governor pressures can be different at the same output shaft speed. The desired governor pressure is determined by many things; including the acceleration of the vehicle. There is no need for concern if the same output shaft speed has different requested pressures. <u>There is a need for concern</u> if the target pressure and actual pressure are not within three PSI for five seconds or more. If this occurs the control system could result in erratic shifting. The only time the governor control system stays at zero is when the gear selector is in park, neutral, reverse or drive with the vehicle at a stop. When the transmission is in park, neutral, or reverse no line pressure is supplied to the governor pressure solenoid, making governor pressure zero.

TRANSMISSION TEMPERATURE SENSOR

Transmission fluid temperature readings are supplied to the PCM by the trans temp sensor. The temp sensor is located in the governor pressure sensor connector. The temperature readings are used to control engagement of the overdrive clutch, the converter clutch, and governor pressure. Normal resistance value for the thermistor at room temperature is approximately 1000 ohms. The powertrain control module (PCM) prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 30°F. If fluid temperature exceeds 260°F, the PCM will cause a 4-3 downshift and engage the converter clutch. Engagement is according to the third gear converter clutch engagement schedule.

The overdrive OFF lamp in the instrument panel, also illuminates when the shift back to third occurs. The transmission will not allow fourth gear operation until fluid temperature decreases to approximately 230°F.

TRANSMISSION OUTPUT SHAFT SPEED SENSOR

The output shaft speed sensor is located in the overdrive housing. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed. Speed sensor signals are triggered by the park gear lugs as they rotate past the sensor pickup face. One revolution of the output shaft produces 23 pulses. Input signals from the sensor are sent to the PCM for processing.

TORQUE CONVERTER ELECTRONICS

The torque converter contains a converter clutch mechanism. The converter clutch is an electronically controlled mechanism. It is engaged in fourth gear, and in third gear only when the overdrive control switch is in the OFF position, and also, in third gear over temp mode. The torque converter is not a serviceable component. It should be replaced as an assembly when: diagnosis indicates a malfunction has occurred, or when a major malfunction allows debris to enter the converter.

3.2.4 OTHER CONTROLS

CHARGING SYSTEM

The charging system is turned on when the engine is started and ASD relay energized. When the ASD relay is on, ASD output voltage is supplied to the ASD sense circuit at the PCM. This voltage is connected in some cases, through the PCM and supplied to one of the generator field terminals (Generator Source +). All others, the Generator field is connected directly to the ASD output voltage. The amount of current produced by the generator is controlled by the Electronic Voltage Regulator (EVR) circuitry, in the PCM. Battery temperature is determined either by IAT, Ambient or Battery temperature sensor. This temperature along with sensed line voltage is used by the PCM to vary battery charging. This is accomplished by cycling the path to ground to the other generator field terminal (Generator field driver).

SPEED CONTROL

The PCM controls vehicle speed by operation of the speed control servo vacuum and vent solenoids. Energizing the vacuum solenoid applies vacuum to the servo to increase throttle position. Operation of the vent solenoid slowly releases the vacuum allowing throttle position to decrease. A special dump solenoid allows immediate release of throttle position caused by braking, cruise control turn off, shifting into neutral, excessive RPM (tires spinning) or ignition key off.

FUEL VAPOR RECOVERY SYSTEM (DUTY CYCLE PURGE CONTROL) GAS ENGINE

Duty Cycle Purge is a system that feeds fuel gases from the purge canister and gasoline tank into the throttle body for mixing with incoming air. Metering of the gases is performed by duty cycling the purge solenoid by the PCM.

The system is disabled during wide-open throttle conditions and while the engine is below a specified coolant temperature. When engine temperature becomes greater than a calibrated parameter, duty cycle purge is delayed for a calibrated time. Once purge delay is over, purge will be ramped in to soften the effect of dumping additional fuel into the engine.

The PCM provides a modulated 5 Hz signal (at closed throttle) or 10 Hz signal (at open throttle) to control this system. Modulation of the signal is based upon a calculated air flow (based upon known fuel flow through the injector at a given pulse width and RPM) and is adjusted to compensate for changes in flow due to varying engine vacuum.

LEAK DETECTION PUMP

LEAK DETECTION PUMP OPERATION

The evaporative emission system is designed to prevent the escape of fuel vapors from the fuel system. Leaks in the system, even small ones, can allow fuel vapors to escape into the atmosphere. Government regulations require onboard testing to make sure that the evaporative (EVAP) system is functioning properly. The leak detection system test for EVAP system leaks and blockage. It also performs self-diagnostics. During self-diagnostics, the Powertrain Control Module (PCM) first checks the Leak Detection Pump (LDP) for electrical and mechanical faults. If the first checks pass, the PCM then uses the LDP to seal the vent valve and pump air into the system to pressurize it. If a leak is present, the PCM will continue pumping the LDP to replace the air that leaks out. The PCM determines the size of the leak based on how fast/long it must pump the LDP as it tries to maintain pressure in the system.

EVAP LEAK DETECTION SYSTEM COMPONENTS (FIGURE 1)

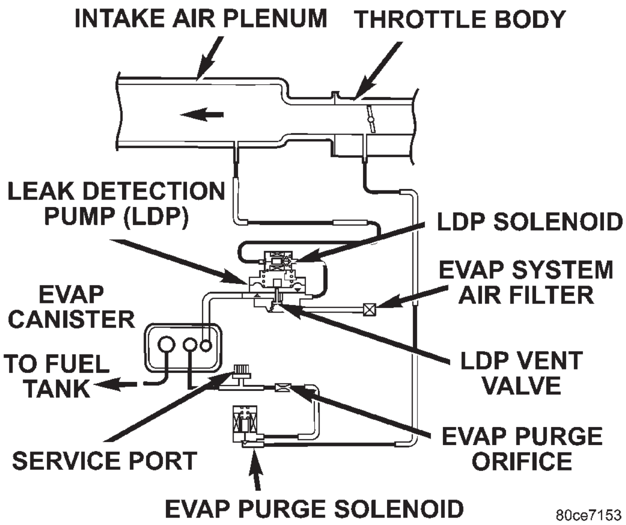
Service Port: Used with special tools like the Miller Evaporative Emissions Leak Detector (EELD) to test for leaks in the system.

EVAP Purge Solenoid: The PCM uses the EVAP purge solenoid to control purging of excess fuel vapors stored in the EVAP canister. It remains closed during leak testing to prevent loss of pressure.

EVAP Canister: The EVAP canister stores fuel vapors from the fuel tank for purging.

EVAP Purge Orifice: Limits purge volume.

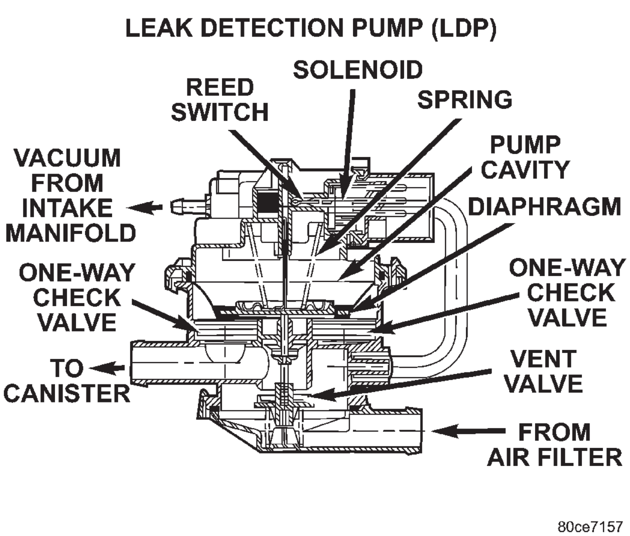
EVAP System Air Filter: Provides air to the LDP for pressurizing the system. It filters out dirt while allowing a vent to atmosphere for the EVAP system.



LEAK DETECTION PUMP (LDP) COMPONENTS

The main purpose of the LDP is to pressurize the fuel system for leak checking. It closes the EVAP system vent to atmospheric pressure so the system can be pressurized for leak testing. The diaphragm is powered by engine vacuum. It pumps air into the EVAP system to develop a pressure of about 7.5″ HO (1/4) psi. A reed switch in the LDP allows the PCM to monitor the position of the LDP diaphragm. The PCM uses the reed switch input to monitor how fast the LDP is pumping air into the EVAP system. This allows detection of leaks and blockage.

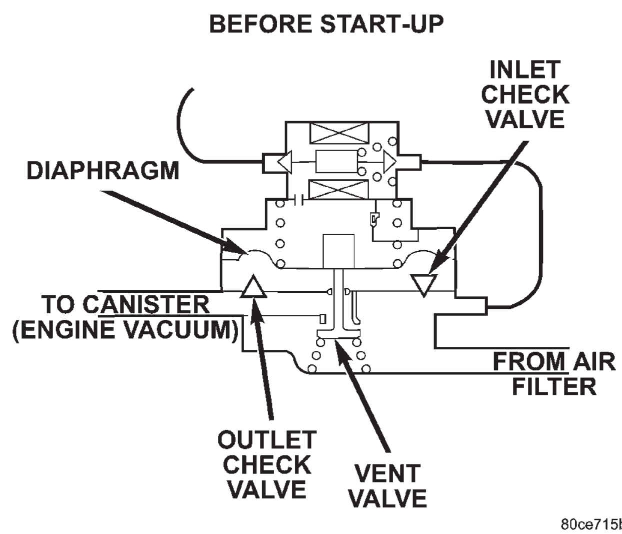
The LDP assembly consists of several parts (Figure 2). The solenoid is controlled by the PCM, and it connects the upper pump cavity to either engine vacuum or atmospheric pressure. A vent valve closes the EVAP system to atmosphere, sealing the system during leak testing. The pump section of the LDP consists of a diaphragm that moves up and down to bring air in through the air filter and inlet check valve, and pump it out through an outlet check valve into the EVAP system.



The diaphragm is pulled up by engine vacuum, and pushed down by spring pressure, as the LDP solenoid turns on and off. The LDP also has a magnetic reed switch to signal diaphragm position to the PCM. When the diaphragm is down, the switch is closed, which sends a 12 V (system voltage) signal to the PCM. When the diaphragm is up, the switch is open, and there is no voltage sent to the PCM. This allows the PCM to monitor LDP pumping action as it turns the LDP solenoid on and off.

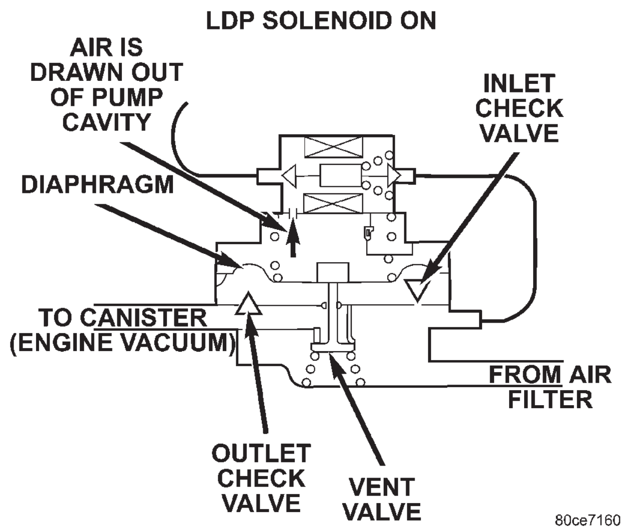
LDP AT REST (NOT POWERED)

When the LDP is at rest (no electrical/vacuum) the diaphragm is allowed to drop down if the internal (EVAP system) pressure is not greater than the return spring. The LDP solenoid blocks the engine vacuum port and opens the atmospheric pressure port connected through the EVAP system air filter. The vent valve is held open by the diaphragm. This allows the canister to see atmospheric pressure (Figure 3).



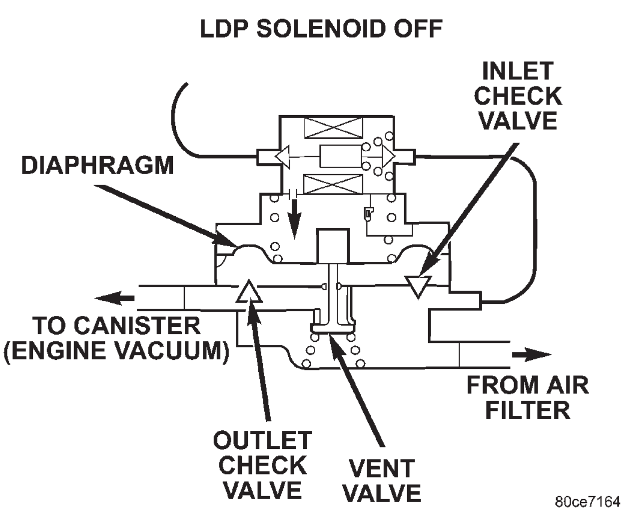
DIAPHRAGM UPWARD MOVEMENT

When the PCM energizes the LDP solenoid, the solenoid blocks the atmospheric port leading through the EVAP air filter and at the same time opens the engine vacuum port to the pump cavity above the diaphragm. The diaphragm moves upward when vacuum above the diaphragm exceeds spring force. This upward movement closes the vent valve. It also causes low pressure below the diaphragm, unseating the inlet check valve and allowing air in from the EVAP air filter. When the diaphragm completes its upward movement, the LDP reed switch turns from closed to open (Figure 4).



DIAPHRAGM DOWNWARD MOVEMENT

Based on reed switch input, the PCM de-energizes the LDP solenoid, causing it to block the vacuum port, and open the atmospheric port. This connects the upper pump cavity to atmosphere through the EVAP air filter. The spring is now able to push the diaphragm down. The downward movement of the diaphragm closes the inlet check valve and opens the outlet check valve pumping air into the evaporative system. The LDP reed switch turns from open to closed, allowing the PCM to monitor LDP pumping (diaphragm up/down) activity (Figure 5. During the pumping mode, the diaphragm will not move down far enough to open the vent valve.



The pumping cycle is repeated as the solenoid is turned on and off. When the evaporative system begins to pressurize, the pressure on the bottom of the diaphragm will begin to oppose the spring pressure, slowing the pumping action. The PCM watches the time from when the solenoid is de-energized, until the diaphragm drops down far enough for the reed switch to change from opened to closed. If the reed switch changes too quickly, a leak may be indicated. The longer it takes the reed switch to change state, the tighter the evaporative system is sealed. If the system pressurizes too quickly, a restriction somwehere in the EVAP system may be indicated.

PUMPING ACTION

During portions of this test, the PCM uses the reed switch to monitor diaphragm movement. The solenoid is only turned on by the PCM after the reed switch changes from open to closed, indicating that the diaphragm has moved down. At other times during the test, the PCM will rapidly cycle the LDP solenoid on and off to quickly pressurize the system. During rapid cycling, the diaphragm will not move enough to change the reed switch state. In the state of rapid cycling, the PCM will use a fixed time interval to cycle the solenoid.

If the system does not pass the EVAP Leak Detection Test, the following DTCs may be set:

- P0442 – EVAP LEAK MONITOR 0.040″ LEAK DETECTED
- P0455 – EVAP LEAK MONITOR LARGE LEAK DETECTED
- P0456 – EVAP LEAK MONITOR 0.020″ LEAK DETECTED
- P1486 – EVAP LEAK MON PINCHED HOSE FOUND
- P1494 – LEAK DETECTION PUMP SW OR MECH FAULT
- P1495 – LEAK DETECTION PUMP SOLENOID CIRCUIT

ENABLING CONDITIONS TO RUN EVAP LEAK DETECTION TEST

1. Cold start: with ambient temperature (obtained from modeling the inlet air temperature sensor on passenger vehicles and the battery temperature sensor on Jeep & truck vehicles) between 4°C (40°F) and 32°C (90°F) for 0.040 leak. Between 4°C (40°F) and 29°C (85°F) for 0.020 leak.
2. Engine coolant temperature within: -12° to -8°C (10° to 18°F) of battery/ambient.
3. Battery voltage between 10 and 15 volts.

NOTE: If battery voltage drops below 10 volts for more than 5 seconds during engine cranking, the EVAP Leak Detection Test will not run.

4. Low fuel warning light off (fuel level must be between 15% and 85%).
5. MAP sensor reading 22 in Hg or above (This is

the manifold absolute pressure, not vacuum).

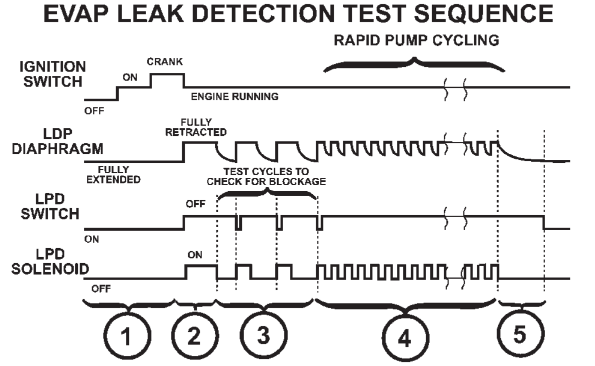
6. No engine stall during test.

NOTE: The following values are approximate and vehicle specific. Use the values seen in pre test/monitor test screen on the DRBIII®. See TSB 25-002-98 for more detail.

A DTC will not set if a one-trip fault is set or if the MIL is illuminated for any of the following:

- Purge Solenoid
- All engine Controller Self Test Faults
- All Cam and/or Crank Sensor Faults
- MAP Sensor Faults
- Ambient/Battery Temperature Sensor Electrical Faults
- All Coolant Sensor Faults
- All TPS Faults
- LDP Pressure Switch Faults
- EGR Solenoid Electrical Faults
- All Injector Faults
- Baro Out Of Range
- Vehicle Speed Faults
- LDP Solenoid Circuit

EVAP LEAK DETECTION TEST SEQUENCE



SECTION 1-P1495 LEAK DETECTION PUMP SOLENOID CIRCUIT CAN SET (KEY "ON")
SECTION 2-P1494 LEAK DETECTION PUMP SW OR MECH FAULT CAN SET
SECTION 3-P1486 EVAP LEAK MON PINCHED HOSE FOUND CAN SET
SECTION 4-NO DTC CAN SET DURING THIS TIME
SECTION 5-P0456 EVAP LEAK MONITOR 0.020 LEAK DETECTED/P0442-EVAP LEAK MONITOR 0.040 LEAK DETECTED/P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED CAN SET-TIMES WILL VARY

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FIGURE 6 SECTION 1

When the ignition key is turned to "ON", the LDP diaphragm should be in the down position and the LDP reed switch should be closed. If the EVAP system has residual pressure, the LDP diaphragm may be up. This could result in the LDP reed switch being open when the key is turned to "ON" and a P1494 fault could be set because the PCM is expecting the reed switch to be closed.

After the key is turned "ON", the PCM immediately tests the LDP solenoid circuit for electrical faults. If a fault is detected, DTC P1495 will set, the MIL will illuminate, and the remaining EVAP Leak Detection Test is cancelled.

NOTE: If battery temperature is not within range, or if the engine coolant temperature is not within a specified range of the battery temperature, the PCM will not run tests for DTC P1494, P1486, P0442, P0455 and P04441. These temperature calibrations may be different between models.

FIGURE 6 SECTION 2

If DTCP1495 is not set, the PCM will check for DTC P1494. If the LDP reed switch was closed when the key was turned to "ON", the PCM energizes the LDP solenoid for up to 8 seconds and monitors the LDP switch. As the LDP diaphragm is pulled up by engine vacuum, the LDP reed switch should change from closed to open. If it does not, the PCM sets a temporary fault (P1494) in memory, and waits until the next time the Enabling Conditions are met to run the test again. If this is again detected, P1494 is stored and the MIL is illuminated. If the problem is not detected during the next enabling cycle, the temporary fault will be cleared.

However, if the PCM detects the reed switch open when the key is turned to "ON", the PCM must determine if this condition is due to residual pressure in the EVAP system, or an actual fault. The PCM stores information in memory on EVAP system purging from previous engine run or drive cycles.

If little or no purging took place, residual pressure could be holding the LDP diaphragm up, causing the LDP switch to be open. Since this is not a malfunction, the PCM cancels the EVAP Leak Detection Test without setting the temporary fault.

If there was sufficient purging during the previous sycle to eliminate EVAP system pressure, the PCM judges that this is a malfunction and sets a temporary fault in memory. The next time that the Enabling Conditions are met, the test will run again. If the fault is again detected, the MIL will illuminate and DTC 1494 will be stored. If the fault is not detected, the temporary fault will be cleared.

FIGURE 6 SECTION 3

If no fault has been detected so far, the PCM begins testing for possible blockage in the EVAP system between the LDP and the fuel tank. This is done by monitoring the time required for the LDP to pump air into the EVAP system during two to three pump cycles. If no blockage is present, the LDP diaphragm is able to quickly pump air out of the

LDP each time the PCM turns off the LDP solenoid. If a blockage is present, the PCM detects that the LDP takes longer to complete each pump cycle. If the pump cycles take longer than expected (approximately 6 to 10 seconds) the PCM will suspect a blockage. On the next drive when Enabling Conditions are met, the test will run again. If blockage is again detected, P1486 is stored, and the MIL is illuminated.

FIGURE 6 SECTION 4

After the LDP blockage tests are completed, the PCM then tests for EVAP system leakage. First, the PCM commands the LDP to rapidly pump for 20 to 50 seconds (depending on fuel level) to build pressure in the EVAP system. This evaluates the system to see if it can be sufficiently pressurized. This evaluation (rapid pump cycling) may occur several times prior to leak checking. The LDP reed switch does not close and open during rapid pumping because the diaphragm does not travel through its full range during this part of the test.

FIGURE 6 SECTION 5

Next, the PCM performs one or more tests cycles by monitoring the time required for the LDP reed switch to close (diaphragm to drop) after the LDP solenoid is turned off.

If the switch does not close, or closes after a long delay, it means that the system does not have any significant leakage and the EVAP Leak Detection Test is complete.

However, if the LDP reed switch closes quickly, there may be a leak or the fuel level may be low enough that the LDP must pump more to finish pressurizing the EVAP system. In this case, the PCM will rapidly pump the LDP again to build pressure in the EVAP system, and follow that by monitoring the time needed for several LDP test cycles. This process of rapid pumping followed by several LDP test cycles may repeat several times before the PCM judges that a leak is present.

When leaks are present, the LDP test cycle time will be inversely proportional to the size of the leak. The larger the leak, the shorter the test cycle time. The smaller the leak, the longer the test cycle time. DTC's may be set when a leak as small as 0.5 mm (0.020″) diameter is present.

If the system detects a leak, a temporary fault will be stored in PCM memory. The time it takes to detect a .020, .040, or larger leak is based on calibrations that vary from model to model. The important point to remember is if a leak is again detected on the next EVAP Leak Detection Test, the MIL will illuminate and a DTC will be stored based on the size of leak detected. If no leak is detected during the next test, the temporary fault will be cleared.

DIAGNOSTIC TIPS

During diagnosis, you can compare the LDP solenoid activity with the monitor sequence in Figure 6. If the PCM detects a problem that could set a DTC, the testing is halted and LDP solenoid activity will stop. As each section of the test begins, it indicates that the previous section passed successfully. By watching to see which tests complete, you can see if any conditions are present that the PCM considers abnormal.

For example, if the LDP solenoid is energized for the test cycles to test for blockage (P1486), it means that the LDP has already passed its test for P1494. Then, if the PCM detects a possible blockage, it will set a temporary fault without turning on the MIL and continue the leak portion of the test. However, the PCM will assume that the system is already pressurized and skip the rapid pump cycles.

Always diagnose leaks, if possible, before disconnecting connections. Disconnecting connections may mask a leak condition.

Keep in mind that if the purge solenoid seat is leaking, it could go undetected since the leak would end up in the intake manifold. Disconnect the purge solenoid at the manifold when leak checking. In addition, a pinched hose fault (P1486) could set if the purge solenoid does not purge the fuel system properly (blocked seat). The purge solenoid must vent the fuel system prior to the LDP system test. If the purge solenoid cannot properly vent the system the LDP cannot properly complete the test for P1486 and this fault can be set due to pressure being in the EVAP system during the test sequence.

Multiple actuation's of the DRBIII® Leak Detection Pump (LDP) Monitor Test can hide a 0.020 leak because of excess vapor generation. Additionally, any source for additional vapor generation can hide a small leak in the EVAP system. Excess vapor generation can delay the fall of the LDP diaphragm thus hiding the small leak. An example of this condition could be bringing a cold vehicle into a warm shop for testing for high ambient temperatures.

Fully plugged and partially plugged underhood vacuum lines have been known to set MIL conditions. P1494 and P0456 can be set for this reason. Always, thoroughly, check plumbing for pinches or blockage before condemning components.

TEST EQUIPMENT

The Evaporative Emission Leak Detector (EELD) Miller Special Tool 8404 is capable of visually detecting leaks in the evaporative system and will take the place of the ultrasonic leak detector 6917A. The EELD utilizes shop air and a smoke generator to visually detect leaks down to 0.020 or smaller. The food grade oil used to make the smoke includes an UV trace dye that will leave telltale signs of the leak under a black light. This is helpful when components have to be removed to determine the exact leak location. For detailed test instructions, follow the operators manual packaged with the EELD.

IMPORTANT

Be sure that the PCM has the latest software update. Reprogram as indicated by any applicable Technical Service Bulletin. After LDP repairs are completed, verify the repair by running the DRBIII® Leak Detection Pump (LDP) Monitor Test as described in Technical Service Bulletin 18-12-99.

3.2.5 NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems, and conditions even though they could have malfunctions that result in driveability problems. A diagnostic code may not be displayed for the following conditions. However, problems with these systems may cause a diagnostic code to be displayed for other systems. For example, a fuel pressure problem will not register a diagnostic code directly, but could cause a rich or lean condition. This could cause an oxygen sensor, fuel system, or misfire monitor trouble code to be stored in the PCM.

Engine Timing − The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket, or crankshaft sprocket. The PCM also cannot detect an incorrectly indexed distributor or Cam Sensor.(*)

Fuel Pressure − Fuel pressure is controlled by the fuel pressure regulator. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line filter, or a pinched fuel supply.(*)

Fuel Injectors − The PCM cannot detect a clogged fuel injector, a sticking pintle, or that an incorrect injector is installed.(*)

Fuel Requirements − Poor quality gasoline can cause problems such as hard starting, stalling, and stumble. Use of methanol-gasoline blends may result in starting and driveability problems. (See individual symptoms and their definitions in Section 6.0 Glossary of Terms).

PCM Grounds − The PCM cannot detect a poor system ground. However, a diagnostic trouble code may be stored in the PCM as a result of this condition.

Throttle Body Air Flow − The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.(*)

Exhaust System − The PCM cannot detect a plugged, restricted, or leaking exhaust system.(*)

Cylinder Compression − The PCM cannot detect uneven, low, or high engine cylinder compression.(*)

Excessive Oil Consumption − Although the PCM monitors the exhaust oxygen content through the oxygen sensor when the system is in a closed loop, it cannot determine excessive oil consumption.

NOTE: Any of these conditions could result in a rich or lean condition causing an oxygen sensor trouble code to be stored in the PCM, or the vehicle may exhibit one or more of the driveability symptoms listed in the Table of Contents.

3.2.6 SKIS OVERVIEW

The Sentry Key Immobilizer System (SKIS) is an immobilizer system designed to prevent unauthorized vehicle operation. The system consists of Sentry Key Immobilizer Module (SKIM) sends a PCI Bus message to the engine controller indicating ignition key status. Upon receiving this message the PCM will terminate engine operation or allow the engine to continue to operate.

3.2.7 SKIM ON-BOARD DIAGNOSTICS

The SKIM has been programmed to transmit and monitor many different coded messages as well as PCI Bus messages. This monitoring is called “On-Board Diagnosis”.

Certain criteria must be met for a diagnostic trouble code to be entered into the SKIM memory. The criteria may be a range of Input voltage, PCI Bus message, or coded messages to the SKIM. If all of the criteria for monitoring a circuit or function are met and a fault is sensed, a diagnostic trouble code will be stored in the SKIM memory.

3.2.8 SKIS OPERATION

When ignition power is supplied to the SKIM, the SKIM performs an internal self-test. After the self-test is completed, the SKIM energizes the antenna (this activates the transponder chip) and sends a challenge to the transponder chip. The transponder chip responds to the challenge by generating an encrypted response message using the following:

Secret Key - This is an electronically stored value (identification number) that is unique to each SKIS. The secret key is stored in the SKIM, PCM, and all ignition key transponders.

Challenge - This is a random number that is generated by the SKIM at each ignition key cycle. The secret key and challenge are the two variables used in the algorithm that produces the crypto algorithm to receive, decode and respond to the message sent by the SKIM. After responding to the coded message, the transponder sends a transponder ID message to the SKIM. The SKIM compares the transponder ID to the available valid ignition key codes in the SKIM memory (8 key maximum). After validating the key, the SKIM sends a PCI Bus message called a “Seed Request” to the engine controller then waits for a PCM response. If the PCM does not respond, the SKIM will send the seed request again. After three failed attempts, the SKIM will stop sending the seed request and store a trouble code. If the PCM sends a seed response, the SKIM sends a valid/invalid key message to the PCM. This is an encrypted message that is generated using the following:

VIN - Vehicle Identification Number

Seed - This is a random number that is generated by the PCM at each ignition key cycle.

The VIN and seed are the two variables used in the rolling code algorithm that encrypts the "valid/invalid key" message. The PCM uses the rolling code algorithm to receive, decode and respond to the valid/invalid key message sent by the SKIM. After sending the valid/invalid key message the SKIM waits 3.5 seconds for a PCM status message from the PCM. If the PCM does not respond with a valid key message to the SKIM, a fault is detected and a trouble code is stored. The SKIS incorporates a warning lamp located in the instrument cluster. The lamp receives power and ground from the instrument cluster. The lamp is actuated when the SKIM sends a PCI Bus message to the instrument cluster requesting the lamp on. The SKIM will request warning lamp illumination for:

– bulb checks at ignition on

– to alert the vehicle operator to a SKIS malfunction

– customer key programming mode

For all faults except transponder faults and VIN mismatch, the lamp remains on steady. In the event of a transponder fault the light flashes at a rate of 1 Hz (once per second). If a fault is present the lamp will remain on or flashing for the complete ignition cycle. If a fault is stored in SKIM memory which prevents the system from operating properly, the PCM will allow the engine to start and run (for two seconds) up to six times. After the sixth attempt the PCM will not allow engine to start.

3.2.9 PROGRAMMING THE POWERTRAIN CONTROL MODULE

Important Notice: Before replacing the PCM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM driver/control circuit failures are caused by internal failure to components (i.e. relay and solenoids) and short circuits (i.e. 12-volt pull-ups, drivers and ground sensors). These failures are difficult to detect when a double fault has occurred and only one DTC has set.

NOTE: If the PCM and the SKIM are replaced at the same time, program the VIN into the PCM first. All vehicle keys will then need to be replaced and programmed to the new SKIM.

The SKIS "Secret Key" is an ID code that is unique to each SKIS. This code is programmed and stored in the SKIM, PCM and transponder chip (ignition key). When replacing the PCM it is necessary to program the secret key into the PCM.

1. Turn the ignition on (transmission in park/neutral).
2. Use the DRBIII® and select "THEFT ALARM", "SKIM" then "MISCELLANEOUS".
3. Select "PCM REPLACED".
4. Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: If three attempts are made to enter the secure access mode using an incorrect PIN, secured access mode will be locked out for one hour. To exit ths lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned off. Also, monitor the battery state and connect a battery charger if necessary).

5. Press "ENTER" to transfer the secret key (the SKIM will send the secret key to the PCM).

3.2.10 PROGRAMMING THE SENTRY KEY IMMOBILIZER MODULE

NOTE: If the PCM and the SKIM are replaced at the same time, program the VIN into the PCM first. All vehicle keys will then need to be replaced and programmed to the new SKIM.

1. Turn the ignition on (transmission in park/neutral).
2. Use the DRBIII® and select "THEFT ALARM", "SKIM", then "MISCELLANEOUS".
3. Select "SKIM MODULE REPLACEMENT (GASOLINE)".
4. Program the vehicle four-digit PIN into the SKIM.
5. Select "COUNTRY CODE" and enter the correct country.

NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, the SKIM must be replaced.

6. Select "UPDATE VIN" (the SKIM will learn the

VIN from the PCM).

7. Press “ENTER” to transfer the VIN (the PCM will send the VIN to the SKIM).
8. The DRBIII® will ask if you want to transfer the secret key from the PCM. This will ensure the current vehicle ignition keys will still operate the SKIS system.

3.2.11 PROGRAMMING THE IGNITION KEYS TO THE SENTRY KEY IMMOBILIZER MODULE

1. Turn the igntion on (transmission in park/ neutral).
2. Use the DRBIII® and select “THEFT ALARM”, “SKIM” then “MISCELLANEOUS”.
3. Slect “PROGRAM IGNITION KEYS”.
4. Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM, the key cannot be transferred to another vehicle.

If ignition key programming is unsuccessful, the DRB III® will display one of the following messages:

Program Not Attempted - The DRBIII® attempts to read the programmed key status and there are no keys programmed in the SKIM memory.

Programming Key Failed - (Possible Used Key From Wrong Vehicle) - SKIM is unable to program key due to one of the following:

– faulty ignition key transponder
– ignition key is programmed to another vehicle.

8 Keys Already Learned, Programming Not Done - SKIM transponder ID memory is full.

– Obtain ignition keys to be programmed from customer (8 keys maximum).
– Using the DRBIII®, erase all ignition keys by selecting “MISCELLANEOUS” and “ERASE ALL CURRENT IGN. KEYS”.
– Program all ignition keys.

Learned Key In Ignition - Ignition key transponder ID is currently programmed in SKIM memory.

3.3 DIAGNOSTIC TROUBLE CODES

Each diagnostic trouble code is diagnosed by following a specific testing procedure. The diagnostic test procedures contain step-by-step instructions for determining the cause of trouble codes as well as no trouble code problems. It is not necessary to perform all of the tests in this book to diagnose an individual code.

Always begin by reading the diagnostic trouble codes using the DRBIII®.

3.3.1 HARD CODE

A diagnostic trouble code that comes back within one cycle of the ignition key is a “hard” code. This means that the defect is present when the PCM checks that circuit or function. Procedures in this manual verify if the trouble code is a hard code at the beginning of each test. When it is not a hard code, an “intermittent” test must be performed.

Codes that are for OBDII/EUROIII monitors will not set with just the ignition key on. Comparing these to non-emission codes, they will seem like an intermittent. These codes require a set of parameters to be performed (The DRBIII® pre-test screens will help with this for MONITOR codes), this is called a “TRIP”. All OBDII/EUROIII DTCs will set after two or in some cases one trip failures, and the MIL will be turned on. These codes require three successful, no failures, TRIPS to extinguish the MIL, followed by 40 warm-up cycles to erase the code. For further explanation of TRIPS, Pre-test screens, Warm-up cycles, and the use of the DRBIII®, refer to the On Board Diagnostic training booklet #81-699-97094.

3.3.2 INTERMITTENT CODE

A diagnostic trouble code that is not present every time the PCM checks the circuit is an “intermittent” code. Most intermittent codes are caused by wiring or connector problems. Intermittents that come and go like this are the most difficult to diagnose; they must be looked for under specific conditions that cause them. The following procedures may assist you in identifying a possible intermittent problem:

- Visually inspect related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.
- Visually inspect the related harnesses. Look for chafed, pierced, or partially broken wire.
- Refer to any S.T.A.R. Hotline Newsletters or technical service bulletins that may apply.
- Use the DRBIII® data recorder or co-pilot.

3.3.3 STARTS SINCE SET COUNTER/DISTANCE SINCE MI SET (EURO III)

This reset counter counts the number of times the vehicle has been started since codes were last set or erased. This counter will count up to 255 start counts.

The number of starts helps determine when the trouble code actually happened. This is recorded by the PCM and can be viewed on the DRBIII® as STARTS since set.

When there are no trouble codes stored in memory, the DRBIII® will display “NO TROUBLE CODES FOUND” and the reset counter will show “STARTS since set = XXX.”

OBDII/EUROIII vehicles will also display a DTC Specific or Global “Good Trip” counter which will indicate the number of “Good Trips” since the DTC was set. After 3 consecutive “Good Trips,” the MIL is extinguished and the good trip counter is replaced by a “Warm Up Cycle” counter. 40 Warm-up Cycles will erase the DTC and Freeze Frame information.

DISTANCE SINCE MI SET (Euro III)

The Euro Stage III OBD directive requires that the distance traveled by the vehicle while the MI is activated must be available at any instant through the serial port on the standard data link connector. This feature works as follows:

1. If the MI is illuminated due to a fault, the distance count is updated (i.e. it is counting).
2. If there is a stale MI fault (i.e. the fault is still frozen in memory but the MI has been extinguished due to 3 good trips), the distance count is held (i.e. frozen).
3. If the distance count is being held due to (Item 2.) and the fault is cleared, the distance is cleared (set to zero).
4. If the distance count is being held due to (Item 2.) and another MI occurs, the distance count is reset (to 0) and begins updated anew.
5. If a fault occurs while the MI is already illuminated due to a previous fault (the distance count is updating), then the distance count continues to update w/out interruption.
6. If the MI is flashing due to active misfire and there is an active fault (i.e. matured fault for which 3 good trips have not occurred), the distance count behaves as the MI in ON.
7. If the MI is flashing due to active misfire and there is no active fault (i.e. the MI is flashing for a 1 malf.), the distance count behaves as if the MI is off (because it is not yet a matured fault).
8. The distance count is cleared whenever the fault is cleared. (Via 40 warm up cycles, or via scan tool).

3.3.4 HANDLING NO TROUBLE CODE PROBLEMS

Symptom checks cannot be used properly unless the driveability problem characteristic actually happens while the vehicle is being tested.

Select the symptom that most accurately describes the vehicle’s driveability problem and then perform the test routine that pertains to this symptom. Perform each routine test in sequence until the problem is found.

SYMPTOM	DIAGNOSTIC TEST
HARD START	CHECKING THE FUEL PRESSURE CHECKING COOLANT SENSOR CALIBRATION CHECKING THROTTLE POSITION SENSOR CALIBRATION CHECKING MAP SENSOR CALIBRATION CHECKING THE MINIMUM IDLE AIR FLOW CHECKING IDLE AIR CONTROL MOTOR OPERATION CHECKING EVAP EMISSION SYSTEM CHECKING IAT SENSOR
ENGINE STALL IN GEAR	CHECK TCC OPERATION
HESITATION/SAG/STUMBLE	CHECKING PCM POWER AND GND CKT CHECKING THE FUEL PRESSURE CHECKING COOLANT SENSOR CALIBRATION CHECKING THROTTLE POSITION SENSOR CALIBRATION CHECKING MAP SENSOR CALIBRATION CHECKING THE MINIMUM IDLE AIR FLOW CHECKING IDLE AIR CONTROL MOTOR OPERATION CHECK EVAP EMISSION SYSTEM

SYMPTOM	DIAGNOSTIC TEST
SURGE	CHECKING PCM POWER AND GND CKT CHECKING THE FUEL PRESSURE CHECKING COOLANT SENSOR CALIBRATION CHECKING THROTTLE POSITION SENSOR CALIBRATION CHECKING MAP SENSOR CALIBRATION CHECKING THE MINIMUM IDLE AIR FLOW CHECKING IDLE AIR CONTROL MOTOR OPERATION CHECKING EVAP EMISSION SYSTEM
LACK OF POWER/SLUGGISH	CHECKING PCM POWER AND GND CKT CHECKING THE FUEL PRESSURE CHECKING COOLANT SENSOR CALIBRATION CHECKING THROTTLE POSITION SENSOR CALIBRATION CHECKING MAP SENSOR CALIBRATION CHECKING THE MINIMUM IDLE AIR FLOW CHECKING IDLE AIR CONTROL MOTOR OPERATION
POOR FUEL ECONOMY	CHECKING PCM POWER AND GND CKT CHECKING THE FUEL PRESSURE CHECKING COOLANT SENSOR CALIBRATION CHECKING THROTTLE POSITION SENSOR CALIBRATION CHECKING THE MINIMUM IDLE AIR FLOW CHECKING IDLE AIR CONTROL MOTOR OPERATION CHECKING EVAP EMISSION SYSTEM CHECKING IAT SENSOR

3.3.5 NO START INFORMATION

IMPORTANT NOTE:

If the Powertrain Control Module has been programmed, a DTC will be set in the ABS and Air bag modules. In addition, if the vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable starting.

FOR ABS AND AIR BAG SYSTEMS:

1. Enter correct VIN and Mileage in PCM.
2. Erase codes in ABS and Air Bag modules.

FOR SKIM THEFT ALARM:

1. Connect the DRBIII® to the data link connector.
2. Go to Theft Alarm, SKIM, Misc. and place the SKIM in *secured access* mode, by using the appropriate PIN code for this vehicle.
3. Select Update the Secret Key data, data will be transferred from the SKIM to the PCM (This is required to allow the vehicle to start with the new PCM).
4. If three attempts are made to enter *secured access* mode using the incorrect PIN, *secured access* mode will be locked out for one hour. To exit this lock out mode, leave the ignition key in the Run/Start position for one hour. Ensure all accessories are turned off. Also monitor the battery state and connect a battery charger if necessary.

After reading Section 3.0 (System Description and Functional Operation), you should have a better understanding of the theory and operation of the on-board diagnostics, and how this relates to the diagnosis of a vehicle that may have a driveability-related symptom or complaint.

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading trouble codes, erasing trouble codes, and other DRBIII® functions.

3.5 DRBIII® ERROR MESSAGES AND BLANK SCREEN

Under normal operation, the DRBIII® will display one of only two error messages:

– User-Requested WARM Boot by pressing MORE and NO at the same time.

```
ver: 2.29
date: 1 Oct 93
file: key_itf.cc
date: Jan 12 1994
line: 544
err: 0x1
User-Requested WARM Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

or

– User-Requested COLD Boot by pressing MORE and YES at the same time.

```
ver: 2.29
date: 1 Oct 99
file: key_hnd1.cc
date: Mar 8 2000
line: 1297
err: 0x1
User-Requested COLD Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

If the DRBIII® should display any other error message, record the entire display and call the Star Center.

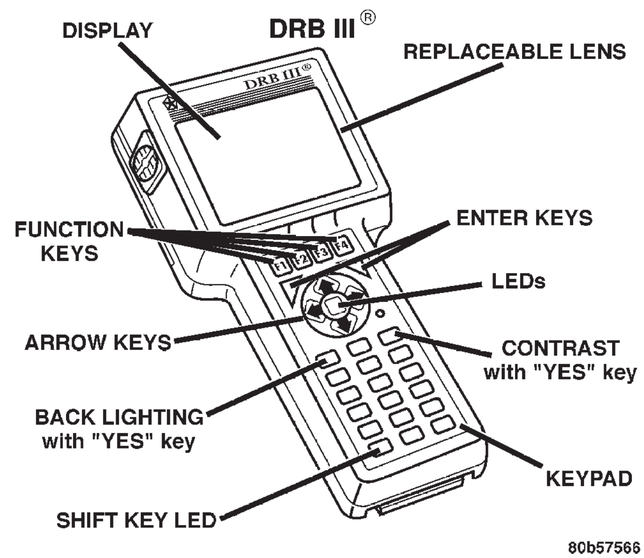
3.5.1 DRBIII® DOES NOT POWER UP

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link connector cavity 16). Check for proper ground connection at DLC cavity. A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, and inoperative DRBIII® may be the result of faulty cable or vehicle wiring. For a blank screen, refer to the appropriate body diagnostics manual.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



4.0 DISCLAIMERS, SAFETY, WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the drive wheels.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing a powertrain system problem, it is important to follow approved procedures where applicable. These procedures can be found in service manual procedures. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the powertrain system are intended to be serviced in assembly only. Attempting to remove or repair certain system subcomponents may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

Follow the vehicle manufacturer's service specifications at all times.

- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips, or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0 - 500 peak volts AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz
Temperature	-50 - 600°C -58 - 1100°F

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- A 10A fuse or circuit breaker must be used to protect the circuit being tested.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS AND CAUTIONS

4.3.1 ROAD TEST WARNINGS

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read the DRBIII® screen while in motion. Do not hang the DRBIII® from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

4.3.2 VEHICLE DAMAGE CAUTIONS

Before disconnecting any control module, make sure the ignition is "off". Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation; this will damage the insulation and wire and eventually cause it to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second DTC could be set, making diagnosis of the original problem more difficult.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box) scan tool
Evaporative Emissions Leak Detector #8404
fuel filler adapter #8382
fuel pressure adapter (C-6631) or #6539
fuel pressure kit (C-4799-B) or #5069
fuel release hose (C-4799-1)
min air flow fitting #6714
jumper wires
ohmmeter
oscilloscope
vacuum gauge
voltmeter
12 volt test light minimum 25 ohms resistance with probe #6801

Caution: A 12 volt test light should not be used for the following circuits, damage to the Powertrain Controller will occur.

- 5 Volt Supply
- 8 Volt Supply
- J1850 PCI Bus
- CCD Bus
- CKP Sensor Signal
- CMP Sensor Signal
- Vehicle Speed Sensor Signal
- O2 Sensor Signal

6.0 ACRONYMS

A/C	air conditioning
ABS	anti-lock brake system
ASD Relay	auto shutdown relay
APPS	accelerator pedal position sensor
Baro	barometric pressure
BCM	body control module
BTS	battery temperature sensor
CAA	clean air act
CAB	controller antilock brakes
CARB	California air resources board
CCD Bus	Chrysler collision detection bus
CKP Sensor	crank position sensor
CMP Sensor	camshaft position sensor
CO	carbon monoxide
DCP Solenoid	duty-cycle purge solenoid
DLC	data link connector
DRBIII®	diagnostic readout box – 3rd generation
DTC	diagnostic trouble code
DVOM	digital volt ohm meter
EATX II	electronic automatic transmission controller – 2nd Generation
EC	European community

ECT Sensor	engine coolant temperature sensor
EE-PROM	electrically erasable programmable read only memory
EGR Valve	exhaust gas recirculation valve
EMCC	electronic modulated converter clutch
EMI	electro-magnetic interference
EOBD	European OBD (based upon Euro Stage III)
EPA	Environmental Protection Agency
EPP	engine position pulse
Eu	European Union
EVAP	evaporative emission system
EVR	electronic voltage regulator
EWMA	exponentially weighted moving average
FTP	federal test procedure
HC	hydrocarbons
HO2S	heated oxygen sensor
Generator	previously called “alternator”
IAC Motor	idle air control motor
IAT Sensor	intake air temperature sensor
I/M	inspection and maintenance testing
JTEC	Jeep/Truck engine controller
LDP	leak detection pump
LSIACV	linear solenoid idle air control valve
MAF	mass air flow
MAP Sensor	manifold absolute pressure sensor
MDS_2®	Mopar diagnostic system – 2nd generation
MIL	malfunction indicator lamp
MTV	manifold tuning valve
NGC	next generation controller
NTC	negative temperature coefficient
NVLD	natural vacuum leak detection
O_2Sensor	oxygen sensor
O2S	oxygen sensor
OBD I	on board diagnostics – 1st generation
OBD II	on-board diagnostics – 2nd generation
ORVR	on-board refueling vapor recovery
PCI Bus	programmable communications interface bus (J1850)
PCM	powertrain control module
PCV	positive crankcase ventilation
PDC	power distribution center
PEP	peripheral expansion port
P/N	park/neutral
PPS	proportional purge solenoid
PS	power steering
PSP	power steering pressure (switch)
PTC	positive temperature coefficient
PWM	pulse-width modulation
RAM	random access memory
RFI	radio frequency interference
RKE	remote keyless entry
RPM	revolutions per minute
SAE	Society of Automotive Engineers
SBEC	single board engine controller
SCW	Similar Conditions Window
SKIM	sentry key immobilizer module
SRV	short runner valve
TCC	torque converter clutch
TCM	transmission control module
TDC	top dead center
TPS	throttle position sensor
TRS	transmission range sensor
VSS	vehicle speed sensor
WOT	wide open throttle

NOTES

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
P0622-GENERATOR FIELD NOT SWITCHING PROPERLY

When Monitored and Set Condition:

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY

When Monitored: With the ignition key on and the engine running.

Set Condition: When the PCM tries to regulate the generator field with no result during monitoring.

POSSIBLE CAUSES
INTERMITTENT CONDITION
GENERATOR FIELD SOURCE (+) CIRCUIT OPEN
GENERATOR FIELD DRIVER CIRCUIT SHORT TO GROUND
GENERATOR FIELD DRIVER CIRCUIT OPEN
GENERATOR FIELD COIL OPEN
GENERATOR FIELD COIL SHORTED
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Using a 12-volt test light connected to ground, backprobe the Generator Field Driver circuit at the back of the Generator. With the DRBIII®, actuate the Generator Field Driver circuit. Does the test light blink? Yes → Go To 2 No → Go To 3	All
2	**NOTE: The conditions that set this DTC are not present at this time. The following tests may help in identifying the intermittent condition.** Ignition on, engine not running. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. With the DRBIII® actuate the Generator Field Driver circuit. Wiggle the wire harness from the Generator to PCM. With the DRBIII®, read DTCs. Does the DTC return? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Record all DTCs and freeze frame data. Carefully inspect all Connectors for corrosion or spread Terminals before continuing. With the DRBIII® actuate the Generator Field Driver circuit. Backprobe the Generator Field Source (+) circuit at back of Generator with a volt meter. Is the voltage above 10.0 volts? Yes → Go To 4 No → Repair the open in the Generator Field Source (+) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
4	Turn the ignition off. Disconnect the PCM harness connector(s). Disconnect the Generator Field harness connector. Measure the resistance between ground and the Generator Field Driver circuit in the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Generator Field Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
5	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Generator Field harness connector. **Note: Check Connectors - Clean/repair as necessary.** Measure the resistance of the Generator Field Driver circuit between the PCM harness connector and the Generator Field harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Generator Field Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
6	Turn the ignition off. Disconnect the Generator Field harness connector. Measure the resistance across the Generator Field Terminals at the Generator. Is the resistance below 0.5 of an ohm? Yes → Replace the Generator. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 7	All
7	Turn the ignition off. Disconnect the Generator Field harness connector at back of the Generator. **Note: Check connectors - Clean/repair as necessary.** Measure resistance across the Generator Field Terminals at the Generator. Is the resistance above 15 ohms? Yes → Repair the Generator as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 8	All

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
P1492-AMBIENT/BATT TEMP SENSOR VOLTS TOO HIGH

When Monitored and Set Condition:

P1492-AMBIENT/BATT TEMP SENSOR VOLTS TOO HIGH

When Monitored: With the ignition key on.

Set Condition: The PCM senses the voltage from the AMBIENT/BATT Temperature Sensor above 4.9 volts for 3 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
AMBIENT/BATT SIGNAL CIRCUIT SHORT TO 12-VOLTS
AMBIENT/BATT SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
AMBIENT/BATT TEMPERATURE SENSOR
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, monitor the Ambient Battery Temperature Sensor voltage. Is the voltage above 4.8 volts? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the AMBIENT/BATT harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Allow the engine to idle. Measure the voltage of the AMBIENT/BATT Signal circuit at the AMBIENT/BATT harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to voltage in the AMBIENT/BATT Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 3	All

P1492-AMBIENT/BATT TEMP SENSOR VOLTS TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the AMBIENT/BATT harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the AMBIENT/BATT Signal circuit between the AMBIENT/BATT harness connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the AMBIENT/BATT Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
4	Turn the ignition off. Disconnect the AMBIENT/BATT Temperature Sensor harness connector. Disconnect PCM harness connector. Measure the resistance in the Sensor ground circuit from the PCM harness connector to the Sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
5	Turn the ignition off. With the DRBIII® in sensors, read the Ambient/Batt Tmp Vlt value. Connect a jumper wire between the AMB/BATT Signal circuit and the Sensor ground circuit at the AMB/BATT connector. Did the Ambient/Batt Temp voltage value change from greater than 4.5 volts to less than 1.0 volt? Yes → Replace the AMBIENT/BATT Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

P1492-AMBIENT/BATT TEMP SENSOR VOLTS TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Ambient/Batt signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All

Symptom:
P1493-AMBIENT/BATT TEMP SENSOR VOLTS TOO LOW

When Monitored and Set Condition:

P1493-AMBIENT/BATT TEMP SENSOR VOLTS TOO LOW

When Monitored: With the ignition on.

Set Condition: The PCM senses the voltage from the AMBIENT/BATT Temperature Sensor below 0.5 of a volt for 3 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
AMBIENT/BATT TEMPERATURE SIGNAL CIRCUIT SHORT TO GROUND
AMBIENT/BATT TEMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
AMBIENT/BATT TEMPERATURE SENSOR
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame information. With DRBIII®, monitor Ambient/Battery Temperature Sensor volts. Is the voltage below 0.5 of a volt? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the AMBIENT/BATT Temperature Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the AMBIENT/BATT Temperature Sensor Signal circuit at the AMBIENT/BATT Temp Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the AMBIENT/BATT Temperature Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 3	All

P1493-AMBIENT/BATT TEMP SENSOR VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the AMBIENT/BATT Temperature Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the AMBIENT/BATT Temperature Sensor Signal circuit and the Sensor ground circuit at the AMBIENT/BATT Temp Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the AMBIENT/BATT Temperature Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 4	All
4	Ignition on, engine not running. With the DRBIII® in sensors, read the AMBIENT/BATT Temp Voltage value. Disconnect the AMBIENT/BATT Temperature Sensor harness connector. Did the Ambient/Batt Temperature Voltage value change from below 1.0 volt to above 4.5 volts? Yes → Replace the AMBIENT/BATT Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Ambient/Batt Signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All

Symptom:
P1594-CHARGING SYSTEM VOLTAGE TOO HIGH

When Monitored and Set Condition:

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH

When Monitored: With the ignition key on and the engine speed greater than 0 RPM.

Set Condition: When the PCM regulates the generator field and there are no detected field problems, but the voltage output does not decrease.

POSSIBLE CAUSES
TARGET VOLTAGE DIFFERS FROM BATTERY VOLTAGE
INTERMITTENT CONDITION
AMBIENT/BATT TEMPERATURE SENSOR
GENERATOR FIELD COIL SHORT TO GROUND
GENERATOR FIELD SHORT TO GROUND
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Battery must be fully charged and be capable of passing a load test. Note: Generator Belt tension and condition must be checked before continuing.** Ignition on, engine not running. With DRBIII®, actuate the Generator Field Driver. With a 12-volt test light connected to ground, backprobe the Generator Field Driver circuit in the back of Generator Field harness connector. Does the test light illuminate brightly and flash? Yes → Go To 2 No → Go To 6	All
2	Ignition on, engine not running. With the DRBIII®, actuate the Generator Field Driver. With DRBIII®, stop the Generator Field Driver actuation. With DRBIII®, read the Target Charging voltage. Is the Target Charging voltage above 13 volts? Yes → Go To 3 No → Go To 4	All

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Start the engine. With the DRBIII®, manually set the engine speed to 1600 RPM. With DRBIII®, read both the Battery voltage and the Target Charging voltage. Compare the Target Charging Voltage to the Battery Voltage reading. Monitor voltage for 5 minutes, if necessary. Was there ever more than a 1.0 volt difference between Battery voltage and Target Charging Voltage? Yes → Replace the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
4	Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the AMBIENT/BATT temperature. Using a thermometer measure under hood temperature near Battery tray. Is the thermometer temperature within 10 deg of DRBIII® Battery temperature? Yes → Go To 5 No → Replace the AMBIENT/BATT Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
5	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All
6	Turn the ignition off. Disconnect the PCM harness connector. Disconnect the Field Harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Generator Field Driver circuit at the Generator connector. Is the resistance below 100 ohms? Yes → Repair or replace the shorted Generator as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 7	All

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the Generator Field harness connector. Measure the resistance between ground and the Generator Field terminals on the Generator. Is the resistance below 100 ohms? Yes → Replace or repair the Generator Field Coil for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
P1682-CHARGING SYSTEM VOLTAGE TOO LOW

When Monitored and Set Condition:

P1682-CHARGING SYSTEM VOLTAGE TOO LOW

When Monitored: With the ignition key on and the engine running over 1500 RPM after 25 seconds.

Set Condition: When the PCM regulates the generator field and there are no detected field problems, but the voltage output does not increase.

POSSIBLE CAUSES
AMBIENT/BATT TEMPERATURE SENSOR
INTERMITTENT CONDITION
B (+) CIRCUIT HIGH RESISTANCE
GENERATOR GROUND HIGH RESISTANCE
GENERATOR FIELD SOURCE (+) CIRCUIT OPEN
GENERATOR FIELD SOURCE CIRCUIT SHORTED TO GROUND
GENERATOR FIELD DRIVER CIRCUIT OPEN
GENERATOR FIELD COIL HIGH RESISTANCE
PCM, DRIVER CIRCUIT

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. **NOTE: Battery must be fully charged and capable of passing a battery load test.** **Note: Generator Belt tension and condition must be checked before continuing.** **NOTE: Inspect the vehicle for any aftermarket accessories that may exceed the maximum Generator output.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. With theDRBIII®, read the target charging voltage. Is the target charging voltage above 15.1 volts? Yes → Go To 2 No → Go To 4	All

P1682-CHARGING SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. **Note: Battery must be fully charged.** **Note: Generator Belt tension and condition must be checked before continuing.** Start the engine. Allow the engine to reach normal operating temperature. With the DRBIII® in sensors, read the AMBIENT/BATT TEMP DEG. Using a Thermometer, measure under hood temperature. Is the temperature within 10 F degrees of Battery temperature? Yes → Go To 3 No → Replace the Ambient/Batt Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
3	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STANK IN A DIRECT LINE WITH THE FAN. SO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and /or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the condition under which the DTC was set. Refer to any Technical Service Bulletins (TSB's) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Generator Field Driver circuit at the Generator connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All
4	Ignition on, engine not running. Measure the voltage between the Generator B(+) Terminal and the Battery (+) Post. **Caution: Ensure all wires are clear of the engine's moving parts.** Start the engine. Is the voltage above 0.4 of a volt? Yes → Repair the high resistance in the B(+) Circuit between the Generator and Battery. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All

P1682-CHARGING SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
5	Start the engine. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Warm the engine to operating temperature. **Caution: Ensure all wires are clear of the engine's moving parts.** Measure the voltage between the Generator case and Battery (-) Post. Is the voltage above 0.1 of a volt? Yes → Repair the high resistance in the Generator Ground circuit between the Generator Case and Battery (-) side. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 6	All
6	Ignition on, engine not running. Record all DTCs and freeze frame data, now erase Codes. Carefully inspect all Connectors for corrosion or spread Terminals before continuing. With the DRBIII® actuate the Generator Field Driver circuit. While backprobing, measure the voltage of the Generator Field Source (+) circuit at back of Generator. Is the voltage above 10.0 volts? Yes → Go To 7 No → Repair the open in the Generator Field Source (+) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
7	Turn the ignition off. Disconnect the PCM harness connector(s). Disconnect the generator field harness connector. Measure the resistance between ground and the Generator Field Source circuit in the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Generator Field Source circuit and replace the PCM. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 8	All
8	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Generator Field harness connector. **Note: Check Connectors - Clean/repair as necessary.** Measure the resistance of the Generator Field Driver circuit between the PCM harness connector and the Generator harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the Generator Field Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

P1682-CHARGING SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the Generator Field harness connector at back of the Generator. **Note: Check connectors - Clean/repair as necessary.** Measure resistance across the Generator Field Terminals at the Generator. Is the resistance above 15 ohms? Yes → Replace or repair the Generator as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
*CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS

POSSIBLE CAUSES
GENERATOR BELT CONDITION
DTC RESET
WIRE HARNESS INSPECTION
B (+) CIRCUIT HIGH RESISTANCE
GENERATOR FIELD SOURCE (+) CIRCUIT OPEN
GENERATOR FIELD COIL HIGH RESISTANCE
GENERATOR FIELD DRIVER CIRCUIT OPEN
GENERATOR GROUND HIGH RESISTANCE
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Verify that the Battery is able to pass a load test before continuing.** Ignition on, engine not running. With the DRBIII®, read the Battery voltage and record the results. Measure Battery voltage B(+) to B(-) Terminal and record the results. Compare the two voltage readings. Is the voltage difference less than one volt? Yes → Go To 2 No → Go To 8	All
2	Ignition on, engine not running. Measure the voltage between the Generator B(+) Terminal and the Battery (+) Post. **Caution: Ensure all wires are clear of the engine's moving parts.** Start the engine. Is the voltage above 0.4 of a volt? Yes → Repair the high resistance in the B(+) Circuit between the Generator and Battery . Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 3	All
3	Ignition on, engine not running. Record all DTCs and freeze frame data, now erase Codes. Carefully inspect all Connectors for corrosion or spread Terminals before continuing. With the DRBIII® actuate the Generator Field Driver circuit. While backprobing, measure the voltage of the Generator Field Source (+) circuit at back of Generator. Is the voltage above 10.0 volts? Yes → Go To 4 No → Repair the Generator Field Source (+) circuit for an open or short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

*CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
4	Start the engine. Warm the engine to operating temperature. **Caution: Ensure all wires are clear of the engine's moving parts.** Measure the voltage between the Generator case and Battery (-) Post. Is the voltage above 0.1 of a volt? Yes → Repair high resistance in the Generator Ground circuit between the Generator Case and Battery (-) side. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
5	Turn the ignition off. Disconnect the Generator Field harness connector at back of the Generator. **Note: Check connectors - Clean/repair as necessary.** Measure resistance across the Generator Field Terminals at the Generator. Is the resistance above 15 ohms? Yes → Replace or repair the Generator as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 6	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Generator Field harness connector. **Note: Check Connectors - Clean/repair as necessary.** Measure the resistance of the Generator Field Driver circuit between the PCM harness connector and the Generator harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Generator Field Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
8	Turn the ignition off. **NOTE: Battery condition must be verified prior to this test.** Inspect the Generator Belt tension and condition. Is the Generator Belt OK? Yes → Go To 9 No → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

*CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
9	Ignition on, engine not running. With the DRBIII®, actuate the Generator Field. Using a 12-volt test light, backprobe the Generator Field Driver Terminal at the back of the Generator. **Note: The test light should blink On and Off every 1.4 seconds.** While monitoring the 12-volt test light, wiggle the Field Terminals back to the PCM and ASD Relay. Was there any interruption in the normal cycle of the test light? Yes → Repair the wire or connector where the wiggling interrupted the voltage cycle. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 10	All
10	Start the engine. Turn on all accessories. Raise engine speed to 2000 RPM for 30 seconds then return to idle. With the DRBIII®, read DTCs. Are there any ″Charging System″ Trouble Codes? Yes → Refer to Symptom list for the related Charging DTCs. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All

Symptom:
*CHECKING THE AMBIENT/BATTERY TEMPERATURE SENSOR

POSSIBLE CAUSES
AMBIENT/BATT (OUT OF CALIBRATION)
AMBIENT/BATT TEMPERATURE SENSOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII® in sensors, read the ″Ambient/Batt Tmp Deg″ value and record the reading. Using a temperature probe, measure the air temperature near the AMBIENT/BATT Temp Sensor. Is the recorded AMBIENT/BATT temperature value within 10° of the temperature probe reading? Yes → Go To 2 No → Replace the AMBIENT/BATT Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
2	Turn the ignition off. Disconnect the AMBIENT/BATT harness Connector. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper across the Terminals of the AMBIENT/BATT (harness side). Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the AMBIENT/BATT voltage. Is the voltage reading equal to zero? Yes → Replace the AMBIENT[B]ATT temperature sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Test Complete.	All

Symptom:
P0601-PCM INTERNAL CONTROLLER FAILURE

POSSIBLE CAUSES
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: This DTC indicates an internal PCM problem.** If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1685-WRONG OR INVALID KEY MSG RECEIVED FROM SKIM

When Monitored and Set Condition:

P1685-WRONG OR INVALID KEY MSG RECEIVED FROM SKIM

When Monitored: With the ignition on.

Set Condition: The PCM does not receive a Valid Key message from the SKIM.

POSSIBLE CAUSES
INCORRECT VIN IN PCM
INVALID SKIM KEY NOT PRESENT
NO COMMUNICATION WITH SKIM
NO VIN PROGRAMMED IN THE PCM
PCM
SKIM TROUBLE CODES SET

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the PCM DTCs. Look for P1685. Is the Starts Since Set counter for DTC P1685 displayed and equal to 0? Yes → Go To 2 No → Go To 7	All
2	With the DRBIII®, attempt to communicate with the SKIM. Turn the ignition on. Can the DRBIII® communicate with the SKIM? Yes → Go To 3 No → Refer to symptom BUS +/- SIGNAL OPEN FROM SKIM in the COMMUNICATION category. Perform SKIS VERIFICATION.	All
3	Turn the ignition on. With the DRBIII®, check for SKIM DTCs. Are any DTCs present in the SKIM? Yes → Refer to BODY information for the related symptom(s). Perform SKIS VERIFICATION. No → Go To 4	All
4	Turn the ignition on. With the DRBIII®, display the VIN that is programmed in the PCM. Has a VIN been programmed into the PCM? Yes → Go To 5 No → Program the correct VIN into the PCM and retest. Perform SKIS VERIFICATION.	All

P1685-WRONG OR INVALID KEY MSG RECEIVED FROM SKIM — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition on. With the DRBIII®, display the VIN that is programmed in the PCM. Was the correct VIN programmed into the PCM? Yes → Go To 6 No → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All
6	Turn the ignition off. Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Turn the ignition on. With the DRBIII®, erase all SKIM and PCM DTCs. Attempt to start and idle the engine. With the DRBIII®, read the PCM DTCs. Does the DRBIII® display this code? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All
7	**NOTE: You must obtain the SKIM pin number.** **NOTE: This DTC could have been set if the SKIM harness connector was disconnected, or if the SKIM was replaced recently.** **NOTE: All keys that the customer uses for this vehicle must be tested to verify they are operating properly.** Turn the ignition on. Verify the correct VIN is programmed into the PCM and SKIM. Turn the ignition off. With the next customer key turn the ignition key on and crank the engine to start. With the DRBIII®, read the PCM DTCs. Look for P1685 Is the Starts Since Set counter for DTC P1685 displayed and equal to 0? Yes → Replace the Ignition Key. Perform SKIS VERIFICATION. No → Test Complete. **NOTE: If this DTC cannot be reset, it could have been an actual theft attempt.**	All

Symptom:
P1686-NO SKIM BUS MESSAGE RECEIVED

When Monitored and Set Condition:

P1686-NO SKIM BUS MESSAGE RECEIVED

When Monitored: With the ignition on.

Set Condition: The PCM does not receive a Bus message from the SKIM when expected.

POSSIBLE CAUSES
SKIM/PCM
INTERMITTENT CONDITION
LOSS OF SKIM COMMUNICATION
PCI BUS CIRCUIT OPEN FROM PCM TO SKIM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB III, read the PCM DTCs. Look for P1686. Is the Starts Since Set counter on the DTC screen for P1686 equal to Zero? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition on. With the DRB III, attempt to communicate with the SKIM. **NOTE: This test will indicate if the Bus is operational from the DLC to the SKIM.** Was the DRB III able to communicate with the SKIM? Yes → Go To 3 No → Refer to symptom BUS +/- SIGNAL OPEN FROM SKIM in the COMMUNICATION category. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the SKIM harness connector. Measure the resistance of the PCI Bus circuit between the PCM harness connector and the SKIM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the PCI Bus circuit between the PCM and the SKIM for an open. Perform SKIS VERIFICATION.	All

P1686-NO SKIM BUS MESSAGE RECEIVED — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Replace the Sentry Key Immobilizer Module in accordance with the Service Information. Turn the ignition on. Display and erase all PCM and SKIM DTCs. Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle. With the DRB, display PCM DTCs. Does the DRB display the same DTC? Yes → Replace and program the PCM in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All
5	**WARNING: KEEP CLEAR OF THE ENGINE'S MOVING PARTS.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom:

P1696-PCM FAILURE EEPROM WRITE DENIED

POSSIBLE CAUSES
PCM FAILURE

Repair Instructions:

PCM FAILURE

Replace and program the Powertrain Control Module in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 5.

Symptom:
P1698-NO BUS MESSAGE FROM TCM

POSSIBLE CAUSES
WIRING HARNESS INTERMITTENT PROBLEM
NO BUS MESSAGE FROM TRANS
PCM PCI BUS CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip counter displayed and equal to zero? Yes → Go To 2 No → Go To 4 **Note: This DTC could have been set when the TCM is disconnected for transmission Diagnostics.**	All
2	Ignition on, engine not running. Connect the DRBIII®I and access Powertrain Control Module. **Note: This test checks for other PCI BUS codes. That indicates diferent circuits in the BUS.** With the DRBIII®, read DTCs. Is a DTC also set for NO SKIM BUS MESSAGE and/or No MIC BUS MESSAGE? Yes → Go To 3 No → Inspect the TCM Fused Ignition Switch circuits and ground circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

P1698-NO BUS MESSAGE FROM TCM — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, read DTCs. This is to ensure power and grounds to the PCM are operational. **NOTE: If the DRBIII® will not read PCM DTC's, follow the "NO RESPONSE TO PCM (SCI only)" symptom path, if vehicle will start. For NO START Conditions follow symptom "NO RESPONSE" in Starting category .** Turn the ignition off. Disconnect the PCM harness connector(s). Connect the DRBIII® to the Data Link connector Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. Select DRBIII® Standalone. Select lab scope. Select Live. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the PCM ground. Connect the Red lead to the PCM PCI Bus circuit Ignition on, engine not running. Observe the voltage displayed on the DRBIII® Lab Scope. What is the voltage displayed on the scope? Pulse from 0 to approximately 7.5 volts Test Complete. Steady 0 volts Repair the open PCI Bus circuit to PCM. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
4	Turn ignition off. **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Test Complete.	All

Symptom:
*NO RESPONSE FROM PCM (PCI BUS)

POSSIBLE CAUSES
PCM PCI NO RESPONSE
PCI BUS CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: As soon as one or more module communicates with the DRB, answer the question.** With the DRBIII®, enter Body then Body Computer. With the DRBIII®, enter Anti-Lock Brakes. With the DRBIII®, enter Body then Electro/Mechanical Cluster (MIC). With the DRBIII®, enter Passive Restraints then Airbag. Were you able to establish communications with any of the modules? Yes → Go To 2 No → Refer to symptom PCI Bus Communication Failure in the Communications category. Perform ROAD TEST VERIFICATION - VER-2.	All

*NO RESPONSE FROM PCM (PCI BUS) — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII® read PCM Diagnostic Trouble Codes. This is to ensure power and grounds to the PCM are operational. **NOTE: If the DRB will not read PCM DTC's, follow the NO RESPONSE TO PCM (SCI only) symptom path, if vehicle will start. For NO START Conditions follow symptom NO RESPONSE in Starting catagory.** **NOTE: If the vehicle will not start and the DRBIII® displays a no response message, refer to the appropriate symptom in the powertrain diagnostic procedures.** Turn the ignition off. Disconnect the PCM C3 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. Select DRBIII® Standalone. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the PCM ground. Connect the Red lead to the PCI Bus circuit in the PCM connector. Turn the ignition on. Observe the voltage display on the DRBIII® Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Powertrain Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the PCI Bus circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*NO RESPONSE FROM PCM (SCI ONLY) - GAS ONLY

POSSIBLE CAUSES
CHECK PCM POWERS AND GROUNDS
SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
SCI RECEIVE CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
SCI CIRCUITS SHORTED TOGETHER
SCI TRANSMIT CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT OPEN
SCI TRANSMIT CIRCUIT OPEN
GROUND CIRCUITS AT DLC OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Perform the symptom Checking PCM Power and Ground Circuits in the Driveability category. Did the vehicle pass this test? Yes → Go To 2 No → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Disconnect the TCM harness connector (if equipped). **NOTE: If vehicle is not equipped with a TCM, answer yes to the question.** Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Transmit circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Transmission Control Module in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM (SCI ONLY) - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the PCM harness connectors. Disconnect the TCM harness connector (if equipped). Turn the ignition on. Measure the voltage of the SCI Transmit circuit at the DLC connector. Is the voltage above 1.0 volt? Yes → Repair the SCI Transmit circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the PCM harness connectors. Turn the ignition on. Measure the voltage of the SCI Receive circuit at the DLC connector. Is the voltage above 1.0 volt? Yes → Repair the SCI Receive circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the PCM harness connectors. Measure the resistance between the SCI Transmit circuit and the SCI Receive circuit at the PCM connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the SCI Transmit and the SCI Receive circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance between ground and the SCI Receive circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Receive circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 8	All
8	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance of the SCI Receive circuit between the PCM C3 connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the SCI Receive circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM (SCI ONLY) - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance of the SCI Transmit circuit between the PCM C3 connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the SCI Transmit circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
10	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the negative battery cable. Measure the resistance between ground and both ground circuits at the DLC. Is the resistance below 5.0 ohms for each measurement? Yes → Go To 11 No → Repair the ground circuit that measured above 5.0 ohms for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
11	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*PCI BUS COMMUNICATION FAILURE

POSSIBLE CAUSES
WITH THE DRB PERFORM A MODULE SCAN
OPEN PCI BUS CIRCUIT AT THE DATA LINK CONNECTOR
USING THE DRB, PERFORM THE PCI BUS CONTROL MODE
DISCONNECT THE MODULE(S) HARNESS CONNECTOR
PCI BUS CIRCUIT SHORTED TO VOLTAGE
DISCONNECT THE MODULE(S) HARNESS CONNECTOR
PCI BUS CIRCUIT SHORTED TO GROUND
WIRING HARNESS INTERMITTENT FAILURE

TEST	ACTION	APPLICABILITY
1	**Note: Determine which modules this vehicle is equipped with before beginning.** Connect the Diagnostic Junction Port Tester #8339 to the DRB and to the Diagnostic Junction Port. Using the DRB, along with the Diagnostic Junction Port Tester #8339, select Junction Port Tool then PCI Bus Module Scan and follow the instructions on the DRB. Was the DRB able to scan (I/D or communicate) with any modules? Yes → Refer to the Communication category for the related symptom(s). (Individual module no responses). Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Measure the resistance of the PCI Bus circuit between the Data Link Connector and the Diagnostic Junction Port connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the PCI Bus circuit for an open between the DLC and the Diagnostic Junction Port. Perform BODY VERIFICATION TEST - VER 1.	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Determine which modules this vehicle is equipped with before beginning.** Connect the Diagnostic Junction Port Tester #8339 to the DRB and to the Diagnostic Junction Port. Using the DRB, along with the Diagnostic Junction Port Tester #8339, select Junction Port Tool then PCI Bus Control Mode and follow the instructions on the DRB. **Note: Perform this function on each pin that is equipped with a PCI Bus circuit.** Did the DRB display No Modules Responding from any of the pins that were scanned? Yes → Go To 4 No → Check the PCI Bus circuit between the DLC and the Diagnostic Junction Port connector for a short to voltage or to ground, repair as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Diagnostic Junction Port Tester cable from the DRB. Keep the tester connected to the Diagnostic Junction Port. Turn the ignition on. Measure the voltage of the PCI Bus circuit on the Diagnostic Junction Port Tester that the DRB displayed No Modules Responding. Is the voltage steadily above 7.0 volts? Yes → Go To 5 No → Go To 6	All
5	Measure the voltage of the PCI Bus circuit on the Diagnostic Junction Port tester that previously measured above 7.0 volts. **Note: Turn the ignition off before disconnecting any module harness connector then turn the ignition on.** Disconnect the module harness connector(s). Note: If the problem occurred on pins 1 or 2 of the Diagnostic Junction Port tester, observe the voltmeter while disconnecting each module connector one at a time. Is the voltage steadily above 7.0 volts with the module(s) disconnected? Yes → Repair the PCI Bus circuit that measured over 7.0 volts for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to voltage was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Diagnostic Junction Port Tester cable from the DRB. Keep the tester connected to the Diagnostic Junction Port. Turn the ignition off. Disconnect the negative battery cable. Measure the resistance between ground and the PCI Bus circuit on the Diagnostic Junction Port Tester that the DRB displayed No Modules Responding. Is the resistance below 100.0 ohms? Yes → Go To 7 No → Go To 8	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Disconnect the negative battery cable. Measure the resistance between ground and the PCI Bus circuit at the Diagnostic Junction Port tester that previously measured below 100.0 ohms. Disconnect the module harness connector(s). Note: If the problem occurred on pins 1 or 2 of the Diagnostic Junction Port tester, observe the ohmmeter while disconnecting each module connector one at a time. Is the resistance below 100.0 ohms with the module(s) disconnected? Yes → Repair the PCI Bus circuit that measured below 100.0 ohms for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to ground was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom List:

P0031-1/1 O2 SENSOR HEATER CIRCUIT LOW
P0032-1/1 O2 SENSOR HEATER CIRCUIT HIGH
P0037-1/2 O2 SENSOR HEATER CIRCUIT LOW
P0038-1/2 O2 SENSOR HEATER CIRCUIT HIGH
P0051-2/1 O2 SENSOR HEATER CIRCUIT LOW
P0052-2/1 O2 SENSOR HEATER CIRCUIT HIGH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0031-1/1 O2 SENSOR HEATER CIRCUIT LOW.

When Monitored and Set Condition:

P0031-1/1 O2 SENSOR HEATER CIRCUIT LOW

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.

Set Condition: Desired state does not match Actual state.

P0032-1/1 O2 SENSOR HEATER CIRCUIT HIGH

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.

Set Condition: Desired state does not equal Actual state.

P0037-1/2 O2 SENSOR HEATER CIRCUIT LOW

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.

Set Condition: Desired state does not equal Actual state.

P0038-1/2 O2 SENSOR HEATER CIRCUIT HIGH

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.

Set Condition: Desired state does not equal Actual state.

P0051-2/1 O2 SENSOR HEATER CIRCUIT LOW

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.

Set Condition: Desired state does not equal Actual state.

P0052-2/1 O2 SENSOR HEATER CIRCUIT HIGH

When Monitored: Battery voltage above 10.6 volts, ECT below a certain Temp but within a set Temperature difference of Battery temp sensor.

Set Condition: Desired state does not equal Actual state.

P0031-1/1 O2 SENSOR HEATER CIRCUIT LOW — Continued

POSSIBLE CAUSES
HEATER CONTROL CIRCUIT OPEN
INTERMITTENT CONDITION
HEATER ELEMENT CHECK
FUSED O2 HEATER FEED CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater test. Monitor the O2 Heater Voltage for 5 minutes. Did the voltage drop down close to zero during the Heater test? Yes → Go To 2 No → Go To 3	All
2	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All
3	Disconnect the O2 Sensor harness connector. Measure the resistance of the O2 Heater element at the O2 Sensor connector(component side). The resistance value for a 4.0L O2 Heater element is 4.0 to 5.0 ohms and 12.1 to 14.8 ohms for a 4.7L O2 Heater element at 70°F (21.1°C). **NOTE: The resistance value will increase with warmer temperatures.** Is the resistance within the listed specifications? Yes → Go To 4 No → Replace the O2 sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0031-1/1 O2 SENSOR HEATER CIRCUIT LOW — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the O2 Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the O2 Heater Control circuit (PWM) from the O2 Sensor to the PCM harness connector.. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair open or high resistance in the controlled ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Disconnect the O2 Sensor harness connector. Ignition on, engine not running. Measure the voltage of the fused O2 Heater feed circuit at the O2 Sensor harness connector. Is the voltage above 12.0 volts? Yes → Go To 6 No → Repair the open in the Fused ASD Relay O2 Heater feed circuit. Inspect the related fuse. An open fuse may be caused by a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0071-BATTERY TEMP SENSOR PERFORMANCE

When Monitored and Set Condition:

P0071-BATTERY TEMP SENSOR PERFORMANCE

When Monitored: With the ignition on and no Battery Temperature Sensor Open or Short Faults present.

Set Condition: After 5 warm cycles have occurred (coolant increases at least 22°C (40°F) to a minimum of 71°C (160°F) and the odometer mileage has increased 196.6 miles and the Battery Temperature has changed less than 4°C (7.2°F) change in temperature. One trip fault.

POSSIBLE CAUSES
INTERMITTENT CONDITION
BATTERY TEMPERATURE SENSOR VOLTAGE BELOW 1.0 VOLT
SENSOR GROUND CIRCUIT HIGH RESISTANCE
BATTERY TEMPERATURE SENSOR SIGNAL CIRCUIT HIGH RESISTANCE
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter equal to zero? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Battery Temperature Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read the Battery Temp Sensor voltage. Is the voltage above 4.6 volts? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Disconnect the Battery Temperature Sensor harness connector. Using a jumper wire, jumper across the Battery Temperature Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read the Battery Temperature Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the Battery Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0071-BATTERY TEMP SENSOR PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Perform a voltage drop test by back probing the Sensor ground circuit at the Ambient Temperature Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the high resistance in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Perform a voltage drop test by back probing the Battery Temperature Sensor Signal circuit at the Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 6 No → Repair the high resistance in the Battery Temperature Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Battery Temp Signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:

P0107-MAP SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0107-MAP SENSOR VOLTAGE TOO LOW

When Monitored: With the engine RPM above 416 but less than 1500, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts.

Set Condition: The MAP Sensor signal voltage is below 0.1 of a volt for 2.0 seconds with the engine running.

POSSIBLE CAUSES
MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
INTERMITTENT CONDITION
5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5 VOLT SUPPLY CIRCUIT OPEN
MAP SENSOR INTERNAL FAILURE
PCM 5 VOLT SUPPLY CIRCUIT
PCM MAP SENSOR SIGNAL

TEST	ACTION	APPLICABILITY
1	Start the engine. With the DRBIII®, read the MAP Sensor voltage. Is the voltage below 0.1 of a volt? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage of the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 3 No → Go To 6	All
3	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. With the DRBIII®, monitor the MAP Sensor voltage. Is the voltage above 1.2 volts? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0107-MAP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance in the 5 Volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0107-MAP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: The conditions that set the DTC are not present at this time. The following list below may help in indentifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** While the engine is running at normal operating temperatures, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible try and duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the MAP Sensor Signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0108-MAP SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0108-MAP SENSOR VOLTAGE TOO HIGH

When Monitored: With the engine RPM above 400, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts

Set Condition: The MAP sensor signal voltage is greater than 4.88 volts at start or with the engine running for 2.2 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
MAP SENSOR SIGNAL CIRCUIT SHORTED TO 5 VOLT SUPPLY CIRCUIT
MAP SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
MAP SENSOR INTERNAL FAILURE
MAP SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Start the engine. With the DRBIII®, read the MAP Sensor voltage. Is the voltage above 4.6 volts? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the MAP Sensor Signal circuit and the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to the 5 Volt Supply circuit in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0108-MAP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage of the MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to voltage in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the MAP Sensor harness connector. Connect a jumper wire between the MAP Sensor Signal circuit and the Sensor ground circuit. Ignition on, engine not running. With the DRBIII®, monitor the MAP Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the MAP Sensor Signal circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the Sensor ground circuit from the PCM harness connector to the MAP Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0108-MAP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: The conditions that set the DTC are not present at this time. The following list below may help in indentifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** While the engine is running at normal operating temperatures, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible try and duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the MAP Sensor Signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0111-INTAKE AIR TEMP PERFORMANCE

When Monitored and Set Condition:

P0111-INTAKE AIR TEMP PERFORMANCE

When Monitored: With the ignition on and no Intake Air Temperature Sensor open/ shorted faults present.

Set Condition: After 5 warm cycles have occurred (coolant increases at least 22°C (40°F) to a minimum of 71°C (160°F) and the odometer mileage has increased 196.6 miles and the Intake Air Temperature has had less than 5°C (9°F) change in temperature.

POSSIBLE CAUSES
INTERMITTENT CONDITION
IAT SENSOR VOLTAGE BELOW 1.0 VOLT
SENSOR GROUND CIRCUIT HIGH RESISTANCE
IAT SENSOR SIGNAL CIRCUIT HIGH RESISTANCE
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter equal to zero? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Inlet Air Temperature Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read the IAT voltage. Is the voltage above 4.6 volts? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Disconnect the Intake Air Temperature Sensor harness connector. Using a jumper wire, jumper across the IAT Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read the IAT voltage. Is the voltage below 1.0 volt? Yes → Replace the Intake Air Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0111-INTAKE AIR TEMP PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Perform a voltage drop test by back probing the Sensor ground circuit at the IAT Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the high resistance in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Perform a voltage drop test by back probing the IAT Sensor Signal circuit at the IAT Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 6 No → Repair the high resistance in the IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Intake Air Temp Signal circuit at the Sensor connector and PCM connector. Turn the ignition on and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0112-INTAKE AIR TEMP SENSOR VOLTAGE LOW

When Monitored and Set Condition:

P0112-INTAKE AIR TEMP SENSOR VOLTAGE LOW

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Intake Air Temperature (IAT) Sensor circuit voltage at the PCM goes below 0.8 of a volt.

POSSIBLE CAUSES
INTERMITTENT CONDITION
IAT SENSOR INTERNAL FAILURE
IAT SENSOR SIGNAL SHORTED TO GROUND
IAT SENSOR SIGNAL SHORTED TO SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the IAT voltage. Is the voltage below 1.0 volt? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the IAT harness connector. Ignition on, engine not running. With the DRBIII®, read IAT voltage. Is the voltage above 1.0 volt? Yes → Replace the IAT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the IAT Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the IAT Sensor Signal circuit at the IAT Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0112-INTAKE AIR TEMP SENSOR VOLTAGE LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the IAT Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the IAT Sensor Signal circuit and the Sensor ground circuit at the IAT Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list below may help in indentifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** While the engine is running at normal operating temperatures, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible try and duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Intake Air Temp Signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0113-INTAKE AIR TEMP SENSOR VOLTAGE HIGH

When Monitored and Set Condition:

P0113-INTAKE AIR TEMP SENSOR VOLTAGE HIGH

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Intake Air Temperature (IAT) Sensor circuit voltage at the PCM goes above 4.9 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
IAT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
IAT SENSOR INTERNAL FAILURE
IAT SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the IAT voltage. Is the voltage above 4.8 volts? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the IAT Sensor harness connector. Start the engine and allow it to idle. Measure the voltage on the IAT Sensor Signal circuit. Is the voltage above 5.3 volts? Yes → Repair the short to voltage in the IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the IAT harness connector. Connect a jumper wire between the IAT Sensor Signal circuit and the Sensor ground circuit in the IAT harness connector. Ignition on, engine not running. With the DRBIII®, read IAT voltage. Is the voltage below 1.0 volt? Yes → Replace the IAT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0113-INTAKE AIR TEMP SENSOR VOLTAGE HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the IAT Sensor harness connector. Disconnect the PCM harness connector (s). Measure the resistance of the IAT Sensor Signal circuit from the IAT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the IAT Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the Sensor ground circuit from the IAT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and Miller special tool # 6801, backprobe the IAT Signal circuit at the IAT Sensor and the PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0117-ECT SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0117-ECT SENSOR VOLTAGE TOO LOW

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Engine Coolant Temperature (ECT) Sensor circuit voltage at the PCM goes below 0.8 of a volt for more than 3 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ECT SENSOR INTERNAL FAILURE
ECT SENSOR SIGNAL SHORTED TO GROUND
ECT SENSOR SIGNAL SHORTED TO SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the ECT Sensor voltage. Is the ECT Sensor voltage below 1.0 volt? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the ECT harness connector. Ignition on, engine not running. With the DRBIII®, read ECT voltage. Is the voltage above 1.0 volt? Yes → Replace the ECT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECT Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the ECT Sensor Signal circuit at the ECT Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0117-ECT SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECT Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the ECT Sensor Signal circuit and the Sensor ground circuit at the ECT Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the ECT Signal circuit at the ECT connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0118-ECT SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0118-ECT SENSOR VOLTAGE TOO HIGH

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Engine Coolant Temperature (ECT) Sensor circuit voltage at the PCM goes above 4.94 volts for more than 3 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ECT SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
ECT SENSOR INTERNAL FAILURE
ECT SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running.. With the DRBIII®, read ECT voltage. Is the voltage above 4.9 volts? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the ECT Sensor harness connector. Ignition on, engine not running. Measure the voltage on the ECT Sensor Signal circuit at the ECT Sensor harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to battery voltage in the ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0118-ECT SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the ECT harness connector. Connect a jumper wire between the ECT Sensor Signal circuit and the Sensor ground circuit in the ECT harness connector. Ignition on, engine not running. With the DRBIII®, read the ECT voltage. Is the voltage below 1.0 volt? Yes → Replace the ECT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the ECT Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the ECT Sensor Signal circuit from the ECT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the ECT Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the Sensor ground circuit from the ECT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0118-ECT SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the ECT Signal circuit at the ECT connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0121-TPS VOLTAGE DOES NOT AGREE WITH MAP

When Monitored and Set Condition:

P0121-TPS VOLTAGE DOES NOT AGREE WITH MAP

When Monitored: With the engine running and no MAP sensor or TPS DTC's set. Engine speed must be greater than 1600 RPM.

Set Condition: The PCM performs two separate tests. When the manifold vacuum is low, the TPS signal should be high. When the manifold vacuum is high, the TPS signal should be low. If the proper TPS voltage is not detected when the two conditions are met, a DTC will be set after 4 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
HIGH RESISTANCE IN MAP 5 VOLT SUPPLY CIRCUIT
MAP 5 VOLT SUPPLY SHORTED TO GROUND
MAP SENSOR
HIGH RESISTANCE IN MAP SENSOR SIGNAL CIRCUIT
HIGH RESISTANCE TO GROUND IN MAP SENSOR SIGNAL CIRCUIT
HIGH RESISTANCE IN MAP SENSOR GROUND CIRCUIT
PCM
HIGH RESISTANCE IN TPS 5 VOLT SUPPLY CIRCUIT
TPS 5 VOLT SUPPLY CIRCUIT RESISTANCE TO GROUND
THROTTLE POSITION SENSOR
HIGH RESISTANCE IN TPS SIGNAL CIRCUIT
TPS SIGNAL HAS HIGH RESISTANCE TO GROUND
HIGH RESISTANCE IN TPS GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose any TPS or MAP component DTC first before continuing.** **NOTE: If the P0500 - No Vehicle Speed Signal is set along with this DTC, refer to the P0500 diagnostics before continuing.** **NOTE: The throttle plate and linkage should be free of binding and carbon build up.** **NOTE: Ensure the throttle plate is at the idle position.** Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip displayed and equal to zero? Yes → Go To 2 No → Go To 18	All

P0121-TPS VOLTAGE DOES NOT AGREE WITH MAP — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine. With the DRBIII®, monitor the MAP Sensor voltage. Snap the throttle. Does the DRBIII® display MAP voltage from below 2.0 volts at idle to above 3.5 volts at WOT? Yes → Go To 3 No → Go To 11	All
3	Ignition on, engine not running. With the DRBIII®, monitor the TPS voltage while slowly depressing the throttle pedal from the idle position to the WOT position. Does voltage start approximately at 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Go To 18 No → Go To 4	All
4	Turn the ignition off. Disconnect the TPS harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit from the TPS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the high resistance in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the TPS harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the 5 Volt Supply circuit at the TPS harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. Disconnect the TPS harness connector. With the DRBIII®, monitor the TPS voltage. Ignition on, engine not running. Connect a jumper wire between the TPS Signal circuit and the Sensor ground circuit . Does the DRBIII® display TPS voltage from approximately 4.9 volts to below 0.5 of a volt? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All

P0121-TPS VOLTAGE DOES NOT AGREE WITH MAP — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the TPS Signal circuit from the TPS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the high resistance in the Throttle Position Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the TPS Signal circuit at the TPS harness connector. Is the resistance below 100 ohms? Yes → Go To 9 No → Repair the short to ground in the Throttle Position Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the Sensor ground circuit from the TPS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the high resistance in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
11	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the 5 Volt Supply circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0121-TPS VOLTAGE DOES NOT AGREE WITH MAP — Continued

TEST	ACTION	APPLICABILITY
12	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the resistance above 100k ohms? Yes → Go To 13 No → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
13	Turn the ignition off. Disconnect the MAP Sensor harness connector. With the DRBIII®, monitor the MAP Sensor voltage. Ignition on, engine not running. Connect a jumper wire between the MAP Sensor Signal circuit and the Sensor ground circuit . Cycle the ignition switch from off to on. With the DRBIII®, monitor the MAP Sensor voltage. Does the DRBIII® display MAP voltage from approximately 4.9 volts to below 0.5 of a volt? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 14	All
14	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the MAP Sensor Signal circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Repair the open in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
15	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Go To 16 No → Repair the short to ground in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0121-TPS VOLTAGE DOES NOT AGREE WITH MAP — Continued

TEST	ACTION	APPLICABILITY
16	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the Sensor ground circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 17 No → Repair the high resistance in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
17	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
18	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0122-TPS VOLTAGE LOW

When Monitored and Set Condition:

P0122-TPS VOLTAGE LOW

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: Throttle Position Sensor voltage at the PCM is lower than 0.1 of a volt for 1.3 seconds.

POSSIBLE CAUSES
THROTTLE POSITION SENSOR SWEEP
INTERMITTENT CONDITION
5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5 VOLT SUPPLY CIRCUIT OPEN
THROTTLE POSITION SENSOR INTERNAL FAILURE
TPS SIGNAL CIRCUIT SHORTED TO GROUND
THROTTLE POSITION SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT
TCM INTERNALLY SHORTED THROTTLE POSITION SIGNAL CIRCUIT
PCM 5 VOLT SUPPLY CIRCUIT
PCM TPS SIGNAL CIRCUIT

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the Throttle Position Sensor voltage. Is the voltage below 0.2 of a volt? Yes → Go To 2 No → Go To 11	All
2	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Ignition on, engine not running. Measure the voltage of the 5 Volt Supply circuit at the TPS harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 3 No → Go To 8	All

P0122-TPS VOLTAGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Is the voltage above 4.5 volts? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Measure the resistance between ground and the TPS Signal circuit at the TPS harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Throttle Position Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Measure the resistance between the TPS Signal circuit and the Sensor ground circuit at the TPS harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the TPS Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**NOTE: If the vehicle is not equipped with a TCM, answer No to this test and continue.** Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the TCM harness connector. Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Is the voltage above 4.5 volts? Yes → Replace the TCM in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0122-TPS VOLTAGE LOW — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Measure the resistance between ground and the 5 Volt Supply circuit at the Throttle Position Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
9	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit from the TPS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
11	Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Slowly open the throttle from the idle position to the wide open throttle position. Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Go To 12 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0122-TPS VOLTAGE LOW — Continued

TEST	ACTION	APPLICABILITY
12	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the TPS Signal circuit at the Sensor connector and PCM connector. Sweep the TPS and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Look for parameter values to change and/or a DTC to set. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0123-THROTTLE POSITION SENSOR VOLTAGE HIGH

When Monitored and Set Condition:

P0123-THROTTLE POSITION SENSOR VOLTAGE HIGH

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: Throttle Position Sensor voltage at the PCM goes above 4.5 volts for 3.2 seconds.

POSSIBLE CAUSES
THROTTLE POSITION SENSOR SWEEP
INTERMITTENT CONDITION
THROTTLE POSITION SENSOR SIGNAL CIRCUIT SHORTED TO 5 VOLT SUPPLY CIRCUIT
THROTTLE POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
THROTTLE POSITION SENSOR INTERNAL FAILURE
SENSOR GROUND CIRCUIT OPEN
THROTTLE POSITION SENSOR SIGNAL CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure the throttle is fully closed and free from binding or carbon build up.** Start the engine. With the DRBIII®, read the Throttle Position Sensor voltage. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Measure the resistance between the TPS Signal circuit and the 5 Volt Supply circuit at the TPS harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to the 5 Volt Supply circuit in the TPS Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0123-THROTTLE POSITION SENSOR VOLTAGE HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Ignition on, engine not running. Measure the voltage on the TPS Signal circuit at the TPS harness connector. **NOTE: If the voltage reading is below 5.3 volts answer NO to this test and continue.** If the voltage is above 5.3 volts, disconnect the Clock Spring harness connector. With the Clock Spring harness disconnected and if the TPS voltage drops to 5.0 volts, replace the Clock Spring. Is the voltage still above 5.3 volts with the Clock Spring harness disconnected? Yes → Repair the short to battery voltage in the TPS Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Connect a jumper wire between the TPS Signal circuit and the Sensor ground circuit. Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Is the voltage below 0.5 of a volt? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the Sensor ground circuit from the TPS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the TPS Signal circuit from the TPS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Throttle Position Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0123-THROTTLE POSITION SENSOR VOLTAGE HIGH — Continued

TEST	ACTION	APPLICABILITY
8	Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Slowly open the throttle from the idle position to the wide open throttle position. Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Go To 9 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the TPS Signal circuit at the TPS connector and PCM connector. Sweep the TPS and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0125-CLOSED LOOP TEMP NOT REACHED

When Monitored and Set Condition:

P0125-CLOSED LOOP TEMP NOT REACHED

When Monitored: With battery voltage greater than 10.4 volts, after engine is started, for ten minutes.

Set Condition: The engine temperature does not go above 18 deg. F after the engine has been running for 10 minutes. Two trips are required to set this DTC.

POSSIBLE CAUSES
ECT SENSOR (OUT OF CALIBRATION)
LOW COOLANT LEVEL
ECT WIRING HARNESS INTERMITTENT
THERMOSTAT OPERATION

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 5	All
2	**NOTE: If a ECT DTC set along with this code, diagnose the ECT DTC first.** **NOTE: Inspect the ECT terminals and related PCM terminals. Ensure the terminals are free from corrosion and damage.** **NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.** **Note: Extremely cold outside ambient temperatures may have caused this DTC to set.** **WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Allow the engine to cool before opening the cooling system.** Check the coolant system to make sure that the coolant is in good condition and at the proper level. Is the coolant level and condition OK? Yes → Go To 3 No → Inspect the vehicle for a coolant leak and add the necessary amount of coolant. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0125-CLOSED LOOP TEMP NOT REACHED — Continued

TEST	ACTION	APPLICABILITY
3	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII® in sensors, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the surrounding temperature (ambient temperature). **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the engine. During engine warm-up, monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F). Was the Eng Coolant Tmp Deg value increase a smooth transition and did it reach at least 180°? Yes → Go To 4 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	**Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII®, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature. **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the Engine. During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F) . Also monitor the actual coolant temperature with a thermometer. **NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the Eng Coolant Tmp Deg in the DRBIII® values should stay relatively close to each other.** Using the appropriate service information, determine the proper opening temperature of the thermostat. Did the thermostat open at the proper temperature? Yes → Test Complete. No → Replace the thermostat. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Perform a wiggle test on the related wire harnesses with the engine running. Watch for the Good Trip Counter to change to 0. Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0131-1/1 O2 SENSOR SHORTED TO GROUND
P0137-1/2 O2 SENSOR SHORTED TO GROUND
P0151-2/1 O2 SENSOR SHORTED TO GROUND
P0157-2/2 O2 SENSOR SHORTED TO GROUND

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0131-1/1 O2 SENSOR SHORTED TO GROUND.

When Monitored and Set Condition:

P0131-1/1 O2 SENSOR SHORTED TO GROUND

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

P0137-1/2 O2 SENSOR SHORTED TO GROUND

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

P0151-2/1 O2 SENSOR SHORTED TO GROUND

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

P0157-2/2 O2 SENSOR SHORTED TO GROUND

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

POSSIBLE CAUSES
INTERMITTENT CONDITION
O2 SENSOR OPERATION
O2 SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
O2 SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT

P0131-1/1 O2 SENSOR SHORTED TO GROUND — Continued

POSSIBLE CAUSES
O2 SENSOR SIGNAL SHORTED HEATER GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Start the engine. Allow the engine to idle for 4 to 5 minutes. With the DRBIII®, read the O2 Sensor voltage. Is the voltage below 0.16 of a volt? Yes → Go To 2 No → Go To 7	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Disconnect the O2 Sensor harness connector. With the DRBIII®, monitor the O2 Sensor voltage. Is the O2 Sensor voltage above 0.16 of a volt? Yes → Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the O2 Sensor harness connector. Measure the resistance between ground and the O2 Sensor Signal circuit at the O2 Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the O2 Sensor harness connector. Measure the resistance between the O2 Sensor Signal circuit and the Sensor ground circuit at the O2 Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All

P0131-1/1 O2 SENSOR SHORTED TO GROUND — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the O2 Sensor harness connector. **NOTE: Two types of O2 Sensor Heater Ground circuits may be used on this vehicle. One type uses an engine ground and the other type uses the PCM as a ground through the Pulse Width Modulated circuit.** Verify what type of O2 Heater ground is used on the O2 Sensor being tested. Measure the resistance between the O2 Sensor Signal circuit and the Heater ground circuit at the O2 Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the O2 Sensor Signal circuit short to the Heater ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0132-1/1 O2 SENSOR SHORTED TO VOLTAGE
P0138-1/2 O2 SENSOR SHORTED TO VOLTAGE
P0152-2/1 O2 SENSOR SHORTED TO VOLTAGE
P0158-2/2 O2 SENSOR SHORTED TO VOLTAGE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0132-1/1 O2 SENSOR SHORTED TO VOLTAGE.

When Monitored and Set Condition:

P0132-1/1 O2 SENSOR SHORTED TO VOLTAGE

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

P0138-1/2 O2 SENSOR SHORTED TO VOLTAGE

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

P0152-2/1 O2 SENSOR SHORTED TO VOLTAGE

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

P0158-2/2 O2 SENSOR SHORTED TO VOLTAGE

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
O2 SENSOR OPERATION
O2 SENSOR SIGNAL SHORTED TO VOLTAGE
O2 SENSOR SIGNAL CIRCUIT SHORTED TO O2 HEATER FEED CIRCUIT
O2 SENSOR SIGNAL OPEN
O2 SENSOR GROUND CIRCUIT OPEN
O2S HEATER FEED CIRCUIT OPEN

P0132-1/1 O2 SENSOR SHORTED TO VOLTAGE — Continued

POSSIBLE CAUSES
O2 SENSOR HEATER GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Start the engine. Allow the engine to idle for 4 to 5 minutes. With the DRBIII®, read the O2 Sensor voltage. Is the voltage above 1.5 volts? Yes → Go To 2 No → Go To 10	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Disconnect the O2 Sensor harness connector. With the DRBIII®, monitor the O2 Sensor voltage. Is the O2 Sensor voltage below 1.5 volts? Yes → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the O2 Sensor harness connector Ignition on, engine not running. Measure the voltage of the O2 Sensor Signal circuit at the O2 Sensor harness connector. Is the voltage above 1.5 volts? Yes → Repair the short to voltage in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the O2 Sensor harness connector. **NOTE: Two relays may be used on this vehicle for the different types of Heated O2 Sensors. One uses the ASD Relay which is only used with PWM O2 Sensor Heaters and the other uses the O2 Heater Relay.** Verify which relay is used to supply power for the O2 Sensor Heater being tested. Measure the resistance between the O2 Sensor Signal circuit and the O2 Heater feed circuit at the O2 Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the O2 Sensor Signal circuit for a short to the O2 Heater Feed circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All

P0132-1/1 O2 SENSOR SHORTED TO VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the O2 Sensor harness connector Disconnect the PCM harness connector. Measure the resistance of the O2 Sensor Signal circuit from the O2 Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the O2 Sensor harness connector Disconnect the PCM harness connector. Measure the resistance of the O2 Sensor ground circuit from the O2 Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the O2 Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Turn the ignition off. Disconnect the O2S harness connector Turn the ignition on. With the DRBIII® actuate the O2 HEATER TEST. Measure the voltage of the relay output circuit. Is the voltage above 11.0 volts? Yes → Go To 8 No → Repair the OPEN Heater Feed circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Disconnect the PCM harness connector. Measure the resistance of the O2 Sensor Heater (PWM) circuit from the O2 Sensor harness connector to the PCM harness connector, or between Ground and O2S Heater Ground. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the O2 Sensor Heater ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0132-1/1 O2 SENSOR SHORTED TO VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
10	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:
P0133-1/1 O2 SENSOR SLOW RESPONSE
P0139-1/2 O2 SENSOR SLOW RESPONSE
P0153-2/1 O2 SENSOR SLOW RESPONSE
P0159-2/2 O2 SENSOR SLOW RESPONSE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0133-1/1 O2 SENSOR SLOW RESPONSE.

When Monitored and Set Condition:

P0133-1/1 O2 SENSOR SLOW RESPONSE

When Monitored: With ECT greater than 147°F, after reaching a vehicle speed of 10 mph, and the throttle remaining open (off idle) for 2 minutes, bring the vehicle to a stop and allow the engine to idle with the transmission in DRIVE.

Set Condition: The oxygen sensor signal voltage is switching from below 0.27 of a volt to above 0.62 of a volt and back fewer times than required.

P0139-1/2 O2 SENSOR SLOW RESPONSE

When Monitored: Start engine. Allow engine to idle. For 1st part of test, if limits are exceeded, test passes. If not, 2nd part of test runs. amb/batt temp >44°F, Baro >22.13″ H2O, battery >10.5 volts, MAP >11.79 & <18.15″ H2O, RPM >1350 & <2200 and vss >50 and <65.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.58 of a volt and back fewer times than required.

P0153-2/1 O2 SENSOR SLOW RESPONSE

When Monitored: With ECT greater than 147°F, after reaching a vehicle speed of 10 mph, and the throttle remaining open (off idle) for 2 minutes, bring the vehicle to a stop and allow the engine to idle with the transmission in DRIVE.

Set Condition: The oxygen sensor signal voltage is switching from below 0.27 of a volt to above 0.62 of a volt and back fewer times than required.

P0159-2/2 O2 SENSOR SLOW RESPONSE

When Monitored: Start engine. Allow engine to idle. For 1st part of test, if limits are exceeded, test passes. If not, 2nd part of test runs. amb/batt temp >44°F, Baro >22.13″ H2O, battery >10.5 volts, MAP >11.79 & <18.15″ H2O, RPM >1350 & <2200 and vss >50 and <65.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.58 of a volt and back fewer times than required.

P0133-1/1 O2 SENSOR SLOW RESPONSE — Continued

POSSIBLE CAUSES
INTERMITTENT CONDITION
EXHAUST LEAK
O2 SENSOR SIGNAL CIRCUIT VOLTAGE DROP
O2 SENSOR GROUND CIRCUIT VOLTAGE DROP
O2 SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip counter displayed and equal to zero? Yes → Go To 2 No → Go To 6	All
2	Start the engine. Inspect the exhaust for leaks between the engine and the related O2 Sensor. Are there any exhaust leaks? Yes → Repair or replace the leaking exhaust parts as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Back probe the O2 Sensor Signal circuit at the O2 Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 4 No → Repair the high resistance on the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Back probe the O2 Sensor ground circuit at the O2 Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the high resistance on the O2 Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0133-1/1 O2 SENSOR SLOW RESPONSE — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view repair. Repair Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the O2 Sensor Signal circuit at the Sensor connector and PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0135-1/1 O2 SENSOR HEATER FAILURE
P0141-1/2 O2 SENSOR HEATER FAILURE
P0155-2/1 O2 SENSOR HEATER FAILURE
P0161-2/2 O2 SENSOR HEATER FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0135-1/1 O2 SENSOR HEATER FAILURE.

When Monitored and Set Condition:

P0135-1/1 O2 SENSOR HEATER FAILURE

When Monitored: With battery voltage greater than 10.5 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 30 to 90 seconds.

P0141-1/2 O2 SENSOR HEATER FAILURE

When Monitored: With battery voltage greater than 10.5 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 60 to 240 seconds.

P0155-2/1 O2 SENSOR HEATER FAILURE

When Monitored: With battery voltage greater than 10.5 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 30 to 90 seconds.

P0161-2/2 O2 SENSOR HEATER FAILURE

When Monitored: With battery voltage greater than 10.5 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 60 to 240 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
O2 HEATER ELEMENT
O2 SENSOR HEATER SUPPLY CIRCUIT OPEN
O2 SENSOR HEATER GROUND CIRCUIT OPEN

P0135-1/1 O2 SENSOR HEATER FAILURE — Continued

POSSIBLE CAUSES
O2 SENSOR HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. **NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. With the DRBIII®, monitor O2 Sensor voltage for at least 2 minutes. Does the voltage stabilize between 0.4 and 0.6 of a volt during the Heater test? Yes → Go To 2 No → Go To 3	All
2	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All
3	Turn the ignition off. **NOTE: Allow the O2 Sensor to cool to room temperature.** Disconnect the O2 Sensor harness connector. Measure the resistance across the O2 Sensor Heater element component side. The resistance value for a 4.0L O2 Heater element is 4.0 to 5.0 ohms and 12.1 to 14.8 ohms for a 4.7L O2 Heater element at 70°F (21.1°C). **NOTE: The resistance value increases with temperature.** Is the resistance value within the listed specifications? Yes → Go To 4 No → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0135-1/1 O2 SENSOR HEATER FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: This test depends on the type of Heated O2 Sensor being tested. The PWM Heated O2 Sensor uses the ASD Relay to supply voltage to the heater element and the other type uses an O2 Heater Relay.** Turn the ignition off. Disconnect the O2 Sensor harness connector. Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. Measure the voltage on the O2 Heater supply circuit. Is the voltage above 11.0 volts? Yes → Go To 5 No → Repair the open in the O2 Sensor Heater Supply cricuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	**NOTE: There may be two types of O2 Heater ground circuits used on this vehicle. Verify which type of O2 Heater ground circuit is being tested, PWM circuit or the O2 Heater Relay ground circuit.** Turn the ignition off. Disconnect the O2 Sensor harness connector. Disconnect the PCM harness connector. **NOTE: If you are testing a Pulse Width Modulated Heated O2 Sensor, measure the resistance of the PWM circuit from the O2 sensor connector to the PCM harness connector.** **NOTE: If you are testing a Heated O2 Sensor that uses an O2 Heater Relay to supply power to the O2 Heater, measure the resistance between ground and the Heater ground terminal of the O2 harness connector.** Is the resistance above 5.0 ohms? Yes → Repair the open in either the O2 Sensor Heater ground or the Pulse Width Modulated circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**NOTE: Before beginning this test, verify what type of Heated O2 Sensor is being tested, either the PWM Heated O2 Sensor or the Heater Relay controlled Heated O2 Sensor.** Disconnect the O2 Sensor connector. Disconnect the PCM harness connector. Remove the O2 Heater Relay if it applies to the type of Heated O2 Sensor being tested. **NOTE: Measure the resistance between ground and the PWM circuit if it applies to the Heated O2 Sensor being tested.** **NOTE: Measure the resistance between ground and the O2 Heater Relay Control circuit if it applies to the Heated O2 Sensor being tested.** Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Heater Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0136-1/2 O2 SENSOR HEATER CIRCUIT MALFUNCTION

When Monitored and Set Condition:

P0136-1/2 O2 SENSOR HEATER CIRCUIT MALFUNCTION

When Monitored: Ignition ON, with battery voltage greater than 10.4 volts.

Set Condition: The state of the PCM relay control circuit, between the PCM and relay coil, does not match the desired state.

POSSIBLE CAUSES
INTERMITTENT CONDITION
O2 SENSOR HEATER RELAY SUPPLY CIRCUIT OPEN OR SHORT TO GROUND
O2 SENSOR HEATER RELAY CONTROL CIRCUIT OPEN
O2S HEATER RELAY CONTROL SHORT TO GROUND
O2S HEATER RELAY COIL OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All
2	Turn ignition off. Remove the O2 Heater Relay. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe both of the ASD Output (feed) terminals at the O2 Heater Relay connector in the PDC. With the DRBIII®, actuate the ASD Relay. Does the test light illuminate brightly when the relay actuates? Yes → Go To 3 No → Repair the Heater Relay Supply circuit for an open and/or short to ground. Check the related fuse. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0136-1/2 O2 SENSOR HEATER CIRCUIT MALFUNCTION — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove the Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance of the O2S Heater Relay Control circuit from the PDC (Heater Relay) connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open O2 Sensor Heater Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Turn the ignition off. Remove the O2 Sensor Heater Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance between ground and the O2S Heater Relay Control circuit at the PDC connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Sensor Heater Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Remove the Heater Relay from the PDC. Measurement is taken at the Heater Relay component. Measure the resistance of the O2S Heater Relay Coil. Is the resistance above 100 ohms? Yes → Replace the O2S Heater Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0136-1/2 O2 SENSOR HEATER CIRCUIT MALFUNCTION — Continued

TEST	ACTION	APPLICABILITY
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:
P0171-1/1 FUEL SYSTEM LEAN
P0174-2/1 FUEL SYSTEM LEAN

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0171-1/1 FUEL SYSTEM LEAN.

When Monitored and Set Condition:

P0171-1/1 FUEL SYSTEM LEAN

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

P0174-2/1 FUEL SYSTEM LEAN

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL PRESSURE OUT OF SPECS
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
LOW FUEL PUMP VOLUME
O2 SENSOR
O2 SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
O2 SENSOR HEATER OPERATION
TPS VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
THROTTLE POSITION SENSOR SWEEP
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL PROBLEM
FUEL FILTER/PRESSURE REGULATOR
PCM

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip counter displayed and equal to zero? Yes → Go To 2 No → Go To 17	All
2	**Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge to the fuel rail. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 339 KPa +/- 34 KPa (49.2 psi +/- 5 psi).** Turn the ignition off. Choose a conclusion that best matches your fuel pressure reading. Below Specification Go To 3 Within Specification Go To 6 Above Specification Replace the fuel pressure regulator and fuel filter. Perform POWERTRAIN VERIFICATION TEST VER - 5. **CAUTION: Stop All Actuations.**	All
3	Turn the ignition off. **Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module. Install special 5/16 fuel line adapter tool #6539 or #6631 between disconnected fuel line and the fuel pump module. Attach a fuel pressure test gauge to the T fitting on tool #6539 or #6631. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 339 KPa +/- 34 KPa (49.2 psi +/- 5 psi).** Is the fuel pressure within specification? Yes → Repair or replace fuel supply line as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4 **Caution: Stop All Actuations.**	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. **WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer. Is the Fuel Inlet Strainer plugged? Yes → Replace the Fuel Pump Inlet Strainer. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**Note: The fuel pressure must be within specification before continuing.** Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Disconnect the fuel supply line at the fuel rail. Connect fuel line adapter #6539(5/16″) or #6631(3/8″) to the disconnected fuel supply line. Insert the other end of the adapter into a graduated container. **Caution: Do not operate the fuel pump for more than 7 seconds in the next step. Fuel pump module reservoir may run empty and damage to the fuel pump will result.** **Note: Specification: A good fuel pump will deliver at least 1/4 liter (1/2 pint) of fuel in 7 seconds.** Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test for 7 seconds. Is the fuel pump volume within specification? Yes → Go To 7 No → Check for a kinked/damaged fuel supply line between the fuel tank and fuel rail. If OK, replace the fuel pump module. Perform POWERTRAIN VERIFICATION TEST VER - 5. **Caution: Stop All Actuations.**	All
7	Turn the ignition off. **NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor and Exhaust System to cool down before continuing the test.** Ignition on, engine not running. With the DRBIII®, read the O2 Sensor voltage. Is the voltage above 4.5 volts? Yes → Go To 8 No → Go To 14	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. **NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. With the DRBIII®, monitor O2 Sensor voltage for at least 2 minutes. Does the voltage stay above 4.5 volts? Yes → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
9	Ignition on, engine not running. With the DRBIII®, read TP Sensor voltage. **NOTE: The throttle must be against the stop.** Is the voltage 0.92 of a volt or less with the Throttle closed? Yes → Go To 10 No → Check for a binding throttle condition. If OK, replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	Ignition on, engine not running. With the DRBIII®, read the TP Sensor voltage. While monitoring the DRBIII®, slowly open and close the throttle. Does the voltage increase and decrease smoothly? Yes → Go To 11 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
11	Turn the ignition off. Connect a Vacuum Gauge to a Manifold Vacuum source. Start the engine. Allow the engine to idle. **Note: If engine will not idle, maintain a constant RPM above idle.** With the DRBIII® in Sensors, read the MAP Sensor vacuum value. Is the DRBIII® reading within 1″ of the Vacuum Gauge reading? Yes → Go To 12 No → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
12	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII®, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature. **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the Engine. During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F). Did the Engine Coolant Temperature increase smoothly and did it reach at least 82°C (180°F)? Yes → Go To 13 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
13	Check for any of the following conditions/mechanical problems. AIR INDUCTION SYSTEM - must be free from leaks. ENGINE VACUUM - must be at least 13 inches in neutral ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. ENGINE PCV SYSTEM - must flow freely TORQUE CONVERTER STALL SPEED - must be within specifications POWER BRAKE BOOSTER - no internal vacuum leaks FUEL - must be free of contamination FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 17	All
14	**NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.** Ignition on, engine not running. Disconnect the O2 Sensor harness connector. With the DRBIII®, monitor the O2 Sensor voltage. Is the O2 Sensor voltage above 4.5 volts? Yes → Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 15	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off. Disconnect the O2 Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the O2 Sensor Signal circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 16	All
16	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
17	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:
P0172-1/1 FUEL SYSTEM RICH
P0175-2/1 FUEL SYSTEM RICH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0172-1/1 FUEL SYSTEM RICH.

When Monitored and Set Condition:

P0172-1/1 FUEL SYSTEM RICH

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and the result is below a certain value for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

P0175-2/1 FUEL SYSTEM RICH

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and the result is below a certain value for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

POSSIBLE CAUSES
INTERMITTENT CONDITION
O2 SENSOR
O2 SENSOR SIGNAL CIRCUIT OPEN
O2 SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
O2 SENSOR HEATER OPERATION
EVAP SYSTEM OPERATION
TPS VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
THROTTLE POSITION SENSOR SWEEP
FUEL FILTER/PRESSURE REGULATOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL PROBLEM
PCM

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs. **NOTE: Any O2 Sensor, TPS, ECT, MAP, or EVAP DTCs must be repaired before continuing.** Is the Good Trip counter displayed and equal to zero? Yes → Go To 2 No → Go To 15	All
2	**Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge to the fuel rail. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 339 KPa +/- 34 KPa (49.2 psi +/- 5 psi).** Turn the ignition off. Choose a conclusion that best matches your fuel pressure reading. Within Specification Go To 3 Above Specification Replace the fuel filter/pressure regulator. Perform POWERTRAIN VERIFICATION TEST VER - 5. **Caution: Stop All Actuations.**	All
3	Ignition on, engine not running. With the DRBIII®, read the O2 Sensor voltage. Is the O2 Sensor voltage above 4.5 volts? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off. **NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4 and 5 volts.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. With the DRBIII®, monitor O2 Sensor voltage for at least 2 minutes. Does the voltage stay above 4.5 volts? Yes → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: The engine must be at operating temperature and in closed loop to perform this test.** Start the engine. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Allow the engine to reach normal operating temperature. With the DRBIII® select System Tests, perform the Purge Vapors Test. Observe the Short Term Adaptive value and press 3 to flow. **NOTE: Short Term Adaptive value change.** Did the Short Term Adaptive value change? Yes → Go To 6 No → Refer to the Driveability category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Ignition on, engine not running. With the DRBIII®, read TPS voltage. **NOTE: The throttle must be against the stop.** Is the voltage 0.92 of a volt or less with the Throttle closed? Yes → Go To 7 No → Check for a binding throttle condition. If OK, replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Ignition on, engine not running. With the DRBIII®, read the TPS voltage. While monitoring the DRBIII®, slowly open and close the throttle. Does the voltage increase and decrease smoothly? Yes → Go To 8 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Turn the ignition off. Connect a Vacuum Gauge to a Manifold Vacuum source. Start the engine. Allow the engine to idle. **Note: If engine will not idle, maintain a constant RPM above idle.** With the DRBIII® in Sensors, read the MAP Sensor vacuum value. Is the DRBIII® reading within 1″ of the Vacuum Gauge reading? Yes → Go To 9 No → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
9	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII®, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature. **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the Engine. During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F). Did the Engine Coolant Temperature value increase a smooth transition and did it reach at least 82°C Yes → Go To 10 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	Check for any of the following conditions/mechanical problems. AIR INDUCTION SYSTEM - must be free from restrictions. ENGINE VACUUM - must be at least 13 inches in neutral ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. ENGINE PCV SYSTEM - must flow freely TORQUE CONVERTER STALL SPEED - must be within specifications POWER BRAKE BOOSTER - no internal vacuum leaks FUEL - must be free of contamination FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 15	All
11	Disconnect the O2 Sensor harness connector. Ignition on, engine not running. With the DRBIII®, monitor the O2 Sensor voltage. Is the O2 Sensor voltage above 4.5 volts? Yes → Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 12	All
12	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the O2 Sensor harness connector. Measure the resistance of the O2 Sensor Signal circuit from the PCM harness connector to the O2 Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 13 No → Repair the open in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
13	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Turn the ignition off. Disconnect the O2 Sensor harness connector. Start the engine. Measure the voltage on the O2 Sensor Signal circuit at the O2 Sensor harness connector. Is the voltage above 5.0 volts? Yes → Repair the short to voltage in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 14	All
14	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
15	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0201-INJECTOR #1 CONTROL CIRCUIT
P0202-INJECTOR #2 CONTROL CIRCUIT
P0203-INJECTOR #3 CONTROL CIRCUIT
P0204-INJECTOR #4 CONTROL CIRCUIT
P0205-INJECTOR #5 CONTROL CIRCUIT
P0206-INJECTOR #6 CONTROL CIRCUIT
P0207-INJECTOR #7 CONTROL CIRCUIT
P0208-INJECTOR #8 CONTROL CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0201-INJECTOR #1 CONTROL CIRCUIT.

When Monitored and Set Condition:

P0201-INJECTOR #1 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0202-INJECTOR #2 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0203-INJECTOR #3 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0204-INJECTOR #4 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0201-INJECTOR #1 CONTROL CIRCUIT — Continued

P0205-INJECTOR #5 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0206-INJECTOR #6 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0207-INJECTOR #7 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0208-INJECTOR #8 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

POSSIBLE CAUSES
WIRE HARNESS INSPECTION
ASD RELAY OUTPUT CIRCUIT
FUEL INJECTOR
FUEL INJECTOR DRIVER CIRCUIT OPEN
FUEL INJECTOR DRIVER CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All

P0201-INJECTOR #1 CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Disconnect the Fuel Injector harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Relay. Using a 12-volt test light connected to ground, backprobe the ASD Relay Output circuit at the Fuel Injector harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
3	Turn the ignition off. Disconnect the Fuel Injector harness connector. Ignition on, engine not running. Using a 12-volt test light connected to 12-volts, backprobe the Fuel Injector Driver circuit. With the DRBIII®, actuate the Fuel Injector. Does the test light blink/flicker? Yes → Replace the Fuel Injector. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the Fuel Injector harness connector. Disconnect the PCM harness connectors. Measure the resistance of the Fuel Injector Driver circuit from the Fuel Injector harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Fuel Injector Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the Fuel Injector harness connector. Disconnect the PCM harness connectors. Measure the resistance between ground and the Fuel Injector Driver circuit at the Fuel Injector harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Fuel Injector Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0201-INJECTOR #1 CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	**At this time, the conditions required to set the DTC are not present.** **NOTE: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as: VSS, MAP, ECT and Load.** **NOTE: Visually inspect the related wire harness, look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Perform a wiggle test of the wire harness and connectors while the engine is running. Listen for the engine to miss or stall. Also, watch for the Good Trip Counter to change to zero. Were any problems found? Yes → Repair the wire harness/connector as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0300-MULTIPLE CYLINDER MIS-FIRE
P0301-CYLINDER #1 MISFIRE
P0302-CYLINDER #2 MISFIRE
P0303-CYLINDER #3 MISFIRE
P0304-CYLINDER #4 MISFIRE
P0305-CYLINDER #5 MISFIRE
P0306-CYLINDER #6 MISFIRE
P0307-CYLINDER #7 MISFIRE
P0308-CYLINDER #8 MISFIRE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0300-MULTIPLE CYLINDER MIS-FIRE.

When Monitored and Set Condition:

P0300-MULTIPLE CYLINDER MIS-FIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0301-CYLINDER #1 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0302-CYLINDER #2 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0303-CYLINDER #3 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

P0304-CYLINDER #4 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0305-CYLINDER #5 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0306-CYLINDER #6 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0307-CYLINDER #7 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0308-CYLINDER #8 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

POSSIBLE CAUSES
INTERMITTENT MISFIRE
SECONDARY IGNITION
ENGINE MECHANICAL PROBLEM
FUEL SYSTEM PROBLEM
ERRATIC CAM/CRANK SENSOR SIGNALS
OTHER POSSIBLE CAUSES FOR MIS-FIRE
PCM

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, select DTCs and RELATED FUNCTIONS. Read and record the FREEZE FRAME DATA. Select OBD II MONITORS. Read and record the MIS-FIRE SIMILAR CONDITIONS WINDOW DATA. With these screens, attempt to duplicate the condition(s) that has set this DTC. When the vehicle is operating in the SIMILAR CONDITIONS WINDOW, refer to the WHICH CYLINDER IS MISFIRING screen. Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute. Is the DRBIII® counting mis-fires at this time? Yes → Go To 2 No → Go To 8	All
2	With the DRBIII®, read the FREEZE FRAME DATA. Use the FREEZE FRAME DATA and attempt to determine the cause of the Misfire DTC. In the FREEZE FRAME DATA, is the LOAD VALUE over 50% and the operating temp normal? Yes → Check secondary ignition components and perform a cylinder leakage test. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST. No → Go To 3	All
3	Check for any of the following conditions/mechanical problems. ENGINE VACUUM - must be at least 13 inches in neutral ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications CYLINDER LEAKAGE TEST - must be within specifications CAM LOBES - must not be worn excessively WEAK or BROKEN VALVE SPRINGS ENGINE PCV SYSTEM - must flow freely TORQUE CONVERTER STALL SPEED - must be within specifications POWER BRAKE BOOSTER - no internal vacuum leaks FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST. No → Go To 4	All
4	With the DRBIII®, read the FREEZE FRAME DATA. Use the FREEZE FRAME DATA and attempt to determine the cause of the Misfire DTC. In the FREEZE FRAME, are the adaptive fuel percentages greater than +/- 15%? Yes → Refer to the Driveablitiy Category and perform the Checking Fuel Delivery symptom. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST. No → Go To 5	All

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
5	With the DRBIII®, read the FREEZE FRAME DATA. Use the FREEZE FRAME DATA and attempt to determine the cause of the Misfire DTC. In the FREEZE FRAME DATA, is the engine RPM over 3000 and the operating temp normal? Yes → Test CMP and CKP signals with Lab Scope, check valve timing, and perform running vacuum test. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST. No → Go To 6	All
6	**Note: Anything that affects the speed of the crankshaft can cause a misfire DTC.** The following are other possible causes for mis-fire: Injector harness connectors, PCM power grounds, restricted exhaust, intake restriction, damaged trigger wheel, contaminated fuel, carbon build up on valves, or the accessory drive belt (serpentine belt). Check for any TSB's that may relate to a Misfire DTC. Do any of the above causes exist? Yes → Repair as necessary. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST.	All
8	**NOTE: The conditions that set the DTC are not present at this time.** An intermittent problem may have been caused by moisture in the secondary ignition. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS, OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the DRBIII®, select DTC's AND RELATED FUNCTIONS. Read and record the FREEZE FRAME DATA. Select OBD II MONITORS. Read and record MIS-FIRE SIMILAR CONDITIONS WINDOW DATA. With these screens, attempt to duplicate the condition that has set the Misfire DTC. While using FREEZE FRAME DATA, pay particular attention to the DTC setting conditions, such as speed, temp, load, and map vacuum. Does the mis-fire reoccur? Yes → Restart diagnostics beginning with Test 2. Perform FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST. No → Test Complete.	All

Symptom:
P0320-NO CRANK REFERENCE SIGNAL AT PCM

When Monitored and Set Condition:

P0320-NO CRANK REFERENCE SIGNAL AT PCM

When Monitored: With the ignition on.

Set Condition: No signal from the crankshaft position sensor is present during engine cranking, and at least 3 camshaft position sensor signals have occurred.

POSSIBLE CAUSES
CAM POSITION SENSOR SIGNAL
CHECKING INTERMITTENT CKP SIGNAL WITH LAB SCOPE
5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5 VOLT SUPPLY CIRCUIT OPEN
5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
CKP SENSOR SIGNAL CIRCUIT SHORTED GROUND
CKP SENSOR SIGNAL CIRCUIT OPEN
CKP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
CKP SENSOR SIGNAL SHORTED TO 5 VOLT SUPPLY CIRCUIT
CRANK SENSOR GROUND CIRCUIT OPEN
PCM - 5 VOLT SUPPLY
PCM - CKP SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the Current CKP State while cranking the engine. Does the DRBIII® display Current CKP State Present while cranking the engine? Yes → Go To 2 No → Go To 4	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: An intermittent failure with the Cam Position Sensor may cause the P0320 code to set.** Turn the ignition off. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the CMP Signal circuit in the CMP Sensor connector and the PCM harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Ignition on, engine not running. Wiggle the related wire harness and gently tap on the Cam Position Sensor. Monitor the lab scope screen. Start the engine. Lightly tap on the CMP Sensor and wiggle the related wire harness. Observe the lab scope screen, looking for any erratic pulses generated by the CMP Sensor. Did the CMP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Cam Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	**NOTE: The following tests may help in identifying a possible intermittent condition with the Crank Sensor or its related wire harness.** Ignition on, engine not running. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the CKP Signal circuit in the Crank Sensor connector and the PCM harness connector. Wiggle the related wire harness and connections. Monitor the lab scope screen. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Lightly tap on the Crank Sensor and wiggle the CKP Sensor connector and the related wire harness. Observe the lab scope screen. Look for any erratic pulses generated by the CKP Sensor. Did the CKP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Crank Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All
4	Turn the ignition off. Disconnect the CKP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the Crank Sensor 5 Volt Supply circuit at the CKP Sensor harness connector. Is the voltage between 4.8 and 5.2 volts? Yes → Go To 5 No → Go To 13	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the CKP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the CKP Sensor Signal circuit at the CKP Sensor harness connector. Is the voltage between 4.5 and 5.0 volts? Yes → Go To 6 No → Go To 8	All
6	Turn the ignition off. Disconnect the CKP Sensor harness connector. Measure the resistance of the Sensor ground circuit from the CKP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.** If there are no possible causes remaining, view repair. Repair Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Turn the ignition off. Disconnect the CKP Sensor harness connector. Measure the resistance between ground and the CKP Sensor Signal circuit at the CKP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
9	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the PCM harness connectors. Measure the resistance of the CKP Sensor Signal circuit from the CKP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the CKP Sensor harness connector. Ignition on, engine not running. Measure the voltage of the CKP Sensor Signal circuit at the CKP Sensor harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to battery voltage in the CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 11	All
11	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the CKP Sensor Signal circuit and the 5 Volt Supply circuit at the CKP Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to the 5 Volt Supply circuit in the CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 12	All
12	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
13	Turn the ignition off. Disconnect the PCM harness connector(s). Disconnect the CKP Sensor harness connector. Measure the resistance between ground and the 5 Volt Supply circuit at the CKP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 14	All
14	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the 5 Volt Supply circuit from the CKP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Repair the open in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off. Disconnect the CKP Sensor harness connector. Ignition on, engine not running. Measure the voltage of the 5 Volt Supply circuit at the CKP Sensor harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to battery voltage in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 16	All
16	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0325-KNOCK SENSOR #1 CIRCUIT
P0330-KNOCK SENSOR #2 CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0325-KNOCK SENSOR #1 CIRCUIT.

When Monitored and Set Condition:

P0325-KNOCK SENSOR #1 CIRCUIT

When Monitored: With the ignition on and the engine running.

Set Condition: Knock Sensor #1 signal below minimum acceptable threshold voltage at particular engine speeds or above 5.0 volts.

P0330-KNOCK SENSOR #2 CIRCUIT

When Monitored: With the ignition on and the engine running.

Set Condition: Knock Sensor #2 signal below minimum acceptable threshold voltage at particular engine speeds or above 5.0 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
KNOCK SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
KNOCK SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR SIGNAL CIRCUIT OPEN
KNOCK SENSOR SIGNAL CIRCUIT SHORTED TO KNOCK SENSOR RETURN CIRCUIT
KNOCK SENSOR RETURN CIRCUIT OPEN
KNOCK SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Record the Freeze Frame Information that set along with the DTC.** Ignition on, engine not running. With the DRBIII®, read DTC's. Is the Good Trip displayed and equal to zero? Yes → Go To 2 No → Go To 8	All

P0325-KNOCK SENSOR #1 CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Disconnect the Knock Sensor harness connector. Ignition on, engine not running. Measure the voltage of the Knock Sensor Signal circuit in the Knock Sensor harness connector. Is the voltage above 2.0 volts? Yes → Repair the short to voltage in the Knock Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the Knock Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the Knock Sensor Signal circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Knock Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the Knock Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the Knock Sensor Signal circuit from the Knock Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Knock Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the Knock Sensor harness connector. Measure the resistance between the Knock Sensor Signal circuit and the Knock Sensor Return circuit in the Knock Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the Knock Sensor Signal circuit for a short to Knock Sensor Return circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. Disconnect the Knock Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the Knock Sensor Return circuit from the Knock Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Knock Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0325-KNOCK SENSOR #1 CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Replace the Knock Sensor. Ignition on, engine not running. With the DRBIII®, erase DTC. Attempt to operate the vehicle using the information noted in the Freeze Frame. With the DRBIII®, read DTC's. Does the DRBIII® display the DTC that was previously erased? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0340-NO CAM SIGNAL AT PCM

When Monitored and Set Condition:

P0340-NO CAM SIGNAL AT PCM

When Monitored: Engine cranking/running.

Set Condition: At least 5 seconds have elapsed with Crankshaft Position Sensor signals present but no Camshaft Position Sensor signal.

POSSIBLE CAUSES
CRANK POSITION SENSOR SIGNAL
CHECKING INTERMITTENT CMP SIGNAL WITH LAB SCOPE
5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5 VOLT SUPPLY CIRCUIT OPEN
5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
CMP SENSOR SIGNAL CIRCUIT SHORTED GROUND
CMP SENSOR SIGNAL CIRCUIT OPEN
CMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
CMP SENSOR SIGNAL SHORTED TO 5 VOLT SUPPLY CIRCUIT
CAM POSITION SENSOR GROUND CIRCUIT OPEN
PCM - 5 VOLT SUPPLY
PCM - CMP SENSOR SIGNAL
CAMSHAFT POSITION SENSOR

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the Current CMP State while cranking the engine. Does the DRBIII® display Current CMP State Present while cranking the engine? Yes → Go To 2 No → Go To 4	All

P0340-NO CAM SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: An intermittent Crank Position Sensor failure may cause the P0340 code to set.** Ignition on, engine not running. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the CKP Signal circuit in the Crank Sensor connector and the PCM harness connector. Wiggle the related wire harness and connections. Monitor the lab scope screen. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Lightly tap on the Crank Sensor and wiggle the CKP Sensor connector and wire harness. Observe the lab scope screen. Look for any erratic pulses generated by the CKP Sensor. Did the CKP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Crank Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	**NOTE: The following tests may help in identifying a possible intermittent condition with the Cam Sensor or its related wire harness.** Ignition on, engine not running. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the CMP Signal circuit in the Cam Sensor connector and the PCM harness connector. Wiggle the related wire harness and connections. Monitor the lab scope screen. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Lightly tap on the Cam Sensor and wiggle the CMP Sensor connector and wire harness. Observe the lab scope screen. Look for any erratic pulses generated by the CMP Sensor. Did the CMP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Cam Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All
4	Turn the ignition off. Disconnect the CMP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the 5 Volt Supply circuit at the CMP Sensor harness connector. Is the voltage between 4.8 and 5.2 volts? Yes → Go To 5 No → Go To 13	All

P0340-NO CAM SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the CMP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the CMP Sensor Signal circuit at the CMP Sensor harness connector. Is the voltage between 4.5 and 5.0 volts? Yes → Go To 6 No → Go To 8	All
6	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the Sensor ground circuit from the CMP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.** If there are no possible causes remaining, view repair. Repair Replace the Camshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Turn the ignition off. Disconnect the CMP Sensor harness connector. Measure the resistance between ground and the CMP Sensor Signal circuit at the CMP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
9	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the CMP Sensor Signal circuit from the CMP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0340-NO CAM SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the CMP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the CMP Sensor Signal circuit at the CMP Sensor harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to battery voltage in the CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 11	All
11	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the CMP Sensor Signal circuit and the 5 Volt Supply circuit at the CMP Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to the 5 Volt Supply circuit in the CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 12	All
12	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
13	Turn the ignition off. Disconnect the PCM harness connector(s). Disconnect the CMP Sensor harness connector. Measure the resistance between ground and the 5 Volt Supply circuit at the CMP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 14	All
14	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit from the CMP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Repair the open in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0340-NO CAM SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off. Disconnect the CMP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the 5 Volt Supply circuit at the CMP Sensor harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to battery voltage in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 16	All
16	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0351-IGNITION COIL #1 PRIMARY CIRCUIT
P0352-IGNITION COIL #2 PRIMARY CIRCUIT
P0353-IGNITION COIL #3 PRIMARY CIRCUIT
P0354-IGNITION COIL #4 PRIMARY CIRCUIT
P0355-IGNITION COIL #5 PRIMARY CIRCUIT
P0356-IGNITION COIL #6 PRIMARY CIRCUIT
P0357-IGNITION COIL #7 PRIMARY CIRCUIT
P0358-IGNITION COIL #8 PRIMARY CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0351-IGNITION COIL #1 PRIMARY CIRCUIT.

When Monitored and Set Condition:

P0351-IGNITION COIL #1 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0352-IGNITION COIL #2 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0353-IGNITION COIL #3 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0351-IGNITION COIL #1 PRIMARY CIRCUIT — Continued

P0354-IGNITION COIL #4 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0355-IGNITION COIL #5 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0356-IGNITION COIL #6 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0357-IGNITION COIL #7 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0358-IGNITION COIL #8 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0351-IGNITION COIL #1 PRIMARY CIRCUIT — Continued

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
CAPACITOR(S) SHORTED TO GROUND
ASD OUTPUT CIRCUIT SHORTED TO GROUND
COIL ON PLUG
COIL DRIVER CIRCUIT SHORTED TO GROUND
COIL DRIVER CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero for? Yes → Go To 2 No → Go To 9	4.7L POWER TECH V8
2	Turn the ignition off. Disconnect the coil on plug harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Relay. Using a 12-volt test light connected to ground (B-), check the ASD Relay Output circuit at the Coil on plug harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Go To 7 **Stop All Actuations**	4.7L POWER TECH V8
3	Turn the ignition off. Disconnect the coil on plug harness connector. **Note: The following resistance measurement should be taken at 70-80 degrees F.** Measure the primary resistance of the Coil on plug. Is the resistance between 0.6 and 0.9 of an ohm? Yes → Go To 4 No → Replace the coil on plug. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.7L POWER TECH V8

P0351-IGNITION COIL #1 PRIMARY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Coil on plug harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the Coil Driver circuit and ground (B-). Is the resistance below 5.0 ohms? Yes → Repair the short to ground in the Coil Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	4.7L POWER TECH V8
5	Turn the ignition off. Disconnect the Coil on plug harness connector. Disconnect the Powertrain Control Module connectors. Measure the resistance of the Coil Driver circuit from the Coil on plug connector to the PCM connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open Coil Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.7L POWER TECH V8
6	If there are no possible causes remaining, review repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.7L POWER TECH V8
7	Turn the ignition off. Disconnect the Ignition Coil harness connector. Remove the ASD Relay from the IPM. Measure the resistance of the ASD Relay Output circuit between the ASD Relay connector and the Ignition Coil harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.7L POWER TECH V8
8	**NOTE: Repeat the following test for both capacitors** **NOTE: The Capacitors are attached to the side of each valve cover.** Turn the ignition off. Disconnect the Capacitor harness connector. Install a good INJ/COIL fuse. With the DRBIII®, actuate the ASD Relay. **NOTE: If the above test result is an open fuse for both capacitor tests, the problem is a short to ground in the ASD Relay Out circuit. Repair the short to ground in the ASD Relay Output circuit and refer to VER-5** Is the INJ/COIL fuse OK for both capacitor tests? Yes → Replace the Capacitor(s) Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Repair the ASD Output circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.7L POWER TECH V8

P0351-IGNITION COIL #1 PRIMARY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	4.7L POWER TECH V8

Symptom List:

P0351-IGNITION COIL #1 PRIMARY CIRCUIT
P0352-IGNITION COIL #2 PRIMARY CIRCUIT
P0353-IGNITION COIL #3 PRIMARY CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0351-IGNITION COIL #1 PRIMARY CIRCUIT.

When Monitored and Set Condition:

P0351-IGNITION COIL #1 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It take less than 3 seconds during cranking or up to 6 seconds while running to set.

P0352-IGNITION COIL #2 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts while cranking or greater than 12 volts with the engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0353-IGNITION COIL #3 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes 3 seconds during cranking or up to 6 seconds while running to set.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT
COIL RAIL RESISTANCE
IGNITION COIL
IGNITION COIL DRIVER CIRCUIT OPEN

P0351-IGNITION COIL #1 PRIMARY CIRCUIT — Continued

POSSIBLE CAUSES
IGNITION COIL DRIVER CIRCUIT SHORTED TO GROUND
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 8	4.0L POWER TECH I-6
2	Turn the ignition off. Disconnect the coil rail harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Relay. Using a 12-volt test light connected to ground, check the ASD relay output circuit at the coil rail harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD relay output circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 5. **Stop All Actuations**	4.0L POWER TECH I-6
3	Turn the ignition off. Disconnect the coil rail harness connector. **Note: The following resistance measurement should be taken at 70-80 degrees F.** Measure the primary resistance of the coil rail. Is the resistance value between 0.53 and 0.65 of an ohm? Yes → Go To 4 No → Replace the coil rail. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.0L POWER TECH I-6
4	Turn the ignition off. Disconnect the Ignition Coil Rail harness connector. Using a 12-volt test light connected to a 12-volt source, probe the Ignition Coil Driver circuit. Crank the engine for 5 seconds while observing the test light. Does the test light blink/flicker? Yes → Replace the Ignition Coil Rail. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	4.0L POWER TECH I-6

P0351-IGNITION COIL #1 PRIMARY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the Coil Rail harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the Ignition Coil Driver circuit from the Ignition Coil connector to the PCM connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Ignition Coil Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.0L POWER TECH I-6
6	Turn the ignition off. Disconnect the Coil Rail harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the Ignition Coil Driver circuit and ground. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Ignition Coil Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	4.0L POWER TECH I-6
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.0L POWER TECH I-6
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	4.0L POWER TECH I-6

Symptom List:

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY
P0432-2/1 CATALYTIC CONVERTER EFFICIENCY

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0420-1/1 CATALYTIC CONVERTER EFFICIENCY.

When Monitored and Set Condition:

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY

When Monitored: After engine warm up to 147° F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).

Set Condition: As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one.

P0432-2/1 CATALYTIC CONVERTER EFFICIENCY

When Monitored: After engine warm up to 147° F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).

Set Condition: As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one.

POSSIBLE CAUSES
INTERMITTENT CONDITION
VISUALLY INSPECT CATALYTIC CONVERTER
EXHAUST LEAK
ENGINE MECHANICAL PROBLEM
UPSTREAM O2 SENSOR OLDER THAN DOWNSTREAM O2 SENSOR
CATALYTIC CONVERTER

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY — Continued

TEST	ACTION	APPLICABILITY
2	Inspect the Catalytic Converter for the following damage. Damage Catalytic Converter, dent and holes. Severe discoloration caused by overheating the Catalytic Converter. Catalytic Converter broke internally. Leaking Catalytic Converter. Were any problems found? Yes → Replace the Catalytic Converter. Repair the condition that may have caused the failure. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Start Engine and let idle. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Check for exhaust leaks between the engine and the appropriate downstream O2 Sensor. Is there any exhaust leaks? Yes → Repair or replace leaking exhaust parts as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	**Check the exhaust for excessive smoke from internal oil or coolant leaks.** Is there an oil or coolant consumption condition present? Yes → Repair engine mechanical condition as necessary and replace Catalytic Converter. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	**NOTE: A new Downstream O2 Sensor along with an aging Upstream O2 Sensor may cause this trouble code to set.** Review vehicle repair history. Has the Downstream O2 Sensor been replaced without replacing the Upstream O2 Sensor? Yes → Replace the appropriate Upstream Oxygen Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Catalytic Converter. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY — Continued

TEST	ACTION	APPLICABILITY
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0441-EVAP PURGE FLOW MONITOR

When Monitored and Set Condition:

P0441-EVAP PURGE FLOW MONITOR

When Monitored: With engine temperature greater than 170° F, fuel control in closed loop, engine idling for 2 minutes, no low fuel, MAP less than 15.7 inches mercury and barometric altitude less than 8,000 feet.

Set Condition: After having passed the Leak Detection Pump (LDP) test, no air flow through the evaporative system is detected by the EVAP monitor.

POSSIBLE CAUSES
INTERMITTENT CONDITION
VISUAL INSPECTION
EVAP PURGE HOSE (SOLENOID TO CANISTER)
EVAP PURGE HOSE (CANISTER TO FUEL TANK)
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE SOLENOID (LEAKY/STUCK OPEN)
EVAP PURGE SOLENOID (STUCK CLOSED)

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 8	All
2	Visually inspect the Evap canister. Look for any physical damage or any signs of fuel that has entered the canister. Any signs of fuel may indicate a bad rollover valve. Were any problems found? Yes → Repair or Replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Visually inspect the Evap purge hose that goes from the Purge Solenoid to the Evap Canister. Look for any physical damage such as a pinched, plugged, ripped or dry rotted hose. Were any problems found? Yes → Repair or replace hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0441-EVAP PURGE FLOW MONITOR — Continued

TEST	ACTION	APPLICABILITY
4	Visually inspect the Evap purge hose that goes between the Evap canister and the fuel tank. Look for any physical damage such as a pinched, plugged, ripped or dry rotted hose. Were any problems found? Yes → Repair or replace hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing. Also check for a pinched or plugged hose from the throttle body to the Purge Solenoid. Inspect the vacuum nipple at the throttle body for any damage or plugging. Is the vacuum supply hose and throttle body vacuum nipple free from defects? Yes → Go To 6 No → Repair the vacuum supply hose/tube as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**Note: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty rollover valve. Replace purge solenoid if contamination is found** Turn the ignition off. Disconnect the vacuum hoses at the EVAP Purge Solenoid. Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port. (component side) Does the Evap Purge Solenoid hold vacuum? Yes → Go To 7 No → Replace the Evap Purge Solenoid and the EVAP canister and clean out EVAP lines as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port. (component side) Ignition on, engine not running. With the DRBIII®, actuate the EVAP Purge Solenoid and observe the vacuum gauge. Does the vacuum drop when the solenoid is actuated? Yes → Test Complete. No → Replace the Evap Purge Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0441-EVAP PURGE FLOW MONITOR — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED
P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED
P0456-EVAP LEAK MONITOR SMALL (.020) LEAK DETECTED

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED.

When Monitored and Set Condition:

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.

Set Condition: If there is a leak larger than 0.040″ and smaller than 0.080″ in the evaporative system.

P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.

Set Condition: There is a leak larger than 0.080″ in the evaporative system.

P0456-EVAP LEAK MONITOR SMALL (.020) LEAK DETECTED

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.

Set Condition: There is a leak larger than 0.020″ and smaller than 0.040″ in the evaporative system.

POSSIBLE CAUSES
EVAPORATIVE EMISSION LEAK DETECTION
EVAP PURGE SOLENOID LEAKS/STUCK OPEN
INTERMITTENT LDP MONITOR FAILURE

TEST	ACTION	APPLICABILITY
1	**Note: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Ensure the gas cap meets OEM specifications.** Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 5	All

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED — Continued

TEST	ACTION	APPLICABILITY
2	To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD). **WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.** **NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.** Disconnect the vacuum supply hose at the Leak Detection Pump. Connect and apply a continuous vacuum supply (i.e. 20″Hg) to the Leak Detection Pump. A vacuum pump such as an A/C recovery unit works well. Using the DRBIII®, select Engine/System Tests and actuate the Leak Detect Pump Test (Option 3/Hold PSI). **NOTE: The above energizes the LDP solenoid and allows the constant vacuum source to apply vacuum to the LDP pump diaphragm. This lifts the diaphragm up and seals the atmospheric canister vent valve at the bottom of the Leak Detection Pump.** Connect the red power lead of Miller Tool #8404 to the battery positive terminal and the black ground lead to battery negative terminal. **NOTE: See Charts and Graph support material EELD Calibration Setup for an example.** Connect shop air to the #8404 EELD. Set the smoke/air control switch to AIR. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size). Press the remote smoke/air start button. Position the red flag on the air flow meter so it is aligned with the indicator ball. When the calibration is complete, release the remote button. The EELD is now calibrated the flow meter in liters per minute to the size leak indicated by the DTC set in the PCM. Install the service port adapter #8404-14 on the vehicle's service port. Connect the Air supply hose from the EELD to the service port. Press the remote button to activate AIR flow. **NOTE: Larger volume fuel tanks, and/or those with less fuel, may require 4 to 5 minutes to fill.** Compare the flow meter indicator ball reading to the red flag. ABOVE the red flag indicates a leak present. BELOW the red flag indicates a sealed system. Is the indicator ball above the red flag? Yes → Go To 3 No → Go To 5	All

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.** To continue testing, you will need Miller Tool #8404 Evaporative Emissions Leak Detector (EELD). Remove the Air supply hose from the service port. Connect the SMOKE supply tip (black hose) to the service port. Set the smoke/air control switch to SMOKE. **NOTE: The flow meter indicator ball will not move at this point.** Press the remote smoke/air start button. **NOTE: Ensure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.** **NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.** While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke. If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke. The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light. Was a leak found? Yes → Repair or replace the leaking component as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 4	All
4	**NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty rollover valve. Replace/repair as necessary.** Turn the ignition off. Disconnect the vacuum hoses at the Evap Purge Solenoid. Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side. **NOTE: Monitor the vacuum gauge for at least 15 seconds.** Does the Evap Purge Solenoid hold vacuum? Yes → Go To 5 No → Replace the Evap Purge Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED — Continued

TEST	ACTION	APPLICABILITY
5	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.** **Note: Refer to any Technical Service Bulletins (TSB's) that may apply.** With the DRBIII® in System Tests, perform the LDP Monitor Test. This will force the PCM to run the LDP Monitor. If the monitor fails, further diagnosis is required to find faulty component. If the monitor passes, the condition is not present at this time. Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Test Complete.	All

Symptom:
P0443-EVAP PURGE SOLENOID CIRCUIT

When Monitored and Set Condition:

P0443-EVAP PURGE SOLENOID CIRCUIT

When Monitored: Continuously after the ignition is turned on and the battery voltage is above 10.4 volts.

Set Condition: Not powering down, not in limp-in and time since last solenoid activation is greater than 72 micro seconds. The PCM will set a trouble code if the actual state of the solenoid does not match the intended state on two consecutive key cycles.

POSSIBLE CAUSES
INTERMITTENT CONDITION
EVAP PURGE SOLENOID
EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN
EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Specific Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Evap Purge Solenoid connector. Measure the resistance between the terminals of the Evap Purge Solenoid. Is the resistance between 30.0 and 40.0 ohms? Yes → Go To 3 No → Replace the Evap Purge Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
3	Turn the ignition off. Disconnect the Evap Purge Solenoid harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Evap Purge Solenoid Control circuit from the PCM harness connector to the Evap Purge Solenoid harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Evap Purge Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0443-EVAP PURGE SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Evap Purge Solenoid harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Evap Purge Solenoid Control circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Evap Purge Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the Evap Purge Solenoid harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage on the Fused Ignition Switch Output circuit at the EVAP Purge Solenoid harness connector. Is the voltage above 10.0 volts? Yes → Go To 6 No → Repair the open in the Fused Ignition Switch Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0460-FUEL LEVEL UNIT NO CHANGE OVER MILES
P0461-FUEL LEVEL UNIT NO CHANGE OVER TIME

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0460-FUEL LEVEL UNIT NO CHANGE OVER MILES.

When Monitored and Set Condition:

P0460-FUEL LEVEL UNIT NO CHANGE OVER MILES

When Monitored: Engine running and fuel level either below 15% or above 85% of capacity.

Set Condition: The PCM sees low fuel, less than 15%, for more than 120 miles or fuel level does not change by at least 4% for more than 250 miles.

P0461-FUEL LEVEL UNIT NO CHANGE OVER TIME

When Monitored: Engine running and fuel level either below 15% or above 85% of capacity.

Set Condition: The PCM sees low fuel, less than 15%, for more than 120 miles or fuel level does not change by at least 4% for more than 250 miles.

POSSIBLE CAUSES
PHYSICALLY DAMAGED/DEFORMED/OBSTRUCTED FUEL TANK
FUEL LEVEL SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. **WARNING: The fuel system is under a constant pressure, even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Remove the fuel tank. Remove the fuel pump module from the fuel tank. Inspect the inside of the fuel tank for any obstructions or deformities. Is the fuel tank free from defects? Yes → Go To 2 No → Repair or replace the fuel tank as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	If there are no possible causes remaining, view repair. Repair Replace the Fuel Level Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW

When Monitored and Set Condition:

P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW

When Monitored: Ignition on and battery voltage above 10.4 volts.

Set Condition: The fuel level sensor signal voltage goes below 0.2 of a volt at the PCM for more than 5 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL LEVEL SENSOR
FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the Fuel Level Sensor voltage. Is the Fuel Level Sensor voltage below 0.2 of a volt? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Ignition on, engine not running. With the DRBIII®, read the Fuel Level Sensor voltage. Did the Fuel Level Sensor voltage change from below 0.2 of a volt to above 4.0 volts? Yes → Replace the Fuel Level Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All
3	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Fuel Level Sensor Signal circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All

P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Fuel Level Sensor Signal circuit and the Sensor ground circuit. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Signal circuit at the Fuel Pump Module connector and PCM connector. Turn the ignition on and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary or refer to the Instrument Category in the Body Diagnostic Manual and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P0463-FUEL LEVEL SENDING UNIT VOLTS TOO HIGH

When Monitored and Set Condition:

P0463-FUEL LEVEL SENDING UNIT VOLTS TOO HIGH

When Monitored: Ignition on and battery voltage above 10.4 volts.

Set Condition: The fuel level sensor signal voltage at the PCM goes above 4.95 volts for more than 90 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL LEVEL SENSOR
FUEL LEVEL SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the Fuel Level Sensor voltage. Is the Fuel Level Sensor voltage above 4.9 volts? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Fuel Pump Module electrical harness connector. Connect a jumper wire between the Fuel Level Sensor Signal circuit and the Sensor ground circuit at the Fuel Pump Module harness connector. Ignition on, engine not running. With the DRBIII®, read the Fuel Level Sensor voltage. Did the Fuel Level Sensor voltage change from above 4.8 volts to below 0.4 of a volt? Yes → Replace the Fuel Level Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All

P0463-FUEL LEVEL SENDING UNIT VOLTS TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor ground circuit from the PCM harness connector to the Fuel Pump Module harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Turn the ignition off. Disconnect the fuel pump module harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - It is critical that the connector is free from any signs of corrosion or deformities - Clean/repair as necessary.** Measure the resistance of the Fuel Level Sensor signal circuit from the PCM harness connector to the Fuel Pump Module harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Fuel Level Sensor Signal circuit and the Sensor ground circuit. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in the Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P0463-FUEL LEVEL SENDING UNIT VOLTS TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Signal circuit at the Fuel Pump Module connector and PCM connector. Turn the ignition on and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary or refer to the Instrument Category in the Body Diagnostic Manual and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P0500-NO VEHICLE SPEED SENSOR SIGNAL

When Monitored and Set Condition:

P0500-NO VEHICLE SPEED SENSOR SIGNAL

When Monitored: Engine Temperature greater than 104 deg F. , MAP vacuum approximately 15″ to 16″ inches of mercury and Engine RPM between 1400 and 3000 rpm.

Set Condition: No Vehicle Speed Signal for more than 15 seconds on two consecutive trips.

POSSIBLE CAUSES
INTERMITTENT CONDITION
VEHICLE SPEED SIGNAL CIRCUIT OPEN
VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND
VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO VOLTAGE
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. **NOTE: Any VSS DTCs in the CAB Module or Body Controller must be properly diagnosed before continuing.** Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Powertrain Control Module harness connectors. Disconnect the ABS Control Module harness connector. Measure the resistance of the Vehicle Speed Signal circuit between the PCM harness connector and the ABS Control Module harness connector. Is the resistance above 5.0 ohms? Yes → Repair the open Vehicle Speed Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the Powertrain Control Module harness connectors. Disconnect the ABS Control Module harness connector. Measure the resistance between ground and the Vehicle Speed Signal circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Vehicle Speed Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0500-NO VEHICLE SPEED SENSOR SIGNAL — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the PCM harness connector. Ignition on, engine not running. Measure the voltage on the Vehicle Speed Signal circuit at the PCM harness connector. Is the voltage above 4.8 volts? Yes → Repair the short to voltage in the Vehicle Speed Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the PCM in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary or refer to the proper ABS Diagnostic Manual and perform the appropriate symptom diagnostics. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0505-IDLE AIR CONTROL MOTOR CIRCUITS

When Monitored and Set Condition:

P0505-IDLE AIR CONTROL MOTOR CIRCUITS

When Monitored: At power-up and battery voltage greater than 11.5 volts.

Set Condition: The PCM senses a short to ground or battery voltage on any of the four Idle Air Control (IAC) driver circuits for 100 msec while the IAC motor is active.

POSSIBLE CAUSES
INTERMITTENT CONDITION
IAC #1 DRIVER CIRCUIT SHORTED TO #2, #3, OR #4
IAC #2 DRIVER CIRCUIT SHORTED TO #3 OR #4
IAC #3 DRIVER CIRCUIT SHORTED TO #4
IAC DRIVER CIRCUIT SHORTED TO VOLTAGE
IAC DRIVER CIRCUIT SHORTED TO GROUND
IAC MOTOR OPERATION
IAC MOTOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip displayed and equal to zero? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the IAC Motor harness connector. Disconnect the Powertrain Control Module harness connectors. **Note: The following steps are checking for a short between the IAC Driver Circuits.** Measure the resistance between the IAC #1 Driver circuit and #2, #3, #4 Driver circuits. Is the resistance below 5.0 ohms on any of the Drivers? Yes → Repair the IAC Driver Circuits shorted together. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0505-IDLE AIR CONTROL MOTOR CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the IAC Motor harness connector. Disconnect the Powertrain Control Module harness connectors. **Note: The following steps are checking for a short between the IAC Driver Circuits.** Measure the resistance between the IAC #2 Driver circuit and #3, #4 Driver circuits. Is the resistance below 5.0 ohms on any of the Drivers? Yes → Repair the IAC Driver Circuits shorted together. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the IAC Motor harness connector. Disconnect the Powertrain Control Module harness connectors. **Note: The following steps are checking for a short between the Driver Circuits.** Measure the resistance between the IAC #3 Driver circuit and the #4 Driver circuit. Is the resistance below 5.0 ohms? Yes → Repair the IAC Driver Circuits shorted together. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the IAC Motor harness connector. Disconnect the Powertrain Control Module harness connector. Remove the ASD Relay. Using a jumper wire, jumper between the Fused B+ circuit and ASD Relay Output circuit in the PDC. Ignition on, engine not running. Measure the voltage of each of the IAC Driver circuit. Is the voltage above 1.0 volt at any IAC Driver circuit? Yes → Repair the IAC Driver circuit(s) for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. Disconnect IAC Motor harness connector. Disconnect the PCM harness connector. Repeat each measurement for each IAC Driver circuit. Measure the resistance of each IAC Driver circuit to ground. Is the resistance below 100 ohms at any IAC Driver circuit? Yes → Repair the IAC Driver circuit(s) for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All

P0505-IDLE AIR CONTROL MOTOR CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the IAC Motor harness connector. Start and idle the engine. Using a test light connected to ground, probe the IAC Driver #1 circuit for 10 seconds. Repeat the above test for the remaining IAC Motor Driver circuits. Does the test light turn on and off while probing each IAC Motor Driver circuit? Yes → Replace the Idle Air Control Motor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0522-OIL PRESSURE SENSOR VOLTS LOW

When Monitored and Set Condition:

P0522-OIL PRESSURE SENSOR VOLTS LOW

When Monitored: With the ignition key on and battery voltage above 10.4 volts.

Set Condition: The oil pressure sensor voltage at PCM goes below 0.1 of a volt for 0.5 of a second.

POSSIBLE CAUSES
INTERMITTENT CONDITION
OIL PRESSURE 5-VOLT SUPPLY CIRCUIT OPEN
OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
OIL PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Start the engine. With the DRBIII® in Sensors, read the Oil Pressure Sensor voltage. Is the Oil Pressure Sensor voltage below 0.1 of a volt? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage on the 5 Volt Supply circuit. Is the voltage between 4.8 and 5.2 volts? Yes → Go To 3 No → Repair the open in the Oil Pressure Sensor 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
3	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance between the Oil Pressure Sensor Signal circuit and ground (B-). Is the resistance below 100 ohms? Yes → Repair the short to ground in the Oil Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All

P0522-OIL PRESSURE SENSOR VOLTS LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Oil Pressure Sensor Signal circuit and the Sensor ground circuit at the Oil Pressure Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to Sensor ground in the Oil Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII® in Sensors, read the Oil Pressure Sensor voltage. Is the voltage above 4.5 volts? Yes → Replace the Oil Pressure Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Oil Pressure Sensor Signal circuit at the sensor connector and the PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P0523-OIL PRESSURE SENSOR VOLTS HIGH

When Monitored and Set Condition:

P0523-OIL PRESSURE SENSOR VOLTS HIGH

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: The oil pressure sensor signal at PCM goes above 4.9 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN
OIL PRESSURE SENSOR
SENSOR GROUND CIRCUIT OPEN
OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII® in Sensors, read the Oil Pressure Sensor voltage. Is the Oil Pressure Sensor voltage above 4.8 volts? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Disconnect the PCM harness connector(s). Measure the resistance of the Oil Pressure Sensor Signal Circuit from the PCM harness connector to the Oil Pressure Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open in the Oil Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
3	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Install a jumper wire between the Sensor Signal circuit, and Sensor ground circuit, at the Sensor harness connector. Ignition on, engine not running. With the DRBIII® in Sensors, read the Oil Pressure Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the Oil Pressure Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All

P0523-OIL PRESSURE SENSOR VOLTS HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit from the Oil Press Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the Oil Pressure Sensor Signal circuit. Is the test light illuminated and bright? Yes → Repair the short to battery voltage in the Oil Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace the Powertrain Control Module. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, back probe the Oil Pressure Signal circuit at the Sensor connector and the PCM connector. Start the engine and look for any differences in the two patterns. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P0700-TCM CONTROLLER DTC PRESENT

POSSIBLE CAUSES
TCM DTC PRESENT SET IN PCM

Repair Instructions:

TCM DTC PRESENT SET IN PCM

A DTC was registered in the Transmission Control Module. With the DRB, go to the TCM and read codes. Refer to the appropriate symptom (DTC).

Symptom List:

P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR
P1196-2/1 O2 SENSOR SLOW DURING CATALYST MONITOR

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR.

When Monitored and Set Condition:

P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR

When Monitored: With the engine running, coolant greater than 170°F, open throttle, steady to slightly increasing vehicle speed greater than 18 mph but less than 55 mph, with a light load on the engine, for a period no less than 5 minutes.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.6 of a volt and back fewer times than required.

P1196-2/1 O2 SENSOR SLOW DURING CATALYST MONITOR

When Monitored: With the engine running, coolant greater than 170°F, open throttle, steady to slightly increasing vehicle speed greater than 18 mph but less than 55 mph, with a light load on the engine, for a period no less than 5 minutes.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.6 of a volt and back fewer times than required.

POSSIBLE CAUSES
INTERMITTENT CONDITION
EXHAUST LEAK
O2 SENSOR SIGNAL CIRCUIT VOLTAGE DROP
O2 SENSOR GROUND CIRCUIT VOLTAGE DROP
O2 SENSOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 6	All

P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine. Inspect the exhaust for leaks between the engine and the appropriate O2 Sensor. Are there any exhaust leaks? Yes → Repair or replace the leaking exhaust parts as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Back probe the O2 Sensor Signal circuit at the O2 Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 4 No → Repair the high resistance on the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	**NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Back probe the O2 Sensor ground circuit at the O2 Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the high resistance on the O2 Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	If there are no possible causes remaining, view repair. Repair Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR — Continued

TEST	ACTION	APPLICABILITY
6	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P1281-ENGINE IS COLD TOO LONG

When Monitored and Set Condition:

P1281-ENGINE IS COLD TOO LONG

When Monitored: The ignition key on, engine running, Ambient Temperatur greater than 20°F, and Vacuum is less than 17″Hg.

Set Condition: The engine does not warm to 85° C (181° F) while driving for more than 3 minutes and less than 1 hour depending on Engine load and Start up Temperature.

POSSIBLE CAUSES
ENGINE COLD TOO LONG

TEST	ACTION	APPLICABILITY
1	**Note: The best way to diagnose this DTC is to allow the vehicle to remain outside overnight in order to have a completely cold soaked engine.** **Note: Extremely cold outside ambient temperatures may cause this DTC to set.** Verify that the coolant level is not low and correct as necessary. Start the engine. With the DRBIII®, set the engine RPM to 1500 and allow the engine to warm up for 10-15 minutes. With the DRBIII®, monitor the ENG COOLANT TMP DEG value during the warm up cycle. Make sure the transition of temperature change is smooth. Did the engine temperature reach a minimum of 80° C (176° F)? Yes → Test Complete. No → Refer to the Service Information for cooling system performance diagnosis. The most probable cause is a Thermostat problem. Also, refer to any related TSBs. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT

When Monitored and Set Condition:

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: An open or shorted condition is detected in the Fuel Pump Relay Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL PUMP RELAY
FUEL PUMP RELAY CONTROL CIRCUIT OPEN
FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the Fuel Pump Relay. Is the Fuel Pump Relay clicking? Yes → Go To 2 No → Go To 3	All
2	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove the Fuel Pump Relay. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between terminals 1 (85) and 2 (86) of the Fuel Pump Relay. Is the resistance between 50 and 90 ohms? Yes → Go To 4 No → Replace the Fuel Pump Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Turn the ignition off. Remove the Fuel Pump Relay from the PDC. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Fuel Pump Relay Control circuit from the Fuel Pump Relay connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Fuel Pump Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Turn the ignition off. Remove the Fuel Pump Relay from the PDC. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Fuel Pump Relay Control circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Fuel Pump Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	Turn the ignition off. Remove the Fuel Pump Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage on the Fused Ignition Switch output circuit in the Fuel Pump Relay connector. Is the voltage above 10.0 volts? Yes → Go To 7 No → Repair the open in the Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1294-TARGET IDLE NOT REACHED

When Monitored and Set Condition:

P1294-TARGET IDLE NOT REACHED

When Monitored: With the engine idling and in drive, if automatic. There must not be a MAP sensor trouble code or a throttle position sensor trouble code.

Set Condition: Engine idle is not within 200 rpm above or 100 rpm below target idle for 14 seconds. Three separate failures are required to set a bad trip. Two bad trips are required to set the code.

POSSIBLE CAUSES
INTERMITTENT CONDITION
VACUUM LEAK
AIR INDUCTION SYSTEM
THROTTLE BODY AND THROTTLE LINKAGE
IAC DRIVER CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **NOTE: All MAP Sensor, IAC, and/or TPS codes present must be diagnosed first before proceeding.** With the DRBIII®, read DTCs. Is the Good Trip displayed and equal to zero? Yes → Go To 2 No → Go To 8	All
2	Inspect the Intake Manifold for vacuum leaks. Inspect the Power Brake Booster for any vacuum leaks. Inspect the PCV system for proper operation or any vacuum leaks. Were any problems found? Yes → Repair vacuum leak as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All
3	Inspect the Air Induction System for the following problems. Restrictions: Dirty Air Cleaner, Foreign material trap in the air intake tube, etc. Leaks: Air Intake tube connection, Air Cleaner housing, etc. Were any problems found? Yes → Repair or replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All

P1294-TARGET IDLE NOT REACHED — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the vacuum line at the PCV valve. Install Miller Tool #6714 (0.185″ air metering orifice) into the disconnected vacuum line in place of the PCV valve. Disconnect the purge hose from the fitting on the throttle body. The purge hose is located on the front of the throttle body next to the MAP sensor. Cap the fitting at the throttle body after the purge hose has been disconnected. Start the engine. Ensure that all accessories are off. Allow the engine to reach operating temperature above 82°C (180°F). With the DRBIII® in System Tests, perform the Minimum Air Flow function. Is the engine RPM between 500 and 900? Yes → Go To 8 No → Go To 5	All
5	Inspect the throttle body plate carbon build up or other restrictions. Inspect the throttle linkage for binding and smooth operation. Ensure the throttle plate is resting on the stop at idle. Remove IAC, inspect the pintle and its seating surface inside the throttle body. Were any problems found? Yes → Clean and/or replace the throttle body as needed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	Turn the ignition off. Disconnect IAC Motor harness connector. Disconnect the PCM harness connector. Measure the resistance of the IAC Driver circuit from the IAC Motor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the IAC Driver circuit(s). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1294-TARGET IDLE NOT REACHED — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P1296-NO 5 VOLTS TO MAP SENSOR

When Monitored and Set Condition:

P1296-NO 5 VOLTS TO MAP SENSOR

When Monitored: During power-down and battery voltage greater than 10.4 volts.

Set Condition: The MAP sensor signal voltage goes below 2.35 volts with the key off for 5 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
5 VOLT SUPPLY CIRCUIT OPEN
MAP SENSOR
MAP SENSOR 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
PCM
PCM SENSE

TEST	ACTION	APPLICABILITY
1	**NOTE: If the P0107 - MAP Sensor Voltage Too Low is also set, diagnose it first before continuing with P1296 - No 5 Volts To MAP Sensor.** Ignition on, engine not running. With the DRBIII® in Sensors, read the MAP sensor voltage. Is the voltage below 2.35 volts? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the voltage above 4.5 volts? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. With the DRBIII® in Sensors, read the MAP Sensor voltage. Is the voltage above 4.5 volts? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P1296-NO 5 VOLTS TO MAP SENSOR — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the MAP Sensor harness connector and the PCM connector. Measure the resistance of the 5 Volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open or high resistance in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the MAP Sensor Electrical harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the MAP Sensor 5 Volt Supply circuit for resistance to ground. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P1297-NO CHANGE IN MAP FROM START TO RUN

When Monitored and Set Condition:

P1297-NO CHANGE IN MAP FROM START TO RUN

When Monitored: With engine RPM +/- 64 of target idle and the throttle blade at closed throttle.

Set Condition: Too small of a difference is seen between barometric pressure with ignition on (engine running) and manifold vacuum for 8.80 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5 VOLT SUPPLY CIRCUIT OPEN
MAP SENSOR INTERNAL FAILURE
MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
MAP SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT
MAP SENSOR VACUUM PORT
PCM 5 VOLT SUPPLY CIRCUIT
PCM MAP SENSOR SIGNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: If a MAP high or Low DTC set along with P1297, diagnose the High or Low DTC first before continuing.** Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip displayed and equal to zero? Yes → Go To 2 No → Go To 12	All
2	Ignition on, engine not running. With the DRBIII®, read the MAP Sensor voltage. Is the voltage below 3.19 volts? Yes → Go To 3 No → Go To 12	All

P1297-NO CHANGE IN MAP FROM START TO RUN — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 4 No → Go To 9	All
4	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. With the DRBIII®, monitor the MAP Sensor voltage. Is the voltage above 1.2 volts? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between the MAP Sensor Signal circuit and the Sensor ground circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to Sensor ground in the MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Turn the ignition off. Remove the MAP Sensor. Inspect the vacuum port, check for restrictions or any foreign materials. Were any restriction found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1297-NO CHANGE IN MAP FROM START TO RUN — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the 5 Volt Supply circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All
10	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the open in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
11	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
12	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: Remove the MAP Sensor and inspect the MAP and vacuum passage for restrictions and foriegn material** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P1299 - VACUUM LEAK FOUND

POSSIBLE CAUSES
VACUUM LEAK
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This code is enabled on engines with plastic intake manifolds and is intended to shut down the engine if a large crack occurs.** **NOTE: A large vacuum leak is mostly the cause of this DTC.** Inspect the Intake manifold for vacuum leaks. Inspect the Power Brake Booster for any vacuum leaks. Inspect the PCV system for proper operation or any vacuum leaks. Were any vacuum leaks found? Yes → Repair vacuum leak as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT

When Monitored and Set Condition:

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT

When Monitored: With ignition key on and battery voltage above 10.4 volts.

Set Condition: An open or shorted condition is detected in the ASD Relay control circuit.

POSSIBLE CAUSES
WIRING HARNESS INTERMITTENT PROBLEM
ASD RELAY
FUSED IGNITION SWITCH OUTPUT CIRCUIT
ASD RELAY CONTROL CIRCUIT OPEN
ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Specific Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Remove the ASD Relay from the PDC. Measure the resistance between terminals 85 and 86 of the ASD Relay. Is the resistance between 50 and 80 ohms? Yes → Go To 3 No → Replace the ASD Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
3	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance of the ASD Relay Control circuit from the ASD Relay cavity in the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the ASD relay control circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance between ground and the ASD Relay Control circuit at the PDC. Is the resistance below 100 ohms? Yes → Repair the ASD Relay control circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Remove the ASD Relay from the PDC. Ignition on, engine not running. Measure the voltage on the Fused Ignition Switch Output circuit at the ASD Relay connector in the PDC. Is the voltage above 10.0 volts? Yes → Go To 6 No → Repair the open in the Fused Ignition Output circuit. Inspect and replace fuses and necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	If there are no more possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	At this time, the conditions required to set the DTC are not present. **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Perform a wiggle test on the related wire harnesses with the engine running. Watch for the Good Trip Counter to change to 0. Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM

When Monitored and Set Condition:

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM

When Monitored: With ignition key on, battery voltage above 10.4 volts, and engine RPM greater than 400.

Set Condition: No voltage sensed at the PCM when the ASD Relay is energized.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY
ASD RELAY OUTPUT CIRCUIT OPEN
FUSED B+ CIRCUIT OPEN
ASD OUTPUT CIRCUIT OPEN
PCM - START
PCM - NO START

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 9	All
2	Attempt to start the engine. Did the engine start? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance of the ASD Relay Output circuit from the ASD Relay cavity in the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Install a substitute relay for the ASD Relay. Attempt to start the vehicle. Did the engine start? Yes → Replace the ASD Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance of the ASD Relay Output circuit from the ASD Relay cavity in the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	Turn the ignition off. Remove the ASD relay from the PDC. Measure the voltage of the Fused B+ circuit at the ASD Relay connector. Is the voltage above 10.0 volts? Yes → Go To 8 No → Repair the open or short to ground in the fused B+ circuit. Note: Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P1391-INTERMITTENT LOSS OF CMP OR CKP

When Monitored and Set Condition:

P1391-INTERMITTENT LOSS OF CMP OR CKP

When Monitored: Engine running or cranking.

Set Condition: When the failure counter reaches 20 for 2 consecutive trips.

POSSIBLE CAUSES
CMP AND CKP OUT OF SYNC
CHECKING INTERMITTENT CMP SIGNAL WITH LAB
HARNESS INSPECTION
TONE WHEEL/PULSE RING INSPECTION
WIRING HARNESS INSPECTION
TONE WHEEL/PULSE RING INSPECTION
CHECKING INTERMITTENT CKP SIGNAL WITH LAB
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR

TEST	ACTION	APPLICABILITY
1	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine and run until operating temp is reached. (Closed Loop) With the DRBIII® under the Misc. menu, choose the Set Sync Signal function and observe the Actual Sync Setting. Does the Actual Sync Setting read In Range? Yes → Go To 2 No → With the DRBIII®, synchronize the Cam and Crank Position Sensors. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. With the DRBIII® lab scope probe and the Miller special tool #6801, backprobe the CMP Signal circuit in the CMP harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Observe the lab scope screen. Are there any irregular or missing signals? Yes → Go To 3 No → Go To 6	All

P1391-INTERMITTENT LOSS OF CMP OR CKP — Continued

TEST	ACTION	APPLICABILITY
3	Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Ensure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) tight. Refer to any TSBs that may apply. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Remove the Camshaft Position Sensor. Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement. Were any problems found? Yes → Repair or replace the Tone Wheel/Pulse Ring as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace the Camshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the CMP Signal circuit in the PCM harness connector and in the CMP harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Observe the lab scope screen. Wiggle the related wire harness and gently tap on the Cam Position Sensor. Look for any differences between the Channel 1 and Channel 2 patterns, generated by the CMP Sensor. Does the DRBIII® screen display any missing or irregular patterns? Yes → Replace the Camshaft Position Sensor or repair the wiring/ connection concern.. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All

P1391-INTERMITTENT LOSS OF CMP OR CKP — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. With the DRBIII® lab scope probe and the Miller special tool #6801, backprobe the CKP Signal circuit in the CKP harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Observe the lab scope screen. Are there any irregular or missing signals? Yes → Go To 8 No → Go To 11	All
8	Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Ensure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) tight. Refer to any TSBs that may apply. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
9	Turn the ignition off. Remove the Crankshaft Position Sensor. Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement. Were any problems found? Yes → Repair or replace the Tone Wheel/Flex Plate as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1391-INTERMITTENT LOSS OF CMP OR CKP — Continued

TEST	ACTION	APPLICABILITY
11	**NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.** Turn the ignition off. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the CKP Signal circuit in the PCM harness connector and CKP harness connector. Both of the graphs should be identical. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Monitor the DRBIII® lab scope screen, both patterns should be the same. Wiggle the related wire harness and gently tap on the Crank Position Sensor. Look for any differences between Channel 1 and Channel 2 patterns generated by the CKP Sensor. Were any erratic or missing signals noticed? Yes → Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT

When Monitored and Set Condition:

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT

When Monitored: Under closed throttle decel with A/C off, ECT above 75, and more than 50 seconds after engine start.

Set Condition: One of the CKP sensor target windows has more than 2.86% variance from the reference window.

POSSIBLE CAUSES
INTERMITTENT CONDITION
CMP SENSOR CONNECTOR/WIRING
CKP SENSOR CONNECTOR/WIRING
DAMAGED TONE WHEEL/FLEX PLATE (CRANKSHAFT)
CRANKSHAFT POSITION SENSOR
FAULTY PCM

TEST	ACTION	APPLICABILITY
1	**Note: Check for any TSB's that may apply to this symptom.** Read and record the Freeze Frame Data. Use this information to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load. Ignition on, engine not running. With the DRBIII® in the miscellaneous menu, choose ″Clear PCM (battery disconnect)″ to reset the PCM. With the DRBIII®, choose the ″Misfire Pretest screen. Road test the vehicle and re-learn the adaptive numerator. The adaptive numerator is learned when the ″Adaptive Numerator Done Learning″ line on the Mis-fire Pre-test screen changes to ″Yes″. Did the adaptive numerator re-learn? Yes → Go To 2 No → Go To 3	All

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All
3	Turn ignition off. **Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Make sure the Camshaft Position Sensor is tight.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. **Note: Visually inspect the Crankshaft Position Sensor and related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Make sure the sensor mounting bolt(s) are tight.** Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect and remove the crankshaft position sensor. Inspect the tone wheel/flexplate slots for damage, foreign material, or excessive movement. Is the tone wheel/flexplate free from defects? Yes → Go To 6 No → Repair/replace tone wheel/flex plate as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. With the DRBIII® lab scope probe and the Miller special tool #6801, back probe the CKP Signal circuit in the PCM harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING..** Start the engine and observe the lab scope screen for any erratic CKP Sensor pulses. Were any erratic Crank Position signals detected? Yes. Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No. Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND

When Monitored and Set Condition:

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40 deg. F and 90 deg. F and coolant temperature within 10 deg. F of battery/ ambient.

Set Condition: LDP test must pass first. If the PCM suspects a pinched hose it will not set a fault until it runs the evap purge flow monitor. If the purge monitor does not pass then the pinched hose fault will be set.

POSSIBLE CAUSES
INTERMITTENT CONDITION
EVAP CANISTER OBSTRUCTED
OBSTRUCTION IN HOSE/TUBE BETWEEN EVAP CANISTER AND PURGE SOLENOID
LDP PRESSURE HOSE OBSTRUCTED
LEAK DETECTION PUMP

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 5	All
2	**Note: All previously disconnected hose(s) reconnected.** Re-pressurize the EVAP System. On Miller Tool #8404, set the Pressure/Hold switch to Open and set the Vent switch to Closed. Turn the pump timer On and watch the gauge. The flow meter gauge on the EELD reads 0 LPM the EVAP system completely pressurized. Disconnect the LDP Pressure hose at the EVAP Canister. The LDP Pressure hose is the hose that connects the Evap Canister to the Leak Detection Pump. Did the pressure drop when the hose was disconnected? Yes → Go To 3 No → Replace the EVAP Canister. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND — Continued

TEST	ACTION	APPLICABILITY
3	**Note: All previously disconnected hose(s) reconnected.** Re-pressurize the EVAP System. On Miller Tool #8404, set the Pressure/Hold switch to Open and set the Vent switch to Closed. Turn the pump timer On and watch the gauge. The flow meter gauge on the EELD reads 0 LPM the EVAP system completely pressurized. Disconnect the EVAP hoses at the Purge Solenoid. Did the pressure drop when the hose was disconnected? Yes → Go To 4 No → Repair or replace hose/tube as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
4	Disconnect and remove the LDP pressure hose. The LDP pressure hose is the hose that connects the EVAP Canister to the Leak Detection Pump. Inspect the LDP pressure hose for any obstructions or physical damage. Is the LDP pressure hose free from defects? Yes → Replace the Leak Detection Pump. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Repair/replace hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
5	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.** **Note: Refer to any Technical Service Bulletins (TSB's) that may apply.** With the DRBIII® in System Tests, perform the LDP Monitor Test. This will force the PCM to run the LDP Monitor. If the monitor fails, further diagnosis is required to find faulty component. If the monitor passes, the condition is not present at this time. Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Test Complete.	All

Symptom:
P1491-RAD FAN CONTROL RELAY CIRCUIT

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUSED B+ CIRCUIT
FUSED IGNITION SWITCH CIRCUIT
RADIATOR FAN GROUND CKT OPEN
RAD FAN RELAY CONTROL CIRCUIT OPEN
RADIATOR FAN RELAY CONTROL CIRCUIT SHORT TO GROUND
RADIATOR FAN RELAY
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Specific Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Remove the Radiator Fan Relay from the PDC. Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the Fused B+ circuit. Inspect fuses and replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
3	Turn the ignition off. Remove the Radiator Fan Relay from the PDC. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open in the Fused Ignition Switch circuit. Inspect fuses and replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Turn the ignition off. Remove the Radiator Fan Relay form the PDC. Measure the Radiator Fan Relay Ground Circuit to Ground. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1491-RAD FAN CONTROL RELAY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the PCM harness connector(s). Remove the Radiator Fan Relay for the PDC. Measure the resistance of the Radiator Fan Relay Control circuit from PDC to PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Radiator Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	Turn the ignition off. Remove the Radiator Fan Relay from the PDC. Disconnect the PCM harness connector(s). Measure the resistance between ground and the Radiator Fan Relay Control circuit. Is the resistance above 100 kohms? Yes → Go To 7 No → Repair the short to ground in the Radiator Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	Turn the ignition off. Disconnect the PCM harness connector(s). Connect a jumper wire to the Radiator Fan Relay Control circuit in the PCM harness connector. Momentarily connect the other end of the jumper wire to ground. Did the Radiator Fan actuate? Yes → Go To 8 No → Replace the Radiator Fan Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1491-RAD FAN CONTROL RELAY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P1494-LEAK DETECTION PUMP SW OR MECHANICAL FAULT

When Monitored and Set Condition:

P1494-LEAK DETECTION PUMP SW OR MECHANICAL FAULT

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40 deg. F and 90 deg. F and coolant temperature within 10 deg. F of battery/ ambient.

Set Condition: The state of the switch does not change when the solenoid is energized.

POSSIBLE CAUSES
LDP SWITCH SENSE CIRCUIT SHORTED TO GROUND
LDP VACUUM SUPPLY
WIRE HARNESS/INTERMITTENT
FAULTY LEAK DETECTION PUMP
LDP SWITCH SENSE CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the vacuum supply hose at the Leak Detection Pump. Connect a vacuum gauge to the disconnected vacuum supply hose at the Leak Detection Pump. Start the engine and read the vacuum gauge. Does the vacuum gauge read at least 13″ Hg? Yes → Go To 3 No → Repair leak or obstruction in vacuum hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1494-LEAK DETECTION PUMP SW OR MECHANICAL FAULT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Leak Detection Pump electrical harness connector. Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the Leak Detect Pump Sw state. While observing the Leak Detect Pump Sw state, connect a jumper wire between a good 12 volt source (B+) and the LDP Switch Sense circuit. Did the Leak Detect Pump Sw state change when the jumper was connected? Yes → Replace the Leak Detection Pump. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 4	All
4	Turn the ignition off. Disconnect the Leak Detection Pump electrical harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the LDP Switch Sense circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the LDP Switch Sense circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 5	All
5	Turn the ignition off. Disconnect the Leak Detection Pump harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the LDP Switch Sense Circuit from the PCM harness connector to LDP harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Leak Detection Pump Switch Sense circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
7	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB's) that may apply.** Perform a wiggle test of the LDP wiring while the circuit is actuated with the DRBIII®. Listen for the LDP to quit actuating. Also watch for the Good Trip Counter to change to 0. Were any problems found? Yes → Repair wire harness/connectors as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Test Complete.	All

Symptom:
P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT

When Monitored and Set Condition:

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT

When Monitored: Continuously when the ignition is on and battery voltage is greater than 10.4 volts.

Set Condition: The state of the solenoid circuit does not match the PCM's desired state.

POSSIBLE CAUSES
GENERATOR SOURCE CIRCUIT OPEN
LEAK DETECTION PUMP SOLENOID CONTROL CIRCUIT OPEN
LDP SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
LEAK DETECTION PUMP
WIRING HARNESS INTERMITTENT
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the DTC Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the Leak Detection Pump electrical harness connector. Ignition on, engine not running. With the DRBIII®, actuate the Leak Detection Pump. Using a 12 volt test light connected to ground, check the Generator Source circuit at the LDP connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the Generator Source circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Leak Detection Pump electrical harness connector. Connect a 12 volt test light to a good 12 volt source. Ignition on, engine not running. With the DRBIII®, actuate the Leak Detection Pump. Check the LDP Solenoid Control circuit with the test light while the Pump is actuating. Does the test light blink? Yes → Go To 4 No → Go To 5	All
4	If there are no possible causes remaining, view repair. Repair Replace the Leak Detection Pump. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
5	Turn the ignition off. Disconnect the Leak Detection Pump electrical harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the LDP Solenoid Control circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the LDP Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 6	All
6	Turn the ignition off. Disconnect the Leak Detection Pump Solenoid harness connector. Disconnect the PCM harness connector(s).. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the LDP Solenoid control Circuit from the PCM harness connector to the LDP harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Leak Detection Pump Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
8	At this time, the conditions required to set the DTC are not present. **NOTE: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Refer to any Technical Service Bulletins (TSB's) that may apply.** Perform a wiggle test of the LDP wiring while the circuit is actuated with the DRB. Listen for the LDP to quit actuating. Also watch for the Good Trip Counter to change to 0. Did the LDP Solenoid ever stop or start clicking? Yes → Repair as necessary where wiggling caused problem to appear. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Test Complete.	All

Symptom:

P1499 - HYDRAULIC FAN SOLENOID CIRCUIT

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUSED ASD RELAY OUTPUT
HYDRAULIC FAN SOLENOID PWM CIRCUIT SHORT TO GROUND
HYDRAULIC FAN SOLENOID PWM CIRCUIT OPEN
HYDRAULIC FAN SOLENOID
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, perform the Hydraulic Fan Solenoid Test found under Engine Test and Systems Test. Does the Radiator Fan operate properly? Yes → Go To 2 No → Go To 3	All
2	At this time, the conditions required to set the DTC are not present. **NOTE: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Refer to any Technical Service Bulletins (TSB's) that may apply.** Perform a wiggle test of the Hydraulic Fan Solenoid wiring while actuating the Fan with the DRBIII®. Watch the Fan to see if it quits working, also watch for the Good Trip Counter to change to 0. Did the Hydraulic Fan ever stop or start moving during the wiggle test? Yes → Repair as necessary where wiggling caused problem to appear. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All
3	Ignition on, engine not running. Using a 12-volt test light connect to ground, probe the Fused ASD Relay Output circuit at the fan solenoid. With the DRBIII®, actuate the ASD Relay. Does the test light illuminate brightly when the ASD Relay is actuated? Yes → Go To 4 No → Repair the open in the Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1499 - HYDRAULIC FAN SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Radiator Fan harness connector. Disconnect the PCM harness connector(s). Measure the resistance between ground and the Hydraulic Fan Solenoid PWM circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Hydraulic Fan PWM circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Disconnect the PCM harness connector(s). Disconnect the Hydraulic Fan Solenoid harness connector. Measure the resistance of the Hydraulic Fan Solenoid PWM circuit from the fan harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Hydraulic Fan Solenoid PWM circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	Turn the ignition off. Backprobe the Hydraulic Fan Solenoid PWM circuit at the PCM harness connector. Ignition on, engine not running. Remove the ASD Relay and use a jumper wire to keep the ASD Output circuit powered up for this step only. Connect a jumper wire to the Hydraulic Fan Solenoid PWM circuit in the PCM harness connector. Momentarily connect the other end of the jumper wire to ground. Did the Radiator Fan actuate? Yes → Go To 7 No → Replace the Hydraulid Radiator Fan Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1899-TRS PERFORMANCE

When Monitored and Set Condition:

P1899-TRS PERFORMANCE

When Monitored: Continuously with the transmission in Park, Neutral, or Drive and NOT in Limp-in mode.

Set Condition: This code will set if the PCM detects an incorrect Park/Neutral switch state for a given mode of vehicle operation.

POSSIBLE CAUSES
INTERMITTENT TRS SENSE CIRCUIT
P/N SWITCH
PARK/NEUTRAL SENSE CIRCUIT OPEN
PARK/NEUTRAL SENSE CIRCUIT SHORTED TO GROUND
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip Counter for P-1899 displayed and equal to 0? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition on. With the DRBIII®, read the PNP switch input state. While moving the gear selector through all gear positions Park to 1st and back to Park, watch the DRBIII® display. Did the DRBIII® display PNP Switch and D/R in the correct gear positions? Yes → Test Complete. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM C1 harness connector. Disconnect the PNP switch harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the PNP switch sense circuit between the PCM C1 harness connector and the PNP switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the PNP sense circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	All

P1899-TRS PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the PCM C1 harness connector. Disconnect the PNP switch harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the PNP switch sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the PNP switch sense circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the PCM C1 harness connector. Check connectors - Clean/repair as necessary Move the gear selector through all gear positions, from Park to 1st and back. While moving the gear selector through the gear positions, measure the resistance between ground and the TRS sense circuit in the PCM C1 harness connector. Did the display change from above 10.0 ohms to below 10.0 ohms? Yes → Go To 6 No → Replace the Park/Neutral Position Switch in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	All
7	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	All

Symptom:
*CHECKING EVAPORATIVE EMISSION OPERATION WITH NO DTCS

POSSIBLE CAUSES
PURGE SYSTEM CONTAMINATED
ROLLOVER VALVE
VACUUM HARNESS INTERMITTENT
WIRING HARNESS INTERMITTENT

TEST	ACTION	APPLICABILITY
1	Start the engine. Allow the engine to reach normal operating temperature. **Note: Engine must be in closed loop.** With the DRBIII®, go to Purge Vapors Test. Press 3 to flow. **Note: Short Term Adaptive should change.** Did Short Term Adaptive change? Yes → Test Complete. No → Go To 2	All
2	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the Evap Purge Solenoid and vacuum harness. Look for any chafed, pierced, pinched, or partially broken hoses.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair vacuum harness/connections as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 3	All
3	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Perform a wiggle test of the Evap Purge Solenoid wiring while the circuit is actuated with the DRBIII®. Listen for the solenoid to quit actuating. Also watch for the Good Trip Counter to change to 0. Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 4	All

*CHECKING EVAPORATIVE EMISSION OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the Purge Solenoid. Inspect the line from rollover valve to the solenoid. Is liquid fuel in the line? Yes → Replace the Rollover Valve. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 5	All
5	Turn the ignition off. Remove the Purge solenoid and tap the ports against a clean solid surface. Did any foreign material fall out? Yes → Replace the purge solenoid and clean or replace the vacuum and purge lines and Evap canister. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Test Complete.	All

Symptom:
*CHECKING FUEL DELIVERY

POSSIBLE CAUSES
FUEL PUMP RELAY
FUEL PRESSURE OUT OF SPECIFICATION
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP
FUEL PUMP CAPACITY (VOLUME) OUT OF SPECS
FUEL PUMP RELAY FUSED B+ CIRCUIT
FUEL PUMP RELAY OUTPUT CIRCUIT OPEN
FUEL PUMP GROUND CIRCUIT OPEN/HIGH RESISTANCE
FUEL PUMP MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test. **Note: It may be necessary to use a mechanics stethoscope in the next step.** Listen for fuel pump operation at the fuel tank. Does the Fuel Pump operate? Yes → Go To 2 No → Go To 6 **Caution: Stop All Actuations.**	All
2	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge to the fuel rail test port. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 339 KPa +/- 34 KPa (49.2 psi +/- 5 psi).** Choose a conclusion that best matches your fuel pressure reading. Below Specification Go To 3 Within Specification Go To 5 Above Specification Replace the fuel filter/fuel pressure regulator. Perform POWERTRAIN VERIFICATION TEST VER - 1. **Caution: Stop All Actuations.**	All

*CHECKING FUEL DELIVERY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module. Install special 5/16″ fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module. Attach a fuel pressure test gauge to the ″T″ fitting on tool #6539. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 334 KPa +/- 34 KPa (49.2 psi +/- 5 psi).** Is the fuel pressure within specification now? Yes → Repair/replace fuel supply line as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 4 **Caution: Stop All Actuations.**	All
4	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose,fitting or line, the fuel system pressure must be released.** Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer. Is the Fuel Inlet Strainer plugged? Yes → Replace the Fuel Pump Inlet Strainer. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
5	**Note: The fuel pressure must be within specification before continuing.** Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Disconnect the fuel supply line at the fuel rail. Connect fuel line adapter #6539(5/16″) or #6631(3/8″) to the disconnected fuel supply line. Insert the other end of the adapter into a graduated container. **Caution: Do not operate the fuel pump for more than 7 seconds in the next step. Fuel pump module reservoir may run empty and damage to the fuel pump will result.** **Note: Specification: A good fuel pump will deliver at least 1/4 liter (1/2 pint) of fuel in 7 seconds.** Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test for 7 seconds. Is the fuel pump capacity within specification? Yes → Test Complete. No → Check for a kinked/damaged fuel supply line between the fuel tank and fuel rail. If OK, replace the fuel pump module. Perform POWERTRAIN VERIFICATION TEST VER - 1. **Caution: Stop All Actuations.**	All

*CHECKING FUEL DELIVERY — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the fuel pump module harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test. Using a 12 volt test light connected to ground, probe the Fuel Pump Relay Output circuit at the Fuel Pump Module harness connector. Does the test light illuminate brightly? Yes → Go To 7 No → Go To 9 **Caution: Stop All Actuations.**	All
7	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. **Note: Check connectors - It is critical that the connector is free from any signs of corrosion or deformities - Clean/repair as necessary.** Using a test light connected to 12-volts, backprobe the Fuel Pump ground circuit at the Fuel Pump Module harness connector. Does the test light illuminate brightly? Yes → Go To 8 No → Repair the open and/or high resistance in the Fuel Pump Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
9	Turn the ignition off. Remove the Fuel Pump Relay from the PDC. Using a 12 volt test light connected to ground, backprobe the Fuel Pump Relay Fused B+ circuit at the PDC. Does the test light illuminate? Yes → Go To 10 No → Repair the open in the Fuel Pump Realy Fused B+ circuit. Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
10	Turn the ignition off. Remove the Fuel Pump Relay from the PDC. Disconnect the Fuel Pump Module harness connector. **NOTE: Check connectors - It is critical that the connector is free from any signs of corrosion or deformities** Measure the resistance of the Fuel Pump Relay Output circuit from the relay connector to the fuel pump module connector. Is the resistance below 5.0 ohms? Yes → Replace the Fuel Pump Relay. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the open in the Fuel Pump Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*CHECKING MAP SENSOR OPERATION WITH NO DTCS

POSSIBLE CAUSES
MAP SENSOR OPERATION
MAP SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Attach a vacuum gauge to a manifold vacuum source. **NOTE: If the engine will not idle, maintain a constant engine speed above idle.** Allow the engine to idle. With the DRBIII®, monitor the MAP sensor vacuum. Compare the MAP vacuum value on the DRBIII® and the vacuum reading on the vacuum gauge. Are the vacuum readings within 1 inch of vacuum of each other? Yes → The MAP sensor is operating normally. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace the MAP sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*CHECKING MINIMUM AIRFLOW

APPLICABILITY	START AT TEST
4.0L POWER TECH I-6	1
4.7L POWER TECH V8	2

POSSIBLE CAUSES
CHECKING THE MINIMUM AIRFLOW
THROTTLE PLATE/LINKAGE BINDING
VACUUM LEAK
THROTTLE BODY
THROTTLE BODY DIRTY

TEST	ACTION	APPLICABILITY
1	Start engine and bring to operating temperature. Be sure all accessories are off before performing this test. Shut off engine and remove air duct and air resonator box from top of throttle body. Disconnect rear CCV breather tube at intake manifold fitting. Let CCV tube hang disconnected at side of engine. Attach a short piece of rubber hose to special tool 6714. Install this hose/tool assembly to intake manifold fitting. Connect the DRBIII®. Start the Engine. Using the DRBIII®, run the Minimum Air Flow test. The DRBIII® will count down to stabilize the idle rpm and display the minimum air flow idle rpm. The idle rpm should be between 500 and 900 rpm. If the idle speed is outside of these specifications, replace the throttle body. Is the engine rpm between 500 and 900 rpm? Yes → Test Complete. No → Replace the throttle body. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.0L POWER TECH I-6

*CHECKING MINIMUM AIRFLOW — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Check the throttle plate and linkage for a binding condition. The throttle linkage must be at idle position. Ensure the throttle plate is fully closed and against it's stop. Is the throttle plate and linkage free of damage? Yes → Go To 3 No → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	4.7L POWER TECH V8
3	Inspect the Intake Manifold for vacuum leaks. Inspect the Power Brake Booster for any vacuum leaks. Inspect the PCV system for proper operation or any vacuum leaks. Were any problems found? Yes → Repair vacuum leak as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	4.7L POWER TECH V8
4	Turn the ignition off. Disconnect the vacuum line at the PCV valve. Install Miller Tool #6714 (0.185″ air metering orifice) into the disconnected vacuum line in place of the PCV valve. Disconnect the purge hose from the fitting on the throttle body. The purge hose is located on the front of the throttle body next to the MAP sensor. Cap the fitting at the throttle body after the purge hose has been disconnected. Start the engine. Ensure that all accessories are off. Allow the engine to reach operating temperature above 82°C (180°F). With the DRBIII® in System Tests, perform the Minimum Air Flow function. Is the engine RPM between 500 and 900? Yes → Test Complete. No → Go To 5	4.7L POWER TECH V8
5	Turn the ignition off. Remove the Throttle Body. **WARNING: Clean throttle body in a well ventilated area. Wear rubber or butyl gloves. Do not let cleaner come in contact with eyes or skin. Avoid ingesting cleaner. Wash thoroughly after using cleaner.** While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Throttle Body Cleaner. Clean the IAC motor passage also. Use compressed air to dry the throttle body. Re-install the throttle body. **Note: Miller Tool #6714 (0.185″ air metering orifice) still attached to the PCV vacuum line and the purge hose fitting on the throttle body capped.** Start the engine. Ensure that all accessories are off. Allow the engine to reach operating temperature above 82°C (180°F). With the DRBIII® in System Tests, perform the Minimum Air Flow function. Is the engine RPM between 500 and 900? Yes → Repair complete. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete. **CAUTION: Stop all actuations. Turn the engine off.**	4.7L POWER TECH V8

Symptom:
*CHECKING RADIATOR FAN OPERATION WITH NO DTCS

POSSIBLE CAUSES
FUSED B(+) CIRCUIT OPEN
RADIATOR FAN GROUND CIRCUIT OPEN
RAD FAN MOTOR
RADIATOR FAN RELAY OUTPUT CIRCUIT OPEN
RADIATOR FAN RELAY

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the Radiator Fan Relay. Does the Radiator Fan Motor cycle on and off? Yes → Test Complete. No → Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, actuate the Radiator Fan Relay. Using a 12-volt Test Light connected to ground, backprobe the Radiator Fan Relay Output circuit in the Radiator Fan Motor harness connector. Does the test light cycle on and off? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off. Disconnect the Radiator Fan Motor harness connector. Measure the resistance between ground and the Radiator Fan Motor ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Radiator Fan ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Radiator Fan Motor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Turn the ignition off. Disconnect the Radiator Fan Relay Connector. Using a 12-volt Test Light connected to ground, check the Fused B(+) circuit in the Radiator Fan Relay connector. Did the light illuminate brightly? Yes → Go To 6 No → Repair the open in the Fused B(+) Circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

*CHECKING RADIATOR FAN OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Radiator Fan Motor harness connector. Remove Rad Fan Relay. Measure the resistance of the Radiator Fan Relay Output circuit between the Radiator Fan Motor harness connector and the Radiator Fan Relay harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Radiator Fan Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	If there are no possible causes remaining, view repair. Repair Replace the Radiator Fan Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*CHECKING THE ENGINE COOLANT TEMPERATURE SENSOR

POSSIBLE CAUSES
ECT SENSOR OPERATION
ECT SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: The engine coolant temperature must be below 62°C (150°F).** Ignition on, engine not running. With the DRBIII®, monitor the ECT value. Start the engine. Does the ECT reach 82°C (180°F) and was it a smooth transition? Yes → Engine Coolant Temperature sensor is operating normally. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*CHECKING THE INTAKE AIR TEMPERATURE SENSOR

POSSIBLE CAUSES
IAT SENSOR OPERATION
IAT SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Do not allow more than a 5 minute delay during the removal of the IAT sensor and measuring the temperature.** Ignition on, engine not running. With the DRBIII®, read and record the IAT temperature value. Remove the IAT sensor. Using a temperature probe, measure the temperature inside the opening of the IAT sensor. Compare both temperature readings. Are the temperature readings within 12°C (10°F) of one another? Yes → The IAT sensor is operating normally. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace the IAT sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*CHECKING THE PCM POWER AND GROUNDS

POSSIBLE CAUSES
PCM FUSED B+ CIRCUIT
PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT
PCM GROUND CIRCUITS

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the PCM harness connector. Using a 12-volt test light connected to ground, probe the PCM Fused B+ circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 2 No → Repair the open in the Fused B+ circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the PCM Fused Ignition Switch Output circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the Ignition Switch Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
3	Turn the ignition off. Disconnect the PCM harness connector. Using a 12-volt test light connected to battery voltage, probe the PCM ground circuits in the PCM harness connector. Does the test light illuminate brightly? Yes → Test Complete. No → Repair the open in the PCM ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:

*CHECKING THROTTLE POSITION SENSOR OPERATION WITH NO DTCS

POSSIBLE CAUSES
THROTTLE POSITION SENSOR VOLTAGE ABOVE 1.5 VOLTS
THROTTLE POSITION SENSOR SWEEP
TP SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the throttle and linkage is not binding and is operating properly.** Ignition on, engine not running. With the DRBIII®, read the Throttle Position Sensor voltage. Is the voltage above 1.5 volts? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Slowly open the throttle from the idle position to the wide open throttle position. Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Throttle Position Sensor Operating normally. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*HYDRAULIC FAN OPERATION

POSSIBLE CAUSES
HARNESS INSPECTION
HYDRAULIC FAN

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII® select Engine Test, Systems Test, and Hydraulic Fan Solenoid Test. Actuate the Hydraulic Fan Solenoid Test. Does the fan operate properly? Yes → Test Complete. No → Go To 2	All
2	Turn the ignition off. Check to see if the fan wire harness is properly connected at the upper right corner of the fan shroud. Check to see if the fan wire harness is properly connected at the fan solenoid on the fan motor. Check the harness for continuity from the Hydraulic Fan Relay to the solenoid. Inspect connector terminals for proper pin fit and corrosion. Inspect the related fuse and relay. Were any problems found? Yes → Repair any defective wire harness concerns. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All
3	Turn the ignition off. Inspect the hydraulic circuit for leaks and repair as necessary. Were any problems found? Yes → Test Complete. No → Replace the Hydraulic Fan assembly. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1598 - A/C PRESSURE SENSOR VOLTS TOO HIGH

When Monitored and Set Condition:

P1598 - A/C PRESSURE SENSOR VOLTS TOO HIGH

When Monitored: With the engine running and the A/C Relay energized.

Set Condition: The A/C Pressure Sensor Signal at the PCM goes above 4.92 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO 5 VOLT SUPPLY CIRCUIT
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
A/C PRESSURE SENSOR INTERNAL FAILURE
A/C PRESSURE SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure the A/C refrigerant System is properly charged per the Service Information.** Start the engine. With the DRBIII®, read the A/C Pressure Sensor voltage. Is the voltage above 4.9 volts? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between the A/C Pressure Sensor Signal circuit and the 5 Volt Supply circuit in the A/C Pressure Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to the 5 Volt Supply circuit in the A/C Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All

P1598 - A/C PRESSURE SENSOR VOLTS TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Ignition on, engine not running. Measure the voltage of the A/C Pressure Sensor Signal circuit in the A/C Pressure Sensor harness connector. Is the voltage above 5.2 volts? Yes → Repair the short to battery voltage in the A/C Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All
4	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Connect a jumper wire between the A/C Pressure Sensor Signal circuit and the Sensor ground circuit. With the DRBIII®, monitor the A/C Pressure Sensor voltage. Ignition on, engine not running. Is the voltage below 1.0 volt? Yes → Replace the A/C Pressure Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the MAP Sensor Signal circuit between the A/C Pressure Sensor harness connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the A/C Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Measure the resistance of the Sensor ground circuit in the A/C Pressure Sensor harness connector to ground. Is the resistance below 30 ohms? Yes → Go To 7 No → Repair the open in the Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1598 - A/C PRESSURE SENSOR VOLTS TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: Ensure the A/C refrigerant System is properly charged per the Service Information.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
P1599 - A/C PRESSURE SENSOR VOLTS TOO LOW

When Monitored and Set Condition:

P1599 - A/C PRESSURE SENSOR VOLTS TOO LOW

When Monitored: With the engine running and the A/C Relay energized.

Set Condition: The A/C Pressure Sensor Signal voltage at the PCM goes below 0.58 of a volt for 2.6 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5 VOLT SUPPLY CIRCUIT OPEN
A/C PRESSURE SENSOR INTERNAL FAILURE
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT
PCM 5 VOLT SUPPLY CIRCUIT
PCM A/C PRESSURE SENSOR SIGNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure the A/C refrigerant System is properly charged per the Service Information.** Start the engine. With the DRBIII®, read the A/C Pressure Sensor voltage. Is the voltage below .07 of a volt? Yes → Go To 2 No → Go To 10	All
2	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Ignition on, engine not running. Measure the voltage of the 5 Volt Supply circuit in the A/C Pressure Sensor harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 3 No → Go To 7	All

P1599 - A/C PRESSURE SENSOR VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. With the DRBIII®, monitor the A/C Pressure Sensor voltage. Ignition on, engine not running. Is the voltage above 0.6 of a volt? Yes → Replace the A/C Pressure Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All
4	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the A/C Pressure Sensor Signal circuit in the A/C Pressure Sensor harness connector to ground. Is the resistance below 100 ohms? Yes → Repair the short to ground in the A/C Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance between the A/C Pressure Sensor Signal circuit and the Sensor ground circuit in the A/C Pressure Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to Sensor ground in the A/C Pressure Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit in the A/C Pressure Sensor harness connector to ground. Is the resistance below 100 ohms? Yes → Repair the short to ground in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 8	All

P1599 - A/C PRESSURE SENSOR VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the PCM harness connector. Measure the resistance of the 5 Volt Supply circuit between the A/C Pressure Sensor harness connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
9	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
10	**NOTE: Ensure the A/C refrigerant System is properly charges per the Service Information.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
*A/C OPERATES IN ALL MODE SWITCH POSITIONS

POSSIBLE CAUSES
CHECK FOR PCM DTCS
POWERTRAIN CONTROL MODULE
A/C CLUTCH
A/C CLUTCH RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
A/C CLUTCH RELAY
CHECK A/C ON/OFF CONTROL CIRCUIT FOR A SHORT TO GROUND
A/C - HEATER CONTROL MODULE/AZC MODULE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, check for PCM DTCs. Are any DTCs present? Yes → Return to the symptom list and choose the symptom(s). With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	Position the Mode switch on the A/C - Heater Control Module to the Panel position (A/C off). Turn the ignition on. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while turning the Mode switch from Panel (A/C off) to Bi-Level (A/C on) and then back to Panel (A/C off). Does the switch state change from ″Off″ to ″On″ and then back to ″Off″. Yes → Go To 3 No → Go To 6	All
3	Position the Mode switch on the A/C - Heater Control Module to the Panel position (A/C off). Turn the ignition on. With the DRBIII® in Powertrain, select Engine and select Inputs/Outputs. Monitor the A/C Select Switch state while turning the Mode switch from Panel (A/C off) to Bi-Level (A/C on) and then back to Panel (A/C off). Does the switch state change from ″Off″ to ″On″ and then back to ″Off″. Yes → Go To 4 No → Replace and program the Powertrain Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

*A/C OPERATES IN ALL MODE SWITCH POSITIONS — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the A/C Clutch harness connector. Start the engine and observe the A/C Clutch and Compressor. Does the A/C Compressor run with the harness connector disconnected? Yes → Replace the A/C Clutch in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the A/C Clutch harness connector. Measure the voltage of the A/C Clutch Relay Output circuit. Is the voltage above 1.0 volt? Yes → Repair the A/C Clutch Relay Output circuit for a short to voltage. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Replace the A/C Clutch Relay. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the AZC Module C2 harness connector. Measure the resistance of the A/C Switch signal circuit between the harness connector and ground. AZC Module C2 or A/C Heater Control C1 connector and ground. Is the resistance below 10K ohms? Yes → Repair the A/C On/Off Control Circuit for a short to ground. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

*A/C OPERATES IN ALL MODE SWITCH POSITIONS — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Make sure that the BCM C1 harness connector is connected to the BCM. Disconnect the A/C - Heater Control C1 harness connector or the AZC Module C2 connector. Turn the ignition on. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while connecting a jumper wire between ground and the A/C Switch signal circuit in the A/C - Heater Control C1 harness connector or the AZC C2 connector. Does the A/C Select Switch state change from ″Off″ to ″On″ when the jumper wire is connected. Yes → Replace the A/C - Heater Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace and program the Body Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHECKING A/C SYSTEM OPERATION WITH NO DTCS

POSSIBLE CAUSES
CHECK FOR PCM DTCS
REFRIGERATION SYSTEM NOT PROPERLY CHARGED
HIGH PRESS CUT-OFF SWITCH
LOW PRESSURE SWITCH
POWERTRAIN CONTROL MODULE
A/C CLUTCH COIL
A/C COMPRESSOR CLUTCH GROUND CIRCUIT OPEN
A/C CLUTCH RELAY OUTPUT CIRCUIT OPEN
A/C REQUEST CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
A/C CLUTCH RELAY
A/C - HEATER CONTROL MODULE/AZC MODULE
BODY CONTROL MODULE
CHECK A/C SWITCH SIGNAL CIRCUIT FOR AN OPEN
A/C SWITCH SIGNAL CONTROL CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, check for PCM DTCs. Are any DTCs present? Yes → Return to the symptom list and choose the symptom(s). With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	Turn the ignition off. Verify that the Refrigerant System is properly charged per Service Procedure. Is the Refrigerant System properly charged? Yes → Go To 3 No → Properly charge the Refrigerant System per Service Information. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

*CHECKING A/C SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Verify the High Pressure Cut-Off Switch per Service Information. Is the High Pressure Cut-Off Switch OK? Yes → Go To 4 No → Replace the High Pressure Cut-Off Switch. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Turn the ignition off. Verify the Low Pressure Switch operation per Service Information. Is the Low Pressure Switch OK? Yes → Go To 5 No → Replace the Low Pressure Switch. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Position the Mode switch on the A/C - Heater Control Module to the Panel position (A/C off). Ignition on, engine not running. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while turning the Mode switch from Panel (A/C off) to Bi-Level (A/C on) and then back to Panel (A/C off). Does the switch state change from ″Off″ to ″On″ and then back to ″Off″. Yes → Go To 6 No → Go To 13	All
6	Position the Mode switch on the A/C - Heater Control Module to the Panel position (A/C off). Ignition on, engine not running. With the DRBIII® in Powertrain, select Engine and select Inputs/Outputs. Monitor the A/C Select Switch state while turning the Mode switch from Panel (A/C off) to Bi-Level (A/C on) and then back to Panel (A/C off). Does the switch state change from ″Off″ to ″On″ and then back to ″Off″. Yes → Go To 7 No → Replace and program the Powertrain Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	Ignition on, engine not running. With the DRBIII®, actuate the A/C clutch relay. Connect a test light between the ground circuit and the A/C Clutch Relay Output circuit. Does the test light illuminate brightly on and off with the relay actuation? Yes → Replace the A/C Clutch Coil. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 8	All

*CHECKING A/C SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the A/C compressor clutch harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the A/C Compressor Clutch ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the A/C compressor clutch ground circuit. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
9	Turn the ignition off. Disconnect the A/C Clutch harness connector. Remove the A/C Clutch Relay. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the A/C Clutch Relay Output circuit between the Relay and the A/C Clutch Coil. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the A/C Clutch Relay Output circuit. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
10	Turn the ignition off. Remove the A/C Clutch Relay. **Note: Check connectors - Clean/repair as necessary.** Measure the voltage of the Fused B(+) circuit at the A/C Clutch Relay connector. Is the voltage above 11.0 volts? Yes → Go To 11 No → Repair the open in the Fused B(+) circuit. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
11	Ignition on, engine not running. Turn the A/C system on and the fan on high. With the DRBIII® in Inputs/Outputs, read the A/C request state. Does the A/C request state change? Yes → Go To 12 No → Repair the open in the A/C Request circuit. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
12	If there are no possible causes remaining, view repair. Repair Replace the A/C Clutch Relay. With the DRBIII®, reset the AZC Module after repair/replacement is completed. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

*CHECKING A/C SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
13	Turn the ignition off. Disconnect the A/C - Heater Control C1 harness connector or AZC Module C2 connector. Ignition on, engine not running. Measure the voltage between the A/C Switch Signal circuit and ground. Is the voltage greater than 11.0 volts? Yes → Go To 14 No → Go To 15	All
14	Turn the ignition off. Disconnect the A/C - Heater Control C1 harness connector or AZC Module C2 connector. Ignition on, engine not running. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while connecting a jumper wire between ground and the A/C Select Switch circuit in the A/C - Heater Control C1 harness connector or AZC Module C2 connector. Does the A/C Select Switch state change from ″Off″ to ″On″ when the jumper wire is connected. Yes → Replace the A/C - Heater Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace and program the Body Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
15	Turn the ignition off. Disconnect the BCM C1 harness connector.. Disconnect the A/C - Heater Control C1 harness connector or AZC Module C2 connector. Measure the resistance of the A/C Select Switch circuit between the BCM C1 harness connector and the A/C - Heater Control C1 harness connector or AZC Module C2 connector. Is the resistance below 5.0 ohms? Yes → Replace and program the Body Control Module in accordance with the Service Information. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Repair the A/C Switch SignalCircuit for an open. With the DRBIII®, reset the AZC Module after repair/ replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:

P1595-SPEED CONTROL SOLENOID CIRCUITS
P1683-SPD CTRL PWR RELAY; OR S/C 12V DRIVER CKT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1595-SPEED CONTROL SOLENOID CIRCUITS.

When Monitored and Set Condition:

P1595-SPEED CONTROL SOLENOID CIRCUITS

When Monitored: With the ignition key on, the speed control switched on, the SET switch pressed and the vehicle in drive gear moving above 35 MPH.

Set Condition: The powertrain control module actuates the vacuum and vent solenoids but they do not respond.

P1683-SPD CTRL PWR RELAY; OR S/C 12V DRIVER CKT

When Monitored: With the ignition key on and the speed control switched on.

Set Condition: The speed control power supply circuit is either open or shorted to ground.

POSSIBLE CAUSES
GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
S/C BRAKE SWITCH OUTPUT CIRCUIT
SPEED CONTROL SWITCH OUTPUT OPEN
BRAKE LAMP SWITCH
SPEED CONTROL POWER SUPPLY CIRCUIT
PCM (S/C POWER SUPPLY)
SPEED CONTROL VACUUM SOLENOID
SPEED CONTROL VACUUM SOLENOID CONTROL CIRCUIT OPEN
PCM (VACUUM SOLENOID)
SPEED CONTROL VACUUM SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
SPEED CONTROL VENT SOLENOID
SPEED CONTROL VENT SOLENOID CONTROL CIRCUIT OPEN
SPEED CONTROL VENT SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
PCM (VENT SOLENOID)

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **NOTE: In the below step you will need to actuate both S/C solenoids separately. Note the operation of the each solenoid when actuated.** With the DRBIII®, actuate the Speed Control Vacuum Solenoid and note operation. With the DRBIII®, actuate the Speed Control Vent Solenoid and note operation. Choose the conclusion that best matches the solenoids operation. Vacuum Solenoid not operating Go To 2 Vent Solenoid not operating Go To 6 Both S/C Solenoids not operating Go To 10 Both S/C Solenoids operating Go To 15	All
2	Turn the ignition off. Disconnect the Speed Control Servo harness connector. Ignition on, engine not running. With the DRBIII®, actuate the Speed Control Vacuum Solenoid. Using a 12-volt test light connected to 12-volts, probe the Speed Control Vacuum Solenoid Control circuit. Does the test light illuminate brightly and flash? Yes → Replace the Speed Control Servo. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 3	All
3	Turn the ignition off. Disconnect the S/C Servo harness connector. Disconnect the PCM harness connector. Measure the resistance of the Speed Control Vacuum Solenoid Control circuit between the PCM harness connector and Speed Control Servo harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Speed Control Vacuum Solenoid Control circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
4	Turn the ignition off. Disconnect the S/C Servo harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the Speed Control Vacuum Solenoid Control circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the Speed Control Vacuum Solenoid Control circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 5	All

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
5	If the there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
6	Turn the ignition off. Disconnect the Speed Control Servo harness connector. Ignition on, engine not running. With the DRBIII®, actuate the Speed Control Vent Solenoid. Using a 12-volt test light connected to 12-volts, probe the Speed Control Vent Solenoid Control circuit in the Speed Control Servo harness connector. Does the test light illuminate brightly and flash? Yes → Replace the Speed Control Servo. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 7	All
7	Turn the ignition off. Disconnect the S/C Servo harness connector. Disconnect the PCM harness connector. Measure the resistance of the Speed Control Vent Solenoid Control circuit between the PCM harness connector and Speed Control Servo harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the Speed Control Vacuum Solenoid Control circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
8	Turn the ignition off. Disconnect the S/C Servo harness connector. Disconnect the PCM harness connector. Measure the resistance between ground and the Speed Control Vent Solenoid Control circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the Speed Control Vacuum Solenoid Control circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 9	All
9	If the there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the S/C Servo harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the S/C Brake Switch Output circuit in the S/C Servo harness connector. Does the test light illuminate brightly? Yes → Replace the Speed Control Servo. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 11	All
11	Turn the ignition off. Disconnect the Speed Control Servo harness connector. Disconnect the Brake Lamp Switch harness connector. Measure the resistance of the Speed Control Brake Switch Output circuit between the Speed Control Servo harness connector and Brake Lamp Switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the Speed Control Brake Switch Output circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
12	Disconnect the Brake Lamp Switch harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the Speed Control Power Supply circuit in the Brake Lamp Switch harness connector. Does the test light illuminate brightly? Yes → Replace the Brake Lamp Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 13	All
13	Turn the ignition off. Disconnect the PCM harness connector. Disconnect the Brake Lamp Switch harness connector. Measure the resistance of the Speed Control Power Supply circuit between the PCM harness connector and the Brake Lamp Switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 14 No → Repair the Speed Control Supply circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
14	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off. Disconnect the S/C Servo harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit in the S/C Servo harness connector. Does the test light illuminate brightly? Yes → Go To 16 No → Repair the ground circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
16	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Test Complete.	All

Symptom:
P1596-SPEED CONTROL SWITCH ALWAYS HIGH

When Monitored and Set Condition:

P1596-SPEED CONTROL SWITCH ALWAYS HIGH

When Monitored: With the ignition key on.

Set Condition: An open circuit is detected in the speed control on/off switch circuit. The circuit must be above 4.8 volts for more than 2 minutes to set the DTC.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SPEED CONTROL ON/OFF SWITCH
CLOCKSPRING SIGNAL/GROUND CIRCUIT OPEN
SPEED CONTROL SWITCH SIGNAL CKT SHORT TO VOLTAGE
SPEED CONTROL SW SIG CKT OPEN PCM TO CLOCK SPRING
SPEED CONTROL SW SIG CKT OPEN CLOCKSPRING TO S/C SWITCH
SPEED CONTROL SWITCH GROUND CIRCUIT OPEN CLOCKSPRING TO S/C SWITCH
SPEED CONTROL SWITCH GROUND CIRCUIT OPEN PCM TO CLOCKSPRING
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the Speed Control inputs state. While monitoring the DRBIII®, push the Speed Control On/Off Switch several times, then leave it on. Did the DRBIII® show Speed Control Switching off and on? Yes → Go To 2 No → Go To 3	All

P1596-SPEED CONTROL SWITCH ALWAYS HIGH — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Test Complete.	All
3	Turn the ignition off. Disconnect the Speed Control On/Off Switch 2-way harness connector only. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance across the S/C On/Off Switch. Is the resistance between 20.3K and 20.7K ohms? Yes → Go To 4 No → Replace the On/Off Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
4	Turn the ignition off. Disconnect the upper and lower 6-way clockspring harness connectors. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the K4 sensor ground circuit between the upper and lower 6-way clockspring harness connectors. Measure the resistance of the V37 speed control switch signal circuit between the upper and lower 6-way clockspring harness connectors. Was the resistance above 5.0 ohms for either circuit? Yes → Replace the clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 5	All
5	Turn the ignition off. Disconnect the Speed Control On/Off Switch 2-way harness connector only. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the S/C Switch Signal circuit for voltage at the On/Off Switch 2-way connector. Is the voltage above 5.3 volts? Yes → Repair the short to battery voltage in the Speed Control Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 6	All

P1596-SPEED CONTROL SWITCH ALWAYS HIGH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Clockspring 6-way harness connector (instrument panel harness side) . Disconnect the PCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Using an Ohmmeter, measure the resistance of the S/C Switch Signal circuit from the PCM to the Clockspring Connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open Speed Control Switch Signal circuit between the PCM and Clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
7	Turn the ignition off. Disconnect the On/Off switch 2-way harness connector. Disconnect the upper clockspring harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the S/C Switch Signal circuit from the clockspring harness connector to the On/Off switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the Speed Control Switch Signal circuit, Clockspring to S/C switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
8	Turn the ignition off. Disconnect the Speed Control On/Off Switch 2-way harness connector. Disconnect the clockspring 6-way harness connector (S/C switch side) **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the S/C Switch Sensor Ground Circuit from the On/Off Switch 2-way harness connector to the clockspring harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open ground circuit between the clockspring and S/C switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
9	Turn the ignition off. Disconnect the clockspring 6-way harness connector (instrument panel harness side). Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the S/C Switch Sensor Ground Circuit from the PCM harness connector to the clockspring harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open ground circuit from PCM to clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
10	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

Symptom:
P1597-SPEED CONTROL SWITCH ALWAYS LOW

When Monitored and Set Condition:

P1597-SPEED CONTROL SWITCH ALWAYS LOW

When Monitored: With the ignition key on and battery voltage above 10.4 volts.

Set Condition: When switch voltage is less than 0.39 of a volt for 2 minutes.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SPEED CONTROL ON/OFF SWITCH
SPEED CONTROL RESUME/ACCEL SWITCH
CLOCKSPRING SHORTED TO GROUND
S/C SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
S/C SIGNAL CIRCUIT SHORT TO SENSOR GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the S/C Switch volts status. Is the S/C Switch voltage below 1.0 volt? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the S/C ON/OFF Switch harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII® in Sensors, read the S/C Switch volts. Did the S/C Switch volts change to 5.0 volts? Yes → Replace the S/C ON/OFF Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 3	All
3	Turn the ignition off. Disconnect the S/C RESUME/ACCEL Switch harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII® in Sensors, read the S/C Switch volts. Did the S/C Switch volts go above 4.0 volts? Yes → Replace the Resume/Accel Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 4	All

P1597-SPEED CONTROL SWITCH ALWAYS LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the clockspring 6-way harness connector (instrument panel wiring side). Ignition on, engine not running. With the DRBIII® in Sensors, read the S/C Switch volts. Did the S/C Switch volts change to 5.0 volts? Yes → Replace the Clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 5	All
5	Turn the ignition off. Disconnect the S/C ON/OFF Switch harness connector. Disconnect the PCM harness connectors. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the S/C Switch Signal circuit and ground (B-) at S/C ON/OFF Switch harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the S/C Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 6	All
6	Turn the ignition off. Disconnect the S/C ON/OFF Switch harness connector. Disconnect the PCM harness connectors. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the S/C Signal circuit and the Sensor Ground circuit at the ON/OFF switch harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short to Sensor ground in theS/C Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

P1597-SPEED CONTROL SWITCH ALWAYS LOW — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DRB Freeze Frame information. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Test Complete.	All

Symptom:
*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON DRB

POSSIBLE CAUSES
DRBIII® DOES NOT SHOW BRAKE SW PRESSED OR RELEASED
FUSED B(+) CIRCUIT OPEN
BRAKE LAMP SWITCH GROUND CIRCUIT OPEN
BRAKE SWITCH (SENSE CKT)
BRAKE LAMP SWITCH SENSE CIRCUIT OPEN
BRAKE LAMP SWITCH SENSE CIRCUIT SHORT TO GROUND
BRAKE LAMP SWITCH OUTPUT LESS THAN 10.0 VOLTS
S/C POWER SUPPLY CIRCUIT BELOW 10 VOLTS AT BRAKE SWITCH CONN
POWERTRAIN CONTROL MODULE (BRAKE SENSE)

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the Brake Switch state. While observing the DRBIII® display, press and release the brake pedal several times. Does the DRBIII® display brake switch PRESSED and RELEASED? Yes → The Brake Lamp Switch is operating properly at this time. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 2	All
2	Turn the ignition off. Disconnect the brake switch harness connector. Using a 12-volt test light connected to ground, check the fused B(+) circuit at the brake switch harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open/high resistance in the Fused B(+) circuit. Check and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
3	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Measure the resistance between ground and the Brake Lamp Switch ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Brake Lamp Switch Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON DRB — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Brake Lamp Switch Sense terminal and the Ground terminal (measurement taken across the switch). Apply and release the Brake Pedal while monitoring the ohmmeter. Does the resistance change from below 5.0 ohms to open circuit? Yes → Go To 5 No → Replace the Brake Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
5	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Disconnect the PCM harness connectors. Measure the resistance of the Brake Lamp Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Brake Lamp Switch Sense circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
6	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Disconnect the PCM harness connectors. Disconnect the CAB harness connector. Measure the resistance between ground and the Brake Lamp Switch Sense circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Brake Lamp Switch Sense circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 7	All
7	Turn the ignition off. Brake pedal must be depressed in the next step. Using a 12-volt test light connected to ground, check the brake lamp switch output circuit at the brake switch harness connector. Is the test light illuminated and bright? Yes → Go To 8 No → Replace or adjust the brake switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
8	Turn the ignition off. Disconnect the Brake Switch harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, actuate the S/C Vacuum Solenoid. Using a 12-volt Test Light, probe the S/C Power Supply circuit in the Brake Switch harness connector. Did the test light illuminate brightly? Yes → Go To 9 No → Refer to symptom list for problems related to the S/C Power Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON DRB — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

Symptom:
*ENGINE CRANKS DOES NOT START

POSSIBLE CAUSES
NO START PRE-TEST
POWERTRAIN FUSES OPEN
SECONDARY INDICATORS PRESENT
SET SYNC SPECIFICATION
NO CKP SENSOR SIGNAL WHEN CRANKING ENGINE
NO CMP SENSOR SIGNAL WHEN CRANKING ENGINE
ENGINE MECHANICAL PROBLEM
ASD RELAY OUTPUT CIRCUIT OPEN
FUEL CONTAMINATION

TEST	ACTION	APPLICABILITY
1	**Note: The following list of items must be checked before continuing with any no start tests.** The battery must be fully charged and in good condition. A low charged battery may produce invalid test results. If the battery is low, charge the battery and then attempt to start the vehicle by cranking the engine for 15 seconds, 3 consecutive times. This will allow any DTC’s to set that may have been erased due to a dead battery. Try to communicate with PCM if not able to communicate check fuses. Ensure the Powers and Ground to the PCM are ok. Make sure the PCM communicates with the DRBIII® and that there are no DTC’s stored in the PCM memory. If the PCM reports a No Response condition, refer to the Communication category for the proper tests. Read the PCM DTC’s with the DRBIII®. If any DTC’s are present, they must be repaired before continuing with any other No Start diagnostic tests. Refer to the Symptom list for the related P-code that is reported by the PCM. Ensure that the CCD bus is functional. Attempt to communicate with the Instrument Cluster and VTSS, If you are unable to establish communications refer to the Communication category for the proper symptoms. The Sentry Key Immobilizer System must be operating properly. Check for proper communication with the DRBIII® and check for DTC’s that may be stored in the Sentry Key Immobilizer Module (SKIM). Repair the DTC(s) before continuing. If no DTC’s are found, using the DRBIII®, select Clear PCM (BATT Disconnect). Crank the engine several times. Using the DRBIII®, read DTC’s. If a DTC is present perform the DTC diagnostics before continuing. Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All

*ENGINE CRANKS DOES NOT START — Continued

TEST	ACTION	APPLICABILITY
2	Check for any open fuses in the PDC or Junction Block that may be related to the No Start condition. Are any of the fuses open? Yes → Replace the open fuse and check the related circuit(s) for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, under DTCs & Related Functions, read the Secondary Indicators while cranking the engine. Are there any Secondary Indicators present while cranking the engine? Yes → Refer to symptom list and perform tests related to the secondary indicator that is reported by the DRBIII®. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Start the engine. With the DRBIII® in Miscellaneous, check the ″Set Sync Signal″. Is the ″Set Sync Signal″ within specifications? Yes → Go To 5 No → With the DRBIII, synchronize the Cam and Crank Position Sensors. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	With the DRBIII® in Sensors, check the ″Current CKP Count″ while cranking the engine. Does the CKP Counter change while cranking the engine? Yes → Go To 6 No → Refer to Driveability Symptom P0320-NO CRANK REFERENCE SIGNAL AT PCM. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	With the DRBIII® in Sensors, check the ″Current CMP Count″ while cranking the engine. Does the ″Current CMP Count″ change while cranking the engine? Yes → Go To 7 No → Refer to Driveability Symptom P0340-NO CAM SIGNAL AT PCM Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Check for any of the following conditions/mechanical problems. ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. FUEL - must be free of contamination FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All

*ENGINE CRANKS DOES NOT START — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Remove the ASD relay from the PDC. Disconnect the PCM harness connectors. Verify the ASD Relay is getting Fused B+ voltage before continuing. Measure the resistance of the ASD relay output circuit from the ASD Relay connector to the PCM harness connector, Ignition coil, and the fuel injectors. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open ASD Relay output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	Verify that the Fuel tank is not empty before continuing. Follow the diagnostics for Checking Fuel Delivery in the Driveability section of this manual. Was the No Start condition solved after following the above diagnostic test? Yes → Test Complete. No → Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
*NO CRANK CONDITION

POSSIBLE CAUSES
MECHANICAL CONDITION
TRANSMISSION RANGE SENSOR
BATTERY CIRCUIT RESISTANCE TOO HIGH
IGNITION SWITCH OUTPUT CIRCUIT OPEN
STARTER RELAY CONTROL CIRCUIT OPEN
STARTER RELAY OUTPUT CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
STARTER
STARTER RELAY

TEST	ACTION	APPLICABILITY
1	**NOTE: Verify the battery is fully charged and capable of passing a load test before continuing.** **WARNING: MAKE SURE THE BATTERY IS DISCONNECTED, THEN WAIT TWO MINUTES BEFORE PROCEEDING.** Turn the engine over by hand to ensure the engine is not seized. Is the engine able to turn over? Yes → Go To 2 No → Repair the mechanical condition preventing the starter motor from cranking. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Move the Gear selector through all gear positions, from Park to 1st and back. While moving the gear selector through each gear, measure the resistance between ground and the P/N Position Switch Sense circuit. Did the resistance change from above 10.0 ohms to below 10.0 ohms? Yes → Go To 3 No → Replace the Transmission Range Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
3	Turn the ignition off. Check the Battery Cables for high resistance using the service information procedure. Did either Battery Cable have a voltage drop greater than 0.2 of a volt? Yes → Repair the Battery circuit for high resistance. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 4	All

*NO CRANK CONDITION — Continued

TEST	ACTION	APPLICABILITY
4	Turn ignition off. Remove the Starter Relay from PDC. **WARNING: The Parking Brake must be on and the Transmission must be in park for a vehicle equipped with an automatic transmission.** **Warning: The engine may be cranked in the next step. Keep away from moving engine parts.** Briefly connect a jumper wire between Starter Relay B+ circuit and the Starter Relay Output circuits. Did the Starter Motor crank the engine? Yes → Go To 5 No → Go To 7	All
5	Turn the ignition off. Remove the Starter Relay from the PDC. Ignition on, engine not running. Using a 12-volt test light, probe the Ignition Switch Output circuit in the Starter Relay connector. While observing 12-volt test light, hold ignition key in the start position. Does the test light illuminate brightly? Yes → Go To 6 No → Repair the open or high resistance in the Ignition Switch Output circuit. Inspect related fuses and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
6	Turn the ignition off. Remove the Starter Relay from the PDC. Disconnect the PCM harness connector. Measure the Starter Relay Control circuit between the Relay terminal and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Starter Motor Relay. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the open in the Starter Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
7	Turn the ignition off. Remove the Starter Relay from the PDC. Disconnect the Starter Relay Output connector from the Starter Solenoid. Measure the resistance of the Starter Relay Output circuit between the Relay and the Solenoid harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the Starter Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO CRANK CONDITION — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Remove the Starter Relay from the PDC. Using a 12-volt test light connected to ground, probe the Fused B+ circuit at the Starter Relay terminal. Does the test light illuminate brightly? Yes → Go To 9 No → Repair the open or high resistance in the Fused B(+) Circuit. Inspect related fuses and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
9	If there are no other possible causes remaining, review repair. Repair Replace the Starter. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*NO RESPONSE FROM PCM WITH A NO START CONDITION

POSSIBLE CAUSES
PCM FUSED B+ CIRCUIT
PCM NO RESPONCE
PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT
PCM GROUND CIRCUITS
5 VOLT SENSOR OPEN OR SHORTED
THROTTLE POSISITON SENSOR
PRIMARY 5-VOLT SUPPLY CKT SHORT TO GROUND
AUXILIARY 5-VOLT CIRCUIT SUPPLY SHORT TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: The DRBIII® and cable must be operating properly for the results of this test to be valid.** **NOTE: Ensure the ignition switch was on when trying to communicate with the PCM.** Turn the ignition off. Disconnect the PCM harness connector(s). Using a 12-volt test light connected to ground, probe the PCM Fused B+ circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 2 No → Repair the Fused B+ circuit. Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM harness connector(s). Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the PCM Fused Ignition Switch Output circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Ignition Switch Output circuit. Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM WITH A NO START CONDITION — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connector(s). Using a 12-volt test light connected to battery voltage, probe the PCM ground circuits in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the PCM ground circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
4	Turn the ignition off. Disconnect the TPS harness connector. Ignition on, engine not running. Measure the voltage on the TPS 5 Volt Supply circuit. Is the voltage between 4.5 and 5.2 volts? Yes → Go To 5 No → Go To 6	All
5	Turn the ignition off. Disconnect the MAP Sensor harness connector. **NOTE: Verify the TPS harness connector is connected.** Ignition on, engine not running. Measure the voltage on the MAP Sensor 5 Volt Supply circuit. Is the voltage between 4.5 and 5.2 volts? Yes → If communication is available with a PCM on a like vehicle, replace and program the Powertrain Control Module in accordance with Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
6	Turn the ignition off. Disconnect the TPS harness connector. Ignition on, engine not running. Measure the voltage on the 5 Volt Supply circuit. Disconnect all the sensors that use a 5 Volt Supply circuit. Did the voltage return to 4.5 to 5.2 volts when disconnecting any of the sensors. Yes → Replace the sensor that is pulling down the 5 Volt supply. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Turn the ignition off. Disconnect PCM harness connector. Disconnect all the sensors that share the Primary 5 Volt Supply circuit. Measure the resistance between ground and the Primary 5 Volt Supply circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Primary 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 8	All

*NO RESPONSE FROM PCM WITH A NO START CONDITION — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the PCM harness connector. Disconnect all sensors that receive Auxiliary 5 Volt Supply. Measure the resistance between ground and the Auxiliary 5 Volt Supply circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Auxiliary 5 Volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 9	All
9	If there is no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*START AND STALL CONDITION

POSSIBLE CAUSES
CHECKING DTCS
CHECKING SKIM DTCS
THROTTLE POSITION SENSOR SWEEP
THROTTLE POSITION SENSOR VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
ENGINE COOLANT TEMPERATURE SENSOR OPERATION
OTHER POSSIBLE CAUSES FOR START & STALL
FUEL CONTAMINATION

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Are any DTCs present? Yes → Refer to the Driveability Category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 2	All
2	Ignition on, engine not running. **NOTE: If you are unable to communicate with the SKIM, refer to the Communication Category and perform the appropriate symptom.** With the DRBIII®, read the SKIM codes. Are there any SKIM DTCs? Yes → Refer to the Vehicle Theft category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read TPS VOLTS. While monitoring the DRBIII®, slowly open and close the Throttle. Is the voltage change smooth? Yes → Go To 4 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
4	Ignition on, engine not running. With the DRBIII®, read Throttle Position voltage. Throttle must be against stop. Is the voltage 0.92 or less with the Throttle closed? Yes → Go To 5 No → Check for a binding throttle condition. If OK, replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*START AND STALL CONDITION — Continued

TEST	ACTION	APPLICABILITY
5	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soaked).** **NOTE: If the vehicle was allowed to sit over night with no engine start, coolant temperature should be near ambient temperatures.** Ignition on, engine not running. With the DRBIII®, read the Engine Coolant Temperature value. **Note: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.** Start the engine. During engine warm-up, monitor the Engine Coolant Temperature value. The temperature value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F). Did the Engine Temperature value increase smoothly and did it reach at least 82° C (180° F)? Yes → Go To 6 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
6	The following additional items should be checked as a possible cause for a start and stall condition. Refer to any Technical Service Bulletins (TSB's) that may apply to the symptom. The exhaust system must be free of any restrictions. The engine compression must be within specifications. The engine valve timing must be within specifications. The engine must be free from vacuum leaks. The throttle body must be free of carbon buildup and dirt. Do any of the above conditions exist? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Verify that the Fuel tank is not empty before continuing. Follow the diagnostics for Checking Fuel Delivery under the Driveability section of this manual. Was the No Start condition solved after following the above diagnostic test? Yes → Test Complete. No → Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
P0711-TRANS TEMP SENSOR, NO TEMP RISE AFTER START

When Monitored and Set Condition:

P0711-TRANS TEMP SENSOR, NO TEMP RISE AFTER START

When Monitored: Continuously with the key on and the engine running.

Set Condition: After 2 trips in which the trans sump temp is < 5°C (40° F) and does not rise more than 8°C (16° F) after 20 minutes of run time with Veh Spd > 48 kmh (30 MPH). It will also set if the eng temp is < 38°C (100° F) with trans temp > 127°C (260° F).

POSSIBLE CAUSES
MULTIPLE TRANSMISSION DTC'S SET
INTERMITTENT TRANSMISSION TEMPERATURE SENSOR
TRANSMISSION TEMPERATURE SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0711 displayed and equal to 0? Yes → Go To 2 No → Go To 6	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition on. With the DRBIII®, read DTCs. Check for any Park/Neutral DTC or Transmission Temperature too Low or too High DTCs. Were any Park/Neutral P1899 or Transmission Temperature Sensor P0712 or P0713 codes present? Yes → Repair all other transmission DTC's before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition on. **Note: To test the transmission temperature sensor, the engine and transmission temperature must be at or below 29.4°C (85° F).** With the DRBIII® read: Engine Coolant temperature and record. Transmission temperature and record. Is the transmission temperature within 5°C (9°F) of the engine coolant temperature? Yes → Go To 4 No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0711-TRANS TEMP SENSOR, NO TEMP RISE AFTER START — Continued

TEST	ACTION	APPLICABILITY
4	**Note: To test the transmission temperature sensor, the engine and transmission temperature must be at or below 29.4°C (85° F).** Start the engine and let it idle in Drive with parking brake on, while monitoring the Transmission Temperature Sensor with the DRBIII®. Look for the temperature to rise 8°C (15°F) within a ten minute period. Did the trans temperature increase at a steady rate and rise 8°C (15°F) over a 10 minute period? Yes → Go To 6 No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn ignition off. Remove the Transmission pan. Disconnect the Governor Pressure Sensor/Transmission Temperature Sensor connector. **Note: Check connectors - Clean/repair as necessary** Measure the resistance of the Transmission Temperature Sensor. **Note: Acceptable Sensor Resistance Ranges in OHMS** Sensor Temp Min Max -40°C (-40°F) 1094 1176 0.00°C (32°F) 1587 1672 25.0°C (77°F) 1960 2040 70.0°C (158°F) 2709 2860 100°C (212°F) 3284 3500 120°C (120°F) 3684 3950 150°C (302°F) 4110 4450 Is the resistance within the specified range when the sensor is at the given temperature? Yes → Test Complete. No → Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Refer to any Technical Service Bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0712-TRANS TEMP SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0712-TRANS TEMP SENSOR VOLTAGE TOO LOW

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set if the Transmission Temperature Sensor Signal circuit voltage goes below 1.55 volts for 2.2 seconds.

POSSIBLE CAUSES
5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
INTERMITTENT TRANSMISSION TEMPERATURE SENSOR
5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
TRANS TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
TRANS TEMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND INSIDE TRANS
5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT INSIDE TRANS
TRANS TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND INSIDE TRANS
TRANS TEMP SENSOR SIGNAL CKT SHORTED TO THE SENSOR GROUND CKT INSIDE TRANS
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Specific Good Trip Counter for P0712 displayed and equal to 0? Yes → Go To 2 No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the 5-volt Supply circuit in the Transmission Solenoid Assembly harness connector. Is the resistance above 100 kohms? Yes → Go To 3 No → Repair the 5-volt Supply circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0712-TRANS TEMP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between the 5-volt Supply circuit and the Sensor Ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the 5-volt Supply circuit for a short to the Sensor Ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Transmission Temperature Sensor Signal circuit in the of the Transmission Solenoid Assembly harness connector. Is the resistance above 100 kohms? Yes → Go To 5 No → Repair the Transmission Temperature Sensor Signal circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between the Transmission Temperature Sensor Signal circuit and Sensor Ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Transmission Temperature Sensor Signal circuit for a short to the Sensor Ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the 5-volt Supply circuit at the Governor Pressure/Transmission Temperature Sensor connector. Is the resistance above 100 kohms? Yes → Go To 7 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0712-TRANS TEMP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary. Measure the resistance between the 5-volt Supply circuit and the Sensor Ground circuit in the Governor Pressure/Transmission Temperature Sensor connector. Is the resistance above 100 kohms? Yes → Go To 8 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. **Note: Check connectors - Clean/repair as necessary** Measure the resistance of the Transmission Temperature Sensor. **Note: Acceptable Sensor Resistance Ranges in OHMS** Sensor Temperature Minimum Maximum -40°C (-40°F) 1094 1176 0°C (32°F) 1587 1672 25°C (77°F) 1960 2040 70°C (158°F) 2709 2860 100°C (212°F) 3284 3500 120°C (120°F) 3684 3950 150°C (302°F) 4110 4450 Is the resistance below the minimum specification for the sensor temperature? Yes → Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Transmission Temperature Sensor Signal circuit at the Governor Pressure/Transmission Temperature Sensor connector. Is the resistance above 100 kohms? Yes → Go To 10 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0712-TRANS TEMP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary. Measure the resistance between the Transmission Temperature Sensor Signal circuit and Sensor Ground circuit at the Governor Pressure/Transmission Temperature Sensor connector. Is the resistance above 100 kohms? Yes → Go To 11 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0713-TRANS TEMP SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0713-TRANS TEMP SENSOR VOLTAGE TOO HIGH

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set if the Transmission Temperature Sensor Signal circuit voltage goes above 3.76 volts for 2.2 seconds.

POSSIBLE CAUSES
TRANS TEMP SENSOR SIGNAL CKT SHORTED TO VOLTAGE
TRANS TEMP SENSOR SIGNAL CIRCUIT SHORTED TO 5-VOLT SUPPLY CIRCUIT
INTERMITTENT TRANSMISSION TEMPERATURE SENSOR
TRANS TEMP SENSOR SIGNAL CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
TRANS TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE INSIDE TRANS
TRANS TEMP SENSOR SIGNAL CIRCUIT SHORTED TO 5-VOLT SUPPLY CIRCUIT INSIDE TRANS
TRANS TEMP SENSOR SIGNAL CIRCUIT OPEN INSIDE TRANS
5-VOLT SUPPLY CIRCUIT OPEN INSIDE TRANS
SENSOR GROUND CIRCUIT OPEN INSIDE TRANS
TRANSMISSION TEMPERATURE SENSOR
PCM - TRANSMISSION TEMPERATURE SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0713 displayed and equal to 0? Yes → Go To 2 No → Go To 14	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0713-TRANS TEMP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Disconnect the PCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Turn the ignition on. Remove the Transmission Control Relay from the PDC. Connect a jumper wire between Transmission Control Relay cavity 30 and cavity 87. Measure the voltage of the Transmission Temperature Sensor Signal circuit in the PCM C2 harness connector. Is the voltage above 1.0 volt? Yes → Repair the Transmission Temperature Sensor Signal circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition off. Disconnect the PCM C1 and C2 harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between the Transmission Temperature Sensor Signal circuit and the 5-volt Supply circuit in the Transmission Solenoid Assembly harness connector. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Transmission Temperature Sensor Signal circuit for a short to the 5-volt Supply circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off. Disconnect the PCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Measure the resistance of the Transmission Temperature Sensor Signal circuit between the PCM C2 harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Transmission Temperature Sensor Signal circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Disconnect the PCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Measure the resistance of the 5-volt Supply circuit between the PCM C2 harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the 5-volt Supply circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0713-TRANS TEMP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the PCM C1 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Measure the resistance of the Sensor Ground circuit between the PCM C1 harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Sensor Ground circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off. **Note: The Transmission Solenoid Assembly harness connector must be connected before proceeding.** Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary Turn the ignition on. Measure the voltage of the Transmission Temperature Sensor Signal circuit in the Governor Pressure/Transmission Temperature Sensor connector. Is the voltage above 10.0 volts? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 8	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance between the Transmission Temperature Sensor Signal circuit and 5-volt Supply circuit in the Governor Pressure/Transmission Temperature Sensor connector. Is the resistance above 100 kohms? Yes → Go To 9 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Check connectors - Clean/repair as necessary Measure the resistance of the Transmission Temperature Sensor Signal circuit between the Transmission Solenoid Assembly connector (transmission side) and the Governor Pressure/Transmission Temperature Sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0713-TRANS TEMP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary Measure the resistance of the 5-volt Supply circuit between the Transmission Solenoid Assembly connector (transmission side) and Governor Pressure/ Transmission Temperature Sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. Check connectors - Clean/repair as necessary Measure the resistance of the Sensor Ground circuit between the Transmission Solenoid Assembly connector (transmission side) and the Governor Pressure/ Transmission Temperature Sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor connector. **Note: Check connectors - Clean/repair as necessary** Measure the resistance of the Transmission Temperature Sensor. **Note: Acceptable Sensor Resistance Ranges in OHMS** Sensor Temperature Minimum Maximum -40°C (-40°F) 1094 1176 0°C (32°F) 1587 1672 25°C (77°F) 1960 2040 70°C (158°F) 2709 2860 100°C (212°F) 3284 3500 120°C (120°F) 3684 3950 150°C (302°F) 4110 4450 Is the resistance above the maximum specification for the sensor temperature? Yes → Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0713-TRANS TEMP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
13	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
14	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0720-LOW OUTPUT SPEED SENSOR - RPM ABOVE 15 MPH

When Monitored and Set Condition:

P0720-LOW OUTPUT SPEED SENSOR - RPM ABOVE 15 MPH

When Monitored: Continuously with the key on, engine running, and gear selector NOT in park or neutral.

Set Condition: This code will set if the vehicle speed (from the CAB module) is above 24 kmh (15 MPH), and the Output Shaft Speed sensor is below 60 RPM for 2.6 seconds.

POSSIBLE CAUSES
PARK/NEUTRAL DTC PRESENT
INTERMITTENT WIRING AND CONNECTORS
OUTPUT SPEED SENSOR GROUND CIRCUIT OPEN
OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
OUTPUT SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
OUTPUT SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR
PCM - OUTPUT SPEED SENSOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0720 displayed and equal to 0? Yes → Go To 2 No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Ignition on, engine not running. With the DRBIII®, read the Powertrain Control Module DTC's. Is there a Park/Neutral DTC present? Yes → Repair the Park/Neutral DTC before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0720-LOW OUTPUT SPEED SENSOR - RPM ABOVE 15 MPH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the Output Speed Sensor harness connector. **NOTE: Check connectors - Clean/repair as necessary** Measure the resistance of the Output Speed Sensor ground circuit between the PCM harness connector and the Output Speed Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Output Speed Sensor negative ground circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the Output Speed Sensor harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the Output Speed Sensor ground circuit. Is the resistance below 5.0 ohms? Yes → Repair the Output Speed Sensor ground circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the Output Speed Sensor harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the Output Speed Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Repair the Output Speed Sensor Signal Positive circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 6	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the Output Speed Sensor harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the Output Speed Sensor Signal circuit between the PCM harness connector and the Output Speed Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Output Speed Sensor Signal circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0720-LOW OUTPUT SPEED SENSOR - RPM ABOVE 15 MPH — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the Output Speed Sensor harness connector. **Check connectors - Clean/repair as necessary** Ignition on, engine not running. Measure the voltage of the Output Speed Sensor ground circuit in the Output Speed Sensor harness connector. Is there any voltage present? Yes → Repair the output speed sensor ground (-) circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 8	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the Output Speed Sensor harness connector. Ignition on, engine not running. Measure the voltage of the Output Speed sensor Signal circuit in the Output Speed Sensor harness connector. Is there any voltage present? Yes → Repair the output speed sensor signal (+) circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Disconnect the Output Speed Sensor harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between the terminals of the Output Speed Sensor. Is the resistance between 300.0 and 1200.0 ohms? Yes → Go To 10 No → Replace the Output Speed Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0720-LOW OUTPUT SPEED SENSOR - RPM ABOVE 15 MPH — Continued

TEST	ACTION	APPLICABILITY
11	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0740-TORQ CONV CLU, NO RPM DROP AT LOCKUP

When Monitored and Set Condition:

P0740-TORQ CONV CLU, NO RPM DROP AT LOCKUP

When Monitored: Continuously with the key on.

Set Condition: This code wills set if the Torque Convertor Clutch (TCC) cannot achieve the desired drop in engine RPM when the TCC solenoid is near the maximum duty cycle. Two trips of three consecutive bad tests are required to set the code. (Vehicle not in low range)

POSSIBLE CAUSES
CHECK FOR MISFIRE CODES
INTERMITTENT TCC SOLENOID
CHECK THE TRANS FLUID LEVEL AND CONDITION
INPUT SHAFT SEALS
INTERNAL PROBLEM OR TCC SOLENOID
OIL PUMP/SHAFT/SEALS
TORQUE CONVERTER
VALVE BODY

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip counter for P0740 displayed and Equal to 0? Yes → Go To 2 No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0740-TORQ CONV CLU, NO RPM DROP AT LOCKUP — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. With the DRBIII®, read DTCs. Are any of the following DTCs present? P0122 Test Complete. P0123 Test Complete. P0743 Test Complete. P1696 Test Complete. P0320 Test Complete. Misfire codes? Go To 3 No → Go To 4	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn ignition on. With the DRBIII®, read DTCs. Are any Misfire codes present? Yes → Repair all Misfire codes before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Check the transmission fluid level and condition per the service information. Is fluid level OK and clear of contamination? Yes → Go To 5 No → Repair the fluid level and condition as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition on. With the DRBIII®, perform the TCC System test. Did the engine stall? Yes → Go To 6 No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Start engine. With the DRBIII®, perform the Gov and 3-4 Shift Valve System Test. Did the engine stall? Yes → Go To 7 No → Go To 8	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0740-TORQ CONV CLU, NO RPM DROP AT LOCKUP — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Replace the TCC Solenoid (part of the Transmission Solenoid Assembly) in accordance with the Service Information. Perform the Gov and 3-4 Shift Valve System Test. With the DRBIII®, select 4th gear. Did the engine stall? Yes → Repair the internal transmission problem in accordance with the Service Information. Check for blocked passage(s). Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off. Remove the transmission oil pump and inspect the reaction shaft, input shaft and input shaft seals. Are any of the parts worn or damaged? Yes → Repair or replace the parts as necessary. Replace the Torque Converter. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn ignition off. Connect a pressure gauge to the transmission cooler out port with a ″T″ connector Start engine. With the DRB, perform the TCC System test. Monitor the gauge pressure while performing the TCC System test. Did the cooler out pressure increase when the TCC was actuated? Yes → Go To 10 No → Repair the valve body in accordance with the Service Information. Check for a blockage or leak in the TCC hydraulic circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn ignition off. Remove the transmission oil pump and inspect the reaction shaft, input shaft and input shaft seals. Are any of the parts damaged or worn? Yes → Repair or replace worn or damaged parts as necessary in accordance with the Service Information and replace the Torque Converter. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	If there are no possible causes remaining, view repair. Repair Replace the Torque Converter. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0740-TORQ CONV CLU, NO RPM DROP AT LOCKUP — Continued

TEST	ACTION	APPLICABILITY
12	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS

When Monitored and Set Condition:

P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS

When Monitored: Continuously with the key on.

Set Condition: This code will set if the voltage detected on the Torque Converter Clutch Solenoid Control circuit at the PCM is different than the expected voltage.

POSSIBLE CAUSES
P1765 DTC PRESENT
INTERMITTENT - TCC SOLENOID CONTROL CIRCUIT
TRANSMISSION CONTROL RELAY OUTPUT
TCC SOLENOID CONTROL CIRCUIT OPEN
TCC SOLENOID CONTROL CIRCUIT OPEN INTERNAL
FUSED B+ CIRCUIT OPEN
TCC SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TCC SOLENOID CONTROL CIRCUIT SHORT TO GROUND INTERNAL
TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO GROUND
TCC SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
TCC SOLENOID CONTROL CIRCUIT SHORT TO SOLENOID CIRCUITS INTERNAL
TCC SOLENOID CONTROL CIRCUIT SHORTED TO OTHER CIRCUITS
TCC SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS INTERNAL
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
TRANSMISSION CONTROL RELAY - POOR CONTACTS
PCM - TCC SOLENOID CONTROL CIRCUIT

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0743 displayed and equal to 0? Yes → Go To 2 No → Go To 18	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTCs. Is the DTC P1765 present? Yes → Perform diagnostics on P1765 TRANS 12 VOLT SUPPLY RELAY CTRL CIRCUIT first before proceeding. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, read Transmission DTCs. Are DTCs, P0743, P0748 and P0753 present? Yes → Go To 4 No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Transmission Control Relay Output circuit in the Transmission Solenoid Assembly harness connector. Does the test light illuminate brightly? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Remove the Transmission Control Relay. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the Transmission Control Relay connector. **NOTE: The light must illuminate brightly. Compare the brightness to being connected directly to the battery.** Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Fused B+ circuit for an open. If the fuse is open make sure to check for a short to ground or excessive resistance in the Fused B+ circuit and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Remove the Transmission Control Relay. Measure the resistance between ground and the Fused Transmission Relay Control Output circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Relay Output circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Ignition on, engine not running. Connect a jumper wire between the Fused Transmission Relay Output circuit and the Fused B+ in the Transmission Relay connector. Using a 12-volt test light connected to ground, check the Fused Transmission Relay Control Output circuit in the Transmission Solenoid Assembly harness connector. **NOTE: The light must illuminate brightly. Compare the brightness to being connected directly to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Fused Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground or excessive resistance in the Fused Transmission Relay Output circuit and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Ignition on, engine not running. Connect a jumper wire between the Fused Transmission Relay Output circuit and the Fused B+ in the Transmission Relay connector. Using a 12-volt test light connected to ground, check the Transmission Relay Control Output circuit in the Fused Transmission Solenoid Assembly harness connector. Does the test light illuminate brightly? Yes → Replace the Transmission Control Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connectors. Disconnect the PCM harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the TCC Solenoid Control circuit between the Transmission Solenoid Assembly harness connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the TCC Solenoid Control circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 5.	without 5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the TCC Solenoid Control circuit in the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TCC Solenoid Control circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Ignition on, engine not running. Measure the voltage of the TCC Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the TCC Solenoid Control circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Remove the Transmission Control Relay. **Check connectors - Clean/repair as necessary** Measure the resistance between the TCC Solenoid Control circuit and all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance between the TCC Solenoid Control circuit and any other circuit below 100 kohms? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Remove the Transmission Control Relay. Measure the resistance of the TCC Solenoid Control circuit between the PCM harness connector and the Fused Transmission Control Relay Output circuit connector. Is the resistance between 25.0 ohms and 60.0 ohms Yes → Go To 14 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	without 5-SPD AUTOMATIC 5-45RFE TRANS
14	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between the TCC Solenoid Control circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair or Replace the Transmission Solenoid Assembly for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 15	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** **NOTE: Resistance between the TCC Solenoid Control circuit and the Governor Pressure Solenoid Control circuit should be 28 to 68 ohms.** Measure the resistance between the TCC Solenoid Control circuit and the Governor Pressure Solenoid Control circuit in the PCM harness connector. **NOTE: Resistance between the TCC Solenoid Control circuit and the 3-4 Shift Solenoid Control circuit should be 50 to 120 ohms.** Measure the resistance between the TCC Solenoid Control circuit and the 3-4 shift Solenoid Control circuit in the PCM harness connector. Is the resistance of both measurements within the specified ranges? Yes → Go To 16 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	without 5-SPD AUTOMATIC 5-45RFE TRANS
16	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Remove the Transmission Control Relay. **Check connectors - Clean/repair as necessary** **NOTE: Resistance between the TCC Solenoid circuit and the circuits below should be above 100 kohms.** Measure the resistance between the Transmission TCC Solenoid Control circuit and the Governor Pressure Solenoid Control circuit in the PCM harness connector. *Sensor Ground circuit in the C2 PCM harness connector. *Transmission Temp Sensor Signal circuit in the PCM harness connector. *Governor Pressure Sensor Signal circuit in the PCM harness connector. *Transmission 5-volt Supply circuit in the C2 PCM harness connector. Are the resistance values, to any of the listed circuits, below 100 kohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 17	without 5-SPD AUTOMATIC 5-45RFE TRANS
17	If there are no possible causes remaining, view repair. Repair Replace the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0743-TORQUE CONVERTER CLUTCH SOLENOID/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
18	At this time, the conditions required to set the DTC are not present. **NOTE: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, broken, bent, pushed out, corroded terminals, or partially broken wires.** **NOTE: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0748-PRESSURE SOL CONTROL/TRANS RELAY CIRCUITS

When Monitored and Set Condition:

P0748-PRESSURE SOL CONTROL/TRANS RELAY CIRCUITS

When Monitored: Continuously with the key on.

Set Condition: This code will set if the voltage detected on the Governor Pressure Solenoid Control circuit at the PCM is different than the expected voltage.

POSSIBLE CAUSES
P1765 DTC PRESENT
INTERMITTENT GOVERNOR PRESSURE SOLENOID
TRANSMISSION RELAY OUTPUT
FUSED B+ CIRCUIT OPEN
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT OPEN
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT OPEN INTERNAL
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO GROUND
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO GROUND INTERNAL
TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO GROUND
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO SOLENOID CIRCUITS INTERNAL
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS INTERNAL
TRANSMISSION CONTROL RELAY - POOR CONTACTS
PCM - GOVERNOR PRESSURE SOLENOID CONTROL CIRCUIT

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0748 displayed and equal to 0? Yes → Go To 2 No → Go To 18	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0748-PRESSURE SOL CONTROL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTCs. Is the DTC P1765 present? Yes → Perform diagnostics on P1765 TRANS 12-VOLT SUPPLY RELAY CTRL CIRCUIT first before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, read Transmission DTCs. Are DTCs P0743, P0748 and P0753 present? Yes → Go To 4 No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid Assembly harness connector. Does the test light illuminate brightly? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Remove the Transmission Control Relay. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the Transmission Control Relay connector. **NOTE: The light must illuminate brightly, if it does not light, or lights dimly, the circuit must be repaired. If there is any doubt, compare the brightness when testing the circuit, to the brightness when connected directly to the battery positive post.** Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Fused B+ circuit for an open. If the fuse is open, make sure to check for a short to ground or excessive resistance in the Fused B+ circuit and repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Remove the Transmission Control Relay. Measure the resistance between ground and the Transmission Relay Control Output circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Relay Output circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 7	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0748-PRESSURE SOL CONTROL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Ignition on, engine not running. Connect a jumper wire between the Fused Transmission Relay Output circuit and Fused B+ in the Transmission Relay connector. Using a 12-volt test light connected to ground, check the Transmission Relay Control Output circuit in the Transmission Solenoid Assembly harness connector. Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Fused Transmission Control Relay Output circuit for an open. If the Fuse is open, make sure to check for a short to ground or excessive resistance in the Fused Transmission Control Relay Output circuit and repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Ignition on, engine not running. Connect a jumper wire between the Transmission Relay Output circuit and the Fused B+ circuit in the Transmission Relay connector. Using a 12-volt test light connected to ground, check the Transmission Relay Control Output circuit in the Transmission Solenoid Assembly harness connector. Does the test light illuminate brightly? Yes → Replace the Transmission Control Relay. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connectors. Disconnect the PCM harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the Governor Pressure Solenoid Control circuit between the Transmission Solenoid Assembly harness connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the Governor Pressure Solenoid Control circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the Governor Pressure Solenoid Control circuit in the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the Governor Pressure Solenoid Control circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0748-PRESSURE SOL CONTROL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Ignition on, engine not running. Measure the voltage of the Governor Pressure Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the Governor Solenoid Control circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Remove the Transmission Control Relay. **Check connectors - Clean/repair as necessary** Measure the resistance between the Governor Pressure Solenoid Control circuit and all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance below 100 kohms between any two circuits? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Remove the Transmission Control Relay. Measure the resistance of the Governor Pressure Solenoid Control circuit between the PCM harness connector and the Transmission Control Relay Output circuit connector. Is the resistance between 3.0 ohms and 6.0 ohms Yes → Go To 14 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
14	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between the Governor Pressure Solenoid Control circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair or Replace the Transmission Solenoid Assembly for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 15	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0748-PRESSURE SOL CONTROL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** **NOTE: Resistance between the Governor Pressure Solenoid Control circuit and the listed circuits should be 28 to 68 ohms.** Measure the resistance between the Governor Pressure Solenoid Control circuit and the... * TCC Solenoid Control circuit in the PCM harness connector. * 3-4 shift Solenoid Control circuit in the PCM harness connector. Is the resistance of both measurements within the range of 28 to 68 ohms? Yes → Go To 16 No → Replace Transmission Solenoid Assembly per Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
16	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Remove the Transmission Control Relay. **Check connectors - Clean/repair as necessary** **NOTE: Resistance between the Governor Pressure Solenoid circuit and the listed circuits should not be below 100 kohms.** Measure the resistance between the Governor Pressure Solenoid Control circuit and the... * Transmission 5-volt supply circuit in the C2 PCM harness connector. * Sensor Ground circuit in the C2 PCM harness connector. * Transmission Temp Sensor Signal circuit in the PCM harness connector. * Governor Pressure Sensor Signal circuit in the PCM harness connector. Are the resistance values for any of the above listed circuits below 100 kohms? Yes → Replace Transmission Solenoid Assembly per Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 17	without 5-SPD AUTOMATIC 5-45RFE TRANS
17	If there are no possible causes remaining, view repair. Repair Replace the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
18	At this time, the conditions required to set the DTC are not present. **NOTE: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, broken, bent, pushed out, corroded terminals, or partially broken wires.** **NOTE: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0751-O/D SWITCH PRESSED (LO) MORE THAN 5 MINUTES

When Monitored and Set Condition:

P0751-O/D SWITCH PRESSED (LO) MORE THAN 5 MINUTES

When Monitored: The engine must have been running for a minimum of 10 seconds. The test for this code is executed every 440ms.

Set Condition: This code will set if the Overdrive Off switch is held low for 5 minutes or more from the time of switch closure or ignition on.

POSSIBLE CAUSES
INTERMITTENT O/D OFF SWITCH
O/D OFF SWITCH SENSE CIRCUIT SHORTED TO GROUND
OVERDRIVE OFF SWITCH
PCM - O/D OFF

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read DTCs. Is the Good Trip Counter for P0751 displayed and equal to 0? Yes → Go To 2 No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition off. Disconnect the PCM harness connector. Disconnect the O/D Off Switch harness connector. Measure the resistance between ground and the O/D off switch sense circuit in the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the O/D OFF switch sense circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition off. Disconnect the PCM C3 harness connector. Measure the resistance between ground and the O/D off switch sense circuit in the PCM C3 harness connector. Press the O/D Off switch button. Does the resistance change from above 5.0 ohms to below 5.0 ohms while pressing the O/D Off Switch? Yes → Go To 4 No → Replace the O/D Off Switch in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0751-O/D SWITCH PRESSED (LO) MORE THAN 5 MINUTES — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS

When Monitored and Set Condition:

P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS

When Monitored: Continuously with the key on.

Set Condition: This code will set if the voltage detected on the 3-4 Shift Solenoid Control circuit at the PCM is different than the expected voltage.

POSSIBLE CAUSES
P1765 DTC PRESENT
INTERMITTENT - 3-4 SHIFT SOLENOID CONTROL CIRCUIT
TRANSMISSION RELAY CONTROL OUTPUT
3-4 SHIFT SOLENOID CONTROL CIRCUIT OPEN
3-4 SHIFT SOLENOID CONTROL CIRCUIT OPEN INTERNAL
FUSED B+ CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
3-4 SHIFT SOLENOID CONTROL CIRCUIT SHORT TO GROUND
3-4 SHIFT SOLENOID CONTROL CIRCUIT SHORT TO GROUND INTERNAL
TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO GROUND
3-4 SHIFT SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
3-4 SHIFT SOLENOID CONTROL CIRCUIT SHORT TO SOLENOID CIRCUITS INTERNAL
3-4 SHIFT SOLENOID CONTROL CIRCUIT SHORTED TO OTHER CIRCUITS
3-4 SHIFT SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS INTERNAL
TRANSMISSION CONTROL RELAY - POOR CONTACTS
PCM - 3-4 SHIFT SOLENOID CONTROL CIRCUIT

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0753 displayed and equal to 0? Yes → Go To 2 No → Go To 18	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTCs. Is the DTC P1765 present? Yes → Perform diagnostics on P1765 TRANS 12 VOLT SUPPLY RELAY CTRL CIRCUIT first before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, read Transmission DTCs. Are DTCs, P0743, P0748 and P0753 present? Yes → Go To 4 No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Transmission Control Relay Output circuit in the Transmission Solenoid Assembly harness connector. Does the test light illuminate brightly? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 5	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Remove the Transmission Control Relay. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the Transmission Control Relay connector. **NOTE: The test light must illuminate brightly. Compare the brightness to when connected directly to the battery.** Does the light illuminate brightly? Yes → Go To 6 No → Repair the Fused B+ circuit for an open. If the fuse is open make sure to check for a short to ground or excessive resistance in the Fused B+ circuit and repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Remove the Transmission Control Relay. Measure the resistance between ground and the Fused Transmission Relay Control Output circuit. Is the resistance below 5.0 ohms? Yes → Repair the Fused Transmission Control Relay Output circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 7	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Ignition on, engine not running. Connect a jumper wire between the Fused Transmission Relay Output circuit and the Fused B+ in the Transmission Relay connector. Using a 12-volt test light connected to ground, check the Fused Transmission Relay Control Output circuit in the Transmission Solenoid Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to when connected directly to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Fused Transmission Control Relay Output circuit for an open. If the Fuse is open, make sure to check for a short to ground or excessive resistance in the Fused Transmission Control Relay Output circuit and repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Check connectors - Clean/repair as necessary Ignition on, engine not running. Connect a jumper wire between the Fused Transmission Relay Output circuit and Fused B+ in the Transmission Relay connector. Using a 12-volt test light connected to ground, check the Fused Transmission Relay Control Output circuit in the Transmission Solenoid Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to when connected directly to the battery.** Does the test light illuminate brightly? Yes → Replace the Transmission Control Relay. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connectors. Disconnect the PCM harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the 3-4 Shift Solenoid Control circuit between the Transmission Solenoid Assembly harness connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the 3-4 Shift Solenoid Control circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the 3-4 Shift Solenoid Control circuit in the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the 3-4 Shift Solenoid Control circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Ignition on, engine not running. Measure the voltage of the 3-4 Shift Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the 3-4 Shift Solenoid Control circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Remove the Transmission Control Relay. **Check connectors - Clean/repair as necessary** Measure the resistance between the 3-4 Shift Solenoid Control circuit and all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance between the 3-4 Shift Solenoid Control circuit and any other circuit below 100 koh Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Remove the Transmission Control Relay. Measure the resistance of the 3-4 Shift Solenoid Control circuit between the PCM harness connector and the Fused Transmission Control Relay Output circuit connector. Is the resistance between 25.0 ohms and 60.0 ohms Yes → Go To 14 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
14	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between the 3-4 Shift Solenoid Control circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair or Replace the Transmission Solenoid Assembly for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 15	without 5-SPD AUTOMATIC 5-45RFE TRANS
15	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** **NOTE: Resistance between the 3-4 Shift Solenoid Control circuit and the Governor Pressure Solenoid Control circuit should be 28 to 68 ohms.** Measure the resistance between the 3-4 Shift Solenoid Control circuit and the Governor Pressure Solenoid Control circuit in the PCM harness connector. **NOTE: Resistance between the 3-4 Shift Solenoid Control circuit and the TCC Solenoid Control circuit should be 50 to 120 ohms.** Measure the resistance between the 3-4 Shift Solenoid Control circuit and the TCC Solenoid Control circuit in the PCM harness connector. Is the resistance of both measurements within the specified ranges? Yes → Go To 16 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
16	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. Remove the Transmission Control Relay. **Check connectors - Clean/repair as necessary** **NOTE: Resistance between the 3-4 Shift Solenoid circuit and the circuits below should be above 100 kohms.** Measure the resistance between the Transmission 3-4 Shift Solenoid Control circuit and the... *Sensor Ground circuit in the C2 PCM harness connector. *Transmission Temp Sensor Signal circuit in the PCM harness connector. *Governor Pressure Sensor Signal circuit in the PCM harness connector. *Transmission 5-volt Supply circuit in the C2 PCM harness connector. Are the resistance values, to any of the listed circuits, below 100 kohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 17	without 5-SPD AUTOMATIC 5-45RFE TRANS
17	If there are no possible causes remaining, view repair. Repair Replace the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0753-TRANS 3-4 SHIFT SOL/TRANS RELAY CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
18	At this time, the conditions required to set the DTC are not present. **NOTE: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, broken, bent, pushed out, corroded terminals, or partially broken wires.** **NOTE: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0783-3-4 SHIFT SOL, NO RPM DROP AT LOCKUP

When Monitored and Set Condition:

P0783-3-4 SHIFT SOL, NO RPM DROP AT LOCKUP

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set if the expected engine RPM drop does not occur within 4 seconds of the gear change being requested by the PCM. Three consecutive bad tests are required to set the code.

POSSIBLE CAUSES
OTHER DTC'S PRESENT
INTERMITTENT 3-4 SOLENOID
FLUID LEVEL AND CONDITION
TRANSMISSION
OIL BURNT OR OIL PAN HAS EXCESSIVE DEBRIS

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip Counter for P0783 displayed and equal to 0? Yes → Go To 2 No → Go To 7	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0783-3-4 SHIFT SOL, NO RPM DROP AT LOCKUP — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. With the DRBIII®, read DTCs. Are any of the following DTCs present? P-1765 Trans 12 V Supply Relay Ctrl Ckt Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P-0743 TCC Solenoid/Trans Relay Ckt Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P0753-Trans 3-4 Shift Sol/Relay Ckt Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P-1899 Park/Neutral Stuck Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P-0340 No Cam Signal at PCM Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P-0121 TPS Does Not Agree with MAP Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P-0122 TPS Low Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. P-0123 TPS High Refer to the appropriate symptom for diagnostics. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Check Transmission fluid level, and condition of the transmission fluid for any debris. Is fluid level OK and clear of contamination? Yes → Go To 4 No → Repair the fluid level and condition as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0783-3-4 SHIFT SOL, NO RPM DROP AT LOCKUP — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Connect a 0 - 2068 KPa (0 - 300 PSI) pressure gauge to the Overdrive Clutch test port. Connect another 0 - 2068 KPa (0 - 300 PSI) pressure gauge to the Governor Pressure test port. Start the engine and allow the transmission temperature to rise to normal operating temperature. **Caution: Apply the parking brake.** Place the gear selector in Drive. While observing the pressure gauges, select 4th gear from Gov and 3-4 Shift Valve Test with the DRBIII®. **Note: The governor pressure should rise to above 138 KPa (20 PSI). Shortly after this, the O/D pressure should rise to above 276 KPa (40 PSI).** Did the pressure act as described? Yes → Go To 5 No → Go To 6	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Remove the transmission oil pan and inspect for excessive debris and burnt oil. Is the oil burnt or does the transmission oil pan contain excessive debris? Yes → Repair the internal transmission problem in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 7	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off. Replace 3-4 Shift Solenoid. Connect a 0 - 2068 KPa (0 - 300 PSI) pressure gauge to the Overdrive Clutch test port. Connect another 0 - 2068 KPa (0 - 300 PSI) pressure gauge to the Governor Pressure test port. Start the engine and allow the transmission temperature to reach normal operating temperature. **Caution: Apply the parking brake.** Place the gear selector in Drive. While observing the pressure gauges, actuate the 3-4 Shift Solenoid with the DRB. **Note: The governor pressure should rise to above 138 KPa (20 PSI). Shortly after this, the O/D pressure should rise to above 276 KPa (40 PSI).** Did the pressure act as described? Yes → Test Complete. No → Overhaul the Transmission in accordance with the Service Information. Pay extra attention to Seals and Clutches related to the OD Clutch. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P0783-3-4 SHIFT SOL, NO RPM DROP AT LOCKUP — Continued

TEST	ACTION	APPLICABILITY
7	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** **Note: The vehicle must be driven (road load) to set this code. Drive the vehicle 4 times from 0 to 89 kmh (0 to 55 MPH) with a constant 20 % throttle position through all gears. Stop the vehicle, shut the engine off and then repeat the procedure.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI

When Monitored and Set Condition:

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set if the gov press sensor output is < 103 KPa (15 PSI) or > 207 KPa (30 PSI) when the requested pressure is 138-172 KPa (20-25 PSI) for 2.2 seconds. Two trips of five consecutive bad 2.2 second tests with sump temp 10-127°C (50-260°F).

POSSIBLE CAUSES
OTHER TRANSMISSION DTC'S
INTERMITTENT GOVERNOR PRESSURE SOLENOID
CHECK TRANS FLUID LEVEL AND CONDITION
5 VOLT SUPPLY CIRCUIT OPEN
GOV PRESSURE SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
GOV PRESS SENSOR SIGNAL CKT SHORT TO GND
GOV PRESS SENSOR SIGNAL CKT SHORT TO SENSOR GND
GOV PRESS SENSOR SIGNAL CKT SHORT TO VOLTAGE
5 VOLT SUPPLY CIRCUIT OPEN INSIDE TRANS
GOV PRESS SENSOR GROUND CKT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO GND INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO SENSOR GND INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO VOLTAGE INSIDE TRANS
OIL BURNT OR OIL PAN HAS EXCESSIVE DEBRIS
VALVE BODY
GOVERNOR PRESSURE SENSOR
INTERNAL TRANSMISSION
PCM - 5 VOLT SUPPLY
PCM - GOV PRESSURE NOT EQUAL TO TARGET

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. **Note: The Transmission Control Relay may be removed during this test, this will set other codes. They can be disregarded.** Is the Trip Counter for P1756 displayed and equal to 0? Yes → Go To 2 No → Go To 26	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition on. With the DRBIII®, read DTCs. Are any other transmission DTCs present? Yes → Repair all other transmission DTCs before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Start the engine. Allow the transmission to reach normal operating temperature. Check the transmission fluid level and condition. Refer to the Service information. Is the fluid level correct and the fluid condition OK? Yes → Go To 4 No → Repair as necessary the transmission fluid level and condition. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	**Caution: Apply the parking brake.** Start engine. Warm the engine to normal operating temperature. With the DRBIII®, read the governor pressure. **Caution: Apply the brakes.** Place the gear selector in Drive. Is the governor pressure above 21 KPa (3 PSI)? Yes → Go To 5 No → Go To 21	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Install a pressure gauge at the governor pressure test port. **Caution: Apply the parking brake.** Start the engine. Warm the engine to normal operating temperature. **Caution: Apply the brakes.** Place the gear selector in Drive. Read the governor pressure on the gauge in Drive. Is the governor pressure on the gauge below 34 KPa (5 PSI)? Yes → Go To 6 No → Go To 24	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. **Check connectors - Clean/repair as necessary** Turn the ignition on. Measure the voltage of the 5 volt supply circuit at the Transmission Solenoid Assembly harness connector. Is the voltage between 4.5 and 5.5 volts? Yes → Go To 7 No → Go To 20	without 5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the governor pressure sensor signal circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid Assembly harness connector and the PCM C1 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the sensor ground circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 10	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 and C2 harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit to the sensor ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to the sensor ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the voltage above 1.0 volt? Yes → Repair the governor pressure sensor signal circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance of the 5 volt supply circuit between the Governor Pressure/Transmission Temperature Sensor harness connector and the Transmission Solenoid Assembly case connector. Is the resistance below 5.0 ohms? Yes → Go To 13 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid case connector and the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 14 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
14	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly case connector and the Governor Pressure/ Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
15	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance between ground and the governor pressure sensor signal circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 16	without 5-SPD AUTOMATIC 5-45RFE TRANS
16	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance between the governor pressure sensor signal circuit and sensor ground circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 17	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
17	Turn the ignition off. **Note: The Transmission Solenoid Assembly harness connector must be connected before proceeding.** Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the voltage above 1.0 volt? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 18	without 5-SPD AUTOMATIC 5-45RFE TRANS
18	Place the gear selector in Neutral. With the DRBIII®, read the Governor Pressure Sensor voltage. Measure the voltage of the governor pressure sensor signal circuit by back probing at the PCM. Compare the voltmeter reading of the governor pressure sensor signal circuit to the DRBIII® Governor Pressure Sensor voltage. Start the engine. Does the DRBIII® Governor Press Sensor voltage match the governor pressure sensor voltage on the vol Yes → Go To 19 No → Replace the Powertrain Control Module. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
19	If there are no possible causes remaining, view repair. Repair Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
20	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the 5 volt supply circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Powertrain Control Module. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Repair the 5 volt supply circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
21	**Caution: Apply the parking brake.** Place the gear selector in Park. Start the engine. Warm the engine to normal operating temperature. With the DRBIII® read the governor pressure. With the engine still running, remove the Transmission Control Relay from the PDC. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **Caution: Apply the brakes.** Place the gear selector in Drive. Is the governor pressure on the DRB 276 - 379 KPa (40 - 55 PSI)? Yes → Go To 22 No → Go To 23	without 5-SPD AUTOMATIC 5-45RFE TRANS
22	Turn the ignition off. Replace the Governor Pressure Solenoid in accordance with the Service Information. Warm the engine to normal operating temperature. With the DRB, monitor the target governor pressure and actual governor pressure. Drive the vehicle at a constant speed 40 - 48 kmh (25 - 30 MPH). **Note: The actual governor pressure should be within 34 KPa (5 PSI) of the target governor pressure with in 3 seconds.** Is the actual governor pressure within 34 KPa (5 PSI) of the target governor pressure? Yes → Test Complete. No → Repair the internal transmission leakage problem in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
23	Turn the ignition off. Install a pressure gauge at the governor pressure test port. **Caution: Apply the parking brake.** Place the gear selector in Park. Start the engine. Warm the engine to normal operating temperature. With the engine still running, remove the Transmission Control Relay from the PDC. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **Caution: Apply the brakes.** Place the gear selector in Drive. Read the governor pressure on the gauge. Is the governor pressure on the gauge 276 - 379 KPa (40 - 55 PSI)? Yes → Test Complete. No → Go To 24	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1756-GOV PRESS NOT EQUAL TO TARGET @ 15-20 PSI — Continued

TEST	ACTION	APPLICABILITY
24	Turn the ignition off. Remove the transmission oil pan and inspect for burnt oil and excessive debris. Is the transmission oil burnt or does the transmission oil pan contain excessive debris? Yes → Repair the transmission in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 25	without 5-SPD AUTOMATIC 5-45RFE TRANS
25	Turn the ignition off. Install a pressure gauge at the governor pressure test port. Replace the Governor Pressure Solenoid in accordance with the Service Information. Start the engine. Warm the engine to normal operating temperature. **Caution: Apply the brakes.** Place the gear selector in Drive. Read the governor pressure on the gauge in Drive. Is the governor pressure on the gauge below 34 KPa (5 PSI)? Yes → Test Complete. No → Replace the valve body in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
26	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH

When Monitored and Set Condition:

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH

When Monitored: Continuously with the key on and engine running.

Set Condition: This code will set if the Governor Press Sensor output is > 21 KPa (3 PSI) when requested pressure is 0 KPa (0 PSI) with Governor Press Solenoid Duty cycle at 95% for 2.65 seconds. Two trips of two consecutive bad 2.65 second tests are required to set the code.

POSSIBLE CAUSES
OTHER TRANS DTC'S PRESENT
CHECK TRANS FLUID LEVEL AND CONDITION
INTERMITTENT GOVERNOR PRESSURE SOLENOID
5 VOLT SUPPLY CIRCUIT OPEN
GOV PRESSURE SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
GOV PRESS SENSOR SIGNAL CKT SHORT TO GND
GOV PRESS SENSOR SIGNAL CKT SHORT TO SENSOR GND
5 VOLT SUPPLY CIRCUIT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO VOLTAGE
GOV PRESS SENSOR GROUND CKT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO GND INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO SENSOR GND INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO VOLTAGE INSIDE TRANS
GOVERNOR PRESSURE SENSOR
OIL BURNT OR OIL PAN HAS EXCESSIVE DEBRIS
VALVE BODY
PCM - 5 VOLT SUPPLY
POWERTRAIN CONTROL MODULE

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. **Note: You may be removing the Transmission Control Relay during this test, this will set other codes. They can be disregarded.** Is the Good Trip Counter for P-1757 displayed and equal to 0? Yes → Go To 2 No → Go To 29	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition on. With the DRBIII®, read DTCs. Are any other transmission DTCs present? Yes → Repair all other transmission DTCs before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Start the engine. Allow the transmission to reach normal operating temperature. Check the transmission fluid level and condition. Is the fluid level correct and the fluid condition OK? Yes → Go To 4 No → Repair as necessary the transmission fluid level and condition. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Start the engine. Warm the engine to normal operating temperature. With the DRBIII®, read the governor pressure. Place the gear selector in Drive. Is the governor pressure above 21 KPa (3 PSI)? Yes → Go To 5 No → Go To 29	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Install a pressure gauge at the governor pressure test port. **Caution: Apply the parking brake.** Start the engine. Warm the engine to normal operating temperature. **Caution: Apply the brakes.** Place the gear selector in Drive. Read the governor pressure on the gauge in Drive. Is the governor pressure on the gauge below 21 KPa (3 PSI)? Yes → Go To 6 No → Go To 27	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. **Check connectors - Clean/repair as necessary** Turn the ignition on. Measure the voltage of the 5 volt supply circuit at the Transmission Solenoid Assembly harness connector. Is the voltage between 4.5 and 5.5 volts? Yes → Go To 7 No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the governor pressure sensor signal circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid Assembly harness connector and the PCM C1 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the sensor ground circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 10	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 and C2 harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit to the sensor ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to the sensor ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the voltage above 1.0 volt? Yes → Repair the governor pressure sensor signal circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 12	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the 5 volt supply circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 19 No → Repair the 5 volt supply circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 14 No → Repair the governor pressure sensor signal circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
14	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the 5 volt supply circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Repair the 5 volt supply circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
15	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid Assembly harness connector and the PCM C1 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 16 No → Repair the sensor ground circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
16	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 17	without 5-SPD AUTOMATIC 5-45RFE TRANS
17	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 and C2 harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit to the sensor ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to the sensor ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 18	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
18	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the voltage above 1.0 volt? Yes → Repair the governor pressure sensor signal circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 19	without 5-SPD AUTOMATIC 5-45RFE TRANS
19	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance of the 5 volt supply circuit between the Governor Pressure/Transmission Temperature Sensor harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Go To 20 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
20	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid Assembly case connector and the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 21 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
21	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly case connector and the Governor Pressure/ Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 22 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
22	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance between ground and the governor pressure sensor signal circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 23	without 5-SPD AUTOMATIC 5-45RFE TRANS
23	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance between the governor pressure sensor signal circuit and sensor ground circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 24	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
24	Turn the ignition off. **Note: The Transmission Solenoid Assembly harness connector must be connected before proceeding.** Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the voltage above 1.0 volt? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 25	without 5-SPD AUTOMATIC 5-45RFE TRANS
25	Start the engine. Place the gear selector in Neutral. With the DRBIII®, read the Governor Pressure Sensor voltage. Measure the voltage of the governor pressure sensor signal circuit by back probing at the PCM. Compare the voltmeter reading of the governor pressure sensor signal circuit to the DRB Governor Pressure Sensor voltage. Does the DRB Gov Press Sensor voltage match the governor pressure sensor voltage on the voltmeter? Yes → Go To 26 No → Replace the Powertrain Control Module. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
26	If there are no possible causes remaining, view repair. Repair Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
27	Turn the ignition off. Remove the transmission oil pan and inspect for burnt oil and excessive debris. Is the transmission oil burnt or does the transmission oil pan contain excessive debris? Yes → Repair the transmission in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 28	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1757-GOV PRESS ABOVE 3 PSI IN GEAR WITH 0 MPH — Continued

TEST	ACTION	APPLICABILITY
28	Turn the ignition off. Install a pressure gauge at the governor pressure test port. Replace the Governor Pressure Solenoid in accordance with the Service Information. Start the engine. Warm the engine to normal operating temperature. **Caution: Apply the brakes.** Place the gear selector in Drive. Read the governor pressure on the gauge in Drive. Is the governor pressure on the gauge below 34 KPa (5 PSI)? Yes → Test Complete. No → Replace the valve body in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
29	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1762-GOV PRESS SEN OFFSET VOLTS TOO LO OR HIGH

When Monitored and Set Condition:

P1762-GOV PRESS SEN OFFSET VOLTS TOO LO OR HIGH

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set if the governor pressure is out of range in park or neutral for 1.3 seconds for three consecutive bad 3.0 second tests and sump temp > 10°C (50°F) and < 127°C (260°F) are required to set the code.

POSSIBLE CAUSES
CHECK FOR OTHER TRANSMISSION DTC'S
POWERTRAIN CONTROL MODULE
INTERMITTENT CONDITION
GOVERNOR PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
5-VOLT SUPPLY CIRCUIT SHORT TO SENSOR GROUND
INTERNAL TRANSMISSION PROBLEM
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
GOVERNOR PRESSURE SENSOR - BELOW 3 PSI
GOVERNOR PRESSURE SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read PCM DTCs. Is the Good Trip counter for P1762 equal to 0? Yes → Go To 2 No → Go To 11	without DG4
2	Turn the ignition on. With the DRBIII®, read PCM DTCs. Are there any other transmission DTCs present? Yes → Repair all other transmission DTCs before proceeding. If a Park/Neutral DTC is present make sure to perform the diagnostics for that first. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without DG4

P1762-GOV PRESS SEN OFFSET VOLTS TOO LO OR HIGH — Continued

TEST	ACTION	APPLICABILITY
3	**CAUTION: Apply the parking brake.** Start the engine. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Place the gear selector in Neutral. With the DRBIII®, read the governor pressure voltage. Measure the voltage of the Governor Pressure Sensor Signal circuit by back probing at the PCM. Compare the voltmeter reading of the Governor Pressure Sensor Signal circuit to the DRB Governor Pressure Sensor voltage. **NOTE: The voltmeter reading should be within 0.25 volts of the DRBIII® Gov Pressure Sensor voltage reading.** Does the DRBIII® Gov Press Sensor voltage match the Gov Press Sen voltage on the voltmeter? Yes → Go To 4 No → Replace the Powertrain Control Module. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without DG4
4	Start the engine. With the DRBIII® in Sensors, read the Governor Pressure with the Transmission Shift selector in Park. Is the Governor Pressure reading on the DRBIII® above 3 PSI? Yes → Go To 5 No → Go To 8	without DG4
5	Turn the ignition off. Connect the DRBIII®, 700 kPa (100 PSI) Pressure Gauge to the Governor Pressure test port. Start the engine. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Allow the transmission to reach normal operating temperature. With the DRBIII® in Sensors, record the Governor Pressure. With the DRBIII®, read the Governor Pressure Gage reading. Compare the DRBIII® Governor Pressure reading with the Pressure Gauge reading. Does the DRBIII® Governor Pressure reading match the Pressure Gauge reading? Yes → Repair internal transmission as necessary. Pay particular attention to internal transmission fluid leakage in the valve body or the Governor Pressure Solenoid. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 6	without DG4

P1762-GOV PRESS SEN OFFSET VOLTS TOO LO OR HIGH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Governor Pressure Sensor Signal circuit in the Transmission Solenoid Assembly harness connector. Is the voltage above 0.5 volt? Yes → Repair the Governor Pressure Sensor Signal circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 7	without DG4
7	If there are no possible causes remaining, view repair. Repair Check internal transmission wiring pertaining to the Governor Pressure Sensor. If wiring is suspect, replace the internal wiring harness. If the internal wiring is OK, replace the Governor Pressure Sensor per the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without DG4
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the 5-volt Supply circuit in the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Go To 9 No → Repair the 5-volt Supply circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without DG4
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance between the 5-volt Supply circuit and the Sensor Ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Go To 10 No → Repair the 5-volt Supply circuit for a short to the Sensor Ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without DG4
10	If there are no possible causes remaining, view repair. Repair Check internal transmission wiring pertaining to the Governor Pressure Sensor. If wiring is suspect, replace the internal wiring harness. If the internal wiring is OK, replace the Governor Pressure Sensor per the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without DG4

P1762-GOV PRESS SEN OFFSET VOLTS TOO LO OR HIGH — Continued

TEST	ACTION	APPLICABILITY
11	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without DG4

Symptom:
P1763-GOVERNOR PRESSURE SENSOR VOLTS TOO HI

When Monitored and Set Condition:

P1763-GOVERNOR PRESSURE SENSOR VOLTS TOO HI

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set when the voltage from the governor pressure sensor is above 4.89 volts for 8.5 seconds.

POSSIBLE CAUSES
OTHER TRANSMISSION DTC'S PRESENT
PARK NEUTRAL DTC PRESENT
TRANSMISSION FLUID LEVEL AND CONDITION
INTERMITTENT PROBLEM
5 VOLT SUPPLY CIRCUIT OPEN
GOV PRESSURE SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
GOV PRESS SENSOR SIGNAL CKT SHORT TO VOLTAGE
5 VOLT SUPPLY CIRCUIT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT OPEN INSIDE TRANS
GOV PRESS SENSOR GROUND CKT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO VOLTAGE INSIDE TRANS
GOVERNOR PRESSURE SENSOR (HIGH)
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip Counter for P1763 displayed and equal to 0? Yes → Go To 2 No → Go To 15	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition on. With the DRBIII®, read DTCs. Are any other transmission DTCs present? Yes → Repair all other transmission DTCs before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1763-GOVERNOR PRESSURE SENSOR VOLTS TOO HI — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition on. With the DRBIII®, read DTCs. Is a Park/Neutral DTC present? Yes → Repair the Park/Neutral DTC before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 4	without 5-SPD AU-TOMATIC 5-45RFE TRANS
4	Start the engine. Allow the transmission to reach normal operating temperature. Check the fluid level and condition. Is the fluid level correct and the fluid condition OK? Yes → Go To 5 No → Repair the transmission fluid level and condition as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AU-TOMATIC 5-45RFE TRANS
5	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the 5 volt supply circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the 5 volt supply circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AU-TOMATIC 5-45RFE TRANS
6	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the governor pressure sensor signal circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AU-TOMATIC 5-45RFE TRANS
7	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid Assembly harness connector and the PCM C1 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the sensor ground circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AU-TOMATIC 5-45RFE TRANS

P1763-GOVERNOR PRESSURE SENSOR VOLTS TOO HI — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the voltage above 1.0 volt? Yes → Repair the governor pressure sensor signal circuit for a short to voltage. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance of the 5 volt supply circuit between the Governor Pressure/Transmission Temperature Sensor harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the governor pressure sensor signal circuit between the Transmission Solenoid Assembly harness connector and the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1763-GOVERNOR PRESSURE SENSOR VOLTS TOO HI — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the sensor ground circuit between the Transmission Solenoid Assembly harness connector and the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off. **Note: The Transmission Solenoid Assembly harness connector must be connected before proceeding.** Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the governor pressure sensor signal circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the voltage above 1.0 volt? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	Start the engine. **CAUTION: Set the parking brake.** Place the gear selector in Neutral. With the DRBIII®, read the governor pressure voltage. Measure the voltage of the governor pressure sensor signal circuit by back probing at the PCM. Compare the voltmeter reading of the governor pressure sensor signal circuit to the DRBIII® Governor Pressure Sensor voltage. Does the DRBIII® Gov Press Sensor voltage match the governor pressure sensor voltage on the voltmete Yes → Go To 14 No → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
14	If there are no possible causes remaining, view repair. Repair Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1763-GOVERNOR PRESSURE SENSOR VOLTS TOO HI — Continued

TEST	ACTION	APPLICABILITY
15	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1764-GOVERNOR PRESSURE SENSOR VOLTS TOO LOW

When Monitored and Set Condition:

P1764-GOVERNOR PRESSURE SENSOR VOLTS TOO LOW

When Monitored: Continuously with the key on and the engine running.

Set Condition: This code will set if the voltage from the Governor Pressure Sensor is below .10 volt for 8.5 seconds.

POSSIBLE CAUSES
OTHER TRANSMISSION DTC'S PRESENT
PARK NEUTRAL DTC PRESENT
INTERMITTENT PROBLEM
TRANSMISSION FLUID LEVEL AND CONDITION
5 VOLT SUPPLY CIRCUIT OPEN
GOV PRESS SENSOR SIGNAL CKT SHORT TO GND
GOV PRESS SENSOR SIGNAL CKT SHORT TO SENSOR GND
5 VOLT SUPPLY CIRCUIT OPEN INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO GND INSIDE TRANS
GOV PRESS SENSOR SIGNAL CKT SHORT TO SENSOR GND INSIDE TRANS
GOVERNOR PRESSURE SENSOR (LOW)
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. Is the Good Trip Counter for P-1764 displayed and equal to 0? Yes → Go To 2 No → Go To 13	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition on. With the DRBIII®, read DTCs. Are any other transmission DTCs present? Yes → Repair all other transmission DTCs before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1764-GOVERNOR PRESSURE SENSOR VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition on. With the DRBIII®, read DTCs. Is the Park/Neutral DTC present? Yes → Repair the Park/Neutral DTC before proceeding. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 4	without 5-SPD AUTOMATIC 5-45RFE TRANS
4	Start the engine. Allow the transmission to reach normal operating temperature. Check the fluid level and condition. Is the fluid level correct and the fluid condition OK? Yes → Go To 5 No → Repair the transmission fluid level and condition as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the 5 volt supply circuit between the Transmission Solenoid Assembly harness connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the 5 volt supply circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the governor pressure sensor signal circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 7	without 5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Disconnect the PCM C1 and C2 harness connectors. **Check connectors - Clean/repair as necessary** Measure the resistance of the governor pressure sensor signal circuit to the sensor ground circuit in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the governor pressure sensor signal circuit for a short to the sensor ground circuit. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 8	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1764-GOVERNOR PRESSURE SENSOR VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Transmission Solenoid Assembly harness connector. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance of the 5 volt supply circuit between the Governor Pressure/Transmission Temperature Sensor harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance between ground and the governor pressure sensor signal circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 10	without 5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off. Remove the transmission oil pan. Disconnect the Governor Pressure/Transmission Temperature Sensor harness connector. Measure the resistance between the governor pressure sensor signal circuit and sensor ground circuit in the Governor Pressure/Transmission Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Solenoid Assembly in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Go To 11	without 5-SPD AUTOMATIC 5-45RFE TRANS
11	Start the engine. Place the gear selector in Neutral. With the DRBIII®, read the Governor Pressure Sensor voltage. Measure the voltage of the governor pressure sensor signal circuit by back probing at the PCM. Compare the voltmeter reading of the governor pressure sensor signal circuit to the DRBIII® Governor Pressure Sensor voltage. Does the DRBIII® Gov Press Sensor voltage match the Gov Press Sensor voltage on the voltmeter? Yes → Go To 12 No → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1764-GOVERNOR PRESSURE SENSOR VOLTS TOO LOW — Continued

TEST	ACTION	APPLICABILITY
12	If there are no possible causes remaining, view repair. Repair Replace the Governor Pressure/Transmission Temperature Sensor in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
13	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1765-TRANS 12 VOLT SUPPLY RELAY CTRL CIRCUIT

When Monitored and Set Condition:

P1765-TRANS 12 VOLT SUPPLY RELAY CTRL CIRCUIT

When Monitored: Continuously with the key on.

Set Condition: This code will set if the voltage detected on the Transmission Relay Control circuit at the PCM is different than the expected voltage for 3 seconds.

POSSIBLE CAUSES
TRANSMISSION CONTROL RELAY
INTERMITTENT TRANS 12 VOLT SUPPLY RELAY
GENERATOR SOURCE CIRCUIT OPEN
GENERATOR SOURCE CIRCUIT SHORTED TO GROUND
TRANSMISSION RELAY CONTROL CIRCUIT OPEN
TRANSMISSION RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM - TRANS RELAY

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB III®, read the PCM DTCs. Is the Good Trip Counter for P-1765 displayed and equal to 0? Yes → Go To 2 No → Go To 9	without 5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition on. With the DRBIII®, actuate the Transmission Control Relay. Is the Transmission Control Relay clicking? Yes → Go To 9 No → Go To 3	without 5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition off. Remove the Transmission Control Relay from the PDC. **Check connectors - Clean/repair as necessary.** Install a substitute relay in place of the Transmission Control Relay. Turn the ignition on. With the DRBIII®, erase trouble codes. Start the engine. With the DRBIII®, read PCM DTCs. Does the DRBIII® display the P1765 DTC? Yes → Go To 4 No → Replace the Transmission Control Relay. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1765-TRANS 12 VOLT SUPPLY RELAY CTRL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the Transmission Control Relay from the PDC. **Check connectors - Clean/repair as necessary.** Turn the ignition on. Using a 12-volt test light connected to ground, check the Generator Source circuit in the Transmission Control Relay connector. Does the test light illuminate brightly? Yes → Go To 5 No → Repair the generator source circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off. Remove the Transmission Control Relay from the PDC. Disconnect the PCM harness connectors. **Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Generator Source circuit in the Transmission Control Relay connector. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the generator source circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off. Remove the Transmission Control Relay from the PDC. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance of the Transmission Control Relay Control circuit between the Transmission Control Relay connector and the PCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the transmission control relay control circuit for an open. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off. Remove the Transmission Control Relay from the PDC. Disconnect the PCM C2 harness connector. **Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Transmission Control Relay Control circuit in the Transmission Control Relay connector. Is the resistance above 100 kohms? Yes → Go To 8 No → Repair the transmission control relay control circuit for a short to ground. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform TRANSMISSION VERIFICATION TEST VER - 1.	without 5-SPD AUTOMATIC 5-45RFE TRANS

P1765-TRANS 12 VOLT SUPPLY RELAY CTRL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
9	At this time, the conditions required to set the DTC are not present. **Note: Use the Freeze Frame Data to help duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform TRANSMISSION VERIFICATION TEST VER - 1. No → Test Complete.	without 5-SPD AUTOMATIC 5-45RFE TRANS

Symptom List:

ANTENNA FAILURE
COP FAILURE
EEPROM FAILURE
INTERNAL FAULT
RAM FAILURE
SERIAL LINK INTERNAL FAULT
STACK OVERFLOW FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ANTENNA FAILURE.

When Monitored and Set Condition:

ANTENNA FAILURE

When Monitored: Every 250 milliseconds with the ignition on.

Set Condition: The SKIM's microcontroller determines that an antenna circuit fault has occurred for 2.0 consecutive seconds.

COP FAILURE

When Monitored: With the ignition on.

Set Condition: The COP timer is not reset by the micro controller every 65.5 milliseconds.

EEPROM FAILURE

When Monitored: With the ignition on.

Set Condition: When the value written to EEPROM memory does not equal the value read back after the write operation.

INTERNAL FAULT

When Monitored: With the ignition on.

Set Condition: The SKIM has detected a fault during an internal self test.

RAM FAILURE

When Monitored: With the ignition on.

Set Condition: The RAM fails a test that checks the RAM's ability to retain memory.

SERIAL LINK INTERNAL FAULT

When Monitored: With the ignition on.

Set Condition: The SKIM fails an internal J1850 communication self test.

STACK OVERFLOW FAILURE

When Monitored: With the ignition on.

Set Condition: The micro controller has exceeded its stack space limit.

ANTENNA FAILURE — Continued

POSSIBLE CAUSES
SKIM INTERNAL DTC FAILURE

TEST	ACTION	APPLICABILITY
1	**Note: This trouble code indicates an internal SKIM fault.** With the DRBIII®, read and record the SKIM DTCs and then erase the SKIM DTCs Perform 10 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle. With the DRBIII® , read the SKIM DTCs. Did the same SKIM DTC return? Yes → Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom List:
PCM STATUS FAILURE
SERIAL LINK EXTERNAL FAULT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be PCM STATUS FAILURE.

When Monitored and Set Condition:

PCM STATUS FAILURE

When Monitored: With the ignition on.

Set Condition: This DTC exists when a PCM STATUS message was not received from the PCM for at least 20.0 consecutive seconds.

SERIAL LINK EXTERNAL FAULT

When Monitored: At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM reset, or during SECRET KEY transfers to the PCM.

Set Condition: When the SKIM does not receive an expected PCI BUS message transmission acknowledgement from the PCM after 3 transmit attempts.

POSSIBLE CAUSES
INTERMITTENT WIRING HARNESS PROBLEM
WIRING HARNESS INSPECTION
SKIM/PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure the PCM has proper power and ground connections before continuing.** With the DRBIII®, read and record the SKIM DTC's then erase the SKIM DTC's. Turn the ignition off. Wait 2 minutes. Turn the ignition on. With the DRBIII®, read the SKIM DTC's. Does the DRBIII® display the DTC that was previously erased? Yes → Go To 2 No → Go To 4	All

PCM STATUS FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. **NOTE: Visually inspect the related wiring harness and CCD/PCI Bus (whichever applicable) circuits. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair as necessary. Perform SKIS VERIFICATION. No → Go To 3	All
3	**NOTE: Before proceeding it will be necessary to obtain the SKIM PIN number.** Turn the ignition on. With the DRBIII®, display and erase all PCM and SKIM DTC's. Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle. With the DRBIII®, read the SKIM DTC's. Does the code appear? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All
4	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom List:

ROLLING CODE FAILURE
VIN MISMATCH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ROLLING CODE FAILURE.

When Monitored and Set Condition:

ROLLING CODE FAILURE

When Monitored: At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM or PCM reset.

Set Condition: When a PCM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM.

VIN MISMATCH

When Monitored: With the ignition on.

Set Condition: When the VIN received from the PCM does not match the VIN stored in the SKIM's EEPROM.

POSSIBLE CAUSES
VERIFYING PCM VIN
INTERMITTENT WIRING HARNESS PROBLEM
PCM

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the SKIM DTC's. Turn the ignition off. Wait 10 seconds. Turn the ignition on and wait 2 minutes. With the DRBIII®, read the SKIM DTC's. Does the DRBIII® display the DTC that was previously erased? Yes → Go To 2 No → Go To 4	All

ROLLING CODE FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Ensure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct vehicle VIN before continuing.** Turn the ignition on. With the DRBIII®, select Engine system from the main menu. Display and record the Vehicle Identification Number. Does the VIN recorded from the PCM match the VIN of the vehicle? Yes → Go To 3 No → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Turn the ignition on. With the DRBIII®, display and clear all PCM and SKIM DTC's. Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle. With the DRBIII®, check for SKIM DTC's. Does the DRBIII® display the same DTC? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All
4	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom List:

TRANSPONDER COMMUNICATION FAILURE
TRANSPONDER CYCLIC REDUNDANCY CHECK (CRC) FAILURE
TRANSPONDER ID MISMATCH
TRANSPONDER RESPONSE MISMATCH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be TRANSPONDER COMMUNICATION FAILURE.

When Monitored and Set Condition:

TRANSPONDER COMMUNICATION FAILURE

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When the SKIM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

TRANSPONDER CYCLIC REDUNDANCY CHECK (CRC) FAILURE

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When 5 consecutive transponder signal transmissions are sent to the SKIM with the correct message format but with invalid data.

TRANSPONDER ID MISMATCH

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When the transponder ID read by the SKIM does not match any of the transponder ID's stored in the SKIM's memory.

TRANSPONDER RESPONSE MISMATCH

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When the transponder's crypto algorithm result fails to match the SKIM's result.

POSSIBLE CAUSES
CHECKING MULTIPLE KEY OPERATION
SKIM
INTERMITTENT WIRING HARNESS PROBLEM
REPLACE IGNITION KEY

TRANSPONDER COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read and record the SKIM DTCs. With the DRBIII®, erase the SKIM DTCs. **NOTE: Perform the following test several times to ensure the DTC is current.** Turn the ignition off. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Does the DRBIII® display the DTC that was previously erased? Yes → Go To 2 No → Go To 7	All
2	Are there multiple vehicle ignition keys available? Yes → Go To 3 No → Go To 4	All
3	**NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys one at a time.** With the DRBIII®, erase the SKIM DTC's. Turn the ignition off. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTC's. Is the DTC present for all ignition keys? Yes → Replace the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All
4	With the DRBIII®, attempt to reprogram the ignition keys to the SKIM. With the DRBIII®, erase the SKIM DTC's. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTC's. Does the DTC reset? Yes → Go To 5 No → Test Complete.	All
5	Replace the ignition key with a new key. With the DRBIII®, program the new ignition key to the SKIM. With the DRBIII®, erase the SKIM DTC's Turn the ignition off. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTC's. Does the DTC reset? Yes → Go To 6 No → Test Complete.	All

TRANSPONDER COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All
7	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform SKIS VERIFICATION. No → Test Complete.	All

Verification Tests

BODY VERIFICATION TEST - VER 1	APPLICABILITY
1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors. 2. If the Sentry Key Immobilizer Module (SKIM) or the Powertrain Control Module (PCM) were replaced, proceed to number 7. If the SKIM or PCM were not replaced, continue to the next number. 3. If the Body Control Module was replaced, turn the ignition on for 15 seconds before attempting to start (to learn VIN) or engine may not start (if VTSS equipped). 4. If the vehicle is equipped with VTSS, use the DRBIII and enable VTSS. Program other options as necessary. 5. If the Passenger Door Module was replaced, use the DRBIII and program all RKE transmitters used with this vehicle. 6. If any repairs were made to the HVAC System, disconnect the battery for 30 seconds and then reconnect or using the DRBIII, recalibrate the HVAC doors. Proceed to number 14. 7. Obtain the Vehicle's unique PIN assigned to it's original SKIM from either the vehicle's invoice or from Chrysler's Customer Center (1-800-992-1997). 8. With the DRBIII, select THEFT ALARM, SKIM, MISCELLANEOUS and select SKIM REPLACED. Enter the 4 digit PIN to put SKIM in Secured Access Mode. 9. The DRBIII will prompt you through the following steps. (1) Program the country code into the SKIM's memory. (2) Program the vehicle's VIN into the SKIM's memory. (3) Transfer the vehicle's Secret Key data from the PCM. 10. Once secured access mode is active, the SKIM will remain in that mode for 60 seconds. 11. Using the DRBIII, program all customer keys into the SKIM's memory. This requires that the SKIM be in secured access mode, using the 4 digit code. 12. Note: If the PCM is replaced, the VIN and the unique Secret Key data must be transfered from the SKIM to the PCM. This procedure requires the SKIM to be placed in secured access mode using the 4-digit code. 13. Note: If 3 attempts are made to enter secured access mode using an incorrect PIN, secured access mode will be locked out for 1 hour which causes the DRBIII to display BUS +\- SIGNALS OPEN. To exit this mode, turn ignition to the RUN position for 1 hour. 14. Ensure all accessories are turned off and the battery is fully charged. 15. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 16. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. Are any DTC's present or is the original complaint still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

FUEL SYSTEM/MISFIRE MONITOR VERIFICATION TEST	APPLICABILITY
1. If any existing DTCs have not been repaired, go to the appropriate Symptom List and follow the path specified. 2. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 3. Connect the DRBIII® to the data link connector. 4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories. 5. If the PCM was not replaced skip steps 6 and 7 and continue the verification. 6. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 7. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM. **8. Note: Make sure that Misfire detection is enabled if you repaired a Misfire DTC. Low fuel level or an un-learned Adaptive Numerator can disable the Misfire monitor.** **9. Note: If the PCM has been replaced or disconnected during testing, the Adaptive Numerator must be re-learned in order for the Misfire Monitor to run.** 10. With the DRB III®, monitor the Similar Conditions to attempt to duplicate the conditions that the vehicle was operating at when the DTC was set. 11. If the conditions cannot be duplicated, with the DRBIII®, erase DTCs. Did the OBD II monitor fail or have any DTCs or symptoms set during the above test? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptoms list (Diagnostic Procedure). No → Repair is not complete, refer to appropriate symptom.	All

POWERTRAIN VERIFICATION TEST VER - 1	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. Inspect the engine oil for contamination. If oil contamination is suspected, change the oil and filter. 3. If the PCM was not replaced skip steps 4 through 6 and continue the verification. 4. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Attempt to start the engine. Is the vehicle still unable to start or are there any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptoms list (Diagnostic Procedure). No → Repair is complete.	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a NO TROUBLE CODE repair, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes or the symptom no longer exists, the repair was successful and testing is complete. 4. If the initial or another symptom exists, the repair is not complete. Check all technical service bulletins or flash updates and return to Symptoms if necessary. 5. If this verification procedure is being performed after a DTC repair, perform steps 6 through 13. 6. Connect the DRBIII® to the data link connector. Using the DRBIII® erase any diagnostic trouble codes and reset all values. 7. If the PCM was not replaced, skip steps 8 through 10 and continue with the verification. 8. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer System (SKIS), Secret Key data must be updated to enable start. 9. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 10. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 11. Road test the vehicle. If the test is for an A/C DTC, ensure it is operating during the following test. 12. Drive the vehicle for at least 5 minutes at or around 64 Kmh (40 mph). Ensure the transmission shifts through all gears. At some point stop the vehicle and turn off the engine for at least 10 seconds. 13. With the DRBIII®, read DTCs. Are there any DTC(s) present? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

POWERTRAIN VERIFICATION TEST VER - 3	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. Connect the DRBIII® to the Data Link Connector and erase the DTCs. 3. If the PCM was not replaced, skip steps 4 through 6 then continue the verification. 4. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Perform the generator output test per service manual information. 8. Raise the engine speed to 2000 rpm for at least 30 seconds. 9. Allow the engine to idle. 10. Cycle the ignition key off then on. 11. With the DRBIII®, read DTCs. Are any DTC(s) or symptoms present? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 4	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. With the DRBIII®, erase DTCs. 3. If the PCM was not replaced, skip steps 4 through 6, then continue with the verification. 4. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Turn the speed control ON (if equipped, cruise light will be on). 8. Depress and release the SET Switch when the vehicle speed is greater than 35MPH. The speed control should engage and hold the selected speed. 9. Depress and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 2 mph. 10. Press and hold the COAST switch. The vehicle speed should decrease. 11. Using caution, depress and release the brake pedal. The speed control should disengage. 12. Bring the vehicle speed back up to 35 MPH. 13. Depress the RESUME/ACCEL switch. The speed control should resume the previously set speed. 14. Hold down the SET switch. The vehicle should decelerate. 15. Ensure vehicle speed is greater than 35 mph and release the SET Switch. The vehicle should adjust and set a new vehicle speed. 16. Depress and release the CANCEL switch. The speed control should disengage. 17. Bring the vehicle speed back up above 35 mph and engage speed control. 18. Depress the OFF switch to turn OFF, (Cruise light will be off). The speed control should disengage. 19. NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET. 20. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h). 21. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed. 22. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. 23. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly. 24. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop. 25. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating). 26. Then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. 27. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition. Did the Speed Control pass the above test? Yes → Repair is complete. No → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure).	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 5	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If any existing diagnostic trouble codes have not been repaired, go to the appropriate Symptom List and follow path specified. 3. Connect the DRBIII® to the data link connector. 4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories. 5. If the PCM was not replaced skip steps 6 through 8 and continue the verification. 6. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 7. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 8. For SKIM theft alarm: Connect DRBIII® to data link connectorto Theft Alarm, SKIM, Misc. and place SKIM in secured access mode by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM. 9. If the Catalyst was replaced, with the DRBIII® go to the miscellaneous Menu Option ″Catalyst Replaced″ and press enter. 10. If a Comprehensive Component DTC was repaired, perform steps 11 and 13. If a Major OBDII Monitor DTC was repaired skip step 11 and continue the verification. 11. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes. 12. With the DRBIII®, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running). 13. If the conditions cannot be duplicated, erase all DTCs with the DRBIII®. Did the OBD II monitor run successfully and has the Good Trip Counter changed to one or more? Yes → Repair is complete. No → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptoms list (Diagnostic Procedure).	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 6	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If any existing diagnostic trouble codes are not repaired, go to symptom list and follow path specified. After all diagnostic trouble codes have been repaired, return to TEST VER-6A and run LDP Dealer Test Mode under Systems Test in DRBIII. 3. If the PCM was not replaced, skip steps 4 through 6 then continue with the verification. 4. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Airbag Systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Airbag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. The LDP Monitor Test Mode has been added to the DRBIII® to verify repairs to the LDP System. A DRBIII® software program was written which causes the PCM to run the LDP Monitor as part of this test. Test failures will be indicated through a stored DTC. 8. LDP Monitor Test Mode is a useful way to run a total system performance test. Use this test to verify any type of LDP system repair. 9. Software program makes temporary changes to operating mode of PCM. For this reason, it is critical that test not be interrupted. PCM's left in this mode as result of interrupted test will illuminate the MIL for 8-10 mi of driving with no DTC's stored. 10. Erasing DTCs will not change this condition. 11. If a vehicle is found to be stuck in the mode described above, the LDP Dealer Test should be re-run in its entirety so that the software program in the DRBIII® can restore the PCM operating mode. 12. Note similarity to LDP Monitor screen found under OBDII Monitors. Failure modes are fewer in this System Test than OBDII LDP Monitor. System Test only stores Small Leak DTC to indicate problem with system. No other type of failure mode indication given. 13. System Test failure may have been, for example, due to a large leak, but the PCM will set the Small Leak DTC to indicate failures that occurred as part of the system test. 14. Connect the DRBIII® to the data link connector. Engine running, turn off all accessories. 15. Note: While test is being performed, PCM must see RPM, minimum MAP, No Vehicle speed and minimum Throttle Position sensor (At idle, in park.) With DRBIII® in System Tests, perform the LDP Monitor Test and follow the instructions on the screen. Are any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the apopropriate Symptom list (Diagnostic Procedure) No → Repair is complete.	All

Verification Tests — Continued

ROAD TEST VERIFICATION - VER-2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a non-DTC test, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes and the symptom no longer exists, the repair was successful and testing is now complete. 4. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins (TSBs) and return to the Symptom List if necessary. 5. For previously read DTCs that have not been dealt with, return to the Symptom List and follow the diagnostic path for that DTC; otherwise, continue. 6. If the Engine Control Module (ECM) or Powertrain Control Module (PCM) has not been changed, perform steps 7 and 8, otherwise, continue with step 9. 7. With the DRB, erase all diagnostic trouble codes (DTCs), then disconnect the DRB. 8. Turn the ignition off for at least 10 seconds. 9. If equipped with a Transfer Case Position Switch, perform step 10, otherwise, continue with step 11. 10. With the ignition switch on, place the Transfer Case Shift Lever in each gear position, stopping for 15 seconds in each position. 11. Ensure no DTCs remain by performing steps 12 through 15. 12. Road test the vehicle. For some of the road test, go at least 64 km/h (40 MPH). If this test is for an A/C Relay Control Circuit, drive the vehicle for at least 5 minutes with the A/C on. 13. At some point, stop the vehicle and turn the engine off for at least 10 seconds, then restart the engine and continue. 14. Upon completion of the road test, turn the engine off and check for DTCs with the DRB. 15. If the repaired DTC has reset, the repair is not complete. Check for any pertinent Technical Service Bulletins (TSBs) and return to the Symptom List. If there are no DTCs, the repair was successful and is now complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

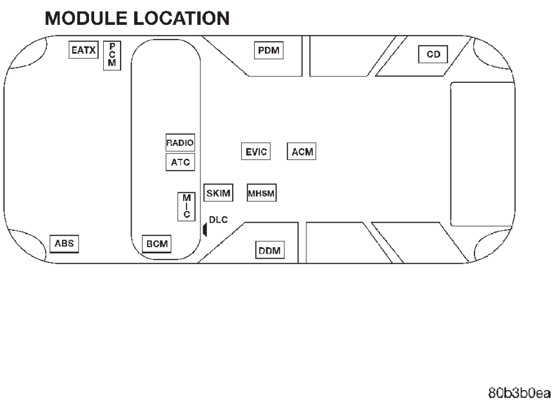
SKIS VERIFICATION	APPLICABILITY
1. Reconnect all previously disconnected components and connectors. 2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKIM. This number can be obtained from the vehicle's invoice or Chrysler's Customer Center (1-800-992-1997). **3. NOTE: When entering the PIN, care should be taken because the SKIM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PINs are entered, the SKIM will Lock Out the DRB III for 1 hour.** 4. To exit Lock Out mode, the ignition key must remain in the Run position continually for 1 hour. Turn off all accessories and connect a battery charger if necessary. 5. With the DRBIII®, select Theft Alarm, SKIM and Miscellaneous. Then, select the desired procedure and follow the steps that will be displayed. 6. If the SKIM has been replaced, ensure all of the vehicle ignition keys are programmed to the new SKIM. **7. NOTE: Prior to returning vehicle to the customer, perform a module scan to be sure that all DTCs are erased. Erase any DTCs that are found.** 8. With the DRBIII®, erase all DTCs. Perform 5 ignition key cycles leaving the key on for at least 90 seconds per cycle. 9. With the DRBIII®, read the SKIM DTCs. Are there any SKIM DTCs? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

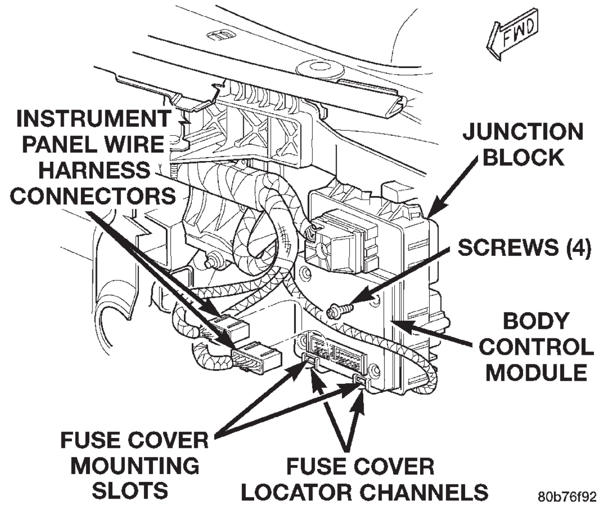
Verification Tests — Continued

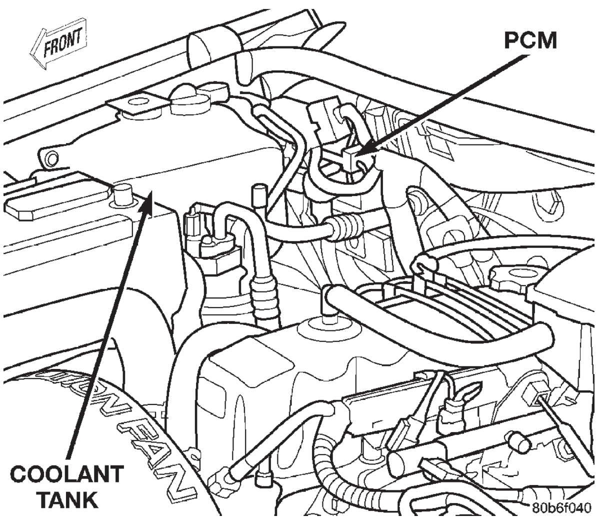
TRANSMISSION VERIFICATION TEST VER - 1	APPLICABILITY
1. Inspect the vehicle to ensure that all engine and transmission components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If any existing diagnostic trouble codes have not been repaired, go to Symptom List and follow path specified. 3. Connect a DRBIII® to the data link connector. 4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories. 5. Start and run the engine until the transmission temperature is above 43°C (110°F). 6. Check the transmission fluid level per the Service Information. Adjust if necessary. 7. Road test the vehicle. Make 15 to 20 1-2, 2-3 and 3-4 up shifts. Perform these shifts from a standing start to 72 km/h (45 MPH) with a constant throttle opening of 20-25%. 8. Below 40 km/h (25 MPH), make 5 to 8 wide open throttle kick downs to 1st gear. Allow at least 5 seconds each in 2nd and 3rd between each kick down. 9. For a specific DTC, drive the vehicle in accordance with the Symptom's When Monitored and Set Conditions to verify the DTC repair. 10. If a DTC sets during the road test, return to the Symptom List and follow the path. If no DTC sets, the repair is complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

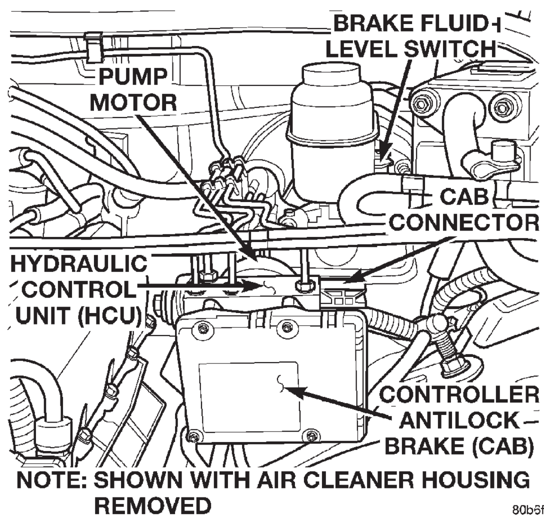
8.0 COMPONENT LOCATIONS

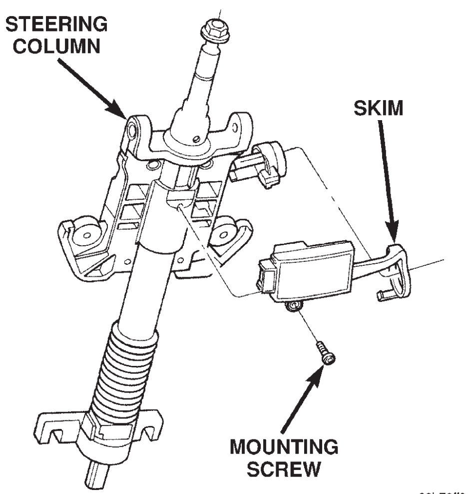
8.1 CONTROL MODULES AND PDC

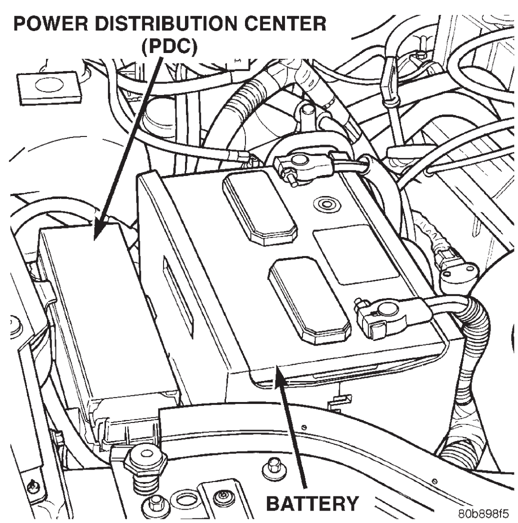




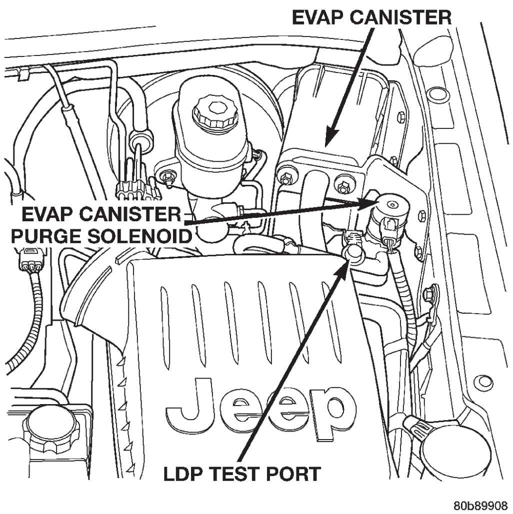








8.2 CONTROLS AND SOLENOIDS



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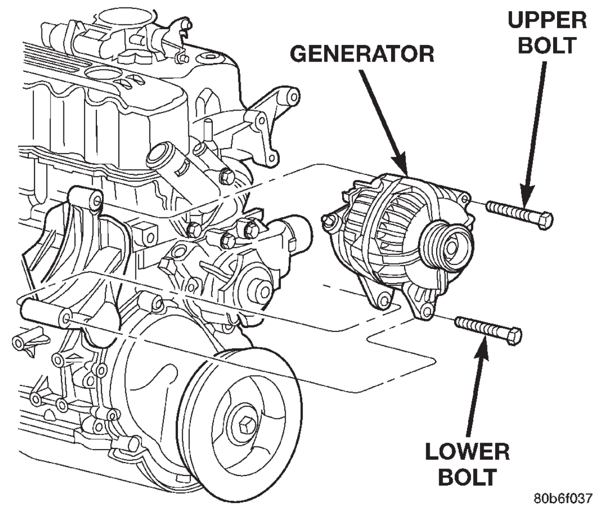

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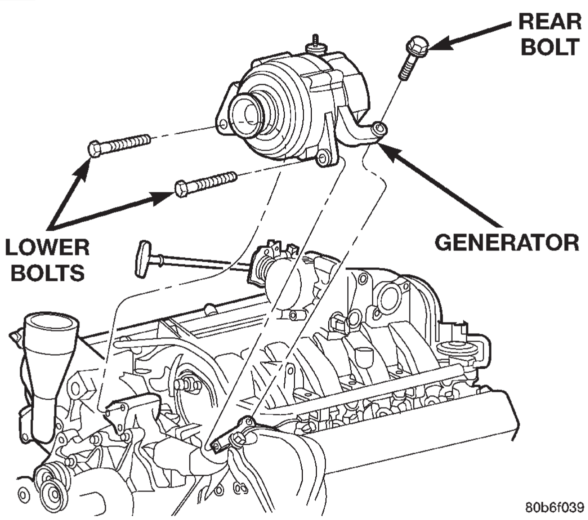

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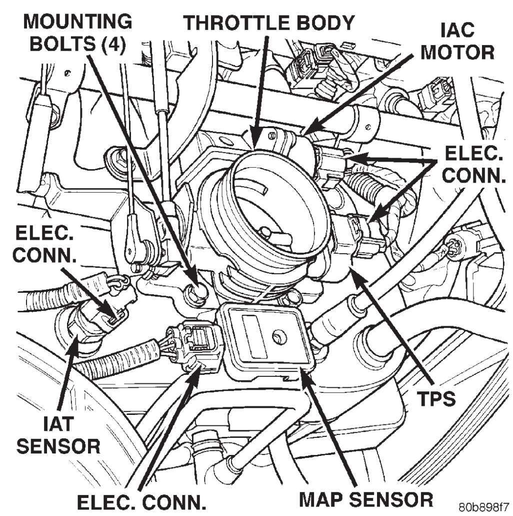

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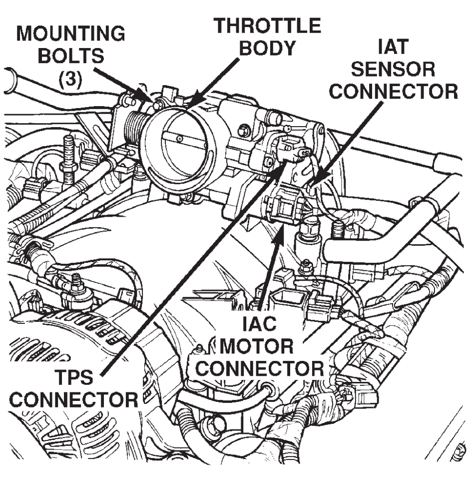

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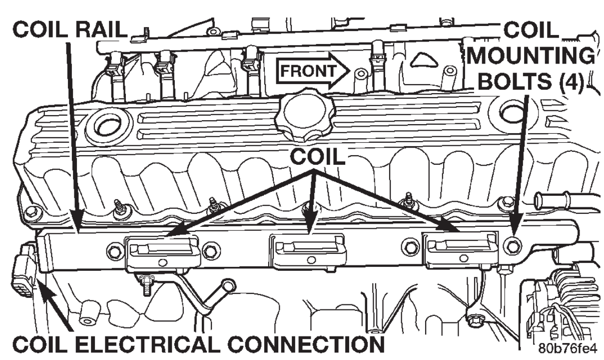

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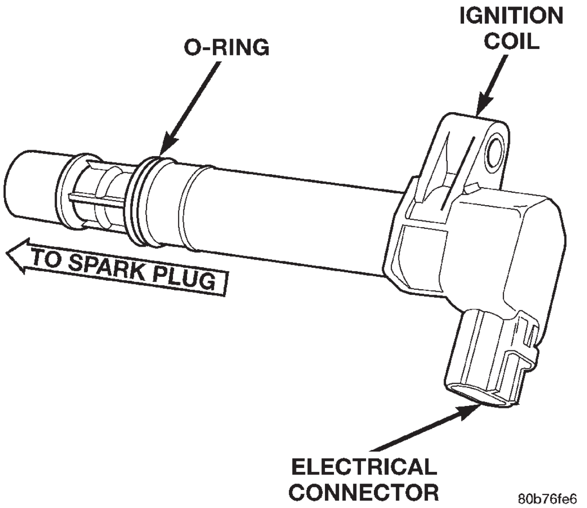
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TO SPARK PLUG
ELECTRICAL CONNECTOR
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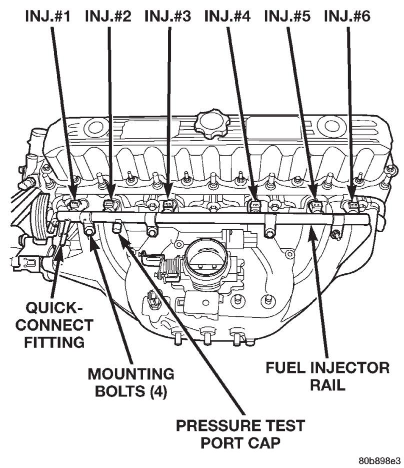
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INJ.#2
INJ.#3
INJ.#4
INJ.#5
INJ.#6
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FUEL INJECTOR RAIL
PRESSURE TEST PORT CAP
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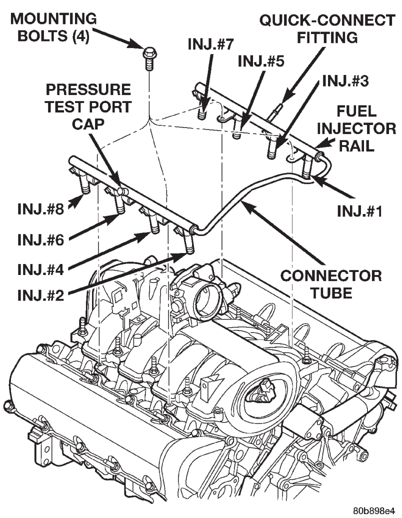
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QUICK-CONNECT FITTING
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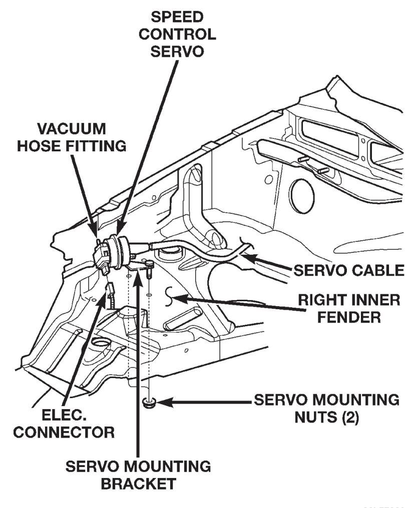
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VACUUM HOSE FITTING
SERVO CABLE
RIGHT INNER FENDER
SERVO MOUNTING NUTS (2)
ELEC. CONNECTOR
SERVO MOUNTING BRACKET
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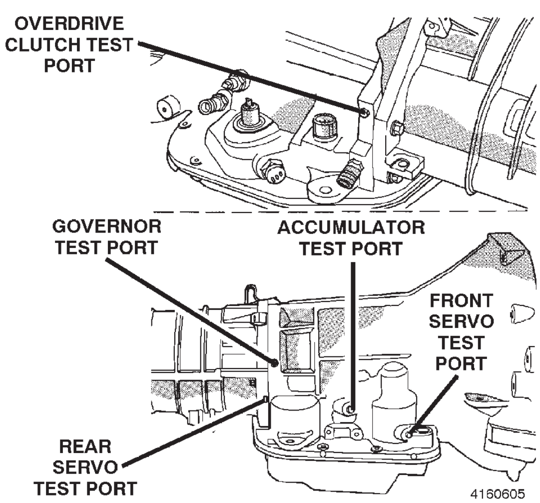
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GOVERNOR TEST PORT
ACCUMULATOR TEST PORT
FRONT SERVO TEST PORT
REAR SERVO TEST PORT
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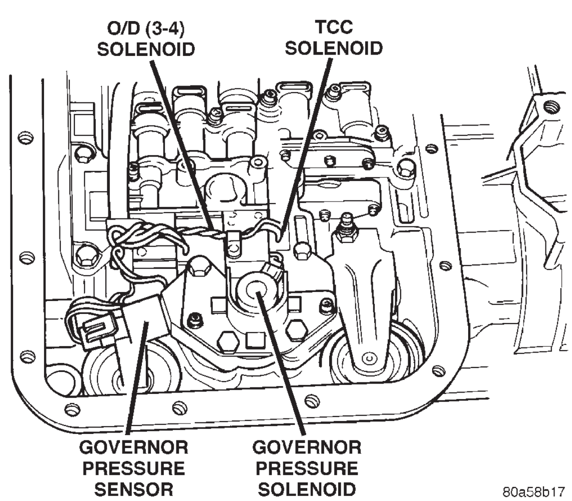
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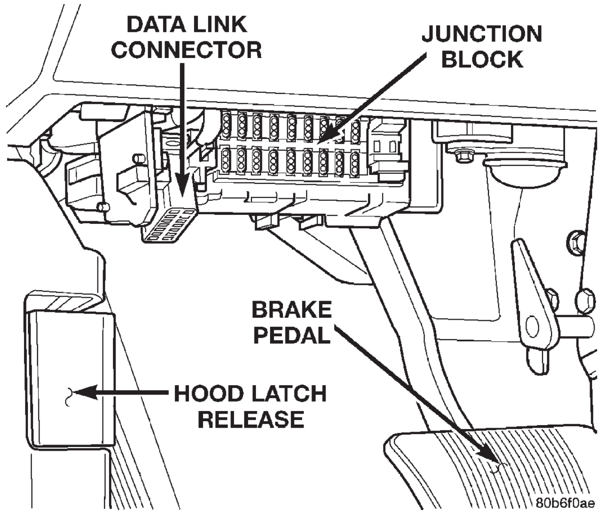

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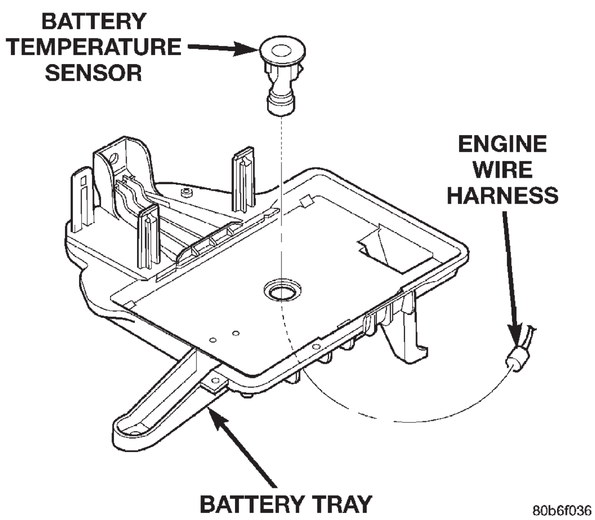

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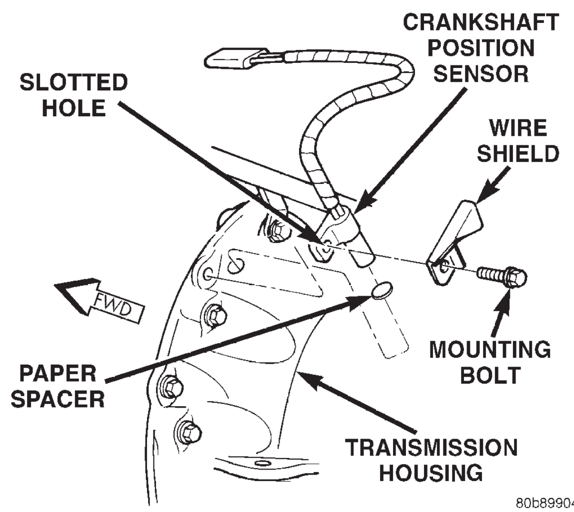

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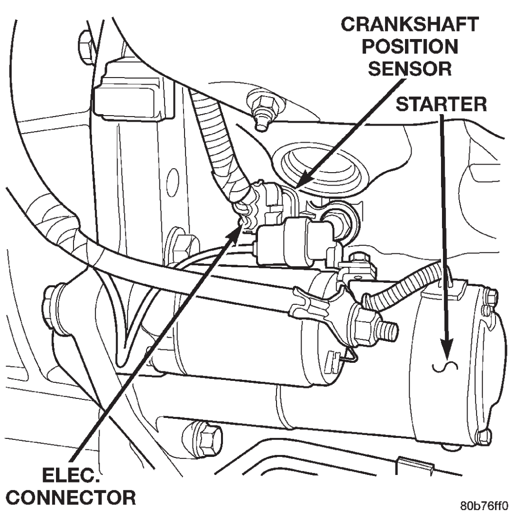

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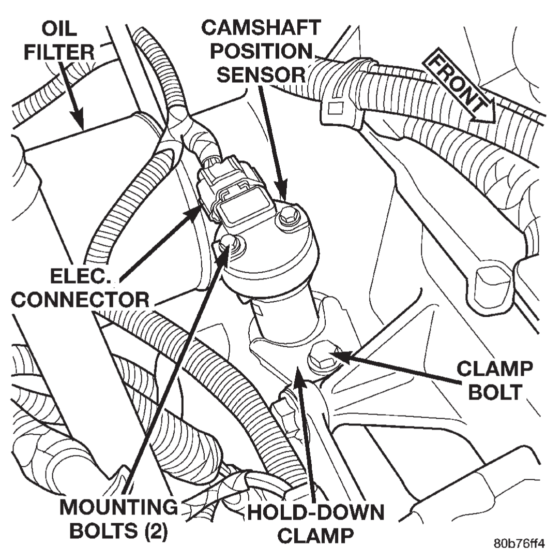

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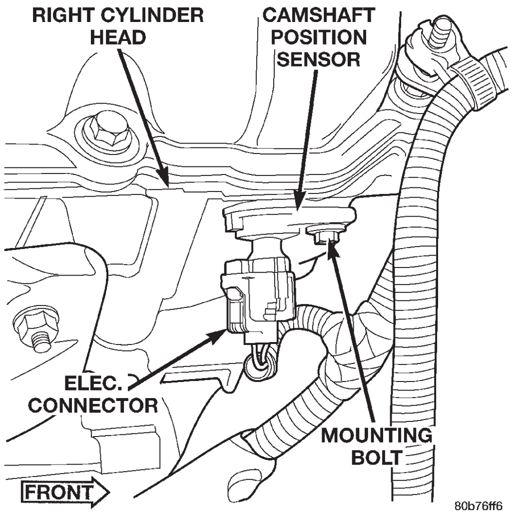

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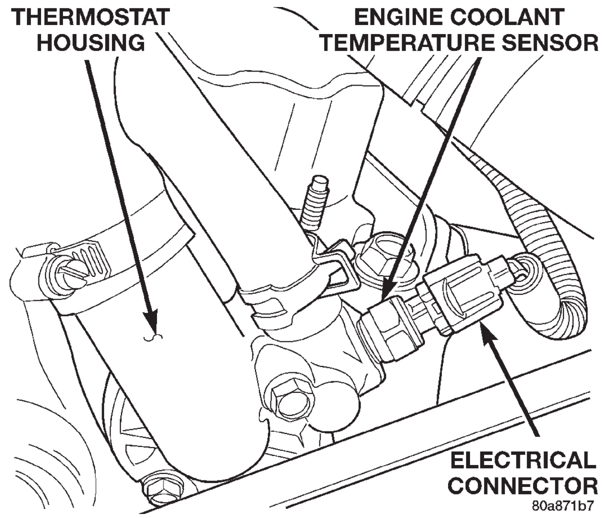

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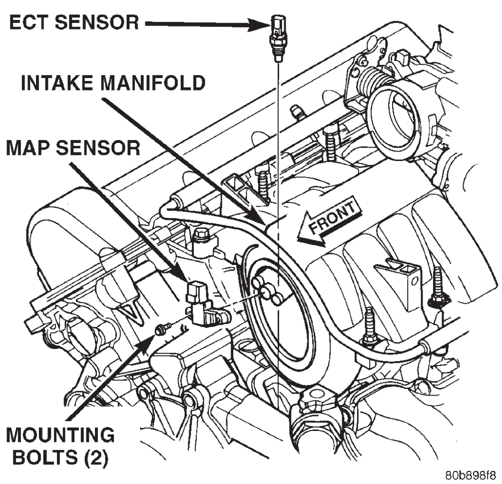
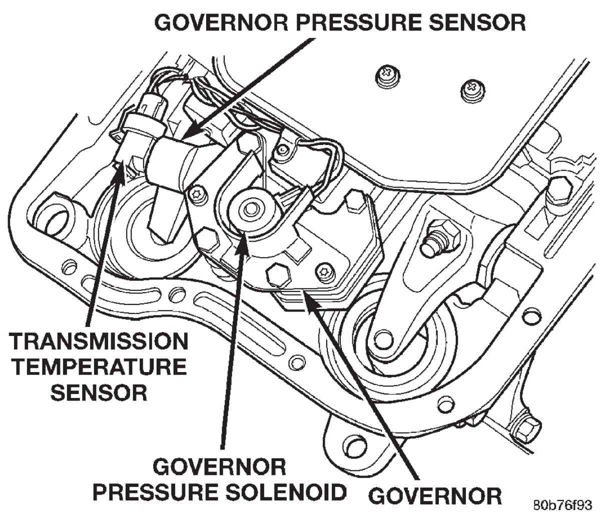
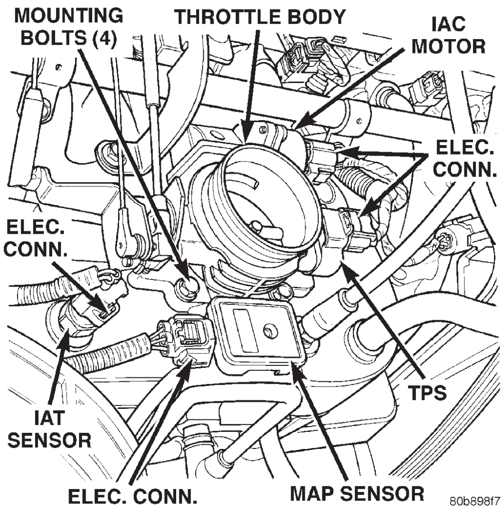
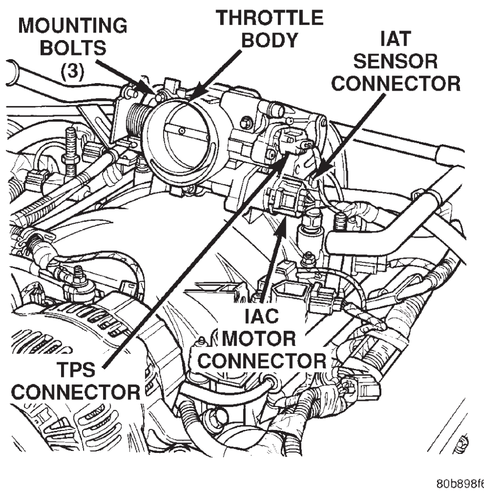




4.0L

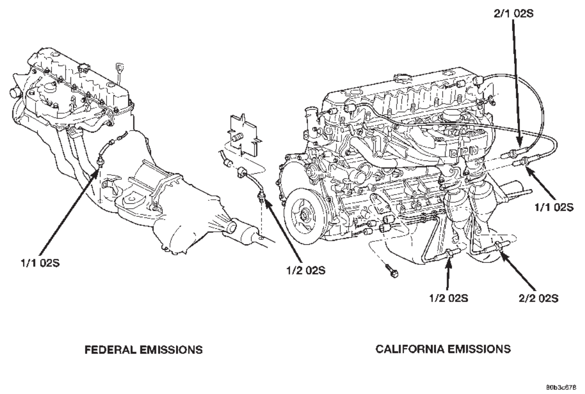


4.7L

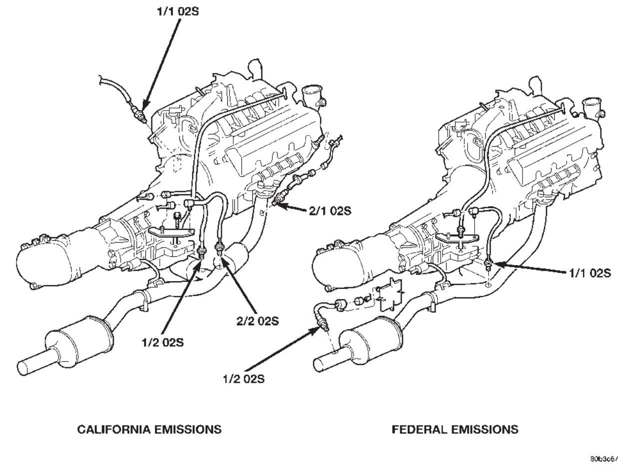


8.4 SENSORS (Continued)

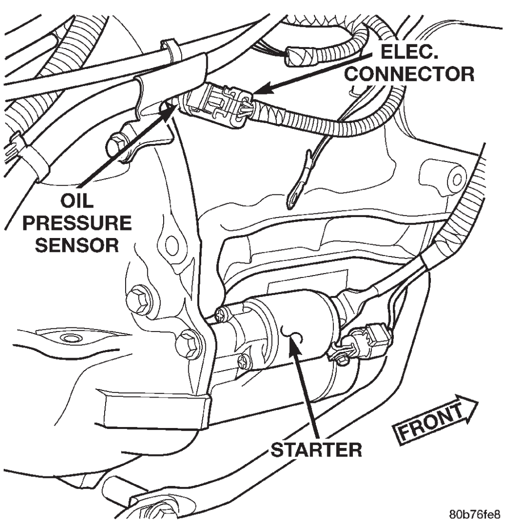
4.0L



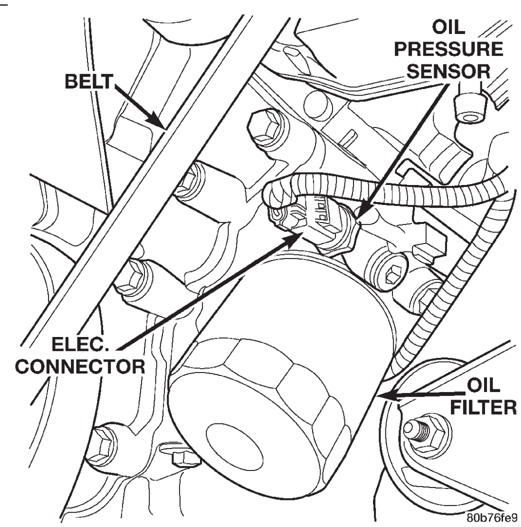
4.7L

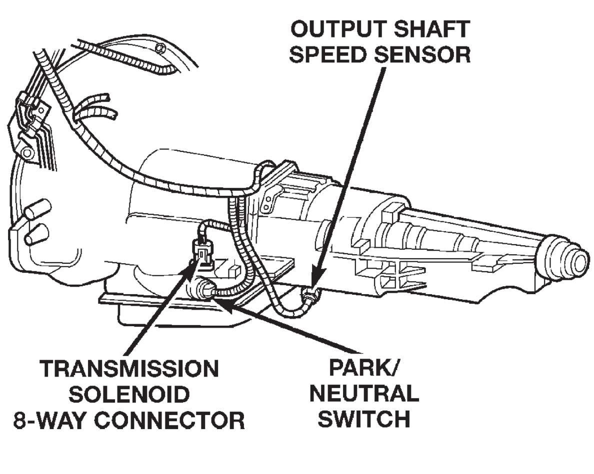


4.0L

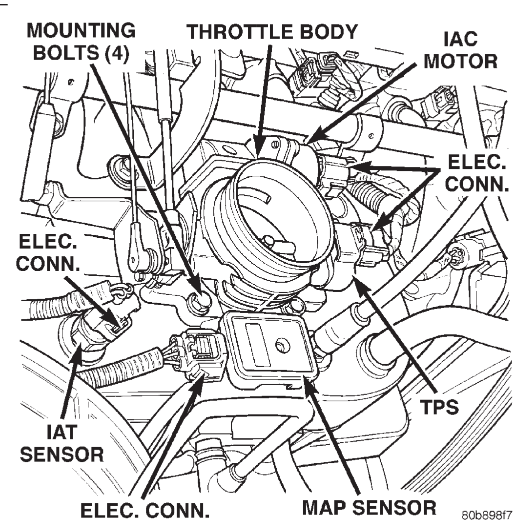


4.7L

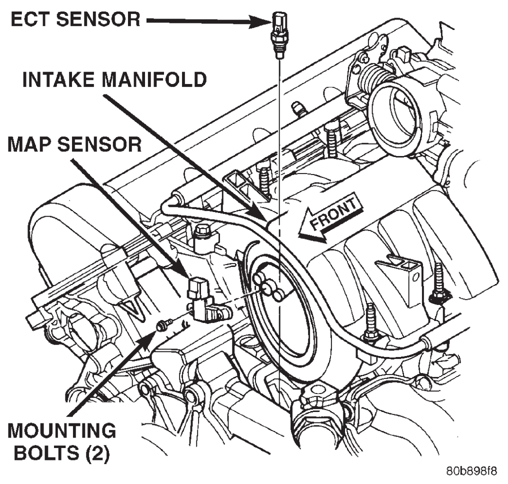




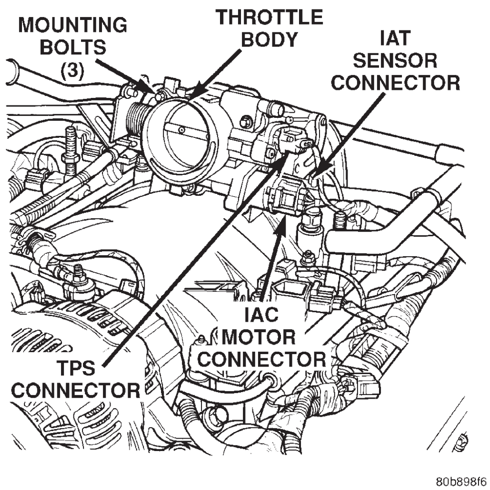
4.0L

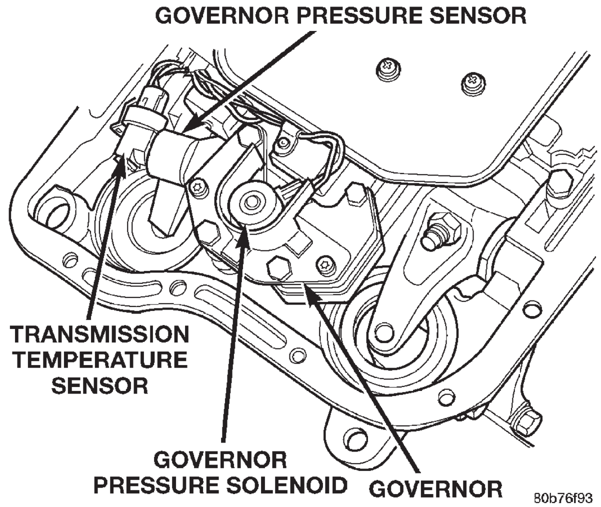


4.7L

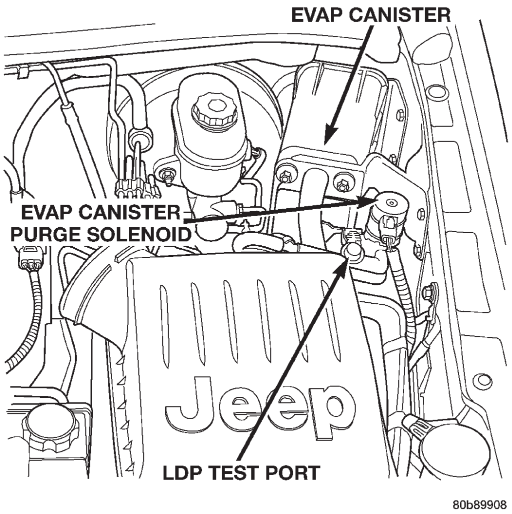


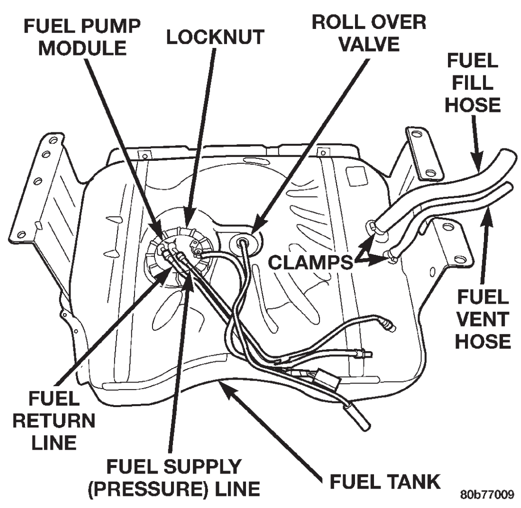
4.7L



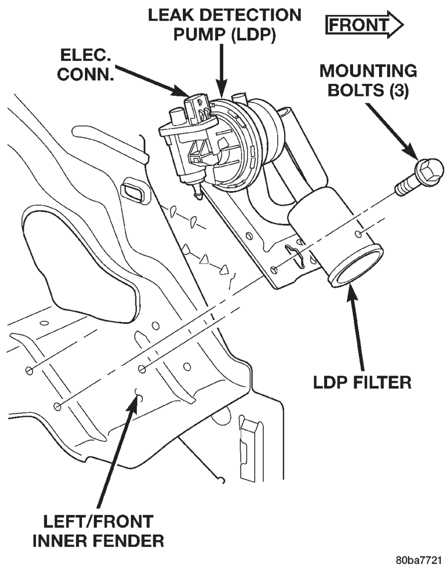


8.5 FUEL SYSTEM

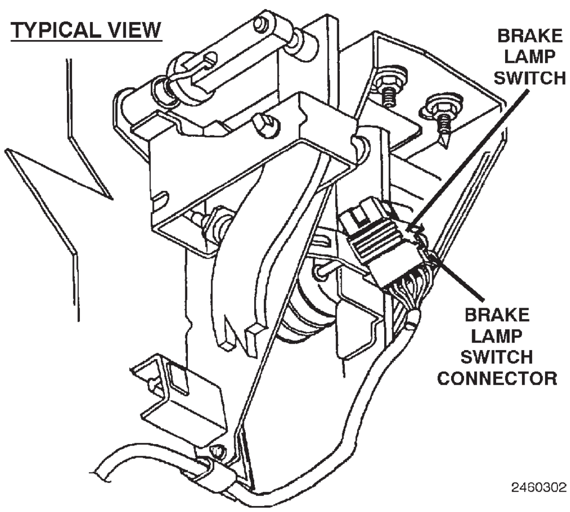


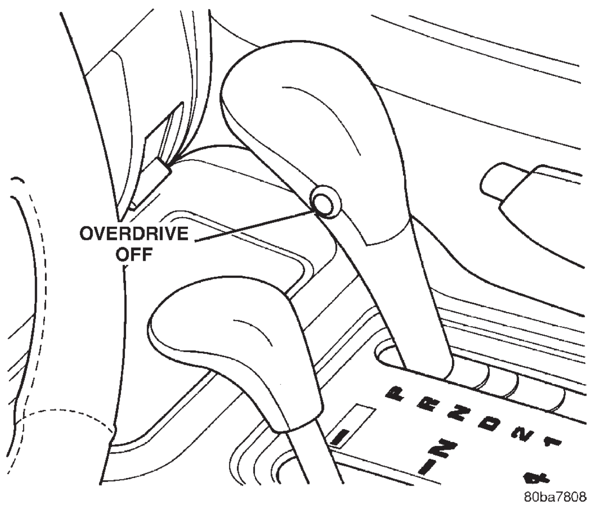


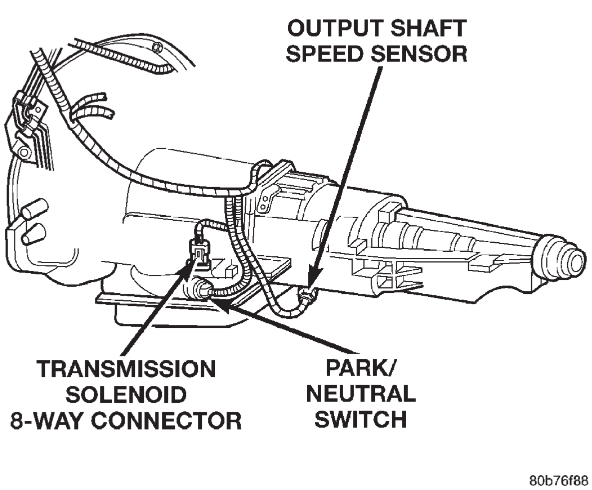
8.5 FUEL SYSTEM (Continued)

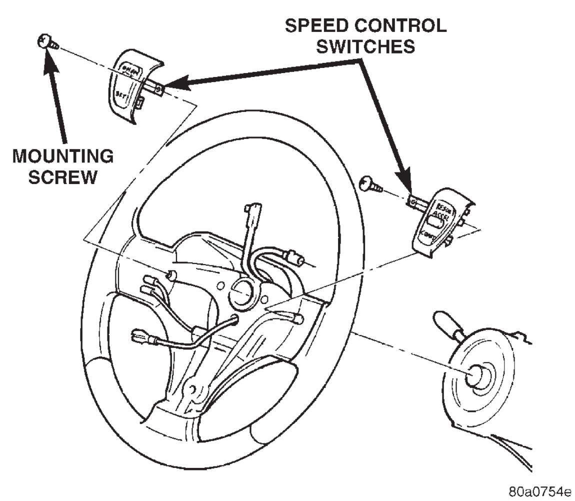


8.6 SWITCHES

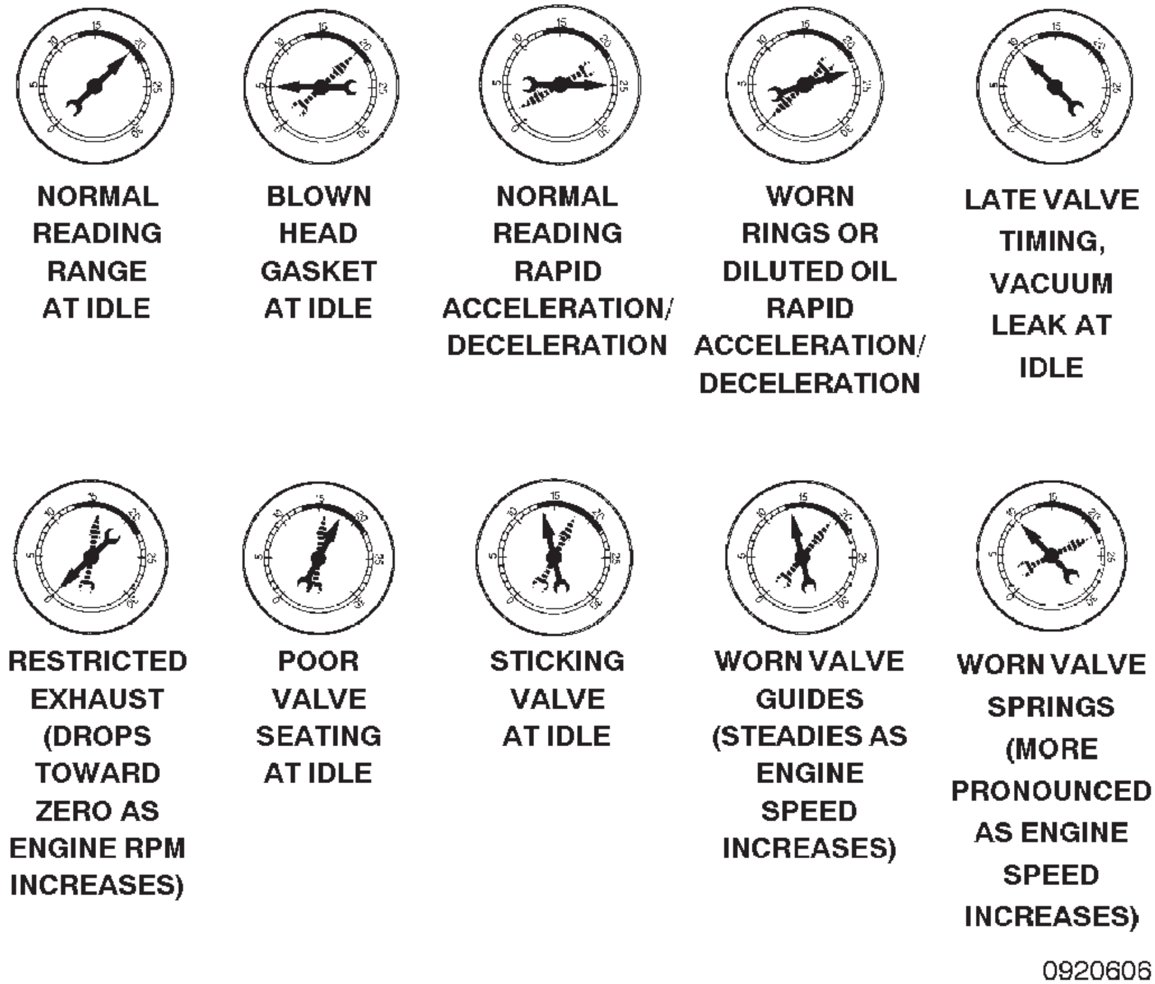






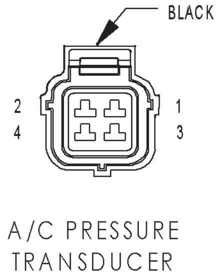


8.7 SPECIFICATIONS



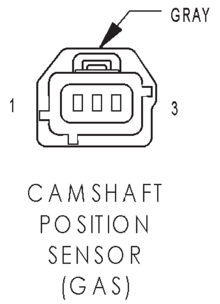
NOTES

9.0 CONNECTOR PINOUTS



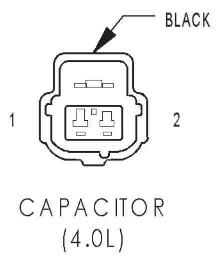
A/C PRESSURE TRANSDUCER - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K6 18VT/WT (DIESEL)	SENSOR REFERENCE VOLTAGE B
2	K6 18VT/BK (GAS)	5 VOLT SUPPLY
3	C18 18DB	A/C PRESSURE SIGNAL
4	-	-



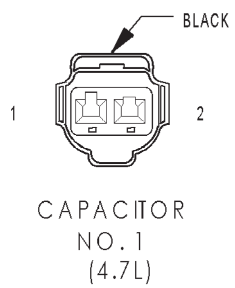
CAMSHAFT POSITION SENSOR (GAS) - GRAY 3 WAY

CAV	CIRCUIT	FUNCTION
1	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5 VOLT SUPPLY



CAPACITOR (4.0L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR (RHD)	AUTOMATIC SHUT DOWN RELAY OUTPUT
1	A142 14DG/OR (LHD)	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-

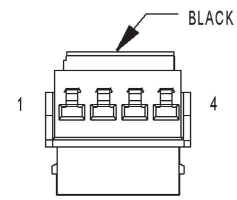


CAPACITOR NO. 1 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-

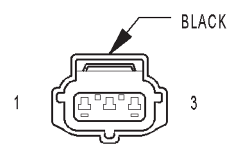
CAPACITOR NO. 2 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
2	-	-



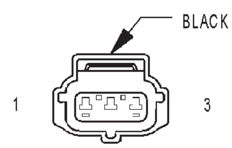
CLOCKSPRING C1 - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	X3 20GY/OR	HORN RELAY CONTROL
2	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
3	K4 20BK/LB	SENSOR GROUND
4	-	-



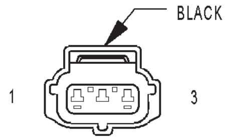
COIL ON PLUG NO. 1 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K91 14TN/RD	COIL DRIVER NO. 1
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON PLUG NO. 2 (4.7L) - BLACK 3 WAY

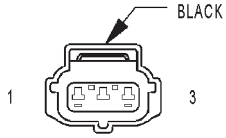
CAV	CIRCUIT	FUNCTION
1	K92 14TN/PK	COIL DRIVER NO. 2
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON PLUG NO. 3 (4.7L)

COIL ON PLUG NO. 3 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-

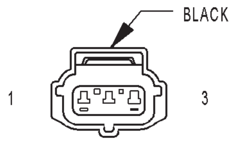


COIL ON PLUG NO. 4 (4.7L)

COIL ON PLUG NO. 4 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K94 14TN/LG	COIL DRIVER NO. 4
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-

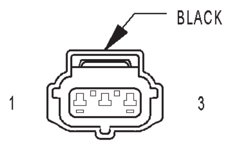
CONNECTOR PINOUTS



COIL ON PLUG NO. 5 (4.7L)

COIL ON PLUG NO. 5 (4.7L) - BLACK 3 WAY

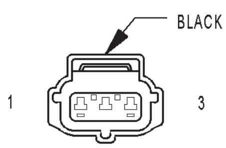
CAV	CIRCUIT	FUNCTION
1	K95 14TN/DG	COIL DRIVER NO. 5
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON PLUG NO. 6 (4.7L)

COIL ON PLUG NO. 6 (4.7L) - BLACK 3 WAY

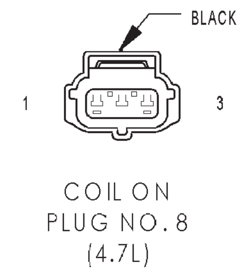
CAV	CIRCUIT	FUNCTION
1	K96 14TN/LB	COIL DRIVER NO. 6
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON PLUG NO. 7 (4.7L)

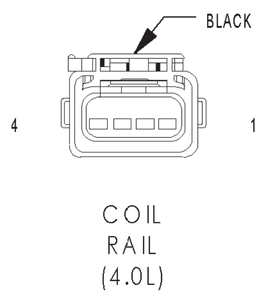
COIL ON PLUG NO. 7 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K97 14BR	COIL DRIVER NO. 7
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



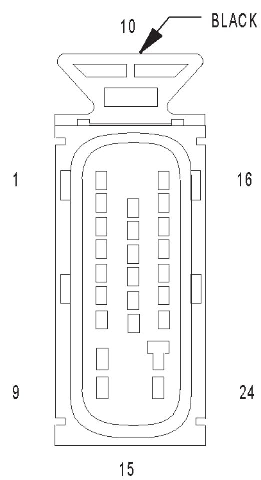
COIL ON PLUG NO. 8 (4.7L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K98 14LB/RD	COIL DRIVER NO. 8
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	-	-



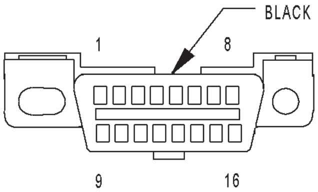
COIL RAIL (4.0L) - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	K91 14TN/RD	COIL DRIVER NO. 1
2	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
3	K92 14TN/PK	COIL DRIVER NO. 2
4	K93 14TN/OR	COIL DRIVER NO. 3



CONTROLLER ANTILOCK BRAKE - BLACK 24 WAY

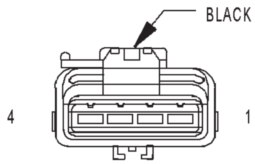
CAV	CIRCUIT	FUNCTION
1	Z101 12BK/OR	GROUND
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL
3	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
4	-	-
5	D25 18VT/YL	PCI BUS
6	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
7	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
8	-	-
9	A20 12RD/DB	FUSED B(+)
10	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	D52 18LG/WT (DIESEL)	CAN C BUS(+)
12	-	-
13	B22 18DG/YL	VEHICLE SPEED SIGNAL
14	D51 18DG/YL (DIESEL)	CAN C BUS(-)
15	-	-
16	Z102 12BK/OR	GROUND
17	G9 18GY/BK	BRAKE FLUID LEVEL SWITCH SENSE
18	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
19	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL
20	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
21	Z231 18BK	GROUND
22	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
23	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
24	A10 12RD/DG	FUSED B(+)



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

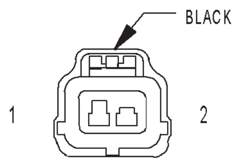
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z305 20BK/OR	GROUND
5	Z306 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)



ELECTRONIC SPEED CONTROL SERVO

ELECTRONIC SPEED CONTROL SERVO - BLACK 4 WAY

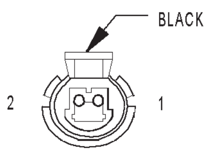
CAV	CIRCUIT	FUNCTION
1	V36 20TN/RD (RHD/GAS)	SPEED CONTROL VACUUM SOLENOID CONTROL
1	V36 18TN/RD (LHD GAS)	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 20LG/RD (RHD/GAS)	SPEED CONTROL VENT SOLENOID CONTROL
2	V35 18LG/RD (LHD GAS)	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
4	Z307 20BK	GROUND



ENGINE COOLANT TEMPERATURE SENSOR (GAS)

ENGINE COOLANT TEMPERATURE SENSOR (GAS) - BLACK 2 WAY

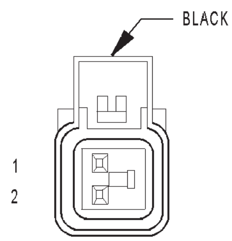
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



EVAP/PURGE SOLENOID (GAS)

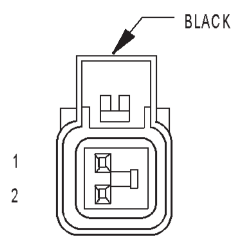
EVAP/PURGE SOLENOID (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	K52 18PK/BK (RHD)	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
2	K52 20PK/BK (LHD)	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL



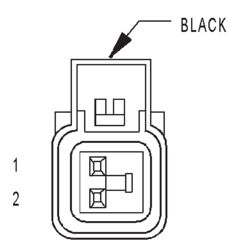
FUEL INJECTOR NO. 1 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



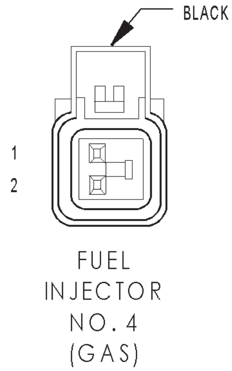
FUEL INJECTOR NO. 2 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



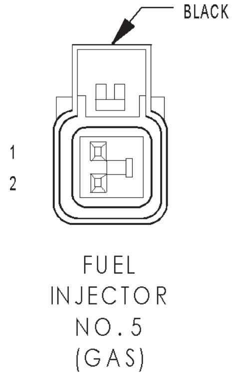
FUEL INJECTOR NO. 3 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



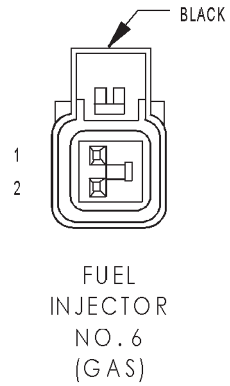
FUEL INJECTOR NO. 4 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



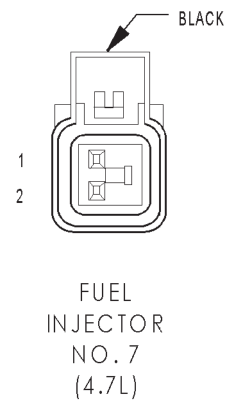
FUEL INJECTOR NO. 5 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



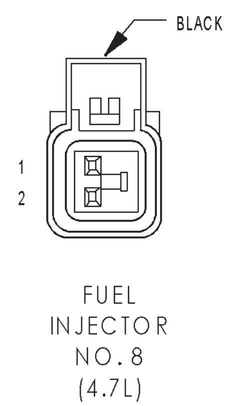
FUEL INJECTOR NO. 6 (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



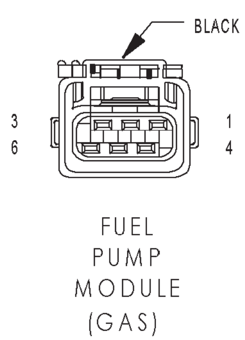
FUEL INJECTOR NO. 7 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K26 18VT	FUEL INJECTOR NO. 7 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



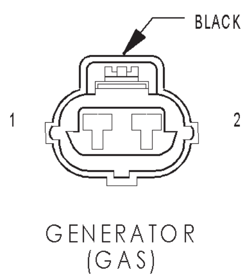
FUEL INJECTOR NO. 8 (4.7L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K28 18GY/LB	FUEL INJECTOR NO. 8 DRIVER
2	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT



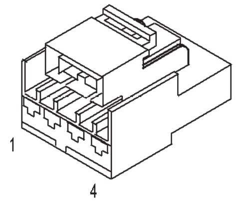
FUEL PUMP MODULE (GAS) - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	A141 16DG/BK	FUEL PUMP RELAY OUTPUT
2	-	-
3	K226 20LB/YL	FUEL LEVEL SENSOR SIGNAL
4	K4 20BK/LB	SENSOR GROUND
5	-	-
6	Z150 16BK	GROUND



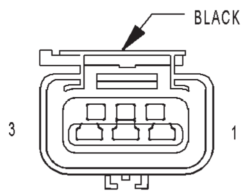
GENERATOR (GAS) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K125 18WT/DB	GENERATOR SOURCE
2	K20 18DG	GENERATOR FIELD DRIVER



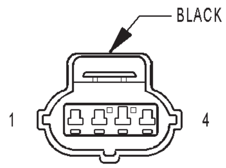
GOVERNOR PRESSURE SENSOR

CAV	CIRCUIT	FUNCTION
1	RD	5 VOLT SUPPLY
2	WT	GOVERNOR PRESSURE SENSOR SIGNAL
3	DG	SENSOR GROUND
4	BK	TRANSMISSION FLUID TEMPERATURE SIGNAL



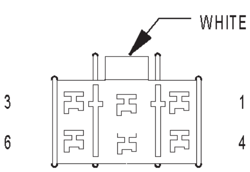
HYDRAULIC COOLING MODULE - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	F15 18DB/WT (DIESEL)	FUSED AUTO SHUT DOWN RELAY OUTPUT
1	F142 18OR/DG (GAS)	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K173 18LG	RADIATOR FAN RELAY CONTROL
3	Z500 18BK	GROUND



IDLE AIR CONTROL MOTOR - BLACK 4 WAY

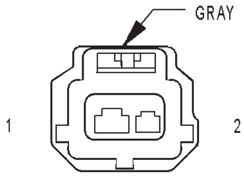
CAV	CIRCUIT	FUNCTION
1	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
4	K39 18GY/BK	IDLE AIR CONTROL NO. 1 DRIVER



IGNITION SWITCH C1 - WHITE 6 WAY

CAV	CIRCUIT	FUNCTION
1	A41 12YL	IGNITION SWITCH OUTPUT (START)
2	A2 12PK/BK	FUSED B(+)
3	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
4	A1 12RD	FUSED B(+)
5	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
6	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)

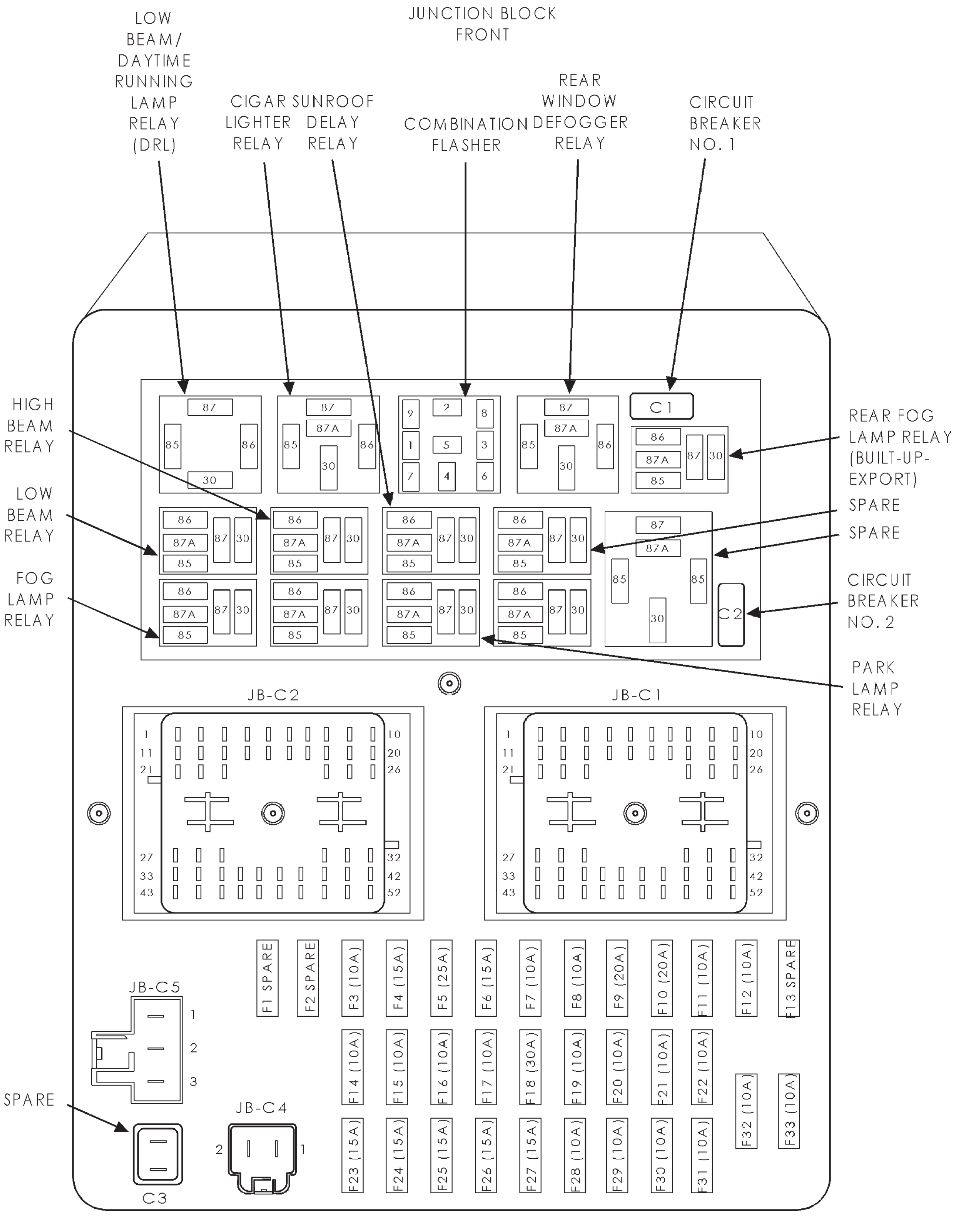
CONNECTOR PINOUTS



INTAKE AIR TEMPERATURE SENSOR (GAS)

INTAKE AIR TEMPERATURE SENSOR (GAS) - GRAY 2 WAY

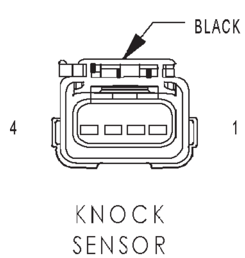
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL



CONNECTOR PINOUTS

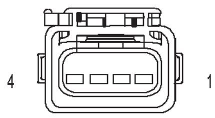
FUSES (JB)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	-	-	-
2	-	-	-
3	10A	L33 18RD	FUSED HIGH BEAM RELAY OUTPUT
4	15A	INTERNAL	FUSED B(+)
5	25A	INTERNAL	FUSED B(+)
6	15A	INTERNAL	FUSED B(+)
7	10A	INTERNAL	FUSED B(+)
8	15A	INTERNAL	FUSED B(+)
9	20A	INTERNAL	FUSED B(+)
10	20A	F72 16RD/YL (EXCEPT BUILT-UP-EXPORT)	FUSED B(+)
11	10A	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
12	10A	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-	-
14	10A	L43 18VT	FUSED LOW BEAM RELAY OUTPUT
15	10A	L44 18VT/RD	FUSED LOW BEAM RELAY OUTPUT
16	10A	L34 18RD/OR	FUSED HIGH BEAM RELAY OUTPUT
17	10A	INTERNAL	FUSED B(+)
18	30A	F9 20RD/BK	FUSED B(+)
19	10A	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
20	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
22	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	15A	F32 20PK/DB	FUSED B(+)
24	15A	INTERNAL	FUSED B(+)
25	15A	INTERNAL	FUSED B(+)
26	15A	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
27	15A	INTERNAL (BUILT-UP-EXPORT)	FUSED B(+)
28	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
29	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 18RD/WT (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 16WT/RD (LHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
31	10A	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
32	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
33	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)



KNOCK SENSOR - BLACK 4 WAY

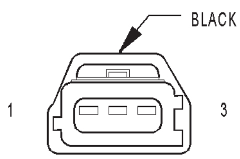
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K42 18DB/LG	KNOCK SENSOR NO. 1 SIGNAL
3	K4 18BK/LB	SENSOR GROUND
4	K142 18GY/BK	KNOCK SENSOR NO. 2 SIGNAL



LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)

LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT) - 4 WAY

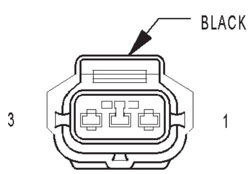
CAV	CIRCUIT	FUNCTION
1	-	-
2	K125 18OR/DG	GENERATOR SOURCE
3	K106 20WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
4	K107 20OR/YL	LEAK DETECTION PUMP SWITCH SENSE



MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L)

MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L) - BLACK 3 WAY

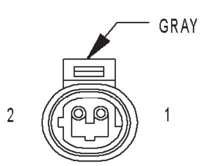
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K1 18DG/RD	MAP SENSOR SIGNAL
3	K7 18OR	5 VOLT SUPPLY



MANIFOLD ABSOLUTE PRESSURE SENSOR (4.7L)

MANIFOLD ABSOLUTE PRESSURE SENSOR (4.7L) - BLACK 3 WAY

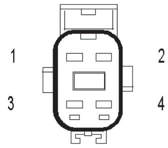
CAV	CIRCUIT	FUNCTION
1	K1 18DG/RD	MAP SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5 VOLT SUPPLY



OUTPUT SPEED SENSOR (4.0L)

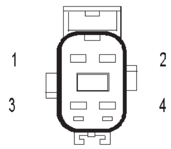
OUTPUT SPEED SENSOR (4.0L) - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL



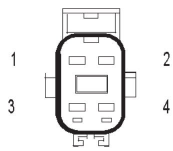
OXYGEN SENSOR 1/1 UPSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
3	K4 18BK/LB	SENSOR GROUND
4	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL



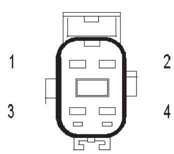
OXYGEN SENSOR 1/2 DOWNSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG (4.0L BUILT-UP-EXPORT)	FUSED AUTO SHUT DOWN RELAY OUTPUT
1	K200 18VT/OR (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
2	K299 18BR/WT (4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR 1/2 HEATER CONTROL
2	Z186 18BK (EXCEPT 4.0L BUILT-UP-EXPORT)	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL



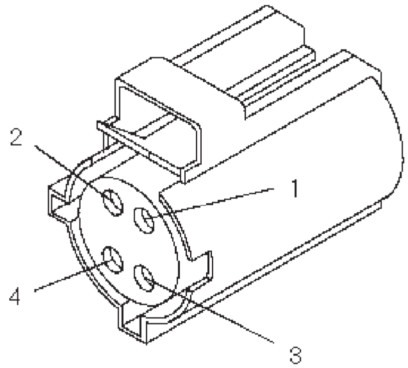
OXYGEN SENSOR 2/1 UPSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K299 18BR/WT	OXYGEN SENSOR 2/1 HEATER CONTROL
3	K4 18BK/LB	SENSOR GROUND
4	K241 18LG/RD	OXYGEN SENSOR 2/1 SIGNAL



OXYGEN SENSOR 2/2 DOWNSTREAM - 4 WAY

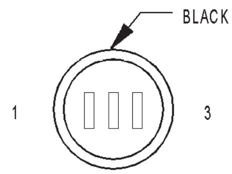
CAV	CIRCUIT	FUNCTION
1	K200 18VT/OR (4.0L)	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
1	K200 18BR/WT (4.7L)	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
2	Z186 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K341 18TN/WT (4.0L)	OXYGEN SENSOR 2/2 SIGNAL
4	K341 18PK/WT (4.7L)	OXYGEN SENSOR 2/2 SIGNAL



OXYGEN SENSOR CONNECTOR (COMPONENT SIDE)

OXYGEN SENSOR CONNECTOR (COMPONENT SIDE)

CAV	CIRCUIT	FUNCTION
1	-	GROUND
2	-	AUTO SHUT DOWN RELAY OUTPUT
3	-	OXYGEN SENSOR GROUND
4	-	OXYGEN SENSOR SIGNAL

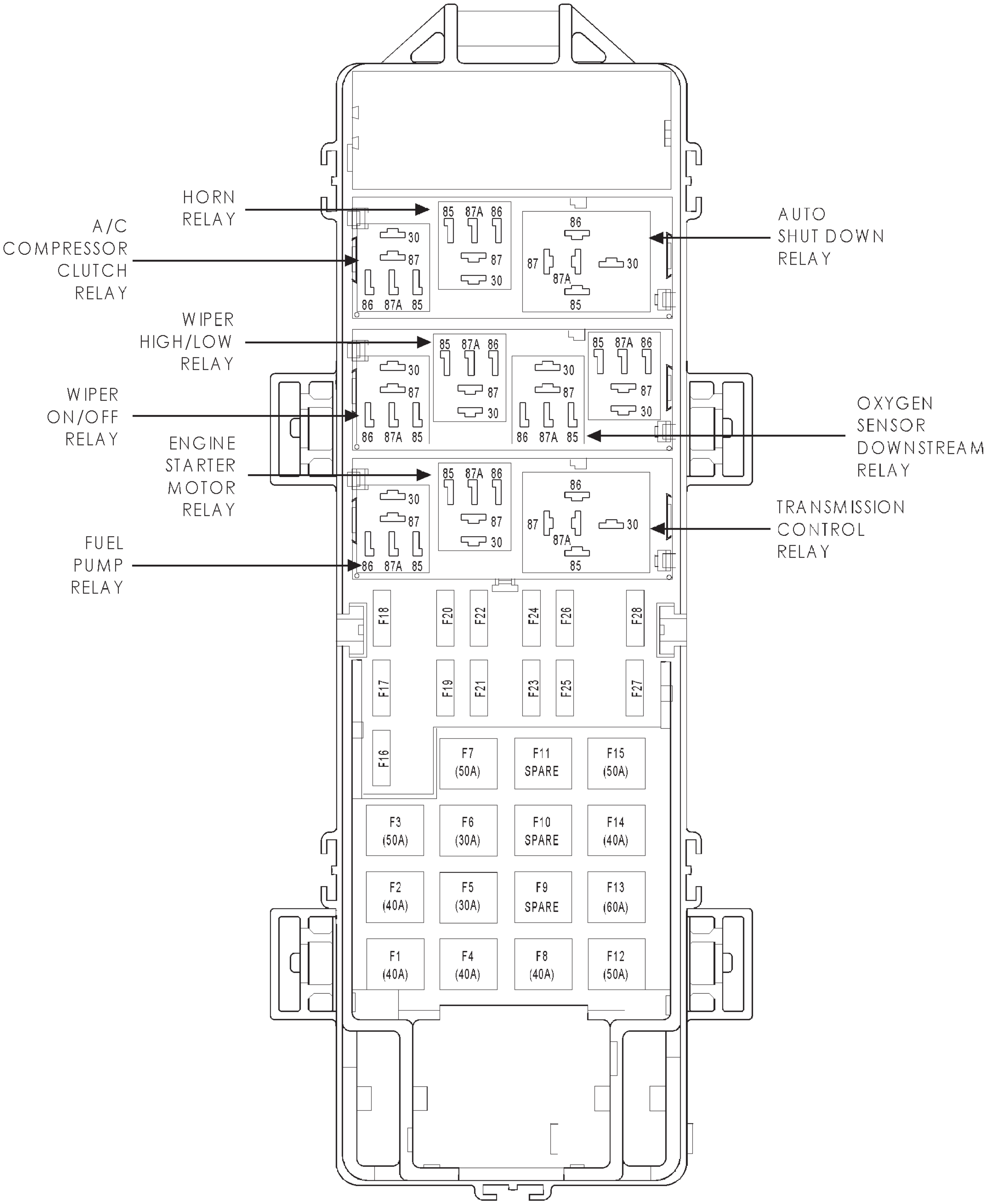


PARK/NEUTRAL POSITION SWITCH (4.0L)

PARK/NEUTRAL POSITION SWITCH (4.0L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
3	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)

POWER DISTRIBUTION CENTER (GAS)



FUSES (GAS)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	30A	A30 14RD/WT	FUSED B(+)
5	30A	A30 14RD/WT (4.7L)	FUSED B(+)
6	30A	A14 14RD/DG	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	-	-	-
12	50A	A146 10OR/WT	FUSED B(+)
13	-	-	-
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	15A	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	15A	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	10A	A7 14RD/BK	FUSED B(+)
20	-	-	-
21	15A	A17 18RD/BK	FUSED B(+)
22	-	-	-
23	-	-	-
24	20A	A62 16VT/LB	FUSED B(+)
25	20A	A20 12RD/DB	FUSED B(+)
26	15A	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
26	15A	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	15A	T15 18YL/BR(4.0L)	FUSED TRANSMISSION CONTROL RELAY OUTPUT

A/C COMPRESSOR CLUTCH RELAY (GAS)

CAV	CIRCUIT	FUNCTION
30	A17 18RD/BK	FUSED B(+)
85	C13 20DB/OR (RHD)	A/C COMPRESSOR CLUTCH RELAY CONTROL
85	C13 18DB/OR (LHD)	A/C COMPRESSOR CLUTCH RELAY CONTROL
86	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	C2 18DB/YL	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

AUTO SHUT DOWN RELAY (GAS)

CAV	CIRCUIT	FUNCTION
30	A14 14RD/DG	FUSED B(+)
85	K51 18DB/YL	AUTO SHUT DOWN RELAY CONTROL
86	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
86	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	A142 14DG/OR	AUTO SHUT DOWN RELAY OUTPUT
87A	-	-

ENGINE STARTER MOTOR RELAY (GAS)

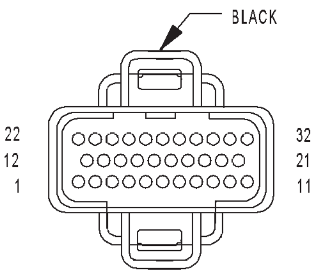
CAV	CIRCUIT	FUNCTION
30	A1 12RD	FUSED (+)
85	T41 18BR/WT (RHD)	PARK/NEUTRAL POSITION SWITCH SENSE
85	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
86	F45 20YL/RD (4.0L RHD)	FUSED IGNITION SWITCH OUTPUT (START)
86	F45 18YL/RD (4.7L)	FUSED IGNITION SWITCH OUTPUT (START)
86	F45 18YL/RD (EXCEPT 4.0L RHD)	FUSED IGNITION SWITCH OUTPUT (START)
87	T40 12LG	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

FUEL PUMP RELAY (GAS)

CAV	CIRCUIT	FUNCTION
30	A62 16VT/WT (RHD)	FUSED B(+)
30	A62 16VT/LB (LHD)	FUSED B(+)
85	K31 18BR	FUEL PUMP RELAY CONTROL
86	F991 20OR/DB (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
86	F991 18OR/DB (LHD)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
86	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	A141 16DG/BK (RHD)	FUEL PUMP RELAY OUTPUT
87	A141 16DG/WT (LHD)	FUEL PUMP RELAY OUTPUT
87A	-	-

OXYGEN SENSOR DOWNSTREAM RELAY

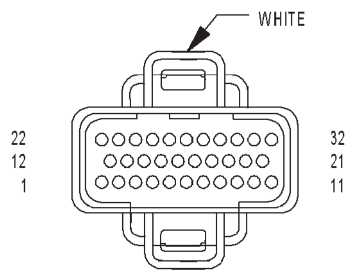
CAV	CIRCUIT	FUNCTION
30	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
30	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
85	K512 18RD/YL	OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
86	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
86	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	K200 18VT/OR	OXYGEN SENSOR DOWNSTREAM RELAY OUTPUT
87A	-	-



POWERTRAIN CONTROL MODULE C1 (GAS)

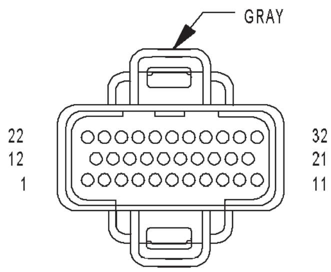
POWERTRAIN CONTROL MODULE C1 (GAS) - BLACK 32 WAY

CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	K94 14TN/LG (4.7L)	COIL DRIVER NO. 4
4	K4 18BK/LB	SENSOR GROUND
5	K96 14TN/LB (4.7L)	COIL DRIVER NO. 6
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K91 14TN/RD	COIL DRIVER NO. 1
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	K98 14LB/RD (4.7L)	COIL DRIVER NO. 8
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	-	-
13	-	-
14	K77 18LG/BK	TRANSFER CASE POSITION SENSOR INPUT
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5 VOLT SUPPLY
18	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/BK	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	K95 14TN/DG (4.7L)	COIL DRIVER NO. 5
22	A7 14RD/BK	FUSED B(+)
23	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SENSOR SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EX-CEPT BUILT-UP-EXPORT)	COIL DRIVER NO. 1
29	K341 18PK/WT (4.7L)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z82 14BK/WT	GROUND
32	Z81 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE C2 (GAS) - WHITE 32 WAY

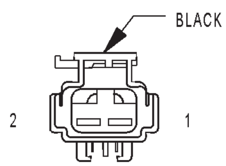
CAV	CIRCUIT	FUNCTION
1	T54 18VT (4.0L)	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	K26 18VT (4.7L)	FUEL INJECTOR NO. 7 DRIVER
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
7	K97 14BR (4.7L)	COIL DRIVER NO. 7
8	K88 18PK (4.0L)	GOVERNOR PRESSURE SOLENOID CONTROL
9	K92 14TN/PK	COIL DRIVER NO. 2
10	K20 18DG	GENERATOR FIELD DRIVER
11	T20 18LB (4.0L)	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
12	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
13	K28 18GY/LB (4.7L)	FUEL INJECTOR NO. 8 DRIVER
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	K173 18LG	RADIATOR FAN RELAY CONTROL
18	-	-
19	C18 18DB	A/C PRESSURE SIGNAL
20	-	-
21	T60 18BR (4.0L)	3-4 SHIFT SOLENOID CONTROL
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
24	-	-
25	T13 18DB/BK (4.0L)	OUTPUT SPEED SENSOR GROUND
26	-	-
27	B22 18DG/YL	VEHICLE SPEED SENSOR SIGNAL
28	T14 18LG/WT (4.0L)	OUTPUT SPEED SENSOR SIGNAL
29	T25 18LG/RD (4.0L)	GOVERNOR PRESSURE SENSOR SIGNAL
30	K30 18PK/YL (4.0L)	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/BK	5 VOLT SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE C3 (GAS)

POWERTRAIN CONTROL MODULE C3 (GAS) - GRAY 32 WAY

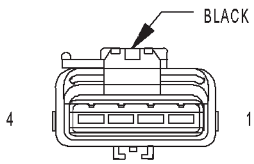
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	-	-
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	K42 18DB/LG (4.7L HIGH OUTPUT)	KNOCK SENSOR SIGNAL
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.7L)	OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
10	K106 18WT/DG (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18OR/DG	SPEED CONTROL SUPPLY
12	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (4.7L RHD)	OVERDRIVE OFF SWITCH SENSE
13	T6 18OR/WT (4.0L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T10 18DG/LG (4.7L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T6 18OR/BK (4.0L RHD)	OVERDRIVE OFF SWITCH SENSE
14	K107 18OR/PK (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SWITCH SENSE
15	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR 2/1 HEATER CONTROL
17	-	-
18	K142 18GY/BK (4.7L HIGH OUTPUT)	KNOCK SENSOR NO. 2 SIGNAL
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG (LHD)	SCI RECEIVE
29	D32 18LG/DG (RHD)	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL



RADIATOR FAN MOTOR

RADIATOR FAN MOTOR - BLACK 2 WAY

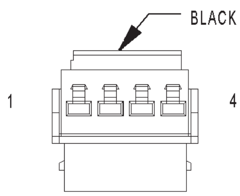
CAV	CIRCUIT	FUNCTION
1	C23 12DG	RADIATOR FAN RELAY OUTPUT
2	Z4 12BK/PK	GROUND



RADIATOR
FAN
RELAY

RADIATOR FAN RELAY - BLACK 4 WAY

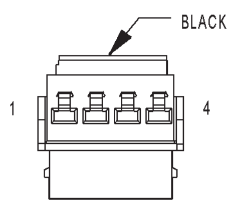
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	C24 20DB/PK	RADIATOR FAN RELAY CONTROL
3	C23 12DG	RADIATOR FAN RELAY OUTPUT
4	A16 12GY	FUSED B(+)



SPEED
CONTROL
SWITCH
NO. 1

SPEED CONTROL SWITCH NO. 1 - BLACK 4 WAY

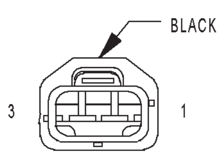
CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



SPEED
CONTROL
SWITCH
NO. 2

SPEED CONTROL SWITCH NO. 2 - BLACK 4 WAY

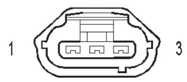
CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



THROTTLE
POSITION
SENSOR
(4.0L)

THROTTLE POSITION SENSOR (4.0L) - BLACK 3 WAY

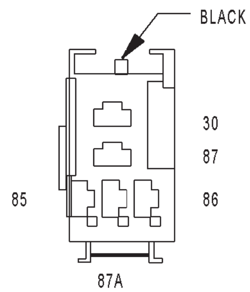
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL



THROTTLE POSITION SENSOR (4.7L)

THROTTLE POSITION SENSOR (4.7L) - 3 WAY

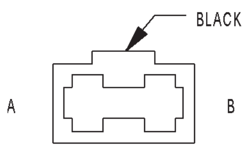
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



TRAILER TOW BRAKE LAMP RELAY

TRAILER TOW BRAKE LAMP RELAY - BLACK 5 WAY

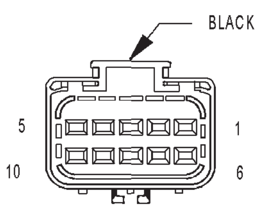
CAV	CIRCUIT	FUNCTION
3O (3)	F9 14RD/BK	FUSED B(+)
85 (2)	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
86 (1)	Z150 18BK	GROUND
87 (5)	L95 14DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L94 14OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT



TRAILER TOW CIRCUIT BREAKER

TRAILER TOW CIRCUIT BREAKER - BLACK 2 WAY

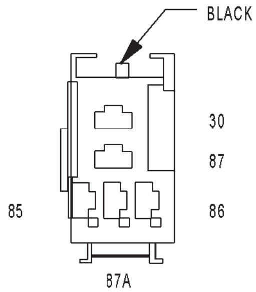
CAV	CIRCUIT	FUNCTION
A	F30 14RD/WT	FUSED CIGAR LIGHTER RELAY OUTPUT
B	F30 14RD/TN	CIGAR LIGHTER RELAY OUTPUT



TRAILER TOW CONNECTOR

TRAILER TOW CONNECTOR - BLACK 10 WAY

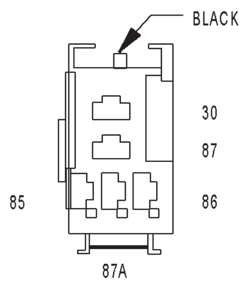
CAV	CIRCUIT	FUNCTION
1	-	-
2	L62 14BR/RD	RIGHT TURN SIGNAL
3	L1 18VT/BK	BACK-UP LAMP FEED
4	F30 14RD/WT	FUSED CIGAR LIGHTER RELAY OUTPUT
5	L7 18BK/YL	PARK LAMP RELAY OUTPUT
6	-	-
7	B40 14LB	TRAILER TOW BRAKE B(+)
8	Z150 14BK	GROUND
9	Z150 14BK	GROUND
10	L63 14DG/RD	LEFT TURN SIGNAL



TRAILER TOW
LEFT TURN RELAY

TRAILER TOW LEFT TURN RELAY - BLACK 5 WAY

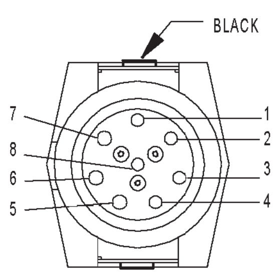
CAV	CIRCUIT	FUNCTION
30 (3)	L63 16DG/RD	LEFT TURN SIGNAL
85 (2)	L63 14DG/RD	LEFT TURN SIGNAL
86 (1)	Z150 18BK	GROUND
87 (5)	L94 14OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L95 14DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT



TRAILER TOW
RIGHT TURN RELAY

TRAILER TOW RIGHT TURN RELAY - BLACK 5 WAY

CAV	CIRCUIT	FUNCTION
30 (3)	L62 14BR/RD	RIGHT TURN SIGNAL
85 (2)	L62 20BR/RD	RIGHT TURN SIGNAL
86 (1)	Z150 18BK	GROUND
87 (5)	L94 14OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L95 14DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT



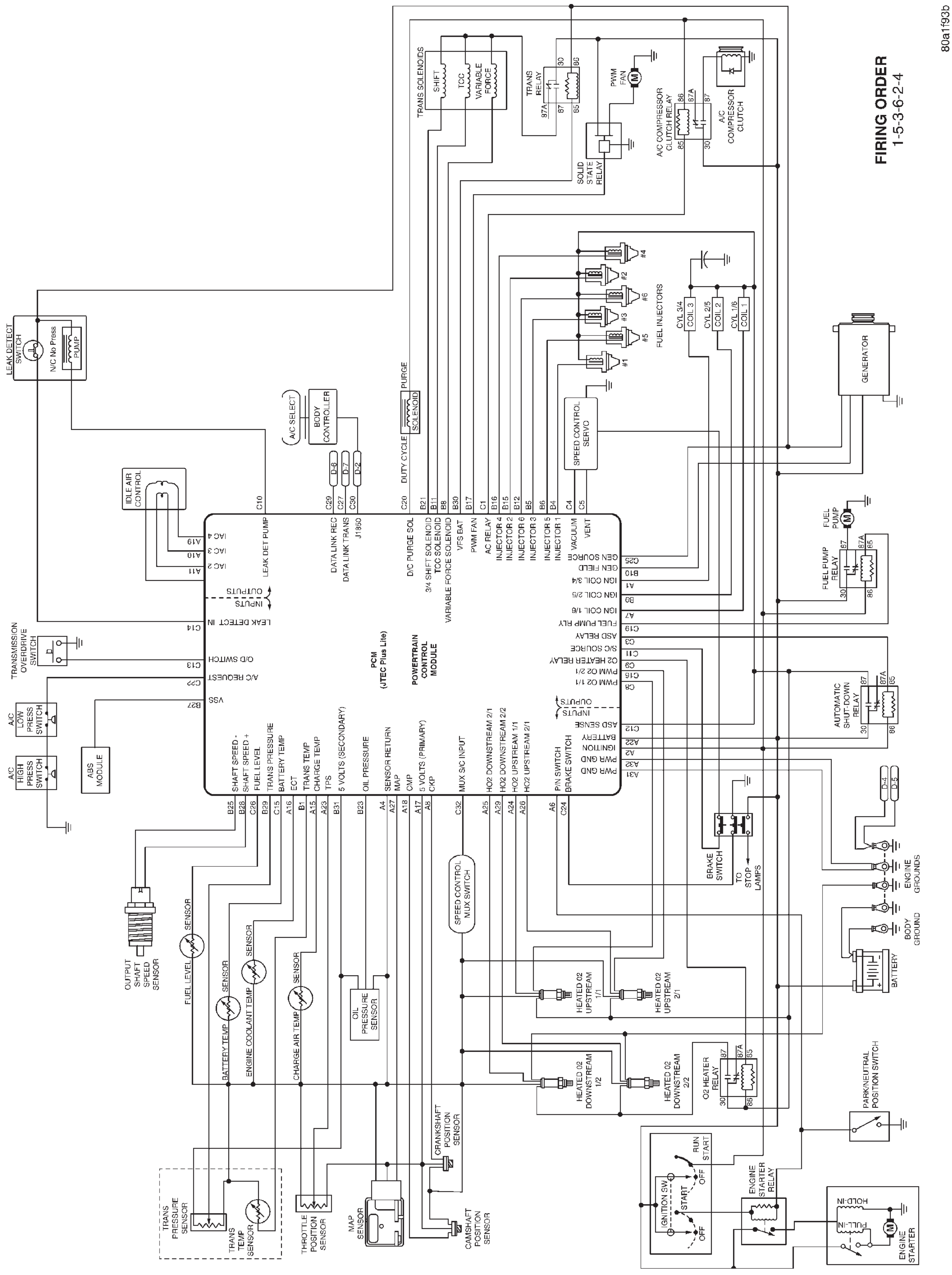
TRANSMISSION
SOLENOID
(4.0L)

TRANSMISSION SOLENOID (4.0L) - BLACK 8 WAY

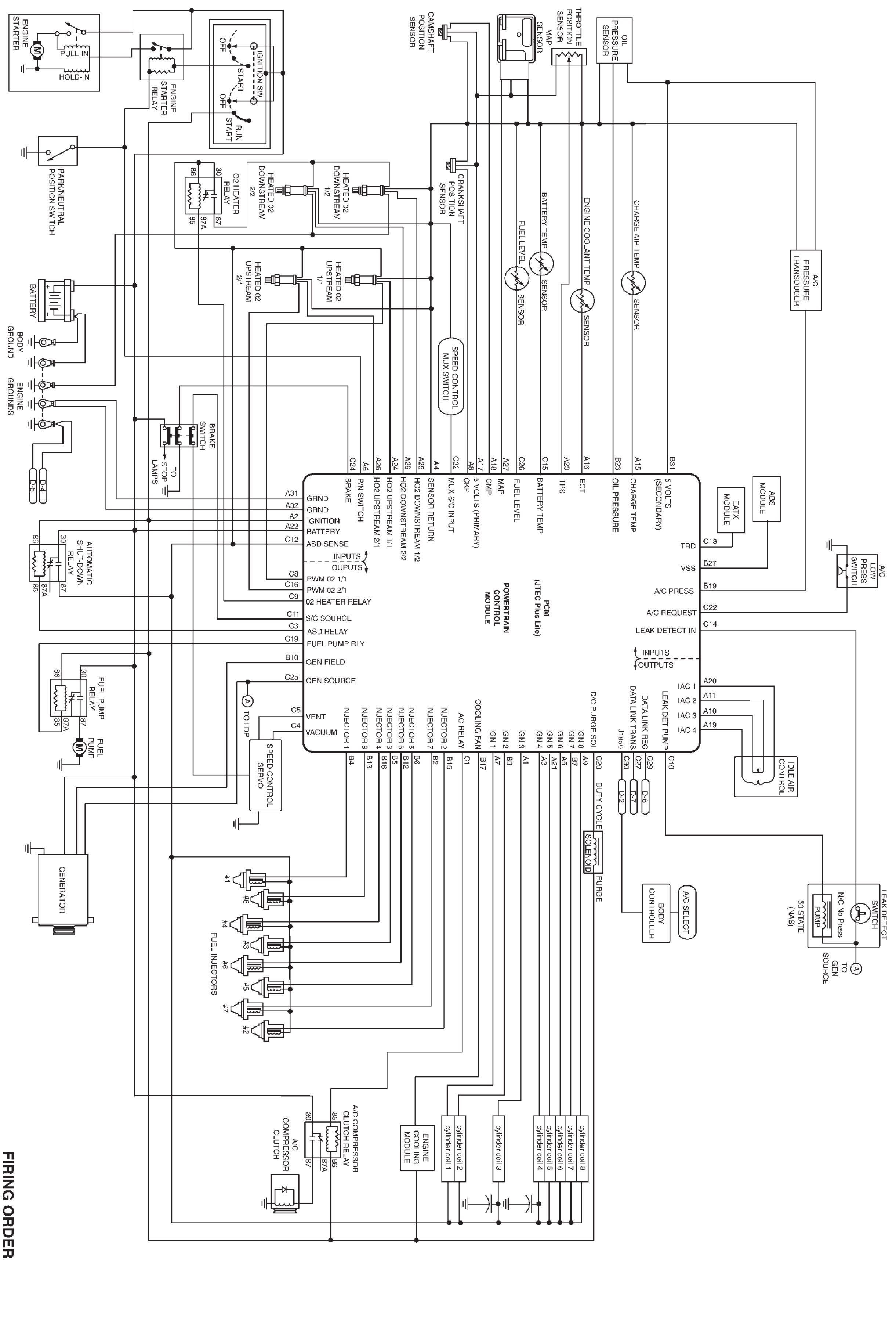
CAV	CIRCUIT	FUNCTION
1	T15 18LG	FUSED TRANSMISSION CONTROL RELAY OUTPUT
2	K6 18VT/BK	5 VOLT SUPPLY
3	K4 18BK/LB	SENSOR GROUND
4	T25 18LG/RD	GOVERNOR PRESSURE SENSOR SIGNAL
5	K88 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
6	T60 18BR	3-4 SHIFT SOLENOID CONTROL
7	T20 18LB	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
8	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL

10.0 SCHEMATIC DIAGRAMS

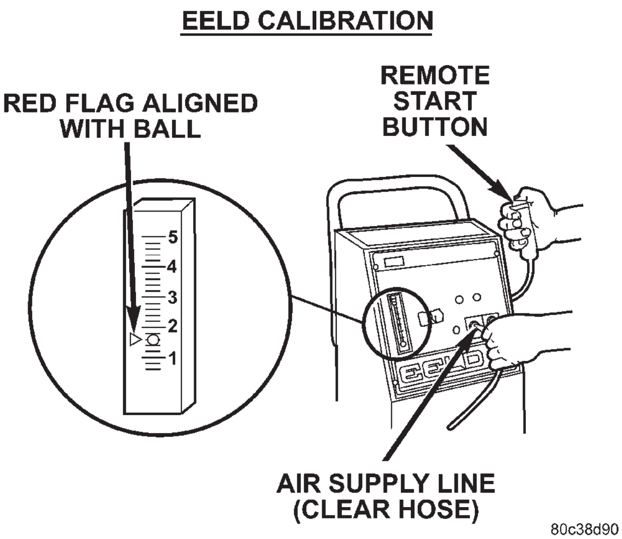
10.1 2001 JEEP WJ 4.0L JTEC SYSTEM



10.2 2001 JEEP WJ 4.7L JTEC SYSTEM



11.0 CHARTS AND GRAPHS



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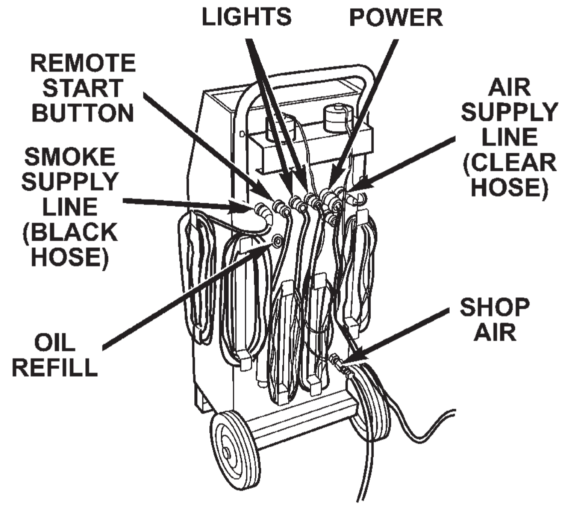

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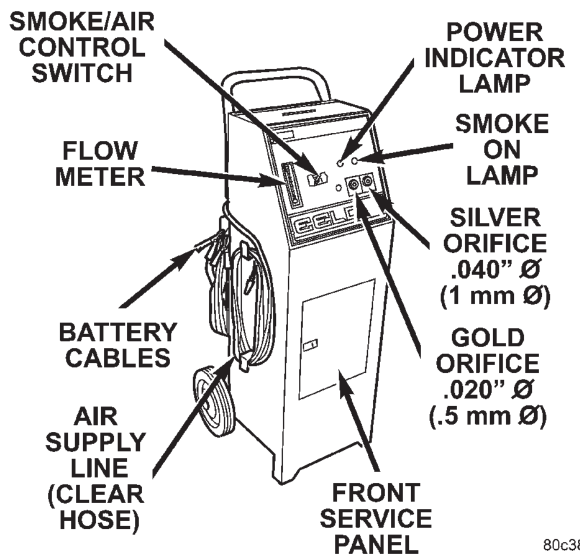

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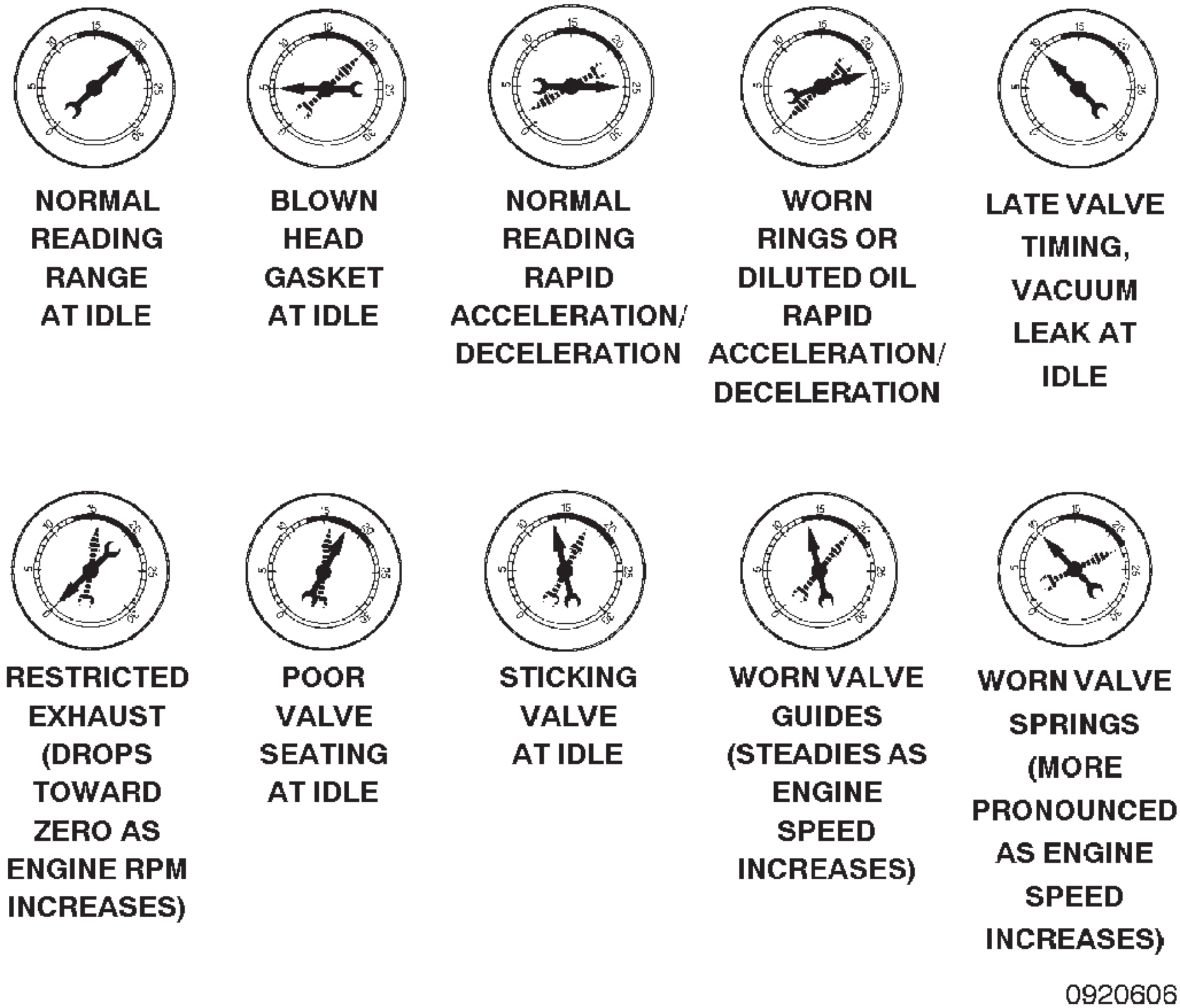
NORMAL READING RANGE AT IDLE
BLOWN HEAD GASKET AT IDLE
NORMAL READING RAPID ACCELERATION/ DECELERATION
WORN RINGS OR DILUTED OIL RAPID ACCELERATION/ DECELERATION
LATE VALVE TIMING, VACUUM LEAK AT IDLE
RESTRICTED EXHAUST (DROPS TOWARD ZERO AS ENGINE RPM INCREASES)
POOR VALVE SEATING AT IDLE
STICKING VALVE AT IDLE
WORN VALVE GUIDES (STEADIES AS ENGINE SPEED INCREASES)
WORN VALVE SPRINGS (MORE PRONOUNCED AS ENGINE SPEED INCREASES)
0920606

CHARTS AND GRAPHS

O2 SENSOR CONFIGURATION

AB 3.9L	1/1	UPSTREAM
AB 3.9L	1/2	DOWNSTREAM
AB 5.2L	1/1	LEFT BANK UPSTREAM
AB 5.2L	1/2	LEFT BANK DOWNSTREAM
AB 5.2L	2/1	RIGHT BANK UPSTREAM
AB 5.2L	2/2	RIGHT BANK DOWNSTREAM
AB 5.9L L/D	1/1	UPSTREAM
AB 5.9L L/D	1/2	DOWNSTREAM
AN 2.5L	1/1	UPSTREAM
AN 2.5L	1/2	DOWNSTREAM
AN 3.9L	1/1	UPSTREAM
AN 3.9L	1/2	DOWNSTREAM
AN 4.7L	1/1	LEFT BANK UPSTREAM
AN 4.7L	1/2	LEFT BANK DOWNSTREAM
AN 4.7L	2/1	RIGHT BANK UPSTREAM
AN 4.7L	2/2	RIGHT BANK DOWNSTREAM
AN 5.9L 2WD	1/1	LEFT BANK UPSTREAM
AN 5.9L 2WD	1/2	PRE CATALYST
AN 5.9L 2WD	1/3	POST CATALYST
AN 5.9L 2WD	2/1	RIGHT BANK UPSTREAM
AN 5.9L 4WD	1/1	UPSTREAM
AN 5.9L 4WD	1/2	DOWNSTREAM
BE/BR 3.9L	1/1	UPSTREAM
BE/BR 3.9L	1/2	DOWNSTREAM
BE/BR 5.2L	1/1	UPSTREAM
BE/BR 5.2L	1/2	DOWNSTREAM
BE/BR 5.9L HD	1/1	LEFT BANK UPSTREAM
BE/BR 5.9L HD	2/1	RIGHT BANK UPSTREAM
BE/BR 5.9L LD	1/1	UPSTREAM
BE/BR 5.9L LD	1/2	DOWNSTREAM
BE/BR 8.0L HD	1/1	LEFT BANK UPSTREAM
BE/BR 8.0L HD	2/1	RIGHT BANK UPSTREAM
BE/BR 8.0L MD	1/1	LEFT BANK UPSTREAM
BE/BR 8.0L MD	1/2	PRE CATALYST
BE/BR 8.0L MD	1/3	POST CATALYST
BE/BR 8.0L MD	2/1	RIGHT BANK UPSTREAM
DN 3.9L	1/1	UPSTREAM
DN 3.9L	1/2	DOWNSTREAM
DN 4.7L	1/1	LEFT BANK UPSTREAM
DN 4.7L	1/2	LEFT BANK DOWNSTREAM
DN 4.7L	2/1	RIGHT BANK UPSTREAM
DN 4.7L	2/2	RIGHT BANK DOWNSTREAM
DN 5.2L	1/1	UPSTREAM
DN 5.2L	1/2	DOWNSTREAM
DN 5.9L	1/1	UPSTREAM
DN 5.9L	1/2	DOWNSTREAM
DR 3.7L	1/1	UPSTREAM
DR 3.7L	1/2	DOWNSTREAM
DR 4.7L	1/1	LEFT BANK UPSTREAM
DR 4.7L	1/2	LEFT BANK DOWNSTREAM
DR 4.7L	2/1	RIGHT BANK UPSTREAM
DR 4.7L	2/2	RIGHT BANK DOWNSTREAM
DR 5.9L LD	1/1	UPSTREAM
DR 5.9L LD	1/2	DOWNSTREAM
KJ 2.4L	1/1	UPSTREAM
KJ 2.4L	1/2	DOWNSTREAM
KJ 3.7L	1/1	LEFT BANK UPSTREAM
KJ 3.7L	1/2	LEFT BANK DOWNSTREAM
KJ 3.7L	2/1	RIGHT BANK UPSTREAM
KJ 3.7L	2/2	RIGHT BANK DOWNSTREAM
SR 8.0L	1/1	LEFT BANK UPSTREAM
SR 8.0L	1/2	LEFT BANK DOWNSTREAM
SR 8.0L	2/1	RIGHT BANK UPSTREAM
SR 8.0L	2/2	RIGHT BANK DOWNSTREAM
TJ 2.5L	1/1	UPSTREAM
TJ 2.5L	1/2	DOWNSTREAM
TJ 4.0L	1/1	FRONT UPSTREAM
TJ 4.0L	1/2	FRONT DOWNSTREAM
TJ 4.0L	2/1	REAR UPSTREAM
TJ 4.0L	2/2	REAR DOWNSTREAM
WJ 4.0L	1/1	FRONT UPSTREAM
WJ 4.0L	1/2	FRONT DOWNSTREAM
WJ 4.0L	2/1	REAR UPSTREAM
WJ 4.0L	2/2	REAR DOWNSTREAM
WJ 4.7L	1/1	LEFT BANK UPSTREAM
WJ 4.7L	1/2	LEFT BANK DOWNSTREAM
WJ 4.7L	2/1	RIGHT BANK UPSTREAM
WJ 4.7L	2/2	RIGHT BANK DOWNSTREAM
WJ 5.9L	1/1	UPSTREAM
WJ 5.9L	1/2	DOWNSTREAM

* LD = Light Duty
* MD = Medium Duty
* HD = Heavy Duty

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NOTES

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all specifications, instructions and graphics needed to diagnose engine control module (ECM) and sentry key immobilizer system (SKIS) problems; they are no start, diagnostic trouble code (DTC) and no trouble code problems for the ECM. The diagnostics in this manual are based on the trouble condition or symptom being present at the time of diagnosis.

When repairs are required, refer to the appropriate service information for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added; carryover systems may be enhanced. IT IS RECOMMENDED THAT YOU REVIEW THE ENTIRE MANUAL TO BECOME FAMILIAR WITH ALL NEW AND CHANGED DIAGNOSTIC PROCEDURES.

This manual will cover all the necessary requirements to begin a logical diagnostic path for each problem. If there is a diagnostic trouble code (DTC) detected, go to the trouble code test. If there are no DTCs present, go to a no trouble code (*), symptom based test.

This book reflects many suggested changes from readers of past issues. After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic procedures manual covers all 2002 WG body vehicles equipped with the 2.7L direct injection diesel engine.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the engine control module (ECM) and sentry key immobilizer system (SKIS) is done in six basic steps:

- verification of complaint
- verification of any related symptom
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

NOTE: All tests in this manual should be performed with the engine at operating temperature, unless specified within a particular test.

2.0 IDENTIFICATION OF SYSTEM

The ECM is located in the left side of the engine compartment attached to the left inner fender behind the battery. The sentry key immobilizer module (SKIM) is located below the steering column behind the steering wheel.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 GENERAL DESCRIPTION

The 2.7L direct injection diesel engine system is equipped with the latest in technical advances. The on-board diagnostics incorporated in the engine control module and SKIM are intended to assist the field technician in repairing vehicle problems by the quickest means.

The engine system incorporates a common rail fuel delivery design. This design utilizes electronically controlled solenoid valve type fuel injectors. Each injector is controlled individually by the ECM. Injector timing and fuel quantity are controlled by the ECM based on inputs from the various sensors. The precision control of the injectors by the ECM helps to reduce the engine noise, odor and smoke.

3.2 FUNCTIONAL OPERATION

3.2.1 ECM ON-BOARD DIAGNOSTICS

The ECM has been programmed to monitor many different circuits of the diesel fuel injection system. This monitoring is called on-board diagnostics.

Certain criteria must be met for a trouble code to be entered into the ECM memory. The criteria may be a range of: engine rpm, engine temperature, time or other input signals to the ECM. If all of the criteria for monitoring a system or circuit are met, and a problem is sensed, then a DTC will be stored in the ECM memory.

It is possible that a DTC for a monitored circuit may not be entered into the ECM memory, even though a malfunction has occurred. This may happen when the monitoring criteria has not been met.

The ECM compares input signal voltages from each input device with specifications (the established high and low limits of the input range) that are programmed into it for that device. If the input voltage is not within the specifications and other trouble code criteria are met, a DTC will be stored in the ECM memory.

3.2.2 ECM OPERATING MODES

As input signals to the ECM change, the ECM adjusts its response to the output devices. For example, the ECM must calculate a different fuel quantity and fuel timing for engine idle condition than it would for a wide open throttle condition. There are several different modes of operation that determine how the ECM responds to the various input signals.

Ignition Switch On (Engine Off)

When the ignition switch is turned on, the ECM activates the glow plug relay for a time period that is determined by engine coolant temperature, atmospheric temperature and battery voltage.

Engine Start-up Mode

The ECM uses the engine temperature sensor and the crankshaft position sensor (engine speed) inputs to determine fuel injection quantity.

Normal Driving Modes

Engine idle, warm-up, acceleration, deceleration and wide open throttle modes are controlled based on all of the sensor inputs to the ECM. The ECM uses these sensor inputs to adjust fuel quantity and fuel injector timing.

Overheat Protection Mode

If the engine temperature is above 105°C (221°F) engine speed above 1000 rpm and vehicle speed is above 30 km/h (19 MPH) the ECM will limit fuel quantity for engine protection.

Limp-In Mode

If there is a fault detected with the accelerator pedal position sensor, the ECM will set the engine speed at 1100 RPM.

Overspeed Protection Mode

If the ECM detects engine RPM that exceeds 5000 RPM, the ECM will shut off fuel to the injectors until engine RPM falls below 4850. (A DTC does not set for engine overspeed. However, the DRBIII® is able to display the absolute maximum engine RPM, coolant temperature and vehicle speed that the ECM has detected during the life of the ECM).

After-Run Mode

The ECM transfers RAM information to ROM and performs an Input/Output state check.

3.2.3 MONITORED CIRCUITS

The ECM is able to monitor and identify most driveability related trouble conditions. Some circuits are directly monitored through ECM feedback circuitry. In addition, the ECM monitors the voltage state of some circuits and compares those states with expected values. Other systems are monitored indirectly when the ECM conducts a rationality test to identify problems.

Although most subsystems of the engine control module are either directly or indirectly monitored, there may be occasions when diagnostic trouble codes are not immediately identified. For a trouble code to set, a specific set of conditions must occur and unless these conditions occur, a DTC will not set.

3.2.4 SKIS OVERIVEW

The sentry key immobilizer system (SKIS) is designed to prevent unauthorized vehicle operation. The system consists of a sentry key immobilizer module (SKIM), ignition key(s) equipped with a transponder chip and the ECM. When the ignition switch is turned on, the SKIM interrogates the ignition key. If the ignition key is Valid or Invalid, the SKIM sends a J1850 Bus message to the ECM indicating ignition key status. Upon receiving this message the ECM will terminate engine operation or allow the engine to continue to operate.

3.2.5 SKIS ON-BOARD DIAGNOSTICS

The sentry key immobilizer module (SKIM) has been programmed to transmit and monitor many different coded messages as well as J1850 Bus messages. This monitoring is called On-Board Diagnostics. Certain criteria must be met for a DTC to be entered into SKIM memory. The criteria may be a range of; input voltage, J1850 Bus message or coded messages to the SKIM. If all of the criteria for monitoring a circuit or function are met and a fault is detected, a DTC will be stored in the SKIM memory.

3.2.6 SKIS OPERATION

When ignition power is supplied to the SKIM, the SKIM performs an internal self-test. After the self-test is complete, the SKIM energizes the antenna (this activates the transponder chip) and sends a challenge to the transponder chip. The transponder chip responds to the challenge by generating an encrypted response message using the following:

Secret Key - an electronically stored value (identification number) that is unique to each SKIS. The secret key is stored in the SKIM, ECM and all ignition key transponders.

Challenge - a random number that is generated by the SKIM at each ignition key cycle.

The secret key and challenge are the two variables used in the algorithm that produces the encrypted response message. The transponder uses the crypto algorithm to receive, decode and respond to the message sent by SKIM. After responding to the coded message, the transponder sends a transponder ID message to the SKIM. The SKIM compares the transponder ID message to the available valid key codes in SKIM memory (8 key maximum at any one time). After validating the ignition key, the SKIM sends a J1850 Bus message called a seed request to the ECM, then waits for the ECM response. If the ECM does not respond, the SKIM will send the seed request again. After twenty failed attempts, the SKIM will stop sending the seed request and store a trouble code in memory. If the ECM sends a seed response, the SKIM sends a valid/invalid key message to the ECM. This is an encrypted message that is generated using the following:

- VIN - Vehicle Identification Number.
- Seed - a random number that is generated by the ECM at each ignition key cycle.

The VIN and seed are two variables used in the rolling code algorithm that encrypts the valid/invalid key message. The ECM uses the rolling code algorithm to receive, decode and respond to the valid/invalid key message sent by the SKIM. After sending the valid/invalid key message, the SKIM waits 3.5 seconds for an ECM status message from the ECM. If the ECM does not respond with a valid key message to the SKIM, a fault is detected and a code is stored.

The SKIS incorporates a warning lamp located in the instrument cluster. The lamp receives switched ignition voltage and is hardwired to the instrument cluster. The SKIS lamp is actuated when the SKIM sends a J1850 Bus message to the instrument cluster requesting the lamp on, off or flashing. The instrument cluster then provides the ground for the lamp.

The SKIM will request lamp operation for the following:

– bulb check at ignition on
– to alert the vehicle operator to a SKIS malfunction
– when the SKIM is in customer key programming mode

For all faults except transponder faults the lamp remains on steady. In the event of a transponder fault the lamp will flash at a rate of 1Hz (once per second). If a fault is present, the lamp will remain on or flashing for the complete ignition cycle. If a fault is stored in SKIM memory which prevents the system from operating properly, the ECM will allow the engine to start and idle for 2 seconds then stall. This may occur up to six times. After the sixth attempt, the ECM prevents the engine from cranking until the fault is corrected.

3.3 DIAGNOSTIC TROUBLE CODES

Each diagnostic trouble code (DTC) is diagnosed by following a specific procedure. The diagnostic test procedure contains step-by-step instruction for determining the cause of the DTC as well as no trouble code problems. It is not necessary to perform all of the tests in this book to diagnose an individual code.

Always begin diagnosis by reading the DTCs using the DRBIII®. This will direct you to the specific test(s) that must be performed.

3.3.1 HARD CODE

A DTC that comes back within one cycle of the ignition key is a hard code. This means that the problem is current every time the ECM/SKIM checks that circuit or function. Procedures in this manual verify if the DTC is a hard code at the beginning of each test. When the fault is not a hard code, an intermittent test must be performed. NOTE: If the DRBIII® displays faults for multiple components (i.e. ECT, VSS, IAT sensors) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate schematic to identify shared circuits.

3.3.2 INTERMITTENT CODE

A DTC that is not current every time the ECM/SKIM checks the circuit or function is an intermittent code. Most intermittent DTCs are caused by wiring or connector problems. Problems that come and go like this are the most difficult to diagnose; they must be looked for under specific conditions that cause them. The following checks may assist you in identifying a possible intermittent problem.

- Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.
- Visually inspect the related wire harness. Look for chafed, pierced, or partially broken wire.
- Refer to hotlines or technical service bulletins that may apply.

NOTE: Electromagnetic (radio) interference can cause an intermittent system malfunction. This interference can interrupt communication between the ignition key transponder and the SKIM.

3.3.3 ECM DIAGNOSTIC TROUBLE CODES

IMPORTANT NOTE: Before replacing the ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most ECM driver/control circuit failures are caused by internal failures to components (i.e. relays and solenoids) and shorted circuits (i.e. sensor pull-ups, drivers and ground circuits). These faults are difficult to detect when a double fault has occurred and only one DTC has set.

If the DRBIII® displays faults for multiple components (i.e. VSS, ECT, Batt Temp, etc.), identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate wiring diagrams to identify shared circuits.

A/C CLUTCH RELAY CIRCUIT OPEN CIRCUIT

A/C CLUTCH RELAY CIRCUIT SHORT CIRCUIT

A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

A/C PRESSURE SENSOR CIRCUIT SUPPLY VOLTAGE TOO HIGH OR LOW

ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY WITH BRAKE SWITCH

ACC PEDAL POSITION SENSOR 1 CKT SIGNAL VOLTAGE TOO HIGH

ACC PEDAL POSITION SENSOR 1 CKT SUPPLY VOLTAGE TOO HIGH OR LOW

ACC PEDAL POSITION SENSOR 2 CKT POTENTIOMETER PLAUSIBILITY 1/2

ACC PEDAL POSITION SENSOR 2 CKT SIGNAL VOLTAGE TOO HIGH

ACC PEDAL POSITION SENSOR 2 CKT SUPPLY VOLTAGE TOO HIGH OR LOW

A/D CONVERTER ERROR 5 VOLT SUPPLY FAILURE

A/D CONVERTER ERROR GROUND TO APP FAILURE

A/D CONVERTER ERROR RAM TEST FAILURE

AFTER RUN SHUT OFF ERROR-INJ. POWERSTAGE

AFTER RUN SHUT OFF ERROR-ZERO QUANTITY

AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO HIGH

AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO LOW

ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO EARLY

ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO LATE

BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH

BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO LOW

BATTERY SENSE LINE 1 VOLTAGE TOO HIGH

BATTERY SENSE LINE 1 VOLTAGE TOO LOW

BATTERY SENSE LINE 2 VOLTAGE TOO HIGH

BATTERY SENSE LINE 2 VOLTAGE TOO LOW

BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

BOOST PRESSURE SENSOR PLAUSIBILITY

BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH

BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW

BOOST PRESSURE SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW

BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY AFTER INIT.

BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT

CALCULATED INJECTOR VOLTAGE TOO HIGH

CAN BUS MESSAGE MISSING FROM TCM

CAN BUS MUTE

CAN BUS OPEN

CAPACITOR VOLTAGE 1 VOLTAGE TOO HIGH

CAPACITOR VOLTAGE 1 VOLTAGE TOO LOW

CKP POSITION SENSOR CIRCUIT DYNAMIC PLAUSIBILITY

CMP POSITION SENSOR CIRCUIT CMP/CKP SYNC FAILURE

CMP POSITION SENSOR CIRCUIT DYNAMIC PLAUSIBILITY

CMP POSITION SENSOR CIRCUIT SIGNAL FREQUENCY TOO HIGH

CMP POSITION SENSOR CIRCUIT STATIC PLAUSIBILITY

CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE

CYLINDER 1-INJECTOR CIRCUIT LOAD DROP

CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

CYLINDER 2-INJECTOR CIRCUIT CURRENT DECREASE

CYLINDER 2-INJECTOR CIRCUIT LOAD DROP

CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

CYLINDER 3-INJECTOR CIRCUIT CURRENT DECREASE

CYLINDER 3-INJECTOR CIRCUIT LOAD DROP

CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

CYLINDER 4-INJECTOR CIRCUIT CURRENT DECREASE

CYLINDER 4-INJECTOR CIRCUIT LOAD DROP

CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

CYLINDER 5-INJECTOR CIRCUIT CURRENT DECREASE

CYLINDER 5-INJECTOR CIRCUIT LOAD DROP

CYLINDER 5-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

CYLINDER 5-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

ECM ERROR GATE ARRAY - COMMUNICATION

ECM ERROR GATE ARRAY - QUANTITY STOP

ECM ERROR RECOVERY HAS OCCURRED

ECM ERROR REDUNDANT OVERRUN MONITORING

EEPROM PLAUSIBILITY CHECKSUM ERROR

EEPROM PLAUSIBILITY CODE WORD INCORRECT OR MISSING

EEPROM PLAUSIBILITY COMMUNICATION ERROR

EEPROM PLAUSIBILITY VARIATION NUMBER ERROR

EEPROM PLAUSIBILITY VIN CHECKSUM ERROR

EEPROM PLAUSIBILITY WRITE ERROR

EGR SOLENOID CIRCUIT NEGATIVE DEVIATION

EGR SOLENOID CIRCUIT OPEN CIRCUIT

EGR SOLENOID CIRCUIT SHORT CIRCUIT

ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

EXTERNAL FUEL QUANTITY ACCESS DEMAND NOT PLAUSIBLE

EXTERNAL FUEL QUANTITY ACCESS PARITY

EXTERNAL FUEL QUANTITY ACCESS TOGGLE BIT

EXTERNAL FUEL QUANTITY ACCESS TORQUE

FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO HIGH

FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO LOW

FUEL PRESS SENSOR CIRCUIT MALF SUPPLY VOLTAGE TOO HIGH OR LOW

FUEL PRESSURE SOLENOID OPEN CIRCUIT

FUEL PRESSURE SOLENOID POWER STAGE ERROR

FUEL PRESSURE SOLENOID SHORT CIRCUIT

FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING

FUEL RAIL PRESSURE MALFUNCTION LEAKAGE DETECTED

FUEL RAIL PRESSURE MALFUNCTION POSITIVE DEVIATION AT ENGINE SPEED TOO HIGH

FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO HIGH - SHUT OFF

FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO LOW

GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH

GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO LOW

GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE TOO HIGH

GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE TOO LOW

GENERATOR FIELD CONTROL MALF HIGH GENERATOR CURRENT

GENERATOR FIELD CONTROL MALF OPEN CIRCUIT

GENERATOR FIELD CONTROL MALF SHORT CIRCUIT

GENERATOR FIELD CURRENT TOO HIGH

GLOW PLUG 1 CONTROL CIRCUIT OPEN CIRCUIT

GLOW PLUG 1 CONTROL CIRCUIT SHORT CIRCUIT

GLOW PLUG 2 CONTROL CIRCUIT OPEN CIRCUIT

GLOW PLUG 2 CONTROL CIRCUIT SHORT CIRCUIT

HYDRAULIC COOLING FAN SOLENOID OPEN CIRCUIT

HYDRAULIC COOLING FAN SOLENOID SHORT CIRCUIT

IGNITION SWITCH PLAUSIBILITY

INJECTOR CLASSSIFICATION ERROR CHECKSUM ERROR

INJECTOR CLASSIFICATION ERROR INVALID INJECTOR CLASS

INTAKE AIR TEMPERATURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

INTAKE AIR TEMPERATURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

INTAKE PORT SWIRL ACTUATOR INTERNAL FAULT

INTAKE PORT SWIRL ACTUATOR OPEN CIRCUIT
INTAKE PORT SWIRL ACTUATOR SHORT CIRCUIT
J1850 COMMUNICATION BUS LOST ARBITRATION
J1850 COMMUNICATION BUS RECEIVE TIMEOUT
J1850 COMMUNICATION BUS SHORT TO GROUND
J1850 COMMUNICATION BUS SHORT TO VOLTAGE
J1850 COMMUNICATION BUS SPI ERROR
J1850 COMMUNICATION BUS TRANSMIT BUFFER OVERRUN
J1850 COMMUNICATION BUS UNAUTHORIZED RESET
MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH
MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO LOW
MASS AIR FLOW SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW
MIL/DIAG LAMP VIA J1850 BUS - IN FRAME RESPONSE ERROR
MIL/DIAG LAMP VIA J1850 BUS - STATUS ERROR
OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO HIGH
OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO LOW
OIL PRESS SENSOR CKT MALF SUPPLY VOLTAGE TOO HIGH OR LOW
P/N SWITCH CIRCUIT RATIONALITY PLAUSIBILITY
S/C SWITCH SIGNAL CIRCUIT PLAUSIBILITY
S/C SWITCH SIGNAL CIRCUIT SIGNAL VOLTAGE TOO HIGH
S/C SWITCH SIGNAL CIRCUIT SIGNAL VOLTAGE TOO LOW
SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO HIGH
SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO LOW
SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO HIGH
SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO LOW
SKIM SYSTEM INVALID KEY CODE RECEIVED
SKIM SYSTEM INVALID SECRET KEY IN EEPROM
SKIM SYSTEM KEY COMMUNICATION TIMED OUT
SKIM SYSTEM WRITE ACCESS TO EEPROM FAILURE
STARTER RELAY CIRCUIT SHORT CIRCUIT
SYSTEM VOLTAGE TOO HIGH
SYSTEM VOLTAGE TOO LOW
TRANSFER CASE POSITION SENSOR PLAUSIBILITY
TRANSFER CASE POSITION SENSOR PLAUSIBILITY 2
TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO HIGH
TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO LOW
TRANS CONTROL INTERNAL CONTROLLER
TRANS CONTROL 1-2/4-5 SOLENOID CIRCUIT
TRANS CONTROL 2-3 SOLENOID CIRCUIT
TRANS CONTROL 3-4 SOLENOID CIRCUIT
TRANS CONTROL TCC SOLENOID CIRCUIT
TRANS CONTROL MOD. PRESS SOLENOID CIRCUIT
TRANS CONTROL SHIFT PRESSURE SOLENOID CIRCUIT
TRANS CONTROL SOLENOID SUPPLY VOLTAGE
TRANS CONTROL N2 OR N3 INPUT SENSOR CIRCUIT
TRANS CONTROL INTERNAL SHIFT FAILURE
TRANS CONTROL ABS SENSOR MESSAGE
TRANS CONTROL IMPROPER RATIO OR TRANSMISSION SLIPPING
TRANS CONTROL ENGINE T-CASE SWITCH MESSAGE
TRANS CONTROL TCC FAULT
TRANS CONTROL IMPROPER GEAR
TURBOCHARGER WASTEGATE SOL CKT NEGATIVE DEVIATION
TURBOCHARGER WASTEGATE SOL CKT OPEN CIRCUIT
TURBOCHARGER WASTEGATE SOL CKT POSITIVE DEVIATION
TURBOCHARGER WASTEGATGE SOL CKT SHORT CIRCUIT
VEHICLE SPEED SENSOR FREQUENCY TOO HIGH
VEHICLE SPEED SENSOR PLAUSIBILITY
VEHICLE SPEED SENSOR SIGNAL VOLTAGE TOO HIGH
VISCOUS HEATER OPEN CIRCUIT
VISCOUS HEATER SHORT CIRCUIT
VOLTAGE REGULATOR SIGNAL VOLTAGE TOO HIGH
VOLTAGE REGULATOR SIGNAL VOLTAGE TOO LOW

3.3.4 SKIM DIAGNOSTIC TROUBLE CODES

ANTENNA FAILURE
COP FAILURE
EEPROM FAILURE

INTERNAL FAULT
PCM STATUS FAILURE
RAM FAILURE
ROLLING CODE FAILURE
SERIAL LINK EXTERNAL FAULT
SERIAL LINK INTERNAL FAULT
STACK OVERFLOW FAILURE
TRANSPONDER COMMUNICATION FAILURE
TRANSPONDER CRC (CYCLIC REDUNDANCY CHECK) FAILURE
TRANSPONDER ID MISMATCH
TRANSPONDER RESPONSE MISMATCH
VIN MISMATCH

3.3.5 HANDLING NO TROUBLE CODE PROBLEMS

After reading Section 3.0 (System Description and Functional Operation), you should have a better understanding of the theory and operation of the on-board diagnostics and how this relates to the diagnosis of a vehicle that may have a driveability-related symptom or complaint. When there are no trouble codes present, refer to the no trouble code (*) tests.

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading the DTCs, erasing the DTCs, lab scope usage and other DRBIII® functions.

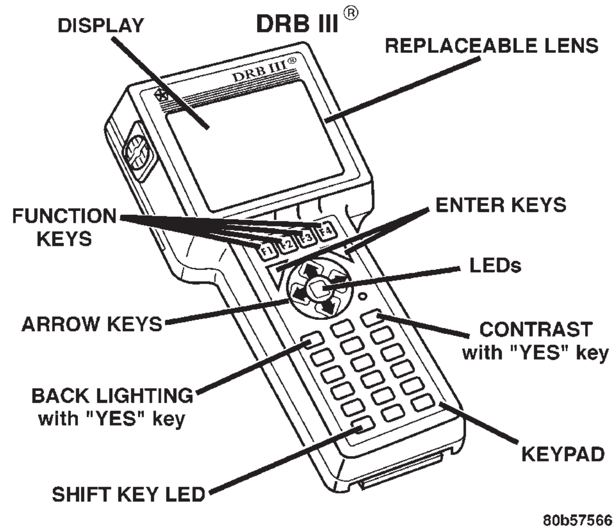
3.4.1 DRBIII® DOES NOT POWER UP

If the LEDs do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage at data link connector cavity 16. A minimum of 11.0 volts is required to adequately power the DRBIII®. Check for proper ground connection at data link connector cavities 4 and 5.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, an inoperative DRBIII® may be the result of a faulty cable or vehicle wiring. For a blank screen, refer to the appropriate diagnostic manual.

3.4.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



4.0 DISCLAIMERS, SAFETY, WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front wheel drive vehicles; the parking brake does not hold the drive wheels.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make electrical contact.

When diagnosing a powertrain system problem, it is important to follow approved procedures where applicable. These procedures can be found in the service manual. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the powertrain system are intended to be serviced as an assembly only. Attempting to remove or repair certain system subcomponents may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND SPECIFICATION LIMITS.

Follow the vehicle manufacturer's service specifications at all times.

- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tip or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0-500 peak volts AC 0-500 volts DC
Ohms (Resistance)*	0-1.12 megohms
Frequency Measure Frequency Generated	0-10 kHz
Temperature	-58 - +1100°F -50 - +600°C

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- The circuit being tested must be protected by a 10 amp fuse or circuit breaker.
- Use the low current shunt to measure circuits up to 10 amps. Use the high current shunt to measure circuits exceeding 10 amps.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.

4.3 WARNINGS AND CAUTIONS

4.3.1 ROAD TEST WARNINGS

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not hang the DRBIII® from the rear view mirror. Do not attempt to read the DRBIII® while driving. Have an assistant available to operate the DRBIII®.

4.3.2 VEHICLE DAMAGE CAUTIONS

Before disconnecting any control module, make sure the ignition is off. Failure to do so could damage the module. When testing voltage or circuit integrity at any control module, use the terminal side (not the wire end) of the harness connector. Do not probe through the insulation; this will damage it and eventually cause it to fail because of corrosion.

Be careful when performing electrical test so as to prevent accidental shorting of terminals. Such a mistake can damage fuses or components. Also, a second code could be set, making diagnosis of the original problem more difficult.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box) scan tool
vacuum gauge
ammeter
ohmmeter
voltmeter
jumper wires and probes
oscilloscope

6.0 GLOSSARY OF TERMS

A/C air conditioning

APP accelerator pedal position (sensor)

ASD automatic shut down

backfire, popback fuel ignites in either the intake or the exhaust system

BCM body control module

BP boost pressure (sensor)

CKP crankshaft position (sensor)

CMP camshaft position (sensor)

cuts out, misses a steady pulsation or the inability of the engine to maintain a consistent rpm

DLC data link connector

detonation, spark knock a mild to severe ping, especially under loaded engine conditions

ECM engine control module

ECT engine coolant temperature (sensor)

EGR exhaust gas recirculation (solenoid/valve)

hard start the engine takes longer than usual to start, even though it is able to crank at normal speed.

IAT intake air temperature (sensor)

lack of power, sluggish the engine power output has been reduced

MAF mass air flow (sensor)

MIL malfunction indicator lamp

ms millisecond(s)

PDC power distribution center

poor fuel economy there is significantly less fuel mileage than other vehicles of the same design and configuration

runs rough/ unstable idle the engine runs unevenly at idle causing the engine to shake if it is severe enough

S/C speed control

SCI standard corporate interface

SKIM sentry key immobilizer module

SKIS sentry key immobilizer system

start and stall The engine starts but immediately dies (stalls)

surge engine rpm fluctuation without corresponding change in accelerator pedal position

SRC signal range check

WIF water in fuel (sensor)

VSS vehicle speed sensor

NOTES

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
*NO RESPONSE FROM ECM (PCI BUS) - DIESEL ONLY

POSSIBLE CAUSES
ECM PCI NO RESPONSE
PCI BUS CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, enter Body then Body Computer. With the DRB, enter Anti-Lock Brakes. With the DRB, enter Body then Electro/Mechanical Cluster (MIC). With the DRB, enter Passive Restraints then Airbag. Were you able to establish communications with any of the modules? Yes → Go To 2 No → Refer to symptom PCI Bus Communication Failure in the Communications category. Perform ROAD TEST VERIFICATION - VER-2.	All
2	With the DRB read ECM Diagnostic Trouble Codes. This is to ensure power and grounds to the ECM are operational. **NOTE: If the DRB will not read ECM DTCs, follow the NO RESPONSE TO ECM (SCI only) symptom path, if vehicle will start. For NO START Conditions follow the no start symptom in the powertrain diagnostic information.** Turn the ignition off. Disconnect the ECM C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to ground. Connect the Red lead to the PCI Bus circuit in the ECM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the PCI Bus circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*NO RESPONSE FROM ECM (SCI ONLY) - DIESEL ONLY

POSSIBLE CAUSES
CHECK ECM POWERS AND GROUNDS
SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
SCI TRANSMIT CIRCUIT SHORTED TO GROUND
SCI TRANSMIT CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Perform the symptom Checking ECM Power and Ground Circuits in the Driveability category. Did the vehicle pass this test? Yes → Go To 2 No → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the DRB from the DLC. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Disconnect the TCM C1 harness connector. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Transmit circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Transmission Control Module in accordance with the service information. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the ECM harness connectors. Disconnect the TCM C1 harness connector. Turn the ignition on. Measure the voltage of the SCI Transmit circuit at the DLC connector (cav 7). Is the voltage above 1.0 volt? Yes → Repair the SCI Transmit circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All

*NO RESPONSE FROM ECM (SCI ONLY) - DIESEL ONLY — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the DRB from the DLC. Measure the resistance of the SCI Transmit circuit between the ECM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the SCI Transmit circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*PCI BUS COMMUNICATION FAILURE

POSSIBLE CAUSES
WITH THE DRB PERFORM A MODULE SCAN
OPEN PCI BUS CIRCUIT AT THE DATA LINK CONNECTOR
USING THE DRB, PERFORM THE PCI BUS CONTROL MODE
DISCONNECT THE MODULE(S) HARNESS CONNECTOR
PCI BUS CIRCUIT SHORTED TO VOLTAGE
DISCONNECT THE MODULE(S) HARNESS CONNECTOR
PCI BUS CIRCUIT SHORTED TO GROUND
WIRING HARNESS INTERMITTENT FAILURE

TEST	ACTION	APPLICABILITY
1	**Note: Determine which modules this vehicle is equipped with before beginning.** Connect the Diagnostic Junction Port Tester #8339 to the DRB and to the Diagnostic Junction Port. Using the DRB, along with the Diagnostic Junction Port Tester #8339, select Junction Port Tool then PCI Bus Module Scan and follow the instructions on the DRB. Was the DRB able to scan (I/D or communicate) with any modules? Yes → Refer to the Communication category for the related symptom(s). (Individual module no responses). Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Measure the resistance of the PCI Bus circuit between the Data Link Connector and the Diagnostic Junction Port connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the PCI Bus circuit for an open between the DLC and the Diagnostic Junction Port. Perform BODY VERIFICATION TEST - VER 1.	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Determine which modules this vehicle is equipped with before beginning.** Connect the Diagnostic Junction Port Tester #8339 to the DRB and to the Diagnostic Junction Port. Using the DRB, along with the Diagnostic Junction Port Tester #8339, select Junction Port Tool then PCI Bus Control Mode and follow the instructions on the DRB. **Note: Perform this function on each pin that is equipped with a PCI Bus circuit.** Did the DRB display No Modules Responding from any of the pins that were scanned? Yes → Go To 4 No → Check the PCI Bus circuit between the DLC and the Diagnostic Junction Port connector for a short to voltage or to ground, repair as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Diagnostic Junction Port Tester cable from the DRB. Keep the tester connected to the Diagnostic Junction Port. Turn the ignition on. Measure the voltage of the PCI Bus circuit on the Diagnostic Junction Port Tester that the DRB displayed No Modules Responding. Is the voltage steadily above 7.0 volts? Yes → Go To 5 No → Go To 6	All
5	Measure the voltage of the PCI Bus circuit on the Diagnostic Junction Port tester that previously measured above 7.0 volts. **Note: Turn the ignition off before disconnecting any module harness connector then turn the ignition on.** Disconnect the module harness connector(s). **NOTE: If the problem occurred on a bus circuit that has more than one module on the same circuit, observe the voltmeter while disconnecting each module connector one at a time.** Is the voltage steadily above 7.0 volts with the module(s) disconnected? Yes → Repair the PCI Bus circuit that measured over 7.0 volts for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to voltage was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Diagnostic Junction Port Tester cable from the DRB. Keep the tester connected to the Diagnostic Junction Port. Turn the ignition off. Disconnect the negative battery cable. Measure the resistance between ground and the PCI Bus circuit on the Diagnostic Junction Port Tester that the DRB displayed No Modules Responding. Is the resistance below 100.0 ohms? Yes → Go To 7 No → Go To 8	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Disconnect the negative battery cable. Measure the resistance between ground and the PCI Bus circuit at the Diagnostic Junction Port tester that previously measured below 100.0 ohms. Disconnect the module harness connector(s). **NOTE: If the problem occurred on a bus circuit that has more than one module on the same circuit, observe the ohmmeter while disconnecting each module connector one at a time.** Is the resistance below 100.0 ohms with the module(s) disconnected? Yes → Repair the PCI Bus circuit that measured below 100.0 ohms for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to ground was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom List:

P0070-AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO HIGH

P0070-AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0070-AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO HIGH.

When Monitored and Set Condition:

P0070-AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: When the BCM detects high voltage on the Ambient Air Temperature Sensor Signal circuit, a J1850 Bus message is sent to the ECM to set this DTC.

P0070-AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: When the BCM detects low voltage on the Ambient Air Temperature Sensor Signal circuit, a J1850 Bus message is sent to the ECM to set this DTC.

POSSIBLE CAUSES
REFER TO COMPASS/MINI TRIP COMPUTER SYMPTOM
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: The Ambient Air Temperature Sensor is hardwired to the Body Control Module (BCM). The Ambient Air Temperature Circuit DTCs are set in the ECM via the J1850 Bus by the BCM.** Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Cycle the ignition switch from OFF to ON. Monitor the DRBIII® for ECM DTCs. Does the DRBIII® display this DTC? Yes → Refer to symptom *TEMPERATURE DISPLAY INACCURATE OR INOPERATIVE in the Overhead Console category in the Body Diagnostic Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All

P0070-AMBIENT AIR TEMPERATURE CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH
P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO LOW
P0100-MASS AIR FLOW SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH.

When Monitored and Set Condition:

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The MAF Sensor Signal voltage is above 4.8 volts for at least 3 seconds.

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Mass Air Flow Sensor Signal voltage is below 1.6 volts for at least 3 seconds.

P0100-MASS AIR FLOW SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Sensor Reference Voltage A voltage to the MAF is below 4.9 volts or above 5.1 volts for at least 3 seconds.

POSSIBLE CAUSES
ASD RELAY OUTPUT CIRCUIT OPEN
ECM - 5-VOLT SUPPLY CIRCUIT
MASS AIRFLOW SENSOR
SENSOR GROUND OPEN
INTERMITTENT CONDITION
SENSOR REFERENCE VOLTAGE A CIRCUIT OPEN
MAF SENSOR SIGNAL CIRCUIT OPEN
FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
SENSOR REFERENCE VOLTAGE A CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
MAF SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
ECM SENSOR GROUND CIRCUIT OPEN
FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

POSSIBLE CAUSES
SENSOR REFERENCE VOLTAGE A CIRCUIT SHORTED TO GROUND
MAF SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
SENSOR REFERENCE VOLTAGE A CIRCUIT SHORTED TO VOLTAGE
MAF SENSOR CIRCUIT SHORTED TO VOLTAGE
ECM - MAF SENSOR SIGNAL CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** **NOTE: Inspect the turbocharger inlet tube between the MAF Sensor and the turbocharger for damage, restriction or poor connection. Any of these conditions can cause a MAF Plausibility DTC.** Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Does the DRB III display a Mass Air Flow Sensor DTC? Yes → Go To 2 No → Go To 18	All
2	Turn the ignition off. Disconnect the MAF Sensor harness connector. Turn the ignition on. Measure the voltage of the Sensor Reference Voltage A circuit in MAF Sensor harness connector. Is the voltage between 4.7 and 5.3 volts? Yes → Go To 3 No → Go To 11	All
3	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the MAF Sensor Signal circuit. Is the voltage above 1.0 volt? Yes → Repair the MAF Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the MAF Sensor Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Repair the MAF Sensor Signal circuit for an open Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the MAF Sensor Signal circuit. Is the resistance below 1000 ohms? Yes → Repair the MAF Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the MAF Sensor Signal circuit and the Sensor Ground circuit at of the MAF Sensor harness connector. Is the resistance below 1000 ohms? Yes → Repair the MAF Sensor Signal for a short to Sensor Ground . Perform ROAD TEST VERIFICATION - VER-2. No → Go To 7	All
7	Turn the ignition off. Disconnect the MAF Sensor harness connector. Connect a jumper wire between MAF Sensor Signal circuit and the 5-volt supply circuit at the MAF Sensor harness connector . Turn the ignition on. With the DRBIII, read the MAF VOLTS. Does the DRBIII display between 4.0 and 5.5 volts? Yes → Go To 8 No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit between the MAF Sensor and the ECM. Is the resistance below 10.0 ohms? Yes → Go To 9 No → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the MAF Sensor harness connector. Turn the ignition on. Measure the voltage between the 5-volt Supply circuit and the Sensor Ground circuit at the MAF Sensor harness connector. Is the voltage above 4.5 volts? Yes → Go To 10 No → Replace and program the ECM in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
10	Turn the ignition off. Disconnect the MAF Sensor harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the ASD Relay Output circuit in the MAF Sensor harness connector Does the test light illuminate brightly? Yes → Replace the MAF Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
11	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Reference Voltage A circuit. Is the resistance below 10.0 ohms? Yes → Go To 12 No → Repair the Sensor Reference Voltage A circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
12	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the Sensor Reference Voltage A circuit and the Sensor Ground circuit at the MAF Sensor harness connector. Disconnect the Accelerator Pedal Position Sensor harness connector. Measure the resistance between the Sensor Reference Voltage A circuit and both Accelerator Pedal Position Sensor Ground circuits. Is the resistance above 100 kohms for both measurements? Yes → Go To 13 No → Repair the Sensor Reference Voltage A circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
13	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Sensor Reference Voltage A circuit at the MAF harness connector. Is the resistance below 1000 ohms? Yes → Repair the Sensor Reference Voltage A circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 14	All
14	Turn the ignition off. Disconnect the MAF Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Sensor Reference Voltage A circuit in the ECM harness connector. Is the voltage above 1.0 volt? Yes → Repair the Sensor Reference Voltage A circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 15	All
15	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the 5-volt Supply circuit and the Sensor Ground circuit at the Fuel Pressure Sensor harness connector. Is the resistance above 1000 ohms? Yes → Go To 16 No → Repair the Fuel Pressure Sensor 5-volt Supply circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
16	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the 5-volt Supply circuit at the Fuel Pressure Sensor harness connector. Is the resistance below 1000 ohms? Yes → Repair the Fuel Pressure Sensor 5-volt Supply circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 17	All

P0100-MASS AIR FLOW SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
17	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the 5-volt Supply circuit in the Fuel Pressure Sensor harness connector. Is the voltage above 1.0 volt? Yes → Repair the Fuel Pressure Sensor 5-volt Supply circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
18	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH
P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO LOW
P0606-ECM ERROR GATE ARRAY - COMMUNICATION
P0606-ECM ERROR GATE ARRAY - COMMUNICATION NOT VERIFIED
P0606-ECM ERROR GATE ARRAY - QUANTITY STOP
P0606-ECM ERROR RECOVERY HAS OCCURRED
P0606-ECM ERROR REDUNDANT OVERRUN MONITORING
P1206-CALCULATED INJECTOR VOLTAGE TOO HIGH
P1206-CALCULATED INJECTOR VOLTAGE TOO LOW
P1601-CAPACITOR VOLTAGE 1 VOLTAGE TOO HIGH
P1601-CAPACITOR VOLTAGE 1 VOLTAGE TOO LOW
P1606-AFTER RUN SHUT OFF ERROR-INJECTION POWERSTAGE
P1606-AFTER RUN SHUT OFF ERROR-ZERO QUANTITY
P1608-A/D CONVERTER ERROR APP SENSOR GROUND FAILURE
P1608-A/D CONVERTER ERROR INTERNAL FAILURE
P1608-A/D CONVERTER ERROR VOLTAGE FAILURE
P1610-VOLTAGE REGULATOR SIGNAL VOLTAGE TOO HIGH
P1610-VOLTAGE REGULATOR SIGNAL VOLTAGE TOO LOW
P1680-EEPROM PLAUSIBILITY CHECKSUM ERROR
P1680-EEPROM PLAUSIBILITY CODE WORD INCORRECT OR MISSING
P1680-EEPROM PLAUSIBILITY COMMUNICATION ERROR
P1680-EEPROM PLAUSIBILITY VARIATION NUMBER ERROR
P1680-EEPROM PLAUSIBILITY VIN CHECKSUM ERROR
P1680-EEPROM PLAUSIBILITY WRITE ERROR
P1685-SKIM SYSTEM INVALID SECRET KEY IN EEPROM
P1685-SKIM SYSTEM WRITE ACCESS TO EEPROM FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH.

When Monitored and Set Condition:

P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Barometric Pressure Sensor Signal is above 4.86 volts.

P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Barometric Pressure Sensor Signal is below 0.22 volts.

P0606-ECM ERROR GATE ARRAY - COMMUNICATION

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P0606-ECM ERROR GATE ARRAY - COMMUNICATION NOT VERIFIED

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P0606-ECM ERROR GATE ARRAY - QUANTITY STOP

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P0606-ECM ERROR RECOVERY HAS OCCURRED

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P0606-ECM ERROR REDUNDANT OVERRUN MONITORING

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P1601-CAPACITOR VOLTAGE 1 VOLTAGE TOO HIGH

When Monitored: With the engine running. During every 180° of engine rotation.

Set Condition: The ECM determines that the capacitor voltage is greater than 100 volts.

P1601-CAPACITOR VOLTAGE 1 VOLTAGE TOO LOW

When Monitored: With the engine running. During every 180° of engine rotation.

Set Condition: The ECM determines that the capacitor voltage is less than 91 volts.

P1606-AFTER RUN SHUT OFF ERROR-INJECTION POWERSTAGE

When Monitored: At ignition off.

Set Condition: The ECM detects the engine speed has not fallen below 650 RPM within 0.5 seconds after ignition off.

P1606-AFTER RUN SHUT OFF ERROR-ZERO QUANTITY

When Monitored: At ignition off.

Set Condition: The ECM detects the engine speed has not fallen below 650 RPM within 0.5 seconds after ignition off.

P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

P1680-EEPROM PLAUSIBILITY CHECKSUM ERROR

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P1680-EEPROM PLAUSIBILITY CODE WORD INCORRECT OR MISSING

When Monitored: With the ignition on.

Set Condition: The ECM detects the codeword test routine not yet performed (for injector classification).

P1680-EEPROM PLAUSIBILITY COMMUNICATION ERROR

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P1680-EEPROM PLAUSIBILITY VARIATION NUMBER ERROR

When Monitored: With the ignition on.

Set Condition: The ECM detects incorrect software programming.

P1680-EEPROM PLAUSIBILITY VIN CHECKSUM ERROR

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P1680-EEPROM PLAUSIBILITY WRITE ERROR

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal failure.

P1685-SKIM SYSTEM INVALID SECRET KEY IN EEPROM

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal mismatch of the secret key code when performing an internal EEPROM check.

P1685-SKIM SYSTEM WRITE ACCESS TO EEPROM FAILURE

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal EEPROM fault.

POSSIBLE CAUSES
ENGINE CONTROL MODULE
INTERMITTENT CONDITION

P0105-BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: This DTC indicates an internal ECM problem.** Turn the ignition on. With the DRBIII®, erase ECM DTCs. Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the DRBIII®, read the ECM DTCs. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Intake Air Temperature Sensor Signal voltage is above 4.83 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
INTAKE AIR TEMP SENSOR GROUND CIRCUIT OPEN
INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT OPEN
IAT SENSOR
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the IAT Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the IAT Sensor Signal circuit. Is the voltage below 1.0 volt? Yes → Go To 3 No → Repair the Intake Air Temperature Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. **NOTE: Remove the jumper wire.**	All

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the IAT Sensor harness connector. Measure the resistance of the Intake Air Temperature Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Intake Air Temperature Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the IAT Sensor harness connector. Connect a jumper wire between the IAT Sensor Signal and IAT Sensor Ground circuits in the IAT Sensor harness connector. Turn the ignition on. Monitor the DRB for ECM DTCs. Does the DRB display P0110 INTAKE AIR TEMP. SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW? Yes → Replace the Intake Air Temperature Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the IAT Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit between the ECM harness connector and the IAT Sensor harness connector. Is the resistance below 10.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Intake Air Temperature Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Intake Air Temperature Sensor Signal voltage is below 0.073 volt.

POSSIBLE CAUSES
INTERMITTENT CONDITION
IAT SENSOR
INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the IAT Sensor harness connector. Turn the ignition on. Monitor the DRB for ECM DTCs. Does the DRB display P0110 INTAKE AIR TEMP SIGNAL VOLTAGE TOO HIGH? Yes → Replace the Intake Air Temperature Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the IAT Sensor harness connector. Measure the resistance between ground and the Intake Air Temperature Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Intake Air Temperature Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0110-INTAKE AIR TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the IAT Sensor harness connector. Measure the resistance between the Intake Air Temperature Sensor Signal circuit and the Sensor Ground circuit. Is the resistance above 100 kohms? Yes → Go To 5 No → Repair the Intake Air Temperature Sensor Signal circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Engine Coolant Temperature Sensor Signal voltage is above 4.98 volts for more than 3 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ECM ECT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
ECT SENSOR GROUND CIRCUIT OPEN
ECT SENSOR
ECT SENSOR SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: If multiple DTCs are present, the most likely cause is a 5-Volt Supply or Sensor Ground circuit shorted to voltage or ground. Refer to the Service Information Wiring section for circuits that would affect multiple DTCs.** Turn the ignition on. With the DRB, monitor the Engine Coolant Temperature (ECT) Sensor voltage. Is the ECT Sensor voltage above 4.98 volts? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the ECT Sensor harness connector. Turn the ignition on. Measure the voltage on the ECT Sensor Signal circuit. Is the voltage above 5.5 volts? Yes → Repair the ECT Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the ECT Sensor harness connector. Connect a jumper wire between the ECT Sensor harness connector cavities. Turn the ignition on. With the DRB, read the ECT Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the ECT Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the ECT Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the ECT Sensor Ground circuit. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Repair the ECT Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the ECT Sensor harness connector. Measure the resistance of the ECT Sensor Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 6 No → Repair the ECT Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Engine Coolant Temperature Sensor Signal voltage is below 0.073 volt for more than 3 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ECT SENSOR
ECT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
ECT SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, monitor the Engine Coolant Temperature (ECT) Sensor voltage. Is the ECT Sensor voltage below 0.073 volt? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the ECT Sensor harness connector. Turn the ignition on. With the DRB, read the ECT Sensor voltage. Is the voltage above 4.0 volts? Yes → Replace the ECT Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the ECT Sensor harness connector. Measure the resistance between ground and the ECT Sensor Signal circuit. Is the resistance above 1000 ohms? Yes → Go To 4 No → Repair the ECT Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0115-ENGINE COOLANT TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the ECT Sensor harness connector. Measure the resistance between the ECT Sensor Signal circuit and Sensor Ground circuit. Is the resistance above 1000 ohms? Yes → Go To 5 No → Repair the ECT Sensor Signal and Ground circuits for a short together. Perform ROAD TEST VERIFICATION - VER-2.	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Fuel Rail Pressure Sensor Signal voltage is above 4.8 volts.

POSSIBLE CAUSES
ECM - FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
ECM - FUEL PRESSURE SENSOR SIGNAL OPEN
FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN
FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
5-VOLT SUPPLY CIRCUIT OPEN
SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
FUEL PRESSURE SENSOR
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.** Turn the ignition on. With the DRB, erase ECM DTCs. Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 10	All

P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Turn the ignition on. Measure the voltage of the Fuel Pressure Sensor Signal circuit. Select the appropriate voltage reading. Voltage is above 5.5 volts. Go To 3 Voltage is between 4.7 and 5.4 volts. Go To 4 Voltage is below 4.7 volts. Go To 9	All
3	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Fuel Pressure Sensor Signal circuit. Is the voltage below 1.0 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Fuel Pressure Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the 5-Volt Supply circuit. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the 5-volt Supply circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Sensor Ground circuit at the Fuel Pressure Sensor and ECM harness connectors. Is the voltage above 1.0 volt at either connector? Yes → Repair the Sensor Ground circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 7 **NOTE: If the Sensor Ground circuit had a short to voltage on it, the ECM will be damaged. Retest the Fuel Pressure Sensor circuit.**	All
7	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Connect a jumper wire between the Fuel Pressure Sensor Signal circuit and the Sensor Ground circuit in the Fuel Pressure Sensor harness connector. Turn the ignition on and monitor the DRB for DTCs. Is DTC P0190 FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO LOW present? Yes → Replace the Fuel Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
9	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Fuel Pressure Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Fuel Pressure Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
10	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Fuel Rail Pressure Sensor Signal voltage is below 0.2 volt.

POSSIBLE CAUSES
FUEL PRESSURE SENSOR
INTERMITTENT CONDITION
FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
ECM - FUEL PRESSURE SENSOR SIGNAL SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.** **NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** Turn the ignition on. With the DRB, erase ECM DTCs. Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Measure the voltage of the Fuel Pressure Sensor Signal circuit. Is the voltage between 4.7 and 5.3 volts? Yes → Replace the Fuel Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0190-FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Fuel Pressure Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Fuel Pressure Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the Sensor Ground circuit and the Fuel Pressure Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 5 No → Repair the Fuel Pressure Sensor Signal circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

P0190-FUEL PRESS SENSOR CIRCUIT MALF SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored and Set Condition:

P0190-FUEL PRESS SENSOR CIRCUIT MALF SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Fuel Pressure Sensor 5-Volt Supply voltage is below 4.9 volts or above 5.1 volts for 100 ms.

POSSIBLE CAUSES
CHECK FOR SENSOR REFERENCE VOLTAGE A CIRCUIT DTCS
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.** Turn the ignition on. With the DRB, read ECM DTCs. Is the High or Low DTC for P0641 SENSOR REFERENCE VOLTAGE A CIRCUIT set with this DTC? Yes → Refer to the symptom list for the related symptom(s). Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom List:

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE
P0201-CYLINDER 1-INJECTOR CIRCUIT LOAD DROP
P0201-CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE
P0201-CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT LOW SIDE
P0202-CYLINDER 2-INJECTOR CIRCUIT CURRENT DECREASE
P0202-CYLINDER 2-INJECTOR CIRCUIT LOAD DROP
P0202-CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE
P0202-CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT LOW SIDE
P0203-CYLINDER 3-INJECTOR CIRCUIT CURRENT DECREASE
P0203-CYLINDER 3-INJECTOR CIRCUIT LOAD DROP
P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE
P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT LOW SIDE
P0204-CYLINDER 4-INJECTOR CIRCUIT CURRENT DECREASE
P0204-CYLINDER 4-INJECTOR CIRCUIT LOAD DROP
P0204-CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE
P0204-CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT LOW SIDE
P0205-CYLINDER 5-INJECTOR CIRCUIT CURRENT DECREASE
P0205-CYLINDER 5-INJECTOR CIRCUIT LOAD DROP
P0205-CYLINDER 5-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE
P0205-CYLINDER 5-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE.

When Monitored and Set Condition:

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE

When Monitored: With the engine running.

Set Condition: The ECM detects an incorrect rate of current decrease after injection occurs.

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE — Continued

P0201-CYLINDER 1-INJECTOR CIRCUIT LOAD DROP

When Monitored: With the engine running.

Set Condition: The ECM detects insufficient current through the injector driver when on.

P0201-CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the common driver circuit.

P0201-CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the injector driver circuit.

P0202-CYLINDER 2-INJECTOR CIRCUIT CURRENT DECREASE

When Monitored: With the engine running.

Set Condition: The ECM detects an incorrect rate of current decrease after injection occurs.

P0202-CYLINDER 2-INJECTOR CIRCUIT LOAD DROP

When Monitored: With the engine running.

Set Condition: The ECM detects insufficient current through the injector driver when on.

P0202-CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the common driver circuit.

P0202-CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the injector driver circuit.

P0203-CYLINDER 3-INJECTOR CIRCUIT CURRENT DECREASE

When Monitored: With the engine running.

Set Condition: The ECM detects an incorrect rate of current decrease after injection occurs.

P0203-CYLINDER 3-INJECTOR CIRCUIT LOAD DROP

When Monitored: With the engine running.

Set Condition: The ECM detects insufficient current through the injector driver when on.

P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the common driver circuit.

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE — Continued

P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the injector driver circuit.

P0204-CYLINDER 4-INJECTOR CIRCUIT CURRENT DECREASE

When Monitored: With the engine running.

Set Condition: The ECM detects an incorrect rate of current decrease after injection occurs.

P0204-CYLINDER 4-INJECTOR CIRCUIT LOAD DROP

When Monitored: With the engine running.

Set Condition: The ECM detects insufficient current through the injector driver when on.

P0204-CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the common driver circuit.

P0204-CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the injector driver circuit.

P0205-CYLINDER 5-INJECTOR CIRCUIT CURRENT DECREASE

When Monitored: With the engine running.

Set Condition: The ECM detects an incorrect rate of current decrease after injection occurs.

P0205-CYLINDER 5-INJECTOR CIRCUIT LOAD DROP

When Monitored: With the engine running.

Set Condition: The ECM detects insufficient current through the injector driver when on.

P0205-CYLINDER 5-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the common driver circuit.

P0205-CYLINDER 5-INJECTOR CIRCUIT OVERCURRENT LOW SIDE

When Monitored: With the engine running.

Set Condition: The ECM detects excessive current on the injector driver circuit.

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE — Continued

POSSIBLE CAUSES
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
COMMON DRIVER CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
COMMON DRIVER CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
COMMON DRIVER CIRCUIT OPEN
FUEL INJECTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 10	All
2	Turn the ignition off. Disconnect the appropriate Cylinder Fuel Injector harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the appropriate Fuel Injector Control circuit. Is the voltage above 1.0 volt? Yes → Repair the Fuel Injector Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the Cylinder Fuel Injector harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Common Driver circuit. Is the voltage above 1.0 volt? Yes → Repair the Common Driver circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Cylinder Fuel Injector harness connector. Measure the resistance between ground and the Fuel Injector Control circuit. Is the resistance below 1000 ohms? Yes → Repair the Fuel Injector Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Cylinder Fuel Injector harness connector. Measure the resistance between ground and the Common Driver circuit. Is the resistance below 1000 ohms? Yes → Repair the Common Driver circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Cylinder Fuel Injector harness connector. Measure the resistance between the Fuel Injector Control circuit and the Common Driver circuit. Is the resistance below 1000 ohms? Yes → Repair the Fuel Injector Control circuit and Common Driver circuit for a short together. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 7	All
7	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Cylinder Fuel Injector harness connector. Measure the resistance of the Fuel Injector Control circuit. Is the resistance below 10 ohms? Yes → Go To 8 No → Repair the Fuel Injector Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Cylinder Fuel Injector harness connector. Measure the resistance of the Common Driver circuit. Is the resistance below 10 ohms? Yes → Go To 9 No → Repair the Common Driver circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Replace the Cylinder Fuel Injector in accordance with the Service Information. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → The repair is complete. Perform ROAD TEST VERIFICATION - VER-2.	All
10	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0235-BOOST PRESSURE SENSOR PLAUSIBILITY

When Monitored and Set Condition:

P0235-BOOST PRESSURE SENSOR PLAUSIBILITY

When Monitored: With the engine speed below 800 rpm.

Set Condition: When the engine is idling, the boost pressure sensor input differs from the barometric pressure sensor input by 2.17 psi for at least 6 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR SIGNAL CIRCUIT
HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR GROUND CIRCUIT
HIGH RESISTANCE IN THE 5-VOLT SUPPLY CIRCUIT
BOOST PRESSURE SENSOR
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** Turn the ignition on. With the DRB, erase ECM DTCs. Turn the ignition off, wait 30 seconds, then start and idle the engine for at least 30 seconds. **NOTE: Engine idle speed must be below 870 RPM.** With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Boost Pressure Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the Boost Pressure Sensor Signal circuit for high resistance. Perform ROAD TEST VERIFICATION - VER-2.	All

P0235-BOOST PRESSURE SENSOR PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Boost Pressure Sensor Ground circuit for high resistance. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the 5-Volt Supply circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the 5-Volt Supply circuit for high resistance. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Replace the Boost Pressure Sensor. Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle, pausing several times to cycle the ignition. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → The repair is complete. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Boost Pressure Sensor Signal voltage exceeds 4.85 volts for at least 2 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
BOOST PRESSURE SENSOR GROUND CIRCUIT OPEN
BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
BOOST PRESSURE SENSOR
POOR CONNECTOR TERMINAL CONTACT
ENGINE CONTROL MODULE (5-VOLT SUPPLY SHORTED TO VOLTAGE)
ENGINE CONTROL MODULE (INTERNAL)
ENGINE CONTROL MODULE (SENSOR SIGNAL SHORTED TO VOLTAGE)

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure all turbocharger inlet and outlet tubes are connected properly, without damage and restriction before continuing with this test. Also ensure the wastegate actuator and actuator rod are attached and functioning properly.** **NOTE: If a P0243 DTC is present with this DTC, diagnose P0243 DTC before continuing.** Turn the ignition on. With the DRB, read the Boost Pressure Sensor voltage. **NOTE: Ensure the turbocharger wastegate is operating properly. This code can be set if turbocharger boost pressure is too high.** Is the voltage above 4.85 volts? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Turn the ignition on. Measure the voltage between ground and the Boost Pressure Sensor 5-volt Supply circuit. Is the voltage above 5.2 volts? Yes → Go To 3 No → Go To 4	All

P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage between ground and the 5-volt Supply circuit. Is the voltage above 1.0 volt? Yes → Repair the 5-volt Supply circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Turn the ignition on. Measure the voltage between ground and the Boost Pressure Sensor Signal circuit. Is the voltage above 1.0 volt? Yes → Go To 5 No → Go To 6	All
5	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage between ground and the Boost Pressure Sensor Signal circuit. Is the voltage above 1.0 volt? Yes → Repair the Boost Pressure Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Boost Pressure Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. **NOTE: Ensure all harness connectors are connected.** Turn the ignition on. Measure the voltage of the Boost Pressure Sensor Signal circuit by back probing ECM harness connector C1, cavity 11. Is the voltage above 4.85 volts? Yes → Replace the Boost Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 8	All
8	Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Ensure good terminal contact between the Turbocharger Boost Pressure Sensor harness connector and the sensor. The repair is complete. Perform ROAD TEST VERIFICATION - VER-2.	All
9	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Turbocharger Boost Pressure Sensor Signal voltage is below 0.30 volt for at least 2 seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
5-VOLT SUPPLY CIRCUIT OPEN
BOOST PRESSURE SENSOR
BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
BOOST PRESSURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER
BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the Turbocharger Boost Pressure Sensor voltage. Is the voltage below 0.3 volt? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Turn the ignition on. Measure the voltage between ground and the 5-volt Supply circuit. Is the voltage above 4.9 volt? Yes → Go To 3 No → Repair the 5-volt Supply circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Turn the ignition on. Connect a jumper wire between the Boost Pressure Sensor Signal and 5-volt Supply circuits. With the DRB, read the Boost Pressure Sensor voltage. Is the Boost Pressure Sensor voltage above 4.5 volts? Yes → Replace the Boost Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Boost Pressure Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 5 No → Repair the Boost Pressure Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the Boost Pressure Sensor Signal circuit and Sensor Ground circuit. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Boost Pressure Sensor Signal circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Boost Pressure Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Boost Pressure Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
8	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0235-BOOST PRESSURE SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored and Set Condition:

P0235-BOOST PRESSURE SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Sensor Reference Voltage B voltage to the Boost Pressure Sensor is below 4.8 volts or above 5.2 volts for at least 100 ms.

POSSIBLE CAUSES
INTERMITTENT CONDITION
APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
SENSOR REFERENCE VOLTAGE B CIRCUIT SHORTED TO GROUND
SENSOR REFERENCE VOLTAGE B CIRCUIT SHORTED TO SENSOR GROUND
SENSOR REFERENCE VOLTAGE B CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** Turn the ignition on. With the DRB, erase ECM DTCs. Turn the ignition off, wait 30 seconds, then turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage between ground and the Sensor Reference Voltage B circuit at the Boost Pressure Sensor harness connector. Is the voltage above 1.0 volt? Yes → Repair the Sensor Reference Voltage B circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0235-BOOST PRESSURE SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Sensor Reference Voltage B circuit at the Boost Pressure Sensor harness connector. Is the resistance above 1000 ohms? Yes → Go To 4 No → Repair the Sensor Reference Voltage B circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the Sensor Ground circuit and the Sensor Reference Voltage B circuit at the Boost Pressure Sensor harness connector. Is the resistance above 1000 ohms? Yes → Go To 5 No → Repair the Sensor Reference Voltage B circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the 5-volt Supply circuit at the APP Sensor harness connector. Is the resistance above 1000 ohms? Yes → Go To 6 No → Repair the APP Sensor 5-volt Supply circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage between ground and the 5-volt Supply circuit at the APP Sensor harness connector. Is the voltage above 1.0 volt? Yes → Repair the APP Sensor 5-volt Supply circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0235-BOOST PRESSURE SENSOR SUPPLY VOLTAGE TOO HIGH OR LOW — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT OPEN CIRCUIT

When Monitored and Set Condition:

P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects an open or short to ground on the Turbocharger Wastegate Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
TURBOCHARGER WASTEGATE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
TURBOCHARGER WASTEGATE SOLENOID CONTROL CKT OPEN
TURBOCHARGER WASTEGATE SOLENOID
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Turbocharger Wastegate Solenoid harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Turbocharger Wastegate Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Turbocharger Wastegate Solenoid Control circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Turbocharger Wastegate Solenoid Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Turbocharger Wastegate Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Turbocharger Wastegate Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Turbocharger Wastegate Solenoid Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Install a substitute Turbocharger Wastegate Solenoid in place of the vehicle's Turbocharger Wastegate Solenoid. **NOTE: Ensure the ECM and Turbocharger Wastegate Solenoid harness connectors are connected.** Turn the ignition on. With the DRB, check for this DTC to set again. Did this DTC set again? Yes → Go To 6 No → Replace the Turbocharger Wastegate Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time.The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT SHORT CIRCUIT

When Monitored and Set Condition:

P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT SHORT CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects a short to battery on the Turbocharger Wastegate Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
TURBOCHARGER WASTEGATE SOLENOID
TURBOCHARGER WASTEGATE SOLENOID CONTROL SHORT TO VOLTAGE
ENGINE CONTROL MODULE - INTERNAL
ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle and monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the Turbocharger Wastegate Solenoid harness connector. Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Does the DRB display P0243 TURBOCHARGER WASTEGATE OPEN CIRCUIT? Yes → Replace the Turbocharger Wastegate Solenoid. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the Turbocharger Wastegate Solenoid harness connector. Turn the ignition on. Measure the voltage of the Turbocharger Wastegate Solenoid Control circuit. Is the voltage below 0.5 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

P0243-TURBOCHARGER WASTEGATE SOLENOID CIRCUIT SHORT CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Turbocharger Wastegate Solenoid harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Turbocharger Wastegate Solenoid Control circuit. Is the voltage below 0.5 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Turbocharger Wastegate Solenoid Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0335-CKP SENSOR CIRCUIT DYNAMIC PLAUSIBILITY

When Monitored and Set Condition:

P0335-CKP SENSOR CIRCUIT DYNAMIC PLAUSIBILITY

When Monitored: With the engine cranking or running.

Set Condition: The ECM detects a change in engine speed that has occurred more rapidly than is physically possible by the engine.

POSSIBLE CAUSES
ENGINE CONTROL MODULE
OPEN SHIELD CIRCUIT
REPLACE THE CRANKSHAFT POSITION SENSOR
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This DTC indicates the Engine Speed Sensor has seen an engine speed above 5200 RPM. This can occur if errant noise is picked up on the CKP Sensor Signal circuit.** Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle and monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 4	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the CKP Sensor harness connector. Measure the resistance of the Shield circuit. Is the resistance below 10.0 ohms? Yes → Go To 3 No → Repair the Shield circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0335-CKP SENSOR CIRCUIT DYNAMIC PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
3	Replace the Crankshaft Position Sensor in accordance with the Service Information. With the DRB, erase ECM DTCs. Perform several drive cycles, turning the ignition off for at least 10 seconds between each drive cycle. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → The repair is complete. Refer to the Service Information to check for engine mechanical problems that may have occurred due to excessive engine speed. Perform ROAD TEST VERIFICATION - VER-2.	All
4	**CAUTION: Refer to the Service Information to check for engine mechanical problems that may have occurred due to excessive engine RPM.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Check the CKP Sensor wiring harness for incorrect routing which may cause EMI interference. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0340-CMP/CKP POSITION SENSOR CIRCUIT - CKP DYNAMIC PLAUSIBILITY

When Monitored and Set Condition:

P0340-CMP/CKP POSITION SENSOR CIRCUIT - CKP DYNAMIC PLAUSIBILITY

When Monitored: The engine speed is above 790 RPM.

Set Condition: The ECM compares the current crankshaft RPM to the last calculated crankshaft RPM and the acceleration or deceleration is greater than is physically possible.

POSSIBLE CAUSES
CHECK CRANKSHAFT POSITION SENSOR SIGNAL
ENGINE CONTROL MODULE
OPEN SHIELD CIRCUIT
INTERMITTENT CONDITION
CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT(S) SHORTED TO GROUND
CKP SENSOR CIRCUITS SHORTED TOGETHER
CKP SENSOR SIGNAL CIRCUITS OPEN
CKP SENSOR SIGNAL CIRCUIT(S) SHORTED TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Attempt to start the engine. Did the engine start? Yes → Go To 2 No → Go To 3	All

P0340-CMP/CKP POSITION SENSOR CIRCUIT - CKP DYNAMIC PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
3	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the both of the CKP Sensor Signal circuits. Is the resistance above 1000 ohms for both measurements? Yes → Go To 4 No → Repair the CKP Sensor Signal circuit(s) for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the CKP Sensor Signal circuits. Is the resistance above 1000 ohms? Yes → Go To 5 No → Repair the CKP Sensor Signal circuits for a short together. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of CKP Sensor Signal circuits. Is the resistance below 10.0 ohms for both measurements? Yes → Go To 6 No → Repair the CKP Sensor Signal circuit(s) for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0340-CMP/CKP POSITION SENSOR CIRCUIT - CKP DYNAMIC PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the CKP Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of both CKP Sensor Signal circuits. Is the voltage below 1.0 volt for both measurements? Yes → Go To 7 No → Repair the CKP Sensor Signal circuit(s) for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Using the DRB lab scope, backprobe both of the CKP Sensor Signal circuits at the ECM harness connector. **NOTE: Refer to Charts and Graphs to view a correct CKP Sensor signal.** Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the DRB. Does the DRB display a steady clean CKP Signal pattern for each circuit? Yes → Go To 8 No → Replace the Crankshaft Position Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the CKP Sensor harness connector. Measure the resistance of the Shield circuit. Is the resistance below 10.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Shield circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P0340-CMP/CKP POSITION SENSOR CIRCUIT - CMP/CKP SYNC FAILURE

When Monitored and Set Condition:

P0340-CMP/CKP POSITION SENSOR CIRCUIT - CMP/CKP SYNC FAILURE

When Monitored: With the engine running.

Set Condition: The ECM determines that the camshaft position sensor signal frequency is not plausible with the crankshaft position sensor signal frequency.

POSSIBLE CAUSES
CHECK CAMSHAFT POSITION SENSOR SIGNAL
CHECK CRANKSHAFT POSITION SENSOR SIGNAL
CHECKING CKP SENSOR FOR DAMAGE
CHECKING CMP SENSOR FOR DAMAGE
ENGINE CONTROL MODULE
GEAR ALIGNMENT
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Attempt to start the engine. With the DRBIII®, read the ECM DTCs. Does the DRB III display this DTC? Yes → Go To 3 No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Does the DRB III display this DTC? Yes → Go To 3 No → Go To 8	All
3	Turn the ignition off. Remove the CMP Sensor. Inspect the camshaft Position Sensor for conditions such as loose mounting screws, damage or debris, also check the camshaft for cracked teeth. Is there any evidence of these conditions? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

P0340-CMP/CKP POSITION SENSOR CIRCUIT - CMP/CKP SYNC FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the CKP Sensor. Inspect the Crankshaft Position Sensor for conditions such as loose mounting screws, damage or debris. Is there any evidence of these conditions? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Using the DRB lab scope, backprobe the CMP Sensor Signal circuit at the CMP Sensor harness connector. Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the DRB. **NOTE: Refer to Charts and Graphs to view a correct CMP Sensor signal.** Does the DRB display a steady clean CMP Signal pattern? Yes → Go To 6 No → Perform Test for DTC P0340-Camshaft Position Sensor Circuit Static Plausibility. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Using the DRB lab scope, backprobe both of the CKP Sensor Signal circuits at the CKP Sensor harness connector. **NOTE: Refer to Charts and Graphs to view a correct CKP Sensor signal.** Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the DRB. Does the DRB display a steady clean CKP Signal pattern for each circuit? Yes → Go To 7 No → Perform Test for DTC P0340-Crankshaft Position Sensor Circuit Dynamic Plausibility. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Refer to the Service Information and check alignment of the camshaft sprocket, crankshaft sprocket and injection pump sprocket. Are all of the sprockets aligned correctly? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair or adjust as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All

P0340-CMP/CKP POSITION SENSOR CIRCUIT - CMP/CKP SYNC FAILURE — Continued

TEST	ACTION	APPLICABILITY
8	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0340-CMP/CKP POSITION SENSOR CIRCUIT - SIGNAL FREQUENCY TOO HIGH

P0340-CMP/CKP POSITION SENSOR CIRCUIT - STATIC PLAUSIBILITY

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0340-CMP/CKP POSITION SENSOR CIRCUIT - SIGNAL FREQUENCY TOO HIGH.

When Monitored and Set Condition:

P0340-CMP/CKP POSITION SENSOR CIRCUIT - SIGNAL FREQUENCY TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects that engine speed is greater than 10,000 RPM.

P0340-CMP/CKP POSITION SENSOR CIRCUIT - STATIC PLAUSIBILITY

When Monitored: With the engine running.

Set Condition: The ECM detects the Camshaft Sensor Signal is missing while the engine is running.

POSSIBLE CAUSES
CHECKING FOR DAMAGE
ECM
SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
VERIFY ASD RELAY OUTPUT
CMP SENSOR SIGNAL CIRCUIT OPEN
CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
ECM SENSOR GROUND CIRCUIT OPEN
VERIFY CMP SENSOR OPERATION DURING CRANKING CRANK
CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
CMP SENSOR CIRCUIT SHORTED TO VOLTAGE

P0340-CMP/CKP POSITION SENSOR CIRCUIT - SIGNAL FREQUENCY TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: The Timing Belt must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.** Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Attempt to start the engine. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 3 No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 3 No → Go To 13	All
3	Turn the ignition off. Disconnect the CMP Sensor harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit in CMP Sensor harness connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the CMP Sensor harness connector. Turn the ignition on. Measure the voltage of the CMP Sensor Signal circuit. Is the voltage above 10.0 volts? Yes → Go To 5 No → Go To 10	All
5	Turn the ignition off. Disconnect the CMP Sensor harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the CMP Sensor Signal circuit. Is the test light on? Yes → Repair the CMP Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All

P0340-CMP/CKP POSITION SENSOR CIRCUIT - SIGNAL FREQUENCY TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit between the CMP Sensor harness connector and the ECM harness connector. Is the resistance below 10.0 ohms? Yes → Go To 7 No → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition on. Disconnect the IAT Sensor harness connector. Disconnect the Camshaft Position Sensor harness connector. Connect one end of a jumper wire to the IAT Sensor signal circuit in the IAT Sensor harness connector. Connect the other end of the jumper wire to the Sensor Ground circuit in the Camshaft Position Sensor harness connector. With the DRBIII® in Engine, Sensors, read the Intake Air Temp volts. Is the voltage below 1.0 volt? Yes → Go To 8 No → Replace and program the ECM in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Remove the CMP Sensor. Inspect the camshaft for conditions such as loose mounting screws, damage, debris or cracked teeth. Is there any evidence of these conditions? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 9	All
9	Turn the ignition off. With the DRBIII® lab scope lead, backprobe the CMP Signal circuit. Set the DRBIII® lab scope settings as follows: Time = 0.1s/Div, 20 volts scale, Offset = 0.00volts, Probe = X10, Coupling = DC. While observing the DRBIII® display, crank the engine. **NOTE: The DRBIII® should display a digital signal (square wave) similar to that shown in the support material.** Does the DRBIII® display an uninterrupted digital signal (square wave)? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Camshaft Position Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0340-CMP/CKP POSITION SENSOR CIRCUIT - SIGNAL FREQUENCY TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the CMP Sensor Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 11 No → Repair the CMP Sensor Signal circuit for an open Perform ROAD TEST VERIFICATION - VER-2.	All
11	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the CMP Sensor Signal circuit. Is the resistance below 1000 ohms? Yes → Repair the CMP Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 12	All
12	Turn the ignition off. Disconnect the CMP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the CMP Sensor Signal circuit and the Sensor Ground circuit at the CMP Sensor harness connector. Is the resistance below 1000 ohms? Yes → Repair the CMP Sensor Signal and Sensor Ground circuits for a short together. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
13	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Remove the CMP Sensor and the CKP Sensor, checking for loose mounting screws and debris on the sensor magnets that can corrupt the sensor signal. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0380-GLOW PLUG 1 CONTROL CIRCUIT - OPEN CIRCUIT
P0380-GLOW PLUG 1 CONTROL CIRCUIT - SHORT CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0380-GLOW PLUG 1 CONTROL CIRCUIT - OPEN CIRCUIT.

When Monitored and Set Condition:

P0380-GLOW PLUG 1 CONTROL CIRCUIT - OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM does not detect voltage on the Glow Plug Relay 1 Control circuit.

P0380-GLOW PLUG 1 CONTROL CIRCUIT - SHORT CIRCUIT

When Monitored: With the ignition off.

Set Condition: The ECM detects excessive current on the Glow Plug Relay 1 Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
SUBSTITUTE GLOW PLUG RELAY 1
GLOW PLUG RELAY 1 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG RELAY 1 CONTROL CIRCUIT SHORTED TO GROUND
GLOW PLUG RELAY 1 CONTROL CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, actuate Glow Plug Relay 1. Is Glow Plug Relay 1 clicking? Yes → Go To 2 No → Go To 3	All

P0380-GLOW PLUG 1 CONTROL CIRCUIT - OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
3	Turn the ignition off. Remove Glow Plug Relay 1 from the PDC. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Install a substitute relay in place of Glow Plug Relay 1. Perform several ignition key cycles, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 5 No → Replace Glow Plug Relay 1. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Remove Glow Plug Relay 1 from the PDC. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Glow Plug Relay 1 Control circuit. Is the voltage above 1.0 volt? Yes → Repair the Glow Plug Relay 1 Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All

P0380-GLOW PLUG 1 CONTROL CIRCUIT - OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Remove Glow Plug Relay 1 from the PDC. Disconnect the ECM harness connectors. Measure the resistance between ground and the Glow Plug Relay 1 Control circuit. Is the resistance above 1000 ohms? Yes → Go To 7 No → Repair the Glow Plug Relay 1 Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Remove Glow Plug Relay 1 from the PDC. Disconnect the ECM harness connectors. Measure the resistance of the Glow Plug Relay 1 Control circuit. Is the resistance below 10.0 ohms? Yes → Go To 8 No → Repair the Glow Plug Relay 1 Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom List:

P0382-GLOW PLUG 2 CONTROL CIRCUIT - OPEN CIRCUIT
P0382-GLOW PLUG 2 CONTROL CIRCUIT - SHORT CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0382-GLOW PLUG 2 CONTROL CIRCUIT - OPEN CIRCUIT.

When Monitored and Set Condition:

P0382-GLOW PLUG 2 CONTROL CIRCUIT - OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM does not detect voltage on the Glow Plug Relay 2 Control circuit.

P0382-GLOW PLUG 2 CONTROL CIRCUIT - SHORT CIRCUIT

When Monitored: With the ignition off.

Set Condition: The ECM detects excessive current on the Glow Plug Relay 2 Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
SUBSTITUTE GLOW PLUG RELAY 2
GLOW PLUG RELAY 2 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG RELAY 2 CONTROL CIRCUIT SHORTED TO GROUND
GLOW PLUG RELAY 2 CONTROL CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, actuate Glow Plug Relay 2. Is Glow Plug Relay 2 clicking? Yes → Go To 2 No → Go To 3	All

P0382-GLOW PLUG 2 CONTROL CIRCUIT - OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
3	Turn the ignition off. Remove Glow Plug Relay 2 from the PDC. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Install a substitute relay in place of Glow Plug Relay 2. Perform several ignition key cycles, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC reset? Yes → Go To 5 No → Replace Glow Plug Relay 2. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Remove Glow Plug Relay 2 from the PDC. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Glow Plug Relay 2 Control circuit. Is the voltage above 1.0 volt? Yes → Repair the Glow Plug Relay 2 Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All

P0382-GLOW PLUG 2 CONTROL CIRCUIT - OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Remove Glow Plug Relay 2 from the PDC. Disconnect the ECM harness connectors. Measure the resistance between ground and the Glow Plug Relay 2 Control circuit. Is the resistance above 1000 ohms? Yes → Go To 7 No → Repair the Glow Plug Relay 2 Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Remove Glow Plug Relay 2 from the PDC. Disconnect the ECM harness connectors. Measure the resistance of the Glow Plug Relay 2 Control circuit. Is the resistance below 10.0 ohms? Yes → Go To 8 No → Repair the Glow Plug Relay 2 Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P0403-EGR SOLENOID CIRCUIT NEGATIVE DEVIATION

When Monitored and Set Condition:

P0403-EGR SOLENOID CIRCUIT NEGATIVE DEVIATION

When Monitored: With the engine running.

Set Condition: The ECM detects EGR flow is less than the requested flow.

POSSIBLE CAUSES
EGR VALVE
INTERMITTENT CONDITION
CHECKING VACUUM SUPPLY
EGR SOLENOID
ENGINE CONTROL MODULE - INTERNAL

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle and monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect both vacuum lines at the EGR Solenoid. Using a vacuum line connection tee, connect the vacuum supply line to the EGR Solenoid Output line at the EGR Solenoid. Disconnect the vacuum line at the EGR Valve. Connect a vacuum gauge to the EGR Solenoid Output line at the EGR Valve. Start the engine. With the engine at idle, note the vacuum gauge reading. Is the vacuum above 22 inches? Yes → Go To 3 No → Inspect the vacuum hoses/tubes for damage, restriction and leaks. If o.k. refer to the Service Information to check the Vacuum Pump operation. Perform ROAD TEST VERIFICATION - VER-2.	All

P0403-EGR SOLENOID CIRCUIT NEGATIVE DEVIATION — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: The engine must be at operating temperature for this test to be valid.** Turn the ignition off. Disconnect the vacuum line at the EGR Valve. Connect a vacuum gauge to the EGR Solenoid Output line at the EGR Valve Start the engine and observe the vacuum gauge reading for 1 minute. **NOTE: The vacuum reading should increase to above 18 inches approximately 5 seconds after the engine is started. The vacuum should decrease to below 2 inches within 40 seconds of engine run time.** Did the vacuum reading increase to above 18 inches then decrease below 2 inches as described? Yes → Go To 4 No → Replace the EGR Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect both vacuum lines at the EGR Solenoid. Using a vacuum line connection tee, connect the vacuum supply line to the EGR Solenoid Output line at the EGR Solenoid. Test drive the vehicle and note the vehicles performance. **NOTE: With the connection tee in place the EGR valve will receive full vacuum supply with the engine running. This should cause a severe reduction in engine power.** Does the vehicle exhibit a severe loss of power? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the EGR Valve. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0403-EGR SOLENOID CIRCUIT OPEN CIRCUIT

When Monitored and Set Condition:

P0403-EGR SOLENOID CIRCUIT OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects an open or short to ground on the EGR Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
EGR SOLENOID CONTROL CIRCUIT OPEN
SUBSTITUTE EGR SOLENOID
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the EGR Solenoid harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the EGR Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the EGR Solenoid Control circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the EGR Solenoid Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0403-EGR SOLENOID CIRCUIT OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the EGR Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance of the EGR Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the EGR Solenoid Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Install a substitute EGR Solenoid in place of the vehicle's EGR Solenoid. **NOTE: Ensure the ECM and EGR Solenoid harness connectors are connected.** Turn the ignition on. With the DRB, check for this DTC to set again. Did this DTC set again? Yes → Go To 6 No → Replace the EGR Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time.The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0403-EGR SOLENOID CIRCUIT SHORT CIRCUIT

When Monitored and Set Condition:

P0403-EGR SOLENOID CIRCUIT SHORT CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects excessive current draw on the EGR Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
EGR SOLENOID
EGR SOLENOID CONTROL SHORTED TO VOLTAGE
ENGINE CONTROL MODULE - INTERNAL
ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle and monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the EGR Solenoid harness connector. Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Does the DRB display P0403 EGR OPEN CIRCUIT? Yes → Replace the EGR Solenoid. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the EGR Solenoid harness connector. Turn the ignition on. Measure the voltage of the EGR Solenoid Control circuit at the EGR Solenoid harness connector. Is the voltage below 0.5 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

P0403-EGR SOLENOID CIRCUIT SHORT CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the EGR Solenoid harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the EGR Solenoid Control circuit. Is the voltage below 0.5 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the EGR Solenoid Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Fuel Level Sensor Signal voltage is above 4.70 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
FUEL LEVEL SENSOR SIGNAL CIRCUIT OPEN
FUEL LEVEL SENSOR GROUND CIRCUIT OPEN
FUEL LEVEL SENSOR
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Turn the ignition off, wait 10 seconds, then turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Level Sensor harness connector. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Fuel Level Sensor Signal circuit. Is the voltage below 0.5 volt? Yes → Go To 3 No → Repair the Fuel Level Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All

P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Level Sensor harness connector. Measure the resistance of the Fuel Level Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Fuel Level Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Level Sensor harness connector. Measure the resistance of the Fuel Level Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Fuel Level Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the Fuel Level Sensor harness connector. Turn the ignition on. With the DRB, read and record the Fuel Level Sensor voltage. **NOTE: The Fuel Level Sensor voltage should be 5.0 ± 0.3 volts with the sensor harness connector disconnected.** Connect a jumper wire between Fuel Level Sensor harness connector cavities 3 and 4. With the DRB, read the Fuel Level Sensor voltage. **NOTE: The Fuel Level Sensor voltage should be less then 1.0 volt with the jumper wire connected.** Are the voltage readings the expected voltages? Yes → Replace the Fuel Level Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Fuel Level Sensor Signal voltage is below 0.15 volt.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL LEVEL SENSOR
FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
FUEL LEVEL SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Turn the ignition off, wait 10 seconds, then turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Fuel Level Sensor harness connector. Turn the ignition on. With the DRB, read the Fuel Level Sensor voltage. Is the voltage above 4.8 volts? Yes → Replace the Fuel Level Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Level Sensor harness connector. Measure the resistance between ground and the Fuel Level Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Fuel Level Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Level Sensor harness connector. Measure the resistance between the Fuel Level Sensor Signal circuit and Sensor Ground circuit. Is the resistance above 100 kohms? Yes → Go To 5 No → Repair the Fuel Level Sensor Signal and Ground circuits for a short together. Perform ROAD TEST VERIFICATION - VER-2.	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0500-VEHICLE SPEED SENSOR FREQUENCY TOO HIGH
P0500-VEHICLE SPEED SENSOR HIGH LEVEL DURATION
P0500-VEHICLE SPEED SENSOR PLAUSIBILITY
P0500-VEHICLE SPEED SENSOR SIGNAL VOLTAGE TOO HIGH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0500-VEHICLE SPEED SENSOR FREQUENCY TOO HIGH.

When Monitored and Set Condition:

P0500-VEHICLE SPEED SENSOR FREQUENCY TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects a vehicle speed greater than the vehicle is capable.

P0500-VEHICLE SPEED SENSOR PLAUSIBILITY

When Monitored: With the engine under load and engine speed greater than 2400 RPM while vehicle speed is below 20 km/h (12 MPH).

Set Condition: The ECM compares the amount of fuel the fuel injectors are delivering to the vehicle speed from the VSS. The VSS indicates a vehicle speed that cannot be achieved with the present amount of fuel being delivered.

P0500-VEHICLE SPEED SENSOR SIGNAL VOLTAGE TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects a vehicle speed greater than 220 km/h (137 MPH).

POSSIBLE CAUSES
INTERMITTENT CONDITION
CHECK FOR RELATED CONTROLLER ANTILOCK BRAKES DTCS
CONTROLLER ANTILOCK BRAKE MODULE
VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND
VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO VOLTAGE
VEHICLE SPEED SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE - NO VOLTAGE
ENGINE CONTROL MODULE - NO VOLTAGE CHANGE
ENGINE CONTROL MODULE - VOLTAGE TOO HIGH

P0500-VEHICLE SPEED SENSOR FREQUENCY TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle. With the DRB, read Vehicle Speed. Does the DRB display an accurate Vehicle Speed? Yes → Go To 2 No → Go To 3	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
3	Turn the ignition on. With the DRB, check for Controller Antilock Brakes DTCs. Are any related CAB DTCs present? Yes → Refer to symptom list for problems related to CAB DTCs before continuing. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the CAB harness connectors. Turn the ignition on. Measure the voltage of the Vehicle Speed Signal circuit. Select the range that the voltage reading falls into. Above 5.4 volts Go To 5 Between 4.5 and 5.4 volts Go To 6 Below 4.5 volts Go To 7	All

P0500-VEHICLE SPEED SENSOR FREQUENCY TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the CAB harness connectors. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Vehicle Speed Signal circuit. Is the voltage above 1.0 volt? Yes → Repair the Vehicle Speed Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the CAB harness connectors. Turn the ignition on. Connect one end of a jumper wire to the Vehicle Speed Signal circuit. With the DRB, select, isolate and observe the Vehicle Speed status while tapping the other end of the jumper wire to ground. Does the DRB display a vehicle speed change while tapping the jumper wire to ground? Yes → Replace the Controller Antilock Brake Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Disconnect the CAB harness connectors. Disconnect the ECM harness connectors. Measure the resistance between ground and the Vehicle Speed Signal circuit. Is the resistance above 100 kohms? Yes → Go To 8 No → Repair the Vehicle Speed Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the CAB harness connectors. Disconnect the ECM harness connectors. Measure the resistance of the Vehicle Speed Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the Vehicle Speed Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
9	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P0514-BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0514-BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The ECM detects Battery Temperature Sensor Signal voltage above 4.9 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
BATTERY TEMPERATURE SENSOR GROUND CIRCUIT OPEN
BATTERY TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
BATTERY TEMPERATURE SENSOR
BATTERY TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, monitor the Battery Temperature Sensor voltage. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Battery Temperature Sensor harness connector. Turn the ignition on. Measure the voltage on the Battery Temperature Sensor Signal circuit. Is the voltage above 5.5 volts? Yes → Repair the Battery Temperature Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0514-BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

— Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Battery Temperature Sensor harness connector. Connect a jumper wire between the Battery Temperature Sensor harness connector cavities. Turn the ignition on. With the DRB, read the Battery Temperature Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the Battery Temperature Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the Battery Temperature Sensor harness connector. Connect a jumper wire between ground and the Battery Temperature Sensor Signal circuit. Turn the ignition on. With the DRB, read the Battery Temperature Sensor voltage. Is the voltage below 1.0 volt? Yes → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Battery Temperature Sensor harness connector. Measure the resistance of the Battery Temperature Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Battery Temperature Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0514-BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0514-BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The ECM detects Battery Temperature Sensor Signal voltage below 0.151 volt.

POSSIBLE CAUSES
INTERMITTENT CONDITION
BATTERY TEMPERATURE SENSOR
BATTERY TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
BATTERY TEMPERATURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, monitor the Battery Temperature Sensor voltage. Is the Battery Temperature Sensor voltage below 0.151 volt? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the Battery Temperature Sensor harness connector. Turn the ignition on. With the DRB, read the Battery Temperature Sensor voltage. Is the voltage above 4.0 volts? Yes → Replace the Battery Temperature Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Battery Temperature Sensor harness connector. Measure the resistance between ground and the Battery Temperature Sensor Signal circuit. Is the resistance above 1000 ohms? Yes → Go To 4 No → Repair the Battery Temperature Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0514-BATTERY TEMP SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

— Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Battery Temperature Sensor harness connector. Measure the resistance between the Battery Temperature Sensor Signal circuit and Sensor Ground circuit. Is the resistance above 1000 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Battery Temperature Sensor Signal and Ground circuits for a short together. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects the Oil Pressure Sensor Signal above 4.9 volts for more than 3 seconds.

POSSIBLE CAUSES
ECM - OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
ECM - OIL PRESSURE SENSOR SIGNAL OPEN
ENGINE OIL PRESSURE SENSOR
OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN
OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** Turn the ignition on. With the DRBIII®, erase ECM DTCs. Start the engine several times, letting the engine run for at least 30 seconds at a time. With the DRBIII®, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Turn the ignition on. Measure the voltage of the Oil Pressure Sensor Signal circuit. Select the appropriate voltage reading. Voltage is above 5.5 volts. Go To 3 Voltage is between 4.7 and 5.4 volts. Go To 4 Voltage is below 4.7 volts. Go To 5	All

P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Oil Pressure Sensor Signal circuit. Is the voltage below 1.0 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Oil Pressure Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Oil Pressure Sensor harness connector. Measure the resistance of the Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Replace the Engine Oil Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Oil Pressure Sensor harness connector. Measure the resistance of the Oil Pressure Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Oil Pressure Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO LOW

When Monitored and Set Condition:

P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO LOW

When Monitored: With the engine running.

Set Condition: The ECM detects the Oil Pressure Sensor Signal voltage below 0.1 volt for more than 3 seconds.

POSSIBLE CAUSES
CHECK THE OIL PRESSURE SENSOR
ECM - OIL PRESSURE SENSOR SIGNAL SHORT TO GROUND
OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase ECM DTCs. Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time. With the DRBIII®, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Measure the voltage of the Oil Pressure Sensor Signal circuit. Is the voltage between 4.7 and 5.3 volts? Yes → Replace the Engine Oil Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Oil Pressure Sensor harness connector. Measure the resistance between ground and the Oil Pressure Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Oil Pressure Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Oil Pressure Sensor harness connector. Measure the resistance between Sensor Ground and the Oil Pressure Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Oil Pressure Sensor Signal circuit for a short to Sensor Ground. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0520-OIL PRESS SENSOR CKT MALF SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored and Set Condition:

P0520-OIL PRESS SENSOR CKT MALF SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Sensor Reference Voltage A voltage to the Oil Pressure Sensor is below 4.8 volts or above 5.2 volts for at least 100 ms.

POSSIBLE CAUSES
INTERMITTENT CONDITION
5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND
5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** Turn the ignition on. With the DRB, erase ECM DTCs. Turn the ignition off, wait 30 seconds, then start and idle the engine. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the Oil Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage between ground and the 5-volt Supply circuit at the Oil Pressure Sensor harness connector. Is the voltage above 1.0 volt? Yes → Repair the 5-volt Supply circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0520-OIL PRESS SENSOR CKT MALF SUPPLY VOLTAGE TOO HIGH OR LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Oil Pressure Sensor harness connector. Measure the resistance between ground and the 5-volt Supply circuit at the Oil Pressure Sensor harness connector. Is the resistance above 1000 ohms? Yes → Go To 4 No → Repair the 5-volt Supply circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Oil Pressure Sensor harness connector. Measure the resistance between Sensor Ground and the 5-volt Supply circuit at the Oil Pressure Sensor harness connector. Is the resistance above 1000 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the 5-volt Supply circuit for a short to Sensor Ground. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH
P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW
P0530-A/C PRESSURE SENSOR CIRCUIT SUPPLY VOLTAGE TOO HIGH OR LOW

Test Note: **All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH.**

When Monitored and Set Condition:

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The A/C Pressure Sensor Signal voltage is above 4.84 volts.

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The A/C Pressure Sensor Signal voltage is below 0.15 volt.

P0530-A/C PRESSURE SENSOR CIRCUIT SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Sensor Reference Voltage B voltage to the A/C Pressure Sensor is below 4.9 volts or above 5.1 volts for at least 100 ms.

POSSIBLE CAUSES
INTERMITTENT CONDITION
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO 5 VOLT SUPPLY CIRCUIT
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
A/C PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
A/C PRESSURE SENSOR
SENSOR REFERENCE VOLTAGE B CIRCUIT OPEN
A/C PRESSURE SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
A/C PRESSURE SENSOR
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND CIRCUIT

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

POSSIBLE CAUSES
ECM - A/C PRESSURE SENSOR SIGNAL
ECM - SENSOR REFERENCE VOLTAGE B CIRCUIT
ECM - SIGNAL VOLTAGE HIGH

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** **NOTE: Ensure the A/C refrigerant System is properly charged per the Service Information.** Start the engine. With the DRBIII®, read the A/C Pressure Sensor voltage. Select the choice that best reflects the DRBIII® reading. Above 4.6 volts Go To 2 Between 0.7 and 4.6 volts Go To 9 Below 0.7 volt Go To 10	All
2	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connector. Measure the resistance between the A/C Pressure Sensor Signal circuit and the 5-volt Supply circuit in the A/C Pressure Sensor harness connector. Is the resistance above 100 kohms? Yes → Go To 3 No → Repair the A/C Pressure Sensor Signal circuit for a short to the 5-volt Supply circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Sensor Ground circuit at the A/C Pressure Sensor and ECM harness connectors. Is the voltage above 1.0 volt at either connector? Yes → Repair the A/C Pressure Sensor Ground circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4 **NOTE: If the Sensor Ground circuit had a short to voltage on it, the ECM may have been damaged. Retest the A/C Pressure Sensor circuit.**	All

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

— Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Turn the ignition on. Measure the voltage of the A/C Pressure Sensor Signal circuit in the A/C Pressure Sensor harness connector. Is the voltage above 5.5 volts? Yes → Repair the A/C Pressure Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Connect a jumper wire between the A/C Pressure Sensor Signal circuit and the Sensor Ground circuit. With the DRBIII®, monitor the A/C Pressure Sensor voltage. Turn the ignition on. Is the voltage below 1.0 volt? Yes → Replace the A/C Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connector. Measure the resistance of the A/C Pressure Sensor Signal circuit. Is the resistance below 5 ohms? Yes → Go To 7 No → Repair the A/C Pressure Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Measure the resistance between ground and the Sensor Ground circuit. Is the resistance below 30 ohms? Yes → Go To 8 No → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
9	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
10	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Turn the ignition on. Measure the voltage of the Sensor Reference Voltage B circuit in the A/C Pressure Sensor harness connector. Is the voltage between 4.5 and 5.5 volts? Yes → Go To 11 No → Go To 15	All
11	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Turn the ignition on. With the DRBIII®, monitor the A/C Pressure Sensor voltage. Is the voltage above 0.7 volt? Yes → Replace the A/C Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 12	All
12	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the A/C Pressure Sensor Signal circuit. Is the resistance above 100 kohms? Yes → Go To 13 No → Repair the A/C Pressure Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P0530-A/C PRESSURE SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH

— **Continued**

TEST	ACTION	APPLICABILITY
13	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the A/C Pressure Sensor Signal circuit and the Sensor Ground circuit. Is the resistance above 100 kohms? Yes → Go To 14 No → Repair the A/C Pressure Sensor Signal circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
14	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
15	Turn the ignition off. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Reference Voltage B circuit. Is the resistance below 5 ohms? Yes → Go To 16 No → Repair the Sensor Reference Voltage B circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
16	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P0560-SYSTEM VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0560-SYSTEM VOLTAGE TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects battery voltage is above 15.5 volts.

POSSIBLE CAUSES
GROUND CIRCUIT HIGH RESISTANCE
BATTERY SUPPLY OR ASD RELAY OUTPUT CIRCUIT HIGH RESISTANCE
GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR INTERNALLY SHORTED TO GROUND
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P1511 or P1512 is present with this DTC, diagnose DTCs P1511 and P1512 before diagnosing this DTC.** **NOTE: The battery must be fully charged and the generator belt must be in good condition and tensioned properly before continuing.** Turn the ignition off. Disconnect the ECM harness connectors. Using a 12-volt test light connected to 12-volts, check all of the ECM Ground circuits including the Battery(-) Sense circuit. Does the test light illuminate brightly for each circuit? Yes → Go To 2 No → Repair the Ground circuit(s) for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Using a 12-volt test light connected to ground, check all of the ECM Battery Supply and ASD Relay Output circuits including the Battery(+) Sense circuit. Does the test light illuminate brightly for each circuit? Yes → Go To 3 No → Repair the Battery Supply or ASD Relay Output circuit(s) for high resistance. Perform CHARGING VERIFICATION - VER-3.	All

P0560-SYSTEM VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect ECM harness connectors. Disconnect the Generator Field harness connector. Measure the resistance between ground and the Generator Field Control circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Generator Field Control circuit for a short to ground. Perform CHARGING VERIFICATION - VER-3.	All
4	Turn the ignition off. Disconnect the Generator Field harness connector. Measure the resistance between ground and the Generator Field Control terminal on the back of the Generator. Is the resistance above 100 kohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform CHARGING VERIFICATION - VER-3. No → Repair or replace the Generator as necessary. Perform CHARGING VERIFICATION - VER-3.	All

Symptom List:

P0560-SYSTEM VOLTAGE TOO LOW
P1536-GENERATOR FIELD CURRENT TOO HIGH
***CHECKING THE CHARGING SYSTEM OPERATION - DIESEL**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0560-SYSTEM VOLTAGE TOO LOW.

When Monitored and Set Condition:

P0560-SYSTEM VOLTAGE TOO LOW

When Monitored: With the engine running.

Set Condition: The ECM detects battery voltage is below 8.0 volts.

P1536-GENERATOR FIELD CURRENT TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects the current on the Generator Field above 10.7 amps.

POSSIBLE CAUSES
INTERMITTENT CONDITION
GENERATOR BELT CONDITION OR TENSION
GENERATOR FIELD
HIGH RESISTANCE IN THE VOLTAGE SUPPLY CIRCUIT(S) TO THE ECM
GENERATOR FIELD CONTROL CIRCUIT SHORTED TO VOLTAGE
GENERATOR FUSED B+ CIRCUIT HIGH RESISTANCE
GENERATOR FIELD CONTROL CIRCUIT OPEN
GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR GROUND CIRCUIT HIGH RESISTANCE
BODY GROUND CIRCUIT OPEN
FUSED ASD RELAY OUTPUT CIRCUIT TO GENERATOR OPEN
ENGINE CONTROL MODULE
HIGH RESISTANCE ON THE BATTERY(+) SENSE CIRCUIT
HIGH RESISTANCE ON THE BATTERY(-) SENSE CIRCUIT

P0560-SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: If there are any Battery Sense DTCs (P1511 or P1512) present with this DTC, diagnose the Battery Sense DTCs first.** **NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator capacity.** **NOTE: The battery must be fully charged before continuing.** Inspect the generator belt condition and tension. Is the generator belt in good condition and tensioned properly? Yes → Go To 2 No → Repair as necessary. Perform CHARGING VERIFICATION - VER-3.	All
2	Turn the ignition on. With the DRB, erase ECM DTCs. Start the engine several times. Allow the engine to run for at least 30 seconds each run cycle while turning the ignition off for at least 10 seconds between each run cycle. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 3 No → Go To 14	All
3	Connect the positive lead of a voltmeter to the generator B+ (12V) terminal and the negative lead to the battery positive (+) post. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Is the voltage on the voltmeter below 0.4 volt? Yes → Go To 4 No → Repair the Generator Fused B+ circuit for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
4	Connect the positive lead of a voltmeter to the generator case (housing) and the negative lead to the battery negative (-) post. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Is the voltage on the voltmeter below 0.4 volt? Yes → Go To 5 No → Repair the Generator Ground circuit for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
5	Turn the ignition off. Measure the voltage between the body and the negative battery terminal. Is the voltage below 0.4 volt? Yes → Go To 6 No → Repair the Body Ground circuit for an open. Perform CHARGING VERIFICATION - VER-3.	All

P0560-SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Generator Field harness connector. Measure the resistance of the Field Control terminals on the back of the Generator. Is the resistance between 2 and 6 ohms? Yes → Go To 7 No → Repair or replace the Generator as necessary. Perform CHARGING VERIFICATION - VER-3.	All
7	Turn the ignition off. With a voltmeter, measure and record the voltage between the Battery terminals. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the ASD Relay Output circuits and Battery(+) Sense circuit in the ECM C1 harness connector. Are all voltage measurements within 0.5 volt of each other? Yes → Go To 8 No → Repair the circuit that had high resistance. Perform CHARGING VERIFICATION - VER-3.	All
8	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Generator Field harness connector. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Generator Field Control circuit. Is the voltage below 1.0 volt? Yes → Go To 9 No → Repair the Generator Field Control circuit for a short to voltage. Perform CHARGING VERIFICATION - VER-3.	All
9	Turn the ignition off. Disconnect ECM harness connectors. Disconnect the Generator Field harness connector. Measure the resistance between ground and the Generator Field Control circuit. Is the resistance above 100 kohms? Yes → Go To 10 No → Repair the Generator Field Control circuit for a short to ground. Perform CHARGING VERIFICATION - VER-3.	All
10	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Generator Field harness connector. Measure the resistance of the Generator Field Control circuit. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the Generator Field Control circuit for an open. Perform CHARGING VERIFICATION - VER-3.	All

P0560-SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off. Disconnect the generator harness connector. Turn the ignition on. Measure the voltage of the Fused ASD Relay Output circuit. Is the voltage above 10.0 volts? Yes → Go To 12 No → Repair the Fused ASD Relay Output circuit for an open. Perform CHARGING VERIFICATION - VER-3.	All
12	Turn the ignition off. Disconnect the ECM harness connectors. Remove Fuse 26 from the PDC. Measure the resistance of the Battery(+) Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 13 No → Repair the Battery(+) Sense circuit for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
13	Turn the ignition off. Disconnect the ECM harness connectors. Measure the resistance of the Battery(-) Sense circuit. Is the resistance below 5.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform CHARGING VERIFICATION - VER-3. No → Repair the Battery(-) Sense circuit for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
14	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform CHARGING VERIFICATION - VER-3. No → Test Complete.	All

Symptom:
P0579-S/C SWITCH SIGNAL CIRCUIT PLAUSIBILITY

POSSIBLE CAUSES
INTERMITTENT CONDITION
HIGH RESISTANCE IN THE S/C SWITCH SIGNAL CIRCUIT
HIGH RESISTANCE IN THE S/C SWITCH GROUND CIRCUIT
S/C SWITCHES
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle and activate the Speed Control. At some point during the test drive, actuate each of the S/C Switch buttons. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the S/C Switch harness connectors. Disconnect the ECM harness connectors. Measure the resistance of the S/C Switch Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the S/C Switch Signal circuit for high resistance. Perform SPEED CONTROL VERIFICATION - VER-4.	All
3	Turn the ignition off. Disconnect the S/C Switch harness connectors. Disconnect the ECM harness connectors. Measure the resistance of the S/C Switch Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the S/C Switch Ground circuit for high resistance. Perform SPEED CONTROL VERIFICATION - VER-4.	All

P0579-S/C SWITCH SIGNAL CIRCUIT PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Replace the S/C Switches. Turn the ignition on. With the DRB, erase ECM DTCs. Test drive the vehicle and activate the Speed Control. At some point during the test drive, actuate each of the S/C Switch buttons. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform SPEED CONTROL VERIFICATION - VER-4. No → The repair is complete. Perform SPEED CONTROL VERIFICATION - VER-4.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform SPEED CONTROL VERIFICATION - VER-4. No → Test Complete.	All

Symptom:
P0579-S/C SWITCH SIGNAL CIRCUIT SIGNAL VOLTAGE TOO HIGH

POSSIBLE CAUSES
ECM - S/C SIGNAL CIRCUIT OPEN
ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE
ECM - SENSOR GROUND OPEN
S/C ON/OFF/SET SWITCH
S/C ON/OFF/SET SWITCH SIGNAL CIRCUIT OPEN
S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE
SENSOR GROUND OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the S/C ON/OFF/SET button harness connector. Turn the ignition on. Measure the voltage of the S/C Switch Signal circuit. Select the appropriate voltage reading. Below 4.5 volts. Go To 2 Between 4.5 and 5.5 volts. Go To 3 Above 5.5 volts Go To 5	All
2	Turn the ignition off. Disconnect the S/C ON/OFF/SET Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance of the S/C Switch Signal circuit. Is the resistance below 10.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform SPEED CONTROL VERIFICATION - VER-4. No → Repair the S/C ON/OFF/SET Switch Signal circuit for an open. Perform SPEED CONTROL VERIFICATION - VER-4.	All
3	Turn the ignition off. Disconnect the S/C ON/OFF/SET switch harness connector. Turn the ignition on. Connect a jumper wire between the S/C Switch Signal circuit and the Sensor Ground at the ON/OFF/SET Switch harness connector. With the DRB, read the S/C Switch volts. Does the DRB display below 0.5 volt? Yes → Replace the S/C ON/OFF/SET Switch. Perform SPEED CONTROL VERIFICATION - VER-4. No → Go To 4	All

P0579-S/C SWITCH SIGNAL CIRCUIT SIGNAL VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the S/C ON/OFF/SET Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit. Is the resistance below 10.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform SPEED CONTROL VERIFICATION - VER-4. No → Repair the Sensor Ground circuit for an open. Perform SPEED CONTROL VERIFICATION - VER-4.	All
5	Turn the ignition off. Disconnect the S/C ON/OFF/SET Switch harness connector. Disconnect the ECM harness connectors. Turn the ignition on. Measure the voltage of the S/C Switch Signal circuit. Is the voltage above 1.0 volt? Yes → Repair the S/C ON/OFF/SET Switch Signal circuit for a short to voltage. Perform SPEED CONTROL VERIFICATION - VER-4. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform SPEED CONTROL VERIFICATION - VER-4.	All

Symptom:
P0579-S/C SWITCH SIGNAL CIRCUIT SIGNAL VOLTAGE TOO LOW

POSSIBLE CAUSES
INTERMITTENT CONDITION
S/C ON/OFF/SET SWITCH
S/C RESUME/ACCEL SWITCH
S/C/ SWITCH SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
S/C SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
ECM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the S/C Switch voltage. Is the S/C Switch voltage below 0.4 volt? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition on. With the DRBIII®, monitor the S/C Switch voltage. Disconnect the S/C ON/OFF/SET Switch harness connector. Did the DRB reading change to above 4.7 volts? Yes → Replace the S/C ON/OFF/SET Switch. Perform SPEED CONTROL VERIFICATION - VER-4. No → Go To 3	All
3	Turn the ignition on. With the DRBIII®, monitor the S/C Switch voltage. Disconnect the S/C Resume/Accel Switch harness connector. Did the volt change to above 4.7 volts? Yes → Replace the S/C Resume/Accel Switch. Perform SPEED CONTROL VERIFICATION - VER-4. No → Go To 4	All
4	Turn the ignition off. Disconnect the S/C ON/OFF/SET Switch harness connector. Disconnect the S/C RESUME/ACCEL Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance between the S/C Switch Signal circuit and the Sensor Ground circuit in the ECM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the S/C Switch Signal circuit shorted to the Sensor Ground circuit. Perform SPEED CONTROL VERIFICATION - VER-4. No → Go To 5	All

P0579-S/C SWITCH SIGNAL CIRCUIT SIGNAL VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the S/C ON/OFF/SET Switch harness connector. Disconnect the S/C RESUME/ACCEL Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the S/C Switch Signal circuit. Is the resistance below 5.0 ohms? Yes → Repair the S/C Switch Signal circuit for a short to ground. Perform SPEED CONTROL VERIFICATION - VER-4. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Engine Control Module in accordance with the Service Information. Perform SPEED CONTROL VERIFICATION - VER-4.	All
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FANS. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FANS. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform SPEED CONTROL VERIFICATION - VER-4. No → Test Complete.	All

Symptom:
P0615-STARTER RELAY CIRCUIT SHORT CIRCUIT

When Monitored and Set Condition:

P0615-STARTER RELAY CIRCUIT SHORT CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects excessive current on the Starter Relay Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SUBSTITUTE ECM/PCM RELAY
STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Attempt to start the engine several times, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 4	All
2	Turn the ignition off. Install a substitute relay in place of the Starter Relay. Attempt to start the engine several times, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 3 No → Replace the Starter Relay. Perform ROAD TEST VERIFICATION - VER-2.	All

P0615-STARTER RELAY CIRCUIT SHORT CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove the Starter Relay from the PDC. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Starter Relay Control circuit. Is the voltage below 1.0 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Starter Relay Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
4	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH
P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO LOW
P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE TOO HIGH
P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE TOO LOW
P0620-GENERATOR FIELD CONTROL MALF CHARGING VOLTS TOO LOW
P0620-GENERATOR FIELD CONTROL MALF HIGH GENERATOR CURRENT
P0620-GENERATOR FIELD CONTROL MALF OPEN CIRCUIT
P0620-GENERATOR FIELD CONTROL MALF SHORT CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH.

When Monitored and Set Condition:

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM detects the battery voltage and the ASD voltage difference is greater than 2 volts.

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO LOW

When Monitored: With the engine running.

Set Condition: The ECM detects the battery voltage and the ASD voltage difference is less than 2 volts.

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE TOO HIGH

When Monitored: With the engine running.

Set Condition: The ECM senses battery voltage above 15.5 volts.

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE TOO LOW

When Monitored: With the engine running.

Set Condition: The ECM detects the battery voltage is less than 8.0 volts.

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH — Continued

P0620-GENERATOR FIELD CONTROL MALF CHARGING VOLTS TOO LOW

When Monitored: With the engine running.

Set Condition: The ECM senses battery voltage that is 1volt or more below desired charging voltage.

P0620-GENERATOR FIELD CONTROL MALF HIGH GENERATOR CURRENT

When Monitored: With the engine running.

Set Condition: The ECM detects a higher current than should be.

P0620-GENERATOR FIELD CONTROL MALF OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects an open or short to ground on the Generator Field Control circuit.

P0620-GENERATOR FIELD CONTROL MALF SHORT CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects excessive current on the Generator Field Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
GENERATOR BELT CONDITION OR TENSION
GENERATOR FIELD
GENERATOR FIELD CONTROL CIRCUIT SHORTED TO VOLTAGE
GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR FIELD CONTROL CIRCUIT OPEN
HIGH RESISTANCE ON THE BATTERY(+) SENSE CIRCUIT
HIGH RESISTANCE ON THE BATTERY(-) SENSE CIRCUIT
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: If there are any Battery Sense DTCs (P1511 or P1512) present with this DTC, diagnose the Battery Sense DTCs first.** **NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator capacity.** **NOTE: The battery must be fully charged before continuing.** Inspect the generator belt condition and tension. Is the generator belt in good condition and tensioned properly? Yes → Go To 2 No → Repair as necessary. Perform CHARGING VERIFICATION - VER-3.	All

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. With the DRB, erase ECM DTCs. Start the engine several times. Allow the engine to run for at least 30 seconds each run cycle while turning the ignition off for at least 10 seconds between each run cycle. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 3 No → Go To 10	All
3	Turn the ignition off. Disconnect the Generator Field harness connector. Measure the resistance of the Field Control terminals on the back of the Generator. Is the resistance between 2 and 6 ohms? Yes → Go To 4 No → Repair or replace the Generator as necessary. Perform CHARGING VERIFICATION - VER-3.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Generator Field harness connector. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Generator Field Control circuit. Is the voltage below 1.0 volt? Yes → Go To 5 No → Repair the Generator Field Control circuit for a short to voltage. Perform CHARGING VERIFICATION - VER-3.	All
5	Turn the ignition off. Disconnect ECM harness connectors. Disconnect the Generator Field harness connector. Measure the resistance between ground and the Generator Field Control circuit. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Generator Field Control circuit for a short to ground. Perform CHARGING VERIFICATION - VER-3.	All
6	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Generator Field harness connector. Measure the resistance of the Generator Field Control circuit. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Generator Field Control circuit for an open. Perform CHARGING VERIFICATION - VER-3.	All

P0620-GENERATOR FIELD CONTROL MALF BATTERY VOLTAGE DEVIATION TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the ECM harness connectors. Remove Fuse 26 from the PDC. Measure the resistance of the Battery(+) Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the Battery(+) Sense circuit for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
8	Turn the ignition off. Disconnect the ECM harness connectors. Measure the resistance of the Battery(-) Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the Battery(-) Sense circuit for high resistance. Perform CHARGING VERIFICATION - VER-3.	All
9	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform CHARGING VERIFICATION - VER-3.	All
10	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform CHARGING VERIFICATION - VER-3. No → Test Complete.	All

Symptom:
P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The ECM detects a short to voltage on the Sensor Reference Voltage A circuit or the Fuel Pressure Sensor 5-Volt Supply circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SENSOR REFERENCE VOLTAGE A SHORTED TO VOLTAGE
ENGINE CONTROL MODULE
FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the MAF and APP Sensor harness connectors. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Sensor Reference Voltage A circuit. Is the voltage above 1.0 volt? Yes → Repair the Sensor Reference Voltage A circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3 **NOTE: Remove the jumper wire and reinstall the ASD Relay.**	All

P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Fuel Pressure Sensor 5-Volt Supply circuit. Is the voltage below 1.0 volt? Yes → Go To 4 No → Repair the Fuel Pressure Sensor 5-Volt Supply circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. **NOTE: Remove the jumper wire and reinstall the ASD Relay.**	All
4	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO LOW

When Monitored and Set Condition:

P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The ECM detects a short to ground on the Sensor Reference Voltage A circuit or a short to ground on the Fuel Pressure Sensor 5-Volt Supply circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUEL PRESSURE SENSOR SHORTED TO GROUND
MASS AIR FLOW SENSOR SHORTED TO GROUND
ACCELERATOR PEDAL POSITION SENSOR 2 SHORTED TO GROUND
SENSOR REFERENCE VOLTAGE A CIRCUIT SHORTED TO GROUND
SENSOR REFERENCE VOLTAGE A CIRCUIT SHORTED TO SENSOR GROUND
FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 10	All
2	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Turn the ignition on. Measure the voltage of the Fuel Pressure Sensor 5-Volt Supply circuit. Is the voltage above 4.8 volts? Yes → Replace the Fuel Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the MAF Sensor harness connector. Turn the ignition on. Measure the voltage of the Sensor Reference Voltage A circuit. Is the voltage above 4.8 volts? Yes → Replace the Mass Air Flow Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the Accelerator Pedal Position Sensor harness connector. Turn the ignition on. Measure the voltage of the Sensor Reference Voltage A circuit. Is the voltage above 4.8 volts? Yes → Replace the Accelerator Pedal Position Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the MAF Sensor and Accelerator Pedal Position Sensor harness connectors. Measure the resistance between ground and the Sensor Reference Voltage A circuit. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Sensor Reference Voltage A circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the MAF Sensor harness connector. Measure the resistance between the Sensor Reference Voltage A circuit and the MAF Sensor Ground circuit. Disconnect the Accelerator Pedal Position Sensor harness connector. Measure the resistance between the Sensor Reference Voltage A circuit and both Accelerator Pedal Position Sensor Ground circuits. Is the resistance above 100 kohms for each measurement? Yes → Go To 7 No → Repair the Sensor Reference Voltage A circuit for a short to the Sensor Ground circuit that measured below 100 kohms. Perform ROAD TEST VERIFICATION - VER-2.	All

P0641-SENSOR REFERENCE VOLTAGE A CKT VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Pressure Sensor harness connector. Measure the resistance between ground and the Fuel Pressure Sensor 5-Volt Supply circuit. Is the resistance above 100 kohms? Yes → Go To 8 No → Repair the Fuel Pressure Sensor 5-Volt Supply circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Fuel Pressure Sensor harness connector. Measure the resistance between the Fuel Pressure Sensor 5-Volt Supply circuit and the Sensor Ground circuit. Is the resistance above 100 kohms? Yes → Go To 9 No → Repair the Fuel Pressure Sensor 5-Volt Supply circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
9	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
10	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0645-A/C CLUTCH RELAY CIRCUIT OPEN CIRCUIT

When Monitored and Set Condition:

P0645-A/C CLUTCH RELAY CIRCUIT OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM does not detect voltage on the A/C Clutch Relay Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUSED ASD RELAY OUTPUT CIRCUIT OPEN
A/C CLUTCH RELAY
A/C CLUTCH RELAY CONTROL CKT OPEN
A/C CLUTCH RELAY CONTROL CIRCUIT SHORT TO GROUND
ECM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, actuate the A/C Clutch Relay. Is the A/C Clutch Relay operating? Yes → Go To 2 No → Go To 3	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

P0645-A/C CLUTCH RELAY CIRCUIT OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused ASD Relay Output circuit in the PDC. Does the test light illuminate? Yes → Go To 4 No → Repair the Fused ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Turn the ignition on. Using a 12-volt test light connected to 12-volts, probe the A/C Clutch Relay Control circuit in the PDC. With the DRBIII®, actuate the A/C Clutch Relay. Does the test light cycle on and off? Yes → Replace the A/C Clutch Relay. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the ECM harness connector. Measure the resistance of the A/C Clutch Relay Control circuit. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the A/C Clutch Relay Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the ECM harness connector. Measure the resistance between ground and the A/C Clutch Relay Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the A/C Clutch Relay Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P0645-A/C CLUTCH RELAY CIRCUIT SHORT CIRCUIT

When Monitored and Set Condition:

P0645-A/C CLUTCH RELAY CIRCUIT SHORT CIRCUIT

When Monitored: With the ignition off.

Set Condition: The ECM detects excessive current on the A/C Clutch Relay Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
A/C CLUTCH RELAY
A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
ECM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, actuate the A/C Clutch Relay. Is the A/C Clutch Relay operating? Yes → Go To 2 No → Go To 3	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

P0645-A/C CLUTCH RELAY CIRCUIT SHORT CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Turn the ignition on. Using a 12-volt test light connected to 12-volts, probe the A/C Clutch Relay Control circuit in the PDC. With the DRBIII®, actuate the A/C Clutch Relay. Does the test light cycle on and off? Yes → Replace the A/C Clutch Relay. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the ECM harness connector. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the A/C Clutch Relay Control circuit. Is the voltage above 1.0 volt? Yes → Repair the A/C Clutch Relay Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The ECM detects a short to voltage on the Sensor Reference Voltage B circuit or the Accelerator Pedal Position Sensor 5-Volt Supply circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SENSOR REFERENCE VOLTAGE B CIRCUIT SHORTED TO VOLTAGE
ACCELERATOR PEDAL POSITION SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the Boost Pressure Sensor harness connector. Disconnect the Engine Oil Pressure Sensor harness connector. Disconnect the A/C Pressure Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Sensor Reference Voltage B circuit. Is the voltage above 1.0 volt? Yes → Repair the Sensor Reference Voltage B circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3 **NOTE: Remove the jumper wire and reinstall the ASD Relay.**	All

P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Accelerator Pedal Position Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage on the Accelerator Pedal Position Sensor 5-Volt Supply circuit. Is the voltage below 1.0 volt? Yes → Go To 4 No → Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. **NOTE: Remove the jumper wire and reinstall the ASD Relay.**	All
4	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO LOW

When Monitored and Set Condition:

P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The ECM detects a short to ground on the Sensor Reference Voltage B circuit, or a short to ground on the Accelerator Pedal Position Sensor 5-Volt Supply circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
A/C PRESS, OIL PRESS, BOOST PRESS, OR APP SENSOR SHORTED TO GROUND
SENSOR REFERENCE VOLTAGE B CIRCUIT SHORTED TO GROUND
SENSOR REFERENCE VOLTAGE B CIRCUIT SHORTED TO SENSOR GROUND
ACCELERATOR PEDAL POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
ACCELERATOR PEDAL POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 8	All

P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. With the DRBIII® in Sensors, monitor the Accelerator Pedal Position and Boost Pressure Sensors only. One at a time while monitoring the DRB sensor readings, disconnect then reconnect the Boost Pressure, Accelerator Pedal Position, A/C Pressure and Engine Oil Pressure Sensor harness connectors. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. **NOTE: If one of the sensors is shorted to ground internally, disconnecting it will cause the voltage reading on the DRB to rise for the monitored sensor that has not been disconnected.** **NOTE: Disconnecting components will generate new DTCs which should be ignored.** Did either of the monitored sensor voltage readings rise when one sensor was disconnected? Yes → Replace the Sensor that, when disconnected, caused the DRB sensor readings to rise. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Boost Pressure, A/C Pressure and Engine Oil Pressure Sensors harness connectors. Measure the resistance between ground and the Sensor Reference Voltage B circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Sensor Reference Voltage B circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Engine Oil Pressure Sensor harness connector. Measure the resistance between the Sensor Reference Voltage B circuit and the Oil Pressure Sensor Ground circuit. Disconnect the Boost Pressure Sensor harness connector. Measure the resistance between the Sensor Reference Voltage B circuit and the Boost Pressure Sensor Ground circuit. Disconnect the A/C Pressure Sensor harness connector. Measure the resistance between the Sensor Reference Voltage B circuit and the A/C Pressure Sensor Ground circuit. Is the resistance above 100 kohms for each measurement? Yes → Go To 5 No → Repair the Sensor Reference Voltage B circuit for a short to the Sensor Ground circuit that measured below 100 kohms. Perform ROAD TEST VERIFICATION - VER-2.	All

P0651-SENSOR REFERENCE VOLTAGE B CKT VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Accelerator Pedal Position Sensor harness connector. Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-Volt Supply circuit. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the Accelerator Pedal Position Sensor harness connector. Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits. Is the resistance above 100 kohms for each measurement? Yes → Go To 7 No → Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
8	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO EARLY

When Monitored and Set Condition:

P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO EARLY

When Monitored: During after-run.

Set Condition: The internal ECM timer determines that the ASD Relay has shut off before the AFTER-RUN mode of operation has been completed.

POSSIBLE CAUSES
CHECK FOR OTHER DTCS
INTERMITTENT CONDITION
SUBSTITUTE ASD RELAY
ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, check for additional DTCs. Are other DTCs present? Yes → Refer to the Symptom List for diagnosis of the other DTCs before continuing. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition on. With the DRB, erase ECM DTCs. Perform several ignition key cycles, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off. Install a substitute relay in place of the ASD Relay. Perform several ignition key cycles, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 4 No → Replace the ASD Relay. Perform ROAD TEST VERIFICATION - VER-2.	All

P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO EARLY — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the ECM harness connectors. Measure the resistance of the ASD Relay Control circuit while wiggling the wiring harness and connectors between the ECM and the PDC. Was the resistance above 5.0 ohms at any time while wiggling the wiring harness and connectors? Yes → Repair the ASD Relay Control circuit for an intermittent open. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO LATE

When Monitored and Set Condition:

P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO LATE

When Monitored: During after-run.

Set Condition: The internal ECM timer determines that the ASD Relay remains on for more than 2.0 seconds after the ECM has turned off the ASD Relay.

POSSIBLE CAUSES
CHECK FOR OTHER DTCS
INTERMITTENT CONDITION
SUBSTITUTE ASD RELAY
ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND INTERMITTENTLY
ASD RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, check for additional DTCs. Are other DTCs present? Yes → Refer to the Symptom List for diagnosis of the other DTCs before continuing. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition on. With the DRB, erase ECM DTCs. Perform several ignition key cycles, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 3 No → Go To 6	All

P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO LATE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Install a substitute relay in place of the ASD Relay. Perform several ignition key cycles, pausing for at least 10 seconds between each cycle. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 4 No → Replace the ASD Relay. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the ECM harness connectors. Measure the resistance between ground and the ASD Relay Control circuit while wiggling the wiring harness and connectors. Was the resistance below 5.0 ohms at any time while wiggling the wiring harness and connectors? Yes → Repair the ASD Relay Control circuit for an intermittent short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Remove the ASD Relay from the PDC. Turn the ignition on. Measure the voltage of the ASD Relay Output circuit. Is the voltage below 0.5 volt? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the ASD Relay Output circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P0700-TRANS CONTROL 1-2/4-5 SOLENOID CIRCUIT
P0700-TRANS CONTROL 2-3 SOLENOID CIRCUIT
P0700-TRANS CONTROL 3-4 SOLENOID CIRCUIT
P0700-TRANS CONTROL INTERNAL CONTROLLER
P0700-TRANS CONTROL MOD. PRESS SOLENOID CIRCUIT
P0700-TRANS CONTROL SHIFT PRESSURE SOLENOID CIRCUIT
P0700-TRANS CONTROL SOLENOID SUPPLY VOLTAGE
P0700-TRANS CONTROL TCC SOLENOID CIRCUIT
P0702-TRANS CONTROL ABS SENSOR MESSAGE
P0702-TRANS CONTROL ENGINE T-CASE SWITCH MESSAGE
P0702-TRANS CONTROL IMPROPER GEAR
P0702-TRANS CONTROL IMPROPER RATIO OR TRANSMISSION SLIPPING
P0702-TRANS CONTROL INTERNAL SHIFTER FAILURE
P0702-TRANS CONTROL N2 OR N3 INPUT SENSOR CIRCUIT
P0702-TRANS CONTROL TCC FAULT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0700-TRANS CONTROL 1-2/4-5 SOLENOID CIRCUIT.

POSSIBLE CAUSES
VERIFY CURRENT DTC

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P1242 is present with this DTC, perform the diagnostic for P1242 before continuing.** **NOTE: This code was set in the ECM by the Transmission Control Module to indicate a transmission fault. Diagnosis of transmission faults should be done using the Transmission Diagnostic Information.** **NOTE: When repairs have been completed, the ECM and TCM must have codes cleared.** Turn the ignition on. With the DRBIII®, erase ECM DTCs only. With the DRBIII®, read ECM DTCs. Are any P0700 or P0702 DTCs present in the ECM? Yes → Refer to Transmission Diagnostic Information for the related symptom(s). Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom List:

P0703-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT

P0703-BRAKE SWITCH SIGNAL CKTS PLAUS W/REDUNDANT CONTACT AFTER INITIALIZATION

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0703-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT.

When Monitored and Set Condition:

P0703-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT

When Monitored: With the ignition on.

Set Condition: The ECM detects the Primary Brake Switch Signal circuit and Secondary Brake Switch Signal circuit inputs to the ECM do not agree.

P0703-BRAKE SWITCH SIGNAL CKTS PLAUS W/REDUNDANT CONTACT AFTER INITIALIZATION

When Monitored: With the ignition on.

Set Condition: The ECM detects the Primary Brake Switch Signal circuit and Secondary Brake Switch Signal circuit inputs to the ECM do not agree.

POSSIBLE CAUSES
INTERMITTENT CONDITION
BRAKE LAMP SWITCH - SECONDARY OPEN
BRAKE LAMP SWITCH FUSED B+ CIRCUIT OPEN
SECONDARY BRAKE SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
BRAKE LAMP SWITCH - PRIMARY OPEN
SECONDARY BRAKE SWITCH GROUND CIRCUIT OPEN
SECONDARY BRAKE SWITCH SIGNAL CIRCUIT OPEN
PRIMARY BRAKE SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE
PRIMARY BRAKE SWITCH SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE - INTERNAL
ENGINE CONTROL MODULE - PRIMARY BRAKE SIGNAL
ENGINE CONTROL MODULE - SECONDARY BRAKE SIGNAL

P0703-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. While observing the PRIM BRAKE SWITCH status on the DRB display, press and release the brake pedal several times. Does the DRB display PRIM BRAKE SWITCH: PRESSED and RELEASED for the appropriate pedal position? Yes → Go To 2 No → Go To 11	All
2	Turn the ignition on. While observing the SEC BRAKE SWITCH status on the DRB display, press and release the brake pedal several times. Does the DRB display SEC BRAKE SWITCH: PRESSED and RELEASED for the appropriate pedal position? Yes → Go To 3 No → Go To 4	All
3	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
4	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Turn the ignition on. Measure the voltage between the Secondary Brake Switch Signal circuit and ground. Is the voltage above 9.0 volts? Yes → Go To 5 No → Go To 8	All

P0703-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the Brake Lamp Switch harness connector. Turn the ignition on. While monitoring the SEC BRAKE SWITCH status with the DRB, connect a jumper wire between ground and the Secondary Brake Switch Signal circuit. Does the DRB display change from PRESSED to RELEASED? Yes → Adjust or replace the Brake Lamp Switch in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Measure the resistance between ground and the Secondary Brake Switch Ground circuit. Is the resistance below 10.0 ohms? Yes → Go To 7 No → Repair the Secondary Brake Switch Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Secondary Brake Switch Signal circuit. Is the resistance above 1000 ohms? Yes → Go To 9 No → Repair the Secondary Brake Switch Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
9	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Secondary Brake Switch Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 10 No → Repair the Secondary Brake Switch Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
10	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P0703-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT — Continued

TEST	ACTION	APPLICABILITY
11	Disconnect the Brake Lamp Switch harness connector. Using a 12-volt test light connected to ground, check the Fused B+ circuit. Does the test light illuminate brightly? Yes → Go To 12 No → Repair the Brake Lamp Switch Fused B+ circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
12	Disconnect the Brake Lamp Switch harness connector. Turn the ignition on. While monitoring the PRIM BRAKE SWITCH status with the DRB, connect a jumper wire between the Primary Brake Switch Signal circuit and the Fused B(+) circuit. Does the DRB display change from RELEASED to PRESSED? Yes → Adjust or replace the Brake Lamp Switch in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 13	All
13	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage between the Primary Brake Switch Signal circuit and ground. Is the voltage above 1.0 volt? Yes → Repair the Primary Brake Switch Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 14	All
14	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Primary Brake Switch Signal circuit. Is the resistance below 5.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Primary Brake Switch Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom List:

P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY
P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY 2
P0836-TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO HIGH
P0836-TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY.

When Monitored and Set Condition:

P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY

When Monitored: When the ECM detects the transfer case in 4WD low.

Set Condition: The ECM detects a vehicle speed that is higher than is possible in 4WD low.

P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY 2

When Monitored: With the ignition on.

Set Condition: The ECM detects a voltage signal from the transfer case switch that does not fall into a valid switch position voltage range.

P0836-TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The Transfer Case Position Sensor Signal circuit voltage is above 3.0 volts.

P0836-TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The Transfer Case Position Sensor Signal circuit voltage is below 0.12 volt.

POSSIBLE CAUSES
CHECKING THE TRANSFER CASE POSITION SENSOR
INTERMITTENT WIRING AND CONNECTORS
TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN
TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND
TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY — Continued

POSSIBLE CAUSES
TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR GROUND CIRCUIT
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, record and erase DTCs. Start the engine and cycle the Transfer Case through all positions. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off to the lock position. Disconnect the ECM harness connectors. Disconnect the Transfer Case Position Sensor harness connector. Remove the ASD Relay. Connect a jumper wire between cavities 30 and 87 of the ASD Relay connector in the PDC. Turn the ignition on. Measure the voltage of the Transfer Case Position Sensor Signal circuit. Is the voltage above 1.0 volt? Yes → Repair the Transfer Case Position Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All
3	Turn the ignition off to the lock position. Disconnect the ECM harness connectors. Disconnect the Transfer Case Position Sensor harness connector. Measure the resistance of the Transfer Case Position Sensor Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 4 No → Repair the Transfer Case Position Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off to the lock position. Disconnect the ECM harness connectors. Disconnect the Transfer Case Position Sensor harness connector. Measure the resistance between ground and the Transfer Case Position Sensor Signal circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Transfer Case Position Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All

P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the ECM harness connectors. Disconnect the Transfer Case Position Sensor harness connector. Measure the resistance between the Transfer Case Position Sensor circuit and the Sensor Ground circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Transfer Case Position Sensor Signal circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	Turn the ignition on. With the DRBIII® read the T-case Sensor Observe the T-case volts on the DRB while moving the transfer case selector lever in each of the transfer case positions. **NOTE: When shifting the transfer case selector to each position, the Sensor voltage should result in the following voltages: 4WD Low 0.16 - 0.40, Neutral 0.68 - 0.97 4WD Full Time 1.24 - 1.55.** Does each position provide the correct voltage? Yes → Replace and program the ECM in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Transfer Case Position Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P0850-P/N SWITCH PLAUSIBILITY

When Monitored and Set Condition:

P0850-P/N SWITCH PLAUSIBILITY

When Monitored: With the engine running at >3700 RPM, accelerator pedal position sensor >70%, fuel quantity >60 mm^3, and the transmission physically not in Park or Neutral.

Set Condition: The ECM receives a P/N Switch input of Neutral or Park.

POSSIBLE CAUSES
CHECKING THE P/N SENSE CIRCUIT
ENGINE CONTROL MODULE
P/N SENSE CIRCUIT SHORTED TO VOLTAGE
P/N SWITCH SENSE CIRCUIT OPEN
P/N SWITCH SENSE CIRCUIT SHORTED TO GROUND
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, record and erase DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the TCM harness connector. Turn the ignition on. With the DRBIII® in Engine Inputs/Outputs, read the P/N Switch state. Connect one end of a jumper wire to the P/N Switch Sense circuit at the TCM harness connector. Connect the other end of the jumper to ground for 10 seconds then disconnect from ground. Dose the DRB Switch state change when connecting and disconnecting from ground? Yes → The Park/Neutral Position Sense circuitry is operating properly. Refer to Transmission Diagnostic information for the related symptom(s). Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P0850-P/N SWITCH PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavities 30 and 87 in the ASD connector in the PDC. Turn the ignition on. Measure the voltage of the P/N Switch Sense circuit. Is the voltage above 1.0 volt? Yes → Repair the Park/Neutral Switch Sense circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Measure the resistance of the P/N Switch Sense circuit. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Repair the Park/Neutral Position Sense circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the P/N Switch Sense circuit. Is the resistance above 1000.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the P/N Switch Sense circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P1130-FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING
P1130-FUEL RAIL PRESSURE MALFUNCTION LEAKAGE DETECTED
P1130-FUEL RAIL PRESSURE MALFUNCTION POSITIVE DEVIATION
P1130-FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO HIGH-SHUT OFF
P1130-FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO LOW
P1130-FUEL RAIL PRESSURE MALFUNCTION SOLENOID OPEN

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1130-FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING.

When Monitored and Set Condition:

P1130-FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING

When Monitored: With the engine speed above 730 rpm.

Set Condition: The fuel rail pressure sensor indicates fuel pressure above what the ECM commanded.

P1130-FUEL RAIL PRESSURE MALFUNCTION LEAKAGE DETECTED

When Monitored: With the engine speed above 730 rpm.

Set Condition:

P1130-FUEL RAIL PRESSURE MALFUNCTION POSITIVE DEVIATION

When Monitored: With the engine speed above 730 rpm.

Set Condition: The ECM commands the fuel pressure solenoid and the fuel pressure sensor indicates a fuel pressure reading less than what is expected by the ECM based on the ECM command to the fuel pressure solenoid.

P1130-FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO HIGH-SHUT OFF

When Monitored: With the engine speed above 730 rpm.

Set Condition: The fuel rail pressure sensor indicates fuel pressure above 21,000 PSI with the engine off.

P1130-FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING — Continued

P1130-FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO LOW

When Monitored: With the engine running.

Set Condition: The ECM determines that the fuel rail pressure is too low for a given engine speed.

P1130-FUEL RAIL PRESSURE MALFUNCTION SOLENOID OPEN

When Monitored: With the engine running.

Set Condition: The ECM detects a higher rate of fuel pressure than the target pressure.

POSSIBLE CAUSES
CHECKING FOR OTHER DTC'S
CHECKING THE FUEL PRESSURE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL PRESSURE SENSOR
FUEL SYSTEM LEAK
INJECTOR COMMON DRIVER CIRCUIT OPEN
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.** Turn the ignition on. With the DRBIII®, read the ECM DTCs. Are there any other DTCs present? Yes → Refer to symptom list for problems related to the DTC other than P1130. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 3 No → Go To 7	All

P1130-FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Inspect the entire fuel system for leakage. Is there any evidence of leakage? Yes → Repair as necessary in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect all of the Fuel Injector harness connectors. Measure the resistance between ground and each of the Fuel Injector Control circuits. Is the resistance below 1000 ohms for any of the measurements? Yes → Repair the appropriate Fuel Injector Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect all of the Fuel Injector harness connectors. Measure the resistance of the Common Injector Driver circuit between the ECM harness connector and each Fuel Injector harness connector. Is the resistance below 10.0 ohms for each measurement? Yes → Go To 6 No → Repair the Injector Common Driver circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Refer to the appropriate Service Information and perform the Fuel Pressure Test. **NOTE: The following is a list of problems that can cause the fuel pressure to become out of specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, gelled fuel, faulty injector.** Is the fuel pressure within specification? Yes → Replace the Fuel Pressure Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair as necessary in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P1130-FUEL RAIL PRESSURE MALFUNCTION ACTUATOR STICKING — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT
P1131-FUEL PRESSURE SOLENOID POWERSTAGE ERROR
P1131-FUEL PRESSURE SOLENOID SHORT CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT.

When Monitored and Set Condition:

P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects an open or short to ground on the Fuel Pressure Solenoid Control circuit.

P1131-FUEL PRESSURE SOLENOID POWERSTAGE ERROR

When Monitored: When the ignition is turned off.

Set Condition: The ECM detects engine speed does not fall below 650 RPM within 1.5 second after ignition off.

P1131-FUEL PRESSURE SOLENOID SHORT CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects a short to voltage on the Fuel Pressure Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
FUEL PRESSURE SOLENOID CONTROL SHORTED TO VOLTAGE
FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN
FUEL PRESSURE SOLENOID
ENGINE CONTROL MODULE

P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
1	**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.** Turn the ignition on. With the DRB, erase ECM DTCs. Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the Fuel Pressure Solenoid harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the Fuel Pressure Solenoid harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Fuel Pressure Solenoid Control circuit. Is the voltage below 1.0 volt? Yes → Go To 4 No → Repair the Fuel Pressure Solenoid Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Fuel Pressure Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Fuel Pressure Solenoid Control circuit. **NOTE: The Fuel Pressure Solenoid Control circuit is duplicated at ECM cavities C2-80 and C2-81.** Is the resistance above 100 kohms? Yes → Go To 5 No → Repair the Fuel Pressure Solenoid Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the Fuel Pressure Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Fuel Pressure Solenoid Control circuit. **NOTE: The Fuel Pressure Solenoid Control circuit is duplicated at ECM cavities C1-80 and C1-81.** Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Fuel Pressure Solenoid Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the Fuel Pressure Solenoid harness connector. Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. **NOTE: The DRB should display P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT.** Turn the ignition off. Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector. Turn the ignition on. With the DRB, erase ECM DTCs. Monitor the DRB for ECM DTCs. **NOTE: The DRB should display P1131-FUEL PRESSURE SOLENOID SHORT CIRCUIT.** Does the DRB display the appropriate DTC for each condition? Yes → Replace the Fuel Pressure Solenoid in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P1131-FUEL PRESSURE SOLENOID OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
8	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time.The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P1205-INJECTOR CLASSIFICATION ERROR

P1205-INJECTOR CLASSIFICATION ERROR CHECKSUM ERROR

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1205-INJECTOR CLASSIFICATION ERROR.

POSSIBLE CAUSES
ECM
VERIFY INJECTOR CLASSIFICATIONS

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII® check for the correct classification of all of the Fuel Injectors. Are all of the injectors classified correctly? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Program the Engine Control Module with the correct Injector Classification in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom List:

P1235-EXTERNAL FUEL QUANTITY BIT ERROR
P1235-EXTERNAL FUEL QUANTITY DEMAND ERROR
P1235-EXTERNAL FUEL QUANTITY PARITY ERROR
P1235-EXTERNAL FUEL QUANTITY TORQUE ERROR

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1235-EXTERNAL FUEL QUANTITY BIT ERROR.

POSSIBLE CAUSES
CHECKING FOR TRANSMISSION CONTROL MODULE DTC'S
TRANSMISSION CONTROL MODULE
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the TCM DTCs. Are there any TCM DTC's? Yes → Refer to symptom list for problems related to TCM DTC's. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	**NOTE: This DTC indicates a communication problem between the TCM and the ECM.** Turn the ignition on. With the DRB, erase ECM DTCs. Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the DRBIII®, read the ECM DTCs. Did this DTC set again? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Replace and program the Transmission Control Module in accordance with the Service Information. Turn the ignition on. With the DRB, erase all ECM and TCM DTC's. Perform several engine run cycles, turning the engine off for at least 20 seconds between each cycle. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

P1235-EXTERNAL FUEL QUANTITY BIT ERROR — Continued

TEST	ACTION	APPLICABILITY
4	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P1242-CAN BUS MESSAGE MISSING
P1242-CAN BUS MESSAGE MISSING FROM TCM

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1242-CAN BUS MESSAGE MISSING.

When Monitored and Set Condition:

P1242-CAN BUS MESSAGE MISSING

When Monitored: With the ignition on.

Set Condition: The ECM detects an open on the CAN Bus circuit.

P1242-CAN BUS MESSAGE MISSING FROM TCM

When Monitored: With the ignition on.

Set Condition: The ECM does not receive an expected CAN Bus message from the TCM.

POSSIBLE CAUSES
CAN C BUS CIRCUITS OPEN
CAN C BUS CIRCUITS SHORTED TO GROUND
CAN C BUS CIRCUITS SHORTED TOGETHER
ENGINE CONTROL MODULE
TRANSMISSION CONTROL MODULE
INTERMITTENT CONDITION
ABS - TERMINATING RESISTOR
ECM - CAN C BUS CIRCUIT
TCM - TERMINATING RESISTOR

TEST	ACTION	APPLICABILITY
1	**NOTE: This DTC indicates a communication problem between the TCM and the ECM.** Turn the ignition on. With the DRB, erase ECM DTCs. Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the DRBIII®, read the ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 8	All

P1242-CAN BUS MESSAGE MISSING — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the TCM harness connectors. Measure and note the resistance of the CAN C Bus (+) circuit between the ECM harness connector and the TCM harness connector. Measure and note the resistance of the CAN C Bus (-) circuit between the ECM harness connector and the TCM harness connector. Is the resistance below 10.0 ohms for each measurement? Yes → Go To 3 No → Repair the CAN C Bus circuit(s) for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the TCM harness connectors. Disconnect the CAB harness connector. Measure and note the resistance between ground and the CAN C Bus (+) circuit at the TCM harness connector. Measure and note the resistance between ground and the CAN C Bus (-) circuit at the TCM harness connector. Is the resistance above 1000 ohms for each measurement? Yes → Go To 4 No → Repair the CAN C Bus circuit(s) for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the TCM harness connectors. Disconnect the CAB harness connector. Measure and note the resistance between the CAN C Bus (+) circuit and the CAN C Bus (-) circuit at the TCM harness connector. Is the resistance above 1000 ohms? Yes → Go To 5 No → Repair the CAN C Bus circuit(s) for a short together. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off to the lock position. Disconnect the ECM harness connector. **NOTE: Make sure both the TCM and the CAB harness connectors are connected before taking this measurement.** Measure the resistance between the CAN C Bus (+) circuit and the CAN C Bus (-) circuit in the ECM harness connector. Is the resistance 60.0 ohms, ± 3.0 ohms? Yes → Go To 6 No → Go To 7	All

P1242-CAN BUS MESSAGE MISSING — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Replace and program the Transmission Control Module in accordance with the Service Information. Turn the ignition on. With the DRB, erase all ECM and TCM DTC's. Perform several engine run cycles, turning the engine off for at least 20 seconds between each cycle. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off to the lock position. Disconnect the CAB harness connector. **NOTE: Make sure both the TCM and the ECM harness connectors are connected before taking this measurement.** Measure the resistance between the CAN Bus (+) circuit and the CAN Bus (-) circuit in the CAB harness connector. Is the resistance 120 ohms, ± 2.0 ohms? Yes → Replace the CAB Module. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Transmission Control Module. Perform ROAD TEST VERIFICATION - VER-2.	All
8	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1242-CAN BUS MUTE

When Monitored and Set Condition:

P1242-CAN BUS MUTE

When Monitored: With the ignition on.

Set Condition: The ECM does not detect any CAN Bus messages.

POSSIBLE CAUSES
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
CAN C BUS CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. Start the engine. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 3	All
2	**NOTE: At any time, if one of the measurements is above 5.0 ohms, answer the question.** Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Measure the resistance of the CAN C Bus (+) circuit between the ECM and the TCM harness connectors. Measure the resistance of the CAN C Bus (-) circuit between the ECM and the TCM harness connectors. Disconnect the CAB harness connector. Measure the resistance of the CAN C Bus (+) circuit between the ECM and CAB harness connectors. Measure the resistance of the CAN C Bus (-) circuit between the ECM and CAB harness connectors. Is the resistance below 5.0 ohms for each measurement? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the CAN C Bus circuit that measured greater than 5.0 ohms for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P1242-CAN BUS MUTE — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time.The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1270-INTAKE PORT SWIRL ACTUATOR SHORT CIRCUIT

When Monitored and Set Condition:

P1270-INTAKE PORT SWIRL ACTUATOR SHORT CIRCUIT

When Monitored: With the ignition on and the ECM attempting to actuate the Intake Port Swirl Actuator.

Set Condition: The ECM detects excessive current on the Intake Port Swirl Actuator Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SWIRL SOLENOID
SWIRL SOLENOID CONTROL SHORT TO VOLTAGE
ECM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. With the DRBIII®, actuate the Swirl Solenoid. With the DRBIII®, read the ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 4	All
2	Turn the ignition off. Disconnect the Swirl Solenoid harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Swirl Solenoid Control circuit. Is the voltage below 1.0 volt? Yes → Go To 3 No → Repair the Swirl Solenoid Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All

P1270-INTAKE PORT SWIRL ACTUATOR SHORT CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Install a substitute Swirl Solenoid. Turn the ignition on. With the DRB, erase ECM DTCs. With the DRBIII®, actuate the Swirl Solenoid. With the DRBIII®, read the ECM DTCs. Does the DRB display this DTC? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Swirl Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
4	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1270-INTAKE PORT SWIRL ACTUATOR GROUND X

When Monitored and Set Condition:

P1270-INTAKE PORT SWIRL ACTUATOR GROUND X

When Monitored: With the ignition on.

Set Condition: The ECM detects an internal fault with the Intake Port Swirl Actuator.

POSSIBLE CAUSES
INTAKE PORT SWIRL ACTUATOR

Repair Instructions:

INTAKE PORT SWIRL ACTUATOR

Replace the Intake Port Swirl Actuator.

Perform ROAD TEST VERIFICATION - VER-2.

Symptom:
P1270-INTAKE PORT SWIRL ACTUATOR OPEN CIRCUIT

When Monitored and Set Condition:

P1270-INTAKE PORT SWIRL ACTUATOR OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM does not detect voltage on the Intake Port Swirl Actuator Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
SWIRL SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
SWIRL SOLENOID CONTROL CKT OPEN
SWIRL SOLENOID
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. With the DRBIII®, actuate the Swirl Solenoid. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Swirl Solenoid harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the Swirl Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Swirl Solenoid Control circuit. Is the resistance above 1000 ohms? Yes → Go To 4 No → Repair the Swirl Solenoid Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P1270-INTAKE PORT SWIRL ACTUATOR OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Swirl Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Swirl Solenoid Control circuit. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Repair the Swirl Solenoid Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Install a substitute Swirl Solenoid in place of the vehicle's Swirl Solenoid. **NOTE: Ensure the ECM and Swirl Solenoid harness connectors are connected.** Turn the ignition on. With the DRBIII®, actuate the Swirl Solenoid. With the DRB, check for this DTC to set again. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Swirl Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time.The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT OPEN CIRCUIT

When Monitored and Set Condition:

P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM does not detect voltage on the Hydraulic Cooling Fan Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
HYDRAULIC COOLING FAN SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
HYDRAULIC COOLING FAN SOLENOID CONTROL CKT OPEN
HYDRAULIC COOLING FAN SOLENOID
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. With the DRBIII®, actuate the Hydraulic Cooling Fan Solenoid. Monitor the DRB for ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Hydraulic Cooling Fan Solenoid harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT OPEN CIRCUIT

— Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Hydraulic Cooling Fan Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Swirl Solenoid Control circuit. Is the resistance above 1000 ohms? Yes → Go To 4 No → Repair the Hydraulic Cooling Fan Solenoid Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the Hydraulic Cooling Fan Solenoid harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Swirl Solenoid Control circuit. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Repair the Hydraulic Cooling Fan Solenoid Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Install a substitute Hydraulic Cooling Fan Solenoid in place of the vehicle's Hydraulic Cooling Fan Solenoid. **NOTE: Ensure the ECM and Hydraulic Cooling Fan Solenoid harness connectors are connected.** Turn the ignition on. With the DRBIII®, actuate the Hydraulic Cooling Fan Solenoid. With the DRB, check for this DTC to set again. Did this DTC set again? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Hydraulic Cooling Fan Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All

P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time.The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT SHORT CIRCUIT

When Monitored and Set Condition:

P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT SHORT CIRCUIT

When Monitored: With the ignition on and the ECM attempting to actuate the Hydraulic Cooling Fan Soleniod.

Set Condition: The ECM detects excessive current on the Hydraulic Cooling Fan Solenoid Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
HYDRAULIC COOLING FAN SOLENOID
HYDRAULIC COOLING FAN SOLENOID CONTROL SHORT TO VOLTAGE
ECM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, erase ECM DTCs. With the DRBIII®, actuate the Hydraulic Cooling Fan Solenoid. With the DRBIII®, read the ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 4	All
2	Turn the ignition off. Disconnect the Hydraulic Cooling Fan Solenoid harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Hydraulic Cooling Fan Solenoid Control circuit. Is the voltage below 1.0 volt? Yes → Go To 3 No → Repair the Hydraulic Cooling Fan Solenoid Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All

P1499-HYDRAULIC COOLING FAN SOLENOID CIRCUIT SHORT CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Install a substitute Hydraulic Cooling Fan Solenoid. Turn the ignition on. With the DRB, erase ECM DTCs. With the DRBIII®, actuate the Hydraulic Cooling Fan Solenoid. With the DRBIII®, read the ECM DTCs. Does the DRB display this DTC? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Hydraulic Cooling Fan Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
4	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P1511-BATTERY SENSE LINE 1 VOLTAGE TOO HIGH
P1511-BATTERY SENSE LINE 1 VOLTAGE TOO LOW
P1512-BATTERY SENSE LINE 2 VOLTAGE TOO HIGH
P1512-BATTERY SENSE LINE 2 VOLTAGE TOO LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1511-BATTERY SENSE LINE 1 VOLTAGE TOO HIGH.

When Monitored and Set Condition:

P1511-BATTERY SENSE LINE 1 VOLTAGE TOO HIGH

When Monitored: With the ignition on or the engine running.

Set Condition: The ECM detects Battery Sense circuit voltage above 16.0 volts.

P1511-BATTERY SENSE LINE 1 VOLTAGE TOO LOW

When Monitored: With the ignition on or the engine running.

Set Condition: The ECM detects Battery Sense circuit voltage below 6.0 volts.

P1512-BATTERY SENSE LINE 2 VOLTAGE TOO HIGH

When Monitored: With the ignition on or the engine running.

Set Condition: The ECM detects Battery Sense circuit voltage above 2.0 volts.

P1512-BATTERY SENSE LINE 2 VOLTAGE TOO LOW

When Monitored: With the ignition on or the engine running.

Set Condition: The ECM detects Battery Sense circuit voltage below -2.0 volts.

POSSIBLE CAUSES
INTERMITTENT CONDITION
FUSE 26 OPEN
ECM GROUND CIRCUIT(S) OPEN
BATTERY(-) SENSE CIRCUIT SHORTED TO VOLTAGE
BATTERY(-) SENSE CIRCUIT OPEN
BATTERY(+) SENSE CIRCUIT SHORTED TO GROUND
BATTERY(+) SENSE CIRCUIT OPEN
ENGINE CONTROL MODULE

P1511-BATTERY SENSE LINE 1 VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0560-SYSTEM VOLTAGE TOO HIGH is present with this DTC, perform diagnostics for P0560 first.** Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Test drive the vehicle. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Remove and inspect Fuse 26 from the PDC. Is the fuse OK? Yes → Go To 3 No → Repair the short that caused the fuse to open and replace the fuse. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the ECM harness connectors. Using a 12-volt test light connected to 12-volts, check both of the ECM ground circuits in ECM harness connector C1 cavities 1 and 2. Did the test light illuminate for both cavities? Yes → Go To 4 No → Repair the ECM Ground circuit(s) for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the Battery (-) Sense circuit in ECM harness connector cavity C1-20. Is the voltage below 1.0 volt? Yes → Go To 5 No → Repair the Battery(-) Sense circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Remove Fuse 26 from the PDC. **NOTE: A short to ground on any circuit associated with Fuse 6 or 26 may cause this DTC to set.** Measure the resistance between ground and the Battery(+) Sense circuit in ECM harness connector C1-19. Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Battery(+) Sense circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

P1511-BATTERY SENSE LINE 1 VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the ECM harness connectors. Measure the resistance between the Battery negative terminal and the Battery(-) Sense circuit in ECM harness connector cavity C1-20. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Battery(-) Sense circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Disconnect the ECM harness connectors. Remove Fuse 26 from the PDC. Measure the resistance of the Battery(+) Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the Battery(+) Sense circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
9	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1605-IGNITION SWITCH PLAUSIBILITY

When Monitored and Set Condition:

P1605-IGNITION SWITCH PLAUSIBILITY

When Monitored: When the ignition is first turned on.

Set Condition: The ECM detects the Ignition Switch Sense momentarily return to the OFF state during ECM initialization.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ENGINE CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	**NOTE: This DTC is set when the ECM sees a change from On to Off and then back On within a few milliseconds during ECM initialization at Key On. Look for an intermittent open or short to ground on the Ignition Switch Sense circuit.** Turn the ignition on. With the DRB, erase ECM DTCs. Cycle the ignition switch on and off several times, pausing for at least 10 seconds at each key off and key on. Turn the ignition on. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the ignition switch harness connector. Measure the resistance of the Fused Ignition Switch Output (RUN/START) circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (RUN/START) circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

P1605-IGNITION SWITCH PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the ignition switch harness connector. Measure the resistance between ground and the Fused Ignition Switch Output (RUN/START) circuit. Is the resistance above 100 kohms? Yes → Go To 4 No → Repair the Fused Ignition Switch Output (RUN/START) circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
4	If there are no possible causes remaining, view repair. Repair Using the schematic, ensure no shared circuits on the Fused Ignition Switch Output (RUN/START) ckt are causing an initial low spike in circuit voltage. If all other components are OK, replace and program the ECM in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
5	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:
P1643-VISCOUS HEATER RELAY OPEN CIRCUIT
P1643-VISCOUS HEATER RELAY SHORT CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1643-VISCOUS HEATER RELAY OPEN CIRCUIT.

When Monitored and Set Condition:

P1643-VISCOUS HEATER RELAY OPEN CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM does not detect voltage on the Viscous Heater Relay Control circuit.

P1643-VISCOUS HEATER RELAY SHORT CIRCUIT

When Monitored: With the ignition on.

Set Condition: The ECM detects excessive current on the Viscous Heater Relay Control circuit.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ASD RELAY OUTPUT CIRCUIT OPEN
SUBSTITUTE VISCOUS HEATER RELAY
VISCOUS HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
VISCOUS HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND
VAISCOUS HEATER RELAY CONTROL CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, actuate the Viscous Heater Relay. Is the Viscous Heater Relay clicking? Yes → Go To 2 No → Go To 3	All

P1643-VISCOUS HEATER RELAY OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
3	Turn the ignition off. Disconnect the Viscous Heater Relay from the PDC. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Viscous Heater Relay connector in the PDC. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Install a substitute relay in place of the Viscous Heater Relay. Turn the ignition on. With the DRB, actuate the Viscous/Cabin Heater Relay for at least 20 seconds. With the DRB, read ECM DTCs. Did this DTC set again? Yes → Go To 5 No → Replace the Viscous Heater Relay. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Remove the Viscous Heater Relay. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the PDC. Turn the ignition on. Measure the voltage on the Viscous Heater Relay Control circuit. Is the voltage above 1.0 volt? Yes → Repair the Viscous Heater Relay Control circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All

P1643-VISCOUS HEATER RELAY OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Remove the Viscous Heater Relay from the PDC. Disconnect the ECM harness connectors. Measure the resistance between ground and the Viscous Heater Relay Control circuit. Is the resistance above 1000 ohms? Yes → Go To 7 No → Repair the Viscous Heater Relay Control circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Remove the Viscous Heater Relay from the PDC. Disconnect the ECM harness connectors. Measure the resistance of the Viscous Heater Relay Control circuit. Is the resistance below 10.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the Viscous Heater Relay Control circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom List:

P1651-MIL/DIAG LAMP VIA J1850 BUS IN FRAME RESPONSE ERROR
P1651-MIL/DIAG LAMP VIA J1850 BUS STATUS ERROR

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1651-MIL/DIAG LAMP VIA J1850 BUS IN FRAME RESPONSE ERROR.

When Monitored and Set Condition:

P1651-MIL/DIAG LAMP VIA J1850 BUS IN FRAME RESPONSE ERROR

When Monitored: With the ignition on.

Set Condition: The ECM does not receive a response from the instrument cluster when a J1850 message to actuate the MIL is transmitted.

P1651-MIL/DIAG LAMP VIA J1850 BUS STATUS ERROR

When Monitored: With the ignition on.

Set Condition: The ECM MIL status does not agree with the instrument cluster MIL status.

POSSIBLE CAUSES
REFER TO COMMUNICATION SECTION
VERIFY INSTRUMENT CLUSTER COMMUNICATION
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Cycle the ignition switch from OFF to ON. Monitor the DRBIII® for ECM DTCs. Does the DRBIII® display this DTC? Yes → Go To 2 No → Go To 3	All

P1651-MIL/DIAG LAMP VIA J1850 BUS IN FRAME RESPONSE ERROR — Continued

TEST	ACTION	APPLICABILITY
2	Start and idle the engine. With the DRBIII®, select Instrument Cluster and read the PCM/ECM Monitors. **NOTE: If the DRB is unable to communicate with the Instrument cluster, refer to the appropriate symptom in the Body Diagnostic Information** Does the DRB display accurate monitors? Yes → [007f]Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Refer to Body Diagnostic Information for problems related to Communication with ECM. Perform ROAD TEST VERIFICATION - VER-2.	All
3	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P1652-J1850 COMMUNICATION BUS LOST ARBITRATION
P1652-J1850 COMMUNICATION BUS RECEIVE TIMEOUT
P1652-J1850 COMMUNICATION BUS SHORT TO GROUND
P1652-J1850 COMMUNICATION BUS SHORT TO VOLTAGE
P1652-J1850 COMMUNICATION BUS SPI ERROR
P1652-J1850 COMMUNICATION BUS TRANSMIT BUFFER OVER-RUN
P1652-J1850 COMMUNICATION BUS UNAUTHORIZED RESET

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1652-J1850 COMMUNICATION BUS LOST ARBITRATION.

When Monitored and Set Condition:

P1652-J1850 COMMUNICATION BUS LOST ARBITRATION

When Monitored: With the ignition on.

Set Condition: A J1850 Bus error occurred while the ECM was sending a message.

P1652-J1850 COMMUNICATION BUS RECEIVE TIMEOUT

When Monitored: With the ignition on.

Set Condition: The ECM has not received a J1850 Bus massage for 2.0 seconds.

P1652-J1850 COMMUNICATION BUS SHORT TO GROUND

When Monitored: With the ignition on.

Set Condition: The ECM detects continuous low voltage on the J1850 Bus circuit.

P1652-J1850 COMMUNICATION BUS SHORT TO VOLTAGE

When Monitored: With the ignition on.

Set Condition: The ECM detects continuous high voltage on the J1850 Bus circuit.

P1652-J1850 COMMUNICATION BUS SPI ERROR

When Monitored: With the ignition on.

Set Condition: The ECM has detected an internal communication problem.

P1652-J1850 COMMUNICATION BUS TRANSMIT BUFFER OVERRUN

When Monitored: With the ignition on.

Set Condition: The ECM has detected an internal problem.

P1652-J1850 COMMUNICATION BUS LOST ARBITRATION — Continued

P1652-J1850 COMMUNICATION BUS UNAUTHORIZED RESET

When Monitored: With the ignition on.

Set Condition: An unauthorized reset of the J1850 hardware occurs during normal operation.

POSSIBLE CAUSES
VERIFY ACTIVE DTC
VERIFY INSTRUMENT CLUSTER COMMUNICATION
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII® attempt to communicate with the Instrument Cluster. Is the Instrument Cluster communicating with the DRB? Yes → Go To 2 No → Refer to the appropriate symptom in the Body Diagnostic Information. Perform ROAD TEST VERIFICATION - VER-2.	All
2	Turn the ignition on. With the DRBIII®, erase the ECM DTCs. Turn the ignition off then turn the ignition on and wait 60 seconds. With the DRBIII®, read the ECM DTCs. Does the DRB display this DTC? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 3	All

P1652-J1850 COMMUNICATION BUS LOST ARBITRATION — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
P1685-SKIM SYSTEM INVALID KEY CODE RECEIVED

When Monitored and Set Condition:

P1685-SKIM SYSTEM INVALID KEY CODE RECEIVED

When Monitored: With the ignition on.

Set Condition: The ECM receives a message from the SKIM indicating an incorrect message was received from the ignition key.

POSSIBLE CAUSES
SKIM/IGNITION KEY FAULT

TEST	ACTION	APPLICABILITY
1	This fault indicates a SKIS problem. View repair. Yes → Refer to SKIS information for the related symptom(s). Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
P1685-SKIM SYSTEM KEY COMMUNICATION TIMED OUT

When Monitored and Set Condition:

P1685-SKIM SYSTEM KEY COMMUNICATION TIMED OUT

When Monitored: With the ignition on.

Set Condition: Communication between the ECM and the SKIM is not completed within 2.0 seconds

POSSIBLE CAUSES
SKIM
INTERMITTENT CONDITION
CHECK FOR SKIM COMMUNICATION AND DTCS
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, check for Sentry Key Immobilizer Module communication and DTCs. Are any SKIS problems or DTCs present? Yes → Refer to symptom list for problems related to SKIM Communication and DTCs before continuing. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, erase ECM DTCs. Turn the ignition on and off several times pausing 10 seconds between each key cycle. With the DRBIII®, read the ECM DTCs. Are any P1685 DTCs present? Yes → Go To 3 No → Go To 4	All
3	Replace and program the SKIM in accordance with the Service Information. Turn the ignition on. With the DRBIII®, erase ECM DTCs. Turn the ignition on and off several times pausing for 10 seconds between key cycles. With the DRBIII®, read ECM DTCs. Are there any P1685 DTCs present? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → The test is complete. Perform ROAD TEST VERIFICATION - VER-2.	All

P1685-SKIM SYSTEM KEY COMMUNICATION TIMED OUT — Continued

TEST	ACTION	APPLICABILITY
4	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom List:

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY
P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY WITH BRAKE SWITCH
P2120-ACC PEDAL POSITION SENSOR 1 CKT SIGNAL VOLTAGE TOO HIGH
P2120-ACC PEDAL POSITION SENSOR 1 CKT SIGNAL VOLTAGE TOO LOW
P2120-ACC PEDAL POSITION SENSOR 1 CKT SUPPLY VOLTAGE TOO HIGH OR LOW
P2125-ACC PEDAL POSITION SENSOR 2 CIRCUIT PLAUSIBILITY (WITH SENSOR 1 CIRCUIT)
P2125-ACC PEDAL POSITION SENSOR 2 CKT SIGNAL VOLTAGE TOO HIGH
P2125-ACC PEDAL POSITION SENSOR 2 CKT SUPPLY VOLTAGE TOO HIGH OR LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY.

When Monitored and Set Condition:

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY

When Monitored: With the ignition on.

Set Condition: The Accelerator Pedal Position Sensor Signal is below 1.6% or above 17.6% and the idle switch is not in the correct state. NOTE: The idle switch is designed to transition when the accel position is approximately 16% (1.00 volt). This code sets the ECM to Limp-in Mode, which includes a fixed engine speed of 1100 RPM.

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY WITH BRAKE SWITCH

When Monitored: With the engine speed above 700 rpm.

Set Condition: The ECM detects the Accelerator Pedal and the Brake Pedal have been depressed at the same time for longer than 5.0 seconds.

P2120-ACC PEDAL POSITION SENSOR 1 CKT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The ECM detects voltage on the Accelerator Pedal Position Sensor Signal circuit above 4.5 volts.

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY — Continued

P2120-ACC PEDAL POSITION SENSOR 1 CKT SIGNAL VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The ECM detects voltage on the Accelerator Pedal Position Sensor Signal circuit 0.0 volt.

P2120-ACC PEDAL POSITION SENSOR 1 CKT SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Accelerator Pedal Position Sensor 5-Volt Supply voltage is above 5.1 volts or below 4.9 volts.

P2125-ACC PEDAL POSITION SENSOR 2 CIRCUIT PLAUSIBILITY (WITH SENSOR 1 CIRCUIT)

When Monitored: With the ignition on.

Set Condition: The ECM determines that the APP Sensor #1 and APP Sensor #2 signals do not agree.

P2125-ACC PEDAL POSITION SENSOR 2 CKT SIGNAL VOLTAGE TOO HIGH

When Monitored: With the ignition on.

Set Condition: The ECM detects voltage on the Accelerator Pedal Position Sensor Signal circuit above 3.3 volts.

P2125-ACC PEDAL POSITION SENSOR 2 CKT SUPPLY VOLTAGE TOO HIGH OR LOW

When Monitored: With the ignition on.

Set Condition: The Accelerator Pedal Position Sensor 5-Volt Supply voltage is above 5.1 volts or below 4.9 volts.

POSSIBLE CAUSES
ACCELERATOR PEDAL POSITION SENSOR
ECM - 5-VOLT SUPPLY CIRCUIT
SENSOR GROUND OPEN (APP SENSOR)
INTERMITTENT CONDITION
5-VOLT SUPPLY OR SENSOR REFERENCE VOLTAGE A CIRCUIT OPEN
APP SENSOR SIGNAL CIRCUIT OPEN
5-VOLT SUP OR SENSOR REF VOLTAGE A CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
5-VOLT SUPPLY OR SENSOR REF VOLTAGE A CIRCUIT SHORTED TO GROUND

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY — Continued

POSSIBLE CAUSES
VERIFY APP SENSOR OPERATION
APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
5-VOLT SUPPLY OR SENSOR REF VOLTAGE A CIRCUIT SHORTED TO VOLTAGE
ECM - SENSOR GROUND OPEN
APP SENSOR CIRCUIT SHORTED TO VOLTAGE
APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
ECM - APP SENSOR SIGNAL CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.** **NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.** **NOTE: The APP Sensor #2 signal should always be 1/2 the voltage of the APP Sensor #1 signal.** Turn the ignition on. With the DRB, read the APP Sensor #1 and APP Sensor #2 Volts with the accelerator pedal in the at rest position. Does the DRB display between 0.50 and 0.90 volt for sensor #1 and 1/2 the #1 voltage for #2? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition on. Fully depress the accelerator pedal. With the DRB, read the voltage for APP Sensor #1 and APP Sensor #2. Does the DRB display between 4.0 and 4.5 volts for #1 and 1/2 #1 voltage for #2? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition on. With the DRB, read the APP Sensor #1 and APP Sensor #2 percentages (%). With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed. **NOTE: The percentage readings for APP Sensor #1 and #2 should increase smoothly as the pedal is depressed.** Does the percentage increase smoothly for both readings with the accelerator pedal travel? Yes → Go To 4 No → Replace the Accelerator Pedal Position Sensor in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
4	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set by slowly pressing and releasing the accelerator pedal several times. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All
5	**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (#1 or #2) that did not display the correct voltages in the previous test.** Turn the ignition off. Disconnect the APP Sensor harness connector. Turn the ignition on. Measure the voltage of the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit in APP Sensor harness connector. Is the voltage between 4.7 and 5.3 volts? Yes → Go To 6 No → Go To 14	All
6	Turn the ignition off. Disconnect the APP Sensor harness connector. Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector . With the DRB, read the PEDAL OUTPUT VOLTS. Does the DRB display between 4.0 and 5.5 volts? Yes → Go To 7 No → Go To 10	All
7	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the APP Sensor Ground circuit. Is the voltage above 1.0 volt? Yes → Repair the App Sensor Ground circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 8	All

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM. Is the resistance below 10.0 ohms? Yes → Go To 9 No → Repair the APP Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
9	Turn the ignition off. Disconnect the APP Sensor harness connector. Using a 12-volt test light connected to 12-volts, check the Sensor ground circuit of the appropriate potentiometer. Does the test light illuminate brightly? Yes → Replace the Accelerator Pedal Position Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
10	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the APP Sensor Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 11 No → Repair the APP Sensor Signal circuit for an open Perform ROAD TEST VERIFICATION - VER-2.	All
11	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the APP Sensor Signal circuit. Is the resistance below 1000 ohms? Yes → Repair the APP Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 12	All
12	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at of the APP Sensor harness connector. Is the resistance below 1000 ohms? Yes → Repair the APP Sensor Signal and Sensor Ground circuits for a short together. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 13	All

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
13	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the APP Sensor Signal circuit. Is the voltage above 1.0 volt? Yes → Repair the APP Sensor Signal circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
14	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit. Is the resistance below 10.0 ohms? Yes → Go To 15 No → Repair the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
15	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit and the Sensor Ground circuit at the APP Sensor harness connector. Is the resistance above 1000 ohms? Yes → Go To 16 No → Repair the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit for a short to the Sensor Ground circuit. Perform ROAD TEST VERIFICATION - VER-2.	All
16	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit. Is the resistance below 1000 ohms? Yes → Repair the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 17	All

P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY — Continued

TEST	ACTION	APPLICABILITY
17	Turn the ignition off. Disconnect the APP Sensor harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector. Turn the ignition on. Measure the voltage of the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit in the ECM harness connector. Is the voltage above 1.0 volt? Yes → Repair the 5-volt Supply (Sensor Reference Voltage A on Sensor #2) circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*A/C INOPERATIVE

POSSIBLE CAUSES
CHECK FOR ECM DTCS
FUSED B+ CIRCUIT OPEN
A/C CLUTCH RELAY
A/C CLUTCH RELAY OUTPUT CIRCUIT SHORTED TO GROUND
A/C CLUTCH RELAY OUTPUT CIRCUIT OPEN
A/C CLUTCH GROUND CIRCUIT OPEN
A/C CLUTCH
ECM - INTERNAL FAULT
AZC MODULE OR A/C - HEATER CONTROL MODULE
BCM - NO SWITCH STATE CHANGE
A/C SWITCH SIGNAL CIRCUIT OPEN
BCM - ON/OFF CONTROL CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the refrigerant system is properly charged. Refer to the appropriate Service Information.** With the DRBIII®, check for ECM DTCs. Are any DTCs present? Yes → Return to the symptom list and choose the symptom(s). Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition on. Position the Mode switch on the AZC Module or the A/C - Heater Control Module to the Panel position. Turn the A/C Select switch off. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while turning the A/C Select switch from off to on and then back to off. Does the switch state change from Off to On and then back to Off? Yes → Go To 3 No → Go To 10	All
3	Turn the ignition on. With the DRBIII®, actuate the A/C Compressor Clutch Relay. Observe the A/C Compressor Clutch during actuation. Is the A/C Compressor Clutch clicking? Yes → Replace and program the ECM in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

*A/C INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: If the A/C Clutch fuse is open, refer to the system schematics for all circuits that are powered by the A/C Clutch fuse to determine the cause of the blown fuse.** Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 5 No → Repair the Fused B+ circuit. Inspect fuse and replace as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Install a substitute relay in place of the A/C Clutch Relay. Turn the ignition on. With the DRBIII®, actuate the A/C Clutch Relay. Does the A/C Clutch Relay cycle on and off? Yes → Replace the A/C Clutch Relay. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 6	All
6	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the A/C Clutch harness connector. Measure the resistance between ground and the A/C Clutch Relay Output circuit. Is the resistance above 100 kohms? Yes → Go To 7 No → Repair the A/C Clutch Relay Output circuit for a short to ground. Inspect fuse and replace as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the A/C Clutch harness connector. Measure the resistance of the A/C Clutch Relay Output circuit. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the A/C Clutch Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
8	Turn the ignition off. Disconnect the A/C Clutch harness connector. Using a 12-volt test light connected to 12-volts, check the A/C Clutch Ground circuit. Does the test light illuminate brightly? Yes → Go To 9 No → Repair the A/C Clutch Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

*A/C INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace the A/C Clutch in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
10	Turn the ignition off. Disconnect the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Turn the ignition on. Measure the voltage of the A/C Switch Signal circuit. Is the voltage greater than 11.0 volts? Yes → Go To 11 No → Go To 12	All
11	Turn the ignition off. Disconnect the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Turn the ignition on. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while connecting a jumper wire between ground and the A/C Switch Signal circuit in the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Does the A/C Select Switch state change from Off to On when the jumper wire is connected? Yes → Replace the AZC Module or the A/C - Heater Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace and program the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
12	Turn the ignition off. Disconnect the BCM C1 harness connector. Disconnect the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Measure the resistance of the A/C Switch Signal circuit between the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector and the BCM C1 harness connector. Is the resistance below 5.0 ohms? Yes → Replace and program the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the A/C Switch Signal circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*A/C OPERATES IN ALL MODE SWITCH POSITIONS

POSSIBLE CAUSES
CHECK FOR ECM DTCS
A/C CLUTCH
A/C CLUTCH RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
A/C CLUTCH RELAY
ENGINE CONTROL MODULE
A/C SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
AZC MODULE OR A/C - HEATER CONTROL MODULE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, check for ECM DTCs. Are any DTCs present? Yes → Return to the symptom list and choose the symptom(s). Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition on. Position the Mode switch on the AZC Module or the A/C - Heater Control Module to the Panel position. Turn the A/C Select switch off. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while turning the A/C Select switch from off to on and then back to off. Does the switch state change from Off to On and then back to Off? Yes → Go To 3 No → Go To 6	All
3	Turn the ignition off. Disconnect the A/C Clutch harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine and observe the A/C Clutch and Compressor. Does the A/C Compressor run with the harness connector disconnected? Yes → Replace the A/C Clutch in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

*A/C OPERATES IN ALL MODE SWITCH POSITIONS — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Disconnect the A/C Clutch harness connector. Turn the ignition on. Measure the voltage of the A/C Clutch Relay Output circuit. Is the voltage above 1.0 volt? Yes → Repair the A/C Clutch Relay Output circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Install a substitute relay in place of the A/C Clutch Relay. Turn the ignition on. With the DRBIII®, actuate the A/C Clutch Relay. Does the A/C Clutch Relay cycle on and off? Yes → Replace the A/C Clutch Relay. Perform ROAD TEST VERIFICATION - VER-2. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Measure the resistance of the A/C Switch Signal circuit between the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector and ground. Is the resistance below 100K ohms? Yes → Repair the A/C Switch Signal Circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Make sure that the BCM harness connectors are connected to the BCM. Disconnect the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Turn the ignition on. With the DRBIII® in BCM, select Inputs/Outputs. Monitor the A/C Select Switch state while connecting a jumper wire between ground and the A/C Switch Signal circuit in the AZC Module C2 harness connector or the A/C - Heater Control C1 harness connector. Does the A/C Select Switch state change from Off to On when the jumper wire is connected? Yes → Replace the AZC Module or the A/C - Heater Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace and program the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHECKING THE ACCELERATOR PEDAL POSITION SENSOR CALIBRATION

POSSIBLE CAUSES
APP SENSOR IDLE VOLTAGE
APP SENSOR WIDE OPEN THROTTLE VOLTAGE
VERIFY APP SENSOR OPERATION

TEST	ACTION	APPLICABILITY
1	**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor receives it's own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.** **NOTE: The APP Sensor #2 signal should always be 1/2 the voltage as the APP Sensor #1 signal** Turn the ignition on. With the DRB, read the APP Sensor #1 and APP Sensor #2 Volts with the accelerator pedal in the at rest position. Does the DRB display between 0.50 and 0.90 volt for sensor #1 and 1/2 the #1 voltage for #2? Yes → Go To 2 No → Replace the Accelerator Pedal Position Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All
2	Turn the ignition on. Fully depress the accelerator pedal. With the DRB, read the voltage for APP Sensor #1 and APP Sensor #2. Does the DRB display between 4.0 and 4.5 volts for #1 and 1/2 #1 voltage for #2? Yes → Go To 3 No → Replace the Accelerator Pedal Position Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition on. With the DRB, read the APP Sensor #1 and APP Sensor #2 percentages (%). With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed. **NOTE: The percentage readings for APP Sensor #1 and #2 should increase smoothly as the pedal is depressed.** Does the percentage increase smoothly for both readings with the accelerator pedal travel? Yes → Test Complete. No → Replace the Accelerator Pedal Position Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE BOOST PRESSURE SENSOR CALIBRATION

POSSIBLE CAUSES
TURBOCHARGER BOOST PRESSURE SENSOR CALIBRATION

TEST	ACTION	APPLICABILITY
1	Allow the engine to idle. With the DRBIII®, select Engine, then Sensors. Read the Boost Pressure Voltage. Is the Boost Pressure Voltage between 1.50 and 2.00 volts? Yes → Test Complete. No → Replace the Turbocharger Boost Pressure Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE ECM POWER AND GROUND CIRCUITS

POSSIBLE CAUSES
ASD RELAY OUTPUT CIRCUIT(S) OPEN
ECM GROUND CIRCUIT(S) OPEN
FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the ECM harness connectors. Using a 12-volt test light connected to 12-volts, check both of the ECM ground circuits in ECM harness connector C1 cavities 1 and 2. Did the test light illuminate for both cavities? Yes → Go To 2 No → Repair the ECM Ground circuit(s) for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Turn the ignition on. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit in ECM harness connector C1 cavity 22. Is the test light on? Yes → Go To 3 No → Repair the Fused Ignition Switch Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Remove the ASD Relay from the PDC. Using a 12-volt test light connected to ground, check the Fused ASD Relay Battery Supply circuit in ASD Relay connector cavity 30. Is the test light on? Yes → Go To 4 No → Repair the Fused ASD Relay Battery Supply circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavity 30 and cavity 87 in the ASD Relay connector. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit in ECM harness connector C1 cavities 4 and 5. Did the test light illuminate for both circuits? Yes → Test Complete. No → Repair the ASD Relay Output circuit(s) for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE EGR SYSTEM

POSSIBLE CAUSES
EGR VALVE
CHECKING VACUUM SUPPLY
EGR SOLENOID

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect both vacuum lines at the EGR Solenoid. Using a vacuum line connection tee, connect the vacuum supply line to the EGR Solenoid Output line at the EGR Solenoid. Disconnect the vacuum line at the EGR Valve. Connect a vacuum gauge to the EGR Solenoid Output line at the EGR Valve. Start the engine. With the engine at idle, note the vacuum gauge reading. Is the vacuum above 22 inches? Yes → Go To 2 No → Inspect the vacuum hoses/tubes for damage, restriction and leaks. If o.k. refer to the Service Information to check the Vacuum Pump operation. Perform ROAD TEST VERIFICATION - VER-2.	All
2	**NOTE: The engine must be at operating temperature for this test to be valid.** Turn the ignition off. Disconnect the vacuum line at the EGR Valve. Connect a vacuum gauge to the EGR Solenoid Output line at the EGR Valve Start the engine and observe the vacuum gauge reading for 1 minute. **NOTE: The vacuum reading should increase to above 18 inches approximately 5 seconds after the engine is started. The vacuum should decrease to below 4 inches within 40 seconds of engine run time.** Did the vacuum reading increase to above 18 inches then decrease below 4 inches as described? Yes → Go To 3 No → Replace the EGR Solenoid. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect both vacuum lines at the EGR Solenoid. Using a vacuum line connection tee, connect the vacuum supply line to the EGR Solenoid Output line at the EGR Solenoid. Test drive the vehicle and note the vehicles performance. **NOTE: With the connection tee in place the EGR valve will receive full vacuum supply with the engine running. This should cause a severe reduction in engine power.** Does the vehicle exhibit a severe loss of power? Yes → Test Complete. No → Replace the EGR Valve. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE ENGINE COOLANT TEMPERATURE SENSOR CALIBRATION

POSSIBLE CAUSES
ECT SENSOR - COLD
ECT SENSOR - HOT

TEST	ACTION	APPLICABILITY
1	**NOTE: The thermostat must be operating correctly for this test to be valid.** With the DRBIII® in Sensors, read and note the engine coolant temperature. Using a temperature probe, measure the engine block temperature near the ECT Sensor. **NOTE: The engine temperature should be below 50°C (120°F).** Are the readings within 7°C (13°F) of each other? Yes → Go To 2 No → Replace the Engine Coolant Temperature Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All
2	**NOTE: The thermostat must be operating correctly for this test to be valid.** Start the engine and bring the engine to operating temperature (thermostat open). Turn the engine off and wait 10 minutes to allow the engine temperature to stabilize. Using a temperature probe, measure the engine block temperature near the ECT Sensor. With the DRBIII®, select Engine, then Sensors and read the engine coolant temperature. Are the readings within 7°C (13°F) of each other? Yes → Test Complete. No → Replace the Engine Coolant Temperature Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE ENGINE MECHANICAL SYSTEMS

POSSIBLE CAUSES
CHECKING ENGINE MECHANICAL SYSTEMS

TEST	ACTION	APPLICABILITY
1	**NOTE: The following items should be checked as a possible cause of a Driveability or No-Start problem.** **WARNING: Do not attempt to remove or separate high pressure fuel line. Attempting to do so could result in severe bodily injury or death.** Engine Valve Timing - must be within specification Engine Compression - must be within specifications Camshaft Lobes - check for abnormal wear Camshaft Position Sensor - check the camshaft position sensor tooth for debris and deterioration Crankshaft Position Sensor - check the crankshaft tone wheel for debris and deterioration Engine Exhaust System - must be free of any restriction Engine Drive Chain and Sprockets - must be properly positioned Vacuum System - must operate properly and be free of any vacuum leaks Fuel - must have adequate supply and must be free of contamination (ie. debris, water and gasoline) Fuel Injectors - must not be plugged or restricted Fuel Lift Pump - must operate properly (where applicable) Fuel Injection Pump - must be producing the correct output volume and pressure Inspect the Fuel Lines, Fuel Filter and Fuel Pressure Relief Valve for signs of restriction and leaks **NOTE: Check for any Technical Service Bulletins that may relate to the problem.** Are there any problems evident? Yes → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:

*CHECKING THE GLOW PLUG OPERATION

POSSIBLE CAUSES
CHECKING THE GLOW PLUGS
FUSED B+ CIRCUIT OPEN
GLOW PLUG RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG RELAY OUTPUT CIRCUIT SHORTED TO GROUND
GLOW PLUG RELAY OUTPUT CIRCUIT OPEN
GLOW PLUG RELAY

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Glow Plug harness connectors for all cylinders. Turn the ignition on. With the DRBIII®, actuate the Glow Plug 1 Relay. Using a 12-volt test light connected to ground, probe Glow Plug harness connectors 1, 3 and 5 during actuator test. With the DRBIII®, actuate the Glow Plug 2 Relay. Using a 12-volt test light connected to ground, probe Glow Plug harness connectors 2 and 4 during actuator test. Does the test light cycle on and off at each Glow Plug harness connector during actuation? Yes → Go To 2 No → Go To 3	All
2	Refer to the Service Information and perform the Glow Plug Test. Are all Glow Plugs operating properly? Yes → Test Complete. No → Replace the Glow Plug(s) as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All
3	**NOTE: If the Glow Plug Relay fuse or fuselink is open, refer to the system schematics for all circuits that are powered by the Glow Plug Relay fuse or fuselink to determine the cause of the blown fuse/fuselink.** Remove the Glow Plug Relay of the affected cylinder(s). Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the Glow Plug Relay connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused B+ (Fuse/Fuselink) circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

*CHECKING THE GLOW PLUG OPERATION — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Glow Plug harness connectors of the affected cylinder(s). Remove the Glow Plug Relay of the affected cylinder(s). Turn the ignition on. Measure the voltage on the Glow Plug Relay Output circuit of the affected cylinder(s). Is the voltage above 1.0 volt? Yes → Repair the Glow Plug Relay Output circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All
5	Turn the ignition off. Disconnect the Glow Plug harness connectors of the affected cylinder(s). Remove the Glow Plug Relay of the affected cylinder(s). Measure the resistance between ground and the Glow Plug Relay Output circuit of the affected cylinder(s). Is the resistance above 100 kohms? Yes → Go To 6 No → Repair the Glow Plug Relay Output circuit for a short to ground. Inspect the fuse or fuselink and replace as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the Glow Plug harness connectors of the affected cylinder(s). Remove the Glow Plug Relay of the affected cylinder(s). Connect a jumper wire across Glow Plug Relay connector cavities 30 and 87. Using a 12-volt test light connected to ground, check the Glow Plug Relay Output circuit at the Glow Plug harness connectors of the affected cylinder(s). Is the test light on at each Glow Plug harness connector? Yes → Go To 7 No → Repair the Glow Plug Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
7	If there are no possible causes remaining, view repair. Repair Replace the Glow Plug Relay of the affected cylinder(s). Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE PARK NEUTRAL SWITCH SIGNAL

POSSIBLE CAUSES
CHECK FOR TRANSMISSION CONTROL MODULE DTCS
ENGINE CONTROL MODULE
P/N SENSE CIRCUIT SHORTED TO VOLTAGE
P/N SWITCH SENSE CIRCUIT OPEN
P/N SWITCH SENSE CIRCUIT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read Transmission DTCs. Are any TCM DTCs present? Yes → Refer to the Transmission Diagnostics Information for related symptom(s). Perform ROAD TEST VERIFICATION - VER-2. No → Go To 2	All
2	Turn the ignition off. Disconnect the TCM harness connector. Turn the ignition on. With the DRBIII® in Engine Inputs/Outputs, read the P/N Switch state. Connect one end of a fused jumper wire to the P/N Switch Sense circuit at the TCM harness connector. Connect the other end of the jumper to ground for 10 seconds then disconnect from ground. Does the DRB Switch state change when connecting and disconnecting from ground? Yes → Test Complete. No → Go To 3	All
3	Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Remove the ASD Relay from the PDC. Connect a jumper wire between cavities 30 and 87 in the ASD connector in the PDC. Turn the ignition on. Measure the voltage of the P/N Switch Sense circuit. Is the voltage above 1.0 volt? Yes → Repair the Park/Neutral Switch Sense circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

*CHECKING THE PARK NEUTRAL SWITCH SIGNAL — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Measure the resistance of the P/N Switch Sense circuit. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Repair the Park/Neutral Position Sense circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the TCM harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the P/N Switch Sense circuit. Is the resistance above 1000.0 ohms? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the P/N Switch Sense circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE SPEED CONTROL OPERATION

POSSIBLE CAUSES
BRAKE SWITCH SIGNAL
ECM DTC(S) PRESENT
ENGINE CONTROL MODULE
SPEED CONTROL SWITCHES
VSS SIGNAL
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the ECM DTCs. Are there any ECM DTCs present? Yes → Refer to symptom list for problems related to the ECM DTC. Perform SPEED CONTROL VERIFICATION - VER-4. No → Go To 2	All
2	Start the engine. With the DRBIII®, read the S/C SWITCH VOLTS. Observe the S/C Switch volts on the DRBIII® while pressing and holding each S/C Switch button separately. **NOTE: Pressing each S/C Switch button should result in the following voltages: ON/OFF 0.55v - 1.15, SET 3.0 - 3.6v, RESUME/ACCEL 3.9 - 4.2v, CANCEL 1.2 - 2.05v, COAST 2.2 - 2.95v, No Button Pressed 4.4 - 4.7v** Does each switch provide the correct voltage? Yes → Go To 3 No → Refer to symptom list for problems related to S/C Switches. Perform SPEED CONTROL VERIFICATION - VER-4.	All
3	Test drive the vehicle above 60 km/h (35 MPH). Attempt to Set the Speed Control. Does the Speed Control function properly? Yes → Test Complete. No → Go To 4	All
4	Turn the ignition on. With the DRBIII® in Sensors, read Vehicle Speed. Have an assistant drive the vehicle while you are observing the Vehicle Speed on the DRBIII®. While observing vehicle speed on the DRBIII®, note any rapid changes (signal dropouts) in the reading that do not correspond with actual vehicle speed. Is the DRBIII® displaying an accurate vehicle speed? Yes → Go To 5 No → Refer to symptom list for problems related to the Vehicle Speed Sensor. Perform SPEED CONTROL VERIFICATION - VER-4.	All

*CHECKING THE SPEED CONTROL OPERATION — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition on. With the DRBIII® in Inputs/Outputs, read the Primary and Secondary brake switch states while pressing and releasing the Brake Pedal several times. Did the DRBIII® indicate the correct brake pedal state when pressing and releasing the Brake Pedal? Yes → Go To 6 No → Refer to symptom list for problems related to Brake Switch Signal. Perform SPEED CONTROL VERIFICATION - VER-4.	All
6	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary. Perform SPEED CONTROL VERIFICATION - VER-4. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform SPEED CONTROL VERIFICATION - VER-4.	All

Symptom:
*CHECKING THE TRANSFER CASE POSITION SENSOR

POSSIBLE CAUSES
CHECKING THE TRANSFER CASE POSITION SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII® read the T-case Sensor Observe the T-case volts on the DRB while moving the transfer case selector lever in each of the transfer case positions. **NOTE: When shifting the transfer case selector to each position, the Sensor voltage should result in the following voltages: 4WD Full Time 1.24 - 1.55, 4WD Low 0.16 - 0.40, Neutral 0.68 - 0.97.** Does each position provide the correct voltage? Yes → Test Complete. No → Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Transfer Case Position Sensor and the ECM. If wiring and connectors are ok, replace the Transfer Case Position Sensor. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE VISCOUS/CABIN HEATER RELAY

POSSIBLE CAUSES
FUSED B+ CIRCUIT OPEN
VISCOUS HEATER RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
VISCOUS HEATER RELAY OUTPUT CIRCUIT SHORTED TO GROUND
VISCOUS HEATER RELAY OUTPUT CIRCUIT OPEN
VISCOUS HEATER RELAY

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, actuate the Viscous Heater Relay. Is the clicking during the actuator test? Yes → Test Complete. No → Go To 2	All
2	**NOTE: If the Viscous Heater Relay fuse or fuselink is open, refer to the system schematics for all circuits that are powered by the Cabin Heater Relay fuse or fuselink to determine the cause of the blown fuse/fuselink.** Remove the Viscous Heater Relay. Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the Viscous Heater Relay connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused B+ (Fuse/Fuselink) circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the Viscous Heater harness connector. Remove the Viscous Heater Relay. Turn the ignition on. Measure the voltage on the Viscous Heater Relay Output circuit. Is the voltage above 1.0 volt? Yes → Repair the Viscous Heater Relay Output circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All
4	Turn the ignition off. Disconnect the Viscous Heater harness connector. Remove the Viscous Heater Relay. Measure the resistance between ground and the Viscous Heater Relay Output circuit. Is the resistance above 1000 ohms? Yes → Go To 5 No → Repair the Viscous Heater Relay Output circuit for a short to ground. Inspect the fuse or fuselink and replace as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All

*CHECKING THE VISCOUS/CABIN HEATER RELAY — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the Viscous Heater harness connector. Remove the Viscous Heater Relay. Connect a jumper wire across Viscous Heater Relay connector cavities 30 and 87. Using a 12-volt test light connected to ground, check the Viscous Heater Relay Output circuit in the Viscous Heater harness connector. Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Viscous Heater Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Viscous Heater Relay. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*CHECKING THE WATER IN FUEL LAMP OPERATION

POSSIBLE CAUSES
ASD RELAY OUTPUT CIRCUIT OPEN
ECM
SENSOR GROUND CIRCUIT OPEN
VERIFY WIF INDICATOR OPERATION
WATER IN FUEL SENOR SIGNAL CIRCUIT OPEN
WATER IN FUEL SENOR SIGNAL CIRCUIT SHORTED TO GROUND
WATER IN FUEL SENOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
WATER IN FUEL SENSOR

TEST	ACTION	APPLICABILITY
1	Perform the Instrument Cluster Self-Test to verify proper WIF Indicator operation. Did the WIF Indicator operate correctly during Self-Test? Yes → Go To 2 No → Test Complete.	All
2	Turn the ignition off. Disconnect the WIF Sensor harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the WIF Sensor harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the ASD Relay Output circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
3	Turn the ignition off. Disconnect the Water In Fuel Sensor harness connector. Turn the ignition on. With the DRB, read the Water In Fuel Switch state. Connect a jumper wire across the Water In Fuel Sensor harness connector cavities 1 and 2 for 10 seconds then disconnect the jumper. **NOTE: The DRB display should read CLOSED with the jumper connected and OPEN when the jumper is not connected.** Does the DRB Display switch between OPEN and CLOSED as described? Yes → The WIF Sensor circuitry and the ECM are functioning properly. If there is still a WIF indicator problem replace the Water In Fuel Sensor. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 4	All

*CHECKING THE WATER IN FUEL LAMP OPERATION — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Water In Fuel Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Water In Fuel Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Water In Fuel Sensor Signal circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
5	Turn the ignition off. Disconnect the Water In Fuel Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Sensor Ground circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	Turn the ignition off. Disconnect the Water In Fuel Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between ground and the Water In Fuel Sensor Signal circuit. Is the resistance below 1000.0 ohms? Yes → Go To 7 No → Repair the Water In Fuel Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.	All
7	Turn the ignition off. Disconnect the Water In Fuel Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance between Sensor Ground and the Water In Fuel Sensor Signal circuit at the WIF Sensor harness connector. Is the resistance below 1000.0 ohms? Yes → Repair the Water In Fuel Sensor Signal circuit for a short to Sensor Ground. Perform ROAD TEST VERIFICATION - VER-2. No → Test Complete.	All

Symptom:
*ENGINE CRANKS BUT WILL NOT START

POSSIBLE CAUSES
CHECK CAMSHAFT POSITION SENSOR SIGNAL
CHECK CRANKSHAFT POSITION SENSOR SIGNAL
CHECKING FOR ECM CODES
CHECKING FOR SKIM CODES
CHECKING THE ECT SENSOR
CHECKING THE GLOW PLUG OPERATION
ENGINE CONTROL MODULE
ENGINE DRIVE GEAR/SPROCKET
FUEL INJECTOR DRIVER CIRCUIT(S) SHORTED TO GROUND
FUEL PRESSURE SENSOR
FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT OPEN
FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN
FUEL SUPPLY CONTAMINATION
FUEL SYSTEM PRESSURE MECHANICAL
FUEL SYSTEM RESTRICTION
SENSOR GROUND OPEN

TEST	ACTION	APPLICABILITY
1	**NOTE: The ECM must have proper power and ground connections for the following tests to be valid. Refer to Checking the ECM Power and Grounds in the symptom list.** Turn the ignition on. With the DRBIII®, read the ECM DTCs. Does the DRBIII® display any ECM DTCs? Yes → Refer to symptom list for problems related to ECM DTC. Perform NO START VERIFICATION - VER-1. No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Does the DRBIII® display any SKIM DTCs? Yes → Refer to symptom list for problems related to SKIM DTC. Perform NO START VERIFICATION - VER-1. No → Go To 3	All

*ENGINE CRANKS BUT WILL NOT START — Continued

TEST	ACTION	APPLICABILITY
3	Using a temperature probe, check the vehicle temperature near the ECT Sensor. Turn the ignition on. With the DRBIII® in Sensors, read the ECT Sensor temperature. Compare the temperature probe reading with the DRBIII® reading. Are the two readings within 10°C of each other? Yes → Go To 4 No → Repair as necessary. Perform NO START VERIFICATION - VER-1.	All
4	**NOTE: Prior to performing this test, be sure to check the Glow Plug Relay operation. Refer to CHECKING GLOW PLUG OPERATION for the related symptom(s).** Refer to the Service Information and check the Glow Plugs for proper operation. Are the Glow Plugs operating properly? Yes → Go To 5 No → Repair as necessary. Perform NO START VERIFICATION - VER-1.	All
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect all 5 Fuel Injector harness connectors. Measure the resistance between Ground and each Fuel Injector Driver circuit at it's respective Fuel Injector harness connector. Is the resistance below 1000 ohms for any of the measurements? Yes → Repair the Fuel Injector Driver circuit(s) for a short to ground. Perform NO START VERIFICATION - VER-1. No → Go To 6	All
6	Inspect the fuel system lines for restrictions, leaks or other problems. Is there any evidence of problems? Yes → Repair as necessary. Perform NO START VERIFICATION - VER-1. No → Go To 7	All
7	Turn the ignition off. Using the DRBIII® lab scope, backprobe the CMP Sensor Signal circuit at the ECM harness connector. Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the DRBIII®. **NOTE: Refer to Charts and Graphs to view a correct CMP Sensor signal.** Does the DRBIII® display a steady clean CMP Signal pattern? Yes → Go To 8 No → Perform Test for DTC P0340-Camshaft Position Sensor Circuit Static Plausibility. Perform NO START VERIFICATION - VER-1.	All

*ENGINE CRANKS BUT WILL NOT START — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Using the DRBIII® lab scope, backprobe both of the CKP Sensor Signal circuits at the ECM harness connector. **NOTE: Refer to Charts and Graphs to view a correct CKP Sensor signal.** Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the DRBIII®. Does the DRBIII® display a steady clean CKP Signal pattern for each circuit? Yes → Go To 9 No → Perform Test for DTC P0340-Crankshaft Position Sensor Circuit Dynamic Plausibility. Perform NO START VERIFICATION - VER-1.	All
9	Refer to the Service Information and perform the fuel pressure test. Is the fuel pressure within specification? Yes → Go To 10 No → Repair as necessary. Perform NO START VERIFICATION - VER-1.	All
10	Refer to the Service Information and perform the fuel pressure test. Note the test results. Using the DRBIII®, read the Fuel Pressure and compare the two readings. Are the two readings within 3450 kPa (500 PSI) of each other? Yes → Go To 11 No → Go To 13	All
11	Refer to the Service Information to ensure the Engine Drive Gears/Sprocket are installed correctly and the camshaft and crankshaft gears are timed correctly. Were any problems found? Yes → Repair as necessary. Perform NO START VERIFICATION - VER-1. No → Go To 12	All
12	Inspect the fuel supply for contamination. Is the fuel contaminated? Yes → Check the fuel supply for contamination. Perform NO START VERIFICATION - VER-1. No → Replace and program the Engine Control Module in accordance with the Service Information. Perform NO START VERIFICATION - VER-1.	All
13	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Fuel Pressure Sensor Signal circuit. Is the resistance below 10.0 ohms? Yes → Go To 14 No → Repair the Fuel Pressure Sensor Signal circuit for an open. Perform NO START VERIFICATION - VER-1.	All

*ENGINE CRANKS BUT WILL NOT START — Continued

TEST	ACTION	APPLICABILITY
14	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Fuel Pressure Sensor 5-volt Supply circuit. Is the resistance below 10.0 ohms? Yes → Go To 15 No → Repair the Fuel Pressure Sensor 5-volt Supply circuit for an open. Perform NO START VERIFICATION - VER-1.	All
15	Turn the ignition off. Disconnect the Fuel Pressure Sensor harness connector. Disconnect the ECM harness connectors. Measure the resistance of the Sensor Ground circuit. Is the resistance below 10.0 ohms? Yes → Replace the Fuel Pressure Sensor in accordance with the Service Information. Perform NO START VERIFICATION - VER-1. No → Repair the Sensor Ground circuit for an open. Perform NO START VERIFICATION - VER-1.	All

Symptom:
*ENGINE WILL NOT CRANK

POSSIBLE CAUSES
BATTERY CABLE HIGH RESISTANCE
CHECKING FOR SKIM OR TCM CODES
ECM
INSPECT BATTERY CABLES
MECHANICAL PROBLEM
OPEN FUSED BATTERY (+) CIRCUIT
OPEN IGNITION SWITCH START CIRCUIT
OPEN IGNITION SWITCH START OUTPUT AT THE ECM
STARTER MOTOR
STARTER RELAY
STARTER RELAY CONTROL CIRCUIT OPEN
STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
STARTER RELAY OUTPUT CIRCUIT OPEN
VERIFY PARK/NEUTRAL SIGNAL

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. **NOTE: The battery must be fully charged before diagnosing a no crank condition.** Inspect the battery cables for corrosion, looseness or other problems. Is there evidence of problems? Yes → Repair as necessary. Perform NO START VERIFICATION - VER-1. No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, read the SKIM and TCM DTCs. Does the DRBIII® display any SKIM or TCM DTCs? Yes → Refer to symptom list for problems related to SKIM or TCM. Perform NO START VERIFICATION - VER-1. No → Go To 3	All
3	Turn the ignition on. With the DRBIII® in Engine, Inputs/Outputs, read the P/N Switch state while moving the gear selector between Park and reverse. Does the P/N Switch state change when moving the gear selector? Yes → Go To 4 No → Refer to symptom list for problems related to Park/Neutral Switch Signal. Perform NO START VERIFICATION - VER-1.	All

*ENGINE WILL NOT CRANK — Continued

TEST	ACTION	APPLICABILITY
4	**WARNING: The transmission must be in Neutral and the parking break must be engaged for this test.** **WARNING: The engine may be cranked in this test. Keep away from moving engine parts.** Turn the ignition off. Remove the Starter Relay from the PDC. Briefly connect a jumper wire between the Starter Relay Output circuit and the Fused B+ circuit at the starter relay connector in the PDC. Did the engine crank? Yes → Go To 5 No → Go To 10	All
5	Turn the ignition off. Remove the Starter Relay from the PDC. Install a substitute relay in place of the Starter Relay. Attempt to start the engine. Does the engine crank? Yes → Replace the Starter Relay. Perform NO START VERIFICATION - VER-1. No → Go To 6	All
6	Remove the Starter Relay from the PDC. Using a 12-volt test light connected to ground, check the Ignition Switch Start circuit while turning the ignition switch to the START position. Does the test light illuminate with the ignition switch in the START position? Yes → Go To 7 No → Repair the Ignition Switch Start circuit for an open. Perform NO START VERIFICATION - VER-1.	All
7	Turn the ignition off. Disconnect the ECM harness connectors. Remove the Starter Relay from the PDC. Remove the ASD Relay from the PDC. Using a jumper wire, connect ASD Relay connector cavities 30 and 87 in the PDC. Turn the ignition on. Measure the voltage of the Starter Relay Control circuit. Is the voltage above 1.0 volt? Yes → Repair the Starter Relay Control circuit for a short to voltage. Perform NO START VERIFICATION - VER-1. No → Go To 8	All
8	Turn the ignition off. Disconnect the ECM harness connectors. Remove the Starter Relay from the PDC. Measure the resistance of the Starter Relay Control circuit. Is the resistance below 10.0 ohms? Yes → Go To 9 No → Repair the Starter Relay Control circuit for an open. Perform NO START VERIFICATION - VER-1.	All

*ENGINE WILL NOT CRANK — Continued

TEST	ACTION	APPLICABILITY
9	Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at ECM C1 harness connector cavity 22 while turning the ignition switch to the START position. Does the test light illuminate with the ignition switch in the START position? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform NO START VERIFICATION - VER-1. No → Repair the Ignition Switch Start Output circuit at the ECM harness connector for an open. Perform NO START VERIFICATION - VER-1.	All
10	Remove the Starter Relay from the PDC. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the Starter Relay connector in the PDC. Is the test light on? Yes → Go To 11 No → Repair the Fused B(+) circuit for an open. Perform NO START VERIFICATION - VER-1.	All
11	Turn the ignition off. Remove the Starter Relay from the PDC. Disconnect the Starter Relay Output wire from the Starter Solenoid. Connect the Starter Relay Output wire (at the Starter) to ground. Using a 12-volt test light connected to 12-volts, check the Starter Relay Output circuit at the Starter Relay connector in the PDC. Does the test light illuminate brightly? Yes → Go To 12 No → Repair the Starter Relay Output circuit for an open. Perform NO START VERIFICATION - VER-1.	All
12	Using the Service Information, check the battery cables for high resistance. Did either battery cable have a voltage drop greater than 0.2 volts? Yes → Replace the battery cable(s). Perform NO START VERIFICATION - VER-1. No → Go To 13	All
13	Turn the ignition off. Attempt to manually rotate the crankshaft 360°. Is the crankshaft able to rotate 360°? Yes → Replace the Starter Motor. Perform NO START VERIFICATION - VER-1. No → Repair the engine mechanical problem. Perform NO START VERIFICATION - VER-1.	All

Symptom List:

- **ANTENNA FAILURE**
- **COP FAILURE**
- **EEPROM FAILURE**
- **INTERNAL FAULT**
- **RAM FAILURE**
- **SERIAL LINK INTERNAL FAULT**
- **STACK OVERFLOW FAILURE**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ANTENNA FAILURE.

When Monitored and Set Condition:

ANTENNA FAILURE

When Monitored: Every 250 milliseconds with the ignition on.

Set Condition: The SKIM's microcontroller determines that an antenna circuit fault has occurred for 2.0 consecutive seconds.

COP FAILURE

When Monitored: With the ignition on.

Set Condition: The COP timer is not reset by the micro controller every 65.5 milliseconds.

EEPROM FAILURE

When Monitored: With the ignition on.

Set Condition: When the value written to EEPROM memory does not equal the value read back after the write operation.

INTERNAL FAULT

When Monitored: With the ignition on.

Set Condition: The SKIM has detected a fault during an internal self test.

RAM FAILURE

When Monitored: With the ignition on.

Set Condition: The RAM fails a test that checks the RAM's ability to retain memory.

SERIAL LINK INTERNAL FAULT

When Monitored: With the ignition on.

Set Condition: The SKIM fails an internal J1850 communication self test.

STACK OVERFLOW FAILURE

When Monitored: With the ignition on.

Set Condition: The micro controller has exceeded its stack space limit.

ANTENNA FAILURE — Continued

POSSIBLE CAUSES
SKIM INTERNAL DTC FAILURE

TEST	ACTION	APPLICABILITY
1	**Note: This trouble code indicates an internal SKIM fault.** With the DRBIII®, read and record the SKIM DTCs and then erase the SKIM DTCs Perform 10 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle. With the DRBIII® , read the SKIM DTCs. Did the same SKIM DTC return? Yes → Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom List:
PCM STATUS FAILURE
SERIAL LINK EXTERNAL FAULT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be PCM STATUS FAILURE.

When Monitored and Set Condition:

PCM STATUS FAILURE

When Monitored: With the ignition on.

Set Condition: This DTC exists when a PCM STATUS message was not received from the PCM for at least 20.0 consecutive seconds.

SERIAL LINK EXTERNAL FAULT

When Monitored: At ignition on, after ignition on during any rolling code handshake that occurs with the ECM due to a SKIM reset, or during SECRET KEY transfers to the ECM.

Set Condition: When the SKIM does not receive an expected PCI BUS message transmission acknowledgement from the ECM after 3 transmit attempts.

POSSIBLE CAUSES
INTERMITTENT WIRING HARNESS PROBLEM
WIRING HARNESS INSPECTION
SKIM/ECM

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure the ECM has proper power and ground connections before continuing.** With the DRBIII®, read and record the SKIM DTCs then erase the SKIM DTCs. Turn the ignition off. Wait 2 minutes. Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Does the DRBIII® display the DTC that was previously erased? Yes → Go To 2 No → Go To 4	All

PCM STATUS FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. **NOTE: Visually inspect the related wiring harness and CCD/PCI Bus (whichever applicable) circuits. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair as necessary. Perform SKIS VERIFICATION. No → Go To 3	All
3	**NOTE: Before proceeding it will be necessary to obtain the SKIM PIN.** Turn the ignition on. With the DRBIII®, display and erase all ECM and SKIM DTC's. Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle. With the DRBIII®, read the SKIM DTCs. Does the code appear? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All
4	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom List:
ROLLING CODE FAILURE
VIN MISMATCH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ROLLING CODE FAILURE.

When Monitored and Set Condition:

ROLLING CODE FAILURE

When Monitored: At ignition on, after ignition on during any rolling code handshake that occurs with the ECM due to a SKIM or ECM reset.

Set Condition: When a PCM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the ECM.

VIN MISMATCH

When Monitored: With the ignition on.

Set Condition: When the VIN received from the ECM does not match the VIN stored in the SKIM's EEPROM.

POSSIBLE CAUSES
VERIFYING ECM VIN
REPLACE SKIM AND CHECK DTC'S
INTERMITTENT WIRING HARNESS PROBLEM
ECM

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the SKIM DTCs. Turn the ignition off. Wait 10 seconds. Turn the ignition on and wait 2 minutes. With the DRBIII®, read the SKIM DTCs. Does the DRBIII® display the DTC that was previously erased? Yes → Go To 2 No → Go To 4	All

ROLLING CODE FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. With the DRBIII®, select Engine system from the main menu. Display and record the Vehicle Identification Number. **NOTE: Ensure that a VIN has been programmed into the ECM. If a VIN is not displayed, attempt to program the ECM with the correct vehicle VIN before continuing.** Does the VIN recorded from the ECM match the VIN of the vehicle? Yes → Go To 3 No → Replace and program the Engine Control Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Turn the ignition on. With the DRBIII®, display and clear all ECM and SKIM DTC's. Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle. With the DRBIII®, check for SKIM DTCs. Does the DRBIII® display the same DTC? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → The repair is complete. Perform SKIS VERIFICATION.	All
4	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom List:

TRANSPONDER COMMUNICATION FAILURE
TRANSPONDER CYCLIC REDUNDANCY CHECK (CRC) FAILURE
TRANSPONDER ID MISMATCH
TRANSPONDER RESPONSE MISMATCH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be TRANSPONDER COMMUNICATION FAILURE.

When Monitored and Set Condition:

TRANSPONDER COMMUNICATION FAILURE

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When the SKIM does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

TRANSPONDER CYCLIC REDUNDANCY CHECK (CRC) FAILURE

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When 5 consecutive transponder signal transmissions are sent to the SKIM with the correct message format but with invalid data.

TRANSPONDER ID MISMATCH

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When the transponder ID read by the SKIM does not match any of the transponder ID's stored in the SKIM's memory.

TRANSPONDER RESPONSE MISMATCH

When Monitored: At ignition on and during Key Programming Mode.

Set Condition: When the transponder's crypto algorithm result fails to match the SKIM's result.

POSSIBLE CAUSES
CHECKING MULTIPLE KEY OPERATION
SKIM
INTERMITTENT WIRING HARNESS PROBLEM
REPLACE IGNITION KEY

TRANSPONDER COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read and record the SKIM DTCs. With the DRBIII®, erase the SKIM DTCs. **NOTE: Perform the following test several times to ensure the DTC is current.** Turn the ignition off. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Does the DRBIII® display the DTC that was previously erased? Yes → Go To 2 No → Go To 7	All
2	Are there multiple vehicle ignition keys available? Yes → Go To 3 No → Go To 4	All
3	**NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys one at a time.** With the DRBIII®, erase the SKIM DTCs. Turn the ignition off. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Is the DTC present for all ignition keys? Yes → Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION. No → Replace the ignition key(s) that cause the SKIM DTC. Perform SKIS VERIFICATION.	All
4	With the DRBIII®, attempt to reprogram the ignition keys to the SKIM. With the DRBIII®, erase the SKIM DTCs. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Does the DTC set again? Yes → Go To 5 No → Test Complete.	All
5	Replace the ignition key with a new key. With the DRBIII®, program the new ignition key to the SKIM. With the DRBIII®, erase the SKIM DTCs. Turn the ignition off. Wait 10 seconds. Turn the ignition on. With the DRBIII®, read the SKIM DTCs. Does the DTC set again? Yes → Go To 6 No → Test Complete.	All

TRANSPONDER COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All
7	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform SKIS VERIFICATION. No → Test Complete.	All

Verification Tests

BODY VERIFICATION TEST - VER 1	APPLICABILITY
1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors. 2. If the Sentry Key Immobilizer Module (SKIM) or the Engine Control Module (ECM) was replaced, proceed to number 5. If the SKIM or ECM was not replaced, continue to the next number. 3. If the Body Control Module was replaced, turn the ignition on for 15 seconds (to learn VIN). If the vehicle is equipped with VTSS, use the DRB and enable VTSS. 4. Program tire size, country code and all RKE transmitters (if RKE Module was replaced) and other options as necessary. Proceed to number 12. 5. Obtain the Vehicle's unique PIN assigned to it's original SKIM from the vehicle's invoice. 6. NOTE: Once Secured Access Mode is active, the SKIM will remain in that mode for 60 seconds. 7. With the DRB, select THEFT ALARM, SKIM, MISCELLANEOUS and select SKIM REPLACED. Enter the 4 digit PIN to put the SKIM in Secured Access Mode. 8. The DRB will prompt for the following steps. 9. Using the DRB, program all customer keys into the SKIM memory. This requires that the SKIM be in Secured Access Mode, using the 4 digit PIN. 10. Note: If the ECM is replaced, the VIN and the unique Secret Key data must be transferred from the SKIM to the ECM. This procedure requires the SKIM to be placed in Secured Access Mode using the 4-digit PIN. 11. Note: If 3 attempts are made to enter Secured Access Mode using an incorrect PIN, Secured Access Mode will be locked out for 1 hour which causes the DRB to display "Bus +\- Signals Open". To exit this mode, turn ignition to Run for 1 hour. 12. Ensure all accessories are turned off and the battery is fully charged. 13. Turn the Ignition on and with the DRB, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 14. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRB, read DTCs from ALL modules. Are any DTCs present or is the original complaint still present? Yes → Repair is not complete, refer to the appropriate symptom. No → Repair is complete.	All

CHARGING VERIFICATION - VER-3	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. With the DRB, erase all diagnostic trouble codes (DTCs). 3. Start the engine. 4. Raise the engine speed to 2000 RPM for at least 30 seconds. 5. Allow the engine to idle. 6. Turn the ignition off for 20 seconds. 7. Turn the ignition on. 8. With the DRB, read ECM DTCs. 9. If this DTC has set again, or another DTC has set, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary. 10. If the charging system is functioning correctly and there are no DTCs, the repair is now complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

NO START VERIFICATION - VER-1	APPLICABILITY
1. NOTE: IMPORTANT! If the Engine Control Module or Sentry Key Immobilizer Module has been replaced, ensure the programming procedure for the module has been performed in accordance with the Service Information. 2. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 3. Inspect the engine oil for contamination. If it is contaminated, change the oil and filter. 4. With the DRB, erase all diagnostic trouble codes (DTCs). 5. Turn the ignition off for at least 10 seconds. 6. Attempt to start the engine. 7. If the engine is unable to start, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary. 8. If the engine starts and continues to run, the repair is now complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

ROAD TEST VERIFICATION - VER-2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a non-DTC test, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes and the symptom no longer exists, the repair was successful and testing is now complete. 4. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins (TSBs) and return to the Symptom List if necessary. 5. For previously read DTCs that have not been dealt with, return to the Symptom List and follow the diagnostic path for that DTC; otherwise, continue. 6. If the Engine Control Module (ECM) has not been changed, perform steps 7 and 8, otherwise, continue with step 9. 7. With the DRB, erase all diagnostic trouble codes (DTCs), then disconnect the DRB. 8. Turn the ignition off for at least 10 seconds. 9. If equipped with a Transfer Case Position Switch, perform step 10, otherwise, continue with step 11. 10. With the ignition switch on, place the Transfer Case Shift Lever in each gear position, stopping for 15 seconds in each position. 11. Ensure no DTCs remain by performing steps 12 through 15. 12. Road test the vehicle. For some of the road test, go at least 64 km/h (40 MPH). If this test is for an A/C Relay Control Circuit, drive the vehicle for at least 5 minutes with the A/C on. 13. At some point, stop the vehicle and turn the engine off for at least 10 seconds, then restart the engine and continue. 14. Upon completion of the road test, turn the engine off and check for DTCs with the DRB. 15. If the repaired DTC has set again, the repair is not complete. Check for any pertinent Technical Service Bulletins (TSBs) and return to the Symptom List. If there are no DTCs, the repair was successful and is now complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

SKIS VERIFICATION	APPLICABILITY
1. Reconnect all previously disconnected components and connectors. 2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKIM. **3. NOTE: When entering the PIN, care should be taken because the SKIM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PINs are entered, the SKIM will Lock Out the DRB for 1 hour.** 4. To exit Lock Out mode, the ignition key must remain in the Run position continually for 1 hour. Turn off all accessories and connect a battery charger if necessary. 5. With the DRB, select Theft Alarm, SKIM and Miscellaneous. Then, select the desired procedure and follow the steps that will be displayed. 6. If the SKIM has been replaced, ensure all of the vehicle ignition keys are programmed to the new SKIM. **7. NOTE: Prior to returning vehicle to the customer, perform a module scan to be sure that all DTCs are erased. Erase any DTCs that are found.** 8. With the DRB, erase all DTCs. Perform 5 ignition key cycles leaving the key on for at least 90 seconds per cycle. 9. With the DRB, read the SKIM DTCs. Are there any SKIM DTCs? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

SPEED CONTROL VERIFICATION - VER-4	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. With the DRB, erase all diagnostic trouble codes (DTCs). 3. Road test the vehicle at a speed above 58 km/h (35 MPH). 4. Turn the speed control ON/OFF switch on. 5. Depress and release the SET switch. If the speed control does not engage, the repair is not complete, continue with step 12. 6. Quickly depress and release the RESUME/ACCEL switch. If the vehicle speed does not increase by 3 km/h (2 MPH), the repair is not complete, continue with step 12. 7. Using caution, depress and release the brake pedal. If the speed control does not disengage, the repair is not complete, continue with step 12. 8. With the vehicle speed at least 56 km/h (35 MPH), depress the RESUME/ACCEL switch. If the speed control does not resume at the previously set speed, the repair is not complete, continue with step 12. 9. Hold down the COAST switch. If the vehicle does not decelerate, the repair is not complete, continue with step 12. 10. While still holding down the COAST switch, ensure the vehicle speed is at least 56 km/h (35 MPH) and release the COAST switch. If the vehicle does not adjust and set a new vehicle speed, the repair is not complete, continue with step 12. 11. With the speed control engaged, depress the ON/OFF switch. If the speed control does not disengage, the repair is not complete, continue with step 12. 12. If the vehicle did not successfully perform all of the previous steps, check for Technical Service Bulletins (TSBs) that pertain to this speed control problem and then, if necessary, return to the Symptom List. 13. If the vehicle successfully performed all of the previous steps, the speed control system is now functioning as designed. The repair is now complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

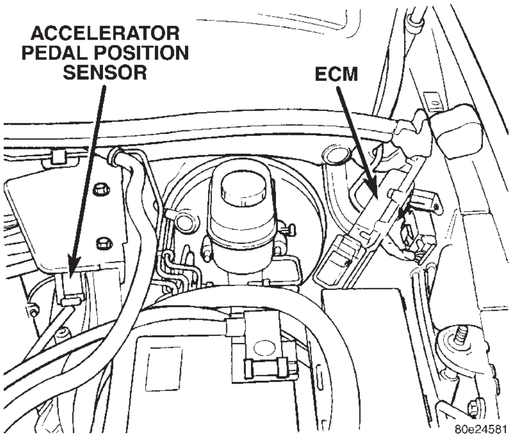
Verification Tests — Continued

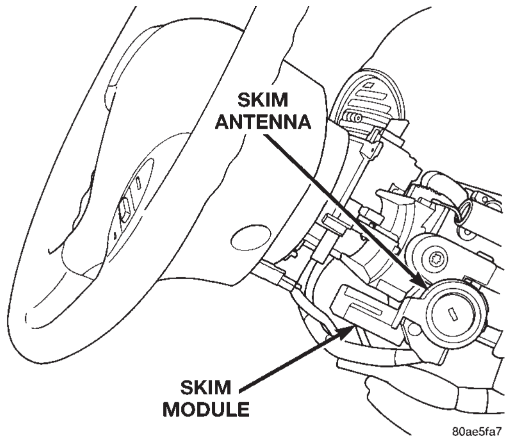
W5J400 TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. NOTE: If the TCM was replaced, use the DRBIII® to program the VIN information into the TCM 2. Reconnect any disconnected components. 3. Connect the DRBIII® to the Data Link Connector. 4. With the DRBIII®, erase ABS DTC's. 5. With the DRBIII®, erase PCM/ECM DTC's. 6. With the DRBIII®, erase Transmission DTC's. 7. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT, above 43° C (110° F). 8. Check the Transmission fluid and adjust if necessary. Refer to the Service Information for the proper Fluid Fill procedure. 9. Perform the ADAPTION PROCEDURE whenever the TCM and/or the Transmission has been replaced or major Transmission repairs have been performed. If none of these apply, proceed to ROAD TEST PROCEDURE. 10. ADAPTION PROCEDURE 11. With the DRBIII®, reset the Transmission adaptives. Resetting the adaptives will set the adaptives to factory settings. 12. Drive the Vehicle until the Transmission Temperature is in the specified range. **13. NOTE: Perform the Coast Down Adaptations first. The Transmission Temperature must be greater than 60° C (140° F) and less than 70° C (158° F). Failure to stay within these temperature ranges will void the procedure.** 14. Perform 4 to 5 Coast Downs from 5th to 4th gear and then 4th to 3rd gear. **15. NOTE: For Upshift adaption, the Transmission temperature must be greater than 60° C (140° F) and less than 100° C (212° F). Failure to stay within these temperature ranges will void this procedure.** 16. From a stop, moderately accelerate the vehicle and obtain all forward gear ranges while keeping the Engine RPM below 1800 RPM. Repeat this procedure 4 to 5 times. 17. Obtaining 5th gear may be difficult at 1800 RPM. Allow the transmission to shift into 5th gear at a higher RPM then lower the RPM to 1800 and perform manual shifts between 4th and 5th gears using the shift lever. 18. The TCM will store the adaptives every 10 minutes. After completion of the Adaption Procedure make sure the vehicle stays running for at least 10 minutes. To manually store the adaptives under 10 minutes, use the DRBIII® Store Adaptives procedure. 19. If the Shift Quality is not acceptable after performing the Adaption Procedure, repeat the Adaption Procedure. **20. NOTE: If internal repairs were performed and the shift quality is still poor after repeating the Adaption Procedure, it may be necessary to check the internal repair. Also check for any TSBs and/or Controller Flash updates that may apply.** 21. ROAD TEST PROCEDURE 22. Road test the vehicle. Make fifteen to twenty 1-2, 2-3, 3-4 and 4-5 upshifts. 23. Perform these shifts from a standing start to 72 Km/h or 45 MPH with a constant throttle opening of 20 to 25 degrees. 24. With speeds below 40 Km/h or 25 MPH, make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 25. With the DRBIII®, perform the Transmission Solenoid Test. 26. With the DRBIII®, read Transmission DTCs. Were there any Diagnostic Trouble Codes set? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

NOTES

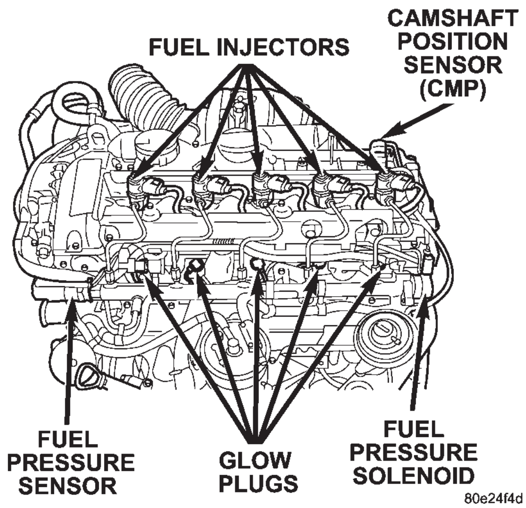
8.0 COMPONENT LOCATIONS

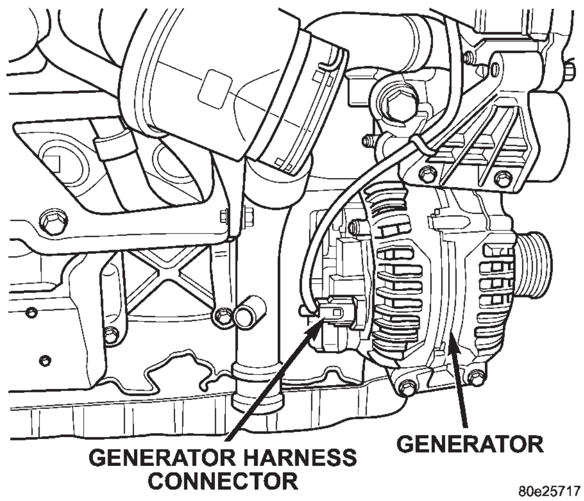
8.1 CONTROL MODULES

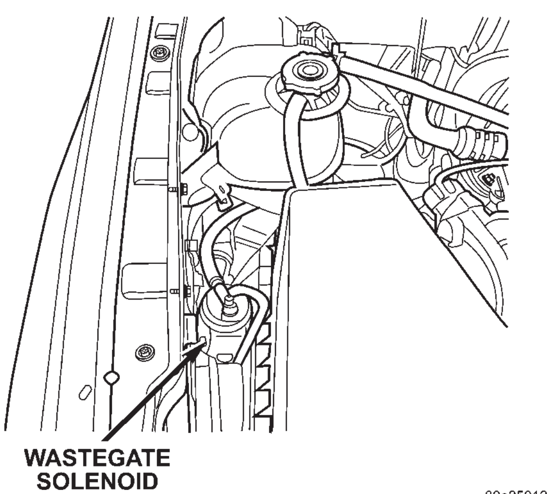


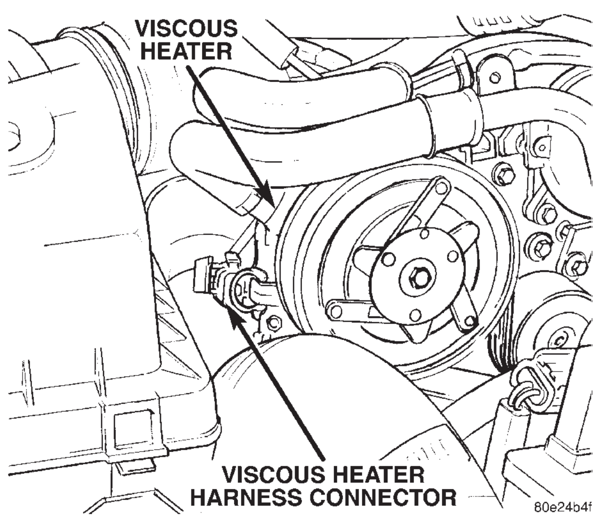


8.2 CONTROLS AND SOLENOIDS

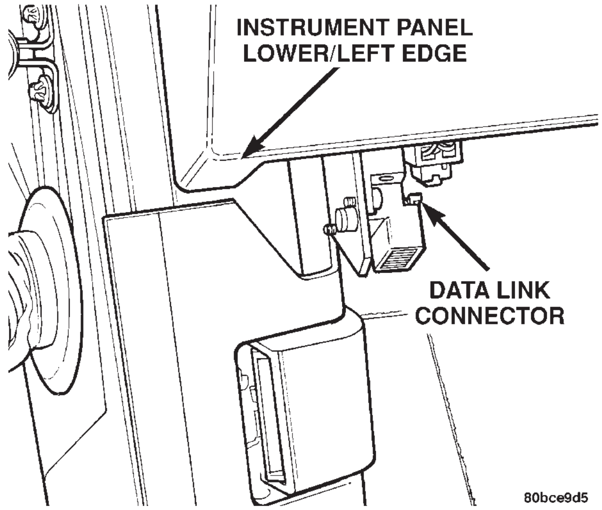




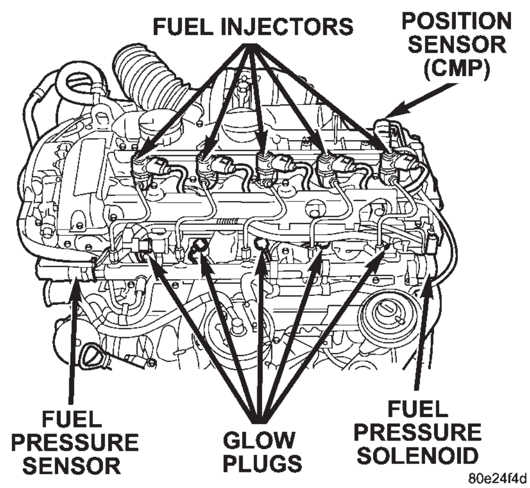




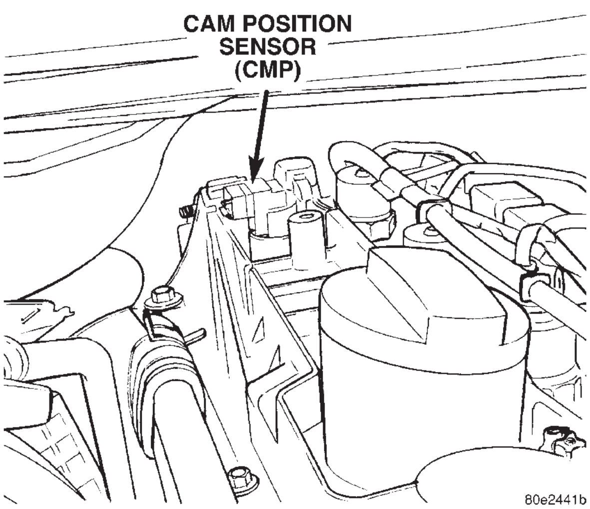
8.3 DATA LINK CONNECTOR

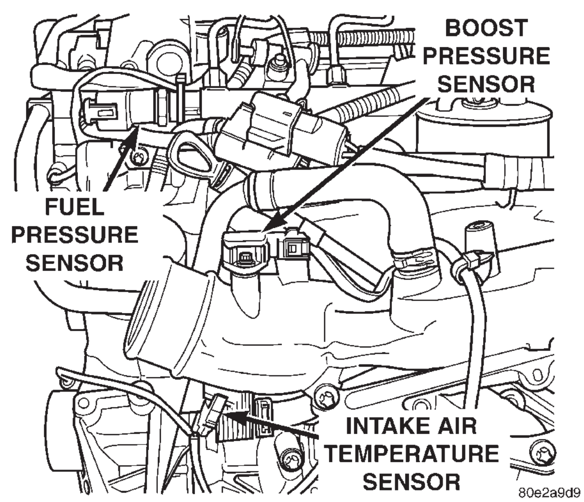


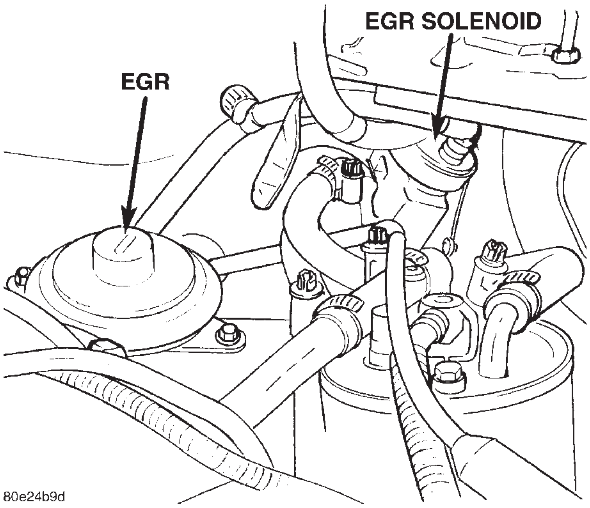
8.4 FUEL SYSTEM



8.5 SENSORS






EGR SOLENOID
EGR
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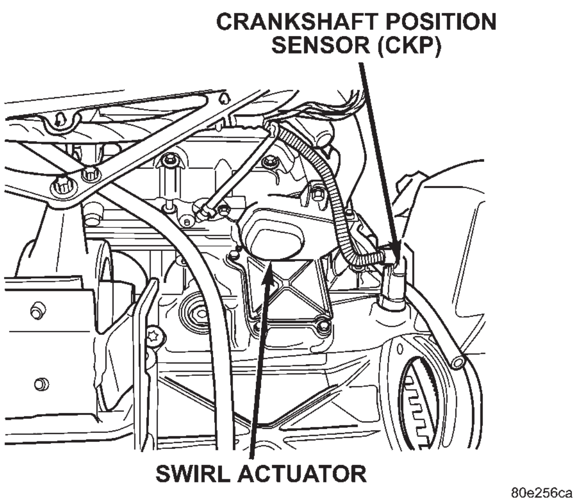
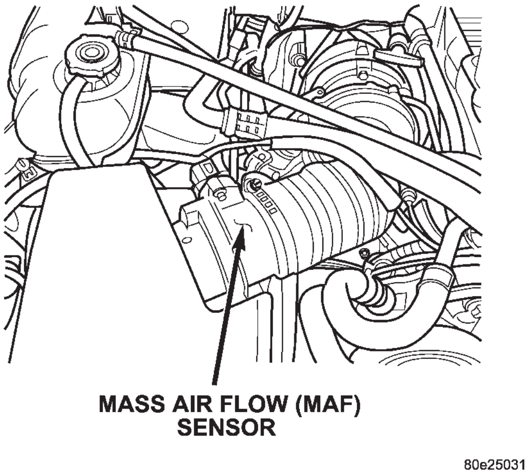

CRANKSHAFT POSITION SENSOR (CKP)
SWIRL ACTUATOR
80e256ca


MASS AIR FLOW (MAF) SENSOR
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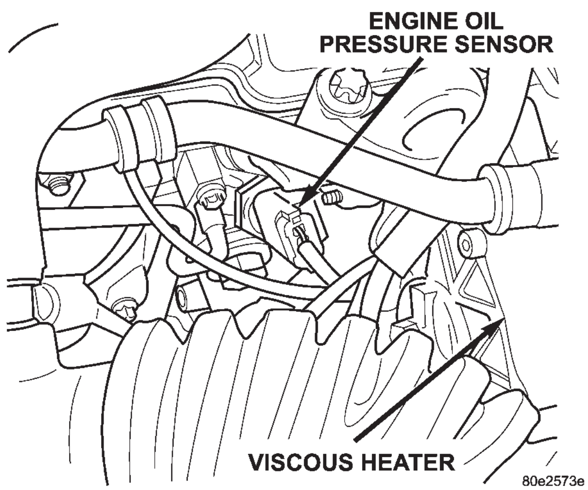
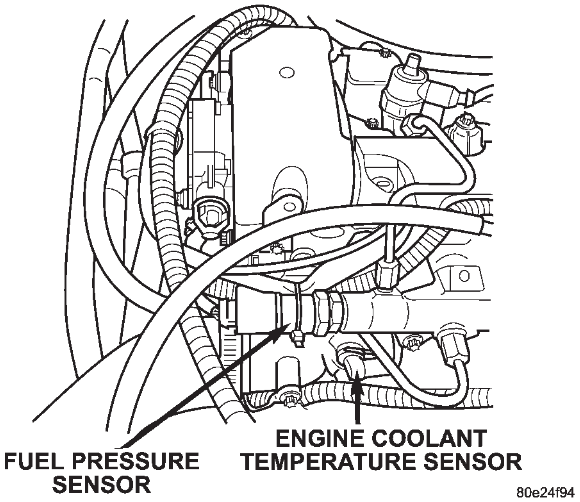

ENGINE OIL PRESSURE SENSOR
VISCOUS HEATER
80e2573e


FUEL PRESSURE SENSOR
ENGINE COOLANT TEMPERATURE SENSOR
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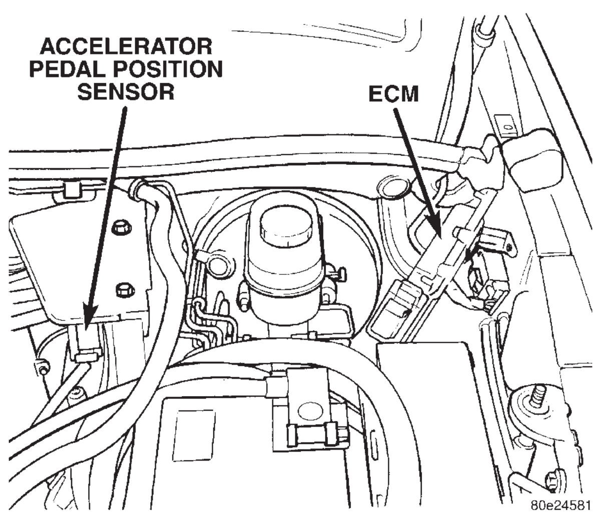
ACCELERATOR PEDAL POSITION SENSOR
ECM
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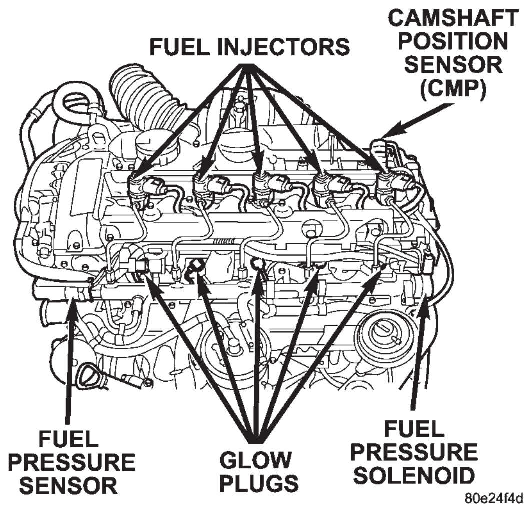
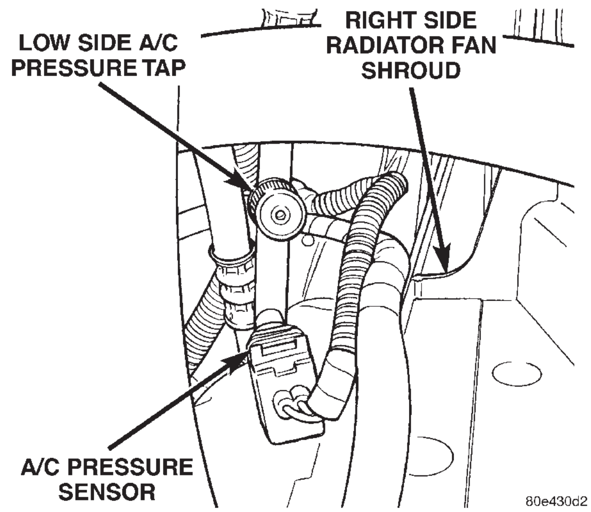
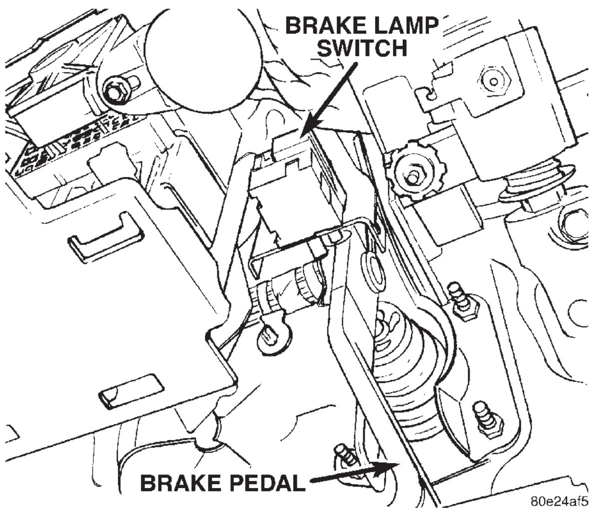
8.5 SENSORS (Continued)

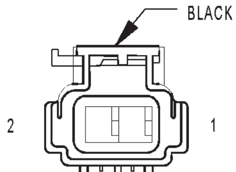




8.6 SWITCHES



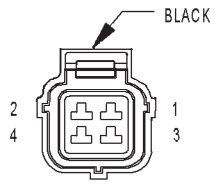
9.0 CONNECTOR PINOUTS



A/C COMPRESSOR CLUTCH

A/C COMPRESSOR CLUTCH - BLACK 2 WAY

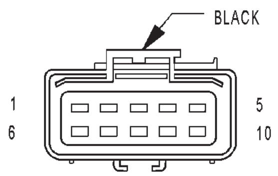
CAV	CIRCUIT	FUNCTION
1	C2 18DB/YL	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z18 18BK	GROUND



A/C PRESSURE TRANSDUCER

A/C PRESSURE TRANSDUCER - BLACK 4 WAY

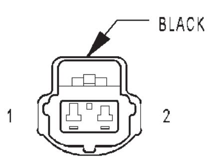
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K6 18VT/WT (DIESEL)	SENSOR REFERENCE VOLTAGE B
2	K6 18VT/BK (GAS)	5 VOLT SUPPLY
3	C18 18DB	A/C PRESSURE SIGNAL
4	-	-



ACCELERATOR PEDAL POSITION SENSOR (DIESEL)

ACCELERATOR PEDAL POSITION SENSOR (DIESEL) - BLACK 10 WAY

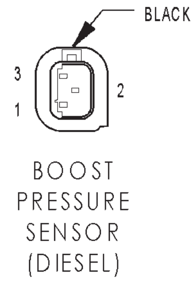
CAV	CIRCUIT	FUNCTION
1	-	-
2	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
3	K22 14RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
4	-	-
5	-	-
6	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
7	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
8	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
9	-	-
10	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY



BATTERY TEMPERATURE SENSOR

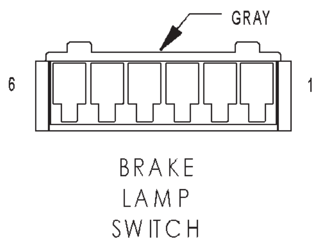
BATTERY TEMPERATURE SENSOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB (GAS LHD)	SENSOR GROUND
1	K4 20BK/LB (DIESEL/RHD)	SENSOR GROUND
2	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL



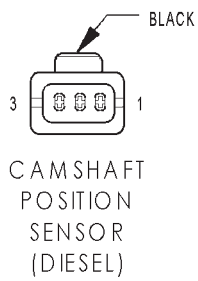
BOOST PRESSURE SENSOR (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	Y53 20VT/WT	BOOST PRESSURE SENSOR SIGNAL
3	K6 20BK/YL	SENSOR REFERENCE VOLTAGE B



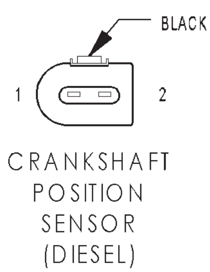
BRAKE LAMP SWITCH - GRAY 6 WAY

CAV	CIRCUIT	FUNCTION
1	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
2	Z238 18BK (LHD)	GROUND
2	Z243 18BK (RHD)	GROUND
3	V32 22OR/DG (GAS)	SPEED CONTROL POWER SUPPLY
4	V30 22DB/RD (GAS)	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 20VT/TN (LHD)	PRIMARY BRAKE SWITCH SIGNAL
5	L50 20WT/TN (RHD)	PRIMARY BRAKE SWITCH SIGNAL
6	F32 20PK/DB	FUSED B(+)



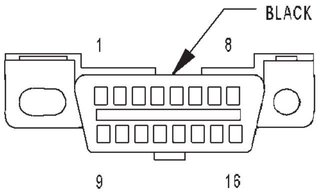
CAMSHAFT POSITION SENSOR (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
2	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
3	F15 18RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT



CRANKSHAFT POSITION SENSOR (DIESEL) - BLACK 2 WAY

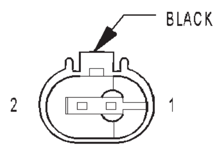
CAV	CIRCUIT	FUNCTION
1	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
2	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

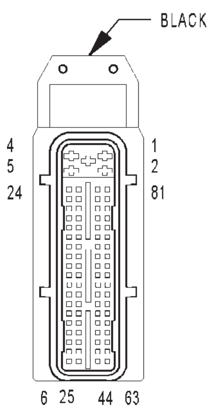
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z305 20BK/OR	GROUND
5	Z306 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)



EGR SOLENOID (DIESEL)

EGR SOLENOID (DIESEL) - BLACK 2 WAY

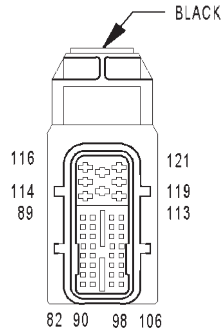
CAV	CIRCUIT	FUNCTION
1	F15 18RD/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K35 20GY/YL	EGR SOLENOID CONTROL



ENGINE CONTROL MODULE C1 (DIESEL)

ENGINE CONTROL MODULE C1 (DIESEL) - BLACK 81 WAY

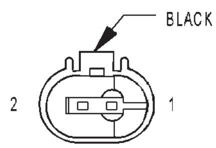
CAV	CIRCUIT	FUNCTION
1	Z108 14BK/DG	GROUND
2	Z108 14BK/DG	GROUND
3	K20 14DB	GENERATOR FIELD CONTROL
4	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
5	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
6	D52 18DG/WT	CAN C BUS(+)
7	D25 20VT/YL	PCI BUS
8	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
9	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
10	-	-
11	Y53 20BK/YL	BOOST PRESSURE SENSOR SIGNAL
12	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL
13	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
14	K22 20RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
15	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
16	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
17	-	-
18	-	-
19	F300 20RD/BK	BATTERY SENSE (+)
20	Z11 20BK/WT	BATTERY SENSE (-)
21	K4 18BK/LB	SENSOR GROUND
22	F991 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
24	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1
25	D51 18WT	CAN C BUS(-)
26	-	-
27	-	-
28	-	-
29	K77 20BR/WT	TRANSFER CASE POSITION SENSOR SIGNAL
30	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
31	-	-
32	K25 20VT/DG	BATTERY TEMPERATURE SENSOR SIGNAL
33	-	-
34	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
35	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY
36	C18 20DB	A/C PRESSURE SENSOR SIGNAL
37	-	-
38	V37 20RD/DG	SPEED CONTROL SWITCH SIGNAL
39	K226 20DB/WT	FUEL LEVEL SENSOR SIGNAL
40	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
41	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL
42	Y101 20	CRANKSHAFT POSITION SENSOR SHIELD
43	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
44	-	-
45	-	-
46	-	-
47	L50 20WT/DB	PRIMARY BRAKE SWITCH SIGNAL
48	K29 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
49	-	-
50	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
51	-	-
52	-	-
53	-	-
54	Z189 20BR	MASS AIR FLOW SENSOR GROUND
55	B22 20DG/YL	VEHICLE SPEED SENSOR SIGNAL
56	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
57	-	-
58	K4 20BK/LB	WATER IN FUEL SENSOR GROUND
59	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL
60	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY
61	K51 20DB/YL	AUTO SHUT DOWN RELAY CONTROL
62	-	-
63	-	-
64	-	-
65	-	-
66	-	-
67	K173 20GY	HYDRAULIC RADIATOR FAN SOLENOID CONTROL
68	-	-
69	C13 20DB/RD	A/C COMPRESSOR CLUTCH RELAY CONTROL
70	-	-
71	-	-
72	K236 20GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
73	-	-
74	T752 20DG/RD	ENGINE STARTER MOTOR RELAY CONTROL
75	K132 20BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
76	Y42 20BR/BK	WASTEGATE SOLENOID CONTROL
77	K152 20WT	GLOW PLUG RELAY NO. 1 CONTROL
78	-	-
79	-	-
80	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
81	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL



ENGINE CONTROL MODULE C2 (DIESEL)

ENGINE CONTROL MODULE C2 (DIESEL) - BLACK 40 WAY

CAV	CIRCUIT	FUNCTION
82	D21 20PK	SCI TRANSMIT
83	-	-
84	-	-
85	-	-
86	-	-
87	-	-
88	-	-
89	K35 20GY/YL	EGR SOLENOID CONTROL
90	-	-
91	-	-
92	-	-
93	-	-
94	G123 20DG/WT	WATER IN FUEL SIGNAL
95	-	-
96	-	-
97	-	-
98	-	-
99	-	-
100	-	-
101	-	-
102	-	-
103	-	-
104	-	-
105	-	-
106	-	-
107	-	-
108	-	-
109	-	-
110	-	-
111	-	-
112	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
113	-	-
114	-	-
115	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
116	K63 14BK	COMMON INJECTOR DRIVER
117	-	-
118	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
119	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
120	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
121	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL

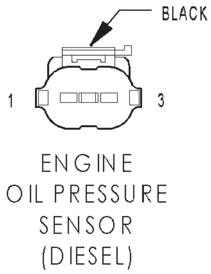


ENGINE COOLANT TEMPERATURE SENSOR (DIESEL)

ENGINE COOLANT TEMPERATURE SENSOR (DIESEL) - BLACK 2 WAY

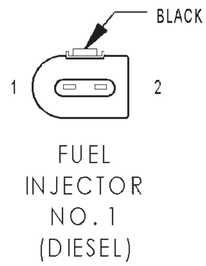
CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL

CONNECTOR PINOUTS



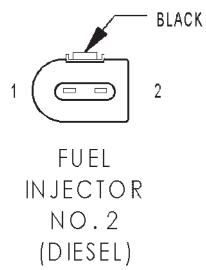
ENGINE OIL PRESSURE SENSOR (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
2	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



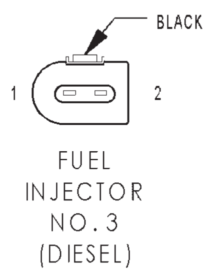
FUEL INJECTOR NO. 1 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



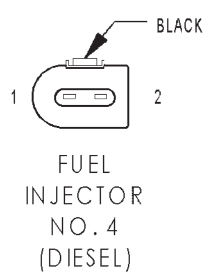
FUEL INJECTOR NO. 2 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



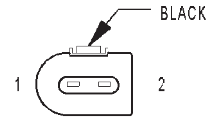
FUEL INJECTOR NO. 3 (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



FUEL INJECTOR NO. 4 (DIESEL) - BLACK 2 WAY

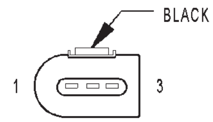
CAV	CIRCUIT	FUNCTION
1	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



FUEL INJECTOR NO. 5 (DIESEL)

FUEL INJECTOR NO. 5 (DIESEL) - BLACK 2 WAY

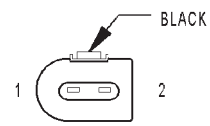
CAV	CIRCUIT	FUNCTION
1	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
2	K63 14BK	COMMON INJECTOR DRIVER



FUEL PRESSURE SENSOR (DIESEL)

FUEL PRESSURE SENSOR (DIESEL) - BLACK 3 WAY

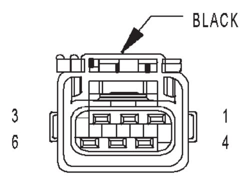
CAV	CIRCUIT	FUNCTION
1	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
2	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
3	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY



FUEL PRESSURE SOLENOID (DIESEL)

FUEL PRESSURE SOLENOID (DIESEL) - BLACK 2 WAY

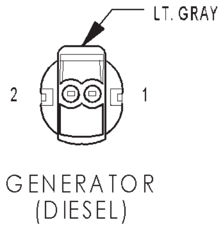
CAV	CIRCUIT	FUNCTION
1	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
2	F142 16RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT



FUEL TANK MODULE (DIESEL)

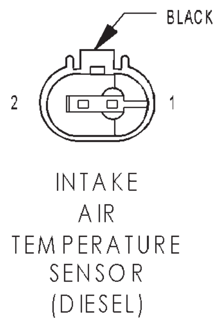
FUEL TANK MODULE (DIESEL) - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	- -
3	K226 20LB/YL	FUEL LEVEL SENSOR SIGNAL
4	K4 20BK/LB	SENSOR GROUND
5	-	-
6	-	-



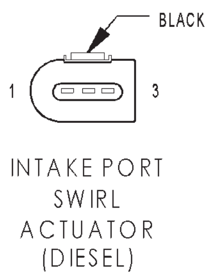
GENERATOR (DIESEL) - LT. GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	F15 14DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K20 14DB	GENERATOR FIELD CONTROL



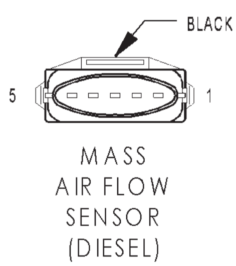
INTAKE AIR TEMPERATURE SENSOR (DIESEL) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL



INTAKE PORT SWIRL ACTUATOR (DIESEL) - BLACK 3 WAY

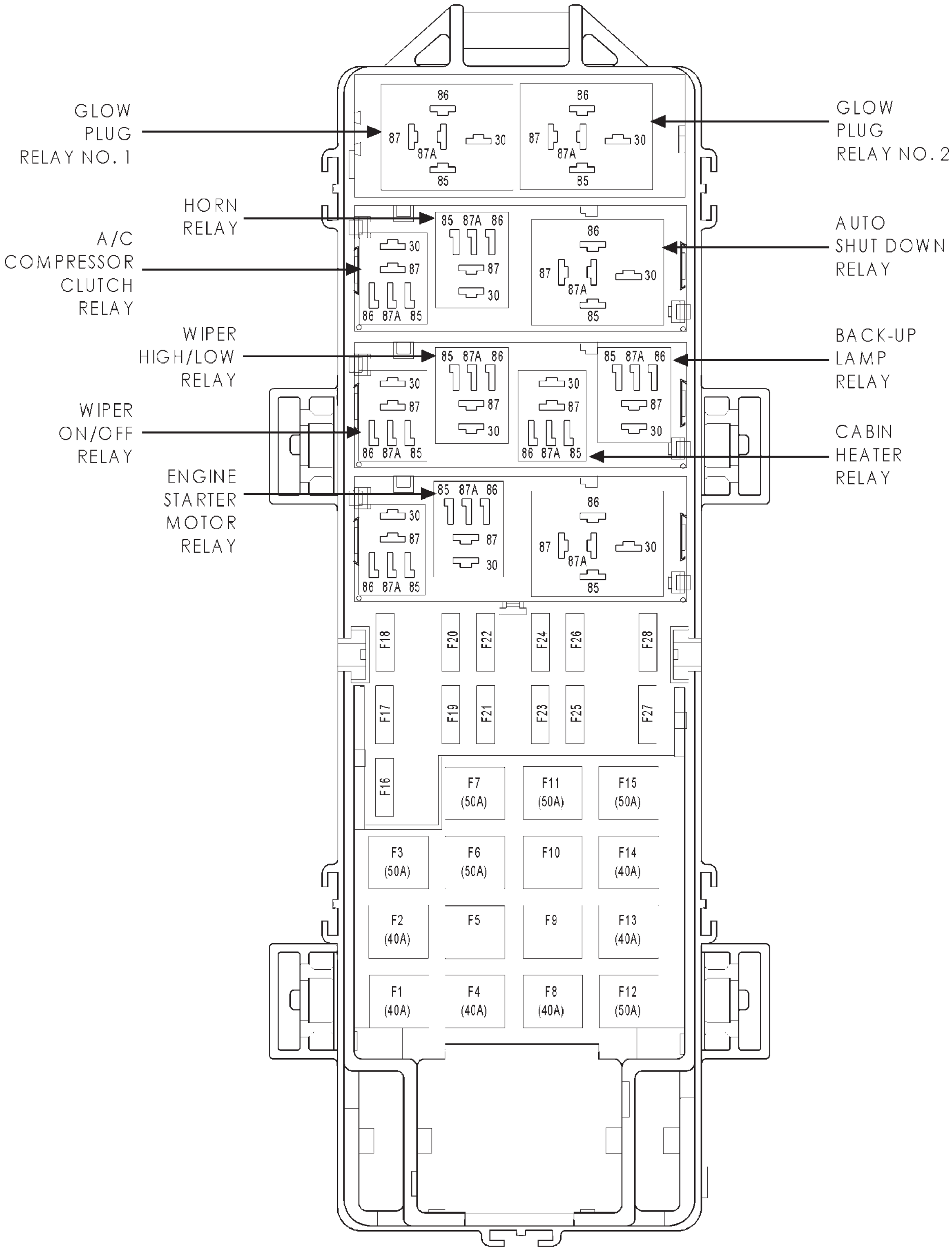
CAV	CIRCUIT	FUNCTION
1	Z18 18BK	GROUND
2	F15 18RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
3	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL



MASS AIR FLOW SENSOR (DIESEL) - BLACK 5 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	F15 16RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
3	Z189 20BR	GROUND
4	F855 20BR/YL	SENSOR REFERENCE VOLTAGE A
5	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL

POWER DISTRIBUTION CENTER (DIESEL)



FUSES (DIESEL)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	-	-	-
6	50A	A105 10DB/RD	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	50A	A110 10VT/RD	FUSED B(+)
12	50A	A146 10OR/WT	FUSED B(+)
13	40A	A14 14RD/WT	FUSED B(+)
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	20A	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	20A	F15 18 DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	-	-	-
20	-	-	-
21	15A	A17 14RD/BK	FUSED B(+)
22	10A	F300 18RD/BK	FUSED B(+)
23	15A	A80 18RD/LG	FUSED B(+)
24	-	-	-
25	20A	A20 12RD/DB	FUSED B(+)
26	20A	F142 14OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	-	-	-

A/C COMPRESSOR CLUTCH RELAY (DIESEL)

CAV	CIRCUIT	FUNCTION
30	A17 14RD/BK	FUSED B(+)
85	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	C2 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

AUTO SHUT DOWN RELAY (DIESEL)

CAV	CIRCUIT	FUNCTION
30	A14 14RD/WT	FUSED B(+)
85	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
86	A14 14RD/WT	FUSED B(+)
87	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
87	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
87A	-	-

ENGINE STARTER MOTOR RELAY (DIESEL)

CAV	CIRCUIT	FUNCTION
30	A1 12RD	FUSED B(+)
85	T752 18DG/OR	ENGINE STARTER MOTOR RELAY CONTROL
86	F45 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
87	T40 12BR	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

GLOW PLUG RELAY NO. 1 (DIESEL)

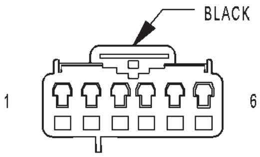
CAV	CIRCUIT	FUNCTION
30	A105 10DB/RD	FUSED B(+)
85	K152 18WT	GLOW PLUG RELAY NO. 1 CONTROL
86	F15 20DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
86	F15 20DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	K154 10GY	GLOW PLUG RELAY NO. 1 OUTPUT
87A	-	-

GLOW PLUG RELAY NO. 2 (DIESEL)

CAV	CIRCUIT	FUNCTION
30	A110 VT/RD	FUSED B(+)
85	K236 18GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
86	F15 20DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
86	F15 20DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	K254 10GY/YL	GLOW PLUG RELAY NO. 2 OUTPUT
87A	-	-

VISCOUS/CABIN HEATER RELAY (DIESEL)

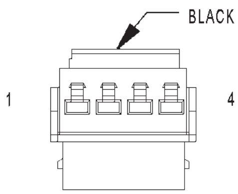
CAV	CIRCUIT	FUNCTION
30	A80 18RD/LG	FUSED B(+)
85	K132 18BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
86	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
87	A82 18PK/LG	VISCOUS/CABIN HEATER RELAY OUTPUT
87A	-	-



SENTRY KEY IMMOBILIZER MODULE

SENTRY KEY IMMOBILIZER MODULE - BLACK 6 WAY

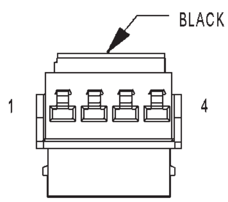
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	Z132 20BK/OR	GROUND
3	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	-	-
5	D25 20YL/VT/BK	PCI BUS
6	-	-



SPEED CONTROL SWITCH NO. 1

SPEED CONTROL SWITCH NO. 1 - BLACK 4 WAY

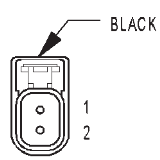
CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



SPEED CONTROL SWITCH NO. 2

SPEED CONTROL SWITCH NO. 2 - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-

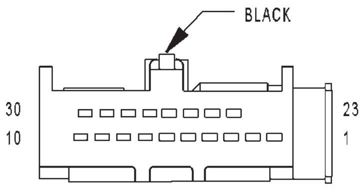


TRANSFER CASE POSITION SENSOR

TRANSFER CASE POSITION SENSOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K77 20BR/WT (DIESEL)	TRANSFER CASE POSITION SENSOR SIGNAL
1	K77 18LG/BK (GAS)	TRANSFER CASE POSITION SENSOR SIGNAL
2	K4 20BK/LB (DIESEL)	SENSOR GROUND
2	K4 18BK/LB (GAS)	SENSOR GROUND

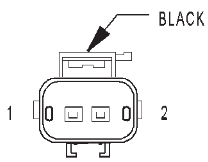
CONNECTOR PINOUTS



TRANSMISSION CONTROL MODULE C1 (DIESEL)

TRANSMISSION CONTROL MODULE C1 (DIESEL) - BLACK 18 WAY

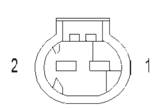
CAV	CIRCUIT	FUNCTION
1	D21 20PK	SCI TRANSMIT
2	-	-
3	W4 20PK/OR	SHIFTER C5 SENSE
4	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL
5	-	-
6	-	-
7	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
8	-	-
9	-	-
10	-	-
23	-	-
24	-	-
25	W0 20DB/WT	SHIFTER C1 SENSE
26	W1 20VT/WT	SHIFTER C2 SENSE
27	W2 20VT	SHIFTER C3 SENSE
28	W3 20BK	SHIFTER C4 SENSE
29	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
30	Z234 20WT	GROUND



VISCOUS/CABIN HEATER (DIESEL)

VISCOUS/CABIN HEATER (DIESEL) - BLACK 2 WAY

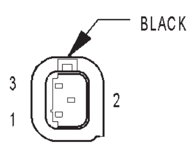
CAV	CIRCUIT	FUNCTION
1	A82 16PK/LG	VISCOUS/CABIN HEATER RELAY OUTPUT
2	Z18 16BK	GROUND



WASTEGATE SOLENOID (DIESEL)

WASTEGATE SOLENOID (DIESEL) - 2 WAY

CAV	CIRCUIT	FUNCTION
1	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	Y42 18OR/DB	WASTEGATE SOLENOID CONTROL



WATER IN FUEL SENSOR (DIESEL)

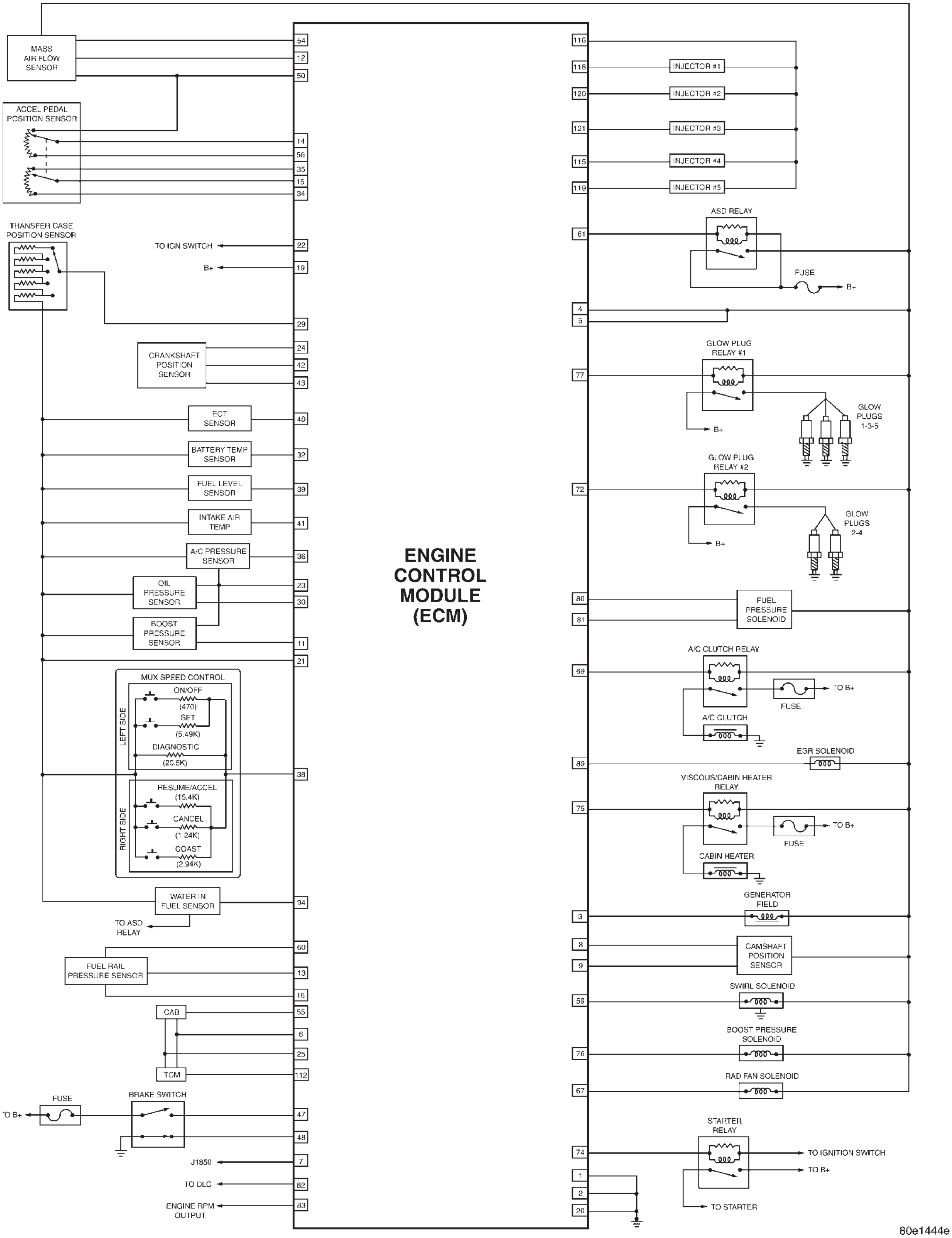
WATER IN FUEL SENSOR (DIESEL) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	G123 20DG/WT	WATER IN FUEL SENSOR SIGNAL
3	F15 20RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT

NOTES

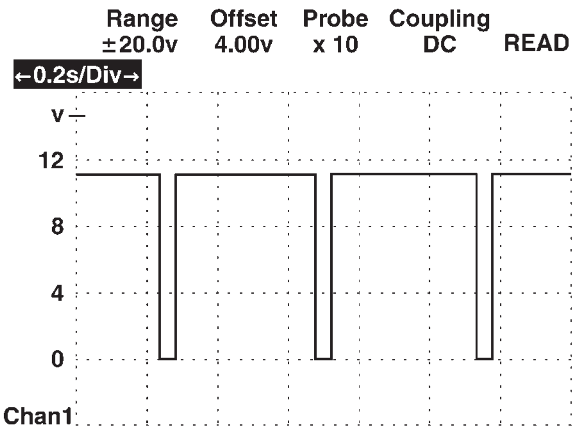
10.0 SCHEMATIC DIAGRAMS

10.1 ENGINE CONTROL MODULE



NOTES

11.0 CHARTS AND GRAPHS



Camshaft Position Sensor Signal - During Engine Cranking

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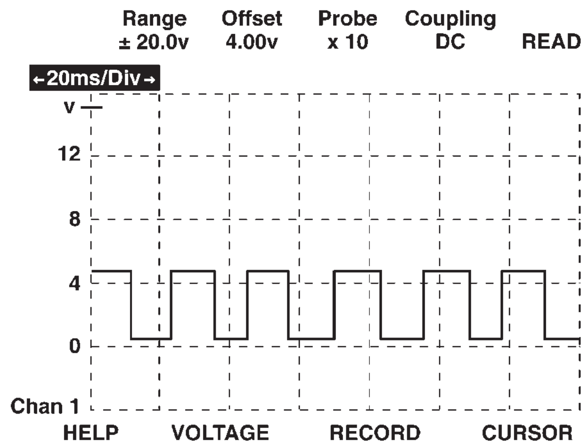

Vehicle Speed Signal - Driving in 3rd gear at 1100-1200 RPM

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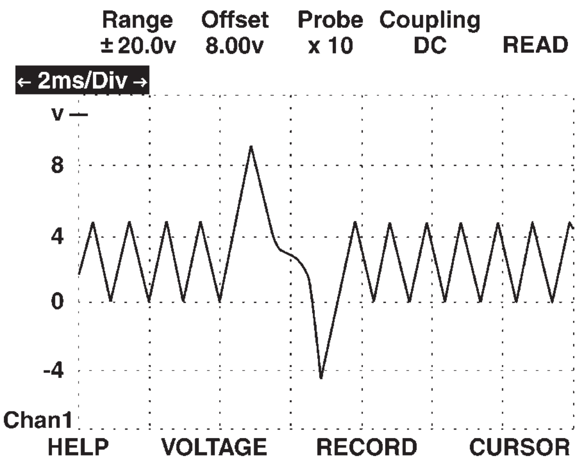
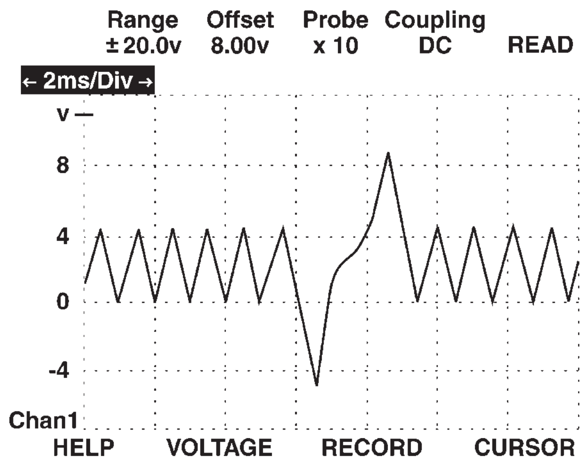


CKP Sensor Signal 1

80d9e01c



CKP Sensor Signal 2

80d9e0d8

NOTES

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all the specifications, instructions and graphics needed to diagnose 2002 body system problems. The diagnostics in this manual are based on the failure condition or symptom being present at the time of diagnosis.

Please follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the appropriate modules; i.e., if the DRBIII® displays a "No Response" or a "Bus ± Signals Open" condition, you must diagnose that first.
2. Read DTC's (diagnostic trouble codes) with the DRBIII®.
3. If no DTC's are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All schematics are in Section 10.0.

An * placed before the symptom description indicates a customer complaint.

When repairs are required, refer to the appropriate service information for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added: carryover systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE DIAGNOSTIC TROUBLE CODE. It is recommended that you review the entire manual to become familiar with all the new and changed diagnostic procedures.

This book reflects many suggested changes from readers of past issues. After using this book, if you have any comments or suggestions, please fill out the sheet in the back of this book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic procedures manual covers all 2002 JEEP GRAND CHEROKEE "body" related faults. This diagnostic procedures manual also covers both left hand drive (LHD) and right hand drive (RHD) vehicles. There may be some slight differences in the location views of components. If the location views shown are on a LHD vehicle, a RHD vehicle will be symmetrically opposite.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the body system is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

The vehicle systems that are part of the "body" system are:

- Airbag
- Audio
- Chime
- Communication
- Electrically heated system
- Exterior lighting
- Heating and A/C
- Instrument Cluster
- Interior Lighting
- Memory Seat
- Overhead Console
- Power Door Lock/RKE
- Power mirrors
- Power sunroof
- Power windows
- Tire Pressure Monitoring (TPM)
- Vehicle theft security system (VTSS)
- Windshield Wiper and Washer

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

The body system on the 2002 WJ/WG consists of a combination of modules that communicate over the PCI bus (Programmable Communication Interface multiplex system). Through the PCI bus, information about the operation of vehicle components and circuits is relayed quickly to the appropriate module(s). All modules receive all the information transmitted on the bus even though a module may not require all information to perform it's function. It will only respond to messages "addressed" to it through a binary coding process. This method of data transmission significantly reduces the complexity of the wiring in the vehicle and the size of wiring harnesses. All of the information about the functioning of all the systems is organized, controlled, and communicated by the PCI bus, which is described in the Communication Section of this general information.

3.1 AIRBAG SYSTEM/OCCUPANT RESTRAINT CONTROLLER SYSTEM

The 2002 WJ/WG Airbag System contain the following components: Occupant Restraint Controller (ORC), Airbag Warning Indicator, Clockspring, Driver and Passenger Airbags, Driver and Passenger Hall-effect Seat Belt buckle Switches (SBS), Driver and Passenger Front and Side Impact Sensors, curtain Airbags, and front impact sensors.

The Occupant Restraint Controller (ORC) is a new type of Airbag Control Module (ACM). The new ACM supports staged airbag deployment and remote impact sensing. Staged deployment is the ability to trigger airbag system squib inflators individually as needed to provide the appropriate restraint for the severity of the impact. The ACM has four major functions: PCI Bus communications, onboard diagnostics, impact sensing, and component deployment. The ACM also contains an energy-storage capacitor. This capacitor stores enough electrical energy to deploy the front airbag components for two seconds following a battery disconnect or failure during an impact. The ACM is secured to the floor panel transmission tunnel under the console. The ACM cannot be repaired or adjusted.

The ACM sends and/or receives PCI Bus messages with the Instrument Cluster (MIC), Body Control Module (BCM), and Impact Sensors Diagnostic trouble codes will be set if the communication with these modules is lost or contains invalid information.

The microprocessor in the ACM monitors the impact sensors signals and the airbag system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault it sends a message to the instrument cluster via PCI bus to turn on the airbag warning indicator. The ACM can set both active and stored diagnostic trouble codes to aid in the diagnosing system problems. See DIAGNOSTIC TROUBLE CODES in this section.

The ACM uses two front impact sensors and ACM Accelerometer to sense the rate of vehicle deceleration, provide verification of the direction and severity of an impact. A pre-programmed decision algorithm in the ACM microprocessor determines when the deceleration rate is severe enough to require airbag system protection. The ACM also uses the driver and front passenger seat belt switch status (buckled or unbuckled) and crash severity to determine the level of driver and front passenger airbag deployment, low medium or high. When the programmed conditions are met, the ACM sends an electrical signal to deploy the appropriate airbag system components.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IS ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. NEVER STRIKE OR KICK THE AIRBAG CONTROL MODULE, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN AIRBAG CONTROL MODULE IS ACCIDENTALLY DROPPED DURING SERVICE, THE MODULE MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT.

The airbag warning indicator is the only point at which the customer can observe symptoms of a system malfunction. Whenever the ignition key is turned to the run or start position, the ACM performs a lamp check by turning the airbag warning indicator on for 6-8 seconds. After the lamp check, if the indicator turns off, it means that the ACM has checked the system and found it to be free of discernible malfunctions. If the lamp remains on, there could be an active fault in the system or the MIC lamp circuit may be internally shorted. If the lamp comes on and stays on for a period longer than 6-8 seconds then goes off, there is usually an intermittent problem in the system.

3.1.1 DRIVER AIRBAG

The airbag protective trim cover is the most visible part of the driver side airbag system. The protective trim cover is fitted to the front of the airbag module and forms a decorative cover in the center of the steering wheel. The module is mounted directly to the steering wheel. Located under the trim cover are the horn switch, the airbag cushion, and the airbag cushion supporting components. The airbag module includes a housing to which the cushion and hybrid inflator are attached and sealed. The 2002 WJ/WG is equipped with driver airbag with dual stage inflators. When supplied with the proper electrical signal, the inflator or inflators discharge the gas directly into the cushion. The airbag module cannot be repaired, and must be replaced if deployed or in any way damaged.

WARNING: THE DRIVER AIRBAG MODULE CONTAINS ARGON GAS PRESSURIZED TO OVER 17236.89 Kpa (2500 PSI). DO NOT ATTEMPT TO DISMANTLE AN AIRBAG MODULE OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURE EXCEEDING 93°C (200°F). REPLACE AIRBAG SYSTEM COMPONENTS ONLY BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION. THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE AIRBAG SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE MOPAR PARTS CATALOG.

CAUTION: Deployed Front Air Bags may or may not have live pyrotechnic material within the air bag inflator. Do not dispose of 2002 Model Year Driver and Passenger Airbags unless you are sure of complete deployment. Please refer to the Hazardous Substance Control System for Proper Disposal. Dispose of deployed air bags in a manner consistent with state, provincial, local, and federal regulations. Use the following table to identify the status of the Airbag Squib.

AIRBAG SQUIB STATUS

(1) Using a DRBIII® read Airbag DTC's **If** the following active codes are present:

ACTIVE DTC	CONDITIONS	SQUIB STATUS
Driver Squib 1 open Driver Squib 2 open	Check the stored DTC's **AND IF** the stored minutes for both are within 15 minutes of each other.	Both Driver Squib 1 and 2 were used.
Driver Squib 1 open Driver Squib 2 open	Check the stored DTC's **AND IF** the stored minutes for Driver Squib 2 open is GREATER than the stored minutes for Driver Squib 1 by 15 minutes or more.	Driver Squib 1 was used; Driver Squib 2 is live.
Driver Squib 1 open Driver Squib 2 open	Check the stored DTC's **AND IF** the stored minutes for Driver Squib 1 open is GREATER than the stored minutes for Driver Squib 2 by 15 minutes or more.	Driver Squib 1 is live; Driver Squib 2 was used.
If Driver Squib 1 open	**AND IF** Driver Squib 2 opens is NOT an active code.	Driver Squib 1 was used; Driver Squib 2 is live.

ACTIVE DTC	CONDITIONS	SQUIB STATUS
If Driver Squib 2 open	**AND IF** Driver Squib 1 open is NOT an active code.	Driver Squib 1 is live; Driver Squib 2 was used.

If neither of the following codes is an active code:

ACTIVE DTC	SQUIB STATUS
Driver squib 1 open	Status of Airbag is Unknown.
Driver Squib 2 open	

3.1.2 CLOCKSPRING

The clockspring is mounted on the steering column behind the steering wheel. This assembly consist of a plastic housing which contains a flat, ribbon-like, electrically conductive tape that winds and unwinds with the steering wheel rotation. The clockspring is used to maintain a continuous electrical circuit between the instrument panel wiring and the driver airbag, the horn, and the vehicle speed control switches if equipped. The clockspring must be properly centered when it is reinstalled on the steering column following any service procedure, or it could be damaged. The clockspring cannot be repaired and it must be replaced.

3.1.3 PASSENGER AIRBAGS

The 2002 WJ/WG is equipped with front passenger airbag with dual stage squib inflators. When supplied with the proper electrical signal the passenger airbag inflator or inflators discharge the gas directly into the cushion. The airbag module cannot be repaired, and must be replaced if deployed or in any way damaged.

WARNING: THE PASSENGER AIRBAG MODULE CONTAINS INERT GAS PRESSURIZED TO 17236.89 Kpa (2500 PSI). DO NOT ATTEMPT TO DISMANTLE AN AIRBAG MODULE OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURE EXCEEDING 93°C (200°F). REPLACE AIRBAG SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION. THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE AIRBAG SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE MOPAR PARTS CATALOG.

CAUTION: Deployed Front Air Bags may or may not have live pyrotechnic material within the air bag inflator. Do not dispose of 2002 Model Year Driver and Passenger Airbags unless you are sure of complete deployment. Please refer to the Hazardous Substance Control System for Proper Disposal. Dispose of deployed air bags in a manner consistent with state, provincial, local, and federal regulations. Use the following table to identify the status of the Airbag Squib.

AIRBAG SQUIB STATUS

(1) Using a DRBIII® read Airbag DTC's **If** the following active codes are present:

ACTIVE DTC	CONDITIONS	SQUIB STATUS
Passenger Squib 1 open Passenger Squib 2 open	Check the stored DTC's **AND IF** the stored minutes for both are within 15 minutes of each other.	Both Passenger Squib 1 and 2 were used.
Passenger Squib 1 open Passenger Squib 2 open	Check the stored DTC's **AND IF** the stored minutes for Passenger Squib 2 open is GREATER than the stored minutes for Passenger Squib 1 by 15 minutes or more.	Passenger Squib 1 was used; Passenger Squib 2 is live.

ACTIVE DTC	CONDITIONS	SQUIB STATUS
Passenger Squib 1 open Passenger Squib 2 open	Check the stored DTC's **AND IF** the stored minutes for Passenger Squib 1 open is GREATER than the stored minutes for Driver Squib 2 by 15 minutes or more.	Passenger Squib 1 is live; Driver Squib 2 was used.
If Passenger Squib 1 open	**AND IF** Passenger Squib 2 open is NOT an active code.	Passenger Squib 1 was used; Passenger Squib 2 is live.
If Passenger Squib 2 open	**AND IF** Passenger Squib 1 open is NOT an active code.	Passenger Squib 1 is live; Passenger Squib 2 was used.

If neither of the following codes is an active code:

ACTIVE DTC	SQUIB STATUS
Passenger squib 1 open	Status of Airbag is Unknown.
Passenger squib 2 open	

3.1.4 SEAT BELT SWITCHES (SBS)

The hall-effect driver and front passenger seat belt switches provide the seat belt status, buckled or unbuckled, via hardwired inputs to the ACM. The ACM uses seat belt switch inputs to determine the appropriate level of airbag deployment. The ACM also controls the seat belt warning indicator via a PCI Bus message to the instrument cluster. The indicator will be turned on if the driver seat belt status is unbuckled. If the seat belt switches are damaged or defective the seat belt buckle assembly must be replaced. The ACM continuously monitors the seat belt switch circuits for an open or shorted conditions.

3.1.5 CURTAIN AIRBAGS

The Left and Right curtain airbags are located in the outboard edge of the roof under the headliner, just above the door openings. When supplied with the proper electrical signal the inflator can discharge the compress gas directly into the curtain airbag. Upon deployment, the curtain will tear open the headliner allowing the curtain airbag to fully deploy between the headliner and seat. The curtain airbag cannot re repaired and must be replaced if deployed or in any way damaged.

WARNING: THE CURTAIN AIRBAG CONTAINS AN INERT GAS PRESSURIZED TO 17236.89 Kpa (2500 PSI). DO NOT ATTEMPT TO DISMANTLE AN AIRBAG MODULE OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURE EXCEEDING 93°C (200°F). REPLACE AIRBAG SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION. THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE AIRBAG SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE MOPAR PARTS CATALOG.

3.1.6 FRONT IMPACT SENSOR

The front impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, and then combined with the ACM Accelerometer provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Airbag Control Module. The ACM microprocessor continuously monitors all of the front passive restraint system electrical circuits to determine the system readiness. If the ACM detects a system fault, it sets a Diagnostic Trouble Code and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through dedicated left and right sensor signal and ground circuits from the ACM. The impact sensors and the ACM communicate by modulating the voltage in the sensor signal circuit. If the sensor is dropped it must be replaced. Disconnect the battery or remove both airbag fuses before servicing impact sensors.

CAUTION: Do not remove or install impact sensors while the sensor is connected to the vehicle wiring.

3.1.7 SIDE IMPACT SENSOR

The side impact sensors are electronic accelerometers that sense the rate of vehicle deceleration and when combined with the ACM Accelerometer provides verification of the direction and severity of a side impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Airbag Control Module. The ACM microprocessor continuously monitors all of the passive restraint system electrical circuits to determine the system readiness. If the ACM detects a system fault, it sets a Diagnostic Trouble Code and controls the airbag warning indicator operation accordingly. The side impact sensors receive battery current and ground through dedicated driver and passenger sensor signal and ground circuits from the ACM. The impact sensors and the ACM communicate by modulating the voltage in the sensor signal circuit. If the sensor is dropped it must be replaced. Disconnect the battery or remove both airbag fuses before servicing impact sensors.

CAUTION: Do not remove or install the impact sensors while the sensor is connected to the vehicle wiring.

3.1.8 SPECIAL TOOLS

Some airbag diagnostic test use special tools, airbag load tools, 8310 and 8443 for testing squib circuits. The load tools contain fixed resistive loads, jumpers and adapters. The fixed loads are connected to cables and mounted in a storage case. The cables can be directly connected to some airbag system connectors. Jumpers are used to convert the load tool cable connectors to the other airbag system connectors. The adapters are connected to the module harness connector to open shorting clips and protect the connector terminal during testing. When using the load tool follow all of the safety procedures in the service information for disconnecting airbag system components. Inspect the wiring, connector and terminals for damage or misalignment. Substitute the airbag load tool in place of a Driver or Passenger Airbag, curtain airbag, clockspring (use a jumper if needed). Then follow all of the safety procedures in the service information for connecting airbag system components. Read the module active DTC's. If the module reports NO ACTIVE DTC's the defective components has been removed from the system and should be replaced. If the DTC is still active, continue this process until all component in the circuit have been tested. Then disconnect the module connector and connect the matching adapter to the module connector. With all airbags disconnected and the adapter installed the squib wiring can be tested for open and shorted conditions.

3.1.9 DIAGNOSTIC TROUBLE CODES

Airbag diagnostic trouble codes consist of active and stored codes. If more than one code exists, diagnostic priority should be given to the active codes. Each diagnostic trouble code is diagnosed by following a specific testing procedure. The diagnostic test procedures contain step-by-step instructions for determining the cause of the trouble codes. It is not necessary to perform all of the tests in this book to diagnose an individual code. Always begin by reading the diagnostic trouble codes with the DRBIII®. This will direct you to the specific test(s) that must be performed. In certain test procedures within this manual, diagnostic trouble codes are used as a diagnostic tool.

3.1.9.1 ACTIVE CODES

The code becomes active as soon as the malfunction is detected or key-on, whichever occurs first. An active trouble code indicates an on-going malfunction. This means that the defect is currently there every time the airbag control module checks that circuit or component. It is impossible to erase an active code. Active diagnostic trouble codes for the airbag system are not permanent and will change within 12 seconds the reason for the code is corrected. With the exception of the warning lamp trouble codes or malfunctions, when a malfunction is detected, the airbag lamp remains lit for a minimum of 12 seconds or as long as the malfunction is present.

3.1.9.2 STORED CODES

Airbag codes are automatically stored in the ACM's memory as soon as the malfunction is detected. A stored code indicates there was an active code present at some time. When a trouble code occurs, the airbag warning indicator illuminates for 12 seconds minimum (even if the problem existed for less than 12 seconds). The code is stored, along with the time in minutes it was active, and the number of times the ignition has been cycled since the problem was last detected.

The minimum time shown for any code will be one minute, even if the code was actually present for less than one minute. Thus, the time shown for a code that was present for two minutes 13 seconds, for example, would be three minutes. If a malfunction is detected a diagnostic trouble code is stored and will remain stored. When and if the malfunction ceases to exist, an ignition cycle count will be initiated for that code. If the ignition cycle count reaches 254 without a reoccurrence of the same malfunction, the diagnostic trouble code is erased and that ignition cycle counter is reset to zero. If the malfunction reoccurs before the count reaches 254, then the ignition cycle counter will be reset and diagnostic trouble code will continue to be a stored code. If a malfunction is not active while performing a diagnostic test procedure, the active code diagnostic test will not locate the source of the problem. In this case, the stored code can indicate an area to inspect. Maintain a safe distance from all airbags while performing the following inspection. If no obvious problems are found, erase stored codes, and with the ignition on wiggle the wire harness and connectors, rotate the steering wheel from stop to stop. Recheck for codes periodically as you work through the system. This procedure may uncover a malfunction that is difficult to locate.

3.2 AUDIO SYSTEM

The PCI Bus inputs into the radio are used for VF dimming and remote steering wheel controls. All the radios are capable of displaying faults and allowing certain actuation tests through the use of the DRBIII®. When attempting to perform PCI Bus diagnostics, the first step is to identify the radio in use in the vehicle.

When trouble shooting output shorts or “output” error messages, the following applies:

On radios without an external amplifier, the term output refers to the path between the radio and the speaker. This type of circuit can be monitored all the way through the speaker connections by the radio assembly. When the radio displays a shorted output DTC with this type of system, the speaker, radio, or wiring could be at fault.

On radios with an external amplifier, the term “output” refers to the circuit between the radio connector and the amplifier. The radio is capable of monitoring only this portion and can tell nothing about the circuit between the amplifier and the speakers. Consequently, a shorted output DTC on this type of system would only refer to this circuit. A faulty speaker could not cause this DTC.

3.2.1 REMOTE RADIO CONTROLS

These radios can be controlled via remote radio switches (optional). These switches are located on the back side of the steering wheel. They control mode, preset, seek up, seek down, volume up and volume down functions.

These functions are inputs to the Body Control Module and can be read with the DRBIII®. The switches are a multiplexed signal to the BCM. The radio control MUX circuit is a 5 volt line that is pulled to ground through different value resistors built into the switches. This causes a voltage drop to be seen by the BCM and it sends a specific message to the radio on the PCI Bus circuit. The radio then responses to the message.

This circuit is fairly simple to troubleshoot. The circuit must be complete from the switches in the steering wheel to the BCM. The ground must be complete so that the switches can cause the voltage drop for the BCM to see. The circuit passes through the clockspring so continuity through this devise must be verified.

3.2.2 CD CHANGER

The CD Changer is mounted in the cargo area of the passenger compartment on the right rear quarter panel. The CD Changer features a removable 10-CD magazine. The CD Changer receives both ground and radio switch power through the radio. The controls on the radio operate the CD Changer through messages sent over the PCI Bus. The two-channel audio outputs of the CD Changer are hard-wired back to the radio, which then outputs the signal through the channels to the speakers or amplifiers.

3.3 HEATING & A/C SYSTEM

3.3.1 SYSTEM AVAILABILITY

- Depending on the model, either a Manual Temperature Control (MTC) or Automatic Zone Control (AZC) HVAC system is available in these vehicles.

3.3.2 SYSTEM CONTROLS

Manual Temperature Control (MTC)

- Refer to the Service Manual for MTC system description and operation information.

The Automatic Zone Control (AZC) Module:

- is fully addressable with the DRBIII®.
- communicates over the Programmable Communication Interface Multiplex System (PCI) Bus.
- has dual infrared sensors, mounted in the AZC module face, which independently measure surface temperature to maintain occupant comfort levels.

- has dual-zone temperature-controls to provide a wide side-to-side variation in temperature to meet the needs of either front seat occupant.
- can be operated in a manual mode.
- uses engine temperature data, received over the PCI Bus, for cold engine blower lock-out.
- uses engine RPM data, received over the PCI Bus, for wide-open throttle A/C cut-out.
- uses vehicle speed data, received over the PCI Bus, to determine air-flow over the condenser for optimum cooling performance.
- uses Evaporator Temperature Sensor data, received over the PCI Bus, to prevent evaporator freeze up while maintaining optimum cooling performance.
- uses Ambient Temperature Sensor data, received over the PCI Bus, to optimize comfort control.
- provides an A/C request to the BCM when compressor operation is desired.
- controls rear defogger operation.
- controls fan speed, providing 10 blower speeds in manual mode and infinite speeds in automatic mode.
  - The Blower Motor Controller provides a 5.0 volt signal to the AZC Module over the Blower Motor Control circuit. The AZC Module provides a variable duty cycle ground to the 5.0 volt signal based on input from the blower switch. When the blower switch is set to LO speed, the AZC Module provides a short duty cycle (less time grounding the signal voltage). As higher blower speeds are requested, the AZC Module increases the duty cycle (more time grounding the signal voltage). When the blower switch reaches HI speed, the duty cycle increases to where the signal pattern is almost a flat line (with brief voltage spikes).
- controls electronic door actuator operation.
  - A simplified control system for operation of the mode, recirculation, and temperature control actuators provides positive positioning without the complexity of feedback from position sensors. The AZC Module knows the number of operating actuator revolutions required for full door travel as well as the number of actuator commutator pulses per revolution. Using these parameters, the AZC Module runs the actuator for the number of commutator pulses that correspond to the desired door position. To maintain accuracy, the system recalibrates itself periodically at known zero and full travel conditions.
- Refer to the Service Manual for additional AZC system description and operation information.

The Dual-Zone AZC HVAC system uses:

- two, two-wire electronic blend door actuators.
- one, two-wire electronic mode door actuator.
- one, two-wire electronic recirculation door actuator.

3.3.3 SYSTEM REVISIONS

The 2002 WJ/WG HVAC systems remain mostly carryover from 2001. Revisions to the 2002 MTC and AZC HVAC systems include:

- the addition of an Evaporator Temperature Sensor which is hard wired to the BCM. Data from the sensor is used to prevent evaporator freeze up while maintaining optimum cooling performance.
- new Diagnostic Trouble Codes (DTCs) for a short low and for an open on the Evaporator Temperature Sensor circuit.

3.3.4 SYSTEM DIAGNOSTICS (MTC)

Fault detection is through Diagnostic Trouble Codes (DTCs)

- DTCs are displayed by the DRBIII®.
- DTCs pertaining to the Evaporator Temperature Sensor are stored in the BCM. Diagnostics for these DTCs can be found in the Heating & A/C category of this manual.
- Diagnostics for symptoms pertaining to A/C compressor operation can be found in the Heating & A/C category of this manual and in the Powertrain Diagnostic Procedures manual.
- DTCs pertaining to A/C compressor control circuits are stored in the PCM/ECM. Diagnostics for these DTCs can be found in the Powertrain Diagnostic Procedures manual
- Refer to the Service Manual for additional MTC system diagnosis and testing information.

3.3.5 SYSTEM DIAGNOSTICS (AZC)

Fault detection is through active and stored Diagnostic Trouble Codes (DTCs)

- DTCs are displayed by the DRBIII®.

  AZC Module DTCs

- Active DTCs are those which currently exist in the system. The condition causing the fault must be repaired in order to clear this type of DTC.
- Active DTCs become stored DTCs when the condition that caused the active DTC no longer exists.
- Stored DTCs will be erased after 72 key cycles or by clearing them with the DRBIII®.
- Diagnostics for symptoms pertaining to A/C compressor operation can be found in the Heating &

A/C category of this manual and in the Powertrain Diagnostic Procedures manual.

- Refer to the Service Manual for additional AZC system diagnosis and testing information.

BCM DTCs

- DTCs pertaining to the Evaporator Temperature Sensor are stored in the BCM. Diagnostics for these DTCs can be found in the Heating & A/C category of this manual.

PCM/ECM DTCs

- DTCs pertaining to A/C compressor control circuits are stored in the PCM/ECM. Diagnostics for these DTCs can be found in the Powertrain Diagnostic Procedures manual.

3.3.6 FOLLOWING A REPAIR (AZC)

The AZC Reset Module function:

- is actuated with the DRBIII®.
- must be actuated if the AZC Module or any door actuator is replaced.
- homes and repositions door actuators.

3.4 BODY CONTROL MODULE

The body control module (BCM) supplies vehicle occupants with visual and audible information and controls various vehicle functions. To provide and receive information, the module is interfaced to the vehicle's serial bus communication network (Programmable Communication Interface or PCI bus). This network consists of the powertrain control module (PCM) or engine control module (ECM) (diesel), the memory/heated seat module (MHSM, MSM or HSM), the sentry key immobilizer module (SKIM), the transmission control module (TCM), the electro/mechanical instrument cluster (MIC), the driver door module (DDM), the passenger door module (PDM), the airbag control module (ACM), the controller antilock brake (CAB), the optional electronic vehicle information center (EVIC), the optional PCI radio, the optional CD changer, the optional automatic zone control module (AZC), the shifter assembly (diesel), the optional power amplifier, the optional adjustable pedal module, the optional rain sensor, and the optional intrusion transceiver module (export). The BCM is operational when battery power is supplied to the module and in addition, ignition switch power is needed for ignition switched functions.

The BCM provides the following new features:

- Full control of all exterior and interior lamps, including these features:
  - > A Battery Saver automatically turns off all exterior and interior lamps within 8 minutes after the ignition is turned off, if they are not turned off by the driver. This includes the front and rear reading/courtesy lamps and the cargo area dome lamp, even if they are turned on manually.
  - > Theater-style interior lighting dims gradually when the doors are closed.
  - > Interior courtesy lamp operation may be "defeated" using the dimmer control ring on the left multifunction switch.
  - > Instrument panel light intensity may be maximized for daytime visibility with the head lamps or parking lights by using the dimmer control ring on the left multifunction switch.
- An Accessory/Sunroof Delay allows continued operation of the sunroof and the power windows after ignition-OFF. These accessories can be operated up to 45 seconds after ignition-OFF or until door is opened.
- Beep tones for warnings and programming actions associated with the Sentry Key Immobilizer system and the EVIC.

The BCM also provides the following features:

- Intermittent wipe and low speed wiper control
- Wiper system status
- Ignition on/off timer
- VF displays synchronization
- Rear door and liftgate ajar status
- Acquisition & transmission of external temperature
- A/C select switch status
- Chime
- Courtesy lamps with fade to off feature
- Reading lights/glove box lamp load shedding control
- Exterior lighting control including automatic headlamps, fog lamp control, rear fog lamp control and parking lamps
- Exterior lamp status
- Headlamp time delay upon ignition off and headlamps switch off
- Parade mode
- Illuminated entry
- Instrument panel dimming
- Vehicle theft security system with panic & horn and hazard lamp activation
- Key-in ignition switch interface
- Brake fluid level switch/park brake switch interface
- Seatbelt reminder
- Speed sensitive intermittent wipe control
- Remote radio switch interface to radio

- Vehicle ignition status
- BCM self diagnostics
- Liftgate courtesy lamp disable
- Rear window defogger control
- Accessory delay control (windows and sunroof)
- Fuel economy and distance to empty (DTE) calculations
- Heated seat switch status
- Exterior lamp load shed
- Support of EVIC programmable features

The BCM receives information over the PCI bus from the PCM in order to support certain features. The required information is as follows:

- Engine RPM
- Engine and battery temperature
- Injector on time and distance pulses
- Vehicle speed
- Engine model
- Fuel tank level
- Vehicle identification number

The BCM provides the PCM with information on the A/C switch status.

The 2002 WJ/WG has several programmable features which can be enabled/disabled by using the EVIC or the DRBIII®.

3.5 CHIME SYSTEM

The chime system responds to requests from five modules: the Body Control Module (BCM), Electronic Vehicle Information Center (EVIC), Mechanical Instrument Cluster (MIC), Sentry Key Immobilizer Module (SKIM) and the Powertrain Control Module (PCM). Each module monitors its related systems and, via the PCI bus, requests the BCM to sound its internal chime as needed.

The chime will sound for the following conditions:

3.5.1 MIC REQUESTED CHIME MESSAGES

- Airbag
- Check Gauges: Charging Voltage Low
Coolant Temp High
Low Oil Pressure
Charging Voltage High
- Low Fuel
- ABS
- Low Battery Voltage
- Water in Fuel (Diesel)
- Low Coolant level (Diesel)

3.5.2 BCM INITIATED CHIME MESSAGES

- Headlamp ON with ignition OFF and driver door open
- Key in ignition with ignition OFF and driver door open
- Seat Belt Warning
- Overspeed Warning (Gulf Coast Countries Only)

3.5.3 EVIC CHIME REQUESTED MESSAGES

When the following messages are displayed the EVIC will send a chime request to the BCM. The BCM will respond with a series of chimes.

- Turn signal on for more than 1.0 mile
- Service reminder
- Coolant level low
- Washer fluid low
- Tire Pressure Monitoring System alert messages (if equipped)
- Door or liftgate ajar (when critical speed is reached)**

**CRITICAL SPEED CHART

DOOR AJAR	TURN CHIME ON	TURN CHIME OFF
LEFT REAR	3.0 MPH (5 kmh)	1.0 MPH (2 kmh)
RIGHT REAR	3.0 MPH (5 kmh)	1.0 MPH (2 kmh)
LIFTGATE	3.0 MPH (5 kmh)	1.0 MPH (2 kmh)
PASSENGER	3.0 MPH (5 kmh)	1.0 MPH (2 kmh)
DRIVER	10.0 MPH (16 kmh)	7.0 MPH (11 kmh)

3.5.4 SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) also uses tactile beep support from the chime warning system. The Sentry Key Immobilizer Module (SKIM) is programmed to send chime request messages over the Programmable Communications Interface (PCI) data bus to the Body Control Module (BCM) to provide audible confirmation that:

- the SKIM has been successfully placed in the Customer Learn mode.
- A new Sentry key transponder has been successfully programmed by the SKIM.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the SKIS. Refer to **Sentry Key Immobilizer System** in the Description and Operation section of the service information - Vehicle Theft/

Alarm systems for more information on the SKIS. For diagnostic information, refer to the Powertrain Diagnostic Information.

3.6 DOOR AJAR SYSTEM

The door ajar, liftgate ajar, and the liftgate flip-up ajar states are used as inputs for various control modules on the vehicle. The DRBIII® will display the state of the door ajar, liftgate ajar, and liftgate flip-up ajar switches in Inputs/Outputs. It's important to note, that when a door, liftgate, or liftgate flip-up is closed, the switch state on the DRBIII® will show OPEN, and when the door, liftgate, or liftgate flip-up is open, the switch state will show CLOSED. During diagnosis, if a door, liftgate, or liftgate flip-up is closed and the DRBIII® displays the switch state as CLOSED, it indicates a shorted ajar circuit. If the door, liftgate, or liftgate flip-up is open and the DRBIII® displays the switch state as OPEN, it indicates an open ajar circuit.

3.7 DOOR MODULES

A multiplexed door module is located on each front door, driver door (DDM) and passenger door (PDM). They control the following features: power door locks, automatic (rolling) door locks, driver window express down, memory recall functions (adjustable pedals, memory seats and mirrors), remote keyless entry, power mirrors, heated mirrors, door key cylinder disarm (driver door only), door lock inhibit and auto unlock on exit. Reduced wiring complexity is a key advantage of using multiplexed door modules. These modules are addressable with the DRBIII® from the "Body" menu to facilitate faster and easier diagnosis.

3.7.1 POWER WINDOWS

The power windows can be raised or lowered from the driver's door module (DDM) or the individual door switch. The DDM has a lock out switch that prevents the windows from being operated from any switch except the driver's door. When the switch is pressed, it also shuts off the individual door switch LED's.

A feature of this system allows the windows to be operated from any window switch for 45 seconds after the ignition is turned off, provided a front door is not opened. Another feature is the "Express Down" driver door only. When the driver presses the down switch to the second detent, the window will travel all the way down even if the switch is released. To stop the window travel, simply press the switch momentarily in either direction.

Twelve volts are provided on the rear window motor circuit on both the up and down circuits. The appropriate door module supplies this voltage. When the rear switch is pressed, the supply circuit to one side of the switch is opened and ground is provided making a complete circuit and therefore operating the window motor.

3.7.2 POWER DOOR LOCKS

The power door locks are operated four different ways:

1. Front door lock switches
2. Auto (rolling) door lock feature (vehicle speed above 15 MPH (24 kmh) and all doors closed).
3. Auto unlock on exit (vehicle stopped after auto door locks had locked the doors, transmission in neutral or park and the drivers door is opened - all doors will unlock).
4. Remote Keyless Entry (RKE)

3.7.3 DOOR LOCK INHIBIT

When the key is in the ignition and in the off position, and either front door is opened, the lock switch on that door is disabled. The unlock switch is still functional. This protects against locking the vehicle with the keys still in the ignition. For example, if the driver's door is opened and the passenger front door closed, the locks are operational from the passenger door switch.

3.7.4 REMOTE KEYLESS ENTRY

When the lock button on the transmitter is pressed, all locks will lock, illuminated entry will be turned off, (providing all doors are closed) and the vehicle theft security system (if equipped) will be armed. When the unlock button on the transmitter is pressed one time, the driver front door will unlock, the illuminated entry will turn on the courtesy lamps, the vehicle theft security system (if equipped) will be disarmed. When the button is pressed a second time, the other doors will unlock. This feature is programmable to open all doors on one press using the EVIC or the DRBIII®.

The passenger door module (PDM) contains the RKE receiver. When the PDM receives a valid signal from the RKE transmitter, it will send a signal on the PCI bus to lock or unlock the doors. The RKE transmitter uses radio frequency signals to communicate with the RKE receiver. If vehicle is equipped with the memory system, the memory message will be received as to which transmitter sent the signal (1 or 2).

3.7.4.1 PANIC FUNCTION

When the panic button on the RKE transmitter is pressed it pulsates the headlamp, hazard lamps and horn relays and actuates the courtesy lamp relay. By pressing the button again the horn and exterior lamps will stop but the courtesy lamps will remain on until the BCM times them out or the ignition is turned on. The panic feature is able to be set if the ignition is on but only if the panic button is pressed prior to the vehicle being started, it will continue for three minutes or until the vehicle has reached a speed of 15 MPH, if not canceled by the operator.

Actuating the headlamp, horn, hazard lamps and courtesy lamp relays with the DRBIII® will verify that the circuits and the body control module are OK. If the panic feature is still inoperable with both transmitters, replacement of the passenger door module will be necessary. If the function is inoperable with just one transmitter, then it is obvious that the transmitter must be replaced.

3.7.5 ROLLING CODE

The rolling code feature changes part of the transmitter message each time that it is used. The transmitter message and the receiver message increment together. Under certain conditions with a rolling code system (pressing a button on the RKE transmitter over 255 times outside the receiver range, battery replacement, etc.), the receiver and transmitter can fall out of synchronization. Note: The lock function works from the RKE keyfob even in out of synchronization condition and therefore it could be verified by pressing the LOCK button on the RKE keyfob. To re-synchronize, press and release the UNLOCK button on the RKE keyfob repeatedly (it may take up to eight cycles) while listening carefully for the power door locks in the vehicle to cycle, indicating that re-synchronization has occurred.

3.7.6 PROGRAMMABLE DOOR LOCK FEATURES

- The RKE can be changed to unlock all doors with one press
- The Automatic Door Locks can be enabled/disabled
- Auto Unlock on Exit can be enabled/disabled
- RKE horn chirp on lock can be enabled/disabled
- RKE optical chirp (turn signal lamps) can be enabled/disabled
- Program a new RKE transmitter (DRBIII® only)
- RKE linked to memory (if equipped with memory system) enabled/disabled (DRBIII® only). Allows memory to be operable only from the driver door switch.

3.8 ELECTRONIC VEHICLE INFORMATION CENTER

The Electronic Vehicle Information Center (EVIC) is located in the overhead console. The EVIC supplements the standard vehicle instrumentation. The EVIC uses a vacuum fluorescent (VF) display to supply the vehicle operator with a compass reading, outdoor temperature, average fuel economy, distance to empty, instantaneous fuel economy, trip odometer, elapsed ignition on time, distance to service, warning messages, service messages and memory system messages. It also provides an interface to enable and disable vehicle programmable features. If equipped, the EVIC is also available with an integrated Universal Garage Door Opener (UGDO) known as HomeLink®. Also if equipped, the EVIC is available with a Tire Pressure Monitoring (TPM) System.

The EVIC function buttons are labeled C/T, RESET, STEP, and MENU. The three UGDO buttons are labeled with dots to indicate the channel number.

The BCM supplies most of the information displayed by the EVIC. Display information is received over the PCI bus. The EVIC sends and receives data over the PCI bus, communicating with the BCM, PCM, and the Instrument Cluster. Tire Pressure Monitoring System information is received by the EVIC in the form of radio transmissions. The tire pressure sensors are mounted to the vehicle wheels. For complete information, refer to the Tire Pressure Monitoring System section in this publication.

3.8.1 VEHICLE INFORMATION DISPLAY

The EVIC provides the following functions:

- Compass direction
- Outside temperature
- Elapsed ignition on time
- Distance to empty
- Average fuel economy
- Instantaneous fuel economy
- Trip odometer
- Distance to service
- Driver alert messages:
  - TURN SIGNAL ON (with vehicle graphic)
  - PERFORM SERVICE
  - DOOR OPEN (individual or multiple doors, with graphic)
  - LIFTGATE OPEN (with graphic)
  - LIFTGLASS OPEN (with graphic)
  - COOLANT LEVEL LOW (with graphic)

– WASHER FLUID LOW (with graphic)

An audible chime or chimes will accompany any displayed warning messages. Chime requests with an OPEN message are dependent upon vehicle speed.

The EVIC will not display information for any of the screens for which it did not receive the proper PCI bus data. Refer to the symptom list in the Overhead Console section for problems related to the EVIC.

The EVIC receives the following messages from the Body Control Module (BCM):

- Verification of US/Metric status
- VF display dimming brightness and exterior lamp status
- Trip Odometer data
- Elapsed Ignition On Time data
- Fuel Economy (Average and Instantaneous)
- Distance to Empty
- Outside Temperature
- Distance to service
- Driver warning messages

The EVIC transmits the following messages to the BCM:

- Status Request: Beep, Reset, US/M Toggle
- Current Display

The EVIC receives the following message from the PCM:

- Vehicle Speed

3.8.2 STEP BUTTON

The STEP Button can be used in one of the following three ways:

1) To sequentially select one of seven displays or blank display in the following order:

- Average Fuel Economy
- Distance to Empty
- Instantaneous Fuel Economy
- Trip Odometer
- Time Elapsed
- Distance to Service Message
- Individual Tire Pressure
- Off (Blank)

2) To set the magnetic variance zone when VARIANCE = X (X = 1 - 15) is indicated in the VF Display.

3) To select the displayed programmable feature setting.

3.8.3 MENU BUTTON

Use the MENU button to sequentially step the EVIC through the programmable features.

Use the MENU button to enter the Tire Pressure Monitoring (TPM) Training Procedure.

3.8.4 RESET BUTTON

The RESET Button has two different functions:

1) To clear the trip functions that may be reset

2) To enter and exit the diagnostic mode

Pressing the RESET button once will clear the trip function that is currently being displayed (except Distance to Service) and the EVIC will send a PCI bus beep request to the BCM. If the RESET button is pressed again within 3 seconds, the EVIC will reset ALL of the trip functions and an additional beep request is sent to the BCM. The trip functions that may be reset are:

- Average Fuel Economy
- Trip Odometer
- Elapsed Time

A reset will only occur if one of the trip functions that may be reset is currently being displayed.

Pressing the RESET button for more than three (3) seconds resets the Distance to Service function while the Distance to Service message is being displayed. The EVIC module will send a beep request to the BCM.

Simultaneously pressing the RESET button and the C/T button while turning the ignition from Off to On will enter the EVIC into the self-diagnostic mode.

3.8.5 COMPASS/TEMPERATURE (C/T) BUTTON

Actuating the Compass/Temperature Button (C/T) will cause the EVIC to display the compass and temperature information. This function will operate from another traveler display or from the programmable feature mode.

3.8.6 TRAVELER DISPLAY FUNCTIONS

Using the STEP button will change the EVIC between modes of operation and display the appropriate information according to data received from the PCI Bus.

3.8.7 COMPASS/TEMPERATURE

The EVIC simultaneously displays the compass reading and the outside temperature. Outside temperature information is received via the PCI bus from the BCM.

The EVIC module internally senses and calculates the compass direction.

3.8.8 COMPASS OPERATION

Upon ignition on, if the calibration information stored in the EVIC memory is within the normal range, the EVIC will perform in slow Auto-Cal mode. In slow Auto-Cal mode, the EVIC continuously compensates for the slowly changing magnetic field of the vehicle. The compass module detects changes in the vehicle magnetism and makes appropriate internal corrections to ensure proper displayed direction.

However, if the calibration information stored in the EVIC memory is not within the normal range at ignition on, the EVIC will enter fast Auto-Cal. CAL is displayed along with the temperature.

Auto activation of the fast Auto-Cal mode will also occur when the EVIC is subjected to high magnetic field strength levels, which cause all compass readings to be erroneous for a continuous period of five (5) minutes. During fast Auto-Cal, CAL will be displayed along with the temperature.

Fast Auto-Cal can also be performed manually, by pressing and holding the RESET button for 10 seconds during the Compass/Temperature display mode.

3.8.9 SETTING MAGNETIC ZONE VARIANCE

Variance is the difference between magnetic North and geographic North. For proper compass function, the correct variance zone must be set. Refer to the Zone Variance map for the correct zone. Follow these steps to check or change the variance zone:

- The ignition switch must be in the On position and the EVIC display must not be blank.
- If the compass/temperature data is not currently being displayed, momentarily press and release the C/T button to display compass/temp information.
- Press and hold the RESET button until VARIANCE = XX is displayed. The EVIC will display the variance zone stored in memory and the word VARIANCE.
- Use the STEP button to select the proper variance zone number, 1 through 15.
- After selecting the proper zone number, momentarily press and release the RESET button. The variance zone is then stored in the memory and the EVIC returns to normal operation.

3.8.10 COMPASS CALIBRATION

The compass module has 2 types of auto-calibration; slow-cal and fast-cal. Slow-cal ensures that during normal vehicle operation the compass performs auto-calibration functions to keep the compass sensors in their proper operating range. Whenever the ignition is On and the EVIC receives PCI bus data indicating that engine RPM is greater than zero, auto-calibration is performed continuously.

If the calibration information stored in the compass module memory is not within the normal range after a power-up cycle, the compass will display CAL. The EVIC will enter into the fast-cal mode until calibration is complete.

To enter the compass into Manual Calibration mode, perform the following steps:

- Drive the vehicle to an area away from any large metal objects or overhead power lines.
- Ensure that the proper variance zone is selected. See ″Setting Magnetic Zone Variance.″
- The ignition switch must be in the On position and the EVIC display must not be blank.
- Press the C/T button to view the Compass/Temperature display.
- Press and hold the RESET button until CAL is displayed, then release the button.
- Drive slowly, less than 5 MPH (8KPH) in at least 1 complete 360 degree circle.
- CAL will remain illuminated to alert the driver that the compass is in the calibration mode.
- After calibration is complete, CAL will turn off.

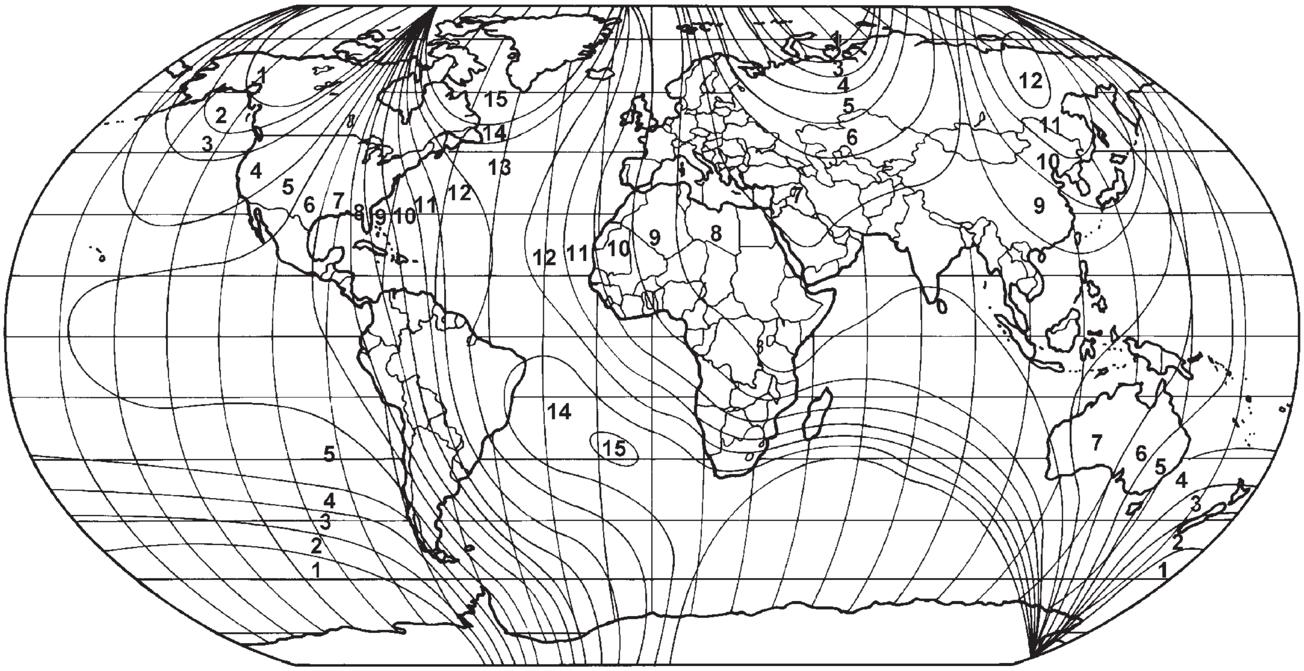
If the compass appears blank, unable to be calibrated, or the compass displays false indications, the vehicle must be demagnetized. Refer to Compass Demagnetizing Procedure in the Service Manual.

3.8.11 DIAGNOSIS AND TESTING

SELF-CHECK DIAGNOSTICS

The EVIC is capable of performing a diagnostic self check on its internal functions. EVIC diagnostics may be performed using a DRBIII(or by using the following procedure:

(1) With the ignition switch in the OFF position, depress and hold the RESET and the C/T buttons.
(2) Turn the ignition switch to the ON position.
(3) Continue to hold both buttons until the software versions are displayed, then release the buttons.
(4) All of the VFD segments will illuminate for 2-4 seconds. Check for segments that do not illuminate or illuminate all the time.



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(5) When the self-check is complete the EVIC will display one of the following messages:

- PASS SELF TEST
- FAILED SELF TEST
- NOT RECEIVING J1850 MESSAGE

(6) To exit the self-check mode, depress the RESET button or cycle the ignition switch and the EVIC will return to normal operation.

If a Communication fault is displayed, refer to the symptom list. If a FAILED is displayed, the EVIC must be replaced.

3.8.12 AMBIENT TEMPERATURE SENSOR

The ambient air temperature is monitored by the BCM and displayed by the EVIC. The BCM receives a hardwire input from the ambient temperature sensor (ATS).

The ATS is a variable resistor that operates on a 5-volt reference signal circuit hardwired from the BCM. The resistance in the ATS changes as the outside temperature rises or falls. The BCM senses the change in reference voltage through the ATS resistor. Based on the resistance of the ATS, the BCM is programmed to correspond to a specific temperature. The BCM stores and filters the ambient temperature data and transmits this data to the EVIC via the PCI Bus. The ATS cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

3.8.13 AMBIENT TEMPERATURE SENSOR FAULT CODES

The outside temperature function is supported by the ambient temperature sensor (ATS), a signal and ground circuit hardwired to the BCM, and the EVIC display.

If the EVIC display indicates 54°C (130°F) or the ATS sense circuit is shorted to ground, the temp display will be 54°C (130°F) to indicate a SHORT circuit condition.

If the EVIC display indicates -40°C (-40°F) or the ATS sense circuit is open, the temp display will be -40°C (-40°F) to indicate an OPEN circuit condition.

If there is an OPEN or SHORT circuit condition, it must be repaired before the EVIC VFD can be tested.

The ATS is supported by the BCM. Ambient Temperature Sensor DTCs will be recorded in the BCM. The ATS can be diagnosed using the following Sensor Test. Test the ATS circuits using the diagnostics in the Body Diagnostic Procedures Manual. If the EVIC passes the self test, and the ATS, the circuits, and PCI bus communications are confirmed to be OK, but the EVIC temperature display is inoperative or incorrect, replace the BCM.

3.8.14 AMBIENT TEMPERATURE SENSOR TEST

(1) Turn the ignition OFF.

(2) Disconnect the ATS harness connector.

(3) Measure the resistance of the ATS using the following min/max values:

- 0° C (32° F) Sensor Resistance = 29.33 - 35.99 Kilohms
- 10° C (50° F) Sensor Resistance = 17.99 - 21.81 Kilohms
- 20° C (68° F) Sensor Resistance = 11.37 - 13.61 Kilohms
- 25° C (77° F) Sensor Resistance = 9.12 - 10.86 Kilohms
- 30° C (86° F) Sensor Resistance = 7.37 - 8.75 Kilohms
- 40° C (104° F) Sensor Resistance = 4.90 - 5.75 Kilohms

The sensor resistance should read between these min/max values. If the resistance values are not OK, replace the Sensor.

3.8.14 HOMELINK® UNIVERSAL TRANSMITTER

If equipped, the HomeLink® Universal Transmitter is integrated into the overhead console. For added security it will operate home security systems that use coded signals known generically as *Rolling Codes*. The overhead console display provides visual feedback to the driver, indicating which HomeLink® transmitter channel button is being pressed. The HomeLink® can learn and store up to three separate transmitter radio frequency codes to operate garage door openers, security gates, and security lighting. The HomeLink® buttons are marked with one, two, or three dots. For complete information, refer to Universal Transmitter in the Service Manual or the Owner's Manual.

3.9 TIRE PRESSURE MONITORING SYSTEM (TPM)

If equipped with the Tire Pressure Monitoring System (TPM), each of the vehicles five wheels will have a valve stem with an integral pressure sensor and radio transmitter. Radio signals from the tire pressure sensor/transmitters are received and interpreted by the Electronic Vehicle Information Center (EVIC).

A sensor/transmitter in a mounted wheel will broadcast its detected pressure once per minute when the vehicle speed is greater than 40 km/h (25 mph). The spare tire sensor will broadcast once every hour. Each sensor's broadcast is uniquely coded so that the EVIC can determine location. The individual tire pressures can be displayed graphically on the EVIC.

3.9.1 TRAINING THE EVIC

The EVIC can be trained to recognize the source locations of pressure sensor/transmitter signals. Use the following training procedure:

(1) Locate "RETRAIN TIRE SENSORS" on the EVIC menu.

(2) Press STEP button to select YES and MENU button to confirm.

When this mode is enabled by selecting "YES" the EVIC will initiate the training procedure.

(3) The EVIC display will prompt the user to: "TRAIN LEFT FRONT TIRE". At this point the user must set the left front tire sensor to learn mode by positioning a magnet (Relearn Magnet special tool 8821) over the valve stem for at least 5 seconds. The Remote Tire Pressure Monitor (RTPM) in the front left tire will transmit a message indicating to the EVIC that it is in learn mode. When the EVIC has received this message and is assured that it has learned an ID, the EVIC will request a horn chirp via a bus message and then display the next train request. Note: There is a 60-second timer for learning the first tire location and a 30-second timer between the remaining tires. If any of these timers expire the EVIC will abort the training procedure.

(4) The EVIC will request the initiation of a training sequence for each tire, one-by-one in a clockwise direction around the vehicle (Left Front, Right Front, Right Rear, Left Rear, and Spare). The EVIC will allow 30 seconds (60 seconds for the first tire) from the beginning of the train request display to the receipt of a unique learn ID message from the RTPM. If, during a training session, a 60 or 30 second timer expires before a unique learn sensor ID is received or the vehicle is not in park, the EVIC will keep the previous set of trained IDs and will display "TRAINING ABORTED" until a button is pressed. Any IDs learned during the current session will be discarded. The EVIC will not store one ID for multiple locations.

(5) Once all five tires are successfully trained, the previous set of stored IDs will be replaced by the new IDs, and the EVIC will display "TRAINING COMPLETE" until a button is pressed.

If the vehicle is equipped with the HomeLink® feature and a HomeLink® button is pressed at any time during the training procedure, the EVIC module will immediately exit the training procedure, discard any IDs learned in the current session and perform the HomeLink® function. After the button is released, the module will display "RETRAIN TIRE SENSORS? NO".

The training procedure can be stopped at any time by pressing the C/T, STEP, RESET or MENU button. When any of these buttons are pressed the EVIC will display “TRAINING ABORTED” until another button is pressed.

Once training is complete, the EVIC can determine when the spare wheel has been mounted on the vehicle. The spare wheel sensor/transmitter is expected to transmit once per hour. If the sensor/transmitter ID for the spare wheel is received at a shorter interval, the EVIC will request a chime and display “SPARE SWAP DETECTED” for five seconds.

3.9.2 PRESSURE THRESHOLDS

The EVIC will monitor the tire pressure signals from the five tire sensor/transmitters and determine if any tire has gone below the Low Pressure Threshold or raised above the High Pressure Threshold. Refer to the table below.

LOW TIRE PRESSURE THRESHOLDS	
SYSTEM STATUS INDICATOR	TIRE PRESSURE
On	172 kPa (25 PSI)
Off	193 kPa (28 PSI)

HIGH TIRE PRESSURE THRESHOLDS	
SYSTEM STATUS INDICATOR	TIRE PRESSURE
On	310 kPa (45 PSI)
Off	276 kPa (40 PSI)

3.9.3 CRITICAL AND NON-CRITICAL PRESSURE ALERTS

A critical alert will be triggered when a tire pressure has gone below or above a set threshold pressure. Depending on what the condition is, the EVIC will request a chime and then display a LOW PRESSURE or HIGH PRESSURE message indicating the appropriate location.

The alert message will display for three seconds and then switch to the tire pressure trip screen. The tire pressure for the tire that has exceeded its threshold will blink at one second intervals on the graphic display. The blinking tire pressure will continue for the rest of the ignition cycle or until an EVIC button is pressed. If the display is removed without correcting the condition, it will reappear without a chime after 60 seconds to warn the driver of the low/high pressure condition.

A non-critical alert will be triggered when low or high pressure threshold has been exceeded in the spare tire. The “SPARE LOW PRESSURE” or “SPARE HIGH PRESSURE” alert will be displayed for 60 seconds during each ignition ON cycle. If the pressure threshold is exceeded while the ignition is OFF, the alert will be delayed 8-10 seconds after ignition ON.

3.9.4 SYSTEM FAULTS

NOTE: The Remote Tire Pressure Monitor Sensors (RTPM) are not internally serviceable. For a Sensor Failure or Low Battery fault, the RTPM must be replaced.

There are four conditions that will cause a Tire Pressure Monitoring System fault to be set. All fault codes are associated with a specific wheel location.

1. If the EVIC detects a non-transmitting Sensor/Transmitter in a road wheel for 10 minutes at a vehicle speed above 40 Km/H (25 MPH), it will:
   a. Store an active fault code.
   b. Request a chime.
   c. Display “SERVICE TIRE PRESS SYSTEM”.
   d. Display a dashed line at the wheel location on the graphic display if the display is activated.
2. When the EVIC detects:

- A low pressure sensor/transmitter battery status for 7 consecutive ignition cycles,
- Any sensor transmitting at a shorter than expected interval or,
- No valid pressure sensor ID from the spare tire for 20 consecutive ignition cycles spaced at least one hour apart, it will:
  a. Store an active fault code.
  b. Request a chime.
  c. Display “SERVICE TIRE PRESS SYSTEM”.

Use the DRBIII® Input/Output function to further isolate the specific concern.

The DRBIII® can be queried to determine the Sensor/Transmitter status:

- “Invalid Pressure” - The Sensor/Transmitter is reporting a negative pressure or a pressure above 434 kPa (63 psi).
- “Low Batt” - The Sensor/Transmitter has reported a low battery status for seven consecutive ignition cycles.
- “Trained” - The Sensor/Transmitter ID code is recognized by the EVIC.
- “Active” - The vehicle is moving at 40 km/h (25 mph) and the Sensor/Transmitter is “awake” and transmitting as expected by the EVIC.

3.9.5 SPARE WHEEL AUTO-LOCATE

If the spare tire is mounted on the vehicle, the EVIC will detect the relocation and determine from the sensor transmit intervals, which wheels are mounted and which one is now the spare. The spare tire sensor/transmitter transmits once per hour. The sensor/transmitters in the mounted wheels transmit once per minute when the vehicle is moving at 40 km/h (25 mph).

3.9.6 REMOVE MAGNET FROM SPARE

A magnet is used to initiate a sensor ID transmission. In the EVIC training procedure, the spare wheel is the last in the sequence. If the magnet is left on the wheel, the sensor/transmitter will continue its ID transmission. If the EVIC detects 20 transmissions from the spare wheel in 60 seconds and the vehicle speed is above 40 km/h (25 mph), it will:

- Request a chime.
- Display "REMOVE MAGNET FROM SPARE" for 60 seconds per ignition-ON cycle.

3.9.6 TIRE PRESSURE UNAVAILABLE

The EVIC can detect high radio noise interference. When the noise level is too high to distinguish a transmission from a sensor/transmitter, it will:

- Display "TIRE PRESSURE UNAVAILABLE" for 5 seconds.
- Request a chime.
- Switch to the graphic display and show dashed lines instead of the tire pressure for the wheel(s) affected by the radio interference.

3.9.7 TIRE PRESSURE NOW AVAILABLE

If the "TIRE PRESSURE UNAVAILABLE" message was displayed because of radio noise interference, the EVIC will:

- Display "TIRE PRESSURE NOW AVAILABLE" for 5 seconds.
- Request a chime.

When the noise level no longer interferes with sensor/transmitter transmissions.

3.9.8 DIAGNOSING AND CLEARING SYSTEM FAULTS

NOTE: The TPM System relearn procedure must be performed before servicing the system.

All Tire Pressure Monitoring System Faults are specific to one location. If a "BATTERY LOW", "SENSOR FAILURE" fault is detected, the location will be displayed. The appropriate sensor/ transmitter can then be replaced.

If a single sensor/transmitter cannot be detected by the EVIC, replace that sensor transmitter. If none of the sensors/transmitters can be detected, refer to Tire Pressure Monitoring System symptoms in the EVIC section.

3.9.9 SYSTEM TEST

A test of the Tire Pressure Monitoring System can be initiated in the EVIC. The test sequence is as follows:

1) Scroll to the blank display by pressing the STEP button.
2) Press and hold the RESET button for five seconds.
3) The EVIC will request a beep to indicate the start of the test.
4) The EVIC will clear the sensor signal counters
5) The vehicle graphic will be displayed with transmission counters at each corner and for the spare. (Same display as for pressures but with counters in place of the tire pressures.)
6) Drive the vehicle at speeds above 40 km/h (25 mph) for 10 minutes.
7) The counters will increase by one each time a sensor signal is received by the EVIC (approximately 1 signal per minute from each wheel except the spare).

The test will continue until any EVIC button is pressed or until the ignition is cycled to OFF.

3.9 EXTERIOR LIGHTING SYSTEM

3.9.1 EXTERIOR LIGHTING BATTERY SAVER

The BCM monitors the status of and controls the park lamp, head lamp and fog lamp relay's. If any exterior lamps are left on after the ignition is turned off, the BCM will turn them off after 8 minutes.

3.9.2 HEADLAMP DELAY

The headlamp time delay operates when the ignition switch is turned off while the headlamps are still on. This feature is customer programmable to provide a 30, 60 or 90 second time delay before turning off the headlamps. This feature can also be disabled.

3.9.3 HEADLAMP SWITCH

The headlight switch on WJ vehicles uses a multiplexed (MUX) circuit to the BCM. The BCM will then control the park lamp, low/high head lamp and fog lamp relay's based on this input.

3.9.4 FOG LAMP CONTROL

The body control module controls the operation of the fog lamp relay which controls the fog lamps. The fog lamps can only be on if the park or low beam headlamps are on. If the high beams are turned on, the fog lamps will automatically be turned off.

3.10 INTERIOR LIGHTING

3.10.1 COURTESY LAMP CONTROL

The body controller has direct control over all of the vehicle's courtesy lamps. The body computer will illuminate the courtesy lamps under any of the following conditions:

1. Any door is ajar and courtesy lamp switch on the left multi-function switch is not in the dome off position.
2. The courtesy lamp switch on the left multi-function switch is in the dome on position.
3. A Remote Keyless entry unlock message is received.
4. Driver door unlocked with key (with VTSS only).

3.10.2 ILLUMINATED ENTRY

Illuminated entry will be initiated when the customer enters the vehicle by unlocking the doors with the key fob, or with the key if the vehicle is equipped with vehicle theft alarm. Upon exiting the vehicle, if the lock button is pressed with a door open, illuminated entry will cancel when the door closes. If the doors are closed and the ignition switch is turned on, the illuminated entry also cancels. The illuminated entry feature will not operate if the courtesy lamp switch is in the dome off position.

3.10.3 INTERIOR LIGHTING BATTERY SAVER

If any of the interior lamps are left on after the ignition is turned off, the BCM will turn them off after 8 minutes. To return to normal operation, the courtesy lamps will operate after the dome lamp switch or door ajar switch changes state. The glove box, switched reading lamps and vanity lamps require that the ignition be turned to the on/acc position.

3.11 ELECTRO/MECHANICAL INSTRUMENT CLUSTER (EMIC)

The Instrument Cluster contains a Fuel, Voltmeter, Coolant Temp, and Oil Pressure gauge, a Tachometer and a Speedometer. With the exception of the Voltmeter, the cluster positions the gauges with PCI Bus messages received from the PCM. The Voltmeter operates directly off of the Fused B+ Switched Ignition Output circuit that supplies ignition voltage for the cluster.

The Instrument Cluster also contains warning indicators that are illuminated by hard wired inputs or by messages received from other modules on the PCI Bus.

The Trip/Total Odometer is a Vacuum Fluorescent Display (VF) that is controlled by PCI Bus messages received from the PCM.

The cluster illumination lamps are hard wired in the Instrument Cluster. When the Park or Headlamps are turned on, the cluster receives a dimmed battery feed from the Headlamp Switch. The cluster I/O Processor controls the VF display dimming and also sends dimming level messages on the PCI Bus.

The EMIC will communicate with the DRBIII® to display PCI Engine Info, PCI Bus Info, and certain input/outputs. Cluster diagnostic capabilities that the DRBIII® will actuate is limited to the Cluster Calibration Points for the gauges. The DRBIII® can also extract active and stored Diagnostic Trouble Codes (DTC) from the Instrument Cluster.

The EMIC is also capable of performing a diagnostic Self-Test that is actuated by depressing and holding the Odometer trip reset stalk while cycling the ignition from the off to the on position. After the cluster Odometer displays CHEC, releasing the reset stalk begins the test. The cluster will then position all of the gauges at specified calibration points and will illuminate all the PCI Bus controlled indicators. The cluster will also illuminate each segment of the VF display.

The EMIC can verify communications with the PCM, ID the module, or change the country code using the DRBIII®. For further information regarding the diagnostic routine and an explanation of the faults, refer to the appropriate Service Manual.

3.11.1 INSTRUMENT PANEL DIMMING

I/P dimming is accomplished using the body computer. The panel dimming level switch is read by the body computer which converts the level to a value that is sent over the PCI bus. Other modules such as the Radio, MIC, and the EVIC use this data so their display intensity matches the other incandescent bulbs in the vehicle that are driven directly by the BCM.

3.12 MEMORY SEATS

The memory system consists of the driver power seat, both outside rear view mirrors and the radio presets. The memory module for the seat is mounted under the driver's seat. The module is available with or without the heated seat feature. The seat module receives input from the 8-way power seat switch, the driver's seat position sensors, both front seat negative temperature coefficients (NTC's) (if heated seat equipped) and the PCI bus circuit. The memory switch, located on the driver door, is wired directly to the driver door module and sends its messages over the PCI bus. The memory seat module performs the following functions: positions the drivers seat, actuates the driver's and passenger's seat heaters (if equipped) and sends the memory location over the PCI bus.

When a memory button is pressed (#1 or #2) on the memory switch, the driver door module sends a recall message to the memory seat module (MSM), the PCI radio and the passenger door module. They will in turn position the driver seat, both mirrors and set the radio presets. When the RKE button is pressed, depending on which transmitter (#1 or #2), the passenger door module sends the recall message.

3.12.1 POWER SEAT

The memory power seat provides the driver with 2 position settings for the driver's seat. Each power seat motor is connected to the MSM with two circuits. Each circuit is switched between battery and ground. By alternating the circuits the MSM controls the movement of the motors based on input from the seat mounted switch.

Each motor contains a potentiometer to monitor the seat position. To monitor the position of the motor, the MSM sends out a 5-volt reference on the sensor supply circuit. The sensor is grounded back to the module on a common ground circuit. Based on the position of the sensor, the MSM monitors the voltage change through the sensor on a separate signal circuit.

The MSM stores the input value of each of the four seat potentiometers in memory when the system is requested. The driver can initiate memory recall, using either the memory switch or the RKE transmitter. When initiated, the MSM adjusts the four seat motors to match the memorized seat position data.

For safety reasons, the memory seat recall is disabled by the MSM when the vehicle is out of park position or if the seatbelt is buckled. Any obstruction to seat movement over a 2 second delay will cause the seat to stop moving in which case a stalled motor would be detected by the MSM which would then flag a trouble code and the corresponding seat output would be deactivated. However, if the object obstructing the seat is removed, the seat will function normally again.

3.12.2 EASY EXIT SEAT (AVAILABLE WITH MEMORY SEAT)

The intent of this feature is to allow for easier entry and exit to the vehicle by moving the seat rearward a short distance when the operator turns the vehicle off. The seat can be recalled to one of it's two set memory positions by pressing either of the memory recall buttons on the switch or the RKE transmitters. If any seat movement is initiated, whether manual or by memory recall, after the ignition has been turned off, this will cancel any ensuing glide to enter movement until the next ignition cycle.

This feature can be enabled/disabled by the owner through the electronic vehicle information center (EVIC) or using the DRBIII®. When using the DRBIII® it will also inform as to what state it is in. To reinstate the feature, simply repeat the process.

3.12.3 GUARD BANDS

The module provides guard bands which prevent the seat track from hitting the hard limits of the given seat axis during manual power seat operation. The guard band values for each hard limit are stored in EEPROM. The guard band can be bypassed by running the seat to the end of its travel and then releasing the switch and pressing it again. The seat will move a short distance further. Once the seat is past the guard band, it can be stored in memory, but if recall is initiated the seat will move to the guard bands and no further.

When a seat module or seat track assembly is replaced, the DRBIII® must be used to perform the "Reset Guard Bands" procedure. WARNING: The operator must be out of the seat when this procedure is being used as the seat will move to the end of it's travel in all 8 positions.

3.12.4 ELECTRICALLY HEATED SEATS

The heated seat feature is available with or without the memory system. The module is located under the driver's seat and is known as the heated seat module (HSM) or the memory heated seat module (MHSM). The control switches for the heated seats are located on the instrument panel and are wired to the body control module. The BCM then sends the message to the HSM via the PCI bus. The system offers two seat temperature settings of approximately 96.8 F (36°C) (LO) and approximately 107.6 F (41°C) (HI).

As the temperature in the seat rises, the negative temperature coefficient (NTC) resistance decreases and the voltage reading detected by the HSM decreases. The seat heater output is deactivated once the voltage reading reaches it's threshold for either setting, high or low.

As the temperature decreases, the voltage reading increases until the upper threshold is reached for either setting high or low. At this point the seat heat output is activated once again and this cycle repeats itself as long as the seat heat request is on.

The thresholds for low and high settings are pre-programmed into the module memory.

The heated seat switch contain resistors pulled up to 5 volts which are processed by the body control module as the voltage readings indicating desired heat setting high or low.

The heater elements inside the seat back and cushion are different for the Limited and Laredo models. The Laredo seat heater elements are wired in series whereas the Limited seat elements are wired in parallel. This means that if an element is open in a Laredo model there will be no heater output to either the cushion or the seat back. If an element is open in a Limited model, the other elements will operate as usual. However, if one of the elements is open, the seat cushion will have to be replaced.

There are three heater elements in the seat cushions for both models. The Laredo uses a resistor wire for its center and both side bolsters (raised outer side panels) and the Limited uses a carbon fiber element for its center and resistor wire for the bolsters.

3.13 SENTRY KEY IMMOBILIZER SYSTEM (SKIS)

The Sentry Key Immobilizer System (SKIS) is an immobilizer system designed to prevent unauthorized vehicle operation. The system consists of a Sentry Key Immobilizer Module (SKIM), ignition key(s) equipped with a transponder chip and engine controller. When the ignition switch is turned on, the SKIM interrogates the ignition key. If the ignition key is "Valid" the SKIM sends a PCI Bus message to the engine controller indicating the presence of a valid ignition key. Upon receiving a "Valid" key signal the PCM/ECM will allow the engine to continue to operate.

For additional information on the SKIS, refer to the appropriate Powertrain Diagnostic information.

3.14 POWER SUNROOF

The power sunroof in the Grand Cherokee is controlled by the Body Control Module (BCM). After the ignition has been turned off, the power sunroof will remain operational for an additional 45 seconds. If the front doors are opened during this time, the BCM will remove power from the sunroof.

3.15 COMMUNICATION

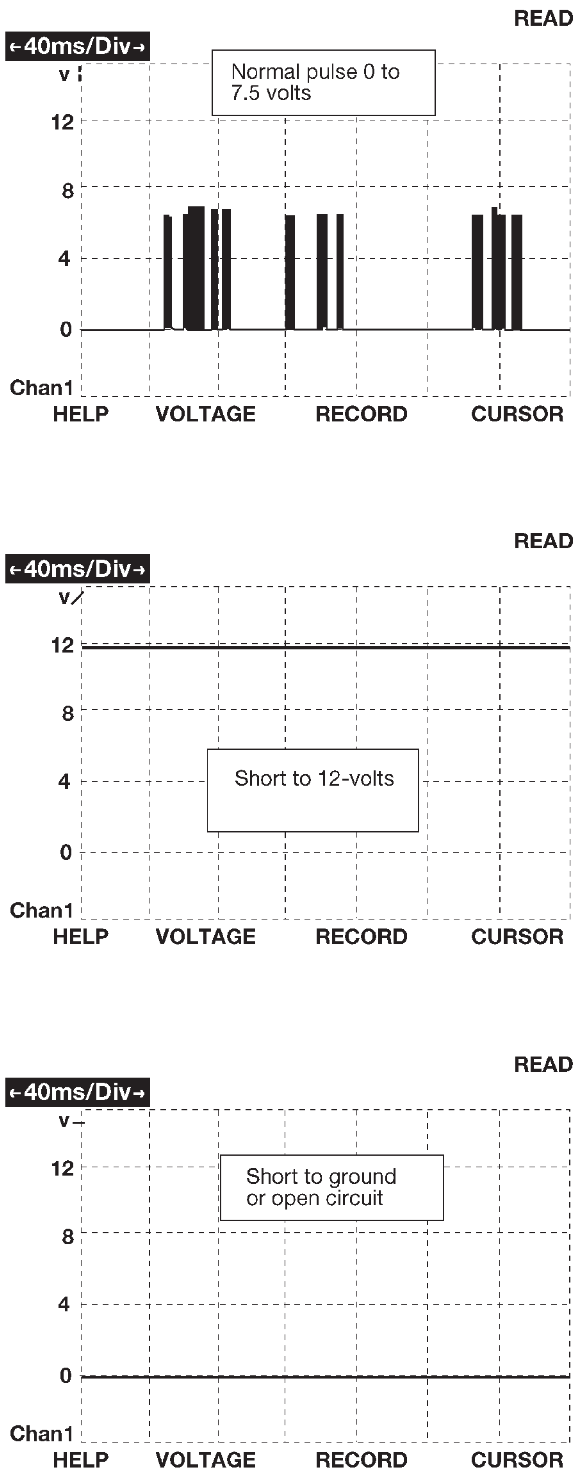
The Programmable Communication Interface or PCI Bus is a single wire multiplexed network capable of supporting binary encoded messages shared between multiple modules. The PCI bus circuit is identified as D25. The modules are wired in parallel. Connections are made in the harness using splices. One splice called the Diagnostic Junction Port, serves as the "Hub" of the bus. The Diagnostic Junction Port provides an access point to isolate most of the modules on the bus in order to assist in diagnosing the circuit. The following modules are used on the WJ/WG:

- Body Control Module
- Adjustable Pedals Module
- Door Modules (Driver & Passenger)
- Airbag Control Module
- Controller Antilock Brake
- Powertrain Control Module
- Engine Control Module (Diesel)
- Radio
- CD Changer
- Transmission Control Module
- Automatic Zone Control Module
- Sentry Key Immobilizer Module
- Seat Module
- Electronic Vehicle Information Center
- Mechanical Instrument Cluster
- Shifter Assembly (Diesel)
- Rain Sensor
- Power Amplifier
- Intrusion Transceiver Module (Export)

Each module provides its own bias and termination in order to transmit and receive messages. The bus voltage is at zero volts when no modules are transmitting and is pulled up to about seven and a half volts when modules are transmitting.

The bus messages are transmitted at a rate averaging 10800 bits per second. Since there is only voltage present when the modules transmit and the message length is only about 500 milliseconds, it is ineffective to try and measure the bus activity with a conventional voltmeter. The preferred method is to use DRBIII® lab scope. The 12v square wave selection on the 20-volt scale provides a good view of the bus activity. Voltage on the bus should pulse between zero and about seven and a half volts. Refer to the following figure for some typical displays.

The PCI Bus failure modes are broken down into two categories. Complete PCI Bus Communication Failure and individual module no response. Causes of complete PCI Bus Communication Failure include a short to ground or battery on the PCI circuit. Individual module no response can be caused by an open circuit at either the Diagnostic



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Junction Port or the module, or an open battery or ground circuit to the affected module.

Symptoms of a complete PCI Bus Communication Failure would include but are not limited to:

- All gauges on the EMIC stay at zero
- All telltales on EMIC illuminate
- EMIC backlighting at full intensity
- Dashed lines in the EVIC ambient temperature display
- No response received from any module on the PCI bus (expect the PCM/ECM)
- No start (if equipped with Sentry Key Immobilizer)

Symptoms of Individual module failure could include any one or more of the above. The difference would be that at least one or more modules would respond to the DRBIII®.

Diagnosis starts with symptom identification. If a complete PCI Bus Communication Failure is suspected, begin by identifying which modules the vehicle is equipped with and then attempt to get a response from the modules with the DRBIII®. If any modules are responding, the failure is not related to the total bus, but can be caused by one or more module's PCI circuit or power supply and ground circuits. The DRBIII® may display "BUS +/- SIGNAL OPEN" or "NO RESPONSE" to indicate a communication problem. These same messages will be displayed if the vehicle is not equipped with that particular module. The CCD error message is a default message used by the DRBIII® and in no way indicates whether or not the PCI bus is operational. The message is only an indication that a module is either not responding or the vehicle is not equipped.

3.16 VEHICLE THEFT SECURITY SYSTEM

The vehicle theft security system (VTSS) is controlled by the body control module, which monitors vehicle doors, liftgate, liftglass and the ignition for unauthorized operation. The alarm activates by sounding the horn, flashing the headlamps, hazard lamps, and the VTSS indicator lamp. The VTSS does not prevent engine operation, this is done with the sentry key immobilizer module. Passive arming occurs upon normal vehicle exit by removing the ignition key, opening the driver door, locking the doors with the power lock, and closing the driver door or locking the doors with RKE. The indicator lamp on the dash will flash for 15 seconds, showing that arming is in progress. If no monitored systems are activated during this period, the system will arm and the indicator will flash at a slower rate. When something triggers the alarm, the system will signal the headlamps, park lamps, and horn for about 18 minutes.

For complaints about the Theft Alarm going off on it's own, use the DRBIII® and select "Theft Alarm", "VTSS" then "Monitor Display" and read the "Alarm Tripped By" status.

Tamper Alert - The VTSS tamper alert will sound the horn three times upon disarming to indicate a tamper condition has occurred.

Manual Override - The system will not arm if the doors are locked using the manual lock control or if the locks are actuated by an inside occupant after the doors are closed.

To verify the system, proceed as follows:

1. Open the driver's door.
2. Remove the ignition key (but keep it in hand).
3. Lock the doors with the power lock switch or the RKE.
4. Close the driver's door.

NOTE: After the doors are closed, locking the doors with RKE will also arm the system.

NOTE: If the VTSS indicator lamp flashed, the system is operational and verified. If not, there may be a problem with the system.

Arming/Disarming - Active arming occurs when the remote keyless entry transmitter is used to lock the vehicle doors, whether the doors are open or closed. If one or more doors are open, the arming sequence is completed only after all doors are closed.

Passive disarming occurs upon normal vehicle entry (unlocking driver's door with the key). This disarming also will halt the alarm once it has been activated.

Active disarming occurs when the remote keyless entry transmitter is used to unlock the vehicle doors. This disarming also will halt the alarm once it has been activated.

Intrusion Transceiver Module (Export only)

The Body Control Module (BCM) along with an Intrusion Transceiver Module (ITM) will control the premium Vehicle Theft Security System (VTSS) on export vehicles. Premium VTSS also includes a battery-backed siren for the audible alert. In addition to the other features of the base VTSS the ITM is used to monitor the interior of the vehicle for movement while the alarm is set. This feature can also be disabled with three additional lock commands from the Remote Keyless Entry system (which will be confirmed with an audible chirp) during the VTSS pre-arming sequence.

When the alarm is tripped it will actuate the hazard lamps for twenty-five seconds and the siren twenty-eight seconds. After that period if the disturbance is still present only the siren will be activated again for twenty-eight seconds with five seconds intervals between warning cycles. This will continue up to ten times unless the disturbance goes away. Also while the alarm is set the siren will monitor it's Fused B(+) and Siren Signal Control circuits. If either of these circuits become open the siren will trip itself to the alarming state.

NOTE: The intrusion transceiver module and/or siren must never be swapped from one vehicle to another. Once connected to a particular vehicle they will only properly function for that vehicle.

NOTE: If the VTSS indicator lamp comes on after ignition on and stays on, the PCI bus communication with the powertrain control module possibly has been lost.

3.17 WINDSHIELD WIPER & WASHER

3.17.1 FRONT WIPER

System Description

The front wiper system consists of the following features: *lo-hi-speed, mist wipers, intermittent wipers, and wipe after wash*. The front wiper system is only active when the ignition is in the run/acc position.

The BCM controls the front wiper system with one low-going output to a relay. With this output the BCM determines the motor wipe rate. This rate is a function of the intermittent wiper switch position and vehicle speed. The BCM times the delay after the wipers have parked. If the driver goes from a longer to a shorter delay interval, a wipe is done immediately. The speed sensitive delay is set based on the current speed of the vehicle. If the vehicle crosses above the speed threshold of 10 MPH (16 kmh) while the intermittent wiper delay is occurring, a smaller delay can be used. If the vehicle crosses below the speed threshold a longer delay should not be used until the current delay is completed.

In the lo-hi and mist state, the BCM constantly outputs an active control signal for a delay of zero. The multifunction switch controls the wiper high/low relay wiper motor in the hi state. This is done with an additional output from the multifunction switch to a relay which selects the motor winding to be energized. The BCM does not distinguish between lo-hi-or mist positions. The mist position is a momentary input to the BCM which causes the wipers to operate at low speed as long as the mist input is present.

The BCM also monitors the front washer motor to perform wipe after wash. The BCM will perform 3 wipes after the wash input is released.

Since the front wiper system is an important safety feature, the BCM will support wiper operation in the event of a failed park input.

If BCM does not detect a change of state on the park input for 8 seconds with the wiper relay energized a Diagnostic Trouble Code will set in the BCM.

Once a failed park switch is detected, intermittent operation is disabled and the BCM will default to the low speed wiper state when the wiper switch is in the intermittent position. The wiper relay will be de-energized when the wiper mode switch is in the OFF position. For open and short states on the wiper mode switch, the wipers should default to OFF.

SYSTEM FEATURES

Rain Sensor Module
The Microprocessor-based Rain Sensor Module (RSM) senses moisture on the outside of the windshield glass, and sends a wipe command to the Body Control Module (BCM). The RSM sends a wipe command to the BCM over the PCI data bus. The BCM then activates or deactivates the front wiper system. Sensitivity inputs are based on the driver-selected settings on the right side multi-function switch.

Speed Sensitive Intermittent Wipe Mode
There are 5 individual delay times with a minimum delay of 1/2 second to a maximum of 18 seconds. When the vehicle speed is under 10 MPH (16 kmh), the delay time is doubled providing a range of 1 second to 36 seconds.

Mist Wipe
The wiper operates as long as the wiper switch is in the mist position.

Park after Ignition Off
Because the wiper relays are powered from the battery the BCM can run the wipers to park after the ignition is turned off.

Wipe after Wash
When the driver presses the wash button and then releases it, the wiper will continue to run for 3 additional wipe cycles.

The wiper system utilizes the BCM to control the on/off relay for low wiper functions, intermittent wiper delay as the switch position changes, pulse wipe, wipe after wash mode, and wiper motor park functions. The BCM uses the vehicle speed input to double the usual delay time below 10 MPH (16 kmh).

FRONT/REAR WIPER AND WASHER SWITCHES (RIGHT MULTI-FUNCTION SWITCH STALK)

The front windshield and rear liftglass wiper/washer switches are located on the wiper multi-function switch stalk which is secured to the right side of the multi-function switch mounting housing on the steering column.

A knob on the end of the wiper multifunction switch stalk is rotated to select the desired front wiper speed (HIGH or LOW) or one of the five intermittent front wiper positions. The wiper stalk is pulled toward the driver to activate the windshield washer system. Both the front wiper and front washer motors will operate continuously for as long as the stalk is held in the momentary FRONT WASH position.

Another rotary switch on the wiper multi-function switch stalk is rotated to select the desired rear wiper speed (ON or DELAY). The wiper stalk is pushed toward the instrument panel to activate the rear liftglass washer system. Both the rear wiper and rear washer motors will operate continuously for as long as the stalk is held in the momentary REAR WASH position.

If any part of the right multi-function switch stalk is faulty or damaged, the entire wiper multi-function switch assembly must be replaced.

3.17.2 REAR WIPER SYSTEM

Five circuits feed the rear wiper module. It has two high current circuits, battery (B+) and ground, that run the motor. The remaining three circuits are low current control circuits.

Two of these circuits come from the rear wiper switch on the right multi-function switch stalk. These circuits are referred to as the rear wiper motor control circuit and the rear wiper motor intermittent control circuit. When the rear wiper switch is in the Off position, both of these circuits are open and the wiper module parks or remains parked. When the rear wiper switch is in the Intermittent position, the intermittent control circuit is switched to ignition voltage, the motor control circuit is open and the wiper is in the intermittent modes. When the rear wiper switch is in the On position, the intermittent control circuit is open and the motor control circuit is switched to ignition voltage and the wiper is in continuous wipe mode.

REAR WIPER SYSTEM CONTROL CIRCUITS

REAR WIPER SWITCH POSITION	DELAY CIRCUIT	CONTINU-OUS CIR-CUIT	AJAR CIRCUIT	WIPER MODE
OFF	*OPEN*	*OPEN*	*OPEN*	PARKED
	OPEN	*OPEN*	*GROUND*	PARKED
DEL	*IGNITION*	*OPEN*	*OPEN*	DELAY
	IGNITION	*OPEN*	*GROUND*	PARKED
ON	*OPEN*	*IGNITION*	*OPEN*	ON
	OPEN	*IGNITION*	*GROUND*	PARKED
WASH	*IGNITON*	*IGNITION*	*OPEN*	WASH
	IGNITION	*IGNITION*	*GROUND*	PARKED

The third control circuit is the AJAR circuit. This circuit is fed by the flip-up glass ajar switch. When the flip-up glass is closed the ajar switch is open and the rear wiper module functions normally. When the flip-up glass is open, the ajar switch is closed and the circuit provides ground to the module. This ground signal indicates to the rear wiper module that it should park if operating or not allow operation if parked.

3.18 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading trouble codes, erasing trouble codes and other DRBIII® functions.

3.18.1 DRBIII® ERROR MESSAGES AND BLANK SCREEN

Under normal operation, the DRBIII® will display one of only two error messages:

– User-Requested WARM Boot or User-Requested COLD Boot

If the DRBIII® should display any other error message, record the entire display and call the STAR Center for information and assistance. This is a sample of such an error message display:

```
ver: 2.14
date: 26 Jul93
file: key_itf.cc
date: Jul 26 1993
line: 548
err: 0x1
User-Requested COLD Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

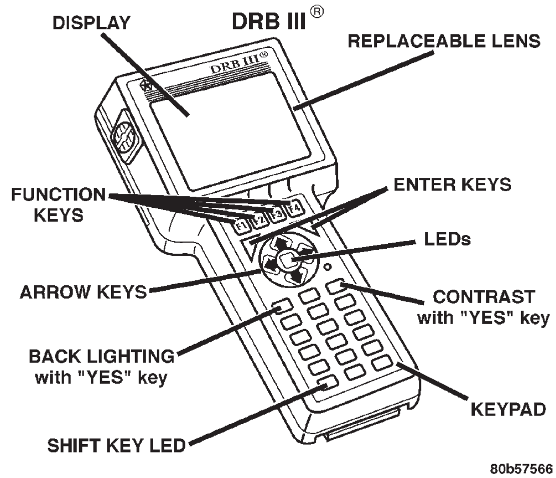
3.18.2 DRBIII® DOES NOT POWER UP

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link connector cavity 16). A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, and inoperative DRBIII® may be the result of faulty cable or vehicle wiring.

3.18.3 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



4.0 DISCLAIMERS, SAFETY, WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the drive wheels.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as rings, watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing a body system problem, it is important to follow approved procedures where applicable. These procedures can be found in this General Information Section or in service manual procedures. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the body system are intended to be serviced as an assembly only. Attempting to remove or repair certain system subcomponents may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

- Follow the vehicle manufacturer's service specifications at all times.
- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips, or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0 - 500 peak volts AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz
Temperature	-58 - 1100°F -50 - 600°C

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with test lead.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is "off". Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation, this will damage it and eventually cause it to fail because of corrosion. Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second code could be set, making diagnosis of the original problem more difficult.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read the DRBIII® screen while in motion. Do not hang the DRB from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box)
Jumper Wires
Ohmmeter
Voltmeter
Diagnostic Junction Port Tester #8339
Test Light
Miller Special Tool #8310
8310 Airbag Load Tool
8443 SRS Airbag Load Tool

6.0 GLOSSARY OF ACRONYMS

ABS	antilock brake system
ACM	airbag control module
AECM	airbag electronic control module (ACM)
APM	adjustable pedals module
ASDM	airbag system diagnostic module (ACM)
AZC	automatic zone control
BCM	body control module
CAB	controller antilock brake
DAB	driver airbag
DDM	driver door module
DLC	data link connector
DTC	diagnostic trouble code
EBL	electric back lite (rear window defogger)
ECM	engine control module
EVIC	electronic vehicle information center
HSM	heated seat module (also called seat module)
HVAC	heater ventilation, air conditioning
I/R	infrared sensor
ITM	intrusion transceiver module
MHSM	memory heated seat module (also called seat module)
MIC	mechanical instrument cluster
MSM	memory seat module
MUX	Multiplexed
ODO	odometer
ORC	occupant restraint controller (ACM)
PAB	passenger airbag
PCI	Programmable Communication Interface (vehicle communication bus)
PCM	powertrain control module
PDC	power distribution center
PDM	passenger door module
PWM	pulse width modulated
RKE	remote keyless entry
SBS	Seatbelt switch
SKIM	sentry key immobilizer module
SKIS	sentry key immobilizer system
SQUIB	also called initiator (located in rear of airbag module)
TCM	transmission control module
TPM	tire pressure monitoring
VFD	vacuum fluorescent display
VTSS	vehicle theft security system

NOTES

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom List:

ACCELEROMETER 1
ACCELEROMETER 2
INTERNAL 1
OUTPUT DRIVER 1
STORED ENERGY FIRING 1

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be INTERNAL MODULE DTC.

When Monitored and Set Condition:

ACCELEROMETER 1

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

ACCELEROMETER 2

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

INTERNAL 1

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

OUTPUT DRIVER 1

When Monitored: With the ignition on the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

STORED ENERGY FIRING 1

When Monitored: With the ignition on the ACM on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the ACM identifies an out of range internal circuit.

INTERNAL MODULE DTC — Continued

POSSIBLE CAUSES
AIRBAG CONTROL MODULE - ACM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **WARNING: IF THE MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** From the list below, select the appropriate module reporting this diagnostic trouble code. SELECT ONE: ACM - ACTIVE or STORED DTC WARNING: MAKE SURE THE BATTERY IS DISCONNECTED, THEN WAIT TWO MINUTES BEFORE PROCEEDING. Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

Symptom List:
AIRBAG WARNING INDICATOR OPEN
AIRBAG WARNING INDICATOR SHORT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be AIRBAG WARNING INDICATOR TEST.

When Monitored and Set Condition:

AIRBAG WARNING INDICATOR OPEN

When Monitored: With ignition on the ACM monitors the PCI Bus for a message from the MIC containing the airbag warning indicator status. The MIC transmits the message one time at ignition on, upon lamp state change, or in response to the ACM lamp message.

Set Condition: This DTC will set if the indicator status is OPEN for 2 or 3 consecutive messages or 2 or 3 seconds.

AIRBAG WARNING INDICATOR SHORT

When Monitored: With ignition on the ACM monitors the PCI Bus for a message from the MIC containing the airbag warning indicator status. The MIC transmits the message one time at ignition on, upon lamp state change, or in response to the ACM lamp message.

Set Condition: This DTC will set if the indicator status is SHORT for 2 or 3 consecutive messages or 2 or 3 seconds.

POSSIBLE CAUSES
MIC, COMMUNICATION FAILURE
WARNING INDICATOR
ACM, WARNING INDICATOR
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

AIRBAG WARNING INDICATOR TEST — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, ensure PCI Bus communications with the Instrument Cluster. Is the Instrument Cluster communicating on the PCI Bus? Yes → Go To 3 No → Refer to category COMMUNICATION CATEGORY and select the related symptom INSTRUMENT CLUSTER BUS +/- SIGNAL OPEN.	All
3	With the DRBIII® select PASSIVE RESTRAINTS, AIRBAG and MONITOR DISPLAY. Using the DRBIII®, read the WARNING LAMP MONITOR screen. Select the LAMP STATUS displayed on the DRB monitors screen. Does the DRBIII® show the LAMP STATUS: OK? YES Go To 4 NO Replace Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
CLUSTER MESSAGE MISMATCH

When Monitored and Set Condition:

CLUSTER MESSAGE MISMATCH

When Monitored: After the MIC bulb test is completed, the ACM compares the Lamp Request by ACM, On or Off, and the Lamp on by MIC, On or Off, PCI Bus messages. Each message is transmitted one time per second or when a change in the lamp state occur.

Set Condition: If the Lamp Request by ACM, On or Off, and the Lamp on by MIC, On or Off, messages do not match, the code will set.

POSSIBLE CAUSES
MIC DIAGNOSTIC CODES
CLUSTER MESSAGE MISMATCH
STORED CODE OR INTERMITTENT CONDITION
ACM, CLUSTER MESSAGE MISMATCH
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition on. With the DRBIII®, read the MIC DTCs. Does the DRBIII® display any active Diagnostic Codes? Yes → Refer to symptom list for problems related to Instrument Cluster. No → Go To 3	All

CLUSTER MESSAGE MISMATCH — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII® select PASSIVE RESTRAINTS, AIRBAG, MONITOR DISPLAY and WARNING LAMP STATUS. Cycle the ignition key and observe the LAMP ON BY MIC and LAMP REQ BY ACM monitors after the 6 to 8 second indicator test. Does the LAMP ON BY MIC and LAMP REQ BY ACM monitors match? YES Go To 4 NO Replace Mechanical Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All
4	**WARNING: MAKE SURE THE BATTERY IS DISCONNECTED, THEN WAIT TWO MINUTES BEFORE PROCEEDING.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER CURTAIN SQUIB CIRCUIT OPEN

When Monitored and Set Condition:

DRIVER CURTAIN SQUIB CIRCUIT OPEN

When Monitored: With the ignition is On, the ACM monitors the resistance of the Curtain Squib circuits.

Set Condition: When the ACM detects an open circuit or high resistance on the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG OPEN
CURTAIN SQUIB LINE 1 OR LINE 2 CIRCUIT OPEN
ACM, CURTAIN SQUIB CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER CURTAIN SQUIB CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the ACM active DTC's. Does the DRBIII® show CURTAIN SQUIB CIRCUIT OPEN? Yes → Go To 3 No → Replace Curtain Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module Connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Curtain Squib Line 1 and Line 2 circuits between the Load Tool ACM adaptor and the Curtain Airbag connector. Is the resistance below 1.0 ohms on both circuits? Yes → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair open or high resistance in the Curtain Squib Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER CURTAIN SQUIB CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER CURTAIN SQUIB CIRCUIT SHORT

When Monitored and Set Condition:

DRIVER CURTAIN SQUIB CIRCUIT SHORT

When Monitored: When the ignition is on, the ACM monitors the resistance between the Curtain Squib circuits.

Set Condition: When the ACM detects a low resistance between the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG SHORT
CURTAIN SQUIB LINE 1 SHORT TO LINE 2
ACM, CURTAIN SQUIB CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER CURTAIN SQUIB CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRB, read the ACM active DTC's. Does the DRBIII® show CURTAIN SQUIB CIRCUIT SHORT? Yes → Go To 3 No → Replace Curtain Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the ACM connector. Measure the resistance between the Curtain Squib Line 1 and Line 2 circuits at the Curtain Airbag connector. Is the resistance below 10K ohms? Yes → Repair Curtain Squib Line 1 shorted to Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER CURTAIN SQUIB CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER CURTAIN SQUIB SHORT TO BATTERY

When Monitored and Set Condition:

DRIVER CURTAIN SQUIB SHORT TO BATTERY

When Monitored: When the ignition is on, the ACM monitors the voltage of the Curtain Squib circuits.

Set Condition: When the ACM detects high voltage on the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG SHORT TO BATTERY
CURTAIN SQUIB LINE 1 OR LINE 2 SHORTED TO BATTERY
ACM, CURTAIN SQUIB SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read ACM active DTC's. Does the DRBIII® display CURTAIN SQUIB SHORT TO BATTERY? Yes → Go To 3 No → Replace Curtain Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER CURTAIN SQUIB SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool ACM adaptor to the ACM connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Curtain Squib Line 1 and Line 2 circuits between the Curtain Airbag connector and ground. Is any voltage present on either circuit? Yes → Repair Curtain Squib Line 1 or Line 2 shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER CURTAIN SQUIB SHORT TO GROUND

When Monitored and Set Condition:

DRIVER CURTAIN SQUIB SHORT TO GROUND

When Monitored: When the ignition is on, the ACM monitors the resistance of the Curtain Squib circuits.

Set Condition: When the ACM detects a short to ground on the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG SHORT TO GROUND
CURTAIN SQUIB LINE 1 OR LINE 2 SHORTED TO GROUND
ACM, CURTAIN SQUIB SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read ACM active DTC's. Does the DRBIII® display CURTAIN SQUIB SHORT TO GROUND? Yes → Go To 3 No → Replace the Curtain Airbag in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER CURTAIN SQUIB SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool ACM adaptor to the ACM connector. Measure the resistance of the Curtain Squib Line 1 and Line 2 circuits between the Curtain Squib connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Curtain Squib Line 1 or Line 2 shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SEAT BELT SWITCH CIRCUIT OPEN

When Monitored and Set Condition:

DRIVER SEAT BELT SWITCH CIRCUIT OPEN

When Monitored: With the ignition on the ACM monitors the Seat Belt Switch circuit for an open condition.

Set Condition: The code will set if the ACM does not detect the correct circuit voltage.

POSSIBLE CAUSES
DRIVER SEAT BELT SWITCH OPEN
DRIVER SEAT BELT SWITCH CIRCUITS OPEN
ACM, DRIVER SEAT BELT SWITCH CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition off. Disconnect the Driver Seat Belt Switch. **NOTE: Check connectors - Clean and repair as necessary.** Turn the ignition on. Measure the voltage between Driver Seat Belt Switch Line 1 and Line 2 circuits at the SBS connector. Is there any voltage present? Yes → Replace the Driver Seat Belt Switch Buckle Assembly. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All

DRIVER SEAT BELT SWITCH CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Driver SBS Line 1 and line 2 circuits between the Driver SBS harness connector and Airbag Load Tool adaptor. Is the resistance of both circuits below 10K ohms? Yes → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair the open Driver Seat Belt Switch Line 1 or Line 2. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SEAT BELT SWITCH SHORT TO BATTERY

When Monitored and Set Condition:

DRIVER SEAT BELT SWITCH SHORT TO BATTERY

When Monitored: With the ignition on the ACM monitors the Seat Belt Buckle Switch circuit for an short to battery.

Set Condition: The code will set if the ACM detects high circuit voltage.

POSSIBLE CAUSES
DRIVER SEAT BELT SWITCH SHORT TO BATTERY
DRIVER SEAT BELT SWITCH CIRCUITS SHORT TO BATTERY
ACM, DRIVER SEAT BELT SWITCH SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4	All
2	Turn the ignition off. Disconnect the Driver Seat Belt Switch. **NOTE: Check connectors - Clean and repair as necessary.** Turn the ignition on. With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SEAT BELT SWITCH CIRCUIT OPEN? Yes → Replace the Driver Seat Belt Switch Buckle Assembly. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All

DRIVER SEAT BELT SWITCH SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the Driver SBS Line 1 and line 2 circuits at the Driver SBS connector. Is there any voltage present? Yes → Repair the Driver Seat Belt Switch line 1 or line 2 shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SEAT BELTS SWITCH SHORT TO GROUND

When Monitored and Set Condition:

DRIVER SEAT BELTS SWITCH SHORT TO GROUND

When Monitored: With the ignition on the ACM monitors the Seat Belt Buckle Switch circuit for a shorted together or shorted to ground condition.

Set Condition: The code will set if the ACM detects low circuit voltage.

POSSIBLE CAUSES
DRIVER SEAT BELT SWITCH SHORT TOGETHER OR TO GROUND
DRIVER SEAT BELT SWITCH CIRCUITS SHORT TOGETHER
DRIVER SEAT BELT SWITCH CIRCUITS SHORT TO GROUND
ACM, DRIVER SEAT BELT SWITCH SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5	All
2	Turn Ignition off. Disconnect the Driver Seat Belt Switch connector. **NOTE: Check connectors - Clean and repair as necessary.** Turn Ignition on. With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SEAT BELT CIRCUIT OPEN? Yes → Replace the Driver Seat Belt Switch Buckle Assembly. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All

DRIVER SEAT BELTS SWITCH SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance between the Driver SBS Line 1 and line 2 circuits at the Driver SBS connector. Is the resistance below 10K ohms? Yes → Repair the Driver Seat Belt Switch Line 1 and Line 2 shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the resistance of the Driver SBS Line 1 and Line 2 circuits between the Driver SBS connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair the Driver Seat Belt Switch line 1 or line 2 shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom List:
DRIVER SIDE IMPACT SENSOR INTERNAL 1
NO DRIVER SIDE IMPACT SENSOR COMMUNICATION

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be DRIVER SIDE IMPACT SENSOR INTERNAL 1.

When Monitored and Set Condition:

DRIVER SIDE IMPACT SENSOR INTERNAL 1

When Monitored: The Left Front Impact sensors is equipped with onboard diagnostics to monitor the sensors internal circuits. If a problem is identified the sensor sends the Driver Side Impact sensor internal 1 message to the ACM.

Set Condition: The code will set if the ACM receives an internal 1 message from the Driver Side Impact Sensor.

NO DRIVER SIDE IMPACT SENSOR COMMUNICATION

When Monitored: The ACM continuously communicates with the Driver Side Impact Sensor over the sensor signal circuit. The sensor communication and onboard diagnostics are powered by the ACM signal.

Set Condition: The code will set, if the ACM and Driver Side Impact Sensor do not establish and maintain valid data communications.

POSSIBLE CAUSES
SIGNAL CIRCUIT SHORTED TO BATTERY
SIGNAL CIRCUIT SHORT TO GROUND
DRIVER SIDE SENSOR CIRCUITS SHORTED TOGETHER
GROUND CIRCUIT OPEN
SIGNAL CIRCUIT OPEN
ACM, DRIVER SIDE IMPACT SENSOR
REPAIR IS COMPLETE
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

DRIVER SIDE IMPACT SENSOR INTERNAL 1 — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 9 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Driver Side Impact Sensor connector. Disconnect the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Driver Side Impact Sensor Signal circuit between the Driver Side Sensor connector and ground. Is there any voltage present? Yes → Repair the Driver Side Impact Sensor Signal circuit shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Measure the resistance of the Driver Side Impact Sensor Signal circuit between the Driver Side Impact Sensor connector and ground. Is the resistance below 100K ohms? Yes → Repair the Driver Side Impact Sense signal circuit shorted for a short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the resistance between the Driver Side Impact Sensor Signal and Sensor Ground circuits at the Driver Side Impact Sensor connector. Is the resistance below 100K ohms? Yes → Repair the Driver Side Impact Sensor circuits shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All
5	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Driver Side Impact Sensor Ground circuit between the Driver Side Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 6 No → Repair the Driver Side Impact Sensor Ground circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SIDE IMPACT SENSOR INTERNAL 1 — Continued

TEST	ACTION	APPLICABILITY
6	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Driver Side Impact Sensor Signal circuit between the Driver Side Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 7 No → Repair the Driver Side Impact Sensor Signal circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All
7	Replace the Driver Side Impact Sensor. Reconnect the vehicle body harness to the impact sensor. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Connect the DRB to the Data Link Connector - use the most current software available. Use the DRB III and erase the stored codes in all airbag system modules. Turn the Ignition Off, and wait 15 seconds before turning the Ignition On. Wait one minute, and read active codes and if there are none present read the stored codes. DID the active Driver Side Impact Sensor DTC return? Yes → Go To 8 No → Repair is complete. Perform AIRBAG VERIFICATION TEST - VER 1.	All
8	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SIDE IMPACT SENSOR INTERNAL 1 — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 CIRCUIT OPEN

When Monitored and Set Condition:

DRIVER SQUIB 1 CIRCUIT OPEN

When Monitored: With the ignition on the ACM monitors the resistance of the Driver Squib 1 circuits.

Set Condition: The ACM detects an open circuit or high resistance in the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG OPEN
CLOCKSPRING SQUIB CIRCUITS OPEN
DRIVER SQUIB 1 LINE 1 OR LINE 2 CIRCUIT OPEN
ACM, DRIVER SQUIB 1 CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT OPEN? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT OPEN? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Clockspring connector. Measure the resistance of the Driver Squib 1 Line 1 and Line 2 circuit between the ACM adaptor and the Clockspring connector. Is the resistance below 1.0 ohms on both circuits? Yes → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair open or high resistance in the Driver Squib 1 Line 1 or Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 CIRCUIT SHORT

When Monitored and Set Condition:

DRIVER SQUIB 1 CIRCUIT SHORT

When Monitored: With the ignition on the ACM monitors the resistance of the Driver Squib 1 circuits.

Set Condition: The ACM has detected low resistance on the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG CIRCUIT SHORT
CLOCKSPRING, DRIVER SQUIB 1 CIRCUIT SHORT
DRIVER SQUIB 1 LINE 1 SHORT TO LINE 2
ACM, DRIVER SQUIB 1 CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Driver Airbag. **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT SHORT? Yes → Go To 3 No → Replace Driver Airbag. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 1 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT SHORT? Yes → Go To 4 No → Replace Clockspring. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Clockspring connector. Measure the resistance between the Driver Squib 1 Line 1 and Line 2 at the Clockspring connector. Is the resistance below 10K ohms? Yes → Repair the Driver Squib 1 Line 1 circuit shorted to Driver Squib 1 Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 SHORT TO BATTERY

When Monitored and Set Condition:

DRIVER SQUIB 1 SHORT TO BATTERY

When Monitored: With the ignition on the ACM monitors the voltage of the Driver Squib 1 circuits.

Set Condition: The ACM has detected high voltage on the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG CIRCUIT SHORT TO BATTERY
CLOCKSPRING, DRIVER SQUIB 1 CIRCUIT SHORT TO BATTERY
DRIVER SQUIB 1 LINE 1 OR LINE 2 SHORT TO BATTERY
ACM, DRIVER SQUIB 1 CIRCUITS SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED ACM DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCS. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO BATTERY? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO BATTERY ? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Disconnect the Load Tool from the Clockspring connector. Measure the voltage on the Driver Squib 1 Line 1 and Line 2 circuits between the Clockspring connector and ground. Is there any voltage present? Yes → Repair the Driver Squib 1 Line 1 or Line 2 circuits shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 SHORT TO GROUND

When Monitored and Set Condition:

DRIVER SQUIB 1 SHORT TO GROUND

When Monitored: With the ignition on the ACM monitors the resistance of the Driver Squib 1 circuits.

Set Condition: The ACM has detected a short to ground in the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG CIRCUIT SHORT TO GROUND
CLOCKSPRING, DRIVER SQUIB 1 CIRCUIT SHORT TO GROUND
DRIVER SQUIB 1 LINE 1 OR LINE 2 SHORTED TO GROUND
ACM, DRIVER SQUIB 1 CIRCUITS SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag Module. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO GROUND? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO GROUND? Yes → Go To 4 No → Replace the Clockspring. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Clockspring connector. Measure the resistance of the Driver Squib 1 Line 1 and Line 2 circuits between Clockspring connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Driver Squib 1 Line 1 or Line 2 circuits shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 2 CIRCUIT OPEN

When Monitored and Set Condition:

DRIVER SQUIB 2 CIRCUIT OPEN

When Monitored: With the ignition on the ACM monitors the resistance of the Driver Squib 2 circuits.

Set Condition: The ACM has detected an open circuit or high resistance in the Driver Squib 2 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG CIRCUIT OPEN
CLOCKSPRING, DRIVER SQUIB 2 CIRCUIT OPEN
DRIVER SQUIB 2 LINE 1 OR LINE 2 CIRCUIT OPEN
ACM, DRIVER SQUIB 2 CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All

DRIVER SQUIB 2 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show DRIVER SQUIB 2 CIRCUIT OPEN? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRB, read the active Airbag DTCs. Does the DRB show DRIVER SQUIB 2 CIRCUIT OPEN? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control module connector. Disconnect the Load Tool from the Clockspring connector. Measure the resistance of the Driver Squib 2 Line 1 and Line 2 circuits between the ACM adaptor and the Clockspring connector. Is the resistance below 1.0 ohms on both circuits? Yes → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair the open or high resistance in the Driver Squib 2 Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 2 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 2 CIRCUIT SHORT

When Monitored and Set Condition:

DRIVER SQUIB 2 CIRCUIT SHORT

When Monitored: With the ignition on the ACM monitors the resistance of the Driver Squib 2 circuits.

Set Condition: The ACM has detected low resistance on the Driver Squib 2 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG CIRCUIT SHORT
CLOCKSPRING, DRIVER SQUIB 2 CIRCUIT SHORT
DRIVER SQUIB 2 LINE 1 SHORT TO LINE 2
ACM, DRIVER SQUIB 2 CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 2 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SQUIB 2 CIRCUIT SHORT? Yes → Go To 3 No → Replace Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SQUIB 2 CIRCUIT SHORT? Yes → Go To 4 No → Replace Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Clockspring connector. Measure the resistance between the Driver Squib 2 Line 1 and Line 2 at the Clockspring connector. Is the resistance below 10K ohms? Yes → Repair the Driver Squib 2 Line 1 circuit shorted to Driver Squib 2 Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 2 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 2 SHORT TO BATTERY

When Monitored and Set Condition:

DRIVER SQUIB 2 SHORT TO BATTERY

When Monitored: With the ignition on the ACM monitors the voltage of the Driver Squib 2 circuits.

Set Condition: The ACM has detected high voltage on the Driver Squib 2 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG CIRCUIT SHORT TO BATTERY
CLOCKSPRING, DRIVER SQUIB 2 CIRCUIT SHORT TO BATTERY
DRIVER SQUIB 2 LINE 1 OR LINE 2 SHORT TO BATTERY
ACM, DRIVER SQUIB 2 CIRCUIT SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 2 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTC's. Does the DRB show DRIVER SQUIB 2 SHORT TO BATTERY? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SQUIB 2 SHORT TO BATTERY ? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Disconnect the Load Tool from the Clockspring connector. Measure the voltage on the Driver Squib 2 Line 1 and Line 2 from the Clockspring connector to ground. Is there any voltage present? Yes → Repair the Driver Squib 2 Line 1 or Line 2 circuits shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 2 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 2 SHORT TO GROUND

When Monitored and Set Condition:

DRIVER SQUIB 2 SHORT TO GROUND

When Monitored: With the ignition on the ACM monitors the resistance of the Driver Squib 2 circuits.

Set Condition: The ACM has detected a short to ground in the Driver Squib 2 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG, CIRCUIT SHORT TO GROUND
CLOCKSPRING, DRIVER SQUIB 2 CIRCUIT SHORT TO GROUND
DRIVER SQUIB 2 LINE 1 OR LINE 2 SHORT TO GROUND
ACM, DRIVER SQUIB 2 CIRCUIT SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 2 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Driver Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connectors. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SQUIB 2 SHORT TO GROUND? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show DRIVER SQUIB 2 SHORT TO GROUND? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Clockspring connector. Measure the resistance of the Driver Squib 2 Line 1 and Line 2 circuits between Clockspring connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Driver Squib 2 Line 1 or Line 2 circuits shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 2 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom List:

LEFT FRONT IMPACT SENSOR INTERNAL 1
NO LEFT FRONT IMPACT SENSOR COMMUNICATION

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be LEFT FRONT IMPACT SENSOR TEST.

When Monitored and Set Condition:

LEFT FRONT IMPACT SENSOR INTERNAL 1

When Monitored: The Left Front Impact sensors is equipped with onboard diagnostics to monitor the sensors internal circuits. If a problem is identified the sensor sends the Left Front Impact sensor internal 1 message to the ACM.

Set Condition: The code will set if the ACM receives an internal 1 message from the Left Front Impact Sensor.

NO LEFT FRONT IMPACT SENSOR COMMUNICATION

When Monitored: The ACM continuously communicates with the Left Front Impact Sensor over the sensor signal circuit. The sensor communication and onboard diagnostics are powered by the ACM signal.

Set Condition: The code will set, if the ACM and Left Front Sensor do not establish and maintain valid data communications.

POSSIBLE CAUSES
SIGNAL CIRCUIT SHORTED TO BATTERY
SIGNAL CIRCUIT SHORT TO GROUND
LEFT SENSOR CIRCUITS SHORTED TOGETHER
GROUND CIRCUIT OPEN
SIGNAL CIRCUIT OPEN
ACM, LEFT FRONT IMPACT SENSOR
REPAIR IS COMPLETE
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

LEFT FRONT IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 9 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Left Front Impact Sensor connector. Disconnect the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Left Front Impact Sensor Signal circuit between the Left Sensor connector and ground. Is there any voltage present? Yes → Repair the Left Front Impact Sensor Signal circuit shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Measure the resistance of the Left Impact Sensor Signal circuit between the Left Impact Sensor connector and ground. Is the resistance below 100K ohms? Yes → Repair the Left Impact Sense signal circuit shorted for a short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the resistance between the Left Front Impact Sensor Signal and Sensor Ground circuits at the Left Impact Sensor connector. Is the resistance below 100K ohms? Yes → Repair the Left Front Impact Sensor circuits shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All
5	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Left Front Impact Sensor Ground circuit between the Left Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 6 No → Repair the Left Front Impact Sensor Ground circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LEFT FRONT IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
6	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Left Front Impact Sensor Signal circuit between the Left Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 7 No → Repair the Left Front Impact Sensor Signal circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All
7	Replace the Left Front Impact Sensor. Reconnect the vehicle body harness to the impact sensor. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Connect the DRB to the Data Link Connector - use the most current software available. Use the DRB III and erase the stored codes in all airbag system modules. Turn the Ignition Off, and wait 15 seconds before turning the Ignition On. Wait one minute, and read active codes and if there are none present read the stored codes. DID the active Left Impact Sensor DTC return? Yes → Go To 8 No → Repair is complete.	All
8	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LEFT FRONT IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
LOSS OF IGNITION RUN - START

When Monitored and Set Condition:

LOSS OF IGNITION RUN - START

When Monitored: With the ignition in the Run or Start position the module monitors the Run - Start circuit for proper system voltage.

Set Condition: The code will set, if the voltage on the Run - Start circuit drops below approximately 4.5 volts for the ACM or 6.7 volts for the SIACM.

POSSIBLE CAUSES
IGNITION SWITCH RUN-START CIRCUIT OPEN
ACM, FUSED IGNITION SW OUTPUT RUN/START SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT RUN-START CIRCUIT OPEN
ACM, FUSED IGNITION OUTPUT RUN-START CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT RUN-START CIRCUIT SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** From the list below, select the appropriate module and DTC type for the this diagnostic trouble code. SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 6 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn ignition off. Remove and inspect the Airbag Run-Start Fuse. **NOTE: Check connectors - Clean and repair as necessary.** Is the Fuse open? Yes → Go To 3 No → Go To 4	All

LOSS OF IGNITION RUN - START — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Disconnect Run - Start fuse. Connect the appropriate Load Tool adaptor to the Airbag connector. Measure the resistance of the Fused Ignition Switch Output Run-Start circuit between the Airbag Control Module adaptor and ground. Is the resistance below 10K ohms? Yes → Repair the Fused Ignition Switch Output Run-Start circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: make sure the battery is disconnected and wait 2 minutes before proceeding. Replace the Airbag Run-Start Fuse. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	Turn the ignition on. Measure the voltage of the Ignition Switch Output circuit between the Airbag Run-Start Fuse and ground. Is the voltage above approximately 4.5 volts? Yes → Go To 5 No → Repair the open Ignition Switch Output Run-Start circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Reinstall the previously removed Airbag Run-Start Fuse. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Fused Ignition Switch Output Run-Start Circuit between the Airbag Control Module connector ground. Is the voltage above approximately 4.5 volts? Yes → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair open Fused Ignition Switch Output Run-Start circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LOSS OF IGNITION RUN - START — Continued

TEST	ACTION	APPLICABILITY
6	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
LOSS OF IGNITION RUN ONLY

When Monitored and Set Condition:

LOSS OF IGNITION RUN ONLY

When Monitored: With the ignition in the run position the module monitors the Run Only circuit for proper system voltage.

Set Condition: If the voltage on the Run Only circuit drops below 4.5 volts, the code will set.

POSSIBLE CAUSES
IGNITION SWITCH OUTPUT RUN CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT OPEN
ACM, FUSED IGNITION OUTPUT RUN CIRCUIT OPEN
CHECKING FOR A SHORTED RUN CIRCUIT
FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT SHORT TO GROUND
ACM, FUSED IGNITION RUN CIRCUIT SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 8 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn Ignition off. Remove and inspect the Airbag Run circuit fuse. Is the Fuse open? Yes → Go To 3 No → Go To 5	All

LOSS OF IGNITION RUN ONLY — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Airbag Run fuse. **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Fused Ignition Switch Output Run circuit between the Run Fuse and ground. Is the resistance below 10.0 ohms ? Yes → Go To 4 No → Replace the defective fuse. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Fused Ignition Switch Output Run circuit between the ACM connector and ground. Is the resistance below 10K ohms ? Yes → Repair the Fused Ignition Switch Output Run circuit for a short to ground and replace Airbag Run Fuse. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions and replace the Run Only Fuse. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	Turn ignition on. Measure the voltage of the Ignition Switch Output Run circuit between the Airbag Run circuit fuse and ground. Is the voltage above approximately 4.5 volts? Yes → Go To 6 No → Repair the open Ignition Switch Output Run circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Reinstall the airbag Run fuse. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Fused Ignition Switch Output Run circuit at the Airbag Control Module connector. Is the voltage above approximately 4.5 volts? Yes → Go To 7 No → Repair the an open or high resistance in the Fused Ignition Switch Output Run circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LOSS OF IGNITION RUN ONLY — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
8	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
NO CLUSTER MESSAGE

When Monitored and Set Condition:

NO CLUSTER MESSAGE

When Monitored: With ignition on, the ACM monitors the PCI Bus for a message from the MIC containing the airbag warning indicator status. The MIC transmits the message one time at ignition on, lamp state change, or in response to the ACM message.

Set Condition: If the MIC message is not received for 10 consecutive seconds, the code will set.

POSSIBLE CAUSES
MIC, COMMUNICATION FAILURE
ACM, NO CLUSTER MESSAGES
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** Turn the ignition on. SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition on. With the DRBIII®, ensure PCI Bus communications with the Instrument Cluster. Is the Instrument Cluster communicating on the PCI Bus? Yes → Go To 3 No → Refer to category COMMUNICATION CATEGORY and select the related symptom INSTRUMENT CLUSTER BUS +/- SIGNAL OPEN.	All

NO CLUSTER MESSAGE — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom List:

NO PASSENGER SIDE IMPACT SENSOR COMMUNICATION
PASSENGER SIDE IMPACT SENSOR INTERNAL 1

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be NO PASSENGER SIDE IMPACT SENSOR TEST.

When Monitored and Set Condition:

NO PASSENGER SIDE IMPACT SENSOR COMMUNICATION

When Monitored: The ACM continuously communicates with the Passenger Side Impact Sensor over the sensor signal circuit. The sensor communication and onboard diagnostics are powered by the ACM signal.

Set Condition: The code will set, if the ACM and Passenger Side Impact Sensor do not establish and maintain valid data communications.

PASSENGER SIDE IMPACT SENSOR INTERNAL 1

When Monitored: The Right Front Impact sensors is equipped with onboard diagnostics to monitor the sensors internal circuits. If a problem is identified the sensor sends the Passenger Side Impact sensor internal 1 message to the ACM.

Set Condition: The code will set if the ACM receives an internal 1 message from the Passenger Side Impact Sensor.

POSSIBLE CAUSES
SIGNAL CIRCUIT SHORTED TO BATTERY
SIGNAL CIRCUIT SHORT TO GROUND
PASSENGER SIDE SENSOR CIRCUITS SHORTED TOGETHER
GROUND CIRCUIT OPEN
SIGNAL CIRCUIT OPEN
ACM, PASSENGER SIDE IMPACT SENSOR
REPAIR IS COMPLETE
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

NO PASSENGER SIDE IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 9 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Side Impact Sensor connector. Disconnect the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Passenger Side Impact Sensor Signal circuit between the Passenger Side Impact Sensor connector and ground. Is there any voltage present? Yes → Repair the Passenger Side Impact Sensor Signal circuit shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Measure the resistance of the Passenger Side Impact Sensor Signal circuit between the Passenger Side Impact Sensor connector and ground. Is the resistance below 100K ohms? Yes → Repair the Passenger Side Sense signal circuit shorted for a short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the resistance between the Passenger Side Impact Sensor Signal and Sensor Ground circuits at the Passenger Side Impact Sensor connector. Is the resistance below 100K ohms? Yes → Repair the Passenger Side Impact Sensor circuits shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All
5	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Passenger Side Impact Sensor Ground circuit between the Passenger Side Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 6 No → Repair the Passenger Side Front Impact Sensor Ground circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All

NO PASSENGER SIDE IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
6	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Passenger Side Impact Sensor Signal circuit between the Passenger Side Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 7 No → Repair the Passenger Side Impact Sensor Signal circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All
7	Replace the Passenger Side Impact Sensor. Reconnect the vehicle body harness to the impact sensor. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Connect the DRB to the Data Link Connector - use the most current software available. Use the DRB III and erase the stored codes in all airbag system modules. Turn the Ignition Off, and wait 15 seconds before turning the Ignition On. Wait one minute, and read active codes and if there are none present read the stored codes. DID the active Passenger Side Impact Sensor DTC return? Yes → Go To 8 No → Test Complete.	All
8	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

NO PASSENGER SIDE IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
NO PCI TRANSMISSION

When Monitored and Set Condition:

NO PCI TRANSMISSION

When Monitored: With the ignition on and the module transmitting information on the PCI BUS.

Set Condition: The code will set if the onboard diagnostic cannot detect the module transmitting information on the PCI BUS for 4 consecutive seconds. NOTE: Any PCI Bus Failure will may cause a stored code to set.

POSSIBLE CAUSES
AIRBAG CONTROL MODULE - ACM
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** IF THE MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Turn the ignition on. From the list below, select the appropriate module and DTC type for the this diagnostic trouble code. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** Select the appropriate module and type of DTC ACM - ACTIVE WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING. Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1. ACM - STORED Go To 2	All

NO PCI TRANSMISSION — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom List:

NO RIGHT FRONT IMPACT SENSOR COMMUNICATION
RIGHT FRONT IMPACT SENSOR INTERNAL 1

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be NO RIGHT FRONT IMPACT SENSOR TEST.

When Monitored and Set Condition:

NO RIGHT FRONT IMPACT SENSOR COMMUNICATION

When Monitored: The ACM continuously communicates with the Right Front Impact Sensor over the sensor signal circuit. The sensor communication and onboard diagnostics are powered by the ACM signal.

Set Condition: The code will set, if the ACM and Right Front Sensor do not establish and maintain valid data communications.

RIGHT FRONT IMPACT SENSOR INTERNAL 1

When Monitored: The Right Front Impact sensors is equipped with onboard diagnostics to monitor the sensors internal circuits. If a problem is identified the sensor sends the Right Front Impact sensor internal 1 message to the ACM.

Set Condition: The code will set if the ACM receives an internal 1 message from the Right Front Impact Sensor.

POSSIBLE CAUSES
SIGNAL CIRCUIT SHORTED TO BATTERY
SIGNAL CIRCUIT SHORT TO GROUND
RIGHT SENSOR CIRCUITS SHORTED TOGETHER
GROUND CIRCUIT OPEN
SIGNAL CIRCUIT OPEN
ACM, RIGHT FRONT IMPACT SENSOR
REPAIR IS COMPLETE
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

NO RIGHT FRONT IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 9 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Right Front Impact Sensor connector. Disconnect the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Right Front Impact Sensor Signal circuit between the Right Sensor connector and ground. Is there any voltage present? Yes → Repair the Right Front Impact Sensor Signal circuit shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Measure the resistance of the Right Impact Sensor Signal circuit between the Right Impact Sensor connector and ground. Is the resistance below 100K ohms? Yes → Repair the Right Impact Sense signal circuit shorted for a short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the resistance between the Right Front Impact Sensor Signal and Sensor Ground circuits at the Right Impact Sensor connector. Is the resistance below 100K ohms? Yes → Repair the Right Front Impact Sensor circuits shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All
5	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Right Front Impact Sensor Ground circuit between the Right Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 6 No → Repair the Right Front Impact Sensor Ground circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All

NO RIGHT FRONT IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
6	Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Measure the resistance of the Right Front Impact Sensor Signal circuit between the Right Impact Sensor connector and the Load Tool adaptor. Is the resistance below 1 ohm? Yes → Go To 7 No → Repair the Right Front Impact Sensor Signal circuit open or high resistance. Perform AIRBAG VERIFICATION TEST - VER 1.	All
7	Replace the Right Front Impact Sensor. Reconnect the vehicle body harness to the impact sensor. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Connect the DRB to the Data Link Connector - use the most current software available. Use the DRB III and erase the stored codes in all airbag system modules. Turn the Ignition Off, and wait 15 seconds before turning the Ignition On. Wait one minute, and read active codes and if there are none present read the stored codes. DID the active Right Impact Sensor DTC return? Yes → Go To 8 No → Repair is complete.	All
8	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

NO RIGHT FRONT IMPACT SENSOR TEST — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER CURTAIN SQUIB CIRCUIT OPEN

When Monitored and Set Condition:

PASSENGER CURTAIN SQUIB CIRCUIT OPEN

When Monitored: With the ignition is On, the ACM monitors the resistance of the Curtain Squib circuits.

Set Condition: When the ACM detects an open circuit or high resistance on the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG OPEN
CURTAIN SQUIB LINE 1 OR LINE 2 CIRCUIT OPEN
ACM, CURTAIN SQUIB CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: RIGHT SIACM - ACTIVE DTC Go To 2 RIGHT SIACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER CURTAIN SQUIB CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the ACM active DTC's. Does the DRB show CURTAIN SQUIB CIRCUIT OPEN? Yes → Go To 3 No → Replace Curtain Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module Connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Side Impact Airbag Control Module connector. Measure the resistance of the Curtain Squib Line 1 and Line 2 circuits between the Load Tool SIACM adaptor and the Curtain Airbag connector. Is the resistance below 1.0 ohms on both circuits? Yes → Test Complete. No → Repair open or high resistance in the Curtain Squib Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER CURTAIN SQUIB CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER CURTAIN SQUIB CIRCUIT SHORT

When Monitored and Set Condition:

PASSENGER CURTAIN SQUIB CIRCUIT SHORT

When Monitored: When the ignition is on, the ACM monitors the resistance between the Curtain Squib circuits.

Set Condition: When the ACM detects a low resistance between the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG SHORT
CURTAIN SQUIB LINE 1 SHORT TO LINE 2
ACM, CURTAIN SQUIB CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER CURTAIN SQUIB CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRB, read the ACM active DTC's. Does the DRB show CURTAIN SQUIB CIRCUIT SHORT? Yes → Go To 3 No → Replace Curtain Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the ACM connector. Measure the resistance between the Curtain Squib Line 1 and Line 2 circuits at the Curtain Airbag connector. Is the resistance below 10K ohms? Yes → Repair Curtain Squib Line 1 shorted to Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Test Complete.	All

PASSENGER CURTAIN SQUIB CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER CURTAIN SQUIB SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER CURTAIN SQUIB SHORT TO BATTERY

When Monitored: When the ignition is on, the ACM monitors the voltage of the Curtain Squib circuits.

Set Condition: When the ACM detects high voltage on the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG SHORT TO BATTERY
CURTAIN SQUIB LINE 1 OR LINE 2 SHORTED TO BATTERY
ACM, CURTAIN SQUIB SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: RIGHT SIACM - ACTIVE DTC Go To 2 RIGHT SIACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read ACM active DTC's. Does the DRBIII® display CURTAIN SQUIB SHORT TO BATTERY? Yes → Go To 3 No → Replace Curtain Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER CURTAIN SQUIB SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool ACM adaptor to the ACM connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Curtain Squib Line 1 and Line 2 circuits between the Curtain Airbag connector and ground. Is any voltage present on either circuit? Yes → Repair Curtain Squib Line 1 or Line 2 shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Test Complete.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:

PASSENGER CURTAIN SQUIB SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER CURTAIN SQUIB SHORT TO GROUND

When Monitored: When the ignition is on, the ACM monitors the resistance of the Curtain Squib circuits.

Set Condition: When the ACM detects a short to ground on the Curtain Squib circuits.

POSSIBLE CAUSES
CURTAIN AIRBAG SHORT TO GROUND
CURTAIN SQUIB LINE 1 OR LINE 2 SHORTED TO GROUND
ACM, CURTAIN SQUIB SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ONE: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Curtain Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Curtain Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read ACM active DTC's. Does the DRBIII® display CURTAIN SQUIB SHORT TO GROUND? Yes → Go To 3 No → Replace the Curtain Airbag in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER CURTAIN SQUIB SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED CURTAIN AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Load Tool Jumper. Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool ACM adaptor to the ACM connector. Measure the resistance of the Curtain Squib Line 1 and Line 2 circuits between the Curtain Squib connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Curtain Squib Line 1 or Line 2 shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Test Complete.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SEAT BELT SWITCH CIRCUIT OPEN

When Monitored and Set Condition:

PASSENGER SBS CIRCUIT OPEN

When Monitored: The ACM monitors the Seat Belt Buckle Switch circuit for an open condition.

Set Condition: The code will set if the ACM does not detect the correct circuit voltage.

POSSIBLE CAUSES
PASSENGER SBS OPEN
PASSENGER SEAT BELT SWITCH CIRCUITS OPEN
ACM, PASSENGER SEAT BELT SWITCH CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition off. Disconnect the Passenger Seat Belt Switch. **NOTE: Check connectors - Clean and repair as necessary.** Turn the ignition on. Measure the voltage between Passenger Seat Belt Switch Line 1 and Line 2 circuits and ground. Is there voltage present on both circuits? Yes → Replace the Passenger Seat Belt Switch Buckle Assembly. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All

PASSENGER SEAT BELT SWITCH CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connectors. Measure the resistance of the Driver SBS Line 1 and line 2 circuits between the Passenger SBS harness connector and Airbag Load Tool adaptor. Is the resistance below 1.0 ohms on both circuits? Yes → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair the open Passenger Seat Belt Switch Line 1 or Line 2. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SEAT BELT SWITCH SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER SEAT BELT SWITCH SHORT TO BATTERY

When Monitored: The ACM monitors the Seat Belt Buckle Switch circuit for an short to battery.

Set Condition: The code will set if the ACM detects high circuit voltage.

POSSIBLE CAUSES
PASSENGER SEAT BELT SWITCH CIRCUITS SHORTED TO BATTERY
PASSENGER SEAT BELT SWITCH SHORT TO BATTERY
ACM, PASSENGER SEAT BELT SWITCH SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition off. **NOTE: Ensure that the battery is fully charged.** Disconnect the Passenger Seat Belt Switch connector. **NOTE: Check connectors - Clean and repair as necessary.** Turn the ignition on. With the DRBIII®, read the active Airbag DTCs. Does the DRB show PASSENGER SBS CIRCUIT OPEN? Yes → Replace the Passenger Seat Belt Switch Buckle Assembly. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SEAT BELT SWITCH SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the Passenger SBS Line 1 and Line 2 circuits at the Passenger SBS connector. Is there any voltage present? Yes → Repair the Passenger Seat Belt Switch line 1 or line 2 shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SEAT BELT SWITCH SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER SEAT BELT SWITCH SHORT TO GROUND

When Monitored: The ACM monitors the Seat Belt Buckle Switch circuit for a shorted together or shorted to ground condition.

Set Condition: The code will set if the ACM detects low circuit voltage.

POSSIBLE CAUSES
PASSENGER SEAT BELT SWITCH SHORT TOGETHER OR TO GROUND
PASSENGER SEAT BELT SWITCH CIRCUITS SHORTED TOGETHER
PASSENGER SEAT BELT SWITCH CIRCUITS SHORTED TO GROUND
ACM, PASSENGER SEAT BELT SWITCH SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn Ignition off. Disconnect the Passenger Seat Belt Switch connector. **NOTE: Check connectors - Clean and repair as necessary.** Turn Ignition on. With the DRBIII®, read the active Airbag DTCs. Does the DRB show PASSENGER SBS CIRCUIT OPEN? Yes → Replace the Passenger Seat Belt Switch Buckle Assembly. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All

PASSENGER SEAT BELT SWITCH SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance between the Driver SBS Line 1 and line 2 circuit at the Passenger SBS connector. Is the resistance below 10K ohms? Yes → Repair the Passenger Seat Belt Switch Line 1 and Line 2 shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Passenger SBS Line 1 and line 2 circuit between the Passenger SBS connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair the Passenger Seat Belt Switch line 1 or line 2 shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with the Service information. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 CIRCUIT OPEN

When Monitored and Set Condition:

PASSENGER SQUIB 1 CIRCUIT OPEN

When Monitored: When the ignition is On, the ACM monitors the resistance of the Passenger Squib 1 circuits.

Set Condition: The ACM has detected an open circuit or high resistance on the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG OPEN
PASSENGER SQUIB 1 LINE 1 OR LINE 2 CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACM, PASSENGER SQUIB 1 CIRCUIT OPEN
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT OPEN? Yes → Go To 3 No → Replace the Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Passenger Airbag connector. Measure the resistance of the Passenger Squib 1 Line 1 and Line 2 circuit between the ACM Adaptor and the Passenger Airbag connector. Is the resistance below 1.0 ohms on both circuits? Yes → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair open or high resistance in Passenger Squib 1 Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All

PASSENGER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 CIRCUIT SHORT

When Monitored and Set Condition:

PASSENGER SQUIB 1 CIRCUIT SHORT

When Monitored: When the ignition is on, the ACM monitors the resistance of the Passenger Squib 1 circuits.

Set Condition: The ACM has detected low resistance in the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG CIRCUIT SHORT
PASSENGER SQUIB 1 LINE 1 SHORT TO LINE 2
ACM, PASSENGER SQUIB 1 CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active airbag DTCs. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT SHORT? Yes → Go To 3 No → Replace Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adapter to the Airbag Control Module connector. Disconnect the Load Tool from the Passenger airbag connector. Measure the resistance between Passenger Squib 1 Line 1 and Squib 1 Line 2 circuit at the Passenger Airbag connector. Is the resistance below 10K ohms? Yes → Repair Passenger Squib 1 Line 1 circuit short to Passenger Squib 1 Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER SQUIB 1 SHORT TO BATTERY

When Monitored: When the ignition is on, the ACM monitors the voltage of the Passenger Squib 1 circuits.

Set Condition: The ACM has detected high voltage on the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG CIRCUIT SHORT TO BATTERY
PASSENGER SQUIB 1 LINE 1 OR LINE 2 SHORT TO BATTERY
ACM, PASSENGER SQUIB 1 CIRCUIT SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT SHORT TO BATTERY? Yes → Go To 3 No → Replace Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** Disconnect the Load Tool from the Passenger Airbag connector. Measure the voltage on the Passenger Squib 1 Line 1 and Line 2 circuits between the Passenger Airbag connector and ground. Is there any voltage present? Yes → Repair Passenger Squib 1 Line 1 or Line 2 circuit short to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER SQUIB 1 SHORT TO GROUND

When Monitored: When the ignition is on, the ACM monitors the resistance of the Passenger Squib 1 circuits for low resistance.

Set Condition: The ACM has detected a short to ground in the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG CIRCUIT SHORT TO GROUND
PASSENGER SQUIB 1 LINE 1 AND LINE 2 SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACM, PASSENGER SQUIB 1 CIRCUIT SHORT TO GROUND
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: Connect the appropriate Load Tool to the Passenger Airbag connector.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT SHORT TO GROUND? Yes → Go To 3 No → Replace the Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Passenger Airbag connector. Measure the resistance of the Passenger Squib 1 Line 1 or Line 2 circuit between the Passenger Airbag Module Connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Passenger Squib 1 Line 1 and Line 2 circuits for a short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 2 CIRCUIT OPEN

When Monitored and Set Condition:

PASSENGER SQUIB 2 CIRCUIT OPEN

When Monitored: When the ignition is On, the ACM monitors the resistance of the Passenger Squib 2 circuits.

Set Condition: The ACM has detected an open circuit or high resistance on the Passenger Squib 2 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG OPEN
PASSENGER SQUIB 2 LINE 1 OR LINE 2 CIRCUIT OPEN
ACM, PASSENGER SQUIB 2 CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SQUIB 2 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show PASSENGER SQUIB 2 CIRCUIT OPEN? Yes → Go To 3 No → Replace Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Passenger Airbag connector. Measure the resistance of the Passenger Squib 2 Line 1 and Line 2 circuits between the ACM adaptor and the Passenger Airbag connector. Is the resistance below 1.0 ohms on both circuits? Yes → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair open or high resistance in Passenger Squib 2 Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 2 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 2 CIRCUIT SHORT

When Monitored and Set Condition:

PASSENGER SQUIB 2 CIRCUIT SHORT

When Monitored: When the ignition is on, the ACM monitors the resistance of the Passenger Squib 2 circuits.

Set Condition: The ACM has detected low resistance in the Passenger Squib 2 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG CIRCUIT SHORT
PASSENGER SQUIB 1 LINE 1 SHORT TO LINE 2
STORED CODE OR INTERMITTENT CONDITION
ACM, PASSENGER SQUIB 2 CIRCUIT SHORT
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active DTCs. Does the DRB show PASSENGER SQUIB 2 CIRCUIT SHORT? Yes → Go To 3 No → Replace Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 2 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connectors. Disconnect the Load Tool from the Passenger Airbag connector. Measure the resistance between the Passenger Squib 2 Line 1 and line 2 circuits at the Passenger Airbag connector. Is the resistance below 10K ohms? Yes → Repair Passenger Squib 2 Line 1 circuit short to Passenger Squib 2 Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 2 SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER SQUIB 2 SHORT TO BATTERY

When Monitored: When the ignition is on, the ACM monitors the voltage of the Passenger Squib 2 circuits.

Set Condition: The ACM has detected high voltage on the Passenger Squib 2 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG CIRCUIT SHORT TO BATTERY
PASSENGER SQUIB 2 LINE 1 OR LINE 2 SHORTED TO BATTERY
ACM, PASSENGER SQUIB 2 CIRCUIT SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show PASSENGER SQUIB 2 CIRCUIT SHORT TO BATTERY? Yes → Go To 3 No → Replace Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 2 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Disconnect the Load Tool from the Passenger Airbag connector. Measure the voltage on the Passenger Squib 2 Line 1 and Line 2 circuits between the Passenger Airbag connector and ground. Is there any voltage present? Yes → Repair Passenger Squib 2 Line 1 or Line 2 circuit shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 2 SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER SQUIB 2 SHORT TO GROUND

When Monitored: When the ignition is on, the ACM monitors the resistance of the Passenger Squib 2 circuits for low resistance.

Set Condition: The ACM has detected a short to ground in the Passenger Squib 2 circuits.

POSSIBLE CAUSES
PASSENGER AIRBAG CIRCUIT SHORTED TO GROUND
PASSENGER SQUIB 2 LINE 1 OR LINE 2 SHORT TO GROUND
ACM, PASSENGER SQUIB 2 CIRCUIT SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the battery is fully charged.** Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Passenger Airbag connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Passenger Airbag connector. **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag DTCs. Does the DRB show PASSENGER SQUIB 2 CIRCUIT SHORT TO GROUND? Yes → Go To 3 No → Replace the Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 2 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean repair as necessary.** Connect the appropriate Load Tool adaptor to the Airbag Control Module connector. Disconnect the Load Tool from the Passenger Airbag connector. Measure the resistance of the Passenger Squib 2 Line 1 and Line 2 circuits between the Passenger Airbag Module connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Passenger Squib 2 Line 1 or Line 2 circuit for a shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**NOTE: Ensure the battery is fully charged.** With the DRBIII®, record and erase all DTCs from all modules. All active codes must be resolved before diagnosing any stored codes. Maintain a safe distance from all airbags while performing the following steps. With the DRBIII® monitor active codes as you work through the system. **NOTE: If equipped with Passenger Airbag On-Off switch, read the DTC's in all switch positions.** Wiggle the wiring harness and connectors of the appropriate airbag system and rotate the steering wheel from stop to stop. **NOTE: Check connectors - Clean and repair as necessary.** You have just attempted to simulate the condition that initially set the trouble code message. The following additional checks may assist you in identifying a possible intermittent problem: - Visually inspect related wire harness connectors. Look for broken, bent, pushed out, spread, corroded, or contaminated terminals. - Visually inspect the related harnesses. Look for chafed, pierced, pinched or partially broken wire. - Refer to Wiring Diagrams and Technical Service Bulletins that may apply. Did the DTC become active ? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
*AIRBAG INDICATOR ON WITHOUT ACTIVE TROUBLE CODES

POSSIBLE CAUSES
FRONT OR SIDE IMPACT SENSOR STORED TROUBLE CODE
ACM, IMPACT SENSOR INTERNAL 1 STORED TROUBLE CODE
INSTRUMENT CLUSTER PROBLEMS

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Make sure that all Airbag and Instrument Cluster active DTCs have been repaired before performing this procedure. With the DRBIII® select MONITOR DISPLAY, WARNING LAMP STATUS and read the PASSIVE RESTRAINTS, AIRBAG, MONITOR DISPLAY, WARNING LAMP STATES. With no active DTCs, Does the LAMP REQ by ACM monitor show ON? Yes → Go To 2 No → Repair or replace the Instrument Cluster as necessary. Perform BODY VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	With the DRBIII®, read the stored DTCs. Does the DRB show a stored FRONT or SIDE IMPACT SENSOR INTERNAL 1 trouble code? Yes → WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING. Replace the front or side impact sensor indicated by the stored diagnostic trouble code. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Instructions. WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
ALL OUTPUTS SHORT - BASE AUDIO SYSTEM

When Monitored and Set Condition:

ALL OUTPUTS SHORT - BASE AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
FRONT SHORTED SPEAKER
REAR SHORTED SPEAKER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display ALL OUTPUTS SHORT? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each front speaker and each I/P speaker (if equipped) connector.** Disconnect each front speaker and each I/P speaker (if equipped) harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with all the speakers disconnected? Yes → Go To 3 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All

ALL OUTPUTS SHORT - BASE AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each rear speaker connector.** Disconnect each rear speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with all the rear speakers disconnected? Yes → Go To 4 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect each front and rear speaker harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect each front and rear speaker harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect each front and rear speaker harness connectors. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM

When Monitored and Set Condition:

ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
SPEAKER SECTION OF POWER AMPLIFIER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display ALL OUTPUTS SHORT? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT? Yes → Go To 3 No → Replace the Power Amplifier in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and any speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and any speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:

CASSETTE PLAYER INOP
CD MECHANICAL FAILURE
***AM/FM SWITCH INOPERATIVE**
***ANY STATION PRESET SWITCH INOPERATIVE**
***BALANCE INOPERATIVE**
***CD EJECT SWITCH INOPERATIVE**
***EQUALIZER INOPERATIVE**
***FADER INOPERATIVE**
***FF/RW SWITCH INOPERATIVE**
***HOUR/MINUTE SWITCHES INOPERATIVE**
***PAUSE/PLAY SWITCH INOPERATIVE**
***PWR SWITCH INOPERATIVE**
***SCAN SWITCH INOPERATIVE**
***SEEK SWITCH INOPERATIVE**
***SET SWITCH INOPERATIVE**
***TAPE EJECT SWITCH INOPERATIVE**
***TIME SWITCH INOPERATIVE**
***TUNE SWITCH INOPERATIVE**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be CASSETTE PLAYER INOP.

When Monitored and Set Condition:

CASSETTE PLAYER INOP

When Monitored: Continuously with the ignition and radio turned on.

Set Condition: The code will set if the radio detects a internal cassette failure.

CD MECHANICAL FAILURE

When Monitored: Continuously with the ignition and CD player turned on.

Set Condition: The code will set if the radio detects a CD mechanical failure.

CASSETTE PLAYER INOP — Continued

POSSIBLE CAUSES
INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	**NOTE: If a DTC is set, erase the DTC and attempt to reset the DTC. If DTC resets, follow this test.** This is an internal radio failure. View repair Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CD CHANGER MECHANICAL FAILURE

When Monitored and Set Condition:

CD CHANGER MECHANICAL FAILURE

When Monitored: Continuously with the ignition and CD Changer turned on.

Set Condition: The code will set if the CD Changer detects a mechanical failure.

POSSIBLE CAUSES
INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	**NOTE: Erase DTC and attempt to reset. If DTC resets, follow this test.** This is an internal CD Changer failure. View repair Repair Replace the CD Changer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CD CHANGER READ FAILURE

When Monitored and Set Condition:

CD CHANGER READ FAILURE

When Monitored: Continuously with the ignition and CD Changer turned on.

Set Condition: The code will set if a CD that is not formatted as a music CD is installed in the CD Changer.

POSSIBLE CAUSES
CD CHANGER READ FAILURE

TEST	ACTION	APPLICABILITY
1	Replace the problem CD with a good, clean, unscratched, music CD. Turn the radio on and select the good CD. With the DRBIII®, read DTC's. Does the DRBIII® display CD CHANGER READ FAILURE? Yes → Replace the CD Changer. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CD CHANGER TEMPERATURE HIGH

When Monitored and Set Condition:

CD CHANGER TEMPERATURE HIGH

When Monitored: Continuously with the ignition and CD Changer turned on.

Set Condition: The code will set if the temperature inside the CD Changer is above +65° C (+145° F).

POSSIBLE CAUSES
HIGH TEMPERATURE FAILURE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the audio DTC's. Start the engine and allow the engine to reach normal operating temperature. If the vehicle has been in the hot sunlight or extreme cold move the vehicle indoors and open the doors to allow the inside temperature to stabilize. The CD Changer will operate between -23° C and 65° C (-10° F and +145° F). With the DRBIII®, read DTC's. Does the DRBIII® display CD CHANGER TEMPERATURE HIGH? Yes → Replace the CD Changer. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CD READ FAILURE

When Monitored and Set Condition:

CD READ FAILURE

When Monitored: Continuously with the ignition and the radio CD player turned on.

Set Condition: The code will set if a CD that is not formatted as a music CD is installed in the radio CD player.

POSSIBLE CAUSES
CD READ FAILURE

TEST	ACTION	APPLICABILITY
1	Replace the problem CD with a good, clean, unscratched, music CD. Turn the radio CD player on. With the DRBIII®, read DTC's. Does the DRBIII® display CD READ FAILURE? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CD TEMPERATURE HIGH

When Monitored and Set Condition:

CD TEMPERATURE HIGH

When Monitored: Continuously with the ignition and the radio CD player turned on.

Set Condition: The code will set if the temperature inside the radio CD player is above +70° C (+156° F).

POSSIBLE CAUSES
HIGH TEMPERATURE FAILURE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the audio DTC's. Start the engine and allow the engine to reach normal operating temperature. If the vehicle has been in the hot sunlight or extreme cold move the vehicle indoors and open the doors to allow the inside temperature to stabilize. The radio CD player will operate between -23° C and 70° C (-10° F and +156° F). With the DRBIII®, read DTC's. Does the DRBIII® display CD TEMPERATURE HIGH? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
NO ANTENNA CONNECTION

When Monitored and Set Condition:

NO ANTENNA CONNECTION

When Monitored: With the ignition on and the radio in seek up/down mode.

Set Condition: With the radio in seek or scan mode for two minutes and the radio does not detect an antenna connection or does not receive a radio station signal.

POSSIBLE CAUSES
BAD ANTENNA CONNECTION
TEST ANTENNA
RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Radio Antenna connector. Inspect the Radio Antenna connection. Was the Antenna connection clean and tight? Yes → Go To 2 No → Repair Antenna connection as needed. Perform BODY VERIFICATION TEST - VER 1.	All
2	Refer to the Audio System in the service information and test the Antenna in accordance with the service procedure. Is the Antenna ok? Yes → Go To 3 No → Repair or replace the Antenna assembly as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
3	**Note: Reconnect all previously disconnected components.** Turn the ignition and Radio on. With the DRBIII®, erase the audio DTC's, put the radio in seek up and seek down mode for approximately 2 minutes before proceeding. With the DRBIII®, read the audio DTC's. Did this DTC reset? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
POWER AMP SHUTDOWN - BASE AUDIO SYSTEM

When Monitored and Set Condition:

POWER AMP SHUTDOWN - BASE AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
FRONT SHORTED SPEAKER
REAR SHORTED SPEAKER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display POWER AMP SHUTDOWN? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each front speaker and each I/P speaker (if equipped) connector.** Disconnect each front speaker and each I/P speaker (if equipped) harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with all the speakers disconnected? Yes → Go To 3 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All

POWER AMP SHUTDOWN - BASE AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each rear speaker connector.** Disconnect each rear speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with all the rear speakers disconnected? Yes → Go To 4 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect each front and rear speaker harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect each front and rear speaker harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect each front and rear speaker harness connectors. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM

When Monitored and Set Condition:

POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
SPEAKER SECTION OF POWER AMPLIFIER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display POWER AMP SHUTDOWN? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN? Yes → Go To 3 No → Replace the Power Amplifier in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and any speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Disconnect the Radio harness connector. Measure the resistance between ground and any speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Power Amplifier harness connectors. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RADIO DIMMING SHORTED HIGH

When Monitored and Set Condition:

RADIO DIMMING SHORTED HIGH

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The BCM is trying to activate the radio dimming output (park lamps on and parade mode requested). The code will set if the BCM pulls this input low and excessive current is sinked into the BCM.

POSSIBLE CAUSES
DIMMER SECTION OF RADIO
PANEL LAMPS DRIVER CIRCUIT SHORTED TO VOLTAGE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Radio harness connector. Turn the ignition on. Turn the park lamps on. Measure the voltage of the Panel Lamps Driver circuit at the Radio connector. Rotate the dimmer switch from full low intensity to full high intensity. Does the voltage increase from approximately 3.5 volts to approximately 12.0 volts? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Radio harness connector. Disconnect the BCM C1 harness connector. Turn the ignition on. Measure the voltage of the Panel Lamps Driver circuit at the Radio connector. Is the voltage above 1.0 volt? Yes → Repair the Panel Lamps Driver circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
REMOTE RADIO SWITCH SHORTED TO GROUND

When Monitored and Set Condition:

REMOTE RADIO SWITCH SHORTED TO GROUND

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The code will set if the BCM detects a short to ground on the Radio Control MUX circuit for more than 5 seconds.

POSSIBLE CAUSES
LEFT REMOTE RADIO SWITCH SHORTED TO GROUND
RIGHT REMOTE RADIO SWITCH SHORTED TO GROUND
RADIO CONTROL MUX CIRCUIT SHORTED TO GROUND AT THE SWITCH
RADIO CONTROL MUX CIRCUIT SHORTED TO THE RETURN CIRCUIT AT THE SWITCH
CLOCKSPRING SHORTED TO GROUND
RADIO CONTROL MUX CIRCUIT SHORTED TO GROUND
RADIO CONTROL MUX CKT SHORTED TO THE RADIO CONTROL MUX RETURN CKT
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**WARNING: Turn the ignition off, disconnect the battery and wait 2 minutes before proceeding.** **CAUTION: Do not place an intact undeployed airbag module face down on a hard surface, the airbag module will propel into the air if accidently deployed.** Remove the Driver Airbag Module. Disconnect the Left Remote Radio Switch harness connector. Turn the ignition on, reconnect the battery. With the DRB, enter Body Computer then Sensors and monitor the Radio Control SW voltage Is the voltage approximately 5.0 volts? Yes → Replace the Left Remote Radio Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All

REMOTE RADIO SWITCH SHORTED TO GROUND — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: Turn the ignition off, disconnect the battery and wait 2 minutes before proceeding.** **CAUTION: Do not place an intact undeployed airbag module face down on a hard surface, the airbag module will propel into the air if accidently deployed.** Remove the Driver Airbag Module. Disconnect the Right Remote Radio Switch harness connector. Turn the ignition on, reconnect the battery. With the DRB, enter Body Computer then Sensors and monitor the Radio Control SW voltage Is the voltage approximately 5.0 volts? Yes → Replace the Right Remote Radio Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Clockspring C4 harness connector. Turn the ignition on. With the DRB, enter Body Computer then Sensors and monitor the Radio Control SW voltage. Is the voltage approximately 5.0 volts? Yes → Go To 4 No → Go To 5	All
4	Turn the ignition off. Disconnect the Clockspring C4 harness connector. **NOTE: Ensure both remote radio switches are disconnected.** Measure the resistance between ground and the Radio Control MUX circuit at the clockspring C4 harness connector. Is the resistance below 5.0 ohms? Yes → Repair the Radio Control MUX circuit for a short to ground between the clockspring and the remote radio switches. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Radio Control MUX circuit for a short to the Radio Control MUX Return circuit between the clockspring and the remote radio switches. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Turn the ignition on. With the DRB, enter Body Computer then Sensors and monitor the Radio Control SW voltage. Is the voltage approximately 5.0 volts? Yes → Replace the Clockspring. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All

REMOTE RADIO SWITCH SHORTED TO GROUND — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Disconnect the BCM C2 harness connector. Measure the resistance between ground and the Radio Control MUX circuit. Is the resistance below 5.0 ohms? Yes → Repair the Radio Control MUX circuit for a short to ground between the clockspring and the BCM. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Disconnect the BCM C2 harness connector. Measure the resistance between the Radio Control MUX circuit and the Radio Control MUX Return circuit. Is the resistance below 5.0 ohms? Yes → Repair the Radio Control MUX circuit for a short to the Radio Control MUX Return circuit between the clockspring and the BCM. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO SOUND FROM ALL SPEAKERS

POSSIBLE CAUSES
INTERMITTENT SHORT - FUSE #5
POWER AMPLIFIER - INTERNAL SHORT
RADIO - FUSED B+ CKT SHORTED
FUSED B+ CIRCUIT SHORTED TO GROUND
INTERMITTENT SHORT - FUSE #30
RADIO - FUSED IGNITION SWITCH CKT SHORTED
FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
OPEN FUSED B+ CIRCUIT TO RADIO
OPEN FUSED IGNITION SWITCH OUTPUT CKT TO RADIO
OPEN RADIO GROUND CIRCUIT
OPEN FUSED B+ CIRCUIT TO POWER AMPLIFIER
OPEN GROUND CIRCUIT TO POWER AMPLIFIER
OPEN ENABLE SIGNAL TO AMPLIFIER CIRCUIT
ENABLE SIGNAL TO AMPLIFIER CIRCUIT SHORTED TO GROUND
RADIO (NO SPEAKER OUTPUT)
RADIO (NO ENABLE SIGNAL TO AMPILIFER)
POWER AMPLIFIER (NO OUTPUT)

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Remove and inspect fuse #5 in the Junction Block. Is the fuse open? Yes → Go To 2 No → Go To 5	All
2	Replace fuse #5 in the Junction Block. Turn the radio on. Remove and inspect fuse #5 in the Junction Block. Is the fuse open? Yes → Go To 3 No → Replace fuse #5 in the Junction Block. Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short to ground condition. Perform BODY VERIFICATION TEST - VER 1.	All

*NO SOUND FROM ALL SPEAKERS — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: If vehicle is not equipped with a power amplifier, answer yes to the question.** Turn the ignition off. Disconnect the Power Amplifier harness connector. Replace fuse #5 in the Junction Block. Turn the radio on. Remove and inspect fuse #5 in the Junction Block. Is the fuse open? Yes → Go To 4 No → Replace the Power Amplifier. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the Radio harness connector. Replace fuse #5 in the Junction Block. Remove and inspect fuse #5 in the Junction Block. Is the fuse open? Yes → Repair the Fused B+ circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Remove and inspect fuse #30 in the Junction Block. Is the fuse open? Yes → Go To 6 No → Go To 8	All
6	Turn the ignition off. Replace fuse #30 in the Junction Block. Turn the ignition on. Turn the radio on. Turn the ignition off. Remove and inspect fuse #30 in the Junction Block. Is the fuse open? Yes → Go To 7 No → Replace fuse #30 in the Junction Block. Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short to ground condition. Perform BODY VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the Radio harness connector. Replace fuse #30 in the Junction Block. Cycle the ignition switch from on to off. Remove and inspect fuse #30 in the Junction Block. Is the fuse open? Yes → Repair the Fused Ignition Switch Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

*NO SOUND FROM ALL SPEAKERS — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Radio harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 9 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Disconnect the Radio harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 10 No → Repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Disconnect the Radio harness connector. Using a 12-volt test light connected to 12-volts, probe the radio ground circuit. Is the test light illuminated? Yes → Go To 11 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
11	**NOTE: If vehicle is not equipped with a power amplifier, answer yes to the question.** Turn the ignition off. Disconnect the Power Amplifier harness connector. Using a 12-volt test light connected to ground, probe both Fused B+ circuits. Is the test light illuminated for both circuits? Yes → Go To 12 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
12	**NOTE: If vehicle is not equipped with a power amplifier, answer yes to the question.** Turn the ignition off. Disconnect the Power Amplifier harness connector. Using a 12-volt test light connected to 12-volts, probe both Ground circuits. Is the test light illuminated for both circuits? Yes → Go To 13 No → Repair the Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*NO SOUND FROM ALL SPEAKERS — Continued

TEST	ACTION	APPLICABILITY
13	**NOTE: If vehicle is not equipped with a power amplifier, answer yes to the question.** Turn the ignition off. Disconnect the Radio harness connector. Disconnect the Power Amplifier harness connector. Measure the resistance of the Enable Signal to Amplifier circuit between the Radio connector and the Power Amplifier connector. Is the resistance below 5.0 ohms? Yes → Go To 14 No → Repair the Enable Signal to Amplifier circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
14	**NOTE: If vehicle is not equipped with a power amplifier, answer no to the question.** Turn the ignition off. Disconnect the Radio harness connector. Disconnect the Power Amplifier harness connector. Measure the resistance between ground and the Enable Signal to Amplifier circuit. Is the resistance below 5.0 ohms? Yes → Repair the Enable Signal to Amplifier circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 15	All
15	**NOTE: If vehicle is not equipped with a power amplifier, answer no to the question.** While back probing, measure the voltage of any speaker (+) circuit in the Radio connector. Turn the ignition and radio on. Is the voltage approximately 5.5 volts? Yes → Go To 16 No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All
16	Turn the ignition off. Disconnect the Power Amplifier harness connector. Turn the ignition and Radio on. Measure the voltage of the Enable Signal to Amplifier circuit in the Power Amplifier connector. Is the voltage above 10.0 volts? Yes → Replace the Power Amplifier. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REMOTE RADIO CONTROLS INOPERATIVE

POSSIBLE CAUSES
OPEN RADIO CONTROL MUX CIRCUIT AT THE SWITCH
OPEN RADIO CONTROL MUX RETURN CIRCUIT AT THE SWITCH
REMOTE RADIO SWITCH
BODY CONTROL MODULE - INTERNAL SHORT
OPEN CLOCKSPRING
OPEN RADIO CONTROL MUX CIRCUIT
OPEN RADIO CONTROL MUX RETURN CIRCUIT
BODY CONTROL MODULE - OPEN INTERNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: If any DTCs are set, diagnose the DTC before continuing.** Turn the ignition and radio on. Operate both remote radio switches. Are both remote radio control switches inoperative? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Turn the ignition on. With the DRB, enter Body Computer then Sensors and monitor the Radio Control SW voltage. Is the voltage approximately 5.0 volts? Yes → Go To 3 No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Turn the ignition on. Connect a jumper wire between cavity 1 and cavity 2 at the Clockspring C3 connector. With the DRB, enter Body Computer then Sensors and monitor the Radio Control SW voltage. Is the voltage approximately 0.0 volts? Yes → Check the circuits between the clockspring connector and the splice for an open. If ok, replace the Clockspring. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*REMOTE RADIO CONTROLS INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Disconnect the BCM C2 harness connector. Measure the resistance of the Radio Control MUX circuit between the BCM C2 connector and the Clockspring C3 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Radio Control MUX circuit for an open between the clockspring and the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the Clockspring C3 harness connector. Disconnect the BCM C2 harness connector. Measure the resistance of the Radio Control MUX Return circuit between the BCM C2 connector and the Clockspring C3 connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Radio Control MUX Return circuit for an open between the clockspring and the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
7	**WARNING: Turn the ignition off, disconnect the battery and wait 2 minutes before proceeding.** **CAUTION: Do not place an intact undeployed airbag module face down on a hard surface, the airbag module will propel into the air if accidently deployed.** Remove the Driver Airbag Module. Disconnect both remote radio switch harness connectors. Turn the ignition on, reconnect the battery. Measure the voltage of the Radio Control MUX circuit at the inoperative remote radio switch. Is the voltage approximately 5.0 volts? Yes → Go To 8 No → Repair the Radio Control MUX circuit for an open between the inoperative switch and the splice. Perform BODY VERIFICATION TEST - VER 1.	All

*REMOTE RADIO CONTROLS INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
8	**WARNING: Turn the ignition off, disconnect the battery and wait 2 minutes before proceeding.** **CAUTION: Do not place an intact undeployed airbag module face down on a hard surface, the airbag module will propel into the air if accidently deployed.** Remove the Driver Airbag Module. Disconnect both remote radio switch harness connectors. Disconnect the Clockspring C4 harness connector. Measure the resistance of the Radio Control MUX Return circuit between the inoperative remote radio switch and the clockspring connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the Radio Control MUX Return circuit for an open between the inoperative switch and the clockspring. Perform BODY VERIFICATION TEST - VER 1.	All
9	If there are no possible causes remaining, view repair. Repair Replace the inoperative Remote Radio Switch. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CHIME INOPERATIVE WITH KEY IN IGNITION, DRIVER DOOR OPEN

POSSIBLE CAUSES
OPEN KEY-IN SWITCH
KEY-IN IGN SWITCH GROUND CIRCUIT OPEN
KEY-IN IGN SWITCH SENSE CIRCUIT OPEN
BODY CONTROL MODULE - KEY-IN IGNITION OPEN
DOOR AJAR PROBLEMS

TEST	ACTION	APPLICABILITY
1	**Note: Ensure the interior lamps turn on and off properly.** **Note: Ensure the exterior lamps turn on and off properly.** Remove the key from the ignition switch. With the DRBIII® select: Body, INPUT OUTPUT, KEY IN IGN SW Insert the key in to the ignition switch. With the DRBIII®, read key in ignition switch status. Does the DRBIII® display; KEY IN IGN SW :CLOSED? Yes → Refer to Door Ajar information for the related symptoms. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Ignition switch C2 connector. With the ignition key in. Using an Ohmmeter, check the resistance across the Ignition Switch Is the resistance above 10.0 ohms? Yes → Replace the Ignition Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn ignition off. Disconnect the Ignition Switch C2 connector. Measure the resistance between ground and the Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Key-in Ignition Switch Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn ignition off. Disconnect the Ignition Switch C2 connector. Disconnect the Body Control Module C1 connector. Measure the resistance of the Key-in Ignition Switch Sense circuit between the BCM C1 connector and the Ignition Switch C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Key-in Ignition Switch Sense Wire. Perform BODY VERIFICATION TEST - VER 1.	All

CHIME INOPERATIVE WITH KEY IN IGNITION, DRIVER DOOR OPEN — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view Repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME INOPERATIVE AT ALL TIMES

POSSIBLE CAUSES
ACTUATES OK
BODY CONTROL MODULE - CHIME INOPERATIVE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Close all doors. With the DRBIII®, actuate the Chime. Does the chime sound when actuated by the DRB? Yes → If the chime operates as it should, check for other reasons that the chime is being inoperative. Refer to symptom list for related problems. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME INOPERATIVE WITH DRIVERS SEAT BELT UNFASTENED

POSSIBLE CAUSES
SEAT BELT STATUS INCORRECT ON DRB
SEAT BELT SWITCH OPEN
GROUND WIRE OPEN
JUNCTION BLOCK - SEAT BELT SWITCH SENSE OPEN
SEAT BELT SWITCH SENSE WIRE OPEN

TEST	ACTION	APPLICABILITY
1	Ensure the Drivers Seat Belt is not fastened. With the DRBIII® select, Body Computer and then Input/Output. Turn the ignition on. Read the Seat Belt Sw Status on the DRBIII®. Does the DRBIII® display Seat Belt Sw Closed? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Seat Belt Switch connector. Connect a jumper wire between Seat Belt Switch Sense circuit and the Ground circuit in the Seat Belt Switch connector. With the DRBIII® select Body, Body Computer and then inputs/Outputs. Turn the ignition on. Read the Seat Belt Sw Status. Does the DRBIII® display Seat Belt Sw Closed? Yes → Replace the Seat Belt Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the Seat Belt Switch connector. Connect a jumper wire between the Seat Belt Switch Sense circuit and chassis ground. With the DRB III select: Body, Body Computer, Input Output. Read the Seat Belt Sw, status. Does the DRB III show Seat Belt Sw: CLOSED? Yes → Repair the open Ground wire. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*CHIME INOPERATIVE WITH DRIVERS SEAT BELT UNFASTENED — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Lower the Junction Block and gain access to the Junction Block C1 connector but do not disconnect. Back probe a jumper wire between the Seat Belt Switch Sense circuit in the Junction Block C1 connector cavity 19 in the upper right corner to ground. Remove the Body Control Module from the Junction Block. Measure the resistance between ground and the Seat Belt Switch Sense ckt in the Junction Block - Body Control Module connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
5	Lower the Junction Block and gain access to the Junction Block C1 connector, but do not disconnect. Back probe a jumper wire between the Seat Belt Switch Sense circuit in the Junction Block C1 connector cavity 19 in the upper right corner to ground. With the DRB III select: Body, Body Computer, Input Output. Read the Seat Belt Sw status. Does the DRB III show Seat Belt Sw: CLOSED? Yes → Repair the open Seat Belt Switch Sense wire. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*CHIME INOPERATIVE WITH EXTERIOR LAMPS, DRIVER DOOR OPEN

POSSIBLE CAUSES
DRB TEST HEADLAMP SWITCH
DOOR AJAR PROBLEMS
EXTERIOR LIGHTING PROBLEMS

TEST	ACTION	APPLICABILITY
1	**Note: Ensure the interior lamps turn on and off properly.** **Note: Ensure the exterior lamps turn on and off properly.** Remove the key from the ignition switch. With the DRBIII® select: Body, Monitor Display, Lighting Monitor. Open the Driver door. With the DRBIII®, read the Driver Door Switch status. Does the DRBIII® display Closed? Yes → Go To 2 No → Refer to Door Ajar information for the related symptoms. Perform BODY VERIFICATION TEST - VER 1.	All
2	**Note: Ensure the interior lamps turn on and off properly.** **Note: Ensure the exterior lamps turn on and off properly.** Remove the key from the ignition switch. With the DRB III select: Body, Monitor Display, Lighting Monitor. Read the Headlamp Switch voltage while turning the Parklamps on. Does the DRBIII® display: 2.0 to 3.2 volts? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Refer to Exterior Lighting information for the related symptoms. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME SOUNDS WITH DRIVER DOOR OPEN

POSSIBLE CAUSES
KEY-IN IGN SWITCH STATUS WRONG
KEY-IN IGNITION SWITCH CIRCUIT SHORTED
KEY-IN IGN SWITCH SENSE WIRE SHORT TO GROUND
BODY CONTROL MODULE - KEY-IN IGNITION SHORTED

TEST	ACTION	APPLICABILITY
1	**Note: Ensure the interior lamps turn on and off properly.** **Note: Ensure the exterior lamps turn on and off properly.** Remove the key from the ignition switch. With the DRB III select: Body, Body Computer, Input Output. Turn off; Headlamps and Parklamps. Read the Key-In Ignition status. Does the DRB III show Key-In Ign OPEN? Yes → No problem found at this time. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Ignition Switch C2 connector. With the DRB III select: Body, Body Computer, Input Output. Read the Key-In Ignition status. Does the DRB III show: Key-In Ign, CLOSED? Yes → Go To 3 No → Replace the Ignition Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the Ignition Switch C2 connector. Disconnect the Body Control Module C1 connector. Measure the resistance of the Key-in Ignition Switch Sense circuit to chassis ground. Is the resistance below 100.0 ohms? Yes → Repair the Key-in Ignition Switch Sense wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	If there are no possible causes remaining, view Repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME SOUNDS WITH DRIVER SEAT BELT FASTENED

POSSIBLE CAUSES
SEAT BELT SWITCH STATUS WRONG
SEAT BELT SWITCH SHORTED
BODY CONTROL MODULE - SEAT BELT SWITCH SHORTED
SEAT BELT SWITCH SENSE WIRE SHORT TO GROUND
JUNCTION BLOCK - SEAT BELT SWITCH SENSE SHORTED

TEST	ACTION	APPLICABILITY
1	Ensure the drivers seat belt is fastened. With the DRB III select: Body, Body Computer, Input Output. Turn the ignition on. Read the Seat Belt Sw, status. Does the DRB III show Seat Belt Sw: CLOSED? Yes → Go To 2 No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Seat Belt Switch connector. With the DRB III select: Body, Body Computer, Input Output. Turn the ignition on. Read the Seat Belt Sw. status. Does the DRB III show Seat Belt Sw: CLOSED? Yes → Go To 3 No → Replace the Seat Belt Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the BCM from the Junction Block. Disconnect the Seat Belt Switch connector. Turn the ignition off. Measure the resistance between ground and the Seat Belt Switch Sense circuit in the Seat Belt Switch connector.. Is the resistance below 100.0 ohms? Yes → Go To 4 No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the Seat Belt Switch connector. Remove the BCM from the Junction Block. Disconnect the Junction Block C1 connector. Measure the resistance between ground and the Seat Belt Switch Sense circuit in the Seat Belt Switch connector.. Is the resistance below 100.0 ohms? Yes → Repair the Seat Belt Switch Sense wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*CHIME SOUNDS WITH DRIVER SEAT BELT FASTENED — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view Repair. Repair Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*VEHICLE SPEED WARNING CHIME PROBLEM

POSSIBLE CAUSES
COUNTRY CODE IN BODY CONTROL MODULE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ensure there is communication between the BCM and the PCM and that there are no related DTC's before continuing. **NOTE: The high speed warning Chime is for Gulf Coast Countries only.** With the DRBIII®, read the Country Code setting in module display. Is the country code setting correct? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Select the correct country code for the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BATTERY IOD DISCONNECT AT BCM

When Monitored and Set Condition:

BATTERY IOD DISCONNECT AT BCM

When Monitored: Each time the DRB request DTC's from the BCM, the BCM check for battery voltage on the IOD circuit.

Set Condition: The DTC will set if the BCM detects a low or no voltage condition on the IOD circuit.

POSSIBLE CAUSES
VERIFYING ACTIVE DTC
PDC FUSE #15
CHECK FUSED B+ FEED TO JUNCTION BLOCK
JUNCTION BLOCK IOD FAILURE
BODY CONTROL MODULE
FUSED B(+) CIRCUIT SHORTED TO GROUND
JUNCTION BLOCK FUSE #7

TEST	ACTION	APPLICABILITY
1	Connect the DRB to the Data Link Connector. Turn the ignition on. With the DRB, erase BCM DTC's. Turn the ignition off then turn the ignition on. With the DRB, read BCM DTC's. **NOTE: If DTC is active check Junction Block fuse #7 for an open.** Does the DRB display: Battery IOD Disconnect at BCM? Yes → Go To 2 No → No problem found at this time. Use the wiring diagrams located in the service information to help isolate a possible intermittent wiring problem. Perform BODY VERIFICATION TEST - VER 1.	All
2	Inspect fuse #15 in the Power Distribution Center. Is the fuse open? Yes → Re-install or replace PDC fuse #15. Use the wiring diagrams located in the service information to help isolate a possible intermittent wiring problem. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

BATTERY IOD DISCONNECT AT BCM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Junction Block C4 harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the Junction Block C4 connector (cavity 1). Is the test light illuminated? Yes → Go To 4 No → Repair the Fused B+ circuit for an open between the Junction Block and the PDC. Perform BODY VERIFICATION TEST - VER 1.	All
4	Inspect the IOD fuse in the Junction Block (Fuse #7). Is the fuse open? Yes → Go To 5 No → Go To 6	All
5	Turn the ignition off. Remove Fuse #7 from the Junction Block. Measure the resistance between ground and the Fused B+ circuit at the junction block fuse #7 (output side of fuse). Is the resistance below 100.0 ohms? Yes → Refer to the wiring diagrams located in the service information to help isolate a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Replace the fuse. Perform BODY VERIFICATION TEST - VER 1.	All
6	Install fuse #7 in the Junction Block. Remove the BCM from the Junction Block. Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the junction block body control module connector cavity 26. Is the test light illuminated? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BCM EEPROM CHECKSUM FAILURE

When Monitored and Set Condition:

BCM EEPROM CHECKSUM FAILURE

When Monitored: Each time the DRB request DTC's from the BCM, the BCM runs an EEPROM checksum test.

Set Condition: The DTC will set if the BCM detects an EEPROM checksum failure.

POSSIBLE CAUSES
BCM INTERNAL EEPROM FAILURE

TEST	ACTION	APPLICABILITY
1	Connect the DRB to the Data Link Connector. Turn the ignition on. With the DRB, erase BCM DTC's. Turn the ignition off then turn the ignition on. With the DRB, read BCM DTC's. Did this DTC reset? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
BCM FLASH CHECKSUM FAILURE

When Monitored and Set Condition:

BCM FLASH CHECKSUM FAILURE

When Monitored: Each time the DRB performs the flash process, the BCM runs a flash checksum test.

Set Condition: The DTC will set if the BCM detects a flash checksum failure.

POSSIBLE CAUSES
BCM INTERNAL FLASH CHECKSUM FAILURE

TEST	ACTION	APPLICABILITY
1	Connect the DRB to the Data Link Connector. Turn the ignition on. With the DRB, erase BCM DTC's. Turn the ignition off then turn the ignition on. With the DRB, read BCM DTC's. Did this DTC reset? Yes → Reflash or Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
DDM MESSAGE NOT RECEIVED

When Monitored and Set Condition:

DDM MESSAGE NOT RECEIVED

When Monitored: With the ignition in run, and the IOD fuse installed.

Set Condition: The BCM does not receive any messages from the Driver Door Module (DDM) for at least 30 seconds.

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE DOOR MODULES
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Door Module. Was the DRB able to I/D or communicate with the Door Modules? Yes → Go To 2 No → Refer to the Communication category and perform the symptom Bus +/- Signals Open or No Response from Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRB, erase DTC's. Turn the ignition on and wait approximately 1 minute. With the DRB, read DTC's. Did this DTC reset? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
MIC MESSAGE NOT RECEIVED AT BCM

When Monitored and Set Condition:

MIC MESSAGE NOT RECEIVED AT BCM

When Monitored: With the ignition in run, and the IOD fuse installed.

Set Condition: The BCM does not receive any messages from the Instrument Cluster (MIC) for at least 30 seconds.

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE INSTRUMENT CLUSTER (MIC)
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Electro/Mech Cluster. Was the DRB able to I/D or communicate with the Instrument Cluster (MIC)? Yes → Go To 2 No → Refer to the Communication category for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRB, erase DTC's. Turn the ignition on and wait approximately 1 minute. With the DRB, read DTC's. Did this DTC reset? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
NO PCI MESSAGES FROM CD CHANGER

When Monitored and Set Condition:

NO PCI MESSAGES FROM CD CHANGER

When Monitored: With the ignition on and the radio on.

Set Condition: If the DRB interrogates the CD changer and does not receive the proper response from the CD changer.

POSSIBLE CAUSES
CD CHANGER (DIN) CABLE
CD CHANGER PCI BUS CIRCUIT OPEN
IGNITION SWITCH OUTPUT CIRCUIT OPEN
RADIO GROUND CKT OPEN
CD CHANGER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Radio C2 connector (DIN cable) from the Radio and the CD Changer. Visually inspect the cable for damage. In the next step check for open wires in the DIN cable. Measure the resistance of the each DIN cable circuit between the Radio DIN cable connector and the CD Changer DIN cable connector. In the next step check for wires shorted to the DIN cable metal connectors. Measure the resistance between each Radio C2 connector (DIN cable) circuit and the cable's metal connector. Are the DIN cable circuits shorted together or open? Yes → Replace the CD Changer (DIN) cable. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All

NO PCI MESSAGES FROM CD CHANGER — Continued

TEST	ACTION	APPLICABILITY
2	Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Disconnect the CD Changer harness connector (DIN cable). Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the CD Changer DIN Cable connector. Reconnect the Radio C2 (DIN Cable) harness connector. Turn the ignition on. Turn the Radio and CD Changer on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 3 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the CD Changer harness connector (DIN cable). Turn the ignition on. Turn the Radio and the CD Changer on. Using a 12-volt test light connected to ground, probe the ignition switch output circuit in the CD Changer DIN Cable connector. Is the test light illuminated? Yes → Go To 4 No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the CD Changer harness connector (DIN cable). Using a 12-volt test light connected to 12-volts, probe each CD Changer ground circuit in the CD Changer connector (DIN cable). Is the test light illuminated for each circuit? Yes → Replace the CD Changer. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PCM MESSAGE NOT RECEIVED AT BCM

When Monitored and Set Condition:

PCM MESSAGE NOT RECEIVED AT BCM

When Monitored: With the ignition in run, and the IOD fuse installed.

Set Condition: The BCM does not receive any messages from the PCM for at least 30 seconds.

POSSIBLE CAUSES
PCM MESSAGE NOT RECEIVED AT BCM
ATTEMPT TO COMMUNICATE WITH THE PCM
PCI BUS CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body Computer, System Tests then PCM Monitor. Does the DRB display: PCM is active on BUS? Yes → Replace the Body Control Module in accordance with the service information.. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition on. With the DRB, attempt to communicate with the PCM. Was the DRB able to communicate with the PCM? Yes → Go To 3 No → Refer to the communication category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Connect the diagnostic junction port tester #8339 to the diagnostic junction port. **Note: Do not connect the tester to the DRB.** Measure the resistance of the PCI Bus circuit between the diagnostic junction port tester and the PCM connector. Is the resistance below 5.0 ohms? Yes → Replace the Powertrain Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PDM MESSAGE NOT RECEIVED

When Monitored and Set Condition:

PDM MESSAGE NOT RECEIVED

When Monitored: With the ignition in run, and the IOD fuse installed.

Set Condition: The BCM does not receive any messages from the Passenger Door Module (PDM) for at least 30 seconds.

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE DOOR MODULES
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Door Module. Was the DRB able to I/D or communicate with the Door Modules? Yes → Go To 2 No → Refer to the Communication category and perform the symptom Bus +/- Signals Open or No Response from Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRB, erase DTC's. Turn the ignition on and wait approximately 1 minute. With the DRB, read DTC's. Did this DTC reset? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
RAIN SENSOR MESSAGES NOT RECEIVED

When Monitored and Set Condition:

RAIN SENSOR MESSAGES NOT RECEIVED

When Monitored: With the ignition in run, and the IOD fuse installed.

Set Condition: The BCM does not receive any messages from the rain sensor module.

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE RAIN SENSOR MODULE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, attempt to communicate with the rain sensor module. Was the DRB able to I/D or communicate with the rain sensor module? Yes → Go To 2 No → Refer to the Communication category for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRB, erase DTC's. Turn the ignition on and wait approximately 1 minute. With the DRB, read DTC's. Did this DTC reset? Yes → Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM AUTOMATIC ZONE CONTROL MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
FUSED B(+) CKT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
AUTOMATIC ZONE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Automatic Zone Control Module C2 harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the Fused B+ circuit for an open or short. Refer to the wiring diagrams in the service information. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Automatic Zone Control Module C2 harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open or short. Refer to the wiring diagrams in the service information. Perform BODY VERIFICATION TEST - VER 1.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM AUTOMATIC ZONE CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Automatic Zone Control Module C2 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set the probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the AZC connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 5 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Automatic Zone Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM BODY CONTROL MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH ANOTHER MODULE
OPEN GROUND CIRCUIT
OPEN PCI BUS CIRCUIT
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Controller Antilock Brake (CAB) module. Was the DRB able to I/D or communicate with the ACM and the CAB? Yes → Go To 2 No → Refer to symptom list for problems related to the PCI Bus Communication Failure. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the BCM C1 harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit (cavity 1). Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM BODY CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the BCM C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the BCM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM DRIVER DOOR MODULE

POSSIBLE CAUSES
OPEN FUSED B+ CIRCUIT
OPEN GROUND CIRCUIT
OPEN PCI BUS CIRCUIT
DRIVER DOOR MODULE

TEST	ACTION	APPLICABILITY
1	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Driver Door Module C1 harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 2 No → Repair the Fused B+ circuit for an open or short, refer to the wiring diagrams in the service information. Perform BODY VERIFICATION TEST - VER 1.	All
2	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Driver Door Module C1 harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM DRIVER DOOR MODULE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Driver Door Module C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Driver Door Module connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM INSTRUMENT CLUSTER

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
OPEN GROUND CIRCUIT
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN FUSED B+ CIRCUIT
OPEN PCI BUS CIRCUIT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Turn all lights off. Disconnect the Instrument Cluster harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Instrument Cluster harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the Instrument Cluster harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 5 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM INSTRUMENT CLUSTER — Continued

TEST	ACTION	APPLICABILITY
5	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Instrument Cluster harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Instrument Cluster connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 6 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM PASSENGER DOOR MODULE

POSSIBLE CAUSES
OPEN FUSED B+ CIRCUIT
OPEN GROUND CIRCUIT
OPEN PCI BUS CIRCUIT
PASSENGER DOOR MODULE

TEST	ACTION	APPLICABILITY
1	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Passenger Door Module C1 harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 2 No → Repair the Fused B+ circuit for an open or short, refer to the wiring diagrams in the service information. Perform BODY VERIFICATION TEST - VER 1.	All
2	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Passenger Door Module C1 harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM PASSENGER DOOR MODULE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Passenger Door Module C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Passenger Door Module connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Passenger Door Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM SEAT MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
FUSED B(+) CKT OPEN
GROUND CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
SEAT MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
2	Turn the ignition off. Disconnect the Seat Module C2 harness connector. Using a 12-volt test light connected to ground, probe both Fused B+ circuits. Is the test light illuminated for both circuits? Yes → Go To 3 No → Repair the Fused B+ circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
3	Turn the ignition off. Disconnect the Seat Module harness connectors. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the ground circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM SEAT MODULE — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Seat Module C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Seat Module C1 connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Seat Module in accordance with the service information. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the PCI Bus circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
GROUND CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
SENTRY KEY IMMOBILIZER MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform SKIS VERIFICATION.	All
2	Turn the ignition off. Disconnect the SKIM harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Disconnect the SKIM harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open. Perform SKIS VERIFICATION.	All
4	Turn the ignition off. Disconnect the SKIM harness connector. Using a 12-volt test light connected to ground, probe the Fused B(+) circuit. Is the test light illuminated? Yes → Go To 5 No → Repair the Fused B+ circuit for an open. Perform SKIS VERIFICATION.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE — Continued

<table>
<tr><th>TEST</th><th>ACTION</th><th>APPLICABILITY</th></tr>
<tr><td>5</td><td>Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.
Disconnect the SKIM harness connector.
Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.
Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.
With the DRBIII® select Pep Module Tools.
Select lab scope.
Select Live Data.
Select 12 volt square wave.
Press F2 for Scope.
Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete.
Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the SKIM connector.
Turn the ignition on.
Observe the voltage display on the DRB Lab Scope.
Does the voltage pulse from 0 to approximately 7.5 volts?

Yes → Go To 6

No → Repair the PCI Bus circuit for an open.
Perform SKIS VERIFICATION.</td><td>All</td></tr>
<tr><td>6</td><td>If there are no possible causes remaining, view repair.

Repair
Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information.
Perform SKIS VERIFICATION.</td><td>All</td></tr>
</table>

Symptom:

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM VEHICLE INFORMATION CENTER

POSSIBLE CAUSES
GROUND CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
VEHICLE INFORMATION CENTER (VIC)

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Vehicle Information Center harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 2 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
2	**NOTE: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off. Disconnect the Vehicle Information Center harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*BUS +/- SIGNALS OPEN OR NO RESPONSE FROM VEHICLE INFORMATION CENTER — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Vehicle Information Center harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the VIC connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Vehicle Information Center in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM ADJUSTABLE PEDALS MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
FUSED B(+) CKT OPEN
GROUND CKT OPEN
OPEN PCI BUS CIRCUIT
ADJUSTABLE PEDALS MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the Fused B+ circuit for an open or short. Refer to the wiring diagrams in the service information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM ADJUSTABLE PEDALS MODULE — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Adjustable Pedals Module harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set the probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Adjustable Pedals Module connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Adjustable Pedals Module in accordance with the service information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM AIRBAG CONTROL MODULE

POSSIBLE CAUSES
CHECKING FOR VOLTAGE AT ACM
GROUND CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
AIRBAG CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Ensure that the battery is fully charged. **WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module harness connectors. Connect the appropriate Load Tool ACM adaptor to the ACM connector. Turn the ignition on and then reconnect the Battery. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output (Run) Circuit and the Fused Ignition Switch Output (Run/Start) Circuit at the ACM connector. NOTE: One open circuit will not cause a NO RESPONSE condition. Is the test light illuminated on both circuits? Yes → Go To 2 No → Repair the Fused Ignition Switch Output (Run) and Fused Ignition Switch Output (Run/Start) circuits for an open. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module harness connectors. Connect the appropriate Load Tool ACM adaptor to the ACM connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. **NOTE: Make sure test light is connected to the Battery positive terminal.** Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform AIRBAG VERIFICATION TEST - VER 1. **Note: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

*NO RESPONSE FROM AIRBAG CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off and wait 2 minutes before proceeding. Disconnect the Airbag Control Module harness connectors. Connect the appropriate Load Tool ACM adaptor to the ACM connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the ACM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Airbag Control Module in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

Symptom:
*NO RESPONSE FROM AMPLIFIER

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE RADIO
GROUND CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
AMPLIFIER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: The Radio must be turned on for the DRB to get a response from the Amplifier.** With the DRB, attempt to communicate with the Radio. Was the DRB able to I/D or communicate with the Radio? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the Radio. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Amplifier C1 harness connector. Using a 12-volt test light connected to 12-volts, probe both ground circuits. Is the test light illuminated for both circuits? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Amplifier C1 harness connector. Using a 12-volt test light connected to ground, probe both Fused B(+) circuits. Is the test light illuminated for both circuits? Yes → Go To 4 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM AMPLIFIER — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Amplifier C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Amplifier connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Amplifier in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE

POSSIBLE CAUSES
NO RESPONSE FROM CAB
REPLACE FUSE #19
CONTROLLER ANTILOCK BRAKE SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
JUNCTION BLOCK SHORTED TO GROUND
GROUND CIRCUIT OPEN
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN PCI BUS CIRCUIT
CONTROLLER ANTILOCK BRAKE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Body Control Module (BCM). Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Communications category and perform the symptom PCI Bus Communication Failure. Perform ABS VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove and inspect fuse #19 in the junction block. Is the fuse open? Yes → Go To 3 No → Go To 6	All
3	Turn the ignition off. Replace Fuse #19 in the junction block. Turn the ignition on. Remove and inspect fuse #19 in the junction block. Is the fuse open? Yes → Go To 4 No → Check the Fused Ignition Switch Output circuit for an intermittent short to ground, refer to the wiring diagrams in the service information. Perform ABS VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Replace fuse #19 in the junction block. Disconnect the CAB harness connector. Turn the ignition on. Remove and inpsect fuse #19 in the junction block. Is the fuse open? Yes → Go To 5 No → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the CAB harness connector. Disconnect the Junction Block C2 harness connector. Measure the resistance between ground and the Fused Ignition Switch Output circuit. Is the resistance below 5.0 ohms? Yes → Repair the Fused Ignition Switch Output circuit for a short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Junction Block in accordance with the service information. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Disconnect the CAB harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 7 No → Repair the ground circuit(s) for an open. Perform ABS VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. **Note: Ensure fuse #19 is installed in the junction block.** Disconnect the CAB harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 8 No → Repair the Fused Ignition Switch Output circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE — Continued

TEST	ACTION	APPLICABILITY
8	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the CAB harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the CAB connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 9 No → Repair the PCI Bus circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
9	If there are no possible causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM ECM (PCI BUS) - DIESEL ONLY

POSSIBLE CAUSES
ECM PCI NO RESPONSE
PCI BUS CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, enter Body then Body Computer. With the DRB, enter Anti-Lock Brakes. With the DRB, enter Body then Electro/Mechanical Cluster (MIC). With the DRB, enter Passive Restraints then Airbag. Were you able to establish communications with any of the modules? Yes → Go To 2 No → Refer to symptom PCI Bus Communication Failure in the Communications category. Perform ROAD TEST VERIFICATION - VER-2.	All
2	With the DRB read ECM Diagnostic Trouble Codes. This is to ensure power and grounds to the ECM are operational. **NOTE: If the DRB will not read ECM DTCs, follow the NO RESPONSE TO ECM (SCI only) symptom path, if vehicle will start. For NO START Conditions follow the no start symptom in the powertrain diagnostic information.** Turn the ignition off. Disconnect the ECM C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to ground. Connect the Red lead to the PCI Bus circuit in the ECM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2. No → Repair the PCI Bus circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*NO RESPONSE FROM ECM (SCI ONLY) - DIESEL ONLY

POSSIBLE CAUSES
CHECK ECM POWERS AND GROUNDS
SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
SCI TRANSMIT CIRCUIT SHORTED TO GROUND
SCI TRANSMIT CIRCUIT OPEN
ENGINE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Perform the symptom Checking ECM Power and Ground Circuits in the Driveability category. Did the vehicle pass this test? Yes → Go To 2 No → Repair as necessary. Perform ROAD TEST VERIFICATION - VER-2.	All
2	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the DRB from the DLC. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Disconnect the TCM C1 harness connector. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Transmit circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2. No → Replace the Transmission Control Module in accordance with the service information. Perform ROAD TEST VERIFICATION - VER-2.	All
4	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the ECM harness connectors. Disconnect the TCM C1 harness connector. Turn the ignition on. Measure the voltage of the SCI Transmit circuit at the DLC connector (cav 7). Is the voltage above 1.0 volt? Yes → Repair the SCI Transmit circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2. No → Go To 5	All

*NO RESPONSE FROM ECM (SCI ONLY) - DIESEL ONLY — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the ECM harness connectors. Disconnect the DRB from the DLC. Measure the resistance of the SCI Transmit circuit between the ECM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the SCI Transmit circuit for an open. Perform ROAD TEST VERIFICATION - VER-2.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Engine Control Module in accordance with the Service Information. Perform ROAD TEST VERIFICATION - VER-2.	All

Symptom:
*NO RESPONSE FROM INTRUSION TRANSCEIVER MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
GROUND CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
INTRUSION TRANSCEIVER MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, attempt to communicate with the BCM. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Intrusion Transceiver Module harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Intrusion Transceiver Module harness connector. Using a 12-volt test light connected to ground, probe the Fused B(+) circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM INTRUSION TRANSCEIVER MODULE — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Intrusion Transceiver Module harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the ITM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Intrusion Transceiver Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM PCM (PCI BUS) - GAS ONLY

POSSIBLE CAUSES
PCM PCI NO RESPONSE
PCI BUS CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: As soon as one or more module communicates with the DRB, answer the question.** With the DRBIII®, enter Body then Body Computer. With the DRBIII®, enter Anti-Lock Brakes. With the DRBIII®, enter Body then Electro/Mechanical Cluster (MIC). With the DRBIII®, enter Passive Restraints then Airbag. Were you able to establish communications with any of the modules? Yes → Go To 2 No → Refer to symptom PCI Bus Communication Failure in the Communications category. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	With the DRBIII® read PCM Diagnostic Trouble Codes. This is to ensure power and grounds to the PCM are operational. **NOTE: If the DRB will not read PCM DTC's, follow the NO RESPONSE TO PCM (SCI only) symptom path.** **NOTE: If the vehicle will not start and the DRBIII® displays a no response message, refer to the appropriate symptom in the powertrain diagnostic procedures.** Turn the ignition off. Disconnect the PCM C3 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the PCM ground. Connect the Red lead to the PCI Bus circuit in the PCM connector. Turn the ignition on. Observe the voltage display on the DRBIII® Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the PCI Bus circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:

*NO RESPONSE FROM PCM (SCI ONLY) - GAS ONLY

POSSIBLE CAUSES
CHECK PCM POWERS AND GROUNDS
SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
SCI RECEIVE CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
SCI CIRCUITS SHORTED TOGETHER
SCI TRANSMIT CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT OPEN
SCI TRANSMIT CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Perform the symptom Checking PCM Power and Ground Circuits in the Driveability category. **NOTE: With the DRBIII® in the generic scan tool mode, attempt to communicate with the PCM.** **NOTE: If the DRBIII® can communicate with the PCM in the generic scan tool mode, it may not be necessary to perform this step.** Did the vehicle pass this test? Yes → Go To 2 No → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Disconnect the TCM harness connector (if equipped). **NOTE: If vehicle is not equipped with a TCM, answer yes to the question.** Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Transmit circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Transmission Control Module in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM (SCI ONLY) - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the PCM harness connectors. Disconnect the TCM harness connector (if equipped). Turn the ignition on. Measure the voltage of the SCI Transmit circuit. Is the voltage above 1.0 volt? Yes → Repair the SCI Transmit circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the PCM harness connectors. Turn the ignition on. Measure the voltage of the SCI Receive circuit. Is the voltage above 1.0 volt? Yes → Repair the SCI Receive circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the DRBIII® from the DLC. Disconnect the PCM harness connectors. Measure the resistance between the SCI Transmit circuit and the SCI Receive circuit at the PCM connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the SCI Transmit and the SCI Receive circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance between ground and the SCI Receive circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Receive circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 8	All
8	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance of the SCI Receive circuit between the PCM C3 connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the SCI Receive circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM (SCI ONLY) - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the PCM C3 harness connector. Disconnect the DRBIII® from the DLC. Measure the resistance of the SCI Transmit circuit between the PCM C3 connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the SCI Transmit circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
10	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*NO RESPONSE FROM RADIO

POSSIBLE CAUSES
NO RESPONSE FROM RADIO
REPLACE FUSE #30
RADIO SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
JUNCTION BLOCK SHORTED TO GROUND
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN FUSED B+ CIRCUIT
RADIO GROUND CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Body Control Module (BCM). Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Communications category and perform the symptom PCI Bus Communication Failure. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove and inspect fuse #30 in the junction block. Is the fuse open? Yes → Go To 3 No → Go To 6	All
3	Turn the ignition off. Replace Fuse #30 in the junction block. Turn the ignition on. Turn the Radio on. Remove and inspect fuse #30 in the junction block. Is the fuse open? Yes → Go To 4 No → Check the Fused Ignition Switch Output circuit for an intermittent short to ground, refer to the wiring diagrams in the service information. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM RADIO — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Replace fuse #30 in the junction block. Disconnect the Radio C1 harness connector. Turn the ignition on. Remove and inpsect fuse #30 in the junction block. Is the fuse open? Yes → Go To 5 No → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the Radio C1 harness connector. Disconnect the Junction Block C3 harness connector. Measure the resistance between ground and the Fused Ignition Switch Output circuit. Is the resistance below 5.0 ohms? Yes → Repair the Fused Ignition Switch Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. **Note: Ensure fuse #30 is installed in the junction block.** Disconnect the Radio C1 harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 7 No → Repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the Radio C1 harness connector. Using a 12-volt test light connected to ground, probe each Fused B+ circuit. Is the test light illuminated for each circuit? Yes → Go To 8 No → Repair the Fused B+ circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Disconnect the Radio C1 harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 9 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM RADIO — Continued

TEST	ACTION	APPLICABILITY
9	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Radio C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Radio connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 10 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
10	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM RAIN SENSOR

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
FUSED B(+) CKT OPEN
GROUND CKT OPEN
OPEN PCI BUS CIRCUIT
RAIN SENSOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Rain Sensor harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the Fused B+ circuit for an open or short. Refer to the wiring diagrams in the service information. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Rain Sensor harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM RAIN SENSOR — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Rain Sensor harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set the probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Rain Sensor connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Rain Sensor in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM SHIFTER ASSEMBLY - DIESEL ONLY

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
OPEN GROUND CIRCUIT
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN PCI BUS CIRCUIT
SHIFTER ASSEMBLY

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Shifter Assembly C1 harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 3 No → Repair the ground circuit for an open. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Shifter Assembly C1 and C2 harness connectors. Turn the ignition on. Using a 12-volt test light connected to ground, probe each Fused Ignition Switch Output circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open or short. Refer to the wiring diagrams in the service information. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM SHIFTER ASSEMBLY - DIESEL ONLY — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Shifter Assembly C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Shifter Assembly connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Shifter Assembly in accordance with the service information. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - DIESEL ONLY

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE ECM
FUSED IGNITION SWITCH OUTPUT (RUN/ST) CIRCUIT OPEN
GROUND CIRCUIT OPEN
SCI TRANSMIT CIRCUIT OPEN
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, attempt to communicate with the ECM. Was the DRB able to I/D or communicate with the ECM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the ECM (SCI Only). Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Run/St) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (Run/St) circuit for an open. Refer to the wiring diagrams in the Service Information. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All
3	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Using a 12-volt test light connected to 12-volts, check the ground circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - DIESEL ONLY — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the TCM C1 harness connector. Disconnect the DRB from the DLC. Measure the resistance of the SCI Transmit circuit between the TCM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Control Module in accordance with the service information. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1. No → Repair the SCI Transmit circuit for an open. Perform W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - GAS ONLY

POSSIBLE CAUSES
NO RESPONSE FROM TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN/ST) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (START) CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
GROUND CIRCUIT(S) OPEN
OPEN PCI BUS CIRCUIT
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Body Control Module (BCM). Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Body Communication category and perform the symptom PCI Bus Communication Failure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Run/St) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (Run/St) circuit for an open. Refer to the wiring diagrams location in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the starter relay from the PDC. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Start) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Observe the test light while momentarily turning the ignition switch to the Start position. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused Ignition Switch Output (Start) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. **Note: Reinstall the original Starter Relay.**	All
4	Turn the ignition off. Disconnect the TCM harness connector. Using a 12-volt test light connected to ground, check the Fused B(+) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 5 No → Repair the Fused B(+) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Using a 12-volt test light connected to 12-volts, check each ground circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly at all the ground circuits? Yes → Go To 6 No → Repair the Ground circuit(s) for an open. Check the main ground connection to engine block and/or chassis. Refer to the wiring diagrams located in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
6	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the TCM harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the TCM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 7 No → Repair the PCI Bus circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
*PCI BUS COMMUNICATION FAILURE

POSSIBLE CAUSES
WITH THE DRB PERFORM A MODULE SCAN
OPEN PCI BUS CIRCUIT AT THE DATA LINK CONNECTOR
USING THE DRB, PERFORM THE PCI BUS CONTROL MODE
DISCONNECT THE MODULE(S) HARNESS CONNECTOR
PCI BUS CIRCUIT SHORTED TO VOLTAGE
DISCONNECT THE MODULE(S) HARNESS CONNECTOR
PCI BUS CIRCUIT SHORTED TO GROUND
WIRING HARNESS INTERMITTENT FAILURE

TEST	ACTION	APPLICABILITY
1	**Note: Determine which modules this vehicle is equipped with before beginning.** Connect the Diagnostic Junction Port Tester #8339 to the DRB and to the Diagnostic Junction Port. Using the DRB, along with the Diagnostic Junction Port Tester #8339, select Junction Port Tool then PCI Bus Module Scan and follow the instructions on the DRB. Was the DRB able to scan (I/D or communicate) with any modules? Yes → Refer to the Communication category for the related symptom(s). (Individual module no responses). Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Measure the resistance of the PCI Bus circuit between the Data Link Connector and the Diagnostic Junction Port connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the PCI Bus circuit for an open between the DLC and the Diagnostic Junction Port. Perform BODY VERIFICATION TEST - VER 1.	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Determine which modules this vehicle is equipped with before beginning.** Connect the Diagnostic Junction Port Tester #8339 to the DRB and to the Diagnostic Junction Port. Using the DRB, along with the Diagnostic Junction Port Tester #8339, select Junction Port Tool then PCI Bus Control Mode and follow the instructions on the DRB. **Note: Perform this function on each pin that is equipped with a PCI Bus circuit.** Did the DRB display No Modules Responding from any of the pins that were scanned? Yes → Go To 4 No → Check the PCI Bus circuit between the DLC and the Diagnostic Junction Port connector for a short to voltage or to ground, repair as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Diagnostic Junction Port Tester cable from the DRB. Keep the tester connected to the Diagnostic Junction Port. Turn the ignition on. Measure the voltage of the PCI Bus circuit on the Diagnostic Junction Port Tester that the DRB displayed No Modules Responding. Is the voltage steadily above 7.0 volts? Yes → Go To 5 No → Go To 6	All
5	Measure the voltage of the PCI Bus circuit on the Diagnostic Junction Port tester that previously measured above 7.0 volts. **Note: Turn the ignition off before disconnecting any module harness connector then turn the ignition on.** Disconnect the module harness connector(s). **NOTE: If the problem occurred on a bus circuit that has more than one module on the same circuit, observe the voltmeter while disconnecting each module connector one at a time.** Is the voltage steadily above 7.0 volts with the module(s) disconnected? Yes → Repair the PCI Bus circuit that measured over 7.0 volts for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to voltage was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Diagnostic Junction Port Tester cable from the DRB. Keep the tester connected to the Diagnostic Junction Port. Turn the ignition off. Disconnect the negative battery cable. Measure the resistance between ground and the PCI Bus circuit on the Diagnostic Junction Port Tester that the DRB displayed No Modules Responding. Is the resistance below 100.0 ohms? Yes → Go To 7 No → Go To 8	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Disconnect the negative battery cable. Measure the resistance between ground and the PCI Bus circuit at the Diagnostic Junction Port tester that previously measured below 100.0 ohms. Disconnect the module harness connector(s). **NOTE: If the problem occurred on a bus circuit that has more than one module on the same circuit, observe the ohmmeter while disconnecting each module connector one at a time.** Is the resistance below 100.0 ohms with the module(s) disconnected? Yes → Repair the PCI Bus circuit that measured below 100.0 ohms for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to ground was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:

*UNABLE TO ACCESS DRIVER DOOR MODULE AND/OR PASSENGER DOOR MODULE WITH DRBIII®

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
CHECK BCM DTCS
INSPECT JUNCTION BLOCK FUSE #22 AND #28
CHECK VOLTAGE SUPPLY TO BCM - JUNCTION BLOCK BCM CONNECTOR CAVITY 5
CHECK VOLTAGE SUPPLY TO BCM - JUNCTION BLOCK BCM CONNECTOR CAVITY 25
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRB, enter Body then Body Computer and read DTC's. Are any DTCs present? Yes → Refer to the appropriate category and perform the diagnostic test associated with the DTC that is set. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Remove and inspect fuse #22 and #28 from the junction block. Is either fuse open? Yes → Refer to the wiring diagrams in the service information to help isolate a possible short to ground condition, replace fuse and retest. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*UNABLE TO ACCESS DRIVER DOOR MODULE AND/OR PASSENGER DOOR MODULE WITH DRBIII® — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. **Note: Ensure Fuse #22 is installed in the junction block.** Remove the BCM from the Junction Block. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit at the Junction Block Body Control Module connector cavity 5. Is the test light illuminated? Yes → Go To 5 No → Replace the Junction Block in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. **NOTE: Ensure Fuse #28 is installed in the junction block.** Remove the BCM from the Junction Block. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit at the Junction Block Body Control Module connector cavity 25. Is the test light illuminated? Yes → Go To 6 No → Replace the Junction Block in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
* DRIVER DOOR AJAR CIRCUIT SHORTED TO GROUND

POSSIBLE CAUSES
DRIVER DOOR LOCK MOTOR/AJAR SWITCH SHORTED TO GROUND
DRIVER DOOR AJAR SWITCH SENSE CKT SHORTED TO GROUND
DRIVER DOOR MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the DR DOOR AJAR SW state. Disconnect the Driver Door Lock Motor/Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the DR DOOR AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Driver Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the DDM harness connector. Disconnect the Driver Door Lock Motor/Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Driver Door Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER DOOR AJAR CIRCUIT OPEN

POSSIBLE CAUSES
DRIVER DOOR MODULE NOT RESPONDING TO INPUT
OPEN DRIVER DOOR AJAR SWITCH GROUND CKT
OPEN DRIVER DOOR LOCK MOTOR/AJAR SWITCH
OPEN DRIVER DOOR AJAR SWITCH SENSE CKT
DRIVER DOOR MODULE

TEST	ACTION	APPLICABILITY
1	Open the driver door. With the DRBIII® in Inputs/Outputs, read the DRVR DOOR AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Driver Door Lock Motor/Ajar switch connector Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the light illuminate? Yes → Go To 3 No → Repair the Driver Door Ajar Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Driver Door Lock Motor/Ajar Switch connector. With the DRBIII® in Inputs/Outputs, read the DRVR DOOR AJAR SW state. Connect a jumper wire between Sense circuit and the Ground circuit. Does the DRBIII® display DRVR DOOR AJAR SW: CLOSED? Yes → Replace the Driver Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the DDM harness connector. Disconnect the Driver Door Lock Motor/Ajar Switch harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Replace the Driver Door Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Driver Door Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HOOD AJAR CIRCUIT OPEN (IF EQUIPPED)

POSSIBLE CAUSES
BCM NOT RESPONDING TO INPUT
GROUND CIRCUIT OPEN
HOOD AJAR SWITCH OPEN
HOOD AJAR SWITCH SENSE CIRCUIT OPEN
BODY CONTROL MODULE, INTERNAL OPEN

TEST	ACTION	APPLICABILITY
1	Open the hood. With the DRBIII® in Inputs/Outputs, read the HOOD AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Hood Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the test light illuminate? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Hood Ajar Switch harness connector. Connect a jumper wire between the Sense circuit and the Ground circuit. With the DRBIII® in Inputs/Outputs, read the HOOD AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Hood Ajar Switch, Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the Hood Ajar Switch harness connector. Disconnect the BCM C1 harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Hood Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HOOD AJAR CIRCUIT SHORT TO GROUND (IF EQUIPPED)

POSSIBLE CAUSES
HOOD AJAR SWITCH SHORT TO GROUND
HOOD AJAR SWITCH SENSE CIRCUIT, SHORT TO GROUND
BCM, SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the Hood Open Sw state. Disconnect the Hood Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the HOOD AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Hood Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the BCM harness connector. Disconnect the Hood Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Hood Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LEFT REAR DOOR AJAR CIRCUIT OPEN

POSSIBLE CAUSES
BCM NOT RESPONDING TO INPUT
GROUND CKT OPEN
LEFT REAR DOOR LOCK MOTOR/AJAR SWITCH OPEN
LEFT REAR DOOR AJAR SWITCH SENSE CKT OPEN
JUNCTION BLOCK - OPEN LEFT REAR DOOR AJAR SWITCH SENSE CKT
BODY CONTROL MODULE INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Open the left rear door. With the DRBIII® in Inputs/Outputs, read the LR DOOR AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Left Rear Door Lock Motor/Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the test light illuminate? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Left Rear Door Lock Motor/Ajar Switch harness connector. Connect a jumper wire between the Sense circuit and the Ground circuit. With the DRBIII® in Inputs/Outputs, read the LR DOOR AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Left Rear Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the Left Rear Door Lock Motor/Ajar Switch harness connector. Disconnect the Junction Block C1 harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Left Rear Door Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*LEFT REAR DOOR AJAR CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the Junction Block C1 harness connector. Remove the BCM from the Junction Block. Measure the resistance of the Left Rear Door Ajar Switch Sense circuit across the Junction Block between the C1 connector and the Junction Block-to-BCM connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LEFT REAR DOOR AJAR CIRCUIT SHORTED TO GROUND

POSSIBLE CAUSES
LEFT REAR DOOR LOCK MOTOR/AJAR SWITCH SHORTED TO GROUND
LEFT REAR DOOR AJAR SWITCH SENSE CKT SHORTED TO GROUND
BODY CONTROL MODULE INTERNAL FAULT
LEFT REAR DOOR AJAR SWITCH SENSE CKT SHORTED TO GROUND IN JUNCTION BLOCK

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the LR DOOR AJAR SW state. Disconnect the Left Rear Door Lock Motor/Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the LR DOOR AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Left Rear Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Junction Block C1 harness connector. Disconnect the Left Rear Door Lock Motor/Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Left Rear Door Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the BCM from the Junction Block. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the test light illuminate? Yes → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LIFTGATE AJAR CIRCUIT OPEN

POSSIBLE CAUSES
BCM NOT RESPONDING TO INPUT
GROUND CIRCUIT OPEN
LIFTGATE AJAR SWITCH SENSE CIRCUIT OPEN
JUNCTION BLOCK - OPEN LIFTGATE AJAR CIRCUIT
BODY CONTROL MODULE-OPEN LIFTGATE AJAR CIRCUIT

TEST	ACTION	APPLICABILITY
1	Open the liftgate. With the DRBIII® in Inputs/Outputs, read the LIFTGATE AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Right or Left Liftgate Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the test light illuminate? Yes → Go To 3 No → Repair the Liftgate Ajar Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Right or Left Liftgate Ajar Switch harness connector. Disconnect the Junction Block C1 harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Liftgate Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Junction Block C1 harness connector. Remove the BCM from the Junction Block. Measure the resistance of the Liftgate Ajar Switch Sense circuit across the Junction Block between the C1 connector and the Junction Block-to-BCM connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LIFTGATE AJAR CIRCUIT SHORT TO GROUND

POSSIBLE CAUSES
LEFT LIFTGATE AJAR SWITCH SHORT TO GROUND
RIGHT LIFTGATE AJAR SWITCH SHORT TO GROUND
LIFTGATE AJAR SWITCH SENSE CIRCUIT, SHORT TO GROUND
LIFTGATE AJAR SWITCH SENSE SHORT IN THE JUNCTION BLOCK
BCM, SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the LIFTGATE AJAR SW state. Disconnect the Left Liftgate Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the LIFTGATE AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Left Liftgate Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	With the DRBIII® in Inputs/Outputs, read the LIFTGATE AJAR SW state. Disconnect the Right Liftgate Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the LIFTGATE AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Right Liftgate Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the Junction Block C1 harness connector. Disconnect the Right and Left Liftgate Ajar Switch harness connectors. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Liftgate Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the BCM from the Junction Block. Using a 12-volt Test Light connected to 12-volts, check the Liftgate Ajar Switch Sense circuit. Does the test light illuminate? Yes → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LIFTGATE FLIP-UP AJAR CIRCUIT OPEN

POSSIBLE CAUSES
BCM NOT RESPONDING TO INPUT
GROUND CIRCUIT OPEN
LIFTGATE FLIP-UP AJAR SWITCH OPEN
LIFTGATE FLIP-UP AJAR SWITCH SENSE CIRCUIT OPEN
JUNCTION BLOCK - OPEN LIFTGATE FLIP-UP AJAR SWITCH SENSE CIRCUIT
BODY CONTROL MODULE, INTERNAL OPEN

TEST	ACTION	APPLICABILITY
1	Open the liftgate flip-up. With the DRBIII® in Inputs/Outputs, read the LFTGT FLIP-UP AJAR state. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Liftgate Flip-Up Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the test light illuminate? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Liftgate Flip-Up Ajar Switch harness connector. Connect a jumper wire between the Sense circuit and the Ground circuit. With the DRBIII® in Inputs/Outputs, read the LFTGT FLIP-UP AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Liftgate Flip-Up Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the Liftgate Flip-Up Ajar Switch harness connector. Disconnect the Junction Block C1 harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Liftgate Flip-Up Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*LIFTGATE FLIP-UP AJAR CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the Junction Block C1 harness connector. Remove the BCM from the Junction Block. Measure the resistance of the Liftgate Flip-Up Ajar Switch Sense circuit across the Junction Block between the C1 connector and the Junction Block-to-BCM connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

*LIFTGATE FLIP-UP AJAR CIRCUIT SHORT TO GROUND

POSSIBLE CAUSES
LIFTGATE FLIP-UP AJAR SWITCH SHORTED TO GROUND
LIFTGATE FLIP-UP AJAR SWITCH SENSE CKT SHORTED TO GROUND
BODY CONTROL MODULE INTERNAL FAULT
LIFTGATE FLIP-UP AJAR SENSE CKT SHORTED TO GROUND IN JUNCTION BLOCK

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the LIFTGLASS SW state. Disconnect the Liftgate Flip-Up Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the LIFTGLASS SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Liftgate Flip-Up Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Junction Block C1 harness connector. Disconnect the Liftgate Flip-Up Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Liftgate Flip-Up Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the BCM from the Junction Block. Using a 12-volt Test Light connected to 12-volts, check the Liftgate Flip-Up Ajar Switch Sense circuit. Does the test light illuminate? Yes → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER DOOR AJAR CIRCUIT OPEN

POSSIBLE CAUSES
PASSENGER DOOR MODULE
OPEN PASSENGER DOOR AJAR SWITCH GROUND CKT
OPEN PASSENGER DOOR LOCK MOTOR/AJAR SWITCH
OPEN PASSENGER DOOR AJAR SWITCH SENSE CKT
PASSENGER DOOR MODULE

TEST	ACTION	APPLICABILITY
1	Open the passenger door. With the DRBIII® in Inputs/Outputs, read the PASS DOOR AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Passenger Door Lock Motor/Ajar switch connector Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the light illuminate? Yes → Go To 3 No → Repair the Passenger Door Ajar Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Passenger Door Lock Motor/Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the PASS DOOR AJAR SW state. Connect a jumper wire between the Sense circuit and the Ground circuit. Does the DRBIII® display PASS DOOR AJAR SW: CLOSED? Yes → Replace the Passenger Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the PDM harness connector. Disconnect the Passenger Door Lock Motor/Ajar Switch harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Replace the Passenger Door Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Passenger Door Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER DOOR AJAR CIRCUIT SHORT TO GROUND

POSSIBLE CAUSES
PASSENGER DOOR LOCK MOTOR/AJAR SWITCH SHORTED TO GROUND
PASSENGER DOOR AJAR SWITCH SENSE CKT SHORTED TO GROUND
PASSENGER DOOR MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the PASS DOOR AJAR SW state. Disconnect the Passenger Door Lock Motor/Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the PASS DOOR AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Passenger Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the PDM harness connector. Disconnect the Passenger Door Lock Motor/Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Passenger Door Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Passenger Door Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RIGHT REAR DOOR AJAR CIRCUIT OPEN

POSSIBLE CAUSES
BCM NOT RESPONDING TO INPUT
GROUND CKT OPEN
RIGHT REAR DOOR AJAR SWITCH OPEN
RIGHT REAR DOOR AJAR SWITCH SENSE CIRCUIT OPEN
BODY CONTROL MODULE INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Open the right rear door. With the DRBIII® in Inputs/Outputs, read the RR DOOR AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Right Rear Door Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Ground circuit. Does the test light illuminate? Yes → Go To 3 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Right Rear Door Ajar Switch harness connector. Connect a jumper wire between the Sense circuit and the Ground circuit. With the DRBIII® in Inputs/Outputs, read the RR DOOR AJAR SW state. Does the DRBIII® display CLOSED? Yes → Replace the Right Rear Door Lock Motor/Ajar Switch, Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the Right Rear Door Ajar Switch harness connector. Disconnect the BCM C1 harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Right Rear Door Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RIGHT REAR DOOR AJAR CIRCUIT SHORT TO GROUND

POSSIBLE CAUSES
RIGHT REAR DOOR LOCK MOTOR/AJAR SWITCH SHORTED TO GROUND
RIGHT REAR DOOR AJAR SWITCH SENSE CKT SHORTED TO GROUND
BODY CONTROL MODULE INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the RR DOOR AJAR SW state. Disconnect the Right Rear Door Lock Motor/Ajar Switch harness connector. With the DRBIII® in Inputs/Outputs, read the RR DOOR AJAR SW state. Does the Switch State change from CLOSED to OPEN? Yes → Replace the Right Rear Door Lock Motor/Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the BCM harness connector. Disconnect the Right Rear Door Lock Motor/Ajar Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Sense circuit. Does the Test Light illuminate? Yes → Repair the Right Rear Door Ajar Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO)

When Monitored and Set Condition:

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module loses the seat heat element output.

POSSIBLE CAUSES
DTC PRESENT
DRIVER SEAT HEATER SYSTEM SHORT TO BATTERY
DRIVER SEAT HEATER B(+) DRIVER CKT SHORTED TO VOLTAGE
DRIVER HEATED SEAT CUSHION SHORTED TO VOLTAGE
DRIVER SEAT HEATER GROUND CKT SHORTED TO VOLTAGE
HEATED SEAT DRIVER CKT SHORTED TO VOLTAGE
DRIVER HEATED SEAT CUSHION OPEN
DRIVER SEAT BACK HEATER OPEN
HEATED SEAT DRIVER CKT OPEN
DRIVER SEAT HEATER GROUND CKT OPEN
DRIVER SEAT HEATER B(+) DRIVER CKT OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the driver seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the DRIVER SEAT HEAT OUTPUT OPEN/SHORT TO BATTERY DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Measure the total resistance of the Driver Seat Heat System between the Driver Seat Heater B(+) Driver and the Driver Seat Heater Ground circuits in the HSM C2 connector. Is the resistance below 50.0 ohms? Yes → Go To 3 No → Go To 7	All
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater B(+) Driver circuit. Is ANY voltage present on the Driver Seat Heater B(+) Driver circuit? Yes → Go To 4 No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater B(+) Driver circuit. Is there ANY voltage on the Driver Seat Heater B(+) Driver circuit? Yes → Repair the Driver Seat Heater B(+) Driver circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Back 4-way connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater Ground circuit. Is there ANY voltage on the Driver Seat Heater Ground circuit? Yes → Go To 6 No → Replace the Driver Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Back 2-way (green) connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater Ground circuit. Is there ANY voltage on the Driver Seat Heater Ground circuit? Yes → Repair the Driver Seat Heater Ground circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the Heated Seat Driver circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the CUSHION SEAT HEATER ELEMENT. Connect one lead to the Heated Seat Driver circuit (cushion side) and the other lead to the Driver Seat Heater B(+) Driver circuit (cushion side) in the Driver Heated Seat Cushion 4 way connector. Is the resistance below 3.0 ohms? Yes → Go To 8 No → Replace the Driver Heated Seat Cushion / Bolster. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Driver Heated Seat Back 2-way (green) connector. Measure the resistance of the SEAT BACK HEATER ELEMENT. Connect one lead to the Heated Seat Driver circuit (seat back side) and the other lead to the Driver Seat Heater Ground circuit (seat back side) in the Driver Heated Seat 2-way connector. Is the resistance below 3.0 ohms? Yes → Go To 9 No → Replace the Driver Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Driver Heated Seat Back 2-way (green) connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Heated Seat Driver circuit between the Driver Heated Seat Back 2-way connector (harness side) and the Driver Heated Seat Cushion 4-way connector (harness side). Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open Heated Seat Driver circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
10	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Driver Heated Seat Back 2-way (green) connector. Disconnect the HSM C2 harness connector. Measure the resistance of the Driver Seat Heater Ground circuit between the Seat Back 2-way connector (harness side) and the Heated Seat Module connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the Driver Seat Heater Ground circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
11	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Disconnect the Heated Seat Module C2 harness connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit between the HSM C2 connector and the Driver Heated Seat Cushion 4-way connector (harness side). Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the open Driver Seat Heater B(+) Driver circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

When Monitored and Set Condition:

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

When Monitored: With the ignition, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module loses the seat heat element output.

POSSIBLE CAUSES
DTC PRESENT
HEATED SEAT MODULE
DRIVER SEAT HEATER B+ DRIVER CKT SHORTED TO VOLTAGE
DRIVER HEATED SEAT CUSHION SHORTED TO VOLTAGE
DRIVER SEAT HEATER GROUND CKT (1) SHORTED TO VOLTAGE
DRIVER SEAT HEATED GROUND CKT (2) SHORTED TO VOLTAGE
CONNECTOR TO SPLICE - CUSHION SIDE - OPEN
DRIVER SEAT HEATER B(+) DRIVER CKT OPEN
DRIVER SEAT HEATER GROUND CKT (JUMPER) OPEN
DRIVER SEAT HEATER GROUND CKT (1) OPEN
DRIVER SEAT HEATER GROUND CKT (2) OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the driver seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the DRIVER SEAT HEAT OUTPUT OPEN/SHORT TO BATTERY DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED) — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Measure the total resistance of the Driver Seat Heater System from the Driver Seat Heater B(+) Driver to the Driver Seat Heater Ground in the HSM C2 connector Is the resistance below 50.0 ohms? Yes → Go To 3 No → Go To 7	All
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater B(+) Driver circuit. Is ANY voltage present on the Driver Seat Heater B(+) Driver circuit? Yes → Go To 4 No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater B(+) Driver circuit. Is there ANY voltage on the Driver Seat Heater B(+) Driver circuit? Yes → Repair the Driver Seat Heater B(+) Driver circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the HSM C2 harness connector. Disconnect the Driver Heated Seat Back 4-way connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater Ground circuit at the HSM C2 connector. Is there ANY voltage on the Driver Seat Heater Ground circuit? Yes → Go To 6 No → Replace the Driver Heated Seat Cushion / Bolster. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED) — Continued

TEST	ACTION	APPLICABILITY
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the HSM C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Disconnect the Driver Heated Seat Back 2-way connector. Turn the ignition on. Measure the voltage of the Driver Seat Heater Ground circuit at the HSM C2 connector. Is there ANY voltage on the Driver Seat Heater Ground circuit? Yes → Repair the Driver Seat Heater Ground circuit for a short to voltage between the HSM C2 connector and the Driver Heated Seat Back 2-way connector. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the Driver Seat Heater Ground circuit for a short to voltage between the Driver Heated Seat Back 2-way connector and the Driver Heated Seat Cushion 4-way connector. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the HSM C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Connect a jumper wire from the Driver Seat Heater B+ Driver circuit to the Driver Seat Heater Ground circuit at the Driver Heated Seat Cushion 4-way connector (harness side). Measure the resistance of the Driver Seat Heater B+ Driver circuit and the Driver Seat Heater Ground circuit in the HSM C2 connector. Is the resistance below 5.0 ohms? Yes → Repair the open circuit in either the Driver Seat Heater Ground or the Driver Seat Heater B(+) Driver wiring between the HSM C2 connector and the splice in the seat. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 8	All
8	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit between the HSM C2 connector and the Driver Heated Seat Cushion 4-way connector (harness side). Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open Driver Seat Heater B(+) Driver circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED) — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Driver Heated Seat Back 2-way (green) connector. Measure the resistance of the Driver Seat Heater Ground circuit (jumper). Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open Driver Seat Heater Ground (jumper) circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
10	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Back 2-way (green) connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater Ground circuit between the 2 connectors. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the open Driver Seat Heater Ground circuit between the Driver Heated Seat Back 2-way connector and the Driver Heated Seat Cushion 4-way connector. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
11	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Back 2-way (green) connector. Disconnect the HSM C2 harness connector. Measure the resistance of the Driver Seat Heater Ground circuit between the Seat Back 2-way connector (harness side) and the Heated Seat Module C2 connector. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the Driver Seat Heater Ground circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
DRIVER SEAT HEAT OUTPUT SHORT TO GND (LIMITED)

When Monitored and Set Condition:

DRIVER SEAT HEAT OUTPUT SHORT TO GND (LIMITED)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module detects an output shorted to ground.

POSSIBLE CAUSES
DTC PRESENT
HEATED SEAT MODULE
DRIVER SEAT HEATER B(+) DRIVER CKT SHORTED TO DRIVER SEAT HEATER GROUND
DRIVER SEAT HEATER B(+) DRIVER CKT SHORTED TO GROUND
HEATED SEAT MODULE
DRIVER HEATED SEAT CUSHION SHORTED TO GROUND
DRIVER HEATED SEAT BACK SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the driver seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the DRIVER SEAT HEAT OUTPUT SHORT TO GROUND DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
2	Using the DRBIII®, select: Body - Memory Seat Module - Erase DTC's. **NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Turn the driver heated seat on. With the DRBIII®, read DTC's. Does the DRBIII® still show Driver Seat Heat Output Short to Gnd? Yes → Go To 3 No → Go To 5	All

DRIVER SEAT HEAT OUTPUT SHORT TO GND (LIMITED) — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit to the Driver Seat Heater Ground circuit in the HSM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Driver Seat Heater B(+) Driver circuit for a short to the Driver Seat Heater Ground circuit. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit to ground. Is the resistance below 5.0 ohms? Yes → Repair the Driver Seat Heater B(+) Driver circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit in the Driver Heated Seat Cushion connector (cushion side) to ground. Is the resistance below 100.0 ohms? Yes → Go To 6 No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Disconnect the Driver Heated Seat Back 2-way (black) connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit in the Driver Heated Seat Cushion connector (cushion side) to ground. Is the resistance below 1000.0 ohms? Yes → Replace the Driver Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Driver Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
DRIVER SEAT HEAT OUTPUT SHORT TO GROUND (LAREDO)

When Monitored and Set Condition:

DRIVER SEAT HEAT OUTPUT SHORT TO GROUND (LAREDO)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module detects an output shorted to ground.

POSSIBLE CAUSES
DTC PRESENT
DRIVER SEAT HEATER B(+) DRIVER CKT SHORTED TO DRIVER SEAT HEATER GROUND
DRIVER SEAT HEATER B(+) DRIVER CKT SHORTED TO GROUND
DRIVER SEAT CUSHION SHORTED TO GROUND
HEATED SEAT MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the driver seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the DRIVER SEAT HEAT OUTPUT SHORT TO GROUND DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Using the DRBIII®, select: Body - Memory Seat Module - Erase DTC's. Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Start the engine. Turn the driver seat heater on and operate at both ranges. With the DRBIII®, read DTC's. Does the DRBIII® still show Driver Seat Heat Output Short to Gnd? Yes → Go To 3 No → Go To 5	All

DRIVER SEAT HEAT OUTPUT SHORT TO GROUND (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit to the Driver Seat Heater Ground circuit in the HSM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Driver Seat Heater B(+) Driver circuit for a short to the Driver Seat Heater Ground circuit. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Heater B(+) Driver circuit to ground. Is the resistance below 5.0 ohms? Yes → Repair the Driver Seat Heater B(+) Driver circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition on. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Cushion connector (cushion side) to ground. Is the resistance below 100.0 ohms? Yes → Replace the Driver Heater Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Test Complete.	All

Symptom:
DRIVER THERMISTOR OUT OF RANGE HIGH

When Monitored and Set Condition:

DRIVER THERMISTOR OUT OF RANGE HIGH

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is immediately set when the Heated Seat Module senses a greater value than the value stored in EEPROM.

POSSIBLE CAUSES
DRIVER HEATED SEAT SENSOR SHORTED
DRIVER SEAT TEMPERATURE SENSOR INPUT CIRCUIT SHORTED TO BATTERY
DRIVER SEAT TEMPERATURE SENSOR INPUT CIRCUIT SHORTED TO 5 VOLT SUPPLY
SEAT SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
HEATED SEAT MODULE - SENSOR SHORTED

TEST	ACTION	APPLICABILITY
1	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance between the Seat Sensor 5 Volt Supply circuit and the Driver Seat Temperature Sensor Input circuit at the driver heated seat cushion (cushion side) connector. Is the resistance below 800 ohms at room temperature? Yes → Replace the Driver Heated Seat Cushion Cover - sensor shorted.. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 2	All
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage between the Driver Seat Temperature Sensor Input circuit and ground. Is the voltage above 5.5 volts? Yes → Repair the Driver Seat Temperature Sensor Input circuit for a short to battery. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

DRIVER THERMISTOR OUT OF RANGE HIGH — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage between the Driver Seat Temperature Sensor Input circuit and ground. Is there ANY voltage on the Driver Seat Temperature Sensor Input circuit? Yes → Repair the Driver Seat Temperature Sensor Input circuit for a short to 5 volt supply. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the resistance of the Seat Sensor 5 Volt Supply circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Seat Sensor 5 Volt Supply circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
DRIVER THERMISTOR OUT OF RANGE LOW

When Monitored and Set Condition:

DRIVER THERMISTOR OUT OF RANGE LOW

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is immediately set when the Heated Seat Module senses a lesser value than the value stored in EEPROM.

POSSIBLE CAUSES
DRIVER HEATED SEAT CUSHION SENSOR OPEN
DRIVER SEAT TEMPERATURE SENSOR INPUT CKT SHORTED TO GROUND
DRIVER HEATED SEAT CUSHION FAILED SENSOR
DRIVER SEAT TEMPERATURE SENSOR INPUT CKT OPEN
SEAT SENSOR 5-VOLT SUPPLY CKT OPEN
HEATED SEAT MODULE
HEATED SEAT MODULE - 5 VOLT SUPPLY OPEN

TEST	ACTION	APPLICABILITY
1	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage between the Seat Sensor 5 Volt Supply circuit and ground. Is the voltage below 4.5 volts? Yes → Go To 2 No → Go To 3	All
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit between the Heated Seat Module connector and the Driver Heated Seat Cushion (harness side) connector. Is the resistance below 5.0 ohms? Yes → Replace the Heated Seat Module - 5 volt supply open. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the open Seat Sensor 5 Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

DRIVER THERMISTOR OUT OF RANGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance between the Seat Sensor 5 Volt Supply circuit and the Driver Seat Temperature Sensor Input circuit at the driver heated seat cushion (cushion side) connector. Is the resistance above 70,000 (70K) ohms at room temperature? Yes → Replace the Driver Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Temperature Sensor Input circuit (harness side) and ground. Is the resistance below 1,000.0 ohms? Yes → Repair the Driver Seat Temperature Sensor Input circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance between the Driver Seat Temp Sensor Input circuit (cushion side) and ground. Is the resistance below 1000.0 ohms? Yes → Replace the Driver Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 6	All
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 connector. Disconnect the Driver Heated Seat Cushion 4-way connector. Measure the resistance of the Driver Seat Temperature Sensor Input circuit from the Heated Seat Module connector to the Driver Heated Seat Cushion connector. Is the resistance below 5.0 ohms? Yes → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the open Driver Seat Temperature Sensor Input circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO)

When Monitored and Set Condition:

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module loses the seat heat element output.

POSSIBLE CAUSES
DTC PRESENT
PASSENGER SEAT HEATER SYSTEM SHORTED TO VOLTAGE
PASSENGER SEAT HEATER B(+) DRIVER CKT SHORTED TO VOLTAGE
PASSENGER HEATED SEAT CUSHION SHORTED TO VOLTAGE
PASSENGER SEAT HEATER GROUND CKT SHORTED TO VOLTAGE
HEATED SEAT DRIVER CKT SHORTED TO VOLTAGE
PASSENGER HEATED SEAT CUSHION OPEN
PASSENGER SEAT BACK HEATER OPEN
HEATED SEAT DRIVER CKT OPEN
PASSENGER SEAT HEATER GROUND CKT OPEN
PASSENGER SEAT HEATER B(+) DRIVER CKT OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the passenger seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the PASSENGER SEAT HEAT OUTPUT OPEN/SHORT TO BATTERY DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Measure the total resistance of the Passenger Seat Heater System between the Passenger Seat Heater B(+) Driver and the Passenger Seat Heater Ground circuits in the HSM C2 connector. Is the resistance below 50.0 ohms? Yes → Go To 3 No → Go To 7	All
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater B(+) Driver circuit. Is ANY voltage present on the Passenger Seat Heater B(+) Driver circuit? Yes → Go To 4 No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater B(+) Driver circuit. Is there ANY voltage on the Passenger Seat Heater B(+) Driver circuit? Yes → Repair the Passenger Seat Heater B(+) Driver circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Back 4-way connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater Ground circuit. Is there ANY voltage on the Passenger Seat Heater Ground circuit? Yes → Go To 6 No → Replace the Passenger Heated Seat Cushion / Bolster. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Back 2-way (green) connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater Ground circuit. Is there ANY voltage on the Passenger Seat Heater Ground circuit? Yes → Repair the Passenger Seat Heater Ground circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the Heated Seat Driver circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the CUSHION SEAT HEATER ELEMENT. Connect one lead to the Heated Seat Driver circuit (cushion side) and the other lead to the Passenger Seat Heater B(+) Driver circuit (cushion side) in the Passenger Heated Seat Cushion 4 way connector. Is the resistance below 2.0 ohms? Yes → Go To 8 No → Replace the Passenger Heated Seat Cushion / Bolster. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Passenger Heated Seat Back 2-way (green) connector. Measure the resistance of the SEAT BACK HEATER ELEMENT. Connect one lead to the Heated Seat Driver circuit (seat back side) and the other lead to the Passenger Seat Heater Ground circuit (seat back side) in the Passenger Heated Seat 2-way connector. Is the resistance below 2.0 ohms? Yes → Go To 9 No → Replace the Passenger Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Passenger Heated Seat Back 2-way (green) connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Heated Seat Driver circuit between the Passenger Heated Seat Back 2-way connector (harness side) and the Passenger Heated Seat Cushion 4-way connector (harness side). Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open Heated Seat Driver circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
10	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Passenger Heated Seat Back 2-way (green) connector. Disconnect the HSM C2 harness connector. Measure the resistance of the Passenger Seat Heater Ground circuit between the Seat Back 2-way connector (harness side) and the Heated Seat Module connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the Passenger Seat Heater Ground circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
11	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Disconnect the Heated Seat Module C2 harness connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit between the HSM C2 connector and the Passenger Heated Seat Cushion 4-way connector (harness side). Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the open Passenger Seat Heater B(+) Driver circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

When Monitored and Set Condition:

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module loses the seat heat element output.

POSSIBLE CAUSES
DTC PRESENT
HEATED SEAT MODULE
PASSENGER SEAT HEATER B(+) DRIVER CKT SHORTED TO VOLTAGE
PASSENGER HEATED SEAT CUSHION SHORTED TO VOLTAGE
PASSENGER SEAT HEATER GROUND CKT (1) SHORTED TO VOLTAGE
PASSENGER SEAT HEATED GROUND CKT (2) SHORTED TO VOLTAGE
CONNECTOR TO SPLICE - CUSHION SIDE - OPEN
PASSENGER SEAT HEATER B(+) DRIVER CKT OPEN
PASSENGER SEAT HEATER GROUND CKT (JUMPER) OPEN
PASSENGER SEAT HEATER GROUND CKT (1) OPEN
PASSENGER SEAT HEATER GROUND CKT (2) OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the driver seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the PASSENGER SEAT HEAT OUTPUT OPEN/SHORT TO BATTERY DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

— Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Measure the total resistance of the Passenger Seat Heater System from the Passenger Seat Heater B(+) Driver to the Passenger Seat Heater Ground circuits in the HSM C2 connector. Is the resistance below 50.0 ohms? Yes → Go To 3 No → Go To 7	All
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater B(+) Driver circuit. Is ANY voltage present on the Passenger Seat Heater B(+) Driver circuit? Yes → Go To 4 No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater B(+) Driver circuit. Is there ANY voltage on the Passenger Seat Heater B(+) Driver circuit? Yes → Repair the Passenger Seat Heater B(+) Driver circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the HSM C2 harness connector. Disconnect the Passenger Heated Seat Back 4-way connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater Ground circuit at the HSM C2 connector. Is there ANY voltage on the Passenger Seat Heater Ground circuit? Yes → Go To 6 No → Replace the Passenger Heated Seat Cushion / Bolster. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

— Continued

TEST	ACTION	APPLICABILITY
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the HSM C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Disconnect the Passenger Heated Seat Back 2-way connector. Turn the ignition on. Measure the voltage of the Passenger Seat Heater Ground circuit at the HSM C2 connector. Is there ANY voltage on the Passenger Seat Heater Ground circuit? Yes → Repair the Passenger Seat Heater Ground circuit for a short to voltage between the HSM C2 connector and the Passenger Heated Seat Back 2-way connector. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the Passenger Seat Heater Ground circuit for a short to voltage between the Passenger Heated Seat Back 2-way connector and the Passenger Heated Seat Cushion 4-way connector. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the HSM C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Connect a jumper wire from the Passenger Seat Heater B+ Driver circuit to the Passenger Seat Heater Ground circuit at the Passenger Heated Seat Cushion 4-way connector (harness side). Measure the resistance of the Passenger Seat Heater B+ Driver circuit and the Passenger Seat Heater Ground circuit in the HSM C2 connector. Is the resistance below 5.0 ohms? Yes → Repair the open circuit in either the Passenger Seat Heater Ground or the Passenger Seat Heater B(+) Driver wiring between the HSM C2 connector and the splice in the seat. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 8	All
8	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit between the HSM C2 connector and the Passenger Heated Seat Cushion 4-way connector (harness side). Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open Passenger Seat Heater B(+) Driver circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER SEAT HEAT OUTPUT OPEN/SHT TO BATTERY (LIMITED)

— Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Disconnect the Passenger Heated Seat Back 2-way (green) connector. Measure the resistance of the Passenger Seat Heater Ground circuit (jumper). Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open Driver Seat Heater Ground (jumper) circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
10	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Back 2-way (green) connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater Ground circuit. Connect one lead to the Passenger Seat Heater Ground circuit at the Passenger Heated Seat Back 2-way connector and the other lead to the Passenger Seat Heater Ground circuit in the Passenger Heated Seat Cushion 4-way connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the open Passenger Seat Heater Ground circuit between the Passenger Heated Seat Back 2-way connector and the Passenger Heated Seat Cushion 4-way connector. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
11	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Back 2-way (green) connector. Disconnect the HSM C2 harness connector. Measure the resistance of the Passenger Seat Heater Ground circuit between the Seat Back 2-way connector (harness side) and the Heated Seat Module C2 connector. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the Passenger Seat Heater Ground circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
PASSENGER SEAT HEAT OUTPUT SHORT TO GND (LAREDO)

When Monitored and Set Condition:

PASSENGER SEAT HEAT OUTPUT SHORT TO GND (LAREDO)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module detects an output shorted to ground.

POSSIBLE CAUSES
DTC PRESENT
PASSENGER SEAT HEATER B(+) DRIVER CKT SHORTED TO GROUND
HEATED SEAT MODULE
PASSENGER HEATED SEAT CUSHION SHORTED TO GROUND
PASSENGER HEATED SEAT BACK SHORTED TO GROUND
HEATED SEAT DRIVER CKT SHORTED TO GROUND
HEATED SEAT MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the passenger seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the PASSENGER SEAT HEAT OUTPUT SHORT TO GROUND DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
2	Using the DRBIII®, select: Body - Memory Seat Module - Erase DTC's. **NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Start the engine. Turn the passenger seat heater on and operate at both ranges. With the DRBIII®, read DTC's. Does the DRBIII® still show Passenger Seat Heat Output Short to Gnd? Yes → Go To 3 No → Go To 4	All

PASSENGER SEAT HEAT OUTPUT SHORT TO GND (LAREDO) — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit to ground. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Seat Heater B(+) Driver circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit in the Passenger Heated Seat Cushion connector (cushion side) to ground. Is the resistance below 100.0 ohms? Yes → Replace the Passenger Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Back 2-way (green) connector. Measure the resistance of the Heated Seat Driver circuit, in the Passenger Heated Seat Back connector (seat back side) to ground. Is the resistance below 1000.0 ohms? Yes → Replace the Passenger Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 6	All
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way (green) connector. Disconnect the Passenger Heated Seat Back 2-way (green) connector. Measure the resistance of the Heated Seat Driver circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Heated Seat Driver circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Test Complete.	All

Symptom:
PASSENGER SEAT HEAT OUTPUT SHORT TO GND (LIMITED)

When Monitored and Set Condition:

PASSENGER SEAT HEAT OUTPUT SHORT TO GND (LIMITED)

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is set immediately after the Heated Seat Module detects an output shorted to ground.

POSSIBLE CAUSES
DTC PRESENT
PASSENGER SEAT HEATER B(+) DRIVER CKT SHORTED TO GROUND
PASSENGER SEAT HEATER B(+) DRIVER CKT SHORTED TO PASSENGER SEAT HEATER GROUND
HEATED SEAT MODULE
HEATED SEAT MODULE
PASSENGER HEATED SEAT CUSHION SHORTED TO GROUND
PASSENGER HEATED SEAT BACK SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Start the engine. Turn the passenger seat heater on and operate in both ranges. With the DRBIII®, read DTCs. Did the PASSENGER SEAT HEAT OUTPUT SHORT TO GROUND DTC return? Yes → Go To 2 No → The conditions required to set the code are currently not present. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
2	Using the DRBIII®, select: Body - Memory Seat Module - Erase DTC's. **NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Start the engine. Turn the Passenger Seat Heater on and operate in both ranges. With the DRBIII®, read DTC's. Does the DRBIII® still show Passenger Seat Heat Output Short to Gnd? Yes → Go To 3 No → Go To 5	All

PASSENGER SEAT HEAT OUTPUT SHORT TO GND (LIMITED) — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit to the Passenger Seat Heater Ground circuit in the HSM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Passenger Seat Heater B(+) Driver circuit for a short to the Passenger Seat Heater Ground circuit. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C2 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit to ground. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Seat Heater B(+) Driver circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Test Complete.	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit in the Passenger Heated Seat Cushion connector (cushion side) to ground. Is the resistance below 100.0 ohms? Yes → Go To 6 No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Disconnect the Passenger Heated Seat Back 2-way (black) connector. Measure the resistance of the Passenger Seat Heater B(+) Driver circuit in the Passenger Heated Seat Cushion connector (cushion side) to ground. Is the resistance below 1000.0 ohms? Yes → Replace the Passenger Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Passenger Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
PASSENGER THERMISTOR OUT OF RANGE HIGH

When Monitored and Set Condition:

PASSENGER THERMISTOR OUT OF RANGE HIGH

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is immediately set when the Heated Seat Module senses a greater value than the value stored in EEPROM.

POSSIBLE CAUSES
PASSENGER SEAT SENSOR SHORTED
PASSENGER SEAT TEMPERATURE SENSOR INPUT CIRCUIT SHORTED TO BATTERY
PASSENGER SEAT TEMPERATURE SENSOR INPUT CKT SHORTED TO 5 VOLTS
HEATED SEAT MODULE - SENSOR SHORTED
SEAT SENSOR 5-VOLT SUPPLY CKT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance between the Seat Sensor 5 Volt Supply circuit and the Passenger Seat Temperature Sensor Input circuit at the Passenger Heated Seat Cushion (cushion side) connector. Is the resistance below 800 ohms at room temperature? Yes → Replace the Passenger Heated Seat Cushion - sensor shorted.. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 2	All
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage between the Passenger Seat Temperature Sensor Input circuit and ground. Is the voltage above 5.5 volts? Yes → Repair the Passenger Seat Temperature Sensor Input circuit for a short to battery. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

PASSENGER THERMISTOR OUT OF RANGE HIGH — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage between the Passenger Seat Temperature Sensor Input circuit and ground. Is there ANY voltage on the Passenger Seat Temperature Sensor Input circuit? Yes → Repair the Passenger Seat Temperature Sensor Input circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 connector. Disconnect the Passenger Heated Seat Cushion 4-way (green) connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the open Seat Sensor 5-Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
PASSENGER THERMISTOR OUT OF RANGE LOW

When Monitored and Set Condition:

PASSENGER THERMISTOR OUT OF RANGE LOW

When Monitored: With the ignition on, during the heated seat operation.

Set Condition: This condition is immediately set when the Heated Seat Module senses a lesser value than the value stored in EEPROM.

POSSIBLE CAUSES
PASSENGER HEATED SEAT CUSHION SENSOR OPEN
PASSENGER SEAT TEMPERATURE SENSOR INPUT CKT SHORTED TO GROUND
PASSENGER HEATED SEAT CUSHION SENSOR SHORT TO GROUND
PASSENGER SEAT TEMPERATURE SENSOR INPUT CKT OPEN
HEATED SEAT MODULE
SEAT SENSOR 5-VOLT SUPPLY CKT OPEN
HEATED SEAT MODULE-5 VOLTS OPEN

TEST	ACTION	APPLICABILITY
1	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Turn the ignition on. Measure the voltage between the Seat Sensor 5 Volt Supply circuit and ground. Is the voltage below 4.5 volts? Yes → Go To 2 No → Go To 3	All
2	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit between the Heated Seat Module connector and the Passenger Heated Seat Cushion (harness side) connector. Is the resistance below 5.0 ohms? Yes → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the open Seat Sensor 5 Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

PASSENGER THERMISTOR OUT OF RANGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance between the Seat Sensor 5 Volt Supply circuit and the Passenger Seat Temperature Sensor Input circuit at the Passenger Heated Seat Cushion (cushion side) connector. Is the resistance above 70,000 (70K) ohms at room temperature? Yes → Replace the Passenger Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 harness connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Temperature Sensor Input circuit to ground. Is the resistance below 1,000.0 ohms? Yes → Repair the Passenger Seat Temperature Sensor Input circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance between the Passenger Seat Temp Sensor Input circuit and ground. Is the resistance below 1000.0 ohms? Yes → Replace the Passenger Seat Cushion Cover Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 6	All
6	**NOTE: Raise the seat to the highest position to gain access to the connectors. The HSM is located at the front of the seat and the Seat Heater connectors are at the rear of the seat.** Turn the ignition off. Disconnect the Heated Seat Module C1 connector. Disconnect the Passenger Heated Seat Cushion 4-way connector. Measure the resistance of the Passenger Seat Temperature Sensor Input circuit from the Heated Seat Module connector to the Passenger Heated Seat Cushion connector. Is the resistance below 5.0 ohms? Yes → Replace the Heated Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Repair the open Passenger Seat Temperature Sensor Input circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
REAR DEF RELAY SHORTED HI

When Monitored and Set Condition:

REAR DEF RELAY SHORTED HI

When Monitored: With the ignition key in the run position.

Set Condition: The BCM attempts to activate the rear defogger relay and senses excessive current on the circuit.

POSSIBLE CAUSES
REAR DEFOGGER RELAY
JUNCTION BLOCK
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Connect a test light between cavities 85 & 86 of the Rear Window Defogger Relay connector. Turn the ignition on. With the DRBIII®, actuate the R Defog Relay and observe the test light. Does the test light flash on and off when the relay is actuated? Yes → Replace the Rear Window Defogger Relay. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 2	All
2	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Disconnect and remove the Body Control Module. Turn the ignition on. Measure the voltage at cavities 85 & 86 of the Relay connector. Is the voltage above 1.0 volts at BOTH cavities? (Note: there should only be voltage on one cavity) Yes → Replace the Junction Block. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Body Control Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
REAR DEFOGGER RELAY OPEN

When Monitored and Set Condition:

REAR DEFOGGER RELAY OPEN

When Monitored: With the ignition in the run position.

Set Condition: The rear defogger relay output of the BCM does not have battery voltage.

POSSIBLE CAUSES
FUSED B(+) CKT SHORTED TO GROUND
REAR DEFOGGER RELAY OUTPUT CKT SHORTED TO GROUND
PDC FUSE #2 OPEN
FUSED B(+) CKT OPEN
REAR WINDOW DEFOGGER RELAY
REAR WINDOW DEFOGGER RELAY CONTROL SHORT TO GROUND.
JUNCTION BLOCK
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Remove and inspect the PDC fuse #2. Is the PDC fuse #2 open? Yes → Go To 2 No → Go To 4	All
2	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Measure the resistance of the Fused B(+) circuits in the Rear Window Defogger Relay connector to ground. Is the resistance below 5.0 ohms? Yes → Repair the Fused B(+) circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

REAR DEFOGGER RELAY OPEN — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Rear Window Defogger connector at the rear window Grid. Remove the Rear Window Defogger Relay from the Junction Block. Measure the resistance between ground and the Rear Window Defogger Relay Output circuit at the Rear Window Defogger connector. Is the resistance below 5.0 ohms? Yes → Repair the Rear Window Defogger Relay Output circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace PDC fuse #2. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Turn the ignition on. Measure the voltage of the Fused B(+) circuit in the Rear Window Defogger Relay connector. Is the voltage above 10.0 volts? Yes → Go To 5 No → Repair the open Fused B(+) circuit from PDC fuse #2. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Connect a test light between cavities 85 & 86 of the Rear Window Defogger Relay connector. Turn the ignition on. With the DRBIII®, actuate the R Defog Relay and observe the test light. Does the test light flash on and off when the relay is actuated? Yes → Replace the Rear Window Defogger Relay. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 6	All
6	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Disconnect and remove the Body Control Module. Measure the resistance of the Rear Window Defogger Relay Control circuit to ground. Is the resistance below 1000.0 ohms? Yes → Replace the Junction Block. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 7	All
7	Turn the ignition off. Lower the Junction Block and remove the Rear Window Defogger Relay. Disconnect and remove the Body Control Module. Measure the resistance of the Rear Window Defogger Relay Control circuit between the relay connector and the J/B-BCM connector in the Junction Block. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Replace the Junction Block. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT BACK HEATER INOPERATIVE (LIMITED)

POSSIBLE CAUSES
DRIVER SEAT BACK HEATER OPEN (LIMITED)
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This test is only valid on Limited models where the Seat Cushion heats properly but the Seat Back does not heat.** Start the Engine. Turn the Heated Seat Switch on. Does the Seat Cushion warm up but the Seat Back does not? Yes → Check for an open circuit in the Seat Back. If okay, replace the Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT BOLSTER HEATER INOPERATIVE (LIMITED)

POSSIBLE CAUSES
DRIVER HEATED SEAT BOLSTER OPEN (LIMITED)
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This test is only valid on Limited models where the Seat Back and Seat Cushion heats properly but the Seat Bolsters do not.** Start the Engine. Turn the Heated Seat Switch on. Does the Seat Back and Seat Cushion warm up but the Seat Bolsters do not? Yes → Check for an open circuit in the Seat. If okay, replace the Heated Seat Cushion Cover. Perform VERIFICATION TEST -MEMORY SYSTEM. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT CUSHION HEATER INOPERATIVE (LIMITED)

POSSIBLE CAUSES
DRIVER HEATED SEAT CUSHION OPEN (LIMITED)
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This test is only valid on Limited models where the Seat Back heats properly but the Seat Cushion does not heat.** Start the Engine. Turn the Heated Seat Switch on. Does the Seat Back warm up but the Seat Cushion does not? Yes → Check for an open circuit in the Seat. If okay, replace the Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*HEATED SEATS INOPERATIVE DUE TO KEY-IN IGNITION SWITCH INPUT

POSSIBLE CAUSES
OBSERVE THE KEY-IN IGNITION SWITCH STATUS
IGNITION SWITCH OPEN
KEY-IN IGNITION SWITCH GROUND CIRCUIT OPEN
KEY-IN IGNITION SWITCH SENSE CIRCUIT OPEN
BCM-INCORRECT KEY-IN IGNITION SWITCH STATUS

TEST	ACTION	APPLICABILITY
1	**Note: Ensure that the Key is still in the Ignition Switch.** With the DRBIII® enter Body Computer then Input Output and read the Key-In Ignition Switch status. Does the DRB display: KEY-IN IGN: CLOSED ? Yes → Test complete. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 2	All
2	Turn the ignition off. Disconnect the Ignition Switch harness connector. Connect a jumper between the Key-In Ignition Switch Sense circuit and Ground circuit. With the DRBIII® enter Body Computer then Input Output and observe the Key-In Ignition Switch status. Does the DRBIII display KEY-IN IGN: CLOSED? Yes → Replace the Ignition Switch. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All
3	Turn the ignition off. Disconnect the Ignition Switch harness connector. Turn all lights off. Measure the resistance between ground and the ground circuit in the ignition switch connector. Is the resistance below 5.0 ohms ? Yes → Go To 4 No → Repair the ground circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*HEATED SEATS INOPERATIVE DUE TO KEY-IN IGNITION SWITCH INPUT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Ignition Switch harness connector. Disconnect the Body Control Module C1 harness connector. Measure the resistance of the Key-In Ignition Switch Sense circuit between the ignition switch connector and the BCM C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Key-In Ignition Switch Sense circuit for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Body Control Module in accordance with the Service Information. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*PASSENGER SEAT BACK HEATER INOPERATIVE (LIMITED)

POSSIBLE CAUSES
PASSENGER HEATED SEAT BACK OPEN (LIMITED)
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This test is only valid on Limited models where the Seat Cushion heats properly but the Seat Back does not heat.** Start the Engine. Turn the Heated Seat Switch on. Does the Seat Cushion warm up but the Seat Back does not? Yes → Check for an open circuit in the Seat. If okay, replace the Heated Seat Back. Perform VERIFICATION TEST -MEMORY SYSTEM. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*PASSENGER SEAT BOLSTER HEATER INOPERATIVE (LIMITED)

POSSIBLE CAUSES
PASSENGER HEATED SEAT BOLSTER OPEN (LIMITED)
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This test is only valid on Limited models where the Seat Back and Seat Cushion heats properly but the e Bolster does not.** Start the Engine. Turn the Heated Seat Switch on. Does the Seat Back and Seat Cushion warm up but the Seat Bolster does not? Yes → Check for an open circuit in the Seat. If okay, replace the Heated Seat Cushion Cover. Perform VERIFICATION TEST -MEMORY SYSTEM. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*PASSENGER SEAT CUSHION HEATER INOPERATIVE (LIMITED)

POSSIBLE CAUSES
PASSENGER HEATED SEAT CUSHION OPEN (LIMITED)
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: This test is only valid on Limited models where the Seat Back heats properly but the Seat Cushion does not heat.** Start the Engine. Turn the Heated Seat Switch on. Does the Seat Back warm up but the Seat Cushion does not? Yes → Check for an open circuit in the Seat. If okay, replace the Heated Seat Cushion. Perform VERIFICATION TEST -MEMORY SYSTEM. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*REAR WINDOW DEFOGGER GRID INOPERATIVE

POSSIBLE CAUSES
REAR DEFOGGER RELAY DTC'S
INTERMITTENT CONDITION
REAR WINDOW DEFOGGER GROUND CKT
REAR WINDOW DEFOGGER GRID OPEN
REAR WINDOW DEFOGGER RELAY OUTPUT OPEN
REAR WINDOW DEFOGGER RELAY
REAR WINDOW DEFOGGER RELAY OUTPUT SHORTED TO GROUND
REPLACE FAULTY FUSE
FUSED B(+) CKT OPEN AT RELAY
SUBSTITUTE RELAY
JUNCTION BLOCK
REAR WINDOW DEFOGGER SWITCH SENSE CKT OPEN
REAR WINDOW DEFOGGER SWITCH SENSE CKT SHORTED TO GROUND
REAR WINDOW DEFOGGER SWITCH SENSE CKT SHORTED TO VOLTAGE
AUTOMATIC ZONE CONTROL MODULE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the Body Computer DTC's. Are there any Rear Defogger Relay DTC's present? Yes → Refer to the symptom list for problems related to Rear Defogger Relay DTC's. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Toggle the Rear Defogger switch and observe the indicator. Does the indicator toggle on and off when the switch is pressed? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition and all lights off. Open the liftgate. Measure the resistance between ground and the Rear Window Defogger Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Rear Window Defogger Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All

*REAR WINDOW DEFOGGER GRID INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition on. Turn the Rear Window Defogger on. Measure the voltage between the Rear Window Defogger Relay Output circuit at the defogger grid on the rear window to ground. Is the voltage above 12.0 volts? Yes → Repair the open in the Rear Window Defogger Grid. Perform BODY VERIFICATION TEST - VER 1. No → Repair the open Rear Window Defogger Relay Output circuit. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition on. With the DRBIII®, read the R DEFOG SWITCH Input/Output display. Toggle the Rear Window Defogger Switch on and off and observe the DRB. Does the DRBIII® show that the Rear Defog Switch is toggling on and off? Yes → Go To 6 No → Go To 12	All
6	Remove and inspect the PDC fuse #2. Is the PDC fuse #2 open? Yes → Go To 7 No → Go To 9	All
7	Remove the Rear Window Defogger Relay from the Junction Block. Measure the resistance of the Rear Window Defogger Relay coil in cavities 85 and 86. Is the resistance between 50.0 and 100.0 ohms? Yes → Go To 8 No → Replace the Rear Window Defogger Relay and replace PDC fuse #2 if necessary. Perform BODY VERIFICATION TEST - VER 1.	All
8	Disconnect the Rear Window Defogger connector at the rear window grid. Remove the Rear Window Defogger Relay from the Junction Block. Measure the resistance between ground and the Rear Window Defogger Relay Output circuit at the Rear Window Defogger connector. Is the resistance below 5.0 ohms? Yes → Repair the Rear Window Defogger Relay Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the PDC fuse #2. Perform BODY VERIFICATION TEST - VER 1.	All
9	Lower the Junction Block and remove the Rear Window Defogger Relay. Turn the ignition on. Measure the voltage of the Fused B(+) circuit in the Rear Window Defogger Relay connector. Is the voltage above 10.0 volts? Yes → Go To 10 No → Repair the open Fused B(+) circuit from PDC fuse #2. Perform BODY VERIFICATION TEST - VER 1.	All

*REAR WINDOW DEFOGGER GRID INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
10	Lower the Junction Block and remove the Rear Window Defogger Relay. Install a known good relay in the Rear Window Defogger Relay connector. Turn the ignition on. Check the Rear Window Defogger for proper operation. Does the system operate properly now? Yes → Replace the original Rear Window Defogger Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	With the DRBIII®, actuate the R DEFOG RELAY. Using a 12-volt Test Light connected to ground, back probe the Rear Window Defogger Relay Output circuit in the Junction Block C1 connected. Does the test light flash on and off when the relay is actuated? Yes → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
12	Turn the ignition off. Disconnect the BCM C2 connector. Disconnect the Temperature Control C1 connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of the Rear Window Defogger Switch Sense circuit between the BCM connector and the AZC connector. Is the resistance below 5.0 ohms? Yes → Go To 13 No → Repair the open Rear Window Defogger Switch Sense circuit. Perform BODY VERIFICATION TEST - VER 1.	All
13	Turn the ignition off. Disconnect the BCM C2 connector. Disconnect the Temperature Control C1 connector. Measure the resistance between ground and the Rear Window Defogger Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Rear Window Defogger Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 14	All

*REAR WINDOW DEFOGGER GRID INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
14	Turn the ignition off. Disconnect the BCM C2 connector. Disconnect the Temperature Control C1 connector. **NOTE: Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage between the Rear Window Defogger Switch Sense circuit and ground. Is there any voltage present? Yes → Repair the Rear Window Switch Sense circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 15	All
15	**NOTE: Ensure the BCM is connected before proceeding.** Turn the ignition off. Disconnect the Temperature Control C1 connector. Connect a jumper wire between the Rear Window Defogger Switch Sense circuit in the Temperature Control connector to ground. Turn the ignition on. With the DRBIII®, read the R DEFOG SWITCH status. Does the DRBIII® display R DEFOG SWITCH: CLOSED? Yes → Replace the Automatic Zone Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REAR WINDOW DEFOGGER SWITCH INDICATOR INOPERATIVE

POSSIBLE CAUSES
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT CKT SHORTED TO GROUND
JUNCTION BLOCK FUSE #11
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT CKT OPEN
TEMPERATURE CONTROL HEAD (AZC OR MANUAL)

TEST	ACTION	APPLICABILITY
1	Inspect Junction Block fuse #11. Is Junction Block fuse #11 open? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. Disconnect the Temperature Control Head C1 connector. Measure the resistance of the Fused Rear Window Defog Relay Output circuit to ground (from the output side of fuse #11) Is the resistance below 5.0 ohms? Yes → Repair the Fused Rear Window Defogger Relay Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block fuse #11. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Temperature Control Head C1 connector. Remove the Rear Window Defogger Relay. **NOTE: Check connectors - Clean/repair as necessary.** Ensure that Junction Block fuse #11 is installed. Measure the resistance of the Fused rear Window Defogger Relay Output circuit from the relay output terminal to the Temperature Control Head C1 connector. Is the resistance below 5.0 ohms? Yes → Replace the Temperature Control Head (AZC or manual). Perform BODY VERIFICATION TEST - VER 1. No → Repair the open Fused Rear Window Defogger Relay Output circuit. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
FOG LAMP RELAY CKT SHORTED HI

When Monitored and Set Condition:

FOG LAMP RELAY CKT SHORTED HI

When Monitored: Ignition in run position.

Set Condition: The BCM detects excessive current on the fog lamp relay control circuit.

POSSIBLE CAUSES
FOG LAMP RELAY
FOG LAMP RELAY CONTROL SH TO B(+)
BCM INTERNAL DEFECT FOG LAMP CONTROL SHORT TO BATTERY

TEST	ACTION	APPLICABILITY
1	Install a known good relay in place of the Fog Lamp Relay. Does the system operate correctly? Yes → Replace the Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the Fog Lamp Relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn ignition on. Measure voltage of the Fog Lamp Relay control circuit at the Junction Block to ground. Is the voltage greater than 1.0 volt? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
FOG LAMP RELAY CKT SHORTED LO/OPEN

When Monitored and Set Condition:

FOG LAMP RELAY CKT SHORTED LO/OPEN

When Monitored: With the ignition switch in the on position.

Set Condition: This DTC sets if no voltage is seen at the fog lamp relay control circuit cavity.

POSSIBLE CAUSES
FOG LAMP RELAY COIL SHORTED
FOG LAMP RELAY OUTPUT CKT SHORT
FOG LAMP RELAY MISSING
OPEN B(+)
OPEN FUSED B+ TO FOG RELAY
FOG LAMP RELAY
FOG LAMP RELAY CONTROL CKT OPEN
FOG LAMP RELAY CONTROL CKT SHORTED TO GROUND
BCM FOG LAMP RELAY CONTROL
FUSE #24

TEST	ACTION	APPLICABILITY
1	Check Junction Block fuse #24. Is fuse #24 open? Yes → Go To 2 No → Go To 4	All
2	Remove the Fog Lamp Relay from the Junction Block. Using an ohmmeter measure the Fog lamp relay coil terminals 85 and 86. Is the resistance between 70 and 80 ohms? Yes → Go To 3 No → Replace the Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the Fog Lamp Relay from the Junction Block. Using an ohmmeter measure the Fog Lamp Relay Output circuit to ground. Is the resistance below 0.5 ohms? Yes → Repair the relay output circuit for a short to ground and replace the fuse if necessary. Perform BODY VERIFICATION TEST - VER 1. No → Replace the fuse. Perform BODY VERIFICATION TEST - VER 1.	All

FOG LAMP RELAY CKT SHORTED LO/OPEN — Continued

TEST	ACTION	APPLICABILITY
4	Looking at the Junction Block, see if the Fog Lamp Relay is present. Is the relay present? Yes → Go To 5 No → Install the missing relay. Perform BODY VERIFICATION TEST - VER 1.	All
5	For the results of this test to be valid voltage must be present at the Junction Block C5 connector cavity #3. Measure the voltage of the B(+) circuit to fuse #24. Is the voltage above 10.0 volts? Yes → Go To 6 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
6	Remove the Fog Lamp Relay from the Junction Block. Measure Fused B+ cavities for the Fog Lamp Relay in the Junction Block. Is the voltage above 10.0 volts at both cavities? Yes → Go To 7 No → Replace the junction block. Perform BODY VERIFICATION TEST - VER 1.	All
7	Install a known good relay in place of the Fog Lamp Relay. Does the system operate correctly? Yes → Replace the Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Remove the Fog Lamp Relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Measure the resistance of the Fog Lamp Relay Control circuit between the relay and the Body Control Module. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
9	Remove the fog lamp relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Measure the resistance of the Fog Lamp Relay Control circuit to ground. Is the resistance below 10.0 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
HAZARD RELAY CKT SHORTED HI

When Monitored and Set Condition:

HAZARD RELAY CKT SHORTED HI

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This code is set if the BCM tries to activate the hazard lamps and excessive current is sinked into the BCM.

POSSIBLE CAUSES
COMBO FLASHER INTERNAL SHORT TO B(+)
HAZARD SWITCH SENSE CIRCUIT SHORTED TO B(+)
BCM HAZARD CIRCUIT SHORT TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Remove the combination flasher from the junction block With the DRB III erase BCM DTC's. Operate either the panic feature on the RKE fob or trigger the vehicle theft alarm. With the DRB re-read the BCM trouble codes. Did the "Hazard relay ckt shorted Hi" trouble code reset? Yes → Go To 2 No → Replace the Combination Flasher. Perform BODY VERIFICATION TEST - VER 1.	All
2	Remove the Combination Flasher from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn ignition on. Using a voltmeter measure the Hazard switch sense ckt cavity 9 to ground at the combination flasher socket in the Junction Block. Was the voltage greater than 1.0 volt? Yes → Repair the Hazard Switch Sense circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
HEADLAMP SW OPEN CKT

When Monitored and Set Condition:

HEADLAMP SW OPEN CKT

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This DTC sets if the BCM detects voltage on the MUX circuit above 4.8 volts.

POSSIBLE CAUSES
HEADLAMP MUX VOLTS > 4.9
HEADLAMP SWITCH MUX OPEN
HEADLAMP SWITCH RETURN OPEN
BCM HEADLAMP MUX

TEST	ACTION	APPLICABILITY
1	Disconnect the left multi-function switch connector. Turn ignition on. Connect a jumper wire between headlamp switch MUX and headlamp switch return at the left multifunction switch. With the DRBIII® in Body Sensors, read the Headlamp sw volts. Does the DRB display ″Headlamp switch″ 0.0 volts? No → Go To 2 Yes → Replace the left multi-function switch Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the left multi-function switch connector. Disconnect the Body Control Module C-1 connector. Measure the resistance of the headlamp switch mux circuit from the BCM C1 connector to the left multi-function switch connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Headlamp Switch Mux circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the left multi-function switch connector. Disconnect the Body Control Module-C1 connector. Using an ohmmeter measure the Headlamp Switch Return circuit from BCM to left multi-function. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open headlamp switch return circuit. Perform BODY VERIFICATION TEST - VER 1.	All

HEADLAMP SW OPEN CKT — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
HEADLAMP SW SHORT TO GROUND

When Monitored and Set Condition:

HEADLAMP SW SHORT TO GROUND

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This DTC sets if the BCM detects voltage on the MUX circuit below 0.3 volts.

POSSIBLE CAUSES
HEADLAMP SWITCH MUX SHORTED
LEFT MULTI-FUNTION SWITCH SHORTED
BCM

TEST	ACTION	APPLICABILITY
1	Disconnect the left multi-function switch connector. Turn ignition on. Does the DRB display ″Headlamp switch″ 5.0 volts? No → Go To 2 Yes → Replace the left multi-function switch. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the left multi-function switch connector. Disconnect the Body Control Module C-1 connector. Measure the resistance of the headlamp switch mux circuit to ground at the left multi-function switch connector. Is the resistance below 5.0 ohms? Yes → Repair the Headlamp Switch Mux circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
HIGH BEAM RELAY CKT SHORTED HI

When Monitored and Set Condition:

HIGH BEAM RELAY CKT SHORTED HI

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This condition is set when the BCM is trying to activate the High beam relay and excessive current is sinked into the BCM.

POSSIBLE CAUSES
HI BEAM RELAY
HIGH BEAM RELAY CONTROL CIRCUIT SHORTED TO B(+)
BCM HIGH BEAM CONTROL SHORT TO BATTERY

TEST	ACTION	APPLICABILITY
1	Install a known good relay in place of the High Beam relay. Does the system now operate correctly? Yes → Replace the High Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the High Beam relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn ignition on. Using a voltmeter measure the High Beam Relay control ckt cavity 86 to ground at the Junction Block. Was the voltage greater than 1.0 volt? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
LOW BEAM RELAY CKT SHORTED HI

When Monitored and Set Condition:

LOW BEAM RELAY CKT SHORTED HI

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This condition is set when the BCM is trying to activate the lo beam relay and excessive current is sinked into the BCM.

POSSIBLE CAUSES
LOW BEAM RELAY
LOW BEAM RELAY CONTROL SHORTED TO B(+)
BCM LOW BEAM CONTROL SHORT TO BATTERY

TEST	ACTION	APPLICABILITY
1	Install a known good relay in place of the Low Beam relay. Does the system now operate correctly? Yes → Replace the Low Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the Low Beam relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn ignition on. Using a voltmeter measure the Low Beam Relay control ckt cavity 86 to ground at the Junction Block. Was the voltage greater than 1.0 volt? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
LOW BEAM RELAY CKT SHORTED LO/OPEN

When Monitored and Set Condition:

LOW BEAM RELAY CKT SHORTED LO/OPEN

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This condition detects if the lo beam relay has not been installed in the vehicle by monitoring the BCM lo beam relay output for battery voltage applied.

POSSIBLE CAUSES
LOW BEAM RELAY
OPEN FUSED B(+)
LOW BEAM RELAY CTL CKT OPEN
LOW BEAM RELAY CONTROL CIRCUIT SHORTED TO GROUND
BCM LOW BEAM CONTROL CIRCUIT SHORTED LOW/OPEN
LOW BEAM RELAY MISSING

TEST	ACTION	APPLICABILITY
1	Install a known good relay in place of the Low Beam relay. Does the system now operate correctly? Yes → Replace the Low Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Looking at the Junction Block, see if the relay is present. Is the relay present? Yes → Go To 3 No → Install the correct relay. Perform BODY VERIFICATION TEST - VER 1.	All
3	For the results of this test to be valid, voltage must be present at the Junction Block C5 connector cavity #1. Measure the voltage of the fused B(+) circuits to Low Beam relay cavities #30 and #85. Is the voltage above 10.0 volts at both cavities? Yes → Go To 4 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All

LOW BEAM RELAY CKT SHORTED LO/OPEN — Continued

TEST	ACTION	APPLICABILITY
4	Remove the Low Beam relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Using an ohmmeter measure the Low Beam Relay control circuit from relay cavity 86 to the Junction Block Body Control Module connector cavity 4. Was the resistance below 5.0 ohms? Yes → Go To 5 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn ignition off. Remove the Body Control Module from the Junction Block. Remove the Low Beam Relay from the junction block. Measure the resistance of the Low Beam Relay Control circuit. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PARK LAMP RELAY CKT SHORTED HI

When Monitored and Set Condition:

PARK LAMP RELAY CKT SHORTED HI

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This condition is set when the BCM is trying to activate the park relay and excessive current is detected on the control circuit.

POSSIBLE CAUSES
PARK LAMP RELAY
BCM PARK LAMP CONTROL SHORT TO BATTERY
PARK LAMP RELAY CONTROL SH TO B(+)

TEST	ACTION	APPLICABILITY
1	Install a known good relay in place of the Park Lamp relay. Does the system now operate correctly? Yes → Replace the Park Lamp relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the park lamp relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn ignition on. Using a voltmeter measure the Park Lamp Relay control ckt cavity 86 to ground at the Junction Block. Was the voltage greater than 1.0 volt? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PARK LAMP RELAY CKT SHORTED LO/OPEN

When Monitored and Set Condition:

PARK LAMP RELAY CKT SHORTED LO/OPEN

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: The DTC is is set if the BCM detects excessive current on the park lamp relay control circuit.

POSSIBLE CAUSES
PARK LAMP RELAY OUTPUT CIRCUIT SHORT
PARK LAMP RELAY MISSING
PARK LAMP RELAY
PARK LAMP RELAY CTL CKT OPEN
OPEN FUSED B(+) TO PARK RELAY
OPEN B(+)
BCM PARKLAMP CONTROL CIRCUIT SHORTED LOW/OPEN
FUSE #6

TEST	ACTION	APPLICABILITY
1	Check J/B fuse #6. Is fuse #6 open? Yes → Go To 2 No → Go To 3	All
2	Remove the park lamp relay from the Junction Block. Using an ohmmeter measure the park lamp relay output circuit from relay cavity 30 to ground. Is the resistance below 0.6 ohms? Yes → Repair the relay output circuit for a short to ground and replace the fuse if necessary. Perform BODY VERIFICATION TEST - VER 1. No → Replace the fuse. Perform BODY VERIFICATION TEST - VER 1.	All
3	Looking at the Junction Block, see if the Park Lamp Relay is present. Is the relay present? Yes → Go To 4 No → Install the missing relay. Perform BODY VERIFICATION TEST - VER 1.	All

PARK LAMP RELAY CKT SHORTED LO/OPEN — Continued

TEST	ACTION	APPLICABILITY
4	Install a known good relay in place of the Park Lamp relay. Does the system now operate correctly? Yes → Replace the Parklamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Remove the Park Lamp relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Using an ohmmeter measure the Park Lamp Relay control circuit from relay cavity 86 to the Junction Block Body Control Module connector cavity 1. Was the resistance below 5.0 ohms? Yes → Go To 6 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
6	For the results of this test to be valid, voltage must be present at the Junction Block C5 connector cavity #1. Measure the voltage of the B(+) circuit to fuse #6. Is the voltage above 10.0 volts? Yes → Go To 7 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
7	Remove the Park Lamp Relay from the Junction Block. Measure cavities 85 and 87 (fused B(+)) for the Park Lamp Relay at the Junction Block. Is the voltage above 10.0 volts at both cavities? Yes → Go To 8 No → Replace the junction block. Perform BODY VERIFICATION TEST - VER 1.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
REAR FOG LAMP RELAY CKT OPEN

When Monitored and Set Condition:

REAR FOG LAMP RELAY CKT OPEN

When Monitored: Ignition switch in the On position and the IOD fuse installed.

Set Condition: This DTC sets if the BCM does not detect any voltage on the control circuit.

POSSIBLE CAUSES
JUNCTION BLOCK - REAR FOG LAMP RELAY CONTROL CKT SHORTED TO GROUND
REAR FOG LAMP RELAY OPEN
JUNCTION BLOCK - REAR FOG LAMP RELAY CONTROL CKT OPEN
BODY CONTROL MODULE
INSPECT FUSE #27
JUNCTION BLOCK - FUSED B+ CKT SHORTED TO GROUND
REAR FOG LAMP RELAY SHORTED
REAR FOG LAMP RELAY OUTPUT CIRCUIT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	Remove the Rear Fog Lamp Relay from the Junction Block. Using a 12-volt Test Light connected to ground, probe cavity 85 of the Rear Fog Lamp Relay connector. Is the test light illuminated? Yes → Go To 2 No → Go To 6	All
2	Remove the Rear Fog Lamp Relay from the Junction Block. Turn the ignition on. Using a 12-volt Test Light connected to 12-volts, probe cavity 86 of the Rear Fog Lamp Relay connector. With the DRB enter Body, Body Computer, then Actuator Tests. While monitoring the test light, actuate the Rear Fog Lamp Relay. Does the test light flash on and off as the relay is actuated? Yes → Replace the Rear Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

REAR FOG LAMP RELAY CKT OPEN — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove the Rear Fog Lamp Relay from the Junction Block. Remove the BCM from the Junction Block. Measure the resistance between ground and cavity 86 of the Rear Fog Lamp Relay connector. Is the resistance below 5.0 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Rear Fog Lamp Relay from the Junction Block. Remove the BCM from the Junction Block. Measure the resistance of the Rear Fog Lamp Relay Control circuit between the Rear Fog Lamp Relay connector cavity 86 and the Junction Block BCM connector cavity 13. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
6	Inspect fuse #27 in the Junction Block. Is the fuse open? Yes → Go To 7 No → Check the B+ feed circuit from the PDC fuse for an open or short. If ok, replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
7	Remove the Rear Fog Lamp Relay from the Junction Block. Turn the ignition off. Measure the resistance between ground and cavity 30 of the Rear Fog Lamp Relay connector. Is the resistance below 5.0 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off. Remove the Rear Fog Lamp Relay from the Junction Block. Remove the BCM from the Junction Block. Measure the resistance between ground and cavity 86 of the Rear Fog Lamp Relay connector. Is the resistance below 5.0 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All

REAR FOG LAMP RELAY CKT OPEN — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Remove the Rear Fog Lamp Relay from the Junction Block. Replace Fuse #27 in the Junction Block with a good fuse. Connect a jumper wire between cavity 30 and cavity 87 of the Rear Fog Lamp Relay connector. Inspect fuse #27 in the Junction Block. Is the fuse open? Yes → Check the Rear Fog Lamp Relay Output circuit for a short to ground. If ok, replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Rear Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
REAR FOG RELAY OUTPUT SHORTED HI

When Monitored and Set Condition:

REAR FOG RELAY OUTPUT SHORTED HI

When Monitored: Ignition switch in the On position and the IOD fuse installed.

Set Condition: This condition is set when the BCM is trying to activate the rear fog lamp relay and excessive current is detected on the control circuit.

POSSIBLE CAUSES
REAR FOG LAMP RELAY SHORTED TO VOLTAGE
JUNCTION BLOCK - REAR FOG LAMP RELAY CONTROL CKT SHORTED TO VOLTAGE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Remove the Rear Fog Lamp Relay from the Junction Block. Turn the ignition on. Measure the voltage of the Rear Fog Lamp Relay Control circuit (cavity 86) in the Rear Fog Lamp Relay connector. Is the voltage above 1.0 volt? Yes → Go To 2 No → Replace the Rear Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove the Rear Fog Lamp Relay from the Junction Block. Remove the BCM from the Junction Block. Turn the ignition on. Measure the voltage of the Rear Fog Lamp Relay Control circuit (cavity 86) in the Rear Fog Lamp Relay connector. Is the voltage above 1.0 volt? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:
***AUTO HEADLAMPS WILL NOT TURN OFF**
***AUTO HEADLAMPS WILL NOT TURN ON**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be *AUTO HEADLAMPS WILL NOT TURN OFF.

POSSIBLE CAUSES
HEADLAMP SWITCH FUNCTION
AUTOMATIC HEADLAMP LIGHT SENSOR OPEN
ULTRALIGHT SENSOR SIGNAL OPEN
BCM ULTRALIGHT SENSE CIRCUIT OPEN
AUTO HEADLAMP SENSOR CIRCUIT SHORTED
ULTRALIGHT SENSOR SIGNAL SHORTED TO GROUND
BCM ULTRALIGHT SENSE CIRCUIT SHORTED

TEST	ACTION	APPLICABILITY
1	With the DRB III read the ″AUTO HEADLAMP SENSE VOLTS″ under sensors while shinning a shop light on the Auto Headlamp Light sensor and then covering it up. The ″Auto Headlamp Sense″ voltage should change from approximately 0.0 to 5.0 volts, Choose outcome. A. Voltage in range Go To 2 B. Stays above 4.8 volts Go To 3 C. Stays below 0.5 volts Go To 7	All
2	With the DRB III under Body sensors, read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch OFF 4.4 VOLTS Parking lamps ON 3.2 VOLTS Headlamps ON 2.0 VOLTS Auto headlamps ON 0.6 VOLTS Do the values on the the DRB match. Yes → Test Complete. No → Replace the Left Multifunction Switch. Perform BODY VERIFICATION TEST - VER 1.	All

*AUTO HEADLAMPS WILL NOT TURN OFF — Continued

TEST	ACTION	APPLICABILITY
3	With the DRB III under Body sensors, read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch OFF 4.4 VOLTS Parking lamps ON 3.2 VOLTS Headlamps ON 2.0 VOLTS Auto headlamps ON 0.6 VOLTS Do the values on the the DRB match. Yes → Go To 4 No → Replace the Left Multifunction Switch. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Automatic headlamp light sensor/VTSS led 4-way connector. Connect a jumper from the ultra light sensor signal ckt to the ultra light sensor return ckt. With the DRB III in sensors read Auto head sensor volts. Does the DRB III show Auto head sensor volts under .5 volts? Yes → Replace the Automatic Headlamp Light Sensor/VTSS LED. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Disconnect the Auto headlamp light sensor 4-way connector. Disconnect the BCM C2 connector. Using an ohmmeter measure the ultralight sense circuit from the Auto headlamp light sensor 4-way to the BCM C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open Ultralight Sensor Signal circuit. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
7	With the DRB III under Body sensors, read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch OFF 4.4 VOLTS Parking lamps ON 3.2 VOLTS Headlamps ON 2.0 VOLTS Auto headlamps ON 0.6 VOLTS Do the values on the the DRB match. Yes → Go To 8 No → Replace the Left Multifunction Switch. Perform BODY VERIFICATION TEST - VER 1.	All
8	Disconnect the Automatic headlamp light sensor/VTSS led 4-way connector. With the DRB III in sensors read Auto Headlamp sensor volts. Does the DRB III display Auto Headlamp sensor above 4.8 volts? Yes → Replace the Auto Headlamp Light Sensor/VTSS LED. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All

*AUTO HEADLAMPS WILL NOT TURN OFF — Continued

TEST	ACTION	APPLICABILITY
9	Disconnect the Auto headlamp light sensor 4-way connector. Disconnect the BCM C2 connector. Using an ohmmeter measure the ultralight sense signal circuit from the Auto headlamp light sensor 4-way to ground. Is the resistance below 5.0 ohms? Yes → Repair the Ultralight Sensor Signal circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*FLASH TO PASS INOPERATIVE

POSSIBLE CAUSES
JUNCTION BLOCK HIGH BEAM RELAY CONTROL OPEN
LEFT MULTI-FUNCTION SWITCH
HIGH BEAM RELAY CONTROL CIRCUIT OPEN TO LEFT MULTI-FUNCTION SWITCH

TEST	ACTION	APPLICABILITY
1	The High Beam Headlamps must be operational for the result of this test to be valid. Disconnect the Left Multi-Function switch harness connector. Measure the voltage of the High Beam Relay control circuit in the Left Multi-Function switch connector. Is the voltage above 10.0 volts? Yes → Replace the Left Multi-Function Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Disconnect the left multi-function switch connector. Disconnect the Junction Block C-3 harness connector. Using an ohmmeter measure the High Beam Relay control circuit from the left multi-function switch connector to the Junction Block C-3 connector. Was the resistance below 5.0 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Repair the High Beam Relay Control circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*FOG LAMPS WILL NOT TURN OFF

POSSIBLE CAUSES
FOG LAMP RELAY
JUNCTION BLOCK
FOG LAMP RELAY OUTPUT CIRCUIT SHORT TO BATTERY
FOG LAMP SWITCH SENSE SHORTED
FOG LAMP SWITCH OPEN/SHORTED
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRB III under Body Input/Outputs, read the Fog lamp switch state while turning the Fog lamp switch on and off. Did the fog lamp switch state change? Yes → Go To 2 No → Go To 4	All
2	Install a known good relay in place of the Fog Lamp relay. Does the system now operate correctly? Yes → Replace the Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the Junction Block C-2 harness connector. Did the fog lamps turn off? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Relay Output circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the left multi-function switch connector if not already disconnected. Disconnect the BCM C2 connector Measure the fog lamp switch sense circuit to ground at the left multi-function switch connector. Is the resistance below 5.0 ohms? Yes → Repair the Fog Lamp Switch Sense for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*FOG LAMPS WILL NOT TURN OFF — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the left multi-function switch connector. With the DRB III under Body Input Outputs read the Fog Lamp switch state while connecting a jumper from the Fog lamp switch sense to the Headlamp switch return at the left multifunction Did the fog lamp switch state change? Yes → Replace the Left Multifunction Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*FOG LAMPS WILL NOT TURN ON

POSSIBLE CAUSES
JUNCTION BLOCK FOG LAMP RELAY OUTPUT CIRCUIT
FOG LAMP SWITCH SENSE SHORTED
OPEN B(+)
FOG LAMP RELAY OUTPUT CKT OPEN
FOG LAMP RELAY
FOG LAMP RELAY CTL CKT OPEN
FOG LAMP RELAY CTL CKT SHORTED TO GROUND
BCM FOG LAMP RELAY CONTROL
BCM FOG LAMP SENSE SHORTED
FOG LAMP SWITCH OPEN/SHORTED
FOG LAMP RELAY OUTPUT WIRE SHORT TO GROUND
FUSE #24

TEST	ACTION	APPLICABILITY
1	With the DRB III under Body Input Outputs read the Fog lamp switch state while turning the Fog lamp switch on and off. Did the fog lamp switch state change? Yes → Go To 2 No → Go To 11	All
2	Check Junction Block fuse #24. Is fuse #24 open? Yes → Go To 3 No → Go To 5	All
3	Remove the fog lamp relay from the Junction Block. Using an ohmmeter measure the fog lamp relay output circuit from relay cavity 87 to ground. Is the resistance below 0.5 ohms? Yes → Go To 4 No → Replace the fuse. Perform BODY VERIFICATION TEST - VER 1.	All

*FOG LAMPS WILL NOT TURN ON — Continued

TEST	ACTION	APPLICABILITY
4	Remove the fog lamp relay from the Junction Block. Disconnect the Junction Block C2 connector. Using an ohmmeter measure the fog lamp relay output circuit from relay cavity 87 to ground. Is the resistance below 0.5 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Repair the relay output wire for a short to ground and replace the fuse if necessary. Perform BODY VERIFICATION TEST - VER 1.	All
5	For the results of this test to be valid, voltage must be present at the Junction Block C5 connector cavity 3. Measure the voltage of the B(+) circuit to fuse #24. Is the voltage above 10.0 volts? Yes → Go To 6 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
6	Install a known good relay in place of the Fog Lamp relay. Does the system now operate correctly? Yes → Replace the Fog Lamp relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Remove the Fog Lamp relay from the Junction Block. Disconnect a Fog Lamp bulb connector. Using an ohmmeter measure the Fog Lamp relay output circuit from relay cavity 87 to the fog lamp bulb connector. Is the resistance below 0.5 ohms? Yes → Go To 8 No → Repair the open fog lamp relay output circuit. Perform BODY VERIFICATION TEST - VER 1.	All
8	Remove the Fog Lamp Relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Using an ohmmeter measure the Fog Lamp Relay control circuit from relay cavity 86 to the Junction Block Body Control Module connector cavity 2. Was the resistance below 5.0 ohms? Yes → Go To 9 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
9	Remove the fog lamp relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Using an ohmmeter measure the Fog Lamp Relay control ckt cavity 86 to ground at the Junction Block. Was the resistance below 10 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All

*FOG LAMPS WILL NOT TURN ON — Continued

TEST	ACTION	APPLICABILITY
10	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
11	Disconnect the left multi-function switch connector. With the DRBIII® under Body Input Outputs read the Fog Lamp switch state while connecting a jumper from the Fog Lamp Switch Sense to the Headlamp switch return at the left multi-function switch connector. Did the fog lamp switch state change? Yes → Replace the Left Multi-function switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 12	All
12	Disconnect the left multi-function switch connector if not already disconnected. Disconnect the BCM C2 connector Measure the Fog Lamp switch sense circuit to ground at the left multi-function switch connector. Is the resistance below 5.0 ohms? Yes → Repair the Fog lamp switch sense for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 13	All
13	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HIGH BEAM HEADLAMPS WILL NOT TURN OFF

POSSIBLE CAUSES
HIGH BEAM RELAY CONTROL WIRE SHORT TO GROUND
JUNCTION BLOCK HIGH BEAM CONTROL SHORT TO GROUND
LEFT MULTI-FUNCTION SWITCH FLASH TO PASS CIRCUIT
LEFT MULTI-FUNCTION SWITCH HIGH BEAM SENSE CIRCUIT SHORTED
HIGH BEAM RELAY OUTPUT SHORTED B+
HIGH BEAM RELAY
HIGH BEAM SWITCH SENSE SHORTED
BCM DEF HIGH BEAM SWITCH SENSE SHORTED
BCM HIGH BEAM RELAY CONTROL SHORTED

TEST	ACTION	APPLICABILITY
1	With the DRBIII® under Body Input Outputs, read the High beam switch state while turning the High Beam switch on and off. Did the high beam switch state change? Yes → Go To 2 No → Go To 7	All
2	Install a known good relay in place of the High Beam relay. Does the system now operate correctly? Yes → Replace the High Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Remove the High beam relay from the junction block. Are the High beam lamps still on? Yes → Repair the High beam relay output for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn ignition off. Remove the High Beam Relay from the Junction Block. Remove the Body Control Module from the Junction Block. Measure the resistance of the High Beam Relay Control circuit to ground at the relay connector. Is the resistance below 10.0 ohms? Yes → Go To 5 No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

*HIGH BEAM HEADLAMPS WILL NOT TURN OFF — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the left multi-function switch connector. Measure the resistance of the High Beam Relay Control circuit between the relay connector and ground. Is the resistance below 10.0 ohms? Yes → Go To 6 No → Replace the left multi-function switch. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Junction Block C3 connector. Measure the resistance of the High Beam Relay Control circuit between the relay connector and ground. Is the resistance below 10.0 ohms? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Repair the High Beam Relay Control wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1.	All
7	Disconnect the left multi-function switch connector. Did the High Beam Lamps turn off? Yes → Replace the left multi-function switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Disconnect the left multi-function switch connector if not already disconnected. Disconnect the BCM C2 connector Measure the high beam switch sense circuit to ground at the left multi-function switch connector. Is the resistance below 5.0 ohms? Yes → Repair the high beam switch sense for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HIGH BEAM HEADLAMPS WILL NOT TURN ON

POSSIBLE CAUSES
FUSED HIGH BEAM RELAY OUTPUT SHORT TO GROUND
HIGH BEAM RELAY OUTPUT CKT OPEN
OPEN FUSED B(+)
HIIGH BEAM RELAY
FUSES
HIGH BEAM SWITCH SENSE OPEN
HIGH BEAM RELAY CONTROL CIRCUIT OPEN
BCM HIGH BEAM CONTROL CIRCUIT
BCM HIGH BEAM SWITCH SENSE OPEN
JUMPER HIGH BEAM SWITCH SENSE TO GROUND

TEST	ACTION	APPLICABILITY
1	With the DRB III under Body Input Outputs read the High beam switch state while turning the high beam switch on and off. Did the high beam switch state change? Yes → Go To 2 No → Go To 9	All
2	Check Junction Block fuses #3 and #16. Are the fuses open? Yes → Go To 3 No → Go To 4	All
3	Using an ohmmeter measure the fused high Beam relay output circuit from the #3 fuse and then the #16 fuse to ground. Is the resistance below 0.4 ohms? Yes → Repair the fused high beam relay output for a short to ground and replace the fuse if necessary. Perform BODY VERIFICATION TEST - VER 1. No → Replace the fuse(s). Perform BODY VERIFICATION TEST - VER 1.	All
4	Install a known good relay in place of the High Beam relay. Does the system now operate correctly? Yes → Replace the High Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*HIGH BEAM HEADLAMPS WILL NOT TURN ON — Continued

TEST	ACTION	APPLICABILITY
5	For the results of this test to be valid, voltage must present at the Junction Block C5 connector cavity #1. Measure the voltage of the fused B(+) circuits to High Beam relay cavities #30 and #85. Is the voltage above 10.0 volts at both cavities? Yes → Go To 6 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
6	Remove the High Beam relay from the Junction Block. Using an ohmmeter measure the High Beam relay output circuit from relay cavity 87 to the right high beam fuse #16 and then the left high beam fuse #3 in the Junction Block. Is the resistance below 5.0 ohms from cavity 87 to both high beam fuses? Yes → Go To 7 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
7	Remove the High Beam relay from the Junction Block. Turn ignition off. Remove the Body Control Module from the Junction Block. Measure the High Beam Relay control circuit from relay cavity to the Junction Block Body Control Module connector. Was the resistance below 5.0 ohms? Yes → Go To 8 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
9	Disconnect the Left-Multifunction switch. With the DRBIII® under Body Input Outputs read the High beam switch state while jumping the high beam switch sense to ground. Did the high beam switch state change? Yes → Replace the Left-Multifunction switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All
10	Disconnect the left multi-function switch connector if not already disconnected. Disconnect the BCM C2 connector Measure the High beam switch sense circuit from the left multi-function switch connector to the BCM C2 connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Repair the open High beam switch sense circuit. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LOW BEAM HEADLAMPS WILL NOT TURN OFF

POSSIBLE CAUSES
LOW BEAM RELAY
LOW BEAM RELAY OUTPUT SHT B(+)
LOW BEAM RELAY CTL CKT SHORTED TO GROUND
HEADLAMP SWITCH FUNCTION
BCM LOW BEAM LAMPS WILL NOT TURN OFF

TEST	ACTION	APPLICABILITY
1	With the DRBIII® under Body sensors read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch OFF 4.4 VOLTS Parking lamps ON 3.2 VOLTS Headlamps ON 2.0 VOLTS Auto headlamps ON 0.6 VOLTS Do the values on the the DRB match. Yes → Go To 2 No → Replace the left multifunction switch. Perform BODY VERIFICATION TEST - VER 1.	All
2	Install a known good relay in place of the Low Beam relay. Does the system now operate correctly? Yes → Replace the Low Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Remove the low beam relay from the Junction Block. Did the lamps turn off? Yes → Go To 4 No → Repair the low beam relay output circuit for a short to battery Perform BODY VERIFICATION TEST - VER 1.	All
4	Reinstall the Low Beam Relay if previously removed. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn the ignition on. Did the low beam headlamps turn off? Yes → Go To 5 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LOW BEAM HEADLAMPS WILL NOT TURN ON

POSSIBLE CAUSES
HEADLAMP SWITCH FUNCTION
LOW BEAM RELAY
LOW BEAM RELAY OUTPUT CKT OPEN
FUSE
LOW BEAM RELAY OUTPUT CKT SHORTED
BCM HEADLAMP MUX INOP

TEST	ACTION	APPLICABILITY
1	Check Junction Block fuses #14 and #15. Is one or both fuses open? Yes → Go To 2 No → Go To 3	All
2	Remove the Low Beam relay from the Junction Block. Remove both of the Low Beam relay fuses #14 and #15. Using an ohmmeter measure the Low Beam relay output circuit from relay cavity 87 to ground. Is the resistance below 0.4 ohms? Yes → Repair the relay output circuit for a short to ground and replace the fuse if necessary. Perform BODY VERIFICATION TEST - VER 1. No → Replace the fuse. Perform BODY VERIFICATION TEST - VER 1.	All
3	With the DRB III under Body sensors, read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch OFF 4.4 VOLTS Parking lamps ON 3.2 VOLTS Headlamps ON 2.0 VOLTS Auto headlamps ON 0.6 VOLTS Do the values on the the DRB match. Yes → Go To 4 No → Replace the left multifunction switch. Perform BODY VERIFICATION TEST - VER 1.	All
4	Install a known good relay in place of the Low Beam relay. Does the system now operate correctly? Yes → Replace the Low Beam relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*LOW BEAM HEADLAMPS WILL NOT TURN ON — Continued

TEST	ACTION	APPLICABILITY
5	Remove the Low Beam relay from the Junction Block. Ensure fuses #14 and #15 are installed in the Junction Block. Using an ohmmeter measure the Low Beam relay output circuit from relay cavity 87 to either the right or left front lighting module connectors. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PARK LAMPS WILL NOT TURN OFF

POSSIBLE CAUSES
HEADLAMP SWITCH FUNCTION
PARK LAMP RELAY
PARK LAMP OUTPUT SHT B(+)
PARK LAMP RELAY CTL CKT SHORTED TO GROUND
BCM PARK LAMP CONTROL CKT

TEST	ACTION	APPLICABILITY
1	With the DRBIII® under Body sensors read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch OFF 4.4 VOLTS Parking lamps ON 3.2 VOLTS Headlamps ON 2.0 VOLTS Auto headlamps ON 0.6 VOLTS Do the values on the the DRB match. Yes → Go To 2 No → Replace the left multifunction switch. Perform BODY VERIFICATION TEST - VER 1.	All
2	Install a known good relay in place of the park lamp relay. Does the system now operate correctly? Yes → Replace the parklamp relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Remove the Park Lamp relay from the Junction Block. Did the lamps turn off? Yes → Go To 4 No → Repair the park lamp relay output circuit for a short to battery Perform BODY VERIFICATION TEST - VER 1.	All
4	Install the park lamp relay if removed in previous test. Turn ignition off. Remove the Body Control Module from the Junction Block. Turn ignition on. Did the park lamps turn off? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PARK LAMPS WILL NOT TURN ON

POSSIBLE CAUSES
CHECK BCM FOR DTCS
HEADLAMP SWITCH FUNCTION
PARK LAMP RELAY
PARK LAMP RELAY OUTPUT CKT OPEN
BCM HEADLAMP MUX INOP

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII® check the BCM for any DTCs. Are any DTCs set? Yes → Refer to symptom list and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	With the DRBIII® under Body sensors read the HEADLAMP SW VOLTS. Move the Headlamp switch to the different modes and compare the values to values shown. Headlamp switch ″OFF″ 4.4 VOLTS Parking lamps ″ON″ 3.2 VOLTS Headlamps ″ON″ 2.0 VOLTS Auto headlamps ″ON″ 0.6 VOLTS Do the values on the the DRB match. Yes → Go To 3 No → Replace the left multifunction switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Install a known good relay in place of the park lamp relay. Does the system now operate correctly? Yes → Replace the parklamp relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Remove the park lamp relay from the Junction Block. Disconnect the appropriate lighting module connector. Using an ohmmeter measure the park lamp relay output circuit from relay cavity 30 to the appropriate lighting module connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open park lamp relay output circuit. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REAR FOG LAMPS WILL NOT TURN OFF

POSSIBLE CAUSES
CHECK BCM FOR DTCS
CHECK THE LEFT MULTI-FUNCTION SWITCH OPERATION
REAR FOG LAMP RELAY
BODY CONTROL MODULE
JUNCTION BLOCK - REAR FOG LAMP RELAY OUTPUT CIRCUIT SHORTED TO GROUND
REAR FOG LAMP RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII® check the BCM for any DTCs. Are any DTCs set? Yes → Refer to symptom list and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the Left Multi-Function Switch to the off position. With the DRBIII® enter Body Computer sensors and monitor the Headlamp SW voltage. Does the DRB display voltage at approximately 0.6 volts? Yes → Replace the Left Multi-Function Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Install a substitute relay in place of the Rear Fog Lamp Relay. **Note: Ensure the Left Multi-Function Switch is in the off position.** Did the Rear Fog Lamps turn off? Yes → Replace the Rear Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the BCM from the Junction Block. Did the rear fog lamps turn off? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*REAR FOG LAMPS WILL NOT TURN OFF — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the Junction Block C1 harness connector. Did the rear fog lamps turn off? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Rear Fog Lamp Relay Output circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REAR FOG LAMPS WILL NOT TURN ON

POSSIBLE CAUSES
CHECK BCM FOR DTCS
CHECK THE LEFT MULTI-FUNCTION SWITCH OPERATION
JUNCTION BLOCK - FUSED B+ CIRCUIT OPEN
REAR FOG LAMP RELAY
REAR FOG LAMP RELAY OUTPUT CIRCUIT OPEN
JUNCTION BLOCK - REAR FOG LAMP RELAY OUTPUT CIRCUIT OPEN
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB check the BCM for any DTCs. Are any DTCs set? Yes → Refer to symptom list and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the Left Multi-Function Switch to the rear fog lamp position. With the DRB enter Body, Body Computer, then sensors and monitor the Headlamp Sw voltage. Does the DRB display voltage at approximately 0.6 volts? Yes → Go To 3 No → Replace the Left Multi-Function Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the Rear Fog Lamp Relay from the Junction Block. Using a 12-volt Test Light connected to ground, probe cavity 30 of the Rear Fog Lamp Relay connector. Is the test light illuminated? Yes → Go To 4 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
4	Install a substitute relay in place of the Rear Fog Lamp Relay. Turn the Rear Fog Lamps on. Did the Rear Fog Lamps turn on? Yes → Replace the Rear Fog Lamp Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*REAR FOG LAMPS WILL NOT TURN ON — Continued

TEST	ACTION	APPLICABILITY
5	Turn the Rear Fog Lamps on. Using a 12-volt Test Light connected to ground, backprobe the Rear Fog Lamp Relay Output circuit at the Junction Block C1 connector cavity 5. Is the test light illuminated? Yes → Repair the Rear Fog Lamp Relay Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Remove the BCM from the Junction Block. Connect a jumper wire between ground and the J/B BCM connector cavity 13 (Junction Block side). Do the Rear Fog Lamps turn on when the jumper wire is connected? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
AMBIENT AIR TEMP FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

AMBIENT AIR TEMP FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: When an outside air temperature signal is expected is not received in the maximum allowed time.

POSSIBLE CAUSES
AZC - AMBIENT AIR TEMP SENSOR
AMBIENT AIR TEMP FAILURE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **Note: Ensure the DRB is capable of communicating with the BCM before continuing.** With the DRB, enter Body, Automatic Temp Control, Monitor Display then PCI Bus Info and observe the outside air temp display. Is the correct Outside Air Temp displayed? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Refer to the Overhead Console category and perform the symptom related to the ambient air temperature sensor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
AMBIENT AIR TEMP FAILURE (AZC) (STORED)

When Monitored and Set Condition:

AMBIENT AIR TEMP FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: When an outside air temperature signal is expected is not received in the maximum allowed time.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. Manually press the recirculation mode switch on, wait 30 seconds then press it off. Manually press the A/C mode switch on, wait 30 seconds then press it off. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BLOWER SELECT SW OPEN (AZC) (ACTIVE)

When Monitored and Set Condition:

BLOWER SELECT SW OPEN (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the blower switch value and it is above 250 A/D counts.

POSSIBLE CAUSES
BLOWER MOTOR SWITCH FAILED OPEN

TEST	ACTION	APPLICABILITY
1	When this code is present the AZC Module must be replaced. View repair Repair Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BLOWER SELECT SW OPEN (AZC) (STORED)

When Monitored and Set Condition:

BLOWER SELECT SW OPEN (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the blower switch value and it is above 250 A/D counts.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. Manually press the recirculation mode switch on, wait 30 seconds then press it off. Manually press the A/C mode switch on, wait 30 seconds then press it off. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BLOWER SELECT SW SHORTED (AZC) (ACTIVE)

When Monitored and Set Condition:

BLOWER SELECT SW SHORTED (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the blower switch value and it is below 5 A/D counts.

POSSIBLE CAUSES
BLOWER MOTOR SWITCH FAILED SHORTED

TEST	ACTION	APPLICABILITY
1	When this code is present the AZC Module must be replaced. View repair Repair Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BLOWER SELECT SW SHORTED (AZC) (STORED)

When Monitored and Set Condition:

BLOWER SELECT SW SHORTED (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the blower switch value and it is below 5 A/D counts.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CAL CHECKSUM FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

CAL CHECKSUM FAILURE (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed after a battery disconnect.

Set Condition: This condition is set if the calibrated check sum does not match the stored value.

POSSIBLE CAUSES
AZC - CAL CHECKSUM FAILURE

TEST	ACTION	APPLICABILITY
1	When this code is present the AZC Module must be replaced. View repair Repair Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CAL CHECKSUM FAILURE (AZC) (STORED)

When Monitored and Set Condition:

CAL CHECKSUM FAILURE (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed after a battery disconnect.

Set Condition: This condition is set if the calibrated check sum does not match the stored value.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
COUNTRY CODE FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

COUNTRY CODE FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the country code message within 8 seconds.

POSSIBLE CAUSES
COUNTRY CODE FAILURE
PROGRAM COUNTRY CODE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body, Body Computer then Module Display and observe the country code. Compare the country code to the VIN. Does the country code match the VIN? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Program the correct country code into the BCM and retest vehicle. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
COUNTRY CODE FAILURE (AZC) (STORED)

When Monitored and Set Condition:

COUNTRY CODE FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the country code message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DEFECTIVE I/R SENSOR (AZC) (ACTIVE)

When Monitored and Set Condition:

DEFECTIVE I/R SENSOR (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC cannot read the I/R sensor values and or the I/R sensor values are not within a defined range of the HVAC air door motor counts.

POSSIBLE CAUSES
AZC - DEFECTIVE I/R SENSOR

TEST	ACTION	APPLICABILITY
1	When this code is present the AZC Module must be replaced. View repair Repair Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DEFECTIVE I/R SENSOR (AZC) (STORED)

When Monitored and Set Condition:

DEFECTIVE I/R SENSOR (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC cannot read the I/R sensor values and or the I/R sensor values are not within a defined range of the HVAC air door motor counts.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DRIVER BLEND DOOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored and Set Condition:

DRIVER BLEND DOOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
DRIVER CIRCUIT (B) SHORTED TO GROUND
DRIVER CIRCUIT (A) SHORTED TO GROUND
DRIVER CIRCUITS (A) AND (B) SHORTED TOGETHER
AZC MODULE DRIVER BLEND DOOR NOT RESPONDING
DRIVER CIRCUIT (A) OPEN
DRIVER CIRCUIT (B) OPEN
DRIVER BLEND DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance between ground and the Driver Blend Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Driver Blend Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance between ground and the Driver Blend Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Driver Blend Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

DRIVER BLEND DOOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance between the Driver Blend Door Driver (B) circuit and the Driver Blend Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Driver Blend Door Driver (B) circuit for a short to the Driver Blend Door Driver (A) circuit. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance of the Driver Blend Door Driver (A) circuit between the AZC Module C1 connector and the Driver Blend Door Motor/Actuator connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Driver Blend Door Driver (A) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance of the Driver Blend Door Driver (B) circuit between the AZC Module C2 connector and the Driver Blend Door Motor/Actuator connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Driver Blend Door Driver (B) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Make sure that the Driver Blend Door Motor harness connector is connected to the Driver Blend Door Motor. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance between the Driver Blend Door Driver (B) circuit and the Driver Blend Door Driver (A) circuit. Is the resistance between 26.0 and 46.0 ohms? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

DRIVER BLEND DOOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
7	If there are no possible causes remaining, view repair. Repair Replace the Driver Blend Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DRIVER BLEND DOOR NOT RESPONDING (AZC) (STORED)

When Monitored and Set Condition:

DRIVER BLEND DOOR NOT RESPONDING (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DRIVER BLEND DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored and Set Condition:

DRIVER BLEND DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
DRIVER CIRCUIT (B) SHORTED TO GROUND
DRIVER CIRCUIT (A) SHORTED TO GROUND
DRIVER BLEND DOOR MOTOR
DRIVER BLEND DOOR MOTOR
CHECK BLEND DOOR LINKAGE
AZC MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Driver Blend Door Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Driver Blend Door Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance between ground and the Driver Blend Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Driver Blend Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

DRIVER BLEND DOOR RANGE TOO LARGE (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Disconnect the AZC module C1 and C2 harness connectors. Measure the resistance between ground and the Driver Blend Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Driver Blend Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Driver Blend Door Motor/Actuator from the vehicle. By hand, attempt to rotate the driver blend door motor in both directions. Did the blend door motor turn in either direction? Yes → Replace the Driver Blend Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Remove the Driver Blend Door Motor from the vehicle. Rotate the blend door (door only), this should rotate approximately 45 degrees from stop to stop. Inspect the blend door linkage for excessive wear or missing linkage. Were any mechanical problems found? Yes → Repair or replace the blend door/linkage as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DRIVER BLEND DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored and Set Condition:

DRIVER BLEND DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DRIVER BLEND DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored and Set Condition:

DRIVER BLEND DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
CHECK THE AZC SIGNAL TOO DRIVER BLEND DOOR
OBSTRUCTED BLEND DOOR
DRIVER BLEND DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Driver Blend Door Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Driver Blend Door Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Driver Blend Door Motor/Actuator harness connector. Connect a 12-volt Test Light across the Driver Blend Door Motor/Actuator harness connector. Turn the ignition on. While monitoring the test light, turn the driver blend control knob from lo to hi. **Note: Observe test light for approximately 30 seconds.** Does the test light start to flash and stay flashing? Yes → Go To 3 No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

DRIVER BLEND DOOR RANGE TOO SMALL (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Driver Blend Door Motor from the vehicle. Rotate the blend door (door only), this should rotate approximately 45 degrees from stop to stop. Does the blend door move smoothly in both directions? Yes → Replace the Driver Blend Door Motor/Actuator. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Repair or replace the blend door as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DRIVER BLEND DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored and Set Condition:

DRIVER BLEND DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE COOLANT RESPONSE FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

ENGINE COOLANT RESPONSE FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the engine coolant response message within 8 seconds.

POSSIBLE CAUSES
CHECK THE PCM FOR ANY DTCS
OBSERVE THE ECT DISPLAY IN THE INSTRUMENT CLUSTER
AUTOMATIC ZONE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB check the PCM for any DTCs. Are any DTCs present? Yes → Refer to the Powertrain Diagnostic Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition on. With the DRB, enter Body, Electro/Mech Cluster (MIC), Monitor Display then PCI Bus Engine Info and monitor the engine coolant temperature display. Does the DRB display approximately the correct engine coolant temperature? Yes → Go To 3 No → Replace and program the Powertrain Control Module in accordance with the Service Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
3	With the DRB, erase the AZC DTC's. Turn the ignition on, wait 1 minute, then check for any AZC DTCs. Did this DTC reset? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
ENGINE COOLANT RESPONSE FAILURE (AZC) (STORED)

When Monitored and Set Condition:

ENGINE COOLANT RESPONSE FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the engine coolant response message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE RPM FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

ENGINE RPM FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the engine RPM response message within 8 seconds.

POSSIBLE CAUSES
CHECK THE PCM FOR ANY DTCS
OBSERVE THE RPM DISPLAY IN THE INSTRUMENT CLUSTER
AUTOMATIC ZONE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB check the PCM for any DTCs. Are any DTCs present? Yes → Refer to the Powertrain Diagnostic Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition on. With the DRB, enter Body, Electro/Mech Cluster (MIC), Monitor Display then PCI Bus Engine Info and monitor the engine RPM display. Start the engine. Does the DRB display approximately the correct engine RPM? Yes → Go To 3 No → Replace and program the Powertrain Control Module in accordance with the Service Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
3	With the DRB, erase the AZC DTC's. Start the engine, wait 1 minute, then check for any AZC DTCs. Did this DTC reset? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
ENGINE RPM FAILURE (AZC) (STORED)

When Monitored and Set Condition:

ENGINE RPM FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the engine RPM response message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
EVAP TEMP SENSOR OPEN (MTC & AZC)

When Monitored and Set Condition:

EVAP TEMP SENSOR OPEN (MTC & AZC)

When Monitored: With the ignition on.

Set Condition: This DTC is displayed if the BCM detects an abnormally high voltage on the Evaporator Temperature Sensor Signal circuit.

POSSIBLE CAUSES
EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
BODY CONTROL MODULE
EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
EVAPORATOR TEMPERATURE SENSOR
WIRING HARNESS INSPECTION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase all BCM DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the BCM DTC's. Does the DRBIII® display this DTC? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the BCM C2 harness connector. Turn the ignition on. Measure the voltage of the Evaporator Temperature Sensor Signal circuit. Is there any voltage present? Yes → Repair the Evaporator Temperature Sensor Signal circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

EVAP TEMP SENSOR OPEN (MTC & AZC) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the BCM C2 harness connector. Measure the resistance between the Evaporator Temperature Sensor Signal circuit and the Sensor Ground circuit. The approximate circuit resistance should be: 2,874 ohms @ 38°C (100°F). 3,214 ohms @ 35°C (95°F). 3,659 ohms @ 32°C (90°F). 4,125 ohms @ 29°C (85°F). 4,615 ohms @ 27°C (80°F). 5,238 ohms @ 24°C (75°F). 5,902 ohms @ 21°C (70°F). 6,733 ohms @ 18°C (65°F). 7,633 ohms @ 16°C (60°F). 8,611 ohms @ 13°C (55°F). 9,838 ohms @ 10°C (50°F). 11,199 ohms @ 7°C (45°F). 13,125 ohms @ 4°C (40°F). 14,883 ohms @ 2°C (35°F). 17,143 ohms @ -1°C (30°F). Is the resistance within the specifications? Yes → Replace and program the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the Evaporator Temperature Sensor harness connector. Measure the resistance of the Evaporator Temperature Sensor Signal circuit between the BCM C2 harness connector and the Evaporator Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Evaporator Temperature Sensor Signal circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the Evaporator Temperature Sensor harness connector. Measure the resistance of the Sensor Ground circuit between the BCM C2 harness connector and the Evaporator Temperature Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Rplace the Evaporator Temperature Sensor in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Sensor Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

EVAP TEMP SENSOR OPEN (MTC & AZC) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. **NOTE: Visually inspect the related wiring harness and circuits. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
EVAP TEMP SENSOR SHORTED (MTC & AZC)

When Monitored and Set Condition:

EVAP TEMP SENSOR SHORTED (MTC & AZC)

When Monitored: With the ignition on.

Set Condition: This DTC is displayed if the BCM detects an abnormally low voltage on the Evaporator Temperature Sensor Signal circuit.

POSSIBLE CAUSES
EVAPORATOR TEMPERATURE SENSOR
EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO SENSOR GROUND CIRCUIT
BODY CONTROL MODULE
WIRING HARNESS INSPECTION

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase all BCM DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the BCM DTC's. Does the DRBIII® display this DTC? Yes → Go To 2 No → Go To 5	All
2	Turn the ignition off. Disconnect the Evaporator Temperature Sensor harness connector. Turn the ignition on. With the DRBIII®, erase all BCM DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the BCM DTC's. Does the DRBIII® display: Evap Temp Sensor Open? Yes → Replace the Evaporator Temperature Sensor in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

EVAP TEMP SENSOR SHORTED (MTC & AZC) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the Evaporator Temperature Sensor harness connector. Measure the resistance between ground and the Evaporator Temperature Sensor Signal circuit. Is the resistance above 100k ohms? Yes → Go To 4 No → Repair the Evaporator Temperature Sensor Signal circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the Body Control Module C2 harness connector. Disconnect the Evaporator Temperature Sensor harness connector. Measure the resistance between the Evaporator Temperature Sensor Signal circuit and the Sensor Ground circuit. Is the resistance above 100k ohms? Yes → Replace and program the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Evaporator Temperature Sensor Signal circuit for a short to Sensor Ground. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. **NOTE: Visually inspect the related wiring harness and circuits. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Refer to any Technical Service Bulletins (TSB) that may apply.** Were any problems found? Yes → Repair as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
IAT RESPONSE FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

IAT RESPONSE FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the intake air temperature response message within 8 seconds.

POSSIBLE CAUSES
CHECK THE PCM FOR ANY DTCS
AUTOMATIC ZONE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB check the PCM for any DTCs. Are any DTCs present? Yes → Refer to the Powertrain Diagnostic Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	With the DRB, erase the AZC DTC's. Turn the ignition on, wait 1 minute, then check for any AZC DTCs. Did this DTC reset? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
IAT RESPONSE FAILURE (AZC) (STORED)

When Monitored and Set Condition:

IAT RESPONSE FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the intake air temperature response message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored and Set Condition:

MODE DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
MODE DOOR DRIVER CIRCUIT (B) SHORTED TO GROUND
MODE DOOR DRIVER CIRCUIT (A) SHORTED TO GROUND
MODE DOOR MOTOR
MODE DOOR MOTOR
CHECK MODE DOOR LINKAGE
AZC MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Mode Motor Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Mode Motor Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Mode Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Mode Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

MODE DOOR RANGE TOO LARGE (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Mode Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Mode Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Mode Door Motor/Actuator from the vehicle. By hand, attempt to rotate the mode door motor in both directions. Did the mode door motor turn in either direction? Yes → Replace the Mode Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Remove the Mode Door Motor from the vehicle. Rotate the mode doors (doors only), these should rotate approximately 45 degrees from stop to stop. Inspect the mode door linkage for excessive wear or missing linkage. Were any mechanical problems found? Yes → Repair or replace the mode door/linkage as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored and Set Condition:

MODE DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored and Set Condition:

MODE DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
CHECK THE AZC SIGNAL TOO MODE DOOR
OBSTRUCTED MODE DOOR
MODE DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Mode Motor Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Mode Motor Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Connect a 12-volt Test Light across the Mode Door Motor/Actuator harness connector. Turn the ignition on. While monitoring the test light, turn the mode control knob in each position. **Note: Observe test light for approximately 30 seconds.** Does the test light start to flash and stay flashing? Yes → Go To 3 No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

MODE DOOR RANGE TOO SMALL (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Mode Door Motor from the vehicle. Rotate the mode doors (doors only), these should rotate approximately 45 degrees from stop to stop. Do the mode doors move smoothly in both directions? Yes → Replace the Mode Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Repair or replace the mode door as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored and Set Condition:

MODE DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE MOTOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored and Set Condition:

MODE MOTOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
MODE DOOR DRIVER CIRCUIT (B) SHORTED TO GROUND
MODE DOOR DRIVER CIRCUIT (A) SHORTED TO GROUND
MODE DOOR DRIVER CIRCUITS (A) AND (B) SHORTED TOGETHER
AZC MODULE MODE DOOR NOT RESPONDING
MODE DOOR DRIVER CIRCUIT (A) OPEN
MODE DOOR DRIVER CIRCUIT (B) OPEN
MODE DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Mode Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Mode Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Mode Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Mode Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

MODE MOTOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between the Mode Door Driver (B) circuit and the Mode Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Mode Door Driver (B) circuit for a short to the Mode Door Driver (A) circuit. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance of the Mode Door Driver (A) circuit between the AZC Module C1 connector and the Mode Door Motor/Actuator connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Mode Door Driver (A) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the Mode Door Motor/Actuator harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance of the Mode Door Driver (B) circuit between the AZC Module C1 connector and the Mode Door Motor/Actuator connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Mode Door Driver (B) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Make sure that the Mode Door Motor harness connector is connected to the Mode Door Motor. Disconnect the AZC module C1 harness connector. Measure the resistance between the Mode Door Driver (B) circuit and the Mode Door Driver (A) circuit. Is the resistance between 26.0 and 46.0 ohms? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

MODE MOTOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
7	If there are no possible causes remaining, view repair. Repair Replace the Mode Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE MOTOR NOT RESPONDING (AZC) (STORED)

When Monitored and Set Condition:

MODE MOTOR NOT RESPONDING (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE SELECT SW OPEN (AZC) (ACTIVE)

When Monitored and Set Condition:

MODE SELECT SW OPEN (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the mode select switch value and it is above 250 A/D counts.

POSSIBLE CAUSES
MODE SELECT SWITCH FAILED OPEN

TEST	ACTION	APPLICABILITY
1	When this code is present the AZC Module must be replaced. View repair Repair Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE SELECT SW OPEN (AZC) (STORED)

When Monitored and Set Condition:

MODE SELECT SW OPEN (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the mode select switch value and it is above 250 A/D counts.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. Manually press the recirculation mode switch on, wait 30 seconds then press it off. Manually press the A/C mode switch on, wait 30 seconds then press it off. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE SELECT SW SHORTED (AZC) (ACTIVE)

When Monitored and Set Condition:

MODE SELECT SW SHORTED (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the mode select switch value and it is below 5 A/D counts.

POSSIBLE CAUSES
MODE SELECT SWITCH FAILED SHORTED

TEST	ACTION	APPLICABILITY
1	When this code is present the AZC Module must be replaced. View repair Repair Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
MODE SELECT SW SHORTED (AZC) (STORED)

When Monitored and Set Condition:

MODE SELECT SW SHORTED (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC reads the mode select switch value and it is below 5 A/D counts.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PASS BLEND DOOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored and Set Condition:

PASS BLEND DOOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
DRIVER CIRCUIT (B) SHORTED TO GROUND
DRIVER CIRCUIT (A) SHORTED TO GROUND
DRIVER CIRCUITS (A) AND (B) SHORTED TOGETHER
AZC MODULE PASSENGER BLEND DOOR NOT RESPONDING
DRIVER CIRCUIT (A) OPEN
DRIVER CIRCUIT (B) OPEN
PASSENGER BLEND DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance between ground and the Passenger Blend Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Blend Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance between ground and the Passenger Blend Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Blend Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

PASS BLEND DOOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance between the Passenger Blend Door Driver (B) circuit and the Passenger Blend Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Blend Door Driver (B) circuit for a short to the Passenger Blend Door Driver (A) circuit. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance of the Passenger Blend Door Driver (A) circuit between the AZC Module C2 connector and the in-line C202 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Passenger Blend Door Driver (A) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance of the Passenger Blend Door Driver (B) circuit between the AZC Module C2 connector and the in-line C202 connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Passenger Blend Door Driver (B) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Make sure that the in-line C202 harness connector is connected. Disconnect the AZC module C2 harness connector. Measure the resistance between the Passenger Blend Door Driver (B) circuit and the Passenger Blend Door Driver (A) circuit. Is the resistance between 26.0 and 46.0 ohms? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

PASS BLEND DOOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
7	**Note: Before replacing the passenger blend door motor, inspect the wiring harness between the in-line C202 connector and the blend door motor for any opens or shorts. Repair as necessary.** If there are no possible causes remaining, view repair. Repair Replace the Passenger Blend Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PASS BLEND DOOR NOT RESPONDING (AZC) (STORED)

When Monitored and Set Condition:

PASS BLEND DOOR NOT RESPONDING (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PASS BLEND DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored and Set Condition:

PASS BLEND DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
DRIVER CIRCUIT (B) SHORTED TO GROUND
DRIVER CIRCUIT (A) SHORTED TO GROUND
PASSENGER BLEND DOOR MOTOR
PASSENGER BLEND DOOR MOTOR
CHECK BLEND DOOR LINKAGE
AZC MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Pass Blend Door Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Pass Blend Door Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance between ground and the Passenger Blend Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Blend Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

PASS BLEND DOOR RANGE TOO LARGE (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance between ground and the Passenger Blend Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Passenger Blend Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Passenger Blend Door Motor/Actuator from the vehicle. By hand, attempt to rotate the passenger blend door motor in both directions. Did the blend door motor turn in either direction? Yes → Replace the Passenger Blend Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Remove the Passenger Blend Door Motor from the vehicle. Rotate the blend door (door only), this should rotate approximately 45 degrees from stop to stop. Inspect the blend door linkage for excessive wear or missing linkage. Were any mechanical problems found? Yes → Repair or replace the blend door/linkage as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PASS BLEND DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored and Set Condition:

PASS BLEND DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PASS BLEND DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored and Set Condition:

PASS BLEND DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
CHECK THE AZC SIGNAL TOO PASSENGER BLEND DOOR
OBSTRUCTED BLEND DOOR
PASSENGER BLEND DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Pass Blend Door Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Pass Blend Door Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the in-line C202 harness connector. Connect a 12-volt Test Light across the passenger blend door driver (A) circuit and the passenger blend door driver (B) circuit at the C202 harness connector (AZC harness side). Turn the ignition on. While monitoring the test light, turn the passenger blend control knob from lo to hi. **Note: Observe test light for approximately 30 seconds.** Does the test light start to flash and stay flashing? Yes → Go To 3 No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

PASS BLEND DOOR RANGE TOO SMALL (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Passenger Blend Door Motor from the vehicle. Rotate the blend door (door only), this should rotate approximately 45 degrees from stop to stop. Does the blend door move smoothly in both directions? Yes → Replace the Passenger Blend Door Motor/Actuator. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Repair or replace the blend door as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PASS BLEND DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored and Set Condition:

PASS BLEND DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RECIRC DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored and Set Condition:

RECIRC DOOR RANGE TOO LARGE (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
DRIVER CIRCUIT (B) SHORTED TO GROUND
DRIVER CIRCUIT (A) SHORTED TO GROUND
RECIRCULATION DOOR MOTOR
RECIRCULATION DOOR MOTOR
CHECK RECIRCULATION DOOR LINKAGE
AZC MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Recirc Motor Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Recirc Motor Not Responding. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Recirculation Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Recirculation Door Driver (B) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

RECIRC DOOR RANGE TOO LARGE (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Recirculation Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Recirculation Door Driver (A) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Recirculation Door Motor/Actuator from the vehicle. By hand, attempt to rotate the recirculation door motor in both directions. Did the recirculation door motor turn in either direction? Yes → Replace the Recirculation Door Motor/Actuator. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Remove the Recirculation Door Motor from the vehicle. Rotate the recirculation door (door only), this should rotate approximately 45 degrees from stop to stop. Inspect the recirculation door linkage for excessive wear or missing linkage. Were any mechanical problems found? Yes → Repair or replace the recirculation door/linkage as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Replace the AZC Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RECIRC DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored and Set Condition:

RECIRC DOOR RANGE TOO LARGE (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is greater than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RECIRC DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored and Set Condition:

RECIRC DOOR RANGE TOO SMALL (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
CHECK THE AZC MODULE FOR DTCS
CHECK THE AZC SIGNAL TOO RECIRCULATION DOOR
OBSTRUCTED RECIRC DOOR
RECIRCULATION DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, read the active AZC DTC's. Is the Recirc Motor Not Responding DTC set? Yes → Refer to the Heating and A/C category and perform the symptom Recirc Motor Not Responding. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the in-line C202 harness connector. Connect a 12-volt Test Light across the recirculation door driver (A) circuit and the recirculation door driver (B) circuit at the C202 harness connector (AZC harness side). Turn the ignition on. While monitoring the test light, press the recirculation control button from off to on. **Note: Observe test light for approximately 30 seconds.** Does the test light start to flash and stay flashing? Yes → Go To 3 No → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

RECIRC DOOR RANGE TOO SMALL (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Recirculation Door Motor from the vehicle. Rotate the recirculation door (door only), this should rotate approximately 45 degrees from stop to stop. Does the recirculation door move smoothly in both directions? Yes → Replace the Recirculation Door Motor/Actuator. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Repair or replace the recirculation door as necessary. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RECIRC DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored and Set Condition:

RECIRC DOOR RANGE TOO SMALL (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set when the AZC monitors the travel range during system initialization and the measured range is less than expected.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RECIRC MOTOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored and Set Condition:

RECIRC MOTOR NOT RESPONDING (AZC) (ACTIVE)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
DRIVER CIRCUIT (B) SHORTED TO GROUND
DRIVER CIRCUIT (A) SHORTED TO GROUND
DRIVER CIRCUITS (A) AND (B) SHORTED TOGETHER
AZC MODULE RECIRCULATION MOTOR NOT RESPONDING
DRIVER CIRCUIT (A) OPEN
DRIVER CIRCUIT (B) OPEN
RECIRCULATION DOOR MOTOR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Recirculation Door Driver (B) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Recirculation Door Driver (B) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between ground and the Recirculation Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Recirculation Door Driver (A) circuit for a short to ground. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

RECIRC MOTOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance between the Recirculation Door Driver (B) circuit and the Recirculation Door Driver (A) circuit. Is the resistance below 5.0 ohms? Yes → Repair the Recirculation Door Driver (B) circuit for a short to the Recirculation Door Driver (A) circuit. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance of the Recirculation Door Driver (A) circuit between the AZC Module C1 connector and the in-line C202 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Recirculation Door Driver (A) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the in-line C202 harness connector. Disconnect the AZC module C1 harness connector. Measure the resistance of the Recirculation Door Driver (B) circuit between the AZC Module C1 connector and the in-line C202 connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Recirculation Door Driver (B) circuit for an open. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Make sure that the in-line C202 harness connector is connected. Disconnect the AZC module C1 harness connector. Measure the resistance between the Recirculation Door Driver (B) circuit and the Recirculation Door Driver (A) circuit. Is the resistance between 26.0 and 46.0 ohms? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

RECIRC MOTOR NOT RESPONDING (AZC) (ACTIVE) — Continued

TEST	ACTION	APPLICABILITY
7	**Note: Before replacing the recirculation door motor, inspect the wiring harness between the in-line C202 connector and the recirculation door motor for any opens or shorts. Repair as necessary.** If there are no possible causes remaining, view repair. Repair Replace the Recirculation Door Motor. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
RECIRC MOTOR NOT RESPONDING (AZC) (STORED)

When Monitored and Set Condition:

RECIRC MOTOR NOT RESPONDING (AZC) (STORED)

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: This condition is set if the AZC does not receive feedback pulses within 5 seconds of the drive voltage being applied.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
VEHICLE SPEED FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

VEHICLE SPEED FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the vehicle speed response message within 8 seconds.

POSSIBLE CAUSES
CHECK THE PCM FOR ANY DTCS
OBSERVE THE VEHICLE SPEED DISPLAY IN THE INSTRUMENT CLUSTER
AUTOMATIC ZONE CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB check the PCM for any DTCs. Are any DTCs present? Yes → Refer to the Powertrain Diagnostic Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Raise the drive wheels off the ground. **Warning: Be sure to keep hands and feet clear of rotating wheels.** With the DRB, enter Body, Electro/Mech Cluster (MIC), Monitor Display then PCI Bus Engine Info and monitor the vehicle speed display. Start the engine and place the transmission in any forward gear. Does the DRB display vehicle speed above zero? Yes → Go To 3 No → Replace and program the Powertrain Control Module in accordance with the Service Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All
3	With the DRB, erase the AZC DTC's. Test drive vehicle, then check for any AZC DTCs. Did this DTC reset? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
VEHICLE SPEED FAILURE (AZC) (STORED)

When Monitored and Set Condition:

VEHICLE SPEED FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the vehicle speed response message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
VEHICLE VIN FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

VEHICLE VIN FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the vehicle VIN response message within 8 seconds.

POSSIBLE CAUSES
VEHICLE VIN FAILURE
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Engine then Miscellaneous. Compare the VIN that is programmed into the PCM with the VIN plate on the vehicle. Do the VIN(s) match? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace and program the Powertrain Control Module in accordance with the Service Information. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
VEHICLE VIN FAILURE (AZC) (STORED)

When Monitored and Set Condition:

VEHICLE VIN FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the vehicle VIN response message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
VF DIMMING FAILURE (AZC) (ACTIVE)

When Monitored and Set Condition:

VF DIMMING FAILURE (AZC) (ACTIVE)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the VF dimming response message within 8 seconds.

POSSIBLE CAUSES
AZC - VF DIMMING FAILURE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRB, read the BCM codes. These BCM DTC'S must NOT be present before continuing, for THIS test to be valid: Head Lamp SW Open CKT, Headlamp Sw Short to Ground, DIM SW Open CKT, DIM SW Short to Ground. With the DRB, enter Automatic Temp Control, Monitor Display then PCI Bus Info and look for the VF DIM Msg Present. Does the DRB display: VF DIM Msg present: Yes? Yes → Replace the AZC Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. With the DRB, Reset Module after repair/replacement is completed. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
VF DIMMING FAILURE (AZC) (STORED)

When Monitored and Set Condition:

VF DIMMING FAILURE (AZC) (STORED)

When Monitored: Every 8 seconds with the ignition on.

Set Condition: This condition is set if the AZC does not receive the VF dimming response message within 8 seconds.

POSSIBLE CAUSES
AZC MODULE STORED CODES PRESENT
STORED CODES TEST COMPLETE

TEST	ACTION	APPLICABILITY
1	**Note: Active codes must be resolved before diagnosing stored codes.** Anytime a code becomes active during this test, proceed to the conclusion question. Turn the ignition on. With the DRB, erase any stored DTC's. Monitor the DRB for active codes during the following test steps. Turn the mode select switch to the panel position with the fan control on low. Manually sweep the driver and passenger temperature control knobs from cold to hot then back to cold. Manually sweep the blower motor control knob through all positions. Manually sweep the mode select switch knob through all positions. With the DRB, perform the AZC self test. With the DRB, actuate all of the AZC door motors. Place the vehicle on a hoist, and raise the wheels off the floor. Start engine. Place the transmission in drive. Brake off. **WARNING: Be sure to keep hands and feet clear of rotating wheels. Keep clear of the engine's moving parts** Did any AZC code become active during this test? Yes → Return to the Symptom List and choose the active code. Perform BODY VERIFICATION TEST - VER 1. No → No problem found at this time. Erase all codes before returning vehicle to customer. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*A/C SWITCH SIGNAL NOT OPERATING PROPERLY (MTC & AZC)

POSSIBLE CAUSES
A/C OPERATES WITH A/C SELECT SWITCH OFF
A/C INOPERABLE WITH NO DTCS PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: This test applies to both manual and automatic temperature control systems.** Which condition is present? A/C Operates With A/C Select Switch Off Refer to *A/C Operates With A/C Select Switch Off in the Powertrain Diagnostic Information. Perform BODY VERIFICATION TEST - VER 1. A/C Inoperable With No DTCS Present For vehicles gasoline engines, refer to *Checking A/C System Operation With No DTCs in the Powertrain Diagnostic Information. For vehicles with diesel engines, refer to *A/C Inoperative in the Powertrain Diagnostic Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BLOWER MOTOR ALWAYS RUNS AT ONE SPEED ONLY (AZC)

POSSIBLE CAUSES
BLOWER MOTOR CONTROL CKT SHORTED TO GROUND
BLOWER MOTOR CONTROL CIRCUIT SHORTED TO BLOWER MOTOR HIGH DRIVER CIRCUIT
AZC MODULE, FAN STUCK ON ONE SPEED ONLY
BLOWER MOTOR CONTROLLER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Disconnect the AZC module C2 harness connector. Measure the resistance between ground and the Blower Motor Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the Blower Motor Control circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Disconnect the Blower Motor harness connector. Measure the resistance between the Blower Motor Control circuit and the Blower Motor High Driver circuit. Is the resistance below 5.0 ohms? Yes → Repair the Blower Motor Control circuit for a short to the Blower Motor High Driver circuit. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Reconnect all previous disconnected components. Use the DRB oscilloscope, select Lab Scope and set the following lab scope parameters. Set voltage range to +10.0v. Set probe to X10. Set time to 20ms/Div. Using the oscilloscope lead, backprobe the Blower Motor Control circuit at the Blower Motor Controller harness connector. Turn the ignition on. Set the blower switch to LO then slowly move to HI while observing the DRB display. The Scope patten should appear similar to what is provided in the reference material (Section 8.0). The voltage should cycle from approximately 0.5 volts, up to 5.0 volts in the low speed fan position. The duty cycle pattern should change smoothly as the blower switch is turned from LO to HI. The pattern should completely flatline when the blower speed reaches the HI setting. Does the DRB display a duty cycle pattern that changes from approximately 0.5 to 5.0 volts in LO? Yes → Go To 4 No → Replace the AZC Module. Perform BODY VERIFICATION TEST - VER 1. **NOTE: With the DRB, Reset Module after repair/replacement is completed.**	All

*BLOWER MOTOR ALWAYS RUNS AT ONE SPEED ONLY (AZC) — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the Blower Motor Controller. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BLOWER MOTOR INOPERATIVE (AZC)

POSSIBLE CAUSES
PDC FUSE #1
BLOWER MOTOR SUPPLY CIRCUIT SHORTED TO GROUND
BLOWER MOTOR SHORTED TO GROUND
BLOWER MOTOR CONTROLLER SHORTRD TO GROUND
CHECK FOR POWER TO THE BLOWER MOTOR CONTROLLER
GROUND CIRCUIT OPEN
BLOWER MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
BLOWER MOTOR CONTROL CIRCUIT OPEN
BLOWER MOTOR CONTROLLER OPEN
AUTOMATIC ZONE CONTROL MODULE OPEN
BLOWER MOTOR OPEN
BLOWER MOTOR CONTROLLER OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Remove and inspect Power Distribution Center (PDC) Fuse #1. Is the fuse open? Yes → Go To 2 No → Go To 5	All
2	Replace PDC Fuse #1. Turn the ignition on. Operate the blower motor in all speeds. Start the engine and operate the AZC system in all modes and speeds. Does the blower motor operate properly without blowing the fuse? Yes → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Measure the resistance between ground and the Blower Motor Supply circuit. Is the resistance below 10K ohms? Yes → Repair the Blower Motor Supply circuit for a short to ground. Replace PDC Fuse #1. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*BLOWER MOTOR INOPERATIVE (AZC) — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Disconnect the Blower Motor harness connector. Replace PDC Fuse #1. **CAUTION: Do not allow the jumper wire contacts to touch one another when connecting them to the Blower Motor. Doing so will cause the results of this test will be inaccurate.** Connect a jumper wire between Pin #1 on the Blower Motor and the Blower Motor Supply circuit in the Blower Motor Controller harness connector. Connect a jumper wire between Pin #2 on the Blower Motor and the Ground circuit in the Blower Motor Controller harness connector. Does the Blower Motor operate at full speed without blowing the fuse? Yes → Replace the Blower Motor Controller in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Blower Motor in accordance with the Service Information. Replace PDC Fuse #1. Perform BODY VERIFICATION TEST - VER 1.	All
5	Ensure PDC Fuse #1 is installed. Disconnect the Blower Motor Controller harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Using a 12-volt test light connected to ground, back probe the Blower Motor Supply circuit in the Blower Motor Controller harness connector. Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Blower Motor Supply circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Measure the resistance between ground and the Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Disconnect the Automatic Zone Control Module C2 harness connector. Turn the ignition on. Measure the voltage of the Blower Motor Control circuit. Is there any voltage present? Yes → Repair the Blower Motor Control circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All

*BLOWER MOTOR INOPERATIVE (AZC) — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Disconnect the Automatic Zone Control Module C2 harness connector. Measure the resistance of the Blower Motor Control circuit between the Blower Motor Controller harness connector and the Automatic Zone Control Module C2 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the Blower Motor Control circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Make sure that the Blower Motor Controller harness connector is connected to the Blower Motor Controller. Make sure that the Automatic Zone Control Module C2 harness connector is connected to the Automatic Zone Control Module. While back probing, measure the voltage of the Blower Motor Control circuit in the Automatic Zone Control Module C2 harness connector. Is the voltage above 4.0 volts? Yes → Go To 10 No → Replace the Blower Motor Controller in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Reconnect all previous disconnected components. Use the DRB oscilloscope, select Lab Scope and set the following lab scope parameters. Set voltage range to +10.0v. Set probe to X10. Set time to 20ms/Div. Using the oscilloscope lead, back probe the Blower Motor Control circuit at the Blower Motor Controller harness connector. Turn the ignition on. Set the blower switch to LO then slowly move to HI while observing the DRB display. The Scope patten should appear similar to what is provided in the reference material (Section 8.0). The voltage should cycle from approximately 0.5 volts, up to 5.0 volts in the low speed fan position. The duty cycle pattern should change smoothly as the blower switch is turned from LO to HI. The pattern should completely flat line when the blower speed reaches the HI setting. Does the DRB display a duty cycle pattern that changes from approximately 0.5 to 5.0 volts in LO? Yes → Go To 11 No → Replace the Automatic Zone Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. **NOTE: With the DRB, Reset Module after repair/replacement is completed.**	All

*BLOWER MOTOR INOPERATIVE (AZC) — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off. Disconnect the Blower Motor Controller harness connector. Disconnect the Blower Motor harness connector. **CAUTION: Do not allow the jumper wire contacts to touch one another when connecting them to the Blower Motor. Doing so will cause the results of this test will be inaccurate.** Connect a jumper wire between Pin #1 on the Blower Motor and the Blower Motor Supply circuit in the Blower Motor Controller harness connector. Connect a jumper wire between Pin #2 on the Blower Motor and the Ground circuit in the Blower Motor Controller harness connector. Does the Blower Motor operate at full speed? Yes → Replace the Blower Motor Controller in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Blower Motor in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:
ABS LAMP CIRCUIT SHORT
AIRBAG LAMP DRIVER FAILURE
BRAKE LAMP CIRCUIT SHORT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ABS LAMP CIRCUIT SHORT.

When Monitored and Set Condition:

ABS LAMP CIRCUIT SHORT

When Monitored: 10 seconds after ignition on.

Set Condition: The Instrument Cluster detects a short in the ABS lamp driver circuit.

AIRBAG LAMP DRIVER FAILURE

When Monitored: 10 seconds after ignition on.

Set Condition: The Instrument Cluster detects a short in the Airbag lamp driver circuit.

BRAKE LAMP CIRCUIT SHORT

When Monitored: With the ignition on. (NOTE: The Instrument Cluster can not monitor with parking brake engaged)

Set Condition: The Instrument Cluster detects a short in the Brake indicator driver circuit.

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	This is an internal cluster failure. If there are no possible causes remaining, view repair. Repair Replace Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:
ABS LAMP OPEN
AIRBAG LAMP OPEN
BRAKE LAMP OPEN

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ABS LAMP OPEN.

When Monitored and Set Condition:

ABS LAMP OPEN

When Monitored: 10 seconds after ignition on.

Set Condition: The Instrument Cluster detects an open in the ABS indicator bulb.

AIRBAG LAMP OPEN

When Monitored: 10 seconds after ignition on

Set Condition: The Instrument Cluster detects an open in the Airbag indicator bulb.

BRAKE LAMP OPEN

When Monitored: With the ignition on. (NOTE: The Instrument Cluster can not monitor while the parking brake is engaged.)

Set Condition: The Instrument Cluster detects an open in the Brake indicator bulb.

POSSIBLE CAUSES
INDICATOR LAMP OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Remove and inspect the indicator bulb in question. Replace the indicator bulb and socket as necessary. Turn the ignition on. Observe the indicator in question during the bulb check. Did the indicator illuminate? Yes → Clear DTC and verify proper operation. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ABS MESSAGE NOT RECEIVED BY MIC

When Monitored and Set Condition:

ABS MESSAGE NOT RECEIVED BY MIC

When Monitored: Monitored during ignition on.

Set Condition: The Instrument Cluster detects no ABS messages received for 6 seconds.

POSSIBLE CAUSES
NO RESPONSE - PCI BUS - ABS
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, attempt to I/D or communicate with the ABS Module. Is there a response from the ABS Module? Yes → Go To 2 No → Refer to symptom *NO RESPONSE FROM CAB CONTROLLER in the COMMUNICATION category. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, erase the DTC from Instrument Cluster. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ACM MESSAGE NOT RECEIVED BY MIC

When Monitored and Set Condition:

ACM MESSAGE NOT RECEIVED BY MIC

When Monitored: Monitored during ignition on.

Set Condition: No ACM messages received for 6 seconds.

POSSIBLE CAUSES
NO RESPONSE - PCI BUS - ACM
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, attempt to I/D or communicate with the ACM. Is there a response from the ACM Module? Yes → Go To 2 No → Refer to symptom *NO RESPONSE FROM ACM in the COMMUNICATION category. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, erase the DTC from Instrument Cluster. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BCM MESSAGES NOT RECEIVED BY MIC

When Monitored and Set Condition:

BCM MESSAGES NOT RECEIVED BY MIC

When Monitored: Monitored during ignition on.

Set Condition: No BCM messages received for 6 seconds.

POSSIBLE CAUSES
NO RESPONSE - PCI BUS - BCM
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, attempt to I/D or communicate with the BCM. Is there a response from the Body Control Module? Yes → Go To 2 No → Refer to symptom *BUS +/- SIGNALS OPEN FROM BCM in the COMMUNICATION category Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, erase the DTC from Instrument Cluster. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Techinical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CHECKSUM FAILURE

When Monitored and Set Condition:

CHECKSUM FAILURE

When Monitored: With the ignition on.

Set Condition: The Instrument Cluster detects EEPROM failure during the internal self check.

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
EATX MESSAGE STATUS

POSSIBLE CAUSES
INTERMITTENT CONDITION
NO RESPONSE - PCI BUS - EATX
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, attempt to I/D or communicate with the EATX. Is there a response from the Transmission Control Module? Yes → Go To 2 No → Refer to symptom *NO RESPONSE FROM TRANSMISSION CONTROL MODULE in the COMMUNICATION category. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, erase DTCs. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
NO PCI BUS COMMUNICATION

POSSIBLE CAUSES
NO RESPONSE - PCI BUS
INTERMITTENT CONDITION
NO RESPONSE - PCI BUS - INSTRUMENT CLUSTER
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: When the Instrument Cluster detects no PCI Bus, the VF will display ″no bus″.** With the DRBIII®, attempt to communicate with other modules on the PCI Bus. Was the DRBIII® able to communicate with other modules? Yes → Go To 2 No → Refer to the COMMUNICATION category for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, select System Monitors, then J1850 Module Scan. Does the DRBIII® display MIC PRESENT on the BUS? Yes → Go To 3 No → Refer to symptom ″No Response from Instrument Cluster in the Communication″ category. Perform BODY VERIFICATION TEST - VER 1.	All
3	With the DRBIII®, erase DTCs. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PCM MESSAGE NOT RECEIVED BY MIC

When Monitored and Set Condition:

PCM MESSAGE NOT RECEIVED BY MIC

When Monitored: With the ignition on.

Set Condition: The Instrument Cluster detects no PCM bus messages received for 6 seconds.

POSSIBLE CAUSES
NO RESPONSE - PCI BUS - PCM
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, select Body Controller and system test. Does the DRB display PCM active on the bus? Yes → Go To 2 No → Refer to symptom *NO RESPONSE FROM PCM (PCI BUS) in the COMMUNICATION category. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, erase the DTC from Instrument Cluster. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The conditionis not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Wisually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
SKIM MESSAGE NOT RECEIVED BY MIC

When Monitored and Set Condition:

SKIM MESSAGE NOT RECEIVED BY MIC

When Monitored: Monitored during ignition on.

Set Condition: No SKIM messages received for 6 seconds.

POSSIBLE CAUSES
NO RESPONSE - PCI BUS - SKIM
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, select THEFT ALARM, then SKIM. Is there a response from the SKIM Module? Yes → Go To 2 No → Refer to symptom BUS +/- SIGNALS OPEN FROM SKIM in the COMMUNICATIONS category. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, erase the DTC from Instrument Cluster. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*AIRBAG INDICATOR NOT OPERATING PROPERLY

POSSIBLE CAUSES
ACM DTC PRESENT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition from the Lock to the Run position. This will start the Airbag bulb check. Did the Airbag indicator illuminate? Yes → Go To 2 No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, read DTCs. Are there any Airbag or Instrument Cluster DTCs present? Yes → Refer to symptom list for problems related to Airbag or Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*ALL GAUGES INOPERATIVE

POSSIBLE CAUSES
FUSED B(+) CIRCUIT SHORT TO GROUND
FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORT TO GROUND
GROUND CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure there is PCI Bus Communication with the Instrument Cluster, PCM and BCM before proceeding with this test.** Turn the ignition off. Remove and inspect the Junction Block Fuse #17. If the fuse is open, replace with proper rated fuse. Turn the ignition on and wait approximately 1 minute. Turn the ignition off. Remove and inspect the Junction Block Fuse #17. Is the fuse open? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. Remove the Junction Block Fuse #17 Disconnect the Instrument Cluster harness connector. Measure the resistance between ground and the Fused B(+) circuit. Is the resistance below 100 ohms? Yes → Repair the fused B(+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Remove and inspect the Junction Block Fuse #22. If the fuse is open, replace with proper rated fuse. Turn the ignition on and wait approximately 1 minute. Turn the ignition off. Remove and inspect the Junction Block Fuse #22. Is the fuse open? Yes → Go To 4 No → Go To 5	All

*ALL GAUGES INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Instrument Cluster harness connector. Measure the resistance between ground and the Fused Ignition Switch Output circuit. Is the resistance below 100 ohms? Yes → Repair the Fused Ignition Switch Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Turn all interior and exterior lights off. Disconnect the Instrument Cluster harness connector. Close all vehicle doors. Measure the resistance of both Instrument Cluster Ground circuits. Was the resistance in either ground circuit above 5.0 ohms? Yes → Repair the Instrument Cluster Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BRAKE INDICATOR INOPERATIVE

POSSIBLE CAUSES
BRAKE FLUID LEVEL SWITCH
PARK BRAKE SWITCH
RED BRAKE WARNING INDICATOR DRIVER CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any Brake, MIC, or Communication DTCs before proceeding with this test.** Is the BRAKE indicator only inoperative with the Park Brake engaged? Yes → Go To 2 No → Replace the Brake Fluid Level Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Park Brake Switch harness connector. Connect a jumper wire between the Red Brake Warning Indicator Driver circuit and ground. Turn the ignition on. Observe the BRAKE indicator. Did the BRAKE indicator illuminate? Yes → Replace the Park Brake Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Park Brake Switch harness connector. Disconnect the Instrument Cluster harness connector. Measure the resistance of the Red Brake Warning Indicator Driver circuit. Is the resistance above 5.0 ohms? Yes → Repair the Red Brake Warning Indicator Driver circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BRAKE WARNING INDICATOR ALWAYS ON

POSSIBLE CAUSES
DTC PRESENT
RED BRAKE WARNING INDICATOR SWITCH
RED BRAKE WARNING INDICATOR DRIVER CIRCUIT SHORT TO GROUND
PARK BRAKE SWITCH
PARK BRAKE - RED BRAKE WARNING INDICATOR DRIVER CIRCUIT SHORT TO GROUND
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Brake Fluid Level is properly filled and the Brake Fluid Level Switch harness connector is properly connected.** With the DRBIII®, erase DTCs. Cycle the ignition and wait approximately 15 seconds. With the DRBIII®, read DTCs. Does the DRBIII® display any Brake or MIC Indicator DTCs? Yes → Refer to symptom list for problems related to BRAKE FLUID LEVEL SWITCH CIRCUIT or BRAKE LAMP DTCs. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Brake Fluid Level Switch harness connector. Measure the resistance of the Red Brake Warning Indicator Switch between pin 1 and pin 2. Is the resistance below 100 ohms? Yes → Replace the Red Brake Warning Indicator (Fluid Level) Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Red Brake Warning Indicator (Fluid Level) Switch harness connector. Disconnect the CAB harness connector. Measure the resistance between ground and the Red Brake Warning Indicator Driver circuit. Is the resistance below 5.0 ohms? Yes → Repair the Red Brake Warning Indicator Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*BRAKE WARNING INDICATOR ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Ensure that the Brake Fluid Level Switch and Instrument Cluster harness connectors are properly connected.** Disconnect the Park Brake Switch harness connector. With the DRBIII® in Inputs/Outputs, read the Park Brake Switch state. Does the DRBIII® display ″Open″? Yes → Replace the Park Brake Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Park Brake Switch harness connector. Disconnect the Instrument Cluster harness connector. Measure the resistance between ground and the Park Brake Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Park Brake - Red Brake Warning Indicator Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHECK ENGINE INDICATOR NOT OPERATING PROPERLY

POSSIBLE CAUSES
DTC PRESENT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition from the Lock to the Run position. This will start the MIL indicator bulb check. Did the Check Engine indicator illuminate for approximately 4 seconds and then go out? Yes → Go To 2 No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
2	Using the DRB read ENGINE DTC's. Are there any PCM DTC's present? Yes → Refer to symptom list for problems related to DRIVEABILITY. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*CHECK GAUGES INDICATOR INOPERATIVE

POSSIBLE CAUSES
DTC PRESENT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition from the Lock to the Run position. This will start the MIL bulb check. Did the Check Engine indicator illuminate for approximately 4 seconds and then go out? No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. Yes → Go To 2	All
2	Ensure that the engine temperature, oil pressure, and battery voltage are operating properly before proceeding with this test. With the DRBIII®, read ENGINE DTC's. Are there any PCM DTC's present? Yes → Refer to symptom list for problems related to DRIVEABILITY. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*COOLANT LEVEL INDICATOR INOPERATIVE - DIESEL ONLY

POSSIBLE CAUSES
COOLANT LEVEL SENSOR
GROUND CIRCUIT OPEN
COOLANT LEVEL SWITCH SENSE CIRCUIT OPEN
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Disconnect the Coolant Level Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Turn the ignition on. With the DRB enter Body, Body Computer, then Sensors. Connect a jumper wire between the Coolant Level Switch Sense circuit and the Ground circuit. With the DRB observe the Coolant Level Sw voltage. Does the DRB display voltage at 0.0 volt? Yes → Replace the Coolant Level Sensor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Coolant Level Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the Coolant Level Sensor Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Coolant Level Sensor harness connector. Disconnect the BCM C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Coolant Level Switch Sense circuit between the Coolant Level Sensor harness connector and the BCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Coolant Level Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CRUISE ON INDICATOR NOT OPERATING PROPERLY

POSSIBLE CAUSES
DTC PRESENT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read engine DTC's. Are there any PCM DTC's present? Yes → Refer to the Driveability category for the related symptom(s) involving the Speed Control System. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Ensure there is communication with the Instrument Cluster, PCM and the ABS modules before proceeding with this test. Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. **NOTE: The Cruise indicator in the PRNDL should illuminate for approximately 5 seconds during the self test.** Did the Cruise indicator illuminate for approximately 3 to 6 seconds? Yes → Test Complete. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*FUEL GAUGE NOT OPERATING PROPERLY

POSSIBLE CAUSES
INSTRUMENT CLUSTER
FUEL LEVEL SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any PCM or Communication DTCs before proceeding with this test.** Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the Fuel gauge during the self test. The Fuel gauge should position the indicator needle at the following calibration points: Empty Stop Empty 1/2 Full Full Stop Did the Fuel gauge position at the proper calibration points? Yes → Refer to the Service Information for problems related to the Fuel Sending Unit. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HIGH BEAM INDICATOR INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Exterior High Beam Headlamps operate properly before proceeding with this test.** **NOTE: Ensure that there is communication between the Instrument Cluster and the BCM before proceeding with this test.** Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII®, or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the High Beam indicator during the Self Test. Did the High Beam indicator illuminate for approximately 4 seconds and then turn off? Yes → Test Complete. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*INSTRUMENT CLUSTER DIMMING INOPERATIVE

POSSIBLE CAUSES
DTC PRESENT
ILLUMINATION BULB OR SOCKET
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure there is communication with the Instrument Cluster and the BCM before proceeding with this test.** With the DRBIII®, read BCM DTCs. Does the DRBIII® display any DTCs? Yes → Refer to symptom list for problems related to the Interior Lighting category. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Remove the Instrument Cluster. Remove and check any inoperative illumination bulbs and sockets. Do the bulbs and sockets check okay? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the illumination bulb or socket as necessary in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LOW COOLANT INDICATOR ALWAYS ON - DIESEL ONLY

POSSIBLE CAUSES
COOLANT LEVEL SENSOR
COOLANT LEVEL SENSE CIRCUIT SHORT TO GROUND
BODY CONTROL MODULE
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the cooling system is correctly filled and operating properly before proceeding with this test.** Disconnect the Coolant Level Switch harness connector. Turn the ignition on. With the DRBIII® in Body Controls, read the Coolant Level SW voltage. Does the DRBIII® display voltage above 4.8 ? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Coolant Level Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Turn the ignition on. With the DRBIII®, read the Coolant Level Sw voltage. Does the DRBIII® display voltage above 4.8 ? Yes → Replace the Coolant Level Sensor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Coolant Level Sensor harness connector. Disconnect the Body Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Coolant Level Switch Sense circuit. Is the resistance below 100.0 ohms? Yes → Repair the Coolant Level Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LOW FUEL INDICATOR INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: The Low Fuel indicator is activated by the MIC using fuel data received from the PCM and Fuel Gauge needle position.** **NOTE: Ensure that MIC and PCM communications and the Fuel Gauge operate properly before proceeding with this test.** Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the Low Fuel indicator during the Self Test. Did the Low Fuel indicator illuminate for approximately 4 seconds and then turn off? Yes → Test Complete. No → Replace the Instrument Cluster in accordance with the Service Information.. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*O/D OFF INDICATOR INOPERATIVE

POSSIBLE CAUSES
MIC SELF TEST
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the O/D OFF indicator during the Self Test. Did the O/D OFF indicator illuminate for approximately 4 seconds and then turn off? No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. Yes → Refer to Transmission Diagnostic information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*OIL PRESSURE GAUGE NOT OPERATING PROPERLY

POSSIBLE CAUSES
DTC PRESENT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: With the DRBIII®, read Powertrain DTC's. If any Oil Pressure Sensor Volts codes are present, refer to symptom list for problems related to Driveability.** Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. The Oil Pressure Gauge should position the indicator needle at the following calibration points: 40 Psi 60 Psi 80 Psi LOW Psi Observe the Oil Pressure Gauge during the self test. Did the Oil Pressure Gauge operate correctly during the self test? Yes → Refer to Driveability Diagnostic information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*SEAT BELT INDICATOR INOPERATIVE

POSSIBLE CAUSES
SEAT BELT SWITCH GROUND OPEN
SEAT BELT SWITCH
SEAT BELT SWITCH SENSE CIRCUIT OPEN
JUNCTION BLOCK SEATBELT SWITCH SENSE CIRCUIT OPEN
INSTRUMENT CLUSTER
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition from the Off position to the Run position and observe the bulb check. Did the Seat Belt indicator illuminate? Yes → Go To 2 No → Replace the Instrument Cluster in accordance with the Service Information.. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Seat Belt Switch harness connector. Measure the resistance of the Seat Belt Switch ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Seat Belt Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition on. Disconnect the Seat Belt Switch harness connector. Connect a jumper wire between the Seatbelt Switch Sense circuit and ground. With the DRBIII® in Body Computer Inputs/Outputs read the Seat Belt SW state. Does the DRBIII® display SEAT BELT SW: CLOSED? Yes → Replace the Seat Belt buckle in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Seat Belt Switch harness connector. Disconnect the Junction Block C1 harness connector. Measure the resistance of the Seat Belt Switch Sense circuit. Is the resistance above 5.0 ohms? Yes → Repair the Seatbelt Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*SEAT BELT INDICATOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Remove the Body Control Module from the Junction Block. Disconnect the Junction Block C1 connector. Measure the resistance of the Junction Block Seat Belt Switch Sense circuit. Is the resistance above 5.0 ohms? Yes → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*SEATBELT INDICATOR ALWAYS ON

POSSIBLE CAUSES
SEAT BELT SWITCH
BCM
SEAT BELT SWITCH SENSE CIRCUIT SHORT TO GROUND
JUNCTION BLOCK SEAT BELT SWITCH SENSE CIRCUIT SHORT TO GROUND
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Buckle the Seat Belt. Turn the ignition on. With the DRBIII® in Body Computer Inputs/Outputs, read the Seat Belt SW state. Does the DRBIII® display Seat Belt SW: OPEN? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Seat Belt Switch harness connector. Turn the ignition on. Does the DRBIII® display Seat Belt SW: OPEN? Yes → Replace the Seat Belt Buckle in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Junction Block C1 harness connector. Disconnect the Seat Belt Switch harness connector. Measure the resistance between ground and the Seat Belt Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Seat Belt Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Body Control Module from the Junction Block. Disconnect the Junction Block C1 harness connector. Measure the resistance between ground and the Seat Belt Switch Sense circuit at the Junction Block. Is the resistance below 5.0 ohms? Yes → Replace the Junction Block in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*SKIM INDICATOR INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any SKIM or Communication DTCs before proceeding with this test.** Turn the ignition from the Off position to the Run position and observe the bulb check. Did the Skim indicator illuminate briefly and then turn off? No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. Yes → Test Complete.	All

Symptom:
*SPEEDOMETER NOT OPERATING PROPERLY

POSSIBLE CAUSES
ABS TIRE PROGRAMMING
SPEEDOMETER INPUT - PROBLEM
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose any PCM or Communication DTCs before proceeding with this test.** **NOTE: Ensure that the ABS module is programmed with the correct tire size.** Perform the Instrument Cluster Self Test using the DRBIII®, or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. The Speedometer should position the indicator needle at the following calibration points: 0 MPH 20 MPH (25 MPH - UK) (40 Km/H) 55 MPH (50 MPH - UK) (80 Km/H) 75 MPH (75 MPH - UK) (120 Km/H) 110 MPH (110 MPH - UK) (230 Km/H) (200 Km/H AUS/JAPAN) Did the Speedometer operate correctly during the self test? Yes → Go To 2 No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, verify that the ABS Tire Size is correctly programmed. Is the Tire Size programmed correctly? Yes → Refer to Powertrain Diagnostic information for the releated symptom(s). Perform BODY VERIFICATION TEST - VER 1. No → Using the Diagnostic (Transmission, or Chassis)/Service Manual Information as a guide, program the correct tire size and then verify that the Speedometer is working. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*TACHOMETER NOT OPERATING PROPERLY

POSSIBLE CAUSES
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any PCM or Communication DTCs before proceeding with this test.** Perform the Instrument Cluster Self Test. The self test can be performed using the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the Tachometer during the self test. The Tachometer should position the indicator needle at the following calibration points: 0 RPM 800 RPM 3000 RPM (2500 RPM Diesel) 7000 RPM (6000 RPM Diesel) Did the Tachometer position at the proper calibration points? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*TEMPERATURE GAUGE INOPERATIVE

POSSIBLE CAUSES
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the cooling system operates properly before proceeding with this test.** **NOTE: Diagnose and repair any PCM, MIC, BCM, or Communication DTCs before proceeding with this test.** Perform the Instrument Cluster self test. The self test can be performed manually or with using the DRBIII®. Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the Temperature gauge during the self test. The Temperature gauge should position the indicator needle at the following calibration points: 40°C (100°F) 100°C (210°F) 122°C (250°F) Temp High Temp Critical Did the Temperature gauge indicate the proper calibration points? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*TRANS OVER TEMP INDICATOR INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any Transmission, PCM, or Communication DTCs before proceeding with this test.** Perform the Instrument Cluster Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the Trans Over Temp indicator during the self test. Did the Trans Temp indicator illuminate for approximately 4 seconds then turn off? Yes → Test Complete. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*VOLTMETER INOPERATIVE

POSSIBLE CAUSES
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any Charging System faults or PCM DTCs before proceeding with this test.** **NOTE: Ensure that there is communication with the Instrument Cluster and the PCM before proceeding with this test.** Perform the Instrument Cluster Self Test. The self test can be performed manually or using the DRBIII®. Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the Voltmeter during the self test. The Voltmeter should position the indicator needle at the following calibration points: 9 Volts 14 Volts 16 Volts Did the Voltmeter position the indicator needle at the proper calibration points? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*WATER IN FUEL INDICATOR PROBLEMS - DIESEL ONLY

POSSIBLE CAUSES
INSTRUMENT CLUSTER
POWERTRAIN FAULT CONDITION

TEST	ACTION	APPLICABILITY
1	Turn the ignition from the Off position to the Run position. Observe the Water In Fuel indicator during the bulb check. Did the Water In Fuel indicator illuminate briefly and then turn off? Yes → Refer to the Powertrain Diagnostic information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DIM SW SHORT TO GROUND

When Monitored and Set Condition:

DIM SW SHORT TO GROUND

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: The voltage of the Panel Lamps Dimmer Signal circuit has gone below 0.3 volts for 5 seconds.

POSSIBLE CAUSES
LEFT MULTIFUNCTION SWITCH SHORTED
PANEL LAMPS DIMMER SIGNAL CIRCUIT SHORT TO GROUND
HEADLAMP SWITCH RETURN CIRCUIT SHORT TO GROUND
BCM

TEST	ACTION	APPLICABILITY
1	Disconnect the Left Multifunction switch connector. Turn ignition on. With the DRBIII® in Sensors, read the Panel Lamp voltage. Is the voltage below 4.0 volts? Yes → Go To 2 No → Replace the Left Multifunction switch. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn ignition off. Disconnect the Left Multi-function switch connector. Disconnect the Body Control Module C1 connector. Measure the resistance of the Panel Lamps Dimmer Signal circuit to a known good ground. Is the resistance below 1000 (1K)ohms? Yes → Repair the Panel Lamps Dimmer Signal circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn ignition off. Disconnect the Left Multi-function switch connector. Disconnect the Body Control Module C1 connector. Measure the resistance of the Headlamp Switch Return circuit to a known good ground. Is the resistance below 1000 (1K)ohms? Yes → Repair the Headlamp Switch Return circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

DIM SW SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DIMMER SWITCH OPEN CIRCUIT

When Monitored and Set Condition:

DIMMER SWITCH OPEN CIRCUIT

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: Any time the voltage on the Panel Lamps Dimmer Signal circuit exceeds 4.8 volts for 5 seconds.

POSSIBLE CAUSES
PANEL LAMP DIMMER SWITCH
PANEL LAMPS DIMMER SIGNAL CIRCUIT OPEN
HEADLAMP SWITCH RETURN OPEN
BCM

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Disconnect the Left Multifunction switch connector. Connect a jumper wire between Panel Lamp Dimmer Signal circuit and Headlamp Switch Return. Turn the ignition on. With the DRBIII® in Sensors, read the Panel Lamps voltage. Does the DRBIII® display Panel Lamp voltage below 0.5 volts ? Yes → Replace the Left Multifunction switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Disconnect the Left Multi-function switch connector. Disconnect the Body Control Module C1 connector. Using an ohmmeter measure the Panel Lamps Dimmer Signal circuit from the BCM C1 connector to the left multi-function switch connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Panel Lamps Dimmer Signal circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the Left Multi-function switch connector. Disconnect the Body Control Module C1 connector. Using an ohmmeter measure the Headlamp Switch Return circuit from BCM to Left Multi-function. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open headlamp switch return circuit. Perform BODY VERIFICATION TEST - VER 1.	All

DIMMER SWITCH OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

LAMP FADE FAILURE SHORT TO BATTERY

When Monitored and Set Condition:

LAMP FADE FAILURE SHORT TO BATTERY

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: The BCM has detected a short to battery on either the Courtesy Lamp Driver circuit or the Courtesy Lamp Control circuit for 5 seconds.

POSSIBLE CAUSES
SHORTED COURTESY LAMP BULB
COURTESY LAMP CONTROL CIRCUIT SHORTED TO BATTERY
COURTESY LAMP DRIVER CIRCUIT SHORTED TO BATTERY
BCM, COURTESY LAMP CIRCUIT

TEST	ACTION	APPLICABILITY
1	**Note: Repeat this test for each of the following bulbs before proceeding to the next test: Instrument Panel Courtesy (2), Rear Reading (2), Front Overhead (2), and Liftgate.** Turn ignition off. Remove one of the bulbs listed in the previous pop up message. Note: after this test leave the bulb out. Turn ignition on. Using the DRB erase all BCM DTC's. Using the DRB read BCM DTC's. Is the ″Lamp Fade Failure Short to battery″ DTC present? Yes → Go To 2 No → Replace bulb, and reinstall all other bulbs removed during testing. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn ignition off. Remove fuse # 8 from the Junction Block. Disconnect the BCM C1 connector. Turn ignition on. Measure the voltage of the Courtesy Lamp Control circuit in the BCM C1 connector. Is there any voltage? Yes → Repair the Courtesy Lamp Control circuit for a short to battery and reinstall all bulbs removed during testing. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

LAMP FADE FAILURE SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect Fuse # 8. Disconnect the Junction Block C1 Connector. Turn ignition on. Measure the voltage of the Courtesy Lamp Driver circuit in the Junction Block C1 connector (cav 16). Is there any voltage? Yes → Repair the Courtesy Lamp Driver circuit for a short to battery and reinstall all bulbs removed during testing. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module (BCM) and reinstall all bulbs removed durning testing. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
LOAD SHED FAILURE SHORT TO BATTERY

When Monitored and Set Condition:

LOAD SHED FAILURE SHORT TO BATTERY

When Monitored: Ignition in RUN and IOD fuse/connector installed

Set Condition: The BCM has detected a short to battery on the Interior Load Shed circuit for 5 seconds

POSSIBLE CAUSES
SHORTED GLOVE BOX LAMP BULB
INTERIOR LAMP LOAD SHED CONTROL SHORT TO BATTERY (COURTESY)
INTERIOR LAMP LOAD SHED CONTROL SHORT TO BATTERY (GLOVE BOX)
BCM, INTERIOR LAMP LOAD SHED CONTROL

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Remove the Glove Box lamp bulb. Turn ignition on. Using the DRB erase all BCM DTC's. Using the DRB read BCM DTC's. Is the "Load Shed Failure Short to battery" DTC present? Yes → Go To 2 No → Replace bulb. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn ignition off. Ensure the Glove Box is closed with the Lamp switch in the off position. Disconnect the BCM C1 connector. Turn ignition on. Measure the voltage of the Interior Lamp Load Shed Control circuit in the C1 connector. Is there any voltage? Yes → Repair the Interior Lamp Load Shed Control circuit for a short to battery. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

LOAD SHED FAILURE SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Ensure all of the Overhead, Rear Reading and Vanity Lamp Switches are in the off position. Disconnect the Junction Block C-1 connector. Turn ignition on. Measure the voltage of the Interior Lamp Load Shed Control circuit in the J/B C1 connector. Is there any voltage? Yes → Repair the Interior Lamp Load Shed Control circuit for a short to battery. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module (BCM). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PANEL LAMP DRIVER FAILURE

When Monitored and Set Condition:

PANEL LAMP DRIVER FAILURE

When Monitored: Ignition in RUN and IOD fuse/connector installed.

Set Condition: This condition is set if the panel lamp driver that illuminates the I/P shuts down from an over temp condition for at least 5 seconds.

POSSIBLE CAUSES
DRIVER HEATED SEAT SWITCH SHORTED TO GROUND
PASSENGER HEATED SEAT SWITCH SHORTED TO GROUND
HVAC CONTROL PANEL SHORTED TO GROUND
PRNDL ILLUMINATION SHORTED TO GROUND
ASH RECEIVER BULB OR SOCKET SHORTED TO GROUND
RADIO SHORTED TO GROUND
PANEL LAMPS DRIVER CIRCUIT SHORTED TO GROUND (HVAC)
PANEL LAMPS DRIVER CIRCUIT SHORTED TO GROUND (PRNDL)
PANEL LAMPS DRIVER CIRCUIT SHORTED TO GROUND (RADIO)
PANEL LAMPS DRIVER CIRCUIT SHORTED TO GROUND (ASH RECEIVER)
PANEL LAMPS DRIVER CIRCUIT SHORTED TO GROUND (HEATED SEATS)
BCM, PANEL LAMP DRIVER FAILURE

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Disconnect the Drivers Heated Seat Switch. Turn ignition on. Erase Body Diagnostic Trouble Codes. Wait 5 seconds then read BCM DTC's. Is the "Panel Lamps Driver" DTC present? Yes → Go To 2 No → Replace the drivers heated seat switch. Perform BODY VERIFICATION TEST - VER 1.	All

PANEL LAMP DRIVER FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	Turn ignition off. Disconnect the Passengers Heated Seat Switch. Turn ignition on. Erase Body Diagnostic Trouble Codes. Wait 5 seconds then read BCM DTC's. Is the ″Panel Lamps Driver″ DTC present? Yes → Go To 3 No → Replace the Passenger Heated Seat Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the appropriate HVAC Control panel connector. C-1 for manual or C-2 for automatic system. Turn ignition on. Erase Body Diagnostic Trouble Codes. Wait 5 seconds then read BCM DTC's. Is the ″Panel Lamps Driver″ DTC present? Yes → Go To 4 No → Replace the HVAC Control panel assemble. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn ignition off. Disconnect the PRNDL/Transfer Case Illumination connector. Turn ignition on. Erase Body Diagnostic Trouble Codes. Wait 5 seconds then read BCM DTC's. Is the ″Panel Lamps Driver″ DTC present? Yes → Go To 5 No → Repair or replace the shorted PRNDL/Transfer Case Illumination. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn ignition off. Disconnect the ash receiver. Turn ignition on. Erase Body Diagnostic Trouble Codes. Wait 5 seconds then read BCM DTC's. Is the ″Panel Lamps Driver″ DTC present? Yes → Go To 6 No → Repair the ash receiver bulb or socket for a short to ground. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn ignition off. Disconnect the radio C1 connector. Turn ignition on. Erase Body Diagnostic Trouble Codes. Wait 5 seconds then read BCM DTC's. Is the ″Panel Lamps Driver″ DTC present? Yes → Go To 7 No → Repair or replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

PANEL LAMP DRIVER FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Turn ignition off. Disconnect the appropriate HVAC Control panel connector. C-1 for manual or C-2 for automatic system. Disconnect the BCM (Body Control Module) C1 connector. Measure the resistance of the Panel Lamps Driver circuit in the BCM C1 connector (cav. 10). Is the resistance below 5.0 ohms? Yes → Repair the Panel Lamp Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn ignition off. Disconnect the PRNDL/Transfer Case Illumination connector. Disconnect the BCM (Body Control Module) C1 connector. Measure the resistance of the Panel Lamps Driver circuit in the BCM C1 connector (cav. 9). Is the resistance below 5.0 ohms? Yes → Repair the Panel Lamp Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn ignition off. Disconnect the radio C1 connector. Disconnect the BCM (Body Control Module) C1 connector. Measure the resistance of the Panel Lamps Driver circuit in the BCM C1 connector (cav. 13). Is the resistance below 5.0 ohms? Yes → Repair the Panel Lamp Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn ignition off. Disconnect the ash receiver lamp. Disconnect the BCM (Body Control Module) C1 connector. Measure the resistance of the Panel Lamps Driver circuit in the BCM C1 connector (cav. 8). Is the resistance below 5.0 ohms? Yes → Repair the Panel Lamp Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	Turn ignition off. Disconnect the driver and passenger heated seat switches. Disconnect the BCM (Body Control Module) C1 connector. Measure the resistance of the Panel Lamps Driver circuit in the BCM C1 connector (cav. 12). Is the resistance below 5.0 ohms? Yes → Repair the Panel Lamp Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 12	All

PANEL LAMP DRIVER FAILURE — Continued

TEST	ACTION	APPLICABILITY
12	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL COURTESY LAMPS INOPERATIVE

POSSIBLE CAUSES
FUSE #8 BLOWN CIRCUIT NOT SHORTED
FUSED B+ CIRCUIT OPEN
FUSED B+ CIRCUIT SHORTED TO GROUND
BCM

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Remove and inspect fuse #8. Is the fuse blown? Yes → Go To 2 No → Go To 3	All
2	Turn ignition off. Remove fuse #8 from the Junction Block. Measure the resistance of the Fused B+ circuit (upper cavity of fuse #8) to a known good ground. Is the resistance below 5.0 ohms? Yes → Repair the Fused B+ circuit for a short to ground and replace the blown fuse. Perform BODY VERIFICATION TEST - VER 1. No → Replace blown fuse #8. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Remove fuse #8 from the Junction Block. Remove the driver's side rear seat overhead reading lamp lens cover. Measure the resistance of the Fused B+ circuit between Fuse #8 (top cavity) and the Rear Passenger's overhead reading lamp (Fused B+ side). Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace BCM (Body Control Module). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ASH TRAY LAMP INOPERATIVE

POSSIBLE CAUSES
BCM DTC
ASH RECEIVER BULB OPEN
OPEN GROUND CIRCUIT
PANEL LAMPS DRIVER CIRCUIT OPEN
BCM

TEST	ACTION	APPLICABILITY
1	Read Body Diagnostic Trouble Codes. Is there a Park Lamp Relay Circuit Shorted Lo/Open DTC? Yes → Refer to symptom Park Lamp Relay Circuit Shorted Lo/Open in the Exterior Lighting. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove and inspect the Ash Receiver bulb. Is the bulb OK? Yes → Go To 3 No → Replace the Ash Receiver bulb. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the Ash Receiver connector. Measure the resistance of the Ground circuit in the Ash Receiver connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn ignition off. Disconnect the Ash Receiver connector. Disconnect the BCM C1 connector. Measure the resistance of the Panel Lamps Driver circuit between the Ash Receiver connector and the BCM C1 connector (cav. #8). Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Panel Lamps Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the BCM. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE (EXCEPT FRONT DOORS)

POSSIBLE CAUSES
BULBS
OPEN FUSED B(+)
COURTESY LAMP CONTROL CIRCUIT OPEN
BCM, COURTESY LAMP

TEST	ACTION	APPLICABILITY
1	Remove and check inoperative bulbs. Are the bulbs OK? Yes → Go To 2 No → Replace the bulbs. Perform BODY VERIFICATION TEST - VER 1.	All
2	Measure the voltage of the Fused B(+) circuit to the Lamp. Is the voltage above 10.0 volts? Yes → Go To 3 No → Repair the open Fused B(+) circuit back to splice. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the BCM C1 connector. Gain access to an inoperative bulb. Measure the Courtesy Lamp Control circuit from the BCM C1 connector to the bulb connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Courtesy Lamp Control circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module (BCM). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE FROM DOME LAMP SWITCH ONLY

POSSIBLE CAUSES
DTC PRESENT
LEFT MULTI FUNCTION SWITCH DIMMER OPEN
BCM DIMMER INOPORATIVE

TEST	ACTION	APPLICABILITY
1	Turn ignition on. Using the DRBIII®, read body DTCs. Are there any DTCs present? Yes → Select the appropriate DTC from the symptom list and perform repair as needed. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Disconnect the Left Multi Function Switch Connector. Connect an ohmmeter between the Panel Lamps Dimmer Signal circuit and the Headlamp Switch Return circuit in the Left Multi-Funtion Switch. Observe the ohmmeter while rotating the dimmer on the Left Multi-Function Switch. Did the resistance vary between approximately 60 and 7900 (7.9K) ohms? Yes → Go To 3 No → Replace the Left Multi Function Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE FROM DRIVERS FRONT DOOR ONLY

POSSIBLE CAUSES
OPEN GROUND WIRE
OPEN DRIVER DOOR AJAR SWITCH SENSE
DRIVER DOOR AJAR SWITCH
DRIVER DOOR MODULE (AJAR SWITCH OPEN)
BODY CONTROL MODULE - DRIVER DOOR AJAR OPEN

TEST	ACTION	APPLICABILITY
1	Open the Drivers door. With the DRB III select: Body Door Modules Input Output Read the Drv Door Ajar Sw state. Does the DRB III Show: CLOSED? Yes → Go To 2 No → Go To 3	All
2	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Driver Door Lock Motor/Ajar switch connector Measure the resistance of the ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open ground wire to the door ajar switch connector. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Driver Door Module C1 connector. Disconnect the Door Lock Motor/Ajar Switch connector. Measure the resistance of the Driver Door Ajar Switch Sense circuit between the door lock motor/ajar switch connector and the DDM C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Driver Door Ajar Switch Sense wire. Perform BODY VERIFICATION TEST - VER 1.	All

*COURTESY LAMPS INOPERATIVE FROM DRIVERS FRONT DOOR ONLY — Continued

TEST	ACTION	APPLICABILITY
5	Remove the inner door trim panel. Disconnect the Driver Door Module C1 connector. Ensure the door is left open during this test. Measure the resistance of the Driver Door Ajar Switch Sense circuit in the DDM C1 connector to ground. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Replace the Driver Door Lock Motor/Ajar Switch Assy. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE FROM LEFT REAR DOOR ONLY

POSSIBLE CAUSES
OPEN DOOR AJAR SWITCH SENSE (LEFT REAR)
OPEN GROUND WIRE
LEFT REAR DOOR AJAR SWITCH
BODY CONTROL MODULE (AJAR SWITCH OPEN)

TEST	ACTION	APPLICABILITY
1	Open the Left Rear door. With the DRB III select: Body Computer Input/Output Read the Left Rear Door Ajar SW state. Does the DRBIII Show: ″CLOSED″? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the inner door trim panel. Disconnect the Junction Block C1 connector. Disconnect the Left Rear Door Lock Motor/Ajar Switch connector. Measure the resistance of the Door Ajar Switch Sense LR circuit between the door lock motor/ajar switch connector and the Junction Block C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Door Ajar Switch Sense wire (Left Rear). Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Driver Rear Door Lock Motor/Ajar switch connector Measure the resistance of the ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open ground wire to the door ajar switch connector. Perform BODY VERIFICATION TEST - VER 1.	All
4	Remove the inner door trim panel. Disconnect the Junction Block ″C1″ connector. Ensure the door is left open during this test. Measure the resistance of the Door Ajar Switch Sense (LR) circuit in the Junction Block ″C1″ connector to ground. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Replace the Door Lock Motor/Ajar Switch Assy. Perform BODY VERIFICATION TEST - VER 1.	All

*COURTESY LAMPS INOPERATIVE FROM LEFT REAR DOOR ONLY — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE FROM LIFTGATE

POSSIBLE CAUSES
BCM, LAMPS DISABLED
CARGO LAMP
COURTESY LAMP DISABLE
OPEN GROUND WIRE
OPEN LIFTGATE AJAR SWITCH SENSE
OPEN LIFTGATE AJAR SWITCH
BODY CONTROL MODULE (LIFTGATE AJAR SWITCH OPEN)

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs Outputs read the Lift Gate Lmp Disable state while depressing the cargo lamp lens switch on and off. Did the disable switch toggle? Yes → Go To 2 No → Go To 7	All
2	With the DRB III select: Body Computer Input/Output Read the Liftgate Sw state with the Liftgate open. Does the DRBIII Show: CLOSED? Yes → If there are no possible causes remaining, replace the BCM. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect either the right or left side Liftgate Ajar Switch connector. Measure the resistance of the ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open ground wire to the ajar switch connector. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Junction Block C1 connector. Disconnect either the right or left side Liftgate Ajar Switch. Measure the resistance of the Liftgate Flip-up Ajar Switch Sense circuit between the disconnected Flip-up Ajar Switch connector and the Junction Block C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Liftgate Ajar Switch Sense wire. Perform BODY VERIFICATION TEST - VER 1.	All

*COURTESY LAMPS INOPERATIVE FROM LIFTGATE — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the suspect faulty right or left Liftgate ajar switch connector. Ensure the latch is in the unlatched position for the particular switch. Using an ohmmeter measure the resistance of the Ajar Switch. Is the resistance below 2.0 ohms? Yes → Go To 6 No → Replace the Liftgate Ajar Switch Assy. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
7	At the Cargo Lamp connector backprobe and measure the voltage of the liftgate courtesy lamp disable circuit with switch in both positions. Is the voltage below 0.5 volt in either position? Yes → If there are no possible causes remaining, replace the BCM. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Disconnect the cargo lamp connector. Measure the voltage of the liftgate courtesy lamp disable circuit. Is the voltage above 2.0 volts? Yes → Repair the courtesy lamp disable circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Cargo Lamp assemble. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE FROM LIFTGATE FLIP-UP GLASS ONLY

POSSIBLE CAUSES
OPEN GROUND WIRE
OPEN LIFTGATE AJAR SWITCH SENSE
BCM FLIP-UP AJAR SWITCH OPEN
OPEN LIFTGATE FLIP-UP AJAR SWITCH

TEST	ACTION	APPLICABILITY
1	With the DRB III select: Body Computer Input/Output Read the Liftglass Sw state with the Liftgate flip-up glass open. Does the DRBIII Show: CLOSED? Yes → Go To 2 No → Go To 3	All
2	If there are no potential causes remaining, replace the Body Control Module. View repair options. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Liftgate Flip-up Ajar Switch connector Measure the resistance of the ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open ground wire to the ajar switch connector. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Junction Block C1 connector. Disconnect a Liftgate Flip-up Ajar Switch. Measure the resistance of the Liftgate Flip-up Ajar Switch Sense circuit between the disconnected Flip-up Ajar Switch connector and the Junction Block C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Liftgate Ajar Switch Sense wire. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Liftgate Flip-Up Ajar Switch Assy. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

***COURTESY LAMPS INOPERATIVE FROM PASSENGER FRONT DOOR ONLY**

POSSIBLE CAUSES
OPEN GROUND WIRE
OPEN PASSENGER DOOR AJAR SWITCH SENSE WIRE
PASSENGER DOOR AJAR SWITCH
BCM COURTESY LAMPS INOPERATIVE FROM PASSENGER FRONT DOOR ONLY
PASSENGER DOOR MODULE (AJAR SWITCH OPEN)

TEST	ACTION	APPLICABILITY
1	Open the passenger door. With the DRB III select: Body Door Modules Input/Output Read the Pass Door Ajar Sw state. Does the DRBIII Show: CLOSED? Yes → Replace the BCM. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Passenger Door Lock Motor/Ajar switch connector Measure the resistance of the ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open ground wire to the door ajar switch connector. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Passenger Door Module C1 connector. Disconnect the Door Lock Motor/Ajar Switch connector. Measure the resistance of the Passenger Door Ajar Switch Sense circuit between the door lock motor/ajar switch connector and the PDM C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Passenger Door Ajar Switch Sense wire. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Passenger Door Module ″C1″ connector. Ensure the door is left open during this test. Measure the resistance of the Passenger Door Ajar Switch Sense circuit in the PDM C1 connector to ground. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Replace the Passenger Door Lock Motor/Ajar Switch Assy. Perform BODY VERIFICATION TEST - VER 1.	All

*COURTESY LAMPS INOPERATIVE FROM PASSENGER FRONT DOOR ONLY — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE FROM RIGHT REAR DOOR ONLY

POSSIBLE CAUSES
OPEN GROUND WIRE
OPEN DOOR AJAR SWITCH SENSE (RR)
BODY CONTROL MODULE (AJAR SWITCH OPEN)
RIGHT REAR DOOR AJAR SWITCH
BCM RIGHT REAR DOOR FAILURE

TEST	ACTION	APPLICABILITY
1	Open the Right Rear door. With the DRB III select: Body Body Controlller Input/Output Read the Right Rear Door Ajar Sw state. Does the DRBIII Show: CLOSED? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Passenger Rear Door Lock Motor/Ajar switch connector Measure the resistance of the ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open ground wire to the door ajar switch connector. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Body Control Module C1 connector. Disconnect the Passenger Rear Door Lock Motor/Ajar Switch connector. Measure the resistance of the Door Ajar Switch Sense (Right Rear) circuit between the door lock motor/ajar switch connector and the Body Control Module C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Door Ajar Switch Sense wire (RR). Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Body Control Module C1 connector. Ensure that the door is open during this test. Measure the resistance of the Door Ajar Switch Sense (Right Rear) circuit in the Body Control Module C1 connector to ground. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Replace the Door Lock Motor/Ajar Switch Assy. Perform BODY VERIFICATION TEST - VER 1.	All

*COURTESY LAMPS INOPERATIVE FROM RIGHT REAR DOOR ONLY — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view "Repair". Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS ON AT ALL TIMES (EXCEPT BOTH FRONT DOOR COURTESY LAMPS IF EQUIP)

POSSIBLE CAUSES
JUNCTION BLOCK
BCM, COURTESY LAMPS STAY ON
COURTESY LAMP DRIVER CIRCUIT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Ensure the courtesy lamp switch is in the off position. Remove the Body Control Module from the Junction Block. Did the courtesy lamps turn off? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Ensure the courtesy lamp switch is in the off position. Disconnect the Junction Block C-1 connector. Measure the Courtesy Lamp Driver circuit from the Junction Block C1 connector cavity 16 to ground. Is the resistance below 5.0 ohms? Yes → Repair the Courtesy Lamp Driver circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Junction Block Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER DOOR COURTESY LAMP INOPERATIVE

POSSIBLE CAUSES
BULB
OPEN COURTESY LAMP DRIVER CIRCUIT
OPEN COURTESY LAMP GROUND CIRCUIT
DRIVER DOOR MODULE COURTESY LAMP

TEST	ACTION	APPLICABILITY
1	Remove and inspect the courtesy lamp bulb. Is the Courtesy Lamp bulb open? Yes → Replace the bulb. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the Driver's Door Courtesy Lamp Bulb. Disconnect the Driver Door Module C-2 connector Measure the Courtesy Lamp Driver circuit from the bulb connector to the Driver Door Module C-2 connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Courtesy Lamp Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the Driver's Door Courtesy Lamp Bulb. Disconnect the Driver Door Module C-2 connector Measure the Courtesy Lamp Ground circuit from the bulb connector to the Driver Door Module C-2 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Courtesy Lamp Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	View repair options. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*GLOVE BOX LAMP INOPERATIVE

POSSIBLE CAUSES
GLOVE BOX BULB
OPEN FUSED B+ CIRCUIT
GLOVE BOX SWITCH
OPEN GLOVE BOX LAMP DRIVER CIRCUIT
BCM

TEST	ACTION	APPLICABILITY
1	Remove and inspect the Glove Box Bulb. Is the bulb OK? Yes → Go To 2 No → Replace the Glove Box Bulb. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the glove box lamp harness connector. Measure the voltage of the Fused B+ circuit. Is the voltage above 10.5 volts? Yes → Go To 3 No → Repair the open Fused B+ circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the glove box lamp harness connector. Disconnect the BCM C1 connector. Measure the resistance of the Glove Box Lamp Driver circuit between the Glove Box Lamp harness connector (cav. 2) and the BCM C1 connector (cav. 23). Is the resistance above 5.0 ohms? Yes → Go To 4 No → Repair the open Glove Box Lamp Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the glove box lamp harness connector. Connect a test light between cavities 1 and 2 of the Glove Box Lamp harness. Did the test light illuminate? Yes → Replace the Glove Box Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	View repair options Repair Replace the BCM (Body Control Module). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HEATED SEAT SWITCH ILLUMINATION LAMP INOPERATIVE

POSSIBLE CAUSES
DRIVERS HEATED SEAT SWITCH BULB OPEN
PASSENGER HEATED SEAT SWITCH BULB OPEN
OPEN GROUND CIRCUIT (DRIVERS SIDE)
OPEN GROUND CIRCUIT (PASSENGER SIDE)
PANEL LAMPS DRIVER CIRCUIT OPEN (PASSENGER SIDE)
PANEL LAMPS DRIVER CIRCUIT OPEN (DRIVERS SIDE)
BCM

TEST	ACTION	APPLICABILITY
1	Remove and inspect the Drivers Heated Seat Switch bulb. Is the bulb OK? Yes → Go To 2 No → Replace the Drivers Heated Seat Switch bulb. Perform BODY VERIFICATION TEST - VER 1.	All
2	Remove and inspect the Passenger Heated Seat Switch bulb. Is the bulb OK? Yes → Go To 3 No → Replace the Passenger Heated Seat Switch bulb. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the Drivers Heated Seat Switch connector. Measure the resistance of the Ground circuit in the Drivers Heated Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn ignition off. Disconnect the Passenger Heated Seat Switch connector. Measure the resistance of the Ground circuit in the Passenger Heated Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All

*HEATED SEAT SWITCH ILLUMINATION LAMP INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
5	Turn ignition off. Disconnect the Passenger Heated Seat Switch connector. Disconnect the BCM C1 connector. Measure the resistance of the Panel Lamps Driver circuit between the Passenger Heated Seat Switch connector and the BCM C1 connector (cav. #12). Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open Panel Lamps Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn ignition off. Disconnect the Drivers Heated Seat Switch connector. Disconnect the BCM C1 connector. Measure the resistance of the Panel Lamps Driver circuit between the Drivers Heated Seat Switch connector and the BCM C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open Panel Lamps Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
7	View repair options. Repair Replace the BCM. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HVAC CONTROL ILLUMINATION LAMPS INOPERATIVE

POSSIBLE CAUSES
HVAC CONTROL ILLUMINATION INOPERATIVE
CONTROL HEAD OPEN GROUND CIRCUIT
PANEL LAMPS DRIVER CIRCUIT OPEN
BCM (HVAC ILUMINATION)

TEST	ACTION	APPLICABILITY
1	Disconnect the appropriate HVAC Control panel connector. C-1 for manual or C-2 for automatic system. Connect a test light between the HVAC ground circuit and Panel Lamps Driver circuit in the HVAC connector(s). Turn on the panel lamps and observe the test light. Did the test light illuminate? Yes → Replace the Heater-A/C Control Panel Assembly. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Disconnect the HVAC connectors. Measure the resistance of the Ground circuit in the HVAC C1 or C2 (see connector pinout to determine which connector). Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open HVAC Ground Circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the HVAC connectors. Disconnect the BCM C1 connector. Measure the resistance of the Panel Lamps Driver circuit between the HVAC C1 or C2 connector (refer to connector pinout to determine which connector) and the BCM C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Panel Lamps Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	View repair options. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*I/P COURTESY LAMPS INOP

POSSIBLE CAUSES
BCM I/P COURTESY LAMPS INOP
BULBS OPEN
OPEN FUSED B(+)
COURTESY LAMP CONTROL CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Remove and check inoperative bulbs. Are the bulbs OK? Yes → Go To 2 No → Replace the bulbs. Perform BODY VERIFICATION TEST - VER 1.	All
2	Measure the voltage of the Fused B(+) circuit to the Lamp. Is the voltage above 10.0 volts? Yes → Go To 3 No → Repair the open Fused B(+) circuit back to splice. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the BCM C1 connector. Gain access to an inoperative bulb. Measure the Courtesy Lamp Control circuit from the BCM C1 connector to the bulb connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Repair the open Courtesy Lamp Control circuit. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LIFTGATE COURTESY LAMP DISABLE FEATURE INOPERATIVE

POSSIBLE CAUSES
OPEN FUSED B(+)
OPEN LIFTGATE COURTESY DISABLE CIRCUIT
LIFTGATE COURTESY DISABLE SWITCH
BCM COURTESY DISABLE

TEST	ACTION	APPLICABILITY
1	Disconnect the Cargo Lamp connector. Measure the voltage of the Fused B(+) circuit at the Cargo Lamp connector. Is the voltage above 10.0 volts? Yes → Go To 2 No → Repair the open Fused B(+) circuit to the Cargo Lamp connector. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Cargo Lamp connector. Disconnect the Junction Block C1 connector. Measure the resistance of the Liftgate Courtesy Disable circuit between the Cargo Lamp connector and the Junction Block C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open ″Liftgate Courtesy Disable″ wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Gain access to the Cargo Lamp connector but do not disconnect. Using a voltmeter backprobe the Liftgate Courtesy Disable circuit at the Cargo Lamp connector while cycling the Disable Switch on and off. Does the voltage toggle from approximatly 10.0 to 0.0 volts? Yes → Go To 4 No → Replace the Liftgate (Cargo) Lamp assemble. Perform BODY VERIFICATION TEST - VER 1.	All
4	View repair options. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*OVERHEAD, REAR AND LIFTGATE LAMPS INOPERATIVE

POSSIBLE CAUSES
BULBS
OPEN FUSED B(+)
COURTESY LAMP DRIVER CIRCUIT OPEN
BCM COURTESY LAMP DRIVER

TEST	ACTION	APPLICABILITY
1	Remove and check inoperative bulbs. Are the bulbs OK? Yes → Go To 2 No → Replace the bulbs. Perform BODY VERIFICATION TEST - VER 1.	All
2	Measure the voltage of the Fused B(+) circuit to the Lamp. Is the voltage above 10.0 volts? Yes → Go To 3 No → Repair the open Fused B(+) circuit back to splice. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the Junction Block C1 connector. Gain access to an inoperative bulb. Measure the Courtesy Lamp Driver circuit from the Junction Block C1 connector cavity 16 to the bulb connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Courtesy Lamp Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the Dome Lamp Switch to the ON position. Disconnect Fuse # 8 from the Junction Block. While backprobing, measure the resistance of the Courtesy Lamp Driver circuit at the Body Control Module C-1 connector cavity # 8. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Replace the Body Control Module (BCM). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER DOOR COURTESY LAMP INOPERATIVE

POSSIBLE CAUSES
BULB
OPEN COURTESY LAMP DRIVER CIRCUIT
OPEN COURTESY LAMP GROUND CIRCUIT
PASSENGER DOOR MODULE COURTESY LAMP

TEST	ACTION	APPLICABILITY
1	Remove and inspect the courtesy lamp bulb. Is the Courtesy Lamp bulb open? Yes → Replace the bulb. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the Passenger Door Courtesy Lamp Bulb. Disconnect the Passenger Door Module C-2 connector Measure the Courtesy Lamp Driver circuit from the bulb connector to the Passenger Door Module C-2 connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Courtesy Lamp Driver circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the Passenger's Door Courtesy Lamp Bulb. Disconnect the Passenger Door Module C-2 connector Measure the Courtesy Lamp Ground circuit from the bulb connector to the Passenger Door Module C-2 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Courtesy Lamp Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	View repair options. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PRNDL/T-CASE ILLUMINATION LAMPS INOPERATIVE

POSSIBLE CAUSES
PRNDL OPEN GROUND CONNECTION
PANEL LAMPS DRIVER CKT OPEN
PRNDL ILLUMINATION
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Disconnect the PRNDL/Transfer Case Illumination connector. Connect a test light between the ground circuit and the Panel Lamps Driver circuit in the PRNDL/Transfer Case Illumination connector. Turn on the panel lamps and observe the test light. Did the test light illuminate? Yes → Replace the PRNDL/Transfer Case Illumination assembly. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Disconnect the PRNDL/Transfer Case Illumination connector. Measure the resistance of the Ground circuit in the PRNDL connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the PRNDL/Transfer Case Illumination connector. Disconnect the BCM C1 connector. Measure the resistance of the Panel Lamps Driver circuit between the PRNDL connector and the BCM C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Panel Lamps Driver Circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	View repair options. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RADIO ILLUMINATION LAMPS INOPERATIVE

POSSIBLE CAUSES
RADIO GROUND CIRCUIT OPEN
BCM (RADIO ILLUMINATION)
PANEL LAMPS DRIVER CKT OPEN
RADIO ILLUMINATION

TEST	ACTION	APPLICABILITY
1	Disconnect the Radio C1 connector. Connect a test light between the Radio ground connection and Panel Lamps Driver circuit in the Radio C1 connector. Turn on the panel lamps and observe the test light. Did the test light illuminate? Yes → Repair or replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Radio ground wire. Measure the resistance between ground and the radio ground wire. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Replace or repair the radio ground strap. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Disconnect the Radio C1 connector. Disconnect the BCM C1 connector. Measure the resistance of the Panel Lamps Driver circuit between the Radio C1 connector and the BCM C1 connector (cav. #13). Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the Panel Lamps Driver Circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	View repair options. Repair Replace the BCM. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*READING & VANITY LAMPS INOPERATIVE

POSSIBLE CAUSES
BULBS
COURTESY LAMP DRIVER CIRCUIT OPEN
BCM, COURTESY LAMP DRIVER

TEST	ACTION	APPLICABILITY
1	Remove and check inoperative bulbs. Are the bulbs OK? Yes → Go To 2 No → Replace the bulbs. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn ignition off. Disconnect the Junction Block C1 connector. Gain access to an inoperative bulb. Measure the Courtesy Lamp Driver circuit from the Junction Block C1 connector to the bulb connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Courtesy Lamp Driver circuit or Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the Dome Lamp Switch to the ON position. Disconnect Fuse # 8 from the Junction Block. While backprobing, measure the resistance of the Courtesy Lamp Driver circuit at the Body Control Module C-1 connector cavity # 8. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Replace the defective Body Control Module (BCM). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
FRONT RISER SENSOR OUT OF RANGE HIGH

When Monitored and Set Condition:

FRONT RISER SENSOR OUT OF RANGE HIGH

When Monitored: Igntion on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value higher than the Memory Seat Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR GROUND WIRE OPEN
FRONT RISER SENSOR SIGNAL SHORT TO MOTOR
SEAT SENSOR 5 VOLT SUPPLY SHORT TO BATTERY
FRONT RISER POSITION SIGNAL CKT SHORT TO VOLTAGE
FRONT RISER SENSOR HIGH
MEMORY SEAT MODULE INTERNAL GROUND OPEN
MEMORY SEAT MODULE FRONT RISER HIGH

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Disconnect the Driver Power Seat Front Riser Sensor connector. Measure the resistance of the Seat Position Sensor Ground circuit at the driver power seat front riser connector. Is the resistance below 5.0 ohms? Yes → Go To 2 No → Go To 7	All
2	Ensure all seat and sensor connectors are connected and front riser motor is operational. With the DRB III select: Body Memory Seat Sensors Monitor the Front Riser Position sensor while operating the seat front riser to both limits. Did the voltage ever go above 8.0 volts ONLY when the motor was in operation? Yes → Replace the Seat Track Assembly. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

FRONT RISER SENSOR OUT OF RANGE HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Disconnect the Driver Power Seat Front Riser Sensor connector. Disconnect the Seat Module C1 connector. Turn ignition on. Measure the voltage between the Front Riser Position Signal circuit and ground. Is the voltage above 0.2 volts? No → Go To 4 Yes → Repair the Front Riser Position Signal circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
4	Disconnect the Seat Front Riser Position Sensor connector. Measure the voltage between the Seat Sensor 5 volt supply circuit and ground. Is the voltage above 5.5 volts? Yes → Repair the seat sensor 5 volt supply ckt for a short to battery. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 5	All
5	Turn ignition off. Disconnect the Driver Power Seat Front Riser Sensor connector. Ensure the Memory Seat Module is fully connected before proceeding. Turn ignition on. With the DRB III® in Memory Seat Sensors. Read the Front Riser Position Sensor voltage Is the voltage above 0.2 volts? Yes → Go To 6 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Front Riser Sensor connector. Measure the resistance of the Seat Position Sensor Ground wire between the Seat Module connector and the sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Sensor Ground Wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
FRONT RISER SENSOR OUT OF RANGE LOW

When Monitored and Set Condition:

FRONT RISER SENSOR OUT OF RANGE LOW

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value lower than the Memory Seat Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR 5 VOLT SUPPLY SHORT TO GROUND
FRONT RISER SENSOR (LOW)
SEAT SENSOR 5 VOLT SUPPLY OPEN
FRONT RISER POSITION SIGNAL CIRCUIT SHORT TO GROUND
FRONT RISER POSITION SIGNAL CIRCUIT OPEN
MEMORY SEAT MODULE INTERNAL 5 VOLT LOW
MEMORY SEAT MODULE INTERNAL SENSE LOW

TEST	ACTION	APPLICABILITY
1	Ensure the Memory Seat Module is fully connected before proceeding. Disconnect the Driver Power Seat Front Riser Sensor connector. Turn ignition on. Measure the voltage of the Seat Sensor 5 Volt Supply circuit. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Disconnect the Driver Power Seat Front Riser Sensor connector. Connect a jumper wire between Seat Sensor 5 Volt Supply and Front Riser Position Signal circuits. Ensure the Memory Seat Module is fully connected before proceeding. With the DRBIII® select: Body, Memory Seat and Sensors. Turn ignition on. Read the Front Riser Position Sensor voltage Is the voltage above 4.5 volts? Yes → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

FRONT RISER SENSOR OUT OF RANGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Front Riser Sensor connector. Measure the resistance of the Front Riser Position Signal circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Front Riser Position Signal Circuit for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	Turn ignition off. Disconnect the Driver Power Seat Front Riser Sensor connector. Disconnect the Seat Module C1 connector. Measure the resistance of the Front Riser Position Signal circuit between the Sensor connector and the Seat Module C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Front Riser Position Signal circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Turn ignition off. Disconnect the Seat Module C1 connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit to body ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Seat Sensor 5 Volt Supply for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 7	All
7	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Front Riser Sensor connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit between the Front Riser Sensor connector and the Seat Module C1 connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Sensor 5 Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
HORIZONTAL SENSOR OUT OF RANGE HIGH

When Monitored and Set Condition:

HORIZONTAL SENSOR OUT OF RANGE HIGH

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value higher than the Memory Heated Seat/Mirror Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR GROUND WIRE OPEN
SEAT HORIZONTAL POSITION SIGNAL SHORT TO MOTOR
SEAT SENSOR 5 VOLT SUPPLY SHORT TO BATTERY
CHECKING SEAT HORIZONTAL POSITION SIGNAL SHORT TO VOLTAGE
HORIZONTAL POSITION SENSOR HIGH
MEMORY SEAT MODULE INTERNAL GROUND OPEN
MEMORY SEAT MODULE INTERNAL HIGH

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Disconnect the Driver Power Seat Horizontal Position Sensor connector Measure the resistance of the Seat Position Sensor Ground circuit to body ground.. Is the resistance below 5.0 ohms? Yes → Go To 2 No → Go To 7	All
2	Ensure all seat and sensor connectors are connected and front Horizontal motor is operational. With the DRB III select: Body, Memory Seat, and Sensors. Monitor the Horizontal Position sensor while operating the seat horizontally to both limits. Did the voltage ever go above 7.0 volts ONLY when the motor was in operation? Yes → Replace the Seat Track Assembly. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All
3	Disconnect the Driver Power Seat Horizontal Position Sensor connector Turn ignition on. Measure the voltage between the Seat Sensor 5 volt supply circuit and ground. Is the voltage above 5.5 volts? Yes → Repair the seat sensor 5 volt supply ckt for a short to battery. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All

HORIZONTAL SENSOR OUT OF RANGE HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Horizontal Position Sensor connector Turn ignition on. Measure the voltage between Seat Horizontal Position Signal circuit and ground. Is there any voltage on the Seat Horizontal Position Signal circuit? No → Go To 5 Yes → Repair the Horizontal Position Signal ckt for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	Turn ignition off. Disconnect the Driver Power Seat Horizontal Position Sensor connector Ensure the Memory Seat Module is fully connected before proceeding. Turn ignition on. With the DRBIII® select: Body, Memory Seat and Sensors. Read the Horizontal Position Sensor voltage Is the voltage above 0.2 volts? Yes → Go To 6 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Disconnect the Driver Power Seat Horizontal Position Sensor connector Disconnect the Seat Module C1 connector. Measure the resistance of the Seat Position Sensor Ground wire between the Seat Module connector and the sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Sensor Ground Wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
HORIZONTAL SENSOR OUT OF RANGE LOW

When Monitored and Set Condition:

HORIZONTAL SENSOR OUT OF RANGE LOW

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value lower than the Memory Heated Seat/Mirror Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR 5 V SUPPLY SHT GND
HORIZONTAL SENSOR (LOW)
SEAT SENSOR 5 VOLT SUPPLY OPEN
HORIZONTAL POS SIGNAL CKT SHORT TO GROUND
SEAT HORIZONTAL POSITION SIGNAL CKT OPEN
MEMORY SEAT MODULE INTERNAL 5 VOLT SUPPLY
MEMORY SEAT MODULE INTERNAL LOW

TEST	ACTION	APPLICABILITY
1	Ensure the Memory Seat Module is fully connected before proceeding. Disconnect the Driver Power Seat Horizontal Sensor connector. Turn ignition on. Measure the voltage of the Seat Sensor 5 Volt Supply circuit. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Disconnect the Driver Power Seat Horizontal Sensor connector. Connect a jumper wire between Seat Sensor 5 Volt Supply and Seat Horizontal Position Signal circuits. Ensure the Memory Seat Module is fully connected before proceeding. With the DRB III select: Body Memory Seat Sensors. Turn ignition on. Read the Horizontal Position Sensor voltage Is the voltage above 4.5 volts? Yes → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

HORIZONTAL SENSOR OUT OF RANGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Horizontal Sensor connector. Measure the resistance of the Seat Horizontal Position Signal circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Seat Horizontal Position Signal Ckt for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Horizontal Sensor connector. Measure the resistance of the Seat Horizontal Position Signal circuit between the Sensor connector and the Seat Module connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Seat Horizontal Position Signal circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Disconnect the Seat Module C1 connector. Turn ignition off. Measure the resistance of the Seat Sensor 5 Volt Supply circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Seat Sensor 5 Volt Supply for a short to Ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 7	All
7	Disconnect the Driver Power Seat Horizontal Position Sensor connector Disconnect the Seat Module C1 connector. Turn ignition off. Measure the resistance of the Seat Sensor 5 Volt Supply circuit between the Sensor connector and the Module connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Sensor 5 Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
REAR RISER SENSOR OUT OF RANGE HIGH

When Monitored and Set Condition:

REAR RISER SENSOR OUT OF RANGE HIGH

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value higher than the Memory Heated Seat/Mirror Module has stored in EEPROM.

POSSIBLE CAUSES
REAR RISER POSITION SIGNAL SHORT TO MOTOR
SEAT SENSOR GROUND WIRE OPEN
SEAT SENSOR 5 VOLT SUPPLY SHORT TO BATTERY
CHECKING REAR RISER POS SIG SHORT TO VOLTAGE
REAR RISER SENSOR (HIGH)
MEMORY SEAT MODULE - INTERNAL SHORT HIGH
MEMORY SEAT MODULE INTERNAL GROUND OPEN

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Disconnect the Driver Power Seat Rear Riser Sensor connector. Measure the resistance of the Seat Position Sensor Ground circuit at the driver power seat rear riser connector. Is the resistance below 5.0 ohms? Yes → Go To 2 No → Go To 7	All
2	Ensure all seat and sensor connectors are connected and front riser motor is operational. With the DRB III select: Body Memory Seat Sensors Monitor the Rear Riser Position sensor while operating the seat rear riser to both limits. Did the voltage ever go above 7.0 volts only when the motor was in operation? Yes → Replace the Seat Track Assembly. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All
3	Disconnect the Driver Power Seat Rear Riser Sensor connector. Turn ignition on. Measure the voltage between the Seat Sensor 5 volt supply circuit and ground. Is the voltage above 5.5 volts? Yes → Repair the seat sensor 5 volt supply ckt for a short to battery. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All

REAR RISER SENSOR OUT OF RANGE HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Rear Riser Sensor connector. Turn ignition on. Measure the voltage between Rear Riser Position Signal circuit and ground. Is there any voltage on the Rear Riser Position Signal circuit? No → Go To 5 Yes → Repair the Rear Riser Position Signal circuit for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	Turn ignition off. Disconnect the Driver Power Seat Rear Riser Sensor connector. Ensure the Memory Seat Module is fully connected before proceeding. Turn ignition on. With the DRB III select: Body Memory Seat Sensors Read the Rear Riser Position Sensor voltage Is the voltage above 0.2 volts? Yes → Go To 6 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Rear Riser Sensor connector. Measure the resistance of the Seat Position Sensor Ground wire between the Seat Module connector and the sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Position Sensor Ground Wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
REAR RISER SENSOR OUT OF RANGE LOW

When Monitored and Set Condition:

REAR RISER SENSOR OUT OF RANGE LOW

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value lower than the Memory Heated Seat/Mirror Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR 5 V SUPPLY SHORT TO GROUND
REAR RISER SENSOR (LOW)
SEAT SENSOR 5 VOLT SUPPLY OPEN
REAR RISER POS SIGNAL CKT SHORT TO GROUND
REAR RISER POSITION SIGNAL CKT OPEN
MEMORY SEAT MODULE INTERNAL 5 VOLT LOW
MEMORY SEAT MODULE INTERNAL LOW

TEST	ACTION	APPLICABILITY
1	Ensure the Memory Seat Module is fully connected before proceeding. Disconnect the Driver Power Seat Rear Riser Sensor connector. Turn ignition on. Measure the voltage of the Seat Sensor 5 Volt Supply circuit. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Disconnect the Driver Power Seat Rear Riser Sensor connector. Connect a jumper wire between Seat Sensor 5 Volt Supply and Rear Riser Position Signal circuits. Ensure the Memory Seat Module is fully connected before proceeding. With the DRB III select: Body Memory Seat Sensors Turn ignition on. Read the Rear Riser Position Sensor voltage Is the voltage above 4.5 volts? Yes → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

REAR RISER SENSOR OUT OF RANGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Rear Riser Sensor connector. Measure the resistance of the Rear Riser Position Signal circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Rear Riser Position Signal Ckt for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Rear Riser Sensor connector. Measure the resistance of the Rear Riser Position Signal circuit between the Sensor connector and the Module connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Rear Riser Position Signal circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Turn ignition off. Disconnect the Seat Module C1 connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Seat Sensor 5 Volt Supply for a short to Ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 7	All
7	Disconnect the Driver Power Seat Rear Riser Sensor connector. Disconnect the Seat Module C1 connector. Turn ignition off. Measure the resistance of the Seat Sensor 5 Volt Supply circuit between the Sensor connector and the Module connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Sensor 5 Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
RECLINER SENSOR OUT OF RANGE HIGH

When Monitored and Set Condition:

RECLINER SENSOR OUT OF RANGE HIGH

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value higher than the Memory Heated Seat/Mirror Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR GROUND WIRE OPEN
RECLINER POSITION SIGNAL SHORT TO MOTOR
SEAT SENSOR 5 VOLT SUPPLY SHORT TO BATTERY
RECLINER POSITION SIGNAL SHORT TO VOLTAGE
RECLINER POSITION SENSOR HIGH
MEMORY SEAT MODULE INTERNAL GROUND OPEN
MEMORY SEAT MODULE INTERNAL HIGH

TEST	ACTION	APPLICABILITY
1	Turn ignition off. Disconnect the Driver Power Seat Recliner Sensor connector. Measure the resistance of the Seat Position Sensor Ground circuit to body ground. Is the resistance below 5.0 ohms? Yes → Go To 2 No → Go To 7	All
2	Ensure all seat and sensor connectors are connected and recliner motor is operational. With the DRB III select: Body Memory Seat Sensors Monitor the Recliner Position sensor while operating the seat Recliner to both limits. Did the voltage ever go above 7.0 volts only when the motor was in operation? Yes → Replace the Seat Track Assembly. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All
3	Disconnect the Driver Power Seat Recliner Sensor connector. Turn ignition on. Measure the voltage between the Seat Sensor 5 volt supply circuit and ground. Is the voltage above 5.5 volts? Yes → Repair the seat sensor 5 volt supply ckt for a short to battery. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All

RECLINER SENSOR OUT OF RANGE HIGH — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Recliner Sensor connector. Turn ignition on. Measure the voltage between Recliner Position Signal circuit and ground. Is there any voltage on the Recliner Position Signal circuit? No → Go To 5 Yes → Repair the Recliner Position Signal ckt for a short to voltage. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	Turn ignition off. Disconnect the Driver Power Seat Recliner Position Sensor connector Ensure the Memory Seat Module is fully connected before proceeding. Turn ignition on. With the DRB III select: Body Memory Seat Sensors Read the Recliner Position Sensor voltage Is the voltage above 0.2 volts? Yes → Go To 6 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Recliner Sensor connector. Measure the resistance of the Seat Position Sensor Ground wire between the MSM connector and the sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Position Sensor Ground Wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
RECLINER SENSOR OUT OF RANGE LOW

When Monitored and Set Condition:

RECLINER SENSOR OUT OF RANGE LOW

When Monitored: Ignition on.

Set Condition: This condition is immediately set when the seat motor potentiometer feeds a value lower than the Memory Heated Seat/Mirror Module has stored in EEPROM.

POSSIBLE CAUSES
SEAT SENSOR 5 V SUPPLY SHORT TO GROUND
RECLINER POSITION SENSOR (LOW)
SEAT SENSOR 5 VOLT SUPPLY OPEN
RECLINER POSITION SIGNAL CKT SHORT TO GROUND
RECLINER POSITION SIGNAL CKT OPEN
MEMORY SEAT MODULE INTERNAL 5 VOLT LOW
MEMORY SEAT MODULE INTERNAL (LOW)

TEST	ACTION	APPLICABILITY
1	Ensure the Memory Seat Module is fully connected before proceeding. Disconnect the Driver Power Seat Recliner Sensor connector. Turn ignition on. Measure the voltage of the Seat Sensor 5 Volt Supply circuit. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Disconnect the Driver Power Seat Recliner Sensor connector. Connect a jumper wire between Seat Sensor 5 Volt Supply and Recliner Position Signal circuits. Ensure the Memory Seat Module is fully connected before proceeding. With the DRB III select: Body Memory Seat Sensors Turn ignition on. Read the Recliner Position Sensor voltage Is the voltage above 4.5 volts? Yes → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 3	All

RECLINER SENSOR OUT OF RANGE LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Recliner Sensor connector. Measure the resistance of the Recliner Position Signal circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Recliner Position Signal Ckt for a short to ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 4	All
4	Turn ignition off. Disconnect the Seat Module C1 connector. Disconnect the Recliner Position Sensor connector. Measure the resistance of the Recliner Position Signal circuit between the Sensor connector and the Module connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Recliner Position Signal circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Turn ignition off. Disconnect the Seat Module C1 connector. Measure the resistance of the Seat Sensor 5 Volt Supply circuit to ground. Is the resistance below 1000 (1 K) ohms? Yes → Repair the Seat Sensor 5 Volt Supply for a short to Ground. Perform VERIFICATION TEST -MEMORY SYSTEM. No → Go To 7	All
7	Disconnect the Recliner Position Sensor connector. Disconnect the Seat Module C1 connector. Turn ignition off. Measure the resistance of the Seat Sensor 5 Volt Supply circuit between the Sensor connector and the Module connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Sensor 5 Volt Supply circuit. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT FRONT RISER MOVEMENT INOPERATIVE

POSSIBLE CAUSES
SEAT FRONT UP DRIVER WIRE OPEN
SEAT FRONT DOWN DRIVER WIRE OPEN
SEAT FRONT DOWN SWITCH SENSE WIRE OPEN
DRIVER FRONT RISER MOTOR INOPERATIVE
DRIVER POWER SEAT SWITCH
MSM FRONT RISER MOTOR OUTPUT
MSM FRONT RISER SWITCH INPUT OPEN
SEAT FRONT UP SWITCH SENSE WIRE OPEN

TEST	ACTION	APPLICABILITY
1	Using the DRB III select: Body Memory Seat Module Actuators Actuate the Front Riser Motor up and then down. Did the Front Riser Motor operate in both directions? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Front Down Switch Sense circuit between the MSM connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Seat Front Down Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
3	Turn ignition off. Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Front Up Switch Sense circuit between the MSM connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Seat Front Up Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT FRONT RISER MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Ensure the Driver Power Seat Switch Is fully connected. Disconnect the Seat Module C1 connector. Connect a test light between the Seat Front Up Switch Sense circuit and the Seat Front Down Switch Sense circuit in the Seat Module connector. Move the Front Riser Switch to the UP and then the DOWN positions and observe the test light. Did the test light illuminate when the switch was moved in BOTH directions? Yes → Go To 5 No → Replace the Driver Power Seat Switch Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power seat front riser motor connector. Measure the resistance of the Seat Front Up Driver circuit between the Seat Module connector and the seat front riser motor connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the Seat Front Up Driver wire for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power seat front riser motor connector. Measure the resistance of the Seat Front Down Driver circuit between the MSM connector and the seat front riser motor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the Seat Front Down Driver wire for an open. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C2 connector. Ensure the Front Riser Motor connector is connected at this time. Connect a jumper wire from the Seat Front Up Driver circuit to the Ground circuit in the Seat Module C2 connector. Connect a jumper wire to the Seat Front Down Driver circuit and momentarily touch it to the Fused B(+) circuit. Reverse the Ground and Fused B(+) jumper wires momentarily to run the motor in the opposite direction. Did the Front Riser Motor run in both directions? Yes → Go To 9 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT FRONT RISER MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT HORIZONTAL MOVEMENT INOPERATIVE

POSSIBLE CAUSES
SEAT HORIZONTAL FORWARD DRIVER WIRE OPEN
SEAT HORIZONTAL FORWARD SWITCH SENSE WIRE OPEN
SEAT HORIZONTAL REARWARD DRIVER WIRE OPEN
SEAT HORIZONTAL REARWARD SWITCH SENSE WIRE OPEN
DRIVER HORIZONTAL MOTOR INOPERATIVE
DRIVER POWER SEAT SWITCH
MSM HORIZONTAL MOTOR OUTPUT OPEN
MSM HORIZONTAL SWITCH INPUT OPEN

TEST	ACTION	APPLICABILITY
1	Using the DRB III select: Body Memory Seat Module Actuators Actuate the Horizontal Motor Forward and then Rearward. Did the Horizontal Motor operate in both directions? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Horizontal Forward Switch Sense circuit between the Seat Module connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Seat Horizontal Forward Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
3	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Horizontal Rearward Switch Sense circuit between the Seat Module connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Seat Horizontal Rearward Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT HORIZONTAL MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Ensure the Driver Power Seat Switch Is fully connected. Disconnect the Seat Module C1 connector. Connect a test light between the Seat Horizontal Forward Switch Sense circuit and the Seat Horizontal Rearward Switch Sense circuit in the Seat Module connector. Move the Seat Horizontal Switch to the Forward and then the Rearward positions and observe the test light. Did the test light illuminate when the switch was moved in both directions. Yes → Go To 5 No → Replace the Driver Power Seat Switch Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power Seat Horizontal Motor connector. Measure the resistance of the Seat Horizontal Forward Driver circuit between the Seat Module connector and the seat horizontal motor connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open Seat Horizontal Forward Driver wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power seat horizontal motor connector. Measure the resistance of the Seat Horizontal Rearward Driver circuit between the Seat Module connector and the seat horizontal motor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Horizontal Rearward Driver wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	Refer to service information to remove the seat and gain access to the connectors. Disconnect the Seat Module C2 connector. Ensure the Seat Horizontal Motor connector is connected at this time. Connect a jumper wire from the Seat Horizontal Forward Driver circuit to the Ground circuit in the Seat Module C2 connector. Connect a jumper wire to the Seat Horizontal Rearward Driver circuit and momentarily touch it to the Fused B(+) circuit. Reverse the Ground and Fused B(+) jumper wires momentarily to run the motor in the opposite direction. Did the Seat Horizontal Motor run in both directions. Yes → Go To 9 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT HORIZONTAL MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT REAR RISER MOVEMENT INOPERATIVE

POSSIBLE CAUSES
SEAT REAR DOWN DRIVER WIRE OPEN
SEAT REAR DOWN SWITCH SENSE WIRE OPEN
SEAT REAR UP DRIVER WIRE OPEN
SEAT REAR UP SWITCH SENSE WIRE OPEN
DRIVER POWER SEAT SWITCH DEFECTIVE
DRIVER REAR RISER MOTOR INOPERATIVE
MSM REAR RISER MOTOR OUTPUT OPEN
MSM REAR RISER SWITCH INPUT OPEN

TEST	ACTION	APPLICABILITY
1	Using the DRB III select: Body Memory Seat Module Actuators Actuate the Rear Riser Motor Up and then Down. Did the Rear Riser Motor operate in both directions? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Rear Down Switch Sense circuit between the Seat Module connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Seat Rear Down Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
3	Turn ignition off. Raise the Driver Seat as high as possible to gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Rear Up Switch Sense circuit between the Seat Module connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Seat Rear Up Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT REAR RISER MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Ensure the Driver Power Seat Switch Is fully connected. Disconnect the Seat Module C1 connector. Connect a test light between the Seat Rear Up Switch Sense circuit and the Seat Rear Down Switch Sense circuit in the seat module connector. Move the Seat Rear Riser Switch to the Up and then the Down positions and observe the test light. Did the test light illuminate when the switch was moved in BOTH directions. Yes → Go To 5 No → Replace the Driver Power Seat Switch Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power seat rear riser motor connector. Measure the resistance of the Seat Rear Down Driver circuit between the Seat Module connector and the seat front riser motor connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open Seat Rear Down Driver wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power seat rear riser motor connector. Measure the resistance of the Seat Rear Up Driver circuit between the Seat Module connector and the seat rear riser motor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Rear Up Driver wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Ensure the Seat Horizontal Motor connector is connected at this time. Connect a jumper wire from the Seat Rear Up Driver circuit to the Ground circuit in the Seat Module C2 connector. Connect a jumper wire to the Seat Rear Down Driver circuit and momentarily touch it to the Fused B(+) circuit. Reverse the Ground and Fused B(+) jumper wires momentarily to run the motor in the opposite direction. Did the Seat Rear Riser Motor run in both directions. Yes → Go To 9 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT REAR RISER MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
*DRIVER SEAT RECLINER MOVEMENT INOPERATIVE

POSSIBLE CAUSES
SEAT RECLINER DOWN DRIVER WIRE OPEN
SEAT RECLINER DOWN SWITCH SENSE WIRE OPEN
SEAT RECLINER UP DRIVER WIRE OPEN
SEAT RECLINER UP SWITCH SENSE WIRE OPEN
DRIVER POWER SEAT SWITCH
DRIVER RECLINER MOTOR INOPERATIVE
MSM RECLINER MOTOR OUTPUT OPEN
MSM RECLINER SWITCH INPUT OPEN

TEST	ACTION	APPLICABILITY
1	Using the DRB III select: Body Memory Seat Module Actuators Actuate the Recliner Motor Up and then Down. Did the Recliner Motor operate in both directions? Yes → Go To 2 No → Go To 6	All
2	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Recliner Down Switch Sense circuit between the MSM connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Seat Recliner Down Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
3	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C1 connector. Disconnect the Driver Power Seat Switch connector. Measure the resistance of the Seat Recliner Up Switch Sense circuit between the Seat Module connector and the Seat Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Seat Recliner Up Switch Sense wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT RECLINER MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Ensure the Driver Power Seat Switch Is fully connected. Disconnect the Seat Module C1 connector. Connect a test light between the Seat Recliner Up Switch Sense circuit and the Seat Recliner Down Switch Sense circuit in the Seat Module connector. Move the Seat Recliner Switch to the Up and then the Down positions and observe the test light. Did the test light illuminate when the switch was moved in BOTH directions. Yes → Go To 5 No → Replace the Driver Power Seat Switch Perform VERIFICATION TEST -MEMORY SYSTEM.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
6	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power Seat Recliner Motor connector. Measure the resistance of the Seat Recliner Down Driver circuit between the Seat Module connector and the seat recliner motor connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open Seat Recliner Down Driver wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
7	Turn ignition off. Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Disconnect the driver power Seat Recliner Motor connector. Measure the resistance of the Seat Recliner Up Driver circuit between the Seat Module connector and the seat recliner motor connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Seat Recliner Up Driver wire. Perform VERIFICATION TEST -MEMORY SYSTEM.	All
8	Refer to service information for seat removal to gain access to the connectors. Disconnect the Seat Module C2 connector. Ensure the Seat Horizontal Motor connector is connected at this time. Connect a jumper wire from the Seat Recliner Up Driver circuit to the Ground circuit in the Seat Module C2 connector. Connect a jumper wire to the Seat Recliner Down Driver ckt and momentarily touch it to the Fused B(+) ckt. Reverse the Ground and Fused B(+) jumper wires momentarily to run the motor in the opposite direction. Did the Seat Recliner Motor run in both directions. Yes → Go To 9 No → Replace the Seat Track Assy. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

*DRIVER SEAT RECLINER MOVEMENT INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace the Memory Seat Module. Perform VERIFICATION TEST -MEMORY SYSTEM.	All

Symptom:
AMBIENT TEMPERATURE SENSOR CIRCUIT OPEN

When Monitored and Set Condition:

AMBIENT TEMPERATURE SENSOR CIRCUIT OPEN

When Monitored: With the ignition on.

Set Condition: The BCM detects the Ambient Temperature Sensor Signal circuit voltage is above 4.8 volts for 5 seconds or more. Customer complaint: EVIC temperature display is -40°C (-40°F).

POSSIBLE CAUSES
AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
AMBIENT TEMPERATURE SENSOR
AMBIENT TEMPERATURE SENSOR RETURN CIRCUIT OPEN
AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Disconnect the Ambient Temperature Sensor harness connector. Connect a jumper wire between the sensor signal and sensor ground circuits. Close all vehicle doors. Turn the ignition on. With the DRBIII® in Sensors, read the Outside Temperature voltage. Is the voltage below 0.5 volts? Yes → Replace the Ambient Temperature Sensor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Disconnect the BCM C2 harness connector. Measure the voltage between the Ambient Temperature Sensor Signal circuit and ground. Is there any voltage present? Yes → Repair the Ambient Temperature Sensor Signal circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

AMBIENT TEMPERATURE SENSOR CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Disconnect the BCM C2 harness connector. Measure the resistance of the Ambient Temperature Sensor Return circuit between the BCM C2 harness connector and the Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Return circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the Ambient Temperature Sensor harness connector. Measure the resistance of the Ambient Temperature Sensor Signal circuit between the BCM C2 harness connector and the Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Signal circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
AMBIENT TEMPERATURE SENSOR CIRCUIT SHORT

When Monitored and Set Condition:

AMBIENT TEMPERATURE SENSOR CIRCUIT SHORT

When Monitored: With the ignition on.

Set Condition: The BCM detects that the Ambient Temperature Sensor signal circuit voltage is below 0.3 volts for 5 seconds or Customer complaint: EVIC temperature display is 55°C (130°).

POSSIBLE CAUSES
AMBIENT TEMPERATURE SENSOR
AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO SENSOR RETURN CIRCUIT
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Close all vehicle doors. Turn the ignition on. Observe the EVIC display. Does the EVIC display -40° F (-40°C)? Yes → Replace the Ambient Temperature Sensor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the BCM C2 harness connector. Disconnect the Ambient Temperature Sensor harness connector. Measure the resistance between ground and the Ambient Temperature Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Signal circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

AMBIENT TEMPERATURE SENSOR CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Disconnect the BCM C2 harness connector. Measure the resistance between the Ambient Temperature Sensor Signal circuit and Ambient Temperature Sensor Return circuit. Is the resistance below 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Signal circuit for a short to the Sensor Return circuit. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
BUS MESSAGES MISSING

When Monitored and Set Condition:

BUS MESSAGES MISSING

When Monitored: While the EVIC is performing a series of tests on the microprocessor, compass coil, and internal circuitry.

Set Condition: This code will set during the self test if the EVIC does not receive PCI Bus messages from the BCM, MIC, or PCM.

POSSIBLE CAUSES
NO RESPONSE - PCI BUS - BCM
NO RESPONSE - PCI BUS - PCM
NO REPONSE - PCI BUS - MIC
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, attempt to communicate with the BCM. Was the DRBIII® able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to COMMUNICATION category for the related symptom. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, select Body Controller, then System Test. Does the DRBIII® display PCM Active on the Bus? Yes → Go To 3 No → Refer to COMMUNICATION category for the related symptom. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition on. With the DRBIII®, select Electro/Mechanical Instrument Cluster. Is there a response from the Instrument Cluster? Yes → Replace and program the Electronic Vehicle Information Center in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Refer to COMMUNICATION category for the related symptom. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
COMPASS TEST FAILURE

POSSIBLE CAUSES
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	Perform the EVIC self test. Turn the ignition off. Depress and hold the RESET and C/T buttons while turning the ignition on. **NOTE: This test may also be performed using the DRBIII®.** Does the EVIC or DRBIII® display "FAILED SELF TEST"? Yes → Replace the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
COOLANT LEVEL SWITCH CIRCUIT OPEN - GAS ONLY

When Monitored and Set Condition:

COOLANT LEVEL SWITCH CIRCUIT OPEN - GAS ONLY

When Monitored: With the ignition on.

Set Condition: The BCM detects the Coolant Level Sensor Signal voltage is above 4.8 volts for 5 seconds or more.

POSSIBLE CAUSES
COOLANT LEVEL SENSOR
COOLANT LEVEL SENSOR GROUND CIRCUIT OPEN
COOLANT LEVEL SENSE CIRCUIT OPEN
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Coolant Level Sensor harness connector. Turn the ignition on. With the DRBIII, read the Coolant Level Sensor status. Connect a jumper wire between the Coolant Level Sense circuit and the Ground circuit. With the DRBIII, monitor the Coolant Level Sensor voltage. Does the DRBIII display 0.0 volts? Yes → Replace the Coolant Level Sensor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Coolant Level Sensor harness connector. Measure the resistance between ground and the Coolant Level Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the Coolant Level Sensor Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

COOLANT LEVEL SWITCH CIRCUIT OPEN - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Coolant Level Sensor harness connector. Disconnect the BCM C2 harness connector. Measure the resistance of the Coolant Level Sense circuit between the Coolant Level Sensor harness connector and the BCM C2 harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Coolant Level Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
DEMAGNETIZE COMPASS

POSSIBLE CAUSES
DEMAGNETIZE COMPASS

TEST	ACTION	APPLICABILITY
1	**NOTE: A blank compass display indicates that vehicle demagnetizing is required.** **NOTE: After demagnetizing, the vehicle will enter Auto Fast-Cal when the ignition is turned on.** **NOTE: Ensure that the correct compass variance is stored in the compass memory. See ″Setting Compass Variance″ in the Service Information.** Refer to the Service Information for the Demagnetizing Procedure. View repair for Verification Test. Repair When the Demagnetizing Procedure is complete perform the Verification Test. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
EVIC INTERNAL FAILURE

When Monitored and Set Condition:

EVIC INTERNAL FAILURE

When Monitored: When a SELF TEST command is received from the DRBIII, the EVIC performs a series of tests on the microprocessor, compass coil, and internal circuitry.

Set Condition: This code will be set during the self test if the EVIC detects a problem the microprocessor, compass coil, or internal circuitry.

POSSIBLE CAUSES
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	Perform the EVIC Self Test. Turn the ignition off. Press and hold the C/T button and the RESET button. Turn the ignition on. **NOTE: The EVIC Self Test can also be performed using the DRBIII®.** Turn the ignition on. With the DRBIII®, select body, VIC, System Test, then Self Test. Observe the EVIC display following the Self Test. When the trouble code EVIC INTERNAL FAILURE is displayed, View repair. If there are no possible causes remaining, view repair. Repair Replace and program the Electronic Vehicle Information Center in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

NO BCM MESSAGES RECEIVED

POSSIBLE CAUSES
DTC PRESENT
NO RESPONSE - PCI BUS - BCM
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Go To 2 No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, attempt to I/D or communicate with the BCM. Was the DRBIII® able to communicate with the BCM? Yes → Replace the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
NO PCM MESSAGES RECEIVED

POSSIBLE CAUSES
DTC PRESENT
NO RESPONSE - PCI BUS - PCM
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. Cycle the ignition and wait approximately 1 minute. With the DRBIII®, read DTCs. Did this DTC reset? Yes → Go To 2 No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, enter Body Computer, System Tests, then PCM Monitor. Does the DRBIII® display PCM Active on the Bus? Yes → Replace the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
SET COMPASS VARIANCE AS PER SERVICE INFORMATION

POSSIBLE CAUSES
SET COMPASS VARIANCE

TEST	ACTION	APPLICABILITY
1	Refer to the Service Information for the Compass Variance procedure. View repair for the Verification Test. Repair When the Compass Variance procedure is complete perform the Verification Test. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
WASHER FLUID SWITCH FAILURE

POSSIBLE CAUSES
WASHER FLUID LEVEL SWITCH
WASHER FLUID LEVEL SWITCH GROUND CIRCUIT OPEN
WASHER FLUID LEVEL SWITCH SENSE CIRCUIT OPEN
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Washer Fluid Level Switch harness connector. Measure the resistance of the Washer Fluid Level Switch between pin 1 and pin 2. Does the resistance measure greater than 3000 ohms? Yes → Replace the Washer Fluid Level Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Washer Fluid Level Switch harness connector. Measure the resistance between ground and the Washer Fluid Level Switch Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Washer Fluid Level Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Washer Fluid Level Switch harness connector. Disconnect the BCM C2 harness connector. Measure the resistance of the Washer Fluid Switch Sense circuit between the Switch connector and the BCM connector. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Washer Fluid Level Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:

***AVERAGE FUEL ECONOMY INACCURATE OR WRONG**
***DISTANCE TO EMPTY INACCURATE OR WRONG**
***DISTANCE TO SERVICE INACCURATE OR WRONG**
***ELAPSED IGNITION ON TIME INACCURATE OR WRONG**
***INSTANT FUEL ECONOMY INACCURATE OR WRONG**
***TRIP ODOMETER INACCURATE OR WRONG**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be *AVERAGE FUEL ECONOMY INACCURATE OR WRONG.

POSSIBLE CAUSES
BODY CONTROL MODULE
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any BCM, PCM, or Communication DTCs before proceeding with this test.** **NOTE: Verify the following for proper operation: Fuel Injector Pulse Rate, Speed Signal input, Fuel Level input, correct Tire size and inflation.** Perform the EVIC Self Test. The self test can be performed with the DRBIII® or manually using the following procedure: Turn the ignition off. Press and hold the RESET and C/T buttons. Turn the ignition on. Continue to hold both buttons until the software version is displayed, then release the buttons. Observe the EVIC display when the self test is complete. Did the EVIC display ″FAILED SELF TEST″? Yes → Replace the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace and program the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*EVIC DIMMING INOPERATIVE

POSSIBLE CAUSES
ILLUMINATION BULB OR SOCKET
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any BCM, EVIC, or Communication DTCs before proceeding with this test.** Turn the ignition off. Remove and inspect the illumination bulb(s) that is inoperative. Is there a problem with the bulb or socket? Yes → Replace the illumination bulb(s) or socket(s) as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Replace, program, and calibrate the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*EVIC INOPERATIVE

POSSIBLE CAUSES
FUSED B(+) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
GROUND CIRCUIT OPEN
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any BCM, PCM, or COMMUNICATION DTCs before proceeding.** Turn the ignition off. Disconnect the Overhead Console harness connector. Measure the voltage between the Fused B+ circuit and ground. Is the voltage above 10.5 volts? Yes → Go To 2 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Overhead Console harness connector. Turn the ignition on. Measure the voltage between the Fused Ignition Switch Output circuit and ground. Is the voltage below 10.5 volts? Yes → Repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Overhead Console harness connector. Measure the resistance between ground and the EVIC ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LOW COOLANT WARNING ALWAYS ON - GAS ONLY

POSSIBLE CAUSES
COOLANT LEVEL
COOLANT LEVEL SWITCH SHORTED
COOLANT LEVEL SWITCH SENSE CIRCUIT SHORT TO GROUND
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the cooling system operates properly before proceeding with this test.** **NOTE: Diagnose and repair any BCM, EVIC, PCM, or Communication DTCs before proceeding with this test.** Inspect the coolant fluid level. Is the coolant filled to the proper level and the cooling system operating properly? Yes → Go To 2 No → Repair as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Coolant Level Switch harness connector. Turn the ignition on. With the DRBIII®, read the ″Coolant Level Sw″ voltage. Does the DRBIII® display voltage above 4.5? Yes → Replace the Coolant Level Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the Coolant Level Sensor harness connector. Disconnect the Body Control Module C2 harness connector. Measure the resistance of the Coolant Level Switch Sense circuit between the Coolant Level Switch connector and ground. Is the resistance below 5.0 ohms? Yes → Repair the Coolant Level Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LOW WASHER FLUID MESSAGE ALWAYS ON

POSSIBLE CAUSES
WASHER FLUID LEVEL SWITCH
WASHER FLUID LEVEL SWITCH SENSE CIRCUIT SHORT TO GROUND
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any BCM or Communication DTCs before proceeding with this test.** Turn the ignition off. Disconnect the Washer Fluid Level Switch harness connector. Turn the ignition on. With the DRBIII select the Body, Body Computer, and then Sensors. With the DRBIII®, read the Washer Fluid Level Switch voltage. Is the Washer Fluid Level Switch voltage above 5.0 volts? Yes → Replace the Washer Fluid Level Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Washer Fluid Level Switch harness connector. Disconnect the BCM C2 harness connector. Measure the resistance between ground and the Washer Fluid Level Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Washer Fluid Level Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*TEMPERATURE DISPLAY INACCURATE OR INOPERATIVE

POSSIBLE CAUSES
AMBIENT TEMPERATURE SENSOR
ELECTRONIC VEHICLE INFORMATION CENTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Diagnose and repair any BCM, EVIC, PCM, or Communication DTCs before proceeding with this test.** **NOTE: The Ambient Temperature Sensor is hardwired to the BCM. Ambient temperature information is transmitted to the EVIC via the PCI Bus.** Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Measure the resistance of the Ambient Temperature Sensor using the following temperature/resistance values: 10°C (50°F) Sensor Resistance = 17.99 - 21.81 Kilohms 20°C (68°F) Sensor Resistance = 11.37 - 13.61 Kilohms 25°C (77°F) Sensor Resistance = 9.12 - 10.88 Kilohms 30°C (86°F) Sensor Resistance = 7.37 - 8.75 Kilohms 40°C (104°F) Sensor Resistance = 4.90 - 5.75 Kilohms 50°C (122°F) Sensor Resistance = 3.33 - 3.88 Kilohms Is the Ambient Temperature Sensor resistance measurement within the min/max specifications? Yes → Go To 2 No → Replace the Ambient Temperature Sensor. Perform BODY VERIFICATION TEST - VER 1.	All
2	Perform the EVIC self test. Turn the ignition off. Press and hold the C/T and Reset buttons. Turn the ignition on. **NOTE: The self test can also be performed using the DRBIII®.** Observe the EVIC display at the conclusion of the self test. Does the EVIC display ″Passed Self Test″? Yes → Test Complete. No → Replace the EVIC in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL DOORS (EXCEPT DRIVER FAIL TO LOCK/UNLOCK

POSSIBLE CAUSES
OPEN DOOR LOCK DRIVER WIRE
OPEN DOOR UNLOCK DRIVER WIRE
PDM - LOCK/UNLOCK OPEN

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Lock Driver circuit between the PDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 2 No → Repair the open Door Lock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
2	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Unlock Driver circuit between the PDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Door Unlock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	If there are no possible causes remaining, view Repair. Repair Replace the Passenger Door Module Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL DOORS (EXCEPT DRIVER) FAIL TO LOCK

POSSIBLE CAUSES
DOOR LOCK DRIVER WIRE SHORT TO GROUND
PASSENGER DOOR MODULE - PASSENGER DOORS FAIL TO LOCK

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Passenger Door Module connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Lock Driver Ckt to body ground. Is the resistance below 20 ohms? Yes → Repair the Door Lock Driver Wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	If there are no possible causes remaining, view ″Repair″. Repair Replace the Passenger Door Module Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL DOORS (EXCEPT DRIVER) FAILS TO UNLOCK

POSSIBLE CAUSES
DOOR UNLOCK DRIVER WIRE SHORT TO GND
PDM DEFECTIVE PASSENGER UNLOCK FAIL

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Passenger Door Module connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Unlock Driver ckt to body ground. Is the resistance below 20 ohms? Yes → Repair the Door Unlock Driver Wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	If there are no possible causes remaining, view Repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL LOCKS INOPERATIVE FROM DRIVER DOOR MODULE

POSSIBLE CAUSES
DDM BUS COMMUNICATON CHECK
DDM - LOCKS INOPERATIVE

TEST	ACTION	APPLICABILITY
1	With the DRBIII, select ″Body″, ″Door Modules″ Does the DRBIII display ″Part No.″ and ″Version No.″ of the Driver Door Module? Yes → Go To 2 No → Refer to symptom *BUS +/- SIGNALS OPEN FROM DRIVER DOOR MODULE in the COMMUNICATION category. Perform BODY VERIFICATION TEST - VER 1.	All
2	If there are no possible causes remaining, view Repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL LOCKS INOPERATIVE FROM PASSENGER DOOR MODULE

POSSIBLE CAUSES
PDM BUS COMMUNICATION CHECK
PDM DEFECTIVE LOCKS INOP

TEST	ACTION	APPLICABILITY
1	With the DRBIII, select ″Body″, ″Door Modules″ Does the DRBIII Display the ″Part No.″ and ″Version No.″ of the Passenger Door Module? Yes → Go To 2 No → Refer to symptom BUS +/- SIGNALS OPEN FROM PASSENGER DOOR MODULE in the COMMUNICATION category. Perform BODY VERIFICATION TEST - VER 1.	All
2	If there are no possible causes remaining, view Repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*AUTOMATIC DOOR LOCKS INOPERATIVE

POSSIBLE CAUSES
AUTO DOOR LOCKS NOT ENABLED
PCM DTC'S PRESENT
DRIVER DOOR MODULE - AUTO LOCKS INOPERATIVE

TEST	ACTION	APPLICABILITY
1	With the DRB, under ″CUSTOMER PREFERENCES″ read the ″Auto Door Lock″ status. Does the DRB show AUTO DOOR LOCKS ENABLED ? Yes → Go To 2 No → With the DRBIII, enable the Auto Door Locks and retest the System. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, read ENGINE DTC's. Are there any TPS or VEHICLE SPEED DTC's present? Yes → Refer to DRIVEABILITY for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	If there are no possible causes remaining, view Repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DOORS LOCK WITH KEY IN IGNITION & FRONT DOOR OPEN

POSSIBLE CAUSES
DRIVER DOOR AJAR SWITCH STATUS INCORRECT
KEY-IN IGNITION SWITCH GROUND CIRCUIT OPEN
KEY-IN IGNITION SWITCH SENSE CIRCUIT OPEN
IGNITION SWITCH OPEN
BCM - DOOR LOCK INHIBIT OPEN
BODY CONTROL MODULE - KEY-IN IGNITION OPEN

TEST	ACTION	APPLICABILITY
1	**Note: Ensure that the Key is still in the Ignition Switch.** With the DRB, read the Key-In Ignition status. Does the DRB show KEY-IN IGN: CLOSED ? No → Go To 2 Yes → Go To 6	All
2	Turn the ignition off. Disconnect the Ignition Switch C2 connector. Turn all lights off. Measure the resistance of the Ground circuit in the ignition switch ″C2″ connector. Is the resistance below 5.0 ohms ? Yes → Go To 3 No → Repair the open ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Ignition Switch ″C2″ connector. Disconnect the Body Control Module ″C1″ connector. Measure the resistance of the Key-In Ignition Switch Sense circuit between the ignition switch ″C2″ connector and the BCM ″C1″ connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Key-In Ignition Switch Sense Circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Ignition Switch ″C2″ connector. Connect a jumper between the Key-In Ignition Switch Sense and Ground Circuits in the Ignition Switch ″C2″ Connector. With the DRB, read the Key-In Ignition status. Does the DRB show KEY-IN IGN: CLOSED ? Yes → Replace the Ignition Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*DOORS LOCK WITH KEY IN IGNITION & FRONT DOOR OPEN — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view Repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All
6	Open the Drivers door. With the DRB III select: ″Body″, ″Door Modules″, ″Input/Output″ Read the ″Drv Door Ajar Sw″ state. Does the DRB III Show: ″CLOSED″? Yes → Go To 7 No → Refer to symptom DRIVER DOOR AJAR CIRCUIT OPEN in the DOOR AJAR category. Perform BODY VERIFICATION TEST - VER 1.	All
7	If there are no possible causes remaining, view Repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER DOOR FAILS TO LOCK

POSSIBLE CAUSES
DRIVER DOOR LOCK DRIVER SHORT TO GND
DDM - DRIVER DOOR LOCK OPEN

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Driver Door Module ″C1″ connector. Disconnect the Driver Door Module ″C1″ connector. Measure the resistance of the Door LOCK Driver circuit in the driver door module ″C1″ connector to body ground. Is the resistance below 20 ohms? Yes → Repair the Driver Door Lock Driver wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	If there are no possible causes remaining, view Repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER DOOR FAILS TO LOCK & UNLOCK

POSSIBLE CAUSES
DRIVER DOOR MODULE - OPEN DOOR LOCK DRIVER
DRIVER DOOR UNLOCK DRIVER WIRE OPEN
OPEN DRIVER DOOR LOCK DRIVER WIRE
DOOR LOCK MOTOR OPEN

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Driver Door Module. Disconnect the Driver Door Module ″C1″ connector. Ensure the drivers window is down and the door lock is LOCKED. Connect a jumper wire between the Door Lock Driver ckt and the Ground ckt in the ″C1″ connector. Connect a jumper wire to the Driver Door Unlock Driver ckt and momentarilly touch it to the Fused B(+) ckt and observe the door lock. Did the drivers door UNLOCK? Yes → Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Driver Door Module ″C1″ connector. Disconnect the Door Lock Motor/Ajar Switch connector. Measure the resistance of the Driver Door Unlock Driver circuit between the DDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Driver Door Unlock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Driver Door Module ″C1″ connector. Disconnect the Door Lock Motor/Ajar Switch connector. Measure the resistance of the Driver Door LOCK Driver circuit between the DDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Driver Door Lock Driver Wire. Perform BODY VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Door Lock Motor. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER DOOR FAILS TO UNLOCK

POSSIBLE CAUSES
DRIVER DOOR UNLOCK DRIVER WIRE SHORT TO GND
DDM - DRIVER DOOR UNLOCK OPEN

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Driver Door Module ″C1″ connector. Disconnect the Driver Door Module ″C1″ connector. Measure the resistance of the Driver Door UNLOCK Driver circuit in the driver door module ″C1″ connector to body ground. Is the resistance below 20 ohms? Yes → Repair the Driver Door Unlock Driver Wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	If there are no possible causes remaining, view Repair. Repair Replace the Driver Door Module Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LEFT REAR DOOR FAILS TO LOCK & UNLOCK

POSSIBLE CAUSES
OPEN DOOR LOCK MOTOR
OPEN DOOR LOCK DRIVER WIRE
OPEN DOOR UNLOCK DRIVER WIRE

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Left Rear Door Lock Motor/Ajar Switch connector. Ensure the Passenger Door Module ″C1″ connector is connected. Connect a test light between the Door Lock Driver and the Door Unlock Driver terminals in the left rear door lock motor/ajar connector. With the DRB III actuate the ″Pas Lock Relay″ and then the ″Pas Unlock Relay″ and observe the test light. Did the test light illuminate when the lock was actuated in both directions? Yes → Replace the Door Lock Motor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Lock Driver circuit between the PDM C1 connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Door Lock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Unlock Driver circuit between the PDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the open Door Unlock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*LIFTGATE LOCK FAILS TO LOCK/UNLOCK

POSSIBLE CAUSES
OPEN LIFTGATE LOCK MOTOR
OPEN DOOR LOCK DRIVER WIRE
OPEN DOOR UNLOCK DRIVER WIRE

TEST	ACTION	APPLICABILITY
1	Remove the liftgate inner door trim panel to gain access to the Liftgate Lock Motor connector. Disconnect the Liftgate Lock Motor connector. **Note: Ensure the Passenger Door Module ″C1″ connector is connected.** Connect a test light between the Door Lock Driver and the Door Unlock Driver terminals in the liftgate lock motor connector. With the DRB III actuate the ″Pas Lock Relay″ and then the ″Pas Unlock Relay″ and observe the test light. Did the test light illuminate when the lock was actuated in both directions? Yes → Replace the Liftgate Lock Motor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the liftgate inner door trim panel to gain access to the Liftgate Lock Motor connector. Disconnect the Liftgate Lock Motor connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Lock Driver ckt between the PDM connector and the liftgate lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Door Lock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the liftgate inner door trim panel to gain access to the Liftgate Lock Motor connector. Disconnect the Liftgate Lock Motor connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Unlock Driver ckt between the PDM connector and the liftgate lock motor connector. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the open Door Unlock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER DOOR FAILS TO LOCK & UNLOCK

POSSIBLE CAUSES
OPEN DOOR LOCK MOTOR
OPEN DOOR LOCK DRIVER WIRE
OPEN DOOR UNLOCK DRIVER WIRE

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. **Note: Ensure the Passenger Door Module ″C1″ connector is connected.** Connect a test light between the Door Lock Driver and the Door Unlock Driver terminals in the passenger door lock motor/ajar connector. With the DRB III actuate the ″Pas Lock Relay″ and then the ″Pas Unlock Relay″ and observe the test light. Did the test light illuminate when the lock was actuated in both directions? Yes → Replace the Door Lock Motor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Lock Driver circuit between the PDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Door Lock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Unlock Driver circuit between the PDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the open Door Unlock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RIGHT REAR DOOR FAILS TO LOCK & UNLOCK

POSSIBLE CAUSES
OPEN DOOR LOCK MOTOR
OPEN DOOR LOCK DRIVER WIRE
OPEN DOOR UNLOCK DRIVER WIRE

TEST	ACTION	APPLICABILITY
1	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Right Rear Door Lock Motor/Ajar Switch connector. Ensure the Passenger Door Module ″C1″ connector is connected. Connect a test light between the Door Lock Driver and the Door Unlock Driver terminals in the right rear door lock motor/ajar connector. With the DRB III actuate the ″Pas Lock Relay″ and then the ″Pas Unlock Relay″ and observe the test light. Did the test light illuminate when the lock was actuated in both directions? Yes → Replace the Right Rear Door Lock Motor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Right Rear Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Lock Driver circuit between the PDM connector and the door lock motor connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Door Lock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the inner door trim panel to gain access to the Door Lock Motor/Ajar Switch connector. Disconnect the Door Lock Motor/Ajar Switch connector. Disconnect the Passenger Door Module ″C1″ connector. Measure the resistance of the Door Unlock Driver circuit between the PDM connector and the right rear door lock motor connector. Is the resistance below 5.0 ohms? Yes → Test Complete. No → Repair the open Door Unlock Driver wire. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RKE INOPERATIVE - JAPAN ONLY

POSSIBLE CAUSES
GROUND CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
DIAGNOSTIC OUT CIRCUIT SHORT TO GROUND
DIAGNOSTIC OUT CIRCUIT OPEN
DRIVER DOOR MODULE - RKE INOPERATIVE
REMOTE KEYLESS ENTRY MODULE - OPEN

TEST	ACTION	APPLICABILITY
1	Remove the driver door trim panel. Disconnect the Remote Keyless Entry module (located near the DDM). Key off. Turn all lights off. Measure the resistance between ground and the Ground circuit. Is the resistance below 10.0 ohms? Yes → Go To 2 No → Repair the open Ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
2	Remove the driver door trim panel. Disconnect the Remote Keyless Entry module (located near the DDM). Measure the voltage between Fused B(+) circuit and ground. Is the voltage above 10.0 volts? Yes → Go To 3 No → Repair the open Fused B(+) circuit. Perform BODY VERIFICATION TEST - VER 1.	All
3	Remove the driver door trim panel. Disconnect the Remote Keyless Entry module (located near the DDM). Disconnect the Driver Door Module ″C1″ connector. Measure the resistance between ground and the Diagnostic Out circuits (cavities 5 & 6). Is the resistance below 1000.0 (1K) ohms? Yes → Repair the Diagnostic Out circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Remove the driver door trim panel. Disconnect the Remote Keyless Entry module (located near the DDM). Disconnect the Driver Door Module ″C1″ connector. Measure the resistance of the Diagnostic Out circuit between the RKE module connector (cavities 5 & 6) and the DDM connector (cavity 8). Is the resistance below 5.0 ohms at all terminals? Yes → Go To 5 No → Repair the open Diagnostic Out circuit. Perform BODY VERIFICATION TEST - VER 1.	All

*RKE INOPERATIVE - JAPAN ONLY — Continued

TEST	ACTION	APPLICABILITY
5	Remove the driver door trim panel. Disconnect the Remote Keyless Entry module (located near the DDM). Measure the voltage of the Diagnostic Out circuit in the RKE connector. Is the voltage between 4.8 and 5.2 vol6ts? Yes → Go To 6 No → Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Remote Keyless Entry Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RKE TRANSMITTER INOPERATIVE

POSSIBLE CAUSES
RKE TRANSMITTER BATTERY VOLTAGE LOW
RKE TRANSMITTER NOT PROGRAMMED
RKE TRANSMITTER DEFECTIVE
PASSENGER DOOR MODULE DEFECTIVE RKE INOP

TEST	ACTION	APPLICABILITY
1	Remove the batteries from the transmitter. Using a voltmeter, test the Batteries. Is the voltage above 3.0 volts in each battery? Yes → Go To 2 No → Replace the Batteries. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRB select BODY, DOOR MODULES, MISCELLANEOUS, then PROGRAM RKE. Follow instructions on the screen. Exit PROGRAM RKE. Try the Door Locks using the Transmitter. Did the Door Locks respond properly to the Transmitter commands ? Yes → Repair complete. Using the DRB, program all other Transmitters used with this Vehicle. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Secure a known good Transmitter. Using the DRB select BODY, DOOR MODULES, MISCELLANOUS then PROGRAM RKE. Follow the instructions on the DRB screen. Exit PROGRAM RKE. Try the Door Locks using the Transmitter. Did the Door Locks respond properly to the Transmitter commands ? Yes → Replace the Transmitter. Program all Transmitters that will be used with this Vehicle. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4 **Note: When repairs are complete ensure all transmitters used with this vehicle are programmed**	All
4	If there are no possible causes remaining, view Repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*RKE TRANSMITTER POOR RANGE - JAPAN ONLY

POSSIBLE CAUSES
ANTENNA SIGNAL CIRCUIT OPEN
REMOTE KEYLESS ENTRY MODULE - POOR RANGE

TEST	ACTION	APPLICABILITY
1	Remove the driver door trim panel. Disconnect the Remote Keyless Entry module (located near the DDM). Measure the resistance of the Antenna Signal circuit between caities 1 & 2. Is the resistance below 1.0 ohm? Yes → Go To 2 No → Repair the open Antenna Signal circuit. Perform BODY VERIFICATION TEST - VER 1.	All
2	If there are no possible causes remaining, view repair. Repair Replace the Remote Keyless Entry Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BOTH MEMORY MIRRORS INOPERATIVE

POSSIBLE CAUSES
BOTH MEMORY MIRRORS INOPERATIVE

TEST	ACTION	APPLICABILITY
1	Ensure the memory seat operates properly before continuing. If not, refer to symptom list for problems related to MEMORY SYSTEM.. If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
***DRIVER MEMORY MIRROR INOPERATIVE**

POSSIBLE CAUSES
DRIVER MIRROR SENSOR GROUND WIRE OPEN
DRIVER DOOR MODULE - SENSOR GROUND OPEN
DRIVER MIRROR SENSOR GROUND SHORTED TO MIRROR VERTICAL POSITION SIGNAL
DRIVER MIRROR SENSOR GROUND SHORTED TO MIRROR HORIZONTAL POSITION SIGNAL
DRIVER DOOR MODULE - MEMORY MIRROR OPEN
DRIVER MIRROR HORIZONTAL POSITION SIGNAL SHORT TO GROUND
DRIVER MIRROR VERTICAL POSITION SIGNAL SHORT TO GROUND
DRIVER MIRROR HORIZONTAL POSITION SIGNAL WIRE OPEN
DRIVER MIRROR VERTICAL POSITION SIGNAL WIRE OPEN
DRIVER POWER MIRROR - MEMORY OPEN
DRIVER DOOR MODULE - MEMORY CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	**Note: The following list of items should be checked before continuing with any power mirror tests.** Ensure door ajar switches are working properly before proceeding. Ensure there is communication with the DDM, PDM and the BCM before proceeding. Ensure the mirror directional switches are working properly before proceeding. If not, replace the DDM. Ensure the mirror select switch is working properly before proceeding. If not, replace the DDM. Ensure both mirrors are operational from the DDM. If not, refer to SERVICE INFORMATION. If all items are operational, continue. Continue Go To 2	All
2	With the DRBIII® read the Drv Mirror Horiz Volts. Operate the mirror from left to right and observe the DRB. Does the voltage vary from approximately 1.0 to 4.0 volts? Yes → Go To 3 No → Go To 5	All
3	With the DRBIII® read the Drv Mirror Vert Volts. Operate the mirror from down to up and observe the DRB. Does the voltage vary from approximately 1.0 to 4.0 volts? Yes → Go To 4 No → Go To 5	All

*DRIVER MEMORY MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
5	Disconnect the Driver Power Mirror connector. Disconnect the DDM C2 connector. Measure the resistance of the Mirror Sensor Ground wire between the Driver Power Mirror connector and the DDM C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open Mirror Sensor Ground wire. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Driver Power Mirror connector. Ensure the DDM C2 connector is connected at this time. Turn ignition off. Turn all lights off. Measure the resistance between ground and the Mirror Sensor Ground circuit in the Driver Power Mirror connector.. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
7	Disconnect the Driver Power Mirror connector. Measure the voltage between Mirror Horizontal Position Signal circuit and ground. Is the voltage approximately 5.0 volts? Yes → Go To 8 No → Go To 10	All
8	Disconnect the Driver Power Mirror connector. Measure the voltage between Mirror Vertical Position Signal circuit and ground. Is the voltage approximately 5.0 volts? Yes → Go To 9 No → Go To 10	All
9	If there are no possible causes remaining, view repair. Repair Replace the Driver Power Mirror. Perform BODY VERIFICATION TEST - VER 1.	All
10	Disconnect the DDM C2 connector. Disconnect the Driver Power Mirror connector. Measure the resistance between the Mirror Sensor Ground circuit and the Mirror Vertical Position Signal circuit in the DDM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Sensor Ground wire for a short to the Mirror Vertical Position Signal wire. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All

*DRIVER MEMORY MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
11	Disconnect the DDM C2 connector. Disconnect the Driver Power Mirror connector. Measure the resistance between the Mirror Sensor Ground circuit and the Mirror Horizontal Position Signal circuit in the DDM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Sensor Ground wire for a short to the Mirror Horizontal Position Signal wire. Perform BODY VERIFICATION TEST - VER 1. No → Go To 12	All
12	Disconnect the DDM C2 connector. Disconnect the Driver Power Mirror connector. Measure the resistance between ground and the Mirror Horizontal Position Signal circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Horizontal Position Signal wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 13	All
13	Disconnect the DDM C2 connector. Disconnect the Driver Power Mirror connector. Measure the resistance between ground and the Mirror Vertical Position Signal circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Vertical Position Signal wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 14	All
14	Disconnect the DDM C2 connector. Disconnect the Driver Power Mirror connector. Measure the resistance of the Mirror Horizontal Position Signal circuit between the DDM C2 connector and the Driver Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Repair the open Mirror Horizontal Position Signal wire. Perform BODY VERIFICATION TEST - VER 1.	All
15	Disconnect the DDM C2 connector. Disconnect the Driver Power Mirror connector. Measure the resistance of the Mirror Vertical Position Signal circuit between the DDM C2 connector and the Driver Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 16 No → Repair the open Mirror Vertical Position Signal wire. Perform BODY VERIFICATION TEST - VER 1.	All
16	If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*FOLDING POWER MIRROR INOPERATIVE

POSSIBLE CAUSES
FOLDING MIRROR TEST
DRIVER POWER MIRROR - FOLDING MIRROR OPEN
PASSENGER FOLDAWAY MIRROR OPEN
POWER FOLDING MIRROR FEED WIRE OPEN
POWER FOLDING MIRROR FEED WIRE SHORTED TO GROUND
POWER FOLDING MIRROR RETURN WIRE OPEN
POWER FOLDING MIRROR RETURN WIRE SHORTED TO GROUND
DRIVER DOOR MODULE - FOLDING MIRROR OPEN
PASSENGER DOOR MODULE - FOLDAWAY MIRROR OPEN
BOTH FOLDING MIRRORS INOPERATIVE
DRIVER POWER MIRROR - SHORT TO GROUND
PASSENGER POWER MIRROR - SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	**Note: The following list of items should be checked before continuing with any power mirror tests.** Ensure door ajar switches are working properly before proceeding. If not OK, refer to symptom list for problems related to INTERIOR LIGHTING. Ensure there is communication with the DDM and the BCM before proceeding. If not OK, refer to symptom list for problems related to COMMUNICATION. Ensure the mirror directional switches are working properly before proceeding. If not, replace the DDM. Ensure the mirror select switch is working properly before proceeding. If not, replace the DDM. If all items are operational, continue. Continue Go To 2	All

*FOLDING POWER MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
2	Ensure all doors are closed. Remove the key from the ignition switch. Operate the mirrors from the power foldaway switch and observe both mirrors. What did you observe. Neither mirror folded or opened. Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1. Driver mirror failed to fold or open. Go To 3 Passenger mirror failed to fold or open. Go To 11 Both mirrors folded and opened. Mirrors are operating properly at this time. Check for intermittent failure from doors and foldaway switches. Perform BODY VERIFICATION TEST - VER 1.	All
3	Key off. Disconnect the Driver Door Module C2 connector. Measure the resistance between ground and the Power Folding Mirror Feed circuit in the DDM C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Go To 7	All
4	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between ground and the Power Folding Mirror Feed wire in the PDM ″C2″ connector. Is the resistance below 5.0 ohms? Yes → Repair the Power Folding Mirror Feed wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between ground and the Power Folding Mirror Return wire in the PDM C2 connector. Is the resistance below 5.0 ohms? Yes → Repair the Power Folding Mirror Return wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Driver Power Mirror. Perform BODY VERIFICATION TEST - VER 1.	All

*FOLDING POWER MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
7	Ensure the DDM C2 connector is connected at this time. Disconnect the Driver Power Mirror connector. Connect a 12-volt test light between the Power Folding Mirror Feed and the Power Folding Mirror Return circuits in the Driver Power Mirror connector. With the DRBIII® actuate Drv Foldaway In then the Drv Foldaway Out relays. Did the test light illuminate when the relays were activated in BOTH directions? Yes → Replace the Driver Foldaway Mirror. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance of the Power Folding Mirror Feed wire between the PDM C2 connector and the Passenger Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open Power Folding Mirror Feed wire. Perform BODY VERIFICATION TEST - VER 1.	All
9	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance of the Power Folding Mirror Return wire between the PDM C2 connector and the Driver Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open Power Folding Mirror Return wire. Perform BODY VERIFICATION TEST - VER 1.	All
10	If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
11	Key off. Disconnect the Passenger Door Module C2 connector. Measure the resistance between ground and the Power Folding Mirror Feed circuit in the PDM C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Go To 15	All
12	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between ground and the Power Folding Mirror Feed wire in the PDM ″C2″ connector. Is the resistance below 5.0 ohms? Yes → Repair the Power Folding Mirror Feed wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 13	All

*FOLDING POWER MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
13	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between ground and the Power Folding Mirror Return wire in the PDM C2 connector. Is the resistance below 5.0 ohms? Yes → Repair the Power Folding Mirror Return wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 14	All
14	If there are no possible causes remaining, view repair. Repair Replace the Passenger Power Mirror. Perform BODY VERIFICATION TEST - VER 1.	All
15	Ensure the PDM C2 connector is connected at this time. Disconnect the Passenger Power Mirror connector. Connect a 12-volt test light between the Power Folding Mirror Feed and the Power Folding Mirror Return circuits in the Passenger Power Mirror connector. With the DRBIII®, actuate ″Pas Foldaway In″ then the ″Pas Foldaway Out″ relays. Did the test light illuminate when the relays were activated in BOTH directions? Yes → Replace the Passenger Door Foldaway Mirror. Perform BODY VERIFICATION TEST - VER 1. No → Go To 16	All
16	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance of the Power Folding Mirror Feed wire between the PDM C2 connector and the Passenger Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 17 No → Repair the open Power Folding Mirror Feed wire. Perform BODY VERIFICATION TEST - VER 1.	All
17	Key off. Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance of the Power Folding Mirror Return wire between the PDM C2 connector and the Driver Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 18 No → Repair the open Power Folding Mirror Return wire. Perform BODY VERIFICATION TEST - VER 1.	All
18	If there are no possible causes remaining, view repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER MEMORY MIRROR INOPERATIVE

POSSIBLE CAUSES
PASSENGER MIRROR SENSOR GROUND WIRE OPEN
PASSENGER DOOR MODULE - SENSOR GROUND OPEN
PASSENGER MIRROR SENSOR GROUND SHORTED TO MIRROR VERTICAL POSITION SIGNAL
PASSENGER MIRROR SENSOR GROUND SHORTED TO MIRROR HORIZONTAL POSITION SIGNAL
PASSENGER DOOR MODULE - MEMORY MIRROR OPEN
PASSENGER MIRROR HORIZONTAL POSITION SIGNAL SHORT TO GROUND
PASSENGER MIRROR VERTICAL POSITION SIGNAL SHORT TO GROUND
PASSENGER MIRROR HORIZONTAL POSITION SIGNAL WIRE OPEN
PASSENGER MIRROR VERTICAL POSITION SIGNAL WIRE OPEN
PASSENGER POWER MIRROR - MEMORY OPEN
PASSENGER DOOR MODULE - MEMORY CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	**Note: The following list of items should be checked before continuing with any power mirror tests.** Ensure door ajar switches are working properly before proceeding. Ensure there is communication with the DDM, PDM and the BCM before proceeding. Ensure the mirror directional switches are working properly before proceeding. If not, replace the DDM. Ensure the mirror select switch is working properly before proceeding. If not, replace the DDM. Ensure both mirrors are operational from the DDM. If not, refer to SERVICE INFORMATION. If all items are operational, continue. Continue Go To 2	All
2	With the DRBIII® read the Pas Mirror Horiz Volts. Operate the mirror from left to right and observe the DRB. Does the voltage vary from approximately 1.0 to 4.0 volts? Yes → Go To 3 No → Go To 5	All
3	With the DRBIII®, read the Pas Mirror Vert Volts. Operate the mirror from down to up and observe the DRB. Does the voltage vary from approximately 1.0 to 4.0 volts? Yes → Go To 4 No → Go To 5	All

*PASSENGER MEMORY MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
5	Disconnect the Passenger Power Mirror connector. Disconnect the PDM C2 connector. Measure the resistance of the Mirror Sensor Ground wire between the PDM C2 connector and the Passenger Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open Mirror Sensor Ground wire. Perform BODY VERIFICATION TEST - VER 1.	All
6	Ensure the PDM C2 connector is connected at this time. Disconnect the Passenger Power Mirror connector. Turn the ignition off. Turn all lights off. Measure the resistance between ground and the Mirror Sensor Ground circuit in the Passenger Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
7	Disconnect the Passenger Power Mirror connector. Measure the voltage between Mirror Horizontal Position Signal circuit and ground. Is the voltage approximately 5.0 volts? Yes → Go To 8 No → Go To 10	All
8	Disconnect the Passenger Power Mirror connector. Measure the voltage between Mirror Vertical Position Signal circuit and ground. Is the voltage approximately 5.0 volts? Yes → Go To 9 No → Go To 10	All
9	If there are no possible causes remaining, view repair. Repair Replace the Passenger Power Mirror. Perform BODY VERIFICATION TEST - VER 1.	All
10	Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between the Mirror Sensor Ground circuit and the Mirror Vertical Position Signal circuit in the PDM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Sensor Ground wire for a short to the Mirror Vertical Position Signal wire. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All

*PASSENGER MEMORY MIRROR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
11	Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between the Mirror Sensor Ground circuit and the Mirror Horizontal Position Signal circuit in the PDM C2 connector. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Sensor Ground wire for a short to the Mirror Horizontal Position Signal wire. Perform BODY VERIFICATION TEST - VER 1. No → Go To 12	All
12	Disconnect the Passenger Door Module C2 connector. Disconnect the passenger Power Mirror connector. Measure the resistance between ground and the Mirror Horizontal Position Signal circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Horizontal Position Signal wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 13	All
13	Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance between ground and the Mirror Vertical Position Signal circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Mirror Vertical Position Signal wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 14	All
14	Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance of the Mirror Horizontal Position Signal circuit between the PDM "C2" connector and the Passenger Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Repair the open Mirror Horizontal Position Signal wire. Perform BODY VERIFICATION TEST - VER 1.	All
15	Disconnect the Passenger Door Module C2 connector. Disconnect the Passenger Power Mirror connector. Measure the resistance of the Mirror Vertical Position Signal circuit between the PDM C2 connector and the Passenger Power Mirror connector. Is the resistance below 5.0 ohms? Yes → Go To 16 No → Repair the open Mirror Vertical Position Signal wire. Perform BODY VERIFICATION TEST - VER 1.	All
16	If there are no possible causes remaining, view repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ACCESSORY (SUNROOF) DELAY RELAY SHORTED HI

When Monitored and Set Condition:

ACCESSORY (SUNROOF) DELAY RELAY SHORTED HI

When Monitored: Igniton in ″RUN″ and IOD fuse/connector installed.

Set Condition: The BCM is trying to activate the sunroof (accy) delay relay. The fault is set when the BCM tries to pull this input low and excessive current is sinked into the BCM.

POSSIBLE CAUSES
SUNROOF DELAY RELAY COIL
SUNROOF DELAY RELAY CONTROL CIRCUIT SHORT TO BATTERY
SUNROOF SECTION OF BCM

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Lower the Junction Block and remove the Sunroof Delay Relay. Measure the resistance of the relay coil across terminals 1 and 2 or (85 and 86) of the relay. What resistance did you measure? Below 65.0 ohms Replace the Sunroof Delay Relay. Perform BODY VERIFICATION TEST - VER 1. Between 65 and 90 ohms Go To 2	All
2	Turn the ignition off. Lower the Junction Block and remove the Sunroof Delay Relay. Remove the Body Control Module from the Junction Block. Turn ignition on. Measure the voltage of the Sunroof Delay Relay Control circuit at the Junction Block BCM connector. Is there any voltage present? Yes → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	If there are no possible causes remaining, view Repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*SUNROOF DELAY INOPERATIVE

POSSIBLE CAUSES
SUNROOF SECTION OF BCM
REFER TO MOTOR INOP

TEST	ACTION	APPLICABILITY
1	The sunroof will be operational for approximately 45 seconds after the ignition has been turned off. If either front door is opened, power to the sunroof will be immediately removed. Ensure that both front doors are closed. Turn ignition on. Open and close the sunroof. What happened while opening and closing the sunroof? Opened and closed normally Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. Failed to open Refer to symptom list for problems related to SUNROOF MOTOR INOPERATIVE. Failed to close Refer to symptom list for problems related to SUNROOF MOTOR INOPERATIVE.	All

Symptom:
*SUNROOF MOTOR INOPERATIVE

POSSIBLE CAUSES
CHECK DTC
OPEN RELAY CONTACT
SUNROOF DELAY RELAY COIL
SUNROOF SWITCH GROUND CIRCUIT OPEN
BLOWN FUSE #25
FUSE #25 DEFECTIVE
JUNCTION BLOCK DEFECTIVE
SUNROOF DELAY RELAY CONTROL J/B OPEN
SUNROOF OPEN SWITCH OPEN
SUNROOF DELAY RELAY OUTPUT SHORTED TO GROUND
SUNROOF VENT SWITCH OPEN
SUNROOF MOTOR B+ WIRE SHORT TO GROUND
SUNROOF MOTOR B- WIRE SHORT TO GROUND
SUNROOF GROUND CIRCUIT OPEN
SUNROOF MOTOR SHORT TO GROUND
″OPEN″ POWER SUNROOF OPEN CIRCUIT
OPEN POWER SUNROOF VENT CIRCUIT
OPEN SUNROOF DELAY RELAY OUTPUT CIRCUIT
BODY CONTROL MODULE - OPEN RELAY CONTROL
SUNROOF ASSEMBLY MODULE OR MOTOR OPEN
SUNROOF CONTROL MODULE - SHORT TO GROUND
SUNROOF CONTROL MODULE OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read Body Computer DTC's. Does the DRBIII® display ″Accessory Delay Relay Shorted Hi″ Yes → Refer to symptom list for problems related to ACCESSORY DELAY RELAY SHORTED HI. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All

*SUNROOF MOTOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Lower the Junction Block and remove the Sunroof Delay Relay. Measure the resistance of the relay coil across terminals 1 & 2 or 85 & 86. What resistance did you measure? Below 65.0 ohms Replace the Sunroof Delay Relay. Perform BODY VERIFICATION TEST - VER 1. Between 65 and 85 ohms Go To 3 Greater than 85 ohms Replace the Sunroof Delay Relay. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn ignition off. Lower the Junction Block and remove the Sunroof Delay Relay. Measure the voltage of the Fused B(+) circuit in the Sunroof (accessory) Delay Relay cavity #30 and cavity #85 to ground. Is the voltage above 10.5 volts in both cavities? Yes → Go To 4 No → Go To 16	All
4	Lower the Junction Block and remove the Sunroof Delay Relay. Connect a test light between the Fused B(+) ckt and the Sunroof Delay Relay Control ckt (cavities 85 & 86) in the relay connector. Turn the ignition to the ″Run″ position and observe the test light.. Does the test light illuminate when ignition is in the ″On″ position? Yes → Go To 5 No → Go To 14	All
5	Turn the ignition off. Remove the Sunroof Delay Relay Connect a jumper wire between the Fused B(+) ckt and the Sunroof Delay Relay Output ckt (cavities 30 & 87) in the relay connector. Turn the ignition on and operate the sunroof. Did the sunroof motor operate? Yes → Replace the Sunroof Delay Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Turn all lights off. Gain access to the sunroof switch and disconnect the connector. Measure the resistance of the ground circuit at the sunroof switch connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the sunroof switch ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*SUNROOF MOTOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Gain access to the sunroof switch and disconnect the connector. Connect an ohmmeter between the power sunroof open circuit and the ground circuit on the sunroof switch. When pressing the ″open″ button on the sunroof switch does the meter read less than 5.0 ohms? Yes → Go To 8 No → Replace the Sunroof Switch. Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Gain access to the sunroof switch and disconnect the connector. Connect an ohmmeter between the power sunroof vent/close circuit and the ground circuit on the sunroof switch. When pressing the ″vent/close″ button on the sunroof switch does the meter read less than 5.0 ohms? Yes → Go To 9 No → Replace the Sunroof Switch. Perform BODY VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Turn all lights off. Gain access to the power sunroof assembly and disconnect the Sunroof Control Module connector (necessary to lower the overhead console, remove the ″A″ pillar trim, sunvisors, assist handles and sunroof pinch welt). Measure the resistance of the ground circuit in the Sunroof Control Module connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the power sunroof assembly open ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Gain access to the power sunroof assembly and disconnect the Sunroof Control Module connector (necessary to lower the overhead console, remove the ″A″ pillar trim, sunvisors, assist handles and sunroof pinch welt). Gain access to the sunroof switch and disconnect the connector. Measure the resistance of the Power Sunroof Open circuit between the Sunroof Control Module and the Sunroof Switch. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the Power Sunroof Open circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*SUNROOF MOTOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off. Gain access to the power sunroof assembly and disconnect the Sunroof Control Module connector (necessary to lower the overhead console, remove the ″A″ pillar trim, sunvisors, assist handles and sunroof pinch welt). Gain access to the Sunroof Switch and disconnect the connector. Measure the resistance of the Power Sunroof Vent circuit between the Sunroof Control Module and the Sunroof Switch. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the Power Sunroof Vent circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
12	Turn the ignition off. Lower the Junction Block and remove the Sunroof Delay Relay. Gain access to the power sunroof assembly and disconnect the Sunroof Control Module connector (necessary to lower the overhead console, remove the ″A″ pillar trim, sunvisors, assist handles and sunroof pinch welt). Measure the resistance of the sunroof delay relay output circuit between the power sunroof control module connector and the sunroof delay relay cavity 87. Is the resistance below 5.0 ohms? Yes → Go To 13 No → Repair the Sunroof Delay Relay Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
13	Remove the headliner as per instructions in ″Service Information″. Disconnect the Sunroof Control Module connector. Momentarily apply Fused 12 volts to the Sunroof Motor B+ circuit and ground the Sunroof Motor B- circuit in the Module connector (the motor should run). Reverse the polarity by switching the power and ground (the motor should run in the opposite direction). Did the glass move in both directions? Yes → Run the motor until the Sunroof is fully closed and replace the Sunroof Control Module Perform BODY VERIFICATION TEST - VER 1. No → Replace the Sunroof Motor. Perform BODY VERIFICATION TEST - VER 1.	All
14	Turn ignition off. Remove the Body Control Module. Lower the Junction Block and remove the Sunroof Delay Relay. Measure the resistance of the Sunroof Delay Relay Control circuit between the Junction Block BCM connector and the Sunroof Delay Relay cavity #86. Is the resistance below 5.0 ohms? Yes → Go To 15 No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1.	All
15	If there are no possible causes remaining, view Repair. Repair Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

*SUNROOF MOTOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
16	Turn ignition off. Remove and inspect the Junction Block Fuse #25. Is the fuse open? No → Replace the Junction Block. Perform BODY VERIFICATION TEST - VER 1. Yes → Go To 17	All
17	Replace the juction block fuse #25 with a known good fuse. Turn ignition on and operate the sunroof. Turn the ignition off. Remove and inspect the Junction Block Fuse #25. Is the fuse blown? Yes → Go To 18 No → Replacing the open fuse has corrected the problem. Test complete. Perform BODY VERIFICATION TEST - VER 1.	All
18	Turn ignition off. Remove the Sunroof (accessory) Delay Relay. Remove the Junction Block Fuse #25. Measure the resistance of the Sunroof (accessory) Delay Relay cavity #30 in the Junction Block to ground. Is the resistance below 5.0 ohms? Yes → Replace the defective Junction Block. Perform BODY VERIFICATION TEST - VER 1. No → Go To 19	All
19	Turn the ignition off. Lower the Junction Block and remove the Sunroof Delay Relay. Gain access to the power sunroof assembly and disconnect the Sunroof Control Module connector (necessary to lower the overhead console, remove the ″A″ pillar trim, sun visors, assist handles and sunroof pinch welt). Measure the resistance of the sunroof delay relay output circuit at the Sunroof Control Module connector to ground. Is the resistance below 1000 ohms? Yes → Repair the Sunroof Delay Relay Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 20	All
20	Remove the headliner as per instructions in ″Service Information″. Disconnect the sunroof motor 2-way connector. Disconnect the Sunroof Control Module connector Measure the resistance between ground and the Sunroof Motor B+ circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Sunroof Motor B+ wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 21	All

*SUNROOF MOTOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
21	Remove the headliner as per instructions in "Service Information". Disconnect the Sunroof Motor 2-way connector. Disconnect the Sunroof Control Module connector Measure the resistance between ground and the Sunroof Motor B- circuit. Is the resistance below 1000.0 ohms? Yes → Repair the Sunroof Motor B- wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 22	All
22	Remove the headliner as per instructions in "Service Information". Disconnect the Sunroof Control Module connector. Ensure the Sunroof Motor connector is connected before proceeding. Measure the resistance between ground and the Sunroof Motor B+ circuit. Is the resistance below 100.0 ohms Yes → Replace the Sunroof Motor. Perform BODY VERIFICATION TEST - VER 1. No → Go To 23	All
23	If there are no possible causes remaining, view repair. Repair Replace the Sunroof Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL POWER WINDOWS INOPERATIVE

POSSIBLE CAUSES
MODULE RESPONSE
DRIVER DOOR MODULE - WINDOWS INOPERATIVE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the DOOR MODULE status. Is the DRBIII able to access Both Door Modules? No → Refer to the COMMUNICATION category for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1. Yes → Replace the Driver Door Module.. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES

POSSIBLE CAUSES
REAR WINDOW SWITCH OPEN
DRIVER REAR WINDOW DRIVER DOWN WIRE OPEN
DRIVER REAR WINDOW DRIVER UP WIRE OPEN
DRIVER REAR WINDOW DRIVER UP WIRE SHORT TO GROUND
DRIVER REAR WINDOW DRIVER DOWN WIRE SHORT TO GROUND
WINDOW DRIVER DOWN WIRE OPEN
WINDOW DRIVER DOWN WIRE SHORT TO GROUND
WINDOW DRIVER UP WIRE OPEN
WINDOW DRIVER UP WIRE SHORT TO GROUND
REAR WINDOW MOTOR OPEN
DRIVER DOOR MODULE - OUTPUT OPEN

TEST	ACTION	APPLICABILITY
1	Remove the Rear Door Trim Panel. Disconnect the rear window switch connector. Turn the ignition on. Using a 12-volt Test Light connected to ground, check the Driver Rear Window Driver Up and Down circuits. Did the test light illuminate brightly on both circuits? Yes → Go To 2 No → Go To 8	All
2	Remove the Rear Door Trim Panel. Disconnect the Driver Rear Power Window Switch connector. Turn the ignition on. **Warning: Keep the window area clear as the window SHOULD move up and down in this test.** Connect a jumper wire from the Window Driver Down terminal in the switch connector to ground. Connect a jumper wire from the Window Driver Up terminal in the switch connector and momentarily connect it to the Rear Window Driver Up terminal in the switch connector. Reverse the Jumper wires to run the motor in the opposite direction. Did the Window Motor operate in both directions? Yes → Replace the Rear Window Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

*DRIVER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Rear Door Trim Panel. Disconnect the Driver Rear Window Switch connector. Disconnect the Driver Rear Power Window Motor connector. Measure the resistance of the Window Driver Down circuit between the window switch connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Window Driver Down wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	Remove the Rear Door Trim Panel. Disconnect the Driver Rear Window Switch connector. Disconnect the Driver Rear Power Window Motor connector. Measure the resistance of the Window Driver Down circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Window Driver Down wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Disconnect the Driver Rear Window Switch connector. Disconnect the Driver Rear Power Window Motor connector. Measure the resistance of the Window Driver Up circuit between the window switch connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Window Driver Up wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Driver Rear Window Switch connector. Disconnect the Driver Rear Power Window Motor connector. Measure the resistance of the Window Driver Up circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Window Driver Up Wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace the Rear Window Motor. Perform BODY VERIFICATION TEST - VER 1.	All
8	Disconnect the Driver Door Module ″C1″ connector. Disconnect the Driver Rear Window Switch connector. Measure the resistance of the Driver Rear Window Driver Down circuit between the DDM connector and the Window Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the Driver Rear Window Driver Down wire for an open.. Perform BODY VERIFICATION TEST - VER 1.	All

*DRIVER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES — Continued

TEST	ACTION	APPLICABILITY
9	Disconnect the Driver Door Module ″C1″ connector. Disconnect the Driver Rear Widow Switch connector. Measure the resistance of the Driver Rear Window Driver Up circuit between the DDM connector and the Window Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the Driver Rear Window Driver Up wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
10	Disconnect the Driver Door Module ″C1″ connector. Disconnect the Driver Rear Window Switch connector. Measure the resistance of the Driver Rear Window Driver Up circuit to ground.. Is the resistance below 1000.0 ohms? Yes → Repair the Driver Rear Window Driver Up wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	Disconnect the Driver Door Module ″C1″ connector. Disconnect the Driver Rear Window Switch connector. Measure the resistance of the Driver Rear Window Driver Down circuit to ground.. Is the resistance below 1000.0 ohms? Yes → Repair the Driver Rear Window Driver Down wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 12	All
12	If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module (output open) Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER REAR WINDOW INOPERATIVE FROM DDM

POSSIBLE CAUSES
DRIVER DOOR MODULE - DRIVER REAR WINDOW INOPERATIVE

TEST	ACTION	APPLICABILITY
1	This test assumes that the driver rear window IS operational from the driver rear door switch. Ensure the driver rear window is operational from the driver rear door switch. If is not, refer to symptom list for problems related to DRIVER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES. SWITCHES. If there are no possible causes remaining, view repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER REAR WINDOW INOPERATIVE FROM REAR SWITCH

POSSIBLE CAUSES
OPEN GROUND CIRCUIT
SWITCH DEFECTIVE

TEST	ACTION	APPLICABILITY
1	**Note Ensure the Window Lock out Switch on the DDM is operating properly before proceeding.** Remove the Rear Door Trim Panel. Disconnect the Power Window Switch connector. Measure the resistance of the Ground circuit to ground. Is the resistance below 5.0 ohms? Yes → Replace the Power Window Switch. Perform BODY VERIFICATION TEST - VER 1. No → Repair the open ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*DRIVER WINDOW INOPERATIVE

POSSIBLE CAUSES
DRIVER DOOR MODULE - OPEN SWITCH
DRIVER DOOR MODULE - OUTPUT OPEN
MOTOR CIRCUIT CHECK
DRIVER WINDOW DRIVER UP WIRE OPEN
DRIVER WINDOW DRIVER UP SHORTED TO GROUND
DRIVER WINDOW DRIVER DOWN WIRE OPEN
DRIVER WINDOW DRIVER UP SHORTED TO VOLTAGE
DRIVER WINDOW DRIVER DOWN SHORTED TO GROUND
DRIVER WINDOW DRIVER DOWN SHORTED TO VOLTAGE
MOTOR DEFECTIVE OPEN
MOTOR DEFECTIVE SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	Connect the DRBIII and select: ″Body″, ″Door Modules″, ″Actuators″ With the DRBIII actuate the ″DRV F WIN UP RLY″ and then the ″DRV F WIN DN RLY″.. Did the window operate up and down? Yes → Replace the Driver Door Module (switch input open) Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Driver Door Module ″C1″ connector. **Warning: Keep the window area clear as the window SHOULD move up and down in this test.** Connect a jumper wire from the Driver Window Driver Down terminal to the ground terminal. Connect a jumper wire from the Driver Window Driver Up terminal and momentarily connect it to the Fused B(+) terminal. Reverse the Jumper wires to run the motor in the opposite direction. Did the window motor operate up and down? Yes → Replace the Driver Door Module (output open). Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

*DRIVER WINDOW INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
3	Disconnect the Driver Door Module ″C1″ connector. Turn ignition off. Measure and record the total resistance of the motor ckt between the Driver Window Driver Up ckt and the Driver Window Driver Down ckt in the DDM ″C1″ connector (should be under 5.0 ohms). Measure and record the resistance of the Driver Window Driver Down ckt to ground in the DDM ″C1″ connector (should be infinite). Turn ignition on. Measure and record the voltage of the Driver Window Driver Down ckt to ground in the DDM ″C1″ connector (should be zero). What were your readings Total resistance above 5.0 ohms Go To 4 Resistance to gnd less than 1000 ohms Go To 7 Voltage above 0.02 volts Go To 10 None of the above Check and repair any reasons for the window regulator to bind. If the mechanism is OK, replace the power window motor. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the driver door module ″C1″ connector. Disconnect the driver power window motor connector. Measure the resistance of the Driver Window Driver Up circuit between the DDM connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Driver Window Driver up wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	Disconnect the driver door module ″C1″ connector. Disconnect the driver power window motor connector. Measure the resistance of the Driver Window Driver Down circuit between the DDM connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Driver Window Driver down wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view Repair. Repair Replace the power window motor. Perform BODY VERIFICATION TEST - VER 1.	All

*DRIVER WINDOW INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
7	Disconnect the driver door module ″C1″ connector. Disconnect the driver power window motor connector. Measure the resistance of the Driver Window Driver Up circuit to ground. Is the resistance below 100.0 ohms? Yes → Repair the Driver Window Driver up wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Disconnect the driver door module ″C1″ connector. Disconnect the driver power window motor connector. Measure the resistance of the Driver Window Driver Down ckt to ground. Is the resistance below 100.0 ohms? Yes → Repair the Driver Window Driver Down wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All
9	If there are no possible causes remaining, view Repair. Repair Replace the Power Window Motor (internal short) Perform BODY VERIFICATION TEST - VER 1.	All
10	Disconnect the driver door module ″C1″ connector. Disconnect the driver power window motor connector. Measure the voltage of the Driver Window Driver Up ckt to ground. Is there ANY voltage on the Driver Window Driver Up wire? Yes → Repair the Driver Window Driver Up wire for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	Disconnect the driver door module ″C1″ connector. Disconnect the driver power window motor connector. Measure the voltage of the Driver Window Driver Down ckt to ground. Is there ANY voltage on the Driver Window Driver Down wire? Yes → Repair the Driver Window Driver Down wire for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*PASSENGER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES

POSSIBLE CAUSES
REAR WINDOW SWITCH OPEN
PASSENGER REAR WINDOW DRIVER DOWN WIRE OPEN
PASSENGER REAR WINDOW DRIVER UP WIRE OPEN
PASSENGER REAR WINDOW DRIVER UP WIRE SHORT TO GROUND
PASSENGER REAR WINDOW DRIVER DOWN WIRE SHORT TO GROUND
WINDOW DRIVER DOWN WIRE OPEN
WINDOW DRIVER DOWN WIRE SHORT TO GROUND
WINDOW DRIVER UP WIRE OPEN
WINDOW DRIVER UP WIRE SHORT TO GROUND
REAR WINDOW MOTOR OPEN
PASSENGER DOOR MODULE - OUTPUT OPEN

TEST	ACTION	APPLICABILITY
1	Remove the Rear Door Trim Panel. Disconnect the rear window switch connector. Turn the ignition on. Using a 12-volt Test Light connected to ground, check the Passenger Rear Window Driver Up and Down circuits. Did the test light illuminate brightly on both circuits? Yes → Go To 2 No → Go To 8	All
2	Remove the Rear Door Trim Panel. Disconnect the Passenger Rear Power Window Switch connector. Turn the ignition on. **Warning: Keep the window area clear as the window SHOULD move up and down in this test.** Connect a jumper wire from the Window Driver Down terminal in the switch connector to ground. Connect a jumper wire from the Window Driver Up terminal in the switch connector and momentarily connect it to the Rear Window Driver Up terminal in the switch connector. Reverse the Jumper wires to run the motor in the opposite direction. Did the Window Motor operate in both directions? Yes → Replace the Rear Window Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

*PASSENGER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Rear Door Trim Panel. Disconnect the Passenger Rear Window Switch connector. Disconnect the Driver Rear Power Window Motor connector. Measure the resistance of the Window Driver Down circuit between the window switch connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Window Driver Down wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	Remove the Rear Door Trim Panel. Disconnect the Passenger Rear Window Switch connector. Disconnect the Passenger Rear Power Window Motor connector. Measure the resistance of the Window Driver Down circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Window Driver Down Wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Disconnect the Passenger Rear Window Switch connector. Disconnect the Passenger Rear Power Window Motor connector. Measure the resistance of the Window Driver Up circuit between the window switch connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Window Driver Up wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Passenger Rear Window Switch connector. Disconnect the Passenger Rear Power Window Motor connector. Measure the resistance of the Window Driver Up circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Window Driver Up Wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace the Rear Window Motor. Perform BODY VERIFICATION TEST - VER 1.	All
8	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Rear Window Switch connector. Measure the resistance of the Passenger Rear Window Driver Down circuit between the PDM connector and the Window Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open Passenger Rear Window Driver Down wire. Perform BODY VERIFICATION TEST - VER 1.	All

*PASSENGER REAR WINDOW INOPERATIVE FROM BOTH SWITCHES

— Continued

TEST	ACTION	APPLICABILITY
9	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Rear Widow Switch connector. Measure the resistance of the Passenger Rear Window Driver Up circuit between the PDM connector and the Window Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the Passenger Rear Window Driver Up wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
10	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Rear Window Switch connector. Measure the resistance of the Passenger Rear Window Driver Up circuit to ground.. Is the resistance below 1000.0 ohms? Yes → Repair the Passenger Rear Window Driver Up wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Rear Window Switch connector. Measure the resistance of the Passenger Rear Window Driver Down circuit to ground.. Is the resistance below 1000.0 ohms? Yes → Repair the Passenger Rear Window Driver Down wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 12	All
12	If there are no possible causes remaining, view repair. Repair Replace the Passenger Door Module (output open) Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER REAR WINDOW INOPERATIVE FROM DDM

POSSIBLE CAUSES
DRIVER DOOR MODULE - PASSENGER REAR WINDOW INOPERATIVE

TEST	ACTION	APPLICABILITY
1	This test assumes that the passenger rear window IS operational from the passenger window switches. If it is not, Refer to symptom list for problems related to Passenger Rear Window Inoperative from Both Switches. If there are no possible causes remaining, view Repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER REAR WINDOW INOPERATIVE FROM REAR SWITCH

POSSIBLE CAUSES
OPEN GROUND CIRCUIT
SWITCH DEFECTIVE

TEST	ACTION	APPLICABILITY
1	**Note Ensure the Window Lock out Switch on the DDM is operating properly before proceeding.** Remove the Rear Door Trim Panel. Disconnect the Power Window Switch connector. Turn the ignition off. Turn all lights off. Measure the resistance of the Ground circuit to ground. Is the resistance below 5.0 ohms? Yes → Replace the Power Window Switch. Perform BODY VERIFICATION TEST - VER 1. No → Repair the open ground circuit. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER WINDOW INOPERATIVE FROM BOTH SWITCHES

POSSIBLE CAUSES
PASSENGER DOOR MODULE - OPEN SWITCH
PASSENGER DOOR MODULE - OUTPUT OPEN
PASSENGER MOTOR CIRCUIT CHECK
PASSENGER WINDOW DRIVER DOWN WIRE OPEN
PASSENGER WINDOW DRIVER UP WIRE OPEN
PASSENGER WINDOW DRIVER DOWN SHORTED TO GROUND
PASSENGER WINDOW DRIVER UP SHORTED TO GROUND
PASSENGER WINDOW DRIVER DOWN SHORTED TO VOLTAGE
PASSENGER WINDOW DRIVER UP SHORTED TO VOLTAGE
WINDOW MOTOR OPEN
WINDOW MOTOR SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure there is communication with the Passenger and Driver Door Modules before proceeding.** Connect the DRBIII and select: ″Body″ ″Door Modules″ ″Actuators″ With the DRBIII actuate the ″PASS F WIN UP RLY″ and then the ″PASS F WIN DN RLY″.. Did the window operate up and down? Yes → Replace the Passenger Door Module (switch input open) Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Passenger Door Module ″C1″ connector. **Warning: Keep the window area clear as the window SHOULD move up and down in this test.** Connect a jumper wire from the Passenger Window Driver Down terminal to the ground terminal . Connect a jumper wire from the Passenger Window Driver Up terminal and momentarily connect it to the Fused B(+) terminal. Reverse the Jumper wires to run the motor in the oposite direction. Did the window motor operate up and down? Yes → Replace the Passenger Door Module (output open). Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

*PASSENGER WINDOW INOPERATIVE FROM BOTH SWITCHES — Continued

TEST	ACTION	APPLICABILITY
3	Disconnect the Passenger Door Module ″C1″ connector. Turn ignition off. Measure and record the total resistance of the motor circuit between the Passenger Window Driver Up circuit and the Passenger Window Driver Down circuit in the PDM ″C1″ connector (should be under 5.0 ohms). Measure and record the resistance of the Passenger Window Driver Down circuit to ground in the PDM ″C1″ connector (should be infinite). Turn ignition on. Measure and record the voltage of the Passenger Window Driver Down circuit to ground in the PDM ″C1″ connector (should be zero). What were your readings Total resistance above 5.0 ohms Go To 4 Resistance to gnd less than 1000 ohms Go To 7 Voltage above 0.02 volts Go To 10 None of the above Check and repair any reasons for the window regulator to bind. If the mechanism is OK, replace the power window motor. Perform BODY VERIFICATION TEST - VER 1.	All
4	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Power Window Motor connector. Measure the resistance of the Passenger Window Driver Down circuit between the PDM connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the Passenger Window Driver Down wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Power Window Motor connector. Measure the resistance of the Passenger Window Driver Up circuit between the PDM connector and the window motor connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Passenger Window Driver Up wire for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view Repair. Repair Replace the Power Window Motor. Perform BODY VERIFICATION TEST - VER 1.	All

*PASSENGER WINDOW INOPERATIVE FROM BOTH SWITCHES — Continued

TEST	ACTION	APPLICABILITY
7	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Power Window Motor connector. Measure the resistance of the Passenger Window Driver Down circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Passenger Window Driver Down wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Power Window Motor connector. Measure the resistance of the Passenger Window Driver Up circuit to ground. Is the resistance below 1000.0 ohms? Yes → Repair the Passenger Window Driver Up wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All
9	If there are no possible causes remaining, view Repair. Repair Replace the Power Window Motor (internal short) Perform BODY VERIFICATION TEST - VER 1.	All
10	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Power Window Motor connector. Measure the voltage of the Passenger Window Driver Down circuit to ground. Is there ANY voltage on the Passenger Window Driver Down wire? Yes → Repair the Passenger Window Driver Down wire for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	Disconnect the Passenger Door Module ″C1″ connector. Disconnect the Passenger Power Window Motor connector. Measure the voltage of the Passenger Window Driver Up circuit to ground. Is there ANY voltage on the Passenger Window Driver Up wire? Yes → Repair the Passenger Window Driver Up wire for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*PASSENGER WINDOW INOPERATIVE FROM DDM

POSSIBLE CAUSES
DRIVER DOOR MODULE - PASSENGER WINDOW INOPERABLE

TEST	ACTION	APPLICABILITY
1	This test assumes that the passenger window IS operational from the passenger door module. If it is not, refer to the symptom Passenger Window Inoperative from Both Switches in the Power Window category. If there are no possible causes remaining, view Repair. Repair Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PASSENGER WINDOW INOPERATIVE FROM PDM

POSSIBLE CAUSES
PASSENGER DOOR MODULE - SWITCH FAILURE

TEST	ACTION	APPLICABILITY
1	**Note Ensure the Window Lock out Switch on the DDM is operating properly before proceeding.** This test assumes that the passenger window IS operational from the Driver Door Module. If it is not, refer to symptom Passenger Window Inoperative from Both Switches in the Power Window category. If there are no possible causes remaining, view Repair. Repair Replace the Passenger Door Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:

LF SENSOR BATTERY LOW
LF TIRE PRESSURE SENSOR FAILURE
LR SENSOR BATTERY LOW
LR TIRE PRESSURE SENSOR FAILURE
RF SENSOR BATTERY LOW
RF TIRE PRESSURE SENSOR FAILURE
RR SENSOR BATTERY LOW
RR TIRE PRESSURE SENSOR FAILURE
SPARE TIRE PRESSURE SENSOR FAILURE
SPARE TIRE SENSOR BATTERY LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be LF SENSOR BATTERY LOW.

When Monitored and Set Condition:

LF SENSOR BATTERY LOW

When Monitored: Key ON.

Set Condition: When the EVIC detects a low battery condition from the LF Sensor/ Transmitter.

LF TIRE PRESSURE SENSOR FAILURE

When Monitored: Key ON.

Set Condition: When the EVIC detects a no-transmit condition from the LF Sensor/ Transmitter.

LR SENSOR BATTERY LOW

When Monitored: Key ON.

Set Condition: When the EVIC detects a low battery condition from the LR Sensor/ Transmitter.

LR TIRE PRESSURE SENSOR FAILURE

When Monitored: Key ON.

Set Condition: When the EVIC detects a no-transmit condition from the LR Sensor/ Transmitter.

RF SENSOR BATTERY LOW

When Monitored: Key ON.

Set Condition: When the EVIC detects a low battery condition from the RF Sensor/ Transmitter.

LF SENSOR BATTERY LOW — Continued

RF TIRE PRESSURE SENSOR FAILURE

When Monitored: Key ON.

Set Condition: When the EVIC detects a no-transmit condition from the RF Sensor/Transmitter.

RR SENSOR BATTERY LOW

When Monitored: Key ON.

Set Condition: When the EVIC detects a low battery condition from the RR Sensor/Transmitter.

RR TIRE PRESSURE SENSOR FAILURE

When Monitored: Key ON.

Set Condition: When the EVIC detects a no-transmit condition from the RR Sensor/Transmitter.

SPARE TIRE PRESSURE SENSOR FAILURE

When Monitored: Key ON.

Set Condition: When the EVIC detects a no-transmit condition from the Spare Tire Sensor/Transmitter.

SPARE TIRE SENSOR BATTERY LOW

When Monitored: Key ON.

Set Condition: When the EVIC detects a low battery condition from the Spare Tire Sensor/Transmitter.

POSSIBLE CAUSES
EVIC INTERNAL FAULT
SENSOR/TRANSMITTER INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Using the procedure in the System Description, retrain the EVIC With the DRBIII®, record and erase DTC's. Drive the vehicle for 10 minutes at 32 km/h (20 mph). With the DRBIII®, read DTCs. Does the DRBIII® display a Sensor Failure or Sensor Low Battery message? Yes → Replace the indicated Tire Pressure Sensor/Transmitter. Perform TIRE PRESSURE VERIFICATION TEST. No → Go To 2	All

LF SENSOR BATTERY LOW — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. Observe the EVIC display. Does the EVIC display SERVICE TIRE PRESS. SYSTEM? Yes → Replace the EVIC in accordance with the Service Information. Perform TIRE PRESSURE VERIFICATION TEST. No → Test Complete.	All

Symptom List:
BCM MESSAGE NOT RECEIVED (EXPORT ONLY)
PRE-ARM TIMEOUT FAILURE (EXPORT ONLY)

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be BCM MESSAGE NOT RECEIVED.

When Monitored and Set Condition:

BCM MESSAGE NOT RECEIVED

When Monitored: Whenever the ITM sends bus messages to the BCM.

Set Condition: If the ITM does not receive status messages from the BCM.

PRE-ARM TIMEOUT FAILURE

When Monitored: During the VTSS pre-arm process.

Set Condition: If the ITM does not receive arm message from the BCM after sixty seconds.

POSSIBLE CAUSES
INTERMITTENT CONDITION
ITM COMMUNICATION WITH THE BCM
INTRUSION TRANSCEIVER MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body Computer. Was the DRB able to I/D or communicate with the Body Computer? Yes → Go To 2 No → Refer to the Communication category for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All

BCM MESSAGE NOT RECEIVED (EXPORT ONLY) — Continued

TEST	ACTION	APPLICABILITY
2	With the DRB, erase ITM DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS and turn the ignition on. With the DRB, read Intrusion Transceiver Module DTC's. Did this DTC reset? Yes → Replace the Intrusion Transceiver Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
HORN RELAY CIRCUIT SHORTED HI

POSSIBLE CAUSES
HORN RELAY - INTERNAL SHORT TO VOLTAGE
HORN RELAY CONTROL CIRCUIT SHORT TO VOLTAGE
BCM - HORN RELAY CONTROL SHORT TO VOLTAGE

TEST	ACTION	APPLICABILITY
1	Substitute the Horn Relay with a good relay. With the DRBIII®, record and erase DTC's. Press the horn pad several times. With the DRBIII®, read DTCs. Did the Horn Relay Ckt Shorted Hi trouble code reset? Yes → Go To 2 No → Replace the original Horn Relay. Perform VTSS VERIFICATION TEST - 1A.	All
2	Turn the ignition off. Remove the Horn Relay from the Power Distribution Center. Remove the Body Control Module from the Junction Block. Turn the ignition on. Measure the voltage between the Horn Relay Control circuit and ground. Is the voltage above 1.0 volt? Yes → Repair the Horn Relay Control circuit for a short to voltage. Perform VTSS VERIFICATION TEST - 1A. No → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom List:
ITM - EEPROM FAILURE (EXPORT ONLY)
LOOPBACK FAILURE (EXPORT ONLY)

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ITM - EEPROM FAILURE.

When Monitored and Set Condition:

ITM - EEPROM FAILURE

When Monitored: Continuously while the VTSS is armed and during change of the VTSS state.

Set Condition: If the EEPROM erase/write does not correctly complete the operation.

LOOPBACK FAILURE

When Monitored: Continuously while the VTSS is armed, pre-armed or reset.

Set Condition: If an internal ITM bus test performed fails.

POSSIBLE CAUSES
INTERMITTENT CONDITION
INTRUSION TRANSCEIVER MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the current Intrusion Transceiver Module DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS and turn the ignition on. With the DRBIII®, read Intrusion Transceiver Module DTC's. Does the DRBIII® display the same DTC? Yes → Replace the Intrusion Transceiver Module. Perform BODY VERIFICATION TEST - VER 1. No → The condition that caused this symptom is currently not present. Test complete. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ITM - TRANSDUCER FAILURE (EXPORT ONLY)

When Monitored and Set Condition:

ITM - TRANSDUCER FAILURE

When Monitored: Continuously during VTSS pre-arm mode.

Set Condition: The ITM sends a test ultrasonic signal during the pre-arm process. If the test signal is not correctly received, the code will be set.

POSSIBLE CAUSES
BLOCKED INTRUSION TRANSCEIVER MODULE SENSORS
INTERMITTENT CONDITION
INTRUSION TRANSCEIVER MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the current Intrusion Transceiver Module DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS and turn the ignition on. With the DRBIII®, read Intrusion Transceiver Module DTC's. Does the DRBIII® display: ITM Transducer Failure? Yes → Go To 2 No → The condition that caused this symptom is currently not present. Test complete. Perform BODY VERIFICATION TEST - VER 1.	All
2	Inspect the louvers of the Intrusion Transceiver Module for blockage from dust or debris. Were there any problems found? Yes → Clean as necessary. Perform VTSS VERIFICATION TEST - 1A. No → Replace the Intrusion Transceiver Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ITM - VIN MISMATCH (EXPORT ONLY)

When Monitored and Set Condition:

ITM - VIN MISMATCH

When Monitored: While the ITM is being disarmed.

Set Condition: If the ITM stored VIN does not match with the BCM.

POSSIBLE CAUSES
INTRUSION TRANSCEIVER MODULE
BODY CONTROL MODULE
CHECK VIN IN BCM AND ITM WITH VIN IN PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Do not attempt to use either an ITM and/or a Siren from another vehicle.** With the DRBIII® display and record the VIN in the Intrusion Transceiver Module. With the DRBIII® select Body Computer. Display and record the VIN in the BCM. With the DRBIII® select Engine. Display and record the VIN in the PCM. Does the VIN in the ITM and the VIN in the BCM match the VIN in the PCM? Yes → Go To 2 No → Replace the Module(s) with the incorrect VIN. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII®, erase the current Intrusion Transceiver Module DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS using the RKE and turn the ignition on. With the DRBIII®, read Intrusion Transceiver Module DTC's. Does the DRBIII® display: ITM VIN Mismatch? Yes → Replace the Intrusion Transceiver Module. Perform BODY VERIFICATION TEST - VER 1. No → The condition that caused this symptom is currently not present. Test complete. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:
NO SERIAL COMMUNICATION (EXPORT ONLY)
SIREN COMMUNICATION FAILURE (EXPORT ONLY)

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be NO SERIAL COMMUNICATION.

When Monitored and Set Condition:

NO SERIAL COMMUNICATION

When Monitored: Continuously while the VTSS is armed.

Set Condition: If the Intrusion Transceiver Module does not receive messages from the Siren.

SIREN COMMUNICATION FAILURE

When Monitored: Continuously while the VTSS is armed.

Set Condition: If the Siren does not receive messages from the Intrusion Transceiver Module.

POSSIBLE CAUSES
INTERMITTENT CONDITION
OPEN FUSED B+ CIRCUIT
SIREN SIGNAL CONTROL CIRCUIT OPEN
SIREN SIGNAL CONTROL CIRCUIT SHORT TO GROUND
INTRUSION TRANSCEIVER MODULE
OPEN GROUND CIRCUIT
VTSS SIREN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the current Intrusion Transceiver Module DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS and turn the ignition on. Does the DRBIII® display the same DTC? Yes → Go To 2 No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform BODY VERIFICATION TEST - VER 1.	All

NO SERIAL COMMUNICATION (EXPORT ONLY) — Continued

TEST	ACTION	APPLICABILITY
2	Gain access to the VTSS Siren. Disconnect the Siren connector. Measure the voltage of the Fused B(+) circuit in the Siren connector. Is the voltage above 10.0 volts? Yes → Go To 3 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Siren connector. Using a 12-volt test light connected to 12-volts, check the ground circuit. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the ground circuit for an open. Perform VTSS VERIFICATION TEST - 1A.	All
4	Use the DRBIII® and set up as follows: Use the Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. Select DRBIII® Standalone. Select lab scope. Select Live. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Disconnect the Siren connector. Connect the black lead to the chassis ground. Connect the red lead to the Siren Signal Control circuit in the Siren connector. Start the engine and hold the engine RPM's above 600. Observe the voltage displayed on the DRBIII® Lab Scope. Is there a voltage square wave present 1 to 2 seconds? Yes → Replace the VTSS Siren. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Disconnect the Siren harness connector. Disconnect the Intrusion Transceiver Module harness connector. Measure the resistance between ground and the Siren Signal Control circuit. Is the resistance above 5.0 ohms? Yes → Go To 6 No → Repair the Siren Signal Control circuit for a short to ground. Perform VTSS VERIFICATION TEST - 1A.	All

NO SERIAL COMMUNICATION (EXPORT ONLY) — Continued

TEST	ACTION	APPLICABILITY
6	Disconnect the Siren harness connector. Disconnect the Intrusion Transceiver Module harness connector. Measure the resistance of the Siren Signal Control circuit between the Intrusion Sensor and the Siren connector. Is the resistance below 5.0 ohms? Yes → Replace the Intrusion Transceiver Module. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Siren Signal Control circuit for an open. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
PCM MESSAGE NOT RECEIVED (EXPORT ONLY)

When Monitored and Set Condition:

PCM MESSAGE NOT RECEIVED

When Monitored: With the ignition on.

Set Condition: The ITM does not receive PCI bus messages from the PCM for 12 seconds.

POSSIBLE CAUSES
PCM MESSAGE NOT RECEIVED
ATTEMPT TO COMMUNICATE WITH THE PCM
PCI BUS CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB enter System Tests then PCM Monitor. Does the DRB display: PCM is active on BUS? Yes → With the DRB, erase ITM DTCs. Cycle the ignition switch, wait 1 minute then recheck for ITM DTCs. If DTC resets, replace the Intrusion Transceiver Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition on. With the DRB, attempt to communicate with the PCM. Was the DRB able to communicate with the PCM? Yes → Go To 3 No → Refer to the communication category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the PCM C3 harness connector. Connect the diagnostic junction port tester #8339 to the diagnostic junction port. **Note: Do not connect the tester to the DRB.** Measure the resistance of the PCI Bus circuit between the diagnostic junction port tester and the PCM connector. Is the resistance below 5.0 ohms? Yes → Replace the Powertrain Control Module in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
SIREN BATTERY HAS BEEN TAMPERED (EXPORT ONLY)

When Monitored and Set Condition:

SIREN BATTERY HAS BEEN TAMPERED

When Monitored: Continuously while the VTSS is armed.

Set Condition: If the siren detects the loss of vehicle battery voltage.

POSSIBLE CAUSES
INTERMITTENT CONDITION
HARNESS TAMPERING
INTRUSION TRANSCEIVER MODULE

TEST	ACTION	APPLICABILITY
1	Inspect the wiring harness to the siren for any signs of tampering or damage. Were there any problems found? Yes → Repair wiring as necessary. Perform VTSS VERIFICATION TEST - 1A. No → Go To 2	All
2	With the DRBIII®, erase the current Intrusion Transceiver Module DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS and turn the ignition on. With the DRBIII®, read Intrusion Transceiver Module DTC's. Does the DRBIII® display: Siren Battery Has Been Tampered? Yes → Replace the Siren in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:
SIREN EEPROM FAILURE (EXPORT ONLY)
SIREN INTERNAL BATTERY (EXPORT ONLY)
SIREN ROM FAILURE (EXPORT ONLY)

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be SIREN EEPROM FAILURE.

When Monitored and Set Condition:

SIREN EEPROM FAILURE

When Monitored: Continuously while the VTSS is armed.

Set Condition: If the checksum of the EEPROM does not calculate to the correct value.

SIREN INTERNAL BATTERY

When Monitored: Continuously with engine rpm over 600.

Set Condition: When the internal battery within the siren does not charge as expected, the ITM sets this code.

SIREN ROM FAILURE

When Monitored: Continuously while the VTSS is armed.

Set Condition: If the checksum of the ROM does not calculate to the correct value.

POSSIBLE CAUSES
INTERMITTENT CONDITION
SIREN

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the current Intrusion Transceiver Module DTC's. Turn the ignition off. Arm the VTSS and wait 1 minute. Disarm the VTSS and turn the ignition on. With the DRBIII®, read Intrusion Transceiver Module DTC's. Does the DRBIII® display the same DTC? Yes → Replace the Siren. Perform BODY VERIFICATION TEST - VER 1. No → The condition that caused this symptom is currently not present. Test complete. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALARM TRIPS ON ITS OWN

POSSIBLE CAUSES
ALARM TRIPPED BY
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the Alarm Trip By status. Were there any causes displayed? Yes → Refer to Symptom List for problems related to the component indicated by the DRBIII®. Perform VTSS VERIFICATION TEST - 1A. No → Go To 2	All
2	**NOTE: The condition that caused the alarm is not present at this time. The following list may help in indentifying the intermittent condition.** Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect related wiring harnesses. Look for chafed, pierced, pinched, or partially broken wires. Visually inspect the related wiring harness connectors. Look for loose connections, broken, bent, pushed out, or corroded terminals. Were any of the above conditions present? Yes → Repair as necessary Perform VTSS VERIFICATION TEST - 1A. No → Test Complete.	All

Symptom:
*DRIVERS DOOR KEY FAILS TO DISARM VTSS

POSSIBLE CAUSES
DRIVER DOOR MODULE RESET
RESET DOOR MODULE
OPEN GROUND CIRCUIT
DRIVER CYLINDER LOCK SWITCH SENSE CIRCUIT SHORTED TO GROUND
OPEN DRIVER CYLINDER LOCK SWITCH SENSE CIRCUIT
DRIVER CYLINDER LOCK SWITCH

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in VTSS, Sensor Display, read the Driver Key Cylinder Sw voltage. Rotate the Key in the Door Key Cylinder from the normal position to the unlock position. Does the Driver Key Cylinder Sw voltage change from 5.0 to 1.6 volts? Yes → Go To 2 No → Go To 3	All
2	Reset the DDM by removing and reinstalling the JB POWER Fuse #12 in the Power Distribution Center. Attempt to disarm the VTSS using the Door Key. Can the VTSS now be disarmed using the Door Key? Yes → Resetting the Driver Door Module has corrected the problem. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Driver Door Module. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Driver Cylinder Lock Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Driver Cylinder Lock Switch Ground circuit. Does the test light illuminate? Yes → Go To 4 No → Repair the Driver Cylinder Lock Switch Ground circuit for an open. Perform VTSS VERIFICATION TEST - 1A.	All
4	Disconnect the Driver Door Module C1 harness connector. Disconnect the Driver Cylinder Lock Switch harness connector. Using a 12-volt Test Light connected to 12-volts, check the Driver Cylinder Lock Switch Sense circuit. Does the test light illuminate? Yes → Repair the Driver Door Cylinder Lock Switch Sense circuit for a short to ground. Perform VTSS VERIFICATION TEST - 1A. No → Go To 5	All

*DRIVERS DOOR KEY FAILS TO DISARM VTSS — Continued

TEST	ACTION	APPLICABILITY
5	Disconnect the Driver Door Module C1 harness connector. Disconnect the Driver Cylinder Lock Switch harness connector. Measure the resistance of the Sense circuit. Is the resistance below 5.0 ohms? Yes → Replace the Driver Cylinder Lock Switch in accordance with the Service Information. Perform VTSS VERIFICATION TEST - 1A. No → Repair the Driver Cylinder Lock Switch Sense circuit for an open. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*HAZARD LAMPS FAIL TO FLASH WITH ALARM TRIPPED

POSSIBLE CAUSES
VERIFY HAZARD OPERATION
BCM -- HAZARDS INOPERATIVE WITH VTSS ALARM TRIPPED
JUNCTION BLOCK

TEST	ACTION	APPLICABILITY
1	Turn the Hazard Lamps on. Do the Hazard Lamps operate properly? Yes → Go To 2 No → Check and diagnose related Body Control Module Diagnostic Trouble Codes. If no DTCs are present, refer to the Service Information. Perform VTSS VERIFICATION TEST - 1A.	All
2	Remove the BCM from the Junction Block. Connect a jumper wire between cavity 10 of the Junction Block and ground. Do the hazard lamps operate? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Replace the Junction Block in accordance with the Service Information. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:

*HEADLAMPS FAIL TO FLASH WITH ALARM TRIPPED

POSSIBLE CAUSES
VERIFY LOW BEAM OPERATION
BCM -- HEADLAMPS FAIL TO FLASH WHEN VTSS IS IN ALARM

TEST	ACTION	APPLICABILITY
1	Turn the Low Beam Headlamps on. Do the Low Beam Headlamps operate properly? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to the Exterior Lighting symptom list and also check for related Body Control Module Diagnostic Trouble Codes. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:

*HORN FAILS TO SOUND WITH ALARM TRIPPED

POSSIBLE CAUSES
CHECK HORN OPERATION
JUNCTION BLOCK - OPEN HORN RELAY CONTROL CIRCUIT
BODY CONTROL MODULE-OPEN HORN RELAY CONTROL CIRCUIT

TEST	ACTION	APPLICABILITY
1	Push the Horn Button on the Steering Wheel. Does the Horn operate properly? Yes → Go To 2 No → Check for and diagnose related Body Control Module Diagnostic Trouble Codes. If there are no DTCs present, refer to the Service Information to diagnose the horn system. Perform VTSS VERIFICATION TEST - 1A.	All
2	Remove the BCM from the junction block. Using a 12-volt test light connected to 12-volts, probe the Horn Relay Control circuit at the J/B side of the Junction Block-to-Body Control Module connector. While monitoring the test light, press the horn button on the steering wheel. Did the test light illuminate when the horn button was pressed? Yes → Replace the Body Contol Module. Perform VTSS VERIFICATION TEST - 1A. No → Replace the Junction Block in accordance with the Service Information. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:

*INTRUSION TRANSCEIVER MODULE SENSITIVITY (EXPORT ONLY)

POSSIBLE CAUSES
INTERIOR TYPE SELECTED IN ITM

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Miscellaneous, check the Current Status of the Interior Type. Is the Interior Type selected correct? Yes → Test Complete. No → Program the correct interior type. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*THEFT ALARM WILL NOT ARM

POSSIBLE CAUSES
CHECK THE VTSS STATUS
CHECK FOR DTCS AND VTSS ARMING INHIBITORS
BODY CONTROL MODULE - NO ALARM OUTPUT

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, check that the Theft Alarm is enabled. Was the Theft Alarm enabled? Yes → Go To 2 No → With the DRBIII®, enable the Vehicle Theft Security System (VTSS). Perform VTSS VERIFICATION TEST - 1A.	All
2	Make sure the liftgate, liftgate flip-up, hood and all doors are closed. Remove the key from the ignition. With the DRBIII®, read the active DTC's, ajar switch states, and the key-in-ignition switch state. Does the DRBIII® display any closed switches or VTSS related DTCs? Yes → Refer to the Symptom List and diagnose the appropriate symptom in the CHIME, DOOR AJAR or VTSS category. Perform VTSS VERIFICATION TEST - 1A. No → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS DOES NOT TRIP FROM DRIVERS DOOR

POSSIBLE CAUSES
BCM-NO VTSS TRIP FROM DRVR DOOR
CHECK DRBIII® FOR DRIVER DOOR AJAR RESPONSE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the DRVR DOOR AJAR SW status. Open the driver door. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom DRIVER DOOR AJAR CKT OPEN in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS DOES NOT TRIP FROM HOOD (IF EQUIPPED)

POSSIBLE CAUSES
CHECK DRBIII® FOR HOOD AJAR RESPONSE
BCM-NO VTSS TRIP FROM HOOD

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the HOOD AJAR SW status. Open the hood. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom HOOD AJAR CKT OPEN in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:

*VTSS DOES NOT TRIP FROM LEFT REAR DOOR

POSSIBLE CAUSES
CHECK DRBIII® FOR LEFT REAR DOOR AJAR RESPONSE
BCM-NO VTSS TRIP FROM LR DOOR

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the LR DOOR AJAR SW status. Open the left rear door. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom LEFT REAR DOOR AJAR CKT OPEN in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS DOES NOT TRIP FROM LIFTGATE

POSSIBLE CAUSES
CHECK DRBIII® FOR LIFTGATE SW RESPONSE
BCM-NO VTSS TRIP FROM LIFTGATE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the LIFTGATE SW status. Open the liftgate. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom LIFTGATE AJAR CKT OPEN in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS DOES NOT TRIP FROM LIFTGATE FLIP-UP GLASS ONLY

POSSIBLE CAUSES
CHECK DRBIII® FOR LIFTGATE FLIP-UP RESPONSE
BCM-NO VTSS TRIP FROM LIFTGATE FLIP-UP GLASS

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the LIFTGLASS SW status. Open the liftgate flip-up glass. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom Lftgate Flip-Up Ajar Circuit Open in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS DOES NOT TRIP FROM PASSENGER FRONT DOOR

POSSIBLE CAUSES
CHECK DRBIII® FOR PASSENGER DOOR AJAR RESPONSE
BCM-NO VTSS TRIP FROM PASSENGER DOOR

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the PASS DOOR AJAR SW status. Open the passenger door. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom PASSENGER DOOR AJAR CKT OPEN in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS DOES NOT TRIP FROM RIGHT REAR DOOR

POSSIBLE CAUSES
CHECK DRBIII® FOR RIGHT REAR DOOR AJAR RESPONSE
BCM-NO VTSS TRIP FROM RR DOOR

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the RR DOOR AJAR SW status. Open the right rear door. Does the DRBIII® display CLOSED? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Refer to symptom RIGHT REAR DOOR AJAR CKT OPEN in the DOOR AJAR category. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
*VTSS INDICATOR INOPERATIVE

POSSIBLE CAUSES
OPEN VTSS INDICATOR FUSED B(+) SUPPLY
OPEN VTSS LED
VTSS INDICATOR DRIVER CIRCUIT OPEN
BODY CONTROL MODULE--OPEN INTERNAL VTSS DRIVER

TEST	ACTION	APPLICABILITY
1	Disconnect the Automatic Headlamp Light Sensor/VTSS LED harness connector. Measure the voltage of the Fused B+ circuit. Is the voltage above 10.0 volts? Yes → Go To 2 No → Repair the VTSS Fused B+ circuit for an open. Perform VTSS VERIFICATION TEST - 1A.	All
2	Disconnect the Automatic Headlamp Light Sensor VTSS/LED harness connector. Using a 12-volt test light connected to 12-volts, check the VTSS Indicator Driver circuit. Turn the ignition on. With the DRB in Vehicle Theft, actuate the VTSS Indicator lamp. Does the test light illuminate when the VTSS Indicator lamp is actuated? Yes → Replace the Automatic Headlamp Light Sensor/VTSS LED assembly. Perform VTSS VERIFICATION TEST - 1A. No → Go To 3	All
3	Disconnect the Automatic Headlamp Light Sensor/ VTSS LED harness connector. Disconnect the BCM C1 harness connector. Measure the resistance of the VTSS Indicator Driver circuit. Is the resistance below 5.0 ohms? Yes → Replace the Body Control Module. Perform VTSS VERIFICATION TEST - 1A. No → Repair the VTSS Indicator Driver circuit for an open. Perform VTSS VERIFICATION TEST - 1A.	All

Symptom:
RAIN SENSOR FAULT

When Monitored and Set Condition:

RAIN SENSOR FAULT

When Monitored: Ignition on.

Set Condition: When the BCM detects a fault from the Rain Sensor Module.

POSSIBLE CAUSES
INTERMITTENT CONDITION
MULTIFUNCTION SWITCH
RAIN SENSOR MODULE
BODY CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, clear all BCM DTC's. Turn the right side multifunction switch to the AUTO position. With the DRBIII®, read the DTC information. Does the DRBIII® read: Rain Sensor Fault? Yes → Go To 2 No → The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the right side Multifunction Switch harness connector. Turn the ignition on. With the DRBIII®, select Body, Body Control Module and read the Multifunction Switch voltage. Does the DRBIII® display voltage above 4.75 volts? Yes → Replace the right side Multifunction Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition on. Turn the right side multifunction switch to the AUTO position. Using a spray bottle, spray water on the RSM area of the windshield. Using the DRBIII® monitor the wipe commands to the BCM from the RSM. Were any wipe commands transmitted to the BCM from the RSM? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Rain Sensor Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
WASHER FLUID SENSOR FAILURE

When Monitored and Set Condition:

WASHER FLUID SENSOR FAILURE

When Monitored: Ignition key in run position.

Set Condition: If the resistance of the washer fluid level sensor input to the BCM is high causing the voltage to be above 4.8 volts for 5 seconds or more.

POSSIBLE CAUSES
VERIFYING ACTIVE DTC - WASHER FLUID SENSOR FAILURE
WASHER FLUID LEVEL SWITCH CIRCUIT VERIFICATION

TEST	ACTION	APPLICABILITY
1	Turn ignition on. With the DRBIII, Erase BCM DTC's Turn ignition off then turn ignition on. Turn the wiper switch to each intermittent position, then low and high speed positions, then push the washer switch. Wait 5 minutes before reading the BCM DTC. With the DRBIII read BCM DTC's. Does the DRB show "WASHER FLUID SENSOR FAILURE"? Yes → Go To 2 No → Test Complete, code not present at this time.	All
2	With the DRBIII, access BCM Sensors. Turn ignition on. Read the Washer Fluid level switch voltage. Is the Washer Fluid Level Switch voltage above 4.8 volts? Yes → Test Complete. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
WIPER ON/OFF RELAY SHORTED HIGH

When Monitored and Set Condition:

WIPER ON/OFF RELAY SHORTED HIGH

When Monitored: The ignition must be in the run position and battery voltage supplied to the BCM on the Fused B(+) circuit.

Set Condition: If the BCM detects high current on the wiper on/off relay control circuit the code will set.

POSSIBLE CAUSES
VERIFYING ACTIVE DTC - WIPER ON/OFF RELAY CONTROL CIRCUIT SHORTED HIGH
WIPER ON/OFF RELAY COIL SHORTED
WIPER ON/OFF RELAY CONTROL CIRCUIT SHORTED TO BATTERY
BCM DEFECTIVE - WIPER ON/OFF RELAY

TEST	ACTION	APPLICABILITY
1	Turn ignition on. With the DRBIII, Erase BCM DTC's Turn ignition off then turn ignition on. Turn the wiper switch to each intermittent position, then low and high speed positions. With the DRBIII read BCM DTC's. Does the DRB show "WIPER ON/OFF RELAY SHORTED HIGH"? Yes → Go To 2 No → Test Complete, code not present at this time.	All
2	Turn ignition off. Remove the On/Off Relay. **Note: Check connectors - Clean / repair as necessary.** Using an ohmmeter, measure between terminals #85 and #86 of the Wiper On/Off Relay. Is the resistance below 50 ohms? Yes → Replace the Wiper ON/Off Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

WIPER ON/OFF RELAY SHORTED HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the Ignition Off. Remove the Wiper On/Off Relay. Disconnect the BCM C1 Connector. **Note: Check connectors - Clean/repair as necessary.** Turn the Ignition On (Engine Off). Using a voltmeter, measure the Wiper On/Off Relay Control circuit at the BCM C1 Connector. Is the voltage above 1.0 volts? Yes → Repair the Wiper On/Off Relay Control circuit shorted to battery. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the Ignition Off. Disconnect the Wiper On/Off Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a voltmeter between cavity 85 of the On/Off Relay and chassis ground. Turn ignition on. Is the voltage above 1.0 volts? Yes → Replace the Body Control Module. Wiper On/Off Relay Control circuit shorted to battery. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
WIPER ON/OFF RELAY SHORTED LOW/OPEN CIRCUIT

When Monitored and Set Condition:

WIPER ON/OFF RELAY SHORTED LOW/OPEN CIRCUIT

When Monitored: The ignition must be in the run position and battery voltage supplied to the BCM on the Fused B(+) circuit.

Set Condition: If the BCM cannot sense any voltage on the wiper on/off relay control circuit.

POSSIBLE CAUSES
JUNCTION BLOCK CIRCUIT BREAKER C1 OPEN
VERIFYING ACTIVE DTC - WIPER ON/OFF RELAY CONTROL CIRCUIT SHORTED LOW/OPEN
FUSED IGNITION SWITCH OUTPUT RUN/ACC CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT RUN/ACC CIRCUIT SHORTED TO GROUND
COMMON CIRCUIT SHORTED TO GROUND
HIGH SPEED OUTPUT SHORTED TO GROUND
LOW SPEED OUTPUT SHORTED TO GROUND
WIPER ON/OFF RELAY CONTROL CIRCUIT OPEN
WIPER ON/OFF RELAY CONTROL CIRCUIT SHORTED TO GROUND
BCM DEFECTIVE- WIPER ON/OFF RELAY CIRCUIT SHORTED LOW/OPEN

TEST	ACTION	APPLICABILITY
1	Turn ignition on. With the DRBIII, Erase BCM DTC's Turn ignition off then turn ignition on. Turn the wiper switch to each intermittent position, then low and high speed positions. With the DRBIII read BCM DTC's. Does the DRB show ″WIPER ON/OFF RELAY OUTPUT SHORTED LOW/OPEN″? Yes → Go To 2 No → Test Complete, code not present at this time.	All
2	Disconnect the Junction Block Circuit Breaker C1. **Note: Check connectors - Clean/repair as necessary.** Install a known good circuit breaker in place of the Junction Block C1 Circuit Breaker. Does the system now operate correctly? Yes → Replace the Junction Block Circuit Breaker C1. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

WIPER ON/OFF RELAY SHORTED LOW/OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Remove the Wiper On/Off Relay. Remove the Junction Block C1 Circuit Breaker. **Note: Check connectors - Clean / repair as necessary.** Connect a jumper wire between the Junction Block C2-9 Fused Ignition Switch Output Run/ACC and ground. Using an Ohmmeter, measure the Fused Ignition Switch Output Run/ACC circuit from the Wiper On/Off Relay connector (cavity 86) and ground. Is the resistance below 5.0 Ohms? Yes → Go To 4 No → Repair the open Fused Ignition Switch Output Run/ACC circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the Ignition Off. Remove the Junction Block C1 Circuit Breaker. Disconnect the Wiper On/Off Relay. **Note: Check connectors - Clean/repair as necessary.** Using an ohmmeter, measure the Fused Ignition Switch Output circuit between the On/Off Relay (Cavity 86) and ground. Is the resistance below 10.0 ohms? Yes → Repair the Fused Ignition Switch Output Run/ACC circuit shorted to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the Ignition Off. Disconnect the Wiper Motor connector. Disconnect the Junction Block C1 Circuit Breaker. **Note: Check connectors - Clean/repair as necessary.** Using an ohmmeter, measure the Fused Ignition Switch Output Run/ACC circuit between the Wiper Motor Connector and ground. Is the resistance below 5.0 ohms? Yes → Repair the Fused Ignition Switch Output Run/ACC circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the Ignition Off. Remove the Wiper High/Low and On/Off Relays. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Wiper Relay Common circuit between the High/Low Relay (cavity 30) and ground. Is the resistance below 10.0 ohms? No → Go To 7 Yes → Repair the Wiper Relay Common circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1.	All

WIPER ON/OFF RELAY SHORTED LOW/OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the Ignition Off. Disconnect the Wiper High/Low Relay. Disconnect the Wiper Motor connector. **Note: Check connectors - Clean/repair as necessary.** Using an ohmmeter, measure the High Speed Output circuit at the High/Low Relay (cavity 87). Is the resistance below 10.0 ohms? Yes → Repair the High Speed Output circuit shorted to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the Ignition Off. Remove the Wiper High/Low Relay. Disconnect the Wiper Motor connector. **Note: Check connectors - Clean/repair as necessary.** Using an ohmmeter, measure the Low Speed Output circuit at the High/Low Relay (cavity 87A). Is the resistance below 10.0 ohms? Yes → Repair the Low Speed Output circuit shorted to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the Ignition Off. Remove the Wiper On/Off Relay. Disconnect the BCM C1 Connector. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire to the Wiper On/Off Relay Control circuit between the Body Control Module C1 connector and ground. Using a ohmmeter, measure the Wiper On/Off Relay Control circuit between the Wiper On/Off Relay cavity 85 of the Power Distribution Center and ground. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open Wiper On/Off Relay Control circuit. Perform BODY VERIFICATION TEST - VER 1.	All
10	Turn the Ignition Off. Disconnect the Wiper On/Off Relay. Disconnect the BCM C1 Connector. **Note: Check connectors - Clean/repair as necessary.** Using a ohmmeter, measure the Wiper On/Off Relay Control circuit between the Wiper On/Off Relay cavity 85 of the Power Distribution Center and ground. Is the resistance below 5.0 ohms? Yes → Repair the Wiper On/Off Relay Control circuit shorted to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All

WIPER ON/OFF RELAY SHORTED LOW/OPEN CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	Turn the Ignition Off. Disconnect the Wiper On/Off Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a test light between cavity 85 and 86 of the Wiper On/Off Relay in the Power Distribution Center. Turn the Ignition On (Engine Off). With the DRBIII actuate the Wiper Relay. Does the test light pulse on and off with the DRBIII actuating the wiper relay? Yes → Test Complete. No → Replace the Body Control Module,shorted low/open. Perform BODY VERIFICATION TEST - VER 1. **Note: Stop the Wiper Motor actuation.**	All

Symptom:
WIPER PARK SWITCH FAILURE

When Monitored and Set Condition:

WIPER PARK SWITCH FAILURE

When Monitored: The ignition must be in the run position and battery voltage supplied to the BCM on the Fused B(+) circuit.

Set Condition: The code will set if the BCM does not detect a low to high voltage transition on the Wiper Park Switch Sense circuit within 8 seconds after energizing the wiper relay On/Off relay.

POSSIBLE CAUSES
WIPER PARK SWITCH OPERATION
WIPER PARK SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
WIPER PARK SWITCH SENSE CIRCUIT OPEN
WIPER PARK SWITCH SENSE CIRCUIT SHORT TO GROUND
GROUND CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT RUN/ACC CIRCUIT OPEN
WIPER MOTOR OPERATION
BCM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase BCM DTC's. Cycle the ignition off and then on. Turn the windshield wiper switch to each intermittent position, then low and high speed positions. Turn the windshield wiper switch to the Low Speed position. With the DRBIII®, read BCM DTC's. Does the DRB display WIPER PARK SWITCH FAILURE? Yes → Go To 2 No → At this time the condition to set the code is not present. Inspect the related wiring harness and connectors, repair as necessary. Perform BODY VERIFICATION TEST - VER 1.	All

WIPER PARK SWITCH FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Disconnect the Windshield Wiper Motor harness connector. Disconnect the Junction Block C2 harness connector. Turn the ignition on. Measure the voltage of the Wiper Park Switch Sense circuit in the Windshield Wiper Motor harness connector. Is there any voltage present? Yes → Repair the Wiper Park Switch Sense circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Windshield Wiper Motor harness connector. Disconnect the Junction Block C2 harness connector. Measure the resistance of the Wiper Park Switch Sense circuit between the Junction Block C2 harness connector and the Wiper Motor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the Wiper Park Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the Windshield Wiper Motor harness connector. Disconnect the Junction Block C2 harness connector. Measure the resistance between ground and the Wiper Park Switch Sense circuit in the Junction Block C2 harness connector. Is the resistance below 100.0 ohms? Yes → Repair the Wiper Park Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Windshield Wiper Motor harness connector. **NOTE: Ensure the ignition switch, all lights and accessories are turned off.** Using a 12-volt test light connected to 12-volts, probe the Ground circuit in the Windshield Wiper Motor harness connector. Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Wiper Motor Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Wiper Motor connector. Turn ignition on. Using a voltmeter measure the Fused Ignition Switch Output Run/ACC circuit at the Wiper Motor connector. Is the voltage above 10 volts? Yes → Go To 7 No → Repair the open Fused Ignition Switch Output Run/ACC circuit. Perform BODY VERIFICATION TEST - VER 1.	All

WIPER PARK SWITCH FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect the Windshield Wiper Motor harness connector. Turn the ignition on. With the DRBIII® in Inputs/Outputs, read the wiper park switch state. Connect one end of a jumper wire to the wiper park switch sense circuit at the windshield wiper motor harness connector. While observing the DRBIII®, connect the other end of the jumper wire to ground for several seconds, then disconnect the jumper wire from ground. Did the wiper park switch input change state when connected to ground then disconnected from ground? Yes → Replace the Wiper Motor. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
WIPER SWITCH MUX CKT OPEN

When Monitored and Set Condition:

WIPER SWITCH MUX CKT OPEN

When Monitored: The ignition must be in the run position and battery voltage supplied to the BCM on the Fused B(+) circuit.

Set Condition: If the voltage on the wiper switch MUX circuit is above 4.8 volts for more than 5 seconds the code will set.

POSSIBLE CAUSES
VERIFYING ACTIVE DTC - WIPER SWITCH MUX CIRCUIT OPEN
WIPER SWITCH RETURN CIRCUIT OPEN
WINDSHIELD WIPER SWITCH MUX CIRCUIT OPEN
RIGHT MULTI - FUNCTION SWITCH DEFECTIVE, WINDSHIELD WIPER SWITCH MUX CKT OPEN
BCM DEFECTIVE - WIPER MUX CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn ignition on. With the DRBIII, Erase BCM DTC's Turn ignition off then turn ignition on. Turn the wiper switch to each intermittent position, then low and high speed positions. With the DRBIII read BCM DTC's. Does the DRB show ″WIPER SWITCH MUX CIRCUIT OPEN″? Yes → Go To 2 No → Test Complete, code not present at this time.	All
2	Turn ignition off. Disconnect the Right Multi - Function Switch connector. Disconnect the BCM C2 connector. Using an ohmmeter, Measure the resistance of the Wiper Switch Return circuit between the BCM C2 connector and the Right Multi - Function connector. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Windshield Wiper Switch Return circuit. Perform BODY VERIFICATION TEST - VER 1.	All

WIPER SWITCH MUX CKT OPEN — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect the Right Multi - Function Switch connector. Disconnect the BCM C2 connector. Using an ohmmeter, Measure the resistance of the Windshield Wiper Switch MUX circuit between the BCM C2 connector and the Right Multi - Function connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open Windshield Wiper Switch MUX circuit. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn ignition off. Disconnect the Right Multi - Function Switch Connector. Turn the Windshield Wiper Switch to the ″OFF″ position. Connect an ohmmeter between the Right Multi - Function Switch terminals #7 and #8. Observe the ohmmeter while turning the Windshield Wiper Switch from the ″ OFF″ position to the ″High speed″ position. Is the resistance below 40.0 ohms in any position Yes → Replace the Right Multi - Function Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the Ignition Off. With a jumper, back probe a jumper wire between the Wiper Switch Return Circuit and the Windshield Wiper Switch MUX circuit at the BCM C2 connector. Turn Ignition on. With the DRBIII, read the WIPER MODE SW VOLTS sensor. Does the DRBIII show the sensor volts above 4.8 volts? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
WIPER SWITCH MUX CKT SHORT TO GROUND

When Monitored and Set Condition:

WIPER SWITCH MUX CKT SHORT TO GROUND

When Monitored: The ignition must be in the run position and battery voltage supplied to the BCM on the Fused B(+) circuit.

Set Condition: If the voltage on the wiper switch MUX circuit drops below 0.3 volts for more than 5 seconds the code will set.

POSSIBLE CAUSES
VERIFYING ACTIVE DTC - WIPER SWITCH MUX CIRCUIT SHORTED TO GROUND
WINDSHIELD WIPER SWITCH MUX CIRCUIT SHORTED TO GROUND
RIGHT MULTI - FUNCTION SWITCH DEFECTIVE, WIPER MUX CIRCUIT SHORTED TO GROUND
BCM DEFECTIVE - WIPER MUX CIRCUIT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	Turn ignition on. With the DRBIII, Erase BCM DTC's Turn ignition off then turn ignition on. Turn the wiper switch to each intermittent position, then low and high speed positions. With the DRBIII read BCM DTC's. Does the DRB show "WIPER SWITCH MUX CIRCUIT SHORTED TO GROUND"? Yes → Go To 2 No → Test Complete, code not present at this time.	All
2	Turn ignition off. Disconnect the Right Multi - Function Switch connector. Disconnect the BCM C2 connector. Using an ohmmeter, Measure the resistance of the Windshield Wiper Switch MUX circuit between the BCM C2 connector and ground. Is the resistance below 5.0 ohms? Yes → Repair the Windshield Wiper Switch MUX circuit shorted to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

WIPER SWITCH MUX CKT SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	Turn ignition off. Disconnect the Right Multi - Function Switch Connector. Turn the Windshield Wiper Switch to the ″OFF″ position. Using an ohmmeter, measure between the Windshield Wiper Switch MUX circuit and the Wiper Switch Return circuit of the Right Multi - Function Switch. Observe the ohmmeter while turning the Windshield Wiper Switch from the ″ OFF″ position to the ″High speed″ position. Is the resistance below 40.0 ohms in any position. Yes → Replace the Right Multi - Function Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the Ignition Off. Disconnect the BCM C2 connector. Turn Ignition on. With the DRBIII, read the ″WIPER MODE SW VOLTS″ sensor. Does the DRBIII show the sensor volts below 0.3 volts? Yes → Replace the Body Control Module. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Verification Tests

45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. Connect the DRBIII® to the Data Link Connector. 2. Reconnect any disconnected components. 3. With the DRBIII®, erase DTC's. 4. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT above 43° Celsius 110° Fahrenheit. 5. Check the Transmission fluid and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure. **6. NOTE: If the TCM has been replaced or if the transmission has been repaired or replaced it is necessary to perform the DRBIII® Quick Learn Procedure.** 7. Road test the vehicle. With the DRBIII®, monitor TPS. Make fifteen to twenty 1-2, 2-3, and 3-4 upshifts and (4 - 4prime for 545RFE only). 8. Perform these shifts from a standing start to 97 Km/h 60 MPH with a constant throttle opening of 20 to 25 degrees. 9. Below 40 Km/h 25 MPH, make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 10. Check for DTC's during the road test. **11. NOTE: Use the EATX OBDII task manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.** Were any Trouble Codes set during the road test? Yes → Refer to the Symptom List for the appropriate diagnostic tests. No → Repair is complete.	All

ABS VERIFICATION TEST - VER 1	APPLICABILITY
1. Turn the ignition off. 2. Connect all previously disconnected components and connectors. 3. Ensure all accessories are turned off and the battery is fully charged. 4. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. 6. If any Diagnostic Trouble Codes are present, return to Symptom list and troubleshoot new or recurring symptom. **7. NOTE: For Sensor Signal and Pump Motor faults, the CAB must sense all 4 wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator.** 8. If there are no DTC's present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several antilock braking stops. **9. Caution: Ensure braking capability is available before road testing.** 10. Again, with the DRBIII® read DTC's. If any DTC's are present, return to Symptom list. 11. If there are no Diagnostic Trouble Codes (DTC's) present, and the customer's concern can no longer be duplicated, the repair is complete. Are any DTC's present or is the original concern still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

ADJUSTABLE PEDALS VERIFICATION TEST - VER 1	APPLICABILITY
1. If the Adjustable Pedals Module was replaced, program two pedal positions if equipped with memory function. 2. Activate the Adjustable Pedals through the full range of movement. 3. Verify that the Adjustable Pedals system is disabled with the vehicle in Reverse. 4. Verify that the Adjustable Pedals system is disabled with Speed Control activated. 5. With the DRBIII®, erase DTCs. 6. With the DRBIII®, read DTCs. Are any DTC's present or is the original complaint still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

AIRBAG VERIFICATION TEST - VER 1	APPLICABILITY
1. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery. **2. WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** 3. Connect the DRBIII® to the Data Link Connector - use the most current software available. 4. Use the DRBIII® and erase the stored codes in all airbag system modules. 5. Turn the Ignition Off, and wait 15 seconds before turning the Ignition On. 6. Wait one minute, and read active codes and if there are none present read the stored codes. 7. Note: If equipped with Airbag On-Off switch, read the DTC's in all switch positions. 8. Note: Read the DTC's in all airbag system related modules. 9. If the DRBIII® shows any active or stored codes, return to the Symptom list and follow path specified for that trouble code. If no active or stored codes are present, the repair is complete. Are any DTC's present or is the original condition still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

BODY VERIFICATION TEST - VER 1	APPLICABILITY
1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors. 2. If the Sentry Key Immobilizer Module (SKIM) or the Powertrain Control Module (PCM) were replaced, proceed to number 9. If the SKIM or PCM were not replaced, continue to the next number. 3. If the Body Control Module was replaced, turn the ignition on for 15 seconds before attempting to start (to learn VIN). 4. If the vehicle is equipped with VTSS, use the DRBIII and enable VTSS. Program other options as necessary. 5. (Export only) If the Intrusion Transceiver Module (ITM) was replaced, use the DRBIII® to enable the ITM and Program Interior type. 6. (Export only) If the Siren was replaced perform the DRBIII® Siren Replacement procedure. 7. If the Passenger Door Module was replaced, use the DRBIII and program all RKE transmitters used with this vehicle. 8. If any repairs were made to the HVAC System, disconnect the battery for 30 seconds and then reconnect or using the DRBIII, recalibrate the HVAC doors. Proceed to number 16. 9. Obtain the Vehicle's unique PIN assigned to it's original SKIM from either the vehicle's invoice or from Chrysler's Customer Center (1-800-992-1997). 10. With the DRBIII, select THEFT ALARM, SKIM, MISCELLANEOUS and select SKIM REPLACED. Enter the 4 digit PIN to put SKIM in Secured Access Mode. 11. The DRBIII will prompt you through the following steps. (1) Program the country code into the SKIM's memory. (2) Program the vehicle's VIN into the SKIM's memory. (3) Transfer the vehicle's Secret Key data from the PCM. 12. Once secured access mode is active, the SKIM will remain in that mode for 60 seconds. 13. Using the DRBIII, program all customer keys into the SKIM's memory. This requires that the SKIM be in secured access mode, using the 4 digit code. 14. Note: If the PCM is replaced, the VIN and the unique Secret Key data must be transfered from the SKIM to the PCM. This procedure requires the SKIM to be placed in secured access mode using the 4-digit code. 15. Note: If 3 attempts are made to enter secured access mode using an incorrect PIN, secured access mode will be locked out for 1 hour which causes the DRBIII to display BUS +\- SIGNALS OPEN. To exit this mode, turn ignition to the RUN position for 1 hour. 16. Ensure all accessories are turned off and the battery is fully charged. 17. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 18. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. Are any DTC's present or is the original complaint still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 1	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. Inspect the engine oil for contamination. If oil contamination is suspected, change the oil and filter. 3. If the PCM was not replaced skip steps 4 through 6 and continue the verification. 4. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Attempt to start the engine. Is the vehicle still unable to start or are there any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptoms list (Diagnostic Procedure). No → Repair is complete.	All

ROAD TEST VERIFICATION - VER-2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a non-DTC test, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes and the symptom no longer exists, the repair was successful and testing is now complete. 4. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins (TSBs) and return to the Symptom List if necessary. 5. For previously read DTCs that have not been dealt with, return to the Symptom List and follow the diagnostic path for that DTC; otherwise, continue. 6. If the Engine Control Module (ECM) has not been changed, perform steps 7 and 8, otherwise, continue with step 9. 7. With the DRB, erase all diagnostic trouble codes (DTCs), then disconnect the DRB. 8. Turn the ignition off for at least 10 seconds. 9. If equipped with a Transfer Case Position Switch, perform step 10, otherwise, continue with step 11. 10. With the ignition switch on, place the Transfer Case Shift Lever in each gear position, stopping for 15 seconds in each position. 11. Ensure no DTCs remain by performing steps 12 through 15. 12. Road test the vehicle. For some of the road test, go at least 64 km/h (40 MPH). If this test is for an A/C Relay Control Circuit, drive the vehicle for at least 5 minutes with the A/C on. 13. At some point, stop the vehicle and turn the engine off for at least 10 seconds, then restart the engine and continue. 14. Upon completion of the road test, turn the engine off and check for DTCs with the DRB. 15. If the repaired DTC has reset, the repair is not complete. Check for any pertinent Technical Service Bulletins (TSBs) and return to the Symptom List. If there are no DTCs, the repair was successful and is now complete. Are any DTCs or symptoms remaining? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

SKIS VERIFICATION	APPLICABILITY
1. Reconnect all previously disconnected components and connectors. 2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKIM. This number can be obtained from the vehicle's invoice or Chrysler's Customer Center (1-800-992-1997). **3. NOTE: When entering the PIN, care should be taken because the SKIM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PINs are entered, the SKIM will Lock Out the DRB for 1 hour.** 4. To exit Lock Out mode, the ignition key must remain in the Run position continually for 1 hour. Turn off all accessories and connect a battery charger if necessary. 5. With the DRB, select Theft Alarm, SKIM and Miscellaneous. Then, select the desired procedure and follow the steps that will be displayed. 6. If the SKIM has been replaced, ensure all of the vehicle ignition keys are programmed to the new SKIM. **7. NOTE: Prior to returning vehicle to the customer, perform a module scan to be sure that all DTCs are erased. Erase any DTCs that are found.** 8. With the DRB, erase all DTCs. Perform 5 ignition key cycles leaving the key on for at least 90 seconds per cycle. 9. With the DRB, read the SKIM DTCs. Are there any SKIM DTCs? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

TIRE PRESSURE VERIFICATION TEST	APPLICABILITY
1. Perform the EVIC training as instructed in the System Description. 2. Using the DRBIII® or the EVIC RESET button, set the EVIC to Diagnostics mode (blank screen). **3. NOTE: Set the EVIC as follows:** 4. Press and hold the EVIC RESET button for five seconds (EVIC will beep). 5. Set the EVIC to display BLOCK COUNTERS. **6. NOTE: A vehicle graphic will display showing counters at wheel locations.** 7. Drive the vehicle at 40 km/h (25 mph) for at least 2 minutes. 8. Observe that the counters increment at least 3 sensor/transmitter receptions for each wheel. Can the EVIC be trained and do the counters show Sensor/Transmitter receptions? Yes → Repair is complete. No → Refer to Diagnosing System Faults in the Description and Operation for this system.	All

Verification Tests — Continued

VERIFICATION TEST -MEMORY SYSTEM	APPLICABILITY
1. Reconnect all previously disconnected components and connectors. 2. If any Memory/Heated Seat, or Driver's Door Module Trouble Codes are present, erase at this time. 3. If the Memory Seat Module was replaced, use the DRB III® and Reset Guard Bands. 4. With the Memory Switch on the Driver's Door, program the Driver's Seat #1 Button to a desired position and Driver #2 Button to a different position. 5. Remove the Ignition Key and close all Doors to allow the Body Control Module to time out (30 seconds). 6. Verify that both Memory positions can be recalled from the RKE transmitter and the Memory Switch on the Driver's Door. 7. Turn the ignition on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 8. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. Are any DTC's present or is the original complaint still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

VTSS VERIFICATION TEST - 1A	APPLICABILITY
1. Ensure all doors, hood, liftgate and liftgate flip-up are closed. 2. Open the driver's door. 3. Remove the ignition key (but keep in hand). 4. Lower the driver door window and lock the doors with RKE transmitter. 5. Close the driver's door. 6. Observe the VTSS Indicator. 7. The VTSS Indicator will flash rapidly for approximately 15 seconds and then begin to flash slowly. The VTSS indicator not performing as described, indicates a system fault. Refer to symptom list for problems related to THEFT ALARM WILL NOT ARM. 8. Perform a system test on the VTSS by duplicating the original complaint. 9. Disarm the system and with the DRBIII®, read DTC's. 10. If the original complaint is corrected and there are no DTC's the repair is complete. Are any DTC's present or is the original complaint still present? Yes → Repair is not complete, refer to the appropriate symptom. Perform VTSS VERIFICATION TEST - 1A. No → Repair is complete.	All

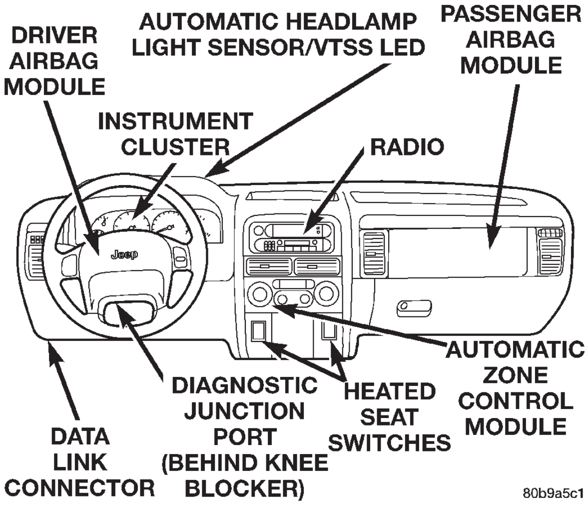
Verification Tests — Continued

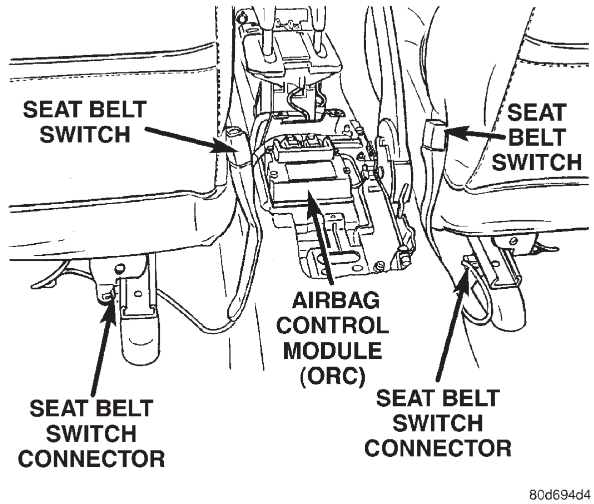
W5AJ400 TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. Connect the DRBIII® to the Data Link Connector. 2. Reconnect any disconnected components. 3. With the DRBIII®, erase DTC's. 4. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT above 43° Celsius 110° Fahrenheit. 5. Check the Transmission fluid and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure. 6. Road test the vehicle. Make fifteen to twenty 1-2, 2-3, and 3-4 upshifts. 7. Perform these shifts from a standing start to 72 Km/h 45 MPH with a constant throttle opening of 20 to 25 degrees. 8. Below 40 Km/h 25 MPH, make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 9. Check for DTC's during the road test. 10. use the actuate all solenoids command check the fault status ?????????????? Were any Trouble Codes set during the road test? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

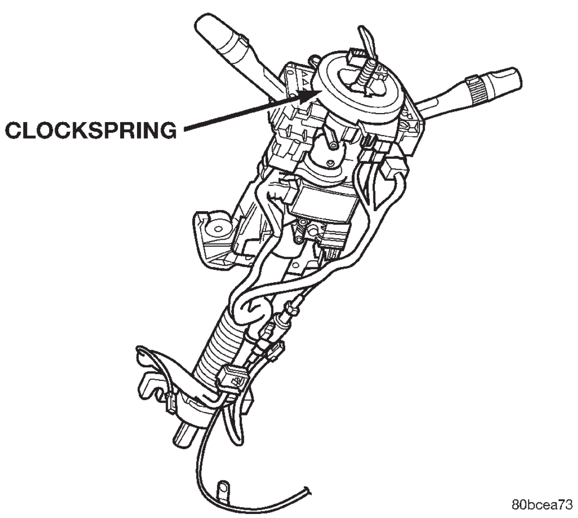
NOTES

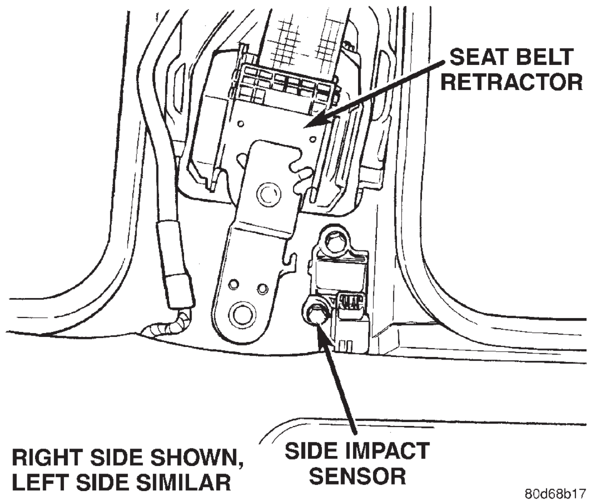
8.0 COMPONENT LOCATIONS

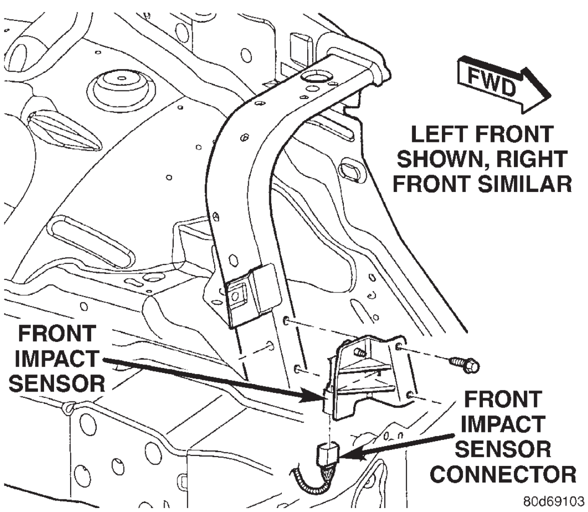
8.1 AIRBAG SYSTEM

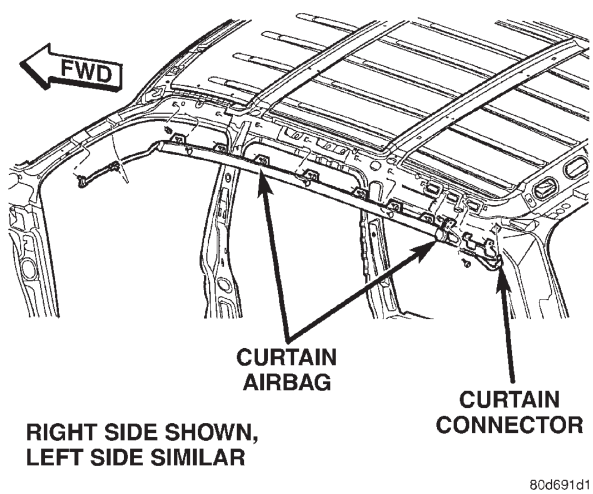




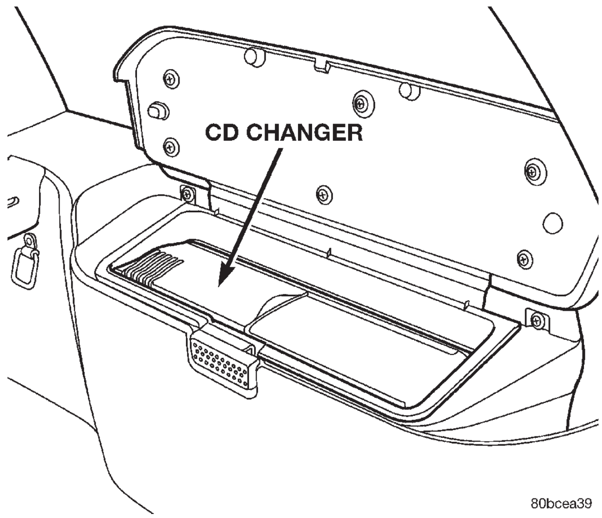


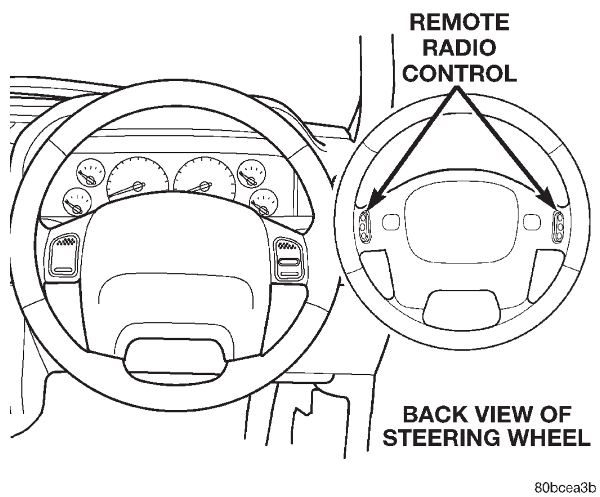


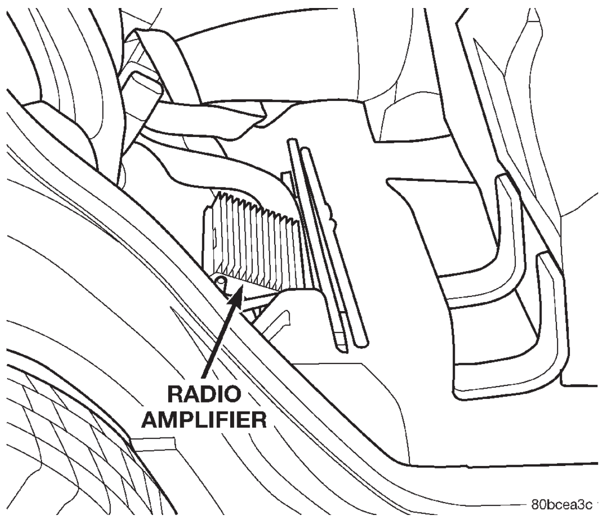




8.2 AUDIO SYSTEM

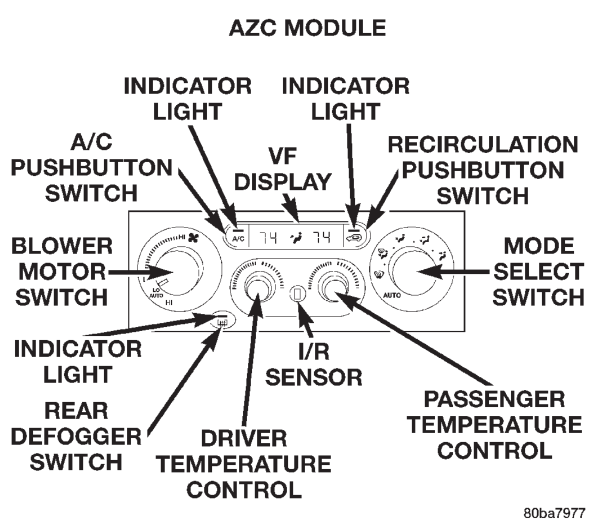




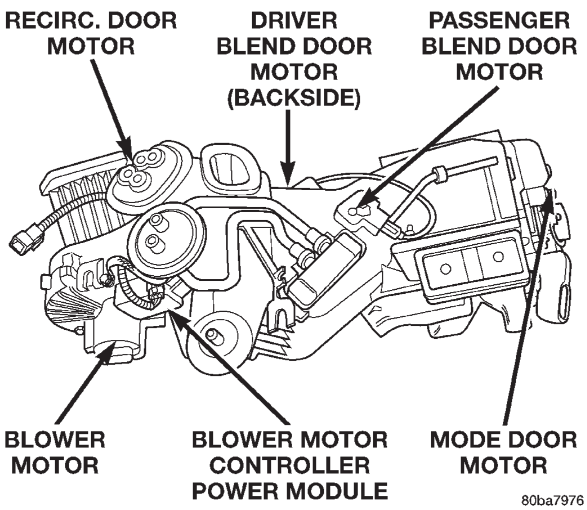


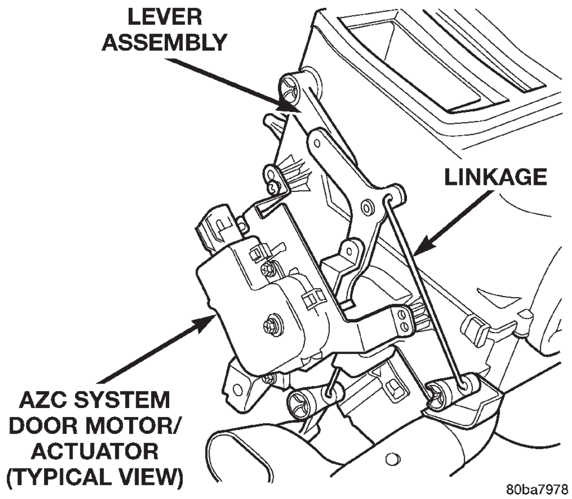
8.3 AUTOMATIC ZONE CONTROL (AZC)

8.3.1 AZC MODULE

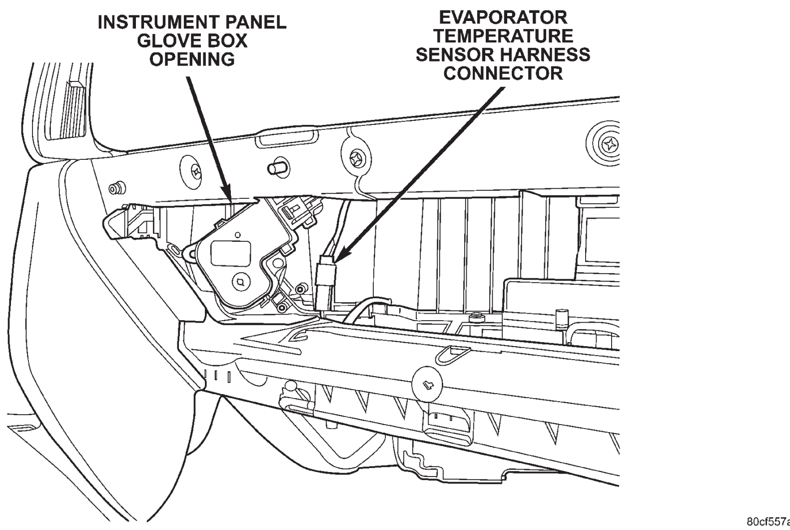


8.3.2 HVAC UNIT

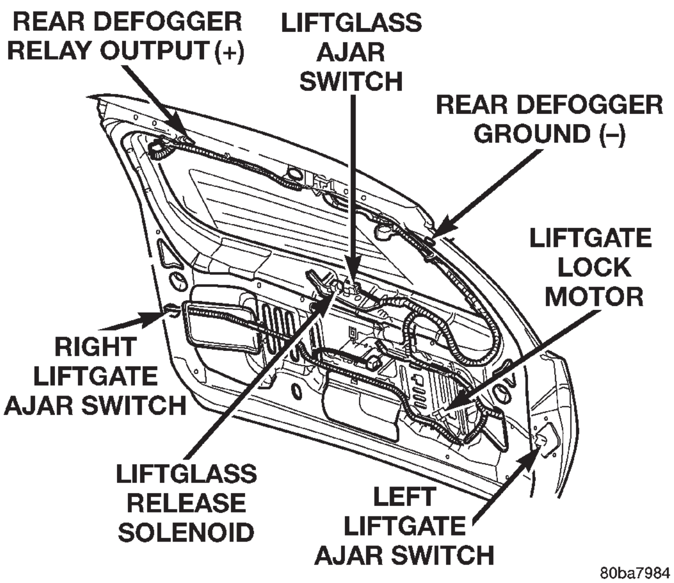




8.3.3 EVAPORATOR TEMPERATURE SENSOR

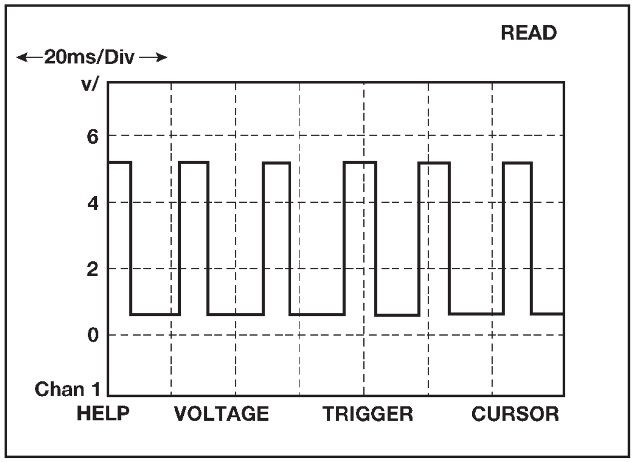


8.3.4 REAR WINDOW DEFOGGER



8.3 AUTOMATIC ZONE CONTROL (AZC) (Continued)

8.3.5 DRB III SCREEN, AZC MODULE BLOWER MOTOR CONTROLLER SIGNAL



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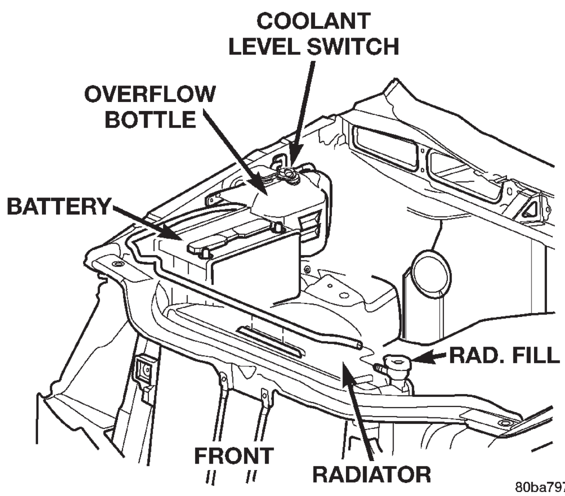
8.4 CHIME SYSTEM



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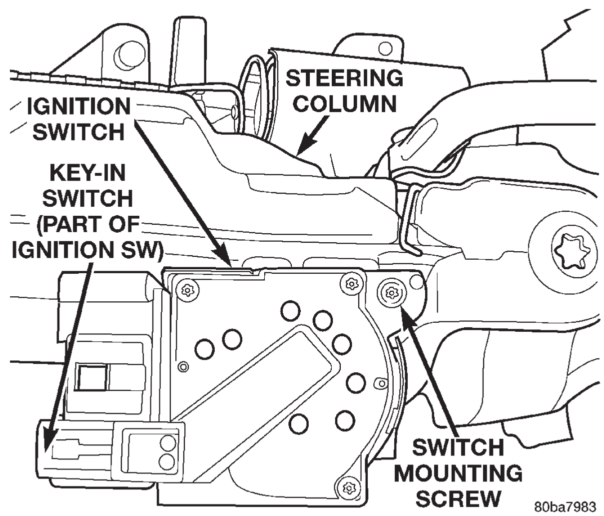

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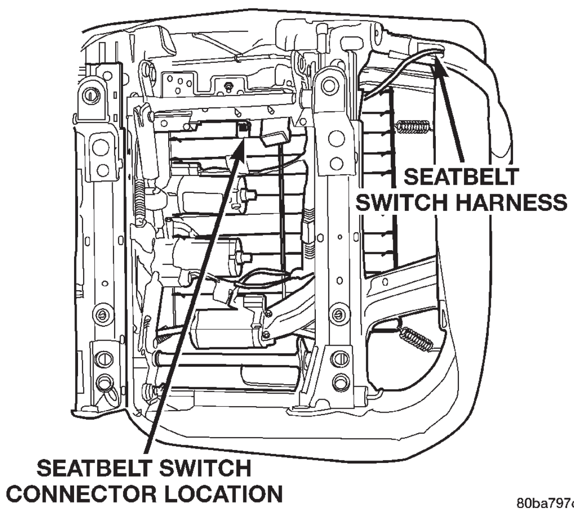

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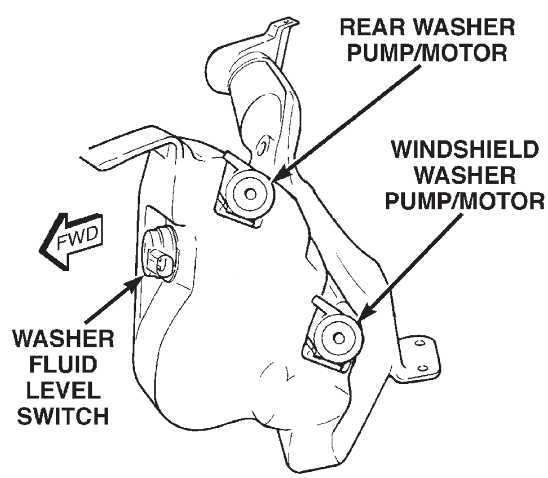

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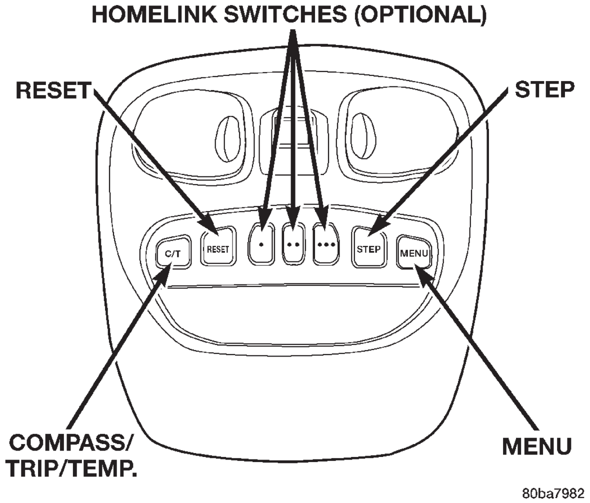
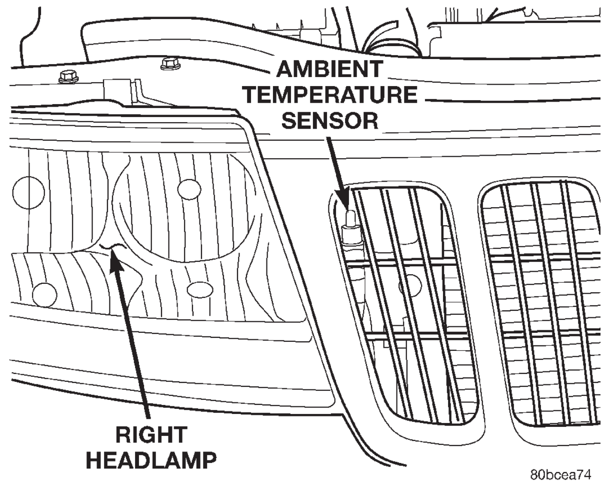
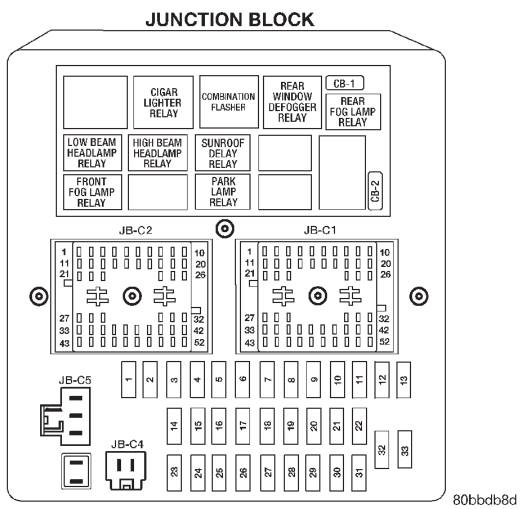
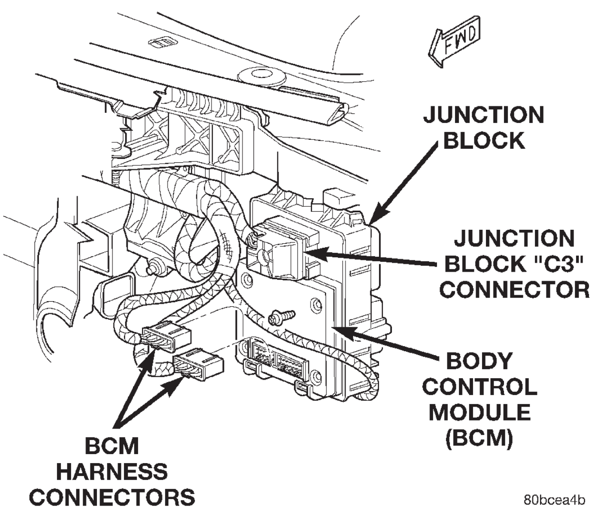
8.5 ELECTRONIC VEHICLE INFORMATION CENTER (EVIC)

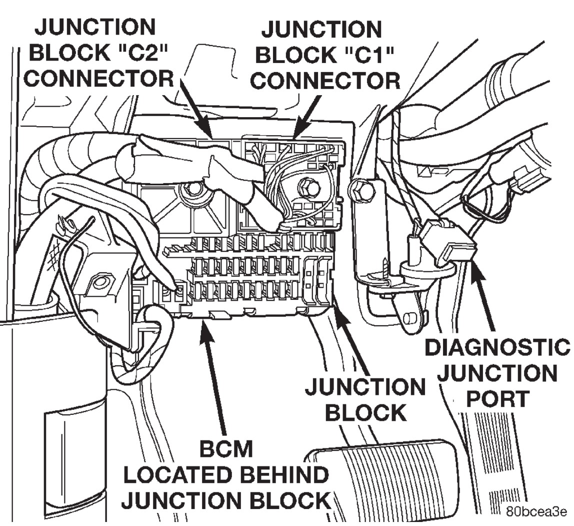




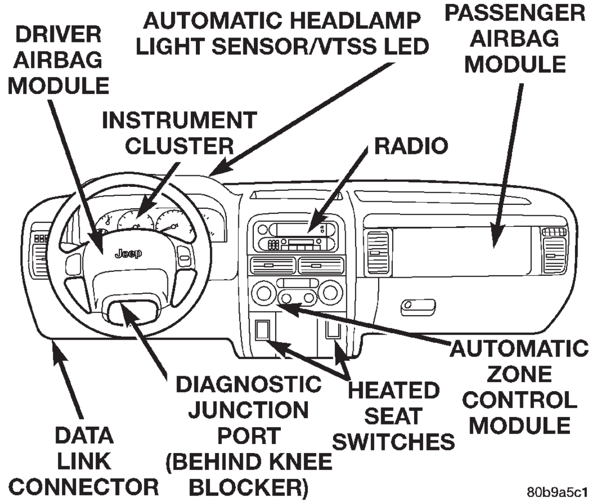
8.6 BODY CONTROL MODULE & JUNCTION BLOCK





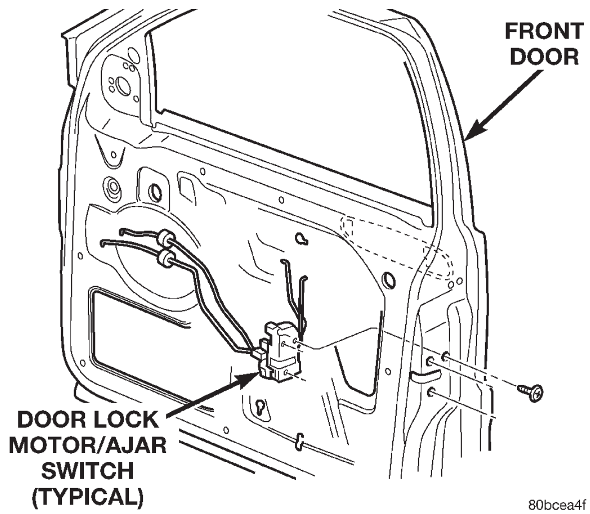


8.7 INSTRUMENT PANEL

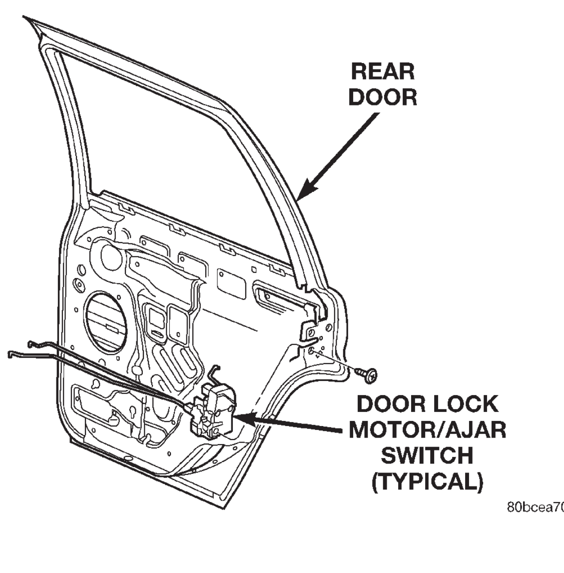


8.8 POWER DOOR LOCKS

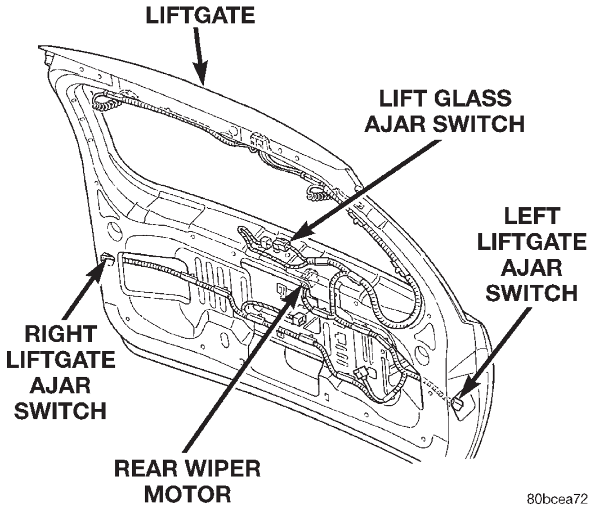
8.8.1 FRONT DOOR

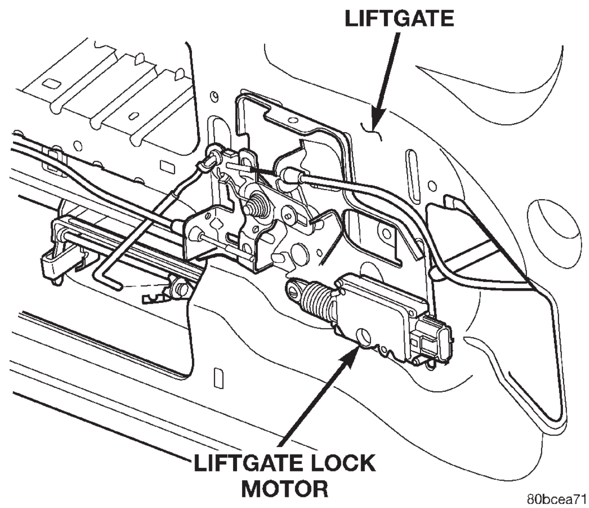


8.8.2 REAR DOOR

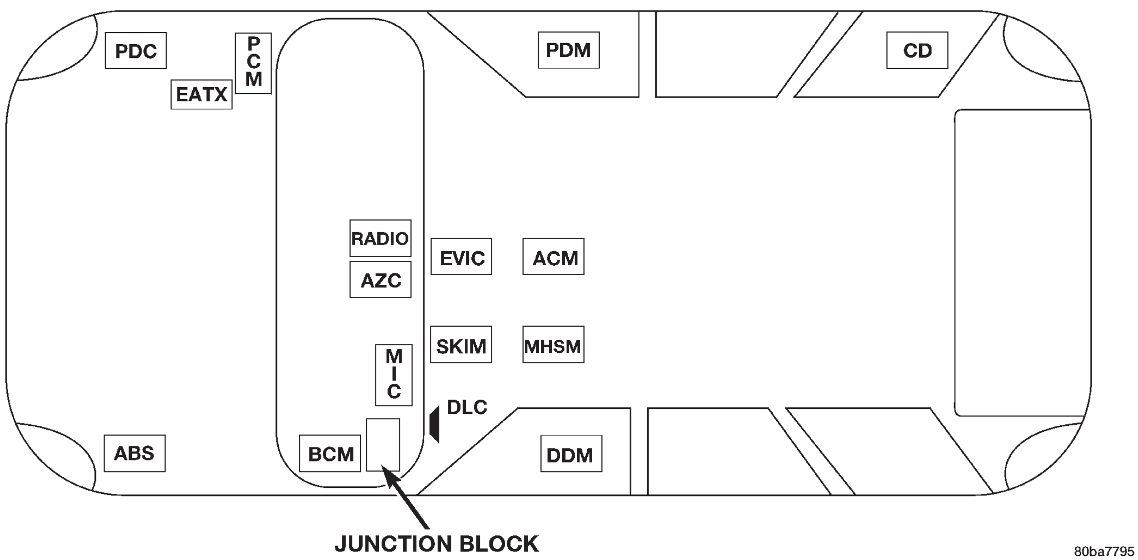


8.8.3 LIFTGATE

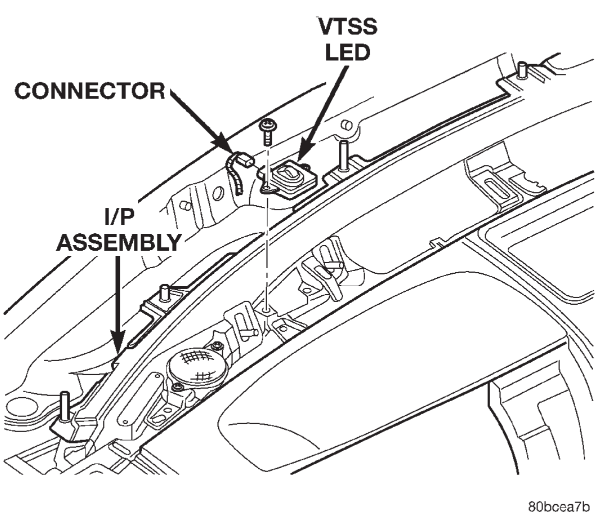


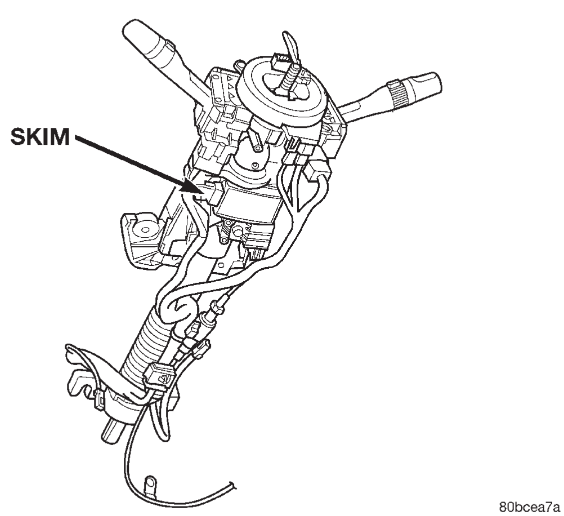


8.9 SYSTEM COMPONENT LOCATIONS

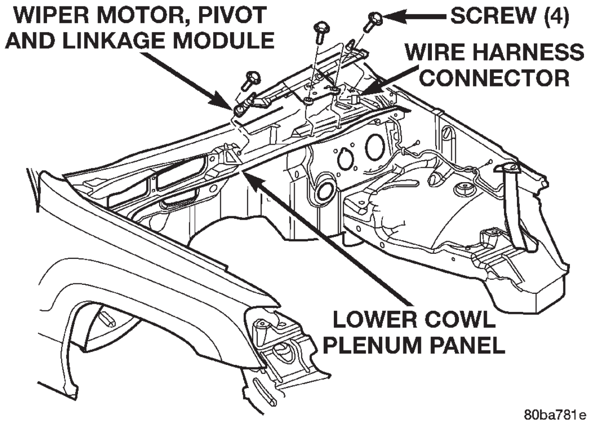


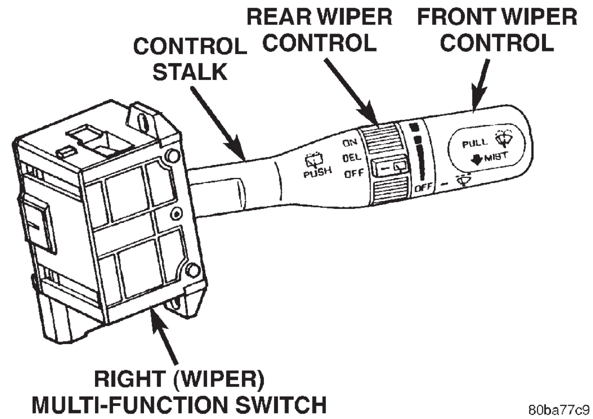
8.10 VEHICLE THEFT SECURITY SYSTEM (VTSS) & SKIS

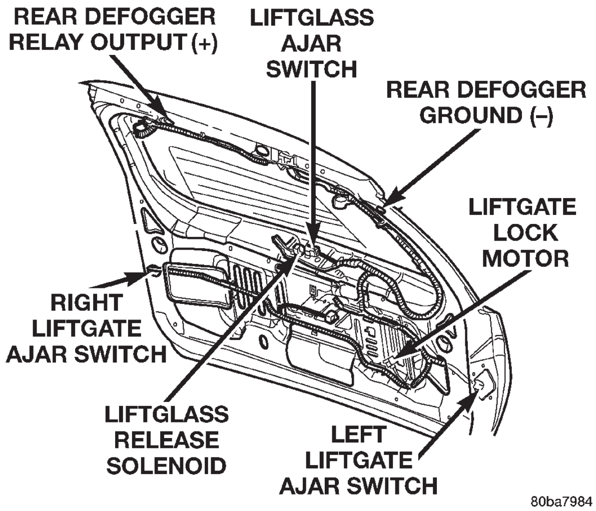


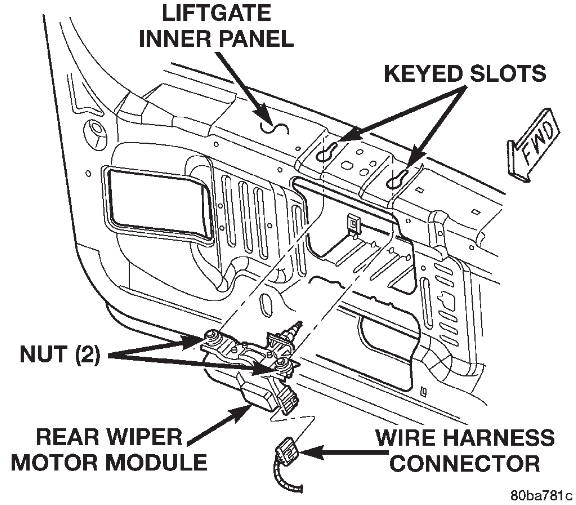


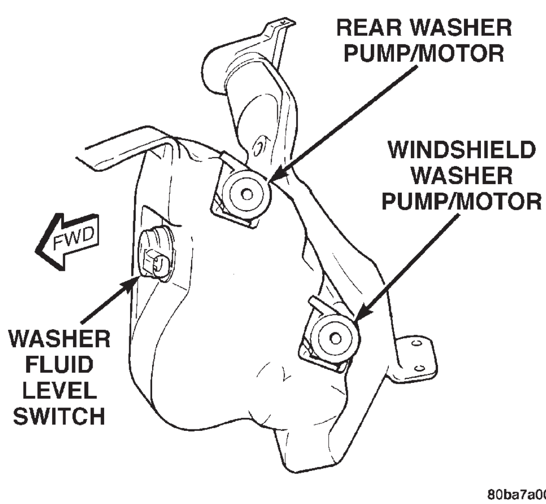
8.11 WIPER SYSTEM

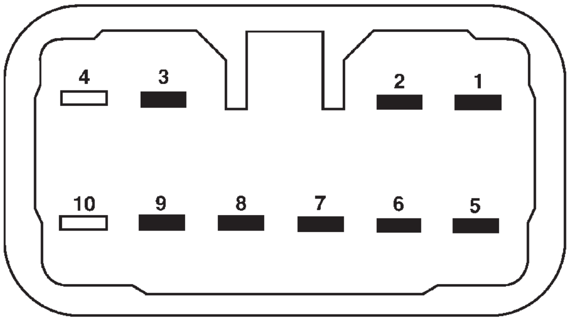












RIGHT (WIPER) MULTI-FUNCTION SWITCH			
FRONT WIPERS SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	—	Pins 7 & 8	4286-4379
Intermittent Wipe Position 1	—	Pins 7 & 8	1445-1480
Intermittent Wipe Position 2	—	Pins 7 & 8	847- 870
Intermittent Wipe Position 3	—	Pins 7 & 8	556- 573
Intermittent Wipe Position 4	—	Pins 7 & 8	367- 380
Intermittent Wipe Position 5	—	Pins 7 & 8	218-229
Low Speed	—	Pins 7 & 8	99-106
High Speed	Pins 1 & 9	Pins 7 & 8	99-106
Mist	—	Pins 7 & 8	49-56
Wash	Pins 1 & 3	—	—

REAR WIPER SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	—	—	—
Delay	Pins 1 & 6	—	—
On	Pins 1 & 5	—	—
Wash	Pins 1 & 5 & 6	—	—

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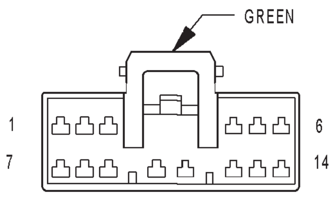
NOTES

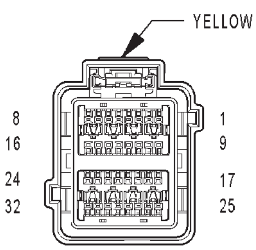
9.0 CONNECTOR PINOUTS



ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT)

ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT) - GREEN 14 WAY

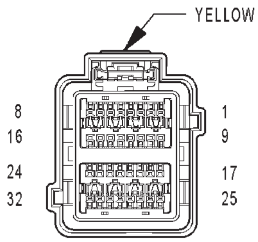
CAV	CIRCUIT	FUNCTION
1	Y151 20LG/BR	ADJUSTABLE PEDALS SWITCH SENSE (FORWARD)
2	Y152 20LG/OR	ADJUSTABLE PEDALS SWITCH SENSE (REARWARD)
3	Q110 16OR/VT	ADJUSTABLE PEDALS MOTOR (FORWARD)
4	F72 16RD/YL	FUSED B(+)
5	-	-
6	Q111 16OR/GY	ADJUSTABLE PEDALS MOTOR (REARWARD)
7	Q113 20OR/DB (MEMORY)	PEDAL POSITION SENSOR FEED
8	Q112 20OR/YL (MEMORY)	PEDAL POSITION SENSOR SENSE
9	Q114 20OR/TN (MEMORY)	PEDAL POSITION SENSOR RETURN
10	Z151 16BK	GROUND
11	Z155 20BK/OR	GROUND
12	L1 18WT/BR	BACK-UP LAMP FEED
13	D25 20VT/YL	PCI BUS
14	Y153 16DB/RD	ADJUSTABLE PEDALS SWITCH FEED



AIRBAG CONTROL MODULE C1 (ORC C1)

AIRBAG CONTROL MODULE C1 (ORC C1) - YELLOW 32 WAY

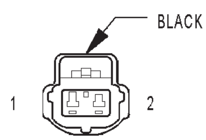
CAV	CIRCUIT	FUNCTION
1	R72 20LB/WT (SIDE AIR-BAGS)	PASSENGER CURTAIN SQUIB LINE 2
2	R74 20LB/YL (SIDE AIR-BAGS)	PASSENGER CURTAIN SQUIB LINE 1
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-
9	R58 20GY	PASSENGER SEAT BELT SWITCH SENSE
10	R60 20VT	PASSENGER SEAT BELT SWITCH GROUND
11	-	-
12	-	-
13	-	-
14	-	-
15	R132 20LG/VT (SIDE AIR-BAGS)	PASSENGER SIDE IMPACT SENSOR SIGNAL
16	R134 20LB/BR (SIDE AIR-BAGS)	PASSENGER SIDE IMPACT SENSOR GROUND
17	R131 20LG/YL (SIDE AIR-BAGS)	DRIVER SIDE IMPACT SENSOR SIGNAL
18	R133 20LB/DG (SIDE AIR-BAGS)	DRIVER SIDE IMPACT SENSOR GROUND
19	-	-
20	-	-
21	-	-
22	-	-
23	R59 20LB	DRIVER SEAT BELT SWITCH GROUND
24	R57 20DG	DRIVER SEAT BELT SWITCH SENSE
25	R73 20LB/BR (SIDE AIR-BAGS)	DRIVER CURTAIN SQUIB LINE 2
26	R75 20LB/OR (SIDE AIR-BAGS)	DRIVER CURTAIN SQUIB LINE 1
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-



AIRBAG CONTROL MODULE C2 (ORC C2)

AIRBAG CONTROL MODULE C2 (ORC C2) - YELLOW 32 WAY

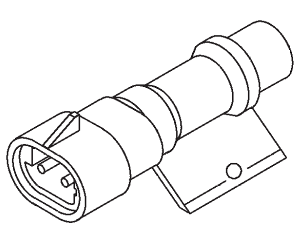
CAV	CIRCUIT	FUNCTION
1	R45 20DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 20BK/LB	DRIVER SQUIB 1 LINE 1
3	R42 20BK/YL	PASSENGER SQUIB 1 LINE 1
4	R44 20DG/YL	PASSENGER SQUIB 1 LINE 2
5	-	-
6	-	-
7	-	-
8	-	-
9	R49 20LB	LEFT FRONT IMPACT SENSOR SIGNAL
10	R47 20DB/LB	LEFT FRONT IMPACT SENSOR GROUND
11	R46 20BR/LB	RIGHT FRONT IMPACT SENSOR GROUND
12	R48 20TN	RIGHT FRONT IMPACT SENSOR SIGNAL
13	-	-
14	-	-
15	-	-
16	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
17	Z6 20BK/PK	GROUND
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	D25 20YL/VT/OR	PCI BUS
24	F14 20LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
25	R63 20TN/LB	DRIVER SQUIB 2 LINE 2
26	R61 20OR/LB	DRIVER SQUIB 2 LINE 1
27	R62 20OR/YL	PASSENGER SQUIB 2 LINE 2
28	R64 20TN/YL	PASSENGER SQUIB 2 LINE 1
29	-	-
30	-	-
31	-	-
32	-	-



AMBIENT TEMPERATURE SENSOR

AMBIENT TEMPERATURE SENSOR - BLACK 2 WAY

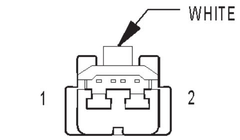
CAV	CIRCUIT	FUNCTION
1	G32 20BK/LB	AMBIENT TEMPERATURE SENSOR RETURN
2	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL



AMBIENT TEMPERATURE SENSOR (SENSOR SIDE)

AMBIENT TEMPERATURE SENSOR (SENSOR SIDE)

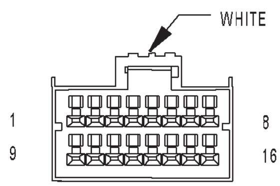
CAV	CIRCUIT	FUNCTION
1	-	AMBIENT TEMPERATURE SENSOR SIGNAL
2	-	SENSOR GROUND



ANTENNA MODULE (BUILT-UP-EXPORT)

ANTENNA MODULE (BUILT-UP-EXPORT) - WHITE 2 WAY

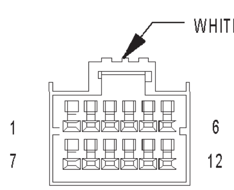
CAV	CIRCUIT	FUNCTION
1	X64 18BK/WT	ENABLE SIGNAL TO AMPLIFIER
2	-	-



AUTOMATIC ZONE CONTROL MODULE C1 (AZC)

AUTOMATIC ZONE CONTROL MODULE C1 (AZC) - WHITE 16 WAY

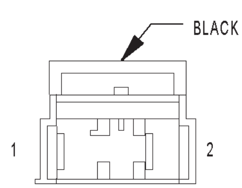
CAV	CIRCUIT	FUNCTION
1	C102 20TN/BK	MODE DOOR DRIVER (B)
2	-	-
3	C32 20GY/DB	RECIRCULATION DOOR DRIVER (A)
4	C100 20YL/DB	RECIRCULATION DOOR DRIVER (B)
5	-	-
6	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
7	-	-
8	Z118 20BK	GROUND
9	C35 20DG/YL	MODE DOOR DRIVER (A)
10	C33 20DB/RD	DRIVER BLEND DOOR DRIVER (A)
11	-	-
12	-	-
13	-	-
14	C81 20LB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
15	-	-
16	-	-



AUTOMATIC ZONE CONTROL MODULE C2 (AZC)

AUTOMATIC ZONE CONTROL MODULE C2 (AZC) - WHITE 12 WAY

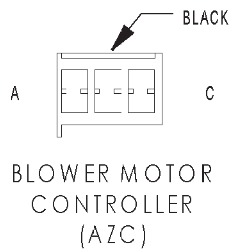
CAV	CIRCUIT	FUNCTION
1	-	-
2	C94 20WT/DG	PASSENGER BLEND DOOR DRIVER (A)
3	C95 20WT/BK	DRIVER BLEND DOOR DRIVER (B)
4	C96 20WT/DB	PASSENGER BLEND DOOR DRIVER (B)
5	-	-
6	E2 20OR	PANEL LAMPS DRIVER
7	C56 20RD/LG	BLOWER MOTOR CONTROL
8	D25 20YL/VT/DG	PCI BUS
9	C103 20DG	A/C SWITCH SIGNAL
10	-	-
11	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
12	M1 20PK	FUSED B(+)



BLOWER MOTOR

BLOWER MOTOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	C1 12DG	BLOWER MOTOR SUPPLY
2	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER

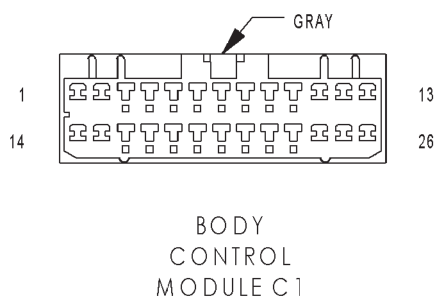


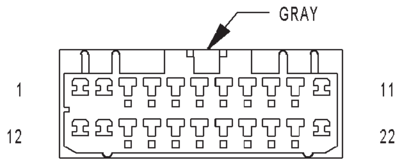
BLOWER MOTOR CONTROLLER (AZC) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
A	Z118 12BK	GROUND
B	C56 20RD/LG	BLOWER MOTOR CONTROL
C	C1 12DG	BLOWER MOTOR SUPPLY

BODY CONTROL MODULE C1 - GRAY 26 WAY

CAV	CIRCUIT	FUNCTION
1	Z132 20BK/OR	GROUND
2	G52 20YL	HEADLAMP SWITCH MUX
3	E19 20RD	PANEL LAMPS DIMMER SIGNAL
4	-	-
5	G70 20BR/TN (BUILT-UP-EXPORT LHD RHD)	HOOD AJAR SWITCH SENSE
6	G26 20LB	KEY-IN IGNITION SWITCH SENSE
7	G76 18TN/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
8	E2 20OR	PANEL LAMPS DRIVER
9	E2 20OR	PANEL LAMPS DRIVER
10	E2 20OR	PANEL LAMPS DRIVER
11	-	-
12	E2 20OR	PANEL LAMPS DRIVER
13	E2 20OR	PANEL LAMPS DRIVER
14	Z132 20BK/OR	GROUND
15	D25 20YL/VT/WT	PCI BUS
16	L80 20WT/DG	HEADLAMP SWITCH RETURN
17	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
18	-	-
19	-	-
20	G69 20BK/OR	VTSS INDICATOR DRIVER
21	-	-
22	V14 20RD/VT	WIPER ON/OFF RELAY CONTROL
23	M20 20BR/OR	COURTESY LAMP LOAD SHED
24	M2 20YL	COURTESY LAMP DRIVER
25	Z234 20BK	GROUND
26	-	-

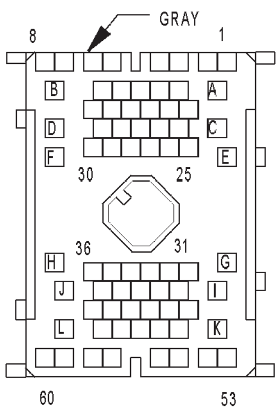




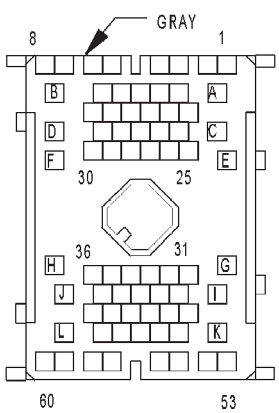
BODY
CONTROL
MODULE C2

BODY CONTROL MODULE C2 - GRAY 22 WAY

CAV	CIRCUIT	FUNCTION
1	C103 20DG	A/C SWITCH SIGNAL
2	V10 20BR	WASHER PUMP SWITCH SENSE
3	V48 20RD/GY	WIPER HIGH CONTROL
4	L40 20BR	HIGH BEAM SWITCH SENSE
5	V11 20BK/TN	WASHER FLUID SWITCH SENSE
6	P134 20TN/LG	PASSENGER SEAT HEATER SWITCH MUX
7	P133 20TN/DG	DRIVER SEAT HEATER SWITCH MUX
8	X20 20RD/YL	RADIO CONTROL MUX
9	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
10	L109 20WT	ULTRALIGHT SENSOR SIGNAL
11	V52 20DG/RD	WINDSHIELD WIPER SWITCH MUX
12	C81 20LB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
13	-	-
14	-	-
15	L27 20WT/TN	FOG LAMP SWITCH SENSE
16	C201 20LB/YL	EVAPORATOR TEMPERATURE SENSOR SIGNAL
17	G18 20PK/BK	COOLANT LEVEL SWITCH SENSE
18	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND
19	X10 20RD/BK	RADIO CONTROL MUX RETURN
20	G32 20BK/LB	SENSOR GROUND
21	L110 20BK/YL	ULTRALIGHT SENSOR RETURN
22	V9 20WT/BK	WINDSHIELD WIPER SWITCH RETURN



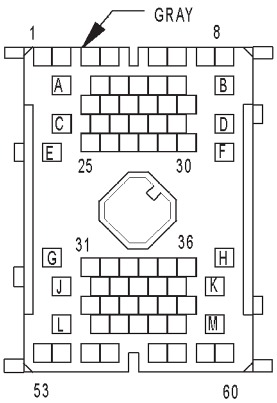
C106
(RHD)
(DIESEL)



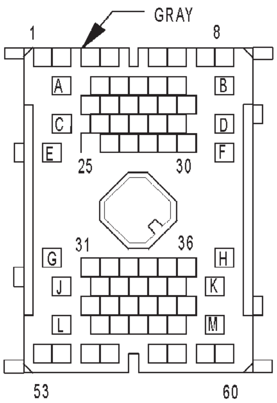
C106
(LHD)
(DIESEL)

C106 (DIESEL) - GRAY (BODY SIDE)

CAV	CIRCUIT
1	F15 20DB/WT
2	-
3	G31 20VT/LG
4	G32 20DB/OR (RHD)
4	G32 20BK/LB (LHD)
5	G18 20PK/BK
6	-
7	-
8	F12 20DB/WT (LHD)
9	-
10	Z231 18BK (RHD)
11	K4 20BK/LB (LHD)
11	G9 18GY/BK (RHD)
12	K6 18VT/WT (LHD)
13	-
14	-
15	-
16	K173 18LG
17	-
18	X2 18DG/RD
19	C18 18DB (LHD)
20	Y42 18OR/DB
21	-
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	-
40	-
41	-
42	R46 20BR/LB
43	R48 20TN
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	L7 20BK/YL
54	L60 20TN
55	-
56	-
57	L39 20LB
58	-
59	L44 18VT/RD
60	L34 18RD/OR
A	B10 14BR/WT (LHD)
B	-
C	-
D	-
E	-
F	-
G	-
H	-
J	-
K	-
L	-
M	B29 14DG/OR



C106
(RHD)
(DIESEL)

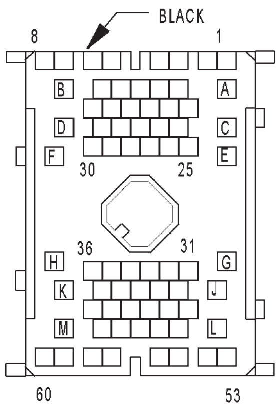


C106
(LHD)
(DIESEL)

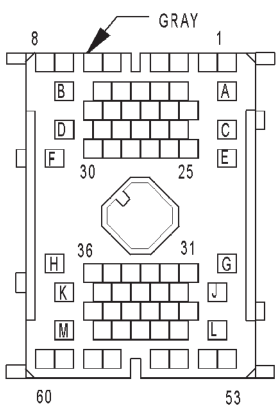
C106 (DIESEL) - GRAY (RIGHT HEADLAMP AND DASH SIDE)

CAV	CIRCUIT
1	F15 18DB/WT
2	-
3	G31 20VT/LG
4	G32 20BK/LB
5	G18 20PK/BK
6	-
7	-
8	-
9	-
10	Z231 18BK (RHD)
11	K4 18BK/LB (LHD)
11	G9 18GY/BK (RHD)
12	K6 18VT/WT (LHD)
13	-
14	-
15	-
16	K173 18LG
17	-
18	X2 18DG/RD
19	C18 18DB (LHD)
20	Y42 18OR/DB
21	-
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-
38	L13 18BR/YL
39	-
40	-
41	-
42	R46 18BR/LB
43	R47 18TN
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	L7 20BK/YL
54	L60 20TN
55	-
56	-
57	L39 20LB
58	-
59	L44 18VT/RD
60	L34 18RD/OR
A	-
B	-
C	-
D	-
E	-
F	-
G	-
H	-
J	-
K	-
L	-
M	-

CONNECTOR PINOUTS



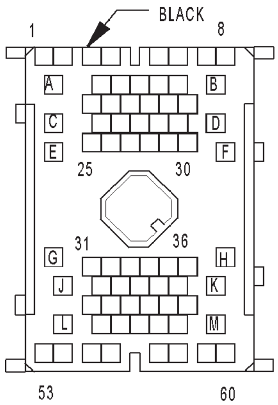
C106
(LHD GAS)



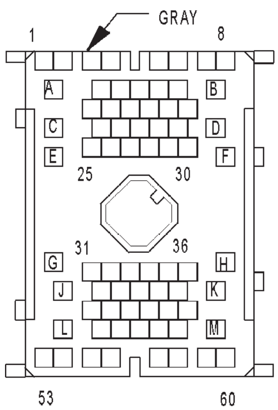
C106
(RHD GAS)

C106 (GAS) - GRAY/RHD BLACK/LHD (BODY SIDE)

CAV	CIRCUIT
1	A141 16DG/BK
2	G18 20PK/BK (LHD)
2	F42 18DG/LG (RHD)
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	F22 18WT/TN (RHD)
7	F22 20WT/PK (LHD)
8	F12 20DB/WT
9	K52 20PK/BK (LHD)
10	K29 20WT/PK (LHD)
10	Z231 18BK (RHD)
11	K512 18LB (RHD)
11	K226 20LB/YL (LHD)
12	K107 20OR/YL (LHD)
13	K251 18LB (RHD)
13	K106 20WT/DG (LHD)
14	T41 18BK/WT (LHD)
14	C13 20DB/OR (RHD)
15	V35 20LG/RD (RHD)
16	V36 20TN/RD (RHD)
17	G9 18GY/BK (RHD)
18	K25 18VT/LG (RHD)
19	K51 20DB/YL (RHD)
20	K125 18WT/DB (LHD)
21	K125 18WT/DB (RHD)
22	K31 18BR (RHD)
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	X3 22GY/OR (LHD)
27	X3 22BK/RD (RHD)
28	G32 20BK/LB (LHD)
28	G32 20DB/OR (RHD)
29	-
30	G31 20VT/LG
31	-
32	V32 22OR/DG (LHD)
33	V30 22DB/RD
34	V16 22VT
35	V14 22RD/VT
36	-
37	F45 20YL/RD
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	-
40	Z306 20BK/LG
41	Z305 20BK/OR
42	R46 20BR/LB
43	R48 20TN
44	F991 20OR/DB
45	B22 18DG/YL (LHD)
46	-
47	-
48	D25 18YL/VT
49	D21 20PK
50	D20 20LG
51	D32 20LG/DG (LHD)
52	T41 18BK/WT (RHD)
52	T6 18OR/BK (LHD)
53	L7 20BK/YL
54	L60 20TN
55	G18 20PK/BK (RHD)
55	V37 22RD/LG (LHD)
56	L1 18VT/BK
57	L39 20LB
58	K4 18BK/LB (LHD)
58	K4 20BK/LB (RHD)
59	L44 18VT/RD
60	L34 18RD/OR
A	A149 12RD/TN
B	A148 16LG/RD
C	C1 12DG
D	-
E	A10 12RD/DG (LHD)
E	A10 10RD/DG (RHD)
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	A20 14RD/DB



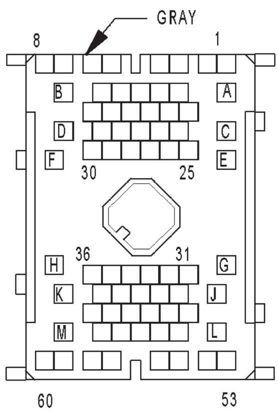
C106
(LHD GAS)



C106
(RHD GAS)

C106 (GAS) - GRAY/RHD BLACK/LHD (RIGHT HEADLAMP AND DASH SIDE)

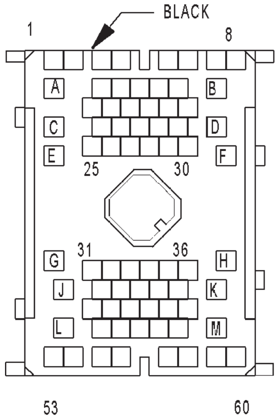
CAV	CIRCUIT
1	A141 16DG/BK (RHD)
1	A141 16DG/WT (LHD)
2	F42 18DG/LG (RHD)
2	G18 18PK/BK (LHD)
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	F22 18WT/TN (4.7L RHD)
7	F22 20WT/PK (EXCEPT 4.7L RHD)
8	F12 18DB/WT
9	K52 18PK/BK (LHD)
10	K29 18WT/PK (LHD)
10	Z231 18BK (RHD)
11	K226 18LB/YL (LHD)
11	K512 18RD/YL (4.7L RHD)
12	K107 18OR/PK (EXCEPT BUILT-UP-EXPORT)
13	K106 18WT/DG (EXCEPT BUILT-UP-EXPORT)
14	C13 18DB/OR (RHD)
14	T41 18BK/WT (LHD)
15	V35 20LG/RD (RHD)
16	V36 20TN/RD (RHD)
17	G9 18GY/BK (RHD)
18	K25 18VT/LG (RHD)
19	K51 18DB/YL (RHD)
20	K125 18WT/DB (EXCEPT BUILT-UP-EXPORT)
21	K125 18WT/DB (RHD)
22	K31 18BR (RHD)
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	X3 20BK/RD
28	G32 20BK/LB
29	-
30	G31 20VT/LG
31	-
32	V32 18OR/DG (LHD)
33	V30 20DB/RD
34	V16 20VT
35	V14 20RD/VT
36	-
37	F45 18YL/RD (LHD/4.7L RHD)
37	F45 20YL/RD (RHD)
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	-
40	Z306 20BK/LG
41	Z305 20BK/OR
42	R46 18BR/LB
43	R48 18TN
44	F991 20OR/DB
45	B22 18DG/YL (LHD)
46	-
47	-
48	D25 18VT/YL (LHD/4.7L RHD)
49	D21 18PK (4.0L LHD/4.7L RHD)
49	D21 20PK (4.7L LHD)
50	D20 20LG (4.7L LHD)
50	D20 18LG (4.7L RHD)
51	D32 18LG (EXCEPT BUILT-UP-EXPORT)
51	D32 18LG/DG (LHD BUILT-UP-EXPORT)
52	T41 18BK/WT (RHD)
52	T6 18OR/WT (LHD)
53	L7 20BK/YL
54	L60 20TN
55	G18 20PK/BK (RHD)
55	V37 18RD/LG (LHD)
56	L1 18VT/BK
57	L39 20LB
58	K4 18BK/LB (LHD)
58	K4 20BK/LB (RHD)
59	L44 18VT/RD
60	L34 18RD/OR
A	A149 12RD/TN
B	A148 16LG/RD
C	C1 12DG
D	-
E	A10 12RD/DG
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	A20 12RD/DB 2



C107
(DIESEL)

C107 (DIESEL) - GRAY (BODY SIDE)

CAV	CIRCUIT
1	X2 18DG/RD
2	V11 20BK/TN
3	K4 20BK/LB
4	V37 22RD/LG (LHD)
4	V37 20RD/LG (RHD)
5	V55 16TN/RD
6	V6 16DB
7	V10 22BR (LHD)
7	V10 20BR (RHD)
8	-
9	K226 18LB/YL (LHD)
9	K226 20LB/YL (RHD)
10	X3 22GY/OR (LHD)
10	X3 22BK/RD (RHD)
11	F15 20DB/WT
12	F45 20YL/RD
13	T41 18BK/WT
14	-
15	G70 20BR/TN
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	-
20	-
21	F991 20OR/DB
22	-
23	X75 20GY/LG
24	Y42 18OR/DB
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18WT/TN (RHD)
34	L50 18VT/TN (LHD)
35	R47 20DB/LB
36	T2 18TN/BK
37	Z305 20BK/OR
38	Z306 20BK/LG
39	R49 20LB
40	K29 18WT/PK
41	C18 20DB (LHD)
42	-
43	K6 18VT/WT (LHD)
44	-
45	V16 22VT
46	V14 22RD/VT
47	L13 18BR/YL
48	D25 18YL/VT
49	D21 20PK
50	K173 18LG
51	-
52	-
53	L7 20BK/YL
54	L61 20TN/LG
55	L1 18VT/BK
56	V20 18BK/WT (LHD)
56	V20 20BK/WT (RHD)
57	L39 20LB
58	F22 20WT/PK (LHD)
58	F22 18WT/TN (RHD)
59	L43 18VT
60	L33 18RD
A	B10 14BR/WT
B	A148 16LG/RD
C	C1 12DG
D	A149 12RD/TN
E	-
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	B29 14DG/OR



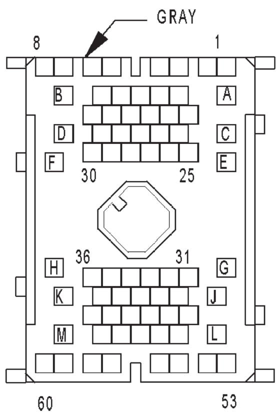
C107
(DIESEL)

C107 (DIESEL) - GRAY (LEFT HEADLAMP AND DASH SIDE)

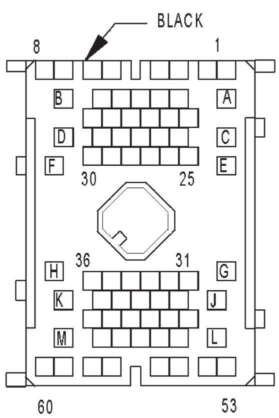
CAV	CIRCUIT
1	X2 18DG/RD
2	V11 20BK/TN
3	K4 18BK/LB
4	V37 18RD/LG
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR
8	-
9	K226 18DB/WT
10	X3 20BK/RD
11	F15 18DB/WT
12	F45 18YL/RD
13	T41 18BK/WT
14	-
15	G70 20BR/TN
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	-
20	-
21	F991 20OR/DB
22	-
23	X75 18GY/LB
24	Y42 18OR/DB
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 18PK
33	F20 18DB/PK
34	L50 18WT/TN
35	R47 18DB/LB
36	T2 18TN/BK
37	Z305 20BK/OR
38	Z306 20BK/LG
39	R49 18LB
40	K29 18WT/PK
41	C18 18DB (RHD)
42	-
43	K6 18VT/WT (RHD)
44	-
45	V16 20VT
46	V14 20RD/VT
47	L13 18BR/YL
48	D25 18VT/YL
49	D21 18PK
50	K173 18LG
51	-
52	-
53	L7 18BK/YL
54	L61 20LG
55	L1 18VT/BK
56	V20 18BK/WT
57	L39 20LB
58	F22 18WT/PK
59	L43 18VT
60	L33 18LG/BR
A	-
B	A148 16LG/RD
C	C1 12DG
D	A149 12RD/TN
E	-
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	-

C107 (GAS) - GRAY/RHD BLACK/LHD (BODY SIDE)

CAV	CIRCUIT
1	V37 20RD/LG (RHD)
2	V11 20BK/TN
3	V3 16BR/WT (GAS)
4	V4 16RD/YL (GAS)
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR (RHD)
7	V10 22BR (LHD)
8	F12 20DB/WT
9	K226 20LB/YL (RHD)
9	K52 20PK/BK (LHD)
10	L13 18BR/YL (BUILT-UP-EXPORT)
11	K512 18LB
12	K4 20BK/LB
13	-
14	T6 18OR/BK (RHD)
15	G70 20BR/TN (BUILT-UP-EXPORT)
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	D32 20LG/DG (RHD)
20	-
21	-
22	-
23	X75 20GY/LG (BUILT-UP-EXPORT)
24	F42 18DG/LG (RHD)
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18VT/TN (LHD)
34	L50 18WT/TN (RHD)
35	R47 20DB/LB (LHD)
36	-
37	K51 20DB/YL (RHD)
38	K25 18VT/LG (RHD)
39	K31 18BR (RHD)
39	R49 20DB (LHD)
40	K29 18WT/PK (RHD)
41	K125 18WT/DB (RHD)
42	V32 22OR/DG (RHD)
43	R47 20DB/LB (RHD)
44	V35 20LG/RD (RHD)
45	B22 18DG/YL (LHD)
45	V36 20TN/RD (RHD)
46	C13 20DB/OR (RHD)
47	L13 18BR/YL (RHD)
48	D25 18YL/VT
49	D21 20PK (RHD)
50	R49 20LB (RHD)
51	-
52	-
53	L7 20BK/YL
54	L61 20TN/LG
55	-
56	V20 18BK/WT (LHD)
56	V20 20BK/WT (RHD)
57	L39 20LB
58	-
59	L43 18VT
60	L33 18RD
A	-
B	-
C	-
D	-
E	A10 12RD/DG (LHD)
E	A10 10RD/DG (RHD)
F	-
G	-
H	-
J	-
K	-
L	-
M	A20 14RD/DB

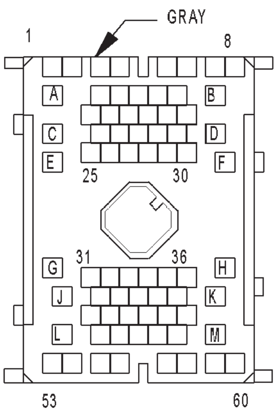


C107
(RHD)
(GAS)

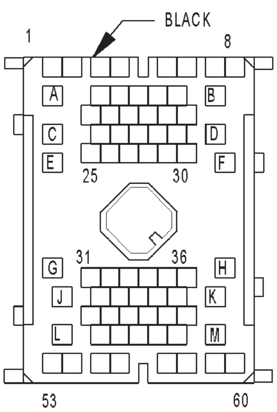


C107
(LHD)
(GAS)

CONNECTOR PINOUTS



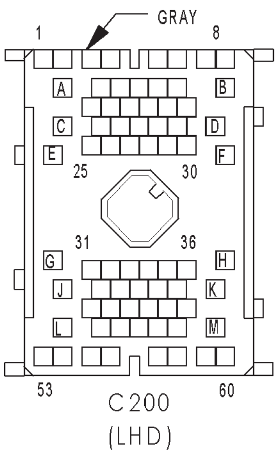
C107
(RHD)
(GAS)

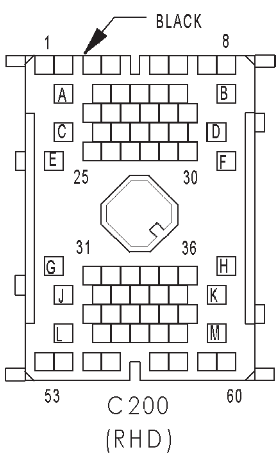


C107
(LHD)
(GAS)

C107 (GAS) - GRAY/RHD BLACK/LHD (LEFT HEADLAMP AND DASH SIDE)

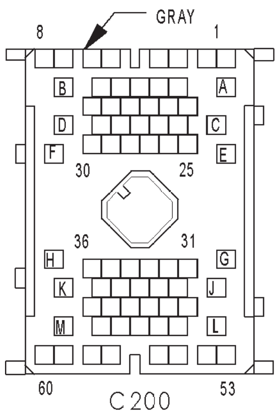
CAV	CIRCUIT
1	V37 18RD/LG (RHD)
2	V11 20BK/TN
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR
8	F12 20DB/WT
9	K52 20PK/BK (LHD)
9	K226 18LB/YL (RHD)
10	-
11	K512 18RD/YL (4.7L RHD)
12	K4 18BK/LB (RHD)
13	-
14	T6 18OR/BK (4.0L RHD)
14	T6 18OR/WT (4.7L RHD)
15	G70 20BR/TN (RHD)
16	G9 18GY/BK (RHD)
17	Z231 18BK (RHD)
18	-
19	D32 18LG/DG (RHD)
20	-
21	-
22	-
23	X75 18GY/LG (RHD)
24	F42 18DG/LG (RHD)
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD (LHD)
32	M1 18PK (RHD)
33	F20 18DB/PK
34	L50 18WT/TN
35	R47 18DB/LB (LHD)
36	-
37	K51 18DB/YL (RHD)
38	K25 18VT/LG (RHD)
39	R49 18LB (LHD)
39	K31 18BR (RHD)
40	K29 18WT/PK (RHD)
41	K125 18WT/DB (RHD)
42	V32 18OR/DG (RHD)
43	R47 18DB/LB (RHD)
44	V35 18LG/RD (RHD)
45	B22 18DG/YL (LHD)
45	V36 18TN/RD (RHD)
46	C13 18DB/OR (RHD)
47	L13 18BR/YL (RHD)
48	D25 18VT/YL
49	D21 18PK (RHD)
50	R49 18LB (RHD)
51	-
52	-
53	L7 20BK/YL
54	L61 20TN/LG
55	-
56	V20 18BK/WT
57	L39 20LB
58	-
59	L43 18VT
60	L33 18RD
A	-
B	-
C	-
D	-
E	A10 12RD/DG
F	-
G	-
H	-
J	-
K	-
L	-
M	A20 12RD/DB



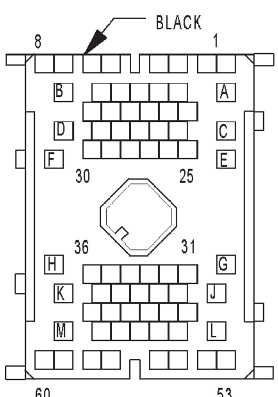


C200 - GRAY/LHD BLACK/RHD (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
1	X84 18OR/BK
2	X86 18OR/RD
3	X81 18YL/BK
4	X83 18YL/RD
5	X53 18DG/OR
6	X55 18BR/RD
7	X54 18VT
8	X56 18DB/PK
9	Y152 20LG/BR (EXCEPT BUILT-UP-EXPORT)
10	D20 20LG
11	Y151 20LG/BR (EXCEPT BUILT-UP-EXPORT)
12	Y153 20DB/RD (EXCEPT BUILT-UP-EXPORT)
13	X40 20WT/RD
14	D25 20YL/VT/GY
15	D25 20YL/VT/BR
16	D32 20LG/DG
17	T41 18BK/WT (DIESEL)
18	Z4 20WT/BK
19	X41 20WT/DG
20	T6 18OR/WT (GAS)
21	D21 20PK
22	K29 18WT/PK
23	X160 20YL
24	X112 20RD
25	-
26	-
27	G70 20BR/TN (BUILT-UP-EXPORT)
28	R47 20DB/LB
29	Z17 20BK
30	R49 20LB
31	G76 18TN/YL
32	T2 20TN/BK (DIESEL)
33	-
34	-
35	X51 18WT/DG
36	X57 18DG/WT
37	L7 18BK/YL (BUILT-UP-EXPORT)
38	L13 20BR/YL (BUILT-UP-EXPORT)
39	V10 20BR
40	X52 18DB/WT
41	X58 18DB/OR
42	-
43	V13 18BR/LG
44	V14 20RD/VT
45	-
46	V20 18BK/WT
47	V22 18BR/YL
48	R46 20BR/LB
49	X64 18BR/WT
50	Z305 20BK/OR
51	Z306 20BK/LG
52	R48 20TN
53	G32 20BK/LB
54	G31 20VT/LG
55	Z9 16BK
56	V11 20BK/TN
57	G18 20PK/BK
58	V37 20RD/LG
59	K4 20BK/LB
60	-
A	-
B	-
C	A1 12RD
D	-
E	-
F	-
G	A2 12PK/BK
H	C1 12DG
J	-
K	-
L	-
M	-



C200
(LHD)



C200
(RHD)

C200 - GRAY/LHD BLACK/RHD (LEFT BODY SIDE)

CAV	CIRCUIT
1	X56 18DB/PK (BASE)
1	X84 18OR/GY (EXCEPT BASE)
2	X86 18OR/RD (EXCEPT BASE)
2	X54 18VT (BASE)
3	X81 18YL/BK (EXCEPT BASE)
3	X55 18BR/RD (BASE)
4	X53 18DG/OR (BASE)
4	X83 18YL/RD (EXCEPT BASE)
5	X53 18DG/OR
6	X55 18BR/RD
7	X54 18VT
8	X56 18DB/PK
9	Y152 20LG/OR (EXCEPT BUILT-UP-EXPORT)
10	D20 20LG (GAS)
11	Y151 20LG/BR (EXCEPT BUILT-UP-EXPORT)
12	Y153 20DB/RD (EXCEPT BUILT-UP-EXPORT)
13	X40 20RD/WT (CD)
14	D25 20YL/VT
15	D25 20YL/VT
16	D32 20LG/DG (GAS)
17	T41 18BK/WT
18	Z4 20WT/BK (CD)
19	X41 20WT/DG (CD)
20	T6 18OR/BK (GAS)
21	D21 20PK (GAS)
22	K29 18WT/PK
23	X160 20YL (CD)
24	X112 20RD (CD)
25	-
26	-
27	G70 20BR/TN (BUILT-UP-EXPORT)
28	R47 20DB/LB
29	Z17 20BK (CD)
30	R49 20LB
31	G76 20TN/YL (RHD)
31	G76 18TN/YL (LHD)
32	T2 18TN/BK (DIESEL)
33	-
34	-
35	X51 18WT/DG
36	X57 18DG/WT
37	L7 18BK/YL (BUILT-UP-EXPORT)
38	L13 18BR/YL (BUILT-UP-EXPORT)
39	V10 22BR (LHD)
39	V10 20BR (RHD)
40	X52 18DB/WT
41	X58 18DB/OR
42	-
43	V13 18BR/LG
44	V14 22RD/VT
45	-
46	V20 20BK/WT (RHD)
46	V20 18BK/WT (LHD)
47	V22 18BR/YL
48	R46 20BR/LB (RHD)
48	R46 18BK/LB (LHD)
49	X64 18BR/WT
50	Z305 20BK/OR
51	Z306 20BK/LG
52	R48 20TN
53	G32 20BK/LG (LHD)
53	G32 20DB/OR (RHD)
54	G31 20VT/LG
55	Z9 16BK
56	V11 20BK/TN
57	G18 20PK/BK
58	V37 22RD/LG (LHD)
58	V37 20RD/LG (RHD)
59	K4 20BK/LB
60	-
A	-
B	-
C	A1 12RD
D	-
E	-
F	-
G	A2 12PK/BK
H	C1 12DG
J	-
K	-
L	-
M	-

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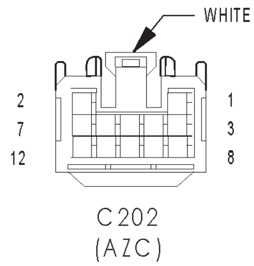
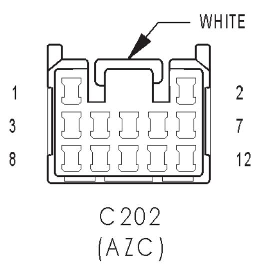


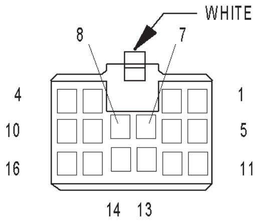
C202 (AZC) - WHITE (A/C SIDE)

CAV	CIRCUIT
1	C100 20YL/DB (RHD)
1	C32 20GY/DB (LHD)
2	C100 20YL/DB (LHD)
2	C32 20GY/DB (RHD)
3	C96 20WT/DB (RHD)
3	C33 20DB/RD (LHD)
4	C94 20WT/DG (RHD)
4	C95 20WT/BK (LHD)
5	C95 20WT/BK (RHD)
5	C94 20WT/DG (LHD)
6	C33 20DB/RD (RHD)
6	C96 20WT/DB (LHD)
7	C35 20DG/YL (RHD)
7	C102 20TN/BK (LHD)
8	C35 20DG/YL (LHD)
8	C102 20TN/BK (RHD)
9	C56 20RD/LG
10	-
11	C201 20LB/YL
12	G32 20BK/LB



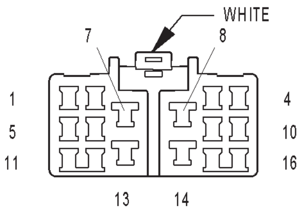
C202 (AZC) - WHITE (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
1	C100 20YL/DB (RHD)
1	C32 20GY/DB (LHD)
2	C100 20YL/DB (LHD)
2	C32 20GY/DB (RHD)
3	C96 20WT/DB (RHD)
3	C33 20DB/RD (LHD)
4	C94 20WT/DG (RHD)
4	C95 20WT/BK (LHD)
5	C95 20WT/BK (RHD)
5	C94 20WT/DG (LHD)
6	C33 20DB/RD (RHD)
6	C96 20WT/DB (LHD)
7	C35 20DG/YL (RHD)
7	C102 20TN/BK (LHD)
8	C35 20DG/YL (LHD)
8	C102 20TN/BK (RHD)
9	C56 20RD/LG
10	-
11	C201 20LB/YL
12	G32 20BK/LB



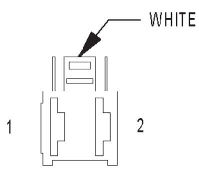
C202 (MTC) - WHITE (A/C SIDE)

CAV	CIRCUIT
1	-
2	C101 20LB/YL
3	G32 20BK/LB
4	-
5	C67 20RD/LB
6	-
7	-
8	-
9	-
10	C6 14LB
11	Z132 20BK/OR
12	F22 20WT/PK
13	C7 12BK/TN
14	C1 12DG
15	C4 16TN
16	C5 16LG



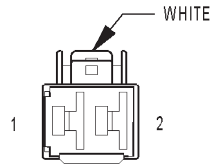
C202 (MTC) - WHITE (INSTRUMENT PANEL SIDE)

CAV	CIRCUIT
1	-
2	C201 20LB/YL
3	G32 20BK/LB
4	-
5	C67 20RD/LB
6	-
7	-
8	-
9	-
10	C6 14LB
11	Z132 20BK/OR
12	F22 20WT/PK
13	C7 12BK/TN
14	C1 12DG
15	C4 16TN
16	C5 16LG



C203 (AZC) - WHITE (A/C SIDE)

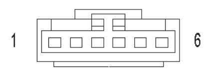
CAV	CIRCUIT
1	Z118 12BK
2	C1 12DG



C203
(AZC)

C203 (AZC) - WHITE (INSTRUMENT PANEL SIDE)

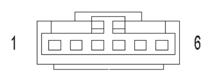
CAV	CIRCUIT
1	Z118 12BK
2	C1 12DG



C317

C317 - (INTRUSION TRANSCEIVER MODULE SIDE)

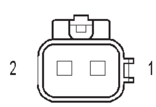
CAV	CIRCUIT
1	Z155 20BK
2	-
3	X75 20GY/LG
4	-
5	D25 20YL/VT
6	F70 20PK



C317

C317 - (OVERHEAD SIDE)

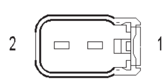
CAV	CIRCUIT
1	Z155 20BK/OR
2	-
3	X75 20GY/LG
4	-
5	D25 20YL/VT
6	F70 20PK



C318

C318 - (LEFT BODY SIDE (LHD)/ RIGHT BODY SIDE (RHD))

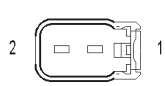
CAV	CIRCUIT
1	R73 20LB/BR
2	R75 20LB/OR



C318

C318 - (OVERLAY SIDE)

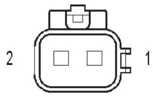
CAV	CIRCUIT
1	R72 20LB/WT (RHD)
1	R73 20LB/BR (LHD)
2	R74 20LB/YL (RHD)
2	R75 20LB/OR (LHD)



C319

C319 - (OVERLAY SIDE)

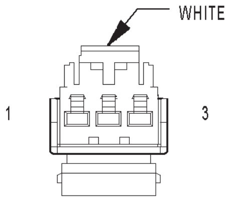
CAV	CIRCUIT
1	R73 20LB/BR (RHD)
1	R72 20LB/WT (LHD)
2	R75 20LB/OR (RHD)
2	R74 20LB/YL (LHD)



C319

C319 - (RIGHT BODY SIDE (LHD)/ LEFT BODY SIDE (RHD))

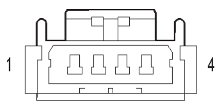
CAV	CIRCUIT
1	R72 20LB/WT (LHD)
2	R74 20LB/YL (LHD)



CARGO LAMP

CARGO LAMP - WHITE 3 WAY

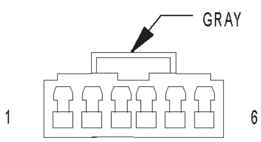
CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	G73 20LG/OR	LIFTGATE COURTESY DISABLE
3	M2 20YL/DG	COURTESY LAMP DRIVER



CLOCKSPRING C2

CLOCKSPRING C2 - 4 WAY

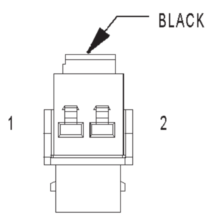
CAV	CIRCUIT	FUNCTION
1	R63 20TN/LB	DRIVER SQUIB 2 LINE 2
2	R61 20OR/LB	DRIVER SQUIB 2 LINE 1
3	R43 20BK/LB	DRIVER SQUIB 1 LINE 1
4	R45 20DG/LB	DRIVER SQUIB 1 LINE 2



CLOCKSPRING C3

CLOCKSPRING C3 - GRAY 6 WAY

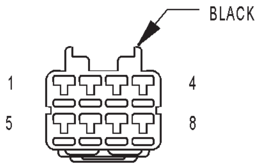
CAV	CIRCUIT	FUNCTION
1	X20 20RD/YL	RADIO CONTROL MUX
2	X10 20RD/BK	RADIO CONTROL MUX RETURN
3	X3 20GY/OR	HORN RELAY CONTROL
4	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
5	K4 20BK/LB	SENSOR GROUND
6	-	-



CLOCKSPRING C4

CLOCKSPRING C4 - BLACK 2 WAY

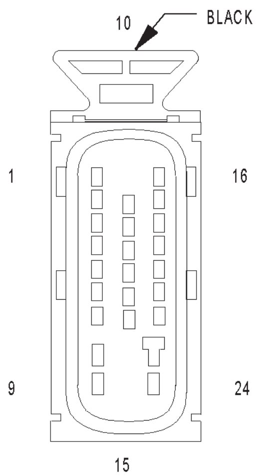
CAV	CIRCUIT	FUNCTION
1	X20 20RD/YL	RADIO CONTROL MUX
2	X10 20RD/BK	RADIO CONTROL MUX RETURN



COMPACT DISC CHANGER (PREMIUM RADIO)

COMPACT DISC CHANGER (PREMIUM RADIO) - BLACK 8 WAY

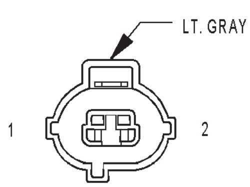
CAV	CIRCUIT	FUNCTION
1	X40 20WT/RD	AUDIO OUT RIGHT
2	C235 20WT/LB	SHIELD
3	D25 20YL/VT	PCI BUS
4	X112 20RD	IGNITION SWITCH OUTPUT (RUN-ACC)
5	X41 20WT/DG	AUDIO OUT LEFT
6	Z4 20WT/BK	GROUND
7	Z17 20BK	GROUND
8	X160 20YL	B(+)



CONTROLLER ANTILOCK BRAKE

CONTROLLER ANTILOCK BRAKE - BLACK 24 WAY

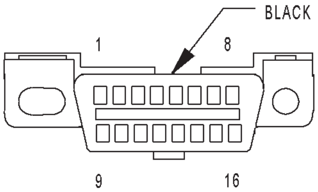
CAV	CIRCUIT	FUNCTION
1	Z101 12BK/OR	GROUND
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL
3	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
4	-	-
5	D25 18VT/YL	PCI BUS
6	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
7	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
8	-	-
9	A20 12RD/DB	FUSED B(+)
10	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	D52 18LG/WT (DIESEL)	CAN C BUS(+)
12	-	-
13	B22 18DG/YL	VEHICLE SPEED SIGNAL
14	D51 18DG/YL (DIESEL)	CAN C BUS(-)
15	-	-
16	Z102 12BK/OR	GROUND
17	G9 18GY/BK	BRAKE FLUID LEVEL SWITCH SENSE
18	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
19	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL
20	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
21	Z231 18BK	GROUND
22	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
23	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
24	A10 12RD/DG	FUSED B(+)



COOLANT LEVEL SENSOR

COOLANT LEVEL SENSOR - LT. GRAY 2 WAY

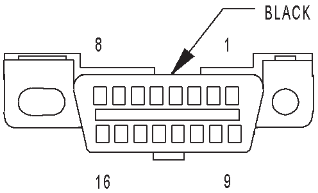
CAV	CIRCUIT	FUNCTION
1	G18 20PK/BK (RHD)	COOLANT LEVEL SWITCH SENSE
1	G18 18PK/BK (LHD)	COOLANT LEVEL SWITCH SENSE
2	Z307 20BK	GROUND



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z305 20BK/OR	GROUND
5	Z306 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)

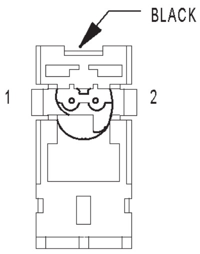


DIAGNOSTIC JUNCTION PORT

DIAGNOSTIC JUNCTION PORT - BLACK 16 WAY

CAV	CIRCUIT	FUNCTION
1	D25 20YL/VT/BR	PCI BUS (PCM/ECM TCM PDM CD SKIM)
2	D25 20YL/VT/DG (AZC)	PCI BUS (AZC)
3	D25 20YL/VT/DB	PCI BUS (RADIO)
4	D25 20YL/VT/OR	PCI BUS (ACM)
5	D25 20YL/VT/RD	PCI BUS (MIC)
6	D25 20YL/VT/WT	PCI BUS (BCM)
7	D25 20YL/VT	PCI BUS (DLC)
8	D25 20YL/VT/GY	PCI BUS (DDM ABS MEM EVIC APM ITM RAIN SENSOR)
9	-	-
10	-	-
11	D25 20YL/VT (DIESEL)	PCI BUS (SHIFTER ASSEMBLY)
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-

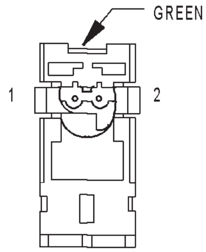
CONNECTOR PINOUTS



DRIVER AIRBAG SQUIB 1

DRIVER AIRBAG SQUIB 1 - BLACK 2 WAY

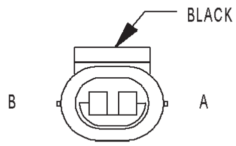
CAV	CIRCUIT	FUNCTION
1	R43 20BK	DRIVER SQUIB 1 LINE 1
2	R45 20BK	DRIVER SQUIB 1 LINE 2



DRIVER
AIRBAG
SQUIB 2

DRIVER AIRBAG SQUIB 2 - GREEN 2 WAY

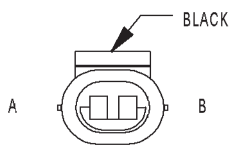
CAV	CIRCUIT	FUNCTION
1	R63 20TN/LB	DRIVER SQUIB 2 LINE 2
2	R61 20OR/LB	DRIVER SQUIB 2 LINE 1



DRIVER
BLEND DOOR
MOTOR/ACTUATOR
(LHD) (AZC)

DRIVER BLEND DOOR MOTOR/ACTUATOR (LHD) (AZC) - BLACK 2 WAY

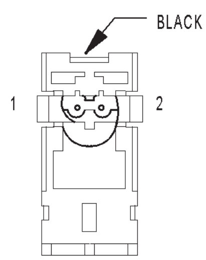
CAV	CIRCUIT	FUNCTION
A	C95 20WT/BK (LHD)	DRIVER BLEND DOOR DRIVER (B)
B	C33 20DB/RD (LHD)	DRIVER BLEND DOOR DRIVER (A)



DRIVER
BLEND DOOR MOTOR/
ACTUATOR
(RHD)(AZC)

DRIVER BLEND DOOR MOTOR/ACTUATOR (RHD) (AZC)- BLACK 2 WAY

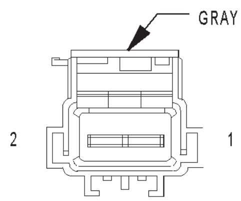
CAV	CIRCUIT	FUNCTION
A	C33 20DB/RD (RHD)	DRIVER BLEND DOOR DRIVER (A)
B	C95 20WT/BK (RHD)	DRIVER BLEND DOOR DRIVER (B)



DRIVER
CURTAIN
AIRBAG

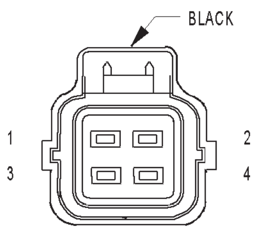
DRIVER CURTAIN AIRBAG - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	R73 20LB/BR	DRIVER CURTAIN SQUIB LINE 2
2	R75 20LB/OR	DRIVER CURTAIN SQUIB LINE 1



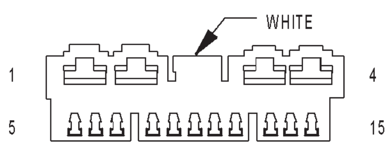
DRIVER CYLINDER LOCK SWITCH - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	G73 20LG/OR	DRIVER CYLINDER LOCK SWITCH SENSE
2	Z1 20BK	GROUND



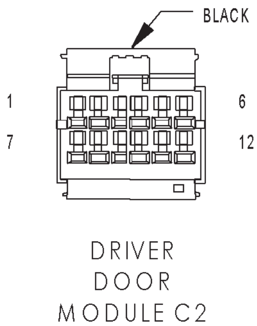
DRIVER DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	G75 18TN/RD	DRIVER DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P34 18PK/BK	DRIVER DOOR UNLOCK DRIVER
4	P35 18OR/BK	DRIVER DOOR LOCK DRIVER



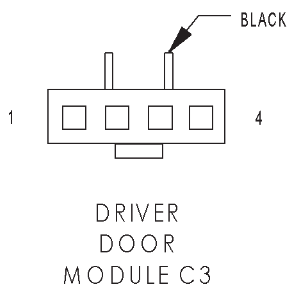
DRIVER DOOR MODULE C1 - WHITE 15 WAY

CAV	CIRCUIT	FUNCTION
1	A146 12OR/WT	FUSED B(+)
2	Q23 16RD/WT	DRIVER REAR WINDOW DRIVER (DOWN)
3	Q13 16DB	DRIVER REAR WINDOW DRIVER (UP)
4	Z1 12BK	GROUND
5	P35 18OR/BK	DRIVER DOOR LOCK DRIVER
6	-	-
7	P34 18PK/BK	DRIVER DOOR UNLOCK DRIVER
8	D30 20VT/YL (JAPAN)	DIAGNOSTIC OUT
9	D25 20YL/VT	PCI BUS
10	G73 20LG/OR	DRIVER CYLINDER LOCK SWITCH SENSE
11	G75 18TN/RD	DRIVER DOOR AJAR SWITCH SENSE
12	E21 20OR/RD	DRIVER DOOR SWITCH ILLUMINATION
13	Q11 16LB	DRIVER WINDOW DRIVER (UP)
14	-	-
15	Q21 16WT	DRIVER WINDOW DRIVER (DOWN)



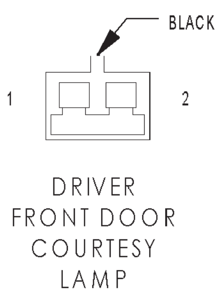
DRIVER DOOR MODULE C2 - BLACK 12 WAY

CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATER GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	M21 20PK/DG	COURTESY LAMP DRIVER
10	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
11	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
12	L121 20BK/RD	COURTESY LAMP GROUND



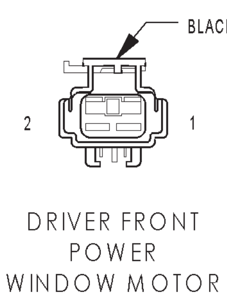
DRIVER DOOR MODULE C3 - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	BK	MEMORY SWITCH RETURN
2	BR	MEMORY SWITCH MUX
3	OR	MEMORY SET INDICATOR DRIVER
4	GY	SWITCH ILLUMINATION DRIVER



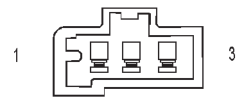
DRIVER FRONT DOOR COURTESY LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	M21 20PK/DG	COURTESY LAMP DRIVER
2	L121 20BK/RD	COURTESY LAMP GROUND



DRIVER FRONT POWER WINDOW MOTOR - BLACK 2 WAY

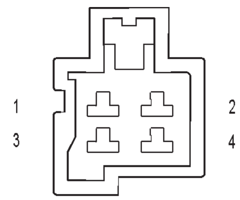
CAV	CIRCUIT	FUNCTION
1	Q21 16WT	DRIVER WINDOW DRIVER (DOWN)
2	Q11 16LB	DRIVER WINDOW DRIVER (UP)



DRIVER
HEATED SEAT
BACK
(PREMIUM I/III)

DRIVER HEATED SEAT BACK (PREMIUM I/III) - 3 WAY

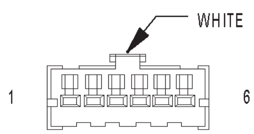
CAV	CIRCUIT	FUNCTION
1	P88 16BK/BR	HEATED SEAT DRIVER
2	Z6 16BK/YL	GROUND
3	-	-



DRIVER
HEATED SEAT
CUSHION
(PREMIUM I/III)

DRIVER HEATED SEAT CUSHION (PREMIUM I/III) - 4 WAY

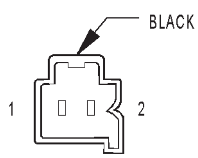
CAV	CIRCUIT	FUNCTION
1	P131 16BK/OR	DRIVER SEAT HEATER B(+) DRIVER
2	P88 16BK/BR	HEATED SEAT DRIVER
3	P135 20LB/BK	DRIVER SEAT TEMPERATURE SENSOR INPUT
4	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



DRIVER
HEATED SEAT
SWITCH

DRIVER HEATED SEAT SWITCH - WHITE 6 WAY

CAV	CIRCUIT	FUNCTION
1	P133 20TN/DG	DRIVER SEAT HEATER SWITCH MUX
2	E2 20OR	PANEL LAMPS DRIVER
3	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
4	-	-
5	Z300 20BK	GROUND
6	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND

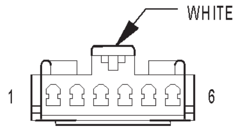


DRIVER
LUMBAR
MOTOR
(MIDLINE/PREMIUM)

DRIVER LUMBAR MOTOR (MIDLINE/PREMIUM) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	P105 16LG/DB	LUMBAR FORWARD SWITCH SENSE
2	P104 16YL/RD	LUMBAR REARWARD SWITCH SENSE

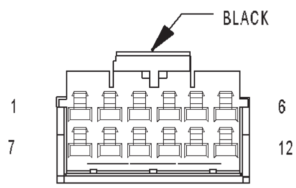
CONNECTOR PINOUTS



DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM)

DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM) - WHITE 6 WAY

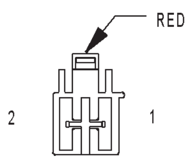
CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 16BK	GROUND
3	P105 16LG/DB (RHD)	LUMBAR FORWARD SWITCH SENSE
3	P104 16YL/RD (LHD)	LUMBAR REAR WARD SWITCH SENSE
4	P104 16YL/RD (RHD)	LUMBAR REAR WARD SWITCH SENSE
4	P105 16LG/DB (LHD)	LUMBAR FORWARD SWITCH SENSE
5	Z1 16BK	GROUND
6	F35 16RD	FUSED B(+)



DRIVER POWER MIRROR

DRIVER POWER MIRROR - BLACK 12 WAY

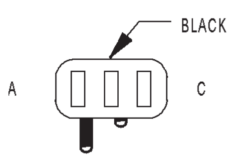
CAV	CIRCUIT	FUNCTION
1	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
2	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
3	P69 20GY	MIRROR SENSOR GROUND
4	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
5	C118 20BK/WT	MIRROR HEATER GROUND
6	P95 20OR	MIRROR HORIZONTAL DRIVER
7	P114 20YL/RD	AUTO DAY NIGHT MIRROR(-)
8	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
9	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
10	P112 20YL/WT	AUTO DAY NIGHT MIRROR(+)
11	P93 20RD	MIRROR VERTICAL DRIVER
12	P91 20WT	MIRROR COMMON DRIVER



DRIVER POWER SEAT FRONT RISER MOTOR

DRIVER POWER SEAT FRONT RISER MOTOR - RED 2 WAY

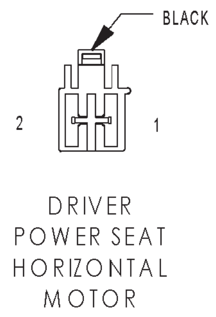
CAV	CIRCUIT	FUNCTION
1	P119 16YL/RD (PREMIUM II/III)	SEAT FRONT UP DRIVER
1	P19 16YL/LG (EXCEPT PREMIUM II/III)	DRIVER SEAT FRONT UP DRIVER
2	P121 16RD/GY (PREMIUM II/III)	SEAT FRONT DOWN DRIVER
2	P21 16RD/LG (EXCEPT PREMIUM II/III)	DRIVER SEAT FRONT DOWN DRIVER



DRIVER POWER SEAT FRONT RISER MOTOR SENSOR (PREMIUM II/III)

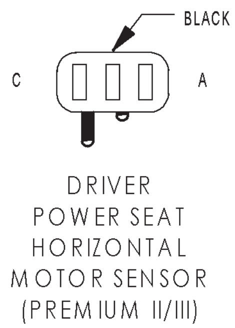
DRIVER POWER SEAT FRONT RISER MOTOR SENSOR (PREMIUM II/III) - 3 WAY

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSOR GROUND
B	P26 20BR	FRONT RISER POSITION SIGNAL
C	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



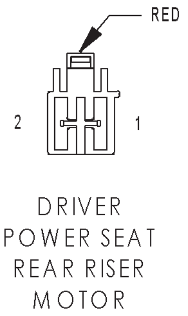
DRIVER POWER SEAT HORIZONTAL MOTOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	P17 16RD/YL (EXCEPT PREMIUM II/III)	DRIVER SEAT HORIZONTAL REARWARD DRIVER
1	P117 16RD/BR (PREMIUM II/III)	SEAT HORIZONTAL REARWARD DRIVER
2	P15 16YL/LB (EXCEPT PREMIUM II/III)	DRIVER SEAT HORIZONTAL FORWARD DRIVER
2	P115 16GY/LG (PREMIUM II/III)	SEAT HORIZONTAL FORWARD DRIVER



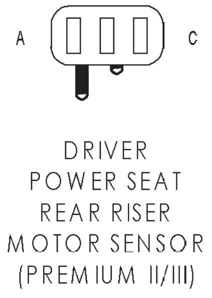
DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR (PREMIUM II/III) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY
B	P25 20VT/RD	SEAT HORIZONTAL POSITION SIGNAL
C	P28 20BR/RD	SEAT POSITION SENSOR GROUND



DRIVER POWER SEAT REAR RISER MOTOR - RED 2 WAY

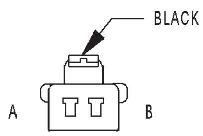
CAV	CIRCUIT	FUNCTION
1	P11 16YL/WT (EXCEPT PREMIUM II/III)	DRIVER SEAT REAR UP DRIVER
1	P111 16YL/DB (PREMIUM II/III)	SEAT REAR UP DRIVER
2	P13 16RD/WT (EXCEPT PREMIUM II/III)	DRIVER SEAT REAR DOWN DRIVER
2	P113 16RD/BK (PREMIUM II/III)	SEAT REAR DOWN DRIVER



DRIVER POWER SEAT REAR RISER MOTOR SENSOR (PREMIUM II/III) - 3 WAY

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSOR GROUND
B	P27 20LB/RD	REAR RISER POSITION SIGNAL
C	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY

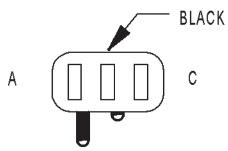
CONNECTOR PINOUTS



DRIVER POWER SEAT RECLINER MOTOR

DRIVER POWER SEAT RECLINER MOTOR - BLACK 2 WAY

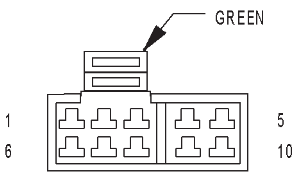
CAV	CIRCUIT	FUNCTION
A	P41 16GY/WT (MIDLINE/ PREMIUM I)	DRIVER SEAT RECLINER DOWN DRIVER
A	P141 16GY/WT (PREMIUM II/III)	SEAT RECLINER DOWN DRIVER
B	P43 16GY/LB (MIDLINE/ PREMIUM I)	DRIVER SEAT RECLINER UP DRIVER
B	P143 16GY/LB (PREMIUM II/III)	SEAT RECLINER UP DRIVER



DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III)

DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III) - BLACK 3 WAY

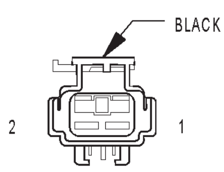
CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY
B	P47 20LB	RECLINER POSITION SIGNAL
C	P28 20BR/RD	SEAT POSITION SENSOR GROUND



DRIVER POWER SEAT SWITCH (MIDLINE/ PREMIUM)

DRIVER POWER SEAT SWITCH (MIDLINE/PREMIUM) - GREEN 10 WAY

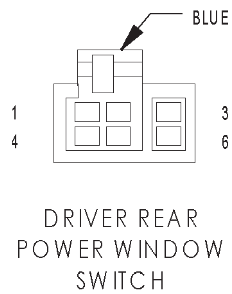
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	P43 16GY/LB (MIDLINE/ PREMIUM I)	DRIVER SEAT RECLINER UP DRIVER
2	P43 20GY/LB (PREMIUM II/III)	RECLINER UP SWITCH SENSE
3	P17 16RD/YL (MIDLINE/ PREMIUM I)	DRIVER SEAT HORIZONTAL REARWARD DRIVER
3	P17 20RD/YL (PREMIUM II/III)	DRIVER SEAT HORIZONTAL REARWARD SWITCH SENSE
4	P41 16GY/WT (MIDLINE/ PREMIUM I)	DRIVER SEAT RECLINER DOWN DRIVER
4	P41 20GY/WT (PREMIUM II/III)	RECLINER DOWN SWITCH SENSE
5	F35 16RD (MIDLINE/ PREMIUM I)	FUSED B(+)
5	P9 20RD/LB (PREMIUM II/III)	SEAT SWITCH B(+) SUPPLY
6	P15 16YL/LB (MIDLINE/ PREMIUM I)	DRIVER SEAT HORIZONTAL FORWARD DRIVER
6	P15 20YL/LB (PREMIUM II/III)	DRIVER SEAT HORIZONTAL FORWARD SWITCH SENSE
7	P19 16YL/LG (MIDLINE/ PREMIUM I)	DRIVER SEAT FRONT UP DRIVER
7	P21 20RD/LG (RHD PRE-MIUM II/III)	DRIVER SEAT FRONT DOWN DRIVER
7	P19 20YL/LG (PREMIUM II/III)	SEAT FRONT UP SWITCH SENSE
8	P13 20RD/WT (RHD PRE-MIUM II/III)	DRIVER SEAT REAR DOWN DRIVER
8	P11 20YL/WT (PREMIUM II/III)	SEAT REAR UP SWITCH SENSE
8	P11 16YL/WT (MIDLINE/ PREMIUM I)	DRIVER SEAT REAR UP DRIVER
9	P13 20RD/WT (PREMIUM II/III)	SEAT REAR DOWN SWITCH SENSE
9	P13 16RD/WT (MIDLINE/ PREMIUM I)	DRIVER SEAT REAR DOWN DRIVER
9	P11 20YL/WT (RHD PRE-MIUM II/III)	DRIVER SEAT REAR UP DRIVER
10	P21 16RD/LG (MIDLINE/ PREMIUM I)	DRIVER SEAT FRONT DOWN DRIVER
10	P21 20RD/LG (PREMIUM II/III)	SEAT FRONT DOWN SWITCH SENSE
10	P19 20YL/LG (RHD PRE-MIUM II/III)	DRIVER SEAT FRONT UP DRIVER



DRIVER REAR POWER WINDOW MOTOR

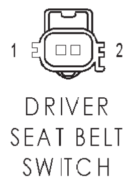
DRIVER REAR POWER WINDOW MOTOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Q124 16DG/WT	WINDOW DRIVER (DOWN)
2	Q114 16GY/WT	WINDOW DRIVER (UP)



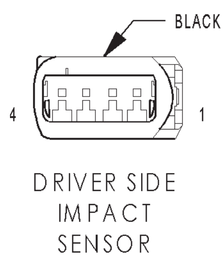
DRIVER REAR POWER WINDOW SWITCH - BLUE 6 WAY

CAV	CIRCUIT	FUNCTION
1	Q14 16GY	DRIVER REAR WINDOW DRIVER UP
2	Q114 16GY/WT	WINDOW DRIVER UP
3	E21 20OR/RD	DRIVER REAR DOOR SWITCH ILLUMINATION
4	Q24 16DG	DRIVER REAR WINDOW DRIVER DOWN
5	Q124 16DG/WT	WINDOW DRIVER DOWN
6	Z1 16BK	GROUND



DRIVER SEAT BELT SWITCH - 2 WAY

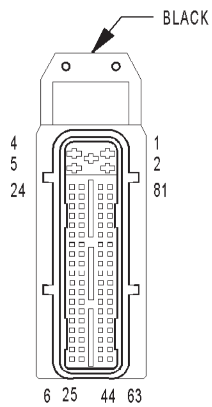
CAV	CIRCUIT	FUNCTION
1	R57 20DG	DRIVER SEAT BELT SWITCH SENSE
2	R59 20LB	DRIVER SEAT BELT SWITCH GROUND



DRIVER SIDE IMPACT SENSOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R133 20LB/DG	DRIVER SIDE IMPACT SENSOR GROUND
4	R131 20LG/YL	DRIVER SIDE IMPACT SENSOR SIGNAL

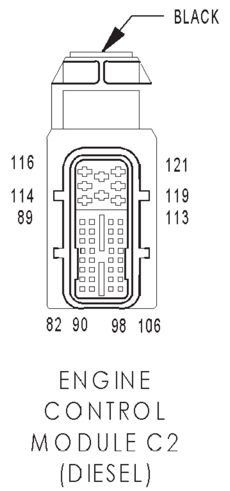
CONNECTOR PINOUTS



ENGINE CONTROL MODULE C1 (DIESEL)

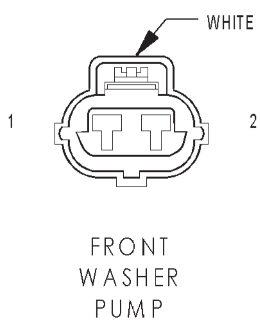
ENGINE CONTROL MODULE C1 (DIESEL) - BLACK 81 WAY

CAV	CIRCUIT	FUNCTION
1	Z108 14BK/DG	GROUND
2	Z108 14BK/DG	GROUND
3	K20 14DB	GENERATOR FIELD CONTROL
4	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
5	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
6	D52 18DG/WT	CAN C BUS(+)
7	D25 20VT/YL	PCI BUS
8	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
9	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
10	-	-
11	Y53 20BK/YL	BOOST PRESSURE SENSOR SIGNAL
12	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL
13	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
14	K22 20RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
15	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
16	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
17	-	-
18	-	-
19	F300 20RD/BK	BATTERY SENSE (+)
20	Z11 20BK/WT	BATTERY SENSE (-)
21	K4 18BK/LB	SENSOR GROUND
22	F991 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
24	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1
25	D51 18WT	CAN C BUS(-)
26	-	-
27	-	-
28	-	-
29	K77 20BR/WT	TRANSFER CASE POSITION SENSOR SIGNAL
30	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
31	-	-
32	K25 20VT/DG	BATTERY TEMPERATURE SENSOR SIGNAL
33	-	-
34	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
35	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY
36	C18 20DB	A/C PRESSURE SENSOR SIGNAL
37	-	-
38	V37 20RD/DG	SPEED CONTROL SWITCH SIGNAL
39	K226 20DB/WT	FUEL LEVEL SENSOR SIGNAL
40	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
41	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL
42	Y101 20	CRANKSHAFT POSITION SENSOR SHIELD
43	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
44	-	-
45	-	-
46	-	-
47	L50 20WT/DB	PRIMARY BRAKE SWITCH SIGNAL
48	K29 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
49	-	-
50	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
51	-	-
52	-	-
53	-	-
54	Z189 20BR	MASS AIR FLOW SENSOR GROUND
55	B22 20DG/YL	VEHICLE SPEED SENSOR SIGNAL
56	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
57	-	-
58	K4 20BK/LB	WATER IN FUEL SENSOR GROUND
59	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL
60	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY
61	K51 20DB/YL	AUTO SHUT DOWN RELAY CONTROL
62	-	-
63	-	-
64	-	-
65	-	-
66	-	-
67	K173 20GY	HYDRAULIC RADIATOR FAN SOLENOID CONTROL
68	-	-
69	C13 20DB/RD	A/C COMPRESSOR CLUTCH RELAY CONTROL
70	-	-
71	-	-
72	K236 20GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
73	-	-
74	T752 20DG/RD	ENGINE STARTER MOTOR RELAY CONTROL
75	K132 20BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
76	Y42 20BR/BK	WASTEGATE SOLENOID CONTROL
77	K152 20WT	GLOW PLUG RELAY NO. 1 CONTROL
78	-	-
79	-	-
80	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
81	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL



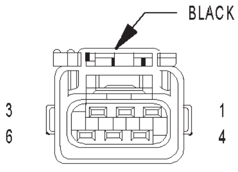
ENGINE CONTROL MODULE C2 (DIESEL) - BLACK 40 WAY

CAV	CIRCUIT	FUNCTION
82	D21 20PK	SCI TRANSMIT
83	-	-
84	-	-
85	-	-
86	-	-
87	-	-
88	-	-
89	K35 20GY/YL	EGR SOLENOID CONTROL
90	-	-
91	-	-
92	-	-
93	-	-
94	G123 20DG/WT	WATER IN FUEL SIGNAL
95	-	-
96	-	-
97	-	-
98	-	-
99	-	-
100	-	-
101	-	-
102	-	-
103	-	-
104	-	-
105	-	-
106	-	-
107	-	-
108	-	-
109	-	-
110	-	-
111	-	-
112	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
113	-	-
114	-	-
115	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
116	K63 14BK	COMMON INJECTOR DRIVER
117	-	-
118	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
119	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
120	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
121	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL



FRONT WASHER PUMP - WHITE 2 WAY

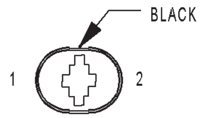
CAV	CIRCUIT	FUNCTION
1	V10 20BR	WASHER PUMP MOTOR SWITCH SENSE
2	Z141 20BK	GROUND



FRONT
WIPER
MOTOR

FRONT WIPER MOTOR - BLACK 6 WAY

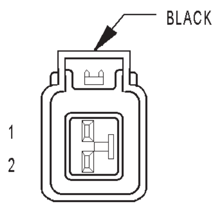
CAV	CIRCUIT	FUNCTION
1	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V55 16TN/RD	WIPER PARK SWITCH SENSE
3	-	-
4	Z141 16BK	GROUND
5	V3 16BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
6	V4 16RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT



HOOD
AJAR
SWITCH
(BUILT-UP-EXPORT)

HOOD AJAR SWITCH (BUILT-UP-EXPORT) - BLACK 2 WAY

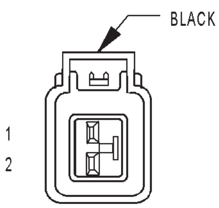
CAV	CIRCUIT	FUNCTION
1	G70 20BR/TN	HOOD AJAR SWITCH SENSE
2	Z141 20BK (DIESEL)	GROUND
2	Z161 20BK (GAS)	GROUND



HORN NO. 1

HORN NO. 1 - BLACK 2 WAY

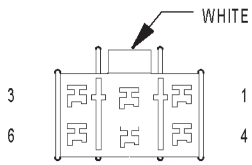
CAV	CIRCUIT	FUNCTION
1	Z307 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



HORN NO. 2

HORN NO. 2 - BLACK 2 WAY

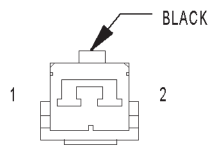
CAV	CIRCUIT	FUNCTION
1	Z307 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



IGNITION
SWITCH C1

IGNITION SWITCH C1 - WHITE 6 WAY

CAV	CIRCUIT	FUNCTION
1	A41 12YL	IGNITION SWITCH OUTPUT (START)
2	A2 12PK/BK	FUSED B(+)
3	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
4	A1 12RD	FUSED B(+)
5	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
6	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)



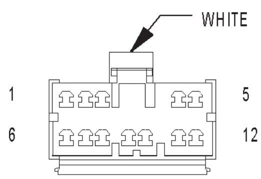
IGNITION
SWITCH C2

IGNITION SWITCH C2 - BLACK 2 WAY

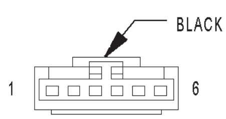
CAV	CIRCUIT	FUNCTION
1	G26 20LB	KEY-IN IGNITION SWITCH SENSE
2	Z234 20BK	GROUND

INSTRUMENT CLUSTER - WHITE 12 WAY

CAV	CIRCUIT	FUNCTION
1	L61 20TN/LG	LEFT TURN SIGNAL
2	L60 20TN	RIGHT TURN SIGNAL
3	-	-
4	-	-
5	G9 20GY/BK	RED BRAKE WARNING INDICATOR DRIVER
6	F33 20PK/RD	FUSED B(+)
7	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
8	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
9	Z300 20BK	GROUND
10	D25 20YL/VT/RD	PCI BUS
11	Z132 20BK/OR	GROUND
12	-	-



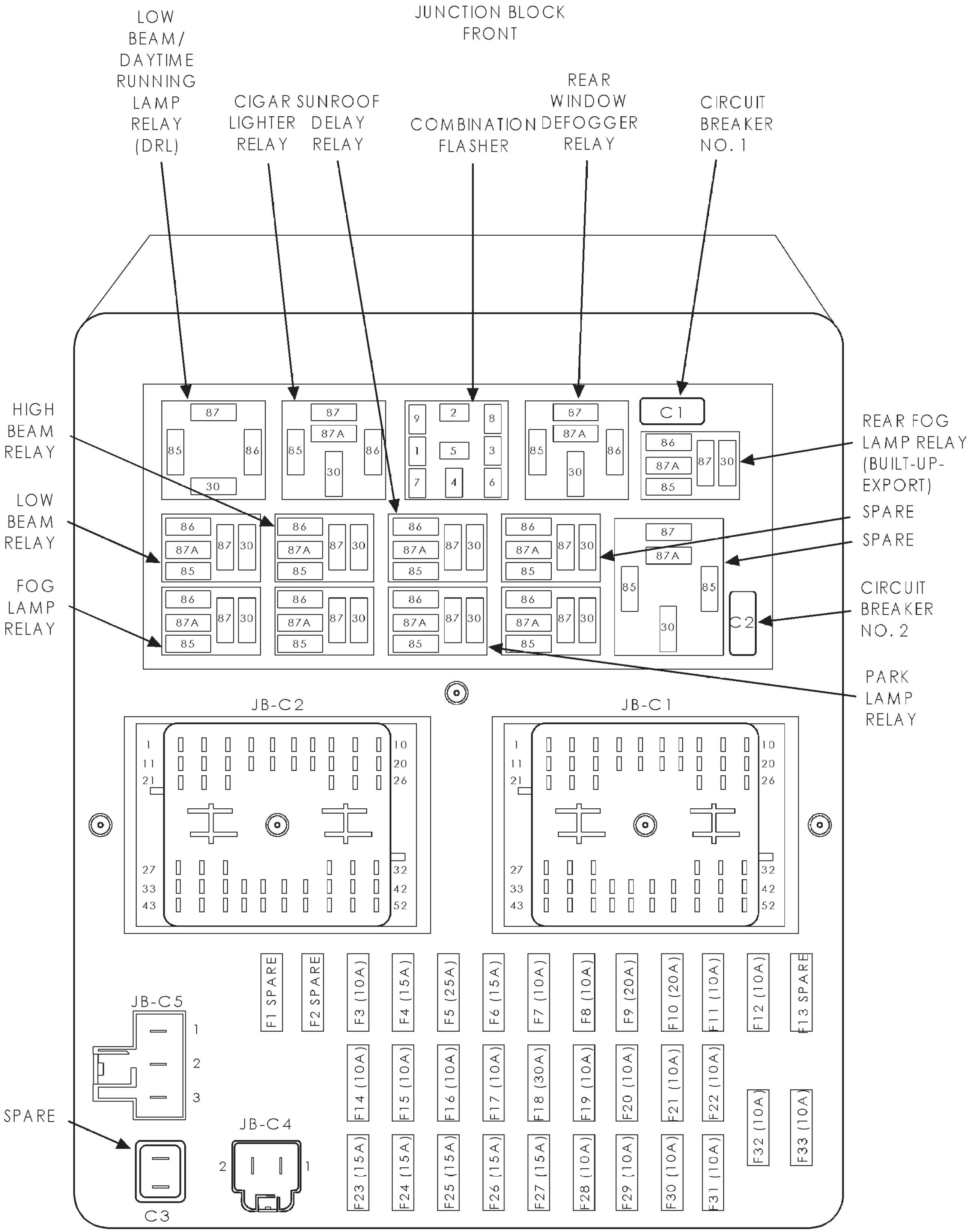
INSTRUMENT
CLUSTER



INTRUSION
TRANSCEIVER
MODULE
(BUILT-UP-EXPORT)

INTRUSION TRANSCEIVER MODULE (BUILT-UP-EXPORT) - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	Z155 20BK	GROUND
2	-	-
3	X75 20GY/LG	SIREN SIGNAL CONTROL
4	-	-
5	D25 20YL/VT	PCI BUS
6	F70 20PK	FUSED B(+)


JUNCTION BLOCK FRONT
LOW BEAM/ DAYTIME RUNNING LAMP RELAY (DRL)
CIGAR LIGHTER RELAY
SUNROOF DELAY RELAY
COMBINATION FLASHER
REAR WINDOW DEFOGGER RELAY
CIRCUIT BREAKER NO. 1
HIGH BEAM RELAY
LOW BEAM RELAY
FOG LAMP RELAY
REAR FOG LAMP RELAY (BUILT-UP-EXPORT)
SPARE
SPARE
CIRCUIT BREAKER NO. 2
PARK LAMP RELAY
C1
C2
JB-C2
JB-C1
JB-C5
JB-C4
C3
SPARE
F1 SPARE
F2 SPARE
F3 (10A)
F4 (15A)
F5 (25A)
F6 (15A)
F7 (10A)
F8 (10A)
F9 (20A)
F10 (20A)
F11 (10A)
F12 (10A)
F13 SPARE
F14 (10A)
F15 (10A)
F16 (10A)
F17 (10A)
F18 (30A)
F19 (10A)
F20 (10A)
F21 (10A)
F22 (10A)
F23 (15A)
F24 (15A)
F25 (15A)
F26 (15A)
F27 (15A)
F28 (10A)
F29 (10A)
F30 (10A)
F31 (10A)
F32 (10A)
F33 (10A)

FUSES (JB)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	-	-	-
2	-	-	-
3	10A	L33 18RD	FUSED HIGH BEAM RELAY OUTPUT
4	15A	INTERNAL	FUSED B(+)
5	25A	INTERNAL	FUSED B(+)
6	15A	INTERNAL	FUSED B(+)
7	10A	INTERNAL	FUSED B(+)
8	15A	INTERNAL	FUSED B(+)
9	20A	INTERNAL	FUSED B(+)
10	20A	F72 16RD/YL (EXCEPT BUILT-UP-EXPORT)	FUSED B(+)
11	10A	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
12	10A	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-	-
14	10A	L43 18VT	FUSED LOW BEAM RELAY OUTPUT
15	10A	L44 18VT/RD	FUSED LOW BEAM RELAY OUTPUT
16	10A	L34 18RD/OR	FUSED HIGH BEAM RELAY OUTPUT
17	10A	INTERNAL	FUSED B(+)
18	30A	F9 20RD/BK	FUSED B(+)
19	10A	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
20	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
22	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	15A	F32 20PK/DB	FUSED B(+)
24	15A	INTERNAL	FUSED B(+)
25	15A	INTERNAL	FUSED B(+)
26	15A	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
27	15A	INTERNAL (BUILT-UP-EXPORT)	FUSED B(+)
28	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
29	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 18RD/WT (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 16WT/RD (LHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
31	10A	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
32	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
33	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)

CIRCUIT BREAKERS

CB NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	20A	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	20A	INTERNAL	FUSED B(+)
3	-	-	-

ACCESSORY DELAY RELAY

CAV	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	ACCESSORY DELAY RELAY CONTROL
87	Q30 16TN	ACCESSORY DELAY RELAY OUTPUT
87A	-	-

FOG LAMP RELAY

CAV	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
85	INTERNAL	FOG LAMP RELAY CONTROL
86	INTERNAL	REAR FOG LAMP RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	L95 18DG/YL	REAR FOG LAMP RELAY OUTPUT
87	INTERNAL	FOG LAMP RELAY OUTPUT
87A	-	-
87A	-	-

HIGH BEAM RELAY

CAV	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	HIGH BEAM RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	HIGH BEAM RELAY OUTPUT
87A	-	-

LOW BEAM RELAY

CAV	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	LOW BEAM RELAY CONTROL
87	INTERNAL	LOW BEAM RELAY OUTPUT
87A	-	-

PARK LAMP RELAY

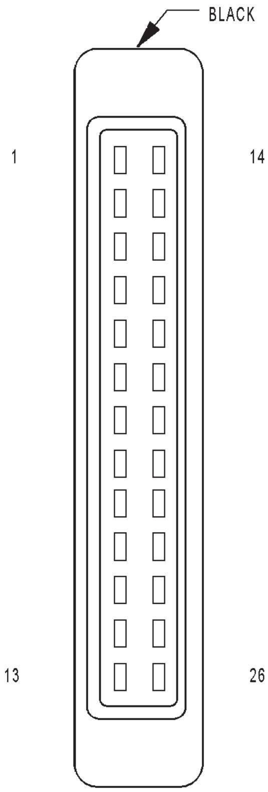
CAV	CIRCUIT	FUNCTION
30	INTERNAL	PARK LAMP RELAY OUTPUT
85	INTERNAL	FUSED B(+)
86	INTERNAL	PARK LAMP RELAY CONTROL
87	INTERNAL	FUSED B(+)
87A	INTERNAL	GROUND

REAR FOG LAMP RELAY (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	REAR FOG LAMP RELAY CONTROL
87	L95 18DG/YL	REAR FOG LAMP RELAY OUTPUT
87A	-	-

REAR WINDOW DEFOGGER RELAY

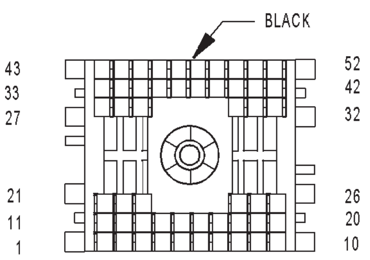
CAV	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	REAR WINDOW DEFOGGER RELAY CONTROL
87	INTERNAL	REAR WINDOW DEFOGGER RELAY OUTPUT
87A	-	-



JUNCTION BLOCK BODY CONTROL MODULE

JUNCTION BLOCK BODY CONTROL MODULE - BLACK 26 WAY

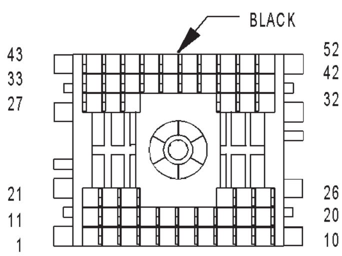
CAV	CIRCUIT	FUNCTION
1	L308	PARK LAMP RELAY CONTROL
2	L26	FOG LAMP RELAY CONTROL
3	Q29	ACCESSORY DELAY RELAY CONTROL
4	L307	LOW BEAM RELAY CONTROL
5	G5	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	X4	HORN RELAY CONTROL
7	V16	WIPER HIGH/LOW RELAY CONTROL
8	G80	LIFTGATE FLIP-UP AJAR SWITCH SENSE
9	L11	HIGH BEAM RELAY CONTROL
10	L91	HAZARD SWITCH SENSE
11	C80	REAR WINDOW DEFOGGER RELAY CONTROL
12	Z2	GROUND
13	L96 (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY CONTROL
14	L7	PARK LAMP RELAY CONTROL
15	Z1	GROUND
16	M2	COURTESY LAMP DRIVER
17	-	-
18	-	-
19	M20	COURTESY LAMP LOAD SHED
20	V55	WIPER PARK SWITCH SENSE
21	G78	LIFTGATE AJAR SWITCH SENSE
22	G10	SEAT BELT SWITCH SENSE
23	G77	LEFT REAR DOOR AJAR SWITCH SENSE
24	G73	LIFTGATE COURTESY DISABLE
25	V23	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
26	M1	FUSED B(+)



JUNCTION BLOCK C1

JUNCTION BLOCK C1 - BLACK 52 WAY

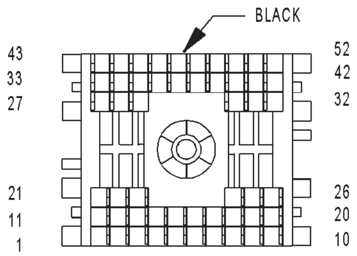
CAV	CIRCUIT	FUNCTION
1	Q30 16TN	ACCESSORY DELAY RELAY OUTPUT
2	L63 18DG/RD	LEFT TURN SIGNAL
3	-	-
4	-	-
5	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
6	-	-
7	-	-
8	-	-
9	G73 20LG/OR	LIFTGATE COURTESY DISABLE
10	G77 20TN/OR	DOOR AJAR SWITCH SENSE
11	L7 18BK/YL	PARK LAMP RELAY OUTPUT
12	-	-
13	-	-
14	-	-
15	F37 16RD (LHD EXCEPT BASE)	FUSED B(+)
15	F37 16RD/LB (RHD)	FUSED B(+)
16	M2 18YL (RHD)	COURTESY LAMP DRIVER
16	M2 20YL/DG (LHD)	COURTESY LAMP DRIVER
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	F22 20WT/PK (RHD)	-
23	-	-
24	G80 20VT/YL	LIFTGATE FLIP-UP AJAR SWITCH SENSE
25	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
26	M20 18YL/BK (RHD)	COURTESY LAMP LOAD SHED
26	M20 20YL/BK (LHD)	COURTESY LAMP LOAD SHED
27	-	-
28	-	-
29	-	-
30	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
31	-	-
32	M1 18PK/RD (RHD)	-
33	-	-
34	-	-
35	F9 14RD/BK	FUSED B(+)
36	F70 18PK	FUSED B(+)
37	-	-
38	-	-
39	-	-
40	-	-
41	F30 14RD/TN (LHD)	CIGAR LIGHTER RELAY OUTPUT
41	F30 16RD/TN (RHD)	CIGAR LIGHTER RELAY OUTPUT
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-
50	C15 12BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
51	-	-
52	-	-



JUNCTION BLOCK C2 (LHD)

JUNCTION BLOCK C2 (LHD) - BLACK 52 WAY

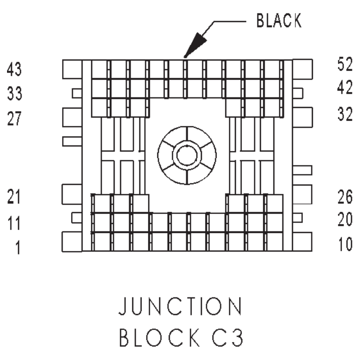
CAV	CIRCUIT	FUNCTION
1	X3 22GY/OR	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 18BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	WIPER HIGH/LOW RELAY CONTROL
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 20BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB (EXCEPT BASE)	FUSED B(+)
25	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	F72 16RD/YL	FUSED B(+)
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 14RD/WT (EXCEPT BASE)	FUSED B(+)



JUNCTION BLOCK C2 (RHD)

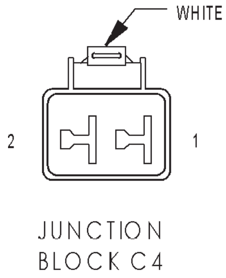
JUNCTION BLOCK C2 (RHD) - BLACK 52 WAY

CAV	CIRCUIT	FUNCTION
1	X3 22BK/RD	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 20BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	-
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 18BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB	FUSED B(+)
25	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	-	-
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 16RD/WT	FUSED B(+)



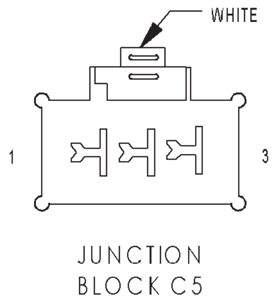
JUNCTION BLOCK C3 - BLACK 52 WAY

CAV	CIRCUIT	FUNCTION
1	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	L60 20TN	RIGHT TURN SIGNAL
4	L302 20LB/YL	RIGHT TURN SWITCH SENSE
5	L61 20TN/LG	LEFT TURN SIGNAL
6	L91 20DB/PK	HAZARD SWITCH SENSE
7	-	-
8	L305 20LB/WT	LEFT TURN SWITCH SENSE
9	-	-
10	L309 20PK/LG	HIGH BEAM RELAY CONTROL
11	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
12	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
13	-	-
14	F85 16VT/WT	FUSED B(+)
15	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
25	F60 16RD/WT	FUSED B(+)
26	-	-
27	A41 12YL	IGNITION SWITCH OUTPUT (START)
28	F14 20LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
29	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
30	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
31	Z234 20BK	GROUND
32	F33 20PK/RD	FUSED B(+)
33	X12 16WT/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
34	M1 20PK	FUSED B(+)
35	M1 20PK (AZC)	FUSED B(+)
36	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)
37	-	-
38	F70 20PK/BK	FUSED B(+)
39	X3 20GY/OR	HORN RELAY CONTROL
40	F30 16RD	FUSED CIGAR LIGHTER RELAY OUTPUT
41	F33 20PK/RD	FUSED B(+)
42	-	-
43	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
44	M1 20PK	FUSED B(+)
45	Z132 20BK/OR	GROUND
46	-	-
47	-	-
48	F70 20PK/BK	FUSED B(+)
49	-	-
50	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
51	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
52	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)



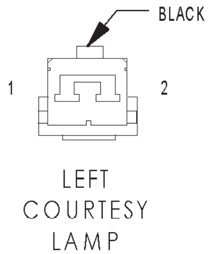
JUNCTION BLOCK C4 - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	A148 10PK/WT	FUSED B(+)
2	A148 10OR/WT	FUSED B(+)



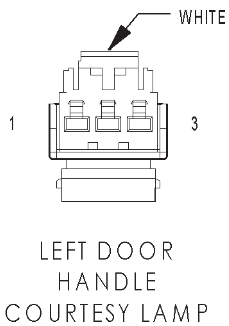
JUNCTION BLOCK C5 - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	A145 10WT/RD	FUSED B(+)
2	A149 12RD/TN	FUSED B(+)
3	A147 10RD/GY	FUSED B(+)



LEFT COURTESY LAMP - BLACK 2 WAY

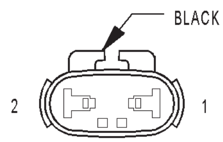
CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M2 20YL	COURTESY LAMP DRIVER



LEFT DOOR HANDLE COURTESY LAMP - WHITE 3 WAY

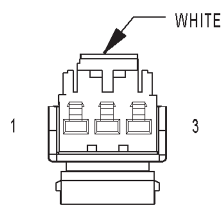
CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED
3	M2 20YL/DG	COURTESY LAMP DRIVER

CONNECTOR PINOUTS



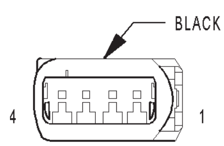
LEFT FOG LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	L39 20LB	FOG LAMP RELAY OUTPUT
2	Z141 20BK (DIESEL/4.7L RHD)	GROUND
2	Z141 18BK (EXCEPT DIESEL/4.7L RHD)	GROUND



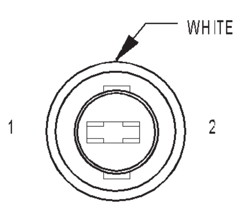
LEFT FRONT DOOR SPEAKER - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	X85 18LB/BK (RHD)	LEFT FRONT DOOR SPEAKER (-)
1	X85 18LG/DG (LHD)	LEFT FRONT DOOR SPEAKER (-)
2	-	-
3	X87 18LB/RD (RHD)	LEFT FRONT DOOR SPEAKER (+)
3	X87 18LG/RD (LHD)	LEFT FRONT DOOR SPEAKER (+)



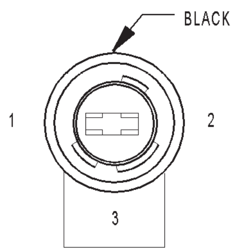
LEFT FRONT IMPACT SENSOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R47 18DB/LB	LEFT FRONT IMPACT SENSOR GROUND
4	R49 18LB	LEFT FRONT IMPACT SENSOR SIGNAL



LEFT FRONT PARK LAMP - WHITE 2 WAY

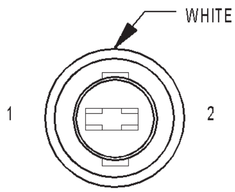
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 20BK/PK	PARK LAMP RELAY OUTPUT



LEFT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)

LEFT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT) - BLACK 3 WAY

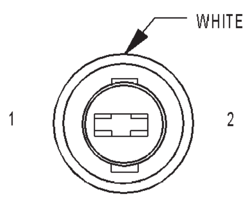
CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY CONTROL
2	Z1 18BK	GROUND
3	L61 20TN/LG	LEFT TURN SIGNAL



LEFT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT)

LEFT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT) - WHITE 2 WAY

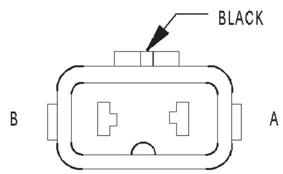
CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	L61 20TN/LG	LEFT TURN SIGNAL



LEFT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT)

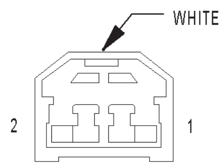
LEFT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT) - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	L61 20TN/LG	LEFT TURN SIGNAL
2	Z1 18BK	GROUND



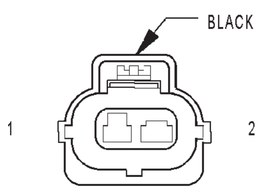
LEFT HIGH BEAM HEADLAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT



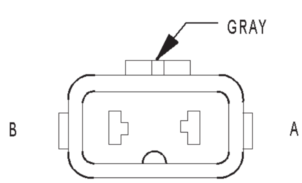
LEFT INSTRUMENT PANEL SPEAKER - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	X83 18YL/RD	LEFT INSTRUMENT PANEL SPEAKER (+)
2	X81 18YL/BK	LEFT INSTRUMENT PANEL SPEAKER (-)



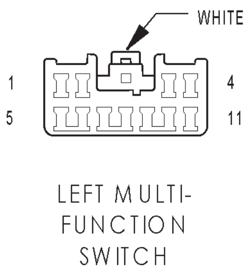
LEFT LIFTGATE AJAR SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE



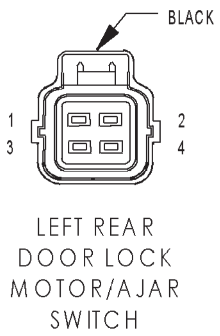
LEFT LOW BEAM HEADLAMP - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L43 18VT	FUSED LEFT LOW BEAM OUTPUT



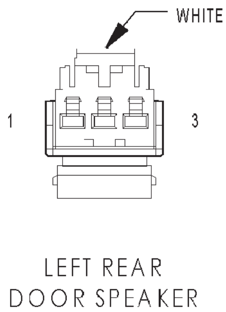
LEFT MULTI-FUNCTION SWITCH - WHITE 11 WAY

CAV	CIRCUIT	FUNCTION
1	L27 20WT/TN	FOG LAMP SWITCH SENSE
2	Z234 20BK	GROUND
3	-	-
4	L80 20WT/DG	HEADLAMP SWITCH RETURN
5	L309 20PK/LG	HIGH BEAM RELAY CONTROL
6	L40 20BR	HIGH BEAM SWITCH SENSE
7	L302 20LB/YL	RIGHT TURN SWITCH SENSE
8	L305 20LB/WT	LEFT TURN SWITCH SENSE
9	L91 20DB/PK	HAZARD SWITCH SENSE
10	E19 20RD	PANEL LAMPS DIMMER SIGNAL
11	G52 20YL	HEADLAMP SWITCH MUX



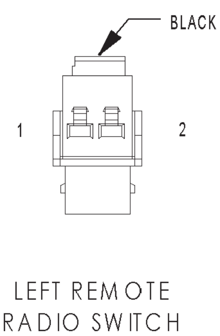
LEFT REAR DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	G77 18TN/YL	LEFT REAR DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



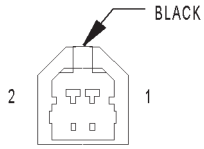
LEFT REAR DOOR SPEAKER - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	X90 18WT/VT	LEFT REAR DOOR SPEAKER (+)
2	-	-
3	X92 18TN/DG	LEFT REAR DOOR SPEAKER (-)



LEFT REMOTE RADIO SWITCH - BLACK 2 WAY

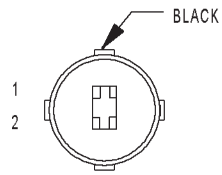
CAV	CIRCUIT	FUNCTION
1	X10 20RD/BK	RADIO CONTROL MUX RETURN
2	X20 20RD/YL	RADIO CONTROL MUX



LEFT VISOR/
VANITY LAMP

LEFT VISOR/VANITY LAMP - BLACK 2 WAY

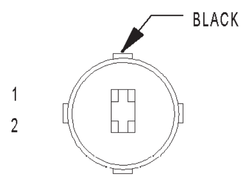
CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED



LICENSE
LAMP NO. 1

LICENSE LAMP NO. 1 - BLACK 2 WAY

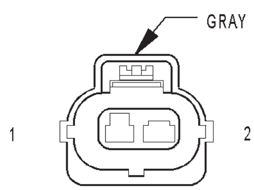
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND



LICENSE
LAMP NO. 2

LICENSE LAMP NO. 2 - BLACK 2 WAY

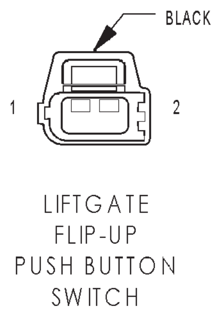
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND



LIFTGATE
FLIP-UP
AJAR SWITCH

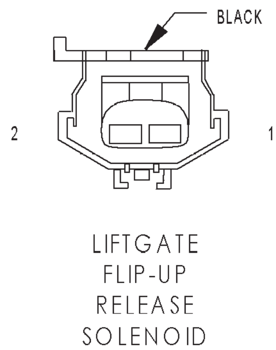
LIFTGATE FLIP-UP AJAR SWITCH - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G80 20VT/YL	LIFTGATE FLIP-UP AJAR SWITCH SENSE



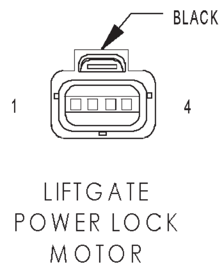
LIFTGATE FLIP-UP PUSH BUTTON SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	P101 18OR/PK	LIFTGATE FLIP-UP SWITCH OUTPUT
2	F70 18PK	FUSED B(+)



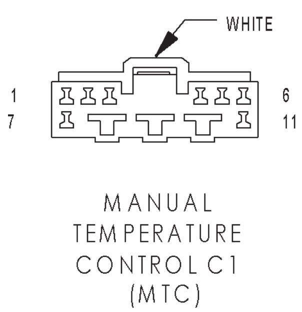
LIFTGATE FLIP-UP RELEASE SOLENOID - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	P100 18OR/BR	LIFTGATE GLASS LIMIT SWITCH OUTPUT



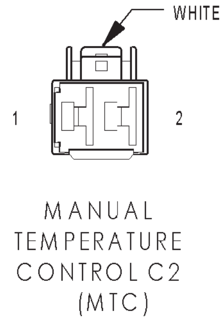
LIFTGATE POWER LOCK MOTOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	P35 18OR/VT	DOOR LOCK DRIVER
2	P36 18PK/VT	DOOR UNLOCK DRIVER
3	P101 18OR/PK	LIFTGATE FLIP-UP SWITCH OUTPUT
4	P100 18OR/BR	LIFTGATE GLASS LIMIT SWITCH OUTPUT



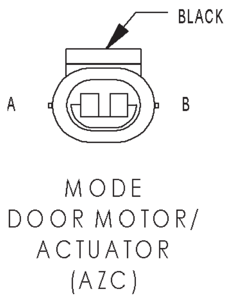
MANUAL TEMPERATURE CONTROL C1 (MTC) - WHITE 11 WAY

CAV	CIRCUIT	FUNCTION
1	C103 20DG	A/C SWITCH SIGNAL
2	Z123 20BK/OR	GROUND
3	C67 20RD/LB	BLEND AIR DOOR POSITION CONTROL
4	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	C81 20LB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
6	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
7	E2 20OR	PANEL LAMPS DRIVER
8	C4 16TN	BLOWER MOTOR LOW DRIVER
9	C5 16LG	BLOWER MOTOR M1 DRIVER
10	C6 14LB	BLOWER MOTOR M2 DRIVER
11	-	-



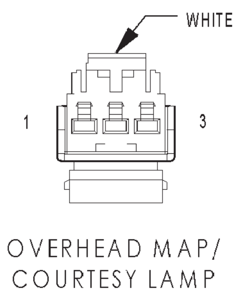
MANUAL TEMPERATURE CONTROL C2 (MTC) - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z118 12BK	GROUND
2	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER



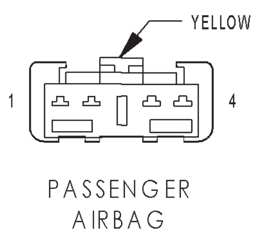
MODE DOOR MOTOR/ACTUATOR (AZC) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
A	C102 20TN/BK (LHD)	MODE DOOR DRIVER (B)
A	C35 20DG/YL (RHD)	MODE DOOR DRIVER (A)
B	C102 20TN/BK (RHD)	MODE DOOR DRIVER (B)
B	C35 20DG/YL (LHD)	MODE DOOR DRIVER (A)



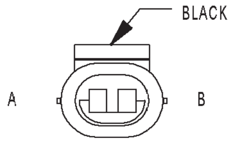
OVERHEAD MAP/COURTESY LAMP - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED
3	M2 20YL/DG	COURTESY LAMP DRIVER



PASSENGER AIRBAG - YELLOW 4 WAY

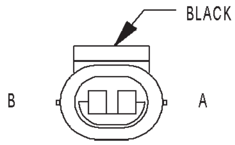
CAV	CIRCUIT	FUNCTION
1	R42 20BK/YL	PASSENGER SQUIB 1 LINE 1
2	R44 20DG/YL	PASSENGER SQUIB 1 LINE 2
3	R64 20TN/YL	PASSENGER SQUIB 2 LINE 1
4	R62 20OR/YL	PASSENGER SQUIB 2 LINE 2



PASSENGER
BLEND DOOR MOTOR/
ACTUATOR
(LHD)(AZC)

PASSENGER BLEND DOOR MOTOR/ACTUATOR (LHD) (AZC) - BLACK 2 WAY

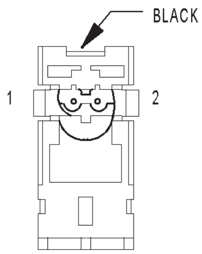
CAV	CIRCUIT	FUNCTION
A	C96 20WT/DB (LHD)	PASSENGER BLEND DOOR DRIVER (B)
B	C94 20WT/DG (LHD)	PASSENGER BLEND DOOR DRIVER (A)



PASSENGER
BLEND DOOR
MOTOR/ACTUATOR
(RHD) (AZC)

PASSENGER BLEND DOOR MOTOR/ACTUATOR (RHD) (AZC) - BLACK 2 WAY

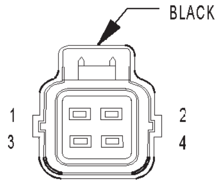
CAV	CIRCUIT	FUNCTION
A	C94 20WT/DG (RHD)	PASSENGER BLEND DOOR DRIVER (A)
B	C96 20WT/DB (RHD)	PASSENGER BLEND DOOR DRIVER (B)



PASSENGER
CURTAIN
AIRBAG

PASSENGER CURTAIN AIRBAG - BLACK 2 WAY

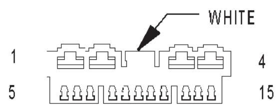
CAV	CIRCUIT	FUNCTION
1	R72 20LB/WT	PASSENGER CURTAIN SQUIB LINE 2
2	R74 20LB/YL	PASSENGER CURTAIN SQUIB LINE 1



PASSENGER
DOOR
LOCK MOTOR/
AJAR SWITCH

PASSENGER DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

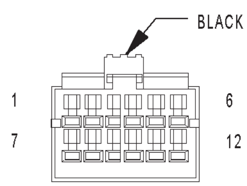
CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



PASSENGER DOOR MODULE C1

PASSENGER DOOR MODULE C1 - WHITE 15 WAY

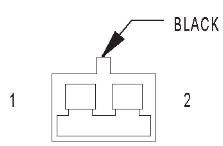
CAV	CIRCUIT	FUNCTION
1	A146 12OR/WT	FUSED B(+)
2	Q24 16DG	PASSENGER REAR WINDOW DRIVER (DOWN)
3	Q14 16GY	PASSENGER REAR WINDOW DRIVER (UP)
4	Z1 12BK	GROUND
5	P35 18OR/VT	DOOR LOCK DRIVER
6	-	-
7	P36 18PK/VT	DOOR UNLOCK DRIVER
8	-	-
9	D25 20YL/VT	PCI BUS
10	-	-
11	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
12	E20 20OR/DB	PASSENGER REAR DOOR SWITCH ILLUMINATION
13	Q12 16BR	PASSENGER WINDOW DRIVER (UP)
14	-	-
15	Q22 16VT	PASSENGER WINDOW DRIVER (DOWN)



PASSENGER DOOR MODULE C2

PASSENGER DOOR MODULE C2 - BLACK 12 WAY

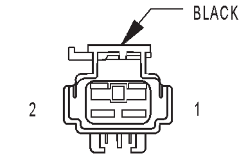
CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATED GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	M21 20PK/DG	COURTESY LAMP DRIVER
10	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
11	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
12	L121 20BK/RD	COURTESY LAMP GROUND



PASSENGER FRONT DOOR COURTESY LAMP

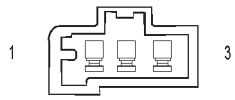
PASSENGER FRONT DOOR COURTESY LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	M21 20PK/DG	COURTESY LAMP DRIVER
2	L121 20BK/RD	COURTESY LAMP GROUND



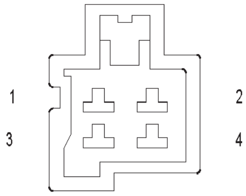
PASSENGER FRONT POWER WINDOW MOTOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Q22 16VT	PASSENGER WINDOW DRIVER (DOWN)
2	Q12 16BR	PASSENGER WINDOW DRIVER (UP)



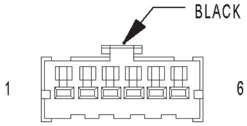
PASSENGER HEATED SEAT BACK (PREMIUM I/III) - 3 WAY

CAV	CIRCUIT	FUNCTION
1	P88 16BK/BR	HEATED SEAT DRIVER
2	Z5 16BK/VT	GROUND
3	-	-



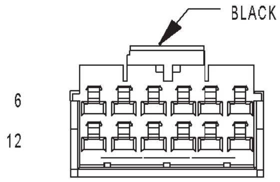
PASSENGER HEATED SEAT CUSHION (PREMIUM I/III) - 4 WAY

CAV	CIRCUIT	FUNCTION
1	P130 16DG/WT	PASSENGER SEAT HEATER B(+) DRIVER
2	P88 16BK/BR	HEATED SEAT DRIVER
3	P86 20DG/YL	PASSENGER SEAT TEMPERATURE SENSOR INPUT
4	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY



PASSENGER HEATED SEAT SWITCH - BLACK 6 WAY

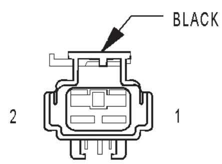
CAV	CIRCUIT	FUNCTION
1	P134 20TN/LG	PASSENGER SEAT HEATER SWITCH MUX
2	E2 20OR	PANEL LAMPS DRIVER
3	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
4	-	-
5	Z300 20BK	GROUND
6	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND



PASSENGER
POWER
MIRROR

PASSENGER POWER MIRROR - BLACK 12 WAY

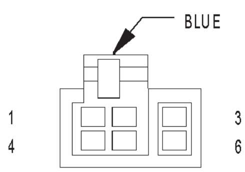
CAV	CIRCUIT	FUNCTION
1	C117 20BK	MIRROR HEATER 12 VOLT SUPPLY
2	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
3	P69 2GY	MIRROR SENSOR GROUND
4	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
5	C118 20BK/WT	MIRROR HEATER GROUND
6	P95 20OR	MIRROR HORIZONTAL DRIVER
7	-	-
8	P99 20DB (BUILT-UP-EXPORT)	FOLDING MIRROR FEED
9	P110 20YL (BUILT-UP-EXPORT)	FOLDING MIRROR RETURN
10	-	-
11	P93 20RD	MIRROR VERTICAL DRIVER
12	P91 20WT	MIRROR COMMON DRIVER



PASSENGER REAR
POWER WINDOW
MOTOR

PASSENGER REAR POWER WINDOW MOTOR - BLACK 2 WAY

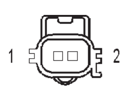
CAV	CIRCUIT	FUNCTION
1	Q124 16DG/WT	WINDOW DRIVER DOWN
2	Q114 16GY/WT	WINDOW DRIVER UP



PASSENGER REAR
POWER WINDOW
SWITCH

PASSENGER REAR POWER WINDOW SWITCH - BLUE 6 WAY

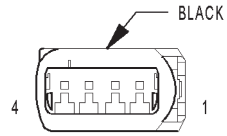
CAV	CIRCUIT	FUNCTION
1	Q14 16GY	PASSENGER REAR WINDOW DRIVER UP
2	Q114 16GY/WT	WINDOW DRIVER UP
3	E21 20OR/RD	PASSENGER REAR DOOR SWITCH ILLUMINATION
4	Q24 16DG	PASSENGER REAR WINDOW DRIVER DOWN
5	Q124 16DG/WT	WINDOW DRIVER DOWN
6	Z1 16BK	GROUND



PASSENGER
SEAT BELT
SWITCH

PASSENGER SEAT BELT SWITCH - 2 WAY

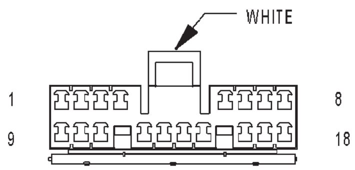
CAV	CIRCUIT	FUNCTION
1	R58 20GY	PASSENGER SEAT BELT SWITCH SENSE
2	R60 20VT	PASSENGER SEAT BELT SWITCH GROUND



PASSENGER SIDE
IMPACT
SENSOR

PASSENGER SIDE IMPACT SENSOR - BLACK 4 WAY

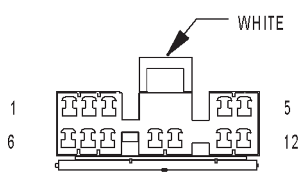
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R134 20LB/BR	PASSENGER SIDE IMPACT SENSOR GROUND
4	R132 20LG/VT	PASSENGER SIDE IMPACT SENSOR SIGNAL



POWER
AMPLIFIER C1
(PREMIUM RADIO)

POWER AMPLIFIER C1 (PREMIUM RADIO) - WHITE 18 WAY

CAV	CIRCUIT	FUNCTION
1	D25 18YL/VT	PCI BUS
2	F60 16RD/WT	FUSED B(+)
3	Z9 16BK	GROUND
4	-	-
5	X58 18DB/OR	RIGHT REAR SPEAKER (-)
6	X57 18DG/WT	LEFT REAR SPEAKER (-)
7	X56 18DB/PK	RIGHT FRONT SPEAKER (-)
8	X55 18BR/RD	LEFT FRONT SPEAKER (-)
9	-	-
10	F60 16RD/WT	FUSED B(+)
11	Z9 16BK	GROUND
12	-	-
13	X64 18BR/WT	ENABLE SIGNAL TO AMPLIFIER
14	-	-
15	X52 18DB/WT	RIGHT REAR SPEAKER (+)
16	X51 18WT/DG	LEFT REAR SPEAKER (+)
17	X54 18VT	RIGHT FRONT SPEAKER (+)
18	X53 18DG/OR	LEFT FRONT SPEAKER (+)

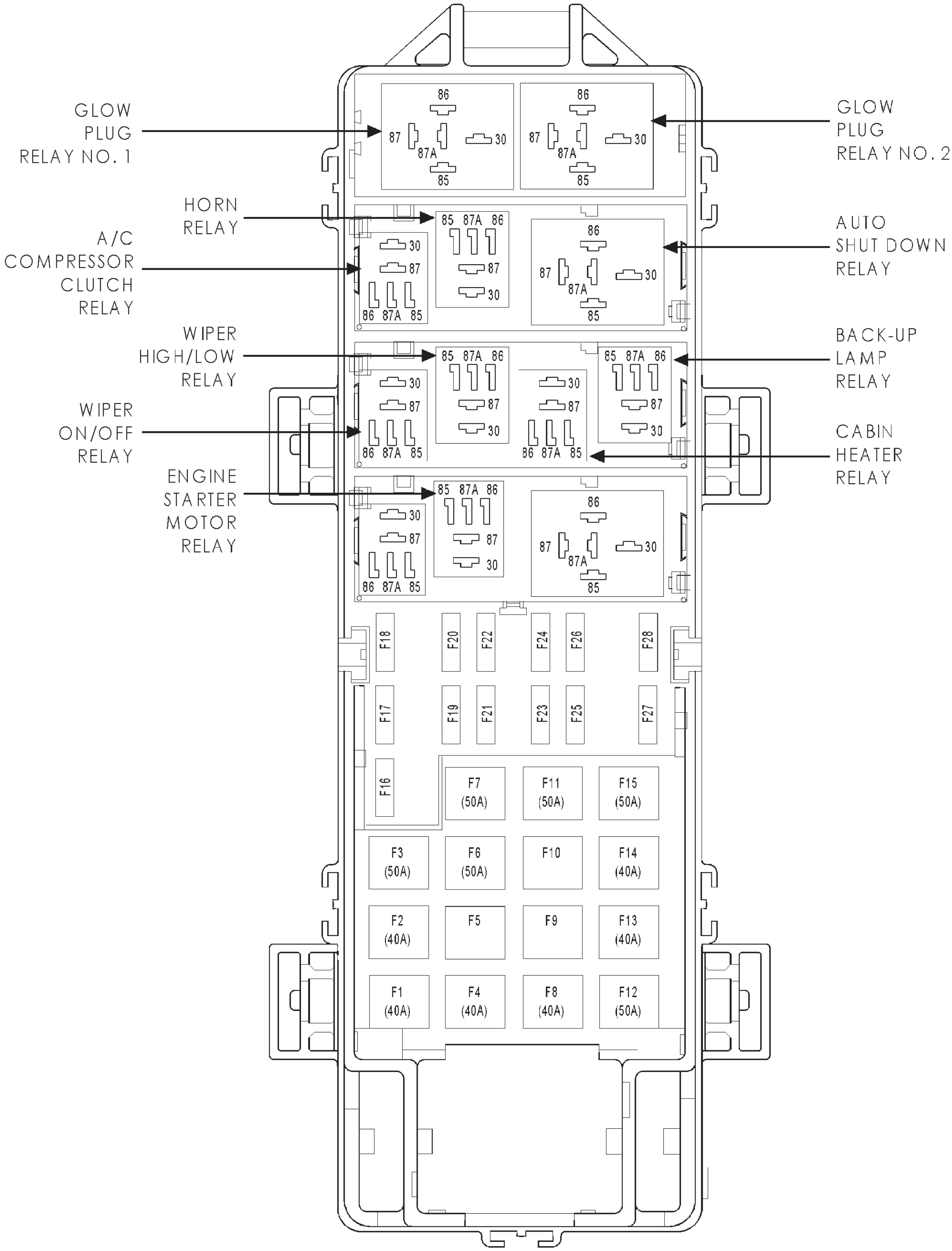


POWER
AMPLIFIER C2
(PREMIUM RADIO)

POWER AMPLIFIER C2 (PREMIUM RADIO) - WHITE 12 WAY

CAV	CIRCUIT	FUNCTION
1	X90 18WT/VT	RIGHT REAR DOOR SPEAKER (+)
2	X92 18TN/DG	RIGHT REAR DOOR SPEAKER (-)
3	X85 18LG/DG	LEFT FRONT DOOR SPEAKER (-)
4	X83 18YL/RD	LEFT INSTRUMENT PANEL SPEAKER (+)
5	X84 18OR/GY	RIGHT INSTRUMENTAL PANEL SPEAKER (-)
6	X93 18DG/WT	LEFT REAR DOOR SPEAKER (+)
7	X91 18WT/DG	LEFT REAR DOOR SPEAKER (-)
8	X87 18LG/RD	LEFT FRONT DOOR SPEAKER (+)
9	X80 18LB/BK	RIGHT FRONT DOOR SPEAKER (-)
10	X82 18LB/RD	RIGHT FRONT DOOR SPEAKER (+)
11	X81 18YL/BK	LEFT INSTRUMENT PANEL SPEAKER (-)
12	X86 18OR/RD	RIGHT INSTRUMENT PANEL SPEAKER (+)

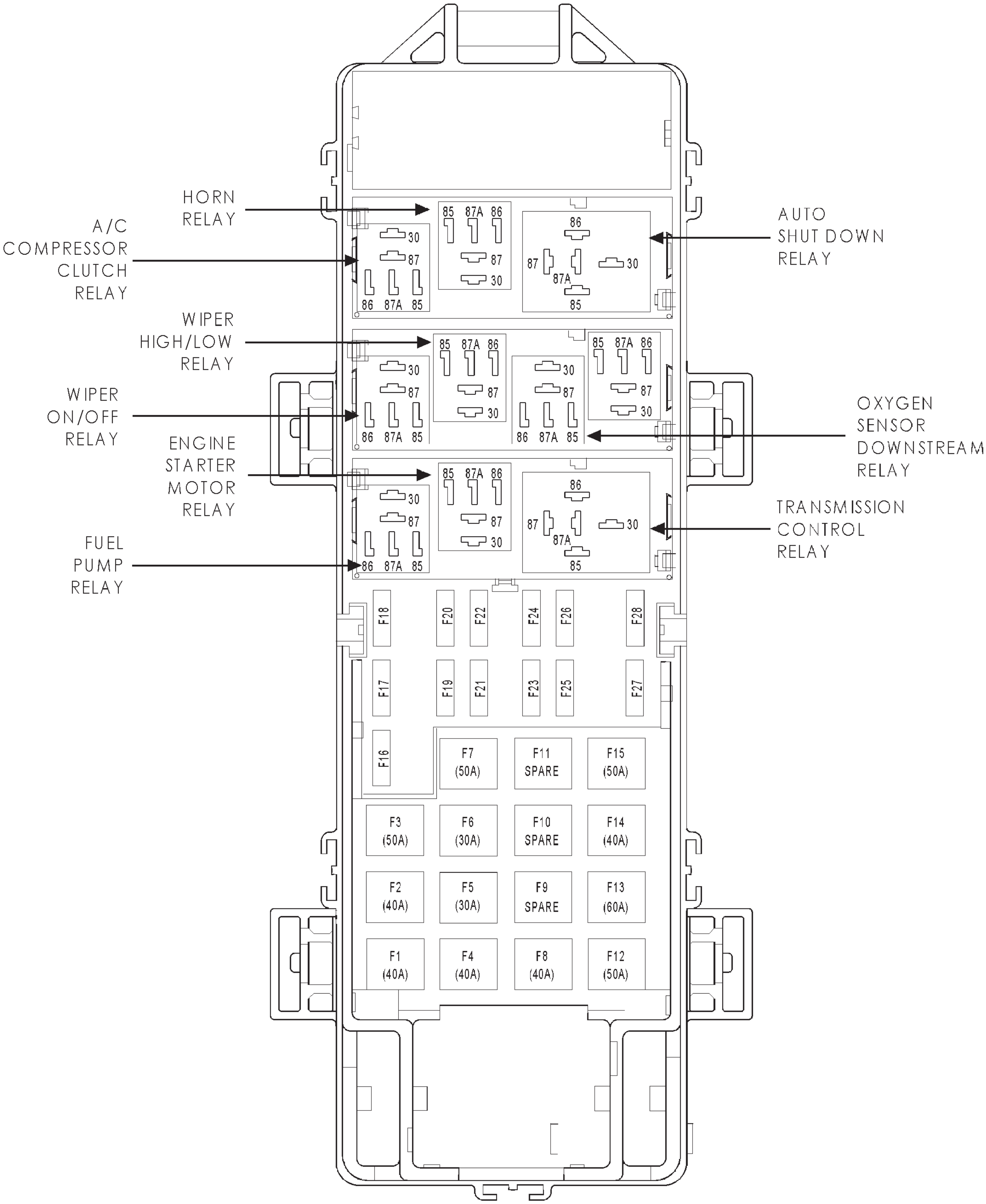
POWER DISTRIBUTION CENTER (DIESEL)



FUSES (DIESEL)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	-	-	-
6	50A	A105 10DB/RD	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	50A	A110 10VT/RD	FUSED B(+)
12	50A	A146 10OR/WT	FUSED B(+)
13	40A	A14 14RD/WT	FUSED B(+)
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	20A	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	20A	F15 18 DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	-	-	-
20	-	-	-
21	15A	A17 14RD/BK	FUSED B(+)
22	10A	F300 18RD/BK	FUSED B(+)
23	15A	A80 18RD/LG	FUSED B(+)
24	-	-	-
25	20A	A20 12RD/DB	FUSED B(+)
26	20A	F142 14OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	-	-	-

POWER DISTRIBUTION CENTER (GAS)



FUSES (GAS)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	30A	A30 14RD/WT	FUSED B(+)
5	30A	A30 14RD/WT (4.7L)	FUSED B(+)
6	30A	A14 14RD/DG	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	-	-	-
12	50A	A146 10OR/WT	FUSED B(+)
13	-	-	-
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	15A	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	15A	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	10A	A7 14RD/BK	FUSED B(+)
20	-	-	-
21	15A	A17 18RD/BK	FUSED B(+)
22	-	-	-
23	-	-	-
24	20A	A62 16VT/LB	FUSED B(+)
25	20A	A20 12RD/DB	FUSED B(+)
26	15A	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
26	15A	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	15A	T15 18YL/BR(4.0L)	FUSED TRANSMISSION CONTROL RELAY OUTPUT

HORN RELAY

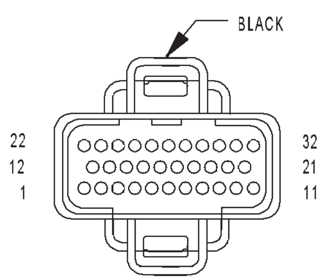
CAV	CIRCUIT	FUNCTION
30	F62 18RD	FUSED B(+)
85	X3 20BK/RD	HORN RELAY CONTROL
86	F62 18RD	FUSED B(+)
87	X2 18DG/RD	HORN RELAY OUTPUT
87	X2 18DG/RD (GAS)	HORN RELAY OUTPUT
87A	-	-

WIPER HIGH/LOW RELAY

CAV	CIRCUIT	FUNCTION
30	V60 16YL/DG (GAS)	WIPER ON/OFF RELAY OUTPUT
30	V60 16TN/RD (DIESEL)	WIPER ON/OFF RELAY OUTPUT
85	V16 20VT	WIPER HIGH/LOW RELAY CONTROL
86	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
86	V6 16DB (DIESEL)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V4 16RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
87A	V3 16BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT

WIPER ON/OFF RELAY

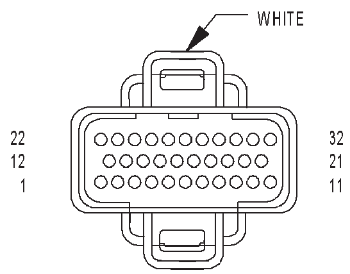
CAV	CIRCUIT	FUNCTION
30	V60 16YL/DG (GAS)	WIPER ON/OFF RELAY OUTPUT
30	V60 16TN/RD (DIESEL)	WIPER ON/OFF RELAY OUTPUT
85	V14 20RD/VT	WIPER ON/OFF RELAY CONTROL
86	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
86	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87A	V55 16TN/RD (DIESEL)	WIPER PARK SWITCH SENSE
87A	V55 16TN/RD	WIPER PARK SWITCH SENSE



POWERTRAIN CONTROL MODULE C1 (GAS)

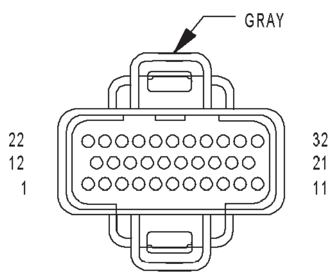
POWERTRAIN CONTROL MODULE C1 (GAS) - BLACK 32 WAY

CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	K94 14TN/LG (4.7L)	COIL DRIVER NO. 4
4	K4 18BK/LB	SENSOR GROUND
5	K96 14TN/LB (4.7L)	COIL DRIVER NO. 6
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K91 14TN/RD	COIL DRIVER NO. 1
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	K98 14LB/RD (4.7L)	COIL DRIVER NO. 8
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	-	-
13	-	-
14	K77 18LG/BK	TRANSFER CASE POSITION SENSOR INPUT
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5 VOLT SUPPLY
18	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/BK	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	K95 14TN/DG (4.7L)	COIL DRIVER NO. 5
22	A7 14RD/BK	FUSED B(+)
23	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SENSOR SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT BUILT-UP-EXPORT)	COIL DRIVER NO. 1
29	K341 18PK/WT (4.7L)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z82 14BK/WT	GROUND
32	Z81 14BK/TN	GROUND



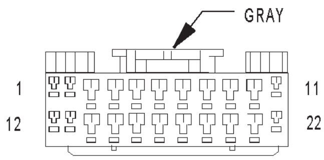
POWERTRAIN CONTROL MODULE C2 (GAS) - WHITE 32 WAY

CAV	CIRCUIT	FUNCTION
1	T54 18VT (4.0L)	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	K26 18VT (4.7L)	FUEL INJECTOR NO. 7 DRIVER
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
7	K97 14BR (4.7L)	COIL DRIVER NO. 7
8	K88 18PK (4.0L)	GOVERNOR PRESSURE SOLENOID CONTROL
9	K92 14TN/PK	COIL DRIVER NO. 2
10	K20 18DG	GENERATOR FIELD DRIVER
11	T20 18LB (4.0L)	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
12	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
13	K28 18GY/LB (4.7L)	FUEL INJECTOR NO. 8 DRIVER
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	K173 18LG	RADIATOR FAN RELAY CONTROL
18	-	-
19	C18 18DB	A/C PRESSURE SIGNAL
20	-	-
21	T60 18BR (4.0L)	3-4 SHIFT SOLENOID CONTROL
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
24	-	-
25	T13 18DB/BK (4.0L)	OUTPUT SPEED SENSOR GROUND
26	-	-
27	B22 18DG/YL	VEHICLE SPEED SENSOR SIGNAL
28	T14 18LG/WT (4.0L)	OUTPUT SPEED SENSOR SIGNAL
29	T25 18LG/RD (4.0L)	GOVERNOR PRESSURE SENSOR SIGNAL
30	K30 18PK/YL (4.0L)	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/BK	5 VOLT SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE C3 (GAS) - GRAY 32 WAY

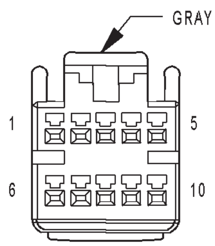
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	-	-
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	K42 18DB/LG (4.7L HIGH OUTPUT)	KNOCK SENSOR SIGNAL
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.7L)	OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
10	K106 18WT/DG (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18OR/DG	SPEED CONTROL SUPPLY
12	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (4.7L RHD)	OVERDRIVE OFF SWITCH SENSE
13	T6 18OR/WT (4.0L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T10 18DG/LG (4.7L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T6 18OR/BK (4.0L RHD)	OVERDRIVE OFF SWITCH SENSE
14	K107 18OR/PK (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SWITCH SENSE
15	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR 2/1 HEATER CONTROL
17	-	-
18	K142 18GY/BK (4.7L HIGH OUTPUT)	KNOCK SENSOR NO. 2 SIGNAL
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG (LHD)	SCI RECEIVE
29	D32 18LG/DG (RHD)	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL



RADIO C1

RADIO C1 - GRAY 22 WAY

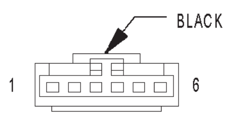
CAV	CIRCUIT	FUNCTION
1	F60 16RD/WT	FUSED B(+)
2	X12 16WT/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	E2 20OR	PANEL LAMPS DRIVER
4	-	-
5	-	-
6	-	-
7	X54 18VT	RIGHT FRONT SPEAKER (+)
8	X56 18DB/PK	RIGHT FRONT SPEAKER (-)
9	X55 18BR/RD	LEFT FRONT SPEAKER (-)
10	X53 18DG/OR	LEFT FRONT SPEAKER (+)
11	Z9 16BK	GROUND
12	F60 16RD/WT	FUSED B(+)
13	X64 18BR/WT	ENABLE SIGNAL TO AMPLIFIER
14	D25 20YL/VT/DB	PCI BUS
15	-	-
16	-	-
17	-	-
18	X51 18WT/DG	LEFT REAR SPEAKER (+)
19	X57 18DG/WT	LEFT REAR SPEAKER (-)
20	X58 18DB/OR	RIGHT REAR SPEAKER (-)
21	X52 18DB/WT	RIGHT REAR SPEAKER (+)
22	Z9 16BK	GROUND



RADIO C2

RADIO C2 - GRAY 10 WAY

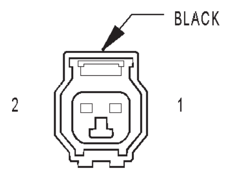
CAV	CIRCUIT	FUNCTION
1	X40 20WT/RD	AUDIO OUT RIGHT
2	Z4 20WT/BK	GROUND
3	Z5 20BK/LB	GROUND
4	-	-
5	X112 20RD	IGNITION SWITCH OUTPUT (RUN ACC)
6	X41 20WT/DG	AUDIO OUT LEFT
7	Z17 20BK	GROUND
8	-	-
9	-	-
10	X160 20YL	FUSED B(+)



RAIN
SENSOR
(AUTOWIPE)

RAIN SENSOR (AUTOWIPE) - BLACK 6 WAY

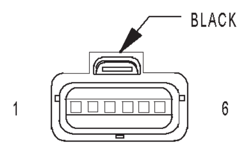
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20BK/PK	PCI BUS
3	-	-
4	Z155 20BK/OR	GROUND
5	Q30 20BK/LB	FUSED B(+)
6	-	-



REAR WASHER PUMP

REAR WASHER PUMP - BLACK 2 WAY

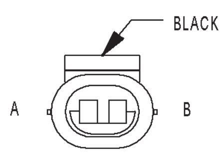
CAV	CIRCUIT	FUNCTION
1	Z141 18BK	GROUND
2	V20 18BK/WT	REAR WASHER PUMP MOTOR CONTROL



REAR WIPER MOTOR

REAR WIPER MOTOR - BLACK 6 WAY

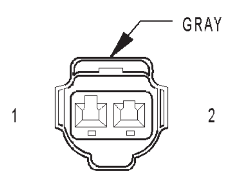
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V13 18BR/LG	REAR WIPER MOTOR CONTROL
3	G80 20VT/YL	LIFTGATE FLIP-UP AJAR SWITCH SENSE
4	V22 18BR/YL	REAR WIPER MOTOR DELAY CONTROL
5	F70 18BK	FUSED B(+)
6	-	-



RECIRCULATION DOOR MOTOR/ ACTUATOR (AZC)

RECIRCULATION DOOR MOTOR/ACTUATOR (AZC) - BLACK 2 WAY

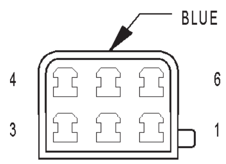
CAV	CIRCUIT	FUNCTION
A	C32 20GY/DB (LHD)	RECIRCULATION DOOR DRIVER (A)
A	C100 20YL/DB (RHD)	RECIRCULATION DOOR DRIVER (B)
B	C32 20GY/DB (RHD)	RECIRCULATION DOOR DRIVER (A)
B	C100 20YL/DB (LHD)	RECIRCULATION DOOR DRIVER (B)



RED BRAKE WARNING INDICATOR SWITCH

RED BRAKE WARNING INDICATOR SWITCH - GRAY 2 WAY

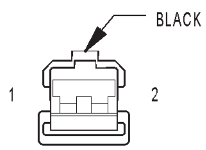
CAV	CIRCUIT	FUNCTION
1	Z231 18BK	GROUND
2	G9 18GY/BK	RED BRAKE WARNING INDICATOR DRIVER



REMOTE KEYLESS MODULE (JAPAN)

REMOTE KEYLESS MODULE (JAPAN) - BLUE 6 WAY

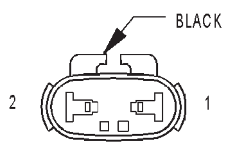
CAV	CIRCUIT	FUNCTION
1	K25 20RD/GY	ANTENNA SIGNAL
2	K25 20RD/GY	ANTENNA SIGNAL
3	M1 18PK	FUSED B(+)
4	Z1 18BK	GROUND
5	D30 20VT/YL	DIAGNOSTIC OUT
6	D30 20VT/YL	DIAGNOSTIC OUT



RIGHT COURTESY LAMP

RIGHT COURTESY LAMP - BLACK 2 WAY

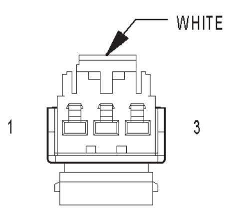
CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M2 20YL	COURTESY LAMP DRIVER



RIGHT FOG LAMP

RIGHT FOG LAMP - BLACK 2 WAY

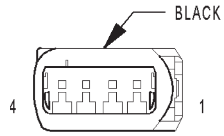
CAV	CIRCUIT	FUNCTION
1	L39 20LB	FOG LAMP RELAY OUTPUT
2	Z142 18BK	GROUND



RIGHT FRONT DOOR SPEAKER

RIGHT FRONT DOOR SPEAKER - WHITE 3 WAY

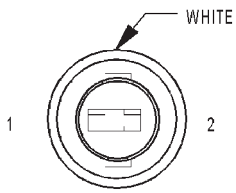
CAV	CIRCUIT	FUNCTION
1	X80 18LG/DG (RHD)	RIGHT FRONT DOOR SPEAKER (-)
1	X80 18LB/BK (LHD)	RIGHT FRONT DOOR SPEAKER (-)
2	-	-
3	X82 18LG/RD (RHD)	RIGHT FRONT DOOR SPEAKER (+)
3	X82 18LB/RD (LHD)	RIGHT FRONT DOOR SPEAKER (+)



RIGHT FRONT IMPACT SENSOR

RIGHT FRONT IMPACT SENSOR - BLACK 4 WAY

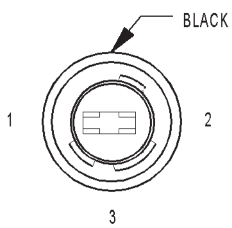
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R46 18BR/LB	RIGHT FRONT IMPACT SENSOR GROUND
4	R48 18TN	RIGHT FRONT IMPACT SENSOR SIGNAL



RIGHT FRONT PARK LAMP

RIGHT FRONT PARK LAMP - WHITE 2 WAY

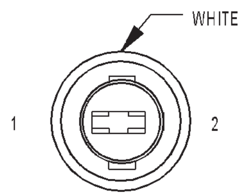
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 20BK/PK	PARK LAMP RELAY OUTPUT



RIGHT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)

RIGHT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT) - BLACK 3 WAY

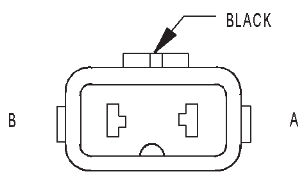
CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND
3	L60 20TN	RIGHT TURN SIGNAL



RIGHT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT)

RIGHT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT) - WHITE 2 WAY

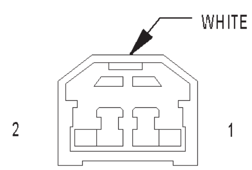
CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	L60 20TN	RIGHT TURN SIGNAL



RIGHT HIGH BEAM HEADLAMP

RIGHT HIGH BEAM HEADLAMP - BLACK 2 WAY

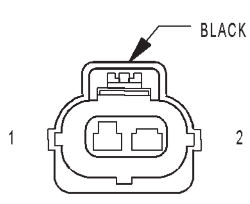
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT



RIGHT INSTRUMENT PANEL SPEAKER

RIGHT INSTRUMENT PANEL SPEAKER - WHITE 2 WAY

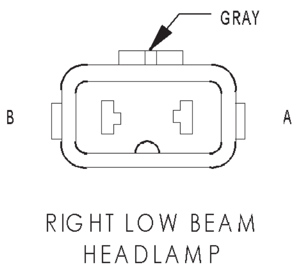
CAV	CIRCUIT	FUNCTION
1	X86 18OR/RD	RIGHT INSTRUMENT PANEL SPEAKER (+)
2	X84 18OR/BK	RIGHT INSTRUMENT PANEL SPEAKER (-)



RIGHT LIFTGATE AJAR SWITCH

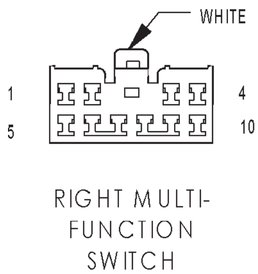
RIGHT LIFTGATE AJAR SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE



RIGHT LOW BEAM HEADLAMP - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT

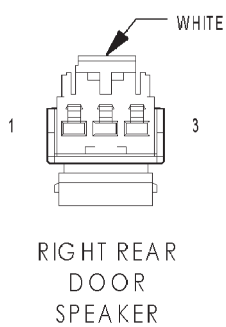


RIGHT MULTI-FUNCTION SWITCH - WHITE 10 WAY

CAV	CIRCUIT	FUNCTION
1	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V20 18BK/WT	REAR WASHER PUMP MOTOR CONTROL
3	V10 20BR	WASHER PUMP MOTOR SWITCH OUTPUT
4	-	-
5	V13 18BR/LG	REAR WIPER MOTOR CONTROL
6	V22 18BR/YL	REAR WIPER MOTOR DELAY CONTROL
7	V9 20WT/BK	WINDSHIELD WIPER SWITCH RETURN
8	V52 20DG/RD	WINDSHIELD WIPER SWITCH MUX
9	V48 20RD/GY	WIPER HIGH CONTROL
10	-	-

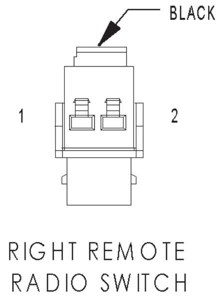
RIGHT REAR DOOR LOCK MOTOR/AJAR SWITCH - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	G76 18TN/YL	RIGHT REAR DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



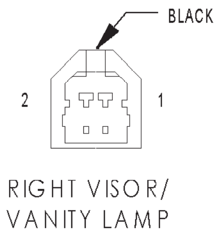
RIGHT REAR DOOR SPEAKER - WHITE 3 WAY

CAV	CIRCUIT	FUNCTION
1	X90 18WT/VT	RIGHT REAR DOOR SPEAKER (+)
2	-	-
3	X92 18TN/DG	RIGHT REAR DOOR SPEAKER (-)



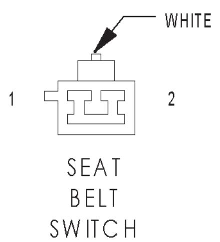
RIGHT REMOTE RADIO SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	X10 20RD/BK	RADIO CONTROL MUX RETURN
2	X20 20RD/YL	RADIO CONTROL MUX



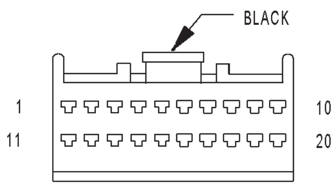
RIGHT VISOR/VANITY LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP LOAD SHED



SEAT BELT SWITCH - WHITE 2 WAY

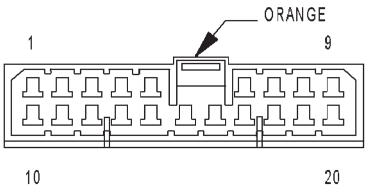
CAV	CIRCUIT	FUNCTION
1	G10 20LG/RD	SEAT BELT SWITCH SENSE
2	Z1 20BK	GROUND



SEAT
MODULE C1
(PREMIUM)

SEAT MODULE C1 (PREMIUM) - BLACK 20 WAY

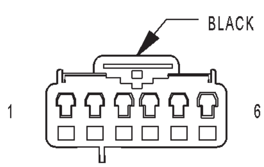
CAV	CIRCUIT	FUNCTION
1	P15 20YL/LB (PREMIUM II/III)	SEAT HORIZONTAL FORWARD SWITCH SENSE
2	-	-
3	P11 20YL/WT(PREMIUM II/III)	SEAT REAR UP SWITCH SENSE
4	P43 20GY/LB (PREMIUM II/III)	RECLINER UP SWITCH SENSE
5	P19 20YL/LG (PREMIUM II/III)	SEAT FRONT UP SWITCH SENSE
6	P86 20DG/YL (PREMIUM I/III)	PASSENGER SEAT TEMPERATURE SENSOR INPUT
7	P27 20LB/RD (PREMIUM II/III)	REAR RISER POSITION SIGNAL
8	P25 20VT/RD (PREMIUM II/III)	SEAT HORIZONTAL POSITION SIGNAL
9	P135 20LB/BK (PREMIUM I/III)	DRIVER SEAT TEMPERATURE SENSOR INPUT
10	P28 20BR/RD (PREMIUM II/III)	SEAT POSITION SENSOR GROUND
11	P41 20GY/WT (PREMIUM II/III)	RECLINER DOWN SWITCH SENSE
12	P17 20RD/YL (PREMIUM II/III)	SEAT HORIZONTAL REARWARD SWITCH SENSE
13	-	-
14	P21 20RD/LG (PREMIUM II/III)	SEAT FRONT DOWN SWITCH SENSE
15	P13 20RD/WT (PREMIUM II/III)	SEAT REAR DOWN SWITCH SENSE
16	P47 20LB (PREMIUM II/III)	RECLINER POSITION SIGNAL
17	P26 20BR (PREMIUM II/ III)	FRONT RISER POSITION SIGNAL
18	P29 20BR/WT	SEAT SENSOR 5 VOLT SUPPLY
19	Z2 20BK/OR	GROUND
20	D25 20VT/YL	PCI BUS



SEAT MODULE C2 (PREMIUM)

SEAT MODULE C2 (PREMIUM) - ORANGE 20 WAY

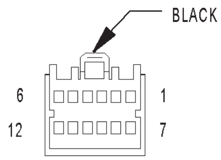
CAV	CIRCUIT	FUNCTION
1	F35 16RD	FUSED B(+)
2	P131 16BK/OR (PREMIUM I/III)	DRIVER SEAT HEATER B(+) DRIVER
3	Z1 16BK	GROUND
4	P119 16YL/RD (PREMIUM II/III)	SEAT FRONT UP DRIVER
5	P121 16RD/GY (PREMIUM II/III)	SEAT FRONT DOWN DRIVER
6	P111 16YL/DB (PREMIUM II/III)	SEAT REAR UP DRIVER
7	P113 16RD/BK (PREMIUM II/III)	SEAT REAR DOWN DRIVER
8	-	-
9	P115 16GY/LG (PREMIUM II/III)	SEAT HORIZONTAL FORWARD DRIVER
10	F35 16RD	FUSED B(+)
11	P130 16DG/WT (PREMIUM I/III)	PASSENGER SEAT HEATER B(+) DRIVER
12	Z1 16BK	GROUND
13	-	-
14	P9 20RD/LB (PREMIUM II/III)	SEAT SWITCH B(+) SUPPLY
15	Z6 16BK/YL (PREMIUM I/III)	GROUND
16	Z5 16BK/VT (PREMIUM I/III)	GROUND
17	-	-
18	P141 16GY/WT (PREMIUM II/III)	SEAT RECLINER DOWN DRIVER
19	P143 16GY/LB (PREMIUM II/III)	SEAT RECLINER UP DRIVER
20	P117 16RD/BR (PREMIUM II/III)	SEAT HORIZONTAL REARWARD DRIVER



SENTRY KEY IMMOBILIZER MODULE

SENTRY KEY IMMOBILIZER MODULE - BLACK 6 WAY

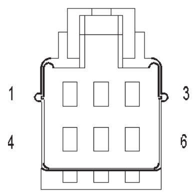
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	Z132 20BK/OR	GROUND
3	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	-	-
5	D25 20YL/VT/BK	PCI BUS
6	-	-



SHIFTER ASSEMBLY C1 (DIESEL)

SHIFTER ASSEMBLY C1 (DIESEL) - BLACK 12 WAY

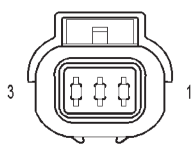
CAV	CIRCUIT	FUNCTION
1	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
5	D25 20OR	PCI BUS
6	W0 20DB/WT	SHIFTER C1 SENSE
7	W1 20VT/WT	SHIFTER C2 SENSE
8	W2 20VT	SHIFTER C3 SENSE
9	W3 20BK	SHIFTER C4 SENSE
10	W4 20PK/OR	SHIFTER C5 SENSE
11	Z234 20WT	GROUND
12	Z234 20WT	GROUND



SHIFTER ASSEMBLY C2 (DIESEL)

SHIFTER ASSEMBLY C2 (DIESEL) - 6 WAY

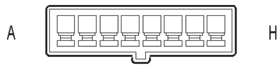
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL



SIREN (BUILT-UP-EXPORT)

SIREN (BUILT-UP-EXPORT) - 3 WAY

CAV	CIRCUIT	FUNCTION
1	Z141 18BK	GROUND
2	X75 18GY/LB (DIESEL)	SIREN SIGNAL CONTROL
2	X75 18GY/LG (GAS)	SIREN SIGNAL CONTROL
3	M1 18PK	FUSED B(+)

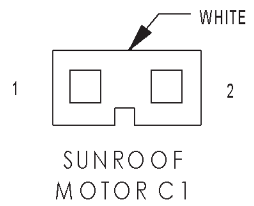


SUNROOF CONTROL MODULE

SUNROOF CONTROL MODULE - 8 WAY

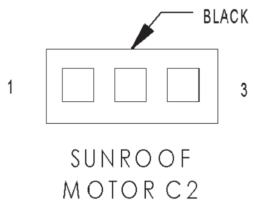
CAV	CIRCUIT	FUNCTION
A	Q46 20OR/WT	SUNROOF MOTOR POSITION SENSOR SIGNAL
B	Q41 20WT	SUNROOF OPEN
C	Q43 20VT	SUNROOF VENT
D	Z1 16BK	GROUND
E	-	-
F	Q30 16DB	ACCESSORY DELAY RELAY OUTPUT
G	Q5 16RD	SUNROOF MOTOR B(+)
H	Q6 16OR	SUNROOF MOTOR B(-)

CONNECTOR PINOUTS



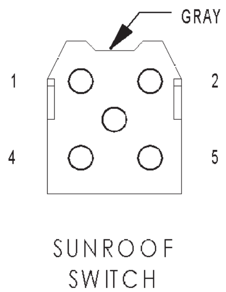
SUNROOF MOTOR C1 - WHITE 2 WAY

CAV	CIRCUIT	FUNCTION
1	Q5 16RD	SUNROOF MOTOR B(+)
2	Q6 16OR	SUNROOF MOTOR B(-)



SUNROOF MOTOR C2 - BLACK 3 WAY

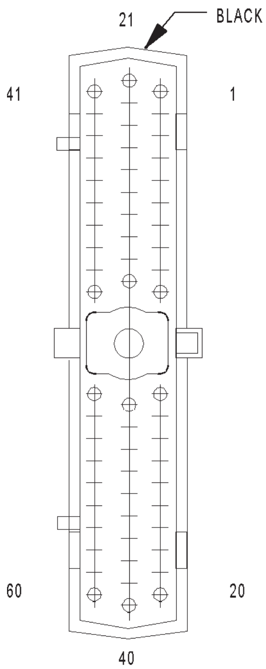
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	Q46 20OR/WT	SUNROOF MOTOR POSITION SENSOR SIGNAL
3	-	-



SUNROOF SWITCH - GRAY 5 WAY

CAV	CIRCUIT	FUNCTION
1	Q43 20VT	SUNROOF VENT
2	-	-
3	Z150 20BK	GROUND
4	-	-
5	Q41 20WT	SUNROOF OPEN

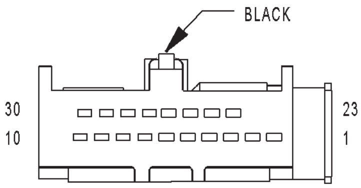
CONNECTOR PINOUTS



TRANSMISSION CONTROL MODULE (4.7L)

TRANSMISSION CONTROL MODULE (4.7L) - BLACK 60 WAY

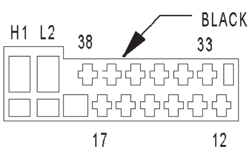
CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	T2 18TN/BK	TRS T2 SENSE
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	F45 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK/YL	TRANSMISSION CONTROL RELAY CONTROL
16	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
19	T119 18WT/DB	2C SOLENOID CONTROL
20	T120 18LG	LR SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
30	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
37	Z113 14BK/WT	GROUND
38	T138 14GY/LB	5 VOLT SUPPLY
39	Z112 14BK/YL	GROUND
40	T140 18VT/LG	MS SOLENOID CONTROL
41	T41 18WT	TRS T41 SENSE
42	T42 18VT/WT	TRS T42 SENSE
43	D25 18YL/VT	PCI BUS
44	-	-
45	-	-
46	D20 18LG	SCI RECEIVE
47	T147 18LB	2C PRESSURE SWITCH SENSE
48	T48 18DB	4C PRESSURE SWITCH SENSE
49	T6 18VT/WT	OVERDRIVE OFF SWITCH SENSE
50	T150 18BR/LB	LR PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z114 14BK/LG	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	T59 18PK	UNDERDRIVE SOLENOID CONTROL
56	A30 14RD/WT	FUSED B(+)
57	Z12 14BK/TN	GROUND
58	-	-
59	T159 18DG/WT	4C SOLENOID CONTROL
60	T60 18BR	OVERDRIVE SOLENOID CONTROL



TRANSMISSION CONTROL MODULE C1 (DIESEL)

TRANSMISSION CONTROL MODULE C1 (DIESEL) - BLACK 18 WAY

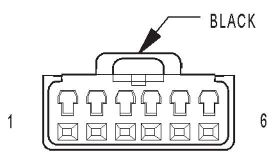
CAV	CIRCUIT	FUNCTION
1	D21 20PK	SCI TRANSMIT
2	-	-
3	W4 20PK/OR	SHIFTER C5 SENSE
4	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL
5	-	-
6	-	-
7	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
8	-	-
9	-	-
10	-	-
23	-	-
24	-	-
25	W0 20DB/WT	SHIFTER C1 SENSE
26	W1 20VT/WT	SHIFTER C2 SENSE
27	W2 20VT	SHIFTER C3 SENSE
28	W3 20BK	SHIFTER C4 SENSE
29	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
30	Z234 20WT	GROUND



TRANSMISSION CONTROL MODULE C2 (DIESEL)

TRANSMISSION CONTROL MODULE C2 (DIESEL) - BLACK 14 WAY

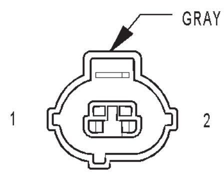
CAV	CIRCUIT	FUNCTION
12	T52 18RD/BK	N2 INPUT SPEED SENSOR
13	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
14	T60 18BR	1-2/4-5 SOLENOID CONTROL
15	T159 18DG/WT	3-4 SOLENOID CONTROL
16	T119 18WT/DB	2-3 SOLENOID CONTROL
17	T120 18LG	TCC SOLENOID CONTROL
33	T13 18DB/BK	SENSOR GROUND
34	T54 18VT	TEMP SENSOR - P/N SWITCH
35	T14 18LG/WT	N3 INPUT SPEED SENSOR
36	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
37	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
38	T16 18RD	SOLENOID SUPPLY VOLTAGE
H1	D52 18LG/WT	CAN C BUS(+)
L2	D51 18DG/WT	CAN C BUS(-)



VEHICLE INFORMATION CENTER

VEHICLE INFORMATION CENTER - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	F70 20PK	FUSED B(+)
4	Z155 20BK/OR	GROUND
5	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	-	-



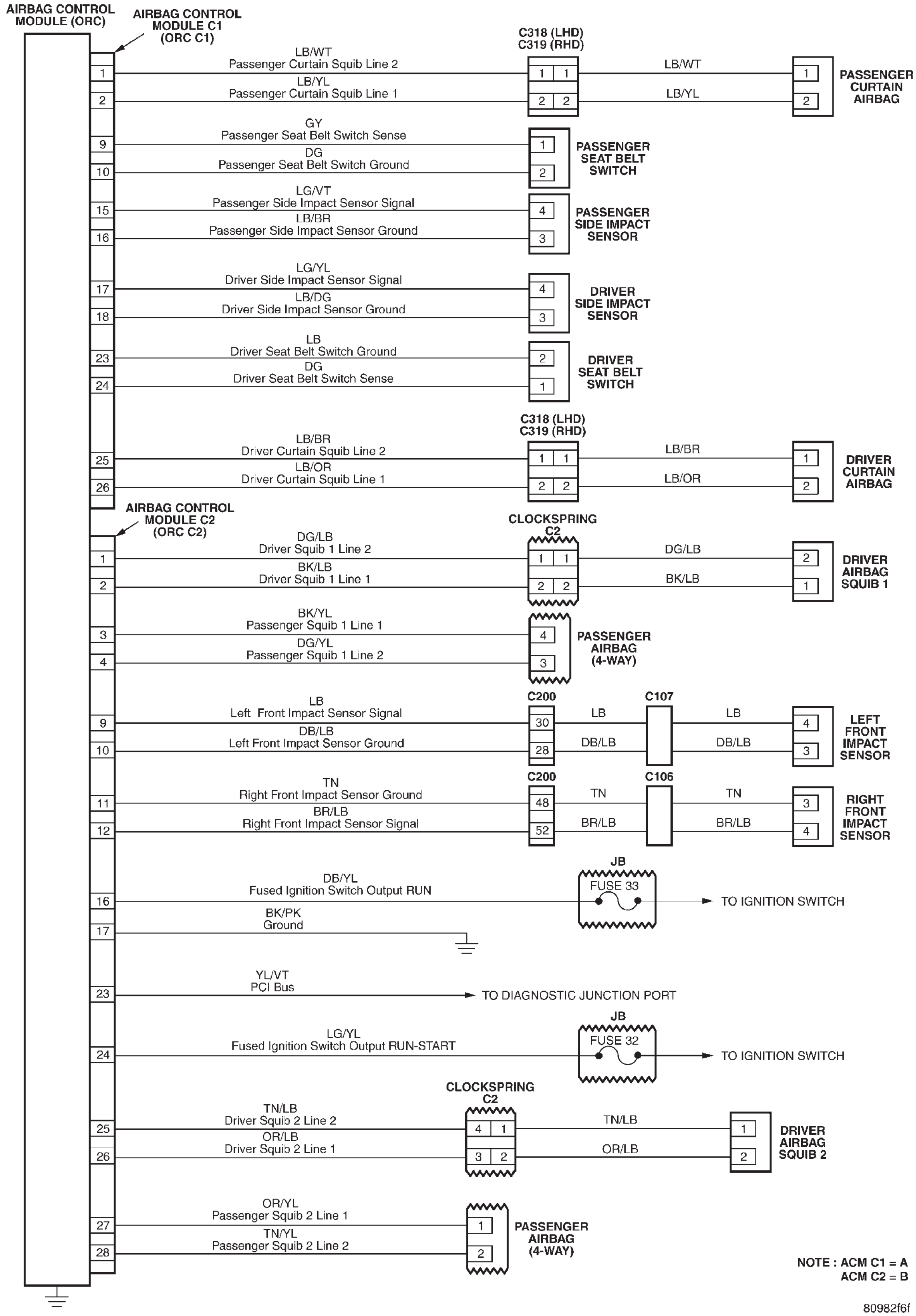
WASHER FLUID LEVEL SWITCH

WASHER FLUID LEVEL SWITCH - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	V11 20BK/TN	WASHER FLUID SWITCH SENSE
2	Z141 20BK	GROUND

10.0 SCHEMATIC DIAGRAMS

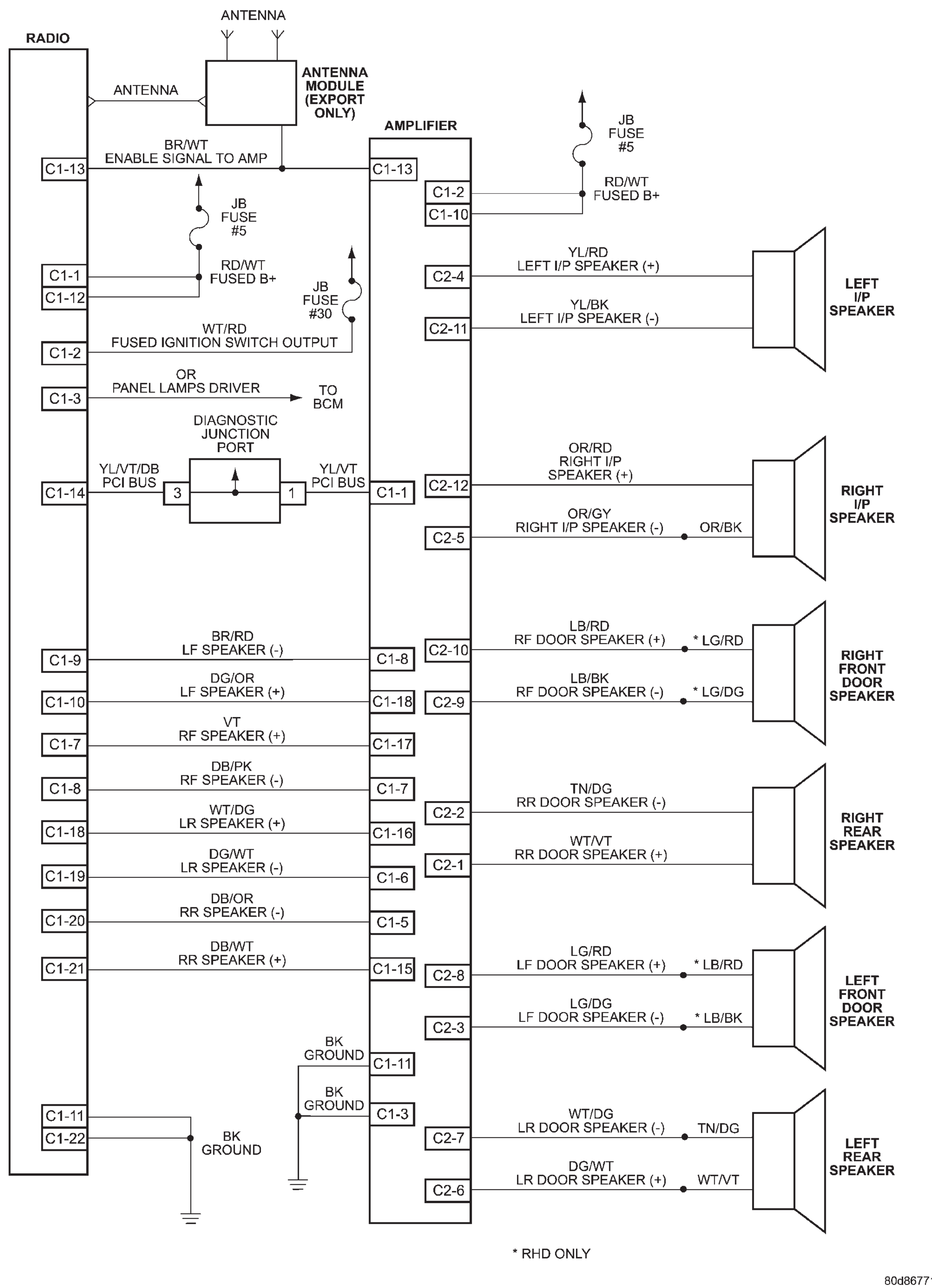
10.1 AIRBAG SYSTEM



S C H E M A T I C D I A G R A M S

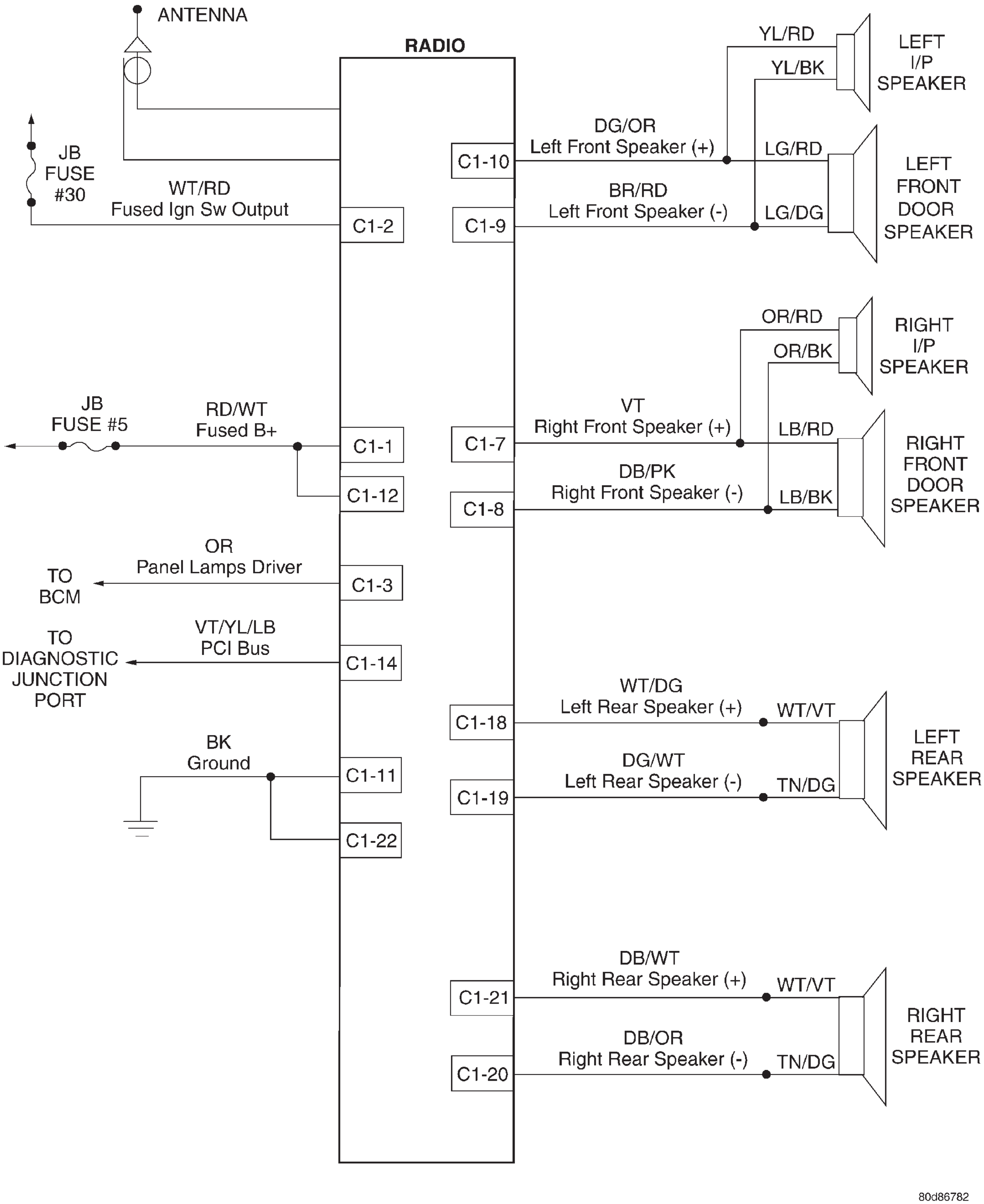
10.2 AUDIO SYSTEM

10.2.1 PREMIUM AUDIO SYSTEM



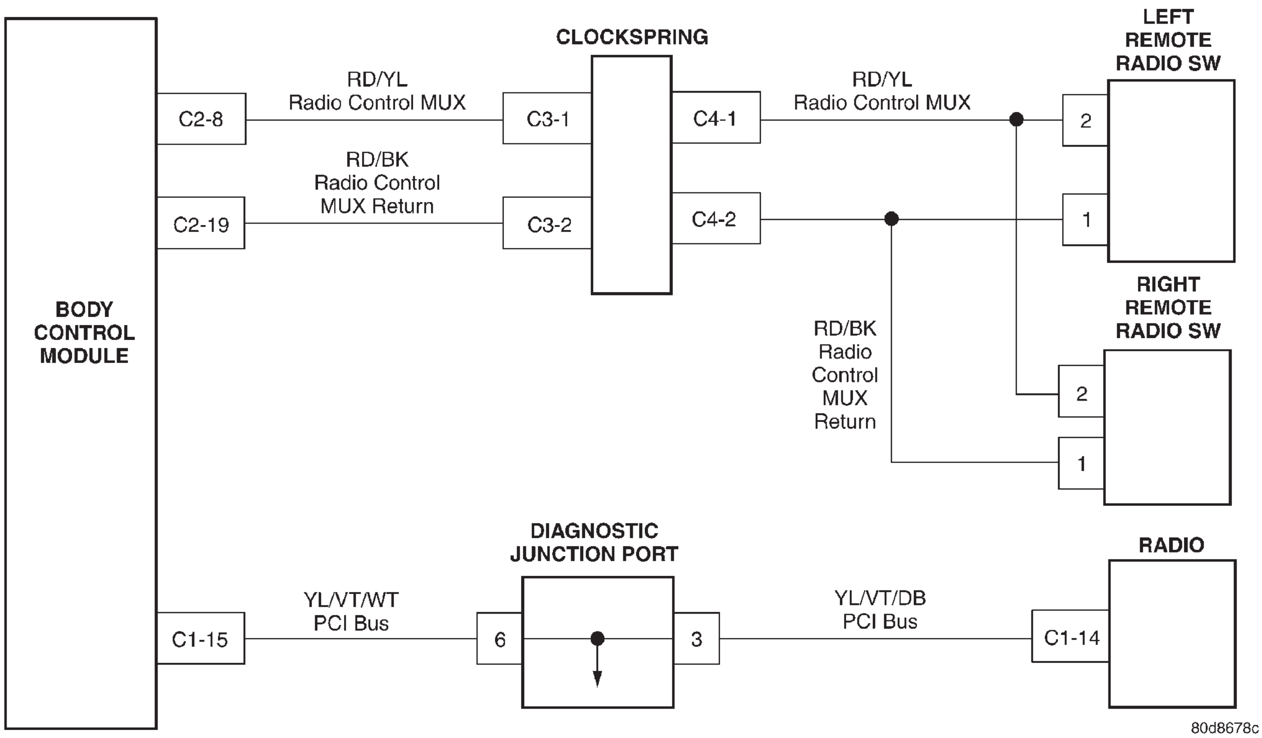
S C H E M A T I C D I A G R A M S

10.2.2 BASE AUDIO SYSTEM



SCHEMATIC DIAGRAMS

10.2.3 REMOTE RADIO CONTROLS



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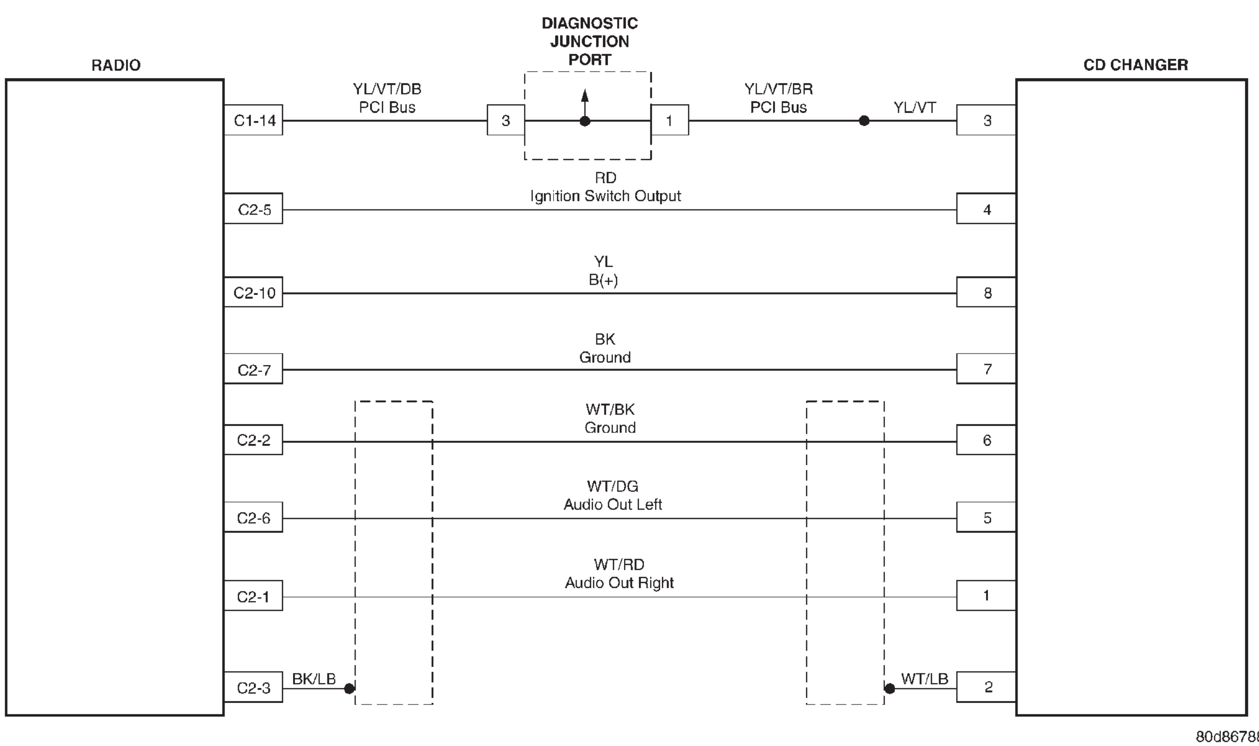
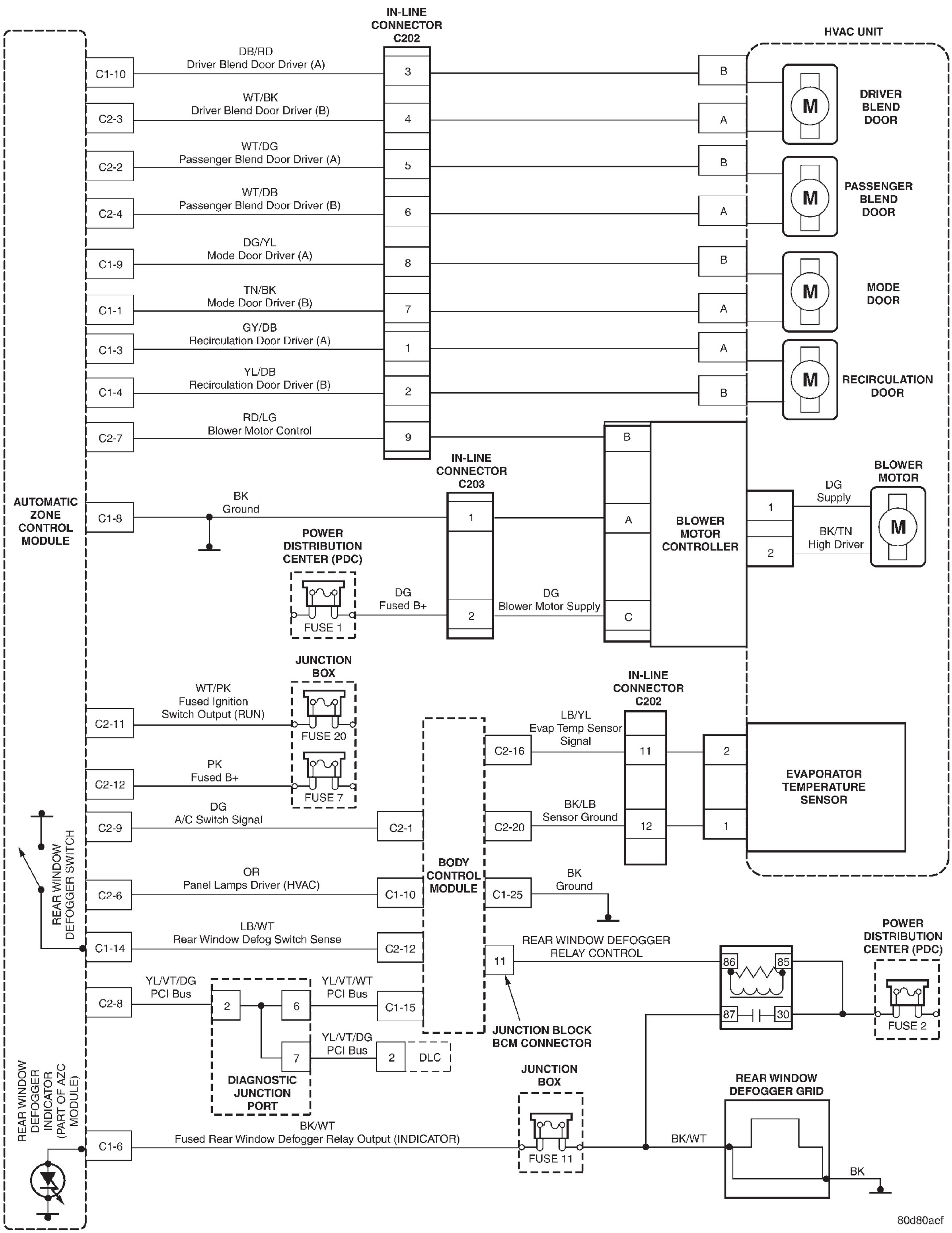


SCHEMATIC DIAGRAMS

10.3 HEATING & A/C

10.3.1 AUTOMATIC ZONE CONTROL – LHD



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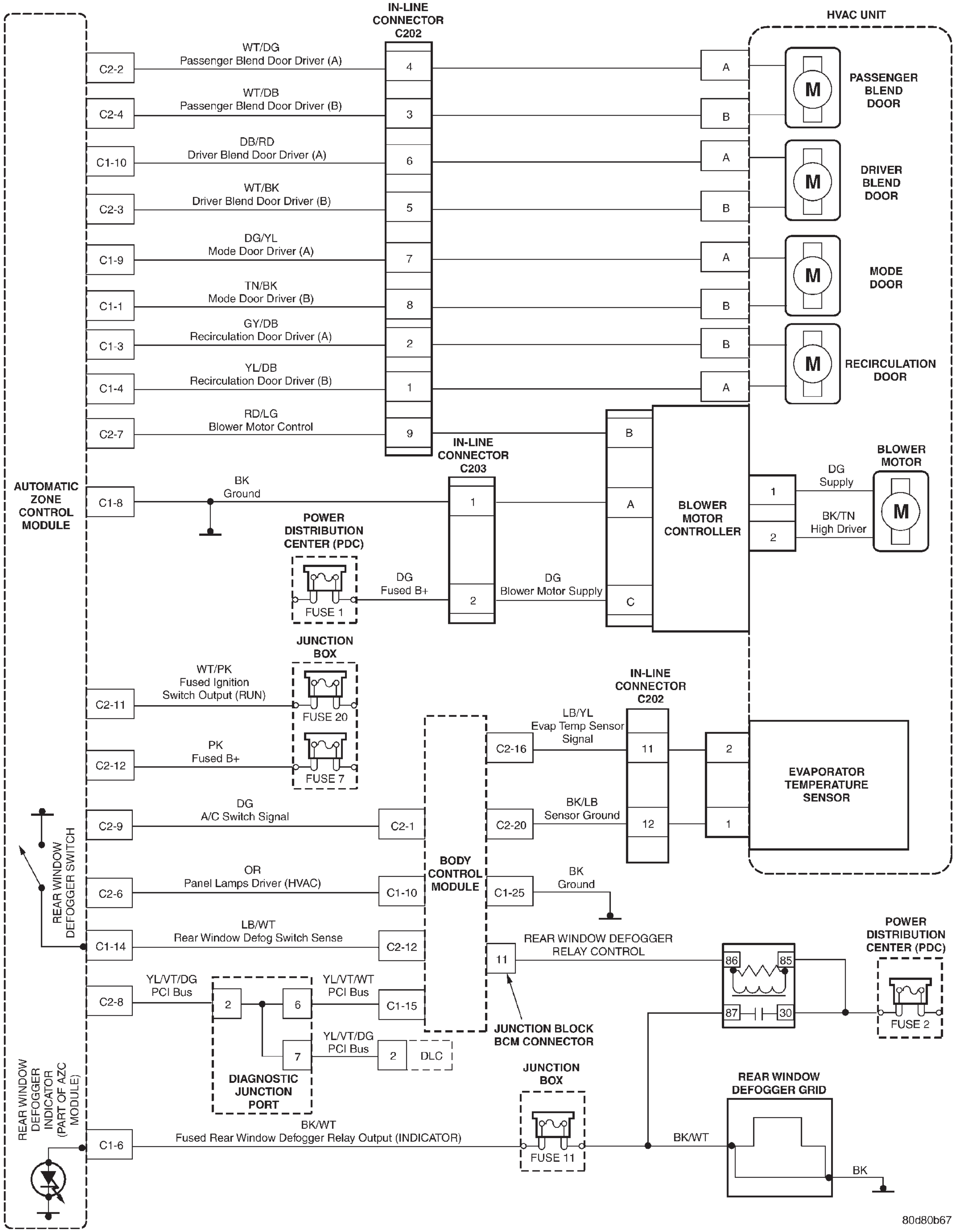
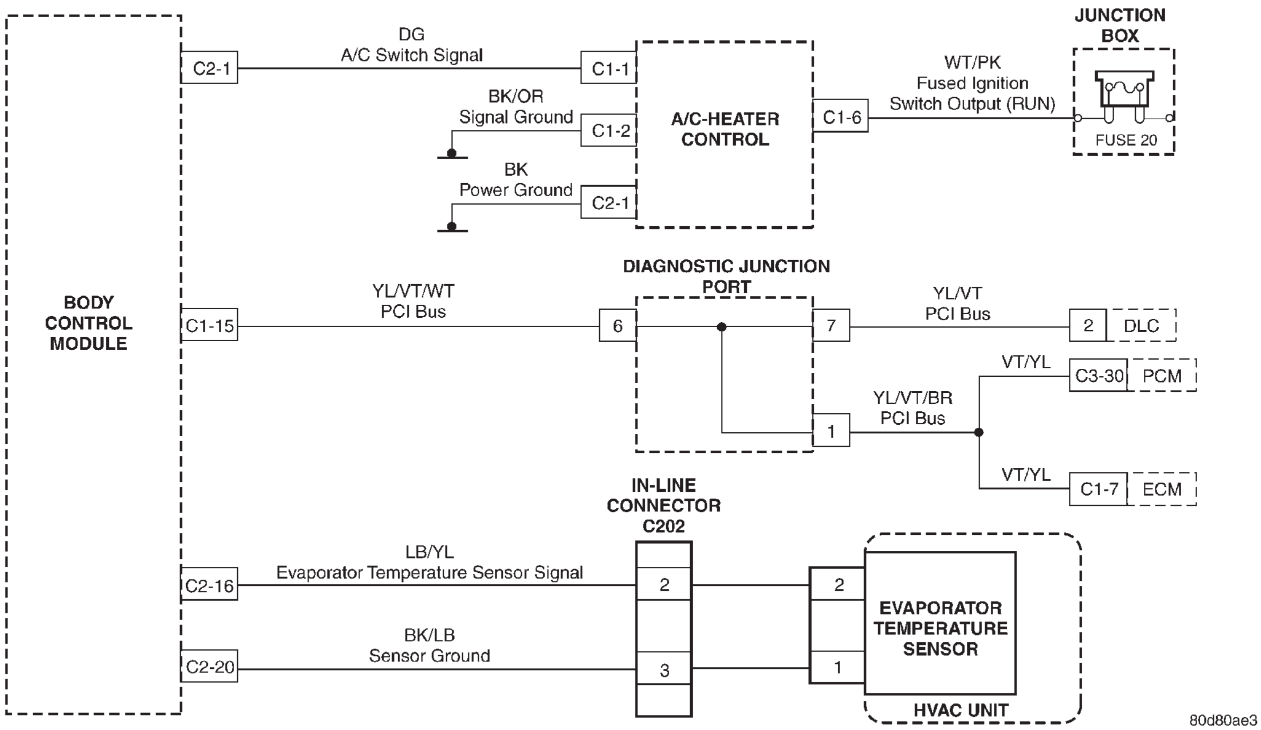


10.3.3 MANUAL TEMPERATURE CONTROL



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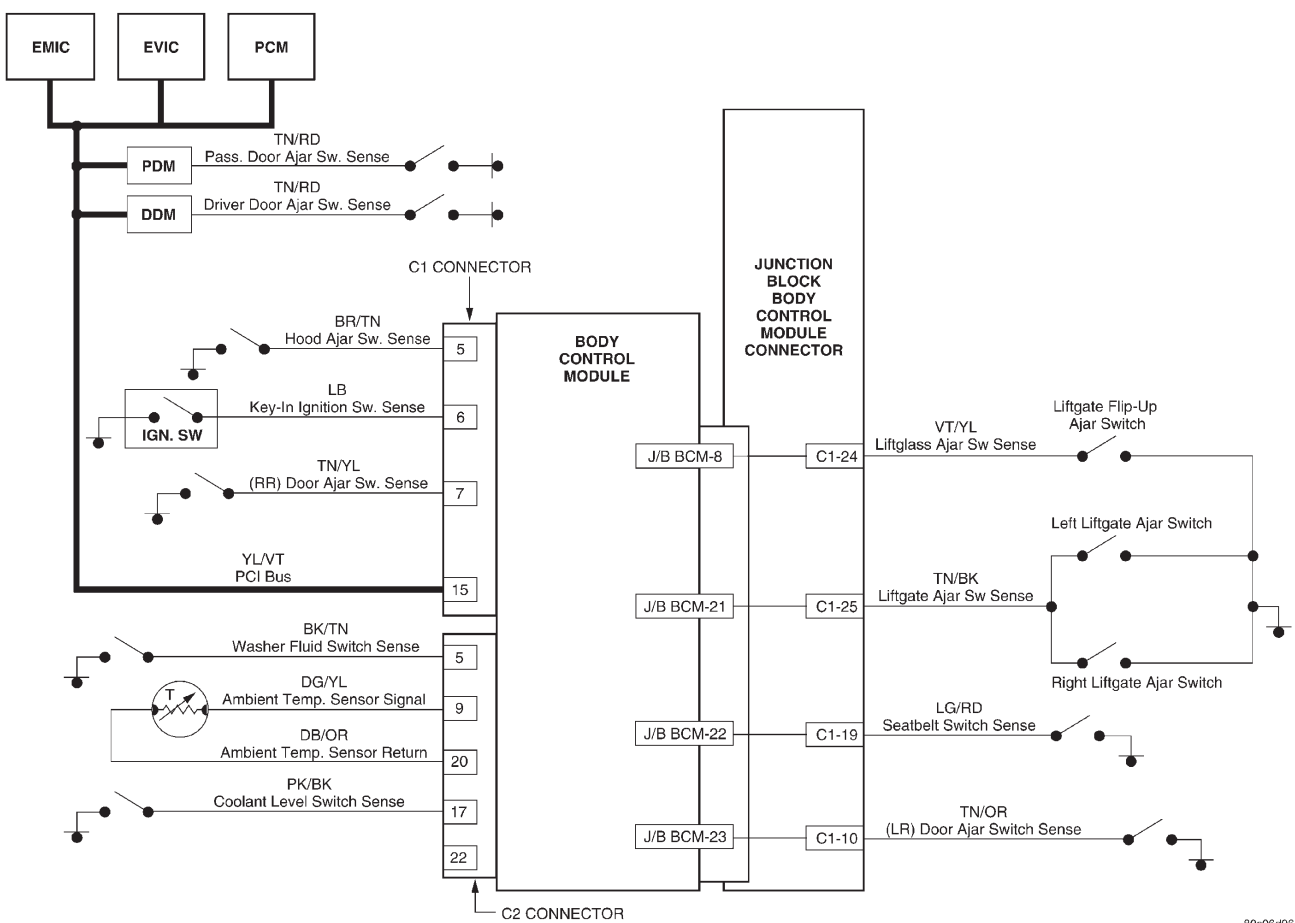
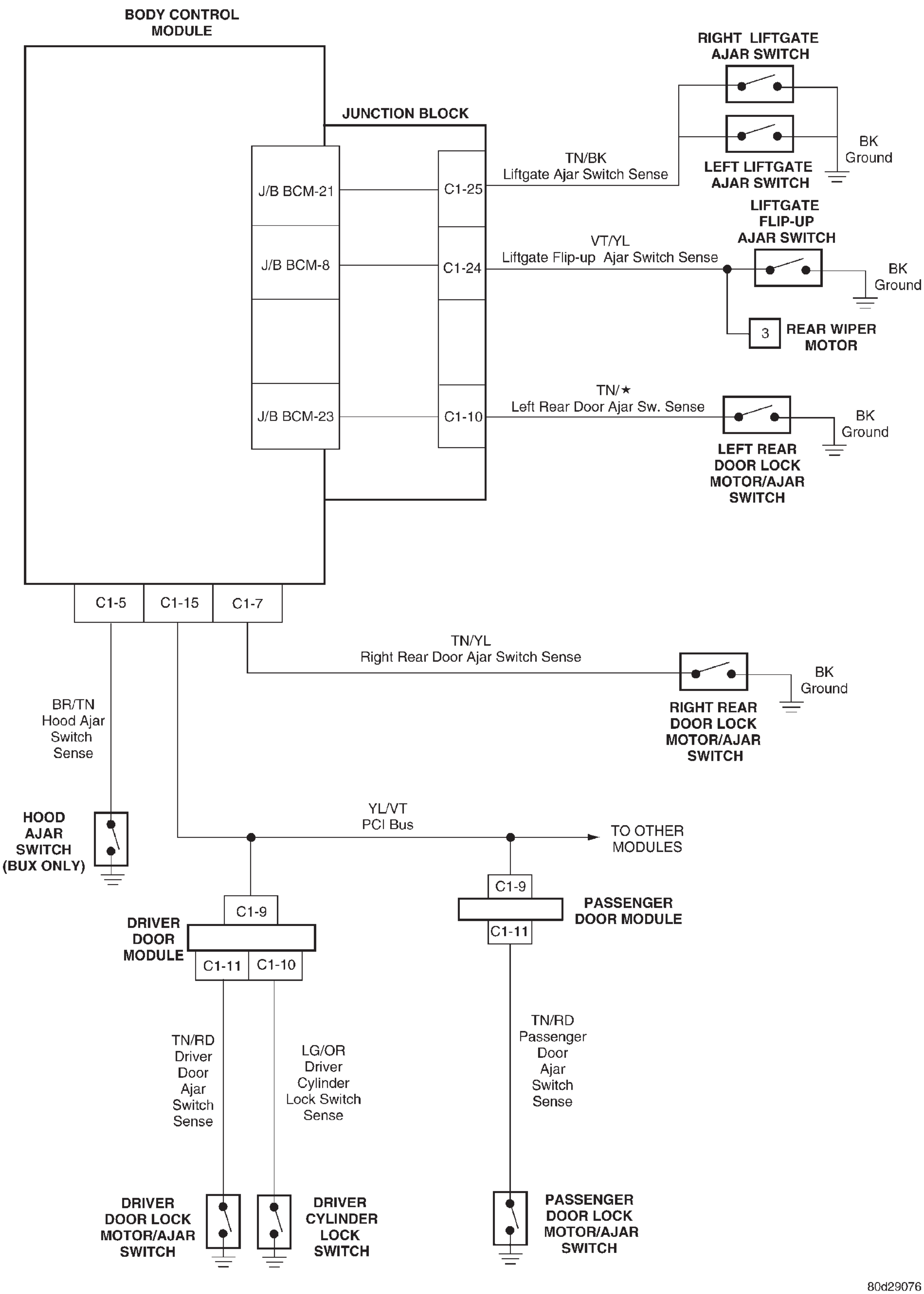


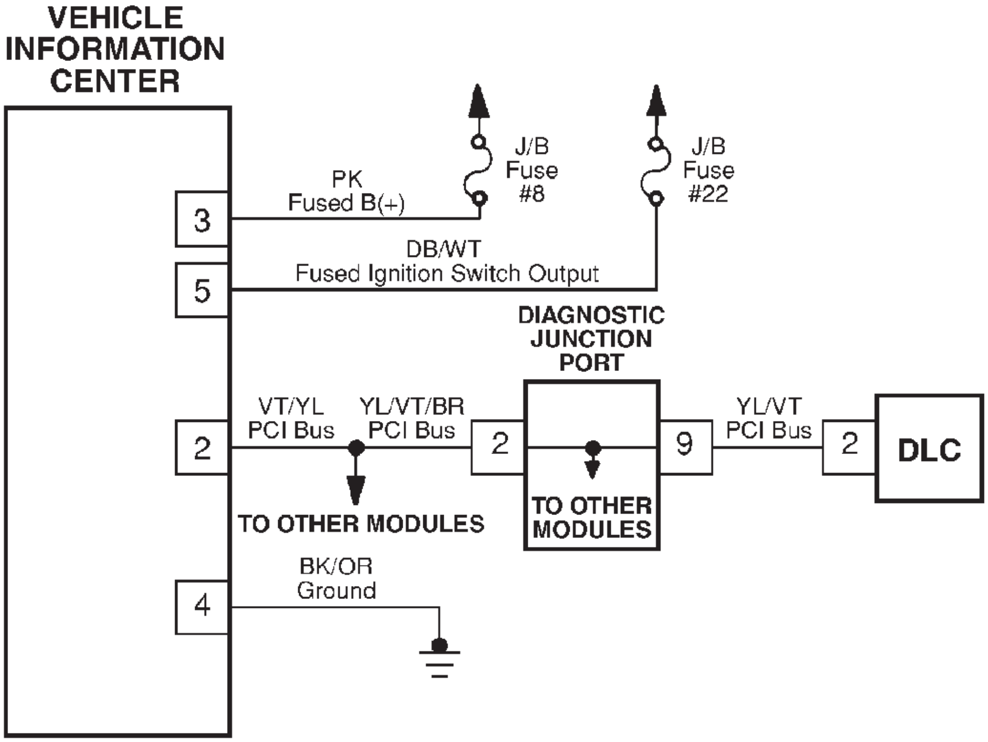
SCHEMATIC DIAGRAMS

10.5 DOOR AJAR SYSTEM



S C H E M A T I C D I A G R A M S

10.6 EVIC



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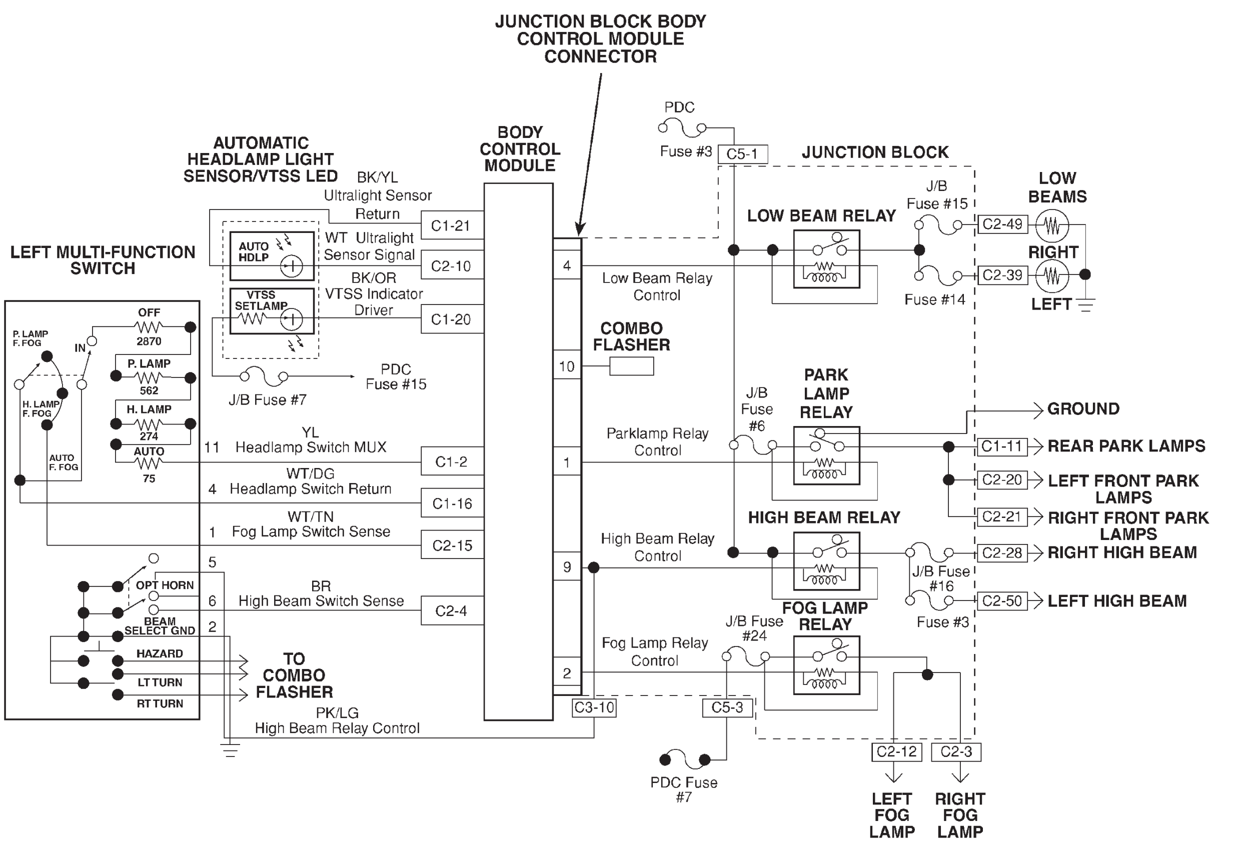

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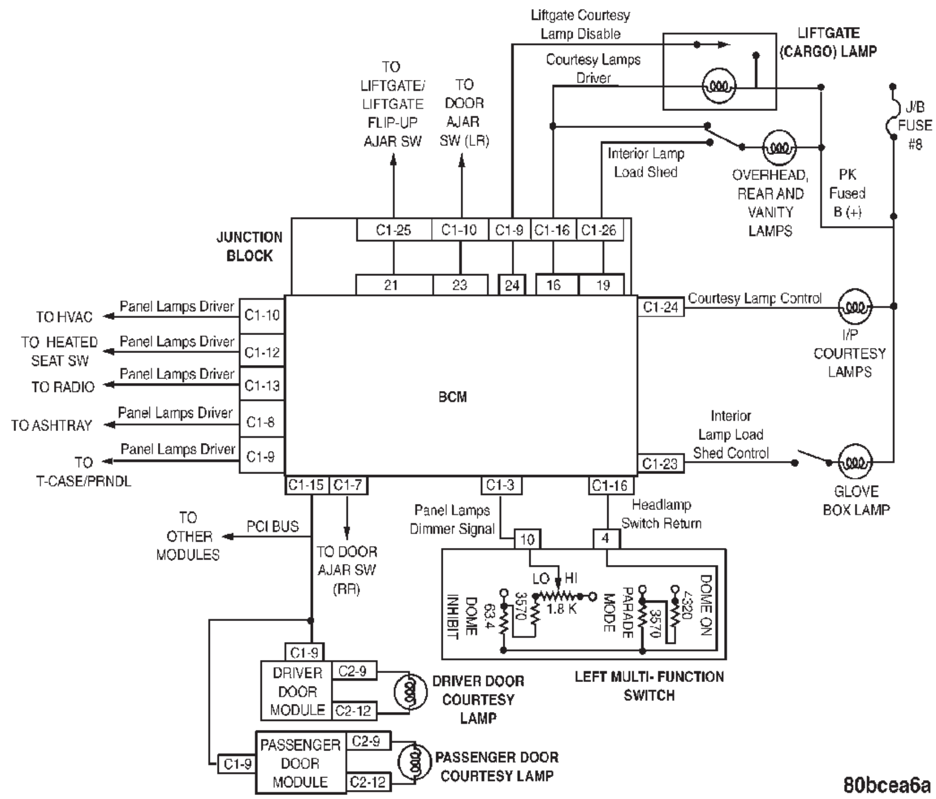

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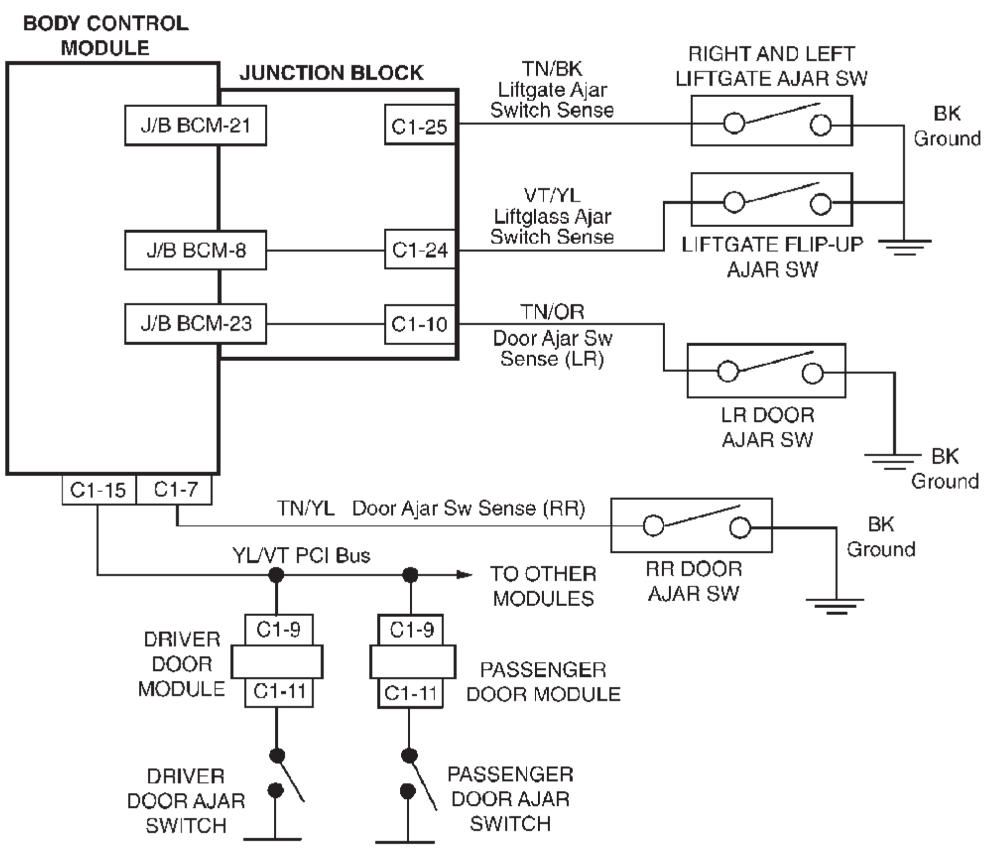

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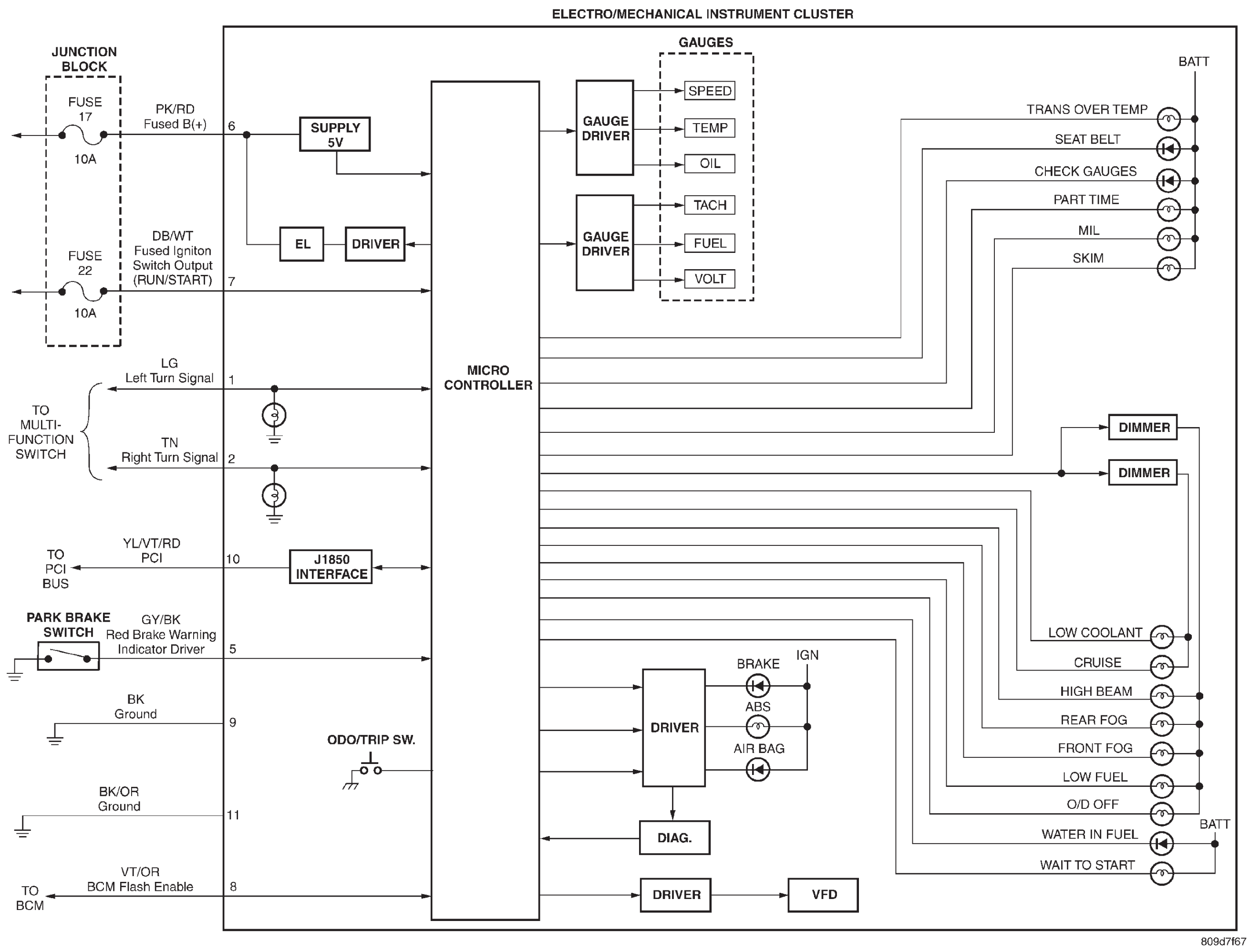
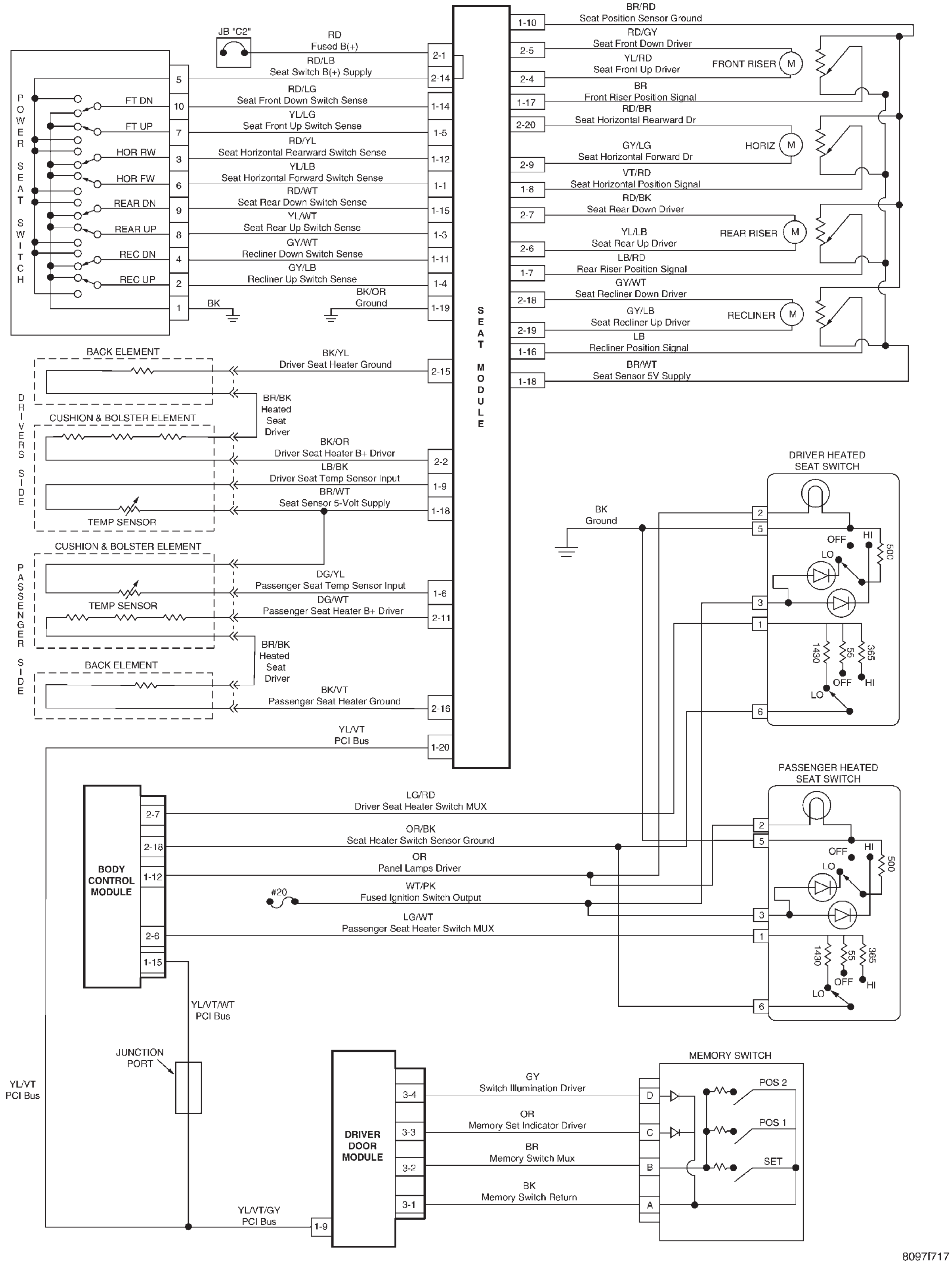
10.9 MECHANICAL INSTRUMENT CLUSTER



10.10 MEMORY HEATED SEATS

10.10.1 LAREDO ONLY



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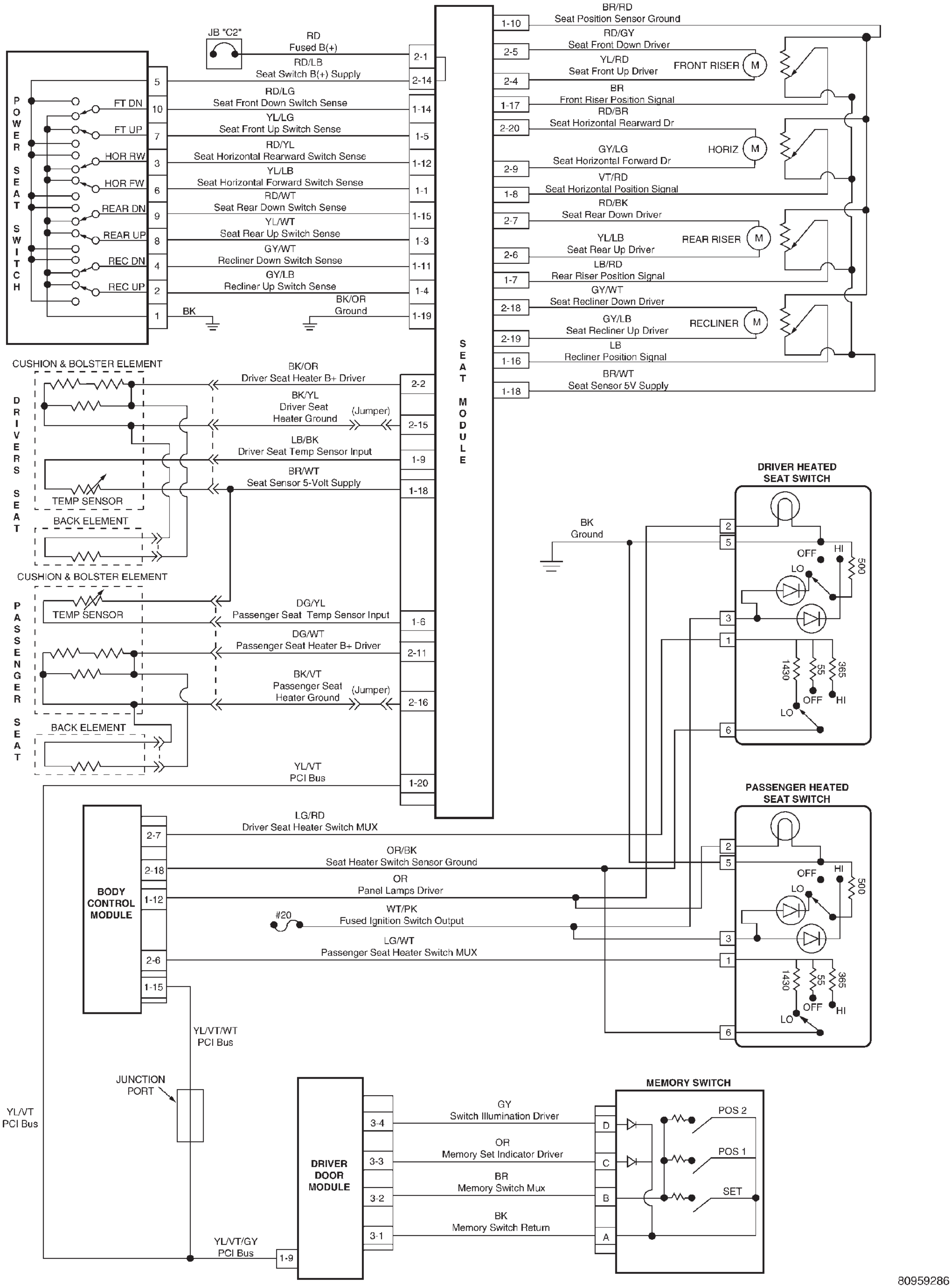
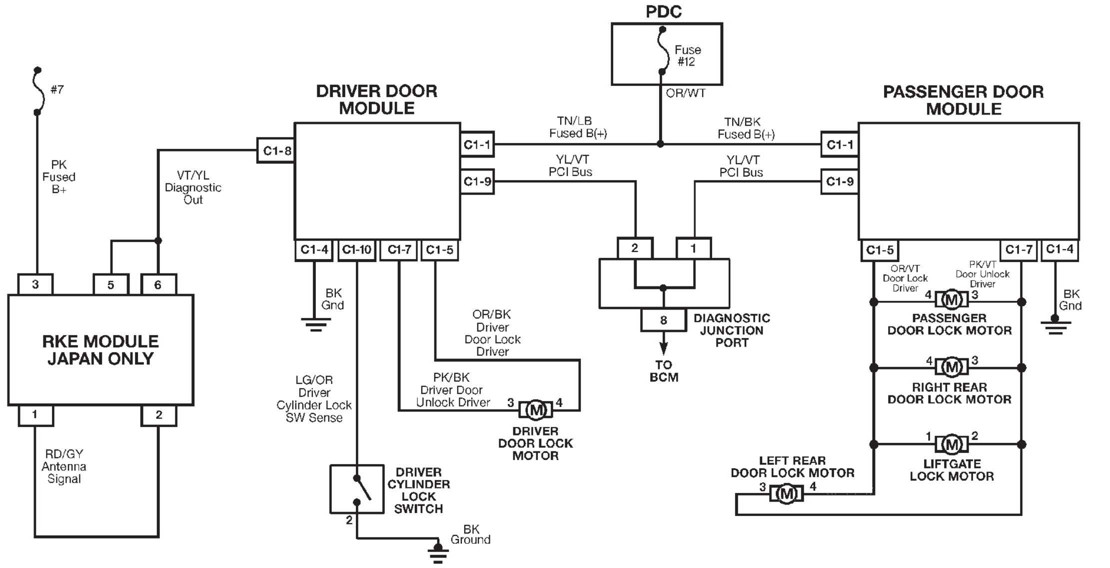


10.11 POWER DOOR LOCKS



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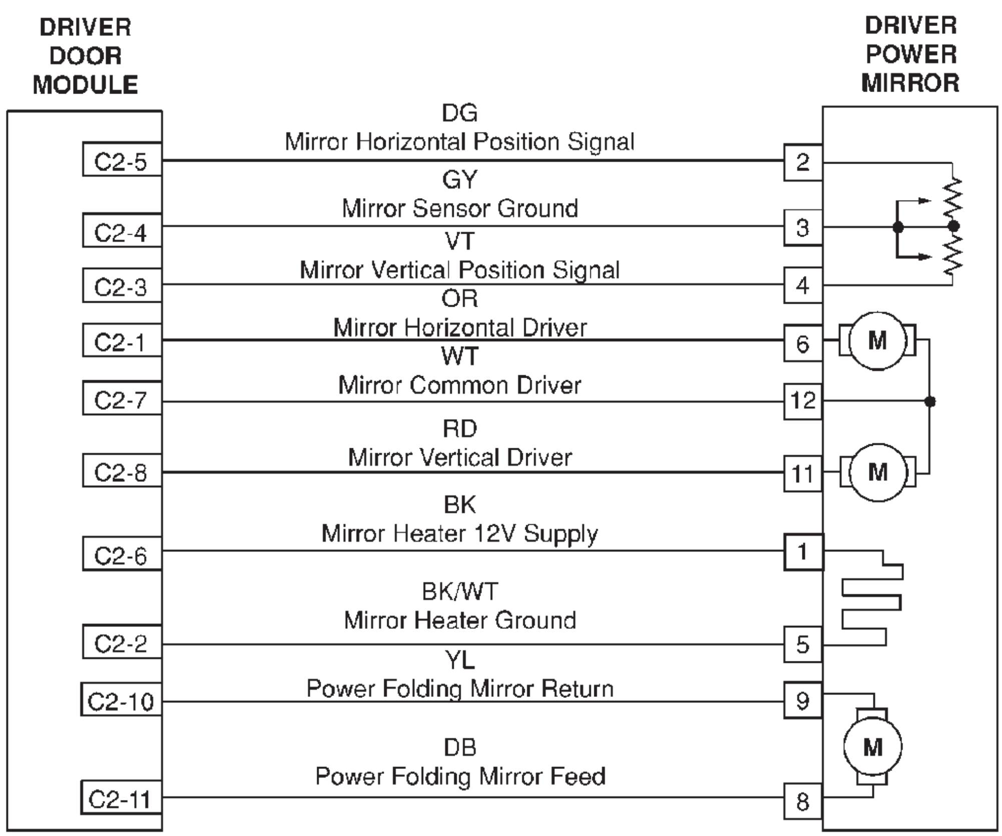
10.12 POWER MIRROR SYSTEM

10.12.1 DRIVER MIRROR



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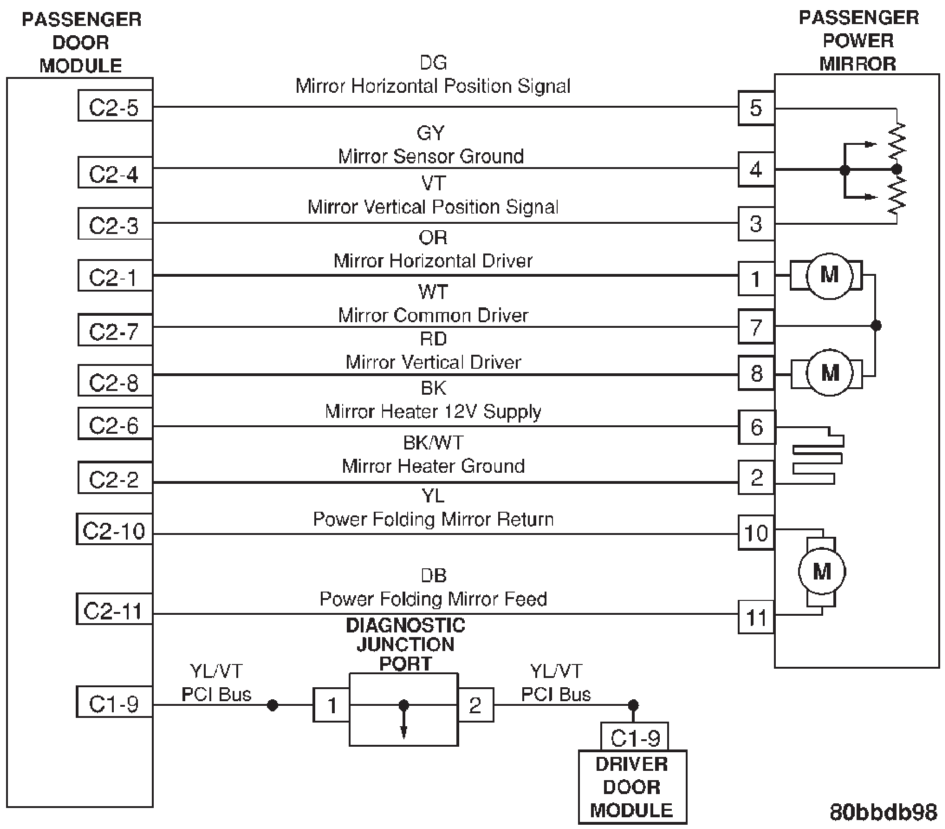
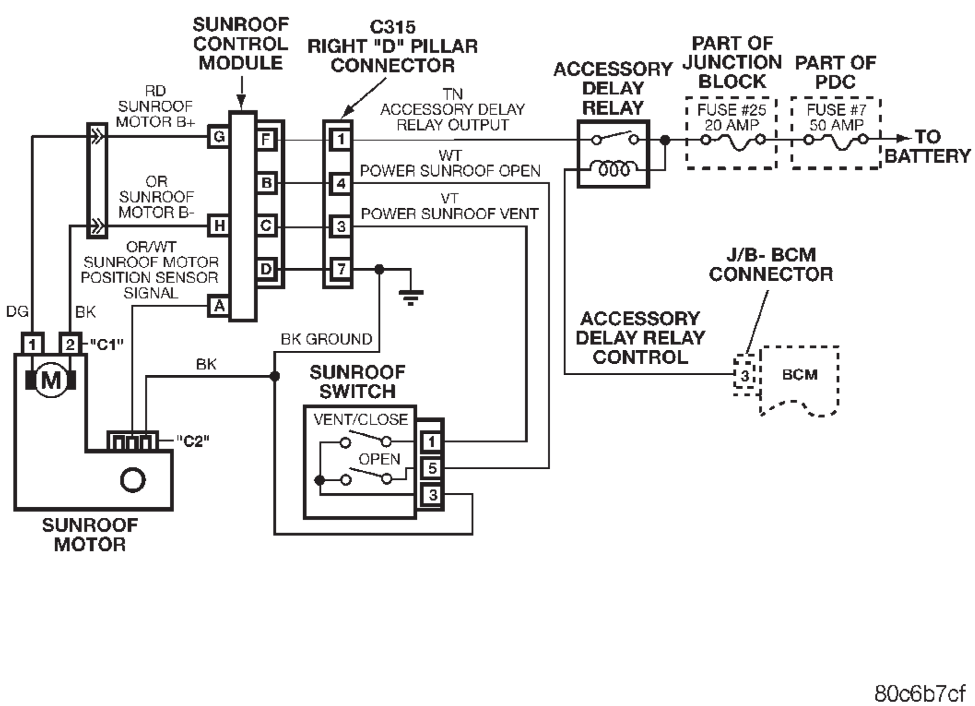
10.12.2 PASSENGER MIRROR

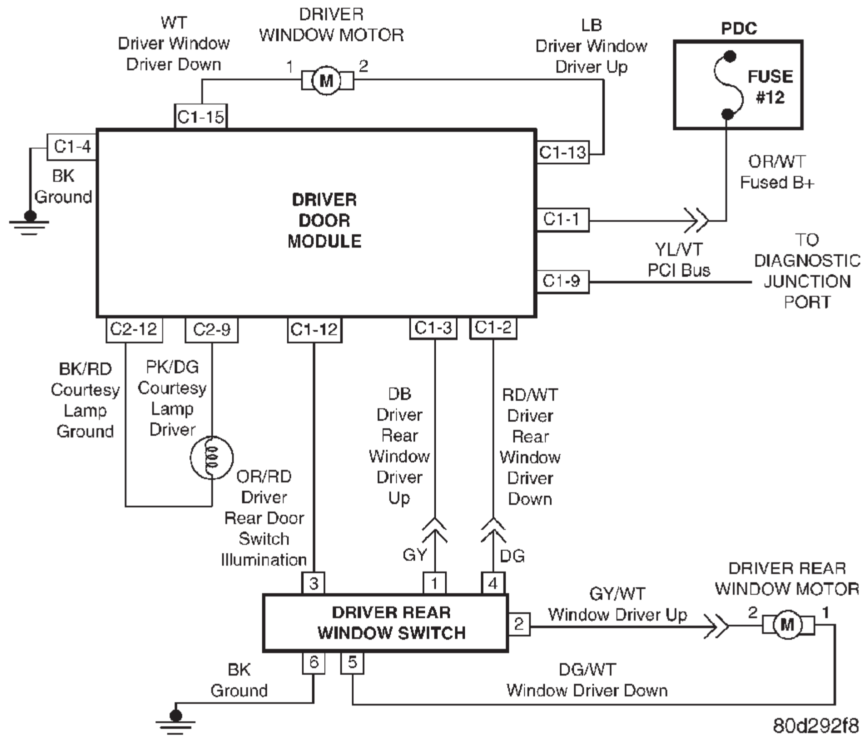


10.13 POWER SUNROOF



10.14 POWER WINDOWS

10.14.1 DRIVER SIDE



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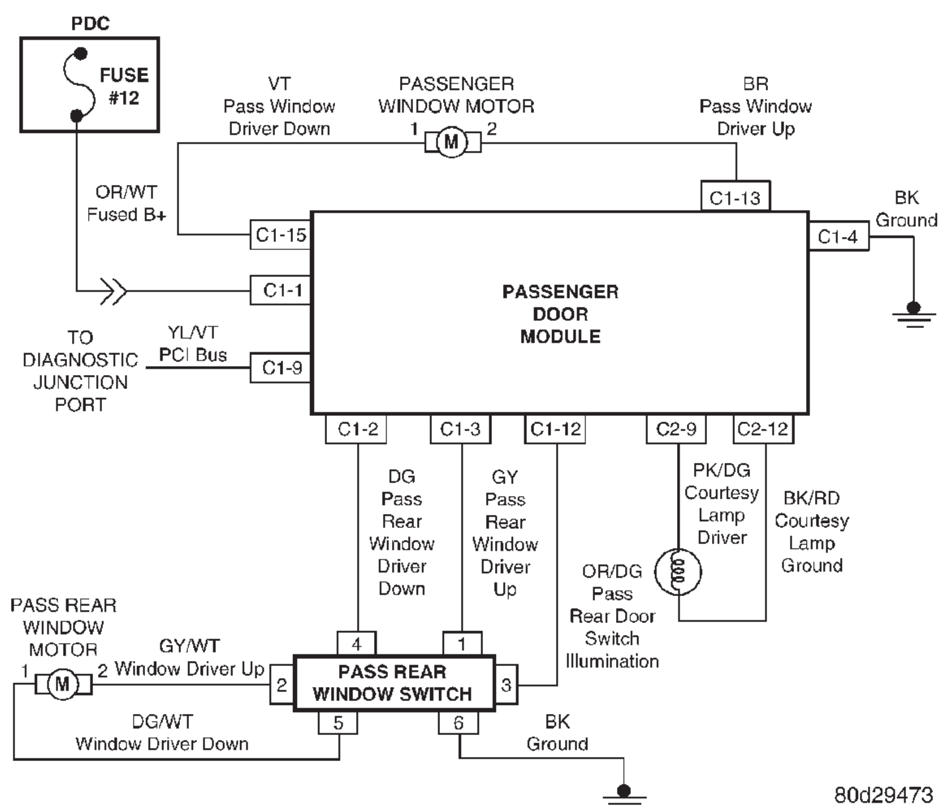
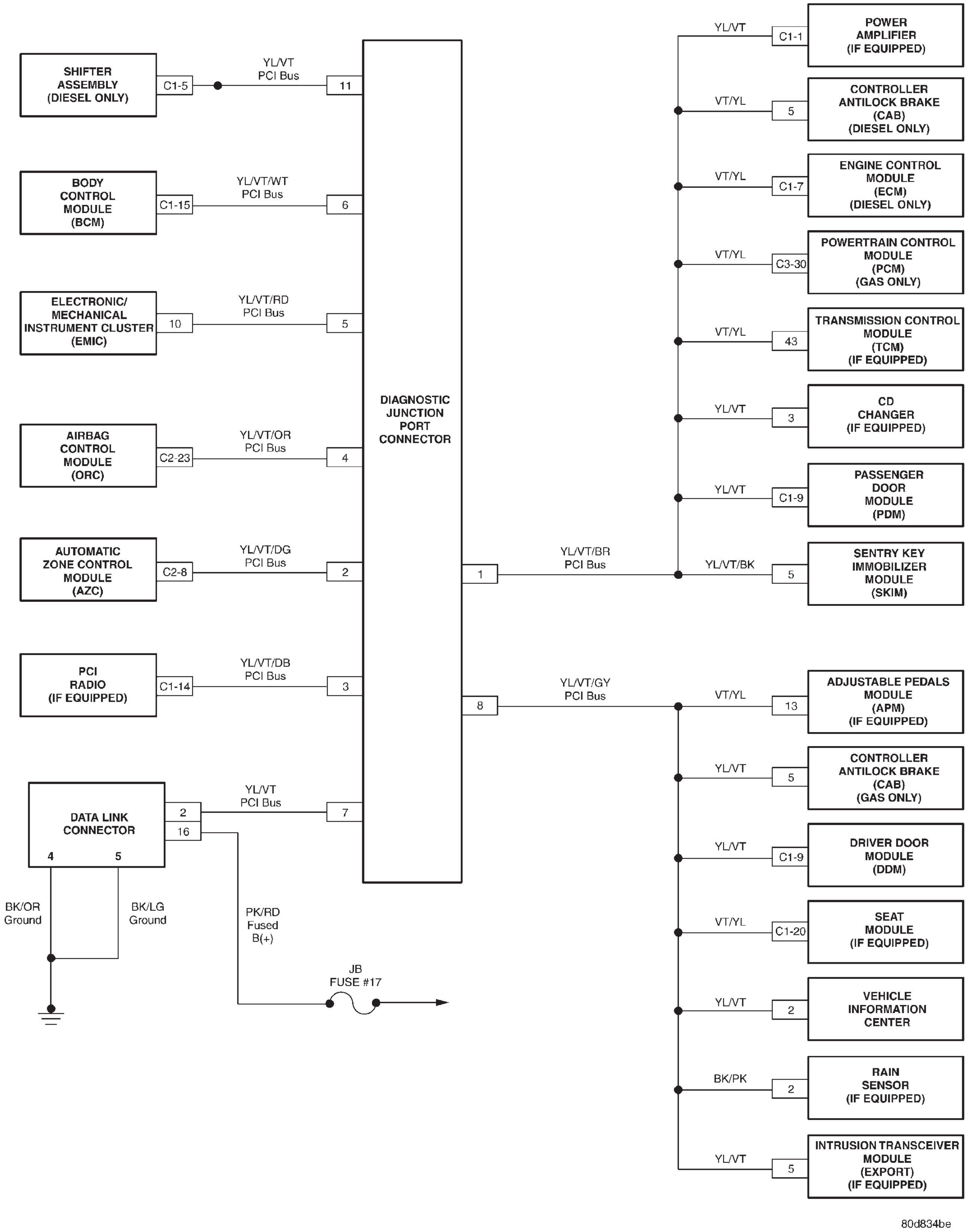


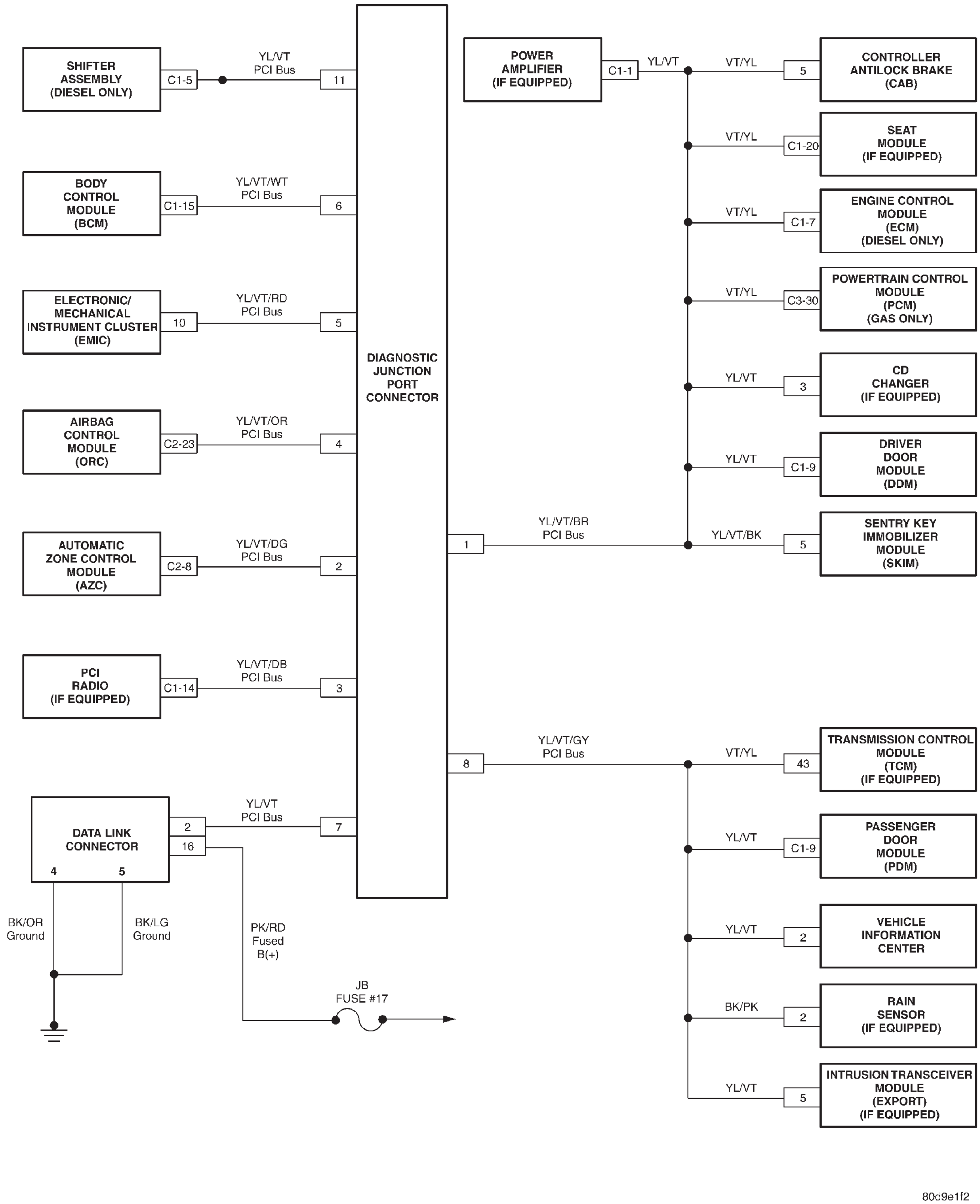
10.15 VEHICLE COMMUNICATION

10.15.1 VEHICLE COMMUNICATION – LHD



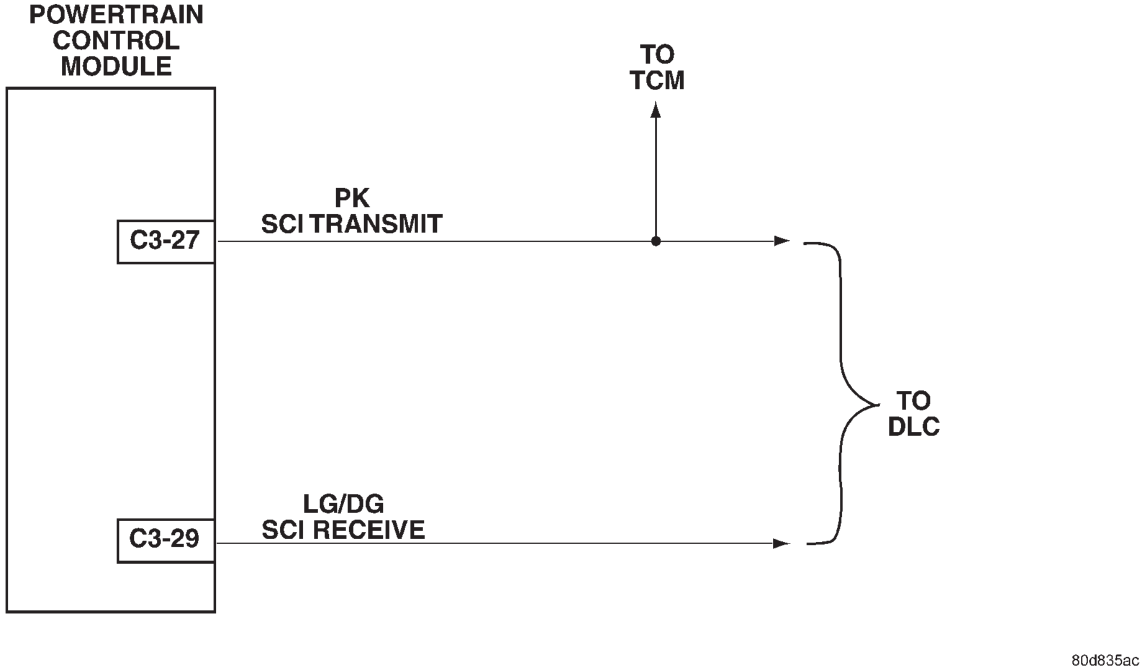
SCHEMATIC DIAGRAMS

10.15.2 VEHICLE COMMUNICATION – RHD

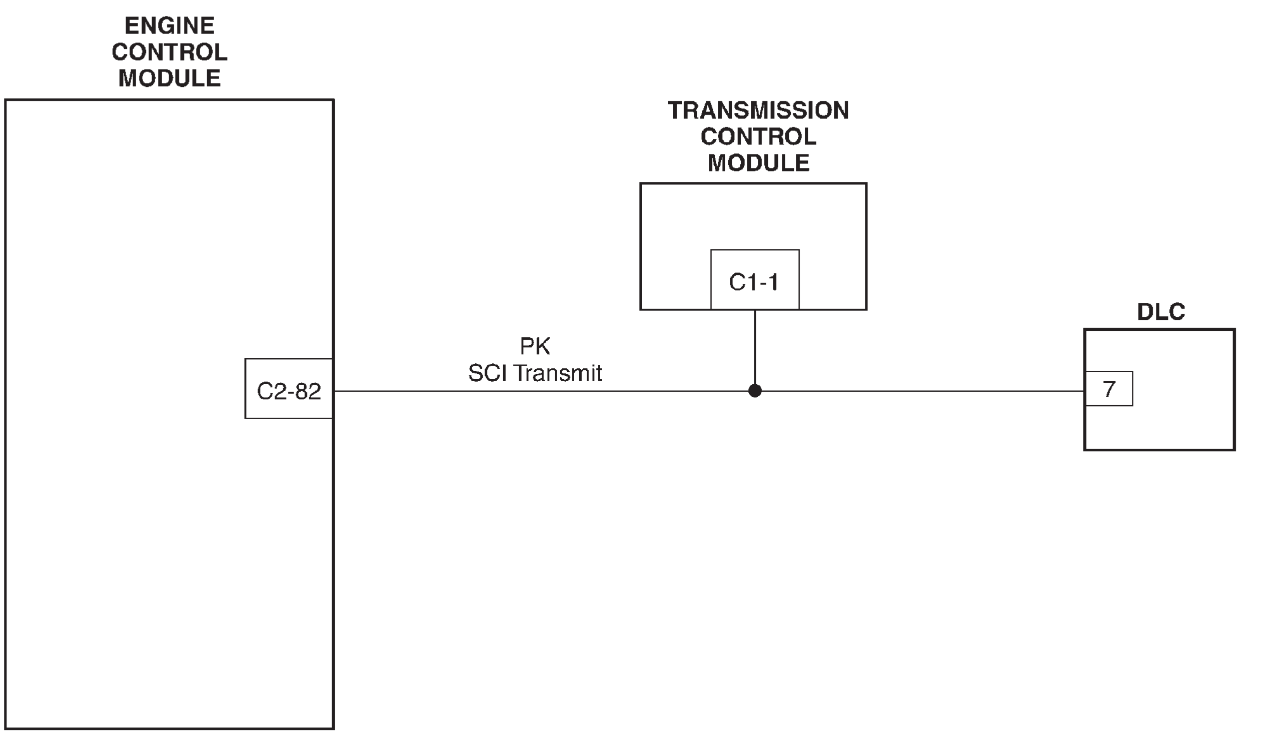


S C H E M A T I C D I A G R A M S

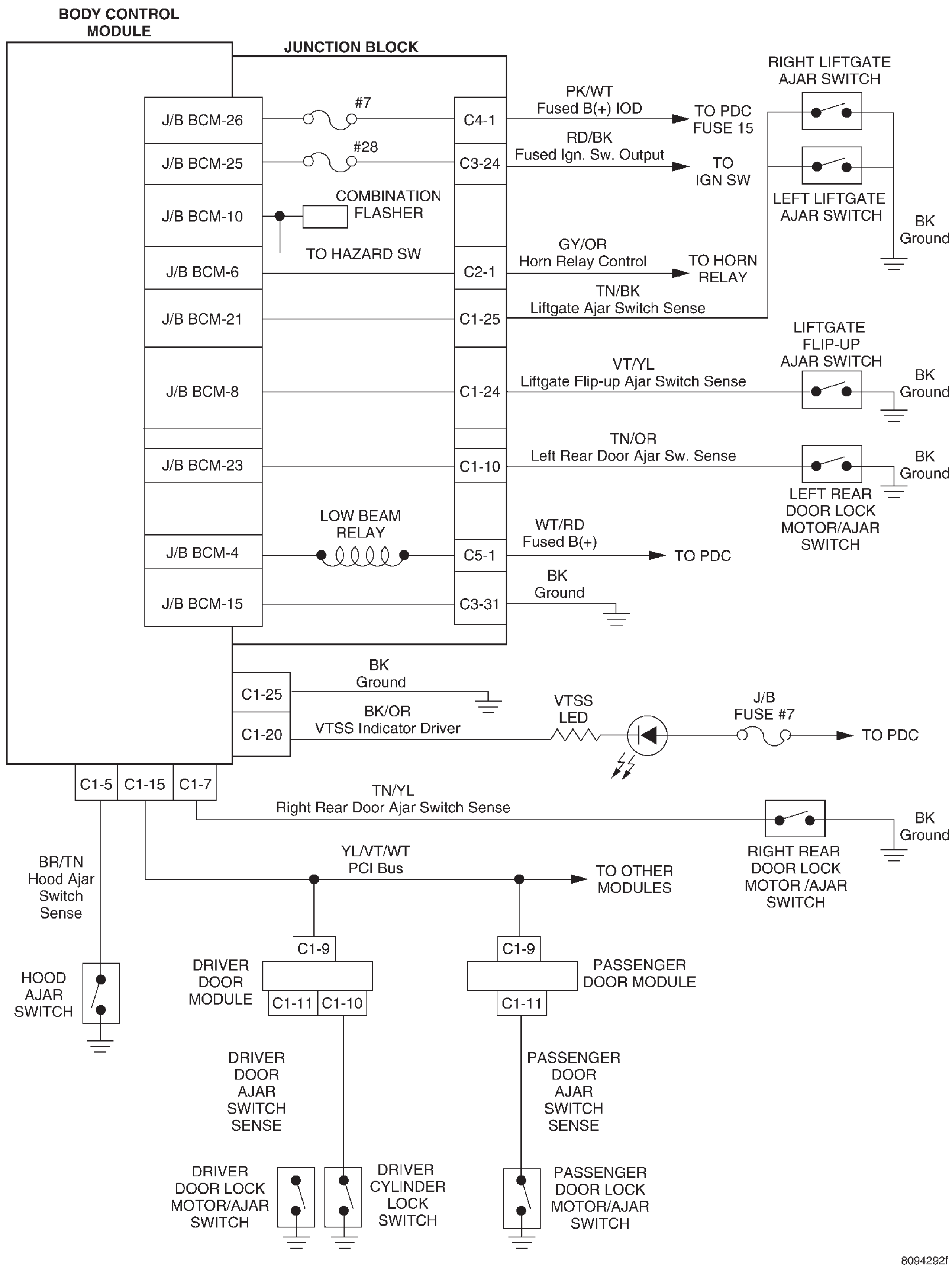
10.15.3 PCM COMMUNICATION



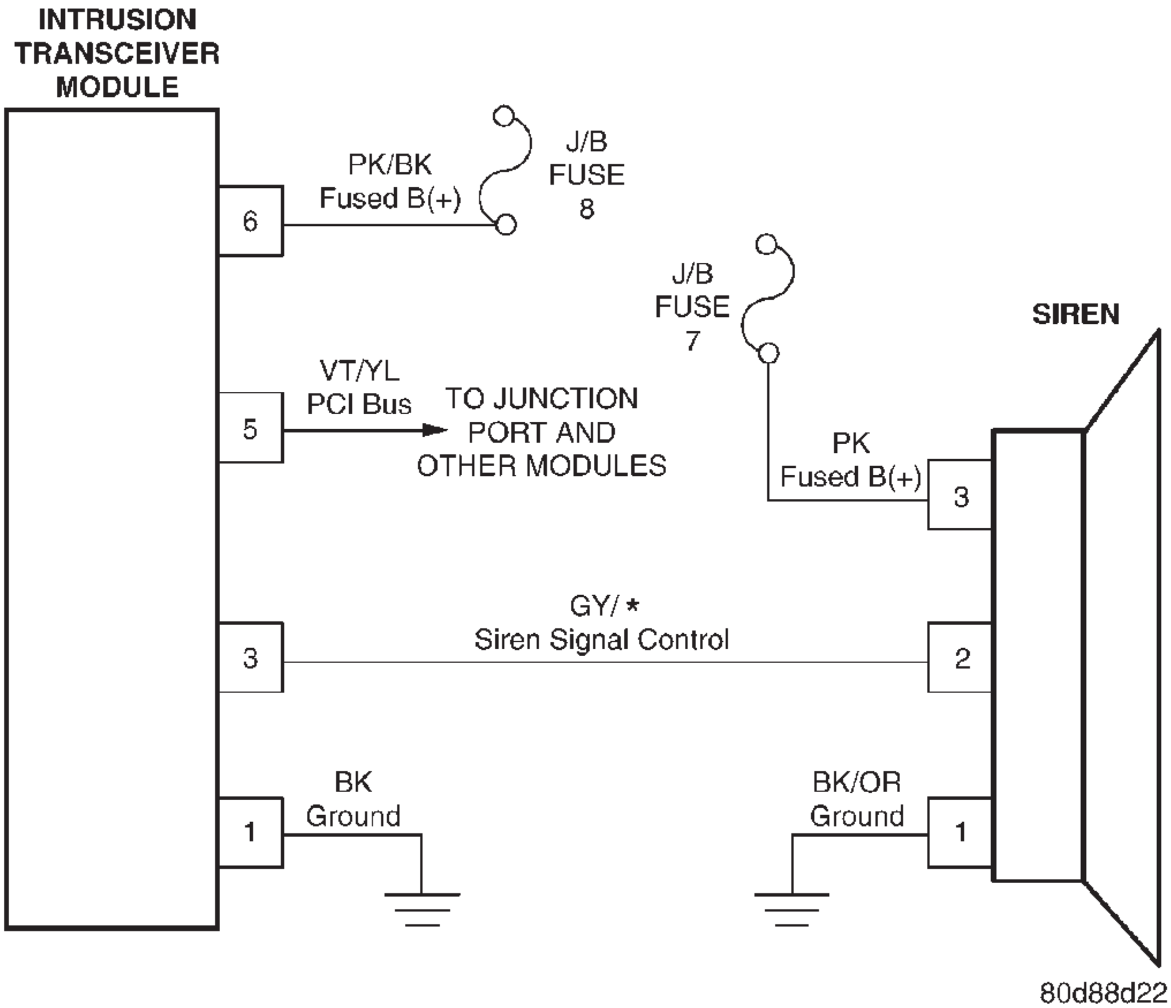
10.15.4 ECM COMMUNICATION – DIESEL



10.16 VEHICLE THEFT SECURITY SYSTEM (VTSS)

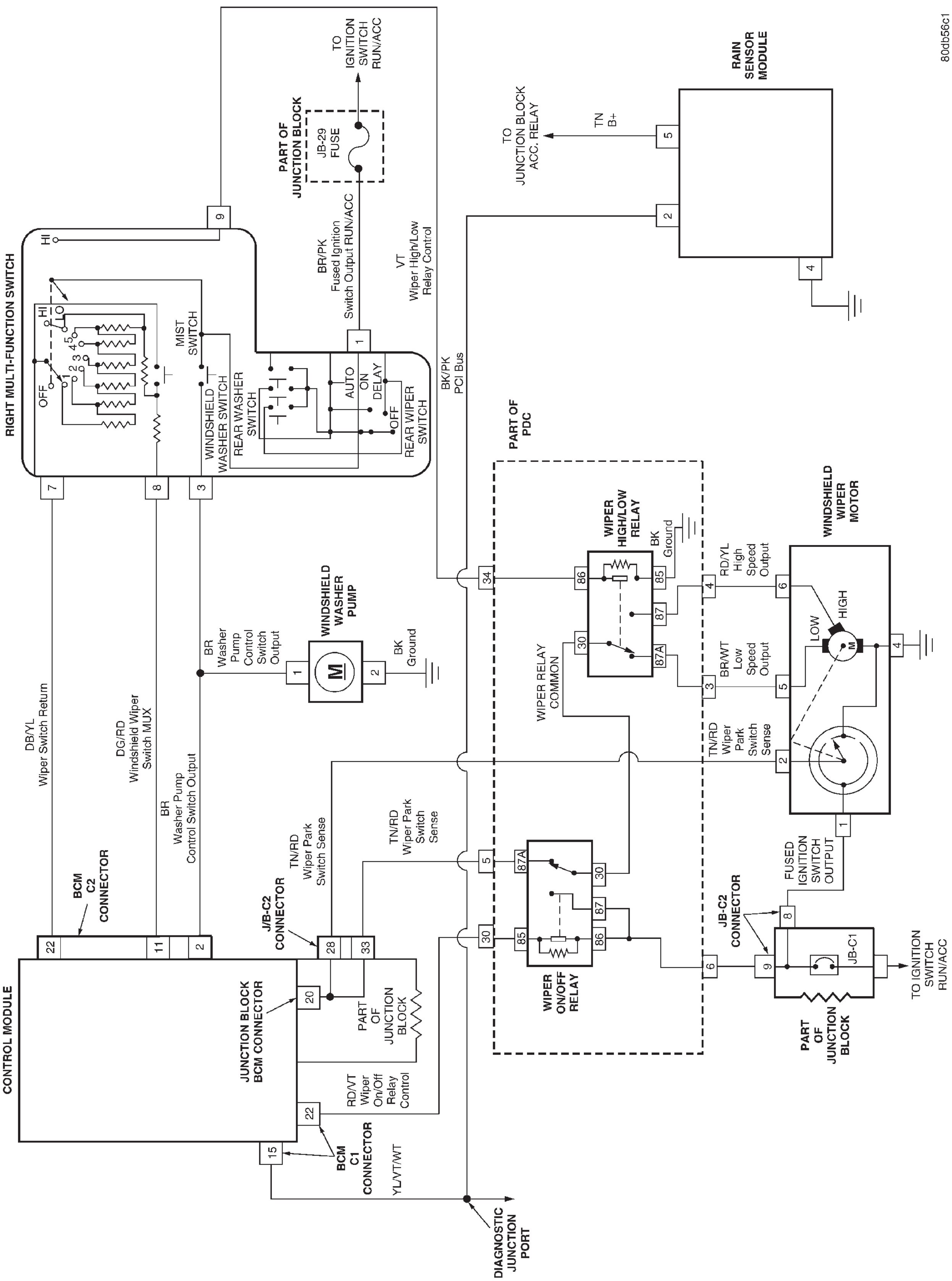


10.16.1 INTRUSION TRANSCEIVER MODULE (EXPORT ONLY)

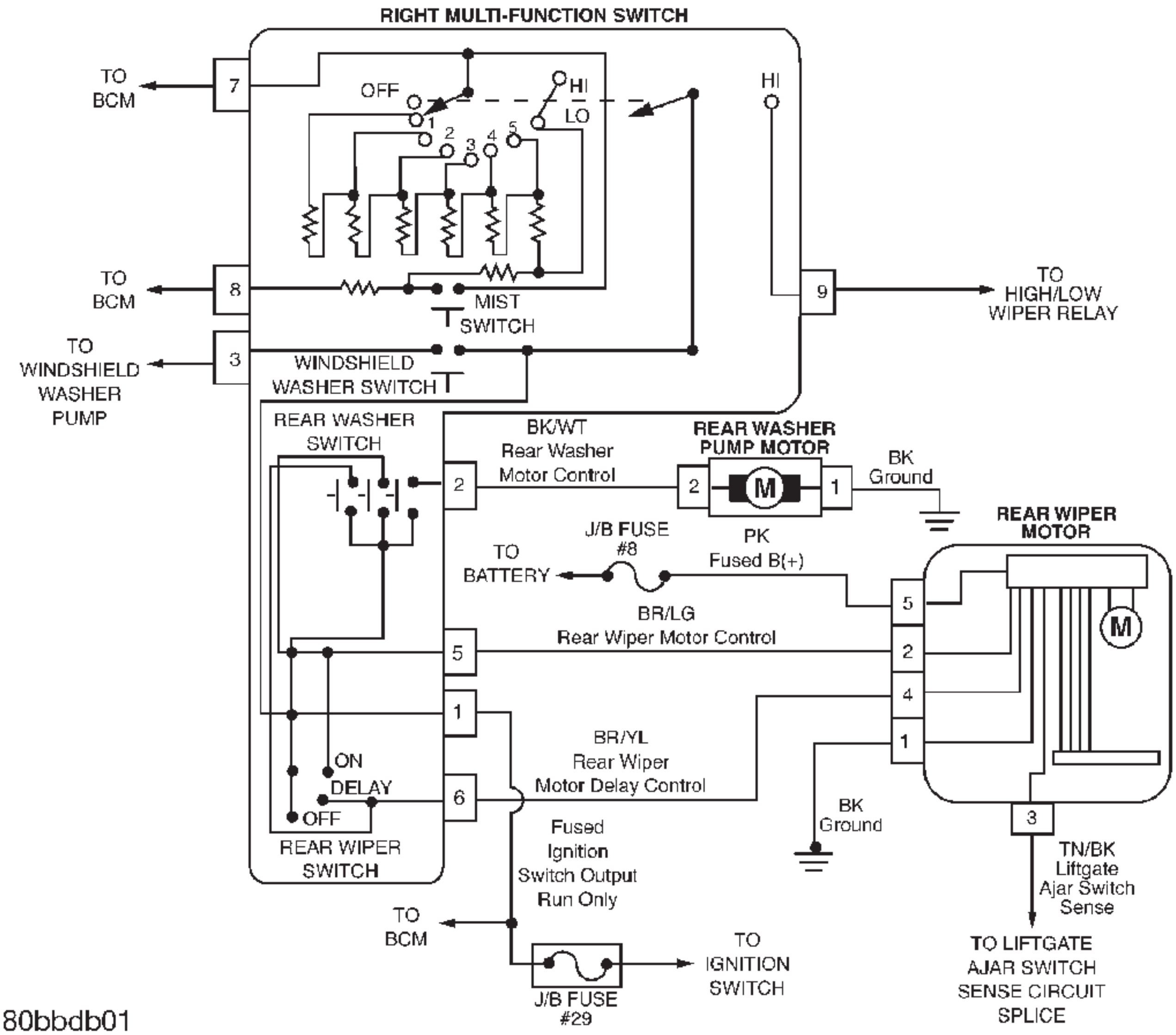


10.17 WINDSHIELD WIPER SYSTEM

10.17.1 FRONT WIPERS



10.17.2 REAR WIPER SYSTEM



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NOTES

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

1.0 INTRODUCTION

The procedures contained in this manual include all the specifications, instructions, and graphics needed to diagnose Mark 20 Antilock Braking System (ABS) problems. The diagnostics in this manual are based on the failure condition or symptom being present at time of diagnosis.

Follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the Controller Antilock Brake (CAB). If the DRBIII® displays a "No Response" condition, you must diagnose that first.
2. Read DTC's (diagnostic trouble codes) with the DRBIII®.
3. If no DTC's are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All schematics are in Section 10.0.

An asterisk (*) placed before the symptom description indicated a customer complaint.

When repairs are required, refer to the appropriate service manual for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added; carryover systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE CODE. It is recommended that you review the entire manual to become familiar with all new and changed diagnostic procedures.

After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic manual covers the Teves Mark 20 Antilock Braking System (ABS) and the Adjustable Pedals system found on the Jeep Grand Cherokee.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the antilock brake system is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

Vehicles equipped with the Teves Mark 20 antilock brake system can be identified by the presence of the hydraulic control unit located with the controller antilock brake (CAB) under the hood near the air cleaner housing.

Vehicles equipped with the Adjustable Pedals system will have an Adjustable Pedals Switch mounted below the instrument cluster and to the right of the steering column.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 TEVES ABS SYSTEM DESCRIPTION

A Controller Antilock Brake (CAB) module is used to monitor wheel speeds and to modulate (control) hydraulic pressure in each brake channel to prevent wheel lock-up during braking. The CAB also provides a vehicle speed signal (VSS) to the powertrain control module.

During a non-ABS stop, the system functions as a standard front/rear split configuration. The primary supplies brake fluid pressure to the front brakes, and the secondary supplies the rear brakes. A conventional combination/proportioning valve is not used. This system uses the existing ABS solenoids to replace and perform the same functions that the combination and proportioning valves do. The CAB has a special software program called Electronic Variable Brake Proportioning (EVBP), that monitors the wheel speeds and when certain criteria are met the software will enable the solenoids to perform the same brake fluid management control as the combination/proportioning valves.

During an ABS stop, the system still uses the front/rear hydraulic split; however, the brake system pressure is further split into three control channels. During ABS operation, the front wheels are controlled independently and are on two separate control channels. The rear wheels are controlled together through one control channel. By using separate control channels for each front wheel, more steering control is maintained during maximum braking.

During an antilock stop, "wheel lock-up" does not necessarily mean that the wheel has locked, it means only that the wheel is turning slower than the vehicle speed. This is called "wheel slip" and is indicated as a percentage. 0% slip means that the wheel is rolling free and 100% slip means that the wheel is locked. The antilock system maintains an average of approximately 20% wheel slip.

It is important to remember that the antilock brake system does not shorten the vehicle stopping distance under all driving conditions, but provides improved control of the vehicle while stopping. Vehicle stopping distance is still dependent on vehicle speed, weight, tires, road surface, and other factors.

3.1.1 PEDAL FEEL/VEHICLES CHARACTERISTICS

There are several pedal feel/vehicle characteristics that are considered normal for antilock braking that may require further explanation.

When stopping conditions activate the antilock brakes, the driver may feel some vibrations/ pulsations in the brake pedal and may hear the solenoid valves clicking and the pump motor running. The vibrations/pulsations are caused by the isolating, building and decaying of brake fluid pressure within the brake lines. The ABS prevents complete wheel lock-up, but some wheel slip is required for the best braking performance. This slip may result in some tire chirping, depending on the road surface. The chirping should not be interpreted as total wheel lock-up. Total wheel lock-up leaves black tire marks on dry pavement, antilock braking may leave some light marks.

At the end of an ABS stop, the ABS may function all the way down to near 0 km/h (0 mph). There may be a slight brake pedal drop anytime the ABS is deactivated.

In case of braking on a bumpy surface, the ABS module may detect wheel locking tendencies due to wheel hop and cycle ABS. In that event the brake pedal may pulsate with a perceived loss of deceleration. ABS braking may also be activated at times while on dry pavement with sand, gravel, or other loose debris on the road.

It should be noted that the pulsating pedal feel characteristic will not illuminate the brake warning lamps or set a trouble code that is stored in the Controller Antilock Brake (CAB). When investigating a hard pedal feel, inspect the sensor and tone wheel teeth for chips/broken teeth, damaged sensor pole tips, excessive runout of the tone wheel, or excessive gap.

3.1.2 SYSTEM COMPONENTS

ANTILOCK BRAKE SYSTEM

- controller antilock brake (CAB)
- vacuum booster
- master cylinder (w/center valves)
- hydraulic control unit (HCU)
- valve block assembly: 6 valve solenoids (3 inlet valves, 3 outlet valves)
  4 accumulators
- brake fluid level switch (part of the fluid reservoir)
- pump/motor assembly:
  1 motor
  2 pumps
- 4 wheel speed sensor/tone wheel assemblies
- ABS warning indicator
- fuses and wiring harness
- fluid reservoir (integral part of master cylinder assembly)

3.1.3 ABS AND RED BRAKE WARNING INDICATOR

The amber ABS warning indicator is located in the instrument cluster. It is used to inform the driver that the antilock function has been turned off due to a system malfunction. On the WJ, the CAB controls the lamp indirectly.

The CAB monitors its own functions. If the CAB determines that the ABS indicator should be on, the CAB sends a message via the PCI BUS to the instrument cluster and the cluster turns on the indicator.

The instrument cluster sends a message over the PCI BUS at regular intervals, if the CAB does not respond the instrument cluster will illuminate the ABS indicator.

The red brake warning indicator is located in the instrument cluster. It can be activated by application of the parking brake, a leak in the front or rear wheel brake hydraulic circuit which causes the master cylinder reservoir to be low on fluid, or by turning the ignition switch to the start position. The red brake warning indicator can also be turned on if the brake fluid level switch circuit becomes open or shorted to ground.

3.1.4 CONTROLLER ANTILOCK BRAKE (CAB)

The antilock brake controller (CAB) is a microprocessor-based device that monitors wheel speeds and controls the antilock functions.

The primary functions of the CAB are:

- monitor wheel speeds
- detect wheel locking tendencies
- control fluid pressure modulations to the brakes during antilock stop operation
- control the ABS warning indicator

- monitor the system for proper operation
- provide communication to the DRBIII® while in diagnostic mode
- store diagnostic information in non-volatile memory

The CAB continuously monitors the speed of each wheel. When a wheel locking tendency is detected, the CAB will command the appropriate HCU valve to modulate brake fluid pressure to that wheel. Brake pedal position is maintained during an antilock stop by being a closed system with the use of 3 accumulators. The CAB continues to control pressure in individual hydraulic circuits until a wheel locking tendency is no longer present. The CAB turns on the pump/motor during an antilock stop.

The antilock brake system is constantly monitored by the CAB for the proper operation. If the CAB detects a system malfunction, it can disable the antilock system and activate the ABS warning indicator. If the antilock function is disabled, the system will revert to standard base brake system operation.

The CAB inputs include the following:

- four wheel speed sensors
- brake lamp switch
- ignition switch
- battery voltage
- diagnostic communication (PCI BUS)

The CAB outputs include the following:

- six valve/solenoid drivers
- pump/motor actuation
- ABS warning indicator actuation
- red brake warning indicator actuation
- diagnostic communication (PCI BUS)

3.1.5 HYDRAULIC CONTROL UNIT

The hydraulic control unit (HCU) contains the valve block assembly, four accumulators, and the pump/motor assembly.

Valve Block Assembly: The valve block assembly contains 6 valves with three inlet valves and three outlet valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring loaded in the closed position. During an antilock stop, these valves are cycled to maintain the proper slip ratio for each channel. The CAB monitors wheel speeds. If the CAB detects a wheel deceleration that is disproportionate to the other wheels, it will close the inlet valve to that wheel. This prevents any increase in fluid pressure. If the wheel continues to decelerate disporportionately, the CAB opens the outlet valve for that wheel to release fluid pressure from that channel. The released fluid is routed to the accumulators. When the wheel speed is no longer disproportionate to the other wheels, the inlet valve will return to its normally open position and the outlet valve will return to the normally closed position.

Pump/Motor Assembly: The pump/motor assembly provides the extra amount of fluid needed during antilock braking. The pump is supplied fluid that is released to the accumulators when the outlet valve is opened during an antilock stop. The pump is also used to drain the accumulator circuits after the antilock stop is complete. The pump is operated by an integral electric motor. This motor is controlled by the CAB. The CAB turns on the motor when an antilock stop is detected. The pump continues to run during the antilock stop and is turned off approximately 3-5 seconds after the stop is complete. The CAB monitors the pump/motor operation internally.

Accumulators: The accumulators provide temporary fluid storage during an antilock stop and are drained by the pump/motor.

3.1.6 SENSORS

Wheel Speed Sensors and Tone Wheels: One wheel speed sensor (WSS) is located at each wheel and sends a small digital signal to the control module (CAB). The CAB sends 12 volts down to the sensor. The sensor has an internal magneto resistance bridge that alters the voltage and amperage of the signal circuit. This voltage and amperage is changed by magnetic induction when a toothed sensor ring (tone wheel) passes by a stationary magnetic sensor (wheel speed sensor). The CAB measures the voltage and amperage of the digital signals for each wheel.

The front wheel sensor is attached to a boss in the steering knuckle. The tone wheel is an itegral part of the front axle shaft. The rear speed sensor is mounted in the caliper adapter plate (rear disc only) and the rear tone wheel is an integral part of the rear rotor hub. **The wheel speed sensor air gap is NOT adjustable. Because of internal circuitry, a resistance check of WJ wheel speed sensors will not determine correct or incorrect function.**

Correct antilock system operation is dependent on wheel speed signals from the wheel speed sensors. The vehicle's wheels and tires should all be the same size and type to generate accurate signals. In addition, the tires should be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals; however, the system will continue to function when using the mini-spare. When driven over rough road surfaces, the rear wheel speed sensor signals may be erratic and cause a false trouble code (drum brakes only).

Brake Warning Indicator Switch: The brake warning indicator switch is a fluid level sending switch. The CAB sends out a 12 volt signal to the switch. The switch has a 1,000 ohm resistor inside of it. This resistor is used for diagnostic purposes. Normal voltage is about 2.3 volts. If the switch is disconnected the resistor will be pulled out of the circuit and the CAB will sense voltage at about 5 volts. If the fluid level becomes too low or the circuit is shorted to ground, the voltage will be about 0 volts. Any fault condition will illuminate the red brake warning indicator and the specific fault can be read on the DRBIII®.

3.2 ADJUSTABLE PEDALS SYSTEM DESCRIPTION

GENERAL

The Adjustable Pedals System (APS) is designed to enable the fore and aft repositioning of the brake and accelerator pedals. This results in improved ergonomics in relation to the steering wheel for taller and shorter drivers. Being able to adjust the pedal positions also allows the driver to set steering wheel tilt and seat position to the most comfortable position. The position of the brake and accelerator pedals can be adjusted without compromising safety or comfort in actuating the pedals. Repositioning the pedals does not change the effort required for actuation.

Change of pedal position is accomplished by means of a motor driven screw. Operating the adjustable pedal switch activates the pedal drive motor. The pedal drive motor turns a screw that changes the position of the brake and accelerator pedals. The pedal can be moved rearward (closer to the driver) or forward (away from driver). The brake pedal is moved on its activating lever to a position where the driver feels most comfortable.

The accelerator pedal is moved at the same time and the same distance as the brake pedal. The accelerator pedal adjustment screw is turned by a flexible shaft slaved off the brake adjustment screw.

Neither the pedal drive motor nor drive mechanism are subject to the mechanical stress of brake or accelerator application.

SYSTEM FEATURES

- Range of Adjustment
  The pedals may be adjusted up to 3 in. (75 mm)
- Pedal Adjustment Speed
  0.5 in./sec (12.5 mm/sec)
- Pedal Adjustment Inhibitors
  Pedal adjustment is inhibited when the vehicle is in reverse or when cruise control is activated.
- Memory
  An optional memory feature is available. This allows storing of one or two preferred pedal positions in the Adjustable Pedal Module (APM). A preferred position can be stored and recalled using the door-mounted switches.
  The door-mounted switches activate the Driver Door Module (DDM). The DDM instructs the APM via the PCI bus to store the current pedal position.
  A stored pedal position can be recalled (but not stored) using the Remote Keyless Entry (RKE).
- Adjustable Pedal Feedback Message
  The Electronic Vehicle Information Center (EVIC) will display a message when the APS is disabled. ie: “Adjustable Pedal Disabled — Cruise Control Engaged” or “Adjustable Pedal Disabled — Vehicle in Reverse”.
- Damage Prevention
  Foot pressure or debris can stall pedal adjustment. In order to avoid damage to system components during pedal adjustment, the APM will monitor pedal position sensor voltage. If the APM does not detect expected voltage change within 1.5 seconds, it will cut power to the adjustable pedal motor.

3.3 DIAGNOSTIC TROUBLE CODES

The vehicle electronic system modules may report any of several diagnostic trouble codes (DTC)s. The possible DTCs for the ABS and Adjustable Pedals System are listed in the table of contents.

Diagnostic trouble codes are retained in memory until erased using the DRB, or automatically erased after 255 key cycles or 3,500 miles.

3.3.1 ABS INITIALIZATION

System initialization starts when the key is turned to “run”. At this point, the CAB performs a complete self-check of all electrical components in the antilock brake systems.

At 20 km/h (12 mph) a dynamic test may be performed. If the brake lamp switch is activated the test will be run at 40 km/h (24 mph) regardless of the brake lamp switch state. This will momentarily run the pump/motor. If during the dynamic test, the driver has his/her foot on the brake pedal, he/she may feel the test through brake pedal pulsations. This is a normal condition.

If any component causes a diagnostic trouble code during system initialization or dynamic check, the CAB will illuminate the ABS warning lamp.

3.3.2 DIAGNOSTIC MODE

For a Mark 20 system to enter a diagnostic mode, vehicle speed must be below 10 km/h (6 mph) and no ABS condition present. If vehicle speed is not below 10 km/h (6 mph), a “No Response” message could be displayed by the DRBIII®. The following are characteristics of diagnostic mode:

- The amber ABS warning indicator will blink rapidly (about ½ second on and ½ second off). If a hard trouble code is present, such as a CAB Power Feed Circuit diagnostic trouble code, the ABS warning indicator will be illuminated without blinking until the diagnostic trouble code condition is corrected.
- Antilock operation is disabled.

3.3.3 INTERMITTENT DIAGNOSTIC TROUBLE CODES

If the malfunction is not present while performing a test procedure, the diagnostic procedures will not locate the problem. In this case, the code can only suggest an area to inspect. Check for the following:

- mechanical interference with brake or accelerator pedal
- loose or corroded conditions
- damaged components (sensors, tone wheels, pedal drive cable)
- damaged wiring
- excessive axle shaft runout
- loose pedal mounting
- hydraulic system leaks
- regular brake system problems, non-ABS related

If no obvious problems are found, erase diagnostic trouble codes and with the key on, wiggle the wire harness and connectors. Recheck for codes periodically as you work through the system. This procedure may uncover a difficult to locate malfunction.

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading diagnostic trouble codes, erasing diagnostic trouble codes and other DRBIII® functions.

3.5 DRBIII® ERROR MESSAGES

Under normal operation, the DRBIII® will display one of only two error messages:

— User-Requested WARM Boot or User-Requested COLD Boot

If the DRBIII® should display any other error message, record the entire display and call the STAR Center for information and assistance. This is a sample of such an error message display:

```
ver: 2.14
date: 26 Jul93
file: key_itf.cc
date: Jul 26 1993
line: 548
err: 0x1
User-Requested COLD Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

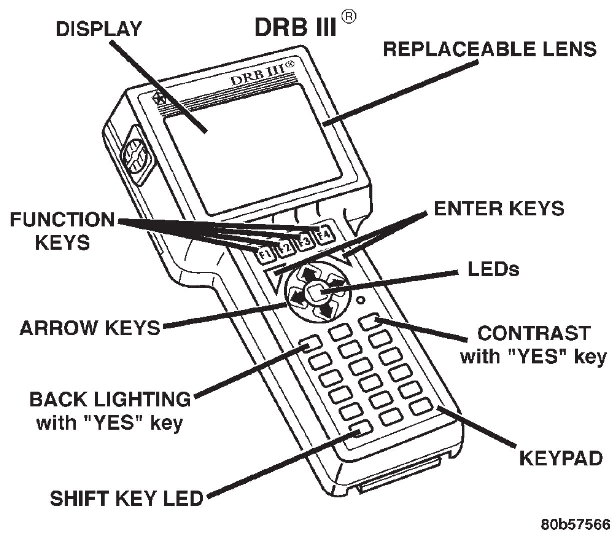
3.5.1 DRBIII® DOES NOT POWER UP (BLANK SCREEN)

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link 16-way connector cavity 16). A minimum of 11 volts is required to adequately power the DRBIII®. Also check for a good ground at the DLC.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, an inoperative DRBIII® may be the result of faulty cable or vehicle wiring.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



4.0 DISCLAIMERS, SAFETY, WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the front drive wheels.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing an antilock brake or adjustable pedals system problem, it is important to follow approved procedures where applicable. These procedures can be found in the service manual. Following these procedures is very important to the safety of individuals diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the antilock brake or adjustable pedals system are intended to be serviced in assembly only. Attempting to remove or repair certain sub-components may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATIONS LIMITS.

Follow the vehicle manufacturer's service specifications at all times.

- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips, or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0 - 500 peak volts AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz
Temperature	-58 - 1100°F -50 - 600°C

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNING

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is "off". Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation; this will damage it and eventually cause it to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second code could be set, making diagnosis of the original problem more difficult.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read the DRBIII® screen while in motion. Do not hang the DRBIII® from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

4.4 DIAGNOSIS

1. Your diagnostic test procedure must begin with a thorough visual inspection of the system in question for damaged components or disconnected connectors. For ABS, the brake lamps must be operational prior to continuing.
2. Connect the DRBIII® to the data link connector located under the dash. If the DRBIII® does not power up, check the power and ground supplies to the connector.
3. Select the system in question. Turn the ignition on. If the DRBIII® displays "No Response", refer to Communication in the Body Diagnostic Procedures manual to diagnose the symptom.
4. Read and record all diagnostic trouble codes. For ABS, if the "CAB Power Feed Circuit" diagnostic trouble code is present, it must be repaired prior to addressing any other DTC's. If any additional codes are present, proceed to the appropriate test.
5. For ABS, if there are no diagnostic trouble codes present, select "Inputs/Outputs" and read the brake switch input as your press and release the brake pedal. If the display does not match the state of the pedal, perform the proper test. For a problem with the amber "ABS" warning indicator, refer to the proper test.
6. For ABS, if no other problems are found, it will be necessary to road test the vehicle. **THE DRBIII® MUST NOT BE CONNECTED TO THE DATA LINK CONNECTOR WHEN ROAD TESTING FOR PROPER ANTILOCK OPERATION. THE SYSTEM IS DISABLED WHILE IN DIAGNOSTIC MODE.** Perform several antilock stops from above 50 Km/h (30 mph) and then repeat steps 2, 3, and 4. If any diagnostic trouble codes are present, proceed to the appropriate test.
7. For ABS, the following conditions should be considered "NORMAL" operation, and no repairs should be attempted to correct them.
   - Brake pedal feedback during an ABS stop (clicking, vibrating)
   - Clicking, groaning or buzzing at 10 Km/h (6 mph) (drive off self test)
   - Groaning noise during an ABS stop
   - Slight brake pedal drop and pop noise when ignition is initially turned on
   - Brake pedal ratcheting down at the end of an ABS stop
8. If the complaint is ABS "cycling" at the end of a stop at low speeds, it may be caused by a marginal wheel speed sensor signal. The sensor air gap, tone wheel condition, and/or brakes hanging up are possible causes of this condition.
9. After a road test in which no problems were found, refer to any Technical Service Bulletins that may apply.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box)
jumper wires
ohmmeter
voltmeter
test light

6.0 GLOSSARY OF TERMS

ABS	antilock brake system
AC	alternating current
APM	adjustable pedals module
BCM	Body Control Module

CAB	controller antilock brake
DC	direct current
DLC	data link connector
DRB	diagnostic read-out box
DTC	diagnostic test code
EMI	electro magnetic interference
EVBP	Electronic Variable Brake Proportioning
HCU	hydraulic control unit
HZ	Hertz
JBLK	junction block
JTEC	Jeep and Truck Engine Controller
LF	left front
LR	left rear
PCI	Programmable Communication Interface
PCM	Powertrain Control Module
PDC	power distribution center
P/M	pump motor
RF	right front
RR	right rear
SOL	solenoid
WSS	wheel speed sensor

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
PEDAL SENSOR OPEN/SHORTED TO BATTERY

When Monitored and Set Condition:

PEDAL SENSOR OPEN/SHORTED TO BATTERY

When Monitored: Constantly.

Set Condition: When the APM detects the voltage on the Sense circuit is too high.

POSSIBLE CAUSES
MOTOR/SENSOR SHORTED OR OPEN
SENSE CIRCUIT SHORT TO BATTERY OR TO SENSOR FEED CIRCUIT
APM-INTERNAL FAULT
INTERMITTENT DTC

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTC's. With the DRBIII®, read DTC's. Does the DRBIII® display PEDAL SENSOR OPEN/SHORTED TO BATTERY DTC active? Yes → Go To 2 No → Go To 4	All
2	Disconnect the Adjustable Pedals Motor/Sensor harness connector. Turn the ignition on. With the DRBIII®, read the active DTCs. Does the DRBIII® display PEDAL SENSOR OPEN/SHORTED TO BATTERY? Yes → Go To 3 No → Replace the Adjustable Pedals Motor/Sensor assembly in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

PEDAL SENSOR OPEN/SHORTED TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Adjustable Pedals Motor/Sensor harness connector. Disconnect the Adjustable Pedals Module harness connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Check the Sense circuit for a short to battery and for a short to the Sensor Feed circuit. Is the Sense circuit shorted? Yes → Repair the Sense circuit for a short to battery or to the Sensor Feed circuit. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Adjustable Pedals Module in accordance with the Service Information.. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PEDAL SENSOR SHORTED TO GROUND

When Monitored and Set Condition:

PEDAL SENSOR SHORTED TO GROUND

When Monitored: Constantly

Set Condition: When the APM detects a ground condition at the Sense circuit.

POSSIBLE CAUSES
MOTOR/SENSOR ASSEMBLY SHORTED TO GROUND
APM-SENSE CIRCUIT GROUNDED
INTERMITTENT DTC

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTC's. With the DRBIII®, read DTC's. Does the DRBIII® display PEDAL SENSOR SHORTED TO GROUND DTC active? Yes → Go To 2 No → Go To 3	All
2	Disconnect the Adjustable Pedals Motor/Sensor harness connector. Turn the ignition on. With the DRBIII®, read the active DTCs. Does the DRBIII® display SENSOR WIRING SHORTED TO GROUND? Yes → Inspect for and correct wiring damage. If no damage is found, replace and program the Adjustable Pedals Module in accordance with the Service Information.. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Repair any Motor/Sensor assembly wiring concerns. If no wring concerns are found, replace the Adjustable Pedals Motor/Sensor assembly. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PEDAL SW STUCK FORWARD

When Monitored and Set Condition:

PEDAL SW STUCK FORWARD

When Monitored: Constantly

Set Condition: When the Adjustable Pedals module detects battery voltage on the Adjustable Pedals Switch FWD circuit for more than 20 seconds.

POSSIBLE CAUSES
ADJUSTABLE PEDALS MODULE INTERNAL FAULT
SWITCH FAILURE
INTERMITTENT DTC
FWD CIRCUIT SHORTED TO BATTERY OR TO BATTERY FEED CIRCUIT

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTC's. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display PEDAL SW STUCK FORWARD DTC active? Yes → Go To 2 No → Go To 4	All
2	Disconnect the Adjustable Pedals switch connector. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display PEDAL SW STUCK FORWARD DTC active? Yes → Go To 3 No → Replace the Adjustable Pedals Switch. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Disconnect the Adjustable Pedals switch connector. Turn the ignition ON. Check the FWD and BATTERY FEED circuits for a short to battery, to ground and to each other. Is there any circuit short? Yes → Repair the circuit short. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Adjustable Pedals Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

PEDAL SW STUCK FORWARD — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PEDAL SW STUCK REARWARD

When Monitored and Set Condition:

PEDAL SW STUCK REARWARD

When Monitored: Constantly

Set Condition: When the Adjustable Pedals module detects battery voltage on the Adjustable Pedals Switch AFT circuit for more than 20 seconds.

POSSIBLE CAUSES
ADJUSTABLE PEDALS MODULE INTERNAL FAULT
SWITCH FAILURE
INTERMITTENT DTC
AFT CIRCUIT SHORTED TO BATTERY OR TO BATTERY FEED CIRCUIT

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTC's. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display PEDAL SW STUCK REARWARD DTC active? Yes → Go To 2 No → Go To 4	All
2	Disconnect the Adjustable Pedals switch connector. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display PEDAL SW STUCK REARWARD DTC active? Yes → Go To 3 No → Replace the Adjustable Pedals Switch. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Disconnect the Adjustable Pedals switch connector. Turn the ignition ON. Check the AFT and BATTERY FEED circuits for a short to battery, to ground and to each other. Is there any circuit short? Yes → Repair the circuit short. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Adjustable Pedals Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

PEDAL SW STUCK REARWARD — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SYSTEM OVER VOLTAGE

When Monitored and Set Condition:

SYSTEM OVER VOLTAGE

When Monitored: Whenever the module is awake

Set Condition: When the APM detects 3 consecutive J1850 Bus messages indicating vehicle voltage over 15.94 VDC.

POSSIBLE CAUSES
VEHICLE VOLTAGE HIGH
APM -- INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the vehicle voltage status. Does the DRBIII® display a high voltage concern? Yes → Refer to Charging information for the related symptom(s). Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Adjustable Pedals Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

Symptom:
SYSTEM UNDER VOLTAGE

When Monitored and Set Condition:

SYSTEM UNDER VOLTAGE

When Monitored: Any time that the module is awake.

Set Condition: When the APM detects 3 consecutive J1850 Vehicle Battery Voltage messages indicating a battery voltage less than 9 VDC.

POSSIBLE CAUSES
VEHICLE VOLTAGE LOW
APM -- INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read the vehicle voltage status. Does the DRBIII® display a low voltage concern? Yes → Refer to Charging information for the related symptom(s). Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Adjustable Pedals Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

Symptom:
*CAN'T ADJUST PEDALS

POSSIBLE CAUSES
VEHICLE IN CRUISE OR REVERSE
DTC OR IN-PLANT MODE ACTIVE
MOTOR/SENSOR ASSEMBLY
MOTOR FWD OR AFT CIRCUIT SHORTED OR OPEN
BATTERY FEED CIRCUIT OPEN
ADJUSTABLE PEDALS MODULE INTERNAL FAULT
ADJ PEDAL SW OPEN

TEST	ACTION	APPLICABILITY
1	**NOTE: Adjustable Pedals are disabled when the vehicle is in Reverse or when the Speed Control is activated.** Check whether vehicle is in Reverse and whether Speed Control is activated. Is the vehicle in Reverse or is Speed Control activated. Yes → Correct as necessary. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Go To 2	All
2	With the DRBIII®, erase DTC's. With the DRBIII®, read DTC's. With the DRBIII® in Inputs/Outputs, read the In-Plant mode state. Are any DTCs active or is the APM in the In-Plant mode? Yes → Refer to symptom list for problems related to the active DTC or disable In-Plant test mode. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Connect a jumper wire between the Battery Feed circuit and ground. Operate the Adjustable Pedals Switch to the Aft and Fwd positions. Using a 12-volt test light connected to 12-volts, check the Aft and Fwd circuits. Does the test light illuminate brightly in each switch position? Yes → Go To 4 No → Go To 6	All

*CAN'T ADJUST PEDALS — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Adjustable Pedals Motor/Sensor harness connector. Operate the Adjustable Pedals Switch to the Fwd position. On the APM side of the connector, using a 12-volt test light connected to ground, check the Fwd circuit. On the APM side of the connector, using a 12-volt test light connected to 12-volts, check the Aft circuit. Does the test light illuminate brightly at each pin? Yes → Repair any wiring concerns. If no concerns are found, replace the Adjustable Pedals Motor/Sensor assembly. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Disconnect the Adjustable Pedals Motor/Sensor connector. Check the FWD and AFT circuits for short to battery, to ground, to each other and for an open. Is the FWD or AFT circuit shorted or open? Yes → Repair the Adjustable Pedals Motor FWD or AFT circuit short or open as necessary. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Adjustable Pedals Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Disconnect the Adjustable Pedals Module harness connector. Disconnect the Adjustable Pedals switch connector. Measure the resistance of the Battery Feed circuit. Is the resistance above 5.0 ohms? Yes → Repair the Battery Feed circuit for an open. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace the Adjustable Pedals Switch. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

Symptom:
*CAN'T SET/RECALL MEMORY POSITIONS

POSSIBLE CAUSES
DTC OR IN-PLANT MODE ACTIVE
DRIVER DOOR MODULE -- INTERNAL FAULT
ADJUSTABLE PEDALS MODULE FAULT

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase DTCs. With the DRBIII®, read the active DTCs. With the DRBIII® in Inputs/Outputs, read the In-Plant state. Any active DTCs or is In-Plant mode activated Yes → Disable the In-Plant mode or refer to symptom list for problems related to the active DTC. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Go To 2	All
2	Attempt to set and recall other memory functions in the vehicle. Can other vehicle memory functions be set and recalled OK? Yes → Replace the Adjustable Pedals Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1. No → Replace and program the Driver Door Module in accordance with the Service Information. Perform ADJUSTABLE PEDALS VERIFICATION TEST - VER 1.	All

Symptom:
BRAKE FLUID LEVEL SWITCH

When Monitored and Set Condition:

BRAKE FLUID LEVEL SWITCH

When Monitored: Ignition on, every 7 milliseconds (ms).

Set Condition: The DTC will be set when the Brake Fluid Level Switch Sense circuit is shorted to ground (below approximately 1 volt for 70 milliseconds) or is open or shorted to voltage (above 4 volts for 70 milliseconds).

POSSIBLE CAUSES
LOW FLUID LEVEL OR SWITCH DISCONNECTED
BRAKE FLUID LEVEL SWITCH RESISTANCE OUT OF SPECIFICATION
BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT SHORTED TO BATTERY
BRAKE FLUID LEVEL SWITCH SENSE OR GROUND CIRCUIT OPEN
CAB - SENSE CIRCUIT OPEN
BRAKE FLUID LEVEL SWITCH SENSE CIRCUIT SHORTED TO GROUND
BRAKE FLUID LEVEL SWITCH SENSE AND GROUND CIRCUITS SHORTED TOGETHER
CAB-INTERNAL SHORT
INTERMITTENT DTC

TEST	ACTION	APPLICABILITY
1	Inspect the Brake Fluid Level in the Master Cylinder Reservoir. Check connection to Brake Fluid Level Switch. Is the Brake Fluid Level Low or the Switch disconnected? Yes → Fill the brake fluid reservoir or reconnect as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Brake Fluid Level Switch connector. **Note: Check connector - Clean/repair as necessary.** Measure resistance of the Brake Fluid Level Switch. Is the resistance between 990 and 1010 ohms? Yes → Go To 3 No → Replace Brake Fluid Level Switch. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKE FLUID LEVEL SWITCH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition on. With the DRBIII®, read Brake Fluid Level Switch voltage. What is the Voltage reading of the Brake Fluid Level Switch? Approximately 2 volts. Go To 4 Above 4 volts. Go To 5 Approximately 0 volts. Go To 8	All
4	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All
5	Turn the ignition off. Disconnect the Brake Fluid Level Switch connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, check the Fluid Level Sense circuit. Does the test light illuminate? Yes → Repair the Brake Fluid Level Switch Sense circuit for a short to voltage. Perform ABS VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the Brake Fluid Level Switch connector. **Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Check connector - Clean/repair as necessary.** Measure the resistance of the Brake Fluid Level Switch Sense and Ground circuits. Is the resistance below 5 ohms for both circuits? Yes → Go To 7 No → Repair the Brake Fluid Level Switch Sense or Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
7	If there are no possible causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

BRAKE FLUID LEVEL SWITCH — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Brake Fluid Level Switch connector **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Check connector - Clean/repair as necessary.** Turn the ignition on. Using a 12-volt test light connected to ground, check the Brake Fluid Level Switch Sense circuit. Is the test light on? Yes → Repair Brake Fluid Level Switch Sense Circuit for a Short to Ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off. Disconnect the Brake Fluid Level Switch connector **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Check connector - Clean/repair as necessary.** Measure the resistance between the Brake Fluid Level Switch Sense and Ground circuits. Is the resistance below 5.0 ohms? Yes → Repair Brake Fluid Level Switch Sense and Ground circuits shorted together. Perform ABS VERIFICATION TEST - VER 1. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
CAB POWER FEED CIRCUIT

When Monitored and Set Condition:

CAB POWER FEED CIRCUIT

When Monitored: Ignition on. The CAB monitors the Fused B(+) circuit at all times for proper system voltage.

Set Condition: If the Fused B(+) voltage is missing when the CAB detects that an internal main driver is not ″on″, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
INTERMITTENT DTC
BLOWN FUSE - FUSED B(+) CIRCUIT
NO B+ SUPPLY TO FUSE
FUSED B(+) CIRCUIT OPEN
B(+) CIRCUIT INTERMITTENTLY SHORTED TO GROUND
B(+) CIRCUIT SHORTED TO GROUND
CAB - FUSED B(+) CIRCUIT OPEN
CAB - FUSED B(+) CIRCUIT SHORTED TO GROUND

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Drive the vehicle above 25 km/h (15 mph) for at least 10 seconds. Stop the vehicle. With the DRBIII®, read DTC's. Does the DRBIII® display CAB Power Feed Circuit DTC present right now? Yes → Go To 2 No → Go To 10	All
2	Turn the ignition off. Remove and Inspect the ABS Fuse 19 in the Junction Block. Is the Fuse blown? Yes → Go To 3 No → Go To 7	All

CAB POWER FEED CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Visually inspect the B(+) Circuit in the wiring harness from the Junction Block to the CAB. Look for any sign of an intermittent short to ground. Is the wiring harness OK? Yes → Go To 4 No → Repair the Fused B(+) Circuit Shorted to Ground. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Remove the ABS Fuse 19 from the Junction Block. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Using a test light connected to 12 volts, probe the Fused B(+) Circuit. Is the test light on? Yes → Repair the Fused B(+) Circuit Shorted to Ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Remove the ABS Fuse 19 from the Junction Block. The CAB must be connected for the results of this test to be valid. Using a test light connected to 12 volts, probe the Fused B(+) Circuit at the Junction Block fuse terminal. Is the test light on? Yes → Replace the CAB. Perform ABS VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. If there are no potential causes remaining, view repair. Continue Replace the Fuse. Perform ABS VERIFICATION TEST - VER 1.	All
7	Remove the ABS Fuse 19 from the Junction Block. Turn the ignition on. Measure the voltage of the Fused B+ supply to Fuse 19 in the Junction Block. Is the voltage above 10 volts? Yes → Go To 8 No → Repair the B+ Supply circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Remove the ABS Fuse 19 from the Junction Block. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the Fused B(+) circuit between the Junction Block Fuse terminal 19 and the CAB connector. Is the resistance below 5 ohms? Yes → Go To 9 No → Repair Fused B(+) Circuit Open. Perform ABS VERIFICATION TEST - VER 1.	All

CAB POWER FEED CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
9	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CLUSTER FAULT

When Monitored and Set Condition:

CLUSTER FAULT

When Monitored: Ignition on, every time a message is sent from the instrument cluster.

Set Condition: When the message from the instrument cluster, via the PCI Bus, informs the CAB that it cannot turn on the ABS Warning Indicator or the Red Baake Warning Indicator.

POSSIBLE CAUSES
CLUSTER FAULT DTC CONDITION PRESENT
CAB-- INTERNAL FAULT
INTERMITTENT DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTC's in the Instrument Cluster, not the CAB module. Are any ABS or brake system-related DTCs present? Yes → Refer to the Cluster category for the related symptom(s). Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All
2	With the DRB, erase DTC's. Turn the ignition on and wait approximately 1 minute. With the DRB, read DTC's. Did this DTC reset? Yes → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CONTROLLER FAILURE

When Monitored and Set Condition:

CONTROLLER FAILURE

When Monitored: Ignition on. The CAB monitors its internal microprocessors for correct operation.

Set Condition: If the CAB detects an internal fault, the DTC is set.

POSSIBLE CAUSES
GROUND AND POWER CONNECTIONS
GROUND CIRCUIT HIGH RESISTANCE
GROUND CIRCUIT INTERFERENCE
CAB - INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	Inspect for non-factory wiring that may interfere with CAB power or ground circuits. Disconnect the CAB harness connector. Inspect the CAB wiring harness for incorrect routing and damage. Inspect the CAB harness and component connectors for corrosion and damage. Were any concerns found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the CAB ground circuits to body ground. Is the resistance below 1.0 ohm? Yes → Go To 3 No → Repair the Ground circuit high resistance. Perform ABS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Turn on all accessories. Measure the voltage of the Ground circuit. Is the voltage below 1.0 volts? Yes → Go To 4 No → Repair as necessary. Unsplice any accessories connected to the CAB ground circuit. Reroute and shield any high voltage cables away from the CAB ground circuit. Perform ABS VERIFICATION TEST - VER 1.	All

CONTROLLER FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
G-SWITCH NOT PROCESSABLE

When Monitored and Set Condition:

G-SWITCH NOT PROCESSABLE

When Monitored: Ignition on. The CAB sends a test signal to its internal G-Sensor and monitors the internal sense circuits.

Set Condition: If the sense circuits are shorted or open for 2 minutes while driving or an otherwise improper signal is detected at any time, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
CAB - INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, record and erase DTC's. With the DRBIII®, read DTCs. Does the DRBIII® display G-SWITCH NOT PROCESSABLE? Yes → Replace the CAB. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
LEFT FRONT SENSOR CIRCUIT FAILURE

When Monitored and Set Condition:

LEFT FRONT SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the wheel speed circuit every 7 milliseconds (ms).

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

POSSIBLE CAUSES
LEFT FRONT WHEEL SPEED SENSOR OR CONNECTOR DAMAGE
LEFT FRONT WHEEL SPEED SENSOR CIRCUITS SHORTED OR OPEN
CAB--NO OUTPUT
INTERMITTENT CIRCUIT DTC
LEFT FRONT WHEEL SPEED SENSOR -- NO OUTPUT
CAB - UNABLE TO READ LEFT FRONT WHEEL SPEED SENSOR SIGNAL

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, record and erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display "Left Front Wheel Speed Sensor Circuit Failure" DTC present right now? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect the Left Front Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

LEFT FRONT SENSOR CIRCUIT FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Left Front Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Check the Left Front Wheel Speed Sensor 12 volt Supply and Signal circuits for a short to battery, ground, to each other and for open. For the purposes of this test, a short to ground must be below 15k ohms. Was any circuit short or open found? Yes → Repair Left Front Wheel Speed Sensor circuit short or open. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn ignition off. Make sure the CAB is not disconnected. Disconnect the Left Front Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Turn ignition on. Measure the voltage across the Left Front Wheel Speed Sensor 12 Volt Supply and Signal circuits at the Left Front Wheel Speed Sensor connector. Is the voltage above 10 volts? Yes → Go To 5 No → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. Using a DC voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits at the CAB. Reconnect the CAB. Turn ignition on. Slowly rotate the left front wheel while observing voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the CAB. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Left Front Wheel Speed Sensor. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
LEFT FRONT SENSOR SIGNAL FAILURE

When Monitored and Set Condition:

LEFT FRONT SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off or every 7 milliseconds (ms). Sensor circuit continuity is checked every 7 milliseconds. Wheel speed phase length supervision is checked every 7 milliseconds.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

POSSIBLE CAUSES
LEFT FRONT WHEEL SPEED SENSOR OR CONNECTOR DAMAGED
TONE WHEEL DAMAGED
LEFT FRONT WHEEL SPEED SENSOR AIR GAP OUT OF SPECIFICATION
LEFT FRONT WHEEL BEARING OUT OF SPECIFICATION
LEFT FRONT WHEEL SPEED SENSOR INOPERATIVE
CAB - WON'T RESPOND TO LEFT FRONT WHEEL SPEED SENSOR SIGNAL
INTERMITTENT SIGNAL DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Using the DRBIII®, monitor the Left Front Wheel Speed Sensor while an assistant drives the vehicle. With an assistant to drive, use the DRBIII® to monitor all wheel speed sensors. Slowly accelerate as straight as possible from a stop to 24 km/h (15 mph). Is Left Front WSS Signal 0 km/h (0 mph) or differing from others by more than 5 km/h (3 mph)? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Inspect the Left Front Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

LEFT FRONT SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Inspect the Tone Wheel for damaged or missing teeth, cracks, or looseness. **Note: The Tone Wheel Teeth should be perfectly square, not bent or nicked.** Is the Tone Wheel OK? Yes → Go To 4 No → Replace the Tone Wheel. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Using a Feeler Gauge, measure the Wheel Speed Sensor Air Gap. **NOTE: The Air Gap should be checked in at least four places on the Tone Wheel.** Is the Air Gap between 0.42 mm - 1.71 mm (0.017″ - 0.068″) ? Yes → Go To 5 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Inspect the wheel bearings for excessive runout or clearance. **Note: Refer to the appropriate service information, if necessary, for procedures or specifications.** Is the bearing clearance OK ? Yes → Go To 6 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. Using a DC voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits at the CAB. Reconnect the CAB. Turn the ignition on. Slowly rotate the left front wheel while observing voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Left Front Wheel Speed Sensor in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

LEFT FRONT SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Visually inspect wheel speed sensor. Visually inspect tone wheel. Visually inspect wiring harness. Visually inspect brakes for locking up due to lining contamination or overheating. Inspect all Components for defects which may cause a Signal DTC to set. Is any Component Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
LEFT REAR SENSOR CIRCUIT FAILURE

When Monitored and Set Condition:

LEFT REAR SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the wheel speed circuit every 7 milliseconds (ms).

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

POSSIBLE CAUSES
LEFT REAR WHEEL SPEED SENSOR OR CONNECTOR DAMAGE
LEFT REAR WHEEL SPEED SENSOR CIRCUITS SHORTED OR OPEN
CAB-NO OUTPUT
LEFT REAR WHEEL SPEED SENSOR -- NO OUTPUT
CAB - UNABLE TO READ LEFT REAR WHEEL SPEED SENSOR SIGNAL
INTERMITTENT CIRCUIT DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, record and erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display Left Rear Wheel Speed Sensor Circuit Failure DTC present right now? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect the Left Rear Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

LEFT REAR SENSOR CIRCUIT FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Left Rear Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Check the Left Rear Wheel Speed Sensor 12 volt Supply and Signal circuits for a short to battery, ground, to each other and for open. For the purposes of this test, a short to ground must be below 15k ohms. Was any circuit short or open found? Yes → Repair Left Rear Wheel Speed Sensor circuit short or open. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn ignition off. Disconnect the Left Rear Wheel Speed Sensor connector. Turn ignition on. Measure the voltage across the Left Rear Wheel Speed Sensor 12 Volt Supply and Signal circuits at the Left Rear Wheel Speed Sensor connector. Is the voltage above 10 volts? Yes → Go To 5 No → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. Using a DC voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits at the CAB. Reconnect the CAB. Turn ignition on. Slowly rotate the left rear wheel while observing voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Left Rear Wheel Speed Sensor. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
LEFT REAR SENSOR SIGNAL FAILURE

When Monitored and Set Condition:

LEFT REAR SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off or every 7 milliseconds (ms). Wheel speed circuit continuity is checked every 7 milliseconds. Wheel speed phase length supervision is checked every 7 milliseconds.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

POSSIBLE CAUSES
LEFT REAR WHEEL SPEED SENSOR OR CONNECTOR DAMAGED
TONE WHEEL DAMAGED
LEFT REAR WHEEL SPEED SENSOR AIR GAP OUT OF SPECIFICATION
WHEEL BEARINGS OUT OF SPECIFICATION
LEFT REAR WHEEL SPEED SENSOR INOPERATIVE
CAB - WON'T RESPOND TO WHEEL SPEED SENSOR SIGNAL
INTERMITTENT SIGNAL DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. While an assistant drives, use the DRBIII® to monitor all Wheel Speed Sensors. Slowly accelerate as straight as possible from a stop to 24 Km/h (15 Mph). With the DRBIII®, monitor all wheel speed sensors. Is Left Rear WSS Signal 0 km/h (0 mph) or differing from others by more than 5 km/h (3 mph)? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Inspect the Left Rear Wheel Speed Sensor and Connector. Is the Sensor or Connector damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

LEFT REAR SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Inspect the Tone Wheel for damaged or missing teeth, cracks, or looseness. **Note: The Tone Wheel Teeth should be perfectly square, not bent or nicked.** Is the Tone Wheel OK? Yes → Go To 4 No → Replace the Tone Wheel. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Using a Feeler Gauge, measure the Wheel Speed Sensor Air Gap. **NOTE: The Air Gap should be checked in at least four places on the Tone Wheel.** Is the Air Gap between 0.42 mm - 1.71 mm (0.017″ - 0.068″) ? Yes → Go To 5 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Inspect the wheel bearings at the affected wheel for excessive runout or clearance. **Note: Refer to the appropriate service information, if necessary, for procedures or specifications.** Is the bearing clearance OK ? Yes → Go To 6 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. With a voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits for the affected wheel at the CAB. Reconnect the CAB. Turn the ignition on. Slowly rotate the left rear wheel while observing the voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

LEFT REAR SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Visually inspect wheel speed sensor. Visually inspect tone wheel. Visually inspect wiring harness. Visually inspect brakes for locking up due to lining contamination or overheating. Inspect all Components for defects which may cause a Signal DTC to set. Is any Component Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PCI BUS COMMUNICATION

When Monitored and Set Condition:

PCI BUS COMMUNICATION

When Monitored: Ignition ON, every 7 ms.

Set Condition: When the CAB does not receive a message from the instrument cluster for 10 seconds.

POSSIBLE CAUSES
CHECK COMMUNICATION TO MIC
CAB-- INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, attempt to communicate with the MIC Was the DRB able to I/D or communicate with the MIC? Yes → Go To 2 No → Refer to the Communication category and perform the symptom Bus +/- Signals Open from the Controller Anti-Lock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
2	With the DRB, erase DTC's. Turn the ignition on and wait approximately 1 minute. With the DRB, read DTC's. Did this DTC reappear? Yes → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PUMP MOTOR CIRCUIT NOT WORKING PROPERLY

When Monitored and Set Condition:

PUMP MOTOR CIRCUIT NOT WORKING PROPERLY

When Monitored: Ignition on. The CAB commands the pump on at 20 km/h (12 mph) to check its operation, if the brake switch is not applied. If the brake is applied, the test will run at 40 km/h (25 mph). The CAB monitors pump voltage every 7 milliseconds.

Set Condition: The DTC is stored when the CAB detects: 1) Improper voltage decay after the pump was turned off. 2) Pump not energized by the CAB, but voltage is present for 3.5 seconds. 3) Pump is turned on by the CAB, but without sufficient voltage to operate it.

POSSIBLE CAUSES
CAB - PUMP MOTOR RUNNING CONTINUOUSLY
ABS PUMP MOTOR INTERMITTENT DTC
FUSED B(+) CIRCUIT INTERMITTENTLY SHORTED TO GROUND
FUSED B(+) CIRCUIT SHORTED TO GROUND
CAB - FUSED B(+) CIRCUIT SHORTED TO GROUND
FUSE BLOWN - PUMP MOTOR CIRCUIT
NO B+ SUPPLY TO FUSE
ABS PUMP MOTOR INOPERATIVE
FUSED B(+) CIRCUIT OPEN
GROUND CIRCUIT OPEN
GROUND CIRCUIT HIGH RESISTANCE
CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Reconnect all connectors. Turn the ignition on. Monitor the pump motor for continuous operation. Is the pump motor running continuously? Yes → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All

PUMP MOTOR CIRCUIT NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition on. With the DRBIII®, read DTC's. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, actuate the ABS pump motor. Did the Pump Motor operate when actuated? No → Go To 3 Yes → Go To 14	All
3	Turn the ignition off. Remove and inspect the ABS Pump fuse #4 in the PDC. Is the Fuse blown? Yes → Go To 4 No → Go To 8	All
4	Turn the ignition off. Make sure the Pump Motor connector is secure. Visually inspect the Fused B(+) Circuit in the wiring harness from the PDC to the CAB. Look for any sign of an Intermittent Short to Ground. Is the wiring harness OK? Yes → Go To 5 No → Repair the Fused B(+) Circuit shorted to ground. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Remove the ABS PUMP Fuse # 4 from the Power Distribution Center (PDC). Disconnect the CAB connector. Make sure the Pump Motor connector is secure. **Note: Check connector - Clean/repair as necessary.** Using a test light connected to 12 volts, probe the Fused B (+) Circuit. Is the test light on? Yes → Repair the Fused B(+) circuit short to ground. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Make sure the Pump Motor connector is secure. Remove the ABS PUMP Fuse 4 from the PDC. The CAB must be connected for the results of this test to be valid. Using a test light connected to 12 volts, probe the Fused B (+) circuit in the PDC. Is the test light on? Yes → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 7	All

PUMP MOTOR CIRCUIT NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Make sure the Pump Motor connector is secure If there are no potential causes remaining, replace the Fuse. If there are no possible causes remaining, view repair. Repair Replace the ABS Pump Motor Fuse. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Remove the ABS PUMP Fuse #4 from the Power Distribution Center (PDC). Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the Fused B (+) circuit between the PDC Fuse Terminal and the CAB connector. Is the resistance below 10 ohms? Yes → Go To 9 No → Repair the Fused B(+) circuit for an open. Make sure the Pump Motor connector is secure. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
9	Turn the ignition on. Using a 12-volt test light connected to ground, check the B+ supply to Fuse 4 in the PDC. Is the B+ supply OK? Yes → Go To 10 No → Repair the B+ supply for an open. Make sure the Pump Motor connector is secure. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Disconnect Pump Motor Connector. Connect a 10 gauge jumper wire between pump motor Fused B (+) circuit and a 40 Amp Fused B (+) circuit. Connect a 10 gauge jumper wire between pump motor ground circuit and a known good body ground. Monitor Pump Motor operation. Is the pump motor running? Yes → Go To 11 No → Replace the ABS Pump Motor/Hydraulic Control Unit assembly. Make sure the Pump Motor connector is secure. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

PUMP MOTOR CIRCUIT NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off. Disconnect CAB Connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the CAB ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 12 No → Repair the ground circuit for an open. Make sure the Pump Motor connector is secure. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
12	Make sure the Pump Motor connector is secure. Turn the ignition on. With the DRBIII®, enable pump motor actuation. **NOTE: Pump motor will not operate, but voltage will be applied.** Measure the voltage drop across the ABS ground circuit connection, with pump motor actuation enabled. Is the voltage below 0.1 volt? Yes → Go To 13 No → Repair the Ground circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
13	If there are no possible causes remaining, view repair. Repair Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
14	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Make sure the Pump Motor connecter is secure. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:

RIGHT FRONT SENSOR CIRCUIT FAILURE

When Monitored and Set Condition:

RIGHT FRONT SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the wheel speed circuit every 7 milliseconds (ms).

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

POSSIBLE CAUSES
RIGHT FRONT WHEEL SPEED SENSOR OR CONNECTOR DAMAGE
RIGHT FRONT WHEEL SPEED SENSOR CIRCUITS SHORTED OR OPEN
CAB-NO OUTPUT
RIGHT FRONT WHEEL SPEED SENSOR -- NO OUTPUT
CAB - UNABLE TO READ RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
INTERMITTENT CIRCUIT DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, record and erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display Right Front Wheel Speed Sensor Circuit Failure DTC present right now? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect the Right Front Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

RIGHT FRONT SENSOR CIRCUIT FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Right Front Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Check the Right Front Wheel Speed Sensor 12 volt Supply and Signal circuits for a short to battery, ground, to each other and for open. For the purposes of this test, a short to ground must be below 15k ohms. Was any circuit short or open found? Yes → Repair Right Front Wheel Speed Sensor circuit short or open. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn ignition off. Make sure the CAB is not disconnected. Disconnect the Left Front Wheel Speed Sensor connector. Turn ignition on. Measure the voltage across the Right Front Wheel Speed Sensor 12 Volt Supply and Signal circuits at the Right Front Wheel Speed Sensor connector. Is the voltage above 10 volts? Yes → Go To 5 No → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. Using a DC voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits at the CAB. Reconnect the CAB. Turn ignition on. Slowly rotate the right front wheel while observing voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the CAB. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Right Front Wheel Speed Sensor. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
RIGHT FRONT SENSOR SIGNAL FAILURE

When Monitored and Set Condition:

RIGHT FRONT SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off or every 7 milliseconds (ms). Wheel speed continuity is checked every 7 milliseconds. Wheel speed phase length supervision is checked every 7 milliseconds.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

POSSIBLE CAUSES
RIGHT FRONT WHEEL SPEED SENSOR OR CONNECTOR DAMAGED
TONE WHEEL DAMAGED
RIGHT FRONT WHEEL SPEED SENSOR AIR GAP OUT OF SPECIFICATION
WHEEL BEARINGS OUT OF SPECIFICATION
RIGHT FRONT WHEEL SPEED SENSOR INOPERATIVE
CAB - WON'T RESPOND TO WHEEL SPEED SENSOR SIGNAL
INTERMITTENT SIGNAL DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. While an assistant drives, use the DRBIII® to monitor all Wheel Speed Sensors. Slowly accelerate as straight as possible from a stop to 24 Km/h (15 Mph). With the DRBIII®, monitor all wheel speed sensors. Is Right Front WSS Signal 0 km/h (0 mph) or differing from others by more than 5 km/h (3 mph)? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Inspect the Right Front Wheel Speed Sensor and Connector. Is the Sensor or Connector damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

RIGHT FRONT SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Inspect the Tone Wheel for damaged or missing teeth, cracks, or looseness. **Note: The Tone Wheel Teeth should be perfectly square, not bent or nicked.** Is the Tone Wheel OK? Yes → Go To 4 No → Replace the Tone Wheel. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Using a Feeler Gauge, measure the Wheel Speed Sensor Air Gap. **NOTE: The Air Gap should be checked in at least four places on the Tone Wheel.** Is the Air Gap between 0.42 mm - 1.71 mm (0.017″ - 0.068″) ? Yes → Go To 5 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Inspect the wheel bearings at the affected wheel for excessive runout or clearance. **Note: Refer to the appropriate service information, if necessary, for procedures or specifications.** Is the bearing clearance OK ? Yes → Go To 6 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. Using a DC voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits at the CAB. Reconnect the CAB. Turn the ignition on. Slowly rotate the right front wheel while observing the voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Right Front Wheel Speed Sensor in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

RIGHT FRONT SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Visually inspect wheel speed sensor. Visually inspect tone wheel. Visually inspect wiring harness. Visually inspect brakes for locking up due to lining contamination or overheating. Inspect all Components for defects which may cause a Signal DTC to set. Is any Component Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:

RIGHT REAR SENSOR CIRCUIT FAILURE

When Monitored and Set Condition:

RIGHT REAR SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the wheel speed circuit every 7 milliseconds (ms).

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

POSSIBLE CAUSES
RIGHT REAR WHEEL SPEED SENSOR OR CONNECTOR DAMAGE
RIGHT REAR WHEEL SPEED SENSOR CIRCUITS SHORTED OR OPEN
CAB-NO OUTPUT
RIGHT REAR WHEEL SPEED SENSOR -- NO OUTPUT
CAB - UNABLE TO READ RIGHT REAR WHEEL SPEED SENSOR SIGNAL
INTERMITTENT CIRCUIT DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTC's. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display Right Rear Wheel Speed Sensor Circuit Failure DTC present right now? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect the Right Rear Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

RIGHT REAR SENSOR CIRCUIT FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Right Rear Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Check the Right Rear Wheel Speed Sensor 12 volt Supply and Signal circuits for a short to battery, ground, to each other and for open. For the purposes of this test, a short to ground must be below 15k ohms. Was any circuit short or open found? Yes → Repair Right Rear Wheel Speed Sensor circuit short or open. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn ignition off. Make sure the CAB is not disconnected. Disconnect the Right Rear Wheel Speed Sensor connector. Turn ignition on. Measure the voltage across the Right Rear Wheel Speed Sensor 12 Volt Supply and Signal circuits at the Right Rear Wheel Speed Sensor connector. Is the voltage above 10 volts? Yes → Go To 5 No → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. Using a DC voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits at the CAB. Reconnect the CAB. Turn ignition on. Slowly rotate the right rear wheel while observing voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Right Rear Wheel Speed Sensor. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
RIGHT REAR SENSOR SIGNAL FAILURE

When Monitored and Set Condition:

RIGHT REAR SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off or every 7 milliseconds (ms). Wheel speed circuit continuity is checked every 7 milliseconds. Wheel speed phase length supervision is checked every 7 milliseconds.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

POSSIBLE CAUSES
RIGHT REAR WHEEL SPEED SENSOR OR CONNECTOR DAMAGED
TONE WHEEL DAMAGED
RIGHT REAR WHEEL SPEED SENSOR AIR GAP OUT OF SPECIFICATION
WHEEL BEARINGS OUT OF SPECIFICATION
RIGHT REAR WHEEL SPEED SENSOR INOPERATIVE
CAB - WON'T RESPOND TO WHEEL SPEED SENSOR SIGNAL
INTERMITTENT SIGNAL DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. While an assistant drives, use the DRBIII® to monitor all Wheel Speed Sensors. Slowly accelerate as straight as possible from a stop to 24 Km/h (15 Mph). With the DRBIII®, monitor all wheel speed sensors. Is Right Rear WSS Signal 0 Km/h (0 Mph) or differing from others by more than 5kmh (3mph)? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Inspect the Right Rear Wheel Speed Sensor and Connector. Is the Sensor or Connector damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

RIGHT REAR SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Inspect the Tone Wheel for damaged or missing teeth, cracks, or looseness. **Note: The Tone Wheel Teeth should be perfectly square, not bent or nicked.** Is the Tone Wheel OK? Yes → Go To 4 No → Replace the Tone Wheel in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Using a Feeler Gauge, measure the Wheel Speed Sensor Air Gap. **NOTE: The Air Gap should be checked in at least four places on the Tone Wheel.** Is the Air Gap between 0.42 mm - 1.71 mm (0.017″ - 0.068″) ? Yes → Go To 5 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Inspect the wheel bearings at the affected wheel for excessive runout or clearance. **Note: Refer to the appropriate service information, if necessary, for procedures or specifications.** Is the bearing clearance OK ? Yes → Go To 6 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn ignition off. Disconnect the CAB harness connector. Remove the harness strain relief to access the wires in the CAB connector. With a voltmeter and special tool 6801, backprobe the Wheel Speed Sensor 12 volt Supply and Signal circuits for the affected wheel at the CAB. Reconnect the CAB. Turn the ignition on. Slowly rotate the right rear wheel while observing the voltmeter reading. Does the voltage change from approximately 1.6 volts to 0.8 volts as the wheel is rotated? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

RIGHT REAR SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Visually inspect wheel speed sensor. Visually inspect tone wheel. Visually inspect wiring harness. Visually inspect brakes for locking up due to lining contamination or overheating. Inspect all Components for defects which may cause a Signal DTC to set. Is any Component Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SYSTEM OVERVOLTAGE

When Monitored and Set Condition:

SYSTEM OVERVOLTAGE

When Monitored: Ignition on. The CAB monitors the Fused B(+) circuit at all times for proper system voltage.

Set Condition: If the voltage is above 16.5 volts for greater than 420 milliseconds (ms), the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
BATTERY OVERCHARGED
INTERMITTENT DTC
FUSED IGNITION SWITCH OUTPUT HIGH
GROUND CIRCUIT OPEN
CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Start the engine. With the DRBIII®, read DTC's. Does the DRBIII® display System Overvoltage DTC? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect for battery charger connected to battery. Is a battery charger connected to the battery? Yes → Charge battery to proper level. Disconnect the battery charger. Clear DTC's. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

SYSTEM OVERVOLTAGE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Start the engine. Raise engine speed above 1,800 RPM. Measure the battery voltage. Is the voltage above 16.5 volts ? Yes → Refer to appropriate service information for charging system testing and repair. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 5 No → Repair the Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
5	If there are no potential causes remaining, view repair. Repair Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SYSTEM UNDERVOLTAGE

When Monitored and Set Condition:

SYSTEM UNDERVOLTAGE

When Monitored: Ignition on. The CAB monitors the Fused Ignition Switch Output circuit voltage above 10 km/h (6 mph) every 7 milliseconds for proper system voltage.

Set Condition: If the voltage is below 9.5 volts, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
BATTERY VOLTAGE LOW
INTERMITTENT DTC
FUSED IGNITION SWITCH OUTPUT CIRCUIT HIGH RESISTANCE
GROUND CIRCUIT OPEN
CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Start the engine. Drive the vehicle above 16 km/h (10 mph) for at least 20 seconds. Stop the vehicle With the DRBIII®, read DTC's. Does the DRBIII® display System Undervoltage DTC? Yes → Go To 2 No → Go To 6	All
2	Engine Running. Measure the battery voltage. Is the battery voltage below 10 volts? Yes → Refer to appropriate service information for charging system testing and repair. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

SYSTEM UNDERVOLTAGE — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the CAB harness connector. Turn the ignition on. Measure the voltage of the Fused Ignition Switch circuit. Is the voltage above 10 volts? Yes → Go To 5 No → Repair the Fused Ignition Switch Output Circuit for high resistance Perform ABS VERIFICATION TEST - VER 1.	All
5	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Verification Tests

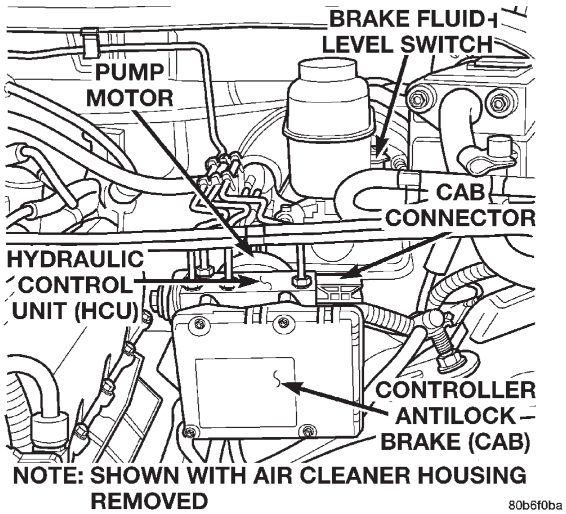
ABS VERIFICATION TEST - VER 1	APPLICABILITY
1. Turn the ignition off. 2. Connect all previously disconnected components and connectors. 3. Ensure all accessories are turned off and the battery is fully charged. 4. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. 6. If any Diagnostic Trouble Codes are present, return to Symptom list and troubleshoot new or recurring symptom. **7. NOTE: For Sensor Signal and Pump Motor faults, the CAB must sense all 4 wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator.** 8. If there are no DTC's present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several antilock braking stops. **9. Caution: Ensure braking capability is available before road testing.** 10. Again, with the DRBIII® read DTC's. If any DTC's are present, return to Symptom list. 11. If there are no Diagnostic Trouble Codes (DTC's) present, and the customer's concern can no longer be duplicated, the repair is complete. Are any DTC's present or is the original concern still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

ADJUSTABLE PEDALS VERIFICATION TEST - VER 1	APPLICABILITY
1. If the Adjustable Pedals Module was replaced, program two pedal positions if equipped with memory function. 2. Activate the Adjustable Pedals through the full range of movement. 3. Verify that the Adjustable Pedals system is disabled with the vehicle in Reverse. 4. Verify that the Adjustable Pedals system is disabled with Speed Control activated. 5. With the DRBIII®, erase DTCs. 6. With the DRBIII®, read DTCs. Are any DTC's present or is the original complaint still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

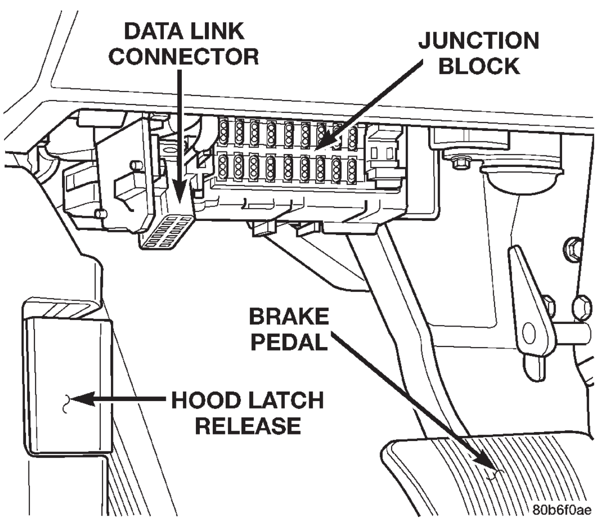
NOTES

8.0 COMPONENT LOCATIONS

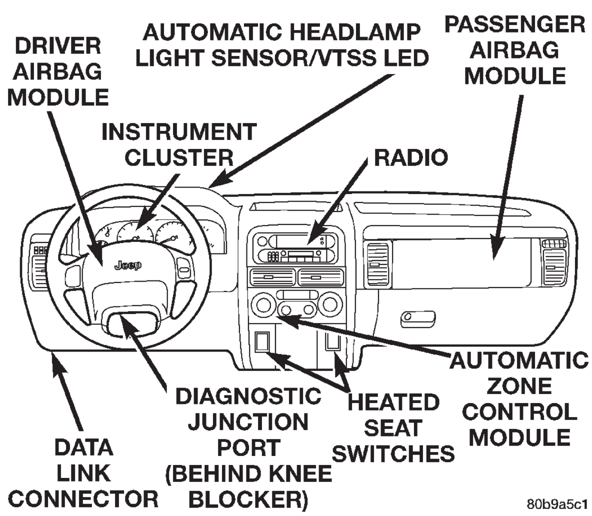
8.1 CONTROLLER ANTILOCK BRAKE



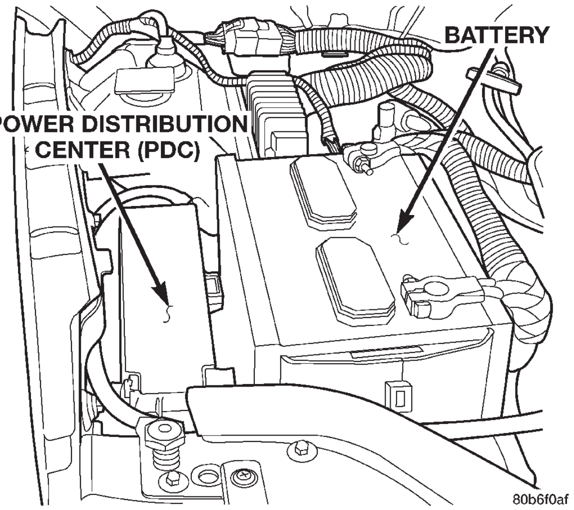
8.2 DATA LINK CONNECTOR

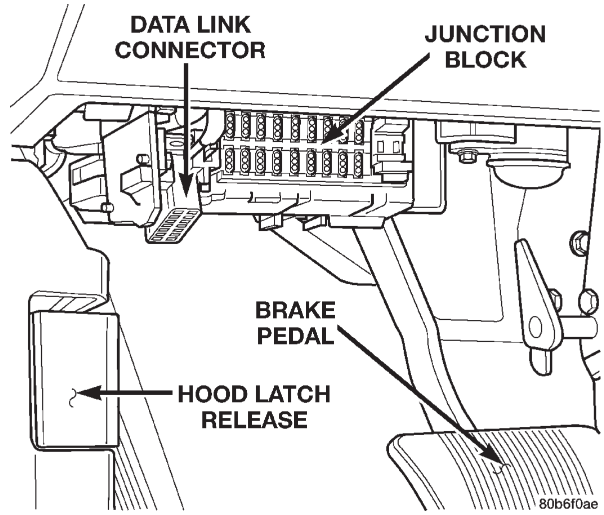


8.2.1 DIAGNOSTIC JUNCTION PORT



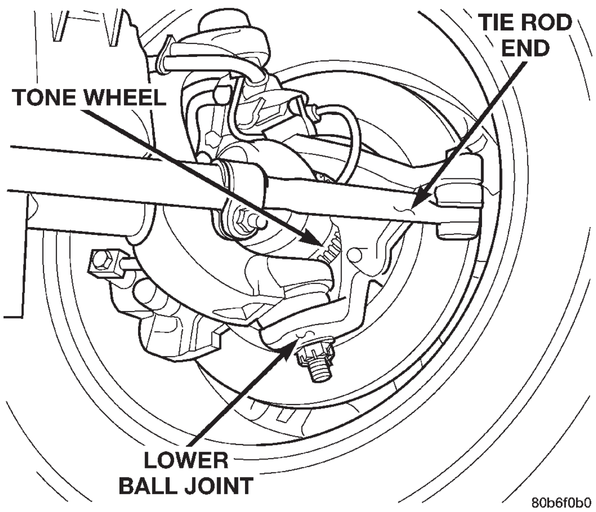
8.3 FUSES



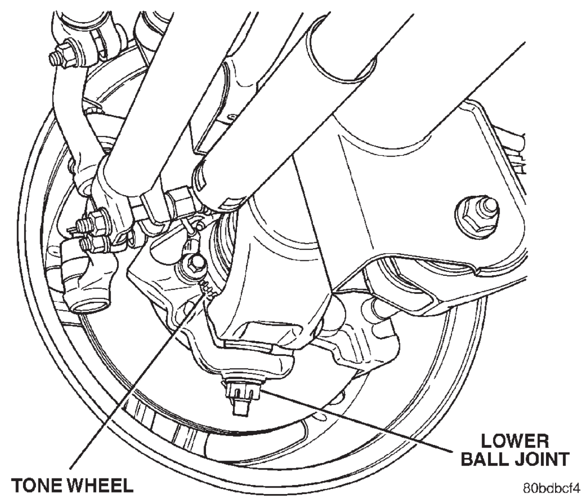


8.4 TONE WHEELS

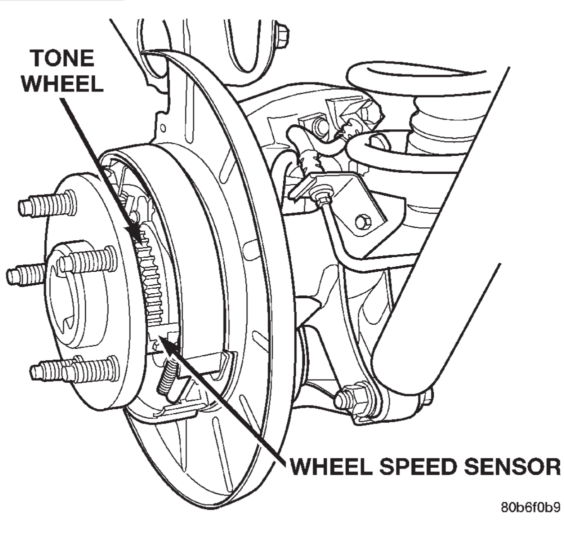
LEFT FRONT



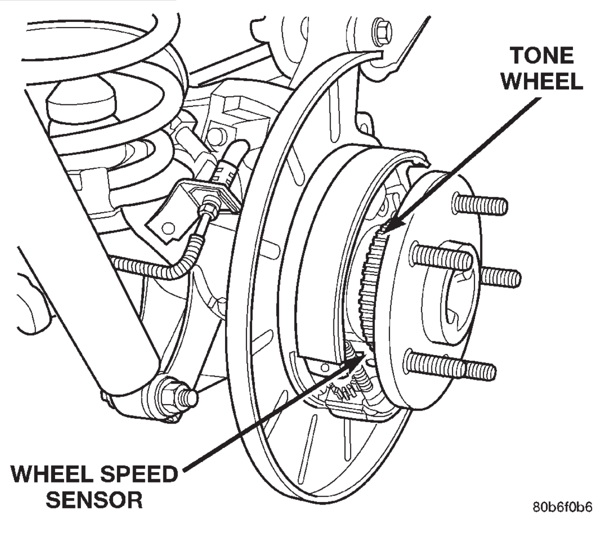
RIGHT FRONT



LEFT REAR

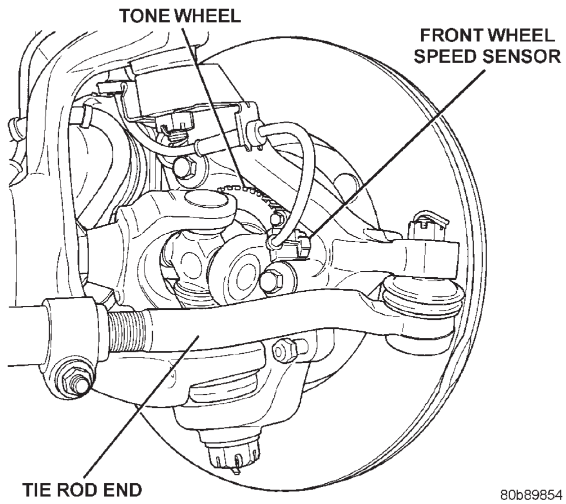


RIGHT REAR

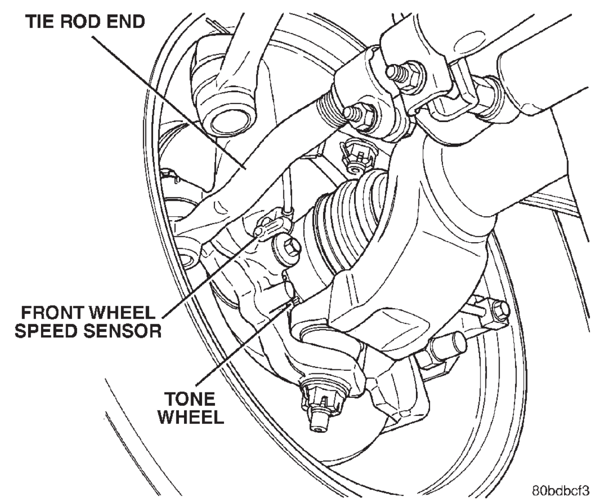


8.5 WHEEL SPEED SENSORS

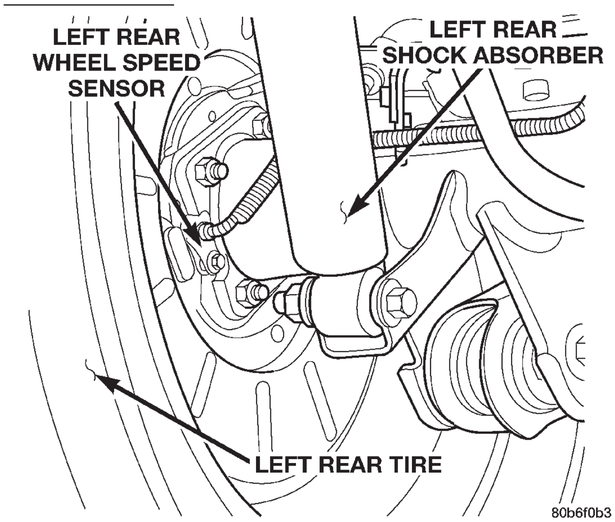
LEFT FRONT



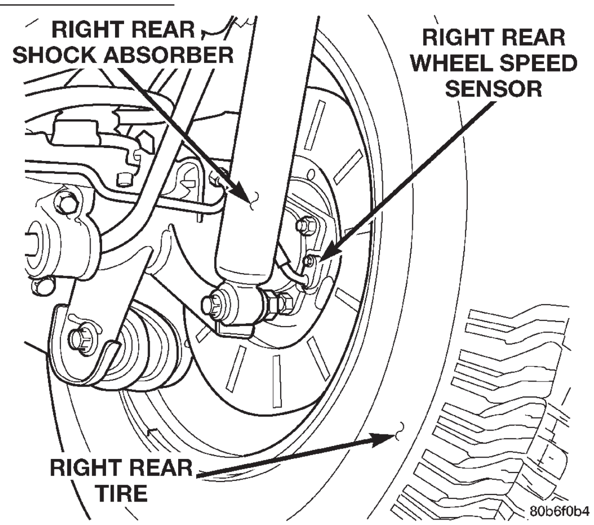
RIGHT FRONT



LEFT REAR

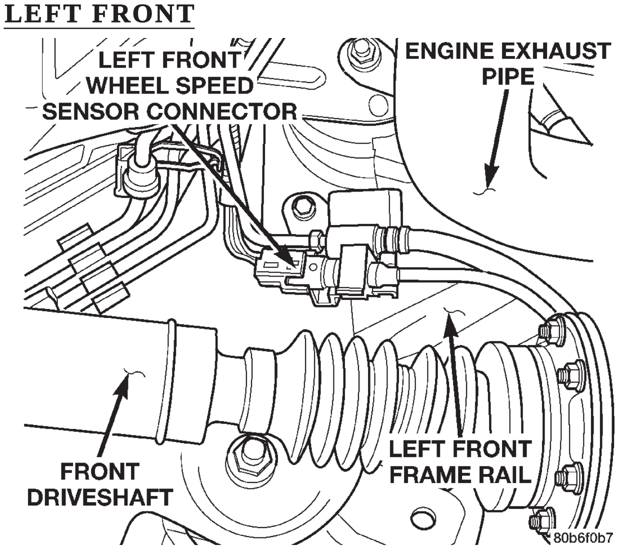


RIGHT REAR

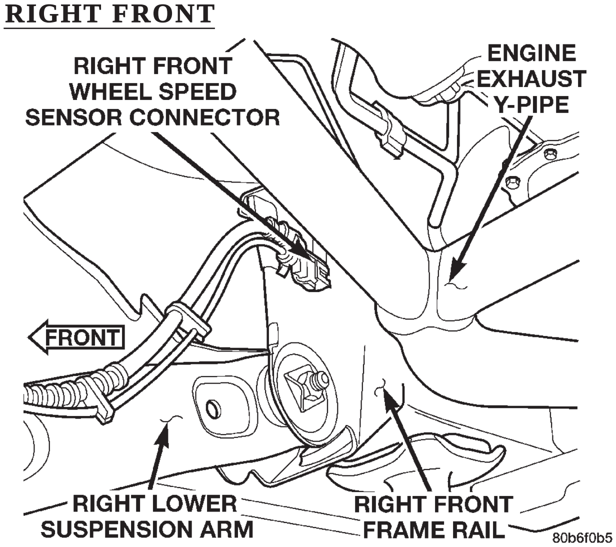


8.6 WHEEL SPEED SENSOR CONNECTORS

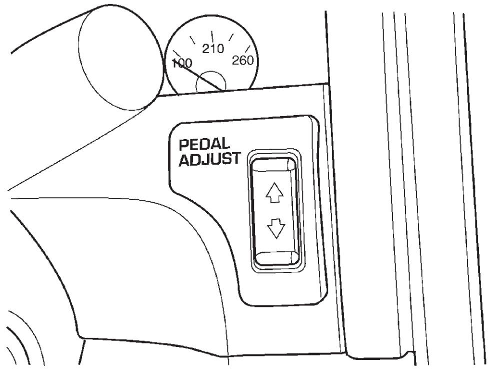
LEFT FRONT



RIGHT FRONT



8.7 ADJUSTABLE PEDALS SWITCH



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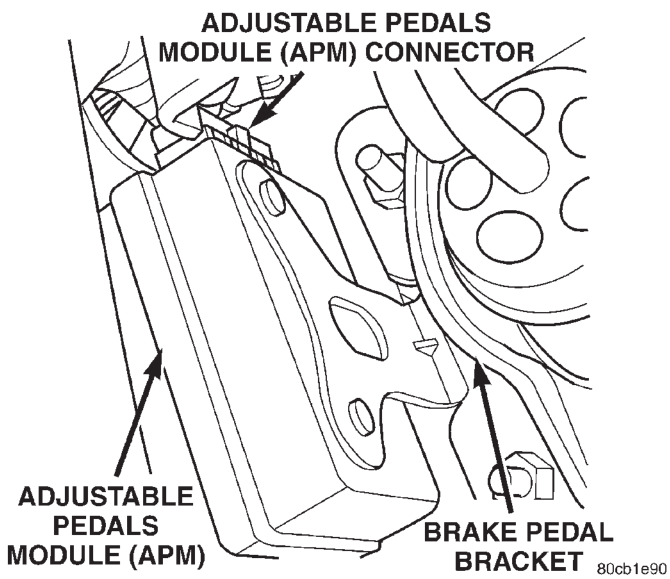
8.8 ADJUSTABLE PEDALS MODULE



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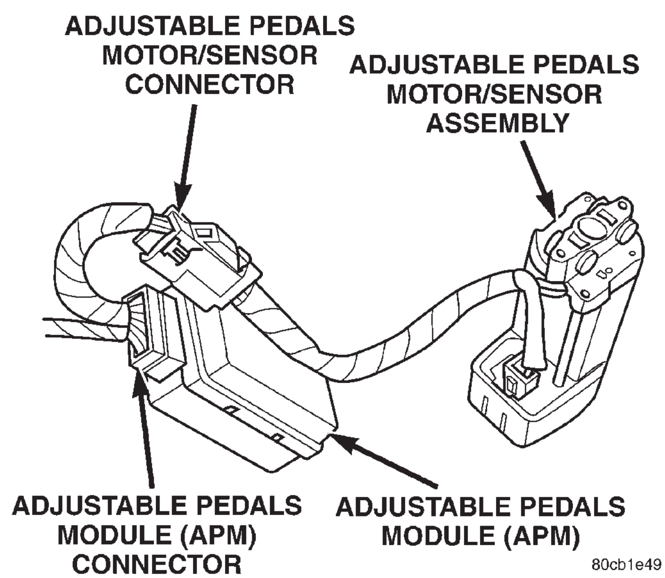
8.9 ADJUSTABLE PEDALS COMPONENTS



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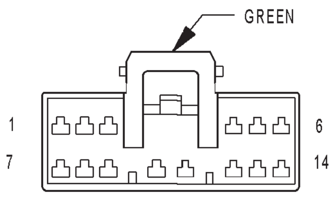
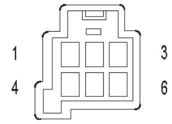
9.0 CONNECTOR PINOUTS



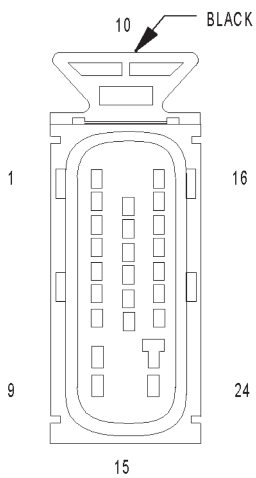
ADJUSTABLE PEDALS MODULE (EXCEPT BUILT-UP-EXPORT) - GREEN 14 WAY

CAV	CIRCUIT	FUNCTION
1	Y151 20LG/BR	ADJUSTABLE PEDALS SWITCH SENSE (FORWARD)
2	Y152 20LG/OR	ADJUSTABLE PEDALS SWITCH SENSE (REARWARD)
3	Q110 16OR/VT	ADJUSTABLE PEDALS MOTOR (FORWARD)
4	F72 16RD/YL	FUSED B(+)
5	-	-
6	Q111 16OR/GY	ADJUSTABLE PEDALS MOTOR (REARWARD)
7	Q113 20OR/DB (MEMORY)	PEDAL POSITION SENSOR FEED
8	Q112 20OR/YL (MEMORY)	PEDAL POSITION SENSOR SENSE
9	Q114 20OR/TN (MEMORY)	PEDAL POSITION SENSOR RETURN
10	Z151 16BK	GROUND
11	Z155 20BK/OR	GROUND
12	L1 18WT/BR	BACK-UP LAMP FEED
13	D25 20VT/YL	PCI BUS
14	Y153 16DB/RD	ADJUSTABLE PEDALS SWITCH FEED



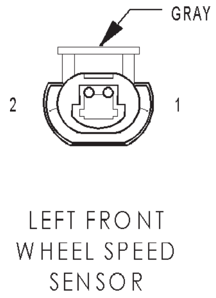
ADJUSTABLE PEDALS MOTOR/SENSOR ASSEMBLY (EXCEPT BUILT-UP-EXPORT) - 6 WAY

CAV	CIRCUIT	FUNCTION
1	Q113 20OR/DB	PEDAL POSITION SENSOR FEED
2	Q112 20OR/YL	PEDAL POSITION SENSOR SENSE
3	Q114 20OR/TN	PEDAL POSITION SENSOR RETURN
4	-	-
5	Q111 16OR/GY	AJDUSTABLE PEDALS MOTOR (REARWARD)
6	Q110 16OR/VT	ADJUSTABLE PEDALS MOTOR (FORWARD)



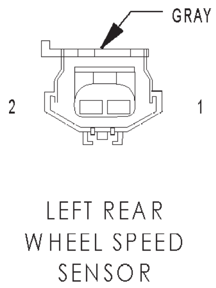
CONTROLLER ANTILOCK BRAKE - BLACK 24 WAY

CAV	CIRCUIT	FUNCTION
1	Z101 12BK/OR	GROUND
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL
3	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
4	-	-
5	D25 18VT/YL	PCI BUS
6	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
7	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
8	-	-
9	A20 12RD/DB	FUSED B(+)
10	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	D52 18LG/WT (DIESEL)	CAN C BUS(+)
12	-	-
13	B22 18DG/YL	VEHICLE SPEED SIGNAL
14	D51 18DG/YL (DIESEL)	CAN C BUS(-)
15	-	-
16	Z102 12BK/OR	GROUND
17	G9 18GY/BK	BRAKE FLUID LEVEL SWITCH SENSE
18	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
19	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL
20	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
21	Z231 18BK	GROUND
22	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
23	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
24	A10 12RD/DG	FUSED B(+)



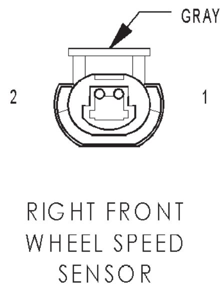
LEFT FRONT WHEEL SPEED SENSOR - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL



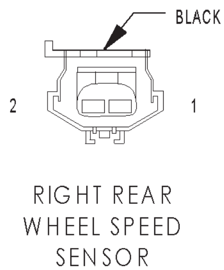
LEFT REAR WHEEL SPEED SENSOR - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL



RIGHT FRONT WHEEL SPEED SENSOR - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL

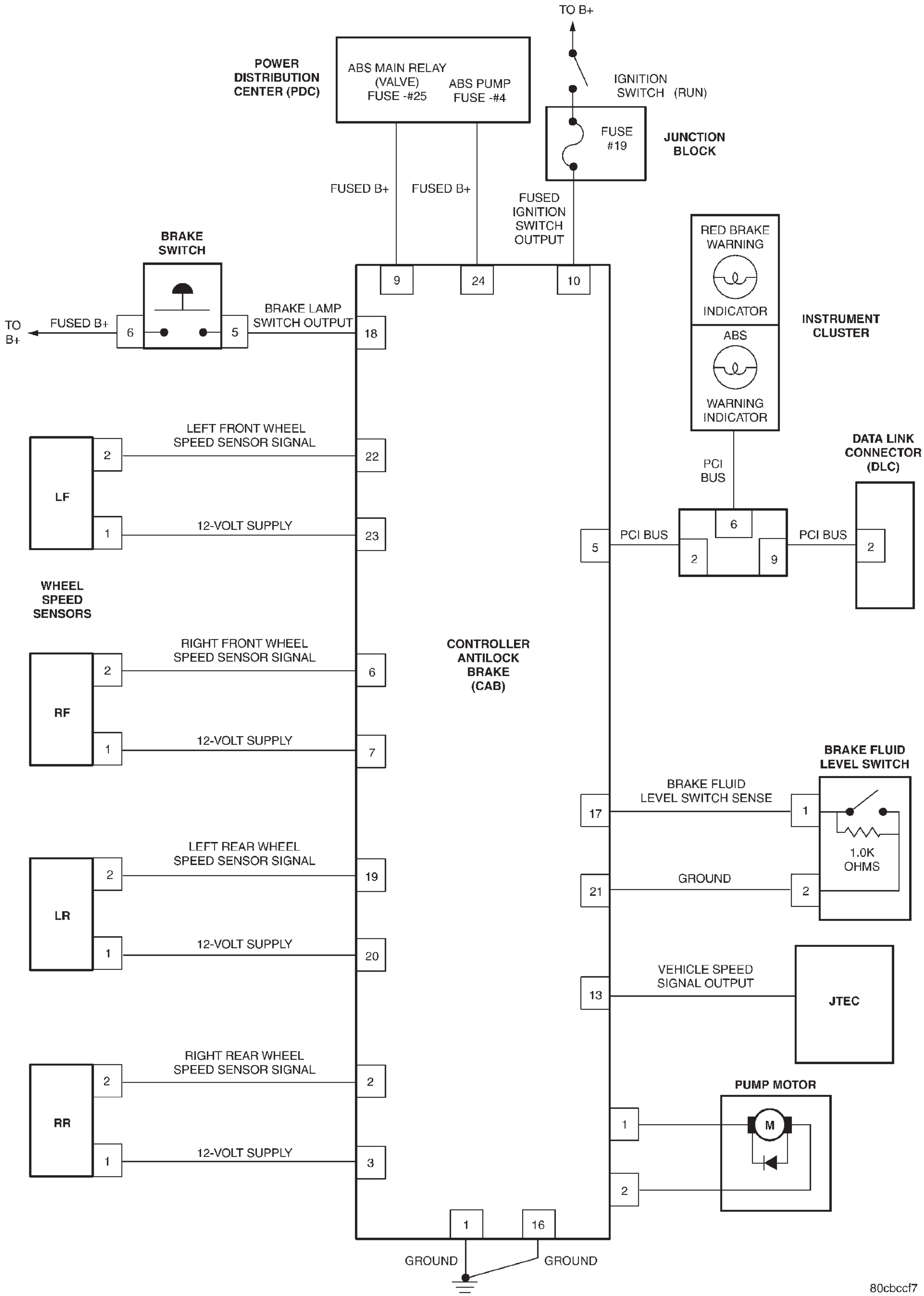


RIGHT REAR WHEEL SPEED SENSOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL

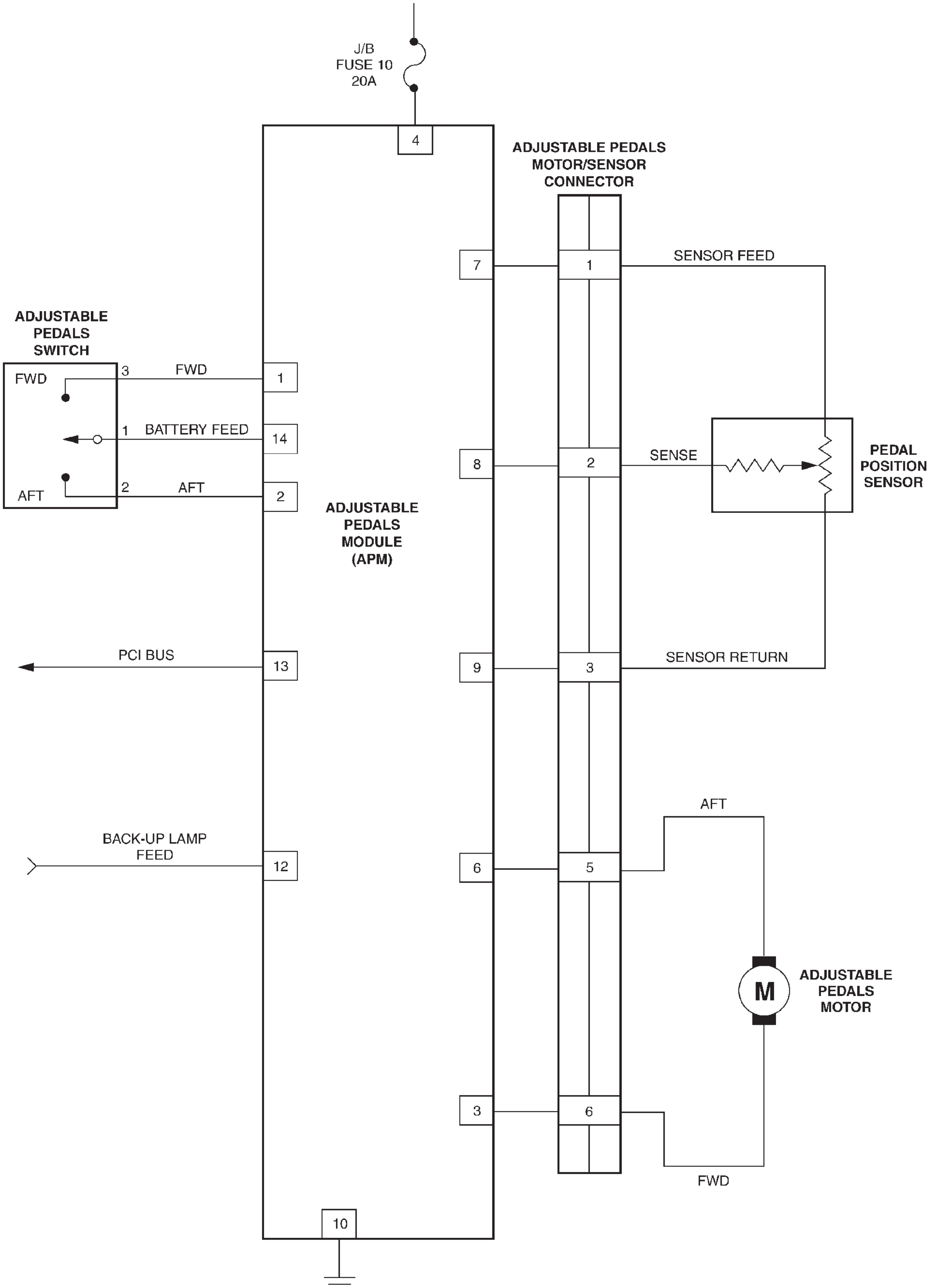
10.0 SCHEMATIC DIAGRAMS

10.1 WJ BODY TEVES MARK 20



SCHEMATIC DIAGRAMS

10.2 ADJUSTABLE PEDALS SYSTEM



NOTES

NOTES

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

1.0 INTRODUCTION

The procedures contained in this manual include all of the specifications, instructions, and graphics needed to diagnose 45RFE/545RFE Electronic Automatic Transmission (EATX) problems. The diagnostics in this manual are based on the failure condition or symptom being present at the time of diagnosis.

When repairs are required, refer to the appropriate volume of the service manual for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added and/or carryover systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE TROUBLE CODE. It is recommended that you review the entire manual to become familiar with all new and changed diagnostic procedures.

1.1 SYSTEM COVERAGE

This diagnostic procedures manual covers all 2002 Model Year WJ/WG equipped with a 45RFE/545RFE Automatic Transmission.

1.2 SIX -STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the 45RFE/545RFE electronic transmission is done in six basic steps:

- Verification of complaint
- Verification of any related symptoms
- Symptom analysis
- Problem isolation
- Repair of isolated problem
- Verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

The 45RFE/545RFE Transmission family can be identified by confirming the presence of a 23 pin electrical connector on the left hand side of the transmission oriented vertically near the manual lever.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 GENERAL DESCRIPTION

The 45RFE/545RFE electronic transmission is a conventional transmission in that it uses hydraulically applied clutches to shift a planetary gear train. However, the electronic control system replaces many of the mechanical and hydraulic components used in conventional transmission valve bodies.

The 45RFE/545RFE electronic transmission is a fully electronically controlled transmission. The Transmission Control Module (TCM) is similar to (but not the same as) the one used in the 41TE and 42LE transmissions, therefore many similarities exist in function and diagnosis.

The 45RFE/545RFE has an overrunning clutch (used in 1st gear), an electronically controlled torque converter clutch, 3 planetary gearsets, and six clutch packs. The clutches are called 2nd Clutch (2C), 4th Clutch (4C), Low/Reverse Clutch (LR), Reverse Clutch (RC), Underdrive Clutch (UD), and Overdrive Clutch (OD).

Although the 45RFE is considered a 4 speed transmission, it really has 5 forward gear ratios., the 545RFE is considered a 5 speed transmission, it really has 6 forward gear ratios. 2nd gear (1.67:1) and 2nd prime (1.50:1) gear are so close in ratio that they are not considered to be different gear ratios, although both are used as 2nd gear under certain conditions. During most upshift and downshift maneuvers, 2nd gear will be used. 2nd prime gear is only used for a high speed 4-2 downshift. The 545RFE transmission is essentially a software change to the TCM that allows an additional overdrive ratio of (.667:1). The gear ratio of 4th Prime is achieved by applying the 2C and OD clutches. The 4th Prime is used above 52 MPH. All gear ratios in the 45RFE/545RFE are achieved by applying two elements (clutches). During a shift, one element is released and another is applied, resulting in a different ratio. This is called a clutch to clutch shift. In order to perform a 4-2 downshift, two elements would have to be released and two different elements applied. The 2nd prime gear ratio allows a clutch to clutch 4-2' (2nd prime) downshift.

The oil pump in the 45RFE/545RFE is a dual stage positive displacement gear type pump. At idle and low engine speeds, both stages are working. Once the engine speed reaches a point where one side of the pump can supply the necessary system requirements, the second stage is vented. This pump configuration gives the pressure and flow of a large displacement pump at low speeds, and the economy of a small displacement pump at higher engine speeds. The oil pump housing also contains some of the valves that are found in the valve body in a 41TE or 42LE transmission. The Converter Clutch Switch Valve, Converter Clutch Regulator Valve, Torque Converter Limit Valve, and the Pressure Regulator Valve, are all found in the oil pump housing.

The electronic control system consists of a Transmission Control Module (TCM), a Transmission Range Sensor (TRS), an Input Speed Sensor (ISS), an Output Speed Sensor (OSS), a Line Pressure Sensor (LPS), a Transmission Temperature Sensor (TTS), five pressure switches, and seven solenoids. Each clutch pack has a corresponding solenoid and pressure switch except for the reverse clutch which is controlled by the manual valve. The other two solenoids are called the Multi Select (MS) solenoid and the Pressure Control Solenoid (PCS).

The MS solenoid is used to control the LR clutch during P-R and N-R garage shifts and to control the OD clutch when the Manual Valve is in the ″D″ position as reported by the TRS. If the manual valve is slightly out of position, the TRS will indicate a temporary zone (T3 or T4). In this case the OD clutch will be controlled by the OD solenoid. Note that if the TRS indicates a temporary zone, this is a valid PRNDL code and will not set a DTC P0706(28). If the PRNDL code consistently indicates a temporary zone while the shift lever is in the ″D″ position, this would indicate some sort of mechanical problem in the shift linkage as opposed to an electrical TRS problem. Note: vehicle operation in the T3 temporary zone can set a DTC P1715(65).

3.2 FUNCTIONAL OPERATION

The 45RFE/545RFE electronic transmission has a fully adaptive control system. The system performs its functions based on continuous real-time sensor feedback information. The control system automatically adapts to changes in engine performance and friction element variations to provide consistent shift quality. The control system ensures that clutch operation during upshifting and downshifting is more responsive without increased harshness.

The Transmission Control Module (TCM) continuously checks for electrical problems, mechanical problems, and some hydraulic problems. When a problem is sensed, the TCM stores a diagnostic trouble code (DTC). Some of these codes cause the transmission to go into ″limp-in″ or ″default″ mode. The 45RFE/545RFE has three default modes:

(I) Immediate shutdown - The TCM de-energizes the transmission control relay. This causes the transmission system to immediately default to third gear if shift lever is in the ″D″ position, or 2nd gear if it is in the ″2″ or ″L″ positions. Park, Neutral, and Reverse are still available.

(O) Orderly Shutdown - If the TCM recognizes a problem that does not require an immediate shutdown, the transmission will maintain the current gear and the transmission control relay will remain energized until de-energizing it will not overspeed the engine. When the vehicle speed reaches a reasonable level the TCM de-energizes the transmission control relay. This causes the transmission system to immediately default to third gear if shift lever is in the ″D″ position, or 2nd gear if it is in the ″2″ or ″L″ positions. Park, Neutral, and Reverse are still available.

(L) Logical Shutdown with Recovery - The TCM does not de-energize the Transmission Control Relay. Instead, the transmission will utilize 1st and 3rd gears while in ″D″, and will use 2nd while in ″2″ or ″L″. All transmission operation in this mode will be at a preset line pressure (open loop). The transmission will resume normal operation (recover) if the detected problem goes away. Three recoveries are permitted in a given key, after the fourth occurrence the operation described above will be maintained.

Once the DRBIII® is in the ″EATX″ portion of the diagnostic program, it constantly monitors the TCM to see if the system is in limp-in mode. If the transmission is in limp-in mode, the DRBIII® will flash the red LED.

3.2.1 TRANSMISSION OPERATION AND SHIFT SCHEDULING AT VARIOUS OIL TEMPERATURES

The transmission covered in this manual has unique shift schedules depending on the temperature of the transmission oil. The shift schedule is modified to extend the life of the transmission while operating under extreme conditions.

The oil temperature is measured with a Temperature Sensor on the 45RFE/545RFE transmission. The Temperature Sensor is an integral component of the Transmission Range Sensor (TRS). If the Temperature Sensor is faulty, (DTC P-1799) the transmission will default to a ″calculated″ oil temperature. Oil temperature will then be calculated using engine coolant temperature, battery/ambient temperature, and engine off time from the Body Control Module (BCM). These inputs are received from the communication bus periodically and are used to initialize the oil temperature at start up. Once the engine is started, the TCM updates the transmission oil temperature based on torque converter slip speed, vehicle speed, gear, and engine coolant temperature to determine an estimated oil temperature during vehicle operation. Vehicles using ″calculated oil temperature″ track oil temperature reasonably accurately during normal operation. However, if a transmission is overfilled, a transmission oil cooler becomes restricted, or if a customer drives aggressively in low gear, the calculated oil temperature will be inaccurate. Consequently the shift schedule selected may be inappropriate for the current conditions. The key highlights of the various shift schedules are as follows:

Extreme Cold: Oil temperature below -27°C (-16°F)

Goes to ″Super Cold″ schedule when temp rises above -24°C (-12°F) oil temperature
Park, Reverse, Neutral and 1st and 3rd gear only
No Torque Converter Clutch engagement

Super Cold: Oil temperature between -27°C (-16°F) and -17°C (0°F)

Goes to ″Cold″ schedule above -12°C (10°F) oil temperature
Delayed 2-3 upshift
Delayed 3-4 upshift
Early 4-3 coastdown shift
Early 3-2 coastdown shift
No 3-1 coastdown or kickdown
High speed 4-2, 3-2, 2-1 kickdown shifts are prevented
No Torque Converter Clutch engagement

Cold: Oil temperature between -17°C (0°F) and 2°C (36°F)

Goes to ″Warm″ schedule when temp rises above 4.4°C (40°F) oil temperature
Shifts at higher throttle openings will be early
High speed 4-2, 3-2, 2-1 kickdown shifts are prevented
Delayed 3-4 upshift
Early 4-3 coastdown shift
Torque Converter Clutch engagement allowed with sump temp greater than 18°C (65°F)

Warm: Oil temperature between 2°C (36°F) and 27°C (80°F)

Normal operation (upshifts, kickdowns, and coastdowns)
No Torque Converter Clutch engagement

Hot (Normal operation): Oil temperature between 27°C (80°F) and 115°C (240°F)

Goes to ″Overheat″ schedule above 115°C (240°F) oil temperature
Reverts to ″Hot″ when temp falls below 110°C (230°F)
Normal operation (upshifts, kickdowns, and coastdowns)
Normal Torque Converter Clutch engagement operation

Overheat: Oil temperature above 115°C (240°F) or engine coolant temperature above 118°C (244°F)

Reverts to ″Hot″ when temp falls below 110°C (230°F) oil temp or ″Overheat″ above 115°C (240°F) oil temp.
Delayed 2-3 upshift 40-51 km/h (25-32 MPH)
Delayed 3-4 upshift 66-77 km/h (41-48 MPH)
3rd gear FEMCC from 48-77 km/h (30-48 MPH)
3rd gear PEMCC from 43-50 km/h (27-31 MPH)
A DTC P0218 High Temperature Operation Activated will be set in the TCM.

Causes for operation in the wrong temperature shift schedule:

Extreme Cold or Cold shift schedule at start up:
Temperature Sensor or circuitry.

Overheat shift schedule after extended operation:
Operation in city traffic or stop and go traffic
Engine idle speed too high - Stuck AIS motor
Aggressive driving in low gear
Long idle time in drive position
Trailer towing in OD gear position (use ″3″ position if frequent shifting occurs)
Cooling system failure causing engine to operate over 110°C (230°F)
Engine coolant temperature stays low too long - If engine coolant temperature drops below 66°C (150°F), the transmission will disengage EMCC. Extended operation with the EMCC disengaged will cause the transmission to overheat.
Brake switch or circuitry - The TCM disengages the TCC when it receives a signal from the PCM that the brake has been depressed. A problem with the brake switch or circuitry will cause the EMCC to disengage. Extended operation with the EMCC disengaged will cause the transmission to overheat.
Transmission fluid overfilled
Transmission cooler or cooler lines restricted
Engine cooling fan inoperative
Temperature Sensor or circuitry.

3.2.2 LINE PRESSURE CONTROL

Proper control of the transmission line pressure is essential for proper operation. The 45RFE/545RFE normally uses closed loop line pressure control, where actual line pressure (reported by the line pressure sensor) is continuously monitored. The TCM determines the desired (target) line pressure which is required, and adjusts the Pressure Control Solenoid (PCS) until the actual line pressure matches the desired line pressure value. In the event of a line pressure sensor failure DTC P0932(CA), the TCM changes to an open loop control at an essentially constant line pressure.

Proper diagnosis of line pressure systems is facilitated by the use of a special tool (T-fitting - Miller #8259) which allows the use of a mechanical pressure gauge to compare the line pressure sensor reading on the DRBIII® to the gauge pressure. Technicians should compare the mechanical gauge reading with the ″actual″ and ″desired″ line pressure reading on the DRBIII®. All three readings should closely match in pressure. Because the mechanical and actual line pressure may not match the desired at low engine speeds (due to low pump output RPM), line pressure should always be checked at 1500 - 2000 RPM.

Typical Line Pressure problems include:

- Mechanical and "actual" readings both less than desired
  - If the mechanical and "actual" readings do not increase significantly as engine speed is raised above 2000 RPM, the pressure control solenoid is usually at fault. The pressure control solenoid is usually accompanied by DTC's P0867(C8) and P0868(C9). The PCS is located in the Transmission Solenoid/TRS assembly.
  - If the mechanical and "actual" readings vary with engine speed (above 2000 RPM), the fault is often a sticking main regulator valve. This valve is located in the transmission pump assembly.
- "Actual" reading on the DRBIII® differs from the Mechanical Pressure reading (higher or lower) by more than 69 kPa (10 PSI). This is sometimes accompanied by a DTC P0869(CB). The fault is usually in the Line Pressure Sensor or the Line Pressure Sensor Wiring.
- All three readings match, but the "actual" reading exhibits momentary intermittent pressure increases to 1724 kPa (250 PSI). The line Pressure Sensor is usually the problem. This will cause erratic shift quality (particularly a harsh 3-1 coast down shift), repair by replacing the Line Pressure Sensor.

3.2.3 DRIVE LEARN PROCEDURE

Procedure To Learn A Smooth 1st Neutral To Drive Shift:

Perform this procedure only if the complaint is for a delayed or harsh shift the first time the transmission is put into gear after the vehicle is allowed to set with the engine not running for at least 10 minutes. Use the following steps to have the TCM learn the 1st N-1 UD CVI.

NOTE: The transmission oil temperature must be between 80 - 110°F (27 - 43°C).

1. Start the engine only when the engine and ignition have been off for at least ten (10) minutes.
2. With the vehicle at a stop and the service brake applied, record the UD CVI while performing a Neutral to Drive shift. During the shift, the UD CVI will temporarily show a different value which is the 1st N-1 UD CVI. The 1st N-1 UD CVI account for air entrapment in the UD clutch that may occur after the engine has been off for a period of time.
3. Repeat steps 1 and 2 until the recorded 1st N-1 UD CVI value stabilizes.

NOTE: It is important that this procedure be performed when the transmission temperature is between 80 - 110°F (27 - 43°C). If this procedure takes too long to complete fully for the allowed transmission oil temperature, the vehicle may be returned to the customer with an explanation that the shift will improve daily during normal vehicle usage. The TCM also learns at higher oil temperatures, but these values (line pressure correction values) are not available for viewing on the DRBIII®.

Procedure To Learn A Smooth Neutral To Drive Garage Shift:

Perform this procedure if the complaint is for a delayed or harsh shift when the transmission is put into gear after the vehicle has had its first shift. Use the following steps to have the TCM learn the N-1 UD CVI.

NOTE: The transmission oil temperature must between 80 - 110°F (27 - 43°C) to learn the UD CVI. Additional learning occurs at temperatures as low as 0°F and as high as 200°F. This procedure may be performed at any temperature that experiences poor shift quality. Although the UD CVI may not change, shift quality should improve.

1. Start the vehicle engine and shift to drive.
2. Move the vehicle forward to a speed of at least 16 km/h (10 MPH) and come to a stop. This ensures no air is present in the UD hydraulic circuit.
3. Perform repeated N-1 shifts at a stop while pausing in Neutral for at least 2-3 seconds and monitor UD CVI volume until the value stabilizes. The value will change during the N-D shift. This is normal since the UD value is different for the N-1 shift then the normal value shown which is used for 4-3 coastdown and kickdowns. Perform repeated shifts in this temperature range until the UD CVI value stabilizes and the N-1 shifts become smooth.
4. This procedure may be performed at any temperature that experiences poor N-1 shift quality. Although the UD CVI may not changes, shift quality should improve.

Procedure To Learn The 1st 2-3 Shift After A Restart Or Shift To Reverse:

Use the following steps to have the TCM learn the 1st 2-3 shift OD CVI.

NOTE: The transmission oil temperature must be above 80°F (27°C).

1. With the vehicle engine running, select reverse gear for over 2 seconds.
2. Shift the transmission to Drive and accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform a 2-3 shift while noting the OD CVI. During the shift, a different value may appear on the screen, which is the 1st 2-3 OD CVI.
3. Repeat steps 1 and 2 until the 1st 2-3 upshift becomes smooth and the 1st 2-3 OD CVI stabilizes.

Procedure To Learn A Smooth 2-3 And 3-4 Upshift:

Use the following steps to have the TCM learn the OD and 4C CVI's.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. Accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform multiple 1-2, 2-3, and 3-4 upshifts. The 2nd 2-3 shift following a restart or shift to reverse will be shown during the shift as a value between the 1st 2-3 OD CVI and the normal OD CVI. Updates to the normal OD CVI will occur after the 2nd shift into 3rd gear, following a restart or shift to reverse.
2. Repeat step 1 until the 2-3 and 3-4 shifts become smooth and the OD and 4C CVI become stable.

Procedure To Learn A Smooth 4-3 Coastdown And Part Throttle 4-3 Kickdown:

Use the following steps to have the TCM learn the UD shift volume.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. At a vehicle speed between 64 - 97 Km/H (40 - 60 MPH), perform repeated 4-3 kickdown shifts.
2. Repeat step 1 until the UD volume becomes somewhat stable and the shift becomes smooth.

Procedure To Learn A Smooth 1-2 Upshift and 3-2 Kickdown:

Use the following steps to have the TCM learn the 2C shift volume.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With a vehicle speed below 48 Km/H (30 MPH) and the transmission in 3rd gear, perform multiple 3-2 kickdowns.
2. Repeat step 1 until the 3-2 kickdowns become smooth and the 2C CVI becomes stable.

Procedure To Learn A Smooth Manual 2-1 Pulldown Shift As Well As A Neutral To Reverse Shift:

Use the following steps to have the TCM learn the LR volume.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With the vehicle speed around 40 - 48 Km/H (25 - 30 MPH) in Manual 2nd, perform manual pulldowns to Low or 1st gear at closed throttle.
2. Repeat step 1 until the LR CVI become stable and the manual 2-1 becomes smooth.

Procedure To Learn A Smooth Neutral To Reverse Shift:

Perform the following shifts.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With the vehicle at a stop, perform Neutral to Reverse shifts until the shift is smooth. An unlearned Neutral to Reverse shift may be harsh or exhibit a double bump. If any of the shifts are still not smooth after the clutch volume stabilizes, an internal transmission problem may be present.

Procedure To Learn A Smooth 4-5 Upshift for 545RFE:

Use the following steps to have the TCM learn the 2CA CVI.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. Accelerate the vehicle through 88 Km/H (55mph) at a steady 10-15 degree throttle opening and perform multiple 4-5 upshifts.
2. Repeat step 1 until the 4-5 shift become smooth and the 2C(A) CVI become stable. There is a separate 2C volume used and learned for 4-5 shifts, 2C(A). It is independent of the 2C CVI learned on 3-2 kickdowns.

3.3 DIAGNOSTIC TROUBLE CODES

Diagnostic trouble codes (DTC's) are codes stored by the Transmission Control Module (TCM) that help us diagnose Transmission problems. They are viewed using the DRBIII® scan tool.

Always begin by performing a visual inspection of the wiring, connectors, cooler lines and the transmission. Any obvious wiring problems or leaks should be repaired prior to performing any diagnostic test procedures. Some engine driveability problems can be misinterpreted as a transmission problem. Ensure that the engine is running properly and that no PCM DTC's are present that could cause a transmission complaint.

If there is a communication bus problem, trouble codes will not be accessible until the problem is fixed. The DRBIII® will display an appropriate message. The following is a possible list of causes for a bus problem:

- open or short to ground/battery in PCI bus circuit (pin 43).
- internal failure of any module or component on the bus

Each diagnostic trouble code is diagnosed by following a specific testing sequence. The diagnostic test procedures contain step-by-step instructions for determining the cause of a transmission diagnostic trouble code. Possible sources of the code are checked and eliminated one by one. It is not necessary to perform all of the tests in this book to diagnose an individual code. These tests are based on the problem being present at the time that the test is run.

If the TCM records a DTC that will adversely affect vehicle emissions, it will request (via the communication bus) that the PCM illuminate the Malfunction Indicator Lamp (MIL). Although these DTC's will be stored in the TCM immediately as a 1 trip failure, it may take up to five minutes of accumulated trouble confirmation to set the DTC and illuminate the MIL. Three consecutive successful OBDII/EUROIII trips or clearing the DTC's with a diagnostic tool (DRBIII® or equivalent) is required to extinguish the MIL. When the TCM requests that the PCM illuminate the MIL, the PCM sets a DTC ($89) to alert the technician that there are DTC's in the TCM. This must also be erased in the PCM in order to extinguish the MIL.

3.3.1 HARD CODE

Any Diagnostic Trouble Code (DTC) that is set whenever the system or component is monitored is a HARD code. This means that the problem is there every time the TCM checks that system or component. Some codes will set immediately at start up and others will require a road test under specific conditions. It must be determined if a code is repeatable (Hard) or intermittent before attempting diagnosis.

3.3.2 ONE TRIP FAILURES

A One Trip Failure, when read from the TCM, is a hard OBDII/EUROIII code that has not matured to the full 5 minutes. This applies only to codes that will turn on the MIL after 5 minutes of substituted gear operation.

3.3.3 INTERMITTENT CODE

A diagnostic trouble code that is not there every time the TCM checks the circuit or function is an ″intermittent″ code. Some intermittent codes, such as codes P0932(CA), P0891(14), P0888(15), P0725(18), P1694(19), P0841(81), P0846(82), P0871(84), P0988(88), P0876(90), P0750(C1), P0755(C2), P0760(C3), P0770(C4), P0765(C5), P2706(C6), P1793(48), P0715(56), P0720(57), P1794(58), and P1799(74) are caused by wiring or connector problems. However intermittent codes P0731(51), P0732(52), P0733(53), P0734(54), P0736(50), P0735(59), P1736(55) (Speed ratio codes) are usually caused by intermittent hydraulic seal leakage in the clutch and/or accumulator circuits. Intermittent speed ratio codes can be set by intermittent speed sensor circuitry or by line noise being induced onto one or both of the speed sensor signal circuits. Problems that come and go like this are the most difficult to diagnose, they must be looked for under the specific conditions that cause them.

3.3.4 STARTS SINCE SET COUNTER

The Starts Since Set counter counts the number of times the vehicle has started since the most recent DTC was set. The counter will count up to 255 starts. Note that this counter only applies to the last code set.

When there are no diagnostic trouble codes stored in memory, the DRBIII® will display ″NO DTC's PRESENT″ and the reset counter will show ″STARTS SINCE CLEAR″ = XXX.

The number of starts helps determine if the diagnostic trouble code is hard or intermittent.

- If the number of starts is less than 3, the code is usually a hard code.
- If the number of starts is greater than 3, it is considered an intermittent code. This means that the engine has been started most of the time without the code recurring.

3.3.5 TROUBLE CODE ERASURE

A Diagnostic trouble code will be cleared from TCM memory if it has not reset for 40 warm-up cycles.

A warm-up cycle is defined as ″sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 71°C (160°F). The Malfunction Indicator Lamp (MIL) will turn off after 3 good trips or when the DTC's are cleared from the TCM.

3.3.6 LIST OF DIAGNOSTIC TROUBLE CODES (DTC) (Detailed descriptions follow list)

The TCM may report any of the following DTC's.

DTC	P-Code	Name of Code	Limp-in	MIL
11	P0613	Internal TCM	Yes	Yes
12	P1684	Battery was disconnected	No	No
13	P0613	Internal TCM	Yes	Yes
14	P0891	Relay output always on	Yes	Yes
15	P0888	Relay output always off	Yes	Yes
16	P0605	Internal TCM	Yes	Yes
17	P0604	Internal TCM	Yes	Yes
18	P0725	Engine speed sensor circuit	Yes	Yes
19	P1694	Bus communication with engine module	No	No
28	P0706	Check shifter signal	No	No
29	P0120	Throttle position sensor signal circuit	No	No
35	P0944	Loss of prime	No	No
36	P1790	Fault immediately after shift	No	No
37	P1775	Solenoid switch valve latched in TCC position	No	Yes
38	P0740	Torque converter clutch control circuit	No	Yes
45	P0613	Internal TCM	No	No
47	P1776	Solenoid switch valve latched in L-R position	Yes	Yes
48	P1793	TRD link communication error	No	No
50	P0736	Gear ratio error in reverse	Yes	Yes
51	P0731	Gear ratio error in 1st	Yes	Yes
52	P0732	Gear ratio error in 2nd	Yes	Yes
53	P0733	Gear ratio error in 3rd	Yes	Yes
54	P0734	Gear ratio error in 4th	Yes	Yes
55	P1736	Gear ratio error in 2nd Prime	Yes	Yes
56	P0715	Input speed sensor error	Yes	Yes
57	P0720	Output speed sensor error	Yes	Yes
58	P1794	Speed sensor ground error	Yes	Yes
59	P0735	Gear ratio error in 4th Prime	Yes	Yes
60	P2700	Inadequate Element Volume LR	No	No
61	P2701	Inadequate Element Volume 2C	No	No
62	P2702	Inadequate Element Volume OD	No	No
63	P2703	Inadequate Element Volume UD	No	No
64	P2704	Inadequate Element Volume 4C	No	No
65	P1715	Restricted Port in T3 Range	No	No
74	P1799	Calculated Oil temperature in use	No	No
75	P0218	High temperature operation activated	No	No
76	P0884	Power up at speed	No	No
80	P0890	Switched battery	Yes	Yes
81	P0841	L-R pressure switch sense circuit	Yes	Yes
82	P0846	2C pressure switch sense circuit	Yes	Yes
84	P0871	OD pressure switch sense circuit	Yes	Yes
88	P0988	4C pressure switch sense circuit	Yes	Yes
90	P0876	UD pressure switch sense circuit	Yes	Yes
A2	P0845	2C hydraulic pressure test failure	Yes	Yes
A4	P0870	OD hydraulic pressure test failure	Yes	Yes
A8	P0987	4C hydraulic pressure test failure	Yes	Yes
B0	P0875	UD hydraulic pressure test failure	Yes	Yes
C1	P0750	L-R solenoid circuit	Yes	Yes

The TCM may report any of the following DTC's.				
DTC	**P-Code**	**Name of Code**	**Limp-in**	**MIL**
C2	P0755	2C solenoid circuit	Yes	Yes
C3	P0760	OD solenoid circuit	Yes	Yes
C4	P0770	4C solenoid circuit	Yes	Yes
C5	P0765	UD solenoid circuit	Yes	Yes
C6	P2706	MS solenoid circuit	Yes	Yes
C8	P0867	Line pressure fault	No	No
C9	P0868	Line pressure low	No	No
CA	P0932	Line pressure sensor fault	No	No
CB	P0869	Line pressure high	No	No
Yes (underlined) indicates that this DTC can take up to five minutes of problem identification before illuminating the MIL.				

3.3.7 DTC DESCRIPTIONS

Name of code: P0604, P0605, P0613(11, 13, 16, 17 or 45) - Internal Controller
When monitored: Whenever the key is in the Run or Run/Start position.
Set condition: This code is set whenever Transmission Control Module (TCM) senses an internal error
Theory of operation: The TCM is constantly monitoring it's internal processor. If an internal problem is detected, this DTC will be set. This DTC can also be set by a bad ground to the TCM and/or Trans Control Relay. In fact, this DTC is rarely set due to a TCM error, it is usually set by a poor ground.
Transmission Effects: The MIL will illuminate (this DTC can take up to five minutes of problem identification before illuminating the MIL) and the transmission system will default to the Immediate Shutdown routine.
Possible causes:

> TCM ground circuit. (check main ground attachment to engine block)

> Relay ground circuit. (check main ground attachment to engine block)

> TCM

Name of code: P1684(12) - Battery was Disconnected (Info Only)
When monitored: Whenever the key is in the Run or Run/Start position.
Set condition: This code is set whenever Transmission Control Module (TCM) is disconnected from battery power (B+) or ground. It will also be set during the DRBIII® Quick Battery Disconnect procedure.
Theory of operation: A battery backed RAM (Random Access Memory) is used to maintain some learned values. When the battery B(+) is disconnected, the memory is lost. When the B(+) is restored, this memory loss is detected by the TCM. The code is set and the learned values are initialized to known constants or previously learned values from EEPROM (Electronic Erasable Programmable Read Only Memory). This results in the reinitialization of some parameters.
Transmission Effects: Loss of trouble code data. The Transmission system will default to the Immediate shutdown routine if power is lost while operating the vehicle. Normal operation is resumed if the power is restored during the same key start.
Possible causes:

> Battery voltage removed from TCM (Fused B+)

> TCM disconnected

> Dead Battery

> Low battery voltage during cranking

> Quick Battery Disconnect by DRBIII® or MDS

> Bad TCM ground circuit.

Name of code: P0891(14) - Relay Always On
When monitored: When ignition key is turned from ″off″ position to ″run″ position and/or ignition key is turned from ″crank″ position to ″run″ position.
Set condition: This code is set if the Transmission Control Module (TCM) senses greater than 3 volts at the Trans Control Relay Output terminal(s) of the TCM prior to the TCM energizing the relay.
Theory of operation: The transmission control relay is used to supply power to the solenoids and pressure switches when the transmission is in normal operating mode. The relay output is fed back to the TCM through pins 16, 17, and 36. It is referred to as ″Transmission Control Relay Output″. This circuit does not supply power to the TCM, it is only a sense circuit. When the relay is off, no power is supplied to the solenoids and pressure switches, and the transmission is in ″limp-in″ or ″default″ mode.

Transmission Effects: The MIL will illuminate (this DTC can take up to five minutes of problem identification before illuminating the MIL) and the transmission system will default to the Immediate Shutdown routine.

Possible causes:

> Short to voltage in the Transmission Solenoid/TRS Assembly (internal into any solenoid control circuit)

> Short to voltage on any solenoid control circuit

> Relay contacts stuck together.

> Short to voltage in Transmission Control Relay output circuit(s).

> Short to voltage in Transmission Relay Control circuit.

> Short to voltage on any pressure switch sense circuit.

> TCM connector problems.

> TCM.

Name of code: P0888(15) - Relay Output Always Off

When monitored: Continuously

Set condition: This code is set when less than 3 volts are present at any transmission control relay output (pins 16,17 or 36) circuits at the Transmission Control Module (TCM) when the TCM is energizing the relay.

Theory of operation: The Transmission Control Relay is used to supply power to the solenoids and pressure switches when the transmission is in normal operating mode. The relay output is fed back to the TCM through pins 16, 17, and 36. It is referred to as ″Transmission Control Relay Output″. This circuit does not supply power to the TCM, it is only a sense circuit. When the relay is off, no power is supplied to the solenoids and pressure switches, and the transmission is in ″limp-in″ or ″default″ mode.

After a controller reset (ignition key turned to the ″run″ position or after cranking engine), the controller energizes the relay. Prior to this the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

Transmission Effects: The MIL will illuminate (this DTC can take up to five minutes of problem identification before illuminating the MIL) and the transmission system will default to the Immediate Shutdown routine.

Possible causes:

> Transmission Control Relay (intermittent relay function caused by oxidized or contaminated relay contacts)

> Short to ground or open circuit in the transmission control relay output circuit(s)

> Short to ground or open circuit in the Transmission Solenoid/TRS assembly

> TCM connector problem

> Relay connector problem

> Relay Ground circuit

> TCM Ground circuit(s)

> TCM

Name of code: P0725(18) - Engine Speed Sensor Circuit

When monitored: Continuously with engine running.

Set condition: This code is set when the engine speed calculated by the Transmission Control Module (TCM) is less than 390 RPM, while the engine speed broadcast by the PCM is greater than 383 RPM. The DTC also sets if the calculated engine speed is greater than 8000 RPM for more that 2.0 seconds. Theory of operation: The TCM uses the crank sensor signal to calculate engine RPM. The TCM uses RPM data from the PCM which is broadcast over the communication bus to determine if the engine is running. The TCM continuously compares calculated engine speed to the engine RPM reported on the bus, by the PCM, so that loss of crankshaft position sensor signal to the TCM will not be misinterpreted as engine not running.

Transmission Effects: The MIL will illuminate (this DTC can take up to five minutes of problem identification before illuminating the MIL) and the transmission system will default to the Logical Shutdown routine.

Possible causes:

> Open or short in engine speed sensor circuit. (Crank sensor signal)

> TCM connector problems (Crank sensor signal or sensor ground terminals)

> Open or short in sensor ground circuit

> Low engine idle speed

> TCM

> PCM.

Name of code: P1694(19) - Bus Communication with Engine Module

When monitored: Continuously with key on.

Set condition: If no bus messages are received from the Powertrain Control Module (PCM) for 10 seconds.

Theory of operation: The TCM communicates with the PCM using the communication bus. It relies on certain information to function properly. The TCM continuously monitors the bus to check for messages broadcast from the PCM.

Transmission Effects: Delayed 3-4 shifts. No EMCC and early 3-4 shifts for a few minutes after engine is started. Generally poor shift quality.

Possible causes:

> Open or shorted bus circuit

> TCM

> PCM

Name of code: P0706(28) - Check Shifter Signal

When Monitored: Continuously with the key on.

Set Condition: Any occurrences of an invalid PRNDL code which lasts for more than 0.028 second.

Theory of Operation: The C1 through C5 (TRS T1, TRS T2, TRS T3, TRS T41, and TRS T42) sense circuits communicate the shift lever position to the TCM. Each circuit is terminated at the transmission with a switch. Each switch can be either open or closed, depending on the shift lever position. The TCM can decode this information and determine the shift lever position. Each shift lever position has it own unique combination of closed and open switches. This is called a PRNDL code. There are 5 switches, therefore: there are many possible combinations of open and closed switches (codes). There are 12 valid codes, two for neutral, one for each other gear position (5), and five temporary (transition zone) codes. The remainder of the codes should **never occur,** these are called invalid codes.

Transmission Effects and possible causes: (This code alone will not illuminate the MIL)

> Excessive metal debris in the tranmsission oil pan

> Worn Code Plate. Check for heavy wearing by TRS switch contacts

> Intermittent C1 through C5 (T1, T2, T3, T41 or T42) circuits. Check for corrosion, terminal push-outs or spread terminals at 60-way TCM connector and/or 23-way transmission connector.

> TRS connector not plugged in, or unplugged with the key on.

> TRS C1 through C5 (T1, T2, T3, T41, or T42) circuit(s) are either open, shorted to ground, or shorted to 12 volts.

> TRS

> TCM

SHIFT LEVER ERROR CODES REPORTED BY THE DRBIII®

ERROR CODE	SWITCH STUCK	POSITION
1	T41/C1 STUCK	OPEN
2	T41/C1 STUCK	CLOSED
3	T42/C2 STUCK	OPEN
4	T42/C2 STUCK	CLOSED
5	T3/C3 STUCK	OPEN
6	T3/C3 STUCK	CLOSED
7	T1/C4 STUCK	OPEN
8	T1/C4 STUCK	CLOSED
9	T2/C5 STUCK	OPEN
10	T2/C5 STUCK	CLOSED
11	OD LOCKOUT STUCK	OPEN
12	OD LOCKOUT STUCK	CLOSED

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NOTE: If you are using the transmission simulator and do not push the OD off button in the vehicle when performing a Shift Lever position test, you will receive a code 11 OD lockout stuck open.

45RFE/545RFE TRS SWITCH STATES

TRS	PARK	TMP1	REV	TMP 2	N1	N2	TMP 3	D	TMP 4	2	TMP 5	L
T1 (C4)	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN
T2 (C5)	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED
T3 (C3)	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	CLOSED
T41 (C1)	CLOSED	OPEN	OPEN	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
T42 (C2)	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN

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Name of code: P0120(29) - Throttle Position Signal

When monitored: Whenever the engine is running.

Set condition: This code is set if the throttle angle goes out of range or changes erratically i.e. faster than the throttle body motion should occur.

Theory of operation: The Transmission Control Module (TCM) receives the throttle position signal from the Throttle Position Sensor (TPS). The TPS has a 5-volt pull up supplied from the Powertrain Control Module (PCM). The signal is checked for out-of-range as well as intermittent (excessive signal changes).

Transmission Effects: The MIL will illuminate, the transmission system will not go into limp-in mode. The TCM will use a ″calculated throttle angle″ supplied by the PCM over the communication bus. If the communication bus is unavailable, the TCM will use a default throttle angle of 24(degrees for the key start in which the code was set. The TCM will try to use the TPS signal again on the next key start. The vehicle may experience extremely erratic transmission shifting just prior to setting the code. If the intermittent does not last long enough to set the code, the customer will say that the transmission violently hunts between gears.

Possible causes:

> Open or shorted TPS signal and/or ground circuits

> TCM connector problems

> Failed TPS or TPS connector (Check PCM DTC's)

> PCM

> TCM

Name of code: P0944(35) - Loss Of Prime

When monitored: If the transmission is slipping in any forward gear and all the pressure switches are indicating no pressure, a loss of prime test is run.

Set condition: If the transmission begins to slip in any forward gear, and all pressure switches are open, a loss of prime test begins. All available elements are momentarily turned on by the Transmission Control Module (TCM) to see if pump prime exists. The code is set if none of the pressure switches respond. The TCM will continue to run the loss of prime test until pump pressure returns. Note: Loss of Prime test is not run when transmission temperature is ″Super Cold″.

Theory of operation: The loss of prime test is used to prevent transmission defaults, which can be caused by a lack of pump prime.

Transmission Effects: Vehicle will not move or transmission slips. Normal operation will continue if pump prime returns.

Possible causes:

> Low transmission fluid level

> Transmission fluid filter improperly installed (Seal installed onto filter neck instead of into pump bore, seal not fully seated against pump bore housing, filter neck not engaged into pump, bolts loose or O-ring missing or damaged)

> Transmission fluid filter clogged, damaged or cracked

> Transmission has massive hydraulic leak (valve body pipe plugs missing, etc.)

> Transmission oil pump

> Transmission oil pump drive is sheared or damaged

> PRNDL indicates a valid OD code in the hydraulic reverse position

Name of code: P1790(36) - Fault Immediately After Shift

When monitored: When a speed ratio error DTC (50 through 55) is stored.

Set condition: This code is set if the associated speed ratio code is stored within 1.3 seconds after a shift.

Theory of operation: This code will only be stored along with a 50 series code. If this code is set, it indicates a probable hydraulic (line pressure) or mechanical problem exists. When this code is set, diagnosing the transmission should be based on the associated speed ratio code and mechanical causes should be considered first.

Transmission Effects: None

Possible causes:

> Mechanical causes as listed under associated speed ratio code.

> Inadequate line pressure

> Cut or damaged clutch piston seals

Name of code: P1775(37) - Solenoid Switch Valve Latched in TCC Position

When monitored: During an attempted shift into 1st gear.

Set condition: This code is set if 6 unsuccessful attempts are made to get into 1st gear, with transmission temp above 27°C (80°F), in one given key start.

Theory of operation: The solenoid switch valve (SSV) controls the direction of the transmission fluid when the L-R solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L-R clutch circuit. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the torque converter clutch (TCC). When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L-R pressure switch is monitored to confirm SSV movement. If movement is not confirmed (the L-R pressure switch does not close), EMCC is inhibited until SSV operation is confirmed.

Transmission Effects: Transmission will have 1st gear, and no EMCC operation. The MIL will illuminate after 5 minutes of no EMCC operation.

Possible causes:

> Valve body - Solenoid Switch Valve stuck in TCC position

> L-R solenoid armature or plunger broken (should also set DTC P0841 (81) and often sets P0740 (38)

> Solenoid malfunction - may also set code P0841(81)

> L-R Pressure Switch Sense circuit shorted to battery

> High idle speed

> PRNDL indicates a valid OD code in the hydraulic reverse position

Name of code: P0740(38) - Torque Converter Clutch Control Circuit

When monitored: During Electronically Modulated Converter Clutch (EMCC) Operation

Set condition: The code will be set if one of the following events happens three times in a given key start, at a throttle angle less than 30° a) With the transmission in EMCC, the TCC/L-R solenoid achieves the maximum duty cycle and is still unable to pull the engine speed within 60 RPM of input speed. b) With the transmission in FEMCC, the TCC RPM (Engine speed - Input speed) is more than 100 RPM for 7.2 seconds.

Theory of operation: When in 2nd, 2nd Prime, 3rd, or 4th gear, the torque converter clutch (TCC) can be engaged when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the L-R solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 RPM. Then the L-R solenoid is fully energized (FEMCC / 100 duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

Transmission Effects: EMCC will still be available after code is set. MIL will illuminate after 5 minutes of accumulated slip in FEMCC. The transmission will attempt normal operation (no limp-in) even after the MIL is illuminated.

Possible causes:

> Cut converter hub O-ring and/or failed torque converter - both should be replaced during a rebuild with code P0740(38) present.

> Sticky CC Regulator valve

Name of code: P1776(47) - Solenoid Switch Valve (SSV) Latched in L-R Position

When monitored: Continuously when doing partial or full EMCC (PEMCC or FEMCC)

Set condition: If the transmission senses the L-R pressure switch closing while performing PEMCC or FEMCC. This code will be set after four unsuccessful attempts to perform PEMCC or FEMCC.

Theory of operation: The solenoid switch valve (SSV) controls the direction of the transmission fluid when the L-R solenoid is energized. SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L-R clutch circuits. In 2nd, 3rd, and 4th, the SSV will be in the upshifted position and directs the fluid into the torque converter clutch (TCC). When doing PEMCC or FEMCC, the L-R pressure switch should indicate no pressure if the SSV is in the TCC position. If the L-R pressure switch indicates pressure while in PEMCC or FEMCC, EMCC operation is aborted and inhibited to avoid inadvertent application of the L-R clutch. Partial EMCC will be attempted if the L-R pressure switch does not indicate pressure. Four occurences of detection of L-R pressure results in setting the code.

Transmission Effects: EMCC is inhibited and the transmission system will default to the Orderly Shutdown routine. (this DTC can take up to five minutes of problem identification before illuminating the MIL).

Possible causes:

> Valve body - Solenoid Switch Valve stuck in L-R position

> Intermittent short to ground or open circuit in L-R Pressure Switch Sense circuit (with code P0841 only)

> Solenoid/TRS assembly (with code P0841(81) only)

> TCM (with code P0841(81) only)

Name of Code: P1793(48) - Torque Reduction (TRD) Link Communication Error

When Monitored: During torque managed shifts (Throttle angle above 54 degrees). This system is also tested whenever the vehicle is stopped and the engine speed is below 1000 RPM.

Set condition: This code is set when the Transmission Control Module (TCM) sends two subsequent torque reduction messages to the Powertrain Control Module (PCM) via the TRD link circuit and does not receive a confirmation from the PCM over the communication bus.

Theory of Operation: During high torque shifts the TCM will send a message requesting that the PCM reduce engine power until the shift is completed. This message is sent from the TCM to the PCM across the Torque Management Request Sense Circuit. The PCM will acknowledge the TCM request by sending a confirmation message across the communication bus. The TRD Link communication is also tested periodically for operation whenever the engine is running and the vehicle is not moving with zero degrees throttle.

Transmission Effects: Maximum throttle angle used by TCM will be 54 degrees. As a result a customer may complain about loss of performance, short shifting when driving aggressively, and/or normal shifting and WOT shifts may be harsh.

Possible Causes:

> Sticky Throttle Position Sensor (TPS)

> Wiring or Connector problems in the Torque Management Request Sense Circuit

> Bus communication problems.

> PCM

> TCM

Name of code:

P0736(50) - Gear Ratio Error in Reverse
P0731(51) - Gear Ratio Error in 1st
P0732(52)- Gear Ratio Error in 2nd
P0733(53) - Gear Ratio Error in 3rd
P0734(54) - Gear Ratio Error in 4th
P1736(55) - Gear Ratio Error in 2nd Prime
P0715(56) - Input Speed Sensor
P0720(57) - Output Speed Sensor
P1794(58) - Speed Sensor Ground
P0735(59) - Gear Ratio Error in 4th Prime

When monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set condition: This code is set if the gear ratio is not correct for the current gear.

– Codes 50 through 59 sets if the ratio of the input RPM (Nt) to the output RPM (No) does not match the current gear ratio.

– Code 56 sets if there is an excessive change in input RPM in any gear

– Code 57 sets if there is an excessive change in output RPM in any gear

– Code 58 sets after a TCM reset in neutral and Nt/No equals a ratio of input to output of 2.00

Theory of operation: The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (codes 50 through 59).
2. An excessive change in input or output speeds indicating signal intermittent will result in codes 56 and/or 57 being set.
3. If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor has 60 teeth and the output speed sensor has 30 teeth, this results in a ratio of 2.00.

Transmission Effects: If a gear ratio error develops, the appropriate code is set as a one trip failure and the 5 minute Intelligent Recovery Timer (IRT) is started. The transmission will then substitute a 1-3 or 3-1 shift to a different gear for the one in which the problem was identified. For example, if a problem is identified while in first gear, the transmission will shift to third gear. The IRT is only counting up while the transmission is substituting one gear for another. Using the previous example, if the vehicle continued down the road and shifted to fourth gear for a long period of time, the IRT would have only counted the time that the transmission was in third gear instead of second. The MIL will illuminate (this DTC can take up to five minutes of problem identification before illuminating the MIL). The transmission system will default to the Logical Shutdown without Recovery routine after 5 minutes of substituted gear operation or if three gear ratio error events occur in a given key start.

Possible causes:

Code P0736(50) - Excludes gear train failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> Valve body - #3 check ball

> L-R switch valve sticking - may also set code P0731(51)

> Speed sensor or associated wiring - may also set codes P0731(51), P0715(56), or P0720(57)

> Multi Select Solenoid sticking or leaking

> Failed or slipping L-R clutch - may also set code P0731(51)
– L-R seal leakage (Intermittent no drive or reverse)
– Sticky L-R accumulator seals (Intermittent no drive or reverse)

> Failed reverse clutch (hard code)
– OD/Rev lip seal leakage
– Worn reaction shaft support seal rings

Code P0731(51) - Excludes gear train failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> Valve body - #1, #2, and/or #4 check ball

> L-R switch valve sticking

> Speed sensor or associated wiring - may also set codes P0736(50), P0715(56), or P0720(57)

> Solenoid/TRS assembly (stuck solenoid(s))

> Failed or intermittent slipping UD clutch - may also set P0732(52) or P0733(53)

– UD seal leakage
– Sticky UD accumulator seals - Worn reaction shaft support seal rings

> Failed or slipping L-R clutch - may have code P0736(50)
– L-R seal leakage
– Sticky L-R accumulator seals

Code P0732(52) – Excludes gear train failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> Valve body - #1, #2, #4, #5 and/or #7 check ball

> Solenoid/TRS assembly - may also set codes P0846(54) and/or P0845(A2)

> Failed or slipping 2nd clutch - 2nd clutch seal leakage - Sticky 2nd clutch accumulator seals

> Failed or intermittent slipping UD clutch - may also set code P0731(51) and/or P0733(53)
– UD clutch seal leakage
– Worn input hub bushing
– Sticky UD clutch accumulator seals
– Worn reaction shaft support seal rings

Code P0733(53) - Excludes geartrain failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> Valve body - #1, #2, and/or #6 check ball

> Speed sensor or associated wiring - may also set codes P0736(50), P0715(56), or P0720(57)

> Solenoid/TRS assembly - may also set codes P0871(84) and/or P0870(A4)

> Failed or slipping OD clutch - may also set code P0734(54)
– OD clutch inner and outer lip seal leakage
– Sticky OD clutch accumulator seals
– Worn reaction shaft support seal rings

> Failed or intermittent slipping UD clutch - may also set codes P0731(51) and/or P0732(52)
– UD seal leakage
– Worn input hub bushing
– Sticky UD clutch accumulator seals
– Worn reaction shaft support seal rings

Code P0734(54) – Excludes gear train failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> Valve body - #1, #2, #5 and/or #6 check ball

> Speed sensor or associated wiring - may also set codes P0736(50), P0715(56), or P0720(57)

> Solenoid/TRS assembly - may also set codes P0988(88) and/or P0987(A8)

> Failed or slipping OD clutch - may also set code P0733(53)
– OD clutch inner and outer lip seal leakage
– Sticky OD clutch accumulator seals
– Worn reaction shaft support seal rings

> Failed or intermittent slipping 4th clutch
– 4th clutch seal leakage
– Sticky 4th clutch accumulator seals
– Worn reaction shaft support seal rings

Code P1736(55) - Excludes gear train failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> Valve body - #1, #4 and/or #5 check ball

> Speed sensor or associated wiring - may also set codes P0736(50), P0715(56), or P0720(57)

> Solenoid/TRS assembly - may also set codes P0876(90) and/or P0875(B0)

> Failed or intermittent slipping UD clutch - may also set codes P0731(51) and/or P0732(52)
– UD seal leakage
– Worn input hub bushing
– Sticky UD clutch accumulator seals
– Worn reaction shaft support seal rings

> Failed or intermittent slipping 4th clutch
– 4th clutch seal leakage
– Sticky 4th clutch accumulator seals
– Worn reaction shaft support seal rings

Codes P0715(56) and P0720(57)

> Failed input or output speed sensor

> Shorted or open wiring between TCM and speed sensor(s)

> Connector problems at 60-way TCM connector and/or speed sensor connector(s)

> Transmission Solenoid/TRS Assembly has an internal short to the Speed Sensor Ground circuit (should also set a P1794 and P1799).

Code P1794(58)

> Open or shorted speed sensor ground (speed sensor ground is different from chassis ground)

> Open or shorted Temperature Sensor wiring to TRS

> Transmission Solenoid/TRS Assembly has an internal short to the Speed Sensor Ground circuit

> TRS - Will also set code P1799(74)

> TCM

Code P0735(59) - Excludes gear train failures which should be obvious upon disassembly

> If code P0944(35) or any line pressure DTC's are set, diagnose these first

> These codes may also be set with the DTC - P1790(36), P0846(82), P0871(84), P0845(A2), P0870(A4), perform these diagnostics first.

> Speed sensor or associated wiring - may also set codes P0736(50), P0715(56), or P0720(57)

> Solenoid/TRS assembly (stuck solenoid(s))

> Failed or slipping OD clutch
OD seal leakage

> Failed or slipping 2C clutch
2C seal leakage

Name of Code: P2700, P2701, P2702, 2703, 2704 (60, 61, 62, 63, 64) - Inadequate Element Volume

When Monitored: Whenever the engine is running, the clutch volume is updated during the requested shift.

Set condition:

Note: Transmission temperature must be 43°C (110°F) to update all volumes.

> **P2700** - When the LR volume falls below 16, the LR volume is updated during a 3-1 or 2-1 manual downshift with the TPS angle below 5 degrees.

> **P2701** - When the 2C volume falls below 5, the 2C volume is updated during a 3-2 kickdown with the TPS angle between 10 and 54 degrees.

> **P2702** - When the OD volume falls below 5, the OD volume is updated during a 2-3 upshift with the TPS angle between 10 and 54 degrees.

> **P2703** - When the UD volume falls below 11, the UD volume is updated during a 4-3 kickdown with the TPS angle between 30 and 54 degrees.

> **P2704** - When the 4C volume falls below 30, the 4C clutch volume is updated when doing a 3-4 shift with throttle angle between 10° and 54°. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 30 and 85.

Theory of Operation: The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. The following are typical clutch volumes, the clutches may be damaged if the volumes are greater or less than the specified below:
2C clutch volume - between 25 and 85
OD clutch volume - between 30 and 100
4C clutch volume - between 30 and 85
UD clutch volume - between 30 and 100

Transmission Effects: These codes usually set with other DTC's, which indicates an internal transmission problem.

Possible Causes:

> Clutch pack clearance out of spec

> Snap ring out of position or broken

> Broken return spring

> Hydraulic leak into clutch circuit with near-zero volume

Name of Code: P1715(65) - Restricted Port in T3 Range

When Monitored: Whenever the Engine is running and the Manual valve is in the T3 range.

Set condition: The code is set if the conditions for a code 47 are present when the manual valve is in the T3 range.

Theory of Operation: The conditions to set a DTC 47 are easily satisfied while in the T3 range. There is no problem with the transmission itself if this code is set.

Transmission Effects: The transmission will go into neutral when this code is set. If the driver puts the shifter in neutral and back to drive, the transmission will operate normally.

Possible Causes:

> Manual linkage out of adjustment, causing T3 range while shifter is in OD.

> Driver resting hand on shift lever while driving, causing T3 range.

Name of Code: P1799(74) - Calculated Oil Temp in Use

When Monitored: Whenever the Engine is running.

Set condition: The code is set if any of the following conditions exist for three consecutive key starts:

> The Temperature Sensor voltage is out of range (below 0.07 volts or greater than 4.94 volts)

> Continuous erratic Temperature Sensor voltage is sensed.

> The Temperature Sensor temperature stays below 27°C (80°F) for an extended period of time.

Theory of Operation: The TCM uses a Temperature Sensor to monitor the transmission's sump temperature. This temperature is used to determine which shift schedule the TCM is to use. If the Temperature Sensor circuit fails to operate properly the TCM will use the calculated oil temperature routine found in prior model year TCM's. If this occurs for three consecutive key starts, the code will be set. The TCM will then test the Temperature Sensor circuit after every 35th OBDII/EUROIII warm-up start. If the Temperature Sensor circuit is OK, the Temperature Sensor data is used in place of the Calculated Oil Temperature Routine.

Transmission Effects: If the Temperature Sensor indicates a temperature below -18°C (0°F) or above

116°C (240°F) at start up, the TCM compares the calculated oil temperature to the indicated oil temperature. If the calculated oil temperature differs significantly from the Temperature Sensor value, the calculated oil temperature will be used for that key start. This code does not cause the transmission to go into limp-in mode.

Possible Causes:

- > Transmission temperature sensor signal circuit short to ground, short to voltage, or open circuit.
- > Speed sensor ground circuit shorted to ground, shorted to voltage, or open circuit.
- > Temperature Sensor
- > TCM

Name of Code: **P0218(75) - High Temperature Operation Activated**

When Monitored: Whenever the engine is running.

Set Condition: Immediately when the Overheat shift schedule is activated.

Theory of Operation: If the transmission oil temperature rises above 116°C (240°F), the overheat shift schedule is activated, refer to the Transmission Operation as a function of Transmission Oil Temperature. The code is an information code only and is being set to aid the technician in determining root cause of a customer driveability issue. The code is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler should be added to the vehicle if the customer regularly drives in a manner that overheats the transmission. Extended operation above 116°C (240°F) will reduce the durability of the transmission and should be avoided. Correcting the cooling system malfunction or installing an additional transmission oil cooler will improve transmission durability especially for customers who operate in city/construction stop and go traffic, tow trailers regularly, drive aggressively in low gear or drive regularly in mountainous areas.

Transmission Effects: Information only code. - Overheat shift schedule was activated, no limp-in condition occurs. See description of overheat shift schedule.

Possible Causes:

- > Transmission Overfilled with Oil
- > Engine cooling fan failure
- > Engine thermostat stuck closed
- > Radiator corroded or packed with dirt
- > Transmission cooler corroded or packed with dirt
- > Transmission fan not functioning properly
- > Transmission Oil Cooler Plugged
- > Customer driving pattern requires additional transmission cooling

Name Of Code: P0884(76) - Power-Up at Speed

When Monitored: When TCM (Transmission Control Module) initially powers-up.

Set Condition: If the TCM powers up and senses a valid forward gear PRNDL code and the output RPM is above 800 RPM approx. 32 km/h (20 MPH) the code will be set.

Theory of Operation: If a vehicle loses power to the TCM, the solenoids will go to their respective power off state. Some solenoids are normally vented and some are normally applied in their power off state. The transmission is designed to be in 3rd gear with all of the solenoids in this state. However, if power is restored, the TCM will power-up and normal operation will be restored.

This code identifies that power to the TCM was restored when the gear selector was in a ″Drive″ position while the vehicle was moving at speeds above 32 km/h (20 MPH). This code does not indicate a problem with the transmission or TCM, instead, it suggests intermittent problems in the fused ignition switch output, fused B(+), or ground circuits to the TCM. Alternately, if a person performs a rolling restart maneuver, the code can be set. Therefore it is critical that this DTC be investigated if the vehicle is experiencing intermittent 3rd gear operation and a subsequent return to normal operation.

Transmission Effects: No limp-in, although the symptom might be described as an intermittent limp-in. Code is for information only when trying to diagnosis intermittent 3rd gear operation and a subsequent return to normal operation.

Possible Causes:

- > No Problem if vehicle is started in ″neutral″ at speeds above 32 km/h (20 MPH) and shifted quickly to a forward gear position.
- > Quick key off then on while driving is any forward gear.

FOR INTERMITTENT 3rd GEAR OPERATION AND THEN A SUBSEQUENT RETURN TO NORMAL OPERATION WITHOUT CYCLING THE IGNITION KEY

- > Intermittent Direct Battery (Fused B(+)) connection between TCM (60-way pin 56) and battery.
- > Intermittent Fused Ignition Switch Output between TCM (60-way pin 11) and ignition switch.
- > Intermittent Ground to TCM (60 way pins 53 and 57).

Name of code: P0890(80) - Switched Battery

When monitored: Ignition key is turned from ″off″ position to ″run″ position and/or ignition key is turned from ″crank″ position to ″run″ position.

Set condition: This code is set if the Transmission Control Module (TCM) senses voltage on any of the pressure switch inputs prior to the TCM energizing the relay.

Theory of operation: The Transmission control relay is used to supply power to the solenoids and pressure switches when the transmission is in normal operating mode. When the relay is off, no power is supplied and the transmission is in "limp-in" mode. The relay output is fed back to the TCM through pins 16, 17 and 38. It is referred to as "Transmission Control Relay Output".

Immediately after a controller reset (ignition key turned to the "run" position or after cranking engine), the TCM verifies that the relay contacts are open by checking for no voltage at the transmission control relay output terminals. After this is verified, the voltage at the pressure switches is checked. There should be no voltage on the pressure switches at this time. The TCM will then activate the relay.

Transmission Effects: The MIL will illuminate and the transmission system will default to the Immediate Shutdown routine.

Possible causes:

> Short to battery on one or more pressure switch sense circuits.

> TCM connector problems.

> Solenoid/TRS connector problems.

> TCM.

Name of code:

P0841(81) - LR Pressure Switch Sense Circuit
P0846(82) - 2C Pressure Switch Sense Circuit
P0871(84) - OD Pressure Switch Sense Circuit
P0988(88) - 4C Pressure Switch Sense Circuit
P0876(90) - UD Pressure Switch Sense Circuit

When monitored: Whenever the engine is running.

Set condition: The appropriate code is set if one of the pressure switches are open or closed at the wrong time in a given gear (see chart below).

Theory of operation: The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown below.

OP = switch is open (No Pressure)
CL = switch is closed (Pressure Indicated)
*LR pressure switch opens above 150 output RPM in 1st gear and closes below a 100 output RPM.

Transmission Effects: The MIL will illuminate and the transmission system will default to the Immediate shutdown routine.

45RFE/545RFE NORMAL PRESSURE SWITCH STATES

GEAR	L/R	2C	4C	UD	OD
R	OPEN	OPEN	OPEN	OPEN	OPEN
N	CLOSED	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2 PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3RD	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	CLOSED	CLOSED	OPEN	CLOSED
4 PRIME	OPEN	OPEN	OPEN	OPEN	CLOSED

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Possible causes:

> If code P0944(35) is present, perform code P0944(35) diagnostic procedures

> Transmission fluid filter improperly installed (Seal installed onto filter neck instead of into pump bore, seal not fully seated against pump bore housing, filter neck not engaged into pump, bolts loose or O-ring missing or damaged)

> Reverse carrier snap ring dislodged (typically sets on heavy throttle acceleration from a dead stop)

> Pressure switch sense circuit open or shorted to ground between TCM and Solenoid/TRS assembly

> Pressure switch sense circuit shorted to battery

> Pressure switch

> Loose valve body bolts

> Plugged filter - internal transmission or torque converter failure

> Check ball not seating.

> Solenoid malfunction (If set with corresponding Solenoid DTC. Ie: 2C Pressure switch set with 2C solenoid)

> Oil Pump (Code P0841(81) only)

> TCM

Name of code:

P0845(A2) - 2C Hydraulic Pressure test failure
P0870(A4) - OD Hydraulic Pressure test failure
P0987(A8) - 4C Hydraulic Pressure test failure
P0875(B0) - UD Hydraulic Pressure test failure

When monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set condition: Immediately after a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the clutch circuits that do not have pressure to identify that the appropriate pressure switch closes. If the pressure switch does not close it is tested again. If the switch does not close the second time, the appropriate code is set.

Theory of operation: The Transmission Control Module (TCM) tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The TCM verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the code is set.

Transmission Effects: The MIL will illuminate and the transmission system will default to the orderly Shutdown routine Possible causes:

> Line Pressure Sensor

> Pressure switch sense circuit shorted to battery between TCM and solenoid/TRS assembly.

> Solenoid malfunction (If set with corresponding Solenoid DTC. Ie: 2C Hydraulic Pressure switch set with 2C solenoid)

> Low oil pressure

> Pressure switch

Name of code:

P0750(C1) - LR Solenoid Circuit
P0755(C2) - 2C Solenoid Circuit
P0760(C3) - OD Solenoid Circuit
P0770(C4) - 4C Solenoid Circuit
P0765(C5) - UD Solenoid Circuit
P2706(C6) - MS Solenoid Circuit

When monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a gear ratio or pressure switch error is detected.

Set condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Theory of operation: Six solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits are periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the TCM. If an inductive spike is not sensed by the Transmission Control Module (TCM) during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate code is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate code.

Transmission Effects: The MIL will illuminate and the transmission system will default to the Immediate Shutdown routine.

Possible causes:

> Open or shorted solenoid circuit(s) between TCM and solenoid/TRS assembly.

> Open ground circuit.

> TCM connector problems.

> Solenoid/TRS connector problem.

> Solenoid/TRS assembly.

> TCM

Name of code:

P0867(C8) - Line Pressure Fault
P0868(C9) - Line Pressure Low
P0869(CB) - Line Pressure High

When monitored: Continuously with engine running.

Set condition: The TCM has an internal error counter for each DTC above. When any of the counters reaches a preset threshold, the appropriate code is set.

Theory of operation: Line pressured is controlled by the TCM. It is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure). The TCM calculates the desired line pressure based on inputs from the transmission and engine. The TCM calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently higher than the target, the line pressure high DTC P0869(CB) will be set. If the actual line pressure is consistently lower than the target, the line pressure low DTC P0868(C9) will be set. If it is consistently out of range, but not consistently high or low, it is considered out of range and the line pressure error DTC P0867(C8) will be set.

Transmission Effects: The Transmission system will default to open loop line pressure control resulting in a fixed PCS duty cycle. This duty cycle will change slightly depending on temperature and current gear. Possible causes:

> Sticking Regulator Valve

> Pressure Control Solenoid

> Line Pressure Sensor.

> Oil pump

> Plugged Filter

> 5V supply circuit to Line Pressure Sensor open (Sensor reading will read a constant value between 586 and 655 kPa (85 and 95 PSI)

> TCM

Name of code:

P0932(CA) - Line Pressure Sensor Fault

When monitored: Continuously with engine running.

Set condition: If the Line Pressure Sensor (LPS) voltage is below 0.35 volts or above 4.75 volts the code will be set.

Theory of operation: Line pressured is controlled by the TCM. It is measured by the LPS and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure). This sensor is continuously checked for out of range voltage by the TCM.

Transmission Effects: The Transmission system will default to open loop line pressure control resulting in a fixed PCS duty cycle. This duty cycle will change slightly depending on temperature and current gear.

Possible causes:

> LPS signal circuit shorted to ground, shorted to voltage, or open.

> 5-volt supply circuit shorted to ground, shorted to voltage, or open.

> Open sensor ground

> Line Pressure Sensor

3.3.8 QUICK LEARN

The Quick Learn function customizes adaptive parameters of the TCM to the transmission characteristics of a vehicle. This gives the customer improved ″as received″ shift quality compared to the initial parameters stored in the TCM.

Notes about Quick Learn Features

The nature of the Quick Learn function requires that certain features must be taken into consideration.

> Quick Learn should generally not be used as a repair procedure unless directed by a repair or diagnostic procedure. If the transmission system is exhibiting a problem that you think is caused by an invalid CVI, you should try to relearn the value by performing the appropriate driving maneuver. In most cases, if a Quick Learn makes a vehicle shift better, the vehicle will return with the same problem.

> Before performing Quick Learn, it is imperative that the vehicle be shifted into OD with the engine running and the oil level set to the correct level. This step will purge air from the clutch circuits to prevent erroneous clutch volume values which could cause poor initial shift quality. Cycle the transmission through all gears 2-3 times immediately before performing Quick Learn. For best results, Quick Learn should be run with the transmission sump temperature > 90°F.

> If an unused TCM is installed on a vehicle with a HOT engine, Quick Learn will cause the TCM to report a cold calculated oil temperature. This requires monitoring the calculated oil temperature using the DRBIII®. If the temperature is below 16°C (60°F), the transmission must be run at idle or driven in gear until it goes above 16°C (60°F). If the temperature is above 93°C (200°F), the transmission must cool to below 93°C (200°F).

> First gear is engaged in overdrive after Quick Learn is completed. Place the vehicle in park after performing Quick Learn.

The Quick Learn function should be performed:

– Upon installation of a new service TCM

– After replacement or rebuild of internal transmission components or the torque converter

– If one or more of the clutch volumes indexes (CVI's) contain skewed readings because of abnormal conditions.

The Quick Learn procedure is performed with the DRBIII® by selecting ″Transmission″ system then ″Miscellaneous″ functions, then ″Quick Learn″. Follow the procedure instructions displayed on the DRBIII®.

To perform the Quick Learn procedure, the following conditions must be met.

NOTE: The oil temperature must be between 16°C (60°F) and 93°C (200°F). above 32°C (90°F) for best results. Cycle the transmission through all gears 2-3 times immediately before performing Quick Learn.

– It is imperative that the vehicle oil level set to the correct level. Shift the transmission into OD with the engine running, this step will purge the air in the clutch circuits to prevent erroneous clutch volume values, which could cause poor initial shift quality.

– Shift the transmission to neutral.

– The brakes must be applied.

– The engine must be idling.

– The throttle angle (TP sensor) must be less than 3 degrees.

– The shift lever position must stay in neutral, after shifting to neutral the engine idle speed will ramp up to 1600rpm and the DRBIII®

will prompt the operator to shift to OD. Do not shift to OD until the engine idle speed stabilizes at 1600rpm.

– The shift lever must stay in OD after the ″Shift to Overdrive″ prompt until the DRBIII® indicates the procedure is complete.

NOTE: The above conditions must be maintained during the procedure to keep the procedure from being aborted.

NOTE: After the Quick Learn Procedure is complete, the vehicle should be drive learned per the Drive Learn Procedure

3.3.9 CLUTCH VOLUMES

The LR clutch volume is updated when doing a **manual** downshift into 1st gear with vehicle speed above 40 km/h (25 MPH) and throttle angle below 5°. The transmission temperature must be above 43°C (110°F).

The clutch volume should be between 45 and 134.

NOTE: You must manually move the shift lever into the low position.

The 2C clutch volume is updated when doing a 3-2 shift with throttle angle between 10° and 54°. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 25 and 85.

The 2CA clutch volume is updated when doing a 4th-4 prime shift with throttle angle between 10° and 54°. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 25 and 85.

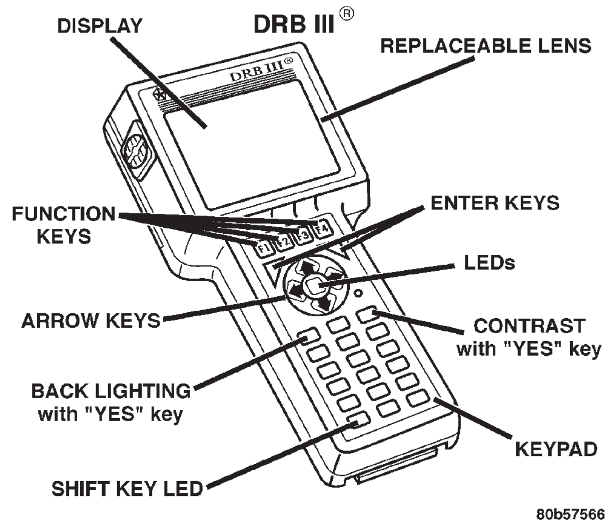
The OD clutch volume is updated when doing a 2-3 shift with throttle angle between 10° and 54°. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 30 and 100.

The 4C clutch volume is updated when doing a 3-4 shift with throttle angle between 10° and 54°. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 30 and 85.

The UD clutch volume is updated when doing a 4-3 shift with throttle angle between 10° and 54°. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 30 and 100.

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading trouble codes, erasing trouble codes, and other DRBIII® functions.



3.5 DRBIII® ERROR MESSAGES

Under normal operation, the DRBIII® will display one of only two error messages:

– User-Requested WARM Boot

– User-Requested COLD Boot If the DRBIII® should display any other error message, record the entire display and call the S.T.A.R. Center.

3.5.1 DRBIII® DOES NOT POWER UP (BLANK SCREEN)

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage. A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, an inoperative DRBIII® may be the result of faulty cable or vehicle wiring. For a blank screen, refer to the appropriate Body Diagnostic manual.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.

3.5.3 SOME DISPLAY ITEMS READ ″---″

This is caused by the scrolling the DRBIII® display a single line up or down. The line which was scrolled onto the screen might read ″---″. Use the page down or page up function to display the information.

3.6 TRANSMISSION SIMULATOR (MILLER TOOL # 8333)

NOTE: Remove the starter Relay when using the transmission simulator - Failure to remove the Starter Relay can cause a TCM - No Response condition.

NOTE: The Transmission Simulator will not accurately diagnose an intermittent fault.

The transmission simulator, simply put, is an electronic device that simulates the electronic functions of any EATX controlled transmission (41TE, 42LE, and 45RFE/545RFE). It's basic function is to aid the technician in determining if an internal transmission problem exists or if the problem resides in the vehicle wiring or Transmission Control Module (TCM). It is only useful for electrical problems. It will not aid in the diagnosis of a failed mechanical component, but it can tell you that the TCM and wiring are working properly and that the problem is internal.

The ignition switch should be in the lock position before attempting to install the simulator. Follow all instructions included with the simulator. If the feedback from the simulator is in doubt, you can verify it's operation by installing it on a known good vehicle. A ″known good vehicle″ would be defined as a vehicle that does not set any DTC's and drives and shifts as expected. One important point to remember is that the Simulator receives it's power from the Trans Relay Output circuit. If the transmission system is in Limp-in (Relay open), the simulator will not operate. This is not really an indication of a problem, but an additional symptom. If the simulator does not power up (″P″ led lit), this is an indication that the problem is still present with the simulator hooked up. This indicates that the problem is in the wiring or TCM and not the transmission.

4.0 DISCLAIMERS, SAFETY, AND WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. If is especially important to block the wheels on front-wheel drive vehicles: the parking brake does not hold the drive wheels.

Some operations in this manual require that hydraulic tubes, hoses, and fittings, disconnected for inspection or testing purposes. These systems, when fully charged, contain fluid at high preessure. Before disconnecting any hydraulic tubes, hoses, and fittings, be sure that the system is fully depressurized.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact. When diagnosing a Transmission system problem, it is important to follow approved procedures where applicable. These procedures can be found in the service information. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic DTC's or error messages may occur. It is extremely important that accurate shift lever position data is available to the TCM. The accuracy of any DTC found in memory is doubtful unless the Shift Lever Test, performed on the DRBIII® Scan Tool, passes without failure.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the Transmission system are intended to be serviced in assembly only. Attempting to remove or repair certain system subcomponents may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service information should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

- Follow the vehicle manufacturer's service specifications at all times.
- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table.

FUNCTION	INPUT LIMIT
Volts	0-500 volts peak AC 0-500 volts DC
Ohms (resistance)*	0-1.12 megohms
Frequency measured Frequency generated	0-10 khz
Temperature	-58-1100°F -50-600°C
*Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.	

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measured voltage above 25v DC or 25v AC.
- The circuit being tested must be protected by a 10A fuse or circuit breaker.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is "lock" position. Failure to do so could damage the module. When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation: this will damage the wire and eventually cause the wire to fail because of corrosion. Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second DTC could be set, making diagnosis of the original problem more difficult. When replacing a blown fuse, it is important to use only a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical system overload. If a properly rated fuse continues to blow, it indicates a problem in the circuit that must be corrected.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic DTC or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read DRBIII® screen while in motion. Do not hang the DRBIII® from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

Road testing is an essential step in the diagnostic process that must not be overlooked. Along with the diagnostic information obtained from the DRBIII® Scan Tool and the original customer concern, the road test helps verify the problem was current and any repairs performed, fixed the vehicle correctly. Always operate and observe the vehicle under actual driving conditions.

Just as important as the road test is, there are preliminary inspections that should be performed prior to the road test. Always check the fluid level and condition before taking the vehicle on a road test. Determine if the incorrect fluid is being used, improper fluid will result in erratic transmission operation. Some of the conditions of incorrect fluid level are as follows:

- Delayed engagement
- Poor shifting or erratic shifting
- Excessive noise
- Overheating

The next step is to verify that the shift linkage is correctly adjusted. If the shift linkage is incorrectly adjusted, a number of complaints can result.

The TCM monitors the Shift Lever Position (SLP) Sensor continuously. If the linkage is incorrectly adjusted, the TCM will sense a shift lever position that is not correct for the gear chosen by the driver. This may cause a DTC to be set. The following complaints may also be the result of an incorrectly adjusted or worn linkage:

- Delayed clutch engagement
- Erratic shifts
- Vehicle will drive in neutral
- Engine will not crank in park or neutral
- Gear shift linkage will be able to be shifted without the key in the ignition
- Not able to remove the ignition key in park
- Parking pawl will not engage properly

The shift linkage should also be adjusted when replacing the Transmission, repairing the valve body, or when repairing any component between the shift lever and the Transmission.

Some questions to ask yourself when performing the road test are as follows:

- Is the complaint or concern what you think the problem is, based on the drivers description of the problem?
- Is the Transmission operating normally, or is there a real problem?
- When does the problem occur?
- Is the problem only in one gear range?
- What temperature does the problem occur?
- Does the vehicle have to sit over night for the problem to occur?
- Does the transmission go into Limp-in mode?

4.3.3 ELECTRONIC PINION FACTOR WARNINGS (IF APPLICABLE)

The pinion factor must be set when replacing the TCM. Note: The pinion factor is a fixed number and cannot be changed or updated in some vehicle applications. If the pinion factor is not set or incorrectly set, any speed related functions will not operate correctly i.e. speedometer, speed control, rolling door locks, other control modules will be affected that depend on speed information.

4.4.4 BULLETINS AND RECALLS

Always perform all Safety Recalls and Technical Service Bulletins that are applicable to the problem.

5.0 REQUIRED TOOLS AND EQUIPMENT

> DRBIII® (diagnostic read-out box) - DRBIII® must use the latest release level.
> Transmission Simulator (Miller # 8333)
> Line Pressure Adapter (Miller #8259)
> Jumper wires
> Test Light
> Ohmmeter
> Voltmeter
> Pressure gauge 0-2068 kPa (0-300 PSI)

6.0 GLOSSARY OF TERMS

6.1 ACRONYMS

CKT	Circuit
CVI	Clutch Volume Index
DLC	Data Link Connector
DRBIII®	Diagnostic Readout Box
DTC	Diagnostic Trouble Code
EATX	Electronic Automatic Transmission
EMCC	Electronically Modulated Converter Clutch
FEMCC	Full Electronically Modulated Converter Clutch
IOD	Ignition off-draw
IRT	Intelligent Recovery Timer
ISS	Input Speed Sensor
LED	Light Emitting Diode
LPS	Line Pressure Sensor
LR	Low/reverse Clutch
MIL	Malfunction Indicator Lamp
MS	Multi Select
OBD	On Board Diagnostics
OD	Overdrive Clutch

OSS	Output Speed Sensor
PCI	Programmable Controller Interface (Vehicle bus system)
PCM	Powertrain Control Module
PCS	Pressure Control Solenoid
PEMCC	Partial Electronically Modulated Converter Clutch
REV	Reverse Clutch
SSV	Solenoid Switch Valve
SW	Switch
TCC	Torque Converter Clutch
TCCM	Transfer Case Control Module
TCM	Transmission Control Module
TP	Throttle Position
TRD	Torque Reduction
TRS	Transmission Range Sensor
TTS	Transmission Temperature Sensor
UD	Underdrive Clutch
2C	2nd Clutch
4C	4th Clutch

6.2 DEFINITIONS

OBDII/EURO III Trip - A vehicle start and drive cycle such that all once per trip diagnostic monitors have run.
Key Start - A vehicle start and run cycle of at least 20 seconds.
Warm-up Cycle - A vehicle start and run cycle such that the engine coolant must rise to at least 71°C (160°F) and must rise by at least 22°C (40°F) from initial startup. To count as a warm-up cycle, no DTC's may occur during the cycle.

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - GAS ONLY

POSSIBLE CAUSES
NO RESPONSE FROM TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN/ST) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (START) CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
GROUND CIRCUIT(S) OPEN
OPEN PCI BUS CIRCUIT
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Body Control Module (BCM). Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Body Communication category and perform the symptom PCI Bus Communication Failure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Run/St) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (Run/St) circuit for an open. Refer to the wiring diagrams location in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the starter relay from the PDC. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Start) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Observe the test light while momentarily turning the ignition switch to the Start position. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused Ignition Switch Output (Start) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. **Note: Reinstall the original Starter Relay.**	All
4	Turn the ignition off. Disconnect the TCM harness connector. Using a 12-volt test light connected to ground, check the Fused B(+) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 5 No → Repair the Fused B(+) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Using a 12-volt test light connected to 12-volts, check each ground circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly at all the ground circuits? Yes → Go To 6 No → Repair the Ground circuit(s) for an open. Check the main ground connection to engine block and/or chassis. Refer to the wiring diagrams located in the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - GAS ONLY — Continued

TEST	ACTION	APPLICABILITY
6	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the TCM harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the TCM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 7 No → Repair the PCI Bus circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0120-THROTTLE POSITION SENSOR SIGNAL CIRCUIT

When Monitored and Set Condition:

P0120-THROTTLE POSITION SENSOR SIGNAL CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The DTC is set if the throttle angle goes out of range or if throttle angle changes abruptly (i.e.: faster than the throttle body motion should occur). Note: This DTC can also be set by repeatedly stabbing the throttle.

POSSIBLE CAUSES
RELATED TPS PCM DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TPS VOLTAGE CHANGE NOT SMOOTH
SENSOR GROUND CIRCUIT OPEN TO TCM
TPS SIGNAL CIRCUIT OPEN TO TCM
TCM - THROTTLE POSITION CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0120-THROTTLE POSITION SENSOR SIGNAL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check Powertrain Control Module DTC's. Are any of the DTCs P0122, P0123 or P0121 present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check the TPS degree. Is the TPS degree reading below 6° or over 120°? Yes → Go To 4 No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the TPS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit between the TPS harness connector and the Transmission Control Module harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Sensor Ground circuit between the TCM harness connector and the splice. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the Throttle Position Sensor (TPS). Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TPS Signal Circuit from the TCM harness connector to the TPS harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open TPS signal circuit between the TCM harness connector and the splice. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0120-THROTTLE POSITION SENSOR SIGNAL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Pay particular attention to the the point where the TPS signal and sensor ground circuits splice off from the engine circuits. Were there any problems found? Yes → Repair wiring and/or connector as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Ignition On, Engine Not Running. With the DRBIII®, read the TPS voltage. While monitoring the DRBIII®, slowly open and close the throttle. Is the TPS voltage change smooth? Yes → Test Complete. No → Replace the Throttle Position Sensor. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0218-HIGH TEMPERATURE OPERATION ACTIVATED

When Monitored and Set Condition:

P0218-HIGH TEMPERATURE OPERATION ACTIVATED

When Monitored: Whenever the engine is running.

Set Condition: Immediately when the Overheat shift schedule is activated 116 degrees C transmission oil temp. (240 degrees F. Trans oil temp).

POSSIBLE CAUSES
ENGINE COOLING SYSTEM
TRANSMISSION OIL PUMP FLOW
HIGH TEMPERATURE OPERATIONS ACTIVATED

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Perform the Oil Pump Flow test per the Service Information. Did the Oil Pump Flow test pass? Yes → Go To 3 No → Repair the cause of either a low, or no Transmission Oil Pump Flow. Refer to the Service Information for the proper repair procedure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0218-HIGH TEMPERATURE OPERATION ACTIVATED — Continued

TEST	ACTION	APPLICABILITY
3	Perform Engine Cooling System diagnostics per the Service Information. Is the Engine Cooling System functioning properly? Yes → Go To 4 No → Repair the cause of the engine overheating. Refer to the Service Information for the proper repair procedure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
4	This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints. This DTC indicates that the transmission has been operating in the "Overheat" shift schedule which may generate a customer complaint. The customer driving patterns may indicate the need for an additional transmission oil cooler. If there are no possible causes remaining, view repair. Repair Repair the cause of transmission overheating. Refer to the Service Information for the proper repair procedure. Make sure to check for any TSBs pertaining to this problem. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0604-INTERNAL TCM

When Monitored and Set Condition:

P0604-INTERNAL TCM

When Monitored: Continuously with the key on.

Set Condition: When ever the TCM detects an internal controller problem.

POSSIBLE CAUSES
TCM INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	If there are no possible causes remaining, view repair. Repair The Transmission Control Module is reporting internal errors and must be replaced. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0605-INTERNAL TCM

When Monitored and Set Condition:

P0605-INTERNAL TCM

When Monitored: Continuously with the key on

Set Condition: When ever the TCM detects an internal controller problem.

POSSIBLE CAUSES
TCM INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	If there are no possible causes remaining, view repair. Repair The Transmission Control Module is reporting internal errors and must be replaced. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0613-INTERNAL TCM

When Monitored and Set Condition:

P0613-INTERNAL TCM

When Monitored: Continuously with the key on.

Set Condition: When ever the TCM detects an internal controller problem.

POSSIBLE CAUSES
GROUND CIRCUIT OPEN
TCM INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off to the lock position. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Using a 12-volt test light connected to 12-volts, check all three ground circuits in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly on all three ground circuits? Yes → Go To 2 No → Repair the Ground circuit(s) as necessary. Check main ground connection to engine block and/or chassis. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
2	If there are no possible causes remaining, view repair. View repair. Repair The Transmission Control Module is reporting internal errors and must be replaced. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0706-CHECK SHIFTER SIGNAL

When Monitored and Set Condition:

P0706-CHECK SHIFTER SIGNAL

When Monitored: Continuously with the ignition key on.

Set Condition: 3 occurrences in one key start of an invalid PRNDL code which lasts for more than 0.1 second.

POSSIBLE CAUSES
INTERMITTENT WIRING & CONNECTORS
SHIFT LINKAGE OUT OF ADJUSTMENT.
TRS T1 SENSE CIRCUIT OPEN
TRS T2 SENSE CIRCUIT OPEN
TRS T3 SENSE CIRCUIT OPEN
TRS T41 SENSE CIRCUIT OPEN
TRS T42 SENSE CIRCUIT OPEN
TRS T1 SENSE CIRCUIT SHORT TO GROUND
TRS T2 SENSE CIRCUIT SHORT TO GROUND
TRS T3 SENSE CIRCUIT SHORT TO GROUND
TRS T41 SENSE CIRCUIT SHORT TO GROUND
TRS T42 SENSE CIRCUIT SHORT TO GROUND
TRS T1 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T2 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T3 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T41 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T42 SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION RANGE SENSOR
TCM - TRS T1 SENSE CIRCUIT
TCM - TRS T2 SENSE CIRCUIT
TCM - TRS T3 SENSE CIRCUIT
TCM - TRS T41 SENSE CIRCUIT
TCM - TRS T42 SENSE CIRCUIT

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, perform the Shift Lever Position Test. Select the test outcome from the following: Test passes: Go To 3 Test fails with DTC: Go To 4 Test fails without DTC: Go To 27	5-SPD AUTOMATIC 5-45RFE TRANS
3	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. Ignition on, engine not running. With the DRBIII®, perform the Shift Lever Position Test. When the DRBIII® instructs you to put the Gear Selector in a particular position, you must do so using the selector switch on the Transmission Simulator. The LED for the gear position in question must be illuminated on the Transmission Simulator prior to pressing "ENTER" on the DRBIII®. **NOTE: When the DRBIII® requests the O/D off button be depressed, you must use the O/D OFF button in the vehicle or you will fail the Shift Lever Position Test with a DTC P0613 (11).** Did the Shift Lever Position test pass? Yes → Go To 5 No → Go To 6 **NOTE: Make sure to disconnect the Transmission Simulator and reconnect all disconnected connectors before proceeding.**	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	With the DRBIII®, observe the TRS sense circuits on the Input/Output screen. (C1 thru C5) Move the shift lever from P to L, pausing momentarily in each gear position. Watch for one of the circuits to not change state. Pick the one that did not change state. TRS T1 sense (C4) Go To 7 TRS T2 sense (C5) Go To 11 TRS T3 sense (C3) Go To 15 TRS T41 sense (C1) Go To 19 TRS T42 sense (C2) Go To 23	5-SPD AUTO-MATIC 5-45RFE TRANS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T1 Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T1 circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T1 Sense circuit in the TCM harness connector.. Is the resistance below 5.0 ohms? Yes → Repair the TRS T1 Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the TRS T1 Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the TRS T1 Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
11	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T2 Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T2 Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 12	5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T2 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T2 Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS
13	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the TRS T2 Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the TRS T2 Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 14	5-SPD AUTOMATIC 5-45RFE TRANS
14	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
15	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T3 Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the open TRS T3 Sense circuit. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 16	5-SPD AUTOMATIC 5-45RFE TRANS
16	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T3 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T3 Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 17	5-SPD AUTOMATIC 5-45RFE TRANS
17	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the TRS T3 Sense circuit at the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the TRS T3 Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 18	5-SPD AUTOMATIC 5-45RFE TRANS
18	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
19	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T41 Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair open TRS T41 Sense circuit. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 20	5-SPD AUTO-MATIC 5-45RFE TRANS
20	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T41 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T41 Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 21	5-SPD AUTO-MATIC 5-45RFE TRANS
21	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the TRS T41 Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the TRS T41 Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 22	5-SPD AUTO-MATIC 5-45RFE TRANS
22	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
23	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T42 Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T42 Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 24	5-SPD AUTO-MATIC 5-45RFE TRANS
24	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T42 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T42 Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 25	5-SPD AUTO-MATIC 5-45RFE TRANS
25	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the TRS T42 Sense circuit at the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the TRS T42 Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 26	5-SPD AUTO-MATIC 5-45RFE TRANS
26	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
27	If there are no possible causes remaining, view repair. Repair Adjust the shift linkage per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0715-INPUT SPEED SENSOR ERROR

When Monitored and Set Condition:

P0715-INPUT SPEED SENSOR ERROR

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If there is an excessive change in input RPM in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
SPEED SENSOR GROUND CIRCUIT OPEN
INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
INPUT SPEED SENSOR
TCM - INPUT SPEED SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0715-INPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine in park. With the DRBIII®, observe the Input Speed Sensor Reading. Is the Input Speed Sensor Reading below 400 RPM? Yes → Go To 3 No → Go To 12	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Using the Transmission Simulator, set the rotary knob to the middle (3000/1000) position. Turn the ″Input/Output″ switch to ″ON″. With the DRBIII®, observe the Input and Output Speed Sensor readings. Does the input speed read 3000 RPM and the Output speed read 1000 RPM (within 50 RPM)? Yes → Go To 4 No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS
4	If there are no possible causes remaining, view repair. Repair Replace the Input Speed Sensor. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Turn ignition switch to the lock position Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Input Speed Sensor Signal circuit from the TCM connector to the Input Speed Sensor connector. Is the resistance above 5.0 ohms? Yes → Repair the Input Speed Sensor Signal circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM harness connector to the Input Speed Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS

P0715-INPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Input Speed Sensor Signal circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Input Speed Sensor Signal circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Speed Sensor Ground circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Place a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the Input Speed Sensor Signal circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Input Speed Sensor Signal circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Place a jumper wire between the fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the Speed Sensor Ground circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Speed Sensor Ground circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS

P0715-INPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
11	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0720-OUTPUT SPEED SENSOR ERROR

When Monitored and Set Condition:

P0720-OUTPUT SPEED SENSOR ERROR

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If there is an excessive change in output RPM in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
SPEED SENSOR GROUND CIRCUIT OPEN
OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR
TCM - OUTPUT SPEED SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0720-OUTPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off to the lock position. **CAUTION: Properly support the vehicle and raise all drive wheels off the ground.** Start the engine in park. Place the transmission gear selector in drive, release foot from brake. **WARNING: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.** With the DRBIII®, monitor the Output Speed Sensor RPM. Is the Output Speed Sensor RPM below 100 RPM? Yes → Go To 3 No → Go To 12	5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1000″ position. With the DRBIII®, read the Input and Output Speed Sensor readings. Does the Input Speed read 3000 RPM and the Output Speed read 1000 RPM, ± 50 RPM? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	If there are no possible causes remaining, view repair. Repair Replace the Output Speed Sensor. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Output Speed Sensor Signal circuit from the TCM harness connector to the Output Speed Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Output Speed Sensor Signal circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS

P0720-OUTPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
6	Turn ignition switch to the lock position Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM connector to the Output Speed Sensor connector. Is the resistance above 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Output Speed Sensor Signal circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Output Speed Sensor Signal circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Speed Sensor Ground circuit. Is the resistance below 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Place a jumper wire between the Fused B+ circuit and the Transmission Relay Output circuit in the Transmission Control Relay connector. Turn ignition on. Measure the voltage of the Output Speed Sensor Signal circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Output Speed Sensor Signal circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS

P0720-OUTPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Place a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the Speed Sensor Ground circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Speed Sensor Ground circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
11	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0725-ENGINE SPEED SENSOR CIRCUIT

When Monitored and Set Condition:

P0725-ENGINE SPEED SENSOR CIRCUIT

When Monitored: Continuously with engine running.

Set Condition: This code is set when the engine speed sensed by the Transmission Control Module (TCM) is less than 400 RPM and the engine is running (As reported by the PCM over the communication bus) for 2 seconds. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED PCM DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
CKP SIGNAL CIRCUIT OPEN TO TCM
SENSOR GROUND CIRCUIT OPEN TO TCM
TCM- ENGINE SPEED SENSOR CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0725-ENGINE SPEED SENSOR CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, check Powertrain Control Module DTC's. Are the DTCs P0320, P1391, and/or P1398 present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Start the engine. Allow the engine to idle. With the DRBIII®, under ″Engine″, in Sensors, read and record ″Engine RPM″. With the DRBIII®, under ″Transmission″, in ″Sensors″, read and record ″Engine RPM″. Compare the two readings. Are the two readings within 50 RPM of each other? No → Go To 4 Yes → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the CKP harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the CKP Sensor Signal circuit between the CKP harness connector and the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the CKP Signal circuit for an open. Pay special attention to the location of CKP Signal circuit spice to the Transmission Control Module. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the CKP Sensor harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit between the CKP Sensor and the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Sensor Ground circuit for an open. Pay special attention to the location of Sensor Ground splice to the TCM. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0725-ENGINE SPEED SENSOR CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Pay particular attention to the point where the CKP Signal circuit and the Sensor Ground circuit splice off from the engine circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0731-GEAR RATIO ERROR IN 1ST

When Monitored and Set Condition:

P0731-GEAR RATIO ERROR IN 1ST

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0731-GEAR RATIO ERROR IN 1ST — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's If any of these DTC's are present, perform their respective tests first. Are DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868, or P0869 present also? Yes → Refer to Symptom list for the related symptom(s). If any of these DTCs are present, they will cause a Speed Ratio Error. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	With the DRBIII®, perform the 1st Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the throttle angle or TPS Degree to 30°, for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the Clutch Test pass, Input Speed remain at zero? Yes → Go To 4 No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS
4	The conditions to set this DTC are not currently present. Check the gearshift linkage adjustment. Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit. Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool # 8333. Remove the Starter Relay from the PDC before using the Transmission Simulator Miller tool # 8333. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Gear ratio DTC's can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. Were there any problems found. Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Repair or replace the transmission as necessary. If the transmission is to be repaired, and there were any line pressure DTC's present along with this DTC, make sure to inspect the Transmission Oil Pump and Pressure Control Solenoid per the Service Information procedures. If DTC's P0876 and/or P0875 were present in addition to the P0731, replace the Transmission Solenoid/TRS Assembly in addition to necessary internal repairs. If there are no possible causes remaining, view repair. Repair Repair internal transmission problem or replace the transmission per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0732-GEAR RATIO ERROR IN 2ND

When Monitored and Set Condition:

P0732-GEAR RATIO ERROR IN 2ND

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
RELATED PRESSURE SWITCH DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0732-GEAR RATIO ERROR IN 2ND — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's If any of these DTC's are present, perform their respective tests first. Are DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868 or P0869 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they will cause a Speed Ratio Error. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, perform the 2nd Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the clutch test pass, Input speed remain at zero? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	The conditions to set this DTC are not currently present. Check the gearshift linkage adjustment. Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit. Remove the starter relay before installing the Transmission Simulator. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool # 8333. Gear ratio DTC's can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. Were there any problems found? Yes → Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	With the DRBIII®, check for other transmission DTC's Is a DTC P0845 2C Hydraulic Pressure Switch and/or P0846 2C Pressure Switch present also? Yes → Repair or replace the Transmission or Solenoid/TRS assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS

P0732-GEAR RATIO ERROR IN 2ND — Continued

TEST	ACTION	APPLICABILITY
6	Repair or replace the transmission as necessary. If the transmission is to be repaired, and there were any line pressure DTC's present along with this DTC, make sure to inspect the Transmission Oil Pump and Pressure Control Solenoid per the Service Information. If DTC's P0846 and/or P0845 are also present, replace the Transmission Solenoid/TRS Assembly in addition to internal repairs. If there are no possible causes remaining, view repair. Repair Repair internal transmission problem or replace the transmission per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0733-GEAR RATIO ERROR IN 3RD

When Monitored and Set Condition:

P0733-GEAR RATIO ERROR IN 3RD

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
RELATED PRESSURE SWITCH DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0733-GEAR RATIO ERROR IN 3RD — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868, or P0869 present also? Yes → Refer to the Transmission category and perform the appropriate symptom.. If any of these DTCs are present, they will cause a Speed Ratio Error. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	With the DRBIII®, check for other transmission DTC's Are the DTCs P0870 OD Hydraulic Pressure Switch and/or P0871 OD Pressure Switch present also? Yes → Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
4	With the DRBIII®, perform the 3rd Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the clutch test pass, Input speed remains at zero? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	The conditions to set this DTC are not currently present. Check the gearshift linkage adjustment. Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit. Remove the starter relay before installing the Transmission Simulator. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator (Miller tool # 8333). Gear ratio DTC's can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. Were there any problems found. Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0733-GEAR RATIO ERROR IN 3RD — Continued

TEST	ACTION	APPLICABILITY
6	Repair or replace the transmission as necessary. If the transmission is to be repaired, and there were any line pressure DTC's present along with this DTC, make sure to inspect the Transmission Oil Pump and Pressure Control Solenoid per the Service Information. NOTE: If DTC's P0871 and/or P0870 are also present, replace the Transmission Solenoid/TRS Assembly in addition to necessary internal repairs. If there are no possible causes remaining, view repair. Repair Repair internal transmission problem or replace the transmission per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0734-GEAR RATIO ERROR IN 4TH

When Monitored and Set Condition:

P0734-GEAR RATIO ERROR IN 4TH

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
RELATED PRESSURE SWITCH DTC'S PRESENT
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0734-GEAR RATIO ERROR IN 4TH — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868 or P0869 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they will cause a Speed Ratio Error. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check for other transmission DTC's Are the DTCs P0987 4C Hydraulic Pressure Switch and/or P0988 4C Pressure Switch present also? Yes → Replace the Transmission or Solenoid/TRS assembly per current warranty policy. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	Repair or replace the transmission as necessary per the Service Information. If the transmission is to be repaired, and there were any line pressure DTC's present along with this DTC, make sure to inspect the Transmission Oil Pump and Pressure Control Solenoid per the Service Information. If DTC's P0988 and/or P0987 are also present, replace the Transmission Solenoid/TRS Assembly in addition to necessary internal repairs. If there are no possible causes remaining, view repair. Repair Replace the Transmission or repair internal transmission problem per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0735-GEAR RATIO ERROR 4TH PRIME

When Monitored and Set Condition:

P0735-GEAR RATIO ERROR 4TH PRIME

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0735-GEAR RATIO ERROR 4TH PRIME — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868 or P0869 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they will cause a Speed Ratio Error. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, perform the 2nd Gear Clutch Test. Follow the instructions on the DRBIII® for test. With the DRBIII®, perform the 3rd Gear Clutch Test. Follow the instructions on the DRBIII® for the test. **NOTE: You must test the 2nd and 3rd clutches to verify 4th Prime operation.** Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds for each Gear tested. **CAUTION: Do not overheat the transmission.** **NOTE: No DTC's will be set while using the DRBIII® to perform a clutch test.** Did both clutch test pass, Input speed remain at zero? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	The conditions to set this DTC are not currently present. Check the gearshift linkage adjustment. Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit. Remove the starter relay before installing the Transmission Simulator. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool # 8333. Gear ratio DTC's can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem. If any Line Pressure DTC's are present along with this DTC, make sure to inspect the Transmission Oil Pump and the Pressure Control Solenoid per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0736-GEAR RATIO ERROR IN REVERSE

When Monitored and Set Condition:

P0736-GEAR RATIO ERROR IN REVERSE

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0736-GEAR RATIO ERROR IN REVERSE — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868 or P0869 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they will cause a Speed Ratio Error. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, perform the Reverse Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the throttle angle , TPS Degree, to 30°, for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the clutch test pass, Input speed remain at zero? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	The conditions to set this DTC are not currently present. Check the gearshift linkage adjustment. Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit. Remove the starter relay before installing the Transmission Simulator. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator (Miller tool # 8333). Gear ratio DTC's can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem. If there are any Line Pressure DTC's present along with this DTC, make sure to inspect the Transmission Oil Pump and Pressure Control Solenoid per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0740-TORQUE CONVERTER CLUTCH CONTROL CIRCUIT

When Monitored and Set Condition:

P0740-TORQUE CONVERTER CLUTCH CONTROL CIRCUIT

When Monitored: During Electronically Modulated Converter Clutch (EMCC) Operation.

Set Condition: Transmission must be in EMCC, with input speed > than 1750 RPM. TCC-L/R Solenoid achieves the maximum duty cycle and can not pull engine speed within 60 RPM of input speed. Also when the transmission is in FEMCC and the engine slips TCC > than 100 RPM for 10 seconds. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC P0750 PRESENT
INTERMITTENT WIRING AND/OR CONNECTORS
INTERNAL TRANSMISSION PROBLEM - TCC OUT OF RANGE
L/R SOLENOID INOPERATIVE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0740-TORQUE CONVERTER CLUTCH CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read transmission DTC's Is the DTC P0750 present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Read and RECORD ALL Transmission DTC's. After recording DTC's, erase DTC's. Drive the vehicle until the transmission temperature is at least 43°C or 110°F. Perform the following steps 3 times. Drive the vehicle at 80 km/h or 50 MPH. Allow 4th gear to engage for at least 10 seconds. Close the Throttle. Tip back into the throttle until the TPS angle is between 25 and 29 degrees. **NOTE: If the throttle angle goes over 30 degrees, you must close the throttle and try again.** Did the TCC engage (Engine speed approximately equal to input speed) during any of the attempts? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	With the DRBIII®, check for other transmission DTC's. Are codes P1775 and P0841 present also? Yes → Replace the Transmission Solenoid/TRS assembly per the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
6	If there are no possible causes remaining, view repair. Repair Internal transmission problem, inspect the oil pump per service manual information and replace if necessary. If no problems are found in the Oil Pump, replace the Solenoid/TRS assembly also replace the Torque Converter in either case. Perform POWERTRAIN VERIFICATION TEST VER - 5.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0750-LR SOLENOID CIRCUIT

When Monitored and Set Condition:

P0750-LR SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio or pressure switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
L/R SOLENOID CONTROL CIRCUIT OPEN
L/R SOLENOID CONTROL CIRCUIT SHORT TO GROUND
L/R SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
SOLENOID/TRS ASSEMBLY- L/R SOLENOID
TCM - L/R SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0750-LR SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891, or P0888 present? Yes → Refer to symptom list and perform test for Transmission Relay related DTC's. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0750 **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0750 set at 0? Yes → Go To 4 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, actuate the L/R Solenoid. Monitor the L/R Solenoid LED on the Transmission Simulator. Did the L/R Solenoid LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0750-LR SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the L/R Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the L/R Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the L/R Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the L/R Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Solenoid Control circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the L/R Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0750-LR SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0755-2C SOLENOID CIRCUIT

When Monitored and Set Condition:

P0755-2C SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a gear ratio or pressure switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
2C SOLENOID CONTROL CIRCUIT OPEN
2C SOLENOID CONTROL CIRCUIT SHORT TO GROUND
2C SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
SOLENOID/TRS ASSEMBLY - 2C SOLENOID
TCM - 2C SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0755-2C SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other Transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891 or P0888 present? Yes → Refer to symptom list and perform test for Transmission Relay related DTC's. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0755. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0755 set at 0? Yes → Go To 4 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Monitor the 2C Solenoid LED on the Transmission Simulator. With the DRBIII®, actuate the 2C Solenoid. Did the 2C Solenoid LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0755-2C SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2C Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2C Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2C Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2C Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC.. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2C Solenoid Control circuit in the Transmission Control Module harness connector. Is the voltage above 0.5 volt? Yes → Repair the 2C Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0755-2C SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0760-OD SOLENOID CIRCUIT

When Monitored and Set Condition:

P0760-OD SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a gear ratio or pressure switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
OD SOLENOID CONTROL CIRCUIT OPEN
OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
OD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
SOLENOID/TRS ASSEMBLY - OD SOLENOID
TCM - OD SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0760-OD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891 or P0888 present. Yes → Refer to symptom list and perform test for Transmission Relay related DTC's. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0760. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0760 set at 0? Yes → Go To 4 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Monitor the OD Solenoid LED on the Transmission Simulator. With the DRBIII®, actuate the OD Solenoid. Did the OD Solenoid LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0760-OD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the OD Solenoid Control circuit from the Transmission Control Module harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the OD Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the OD Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the OD Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the OD Solenoid Control circuit in the Transmission Control Module harness connector. Is the voltage above 0.5 volt? Yes → Repair the OD Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0760-OD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0765-UD SOLENOID CIRCUIT

When Monitored and Set Condition:

P0765-UD SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a gear ratio or pressure switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
UD SOLENOID CONTROL CIRCUIT OPEN
UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
UD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
SOLENOID/TRS ASSEMBLY - UD SOLENOID
TCM - UD SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0765-UD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTCs P0890, P0891or P0888 present? Yes → Refer to symptom list and perform test for Transmission Control Relay related DTCs. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0765 **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0765 set at 0? Yes → Go To 4 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Monitor the UD Solenoid LED on the Transmission Simulator. With the DRBIII®, actuate the UD Solenoid. Did the UD Solenoid LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0765-UD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the UD Solenoid Control circuit between the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the UD Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the UD Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the UD Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the UD Solenoid Control circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the UD Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the TCM per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0765-UD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0770-4C SOLENOID CIRCUIT

When Monitored and Set Condition:

P0770-4C SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a gear ratio or pressure switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
4C SOLENOID CONTROL CIRCUIT OPEN
4C SOLENOID CONTROL CIRCUIT SHORT TO GROUND
4C SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
SOLENOID/TRS ASSEMBLY - 4C SOLENOID
TCM - 4C SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0770-4C SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891 or P0888 present? Yes → Refer to symptom list and perform test for Transmission Relay related DTC's. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0770. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0770 set at 0? Yes → Go To 4 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Control Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Monitor the 4C Solenoid LED on the Transmission Simulator, Miller tool #8333. With the DRBIII®, actuate the 4C Solenoid. Did the 4C Solenoid LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair. Replace Transmission Solenoid/TRS Assembly as required. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0770-4C SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 4C Solenoid Control circuit from the Transmission Control Module harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 4C Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 4C Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the 4C Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 4C Solenoid Control circuit in the Transmission Control Module harness connector. Is the voltage above 0.5 volt? Yes → Repair the 4C Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0770-4C SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0841-LR PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0841-LR PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The appropriate code is set if one of the pressure switches are open or closed at the wrong time in a given gear .

POSSIBLE CAUSES
LOSS OF PRIME P0944 PRESENT
RELATED RELAY DTC'S PRESENT
INTERMITTENT CONDITIONS
L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
L/R PRESSURE SWITCH
TCM - L/R PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0841-LR PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other Transmission DTC's. Is DTC P0944 present in addition to the DTC that you are diagnosing? Yes → Refer to symptom list and perform test for P0944. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	With the DRBIII®, check for other Transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891, or P0888 present?. Yes → Refer to symptom list and perform test for the related Transmission Control Relay DTC (s). Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
4	With the DRBIII®, Check the STARTS SINCE SET counter for P0841. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 12	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission simulator (Miller tool #8333) **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Place pressure switch selector on L/R and observe L/R Pressure Switch state on the DRBIII® screen while pressing the pressure switch test button. Did the pressure switch state change from open to closed when the switch was depressed? Yes → Go To 6 No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
6	If there are no possible causes remaining, view repair. Repair Replace the Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0841-LR PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the L/R Pressure Switch Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Relay Output circuit in the Transmission Solenoid/TRS harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 9 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the L/R Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS

P0841-LR PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the L/R Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
11	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Sump filter installed incorrectly Reverse carrier snap ring dislodged (typically sets code on heavy throttle acceleration from a dead stop) Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0845-2C HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0845-2C HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

POSSIBLE CAUSES
RELATED LINE PRESSURE DTC'S PRESENT
RELATED PRESSURE SWITCH AND/OR SPEED RATIO DTC'S PRESENT
TCM AND WIRING - LOW LINE PRESSURE
INTERMITTENT WIRING AND CONNECTORS
2C PRESSURE SWITCH SENSE CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
EXCESSIVE DEBRIS IN OIL PAN
INTERNAL TRANSMISSION PROBLEM - 2C PRESSURE TEST
TCM - 2C PRESSURE SWITCH
TCM - NO 5 VOLT - LOW LINE PRESSURE SENSOR

P0845-2C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other transmission DTC's Are there any line pressure related DTC's P0867, P0932, P0868, P0869, or P0944 present? Yes → Refer to Symptom List for the related symptom(s). Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check for other transmission DTC's Is the DTC P0732 and/or P0846 present also? Yes → Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	With the DRBIII, Check the STARTS SINCE SET counter for P0845. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 19	5-SPD AUTOMATIC 5-45RFE TRANS

P0845-2C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Start the engine. Warm the transmission to 82° C or 180° F. Firmly apply the brakes. With the DRBIII®, monitor the Line Pressure during the following step. Move the shift lever to each gear position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range. Did the line pressure remain at a steady value between 585 and 655 Kpa or 85 or 95 PSI? Yes → Go To 6 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
6	Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Firmly push the Transmission Line Pressure Sensor connector towards the Transmission. Did the Line Pressure change to about 207 kPa or 30 PSI when the connector was pushed? Yes → Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator Miller tool# 8333. With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch. **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Did the Line Pressure remain steady in all three positions? Yes → Replace the Line Pressure Sensor per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS

P0845-2C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-volt Supply circuit from the Line Pressure Sensor harness connector to the TCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt Supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 5-volt Supply circuit. Is the resistance below 5.0 ohms? Yes → Repair the 5-volt Supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN AND REPROGRAM PINION FACTOR. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator Miller tool# 8333. With the Transmission Simulator Miller tool# 8333, turn the Pressure Switch selector to 2C. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the 2C Pressure Switch state during the following step. While pressing and holding the Pressure Switch test button, wiggle the wiring harness and connectors pertaining to the 2C Pressure Switch. Did the 2C Pressure Switch state change to closed and remain closed while wiggling the wires? Yes → Go To 12 No → Go To 14	5-SPD AUTOMATIC 5-45RFE TRANS

P0845-2C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
12	Remove and inspect the Transmission Oil Pan per the Service Information. Does the Transmission Oil Pan contain excessive debris or contamination? Yes → Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS
13	If there are no possible causes remaining, view repair. Repair Repair Internal Transmission as necessary. Disassemble and inspect the Valve Body and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
14	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2C Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2C Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 15	5-SPD AUTOMATIC 5-45RFE TRANS
15	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the TCM harness connector. Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 16 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0845-2C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
16	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2C Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2C Pressure Switch circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 17	5-SPD AUTO-MATIC 5-45RFE TRANS
17	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2C Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the 2C Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 18	5-SPD AUTO-MATIC 5-45RFE TRANS
18	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
19	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0846-2C PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0846-2C PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The appropriate code is set if one of the pressure switches are open or closed at the wrong time in a given gear .

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT CONDITIONS
2C PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
2C PRESSURE SWITCH
TCM - 2C PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0846-2C PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891, or P0888 present? Yes → Refer to symptom list and perform test for Transmission Control Relay related DTCs. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0846, 2 or less? Yes → Go To 4 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Pressure Switch selector switch on 2C. With the DRBIII®, monitor the 2C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator. Did the state of the 2C Pressure Switch change while pressing the Pressure Switch Test button? Yes → Go To 5 No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2C Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2C Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS

P0846-2C PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2C Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2C Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2C Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the 2C Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0846-2C PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Check for a Sump filter not installed correctly Reverse carrier snap ring dislodged (typically sets on heavy throttle acceleration from a dead stop) Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0867-LINE PRESSURE FAULT

When Monitored and Set Condition:

P0867-LINE PRESSURE FAULT

When Monitored: Continuously while driving in a forward gear.

Set Condition: The TCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the difference between Actual Line Pressure and Desired Line Pressure is 10 PSI or greater, this code will be set.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
POOR CONNECTION OR WIRING
TRANSMISSION - LINE PRESSURE OUT OF RANGE
TCM - LINE PRESSURE OUT OF RANGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0867-LINE PRESSURE FAULT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any other line pressure related DTC's P0932, P0868, or P0869 present? Yes → Refer to symptom list and perform test for other line pressure related DTC's. Run test for P0932 first if present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	**CAUTION: Apply Parking Brake** Start the engine. **CAUTION: Firmly apply the brakes.** With the DRBIII®, monitor the Line Pressure, Desired Line Pressure and the TPS Degrees. While firmly applying the brakes place shifter in the R position. Then slowly press the accelerator pedal to TPS degree of 15. Compare the Line Pressure reading to the Desired Line Pressure reading on the DRBIII®. Does the Line Pressure and Desired Line Pressure stay within ± 34 kPa or 5 PSI? No → Go To 4 Yes → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
4	With the DRBIII®, monitor the Line Pressure Sensor voltage while wiggling the wiring harness and connectors pertaining to the Line Pressure Sensor and the Solenoid/TRS assembly. Did the voltage remain steady while wiggling the wiring harness and connectors? Yes → Go To 5 No → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch. Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Using the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Does the Line Pressure fluctuate up and down more than 69 kPa or 10 PSI at any of the positions? Yes → Go To 6 No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS

P0867-LINE PRESSURE FAULT — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
7	If there are no possible causes remaining, view repair. Repair If the transmission is to be repaired, inspect the oil pump per Service Manual information and replace if necessary. If no problem is found, replace the Solenoid/TRS assembly - stuck Pressure Control Solenoid. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
8	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Where there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0868-LINE PRESSURE LOW

When Monitored and Set Condition:

P0868-LINE PRESSURE LOW

When Monitored: Continuously while driving in a forward gear.

Set Condition: The TCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If Actual Line Pressure is more than 10 PSI below Desired Line Pressure, this code will be set.

POSSIBLE CAUSES
CHECK FOR RELATED DTC'S
TCM AND WIRING - LOW LINE PRESSURE
INTERMITTENT WIRING AND CONNECTORS
5 VOLT SUPPLY CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
5 VOLT SUPPLY CIRCUIT SHORT TO GROUND
5 VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE
PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION - LINE PRESSURE LOW
LINE PRESSURE SENSOR - CALIBRATION OUT OF LIMITS
PLUGGED FILTER
TCM - LINE PRESSURE LOW

P0868-LINE PRESSURE LOW — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other transmission DTC's Is the DTC P0932 present also? Yes → Refer to symptom list for problems related to P0932. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check the STARTS SINCE SET counter for P0868. **NOTE: This counter only applies to the last DTC set.** Is the START SINCE SET COUNTER 2 or less? Yes → Go To 4 No → Go To 14	5-SPD AUTOMATIC 5-45RFE TRANS
4	Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure, firmly push the Line Pressure Sensor harness connector towards the Transmission. Did the Line Pressure change to about 207 kPa or 30 PSI when the connector was pushed? Yes → Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS

P0868-LINE PRESSURE LOW — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator Miller tool# 8333. With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch. **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Did the Line Pressure remain steady in all three positions? Yes → Go To 6 No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Install the Line Pressure Adaptor, Miller tool# 8259, and the Pressure Gage, Miller tool# C-3293, 0 to 2000 kPa or 0 to 300 PSI. Start the engine in park. With the DRBIII® monitor the Line Pressure. Monitor the reading on the Pressure Gage Miller tool# C-3293. Compare the Line Pressure readings between the DRBIII® and the Pressure Gage. Is the Line Pressure Gauge reading within 34 kPa or 5 PSI of the DRBIII® reading? Yes → Go To 7 No → Replace the Line Pressure Sensor per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
7	Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information. Remove and inspect the Primary Oil Filter per the Service Information. **NOTE: Make sure the Primary Transmission Oil Filter and/or O-ring is not cracked or split.** Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged? Yes → Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or O-ring. If the Primary Transmission Oil Filter is plugged refer to the Service Information for the proper Hydraulic repair procedure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS

P0868-LINE PRESSURE LOW — Continued

TEST	ACTION	APPLICABILITY
8	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem. If the transmission is to be repaired, inspect the oil pump per the Service Information and replace if necessary. If no problem is found, replace the Solenoid/TRS assembly. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-volt Supply circuit from the Line Pressure Sensor harness connector to the TCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt Supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 5-volt Supply circuit. Is the resistance Below 5.0 ohms? Yes → Repair the 5-volt Supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. Place a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. **Note: Check connectors - Clean/repair as necessary.** Measure the voltage of the 5-volt Supply circuit in the TCM harness connector. Is the voltage above 5.5 volts? Yes → Repair the 5-volt Supply circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 12	5-SPD AUTOMATIC 5-45RFE TRANS

P0868-LINE PRESSURE LOW — Continued

TEST	ACTION	APPLICABILITY
12	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Trans Relay Output circuit in the relay connector. Ignition on, engine not running. Measure the voltage of the Pressure Control Solenoid control circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Pressure Control Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS
13	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
14	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0869-LINE PRESSURE HIGH

When Monitored and Set Condition:

P0869-LINE PRESSURE HIGH

When Monitored: Continuously while driving in a forward gear.

Set Condition: The TCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If Actual Line Pressure is more than 10 PSI above Desired Line Pressure, this code will be set.

POSSIBLE CAUSES
CHECK FOR RELATED DTC'S
TCM AND WIRING - LINE PRESSURE HIGH
INTERMITTENT WIRING AND CONNECTORS
5-VOLT SUPPLY CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
PRESSURE CONTROL SOLENOID CONTROL CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO GROUND
INTERNAL TRANSMISSION - LINE PRESSURE HIGH
LINE PRESSURE SENSOR - CALIBRATION OUT OF LIMITS
TCM - LINE PRESSURE HIGH

P0869-LINE PRESSURE HIGH — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other Transmission DTC's Is the DTC P0932 present also? Yes → Refer to symptom list for problems related to P0932. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	The transmission temperature must be at least 180 degrees for the results of this test to be valid. With the DRBIII®, check the STARTS SINCE SET counter for P0869. Is the STARTS SINCE SET COUNTER 2 or less? Yes → Go To 4 No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS
4	Ignition on, engine not running. With the DRBIII®, monitor the Transmission Line Pressure. Firmly push the Line Pressure Sensor harness connector inward towards the Transmission. Did the Line Pressure change to about 207 kPa or 30 PSI when the sensor connector was pushed? Yes → Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS

P0869-LINE PRESSURE HIGH — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator Miller tool# 8333. With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch. **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Did the Line Pressure remain steady in all three positions? Yes → Go To 6 No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Install the Line Pressure Adaptor, Miller tool# 8259, and the Pressure Gage, Miller tool# C-3293, 0 to 2000 kPa or 0 to 300 PSI. Start the engine in park. With the DRBIII®, monitor the Line Pressure. Monitor the reading on the Pressure Gage, Miller tool# C-3293. Compare the Line Pressure reading between the DRBIII® and the Pressure Gage. Is the Pressure Gauge reading within 34 kPa or 5 PSI of the DRBIII® reading? Yes → Go To 7 No → Replace the Line Pressure Sensor. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
7	If there are no possible causes remaining, view repair. Repair If the transmission is to be repaired, inspect the oil pump per the Service Information and replace if necessary. If no problem is found, replace the Solenoid/TRS assembly - stuck Pressure Control Solenoid. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-volt Supply circuit from the Line Pressure Sensor harness connector to the Transmission Control Module harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt Supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS

P0869-LINE PRESSURE HIGH — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid /TRS harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Pressure Control Solenoid Control circuit from the Transmission Control Module harness connector to the Solenoid/TRS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Pressure Control Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 5-volt Supply circuit. Is the resistance below 5.0 ohms? Yes → Repair the 5-volt Supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid/TRS harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Pressure Control Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the Pressure Control Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 12	5-SPD AUTOMATIC 5-45RFE TRANS
12	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0869-LINE PRESSURE HIGH — Continued

TEST	ACTION	APPLICABILITY
13	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0870-OD HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0870-OD HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the clutch circuits that don't have pressure to identify the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

POSSIBLE CAUSES
RELATED LINE PRESSURE DTC'S PRESENT
RELATED SPEED RATIO AND/OR PRESSURE SWITCH DTC'S PRESENT
TCM AND WIRING - LOW LINE PRESSURE
INTERMITTENT WIRING & CONNECTORS
5-VOLT SUPPLY CIRCUIT OPEN
OD PRESSURE SWITCH SENSE CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
EXCESSIVE DEBRIS IN OIL PAN
INTERNAL TRANSMISSION PROBLEM - OD PRESSURE TEST
TCM - NO 5 VOLTS - LOW LINE PRESSURE SENSOR
TCM - OD PRESSURE SWITCH

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other Transmission DTC's Are there any Line Pressure related DTC's P0867, P0932, P0868, P0869, or P0944 present? Yes → Refer to symptom list and perform appropriate test. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check for other Transmission DTC's Is the DTC P0733 and/or P0871 present also? Yes → Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	With the DRBIII®, Check the STARTS SINCE SET counter for P0870. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 19	5-SPD AUTOMATIC 5-45RFE TRANS

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Start engine. Warm transmission to 82° C or 180 ° F. Firmly apply brakes. With the DRBIII®, monitor the Transmission Line Pressure. Move the shift lever to each gear position and record the Line Pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range. Did the Line Pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI? Yes → Go To 6 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch. Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Using the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Did the Line Pressure remain steady in all 3 positions? Yes → Replace the Line Pressure Sensor per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure while firmly pushing the Line Pressure Sensor connector towards the Transmission. Did the Line Pressure change to about 207 kPa or 30 PSI when the connector was pushed? Yes → Disconnect and properly reconnect the Line Pressure Sensor harness connector. Inspect terminals and repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-volt Supply circuit from the Line Pressure Sensor harness connector to the TCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 5-volt Supply circuit. Is the resistance below 5.0 ohms? Yes → Repair the 5-volt Supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the OD Pressure Switch state during the following steps. With the Transmission Simulator Miller tool# 8333, place the selector switch on OD. While pressing the Pressure Switch test button, wiggle the wiring harness and connectors pertaining to the OD Pressure Switch. Did the OD pressure switch state change to closed and remain closed while wiggling the wires? Yes → Go To 12 No → Go To 14	5-SPD AUTO-MATIC 5-45RFE TRANS
12	Remove and inspect the Transmission Oil Pan per the Service Information. Does the Transmission Oil Pan contain excessive debris or contamination? Yes → Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTO-MATIC 5-45RFE TRANS

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
13	If there are no possible causes remaining, view repair. Repair Repair Internal Transmission as necessary. Disassemble and inspect the Valve Body and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
14	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the OD Pressure Switch Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the OD Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 15	5-SPD AUTO-MATIC 5-45RFE TRANS
15	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the Transmission Control Relay from the PDC. Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit at the Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 16 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
16	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the OD Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the OD Pressure Switch circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 17	5-SPD AUTO-MATIC 5-45RFE TRANS

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
17	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the OD Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the OD Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 18	5-SPD AUTOMATIC 5-45RFE TRANS
18	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
19	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0871-OD PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0871-OD PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The appropriate code is set if one of the pressure switches are open or closed at the wrong time in a given gear.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING & CONNECTORS
OD PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
OD PRESSURE SWITCH
TCM - OD PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0871-OD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTC's, P0890, P0891, or P0888 present? Yes → Refer to symptom list and perform test for Transmission Control Relay related DTCs. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Ignition on, engine not running. With the DRBIII®, Check the STARTS SINCE SET counter for P0871. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Pressure Switch selector switch to OD. With the DRBIII®, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the state of the OD Pressure Switch change while pressing the Pressure Switch Test button? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of the OD Pressure Switch Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the OD Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS

P0871-OD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Relay output circuit in the Transmission Solenoid/TRS harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair cause of unlit or dim test light. Open circuit or high resistance in Transmission Relay output circuit. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the OD Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the OD Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the OD Pressure Switch Sense circuit at the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the OD Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0871-OD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Check for a Sump filter not installed correctly Reverse carrier snap ring dislodged (typically sets on heavy throttle acceleration from a dead stop) Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0875-UD HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0875-UD HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the clutch circuits don't have pressure to identify the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

POSSIBLE CAUSES
RELATED LINE PRESSURE DTC'S PRESENT
RELATED SPEED RATIO AND/OR PRESSURE SWITCH DTC'S PRESENT
TCM AND WIRING - LOW LINE PRESSURE
INTERMITTENT WIRING AND CONNECTORS
5-VOLT SUPPLY CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
UD PRESSURE SWITCH SENSE CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
UD PRESSURE SWITCH CIRCUIT SHORT TO GROUND
UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
EXCESSIVE DEBRIS IN OIL PAN
INTERNAL TRANSMISSION - UD PRESSURE TEST
TCM - NO 5 VOLTS - LOW LINE PRESSURE SENSOR
TCM - UD PRESSURE SWITCH

P0875-UD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other Transmission DTC's Are there any line pressure related DTC's, P0867, P0932, P0868, P0869, or P0944 present? Yes → Refer to Symptom List for the related symptom(s). Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check for other transmission DTC's Are the DTC's P0731, P0732, P0733 and/or P0876 present? Yes → Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	With the DRBIII®, Check the STARTS SINCE SET counter for P0875. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 19	5-SPD AUTOMATIC 5-45RFE TRANS

P0875-UD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Start engine. Warm the transmission to 82° C or 180° F. Firmly apply brakes. With the DRBIII®, monitor the Line Pressure in the following step. Move the shift lever to each gear position and record the Line Pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range. Did the Line Pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI? Yes → Go To 6 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
6	Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure for the following step. Firmly push the Line Pressure Sensor connector inward towards the Transmission. Did the Line Pressure change to about 207 kPa or 30 PSI when the connector was pushed? Yes → Disconnect and properly reconnect the Line Pressure Sensor harness connector. Inspect terminals and repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator Miller tool #8333. With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch. **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure in the following step. With the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Did the Line Pressure remain steady in all three positions? Yes → Replace the Line Pressure Sensor per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-volt Supply circuit from the Line Pressure Sensor harness connector to the TCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt Supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS

P0875-UD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 5-volt Supply circuit. Is the resistance Below 5.0 ohms? Yes → Repair the 5-volt Supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, monitor the UD Pressure Switch state. With the Transmission Simulator Miller tool# 8333, place the selector switch on UD. While pressing and holding the Pressure Switch test button, wiggle the wiring harness and connectors pertaining to the UD Pressure Switch. Did the UD Pressure Switch state change to closed and remain closed while wiggling the wires? Yes → Go To 12 No → Go To 14	5-SPD AUTOMATIC 5-45RFE TRANS
12	Remove and inspect Transmission Oil Pan per the Service Information. Does it contain excessive debris or contamination? Yes → Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS

P0875-UD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
13	If there are no possible causes remaining, view repair. Repair Repair Internal Transmission as necessary. Disassemble and inspect the Valve Body and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
14	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 15 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
15	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the UD Pressure Switch Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the UD Pressure Switch Sense circuit for an open.. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 16	5-SPD AUTO-MATIC 5-45RFE TRANS
16	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the UD Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the UD Pressure Switch circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 17	5-SPD AUTO-MATIC 5-45RFE TRANS

P0875-UD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
17	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the UD Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the UD Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 18	5-SPD AUTO-MATIC 5-45RFE TRANS
18	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
19	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0876-UD PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0876-UD PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: This DTC is set if the UD pressure switch is in the wrong state for the current gear. For example, this code would be set if the UD pressure switch remained off while the transmission was in second gear.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT CONDITIONS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
UD PRESSURE SWITCH SENSE CIRCUIT OPEN
UD PRESSURE SWITCH CIRCUIT SHORT TO GROUND
UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
UD PRESSURE SWITCH
TCM - UD PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0876-UD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTCs P0890, P0891, and/or P0888 present? Yes → Refer to symptom list and perform test for Transmission Control Relay related DTC's. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	Ignition on, engine not running. With the DRBIII®, Check the STARTS SINCE SET counter for P0876. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Pressure Switch selector switch to UD. With the DRBIII®, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button? Yes → Go To 5 No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0876-UD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the UD Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the UD Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the UD Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the UD Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the UD Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the UD Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair. Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P0876-UD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Sump filter installed incorrectly. Reverse carrier snap ring dislodged (typically sets code on heavy throttle acceleration from a dead stop) Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0884-POWER UP AT SPEED

When Monitored and Set Condition:

P0884-POWER UP AT SPEED

When Monitored: When TCM (Transmission Control Module) initially powers-up.

Set Condition: If the TCM powers up and senses a valid forward gear PRNDL code and the output RPM is above 800 RPM (approximate. 32 km/h 20 MPH) the code will be set.

POSSIBLE CAUSES
POWER UP AT SPEED

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	This DTC is set when the TCM is initialized while the vehicle is moving down the road in a valid forward gear. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. **NOTE: Check all of the Fused B(+), Fused Ignition Switch Output, and ground circuits to the TCM for an intermittent open or short to ground.** If there are no possible causes remaining, view repair. Repair Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0888-RELAY OUTPUT ALWAYS OFF

When Monitored and Set Condition:

P0888-RELAY OUTPUT ALWAYS OFF

When Monitored: Continuously

Set Condition: This code is set when less than 3 volts are present at the transmission control relay output (pins 16,17 and 36) circuits at the Transmission Control Module (TCM) when the TCM is energizing the relay.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
FUSED B+ CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN
TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN
TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORTED TO GROUND
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORTED TO GROUND
TRANSMISSION CONTROL RELAY STUCK OPEN
TCM - TRANSMISSION CONTROL RELAY ALWAYS OFF

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0888-RELAY OUTPUT ALWAYS OFF — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter equal to 0? Yes → Go To 3 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Using a 12-volt test light connected to ground, check the Fused B(+) circuit in the Transmission Control Relay connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused B(+) circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Using a 12-volt test light connected to ground, check the all three Transmission Control Relay Output circuits in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly on all three circuits? Yes → Go To 5 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Transmission Control Relay Control circuit between the Transmission Control Relay connector and the TCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Transmission Control Relay Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS

P0888-RELAY OUTPUT ALWAYS OFF — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Transmission Control Relay ground circuit in the Transmission Control Relay connector.. Is the resistance above 5.0 ohms? Yes → Repair the Ground circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Transmission Control Relay Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Control Relay Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Transmission Control Relay Output circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Control Relay Output circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Measure the voltage of the Transmission Control Relay Output circuit in the TCM harness connector. Is the voltage above 10.0 volts? Yes → Replace the Transmission Control Relay. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS

P0888-RELAY OUTPUT ALWAYS OFF — Continued

TEST	ACTION	APPLICABILITY
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0890-SWITCHED BATTERY

When Monitored and Set Condition:

P0890-SWITCHED BATTERY

When Monitored: Ignition key is turned from ″off″ position to ″run″ position and/or ignition key is turned from ″crank″ position to ″run″ position.

Set Condition: This code is set if the Transmission Control Module (TCM) senses voltage on any of the pressure switch inputs prior to the TCM energizing the relay.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TCM- SWITCHED BATTERY

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0890-SWITCHED BATTERY — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, Check the STARTS SINCE SET counter for P0890. **NOTE: This counter only applies to the last DTC set.** Is the "Starts Since Set" counter equal to zero? Yes → Go To 3 No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2C Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the 2C Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay harness connector. Ignition on, engine not running. Measure the voltage of the 4C Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the 4C Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS

P0890-SWITCHED BATTERY — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the L/R Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the OD Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the OD Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the UD Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the UD Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS

P0890-SWITCHED BATTERY — Continued

TEST	ACTION	APPLICABILITY
8	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
9	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0891-TRANSMISSION RELAY ALWAYS ON

When Monitored and Set Condition:

P0891-TRANSMISSION RELAY ALWAYS ON

When Monitored: When ignition key is turned from ″off″ position to ″run″ position and/or ignition key is turned from ″crank″ position to ″run″ position.

Set Condition: This code is set if the Transmission Control Module (TCM) senses greater than 3 volts at the Trans Control Relay Output terminal(s) of the TCM prior to the TCM energizing the relay.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO VOLTAGE
TRANSMISSION CONTROL RELAY STUCK CLOSED
TCM - TRANSMISSION CONTROL RELAY ALWAYS ON

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0891-TRANSMISSION RELAY ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter equal to 0? Yes → Go To 3 No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage at the Transmission Control Relay Control circuit in the Transmission Control Relay connector. Is the voltage above 0.5 volts? Yes → Repair the Transmission Control Relay Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Transmission Control Relay from the PDC. Turn the ignition off to the lock position. Measure the voltage at the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Is the voltage above 0.5 volts? Yes → Repair the Transmission Control Relay Output circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Fused B(+) circuit and the Transmission Control Relay Output Circuit, Pins 30 and 87, of the Transmission Control Relay. Is the resistance above 5.0 ohms? Yes → Go To 6 No → Replace the Transmission Control Relay. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0891-TRANSMISSION RELAY ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0932-LINE PRESSURE SENSOR FAULT

When Monitored and Set Condition:

P0932-LINE PRESSURE SENSOR FAULT

When Monitored: Continuously with engine running.

Set Condition: If the Line Pressure Sensor (LPS) voltage is below 0.2 volts or above 4.75 volts the code will be set.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
5-VOLT SUPPLY CIRCUIT OPEN
GROUND CIRCUIT OPEN
LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
LINE PRESSURE SENSOR
TCM - HIGH LINE PRESSURE SENSOR
TCM - LOW LINE PRESSURE SENSOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0932-LINE PRESSURE SENSOR FAULT — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read the Line Pressure Sensor voltage. Is the Line Pressure Sensor voltage between 0.2 and 4.75 volts? Yes → Go To 3 No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
3	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool #8333. Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure. Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions. Note: The readings should be within ± 2.0 PSI on the DRBIII® of the pressure reading specified on Transmission Simulator. What is the Line Pressure Sensor voltage? Below 0.2 volts (241Kpa or 35 PSI). Go To 5 Between .2 and 4.75 volts (76 PSI) Go To 9 Above 4.75 volts (1586 Kpa or 230 PSI) Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Turn ignition switch to the lock position Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-Volt Supply circuit from the Line Pressure Sensor connector to the TCM connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt Supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS

P0932-LINE PRESSURE SENSOR FAULT — Continued

TEST	ACTION	APPLICABILITY
6	Turn ignition switch to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the 5-Volt Supply circuit and ground. Is the resistance Below 5.0 ohms? Yes → Repair the 5-volt Supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
7	Turn ignition switch to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Line Pressure Sensor Signal circuit and ground. Is the resistance Below 5.0 ohms? Yes → Repair the Line Pressure Sensor Signal circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS
8	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
9	If there are no possible causes remaining, view repair. Repair Replace the Line Pressure Sensor. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
10	Turn ignition switch to the lock position Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Ground circuit from the Line Pressure Sensor connector to the TCM connector. Is the resistance above 5.0 ohms? Yes → Repair the Ground circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS

P0932-LINE PRESSURE SENSOR FAULT — Continued

TEST	ACTION	APPLICABILITY
11	Turn ignition switch to the lock position Disconnect the TCM harness connector.. Disconnect the Line Pressure Sensor connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Line Pressure Sensor Signal circuit from the Line Pressure Sensor connector to the TCM connector. Is the resistance above 5.0 ohms? Yes → Repair the Line Pressure Sensor Signal circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 12	5-SPD AUTOMATIC 5-45RFE TRANS
12	Turn the ignition switch to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) and the Transmission Relay Output circuits in the relay connector. Turn ignition on. Measure the voltage of the Line Pressure Sensor Signal circuit in the TCM connector. Is the voltage above 5.5 volts? Yes → Repair the Line Pressure Sensor Signal circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS
13	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P0944-LOSS OF PRIME

When Monitored and Set Condition:

P0944-LOSS OF PRIME

When Monitored: If the transmission is slipping in any forward gear and the pressure switches are not indicating pressure, a loss of prime test is run.

Set Condition: If the transmission begins to slip in a forward gear and the pressure switch(s) that should be closed are open a loss of prime test begins. Available elements are turned on by the TCM to see if pump prime exists. The DTC sets if no pressure switch(s) respond.

POSSIBLE CAUSES
INVALID PRNDL CODE
INTERMITTENT OPERATION
TRANSMISSION OIL FILTER
OIL PUMP - LOSS OF PRIME

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0944-LOSS OF PRIME — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine. The transmission must be at operating temperature prior to checking pressure. A cold transmission will give higher readings. Firmly apply the brakes and place transmission in (R) reverse. With the DRBIII®, monitor the Transmission Line Pressure. Is the Line Pressure below 1034 kpa (150 PSI) or is it fluctuating more than +/- 69 kpa (10 PSI). No → Go To 3 Yes → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
3	The conditions necessary to set this DTC are not present at this time. Verify with the customer if a delayed engagement and/or an intermittent ″No Drive″ condition has occurred. If the customers answer is ″No″ erase the DTC and return the vehicle to the customer. Make sure to check for any TSBs or controller flash updates that my apply. Has the customer experienced any delayed engagement and/or ″No Drive″ conditions? Yes → Repair internal transmission problem as necessary. Replace the Transmission Oil Pump if inspection reveals no signs of internal seal leakage. Refer to the Service Information for the proper repair procedure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
4	Using the DRBIII®, perform a Shift Lever Position test. Follow the instructions on the DRBIII®. Did the Shift Lever Position Test pass? Yes → Go To 5 No → Refer to symptom list and perform the appropriate test for DTC P0706. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
5	Remove and inspect the Transmission Oil Pan per the Service Information. Remove and inspect the Primary Oil Filter per the Service Information. Inspect the oil filter O-ring for damage and proper installation. Does the Oil Pan contain excessive debris and/or is the Oil Filter plugged or O-ring damaged? Yes → Repair the cause of the plugged transmission oil filter or excessive debris, Seal installed onto filter neck instead of into pump bore, seal not fully seated against pump housing, filter neck not engaged into pump. See Service information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS

P0944-LOSS OF PRIME — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission or Transmission Oil Pump as necessary. Refer to the Service Information for the proper repair procedure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0987-4C HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0987-4C HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed > 1000 RPM, the TCM momentarily turns on element pressure to the clutch circuits that don't have pressure to identify the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets

POSSIBLE CAUSES
RELATED LINE PRESSURE DTC'S PRESENT
RELATED SPEED RATIO AND/OR PRESSURE SWITCH DTC PRESENT
POOR LINE PRESSURE SENSOR CONNECTION
TCM AND WIRING - LOW LINE PRESSURE
INTERMITTENT WIRING AND CONNECTORS
4C PRESSURE SWITCH SENSE CIRCUIT OPEN
5-VOLT SUPPLY CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
EXCESSIVE DEBRIS IN OIL PAN
INTERNAL TRANSMISSION - 4C PRESSURE TEST
TCM - 4C PRESSURE SWITCH
TCM - NO 5 VOLTS LOW LINE PRESSURE SENSOR

P0987-4C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other transmission DTC's Are there any Line Pressure related DTC's P0867, P0932, P0868, P0869, or P0944 present? Yes → Refer to symptom list and perform the appropriate test. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, check for other transmission DTC's Is the DTC P0734 and/or P0988 present also? Yes → Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	Perform a visual inspection of all connectors, wiring, and cooler connections before proceeding. Repair as necessary. With the DRBIII®, Check the STARTS SINCE SET counter for P0987. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 19	5-SPD AUTOMATIC 5-45RFE TRANS

P0987-4C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Start the engine. Warm the transmission to 82° C or 180° F. With the DRBIII®, monitor the Transmission Line Pressure. **CAUTION: Firmly apply the brakes.** With the brakes firmly applied, move the shift lever to each gear position and record the Transmission Line Pressure for each position. Allow the pressure to stabilize for at least 5 seconds in each range. Did the line pressure remain at a steady value between 586 and 655 Kpa or 85 and 95 PSI? Yes → Go To 6 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Ignition on, engine not running. With the DRBIII® in Sensors, monitor the Actual Line Pressure. While monitoring the Line Pressure, firmly push the Line Pressure Sensor harness connector towards the transmission. Did the Line Pressure change to about 207 kPa or 30 PSI when the harness connector was pushed Yes → Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch. **NOTE: All three DRBIII® Line Pressure readings should be steady and ± 2.0 PSI of the reading specified on the Transmission Simulator.** Ignition on, engine not running. With the DRBIII®, monitor the Line Pressure during the following step. Using the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions. Did the Line Pressure remain steady in all three positions? Yes → Replace the Line Pressure Sensor per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS

P0987-4C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 5-volt Supply circuit from the Line Pressure Sensor harness connector to the TCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 5-volt Supply circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTO-MATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Line Pressure Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 5-volt Supply circuit. Is the resistance below 5.0 ohms? Yes → Repair 5-volt supply circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTO-MATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
11	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. On the Transmission Simulator, place the Pressure Switch selector switch to 4C. With the DRBIII®, monitor the 4C Pressure Switch state. While monitoring the DRBIII® press the Pressure Switch Test button on the Transmission Simulator while wiggling the wiring pertaining to the 4C Pressure Switch. Did the 4C Pressure Switch state change to closed and remain closed while wiggling the wires? Yes → Go To 12 No → Go To 14	5-SPD AUTO-MATIC 5-45RFE TRANS

P0987-4C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
12	Remove and inspect Transmission Oil Pan per Service Information. Does the Transmission Oil Pan contain excessive debris or contamination? Yes → Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTOMATIC 5-45RFE TRANS
13	If there are no possible causes remaining, view repair. Repair Repair Internal Transmission as necessary. Disassemble and inspect the Valve Body and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
14	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 4C Pressure Switch Sense circuit between the TCM harness connector to the Solenoid/TRS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 4C Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 15	5-SPD AUTOMATIC 5-45RFE TRANS
15	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS harness connector. Remove the Transmission Control Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 16 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0987-4C HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
16	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 4C Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the 4C Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 17	5-SPD AUTO-MATIC 5-45RFE TRANS
17	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid/TRS harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 4C Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the 4C Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 18	5-SPD AUTO-MATIC 5-45RFE TRANS
18	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
19	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P0988-4C PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0988-4C PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: This DTC is set if the 4C pressure switch is in the wrong state for the current gear. For example, this code would be set if the 4C pressure switch came on while the transmission was in second gear.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT CONDITIONS
4C PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
4C PRESSURE SWITCH
TCM - 4C PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0988-4C PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTC's P0890, P0891, or P0888 present? Yes → Refer to symptom list and perform test for Transmission Control Relay related DTCs. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Ignition on, engine not running. With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0988, 2 or less? Yes → Go To 4 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator turn the Pressure Switch selector switch to 4C. With the DRBIII®, monitor the 4C Pressure Switch state while pressing the Pressure Switch Test button. Did the state of the 4C Pressure Switch change while pressing the Pressure Switch Test button? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 4C Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 4C Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS

P0988-4C PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 4C Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the 4C Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Control Module harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 4C Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the 4C Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P0988-4C PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Sump filter installed incorrectly. Reverse carrier snap ring dislodged (typically sets code on heavy throttle acceleration from a dead stop) Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1684-BATTERY WAS DISCONNECTED

When Monitored and Set Condition:

P1684-BATTERY WAS DISCONNECTED

When Monitored: Whenever the key is in the Run/Start position.

Set Condition: This code is set whenever Transmission Control Module - TCM is disconnected from battery power B+ or ground. It will also be set during the DRBIII® Battery Disconnect procedure.

POSSIBLE CAUSES
BATTERY WAS DISCONNECTED
DRBIII® BATTERY DISCONNECT PERFORMED
QUICK LEARN WAS PERFORMED
TCM WAS REPLACED OR DISCONNECTED
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	This DTC is an informational DTC only. This DTC is set due to a momentary loss of the Fused B(+) feed to the TCM. Continue to view the possible causes for this DTC. Continue Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS

P1684-BATTERY WAS DISCONNECTED — Continued

TEST	ACTION	APPLICABILITY
3	Has the battery been disconnected, lost it's charge, or been replaced recently? Yes → This is the cause of the DTC. Erase the DTC and return vehicle to customer. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Has a DRBIII® Battery Disconnect procedure been performed? Yes → This is the cause of the DTC. Erase the DTC and return the vehicle to customer. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Has a "QUICK LEARN" been performed with the DRBIII®? Yes → This is the cause of the DTC. Erase the DTC and return the vehicle to customer. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Has the TCM been replaced or disconnected? Yes → Replacing or disconnecting the TCM will set this DTC. Erase the DTC and return the vehicle to the customer. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. **NOTE: Check all power and ground circuits to the TCM for intermittent or high resistance circuits.** Wiggle the wires while checking for shorts and open circuits. Check for any TSB's or controller flash updates that may apply. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P1694-BUS COMMUNICATION WITH ENGINE MODULE

When Monitored and Set Condition:

P1694-BUS COMMUNICATION WITH ENGINE MODULE

When Monitored: Continuously with ignition key on.

Set Condition: If no bus messages are received from the Powertrain Control Module (PCM) for 10 seconds. Note: Some after market equipment will also set this DTC. example: remote starters and communication equipment.

POSSIBLE CAUSES
OTHER BUS PROBLEMS PRESENT
INTERMITTENT WIRING AND CONNECTORS
PCI BUS CIRCUIT OPEN
TCM - BUS PROBLEM

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter equal to zero? Yes → Go To 3 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS

P1694-BUS COMMUNICATION WITH ENGINE MODULE — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, attempt to communicate with other modules on the vehicle, check for evidence of a vehicle bus problem. Bus related DTC's in other modules point to an overall vehicle bus problem. Other symptoms such as a customer complaint of intermittent operation of bus controlled features also indicate a bus problem. Does the PRNDL display indicate ″No Bus″ or is there any evidence of an overall vehicle bus problem? Yes → Refer to the Communication Category and perform the appropriate symptom. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the PCM harness connectors. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the PCI Bus circuit from the PCM harness connector to the Data Link Connector. **NOTE: CAREFULLY PROBE THE DLC. DAMAGE TO THE DLC TERMINALS WILL RESULT IN POOR TERMINAL TO PIN CONNECTION.** Is the resistance above 5.0 ohms? Yes → Repair the open PCI Bus circuit between the PCM and the Data Link Connector. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Note: Some after market equipment will set this DTC. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1715-RESTRICTED PORT IN T3 RANGE

When Monitored and Set Condition:

P1715-RESTRICTED PORT IN T3 RANGE

When Monitored: Whenever the PRNDL code indicates Temp3.

Set Condition: This code sets whenever the conditions for a code P1776 (47) are satisfied with the shifter in the temp3 zone. This causes a restricted port.

POSSIBLE CAUSES
RELATED TRANSMISSION DTC'S PRESENT
CUSTOMER DRIVING HABITS
MISADJUSTED SHIFTER

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, check for other transmission DTC's Are any of the following DTC's P0731, P0732, P0733, P0734, P1736 or P0715 present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 2	5-SPD AUTO-MATIC 5-45RFE TRANS
2	Check Shifter adjustment per the Service Information. Adjust if necessary. Did the shifter need to be adjusted?. Yes → Adjust the shift linkage per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	This DTC can be set if the customer rests his or her hand on the shift lever while they are driving. The transmission can be put in the T3 position if just enough forward pressure is exerted on the shift lever. When this occurs, the feed port to the clutch is restricted, the transmission will declare neutral, and this DTC will be set. The customer should be informed not to rest his or her hand on the shifter while driving. This DTC can also be set by simply bumping the shift lever toward neutral while accelerating. If there are no possible causes remaining, view repair. Repair This DTC can be set by putting too much forward pressure on the shift lever while it is in the OD position. Make sure the customer is informed. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P1736-GEAR RATIO ERROR IN 2ND PRIME

When Monitored and Set Condition:

P1736-GEAR RATIO ERROR IN 2ND PRIME

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION INTERNAL - GEAR RATIO ERROR 2ND PRIME

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1736-GEAR RATIO ERROR IN 2ND PRIME — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's Are any of the DTC's P0944, P0715, P0720, P1794, P0867, P0932, P0868, or P0869 also present? Yes → If any of these DTCs are present, they will cause a speed ratio error. Refer to appropriate symptom in the Transmission category. Perform the test for P0944 first if it is present. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, perform the 2nd prime Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the clutch test pass, Input Speed remain at zero? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	The conditions to set this DTC are not currently present. Check the gearshift linkage adjustment. Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit. Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool # 8333. Gear ratio DTC's can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. If there are no possible causes remaining, view repair. Repair Repair as necessary. If a internal problem is present, refer to the Service information for the proper internal repair procedure. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Repair or replace transmission as necessary. If the transmission is to be repaired, and there were any line pressure DTC's present along with this DTC, make sure to inspect the pump and Pressure Control Solenoid per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION

When Monitored and Set Condition:

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION

When Monitored: During an attempted shift into 1st gear.

Set Condition: This code is set if three unsuccessful attempts are made to get into 1st gear in one given key start. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
RELATED DTC P0841 PRESENT
INTERMITTENT WIRING AND CONNECTORS
LR PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION - SOLENOID SWITCH VALVE STUCK
TCM - LR PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's Is the DTC P0841 present also? Yes → Refer to symptom list and perform test for P0841. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Perform a visual inspection of all connectors, wiring, and cooler connections before proceeding. Repair as necessary. With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P1775 at 2 or less? Yes → Go To 4 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Pressure Switch selector switch to LR. With the DRBIII®, monitor the LR Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission as necessary. Inspect the Solenoid Switch Valve per the Service Information and repair or replace as necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the LR Pressure Switch Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the LR Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the LR Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the LR Pressure Switch Sense circuit short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the LR Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the LR Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. This DTC can also be set by the SSV intermittently sticking in it's bore under extreme temperature conditions. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION

When Monitored and Set Condition:

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION

When Monitored: Continuously when doing partial or full EMCC - PEMCC or FEMCC.

Set Condition: If the transmission senses the L/R pressure switch closing while performing PEMCC or FEMCC. This code will be set after two unsuccessful attempts to perform PEMCC or FEMCC. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
RELATED DTC P0841 PRESENT
INTERMITTENT WIRING AND CONNECTORS
LR PRESSURE SWITCH SENSE CIRCUIT OPEN
LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION - SOLENOID SWITCH VALVE STUCK
TCM - LR PRESSURE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's Is the DTC P0841 present also? Yes → Refer to symptom list and perform the appropriate test for DTC P1784. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Perform a visual inspection of all connectors, wiring, and cooler connections before proceeding. Repair as necessary. With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Pressure Switch selector switch to LR. With the DRBIII®, monitor the LR Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the state of the LR Pressure Switch change while pressing the Pressure Switch Test button? Yes → Go To 5 No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem as necessary. Inspect the Solenoid Switch Valve per the Service Information and repair or replace as necessary. If no problems are found, replace the Solenoid/TRS Assembly per the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the LR Pressure Switch Sense circuit from the TCM harness connector to the Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the LR Pressure Switch Sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the LR Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the LR Pressure Switch Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Measure the voltage of the L/R Pressure Switch Sense circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the LR Pressure Switch Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Transmission Solenoid/TRS Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION — Continued

TEST	ACTION	APPLICABILITY
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. This DTC can also be set by the Solenoid Switch Valve intermittently sticking in it's bore under extreme temperature conditions. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1790-FAULT IMMEDIATELY AFTER SHIFT

When Monitored and Set Condition:

P1790-FAULT IMMEDIATELY AFTER SHIFT

When Monitored: After a speed ratio error is stored.

Set Condition: This code is set if the associated speed ratio code is stored within 1.3 seconds after a shift.

POSSIBLE CAUSES
FAULT AFTER SHIFT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	This DTC is set along with a speed ratio DTC. Perform the appropriate test for the Speed Ratio DTC stored. Check 1 trip failures if there are no speed ratio codes current. If there are no possible causes remaining, view repair. Repair This code is set if an associated speed ratio code is stored within 1.3 seconds after a shift. Perform the appropriate speed ratio DTC test. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1793-TRD LINK COMMUNICATION ERROR

When Monitored and Set Condition:

P1793-TRD LINK COMMUNICATION ERROR

When Monitored: During torque managed shifts with Throttle angle above 54 degrees. This system is also tested whenever the vehicle is stopped and the engine speed is below 1000 RPM.

Set Condition: This code is set when the Transmission Control Module sends two subsequent Torque Reduction messages (pulses the TRD ckt to ground) to the Powertrain Control Module via the TRD link circuit and the TCM does not receive a confirmation from the PCM over the communication bus.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT WIRING & CONNECTORS
TORQUE MANAGEMENT REQUEST SENSE CIRCUIT OPEN
TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORT TO GROUND
TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORTED TO VOLTAGE
PCM - TRD LINK COMMUNICATION ERROR
TCM - TRD LINK COMMUNICATION ERROR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1793-TRD LINK COMMUNICATION ERROR — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's Are any of the DTCs P1694, P0731, P0732, P0733, P0734, or P1736 present also? Yes → If any of these DTCs are present, disregard the P1793 DTC. Refer to the symptom list and perform the diagnostics for the other DTC's first. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET equal to zero? Yes → Go To 4 No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the PCM harness connector(s). **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Torque Management Request Sense circuit from the TCM harness connector to the PCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the open Torque Management Request Sense circuit. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the PCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Torque Management Request Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Torque Management Request Sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS

P1793-TRD LINK COMMUNICATION ERROR — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Torque Management Request Sense circuit in the TCM harness connector. Is the voltage above 10.5 volts? Yes → Repair the Torque Management Request Sense circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition switch to the lock position. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the Torque Management Request Sense circuit in the TCM connector. Is the voltage above 7.0 volts? Yes → Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	If there are no possible causes remaining, view repair. Repair Replace the Powertrain Control Module. Perform POWERTRAIN VERIFICATION TEST VER - 2.	5-SPD AUTOMATIC 5-45RFE TRANS
9	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P1794-SPEED SENSOR GROUND ERROR

When Monitored and Set Condition:

P1794-SPEED SENSOR GROUND ERROR

When Monitored: The gear ratio is monitored continuously while the Transmission is in gear.

Set Condition: After a TCM reset in neutral and a ratio of input to output, of 1 to 2. This DTC can take up to five minutes of problem identification before illuminating the MIL.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
SPEED SENSOR GROUND CIRCUIT OPEN
SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
TCM - SPEED SENSOR GROUND CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Engine Running. Shift lever in park. With the DRBIII®, read the Transmission Output and Input Speed Sensor states. Is the Output Speed Sensor reading twice the Input Speed Sensor reading? Yes → Go To 3 No → Go To 8	5-SPD AUTO-MATIC 5-45RFE TRANS

P1794-SPEED SENSOR GROUND ERROR — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator Miller tool 8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, set the Input/Output Speed selector switch to the ″3000/1000″ position. Turn the Input/Output Speed switch to ″ON″. With the DRBIII®, monitor the Input and Output Speed Sensor state. Does the input speed read 3000 RPM and the Output speed read 1000 RPM, within 50 RPM? Yes → Go To 8 No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input and Output Speed Sensor harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly, Input, and Output Speed Sensor harness connectors. Is the resistance above 5.0 ohms on any of the above measurements? Yes → Repair the Speed Sensor Ground circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the Input and Output Speed Sensor harness connectors. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Input Sensor Ground circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair the Speed Senor Ground circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTO-MATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Input and Output Speed Sensors. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Speed Sensor Ground circuit. Is the voltage above 0.5 volt? Yes → Repair the Speed Sensor Ground circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTO-MATIC 5-45RFE TRANS

P1794-SPEED SENSOR GROUND ERROR — Continued

TEST	ACTION	APPLICABILITY
7	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
8	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P1799-CALCULATED OIL TEMP IN USE

When Monitored and Set Condition:

P1799-CALCULATED OIL TEMP IN USE

When Monitored: Whenever the engine is running.

Set Condition: The DTC will set if any of the three conditions are present. Thermistor voltage (Transmission Temperature Sensor) out of range. Continuous erratic thermistor voltage is sensed. Thermistor Temperature stays low for an extended period of time.

POSSIBLE CAUSES
INTERMITTENT WIRING & CONNECTORS
SPEED SENSOR GROUND CIRCUIT OPEN
TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION TEMPERATURE SENSOR - INOPERATIVE
TCM - CALCULATED OIL TEMP IN USE
TCM - TRANSMISSION TEMPERATURE SENSOR HIGH
TCM - TRANSMISSION TEMPERATURE SENSOR LOW

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1799-CALCULATED OIL TEMP IN USE — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, Check the STARTS SINCE SET counter. **Note: This counter only applies to the last code set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 3 No → Go To 12	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove Starter Relay can cause a TCM - No Response condition.** Install Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Input/Output switch to OFF. With the DRBIII®, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator. Compare the DRBIII® readings with the numbers listed on the Transmission Simulator. Pick one of the following that best matches your readings. DRBIII® readings always high. Go To 4 DRBIII® readings = simulator +/- 0.25 V Go To 9 DRBIII® readings always low Go To 10 DRBIII® readings erratic. Go To 12	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS

P1799-CALCULATED OIL TEMP IN USE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector.. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Transmission Temperature Sensor Signal circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Transmission Temperature Sensor Signal circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the Input and Output Speed Sensors. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Speed Sensor Ground circuit. Is the voltage above 0.5 volt? Yes → Repair the Speed Sensor Ground circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the Transmission Temperature Sensor Signal circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Transmission Temperature Sensor Signal circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	5-SPD AUTOMATIC 5-45RFE TRANS
8	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P1799-CALCULATED OIL TEMP IN USE — Continued

TEST	ACTION	APPLICABILITY
9	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS assembly as required. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
10	Turn the ignition off to the lock position. Disconnect the TCM harness connector.. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Transmission Temperature Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Temperature Sensor Signal circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	5-SPD AUTO-MATIC 5-45RFE TRANS
11	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
12	Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Check for any applicable TSB's that may apply. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 13	5-SPD AUTO-MATIC 5-45RFE TRANS
13	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
P2700-INADEQUATE ELEMENT VOLUME LR

When Monitored and Set Condition:

P2700-INADEQUATE ELEMENT VOLUME LR

When Monitored: Whenever the engine is running. The LR volume is updated during a 3-1 or 2-1 manual downshift with throttle angle below 5 degrees. Trans temp must be at least 43 C (110 F)

Set Condition: When the LR volume falls below 16.

POSSIBLE CAUSES
INTERNAL TRANSMISSION - LR CLUTCH VOLUME INDEX LOW
TCM - LR CLUTCH VOLUME INDEX LOW

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, erase DTC″s **NOTE: The TRANS TEMP DEG must be at least 43°C or 110°F before performing the following steps.** Drive the vehicle and perform at least ten 3-1 manual downshifts at closed throttle from speeds of about 32 km/h or 20 MPH. With the DRBIII®, read the LR CL VOL INDEX. Is the LR CL VOL INDEX below 20? Yes → Go To 3 No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS

P2700-INADEQUATE ELEMENT VOLUME LR — Continued

TEST	ACTION	APPLICABILITY
3	If there are no possible causes remaining, view repair. Repair Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure for components related to the LR clutch. A broken or weak return spring or a dislocated snap ring could cause this problem. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
4	**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 km/h or 50 MPH, then brake lightly to a stop. Turn off engine. With the DRBIII®, record the CL VOL INDEX (CVI) for all clutches. With the DRBIII®, perform a BATTERY DISCONNECT. With the DRBIII®, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT. Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT? Yes → Go To 5 No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P2701-INADEQUATE ELEMENT VOLUME 2C

When Monitored and Set Condition:

P2701-INADEQUATE ELEMENT VOLUME 2C

When Monitored: Whenever the engine is running. The 2C volume is updated during a 3-2 kickdown with throttle angle between 10 and 54 degrees. Trans temp must be at least 43 C (110 F)

Set Condition: When the 2C volume falls below 5.

POSSIBLE CAUSES
INTERNAL TRANSMISSION - 2C CLUTCH VOLUME INDEX LOW
TCM - 2C CLUTCH VOLUME INDEX LOW

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P2701-INADEQUATE ELEMENT VOLUME 2C — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, erase DTC″s Drive the vehicle at about 80 km/h or 50 MPH, then depress the OD off button. This will put the vehicle into third gear. **NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Perform at least ten 3-2 kickdowns by depressing the throttle between 10 and 54 TPS DEGREES at speeds of about 80 km/h or 50 MPH. With the DRBIII®, read the 2C CL VOL INDEX. Is the 2C CL VOL INDEX below 10? Yes → Go To 3 No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
3	If there are no possible causes remaining, view repair. Repair Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure for components related to the 2C clutch. A broken or weak return spring or a dislocated snap ring could cause this problem. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
4	**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 km/h or 50 MPH, then brake lightly to a stop. Turn off engine. With the DRBIII®, record the CL VOL INDEX (CVI) for all clutches With the DRBIII®, perform a BATTERY DISCONNECT. With the DRBIII®, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT. Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT? Yes → Go To 5 No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P2702-INADEQUATE ELEMENT VOLUME OD

When Monitored and Set Condition:

P2702-INADEQUATE ELEMENT VOLUME OD

When Monitored: Whenever the engine is running. The OD volume is updated during a 2-3 upshift with throttle angle between 10 and 54 degrees. Trans temp must be at least 43 C (110 F)

Set Condition: When the OD volume falls below 5.

POSSIBLE CAUSES
INTERNAL TRANSMISSION - O/D CLUTCH VOLUME INDEX LOW
TCM- OD CLUTCH VOLUME INDEX LOW

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, erase DTC″s **NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Drive the vehicle and perform at least ten 2-3 upshifts with the throttle between 10 and 54 TPS DEGREES. With the DRBIII®, read the OD CL VOL INDEX. Is the OD CL VOL INDEX below 10? Yes → Go To 3 No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS

P2702-INADEQUATE ELEMENT VOLUME OD — Continued

TEST	ACTION	APPLICABILITY
3	If there are no possible causes remaining, view repair. Repair Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure for components related to the OD clutch. A broken or weak return spring or a dislocated snap ring could cause this problem. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
4	**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 km/h or 50 MPH, then brake lightly to a stop. Turn off engine. With the DRBIII®, record the CL VOL INDEX (CVI) for all clutches. With the DRBIII®, perform a BATTERY DISCONNECT. With the DRBIII®, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT. Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT? Yes → Go To 5 No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P2703- INADEQUATE ELEMENT VOLUME UD

When Monitored and Set Condition:

P2703- INADEQUATE ELEMENT VOLUME UD

When Monitored: Whenever the engine is running. The UD volume is updated during a 4-3 kickdown with throttle angle between 10 and 54 degrees. Trans temp must be at least 43 C (110 F)

Set Condition: When the UD volume falls below 11.

POSSIBLE CAUSES
INTERNAL TRANSMISSION - UD CLUTCH VOLUME INDEX LOW
TCM- UD CLUTCH VOLUME INDEX LOW

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, erase DTC″s **NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Drive the vehicle and perform at least ten 4-3 kickdowns by depressing the throttle between 30 and 54 TPS DEGREES at speeds about 80 km/h or 50 MPH. With the DRBIII®, read the UD CL VOL INDEX. Is the UD CL VOL INDEX below 10? Yes → Go To 3 No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS

P2703- INADEQUATE ELEMENT VOLUME UD — Continued

TEST	ACTION	APPLICABILITY
3	If there are no possible causes remaining, view repair. Repair Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure for components related to the UD clutch. A broken or weak return spring or a dislocated snap ring could cause this problem. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
4	**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 km/h or 50 MPH, then brake lightly to a stop. Turn off engine. With the DRBIII®, record CL VOL INDEX (CVI) for all clutches. With the DRBIII®, perform a BATTERY DISCONNECT. With the DRBIII®, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT. Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT? Yes → Go To 5 No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P2704-INADEQUATE ELEMENT VOLUME 4C

When Monitored and Set Condition:

P2704-INADEQUATE ELEMENT VOLUME 4C

When Monitored: Whenever the engine is running. The 4C volume is updated during a 3-4 upshift with throttle angle between 10 and 54 degrees. Trans temp must be at least 43 C (110 F)

Set Condition: When the 4C volume falls below 5.

POSSIBLE CAUSES
INTERNAL TRANSMISSION - 4C CLUTCH VOLUME LOW
TCM- 4C VOLUME LOW

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P2704-INADEQUATE ELEMENT VOLUME 4C — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: Check the Transmission Fluid Level. If the Transmission Fluid is low, repair any Transmission Fluid leak as necessary and adjust the Transmission Fluid Level per the Service Information.** With the DRBIII®, record the 4C CL VOL INDEX. With the DRBIII®, erase DTC's. Perform at least 10 3-4 upshifts with the throttle between 10 and 54 degrees. The Transmission Temperature must be at least 43°C or 110 °F. With the DRBIII®, read the 4C CL VOL INDEX. Is the current 4C CL VOL INDEX below 10? Yes → Go To 3 No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
3	If there are no possible causes remaining, view repair. Repair Repair or replace the transmission as necessary per the Service Information. Pay special attention to the mechanical components related to the 4th clutch. A deteriorated return spring or a dislocated snap ring could cause this problem. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
4	Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 50 MPH, then brake lightly to a stop. Turn off engine. With the DRBIII®, observe and record CVI's. With the DRBIII®, perform a battery disconnect. With the DRBIII®, Observe CVI's Are any of the CVI's less than 5 or are they different than before the battery disconnect? Yes → Go To 5 No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
P2706-MS SOLENOID CIRCUIT

When Monitored and Set Condition:

P2706-MS SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a gear ratio or pressure switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
MS SOLENOID CONTROL CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND
MS SOLENOID CIRCUIT SHORT TO VOLTAGE
MS SOLENOID INOPERATIVE
TCM - MS SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing transmission symptom diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSB's related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P2706-MS SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other transmission DTC's. Are there any Transmission Control Relay related DTCs P0890, P0891, and/or P0888 present? Yes → Refer to symptom list and perform test for Transmission Control Relay related DTCs. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, Check the STARTS SINCE SET counter for P2706. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P2706 set at 0? Yes → Go To 4 No → Go To 11	5-SPD AUTOMATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Remove the Starter Relay from the PDC. **NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.** Install the Transmission Simulator, Miller tool #8333. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running.. With the DRBIII®, actuate the MS Solenoid. Monitor the MS Solenoid LED on the Transmission Simulator. Did the LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly as required. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the MS Solenoid Control circuit between the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the MS Solenoid Control circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS

P2706-MS SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/TRS harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the MS Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the MS Solenoid Control circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	5-SPD AUTOMATIC 5-45RFE TRANS
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the MS Solenoid Control circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the MS Solenoid Control circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	5-SPD AUTOMATIC 5-45RFE TRANS
10	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. WITH THE DRBIII® PERFORM QUICK LEARN Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

P2706-MS SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Check for any applicable TSB that may apply. Wiggle the wires while checking for shorts or open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*BACKUP LAMPS COME ON WHILE SHIFTER IS NOT IN REVERSE POSITION

POSSIBLE CAUSES
BACKUP SUPPLY CIRCUIT SHORT TO VOLTAGE
TRANSMISSION RANGE SENSOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Firmly apply brakes. Place the Shift Lever in the position which causes the Backup Lamps to come on at the wrong time. Do the Backup Lamps come while the shifter is not in Reverse? Yes → Go To 2 No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS
2	Ignition on, engine not running. Place the shift lever in a position that causes the Backup Lamps to come on when they should not. Disconnect the Transmission Solenoid /TRS Assembly harness connector. **NOTE: This will cause a DTC to be stored in the TCM. They must be erased before returning the vehicle to the customer.** Did the Backup Lamps go out when the connector was disconnected? Yes → Go To 3 No → Go To 4	5-SPD AUTO-MATIC 5-45RFE TRANS
3	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly as required. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/TRS Assembly harness connector. Ignition on, engine not running. Measure the voltage of the Backup Light Supply circuit in the Solenoid/TRS harness connector. Is the voltage above 0.5 volt? Yes → Repair the Backup Lights Supply circuit for a short to voltage. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
*BACKUP LAMPS INOPERATIVE

POSSIBLE CAUSES
BACK UP LAMP GROUND CIRCUIT OPEN
BACKUP LAMP SUPPLY CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
BACKUP LAMP SUPPLY CIRCUIT SHORT TO GROUND
OPEN BACKUP LAMP BULBS
TRANSMISSION RANGE SENSOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Place foot firmly on brake pedal. Place the shift lever in the reverse position. Do either of the Backup Lamps work? Yes → Test Complete. No → Go To 2	5-SPD AUTOMATIC 5-45RFE TRANS
2	Turn the ignition off to the lock position. Install Transmission Simulator Miller tool #8333. Ignition on, engine not running. Press the Reverse Light Test button on the Transmission Simulator while observing the Backup Lamps. Do either of the Backup Lamps come on? Yes → Go To 3 No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
3	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly as required.	5-SPD AUTOMATIC 5-45RFE TRANS
4	Remove the Backup Lamp bulb. Using a 12-volt test light connected to 12-volts, check the Backup Lamp ground circuit. Does the light illuminate brightly? Yes → Go To 5 No → Repair the bad ground circuit to the Back up Lamp bulb socket.	5-SPD AUTOMATIC 5-45RFE TRANS
5	Remove both Backup Lamp bulbs. Measure the resistance of both Backup Lamp bulbs. Is the resistance above 5.0 ohms for either Backup Lamp bulbs? Yes → Replace the Backup Lamp bulb or bulbs as required. No → Go To 6	5-SPD AUTOMATIC 5-45RFE TRANS

*BACKUP LAMPS INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Remove the Backup Lamp bulb. Disconnect the Transmission Solenoid /TRS Assembly harness connector. Measure the resistance of the Backup Lamp Supply circuit from the Backup lamp Socket to the Solenoid/TRS connector. Is the resistance above 5.0 ohms? Yes → Repair the Backup Lamp circuit for an open. No → Go To 7	5-SPD AUTOMATIC 5-45RFE TRANS
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid /TRS harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit. Does the light illuminate brightly? Yes → Go To 8 No → Repair the Fused Ignition Switch Output circuit for an open. Check fuse and replace, if necessary repair cause of open fuse. Possible short to ground or excessive resistance.	5-SPD AUTOMATIC 5-45RFE TRANS
8	Turn the ignition off to the lock position. Remove the Backup Lamp bulb. Disconnect the Transmission Solenoid/TRS connector. Measure the resistance between the Backup Lamp Supply circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair the Backup Supply Lamp circuit for a short to ground.. Check fuse and replace if necessary. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*BUMP FELT SHORTLY AFTER STOP WITH NO DTC'S PRESENT

POSSIBLE CAUSES
STICKING SLIP JOINT

TEST	ACTION	APPLICABILITY
1	This condition is normally caused by a stick and slip condition between the prop shaft slip joint and the transfer case output shaft. If there are no possible causes remaining, view repair. Repair Check for TSB's relating to this condition.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:

*BUMP FELT WHILE COASTING IN NEUTRAL WITH NO DTC'S PRESENT

TEST	ACTION	APPLICABILITY
1	Check for a TCM flash update or TSB to address this issue. Perform the drive learn procedure for the LR clutch element. **NOTE: Some bump while coasting in neutral is normal.** Perform the above procedures to reduce excessive bump in neutral. Repair Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*CHECKING PARK/NEUTRAL SWITCH OPERATION

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
PARK/NEUTRAL SWITCH SENSE CIRCUIT OPEN
PARK/NEUTRAL SWITCH SENSE CIRCUIT SHORT TO GROUND
PARK/NEUTRAL POSITION SWITCH
POWERTRAIN CONTROL MODULE - PARK NEUTRAL SWITCH

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, monitor the PNP Switch Input status. Move the gear selector through all gear positions, Park to 1st and back to Park. Did the DRB display P/N and D/R in the correct gear positions? Yes → Go To 2 No → Go To 3	5-SPD AUTO-MATIC 5-45RFE TRANS
2	The condition is not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	5-SPD AUTO-MATIC 5-45RFE TRANS
3	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the PNP Switch harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance of the PNP Switch Sense circuit between the PCM harness connector and the PNP Switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the PNP switch sense circuit for an open. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
4	Ignition on, engine not running. Disconnect the PCM harness connector. Disconnect the PNP Switch harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between the PNP Switch Sense Circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair the PNP switch sense circuit for a short to ground. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	5-SPD AUTO-MATIC 5-45RFE TRANS

*CHECKING PARK/NEUTRAL SWITCH OPERATION — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Check connectors - Clean/repair as necessary Move the gear selector through all gear positions, from Park to 1st and back. While moving the gear selector through the gear positions, measure the resistance between ground and the PNP Switch Sense circuit in the PCM harness connector. Did the display change from above 10.0 ohms to below 10.0 ohms? Yes → Go To 6 No → Replace the Park/Neutral Position Switch in accordance with the Service Information. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS
6	If there are no possible causes remaining, view repair. Repair Replace the Powertrain Control Module. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTO-MATIC 5-45RFE TRANS

Symptom:
*POOR SHIFT QUALITY

POSSIBLE CAUSES
POOR SHIFT QUALITY

TEST	ACTION	APPLICABILITY
1	Check the transmission fluid level per the service information. Is the fluid level ok? Yes → Test Complete. No → Correct the fluid level as necessary. Check and repair all leaks in the transmission if the fluid level is low. Note: This is one possible cause of poor shift quality. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*TRANSMISSION NOISY WITH NO DTC'S PRESENT

POSSIBLE CAUSES
INCORRECT FLUID LEVEL
INTERNAL TRANSMISSION PROBLEM - NOISY WHILE DRIVING
INTERNAL TRANSMISSION PROBLEM - NOISY WHILE STANDING STILL

TEST	ACTION	APPLICABILITY
1	Check and adjust the oil level per the service information before continuing. Place vehicle on hoist. Run vehicle on hoist under conditions necessary to duplicate the noise. Using Chassis Ears or other suitable device, verify that the noise is coming from the transmission. Is the noise coming from the transmission? Yes → Go To 2 No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS
2	Check the transmission fluid level per the Service Information. **NOTE: The transmission must be hot when checking oil level. When the temperature is below 10° Celsius 50° Fahrenheit it is possible that no oil will show on the dipstick, even though the transmission has an adequate fill level when warm.** Is the fluid level OK? Yes → Go To 3 No → Adjust fluid level. Repair cause of incorrect fluid level. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the shift lever in neutral, raise the engine speed and listen to the noise. **Note: Make sure the radio is turned OFF. Alternator noise can come through the speakers and be misinterpreted as Transmission Pump Whine. This can happen even with the volume turned down, THE RADIO MUST BE TURNED OFF.** Does the noise get louder or change pitch while the engine speed is changing? Yes → Go To 4 No → Go To 5	5-SPD AUTOMATIC 5-45RFE TRANS
4	The transmission has an internal problem and must be replaced or repaired. If the transmission is to be repaired, inspect all of the transmission components for signs of wear. Pay particular attention to bearings in front half of transmission. If no problems found, replace oil pump.. If there are no possible causes remaining, view repair. Repair Replace transmission or repair internal transmission problem as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

*TRANSMISSION NOISY WITH NO DTC'S PRESENT — Continued

TEST	ACTION	APPLICABILITY
5	View repair options. Repair Repair internal transmission problem as necessary. If the transmission is to be repaired, inspect all of the transmission components for signs of wear. Pay particular attention to bearings, pinion gears, etc. Repair or replace as necessary. Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:

*TRANSMISSION SHIFTS EARLY WITH NO DTC'S

POSSIBLE CAUSES
COLD TRANSMISSION
BUS PROBLEMS
INTERMITTENT WIRING & CONNECTORS

TEST	ACTION	APPLICABILITY
1	If the transmission shifts too early when the transmission is cold, this is a normal condition. Did the problem occur when the transmission temperature was cold? Yes → The software is designed to protect the transmission from high torque and/or high RPM shifts during cold operation. No → Go To 2	5-SPD AUTOMATIC 5-45RFE TRANS
2	Using the DRBIII®, attempt communication with other Modules, check for signs of a bus problem such as bus related DTC's and/or communication problems. Although it takes two occurences of a missed TRD link message to set the fault code, one missed message will cause the transmission to short shift until the next start up. If the vehicle has any indications of a bus problem, the bus must be repaired first Do any of the other modules show signs of a bus problem? Yes → Refer to the appropriate category for the bus problem. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	Using the schematics as a guide, inspect the wiring and connectors specific to the Torque Management Request Sense circuit. Wiggle the wires while checking for shorts and open circuits. Although it takes two occurences of a missed TRD link message to set the fault code, one missed message will cause the transmission to short shift until the next start up. If the vehicle has any indications of a bus problem, the bus must be repaired first Were any problems found? Yes → Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*TRANSMISSION SHIFTS ROUGH AFTER TCM REPLACEMENT OR REFLASH

POSSIBLE CAUSES
TRANSMISSION SHIFTS ROUGH AFTER TCM REPLACEMENT OR REFLASH

TEST	ACTION	APPLICABILITY
1	Perform this procedure if the transmission shifts rough after TCM was replaced or Reflashed. Does the transmission shift rough after a TCM replacement or Reflash? Yes → Perform Quick Learn and the Drive Learn Procedure No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*TRANSMISSION SIMULATOR WILL NOT POWER UP

TEST	ACTION	APPLICABILITY
1	**Note: If the transmission simulator tool 8333 will not power up, this is a symptom of the transmission relay being open (such as Limp-in) and/or this also could be a indication of the trans simulator not installed correctly on the vehicle.** **Note: Check the simulator ground cable connection.** Repair these symptoms before having the transmission simulator 8333 repaired. Continue Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Symptom:
*VEHICLE IS SLUGGISH WITH NO DTC'S PRESENT

POSSIBLE CAUSES
ENGINE VISCOUS FAN
COLD TRANSMISSION
BUS PROBLEMS
INTERMITTENT WIRING & CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Engine viscous fan sticking can cause this complaint.** Check the engine viscous fan for proper operation per the service information. Does the engine fan operate correctly? Yes → Repair the engine viscous fan per the Service Information. No → Go To 2	5-SPD AUTOMATIC 5-45RFE TRANS
2	If the transmission shifts too early when the transmission is cold, this is a normal condition. Did the problem occur when the transmission temperature was cold? Yes → The software is designed to protect the transmission from high torque and/or high RPM shifts during cold operation. No → Go To 3	5-SPD AUTOMATIC 5-45RFE TRANS
3	With the DRBIII®, attempt communications with other Modules, check for signs of a bus problem such as bus related DTC's and/or communication problems. Although it takes two occurences of a missed TRD link message to set the fault code, one missed message will cause the transmission to short shift until the next start up. If the vehicle has any indications of a bus problem, the bus must be repaired first Do any of the other modules show signs of a bus problem? Yes → Refer to the appropriate category for the bus problem. No → Go To 4	5-SPD AUTOMATIC 5-45RFE TRANS
4	Using the schematics as a guide, inspect the wiring and connectors specific to the Torque Management Request Sense circuit. Wiggle the wires while checking for shorts and open circuits. Although it takes two occurences of a missed TRD link message to set the fault code, one missed message will cause the transmission to short shift until the next start up. If the vehicle has any indications of a bus problem, the bus must be repaired first Were any problems found? Yes → Repair as necessary. No → Test Complete.	5-SPD AUTOMATIC 5-45RFE TRANS

Verification Tests

45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. Connect the DRBIII® to the Data Link Connector. 2. Reconnect any disconnected components. 3. With the DRBIII®, erase DTC's. 4. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT above 43° Celsius 110° Fahrenheit. 5. Check the Transmission fluid and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure. **6. NOTE: If the TCM has been replaced or if the transmission has been repaired or replaced it is necessary to perform the DRBIII® Quick Learn Procedure.** 7. Road test the vehicle. With the DRBIII®, monitor TPS. Make fifteen to twenty 1-2, 2-3, and 3-4 upshifts and (4 - 4prime for 545RFE only). 8. Perform these shifts from a standing start to 97 Km/h 60 MPH with a constant throttle opening of 20 to 25 degrees. 9. Below 40 Km/h 25 MPH, make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 10. Check for DTC's during the road test. **11. NOTE: Use the EATX OBDII task manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.** Were any Trouble Codes set during the road test? Yes → Refer to the Symptom List for the appropriate diagnostic tests. No → Repair is complete.	All

POWERTRAIN VERIFICATION TEST VER - 2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a NO TROUBLE CODE repair, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes or the symptom no longer exists, the repair was successful and testing is complete. 4. If the initial or another symptom exists, the repair is not complete. Check all technical service bulletins or flash updates and return to Symptoms if necessary. 5. If this verification procedure is being performed after a DTC repair, perform steps 6 through 13. 6. Connect the DRBIII® to the data link connector. Using the DRBIII® erase any diagnostic trouble codes and reset all values. 7. If the PCM was not replaced, skip steps 8 through 10 and continue with the verification. 8. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer System (SKIS), Secret Key data must be updated to enable start. 9. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 10. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 11. Road test the vehicle. If the test is for an A/C DTC, ensure it is operating during the following test. 12. Drive the vehicle for at least 5 minutes at or around 64 Kmh (40 mph). Ensure the transmission shifts through all gears. At some point stop the vehicle and turn off the engine for at least 10 seconds. 13. With the DRBIII®, read DTCs. Are there any DTC(s) present? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	5-SPD AUTO-MATIC 5-45RFE TRANS

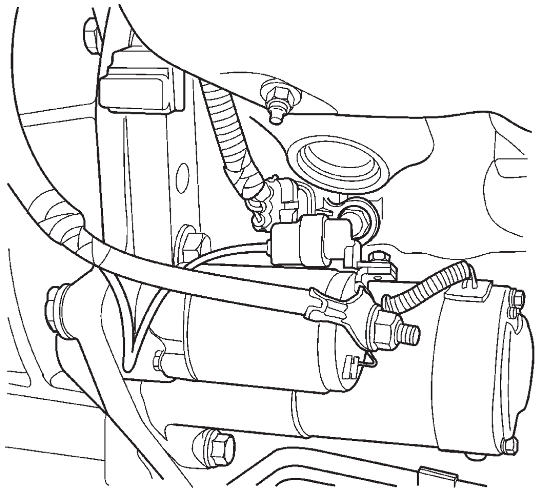
Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 5	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If any existing diagnostic trouble codes have not been repaired, go to the appropriate Symptom List and follow path specified. 3. Connect the DRBIII® to the data link connector. 4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories. 5. If the PCM was not replaced skip steps 6 through 8 and continue the verification. 6. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 7. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 8. For SKIM theft alarm: Connect DRBIII® to data link connectorto Theft Alarm, SKIM, Misc. and place SKIM in secured access mode by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM. 9. If the Catalyst was replaced, with the DRBIII® go to the miscellaneous Menu Option ″Catalyst Replaced″ and press enter. 10. If a Comprehensive Component DTC was repaired, perform steps 11 and 13. If a Major OBDII Monitor DTC was repaired skip step 11 and continue the verification. 11. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes. 12. With the DRBIII®, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running). 13. If the conditions cannot be duplicated, erase all DTCs with the DRBIII®. Did the OBD II monitor run successfully and has the Good Trip Counter changed to one or more? Yes → Repair is complete. No → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptoms list (Diagnostic Procedure).	5-SPD AUTOMATIC 5-45RFE TRANS

NOTES

8.0 COMPONENT LOCATIONS

8.1 CRANKSHAFT POSITION SENSOR



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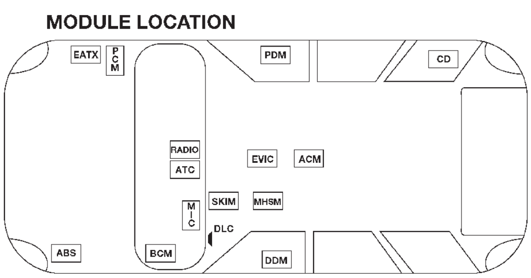
8.2 ELECTRONIC MODULE LOCATIONS



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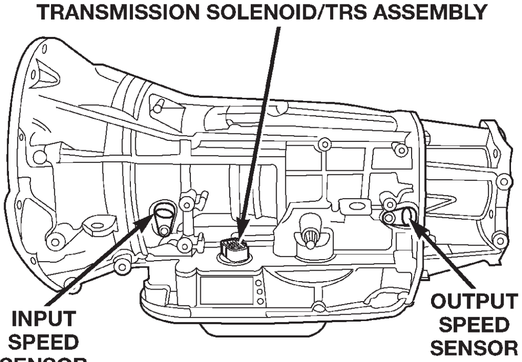
8.3 TRANSMISSION COMPONENT LOCATIONS



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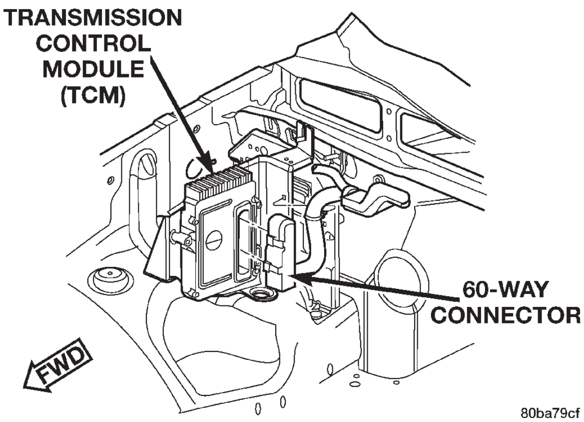
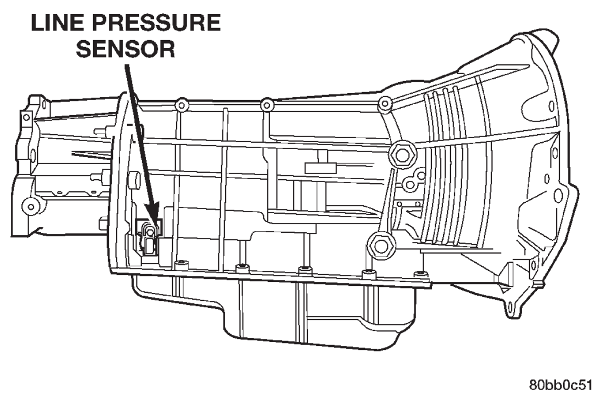
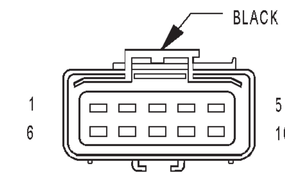
8.4 TRANSMISSION CONTROL MODULE



8.5 TRANSMISSION LINE PRESSURE SENSOR



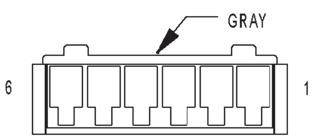
9.0 CONNECTOR PINOUTS



ACCELERATOR PEDAL POSITION SENSOR (DIESEL)

ACCELERATOR PEDAL POSITION SENSOR (DIESEL) - BLACK 10 WAY

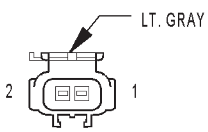
CAV	CIRCUIT	FUNCTION
1	-	-
2	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
3	K22 14RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
4	-	-
5	-	-
6	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
7	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
8	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
9	-	-
10	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY



BRAKE LAMP SWITCH

BRAKE LAMP SWITCH - GRAY 6 WAY

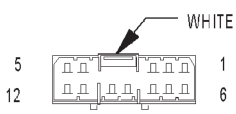
CAV	CIRCUIT	FUNCTION
1	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
2	Z238 18BK (LHD)	GROUND
2	Z243 18BK (RHD)	GROUND
3	V32 22OR/DG (GAS)	SPEED CONTROL POWER SUPPLY
4	V30 22DB/RD (GAS)	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 20VT/TN (LHD)	PRIMARY BRAKE SWITCH SIGNAL
5	L50 20WT/TN (RHD)	PRIMARY BRAKE SWITCH SIGNAL
6	F32 20PK/DB	FUSED B(+)



C113 (DIESEL)

C113 (DIESEL) - LT. GRAY (TRANSMISSION SIDE)

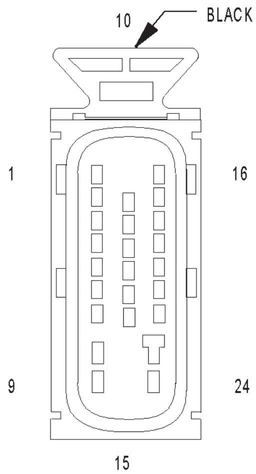
CAV	CIRCUIT
1	D52 18LG/WT
2	D51 18DG/WT



C201 (DIESEL)

C201 (DIESEL) - WHITE (SHIFTER ASSEMBLY SIDE)

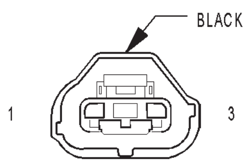
CAV	CIRCUIT
1	-
2	-
3	-
4	K2 20WT/PK
5	D25 20RD
6	-
7	D21 20PK
8	F12 20DB/WT
9	T2 20TN/BK
10	Z234 20WT
11	T41 20BK/WT
12	F991 20OR/DB



CONTROLLER ANTILOCK BRAKE

CONTROLLER ANTILOCK BRAKE - BLACK 24 WAY

CAV	CIRCUIT	FUNCTION
1	Z101 12BK/OR	GROUND
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL
3	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
4	-	-
5	D25 18VT/YL	PCI BUS
6	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
7	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
8	-	-
9	A20 12RD/DB	FUSED B(+)
10	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	D52 18LG/WT (DIESEL)	CAN C BUS(+)
12	-	-
13	B22 18DG/YL	VEHICLE SPEED SIGNAL
14	D51 18DG/YL (DIESEL)	CAN C BUS(-)
15	-	-
16	Z102 12BK/OR	GROUND
17	G9 18GY/BK	BRAKE FLUID LEVEL SWITCH SENSE
18	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
19	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL
20	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
21	Z231 18BK	GROUND
22	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
23	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
24	A10 12RD/DG	FUSED B(+)

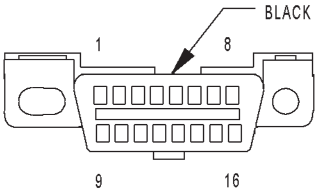


CRANKSHAFT POSITION SENSOR (GAS)

CRANKSHAFT POSITION SENSOR (GAS) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5 VOLT SUPPLY

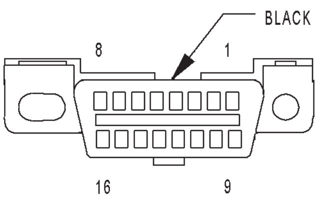
CONNECTOR PINOUTS



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

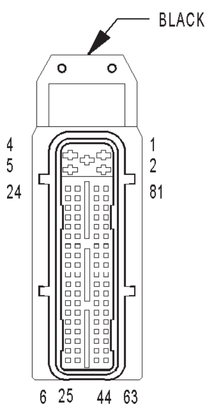
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z305 20BK/OR	GROUND
5	Z306 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)



DIAGNOSTIC JUNCTION PORT

DIAGNOSTIC JUNCTION PORT - BLACK 16 WAY

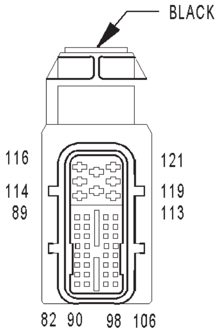
CAV	CIRCUIT	FUNCTION
1	D25 20YL/VT/BR	PCI BUS (PCM/ECM TCM PDM CD SKIM)
2	D25 20YL/VT/DG (AZC)	PCI BUS (AZC)
3	D25 20YL/VT/DB	PCI BUS (RADIO)
4	D25 20YL/VT/OR	PCI BUS (ACM)
5	D25 20YL/VT/RD	PCI BUS (MIC)
6	D25 20YL/VT/WT	PCI BUS (BCM)
7	D25 20YL/VT	PCI BUS (DLC)
8	D25 20YL/VT/GY	PCI BUS (DDM ABS MEM EVIC APM ITM RAIN SENSOR)
9	-	-
10	-	-
11	D25 20YL/VT (DIESEL)	PCI BUS (SHIFTER ASSEMBLY)
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-



ENGINE CONTROL MODULE C1 (DIESEL)

ENGINE CONTROL MODULE C1 (DIESEL) - BLACK 81 WAY

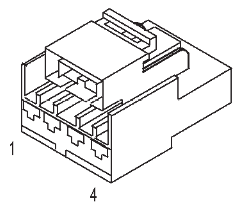
CAV	CIRCUIT	FUNCTION
1	Z108 14BK/DG	GROUND
2	Z108 14BK/DG	GROUND
3	K20 14DB	GENERATOR FIELD CONTROL
4	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
5	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
6	D52 18DG/WT	CAN C BUS(+)
7	D25 20VT/YL	PCI BUS
8	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
9	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
10	-	-
11	Y53 20BK/YL	BOOST PRESSURE SENSOR SIGNAL
12	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL
13	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
14	K22 20RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
15	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
16	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
17	-	-
18	-	-
19	F300 20RD/BK	BATTERY SENSE (+)
20	Z11 20BK/WT	BATTERY SENSE (-)
21	K4 18BK/LB	SENSOR GROUND
22	F991 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
24	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1
25	D51 18WT	CAN C BUS(-)
26	-	-
27	-	-
28	-	-
29	K77 20BR/WT	TRANSFER CASE POSITION SENSOR SIGNAL
30	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
31	-	-
32	K25 20VT/DG	BATTERY TEMPERATURE SENSOR SIGNAL
33	-	-
34	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
35	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY
36	C18 20DB	A/C PRESSURE SENSOR SIGNAL
37	-	-
38	V37 20RD/DG	SPEED CONTROL SWITCH SIGNAL
39	K226 20DB/WT	FUEL LEVEL SENSOR SIGNAL
40	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
41	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL
42	Y101 20	CRANKSHAFT POSITION SENSOR SHIELD
43	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
44	-	-
45	-	-
46	-	-
47	L50 20WT/DB	PRIMARY BRAKE SWITCH SIGNAL
48	K29 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
49	-	-
50	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
51	-	-
52	-	-
53	-	-
54	Z189 20BR	MASS AIR FLOW SENSOR GROUND
55	B22 20DG/YL	VEHICLE SPEED SENSOR SIGNAL
56	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
57	-	-
58	K4 20BK/LB	WATER IN FUEL SENSOR GROUND
59	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL
60	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY
61	K51 20DB/YL	AUTO SHUT DOWN RELAY CONTROL
62	-	-
63	-	-
64	-	-
65	-	-
66	-	-
67	K173 20GY	HYDRAULIC RADIATOR FAN SOLENOID CONTROL
68	-	-
69	C13 20DB/RD	A/C COMPRESSOR CLUTCH RELAY CONTROL
70	-	-
71	-	-
72	K236 20GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
73	-	-
74	T752 20DG/RD	ENGINE STARTER MOTOR RELAY CONTROL
75	K132 20BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
76	Y42 20BR/BK	WASTEGATE SOLENOID CONTROL
77	K152 20WT	GLOW PLUG RELAY NO. 1 CONTROL
78	-	-
79	-	-
80	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
81	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL



ENGINE CONTROL MODULE C2 (DIESEL)

ENGINE CONTROL MODULE C2 (DIESEL) - BLACK 40 WAY

CAV	CIRCUIT	FUNCTION
82	D21 20PK	SCI TRANSMIT
83	-	-
84	-	-
85	-	-
86	-	-
87	-	-
88	-	-
89	K35 20GY/YL	EGR SOLENOID CONTROL
90	-	-
91	-	-
92	-	-
93	-	-
94	G123 20DG/WT	WATER IN FUEL SIGNAL
95	-	-
96	-	-
97	-	-
98	-	-
99	-	-
100	-	-
101	-	-
102	-	-
103	-	-
104	-	-
105	-	-
106	-	-
107	-	-
108	-	-
109	-	-
110	-	-
111	-	-
112	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
113	-	-
114	-	-
115	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
116	K63 14BK	COMMON INJECTOR DRIVER
117	-	-
118	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
119	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
120	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
121	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL

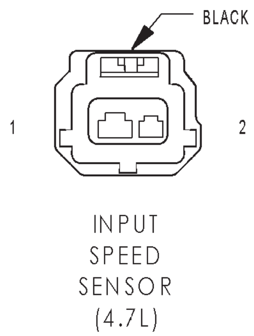


GOVERNOR PRESSURE SENOR

GOVERNOR PRESSURE SENSOR

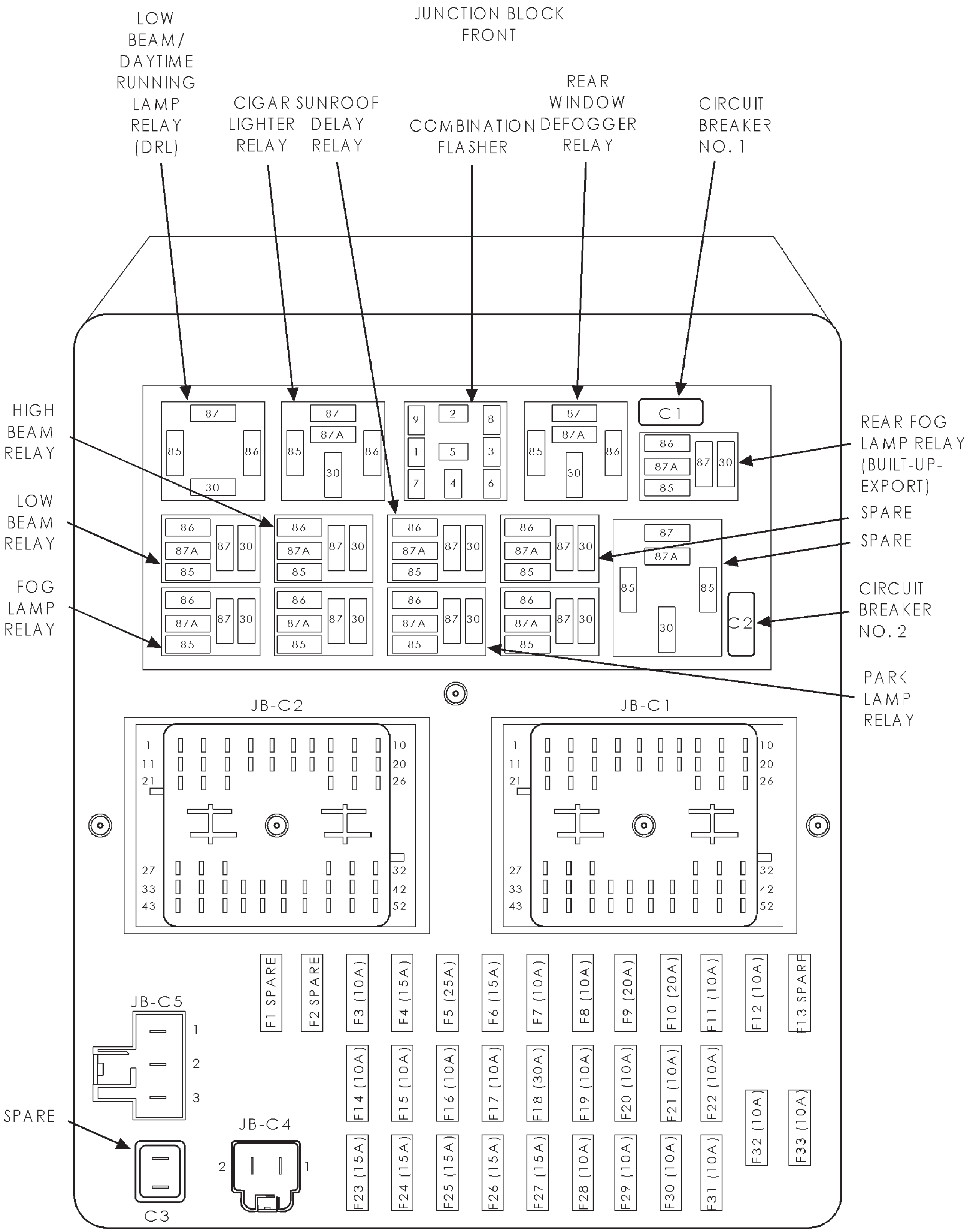
CAV	CIRCUIT	FUNCTION
1	RD	5 VOLT SUPPLY
2	WT	GOVERNOR PRESSURE SENSOR SIGNAL
3	DG	SENSOR GROUND
4	BK	TRANSMISSION FLUID TEMPERATURE SIGNAL

CONNECTOR PINOUTS



INPUT SPEED SENSOR (4.7L) - BLACK 2 WAY

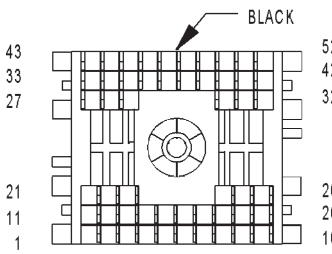
CAV	CIRCUIT	FUNCTION
1	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



JUNCTION BLOCK FRONT
LOW BEAM/ DAYTIME RUNNING LAMP RELAY (DRL)
CIGAR LIGHTER RELAY
SUNROOF DELAY RELAY
COMBINATION FLASHER
REAR WINDOW DEFOGGER RELAY
CIRCUIT BREAKER NO. 1
HIGH BEAM RELAY
LOW BEAM RELAY
FOG LAMP RELAY
REAR FOG LAMP RELAY (BUILT-UP-EXPORT)
SPARE
SPARE
CIRCUIT BREAKER NO. 2
PARK LAMP RELAY
C1
C2
JB-C2
JB-C1
JB-C5
JB-C4
C3
SPARE
F1 SPARE
F2 SPARE
F3 (10A)
F4 (15A)
F5 (25A)
F6 (15A)
F7 (10A)
F8 (10A)
F9 (20A)
F10 (20A)
F11 (10A)
F12 (10A)
F13 SPARE
F14 (10A)
F15 (10A)
F16 (10A)
F17 (10A)
F18 (30A)
F19 (10A)
F20 (10A)
F21 (10A)
F22 (10A)
F23 (15A)
F24 (15A)
F25 (15A)
F26 (15A)
F27 (15A)
F28 (10A)
F29 (10A)
F30 (10A)
F31 (10A)
F32 (10A)
F33 (10A)

FUSES (JB)

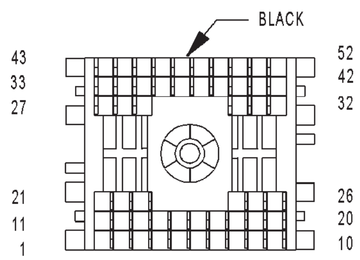
FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	-	-	-
2	-	-	-
3	10A	L33 18RD	FUSED HIGH BEAM RELAY OUTPUT
4	15A	INTERNAL	FUSED B(+)
5	25A	INTERNAL	FUSED B(+)
6	15A	INTERNAL	FUSED B(+)
7	10A	INTERNAL	FUSED B(+)
8	15A	INTERNAL	FUSED B(+)
9	20A	INTERNAL	FUSED B(+)
10	20A	F72 16RD/YL (EXCEPT BUILT-UP-EXPORT)	FUSED B(+)
11	10A	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
12	10A	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-	-
14	10A	L43 18VT	FUSED LOW BEAM RELAY OUTPUT
15	10A	L44 18VT/RD	FUSED LOW BEAM RELAY OUTPUT
16	10A	L34 18RD/OR	FUSED HIGH BEAM RELAY OUTPUT
17	10A	INTERNAL	FUSED B(+)
18	30A	F9 20RD/BK	FUSED B(+)
19	10A	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
20	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
22	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	15A	F32 20PK/DB	FUSED B(+)
24	15A	INTERNAL	FUSED B(+)
25	15A	INTERNAL	FUSED B(+)
26	15A	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
27	15A	INTERNAL (BUILT-UP-EXPORT)	FUSED B(+)
28	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
29	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 18RD/WT (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 16WT/RD (LHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
31	10A	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
32	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
33	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)



JUNCTION BLOCK C2 (LHD)

JUNCTION BLOCK C2 (LHD) - BLACK 52 WAY

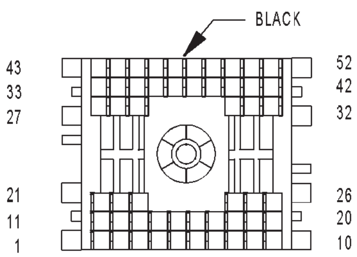
CAV	CIRCUIT	FUNCTION
1	X3 22GY/OR	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 18BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	WIPER HIGH/LOW RELAY CONTROL
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 20BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB (EXCEPT BASE)	FUSED B(+)
25	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	F72 16RD/YL	FUSED B(+)
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 14RD/WT (EXCEPT BASE)	FUSED B(+)



JUNCTION BLOCK C2 (RHD)

JUNCTION BLOCK C2 (RHD) - BLACK 52 WAY

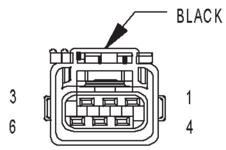
CAV	CIRCUIT	FUNCTION
1	X3 22BK/RD	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 20BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	-
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 18BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB	FUSED B(+)
25	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	-	-
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 16RD/WT	FUSED B(+)



JUNCTION BLOCK C3 - BLACK 52 WAY

CAV	CIRCUIT	FUNCTION
1	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	L60 20TN	RIGHT TURN SIGNAL
4	L302 20LB/YL	RIGHT TURN SWITCH SENSE
5	L61 20TN/LG	LEFT TURN SIGNAL
6	L91 20DB/PK	HAZARD SWITCH SENSE
7	-	-
8	L305 20LB/WT	LEFT TURN SWITCH SENSE
9	-	-
10	L309 20PK/LG	HIGH BEAM RELAY CONTROL
11	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
12	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
13	-	-
14	F85 16VT/WT	FUSED B(+)
15	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
25	F60 16RD/WT	FUSED B(+)
26	-	-
27	A41 12YL	IGNITION SWITCH OUTPUT (START)
28	F14 20LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
29	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
30	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
31	Z234 20BK	GROUND
32	F33 20PK/RD	FUSED B(+)
33	X12 16WT/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
34	M1 20PK	FUSED B(+)
35	M1 20PK (AZC)	FUSED B(+)
36	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)
37	-	-
38	F70 20PK/BK	FUSED B(+)
39	X3 20GY/OR	HORN RELAY CONTROL
40	F30 16RD	FUSED CIGAR LIGHTER RELAY OUTPUT
41	F33 20PK/RD	FUSED B(+)
42	-	-
43	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
44	M1 20PK	FUSED B(+)
45	Z132 20BK/OR	GROUND
46	-	-
47	-	-
48	F70 20PK/BK	FUSED B(+)
49	-	-
50	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
51	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
52	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)

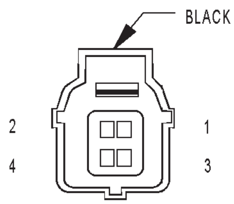
CONNECTOR PINOUTS



LEFT REAR LAMP ASSEMBLY

LEFT REAR LAMP ASSEMBLY - BLACK 6 WAY

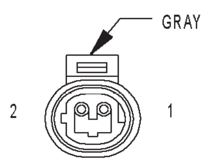
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L63 18DG/RD	LEFT TURN SIGNAL
5	Z150 18BK	GROUND
6	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL



LINE PRESSURE SENSOR (4.7L)

LINE PRESSURE SENSOR (4.7L) - BLACK 4 WAY

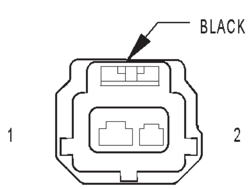
CAV	CIRCUIT	FUNCTION
1	Z114 14BK/LB	GROUND
2	T138 14GY/LB	5 VOLT SUPPLY
3	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
4	-	-



OUTPUT SPEED SENSOR (4.0L)

OUTPUT SPEED SENSOR (4.0L) - GRAY 2 WAY

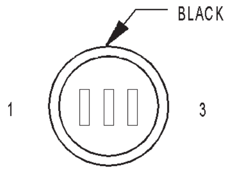
CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL



OUTPUT SPEED SENSOR (4.7L)

OUTPUT SPEED SENSOR (4.7L) - BLACK 2 WAY

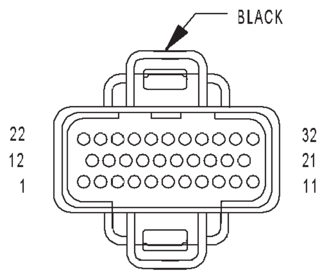
CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



PARK/NEUTRAL POSITION SWITCH (4.0L)

PARK/NEUTRAL POSITION SWITCH (4.0L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
3	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)

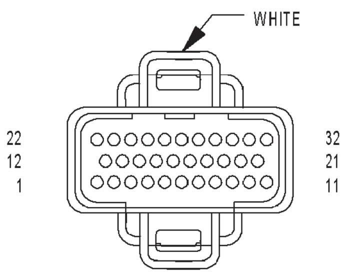


POWERTRAIN CONTROL MODULE C1 (GAS)

POWERTRAIN CONTROL MODULE C1 (GAS) - BLACK 32 WAY

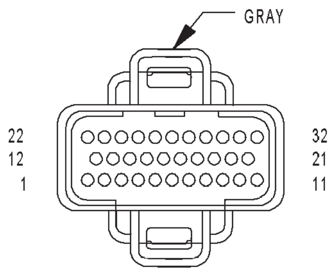
CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	K94 14TN/LG (4.7L)	COIL DRIVER NO. 4
4	K4 18BK/LB	SENSOR GROUND
5	K96 14TN/LB (4.7L)	COIL DRIVER NO. 6
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K91 14TN/RD	COIL DRIVER NO. 1
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	K98 14LB/RD (4.7L)	COIL DRIVER NO. 8
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	-	-
13	-	-
14	K77 18LG/BK	TRANSFER CASE POSITION SENSOR INPUT
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5 VOLT SUPPLY
18	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/BK	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	K95 14TN/DG (4.7L)	COIL DRIVER NO. 5
22	A7 14RD/BK	FUSED B(+)
23	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (EXCEPT 4.0L BUILT-UP-EXPORT)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SENSOR SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT BUILT-UP-EXPORT)	COIL DRIVER NO. 1
29	K341 18PK/WT (4.7L)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z82 14BK/WT	GROUND
32	Z81 14BK/TN	GROUND

CONNECTOR PINOUTS



POWERTRAIN CONTROL MODULE C2 (GAS) - WHITE 32 WAY

CAV	CIRCUIT	FUNCTION
1	T54 18VT (4.0L)	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	K26 18VT (4.7L)	FUEL INJECTOR NO. 7 DRIVER
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
7	K97 14BR (4.7L)	COIL DRIVER NO. 7
8	K88 18PK (4.0L)	GOVERNOR PRESSURE SOLENOID CONTROL
9	K92 14TN/PK	COIL DRIVER NO. 2
10	K20 18DG	GENERATOR FIELD DRIVER
11	T20 18LB (4.0L)	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
12	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
13	K28 18GY/LB (4.7L)	FUEL INJECTOR NO. 8 DRIVER
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	K173 18LG	RADIATOR FAN RELAY CONTROL
18	-	-
19	C18 18DB	A/C PRESSURE SIGNAL
20	-	-
21	T60 18BR (4.0L)	3-4 SHIFT SOLENOID CONTROL
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
24	-	-
25	T13 18DB/BK (4.0L)	OUTPUT SPEED SENSOR GROUND
26	-	-
27	B22 18DG/YL	VEHICLE SPEED SENSOR SIGNAL
28	T14 18LG/WT (4.0L)	OUTPUT SPEED SENSOR SIGNAL
29	T25 18LG/RD (4.0L)	GOVERNOR PRESSURE SENSOR SIGNAL
30	K30 18PK/YL (4.0L)	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/BK	5 VOLT SUPPLY
32	-	-

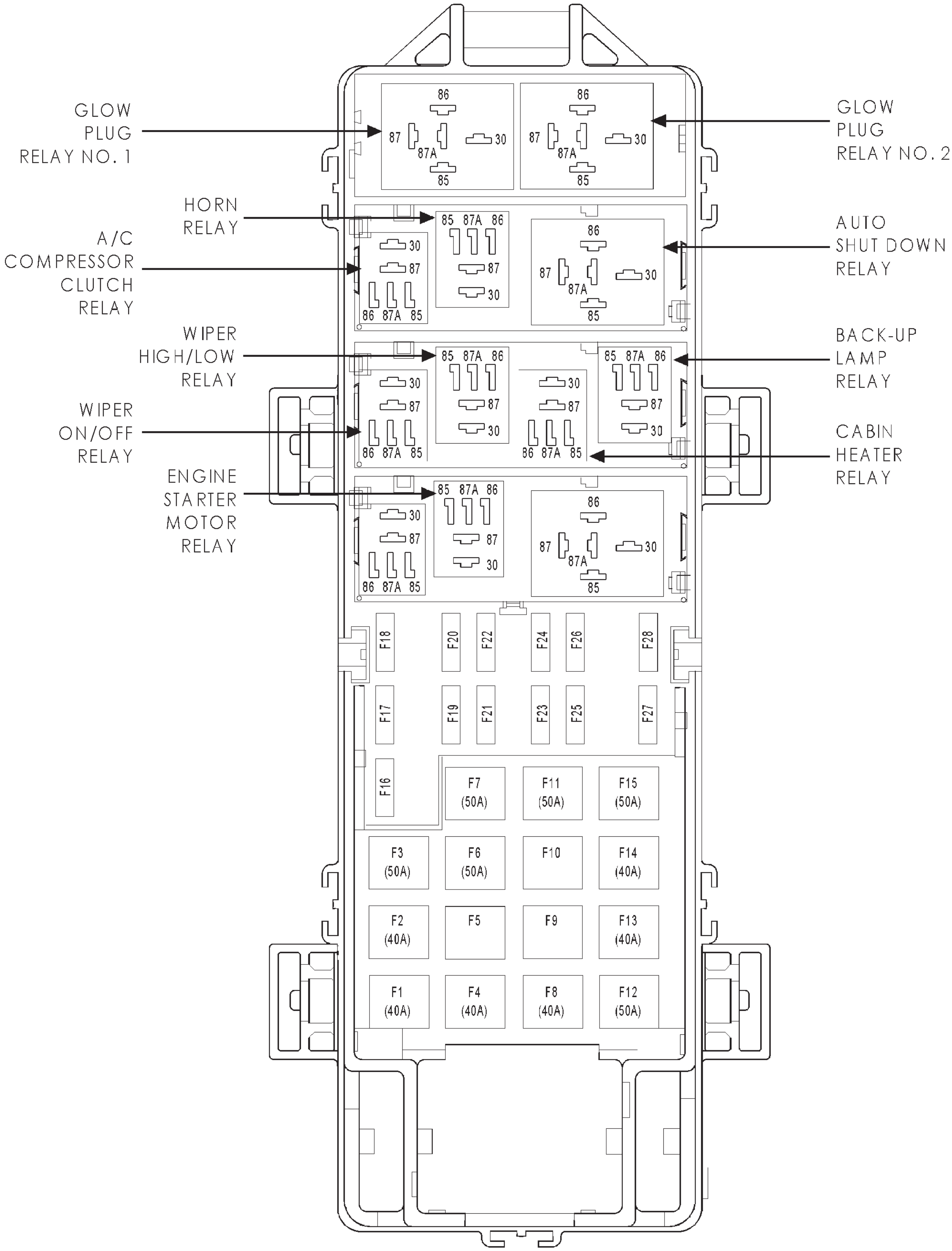


POWERTRAIN CONTROL MODULE C3 (GAS)

POWERTRAIN CONTROL MODULE C3 (GAS) - GRAY 32 WAY

CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	-	-
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	K42 18DB/LG (4.7L HIGH OUTPUT)	KNOCK SENSOR SIGNAL
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.7L)	OXYGEN SENSOR DOWNSTREAM RELAY CONTROL
10	K106 18WT/DG (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18OR/DG	SPEED CONTROL SUPPLY
12	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (4.7L RHD)	OVERDRIVE OFF SWITCH SENSE
13	T6 18OR/WT (4.0L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T10 18DG/LG (4.7L LHD)	OVERDRIVE OFF SWITCH SENSE
13	T6 18OR/BK (4.0L RHD)	OVERDRIVE OFF SWITCH SENSE
14	K107 18OR/PK (EXCEPT BUILT-UP-EXPORT)	LEAK DETECTION PUMP SWITCH SENSE
15	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR 2/1 HEATER CONTROL
17	-	-
18	K142 18GY/BK (4.7L HIGH OUTPUT)	KNOCK SENSOR NO. 2 SIGNAL
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG (LHD)	SCI RECEIVE
29	D32 18LG/DG (RHD)	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL

POWER DISTRIBUTION CENTER (DIESEL)



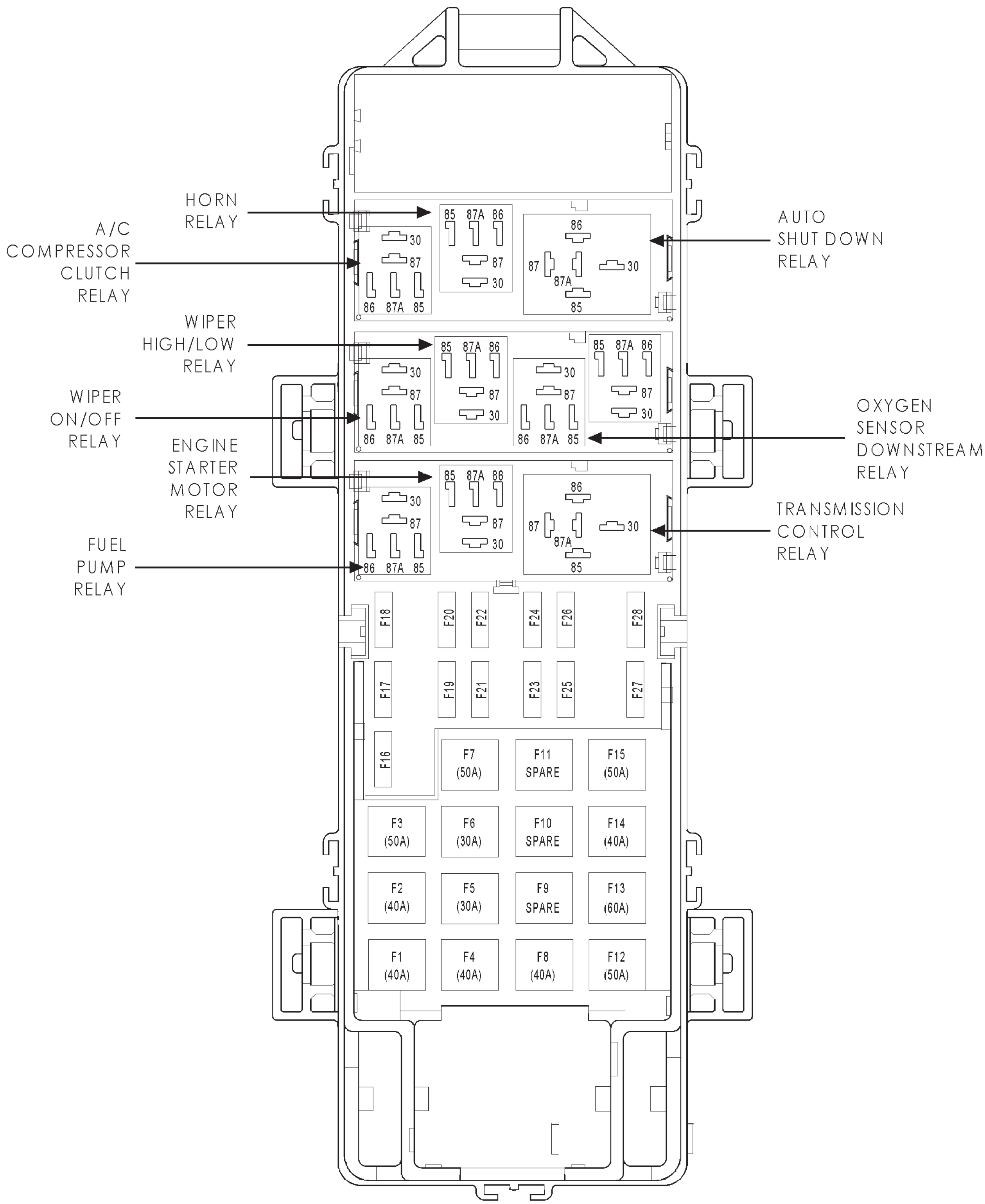
FUSES (DIESEL)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	-	-	-
6	50A	A105 10DB/RD	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	50A	A110 10VT/RD	FUSED B(+)
12	50A	A146 10OR/WT	FUSED B(+)
13	40A	A14 14RD/WT	FUSED B(+)
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	20A	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	20A	F15 18 DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	-	-	-
20	-	-	-
21	15A	A17 14RD/BK	FUSED B(+)
22	10A	F300 18RD/BK	FUSED B(+)
23	15A	A80 18RD/LG	FUSED B(+)
24	-	-	-
25	20A	A20 12RD/DB	FUSED B(+)
26	20A	F142 14OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	-	-	-

BACK-UP LAMP RELAY (DIESEL)

CAV	CIRCUIT	FUNCTION
30	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
85	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
85	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
86	T2 18TN/BK	BACK-UP LAMP RELAY CONTROL
87	L1 18VT/BK	BACK-UP LAMP FEED
87A	-	-

POWER DISTRIBUTION CENTER (GAS)

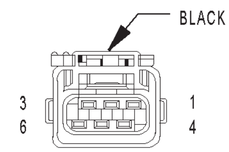


FUSES (GAS)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	30A	A30 14RD/WT	FUSED B(+)
5	30A	A30 14RD/WT (4.7L)	FUSED B(+)
6	30A	A14 14RD/DG	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	-	-	-
12	50A	A146 10OR/WT	FUSED B(+)
13	-	-	-
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	15A	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	15A	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	10A	A7 14RD/BK	FUSED B(+)
20	-	-	-
21	15A	A17 18RD/BK	FUSED B(+)
22	-	-	-
23	-	-	-
24	20A	A62 16VT/LB	FUSED B(+)
25	20A	A20 12RD/DB	FUSED B(+)
26	15A	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
26	15A	F42 18DG/LG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	15A	T15 18YL/BR(4.0L)	FUSED TRANSMISSION CONTROL RELAY OUTPUT

TRANSMISSION CONTROL RELAY (GAS)

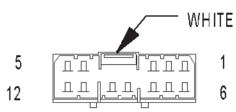
CAV	CIRCUIT	FUNCTION
30	A30 14RD/WT	FUSED B(+)
85	K125 18WT/DB (4.0L)	GENERATOR SOURCE
85	Z307 18BK (4.7L)	GROUND
86	K30 20PK (RHD)	TRANSMISSION CONTROL RELAY CONTROL
86	K30 20PK/YL (LHD)	TRANSMISSION CONTROL RELAY CONTROL
87	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
87A	-	-



RIGHT REAR
LAMP ASSEMBLY

RIGHT REAR LAMP ASSEMBLY - BLACK 6 WAY

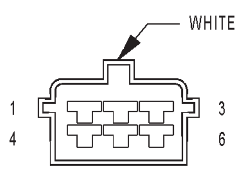
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L62 18BR/RD	RIGHT TURN SIGNAL
5	Z151 18BK	GROUND
6	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL



SHIFTER
ASSEMBLY
(C201 DIESEL)

SHIFTER ASSEMBLY (C201 DIESEL) - WHITE 12 WAY

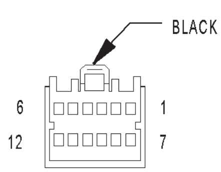
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	D25 20RD	PCI BUS
6	-	-
7	D21 20PK	SCI TRANSMIT
8	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
9	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
10	Z234 20WT	GROUND
11	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
12	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)



SHIFTER
ASSEMBLY
(GAS)

SHIFTER ASSEMBLY (GAS) - WHITE 6 WAY

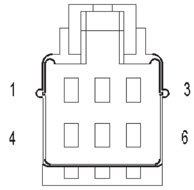
CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	Z234 18BK	GROUND
3	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
4	Z300 18BK	GROUND
5	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL



SHIFTER
ASSEMBLY C1
(DIESEL)

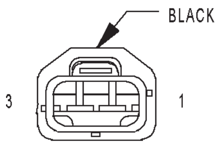
SHIFTER ASSEMBLY C1 (DIESEL) - BLACK 12 WAY

CAV	CIRCUIT	FUNCTION
1	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
5	D25 20OR	PCI BUS
6	W0 20DB/WT	SHIFTER C1 SENSE
7	W1 20VT/WT	SHIFTER C2 SENSE
8	W2 20VT	SHIFTER C3 SENSE
9	W3 20BK	SHIFTER C4 SENSE
10	W4 20PK/OR	SHIFTER C5 SENSE
11	Z234 20WT	GROUND
12	Z234 20WT	GROUND



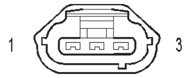
SHIFTER ASSEMBLY C2 (DIESEL) - 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL



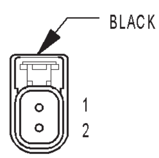
THROTTLE POSITION SENSOR (4.0L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL



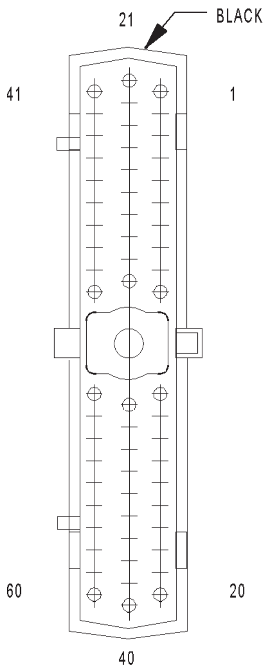
THROTTLE POSITION SENSOR (4.7L) - 3 WAY

CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



TRANSFER CASE POSITION SENSOR - BLACK 2 WAY

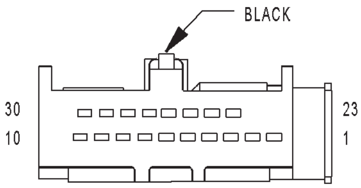
CAV	CIRCUIT	FUNCTION
1	K77 20BR/WT (DIESEL)	TRANSFER CASE POSITION SENSOR SIGNAL
1	K77 18LG/BK (GAS)	TRANSFER CASE POSITION SENSOR SIGNAL
2	K4 20BK/LB (DIESEL)	SENSOR GROUND
2	K4 18BK/LB (GAS)	SENSOR GROUND



TRANSMISSION CONTROL MODULE (4.7L)

TRANSMISSION CONTROL MODULE (4.7L) - BLACK 60 WAY

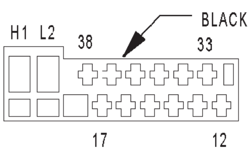
CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	T2 18TN/BK	TRS T2 SENSE
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	F45 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK/YL	TRANSMISSION CONTROL RELAY CONTROL
16	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
19	T119 18WT/DB	2C SOLENOID CONTROL
20	T120 18LG	LR SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
30	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
37	Z113 14BK/WT	GROUND
38	T138 14GY/LB	5 VOLT SUPPLY
39	Z112 14BK/YL	GROUND
40	T140 18VT/LG	MS SOLENOID CONTROL
41	T41 18WT	TRS T41 SENSE
42	T42 18VT/WT	TRS T42 SENSE
43	D25 18YL/VT	PCI BUS
44	-	-
45	-	-
46	D20 18LG	SCI RECEIVE
47	T147 18LB	2C PRESSURE SWITCH SENSE
48	T48 18DB	4C PRESSURE SWITCH SENSE
49	T6 18VT/WT	OVERDRIVE OFF SWITCH SENSE
50	T150 18BR/LB	LR PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z114 14BK/LG	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	T59 18PK	UNDERDRIVE SOLENOID CONTROL
56	A30 14RD/WT	FUSED B(+)
57	Z12 14BK/TN	GROUND
58	-	-
59	T159 18DG/WT	4C SOLENOID CONTROL
60	T60 18BR	OVERDRIVE SOLENOID CONTROL



TRANSMISSION CONTROL MODULE C1 (DIESEL)

TRANSMISSION CONTROL MODULE C1 (DIESEL) - BLACK 18 WAY

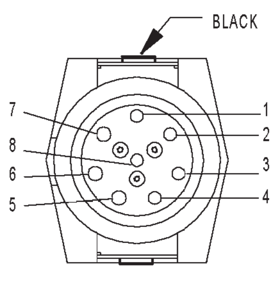
CAV	CIRCUIT	FUNCTION
1	D21 20PK	SCI TRANSMIT
2	-	-
3	W4 20PK/OR	SHIFTER C5 SENSE
4	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL
5	-	-
6	-	-
7	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
8	-	-
9	-	-
10	-	-
23	-	-
24	-	-
25	W0 20DB/WT	SHIFTER C1 SENSE
26	W1 20VT/WT	SHIFTER C2 SENSE
27	W2 20VT	SHIFTER C3 SENSE
28	W3 20BK	SHIFTER C4 SENSE
29	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
30	Z234 20WT	GROUND



TRANSMISSION CONTROL MODULE C2 (DIESEL)

TRANSMISSION CONTROL MODULE C2 (DIESEL) - BLACK 14 WAY

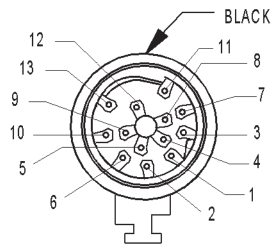
CAV	CIRCUIT	FUNCTION
12	T52 18RD/BK	N2 INPUT SPEED SENSOR
13	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
14	T60 18BR	1-2/4-5 SOLENOID CONTROL
15	T159 18DG/WT	3-4 SOLENOID CONTROL
16	T119 18WT/DB	2-3 SOLENOID CONTROL
17	T120 18LG	TCC SOLENOID CONTROL
33	T13 18DB/BK	SENSOR GROUND
34	T54 18VT	TEMP SENSOR - P/N SWITCH
35	T14 18LG/WT	N3 INPUT SPEED SENSOR
36	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
37	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
38	T16 18RD	SOLENOID SUPPLY VOLTAGE
H1	D52 18LG/WT	CAN C BUS(+)
L2	D51 18DG/WT	CAN C BUS(-)



TRANSMISSION SOLENOID (4.0L)

TRANSMISSION SOLENOID (4.0L) - BLACK 8 WAY

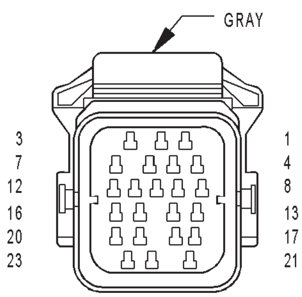
CAV	CIRCUIT	FUNCTION
1	T15 18LG	FUSED TRANSMISSION CONTROL RELAY OUTPUT
2	K6 18VT/BK	5 VOLT SUPPLY
3	K4 18BK/LB	SENSOR GROUND
4	T25 18LG/RD	GOVERNOR PRESSURE SENSOR SIGNAL
5	K88 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
6	T60 18BR	3-4 SHIFT SOLENOID CONTROL
7	T20 18LB	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
8	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL



TRANSMISSION SOLENOID ASSEMBLY (DIESEL)

TRANSMISSION SOLENOID ASSEMBLY (DIESEL) - BLACK 13 WAY

CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	N3 INPUT SPEED SENSOR
2	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
3	T52 18RD/BK	N2 INPUT SPEED SENSOR SIGNAL
4	T54 18VT	TEMP SENSOR - P/N SWITCH
5	-	-
6	T16 18RD	SOLENOID SUPPLY VOLTAGE
7	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
8	T119 18WT/DB	2-3 SOLENOID CONTROL
9	T159 18DG/WT	3-4 SOLENOID CONTROL
10	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
11	T120 18LG	TCC SOLENOID CONTROL
12	T13 18DB/BK	SENSOR GROUND
13	T60 18BR	1-2/4-5 SOLENOID CONTROL



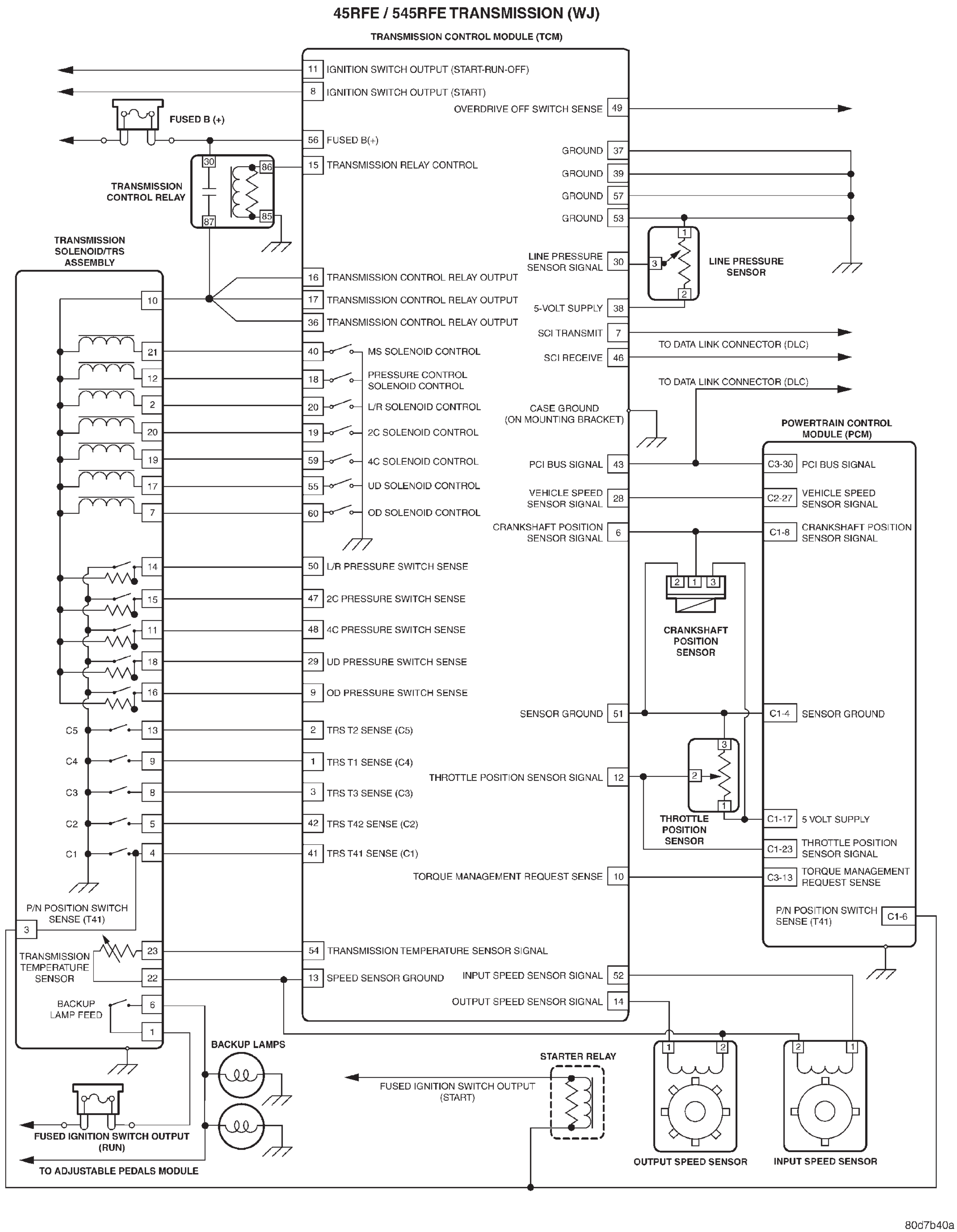
TRANSMISSION SOLENOID/ TRS ASSEMBLY (4.7L)

TRANSMISSION SOLENOID/TRS ASSEMBLY (4.7L) - GRAY 23 WAY

CAV	CIRCUIT	FUNCTION
1	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	T120 18LG	LR SOLENOID CONTROL
3	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
4	T41 18WT	TRS T41 SENSE
5	T42 18VT/WT	TRS T42 SENSE
6	L1 18VT/BK	BACK-UP LAMP FEED
7	T60 18BR	OVERDRIVE SOLENOID CONTROL
8	T3 18VT	TRS T3 SENSE
9	T1 18LG/BK	TRS T1 SENSE
10	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
11	T48 18DB	4C PRESSURE SWITCH SENSE
12	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
13	T2 18TN/BK	TRS T2 SENSE
14	T150 18BR/LB	LR PRESSURE SWITCH SENSE
15	T147 18LB	2C PRESSURE SWITCH SENSE
16	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
17	T59 18PK	UNDERDRIVE SOLENOID CONTROL
18	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
19	T159 18DG/WT	4C SOLENOID CONTROL
20	T119 18WT/DB	2C SOLENOID CONTROL
21	T140 18VT/LG	MS SOLENOID CONTROL
22	T13 18DB/BK	SPEED SENSOR GROUND
23	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL

10.0 SCHEMATIC DIAGRAMS

10.1 TRANSMISSION SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAMS

NOTES

11.0 CHARTS AND GRAPHS

11.1 PRESSURE SWITCH STATES

45RFE/545RFE NORMAL PRESSURE SWITCH STATES

GEAR	L/R	2C	4C	UD	OD
R	OPEN	OPEN	OPEN	OPEN	OPEN
N	CLOSED	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2 PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3RD	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	CLOSED	CLOSED	OPEN	CLOSED
4 PRIME	OPEN	OPEN	OPEN	OPEN	CLOSED

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11.2 SHIFT LEVER ERROR CODES

SHIFT LEVER ERROR CODES
REPORTED BY THE DRBIII®

ERROR CODE	SWITCH STUCK	POSITION
1	T41/C1 STUCK	OPEN
2	T41/C1 STUCK	CLOSED
3	T42/C2 STUCK	OPEN
4	T42/C2 STUCK	CLOSED
5	T3/C3 STUCK	OPEN
6	T3/C3 STUCK	CLOSED
7	T1/C4 STUCK	OPEN
8	T1/C4 STUCK	CLOSED
9	T2/C5 STUCK	OPEN
10	T2/C5 STUCK	CLOSED
11	OD LOCKOUT STUCK	OPEN
12	OD LOCKOUT STUCK	CLOSED

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11.3 TRANSMISSION RANGE SENSOR STATES

45RFE/545RFE TRS SWITCH STATES

TRS	PARK	TMP1	REV	TMP 2	N1	N2	TMP 3	D	TMP 4	2	TMP 5	L
T1 (C4)	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN
T2 (C5)	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED
T3 (C3)	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	CLOSED
T41 (C1)	CLOSED	OPEN	OPEN	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
T42 (C2)	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN

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NOTES

NOTES

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all of the specifications, instructions, and graphics needed to diagnose W5J400 Electronic Automatic Transmission problems. The diagnostics in this manual are based on the failure condition or symptom being present at the time of diagnosis.

When repairs are required, refer to the appropriate volume of the service information for the proper removal and repair procedure.

READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE TROUBLE CODE.

Diagnostic procedures change every year. New diagnostic systems may be added and/or carryover systems may be enhanced. It is recommended that you review the entire manual to become familiar with all new and changed diagnostic procedures.

1.1 SYSTEM COVERAGE

This diagnostic procedures manual covers all 2002 MY Grand Cherokee equipped with a W5J400 Automatic Transmission.

1.2 SIX -STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the W5J400 electronic transmission is done in six basic steps:

Verification of complaint
Verification of any related symptoms
Symptom analysis
Problem isolation
Repair of isolated problem
Verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

The W5J400 Transmission family can be identified by the presence of a 13 pin electrical connector, with a bayonet lock on the right hand side of the transmission. The connector is oriented horizontally.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 GENERAL DESCRIPTION

The W5J400 electronic transmission is an electronically controlled five speed transmission with a controlled slip torque converter. The W5J400 electronic transmission is a conventional transmission in that it uses hydraulically applied clutches to shift a planetary gear train. However, the electronic control system replaces many of the mechanical and hydraulic components used in conventional transmission valve bodies.

The ratios for the gear stages are obtained by 3 planetary gear sets. Fifth Gear is designed as an Overdrive with a high speed ratio. The gears are actuated electronically/hydraulically. The electronic control system enables precise adaptation of pressures to the respective operating conditions and to the engine output during a shift phase, which results in a significant improvement in shift quality.

3.2 FUNCTIONAL OPERATION

The W5J400 electronic transmission has a fully adaptive control system. The system performs its functions based on continuous real-time sensor and switch feedback information. In addition the TCM receives information from the PCM/ECM (engine management) and ABS (chassis systems) controllers over the CAN bus. The CAN bus is a high speed communication bus that allows real time control capability between various controllers. Most messages are sent every 20 milliseconds, this means critical information can be shared between the Transmission, Engine and ABS controllers. The CAN bus is a two wire bus with a CAN C Bus (+) circuit and a CAN C Bus (-) circuit. The CAN bus uses a twisted pair of wires in the harness to reduce the potential of radio and noise interference. The CAN bus also uses a 120 ohm terminating resistor in both the TCM and ABS modules. The module terminating resistance is measured across both CAN bus circuits at the TCM or ABS module, with the PCM/ECM, TCM and ABS modules disconnected.

The control system automatically adapts to changes in engine performance, vehicle speed, and transmission temperature variations to provide consistent shift quality. The control system ensures that clutch operation during upshifting and downshifting is more responsive without increased harshness. The TCM controls the actuation of solenoid valves for modulating shift pressure and gear change. The required pressure level is calculated from the load condition, engine speed. Power for the transmission system is supplied through the Shifter Assembly (no transmission control relay). The TCM is located in the center console of the vehicle.

The Transmission Control Module (TCM) continuously checks for electrical problems, mechanical problems, and some hydraulic problems. When a problem is sensed, the TCM stores a diagnostic trouble code (DTC). Some of these codes cause the transmission to go into ″limp-in″ or ″default″ mode. The W5J400 will default in the current gear position if a DTC is detected, then after a key cycle or shift to park the transmission will go into Limp-in, which is mechanical 2nd gear. Some DTC's may allow the transmission to resume normal operation (recover) if the detected problem goes away. Permanent limp-in DTC will recover when the key is cycled, but if the same DTC is detected for three key cycles the system will not recover and the DTC must be cleared from the TCM with the DRBIII® scan tool.

Once the DRBIII® is in the Transmission portion of the diagnostic program, it constantly monitors the TCM to see if the system is in limp-in mode. If the transmission is in limp-in mode, the DRBIII® will flash the red LED.

3.2.1 CONTROLLER MODES OF OPERATION

Permanent limp-in mode

When the TCM determines there is a non-recoverable condition present that will not allow proper transmission operation, it will place the transmission in permanent limp-in mode. When the condition occurs the TCM will turn off all solenoids as well as the solenoid supply output circuit. If this occurs while the vehicle is moving, the transmission will remain in the current gear until the ignition is turned off or shifter is placed in the ″P″ position. Once the shifter has been placed in ″P″ the Transmission will only allow 2nd gear operation. . If the problem occurs while the vehicle is not moving the transmission will only allow 2nd gear operation.

Temporary limp-in mode

This mode is the same as the permanent limp-in mode except if the condition is no longer present the system will resume normal operation. (Recoverable DTC)

Undervoltage limp-in mode

When the TCM detects that system voltage has dropped below 8.5 volts it will disable voltage dependant diagnostics and place the transmission in the temporary limp-in mode. When the TCM senses that the voltage has risen above 9.0 volts, normal transmission operation will be resumed.

Hardware Error Mode

When the TCM detects a major internal error the transmission will be placed in the permanent limp-in mode and cease all communication over the CAN bus. Once the TCM has entered this mode normal transmission operation will not resume until all DTC's are cleared from the TCM.

Loss of Drive

If the TCM detects a situation that has resulted or may result in a catastrophic engine or transmission failure, the transmission will be placed in the neutral position. Improper Ratio, Input Sensor Overspeed, or Engine Overspeed DTC's will cause the loss of drive.

Controlled Limp-in Mode

When a failure condition does not require the TCM to shut down the solenoid supply, but the failure is of a degree where the TCM will place the transmission into a predefined gear, there will be several shift performance issues. Examples of this are, with the transmission slipping the controller will attempt to place the transmission into third gear and maintain third gear for all forward drive conditions. Another example is some of the CAN bus message issues if the TCM does not receive required information from the Engine Controller, then default values are used which may result in poor transmission shift performance.

3.2.2 MIL ILLUMINATION

For failures detected by the Transmission Controller that result in the controller placing the transmission into a limp-in mode, except for System Overvoltage and System Undervoltage DTCs, the MIL will be illuminated. The Transmission Controller will inform the PCM/ECM over the CAN bus that a failure has occurred. The PCM/ECM will store one of two DTC's P0700 or P0702 depending on which transmission DTC is present and will illuminate the MIL. If the condition is removed and the failure becomes Stored (Intermittent), the Transmission controller will stop reporting that the DTC is active and the PCM/ECM will extinguish the MIL.

Note: The MIL will light when the problem is first detected and it will not go off until the next ignition cycle, after all problem conditions have been checked for their presence. This normally takes several minutes of driving.

3.2.3 FREEZE FRAME

The TCM will record up to two freeze frames for each DTC. When a failure is initially detected the controller will store the information for that DTC in the first Freeze Frame. On the next occurrence of the same DTC the controller will save the same DTC information in a second Freeze Frame. If the DTC occurs for a third time the freeze frame information from the second occurrence will be over written with the third occurrence of the DTC. Therefore, the controller will store the freeze frame information for the first and last occurrence for each DTC stored in memory. The freeze frame also allows higher priority DTCs to replace lower priority DTCs for diagnostic purposes.

The Freeze frame information is very useful in determining the conditions under which an intermittent DTC is setting. Use the reported Freeze Frame information to duplicate the DTC set conditions

Note: The turbine speed is calculated from the N2 and N3 input speed sensors. The N2 and N3 input speed sensors are both active in 2nd, 3rd, and 4th gears. The N3 input speed is not reported in1st and 5th gears and will not match the turbine speed.

Information provided in Freeze frame:

Time since ignition Cycle
Mileage (km)
Battery voltage
Trans oil temperature
Actual gear/ Target Gear
Output speed
Turbine speed
Shifter Position
Calculated Gear

3.2.4 SOLENOIDS

1-2/4-5 solenoid - The 1-2/4-5 solenoid is activated when the TCM determines that the transmission must shift into or out of 2nd gear or 5th gear. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated, hydraulic pressure is applied to the proper shift elements in the transmission to allow the desired shift. Once the shift is completed, the solenoid is turned off.

2-3 solenoid - The 2-3 solenoid is activated when the TCM determines that the transmission must shift into or out of 3rd gear. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated hydraulic pressure is applied to the proper shift elements in the transmission to allow the desired shift. Once the shift is completed, the solenoid is turned off.

3-4 solenoid - The 3-4 solenoid is activated when the TCM determines that the transmission must shift into or out of 4th gear. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated, hydraulic pressure is applied to the proper shift elements in the transmission to allow the desired shift. Once the shift is completed, the solenoid is turned off.

TCC solenoid - The TCC solenoid is activated when the TCM determines that the Torque converter clutch should be activated. The TCC clutch is a variable slip torque clutch that allows control of torque converter slip from 5% to 95.5% of full TCC engagement. The clutch is controlled by the TCC solenoid which is pulse width modulated (PWM) to provide the desired amount of slip.

Shift Pressure Solenoid - The Shift Pressure Solenoid is activated when the TCM determines that a transmission shift is required. The solenoid is PWM controller to allow the proper amount of hydraulic pressure to the shift elements. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated, hydraulic pressure is removed from the proper shift elements to allow the desired shift. Once the shift is completed, the solenoid is turned off.

Modulation pressure solenoid - The modulation pressure is always active. The solenoid is pulse width modulated (PWM) controlled and is used to modulate the hydraulic system pressure to the desired pressure.

3.2.5 TRANSMISSION COMPONENT DESCRIPTIONS

Shift Assembly

The Shift Selector is similar to the TRS found on other DaimlerChrysler products, but is located in the Shifter Assembly instead of the transmission. The Shift Selector switches transmit all selector lever positions to the TCM. Light Emitting Diodes (LED's) are used as a light source in order to display the current selector lever position and provide basic shifter lighting. The shifter also has a vehicle PCI bus circuit for communication with the cluster (electronic PRNDL display). The Reverse light switch is integrated into the shifter module and controls the reverse lights through a reverse lamp relay. The Brake Shift Interlock solenoid and Park lockout solenoid, are also part of the Shift Selector module and are controlled by the TCM. The shifter module also supplies all power to the transmission system.

Note: If there are no LEDS illuminated on the shifter and the vehicle will not start, the TCM has a no response check the shifter assembly power connections for loss of voltage or ground.

Park lockout

This feature prevents inadvertent selection of Park at speeds above approximately 10 km/h (6MPH). The Park lockout solenoid is part of the Shifter Assembly and is controlled by the TCM.

Reverse Lamp Relay

The Reverse Light Switch is integrated into the shifter module and controls the reverse lights through a reverse lamp relay. The reverse lamp relay is located in the engine compartment. The reverse light switch provides a ground, to the reverse lamp relay solenoid control circuit, which turns the reverse lights on.

Brake shift inter-lock

To prevent unauthorized shifting out of the park position, the Selector lever is locked in the Park position until the ignition key is turned to the run position and the brake pedal is pressed. This will allow the driver to shift out of the park position.

Trans temp sensor - P/N Switch circuit

The TCM will detect the selector lever in park and neutral positions. The TCM does this by monitoring the Transmission temperature sensor signal along with the shifter position signals. The P/N switch contact is operated by a cam located in the transmission which, opens a reed contact switch that is wired in series with the transmission temperature sensor. When the P/N contact switch is opened in park and neutral, the TCM senses a high transmission temperature. Confirming the P/N switch status. Note: In park or neutral, the TCM uses engine temperature (to avoid setting a DTC). The TCM sends a hardwired signal to the PCM/ECM that will allow the PCM/ECM controlled start circuit to engage in P or N only. The TCM also sends a P/N bus message to the PCM/ECM to confirm the P/N switch status.

NOTE: The Engine Controller will allow starting of the vehicle if either the bus or hardwired P/N signal is present.

Input Speed Sensors

The W5J400 transmission has two input speed sensors N2 and N3, both speed sensors are located on the valve body and report DTC's for the input speed sensors errors. The speed sensors are hall effect speed sensors that are used by the TCM to calculate the transmissions input speed. Since the input speed could not be measured directly, two of the drive elements are measured. Two input speed sensors were required because both drive elements are not active in all gears. The input sensors N2 and N3 will report the same input speed in gears 2nd, 3rd or 4th. If the N2 and N3 input speed signals are not the same in these gears then there is an issue with the transmission and the DTC Input Sensors Mismatch will be set.

The N3 input speed is not reported in 1st and 5th gears. The N2 sensor is not reported in Reverse. The Input Speed Sensor Overspeed is a rationality check that is intended to indicate a major transmission failure and will cause a loss of drive (place the transmission in Neutral)

Output Speed Sensor (ABS signal)

The W5J400 transmission does not have an output shaft speed sensor. The TCM uses the ABS (Antilock Brake System) Wheel Speed sensor information, it receives over the CAN bus, to calculate the transmissions output shaft speed. The TCM monitors the ABS system for functionality and reports ABS speed sensor and communication DTCs, which will affect proper transmission operation. The MIL will be requested if two or more wheel speed sensors are involved. If both rear wheel speeds are not valid, Temporary Limp-in mode is activated and backup value for wheel speeds will be used. The TCM also uses the Axle ratio and Transfer case position and Ratio when in 4 Low to calculate transmission output speed. The TCM knows what mode the T-Case is in at all times. This is accomplished by a sensor on the transfer case that is wired to the PCM/ECM. Some four-wheel drive applications require averaging all four wheel speed sensors to calculate an accurate output shaft speed. This is not required with the W5J400 transmission system, the front sensors are used for various other calculations (vehicle speed, transverse acceleration) etc.

3.2.6 TRANSMISSION OPERATION AND SHIFT SCHEDULING

The transmission covered in this manual has unique shift schedules depending on the temperature of the transmission oil. The transmission oil temperature has a decisive effect on the shift quality of the transmission. The shift schedule is modified to extend the life of the transmission while operating under extreme conditions and to improve driver comfort by modifying shift schedules.

The transmission oil temperature is measured with a Temperature Sensor on the W5J400 transmission. The Temperature Sensor is an integral component of the Transmission Solenoid assembly. If the Temperature Sensor is causing a problem, a DTC will be set in the TCM.

The transmission temperature sensor is wired in series with the Park /Neutral (P/N) switch. The P/N switch is also located in the transmission. The transmission temperature is only read by the TCM when the P/N switch closes while in the R, D, 4,3,2,1 position. When the shifter lever is in the park or neutral position, the P/N switch opens and the temperature being displayed is Engine temperature.

3.2.7 TRANSMISSION ADAPTIVES - INITIALIZE AND STORE

Initialize Adaptive - This TCM function should be used when a new transmission has been placed in the vehicle. This command will reset the TCM adaptive to the factory setting.

Store Adaptive - This command should be used after the vehicle has been test driven by the technician to store any learned adaptive changes that occurred during the test drive. During normal operation adaptive are updated every 10 minutes. Using this command the latest adaptive will be written to the TCM immediately.

3.3 DIAGNOSTIC TROUBLE CODES

Diagnostic trouble codes (DTC's) are codes stored by the Transmission Control Module (TCM) to help diagnose Transmission problems. They are viewed using the DRBIII® scan tool.

Always begin by performing a visual inspection of the wiring, connectors, cooler lines and the transmission. Any obvious wiring problems or leaks should be repaired prior to performing any diagnostic test procedures. Some engine driveability problems can be misinterpreted as a transmission problem. Ensure that the engine is running properly and that no PCM/ECM DTC's are present that could cause a transmission complaint.

If there is a communication SCI (K line) circuit problem, trouble codes will not be accessible until the problem is fixed. The DRBIII® will display an appropriate message. The following is a possible list of causes for a bus problem:

- open or short to ground/battery in SCI (K line) circuit.
- internal failure of any module or component connected to the SCI (K line) circuit

Each diagnostic trouble code is diagnosed by following a specific testing sequence. The diagnostic test procedures contain step-by-step instructions for determining the cause of a transmission diagnostic trouble code. Possible sources of the code are checked and eliminated one by one. It is not necessary to perform all of the tests in this book to diagnose an individual code. These tests are based on the problem being present at the time that the test is run.

If the TCM records a DTC that will adversely affect the vehicles transmission, it will request (via the communication bus) that the PCM/ECM illuminate the Malfunction Indicator Lamp (MIL). All transmission DTC's will be stored in the TCM.

3.3.1 ACTIVE (HARD) CODE

Any Diagnostic Trouble Code (DTC) that is set whenever the system or component is monitored is an Active code. This means that the problem is there every time the TCM checks that system or component. Some codes will set immediately at start up and others will require a road test under specific conditions to set the DTC. It must be determined if a code is Active (repeatable) or Stored (Intermittent) before attempting diagnosis.

3.3.2 STORED (INTERMITTENT) CODE

A diagnostic trouble code that is not there every time the TCM checks the circuit or function is a Stored (Intermittent) code. Problems that come and go like this are the most difficult to diagnose, they must be looked for under the specific conditions that cause them. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status. A DTC status can be ″Active″ or ″Stored″ (Intermittent). Active is when the DTC is present in the controller and the transmission is in the particular mode of operation for that DTC. Stored means that the DTC occurred at some point, but is not currently present, or the conditions have not been right to check for the presence of the problem, when a DTC is classified as Stored (Intermittent), no TCM reaction is required.

3.3.3 EMERGENCY RUNNING FUNCTION

If DTCs occur, safe-driving conditions must be retained but full functionality of the transmission will be limited to avoid damaging the automatic transmission. In the event of certain DTCs the TCM switches to emergency running. The TCM will store the appropriate DTC codes and solenoids will be de-energized (turned off)

The transmission effects will be:

- The last gear shifted remains in that position
- The modulating pressure and shift pressure increase to maximum value
- The torque converter clutch is disengaged (turned off)

Shifting manually after a DTC detection

Note: The vehicle can still be shifted manually to 2nd or reverse gear.

To accomplish these shifts you must
Stop the vehicle
Turn the ignition off
Start the engine

Place the selector lever into D for 2nd gear

Place the selector lever into R for reverse gear

The emergency running function is retained until the DTC is eliminated or the stored DTC code is erased.

Stored (Intermittent) DTCs can be reset by cycling the ignition switch

3.3.4 ERROR STATUS

DRBIII® will display: **DTC (name)**
DTC Status (Active or Stored)
DTC I.D. (Number of DTC)

The TCM stores information for each DTC stored in memory. This information defines the status of a particular DTC.

DTC I.D.	For each DTC a unique error number is defined. These DTC ID numbers count linear starting with 1. The unique number is used to identify DTC's in the TCM.	
Error Status	Active or Stored	Active: The DTC is present at the time of and is current error status in error memory. Stored (intermittent) : A DTC becomes Stored (Intermittent), if it was previously stored in memory and DTC set conditions are not satisfied.
Error Counter	The error counter shows how often a DTC was detected, which means a change of a DTC to 'active' status happened (the error counter will be incremented each time that a failure is detected independent of ignition cycles) The error counter is only incremented and allows to distinguish whether a DTC is a Active or an Stored (intermittent) DTC. The error counter is the number of times the TCM detects the DTC, the counter starts at 0 and counts to 255 (the maximum value is 255).	
Warm-up-Cycle Counter	The warm-up cycle counter is incremented (conditions for this problem detection have been met) if an error did not occur during the current driving cycle. and if a value of 255 is reached the error may be deleted from error memory. The counter starts at 0 and counts to 255 (the maximum value is 255). The counter will be reset to 0 if the problem occurs again.	
Driving Cycle Since First Set	The Driving Cycle First Set - will count the number of times the vehicle has completed a driving cycle since the DTC was first set. The counter will count up to 255 starts or until cleared.	

*Driving Cycle - A driving cycle is set when the engine speed is greater than 450 rpm. If one of the errors 28, 37, 39 or 82 is present the driving cycle is incremented immediately.

3.3.5 TROUBLE CODE ERASURE

Diagnostic Trouble Codes can be erased in two ways. The first is to erase the DTC with the DRBIII® or scan tool. The second is if the DTC is no longer present, the DTC is reset by the TCM (after an ignition cycle), which will place the DTC in an intermittent status (Stored DTC).

When there are no diagnostic trouble codes stored in memory, the DRBIII® will display ″NO DTC's DETECTED″

3.3.6 LIST OF DIAGNOSTIC TROUBLE CODES

The TCM may report any of the following DTC's.

DTC ID	Name of Code	Limp-in	MIL
46,47,48,57, 58,59,60,61, 62,63,65, 66,67, 69	Internal Controller	YES[1]	ON
2 , 71	1-2/4-5 Solenoid Circuit	YES[1]	ON
3, 72	2-3 Solenoid Circuit	YES[1]	ON
4, 73	3-4 Solenoid Circuit	YES[1]	ON
5	TCC Solenoid Circuit	YES[1]	ON
6	Mod. Press Solenoid Circuit	YES[1]	ON
7	Shift Pressure Solenoid Circuit	YES[1]	ON
8	Park Lock Out Solenoid Circuit	NO	OFF
9	P/N Output Circuit	NO	OFF
10	Solenoid Supply Voltage	YES[1]	ON
11	Sensor Supply Voltage	YES[1]	ON
12	N2 Input Sensor Circuit	YES[2]	ON
13	N3 Input Sensor Circuit	YES[2]	ON
14	Input Sensors Mismatch	YES[2]	ON
15	Input Sensor Overspeed	LOSS of DRIVE	ON
17	Shifter Signal Invalid	YES[2]	ON
19	System Overvoltage	YES[2]	OFF
20	Trans Temp Sensor Shorted	NO	OFF
21	System Undervoltage	YES[3]	OFF
22	ABS RR Sensor Message	YES[2]	ON [4]
23	ABS LR Sensor Message	YES[2]	ON [4]
24	ABS RF Sensor Message	YES[2]	ON [4]
25	ABS LF Sensor Message	YES[2]	ON [4]
26	Engine APP/TPS Message	NO	OFF
27	Engine Torque Message Incorrect	NO	OFF
28	Engine RPM Message	NO	OFF
29	Engine Torque Message Incorrect	NO	OFF
31	Engine Torque Message Incorrect	NO	OFF
32	Engine Torque Message Incorrect	NO	OFF
33	ABS Brake Message	NO	OFF
35	Engine CAN Message Missing	NO	OFF
36	Engine CAN Message Missing	YES[2]	ON
37	CAN Bus Circuit	YES[2]	ON

DTC ID	Name of Code	Limp-in	MIL
38	ABS CAN Message Missing	YES[2]	ON
39	Engine CAN Message Missing	NO	OFF
43	Engine Temp Message	NO	OFF
44	Engine T-case Switch Message	YES[1]	ON
49	Engine Overspeed	LOSS of DRIVE	ON
50	Improper Ratio	LOSS of DRIVE	ON
51	Transmission Slipping	NO[5]	ON
52	TCC Stuck On	NO	OFF
53	TCC Over Temp	NO	OFF
54	Engine Torque Reduction	NO	OFF
55	Improper Gear	YES[2]	ON
56	Solenoid Supply/Watchdog	YES[6 then 1]	ON
74	Trans Temp Sensor-P/N switch circuit	NO	OFF
75	Trans Temp Sensor Erratic	NO	OFF
76	Internal Shifter failure	YES[2]	ON
81	ABS CAN Message Incorrect	YES[2]	ON
82	Engine CAN Message Missing	NO	OFF
83	Engine CAN Message Missing	YES[2]	ON
85	Engine CAN Message Incorrect	NO	OFF

Permanent Limp-in mode [1] Temporary Limp-in mode [2] Undervoltage Limp-in [3] MIL on if two or more sensors [4] Conditional limp-in [5] Hardware Error[6]

3.3.7 DTC DESCRIPTIONS

Name of code: Internal Controller (46,47,48,57,58,59,60,61,62,63,65,66,67,69)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: This code is set whenever Transmission Control Module (TCM) senses an internal error.

Theory of Operation: The TCM is constantly monitoring it's internal processor. If an internal problem is detected, this DTC will be set. The TCM performs various internal tests to verify proper controller operation. When one of these tests fail the controller will enter Hardware Error mode and the controller should be replaced.

Transmission Effects: The MIL will illuminate and the transmission system will default to the Limp-in.

Possible causes:

- Solenoid DTC's will set the internal controller code (repair first before replacing TCM)
- TCM

Name of code: 1-2/4-5 Solenoid Circuit (2, 71)

When Monitored: Always monitored with system active at each ignition cycle, but only a short to ground will be detected without the engine running..

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The 1-2/4-5 solenoid is activated when the TCM determines that the transmission must shift into or out of 2nd gear or 5th gear. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated hydraulic pressure is applied to the proper shift elements in the transmission to allow the desired shift. Once the shift is completed the solenoid is turned off. Note: DTC ID 71 varies from DTC ID 2 in the manner that the DTC is detected. This detection method uses direct feed back to the microprocessor and not the diagnostic capabilities of the driver circuits. This detection method will only detect open circuits, shorts to ground and shorted drivers when the output is off and the engine is running.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive solenoid failures are detected by the TCM, the TCM will not retest the solenoid and place the transmission is Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Solenoid circuit wiring
- Solenoid internal
- TCM

Name of code: 2-3 Solenoid Circuit (3, 72)

When Monitored: Always monitored with system active at each ignition cycle, but only a short to ground will be detected without the engine running.. Set condition:. If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The 2-3 solenoid is activated when the TCM determines that the transmission must shift into or out of 3rd gear. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated hydraulic pressure is applied to the proper shift elements in the transmission to allow the desired shift. Once the shift is completed, the solenoid is turned off. Note: DTC ID 72 varies from DTC ID 3 in the manner that the DTC is detected. This detection method uses direct feed back to the microprocessor and not the diagnostic capabilities of the driver circuits. This detection method will only detect open circuits, shorts to ground and shorted drivers when the output is off and the engine is running.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive solenoid failures are detected by the TCM, the TCM will not retest the solenoid and places the transmission in Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Solenoid circuit wiring
- Solenoid internal
- TCM

Name of code: 3-4 Solenoid Circuit (4, 73)

When Monitored: Always monitored with system active at each ignition cycle, but only a short to ground will be detected without the engine running.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The 3-4 solenoid is activated when the TCM determines that the transmission must shift into or out of 4th gear. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated, hydraulic pressure is applied to the proper shift elements in the transmission to allow the desired shift. Once the shift is completed, the solenoid is turned off. Note: DTC ID 73 varies from DTC ID 4 in the manner that the DTC is detected. This detection method uses direct feed back to the microprocessor and not the diagnostic capabilities of the driver circuits. This detection method will only detect open circuits, shorts to ground and shorted drivers when the output is off and the engine is running.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive solenoid failures are detected by the TCM, the TCM will not retest the solenoid and places the transmission in Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Solenoid circuit wiring
- Solenoid internal
- TCM

Name of code: TCC Solenoid Circuit (5)

When Monitored: Always monitored with system active at each ignition cycle. Solenoid inactive, Solenoid active and controlled above 25% duty cycle, Solenoid Supply Active.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The TCC solenoid is activated when the TCM determines that the Torque converter clutch should be activated. The TCC clutch is a variable slip torque clutch that allows control of torque converter slip from 5% to 95.5% of full TCC engagement. The clutch is controlled by the TCC solenoid which is pulse width modulated (PWM) to provide the desired amount of slip.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive solenoid failures are detected by the TCM, the TCM will not retest the solenoid and places the transmission in Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Solenoid circuit wiring
- Solenoid internal
- TCM

Name of code: Mod. Press Solenoid Circuit (6)

When Monitored: Always monitored with system active at each ignition cycle. Solenoid off, Solenoid active with 25-75% duty cycle, Solenoid Supply Active

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The modulation pressure is always active. The solenoid is pulse width modulated (PWM) controlled and is used to modulate the hydraulic system pressure to the desired pressure.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive solenoid failures are detected by the TCM, the TCM will not retest the solenoid and places the transmission in Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Solenoid circuit wiring
- Solenoid internal
- TCM

Name of code: Shift Pressure Solenoid Circuit (7)

When Monitored: When the solenoid is off, solenoid active with 25-75% duty cycle and/or the solenoid supply is active

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The Shift Pressure Solenoid is activated when the TCM determines that a transmission shift is required. The solenoid is PWM controller to allow the proper amount of hydraulic pressure to the shift elements. The solenoid is only activated during the shifting of the transmission. When the solenoid is activated, hydraulic pressure is applied to the proper shift elements through one of the shift solenoids in the transmission to allow the desired shift. Once the shift is completed the solenoid is turned off.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive solenoid failures are detected by the TCM, the TCM will not retest the solenoid and places the transmission in Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Solenoid circuit wiring
- Solenoid internal
- TCM

Name of code: Park Lockout Solenoid Circuit (8)

When Monitored: When the solenoid is off and when the solenoid is active.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

Theory of Operation: The Park lockout Solenoid is activated when vehicle speed is greater then 6 MPH to protect the transmission from inadvertently being shifted into Park while moving. The Park lock out solenoid is located in the Shifter assembly.

Transmission Effects: Transmission may be able to be shifted into Park when vehicle speed is above 6 MPH. The DTC is evaluated with each ignition cycle if the DTC is detected the solenoid is switched off until the ignition is cycled. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Solenoid circuit wiring
- Solenoid
- TCM

Name of code: P/N Output Circuit (9)

When Monitored: Shifter is in park or neutral and the solenoid is active

Set Condition: Shifter is in park or neutral and the output is active

Theory of Operation: The Park/Neutral output is a hard wired connection to the Engine Controller. The TCM will activate this output when is detects that the Shifter is in the park or neutral position. The TCM will also send a P/N bus message to the PCM/ECM. The P/N switch is wired in series with the transmission temperature sensor and is open in park and neutral. This is a redundant signal as the PCM/ECM also receives a message over the CAN bus that provides the same information. The PCM/ECM will allow starting of the vehicle if either of these signals is present. NOTE: The Engine Controller will allow starting of the vehicle if either the bus or hardwired signal is present.

Transmission Effects: The vehicle may be able to be started in gear. Once set in the system, the output is switched off and the TCM will not reevaluate DTC until the ignition key is cycled. If the

DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- P/N circuit wiring
- PCM/ECM
- TCM

Name of code: Solenoid Supply Voltage (10)

When Monitored: When the output is active and no under-voltage condition exists.

Set Condition: If the measured Solenoid Supply Voltage and measured battery voltage differ by 3.6 volts. (Watchdog DTC is set if short to B+)

Theory of Operation: The Solenoid Supply Voltage output of the TCM provides the voltage to the three shift solenoids, two pressure solenoids and TCC solenoids. The output is active whenever the system is in normal operation. If a major system DTC is detected this output is turned off to ensure that no solenoids are active.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM will place the transmission is Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Short to B+ on any solenoid circuit
- Solenoid supply circuit
- Solenoid internal
- TCM

Name of code: Sensor Supply Voltage (11)

When Monitored: Always monitored with system active at each ignition cycle and no under-voltage condition exists.

Set Condition: If measured sensor voltage is not within specified limits 4.8-7.2 volts or if a problem with the regulator, Sensor Supply Voltage shorted to ground, Sensor Supply Voltage shorted to battery is detected.

Theory of Operation: The Sensor Supply Voltage output provides the 6.0V supply voltage to both input speed sensors. The output is active whenever the system is in operation.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM will place the transmission is Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Sensor supply circuit
- Solenoid internal
- TCM

Name of code: N2 Input Sensor Circuit (12)

When Monitored: Engine speed greater than 450 rpm, no engine speed DTC's, no TCM under-voltage system operation, no output speed sensor DTC's (signal from the ABS system), all wheel speeds above 250 rpm (signal from the ABS system), no rear wheel speed DTC's (signal from the ABS system), and no wheel slip detected (signal from the ABS system).

Set Condition: If the N2 input speed sensor is equal to 0 rpm or a short to ground, short to battery open input speed sensor, input speed sensor, open sensor supply circuit.

Theory of Operation: The N2 Input Speed Sensor is one of two hall effect speed sensors that are used by the TCM to calculate the transmissions input speed. Since the input speed could not be measured directly two of the drive elements are measured. Two input speed sensors were required because both drive elements are not active in all gears.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM places the transmission in Limp-in until the DTC is erased with the DRBIII®. The TCM will use a back up value for the N2 input speed sensor of 8000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Sensor circuit wiring
- Open Sensor Supply Circuit
- Solenoid internal
- TCM

Name of code: N3 Input Sensor Circuit (13)

When Monitored: Engine speed greater than 450 rpm, no engine speed DTC's, no TCM under-voltage system operation, no output speed sensor DTC's (signal from the ABS system), all wheel speeds above 250 rpm (signal from the ABS system), no rear wheel speed DTC's (signal from the ABS system), and no wheel slip detected (signal from the ABS system), no shifting operation, detected gear is 3rd or 4th and the detected gear is the actual vehicle gear.

Set Condition: If the N3 input speed sensor is equal to 0 rpm or a short to ground, short to battery open input speed sensor, input speed sensor, open sensor supply circuit.

Theory of Operation: The N3 Input Speed Sensor is one of two Hall effect speed sensors that are used by the TCM to calculate the transmissions input speed. Since the input speed could not be measured directly two of the drive elements are measured. Two input speed sensors were required because both drive elements are not active in all gears.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM places the transmission in Limp-in until the DTC is erased with the DRBIII®. The TCM will use a back up value for the N3 input speed sensor of 8000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Sensor circuit wiring
- Open Sensor Supply Circuit
- Solenoid internal
- TCM

Name of code: Input Sensors Mismatch (14)

When Monitored: Engine speed greater than 450 rpm, no engine speed DTC's, no TCM under-voltage system operation, no output speed sensor DTC's (signal from the ABS system), all wheel speeds above 250 rpm (signal from the ABS system), no rear wheel speed DTC's (signal from the ABS system), and no wheel slip detected (signal from the ABS system), no shifting operation, N3 input speed sensor greater than 800 rpm and N2 input speed sensor greater than 0 rpm and the TCM not in reset.

Set Condition: If the speed difference between the N2 and N3 input speed sensors is greater than 150 rpm.

Theory of Operation: The N2 and N3 Input Speed Sensors will report the same speed in gears 2,3 or 4. If these signals are not the same in these gears then there is an issue with the transmission.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM places the transmission in Limp-in until the DTC is erased with the DRBIII®. The TCM will use a back up value for the N2 and N3 input speed sensors of 8000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Transmission internal
- Solenoid internal
- TCM

Name of code: Input Sensor Overspeed (15)

When Monitored: Whenever the N2 input speed sensor is greater than 0 rpm

Set Condition: If the rpm of the N2 or N3 input speed sensor is greater than 7700 rpm

Theory of Operation: The rationality check is intended to indicate a catastrophic transmission failure. The MIL will illuminate and the transmission will be placed in neutral until the ignition key is cycled. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Transmission Effects: Loss of drive and the transmission will shift to neutral

Possible causes:

- Transmission internal
- TCM

Name of code: Shifter Signal Invalid (17)

When Monitored: Always monitored with system active at each ignition cycle and no under-voltage condition exists

Set Condition: The Shifter detects an invalid code, shifter failure, TCM failure, Short to ground, open circuit or short to battery on one of the five circuits.

Theory of Operation: This transmission does not have a Range Sensor internally. The customer requested gear must be communicated by the shifter module to the TCM. This is accomplished by five circuits, which send a gray code to the transmission controller. If this gray code is incorrect, this DTC is set. The shifter sense circuits communicate the shift lever position to the TCM. Each circuit is terminated at the shifter. Each circuit can be either HI or LO, depending on the shift lever position. The TCM can decode this information and determine the shift lever position. Each shift lever position has a certain combination of circuits, which will be HI and LO, this is called a PRNDL code. There are five circuits, therefore: there are many possible combinations of HI and LO circuit (codes). The following chart shows the normal switch states for each shift lever position.

PRNDL SWITCH INPUTS FROM THE SHIFTER

Switch	**Park**	**T1**	**Rev**	**T2**	**N**	**T3**	**D**	**4**	**3**	**2**	**1**
C1	HI	LO	LO	LO	HI	HI	LO	LO	LO	HI	HI
C2	HI	HI	HI	LO	LO	LO	LO	LO	HI	LO	HI
C3	HI	HI	HI	HI	HI	LO	HI	LO	LO	LO	LO
C4	LO	LO	HI	HI	HI	HI	LO	HI	LO	LO	HI
C5	LO	HI	LO	HI	LO	HI	LO	LO	LO	LO	LO
HI = 12 volts LO = 0 volts											

DRBIII® error code list

ERROR CODE	SWITCH STUCK	POSITION
1.	C1 Stuck	Open
2.	C1 Stuck	Closed
3.	C2 Stuck	Open
4.	C2 Stuck	Closed
5.	C3 Stuck	Open
6.	C3 Stuck	Closed
7.	C4 Stuck	Open
8.	C4 Stuck	Closed
9.	C5 Stuck	Open
10.	C5 Stuck	Closed

Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM will place the transmission in Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Shifter circuit wiring
- Internal Shifter
- TCM

Name of code: System Overvoltage (19)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Ignition voltage above 16.9 volts with the engine and transmission input speed sensors above 2000 rpm for 60 seconds

Theory of Operation: The TCM monitors the ignition voltage that it is supplied. This DTC is set when the monitored voltage raises above a threshold. Temporary limp-in mode will be activated when the voltage reaches the threshold, but the System Overvoltage DTC will not be saved unless the engine speed and transmission input speed is greater then 2000 RPM for 60 seconds. The system will recover if the ignition voltage drops below 16.4 volts.

Transmission Effects: The transmission will be placed in Temporary Limp-in. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Charging system
- 24-volt jump(jumpstart of vehicle with battery in series)
- TCM

Name of code: Transmission Temp Sensor Shorted (20)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Temperature sensor input is below a threshold (.5V), failed temperature sensor, short to ground, TCM

Theory of Operation: The Solenoid Assembly in the transmission contains a sensor that monitors the oil temperature of the transmission. This sensor is wired in series with the P/N Switch. The transmission temperature sensors expected state is detected as OPEN when the transmission is in Park or Neutral. When in park or neutral, the temperature displayed will be engine temperature.

Transmission Effects: No Reaction, Engine temperature is substituted for transmission temperature. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Temp Sensor wiring
- Solenoid internal
- TCM

Name of code: System Undervoltage (21)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Ignition voltage falls below 8.5 volts with engine rpm greater than 2000 RPM for 60 seconds.

Theory of Operation: The Transmission Controller monitors the ignition voltage that it is supplied. This DTC is set when the monitored voltage falls below a threshold. Undervoltage limp-in mode will be activated when the voltage reaches the threshold, but a DTC will not be saved unless the engine speed and transmission input speed is greater then 2000 RPM for 60 seconds. The system will recover if the ignition voltage rises above 9.0 volts.

Transmission Effects: The TCM will go into undervoltage limp-in. Diagnostic DTC detection for other DTC's is turned off. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Charging system
- Fused Ignition wiring
- Low battery voltage
- TCM

Name of code: ABS RR Sensor Message (22)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect DTCs are not active

Set Condition: ABS signal ″wheel speed rear right″ not valid or ABS has detected a sensor failure.

Theory of Operation: The W5J400 transmission does not have an output shaft speed sensor. The TCM uses the ABS Wheel Speed sensor information, it receives over the CAN bus, to calculate the output shaft speed. This calculation considers the Axle ratio and Transfer case position and gear ratio when in 4 Low.

Transmission Effects: MIL on if two or more wheel speed sensors are involved. The secondary system reaction is to use wheel speed rear left as backup value, if two wheel speeds are not valid Temporary Limp-in mode is activated and backup value for wheel speeds = 2000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- ABS Wheel speed sensor
- ABS controller
- TCM

Name of code: ABS LR Sensor Message (23)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal ″wheel speed rear left″ not valid or ABS has detected a sensor failure.

Theory of Operation: The W5J400 transmission does not have an output shaft speed sensor. The TCM uses the ABS Wheel Speed sensor information, it receives over the CAN bus, to calculate the output shaft speed. This calculation considers the Axle ratio and Transfer case position and ratio when in 4 Low.

Transmission Effects: MIL on if two or more wheel speed sensors are involved. The secondary system reaction is to use wheel speed rear right as backup value, if two wheel speeds are not valid Temporary Limp-in mode is activated and backup value for wheel speeds = 2000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- ABS Wheel speed sensor
- ABS controller
- TCM

Name of code: ABS RF Sensor Message (24)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal ″Wheel Speed Front Right″ not valid or ABS has detected a sensor failure.

Theory of Operation: The W5J400 transmission does not have an output shaft speed sensor. The TCM uses the ABS Wheel Speed sensor information, it receives over the CAN bus, to calculate the output shaft speed. This calculation considers the Axle ratio and Transfer case position and ratio when in 4 Low. For some 4 Wheel Drive applications, it is required to average all four sensors to calculate an accurate output shaft speed. This is not required with this system, the front sensors are used for various other calculations (vehicle speed, transverse acceleration) etc.

Transmission Effects: no reaction- front sensors used for other calculations, MIL on if two or more wheel speed sensors are involved. The secondary system reaction is if two wheel speeds are not valid Temporary Limp-in mode is activated and backup value for wheel speeds = 2000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- ABS Wheel speed sensor
- ABS controller
- TCM

Name of code: ABS LF Sensor Message (25)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal ″Wheel Speed Front Left″ not valid or ABS has detected a sensor failure.

Theory of Operation: The W5J400 transmission does not have an output shaft speed sensor. The TCM uses the ABS Wheel Speed sensor information, it receives over the CAN bus, to calculate the output shaft speed. This calculation considers the Axle ratio and Transfer case position and ratio when in 4 Low. For some 4 WD applications it is required to average all four sensor to calculate an accurate output shaft speed. This is not required with this system, front sensors are used for various other calculations (vehicle speed, transverse acceleration) etc.

Transmission Effects: No reaction- front sensors are used for other calculations, The MIL will be turned on if two or more wheel speed sensors are involved. The secondary system reaction is if two wheel speeds are not valid Temporary Limp-in mode is activated and backup value for wheel speeds = 2000 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- ABS Wheel speed sensor
- ABS controller
- TCM

Name of code: Engine APP/TPS Message (26)

When Monitored: - Valid APP/TPS CAN Message Received at least once and CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: - APP/TPS (accelerator pedal position) Message not valid or PCM/ECM engine sensor DTC detected. NOTE: The PCM/ECM can not detect a short to ground or an open circuit of the APP/TPS. The above DTC should only be indicated if the APP/TPS signal is shorted to Battery or Sensor supply.

Theory of Operation: The TCM does not have a direct interface with the APP/TPS (accelerator pedal position). It obtains this information over the CAN bus from the PCM/ECM.

Transmission Effects: No reaction - backup value for APP/TPS accelerator pedal position = 25 %. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status

Possible causes:

- APP/TPS (accelerator pedal position)
- PCM/ECM
- TCM

Name of code: Engine Torque Message Incorrect (27)

When Monitored: Valid Torque CAN messages received at least once and CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: - Engine torque message not valid or PCM/ECM controller error.

Theory of Operation: The TCM receives engine torque information over the CAN bus from the PCM/ECM. This information is used to determine what torque reduction will be required during a transmission shift. The TCM requests the torque reduction from the PCM/ECM over the CAN bus. This message indicates the level of torque that the engine is presently producing.

Transmission Effects: No reaction - Shifts performed with higher system pressures and a backup value for engine torque = 600 Nm (443 Ft/LBS). If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- PCM/ECM
- TCM

Name of code: Engine RPM Message (28)

When Monitored: - Valid RPM CAN message received at least once CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: Signal ″engine speed″ not valid or PCM/ECM error.

Theory of Operation: The TCM receives engine RPM information over the CAN bus from the PCM/ECM

Transmission Effects: No reaction - backup value for engine speed = 750 rpm. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Engine Speed Sensor
- PCM/ECM
- TCM

Name of code: Engine Torque Message Incorrect (29)

When Monitored: - Valid Torque CAN messages received at least once and CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: - Engine torque minimum message not valid or PCM/ECM error.

Theory of Operation: The TCM receives engine torque information over the CAN bus from the PCM/ECM. This information is used to determine what torque reduction will be required during a transmission shift. The TCM requests the torque reduction from the PCM/ECM over the CAN bus. This message is used to set the minimum level of torque that the TCM can request

Transmission Effects: No reaction - Shifts performed with higher system pressures and a backup value for minimum engine torque = 600 Nm (443 Ft/LBS) If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- PCM/ECM
- TCM

Name of code: Engine Torque Message Incorrect (31)

When Monitored: - Valid Torque CAN messages received at least once and CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: - Engine torque Maximum message not valid or PCM/ECM error.

Theory of Operation: The TCM receives engine torque information over the CAN bus from the PCM/ECM. This information is used to determine what torque reduction will be required during a transmission shift. The TCM requests the torque reduction from the PCM/ECM over the CAN bus. This message is used to set the maximum level of torque that the TCM can request

Transmission Effects: No reaction - Shifts performed with higher system pressures and a backup value for engine torque = 600 Nm (443 Ft/LBS) If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- PCM/ECM
- TCM

Name of code: Engine Torque Message Incorrect (32)

When Monitored: - Valid Torque CAN messages received at least once and CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: Signal "torque demand ESP" not valid or PCM/ECM error.

Theory of Operation: The TCM receives engine torque information over the CAN bus from the PCM/ECM. This information is used to determine what torque reduction will be required during a transmission shift. The TCM requests the torque reduction from the PCM/ECM over the CAN bus. This message indicates what the present torque of the engine would be without a TCM torque reduction request.

Transmission Effects: No reaction - Shifts performed with higher system pressures and a backup value for engine torque = 600 Nm (443 Ft/LBS) If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- PCM/ECM
- TCM

Name of code: ABS Brake Message (33)

When Monitored: Valid Brake CAN message received at least once and CAN Bus Circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active.

Set Condition: Signal "brake-light switch" not valid- ABS sending invalid value.

Theory of Operation: The TCM receives the brake switch status from the ABS controller over the CAN bus.

Transmission Effects: No reaction - brake light switch signal is set to a default value (not actuated). If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- ABS
- TCM

Name of code: Engine CAN Message missing (35)

When Monitored: CAN Bus circuit error not present, 1 second after ignition on and not in Park or Neutral, no System Overvoltage or System Undervoltage conditions present, or transmission in Park or Neutral and engine RPM greater than 850 RPM.

Set Condition: This DTC is set if the Vehicle Mileage CAN message from the PCM/ECM was not received in the required time.

Theory of Operation: The TCM receives information from the Engine controller over the CAN bus.

Transmission Effects: No reaction, no Mileage reported in DTC History, if the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Possible causes:

- CAN Bus wiring
- Ignition to PCM/ECM
- PCM/ECM
- TCM

Name of code: Engine CAN Message Missing (36)

When Monitored: CAN Bus Circuit error not present, 1 sec after ignition on and the transmission is not in Park or Neutral, no System Overvoltage or System Undervoltage conditions present, transmission in Park or Neutral and engine RPM greater than 850 RPM

Set Condition: : This DTC is set if the Engine Coolant and T-Case Status CAN message from the PCM/ECM was not received in the required time. - PCM/ECM controller issue

Theory of Operation: The TCM receives information from the PCM/ECM over the CAN bus.

Transmission Effects: The transmission will be placed in Temporary Limp-in, a backup value for engine coolant temperature = 80 °C (176 °F) - transfer case 4H default value used. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- CAN Bus
- Ignition to PCM/ECM
- PCM/ECM
- TCM

Name of code: CAN Bus Circuit (37)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Open circuit in the CAN C Bus (+) circuit or CAN C Bus (-) circuit, Short to ground of CAN C Bus (+) circuit or CAN C Bus (-) circuit, Short to Voltage of CAN C Bus (+) circuit or CAN C

Bus (-) circuit, CAN C Bus (+) circuit shorted to CAN C Bus (-) circuit, or a TCM Failure

Theory of Operation: The TCM receives information from the PCM/ECM and ABS controllers over the CAN bus. The CAN bus is a high speed communication bus that allows real time control capability between various controllers. Most messages are sent every 20 milliseconds, this means critical information can be shared between controllers. The CAN bus is a two wire bus with a CAN C Bus (+) circuit and a CAN C Bus (-) circuit. These circuits are twisted pairs in the harness to reduce the potential of radio and noise interference.

Transmission Effects: The transmission will be placed in Temporary Limp-in. All Secondary System Reactions for Missing messages will be activated. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Possible causes:

- CAN Bus wiring
- ABS
- PCM/ECM
- TCM

Name of code: ABS CAN Message missing (38)

When Monitored: CAN Bus Circuit error not present, 1 second after ignition on and not in Park or Neutral, no System Overvoltage or System Undervoltage conditions present, or transmission in Park or Neutral and engine RPM greater than 850 RPM

Set Condition: This DTC is set when a CAN ID was not received in the required time and are not being sent from the ABS Controller. NOTE: The ABS controller is powered by the run only ignition feed. This means that this DTC will be set if the key is placed in the start position with the transmission in gear or if in Park or Neutral and the engine RPM is greater than 850 RPM. Because of this, the presence of this DTC should be verified by turning the ignition on to the run position and placing the Shifter in the R position.

Theory of Operation: The TCM receives information from the ABS controller over the CAN bus.

Transmission Effects: The transmission will be placed in Temporary Limp-in. Backup values for wheel speed set to 2000 RPM. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Possible causes:

- CAN Bus wiring
- Ignition to PCM/ECM
- ABS
- TCM

Name of code: Engine CAN Message missing (39)

When Monitored: CAN Bus Circuit error not present, 1 second after ignition on and not in Park or Neutral, no System Overvoltage or System Undervoltage conditions present, or transmission in Park or Neutral and engine RPM greater than 850 RPM

Set Condition: This DTC is set when the Engine Torque, APP/TPS and RPM CAN messages from the PCM/.ECM was not received in the required time.

Theory of Operation: The TCM receives information from the Engine controller over the CAN bus.

Transmission Effects: Controlled Limp-in, backup value for accelerator pedal position is 25%, backup value for engine rpm is 750 rpm, TCM uses backup value for engine torque of 600 Nm, and other PCM/ECM signals are set to default. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Possible causes:

- CAN Bus wiring
- Ignition to PCM/ECM
- PCM/ECM
- TCM

Name of code: Engine Temp Message (43)

When Monitored: Valid Engine Temp CAN message received at least once and CAN Bus Circuit error, Engine CAN Message Missing and Engine CAN Messages Incorrect are not active.

Set Condition: Engine coolant temperature signal is not valid - indicates a possible coolant temperature sensor error.

Theory of Operation: The TCM receives engine temperature information over the CAN bus from the Diesel Controller. This information is used to modify transmission shifting based on engine temperature. It is also used as a backup if the transmission temperature sensor fails.

Transmission Effects: No reaction - backup value for engine coolant temperature = 80 °C

Possible causes:

- Engine Temperature Sensor Wiring
- Engine Temperature Sensor
- PCM/ECM
- TCM

Name of code: Engine T-case Switch Message (44)

When Monitored: Valid T-Case CAN message received at least once, the CAN Buss Circuit and Engine CAN Message Missing are not active.

Set Condition: Transfer Case Status signal not valid - indicates possible T-Case sensor error.

Theory of Operation: The W5J400 Transmission does not have an output speed sensor. The output shaft speed is calculated from the ABS wheel speed information received over the CAN bus. In order to calculate the output shaft speed the TCM uses the axle ratio and the transfer case ratio when in low gear. The TCM must know what mode the T-Case is in at all times. This is accomplished by a sensor in the transfer case that is wired to the PCM/ECM.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Permanent Limp-in. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status

Possible causes:

- Transfer Case Sensor wiring
- Transfer Case Sensor
- Transfer Case - Mechanical
- PCM/ECM
- TCM

Name of code: Engine Overspeed (49)

When Monitored: Valid Engine RPM message received at least once, the CAN Bus Circuit and Engine CAN Message Missing are not active.

Set Condition: If the engine speed increases above 5100 RPM.

Theory of Operation: The TCM monitors the engine speed over the CAN bus. If the engine speed increases above a set value (5100 RPM) the TCM assumes that either the information from the Engine controller is incorrect or that a major mechanical problem exists. The TCM will then force the transmission into neutral to protect the transmission.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Neutral (LOSS of DRIVE) until the ignition key is cycled. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Engine - Mechanical
- Transmission - Mechanical
- PCM/ECM
- TCM

Name of code: Improper Ratio (50)

When Monitored: Engine rpm greater than 450 rpm, output speed greater than 180 rpm, no N2 - N3 input speed sensor errors present, no gear selector lever errors present, no ABS system errors, no transfer case errors present, and all wheel speeds above 450 rpm.

Set Condition: No shifting operation and detected gear is not the actual gear No shifting operation - detected (calculated) gear is less than actual(expected) gear or no plausible gear is calculated or Actual turbine speed - calculated turbine speed > 300 rpm or calculated transmission ration is above threshold. During an Upshift - detected (calculated) gear is less than actual(expected) gear-1. During Downshift - detected (calculated) gear is less than actual (expected) gear

Theory of Operation: The TCM constantly calculates the transmission ratio based on the N2-N3 input speed signals and the calculated output shaft speed (CAN message from the ABS). The TCM will detect if the transmission is trying to mechanically shift into a lower gear, then the TCM intends.

Transmission Effects: The MIL will illuminate and the transmission will be placed in Neutral (LOSS of DRIVE) until the ignition key is cycled. If the DTC is reset (after an ignition cycle) the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Solenoid wiring
- Transfer Case position sensor
- Transmission - mechanical
- TCM

Name of code: Transmission Slipping (51)

When Monitored: Engine rpm greater than 450 rpm, output speed greater than 180 rpm, no N2 - N3 input speed sensor errors present, no gear selector lever errors present, no ABS system errors, no transfer case errors present, and all wheel speeds between 70 - 380 rpm with no wheel slip detected.

Set Condition: Calculated ratio not within allowable range for the engaged gear. No shifting operation.

Theory of Operation: The TCM constantly calculates the transmission ratio based on the N2-N3 input speed signals and the calculated output shaft speed (CAN message from the ABS). The TCM will detect if the transmission is slipping or an invalid gear ratio is present

Transmission Effects: Controlled Limp-in and delayed engagement in reverse, modulating pressure is set to maximum value and a transmission shift into 3rd gear only, will be allowed, MIL will illuminate, DTC re-evaluated after ignition key is cycled. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Transfer Case position error
- Transfer case - mechanical
- Transfer Case - shift cable adjustment
- Transmission - mechanical
- Axle - mechanical
- Axle ratio incorrect
- TCM

Name of code: TCC Stuck On (52)

When Monitored: TCM not in initialization phase, No input speed sensor N2 - N3 codes present, no CAN bus code present, no PCM/ECM codes present, no CAN engine speed codes present, Engine speed Greater than 450 rpm, no CAN engine torque codes present, no shift in progress, must be in a forward gear (1, 2, 3, 4 or 5 engaged), TCM torque converter status = OPEN

Set Condition: Engine RPM-Turbine Speed 100NM for 1 second

Theory of Operation: The TCM constantly monitors the amount of torque converter slippage. When the torque converter is open the slippage is expected to be above a threshold. If the slippage is less then expected when the TCC is open then the TCM assumes that the TCC is stuck on.
Transmission Effects: No reaction, If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.
Possible causes:

- Solenoid
- Transmission - mechanical
- TCM

Name of code: TCC Over Temp (53)
When Monitored: TCM not in initialization phase, Solenoid supply active, No input speed sensor N2 - N3 codes present, no CAN bus code present, no PCM/ECM codes present, no CAN engine speed codes present, TCM torque converter clutch in slip mode.
Set Condition: Friction loss factor reaches threshold
Theory of Operation: The TCM monitors the friction losses of the torque converter clutch while it is in slipping mode. The friction losses are calculated using the CAN signals engine speed and engine torque as well as the torque converters turbine speed calculated by the TCM. Depending on the friction losses calculated in each program cycle, a corresponding value is added to a factor as long as the torque converter clutch is in slipping mode. The factor is set to 0 when the clutch is opened. If the factor reaches a specified value a DTC is detected.
Transmission Effects: No reaction, the desired value for the TCC slip is set to it's minimum value until the DTC is cleared by the DRBIII®. DTC's must be erased in order to return to normal operation.
Possible causes:

- Transmission - mechanical

Name of code: Engine Torque Reduction (54)
When Monitored: Engine intervention active for at least 20 ms, no engine torque errors, engine torque demand is greater than 0.
Set Condition: Torque Reduction acknowledge bit - not set, no shift aborts, the error flag ″torque reduction acknowledge″ is not set, Engine controller not supporting torque requests.
Theory of Operation: The TCM requests torque reductions, over the CAN bus, during a transmission shift to improve shift quality. The TCM verifies that the PCM/ECM has performed the requested torque reduction by monitoring the response to the request. If the response is not within a specified tolerance the TCM increments a counter. If this counter reaches a threshold then a failure is detected
Transmission Effects: No reaction, If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.
Possible causes:

- PCM/ECM
- TCM

Name of code: Improper Gear (55)
When Monitored: The conditions for gear detection: are, engine speed greater than 450 rpm, No input speed sensor failures are active, no selector lever error active, selector lever is not in intermediate position, selector lever position is not showing power-up value, no output speed error is active, no transfer case error is active, output speed (ABS system) greater than 180 rpm, no wheel speed (ABS system) overspeed detected.
Set Condition: If problem is present for the 3 consecutive ignition cycles then the system will be placed into Limp-in mode until the DTC is cleared by the DRBIII® diagnostic tool.
Theory of Operation: The TCM compares the calculated gear with the gear the transmission has actually engaged. The actual gear is identified by verifying the signals of the two speed sensors N2 and N3 as well as the transmission output speed (from the ABS system). If the actual gear differs from the gear calculated by the TCM, the TCM value is adjusted to the engaged gear and a counter is increased by 2 points. If after a shift the engaged gear and the calculated gear still match, the counter is decreased by 1 point. A DTC is detected as soon as the counter exceeds a threshold.
Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If three consecutive failures are detected by the TCM, the TCM will place the transmission is Limp-in until the DTC is erased with the DRBIII®. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.
Possible causes:

- Solenoid valve
- Internal Transmission
- TCM

Name of code: Solenoid Supply/Watchdog (56)
When Monitored: Always monitored with system active at each ignition cycle.
Set Condition: During the power up of the TCM, it tests the ability of the external watchdog to shut down the Solenoid Supply driver.
Theory of Operation: The TCM performs various internal tests to verify proper TCM operation. During the power up of the TCM it tests the ability of the external watchdog to shut down the Solenoid Supply driver. It does this by not servicing the external watchdog, this will cause a false triggering of the Watchdog and should result in the shut down

of the Solenoid Supply Driver. The controller monitors the A/D feedback on the Solenoid Supply driver output to ensure that 12 V is no longer present there. Note: You must eliminate a short to B+ on solenoids and/or wiring before replacing the TCM, a short to Battery on the solenoid supply output or one of the other solenoids will result in HI on the Solenoid Supply output and may set this DTC in error.

Transmission Effects: Hardware Error Mode - When the TCM detects a major internal error the transmission will be placed in the permanent limp-in mode and cease all communication over the CAN bus. Once the TCM has entered this mode normal transmission operation will not resume until all DTC's are cleared from the TCM. This DTC will not reset with ignition off. The DTC must be cleared with the DRBIII® diagnostic tool in order to return to normal operation

Possible causes:

- Short to Battery on Solenoid Supply line or one of the Solenoids
- TCM

Name of code: Transmission Temperature Sensor - P/N switch circuit (74)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Temp sensor is open while in forward gears (1-5), temp sensor, open trans temp circuit, P/N Switch.

Theory of Operation: The Solenoid Assembly of the W5J400 transmission contains a temperature sensor to monitor the transmission oil temperature. This sensor is wired in series with the transmission Park/Neutral switch. The TCM expects to see a valid voltage level from the sensor when the shifter is in any forward gear position, and it expects to see an open circuit condition when the shifter is in the Park or Neutral position. When the TCM detects and open circuit when in a forward gear position the DTC is set.

Transmission Effects: No reaction, there will be a 500mSec delay in the starting of the engine and engine temperature is used for transmission temperature. Error is set to intermittent only after the DTC condition is removed. Error will remain active after reset by default until it has been verified that the error is no longer present.

Possible causes:

- Temp Sensor wiring
- Shifter Adjustment
- Solenoid
- Internal Shifter
- TCM

Name of code: Trans Temp Sensor Erratic (75)

When Monitored: When transmission temperature is below 170° C (338° F)

Set Condition: When there is a 10° C (18° F) variation between each transmission temperature sensor read. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

Theory of Operation: The Solenoid Assembly of the W5J400 transmission contains a temperature sensor to monitor the transmission oil temperature. This sensor is wired in series with the transmission Park/Neutral switch. The TCM expects to see a valid voltage level from the sensor when the shifter is in any forward gear position, and it expects to see an open circuit condition when the shifter is in the Park or Neutral position. The TCM will set this DTC when it detects that the Temperature sensor input is changing to fast to be realistic

Transmission Effects: No reaction, If three consecutive failures are detected by the TCM the DTC will be set, the DTC will reset when there is less than a 2° C (36° F) variation between sensor reads for 5 seconds. Error is set to intermittent after a reset occurs. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status. Error is set to intermittent only after the DTC condition is removed. Error will remain active after reset by default until it has been verified that the error is no longer present.

Possible causes:

- Temp Sensor wiring (intermittent)
- Solenoid
- TCM

Name of code: Internal Shifter failure (76)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Shifter sends an erroneous signal indicating the shifter detected an Internal shifter problem, shifter held in an intermediate position for more than 30 seconds.

Theory of Operation: The W5J400 transmission does not have a Range Sensor internally. The customer requested gear must be communicated by the shifter module to the TCM. This is accomplished by five circuits, which sends a gray code to the TCM. The Shifter module performs it's own internal checks for proper operation. When the Shifter detects an internal failure it sends a DTC to the TCM. Clear DTC if DTC returns replace shifter

Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If the DTC is reset, the DTC will be set to Stored (Intermittent) status.

Possible causes:

- Shifter held in intermediate position for more then 30 seconds
- Shifter out of adjustment
- Shifter Module - internal

Name of code: ABS CAN Messages Incorrect (81)
When Monitored: ABS messages received at least once and CAN Bus Circuit (37) is not active
Set Condition: DTC Detected if the number of bytes incorrect for CAN ID.
Theory of Operation: The messages sent on the CAN bus are distinguished by an ID. Each CAN ID is defined to contain a certain number of bytes. The TCM verifies that it has received the proper number of bytes for each ID.
Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status. The TCM will use a default wheel speed of 2000 RPM.
Possible causes:

- ABS
- TCM

Name of code: Engine CAN Messages Incorrect (82)
When Monitored: CAN-ID received at least once and CAN Bus Circuit (37) is not active
Set Condition: DTC Detected if the number of bytes incorrect for CAN ID.
Theory of Operation: The messages sent on the CAN Bus are distinguished by an ID. Each CAN ID is defined to contain a certain number of bytes. The TCM verifies that it has received the proper number of bytes for each ID.
Transmission Effects: No reaction, system recovery if the correct message sent, backup value for accelerator pedal position = 25 %, backup value for engine speed = 750 rpm, TCM uses a backup value for engine torque = 600 Nm (443 ft lbs), default values for engine signals. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.
Possible causes:

- PCM/ECM
- TCM

Name of code: Engine CAN Messages Incorrect (83)
When Monitored: CAN-ID received at least once and CAN Bus Circuit (37) is not active
Set Condition: DTC Detected if the number of bytes incorrect for CAN ID.
Theory of Operation: The messages sent on the CAN bus are distinguished by an ID. Each CAN ID is defined to contain a certain number of bytes. The TCM verifies that it has received the proper number of bytes for each ID.
Transmission Effects: The MIL will illuminate and the transmission will be placed in Temporary Limp-in until the ignition key is cycled. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status. The system will recover if the correct message sent. The TCM will use backup value for engine coolant temperature = 80° C (176° F), default values used for transfer case signals.
Possible causes:

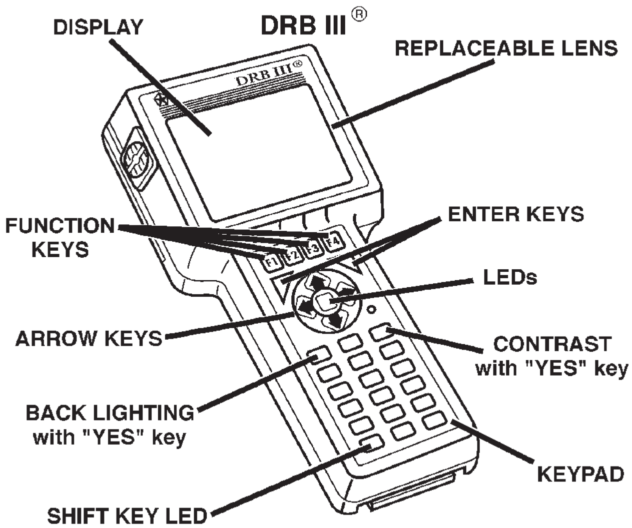
- PCM/ECM
- TCM

Name of code: Engine CAN Messages Incorrect (85)
When Monitored: CAN-ID received at least once and CAN Bus Circuit (37) is not active
Set Condition: DTC Detected if the number of bytes incorrect for CAN ID.
Theory of Operation: The messages sent on the CAN bus are distinguished by an ID. Each CAN ID is defined to contain a certain number of bytes. The TCM verifies that it has received the proper number of bytes for each ID.
Transmission Effects: No effect on the transmission system operation. No mileage information will be stored in Freeze Frame for transmission. The DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status. The system will recover if the correct message received from the engine controller.
Possible causes:

- PCM/ECM
- TCM

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading trouble codes, erasing trouble codes, and other DRBIII® functions.



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3.5 DRBIII® ERROR MESSAGES

Under normal operation, the DRBIII® will display one of only two error messages:

- User-Requested WARM Boot
- User-Requested COLD Boot

If the DRBIII® should display any other error message, record the entire display and call the S.T.A.R. Center.

3.5.1 DRBIII® DOES NOT POWER UP (BLANK SCREEN)

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage. A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, an inoperative DRBIII® may be the result of faulty cable or vehicle wiring. For a blank screen, refer to the appropriate Body Diagnostic manual.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.

4.0 DISCLAIMERS, SAFETY, AND WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. If is especially important to block the wheels on front-wheel drive vehicles: the parking brake does not hold the drive wheels.

Some operations in this manual require that hydraulic tubes, hoses, and fittings, disconnected for inspection or testing purposes. These systems, when fully charged, contain fluid at high pressure.

Before disconnecting any hydraulic tubes, hoses, and fittings, be sure that the system is fully depressurized.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing a Transmission system problem, it is important to follow approved procedures where applicable. These procedures can be found in the service information. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic DTC's or error messages may occur. It is extremely important that accurate shift lever position data is available to the TCM. The accuracy of any DTC found in memory is doubtful unless the Shift Lever Test, performed on the DRBIII® Scan Tool, passes without failure.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the Transmission system are intended to be serviced in assembly only. Attempting to remove or repair certain system sub-components may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service information should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

- Follow the vehicle manufacturer's service specifications at all times.
- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table.

FUNCTION	INPUT LIMIT	Volts
0-500 volts peak AC	0-500 volts DC	Ohms (resistance)*
0-1.12 megohms	Frequency measured Frequency generated	0-10 khz
Temperature	-58-1100°F	-50-600°C
*Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.		

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measured voltage above 25v DC or 25v AC.
- The circuit being tested must be protected by a 10A fuse or circuit breaker.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is "lock" position. Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation: this will damage the wire and eventually cause the wire to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second DTC could be set, making diagnosis of the original problem more difficult.

When replacing a blown fuse, it is important to use only a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical system overload. If a properly rated fuse continues to blow, it indicates a problem in the circuit that must be corrected.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic DTC or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read DRBIII® screen while in motion. Do not hang the DRBIII® from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

Road testing is an essential step in the diagnostic process that must not be overlooked. Along with the diagnostic information obtained from the DRBIII® Scan Tool and the original customer concern, the road test helps verify the problem was current and any repairs performed, fixed the vehicle correctly. Always operate and observe the vehicle under actual driving conditions.

Just as important as the road test is, there are preliminary inspections that should be performed prior to the road test. Always check the fluid level and condition before taking the vehicle on a road test. Determine if the incorrect fluid is being used, improper fluid will result in erratic transmission operation.

Some of the conditions of incorrect fluid level are as follows:

- Delayed engagement
- Poor shifting or erratic shifting
- Excessive noise
- Overheating

The next step is to verify that the shift linkage is correctly adjusted. If the shift linkage is incorrectly adjusted, a number of complaints can result.

The TCM monitors the Shift Lever Position (SLP) continuously. If the linkage is incorrectly adjusted, the TCM will sense a shift lever position that is not correct for the gear chosen by the driver. This may cause a DTC to be set.

The following complaints may also be the result of an incorrectly adjusted or worn linkage:

- Delayed clutch engagement
- Erratic shifts
- Vehicle will drive in neutral
- Engine will not crank in park or neutral
- Gear shift linkage will be able to be shifted without the key in the ignition
- Not able to remove the ignition key in park
- Parking pawl will not engage properly

The shift linkage should also be adjusted when replacing the Transmission, repairing the valve body, or when repairing any component between the shift lever and the Transmission.

Some questions to ask yourself when performing the road test are as follows:

- Is the complaint or concern what you think the problem is, based on the drivers description of the problem?
- Is the Transmission operating normally, or is there a real problem?
- When does the problem occur?
- Is the problem only in one gear range?
- What temperature does the problem occur?
- Does the vehicle have to sit over night for the problem to occur?
- Does the transmission go into Limp-in mode?

4.4 BULLETINS AND RECALLS

ALWAYS PERFORM ALL SAFETY RECALLS AND TECHNICAL SERVICE BULLETINS THAT ARE APPLICABLE TO THE PROBLEM.

5.0 REQUIRED TOOLS AND EQUIPMENT

- DRBIII® (diagnostic read-out box) - DRBIII® must use the latest release level.
- Jumper wires
- Test Light
- Ohmmeter
- Voltmeter

6.0 GLOSSARY OF TERMS

6.1 ACRONYMS

ABS	Antilock Braking system
A/C	Air conditioner
A/D	Analog to Digital conversion
APP	Accelerator Pedal Position
CAN	Controller Area Network (Inter-module Bus)
CKT	Circuit
DLC	Data Link Connector
DRBIII®	Diagnostic Readout Box
DTC	Diagnostic Trouble Code
EATX	Electronic Automatic Transmission
ECM	Diesel Engine Controller
EMCC	Electronically Modulated Converter Clutch
IOD	Ignition off-draw
ISS	Input Speed Sensor (N2 and N3)
LED	Light Emitting Diode
MIL	Malfunction Indicator Lamp
OSS	Output Speed Sensor (derived form the ABS controller)
PCI	Programmable Controller Interface (Vehicle bus system)
PCM/ECM	Powertrain or Engine Control Module
PEMCC	Partial Electronically Modulated Converter Clutch
PWM	Pulse width modulated
SW	Switch
TCC	Torque Converter Clutch
TCM	Transmission Control Module
TP	Throttle Position
TRD	Torque Reduction
TTS	Transmission Temperature Sensor
1-2/4-5 solenoid	controls the shift into and out of 2nd gear or 5th gear.
2-3 solenoid	controls the shift into and out of 3rd gear
3-4 solenoid	controls the shift into and out of 4th gear
TCC solenoid	is pulse width modulated and controls the TCC clutch
Shift Pressure Solenoid	is a pulse width modulated solenoid and controls the hydraulic pressure to the shift elements.
Modulation pressure solenoid	is a pulse width modulated solenoid and controls the hydraulic system pressure

6.2 DEFINITIONS

Driving cycle counter - The starts since first set counter indicates the number of driving cycles since the first occurrence of an error.

NOTES

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
*NO RESPONSE FROM SHIFTER ASSEMBLY - DIESEL ONLY

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE BCM
OPEN GROUND CIRCUIT
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN PCI BUS CIRCUIT
SHIFTER ASSEMBLY

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Body Computer. Was the DRB able to I/D or communicate with the BCM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the BCM. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Shifter Assembly C1 harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 3 No → Repair the ground circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Shifter Assembly C1 and C2 harness connectors. Turn the ignition on. Using a 12-volt test light connected to ground, probe each Fused Ignition Switch Output circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open or short. Refer to the wiring diagrams in the service information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM SHIFTER ASSEMBLY - DIESEL ONLY — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Shifter Assembly C1 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Shifter Assembly connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace the Shifter Assembly in accordance with the service information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Repair the PCI Bus circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - DIESEL ONLY

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE ECM
FUSED IGNITION SWITCH OUTPUT (RUN/ST) CIRCUIT OPEN
GROUND CIRCUIT OPEN
SCI TRANSMIT CIRCUIT OPEN
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, attempt to communicate with the ECM. Was the DRB able to I/D or communicate with the ECM? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the ECM (SCI Only). Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Run/St) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (Run/St) circuit for an open. Refer to the wiring diagrams in the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
3	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Using a 12-volt test light connected to 12-volts, check the ground circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE - DIESEL ONLY — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the TCM C1 harness connector. Disconnect the DRB from the DLC. Measure the resistance of the SCI Transmit circuit between the TCM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Replace the Transmission Control Module in accordance with the service information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Repair the SCI Transmit circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
1-2/4-5 SOLENOID CIRCUIT (2, 71)

When Monitored and Set Condition:

1-2/4-5 SOLENOID CIRCUIT (2, 71)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
1-2/4-5 SOLENOID CONTROL CIRCUIT OPEN
1-2/4-5 SOLENOID CONTROL CIRCUIT SHORT TO GROUND
1-2/4-5 SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
1-2/4-5 SOLENOID
TCM - 1-2/4-5 SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

1-2/4-5 SOLENOID CIRCUIT (2, 71) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Solenoid Test. With the DRBIII®, read DTCs. Did the DTC, 1-2/4-5 SOLENOID CIRCUIT, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 1-2/4-5 Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 1-2/4-5 Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 1-2/4-5 Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the 1-2/4-5 Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 1-2/4-5 Solenoid Control circuit to all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the 1-2/4-5 Solenoid Control circuit for a short to other circuit-s. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

1-2/4-5 SOLENOID CIRCUIT (2, 71) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the 1-2/4-5 Solenoid Control circuit and the Solenoid Supply Voltage Circuit in the Transmission Control Module C2 harness connector. Is the resistance between 2.5 and 6.5 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the 1-2/4-5 Solenoid per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
2-3 SOLENOID CIRCUIT (3, 72)

When Monitored and Set Condition:

2-3 SOLENOID CIRCUIT (3, 72)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
2-3 SOLENOID CONTROL CIRCUIT OPEN
2-3 SOLENOID CONTROL CIRCUIT SHORT TO GROUND
2-3 SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
2-3 SOLENOID
TCM - 2-3 SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

2-3 SOLENOID CIRCUIT (3, 72) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Solenoid Test. With the DRBIII®, read DTCs. Did the DTC, 2-3 SOLENOID CIRCUIT, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2-3 Solenoid Control circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2-3 Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2-3 Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2-3 Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2-3 Solenoid Control circuit to all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the 2-3 Solenoid Control circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

2-3 SOLENOID CIRCUIT (3, 72) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the 2-3 Solenoid Control circuit and the Solenoid Supply Voltage Circuit in the Transmission Control Module C2 harness connector. Is the resistance between 2.5 and 6.5 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the 2-3 Solenoid per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
3-4 SOLENOID CIRCUIT (4, 73)

When Monitored and Set Condition:

3-4 SOLENOID CIRCUIT (4, 73)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
3-4 SOLENOID CONTROL CIRCUIT OPEN
3-4 SOLENOID CONTROL CIRCUIT SHORT TO GROUND
3-4 SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
3-4 SOLENOID
TCM - 3-4 SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

3-4 SOLENOID CIRCUIT (4, 73) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Solenoid Test. With the DRBIII®, read DTCs. Did the DTC, 3-4 SOLENOID CIRCUIT, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 3-4 Solenoid Control circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 3-4 Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 3-4 Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the 3-4 Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 3-4 Solenoid Control circuit between all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the 3-4 Solenoid Control circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

3-4 SOLENOID CIRCUIT (4, 73) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the 3-4 Solenoid Control circuit and the Solenoid Supply Voltage Circuit in the Transmission Control Module C2 harness connector. Is the resistance between 2.5 and 6.5 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the 3-4 Solenoid per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
ABS BRAKE MESSAGE (33)

When Monitored and Set Condition:

ABS BRAKE MESSAGE (33)

When Monitored: Valid Brake CAN message received at least once and CAN Bus Circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active.

Set Condition: Signal "brake-light switch" not valid- ABS sending invalid value.

POSSIBLE CAUSES
CAN C BUS CIRCUIT 37 DTC PRESENT
ABS DTCS PRESENT
ABS - BRAKE MESSAGE ERROR
TCM - BRAKE MESSAGE ERROR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

ABS BRAKE MESSAGE (33) — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. With the DRBIII®, read ABS DTCs. Are there any ABS or bus related DTCs present? Yes → Repair all ABS DTCS before proceeding. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Replace and program the ABS Control Module. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ABS BRAKE MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ABS CAN MESSAGE INCORRECT (81)

When Monitored and Set Condition:

ABS CAN MESSAGE INCORRECT (81)

When Monitored: ABS CAN messages received at least once and CAN Bus Circuit (37) is not active

Set Condition: DTC Detected if the number of bytes incorrect for CAN ID.

POSSIBLE CAUSES
ABS - INTERNAL
TCM - INTERNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Turn the ignition off to the lock position. Replace the ABS Control Module per the Service Information. Ignition on, engine not running. With the DRBIII®, erase Transmission DTCs. Start the engine and with the brakes firmly applied place the gear selector into Drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ABS CAN MESSAGES INCORRECT, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ABS CAN MESSAGE MISSING (38)

When Monitored and Set Condition:

ABS CAN MESSAGE MISSING (38)

When Monitored: CAN Bus Circuit error not present, 1 second after ignition on and not in Park or Neutral, no System Overvoltage or System Undervoltage conditions present, or transmission in Park or Neutral and engine RPM greater than 850 RPM

Set Condition: This DTC is set when a CAN ID was not received in the required time are not being sent from the ABS Controller. NOTE: The ABS controller is powered by the run only ignition feed. This means that this DTC will be set if the key is placed in the start position with the transmission in gear or if in Park or Neutral and the engine RPM is greater than 850 RPM.

POSSIBLE CAUSES
ABS DTC SET IF ATTEMPT TO START VEHICLE IN GEAR
CAN BUS CIRCUIT 37 - DTC PRESENT
CAN C BUS +/- CIRCUIT OPEN
ABS DTCS PRESENT
ABS - CAN MESSAGE MISSING
TCM - CAN MESSAGE MISSING

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ABS CAN MESSAGE MISSING (38) — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: This DTC can be erroneously set if the vehicle was started in gear or with the engine running.** Was the vehicle started in gear or with the engine running? Yes → Note: If the ignition switch is moved to the run/start (crank) position with the shifter lever not in the Park or Neutral position, or if the run/start with the engine rpm >850 an ABS CAN Message Missing DTC will be set. Erase DTC and return to customer. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the ABS harness connector. Disconnect the TCM C2 harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of the CAN C Bus + circuit between the ABS harness connector and the TCM C2 harness connector. Measure the resistance of the CAN C Bus - circuit between the ABS harness connector and the TCM C2 harness connector. Is the resistance above 5.0 ohms on either circuit? Yes → Repair the CAN C BUS + or - circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Ignition on, engine not running. With the DRBIII®, read ABS DTCs. Are there any performance or bus related ABS DTCs present? Yes → Repair all ABS DTCs before proceeding. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

ABS CAN MESSAGE MISSING (38) — Continued

TEST	ACTION	APPLICABILITY
6	Replace and program the ABS Control Module. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ABS CAN MESSAGE MISSING, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ABS LF SENSOR MESSAGE (25)

When Monitored and Set Condition:

ABS LF SENSOR MESSAGE (25)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal ″Wheel Speed Front Left″ not valid or ABS has detected a sensor failure.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ABS DTCS PRESENT
ABS CONTROL MODULE - ABS LF SENSOR MESSAGE
TCM - ABS LF SENSOR MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ABS LF SENSOR MESSAGE (25) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read ABS DTCs. Are there any ABS DTCs present? Yes → Refer to the ABS category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Replace the ABS Control Module per the Service Information. With the DRBIII®, erase Transmission DTCs. Road test the Vehicle. With the DRBIII®, read Transmission DTCs. Does the DTC, ABS LF SENSOR MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ABS LR SENSOR MESSAGE (23)

When Monitored and Set Condition:

ABS LR SENSOR MESSAGE (23)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal ″wheel speed rear left″ not valid or ABS has detected a sensor failure.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ABS DTCS PRESENT
ABS CONTROL MODULE - ABS LR SENSOR MESSAGE
TCM - ABS LR SENSOR MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ABS LR SENSOR MESSAGE (23) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read ABS DTCs. Are there any ABS DTCs present? Yes → Refer to the ABS category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Replace the ABS Control Module per the Service Information. With the DRBIII®, erase Transmission DTCs. Road test the Vehicle. With the DRBIII®, read Transmission DTCs. Does the DTC, ABS LR SENSOR MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ABS RF SENSOR MESSAGE (24)

When Monitored and Set Condition:

ABS RF SENSOR MESSAGE (24)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal "Wheel Speed Front Right" not valid or ABS has detected a sensor failure.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ABS DTCS PRESENT
ABS CONTROL MODULE - ABS RF SENSOR MESSAGE
TCM - ABS RF SENSOR MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ABS RF SENSOR MESSAGE (24) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read ABS DTCs. Are there any ABS DTCs present? Yes → Refer to the ABS category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Replace the ABS Control Module per the Service Information. With the DRBIII®, erase Transmission DTCs. Road test the Vehicle. With the DRBIII®, read Transmission DTCs. Does the DTC, ABS RF SENSOR MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ABS RR SENSOR MESSAGE (22)

When Monitored and Set Condition:

ABS RR SENSOR MESSAGE (22)

When Monitored: Valid ABS CAN messages received at least once and the CAN Bus circuit, ABS CAN Message Missing, ABS CAN Message Incorrect are not active

Set Condition: ABS signal "wheel speed rear right" not valid or ABS has detected a sensor failure.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ABS DTCS PRESENT
ABS CONTROL MODULE - ABS RR SENSOR MESSAGE
TCM - ABS RR SENSOR MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ABS RR SENSOR MESSAGE (22) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read ABS DTCs. Are there any ABS DTCs present? Yes → Refer to the ABS category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Replace the ABS Control Module per the Service Information. With the DRBIII®, erase Transmission DTCs. Road test the Vehicle. With the DRBIII®, read Transmission DTCs. Does the DTC, ABS RR SENSOR MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
CAN BUS CIRCUIT (37)

When Monitored and Set Condition:

CAN BUS CIRCUIT (37)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Open circuit in the CAN C Bus (+) circuit or CAN C Bus (-) circuit, Short to ground of CAN C Bus (+) circuit or CAN C Bus (-) circuit, Short to Voltage of CAN C Bus (+) circuit or CAN C Bus (-) circuit, CAN C Bus (+) circuit shorted to CAN C Bus (-) circuit, or a TCM failure. Note: All CAN message missing DTCS will also be present, which indicates a Bus Failure.

POSSIBLE CAUSES
CAN C BUS(+) SHORT TO CAN C BUS (-)
CAN C BUS (+) AND/OR CAN C BUS (-) CIRCUIT OPEN
CAN C BUS (+) AND/OR CAN C BUS (-) CIRCUIT SHORT TO GROUND
CAN C BUS (+) AND/OR CAN C BUS (-) CIRCUIT SHORT TO OTHER CIRCUITS
ABS - TERMINATING RESISTOR
PCM/ECM - CAN BUS CIRCUIT
TCM - TERMINATING RESISTOR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

CAN BUS CIRCUIT (37) — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: If the CAN BUS CIRCUIT (37) DTC is present, all the CAN MESSAGE MISSING DTCs will be set also. Ignore the Missing Message DTCs and perform the CAN BUS CIRCUIT (37) DTC test.** Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the PCM/ECM harness connector. Disconnect the ABS harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of both the CAN C Bus (+) circuit and the CAN C Bus (-) circuit between the TCM C2 harness connector and both the PCM/ECM harness connector and the ABS harness connector. Is the resistance above 5.0 ohms on either Bus circuit? Yes → Repair the CAN C Bus (+) and/or CAN C Bus (-) circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off to the lock position. Disconnect the ABS harness connector. Disconnect the PCM/ECM harness connector. Disconnect the TCM C2 harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance between the CAN C Bus (+) circuit and the CAN C Bus (-) circuit. Is the resistance below 5.0 ohms? Yes → Repair the short between the CAN C Bus (+) circuit and the CAN C Bus (-) circuit. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the PCM/ECM harness connector. Disconnect the ABS harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and both the CAN C Bus (+) circuit and the CAN C Bus (-) circuit. Is the resistance below 5.0 ohms on either Bus circuit? Yes → Repair the CAN C Bus (+) and/or CAN C Bus (-) circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All

CAN BUS CIRCUIT (37) — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of both the CAN C Bus (+) circuit and the CAN C Bus (-) circuit to all other circuits in the TCM C2 harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the CAN C Bus (+) and/or CAN C Bus (-) circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the PCM/ECM harness connector. **NOTE: Check connectors - Clean/repair as necessary.** **NOTE: Make sure both the TCM and the ABS harness connectors are connected before taking this measurement.** Measure the resistance between the CAN C Bus (+) circuit and the CAN C Bus (-) circuit in the PCM/ECM harness connector. Is the resistance 60.0 ohms, ± 3.0 ohms? Yes → Replace the Powertrain/Engine Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off to the lock position. Disconnect the ABS harness connector. **NOTE: Make sure both the TCM and the ECM harness connectors are connected before taking this measurement.** Measure the resistance between the CAN C Bus (+) circuit and the CAN C Bus (-) circuit in the ABS harness connector. Is the resistance 120 ohms, ± 2.0 ohms? Yes → Replace the ABS Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE APP/TPS MESSAGE (26)

When Monitored and Set Condition:

ENGINE APP/TPS MESSAGE (26)

When Monitored: When a valid Accelerator Pedal Position (APP) or Throttle Position Sensor (TPS) CAN Message Received at least once and the DTCs, CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: Accelerator Pedal Position (APP) or Throttle Position Sensor (TPS) Message not valid or a ECM or PCM Engine Sensor DTC detected.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ENGINE APP OR TPS DTCS PRESENT
ENGINE COMMUNICATION DTCS PRESENT
INTERMITTENT WIRING AND CONNECTORS
PCM/ECM - ENGINE APP/TPS MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ENGINE APP/TPS MESSAGE (26) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. Is the DTC ENGINE APPS/TPS MESSAGE displayed as ACTIVE? Yes → Go To 4 No → Go To 8	All
4	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any Engine bus related DTCs present? Yes → Refer to the Communication category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any APP or TPS DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Replace the Transmission Control Module. Perform W5A400 TRANSMISSION VER TEST-1 Did the DTC ″ENGINE TPS MESSAGE″ reset? Yes → Go To 7 No → Test Complete.	All
7	If there are no possible causes remaining, view repair. Repair Replace the Powertrain/Engine Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

ENGINE APP/TPS MESSAGE (26) — Continued

TEST	ACTION	APPLICABILITY
8	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check for any Technical Service Bulletins that may apply.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
ENGINE CAN MESSAGE INCORRECT (85)

When Monitored and Set Condition:

ENGINE CAN MESSAGE INCORRECT (85)

When Monitored: CAN-ID received at least once and CAN Bus Circuit (37) is not active.

Set Condition: DTC Detected if the number of bytes incorrect for CAN ID.

POSSIBLE CAUSES
ENGINE DTCS PRESENT
PCM/ECM - ENGINE CAN MESSAGE INCORRECT
TCM - ENGINE CAN MESSAGE INCORRECT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any performance or bus related Engine DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

ENGINE CAN MESSAGE INCORRECT (85) — Continued

TEST	ACTION	APPLICABILITY
3	Replace and program the PCM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE CAN MESSAGE INCORRECT, reset? Yes → Go To 4 No → Test Complete Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE CAN MESSAGE MISSING (35, 36, 39, 82, 83)

When Monitored and Set Condition:

ENGINE CAN MESSAGE MISSING (35, 36, 39, 82, 83)

When Monitored: CAN Bus circuit error not present, 1 second after ignition on and not in Park or Neutral, no System Overvoltage or System Undervoltage conditions present, or transmission in Park or Neutral and engine RPM greater than 850 RPM.

Set Condition: This DTC is set if a CAN ID was not received in the required time, being sent from the Engine Controller.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 - DTC PRESENT
CAN C BUS +/- CIRCUIT OPEN
ENGINE DTCS PRESENT
PCM/ECM - ENGINE CAN MESSAGE MISSING
TCM - ENGINE CAN MESSAGE MISSING

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ENGINE CAN MESSAGE MISSING (35, 36, 39, 82, 83) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off to the lock position. Disconnect the PCM/ECM harness connector(s). Disconnect the TCM C2 harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of the CAN C Bus + circuit between the PCM/ECM harness connector and the TCM C2 harness connector. Measure the resistance of the CAN C Bus - circuit between the PCM/ECM harness connector and the TCM C2 harness connector. Is the resistance above 5.0 ohms on either circuit? Yes → Repair the CAN C BUS + or - circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any performance or bus related Engine DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Replace and program the PCM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE CAN MESSAGE MISSING, reset? Yes → Go To 6 No → Test Complete Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE OVERSPEED (49)

When Monitored and Set Condition:

ENGINE OVERSPEED (49)

When Monitored: Valid Engine RPM message received at least once, the CAN Bus Circuit and Engine CAN Message Missing are not active.

Set Condition: If the engine speed increases above 5100 RPM.

POSSIBLE CAUSES
ENGINE - MECHANICAL PROBLEM
TRANSMISSION - MECHANICAL PROBLEM
PCM/ECM - ENGINE OVERSPEED
TCM - ENGINE OVERSPEED

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Determine if there are any Engine Mechanical problems present. Are there any Engine Mechanical problems present? Yes → Refer to the Service Information for the proper repair procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

ENGINE OVERSPEED (49) — Continued

TEST	ACTION	APPLICABILITY
3	Determine if there are any Transmission Mechanical problems present. Remove the Transmission Oil Pan and inspect for debris or a plugged Transmission Oil Filter. Is there any debris, plugged Transmission Oil Filter, or signs of an Internal Transmission problem? Yes → Refer to the Service Information for the proper repair procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	**NOTE: The Engine and Transmission must not have mechanical problems and be operating normally before proceeding with this test.** Turn the ignition off to the lock position. Replace and program the PCM/ECM Control Module per the Service Information. With the DRBIII®, erase Transmission DTCs. Road test the Vehicle. With the DRBIII®, read Transmission DTCs. Does the DTC, ENGINE OVERSPEED, reset? Yes → Go To 5 No → Replacing the PCM/ECM has corrected the problem. Perform the Powertrain Verification test. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the TCM. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE RPM MESSAGE (28)

When Monitored and Set Condition:

ENGINE RPM MESSAGE (28)

When Monitored: Valid TPS CAN message received at least once CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: Signal ″engine speed″ not valid or PCM/ECM error.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ENGINE DTCS PRESENT
PCM/ECM - ENGINE RPM MESSAGE
TCM - ENGINE RPM MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

ENGINE RPM MESSAGE (28) — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any performance or bus related Engine DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Replace and program the PCM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE RPM MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE T-CASE SW MESSAGE (44)

When Monitored and Set Condition:

ENGINE T-CASE SW MESSAGE (44)

When Monitored: Valid T-Case CAN message received at least once, the CAN Buss Circuit and Engine CAN Message Missing are not active.

Set Condition: Transfer Case Status signal not valid - indicates possible T-Case sensor error.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ENGINE DTCS PRESENT
PCM/ECM - ENGINE T-CASE SWITCH MESSAGE
TCM - ENGINE T-CASE SWITCH MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ENGINE T-CASE SW MESSAGE (44) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any Transfer Case or Bus related Engine DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Replace and program the PCM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE T-CASE SWITCH MESSAGE, reset? Yes → Go To 5 No → Test Complete Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE TEMP MESSAGE (43)

When Monitored and Set Condition:

ENGINE TEMP MESSAGE (43)

When Monitored: Valid Engine Temp CAN message received at least once and CAN Bus Circuit error, Engine CAN Message Missing and Engine CAN Messages Incorrect are not active.

Set Condition: Engine coolant temperature signal is not valid - indicates possible coolant temperature sensor error.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 DTC PRESENT
ENGINE DTCS PRESENT
PCM/ECM- ENGINE TEMP MESSAGE
TCM - ENGINE TEMP MESSAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ENGINE TEMP MESSAGE (43) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any Engine Temperature Sensor DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Replace and program the PCM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE TEMP MESSAGE, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
ENGINE TORQUE MESSAGE INCORRECT (27, 29, 31, 32)

When Monitored and Set Condition:

ENGINE TORQUE MESSAGE INCORRECT (27, 29, 31, 32)

When Monitored: Valid Torque CAN messages received at least once and CAN Bus Circuit, Engine CAN Message Missing and Engine CAN Message Incorrect are not active.

Set Condition: Engine torque message not valid or PCM/ECM controller error.

POSSIBLE CAUSES
ENGINE DTCS PRESENT
PCM/ECM - ENGINE TORQUE MESSAGE INCORRECT
TCM - TORQUE MESSAGE INCORRECT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any performance or bus related Engine DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. No → Go To 3	All

ENGINE TORQUE MESSAGE INCORRECT (27, 29, 31, 32) — Continued

TEST	ACTION	APPLICABILITY
3	Replace and program the ECM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Drive the vehicle performing multiple aggressive upshifts and downshifts. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE TORQUE MESSAGE INCORRECT, reset? Yes → Go To 4 No → Test Complete Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:

ENGINE TORQUE REDUCTION (54)

When Monitored and Set Condition:

ENGINE TORQUE REDUCTION (54)

When Monitored: Engine intervention active for at least 20 ms, no engine torque errors, engine torque demand is greater than 0.

Set Condition: Torque Reduction acknowledge bit - not set, no shift aborts, the error flag ″torque reduction acknowledge″ is not set, Engine controller not supporting torque requests.

POSSIBLE CAUSES
CAN BUS CIRCUIT 37 - DTC PRESENT
CAN C BUS +/- CIRCUIT OPEN
ENGINE DTCS PRESENT
PCM/ECM - ENGINE CAN MESSAGE MISSING
TCM - ENGINE CAN MESSAGE MISSING

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

ENGINE TORQUE REDUCTION (54) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. **NOTE: If the DTC, CAN BUS CIRCUIT 37, is present, perform diagnostics on that symptom first.** Is the DTC, CAN BUS CIRCUIT 37, present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off to the lock position. Disconnect the PCM/ECM harness connector(s). Disconnect the TCM C2 harness connector. Measure the resistance of the CAN C Bus + circuit between the PCM/ECM harness connector and the TCM C2 harness connector. Measure the resistance of the CAN C Bus - circuit between the PCM/ECM harness connector and the TCM C2 harness connector. Is the CAN C Bus + or - circuit open? Yes → Repair the CAN C BUS + or - circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any performance or bus related Engine DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Replace and program the PCM/ECM per the Service Information. With the DRBIII®, erase Transmission DTCs. Start the engine. With the brakes firmly applied, shift the gear selector into drive. With the DRBIII®, read Transmission DTCs. Did the DTC, ENGINE CAN MESSAGE MISSING, reset? Yes → Go To 6 No → Test Complete Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
IMPROPER GEAR (55)

When Monitored and Set Condition:

IMPROPER GEAR (55)

When Monitored: Engine RPM greater than 450 and output speed (ABS) greater than 180 RPM. No Input Speed sensor N2 - N3, Shift lever, Transfer Case, and/or ABS wheel speed DTCs present.

Set Condition: The TCM compares the calculated gear with the gear the transmission has actually engaged. If the actual gear differs from the gear calculated by the TCM, the TCM value is adjusted to the engaged gear and a counter is increased by 2. If after a shift the engaged gear and the calculated gear still match , the counter is decreased by 1 point. A DTC is detected as soon as the counter exceeds a threshold. If the fault is detected 3 consecutive ignition cycles the transmission will be placed in Limp-in and the MIL activated.

POSSIBLE CAUSES
ABS DTCS PRESENT
SOLENOID DTCS PRESENT
INTERNAL TRANSMISSION
TCM - IMPROPER GEAR

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

IMPROPER GEAR (55) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. Are there any Transmission Solenoid DTCs present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, read ABS DTCs. Are there any ABS DTCs present? Yes → Refer to the Antilock Brake category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Remove and inspect the Transmission Valve Body and Solenoid Assembly per the Service Information. **NOTE: This DTC is usually set due to a internal transmission problem such as but not limited to: stuck solenoid or valve and/or contamination in the valve body, broken springs, leaking clutch seals, dislodged or broken snap ring.** Inspect internal transmission per the Service Information. Where there any problems found? Yes → Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
IMPROPER RATIO (50)

When Monitored and Set Condition:

IMPROPER RATIO (50)

When Monitored: Engine rpm greater than 450 rpm, output speed greater than 180 rpm, no N2 - N3 input speed sensor errors present, no gear selector lever errors present, no ABS system errors, no transfer case errors present, and all wheel speeds above 450 rpm.

Set Condition: No shifting operation and detected gear is not the actual gear No shifting operation - detected (calculated) gear is less than actual(expected) gear or no plausible gear is calculated or Actual turbine speed - calculated turbine speed > 300 rpm or calculated transmission ration is above threshold. During an Upshift - detected (calculated) gear is less than actual(expected) gear-1. During Downshift - detected (calculated) gear is less than actual (expected) gear

POSSIBLE CAUSES
TRANSMISSION MECHANICAL PROBLEM
TCM - IMPROPER RATIO

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

IMPROPER RATIO (50) — Continued

TEST	ACTION	APPLICABILITY
2	Determine if there are any Transmission Mechanical problems present. Remove the Transmission Oil Pan and inspect for debris or a plugged Transmission Oil Filter. Refer to the Service Information for proper removal and inspection procedures. Is there any Debris, plugged Transmission Oil filter, or signs of an Internal Transmission problem? Yes → Refer to the Service Information for the proper repair procedure. Pay particular attention to the Valve body components and stuck solenoids. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
INPUT SENSOR OVERSPEED (15)

When Monitored and Set Condition:

INPUT SENSOR OVERSPEED (15)

When Monitored: Whenever the N2 input speed sensor is greater than 0 rpm

Set Condition: If the rpm of the N2 or N3 input speed sensor is greater than 7700 rpm

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
INTERNAL TRANSMISSION
TCM - INPUT SENSOR OVERSPEED

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

INPUT SENSOR OVERSPEED (15) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase Transmission DTCs. Raise the vehicle on the hoist. Start the engine. **NOTE: This condition indicates a catastrophic transmission failure.** With the DRBIII® in Sensors, monitor the N2 and N3 Speed Sensors. Firmly apply the brakes and place the gear selector in Drive (D). Release the brakes and raise the engine RPM to allow the Transmission to upshift to the 2-3 and 3-4 shift schedule. **CAUTION: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.** Did either the N2 or N3 Speed Sensors display a RPM above 7700? Yes → Go To 3 No → Go To 5	All
3	Remove the Transmission Oil Pan and inspect for debris or a plugged Transmission Oil Filter. Is there any debris, plugged Transmission Oil Filter, or signs of an Internal Transmission problem? Yes → Repair Internal Transmission as necessary. Refer to the Service Information for proper repair procedures. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check for any Technical Service Bulletins that may apply.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
INPUT SENSORS MISMATCH (14)

When Monitored and Set Condition:

INPUT SENSORS MISMATCH (14)

When Monitored: Engine speed greater than 450 rpm, no engine speed DTC's, no TCM under-voltage system operation, no output speed sensor DTC's (signal from the ABS system), all wheel speeds above 250 rpm (signal from the ABS system), no rear wheel speed DTC's (signal from the ABS system), and no wheel slip detected (signal from the ABS system), no shifting operation, N3 input speed sensor greater than 800 rpm and N2 input speed sensor greater than 0 rpm and the TCM not in reset.

Set Condition: If the speed difference between the N2 and N3 input speed sensors is greater than 150 rpm.

POSSIBLE CAUSES
SPEED SENSOR DTCS PRESENT
INTERMITTENT WIRING AND CONNECTORS
INTERNAL TRANSMISSION
TCM - INPUT SPEED SENSOR MISMATCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

INPUT SENSORS MISMATCH (14) — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read DTCs. Are any Speed Sensor or Sensor Supply DTCs present? Yes → Repair any Speed Sensor and/or Sensor Supply DTCs before proceeding with test. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, erase Transmission DTCs. Start the engine. Drive the vehicle to speeds to allow multiple 2-3 and 3-4 upshifts. Does the DTC ″INPUT SENSOR MISMATCH″ reset and displayed as ″ACTIVE″? Yes → Go To 4 No → Go To 6	All
4	Remove the Transmission Oil Pan and inspect for debris or a plugged Transmission Oil Filter. Is there any debris, plugged Transmission Oil Filter, or signs of an Internal Transmission problem? Yes → Repair Internal Transmission as necessary. Refer to the Service Information for proper repair procedures. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
6	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check for any Technical Service Bulletins that may apply.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
INTERNAL CONTROLLER

When Monitored and Set Condition:

INTERNAL CONTROLLER

When Monitored: Always monitored with system active at each ignition cycle

Set Condition: This code is set whenever Transmission Control Module (TCM) senses an internal error. If this Internal Controller DTC is set with any Solenoid DTC's repair the Solenoid DTC's first, erase all DTC's, then verify the Internal Controller DTC sets before replacing the TCM.

POSSIBLE CAUSES
TCM - INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	If there are no possible causes remaining, view repair. Repair The Transmission Control Module is reporting internal errors and must be replaced. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
INTERNAL SHIFTER FAILURE (76)

When Monitored and Set Condition:

INTERNAL SHIFTER FAILURE (76)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Shifter sends an erroneous signal indicating the shifter detected a fault. Internal shifter fault, shifter held in an intermediate position for more than 30 seconds.

POSSIBLE CAUSES
SHIFTER OUT OF ADJUSTMENT
SHIFTER HELD INTERMEDIATE POSITION
SHIFTER ASSEMBLY - INTERNAL

TEST	ACTION	APPLICABILITY
1	Check the shifter adjustment per the Service Information. **NOTE: Verify the proper LED is illuminated and matches the selected gear position.** Was the shifter properly adjusted and LEDs illuminated correctly? Yes → Go To 2 No → Adjust the Shifter Assembly per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
2	**NOTE: This DTC can be set, if the driver rests their hand on the shifter while driving.** With the DRBIII®, erase DTCs. Place the shifter in each gear position for 30 seconds each. **NOTE: Remember to remove your hand from the shifter after selecting each of the gear positions.** Did the INTERNAL SHIFTER FAILURE DTC set? Yes → Go To 3 No → Advise the customer that resting your hand on the shifter or moving the shifter while driving can set this DTC. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
3	If there are no possible causes remaining, view repair. Repair Yes → Replace the Shifter Assembly. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
MOD. PRESS SOLENOID CIRCUIT (6)

When Monitored and Set Condition:

MOD. PRESS SOLENOID CIRCUIT (6)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
MOD. PRESS SOLENOID CONTROL CIRCUIT OPEN
MOD. PRESS SOLENOID CONTROL CIRCUIT SHORT TO GROUND
MOD. PRESS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
MOD PRESS SOLENOID
TCM - MOD. PRESS SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

MOD. PRESS SOLENOID CIRCUIT (6) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Solenoid Test With the DRBIII®, read DTCs. Did the DTC, Mod Press SOLENOID CIRCUIT, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Mod. Press Solenoid Control circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Mod. Press Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Mod. Press Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the Mod. Press Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Mod Press Solenoid Control circuit to all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Mod. Press Solenoid Control circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

MOD. PRESS SOLENOID CIRCUIT (6) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Mod Press Solenoid Control circuit and the Solenoid Supply Voltage Circuit in the Transmission Control Module C2 harness connector. Is the resistance between 4.0 and 8.0 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Mod Press Solenoid per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
N2 INPUT SPEED SENSOR CIRCUIT (12)

When Monitored and Set Condition:

N2 INPUT SPEED SENSOR CIRCUIT (12)

When Monitored: Engine speed greater than 450 rpm, no engine speed DTC's, no TCM under-voltage system operation, no output speed sensor DTC's (signal from the ABS system), all wheel speeds above 250 rpm (signal from the ABS system), no rear wheel speed DTC's (signal from the ABS system), and no wheel slip detected (signal from the ABS system).

Set Condition: If the N2 input speed sensor is equal to 0 rpm or a short to ground, short to battery, open input speed sensor, faulty input speed sensor, open sensor supply circuit.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
SENSOR SUPPLY VOLTAGE CIRCUIT OPEN
N2 INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
N2 SPEED SENSOR SIGNAL CIRCUIT SHORT TO OTHER CIRCUIT
SENSOR GROUND CIRCUIT OPEN
SENSOR GROUND CIRCUIT SHORT TO OTHER CIRCUIT
N2 INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
SENSOR GROUND CIRCUIT SHORT TO GROUND
N2 INPUT SPEED SENSOR
TCM - N2 INPUT SPEED SENSOR

N2 INPUT SPEED SENSOR CIRCUIT (12) — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Supply Voltage circuit between the TCM connector and the Transmission Solenoid Assembly connector Is the resistance above 5.0 ohms? Yes → Repair the Sensor Supply Voltage circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, read DTCs. **NOTE: The vehicle must be driven to at least 32 Km/h (20 MPH) for this DTC to be displayed as active.** Is the Warm up counter displayed and equal to 0? Yes → Go To 4 No → Go To 12	All
4	Turn the ignition switch to the lock position Disconnect the TCM harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the N2 Input Speed Sensor Signal circuit from the TCM connector to the Transmission Solenoid Assembly connector. Is the resistance above 5.0 ohms? Yes → Repair the N2 Input Speed Sensor Signal circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All

N2 INPUT SPEED SENSOR CIRCUIT (12) — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Sensor Ground circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the N2 Speed Sensor Signal circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the N2 Speed Sensor Signal circuit for a short to other circuit-s. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the N2 Input Speed Sensor Signal circuit. Is the resistance Below 5.0 ohms? Yes → Repair the N2 Input Speed Sensor Signal circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Sensor Ground circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All

N2 INPUT SPEED SENSOR CIRCUIT (12) — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Sensor Ground circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Sensor Ground circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn the ignition off to the lock position. With the DRBIII®/PEP Module being used as a Dual Channel Lab Scope with Miller Special tool #6801. Backprobe N2 Input Speed Sensor Signal circuit using Channel 1 at the TCM harness connector. Raise all drive wheels off the ground. **CAUTION: Properly support vehicle** Start the engine. Place gear selector in drive and increase vehicle speed to engage 2nd gear **CAUTION: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.** Compare the Scope Pattern on the DRBIII® with a typical 5 volt square wave pattern. Does the scope pattern match a typical 5 volt square wave Signal Scope Pattern? Yes → Go To 11 No → Replace the N2 Input Speed Sensor. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
11	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were any problems found? Yes → Repair as necessary. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
N3 INPUT SPEED SENSOR CIRCUIT (13)

When Monitored and Set Condition:

N3 INPUT SPEED SENSOR CIRCUIT (13)

When Monitored: Engine speed greater than 450 rpm, no engine speed DTC's, no TCM under-voltage system operation, no output speed sensor DTC's (signal from the ABS system), all wheel speeds above 250 rpm (signal from the ABS system), no rear wheel speed DTC's (signal from the ABS system), and no wheel slip detected (signal from the ABS system), no shifting operation, detected gear is 3rd or 4th and the detected gear is the actual vehicle gear.

Set Condition: If the N3 input speed sensor is equal to 0 rpm or a short to ground, short to battery open input speed sensor, faulty input speed sensor, open sensor supply circuit.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
SENSOR SUPPLY VOLTAGE CIRCUIT OPEN
N3 INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
N3 SPEED SENSOR SIGNAL CIRCUIT SHORT TO OTHER CIRCUIT
SENSOR GROUND CIRCUIT OPEN
SENSOR GROUND CIRCUIT SHORT TO OTHER CIRCUIT
N3 INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
SENSOR GROUND CIRCUIT SHORT TO GROUND
N3 INPUT SPEED SENSOR
TCM - N3 INPUT SPEED SENSOR

N3 INPUT SPEED SENSOR CIRCUIT (13) — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Supply Voltage circuit between the TCM connector and the Transmission Solenoid Assembly connector Is the resistance above 5.0 ohms? Yes → Repair the Sensor Supply Voltage circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, read DTCs. **NOTE: The vehicle must be driven to at least 32 Km/h (20 MPH) for this DTC to be displayed as active.** Is the Warm up counter displayed and equal to 0? Yes → Go To 4 No → Go To 12	All
4	Turn the ignition switch to the lock position Disconnect the TCM harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the N3 Input Speed Sensor Signal circuit from the TCM connector to the Transmission Solenoid Assembly connector. Is the resistance above 5.0 ohms? Yes → Repair the N3 Input Speed Sensor Signal circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All

N3 INPUT SPEED SENSOR CIRCUIT (13) — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Sensor Ground circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the N3 Speed Sensor Signal circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the N3 Speed Sensor Signal circuit for a short to other circuit-s. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the N3 Input Speed Sensor Signal circuit. Is the resistance Below 5.0 ohms? Yes → Repair the N3 Input Speed Sensor Signal circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Sensor Ground circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All

N3 INPUT SPEED SENSOR CIRCUIT (13) — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Sensor Ground circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Sensor Ground circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn the ignition off to the lock position. With the DRBIII®/PEP Module being used as a Dual Channel Lab Scope with Miller Special tool #6801. Backprobe N3 Input Speed Sensor Signal circuit using Channel 1 at the TCM harness connector. Raise all drive wheels off the ground. **CAUTION: Properly support vehicle** Start the engine. Place gear selector in drive and increase vehicle speed to engage 2nd gear **CAUTION: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.** Compare the Scope Pattern on the DRBIII® with a typical 5 volt square wave pattern. Does the scope pattern match a typical 5 volt square wave Signal Scope Pattern? Yes → Go To 11 No → Replace the N3 Input Speed Sensor. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
11	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were any problems found? Yes → Repair as necessary. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P/N OUTPUT CIRCUIT (9)

When Monitored and Set Condition:

P/N OUTPUT CIRCUIT (9)

When Monitored: Shifter is in park or neutral and the solenoid is active

Set Condition: Shifter is in park or neutral and the output is active. NOTE: The P/N Ouput signal is duplicated over the CAN bus and the vehicle will start if either the hard wired P/N signal or the CAN bus P/N signal is present.

POSSIBLE CAUSES
ENGINE PARK/NEUTRAL DTC PRESENT
TRANS TEMP SENSOR SHORTED DTC PRESENT
INTERMITTENT WIRING AND CONNECTORS
PARK/NEUTRAL POSITION SWITCH SENSE CIRCUIT OPEN
PARK/NEUTRAL POSITION SWITCH SENSE CIRCUIT SHORT TO GROUND
PARK/NEUTRAL POSITION SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
SHIFTER SENSE VOLTAGE C1 AND C3 OUT OF TOLERANCE
TCM - P/N OUTPUT CIRCUIT
PCM/ECM - P/N OUTPUT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P/N OUTPUT CIRCUIT (9) — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for Engine DTCs. Are there any Park/Neutral DTCs present? Yes → Repair all PCM/ECM P/N DTCS before diagnosing the P/N Output circuit. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, check for Trans Temp Sensor Shorted Circuit DTC. Is the Trans Temp Sensor Shorted DTC present? Yes → Repair the Trans Temp Sensor Shorted DTC before proceeding with diagnostics. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Engine Running. Shift lever in park. With the DRBIII®, read DTCs. Is the DTC status displayed as Active? Yes → Go To 5 No → Go To 11	All
5	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the PCM/ECM harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Park/Neutral Position Switch Sense circuit from the TCM C1 harness connector to the PCM/ECM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Park/Neutral Position Switch Sense circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the PCM/ECM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Park/Neutral Position Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Park/Neutral Position Switch Sense circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P/N OUTPUT CIRCUIT (9) — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the PCM/ECM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Park/Neutral Position Switch Sense circuit in the TCM C1 harness connector. Is the voltage above 0.5 volt? Yes → Repair the Park/Neutral Position Switch Sense circuit for a short to voltage. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Place the Shifter in Park. Ignition on, engine not running. Measure the voltage between Shifter C1 Sense circuit and ground. Measure the voltage between Shifter C3 Sense circuit and ground. **NOTE: The voltage measured will be approximately 12.0 volts** Did the voltage differ by more than 2.0 volts between both Shifter Sense circuits? Yes → Replace the Shifter Assembly. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between P/N Output circuit and ground. Crank the engine. Did the starter engage? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace the PCM/ECM. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

P/N OUTPUT CIRCUIT (9) — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PARK LOCK OUT SOLENOID CIRCUIT (8)

When Monitored and Set Condition:

PARK LOCK OUT SOLENOID CIRCUIT (8)

When Monitored: When the solenoid is off and when the solenoid is active.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM. Note: You must drive the vehicle above 6 MPH to activate the Park Lockout Solenoid.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN
PARK LOCKOUT SOLENOID CONTROL CIRCUIT OPEN
PARK LOCKOUT SOLENOID CONTROL CIRCUIT SHORT TO GROUND
PARK LOCK OUT SOLENOID
TCM - PARK LOCKOUT SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

PARK LOCK OUT SOLENOID CIRCUIT (8) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Park Solenoid Test. With the DRBIII®, read DTCs. Did the DTC, PARK LOCKOUT SOLENOID, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Shifter Assembly C2 harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch (Run/Start) circuit in the Shifter Assembly C2 harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to when connected directly to the battery.** Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused Ignition Switch Output (run/start) circuit for an open. If the fuse is open make sure to check for a short to ground or excessive resistance in the Fused Ignition Switch Output (run/start) circuit and repair as necessary. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C1 harness connector. Disconnect the Shifter Assembly C2 harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Park Lockout Solenoid Control circuit from the TCM C1 harness connector to the Shifter Assembly C2 harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Park Lockout Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C1 harness connector. Disconnect the Shifter Assembly C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Park Lockout Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the Park Lockout Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

PARK LOCK OUT SOLENOID CIRCUIT (8) — Continued

TEST	ACTION	APPLICABILITY
6	With the DRBIII® actuate the Park Lock Out Solenoid. Does the Park Lock Out Solenoid actuate? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Park Lock Out Solenoid. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SENSOR SUPPLY VOLTAGE (11)

When Monitored and Set Condition:

SENSOR SUPPLY VOLTAGE (11)

When Monitored: Always monitored with system active at each ignition cycle and no under-voltage condition exists.

Set Condition: If measured sensor voltage is not within specified limits 4.8-7.2 volts or if a Faulty regulator, Sensor Supply Voltage shorted to ground, Sensor Supply Voltage shorted to battery is detected.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
SENSOR SUPPLY CIRCUIT SHORT TO OTHER CIRCUIT
SENSOR SUPPLY VOLTAGE CIRCUIT SHORT TO GROUND
TCM - SENSOR SUPPLY VOLTAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. Is the DTC Sensor Supply Voltage displayed as ACTIVE? Yes → Go To 3 No → Go To 5	All

SENSOR SUPPLY VOLTAGE (11) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Supply circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Sensor Supply circuit for a short to other circuit-s. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Supply circuit to chassis ground in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms? Yes → Repair the Sensor Supply Voltage circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check for any Technical Service Bulletins that may apply.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SHIFT PRESS SOLENOID CIRCUIT (7)

When Monitored and Set Condition:

SHIFT PRESS SOLENOID CIRCUIT (7)

When Monitored: When the solenoid is off, solenoid active with 25-75% duty cycle and/or the solenoid supply is active

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
SHIFT PRESSURE SOLENOID CONTROL CIRCUIT OPEN
SHIFT PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO GROUND
SHIFT PRESSURE SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
SHIFT PRESSURE SOLENOID ASSEMBLY
TCM - SHIFT PRESSURE SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

SHIFT PRESS SOLENOID CIRCUIT (7) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Solenoid Test. With the DRBIII®, read DTCs. Did the DTC, SHIFT PRESSURE SOLENOID CIRCUIT, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Shift Pressure Solenoid Control circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Shift Pressure Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Shift Pressure Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the Shift Pressure Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Shift Pressure Solenoid Control circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Shift Pressure Solenoid Control circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

SHIFT PRESS SOLENOID CIRCUIT (7) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Shift Pressure Solenoid Control circuit and the Solenoid Supply Voltage Circuit in the Transmission Control Module C2 harness connector. Is the resistance between 4.0 and 8.0 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Shift Pressure Solenoid. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SHIFTER SIGNAL INVALID (17)

When Monitored and Set Condition:

SHIFTER SIGNAL INVALID (17)

When Monitored: Always monitored with system active at each ignition cycle and no under-voltage condition exists

Set Condition: The Shifter detects an invalid code, shifter failure, TCM failure, Short to ground, open circuit or short to battery on one of the five circuits.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
C1 - C5 SHIFTER SENSE CIRCUITS OPEN
C1- C5 SHIFTER SENSE CIRCUITS SHORT TO GROUND
C1 - C5 SHIFTER SENSE CIRCUITS SHORT TO OTHER CIRCUITS
SHIFTER ASSEMBLY - SHIFTER SIGNAL INVALID
TCM - SHIFTER SIGNAL INVALID

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, perform the Shift Lever Position Test. Did the Shift Lever Test pass? Yes → Go To 3 No → Go To 4	All

SHIFTER SIGNAL INVALID (17) — Continued

TEST	ACTION	APPLICABILITY
3	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check for any Technical Service Bulletins that may apply.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
4	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the Shifter Assembly C1 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Shifter Sense circuit (C1 -C5) between the Shifter Assembly C1 and TCM C1 harness connectors. Is the resistance above 5.0 ohms on any of the C1 - C5 circuits? Yes → Repair the C1 - C5 Shifter Sense circuits for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the Shifter Assembly C1 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the C1- C5 Shifter Sense circuits. Is the resistance below 5.0 ohms on any circuit? Yes → Repair the C1 - C5 Shifter Sense Circuits for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the Shifter Assembly C1 harness connector. Disconnect the Shifter Assembly C201 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the C1- C5 Shifter Sense circuits to all other circuits in the Shifter Assembly C1 and C201 harness connectors. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the C1 - C5 Shifter Sense circuits for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

SHIFTER SIGNAL INVALID (17) — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector(s). **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Step #1 Place the shifter in the Park position. Measure the voltage of the Shifter Sense circuits C1 thru C5 at the TCM C1 harness connector. The voltages on C1, C2, and C3 should have greater than 5.2 volts. The voltage on C4 and C5 should be below 1.5 volts. Step #2 Place and hold the shifter in an intermediate position - between Park and Reverse. Measure only the voltage of the C5 Shifter Sense circuit at the TCM C1 harness connector. The voltage on C5 should be greater than 5.2 volts. Step #3 Place the shifter in 4th gear. Measure the voltage of the Shifter Sense circuits C1 thru C5 at the TCM C1 harness connector. The voltage on C4 should be greater than 5.2 volts. The voltages on C1, C2, C3, C5 should all be below 1.5 volts. Were all measured Shifter Sense voltages correct? Yes → Go To 8 No → Replace the Shifter Assembly. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
SOLENOID SUPPLY VOLTAGE (10)

When Monitored and Set Condition:

SOLENOID SUPPLY VOLTAGE (10)

When Monitored: When the solenoid is active or not active and no under-voltage condition exists.

Set Condition: If voltage is present when the output is off or the measured supply voltage and measured battery voltage differ by 3.6 volts.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
SOLENOID SUPPLY CIRCUIT SHORT TO OTHER CIRCUIT
SOLENOID SUPPLY VOLTAGE CIRCUIT SHORT TO GROUND
SOLENOID ASSEMBLY
TCM - SOLENOID SUPPLY VOLTAGE CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTCs. Is the DTC, Solenoid Supply Voltage, displayed as ACTIVE? Yes → Go To 3 No → Go To 6	All

SOLENOID SUPPLY VOLTAGE (10) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Solenoid Supply circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Solenoid Supply circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Solenoid Supply circuit to chassis ground in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms? Yes → Repair the Solenoid Supply Voltage circuit for a short to ground or high resistance. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between all Solenoid Control circuits and chassis ground in the Transmission Control Module C2 harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Solenoid that is shorted to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
6	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check for any Technical Service Bulletins that may apply.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SOLENOID SUPPLY/WATCHDOG (56)

When Monitored and Set Condition:

SOLENOID SUPPLY/WATCHDOG (56)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: During the power up of the TCM, it tests the ability of the external watchdog to shut down the Solenoid Supply driver.

POSSIBLE CAUSES
SOLENOID SUPPLY CIRCUIT SHORT TO OTHER CIRCUITS
SOLENOID DTCS PRESENT
TCM - SOLENOID SUPPLY WATCHDOG

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, read DTCs. Are any Solenoid DTCs present? Yes → Repair all Solenoid DTCs before proceeding with test. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

SOLENOID SUPPLY/WATCHDOG (56) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Remove the TCM harness connector. Disconnect the Solenoid harness connector. Check the resistance between the Solenoid Supply circuit and all other circuits in the TCM harness connector. Is the resistance below 5.0 ohms between Solenoid Supply and any other circuit? Yes → Repair the Solenoid Supply circuit short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → The TCM has an internal error. Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
SYSTEM OVERVOLTAGE (19)

When Monitored and Set Condition:

SYSTEM OVERVOLTAGE (19)

When Monitored: Always monitored with system active at each ignition cycle

Set Condition: Ignition voltage above 16.9 volts with the engine and transmission input speed sensors above 2000 rpm for 60 seconds

POSSIBLE CAUSES
VEHICLE JUMP STARTED IMPROPERLY
ENGINE CHARGING SYSTEM DTC'S PRESENT
FUSED IGNITION SWITCH OUTPUT (RUN-START) HIGH AT TCM
TCM - SYSTEM OVERVOLTAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Determine is the vehicle was jump started improperly. **NOTE: If the battery was jump started with the batteries in series, the System Overvoltage DTC will be set.** Was the vehicle jump started improperly? Yes → Erase the DTC , if the vehicle was jump started improperly. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

SYSTEM OVERVOLTAGE (19) — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, read the Engine DTC's. Are there any Engine Charging System DTC's present? Yes → Refer to the Charging category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Check connectors - Clean/repair as necessary. Start the engine. Increase the Engine Speed to 1500 RPM. Measure the voltage of the Fused Ignition Switch Output (Run-Start) circuit in the TCM C1 harness connector. Is the voltage below 16.9 volts? Yes → Go To 5 No → Refer the Charging category and perform the symptom, Charging System with No DTCs present. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the TCM. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
SYSTEM UNDERVOLTAGE (21)

When Monitored and Set Condition:

SYSTEM UNDERVOLTAGE (21)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Ignition voltage falls below 8.5 volts with the engine rpm greater than 2000 rpm for 60 seconds.

POSSIBLE CAUSES
ENGINE CHARGING SYSTEM DTC'S PRESENT
FUSED IGNITION SWITCH OUTPUT (RUN-START) LO AT TCM
TCM - SYSTEM UNDER VOLTAGE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, read Engine DTC's. Are there any Engine Charging System DTC's present? Yes → Refer to the Charging category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

SYSTEM UNDERVOLTAGE (21) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Start the engine. Increase the Engine Speed to 1500 RPM. Measure the voltage of the Fused Ignition Switch Output (run-start) circuit in the TCM C1 harness connector. Is the voltage below 9.0 volts? Yes → Repair the Fused Ignition Output (Run-Start) circuit for an open or high resistance. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
TCC OVER TEMP (53)

When Monitored and Set Condition:

TCC OVER TEMP (53)

When Monitored: Solenoid supply active. No Input Speed Sensor N2 - N3, CAN C Bus, PCM/ECM, CAN Engine, CAN Engine Speed DTCs present. Torque Converter Clutch in slip mode.

Set Condition: Friction loss factor reaches threshold.

POSSIBLE CAUSES
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	This DTC is an informational DTC. Check for any TSBs or Controller updates that may apply. This is usually a sign of TCC failure or internal transmission problems. Check the Engine and Transmission Cooling Systems for proper operation. View repair. Repair Repair internal Transmission as necessary. Refer to the Service Information for proper repair procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
TCC SOLENOID CIRCUIT (5)

When Monitored and Set Condition:

TCC SOLENOID CIRCUIT (5)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: If the TCM detects a short to ground or battery on the solenoid control circuit, shorted solenoid, open solenoid, or an open or shorted solenoid control circuit driver in the TCM.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
TCC SOLENOID CONTROL CIRCUIT OPEN
TCC SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TCC SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
TCC SOLENOID
TCM - TCC SOLENOID CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

TCC SOLENOID CIRCUIT (5) — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, erase DTCs. With the DRBIII®, perform the Solenoid Test. With the DRBIII®, read DTCs. Did the DTC, TCC SOLENOID CIRCUIT, reset? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TCC Solenoid Control circuit from the TCM C2 harness connector to the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TCC Solenoid Control circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TCC Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the TCC Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TCC Solenoid Control circuit to all other circuits in the Transmission Solenoid Assembly harness connector. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the TCC Solenoid Control circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

TCC SOLENOID CIRCUIT (5) — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the Transmission Control Module C2 harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the TCC Solenoid Control circuit and the Solenoid Supply Voltage Circuit in the Transmission Control Module C2 harness connector. Is the resistance between 2.0 and 4.0 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the TCC Solenoid per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. **NOTE: Check the Technical Service Bulletins.** Were there any problems found? Yes → Repair as necessary Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
TCC STUCK ON (52)

When Monitored and Set Condition:

TCC STUCK ON (52)

When Monitored: No Input Speed Sensor N2 - N3, CAN C Bus, PCM/ECM, CAN Engine, No CAN Engine Torque and/or Shift in progress DTCs present. Must be in a valid forward gear.

Set Condition: Engine RPM - Turbine Speed is greater than 30 RPM when the Engine torque is less than 100 NM for 1.0 second

POSSIBLE CAUSES
TCC SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TCC SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
INTERNAL TRANSMISSION
TCM - TCC STUCK ON

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

TCC STUCK ON (52) — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. Start the engine. With the brakes firmly applied, shift the gear selector into Drive. Did the engine stall or stumble? Yes → Repair the internal transmission. Pay particular attention to the components related to the TCC. Refer to the Service Information for the proper repair procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance between ground and the TCC Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the TCC Solenoid Control circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid harness connector. Measure the resistance of the TCC Solenoid Control circuit to all other circuits in the Transmission Solenoid harness connector. Is the resistance below 5.0 ohms on any circuit? Yes → Repair the TCC Solenoid Control circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
TRANS TEMP SENSOR - P/N SWITCH CIRCUIT (74)

When Monitored and Set Condition:

TRANS TEMP SENSOR - P/N SWITCH CIRCUIT (74)

When Monitored: Always monitored with system active at each ignition cycle.

Set Condition: Temp sensor is open while in forward gears (1-5), temp sensor, open Trans temp circuit, P/N Switch.

POSSIBLE CAUSES
SHIFTER ADJUSTMENT
SHIFT LEVER POSITION TEST
SENSOR GROUND CIRCUIT OPEN
TEMP SENSOR - P/N SWITCH CIRCUIT OPEN
TEMP SENSOR - P/N SWITCH CIRCUIT SHORT TO GROUND
SENSOR GROUND CIRCUIT SHORT TO OTHER CIRCUITS
TEMP SENSOR- P/N SWITCH CIRCUIT SHORT TO OTHER CIRCUITS
TEMP SENSOR - P/N SWITCH
TCM - TEMP SENSOR - P/N SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

TRANS TEMP SENSOR - P/N SWITCH CIRCUIT (74) — Continued

TEST	ACTION	APPLICABILITY
2	Check the Shifter Assembly adjustment per the Service Information. Was the Shifter Assembly adjusted correctly? Yes → Go To 3 No → Adjust the Shifter Assembly per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
3	With the DRBIII®, perform the Shift Lever Position Test. Follow the instructions on the DRBIII®. Did the Shift Lever Position Test pass? Yes → Go To 4 No → Refer to the Transmission Category and perform Symptom *SHIFTER ERROR (1-10) Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance of the Sensor Ground circuit between the TCM C2 harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Sensor Ground circuit for an open or high resistance. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance of the Transmission Temp Sensor - P/N Switch circuit between the TCM C2 harness connector and the Transmission Solenoid Assembly harness connector. Is the resistance above 5.0 ohms. Yes → Repair the Transmission Temp Sensor - P/N Switch circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance between ground and the Transmission Temp Sensor - P/N Switch circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Temp Sensor - P/N Switch circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

TRANS TEMP SENSOR - P/N SWITCH CIRCUIT (74) — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM C1 and C2 harness connectors. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance between the Sensor Ground circuit and all other circuits in the TCM C1 and C2 harness connectors. Is the resistance below 5.0 ohms on any of the circuits? Yes → Repair the Sensor Ground circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM C1 and C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance between the Temp Sensor - P/N Switch circuit and all other circuits in the TCM C1 and C2 harness connector. Is the resistance below 5.0 ohms on any circuit? Yes → Repair the Transmission Temp Sensor - P/N Switch circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. **NOTE: Make sure the Transmission Solenoid Assembly harness connector is connected or the results of the test will be invalid.** With the brakes firmly applied, place the gear selector in Drive. Measure the resistance between the Temp Sensor - P/N Switch circuit and the Sensor Ground circuit in the TCM C2 harness connector. Is the resistance between 500 and 2500 ohms? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Temp Sensor - P/N Switch Assembly per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
TRANS TEMP SENSOR ERRATIC (75)

When Monitored and Set Condition:

TRANS TEMP SENSOR ERRATIC (75)

When Monitored: When transmission temperature is below 170° C (338° F)

Set Condition: When there is a 10° C (18° F) variation between each transmission temperature sensor read. If the DTC is reset (after an ignition cycle), the DTC will be set to Stored (Intermittent) status.

POSSIBLE CAUSES
TRANSMISSION TEMP SENSOR WIRING
TCM - TRANS TEMP SENSOR ERRATIC

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII® , monitor the Transmission Temperature. With the brakes firmly applied, place the gear selector in Drive. While monitoring the DRBIII®, wiggle the wires and connectors from the TCM to the Transmission Solenoid Assembly. Did the Transmission Temperature fluctuate while wiggling the wires? Yes → Repair the wiring and/or connectors as necessary. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

TRANS TEMP SENSOR ERRATIC (75) — Continued

TEST	ACTION	APPLICABILITY
3	Replace the Transmission Temp Sensor - P/N Switch Assembly per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. Did the DTC, TRANS TEMP SENSOR ERRATIC, reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
TRANS TEMP SENSOR SHORTED (20)

When Monitored and Set Condition:

TRANS TEMP SENSOR SHORTED (20)

When Monitored: Always monitored with system active

Set Condition: Temperature sensor input below a threshold, failed temperature sensor, short to ground, TCM

POSSIBLE CAUSES
TEMP SENSOR - P/N SWITCH CIRCUIT SHORT TO GROUND
TEMP SENSOR - P/N SWITCH CIRCUIT SHORT TO OTHER CIRCUITS
TCM - P/N SWITCH CIRCUIT
TRANSMISSION TEMPERATURE SENSOR
TCM - TRANS TEMP SENSOR SHORTED
TRANSMISSION TEMP SENSOR - P/N SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Attempt to start the vehicle in Park and Neutral. Does the engine start in either position, Park or Neutral? Yes → Go To 3 No → Go To 5	All

TRANS TEMP SENSOR SHORTED (20) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Place the gear selector to Drive (D). Measure the resistance of the Transmission Temperature Sensor between the Temp Sensor - P/N Switch circuit and the Sensor Ground circuit in the TCM C2 harness connector. Is the resistance between 500 ohms and 2500 ohms. Yes → Go To 4 No → Check for a poor terminal to pin connections at the Solenoid Assembly harness connector and repair as necessary. If no problems are found in the connector, replace the Transmission Temperature Sensor - P/N Switch Assembly per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid harness connector. **NOTE: This procedure may set several DTCs in both the ECM and TCM. Disregard and erase DTCs after this procedure.** With the gear selector in park, attempt to start the vehicle. Does the vehicle start? Yes → Replace the Transmission Temperature Sensor - P/N Switch Assembly per the Service Information. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Disconnect the Transmission Solenoid Assembly harness connector. Measure the resistance between ground and the Temp Sensor - P/N Switch circuit. Is the resistance below 5.0 ohms? Yes → Repair the Temp Sensor - P/N Switch circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

TRANS TEMP SENSOR SHORTED (20) — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Disconnect the TCM C1 and C2 harness connectors. Measure the resistance of the Temp Sensor - P/N Switch circuit to all other circuits in the TCM C1 and C2 harness connectors. Is the resistance below 5.0 ohms between any other circuit? Yes → Repair the Temp Sensor - P/N Switch circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
TRANSMISSION SLIPPING (51)

When Monitored and Set Condition:

TRANSMISSION SLIPPING (51)

When Monitored: Engine rpm greater than 450 rpm, output speed greater than 180 rpm, no N2 - N3 input speed sensor errors present, no gear selector lever errors present, no ABS system errors, no transfer case errors present, and all wheel speeds between 70 - 380 rpm with no wheel slip detected. Set Condition: Calculated ratio not within allowable range for the engaged gear. No shifting operation.

Set Condition: The TCM constantly calculates the transmission ratio based on the N2 - N3 input speed signals and the calculated output shaft speed (CAN message from the ABS). The TCM will detect if the transmission is slipping or an invalid gear ratio is present

POSSIBLE CAUSES
OTHER DTCS PRESENT
TRANSFER CASE DTCS PRESENT
TRANSFER CASE SHIFT CABLE OUT OF ADJUSTMENT
AXLE - MECHANICAL - GEAR RATIO
INTERNAL TRANSMISSION
TCM - TRANSMISSION SLIPPING

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

TRANSMISSION SLIPPING (51) — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTCs. Are there any Improper Gear and/or Improper Ratio DTCs present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, read Engine DTCs. Are there any Transfer Case related DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Check to Transfer Case Shift cable for proper adjustment per the Service Information. Is the Transfer Case cable properly adjusted? Yes → Go To 5 No → Adjust Transfer Case cable as necessary. Refer to the Service Information for proper adjustment procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Verify the correct axle gear ratio and make sure there are no mechanical problems. Refer to the Service Information for the proper procedures. Were there any problems found? Yes → Refer to the Service Information for proper repair procedures. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Determine if the Transmission is mechanically slipping. Is the transmission slipping? Yes → Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:

*ABS DTC SET WHEN ATTEMPTING TO START VEHICLE IN GEAR OTHER THAN PARK OR NEUTRAL

POSSIBLE CAUSES
ABS DTC 38 SET WHEN ATTEMPTING TO START VEHICLE IN GEAR OTHER THAN P/N

Repair Instructions:

ABS DTC 38 SET WHEN ATTEMPTING TO START VEHICLE IN GEAR OTHER THAN P/N

Note: If the ignition switch is moved to the run/start (crank) position with the shifter lever not in the Park or Neutral position, or if the run/start with the engine rpm >850 an ABS CAN Message Missing DTC will be set. Erase DTC and return to customer.

Symptom:
*ADAPTION PROCEDURE

POSSIBLE CAUSES
ADAPTION PROCEDURE

TEST	ACTION	APPLICABILITY
1	This procedure should be performed whenever the TCM has been replaced, the Transmission has been replaced, or major Transmission repairs have been performed. With the DRBIII®, reset the Transmission adaptives. Resetting the adaptives will set the adaptives to factory settings. **NOTE: Perform the Coast Down Adaptations first. The Transmission Temperature must be greater than 60°C (140°F) and less than 70°C (158°F). Failure to stay within these temperature ranges will void the procedure.** Drive the Vehicle until the Transmission Temperature is in the specified range. Perform 4 to 5 Coast Downs from 5th to 4th gear and then 4th to 3rd gear. **NOTE: For Upshift adaption, the Transmission temperature must be greater than 60°C (140°F) and less than 100°C (212°F). Failure to stay within these temperature ranges will void this procedure.** From a stop, moderately accelerate the vehicle and obtain all forward gear ranges while keeping the Engine RPM below 1800 RPM. Repeat this procedure 4 to 5 times. Obtaining 5th gear may be difficult at 1800 RPM. Allow the transmission to shift into 5th gear at a higher RPM then lower the RPM to 1800 and perform manual shifts between 4th and 5th gears using the shift lever. The TCM will store the adaptives every 10 minutes. After completion of the Adaption Procedure make sure the vehicle stays running for at least 10 minutes. It is possible to manually store the adaptives under the 10 minute time frame using the DRBIII® Store Adaptives procedure. Is the Shift quality acceptable after performing this procedure? Yes → Test Complete. No → Repeat the Adaption Procedure. Note: If internal repairs were performed and the shift quality is still poor after repeating the Adaption Procedure, it may be necessary to check the internal repair. Also check for any TSBs or Controller Flash updates.	All

Symptom:
*NO START CONDITION WITH NO DTCS PRESENT

POSSIBLE CAUSES
CAN C BUS + OR - CIRCUIT SHORT TO GROUND
TRANS TEMP SENSOR - P/N SWITCH STUCK CLOSED

TEST	ACTION	APPLICABILITY
1	Turn the ignition off to the lock position. Disconnect the PCM/ECM harness connector. Measure the resistance between ground and the CAN C BUS (+) circuit in the PCM/ECM harness connector. Measure the resistance between ground and the CAN C BUS (-) circuit in the PCM/ECM harness connector. Is the CAN C BUS (+) and/or (-) below 5.0 ohms? Yes → Repair the CAN C Bus + and/or - circuit for a short to ground. No → Go To 2	All
2	Turn the ignition off to the lock position. Disconnect the TCM C2 harness connector. Place the gear selector in Park. Measure the resistance between the Temp Sensor - P/N Switch circuit and the Sensor Ground circuit in the TCM C2 harness connector. Is the resistance between 500 ohms and 2500 ohms. Yes → Replace the Transmission Temperature Sensor - P/N Switch Assembly per the Service Information. No → Test Complete.	All

Symptom:
*SHIFTER ERROR (1-10)

POSSIBLE CAUSES
SHIFTER C1 - C5 SENSE CIRCUIT STUCK OPEN
SHIFTER C1 - C5 SENSE CIRCUIT SHORT TO GROUND
SHIFTER C1 - C5 SENSE CIRCUIT SHORT TO OTHER CIRCUITS
SHIFTER ASSEMBLY - SHIFT SENSE CIRCUIT
TCM - SHIFT SENSE CIRCUIT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTCs. Check and repair all engine DTCs prior to performing transmission symptom diagnostics. With the DRBIII®, read and record all Transmission DTCs. **NOTE: Check connectors - Clean/repair as necessary. Poor pin to terminal connections can set DTCs.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Most DTCs set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **Note: Verify flash level of transmission controller. Some problems are corrected by software upgrades to the transmission controller.** **NOTE: Check for applicable TSBs related to the problem.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	This test is intended to help in the diagnosis of the Shift Lever Test reported error code. Select the error code reported by the DRBIII®. Shifter error code 1,3,5,7,9 Go To 3 Shifter error code 2,4,6,8,10 Go To 4	All
3	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the Shifter Assembly C1 harness connector. Measure the resistance of the C1 - C5 Sense circuit between the Shifter Assembly C1 harness connector and the TCM C1 harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the reported Shifter C1- C5 Sense circuit for an open. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

*SHIFTER ERROR (1-10) — Continued

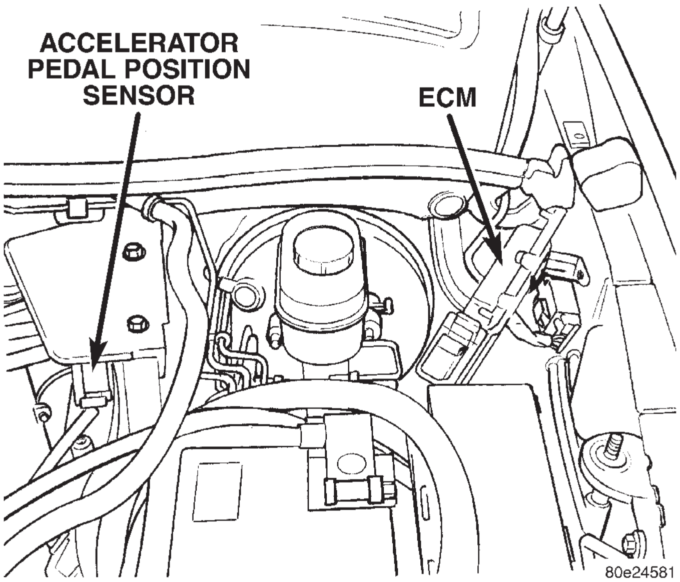
TEST	ACTION	APPLICABILITY
4	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the Shifter Assembly C1 harness connector. Measure the resistance between ground and the reported Shifter C1- C5 Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the reported Shifter C1- C5 Sense circuit for a short to ground. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the TCM C1 harness connector. Disconnect the Shifter Assembly C1 harness connector. Measure the resistance between the C1 - C5 Shifter Sense circuit and all other circuits in the Shifter Assembly C1 harness connector. Is the resistance below 5.0 ohms on any circuit? Yes → Repair the reported Shifter C1 - C5 Sense circuit for a short to other circuits. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Replace the Shifter Assembly per the Service Information. With the DRBIII®, erase any Transmission DTCs. With the DRBIII®, perform the Shift Lever Position Test. Follow the instructions on the DRBIII®. Did the Shift Lever error code reset? Yes → Replace the Transmission Control Module. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete. Perform W5J400 TRANSMISSION VERIFICATION TEST - VER 1.	All

Verification Tests

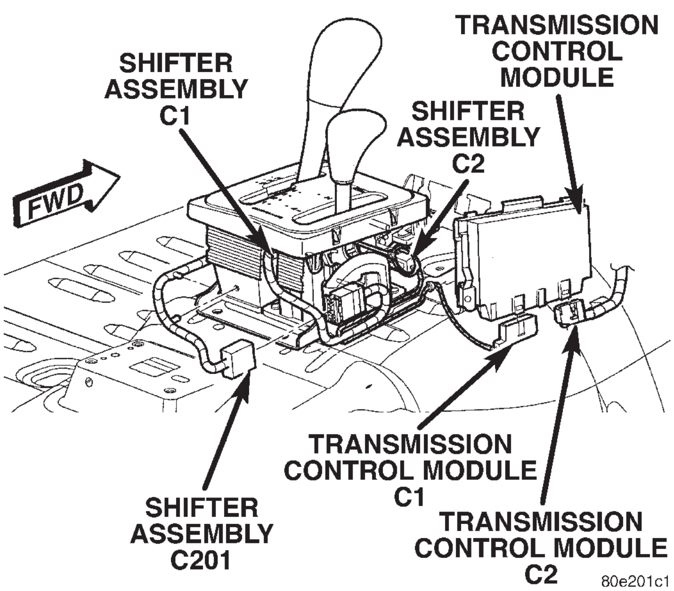
W5J400 TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. NOTE: If the TCM was replaced, use the DRBIII® to program the VIN information into the TCM 2. Reconnect any disconnected components. 3. Connect the DRBIII® to the Data Link Connector. 4. With the DRBIII®, erase ABS DTC's. 5. With the DRBIII®, erase PCM/ECM DTC's. 6. With the DRBIII®, erase Transmission DTC's. 7. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT, above 43° C (110° F). 8. Check the Transmission fluid and adjust if necessary. Refer to the Service Information for the proper Fluid Fill procedure. 9. Perform the ADAPTION PROCEDURE whenever the TCM and/or the Transmission has been replaced or major Transmission repairs have been performed. If none of these apply, proceed to ROAD TEST PROCEDURE. 10. ADAPTION PROCEDURE 11. With the DRBIII®, reset the Transmission adaptives. Resetting the adaptives will set the adaptives to factory settings. 12. Drive the Vehicle until the Transmission Temperature is in the specified range. **13. NOTE: Perform the Coast Down Adaptations first. The Transmission Temperature must be greater than 60° C (140° F) and less than 70° C (158° F). Failure to stay within these temperature ranges will void the procedure.** 14. Perform 4 to 5 Coast Downs from 5th to 4th gear and then 4th to 3rd gear. **15. NOTE: For Upshift adaption, the Transmission temperature must be greater than 60° C (140° F) and less than 100° C (212° F). Failure to stay within these temperature ranges will void this procedure.** 16. From a stop, moderately accelerate the vehicle and obtain all forward gear ranges while keeping the Engine RPM below 1800 RPM. Repeat this procedure 4 to 5 times. 17. Obtaining 5th gear may be difficult at 1800 RPM. Allow the transmission to shift into 5th gear at a higher RPM then lower the RPM to 1800 and perform manual shifts between 4th and 5th gears using the shift lever. 18. The TCM will store the adaptives every 10 minutes. After completion of the Adaption Procedure make sure the vehicle stays running for at least 10 minutes. To manually store the adaptives under 10 minutes, use the DRBIII® Store Adaptives procedure. 19. If the Shift Quality is not acceptable after performing the Adaption Procedure, repeat the Adaption Procedure. **20. NOTE: If internal repairs were performed and the shift quality is still poor after repeating the Adaption Procedure, it may be necessary to check the internal repair. Also check for any TSBs and/or Controller Flash updates that may apply.** 21. ROAD TEST PROCEDURE 22. Road test the vehicle. Make fifteen to twenty 1-2, 2-3, 3-4 and 4-5 upshifts. 23. Perform these shifts from a standing start to 72 Km/h or 45 MPH with a constant throttle opening of 20 to 25 degrees. 24. With speeds below 40 Km/h or 25 MPH, make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 25. With the DRBIII®, perform the Transmission Solenoid Test. 26. With the DRBIII®, read Transmission DTCs. Were there any Diagnostic Trouble Codes set? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

8.0 COMPONENT LOCATIONS

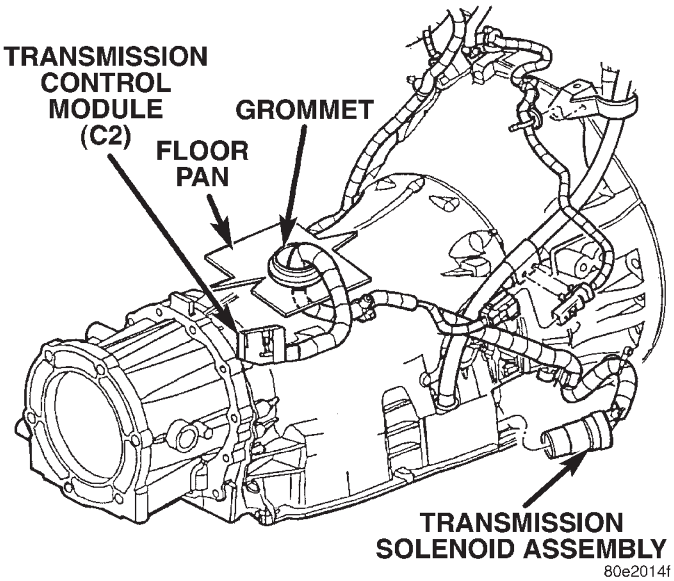
8.1 ENGINE CONTROL MODULE



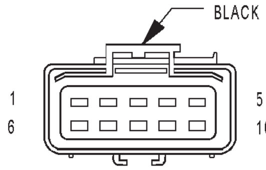
8.2 SHIFTER ASSEMBLY/TRANSMISSION CONTROL MODULE



8.3 TRANSMISSION SOLENOID ASSEMBLY



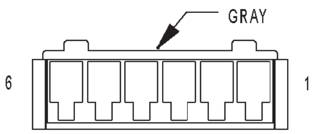
9.0 CONNECTOR PINOUTS



ACCELERATOR PEDAL POSITION SENSOR (DIESEL)

ACCELERATOR PEDAL POSITION SENSOR (DIESEL) - BLACK 10 WAY

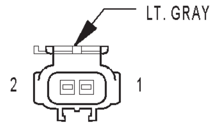
CAV	CIRCUIT	FUNCTION
1	-	-
2	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
3	K22 14RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
4	-	-
5	-	-
6	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
7	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
8	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
9	-	-
10	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY



BRAKE LAMP SWITCH

BRAKE LAMP SWITCH - GRAY 6 WAY

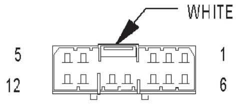
CAV	CIRCUIT	FUNCTION
1	K29 18WT/PK	SECONDARY BRAKE SWITCH SIGNAL
2	Z238 18BK (LHD)	GROUND
2	Z243 18BK (RHD)	GROUND
3	V32 22OR/DG (GAS)	SPEED CONTROL POWER SUPPLY
4	V30 22DB/RD (GAS)	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 20VT/TN (LHD)	PRIMARY BRAKE SWITCH SIGNAL
5	L50 20WT/TN (RHD)	PRIMARY BRAKE SWITCH SIGNAL
6	F32 20PK/DB	FUSED B(+)



C113 (DIESEL)

C113 (DIESEL) - LT. GRAY (TRANSMISSION SIDE)

CAV	CIRCUIT
1	D52 18LG/WT
2	D51 18DG/WT

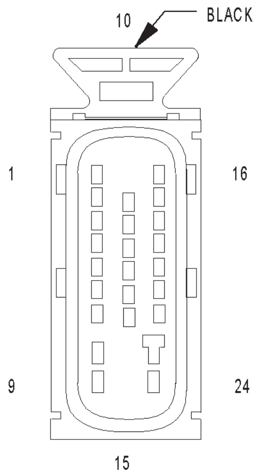


C201 (DIESEL)

C201 (DIESEL) - WHITE (SHIFTER ASSEMBLY SIDE)

CAV	CIRCUIT
1	-
2	-
3	-
4	K2 20WT/PK
5	D25 20RD
6	-
7	D21 20PK
8	F12 20DB/WT
9	T2 20TN/BK
10	Z234 20WT
11	T41 20BK/WT
12	F991 20OR/DB

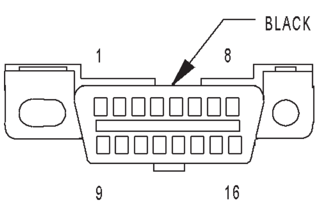
CONNECTOR PINOUTS



CONTROLLER ANTILOCK BRAKE

CONTROLLER ANTILOCK BRAKE - BLACK 24 WAY

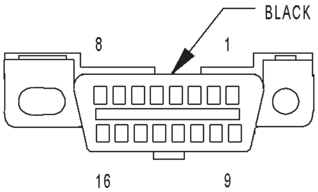
CAV	CIRCUIT	FUNCTION
1	Z101 12BK/OR	GROUND
2	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR SIGNAL
3	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
4	-	-
5	D25 18VT/YL	PCI BUS
6	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
7	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
8	-	-
9	A20 12RD/DB	FUSED B(+)
10	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
11	D52 18LG/WT (DIESEL)	CAN C BUS(+)
12	-	-
13	B22 18DG/YL	VEHICLE SPEED SIGNAL
14	D51 18DG/YL (DIESEL)	CAN C BUS(-)
15	-	-
16	Z102 12BK/OR	GROUND
17	G9 18GY/BK	BRAKE FLUID LEVEL SWITCH SENSE
18	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL
19	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR SIGNAL
20	B4 18LG	LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
21	Z231 18BK	GROUND
22	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR SIGNAL
23	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
24	A10 12RD/DG	FUSED B(+)



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

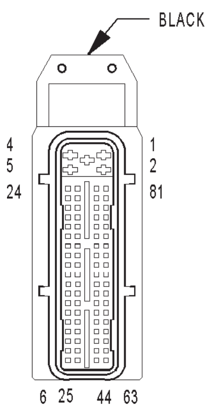
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z305 20BK/OR	GROUND
5	Z306 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)



DIAGNOSTIC
JUNCTION PORT

DIAGNOSTIC JUNCTION PORT - BLACK 16 WAY

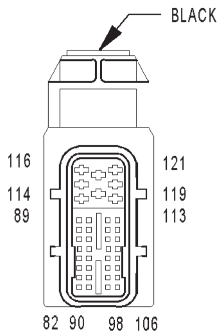
CAV	CIRCUIT	FUNCTION
1	D25 20YL/VT/BR	PCI BUS (PCM/ECM TCM PDM CD SKIM)
2	D25 20YL/VT/DG (AZC)	PCI BUS (AZC)
3	D25 20YL/VT/DB	PCI BUS (RADIO)
4	D25 20YL/VT/OR	PCI BUS (ACM)
5	D25 20YL/VT/RD	PCI BUS (MIC)
6	D25 20YL/VT/WT	PCI BUS (BCM)
7	D25 20YL/VT	PCI BUS (DLC)
8	D25 20YL/VT/GY	PCI BUS (DDM ABS MEM EVIC APM ITM RAIN SENSOR)
9	-	-
10	-	-
11	D25 20YL/VT (DIESEL)	PCI BUS (SHIFTER ASSEMBLY)
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-



ENGINE CONTROL MODULE C1 (DIESEL)

ENGINE CONTROL MODULE C1 (DIESEL) - BLACK 81 WAY

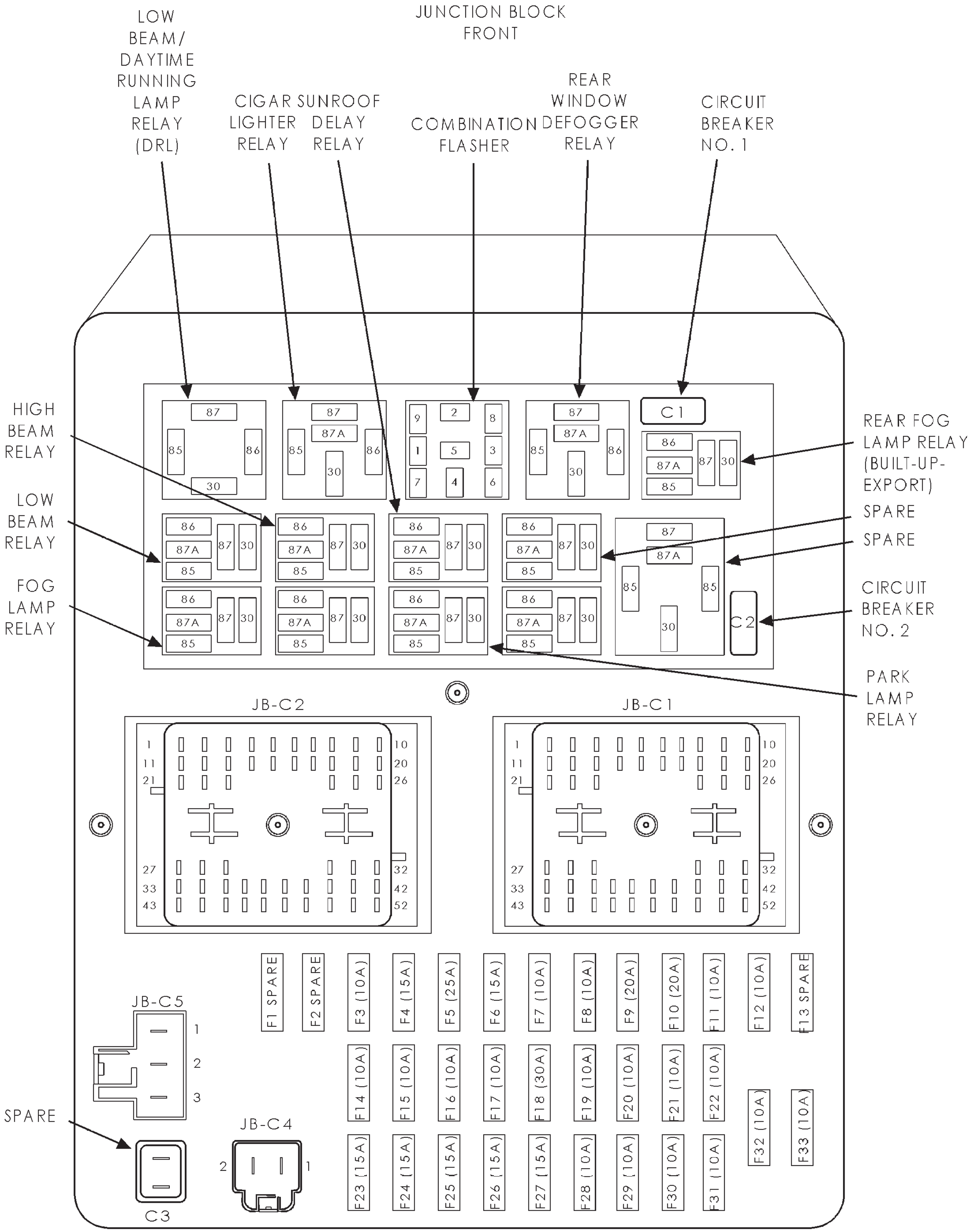
CAV	CIRCUIT	FUNCTION
1	Z108 14BK/DG	GROUND
2	Z108 14BK/DG	GROUND
3	K20 14DB	GENERATOR FIELD CONTROL
4	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
5	F142 14RD/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
6	D52 18DG/WT	CAN C BUS(+)
7	D25 20VT/YL	PCI BUS
8	K944 20BR/DG	CAMSHAFT POSITION SENSOR GROUND
9	K44 20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
10	-	-
11	Y53 20BK/YL	BOOST PRESSURE SENSOR SIGNAL
12	K155 20YL/WT	MASS AIR FLOW SENSOR SIGNAL
13	Y40 20DG/VT	FUEL PRESSURE SENSOR SIGNAL
14	K22 20RD/DB	ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL
15	K81 20DB/DG	ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL
16	Y100 20BR/GY	FUEL PRESSURE SENSOR GROUND
17	-	-
18	-	-
19	F300 20RD/BK	BATTERY SENSE (+)
20	Z11 20BK/WT	BATTERY SENSE (-)
21	K4 18BK/LB	SENSOR GROUND
22	F991 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	K6 18VT/WT	SENSOR REFERENCE VOLTAGE B
24	K3 20BK	CRANKSHAFT POSITION SENSOR SIGNAL 1
25	D51 18WT	CAN C BUS(-)
26	-	-
27	-	-
28	-	-
29	K77 20BR/WT	TRANSFER CASE POSITION SENSOR SIGNAL
30	G60 20BR/DB	ENGINE OIL PRESSURE SENSOR SIGNAL
31	-	-
32	K25 20VT/DG	BATTERY TEMPERATURE SENSOR SIGNAL
33	-	-
34	K255 20WT/DG	ACCELERATOR PEDAL POSITION SENSOR 1 GROUND
35	Y43 20WT/VT	ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY
36	C18 20DB	A/C PRESSURE SENSOR SIGNAL
37	-	-
38	V37 20RD/DG	SPEED CONTROL SWITCH SIGNAL
39	K226 20DB/WT	FUEL LEVEL SENSOR SIGNAL
40	K2 20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
41	K21 20DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL
42	Y101 20	CRANKSHAFT POSITION SENSOR SHIELD
43	K924 20YL	CRANKSHAFT POSITION SENSOR SIGNAL 2
44	-	-
45	-	-
46	-	-
47	L50 20WT/DB	PRIMARY BRAKE SWITCH SIGNAL
48	K29 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
49	-	-
50	F855 18BR/YL	SENSOR REFERENCE VOLTAGE A
51	-	-
52	-	-
53	-	-
54	Z189 20BR	MASS AIR FLOW SENSOR GROUND
55	B22 20DG/YL	VEHICLE SPEED SENSOR SIGNAL
56	K225 18BK	ACCELERATOR PEDAL POSITION SENSOR 2 GROUND
57	-	-
58	K4 20BK/LB	WATER IN FUEL SENSOR GROUND
59	K900 18GY	INTAKE PORT SWIRL ACTUATOR SIGNAL
60	K7 20RD/WT	FUEL PRESSURE SENSOR 5 VOLT SUPPLY
61	K51 20DB/YL	AUTO SHUT DOWN RELAY CONTROL
62	-	-
63	-	-
64	-	-
65	-	-
66	-	-
67	K173 20GY	HYDRAULIC RADIATOR FAN SOLENOID CONTROL
68	-	-
69	C13 20DB/RD	A/C COMPRESSOR CLUTCH RELAY CONTROL
70	-	-
71	-	-
72	K236 20GY/PK	GLOW PLUG RELAY NO. 2 CONTROL
73	-	-
74	T752 20DG/RD	ENGINE STARTER MOTOR RELAY CONTROL
75	K132 20BR/BK	VISCOUS/CABIN HEATER RELAY CONTROL
76	Y42 20BR/BK	WASTEGATE SOLENOID CONTROL
77	K152 20WT	GLOW PLUG RELAY NO. 1 CONTROL
78	-	-
79	-	-
80	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL
81	K46 20DB/BK	FUEL PRESSURE SOLENOID CONTROL



ENGINE CONTROL MODULE C2 (DIESEL)

ENGINE CONTROL MODULE C2 (DIESEL) - BLACK 40 WAY

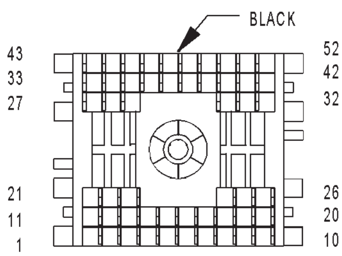
CAV	CIRCUIT	FUNCTION
82	D21 20PK	SCI TRANSMIT
83	-	-
84	-	-
85	-	-
86	-	-
87	-	-
88	-	-
89	K35 20GY/YL	EGR SOLENOID CONTROL
90	-	-
91	-	-
92	-	-
93	-	-
94	G123 20DG/WT	WATER IN FUEL SIGNAL
95	-	-
96	-	-
97	-	-
98	-	-
99	-	-
100	-	-
101	-	-
102	-	-
103	-	-
104	-	-
105	-	-
106	-	-
107	-	-
108	-	-
109	-	-
110	-	-
111	-	-
112	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
113	-	-
114	-	-
115	K14 14BK/YL	FUEL INJECTOR NO. 4 CONTROL
116	K63 14BK	COMMON INJECTOR DRIVER
117	-	-
118	K11 14BK/DB	FUEL INJECTOR NO. 1 CONTROL
119	K38 14BK/DG	FUEL INJECTOR NO. 5 CONTROL
120	K12 14BK/VT	FUEL INJECTOR NO. 2 CONTROL
121	K13 14BK/RD	FUEL INJECTOR NO. 3 CONTROL



CONNECTOR PINOUTS

FUSES (JB)

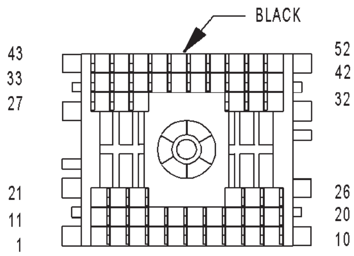
FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	-	-	-
2	-	-	-
3	10A	L33 18RD	FUSED HIGH BEAM RELAY OUTPUT
4	15A	INTERNAL	FUSED B(+)
5	25A	INTERNAL	FUSED B(+)
6	15A	INTERNAL	FUSED B(+)
7	10A	INTERNAL	FUSED B(+)
8	15A	INTERNAL	FUSED B(+)
9	20A	INTERNAL	FUSED B(+)
10	20A	F72 16RD/YL (EXCEPT BUILT-UP-EXPORT)	FUSED B(+)
11	10A	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
12	10A	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	-	-	-
14	10A	L43 18VT	FUSED LOW BEAM RELAY OUTPUT
15	10A	L44 18VT/RD	FUSED LOW BEAM RELAY OUTPUT
16	10A	L34 18RD/OR	FUSED HIGH BEAM RELAY OUTPUT
17	10A	INTERNAL	FUSED B(+)
18	30A	F9 20RD/BK	FUSED B(+)
19	10A	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
20	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
22	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
23	15A	F32 20PK/DB	FUSED B(+)
24	15A	INTERNAL	FUSED B(+)
25	15A	INTERNAL	FUSED B(+)
26	15A	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
27	15A	INTERNAL (BUILT-UP-EXPORT)	FUSED B(+)
28	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
29	10A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 18RD/WT (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
30	10A	X12 16WT/RD (LHD)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
31	10A	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
32	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
33	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)



JUNCTION BLOCK C2 (LHD)

JUNCTION BLOCK C2 (LHD) - BLACK 52 WAY

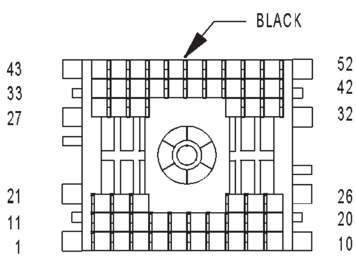
CAV	CIRCUIT	FUNCTION
1	X3 22GY/OR	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 18BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	WIPER HIGH/LOW RELAY CONTROL
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 20BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB (EXCEPT BASE)	FUSED B(+)
25	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	F72 16RD/YL	FUSED B(+)
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 14RD/WT (EXCEPT BASE)	FUSED B(+)



JUNCTION BLOCK C2 (RHD)

JUNCTION BLOCK C2 (RHD) - BLACK 52 WAY

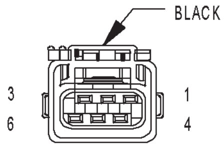
CAV	CIRCUIT	FUNCTION
1	X3 22BK/RD	HORN RELAY CONTROL
2	-	-
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 20BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	V16 22VT	-
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 18BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB	FUSED B(+)
25	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	-	-
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD (GAS)	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	A146 12OR/WT	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F12 20DB/WT (GAS)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
44	-	-
45	A146 12OR/WT	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 16RD/WT	FUSED B(+)



JUNCTION
BLOCK C3

JUNCTION BLOCK C3 - BLACK 52 WAY

CAV	CIRCUIT	FUNCTION
1	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	L60 20TN	RIGHT TURN SIGNAL
4	L302 20LB/YL	RIGHT TURN SWITCH SENSE
5	L61 20TN/LG	LEFT TURN SIGNAL
6	L91 20DB/PK	HAZARD SWITCH SENSE
7	-	-
8	L305 20LB/WT	LEFT TURN SWITCH SENSE
9	-	-
10	L309 20PK/LG	HIGH BEAM RELAY CONTROL
11	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
12	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
13	-	-
14	F85 16VT/WT	FUSED B(+)
15	C79 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
25	F60 16RD/WT	FUSED B(+)
26	-	-
27	A41 12YL	IGNITION SWITCH OUTPUT (START)
28	F14 20LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
29	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
30	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
31	Z234 20BK	GROUND
32	F33 20PK/RD	FUSED B(+)
33	X12 16WT/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
34	M1 20PK	FUSED B(+)
35	M1 20PK (AZC)	FUSED B(+)
36	A21 12DB	IGNITION SWITCH OUTPUT (RUN-START)
37	-	-
38	F70 20PK/BK	FUSED B(+)
39	X3 20GY/OR	HORN RELAY CONTROL
40	F30 16RD	FUSED CIGAR LIGHTER RELAY OUTPUT
41	F33 20PK/RD	FUSED B(+)
42	-	-
43	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
44	M1 20PK	FUSED B(+)
45	Z132 20BK/OR	GROUND
46	-	-
47	-	-
48	F70 20PK/BK	FUSED B(+)
49	-	-
50	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
51	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
52	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)

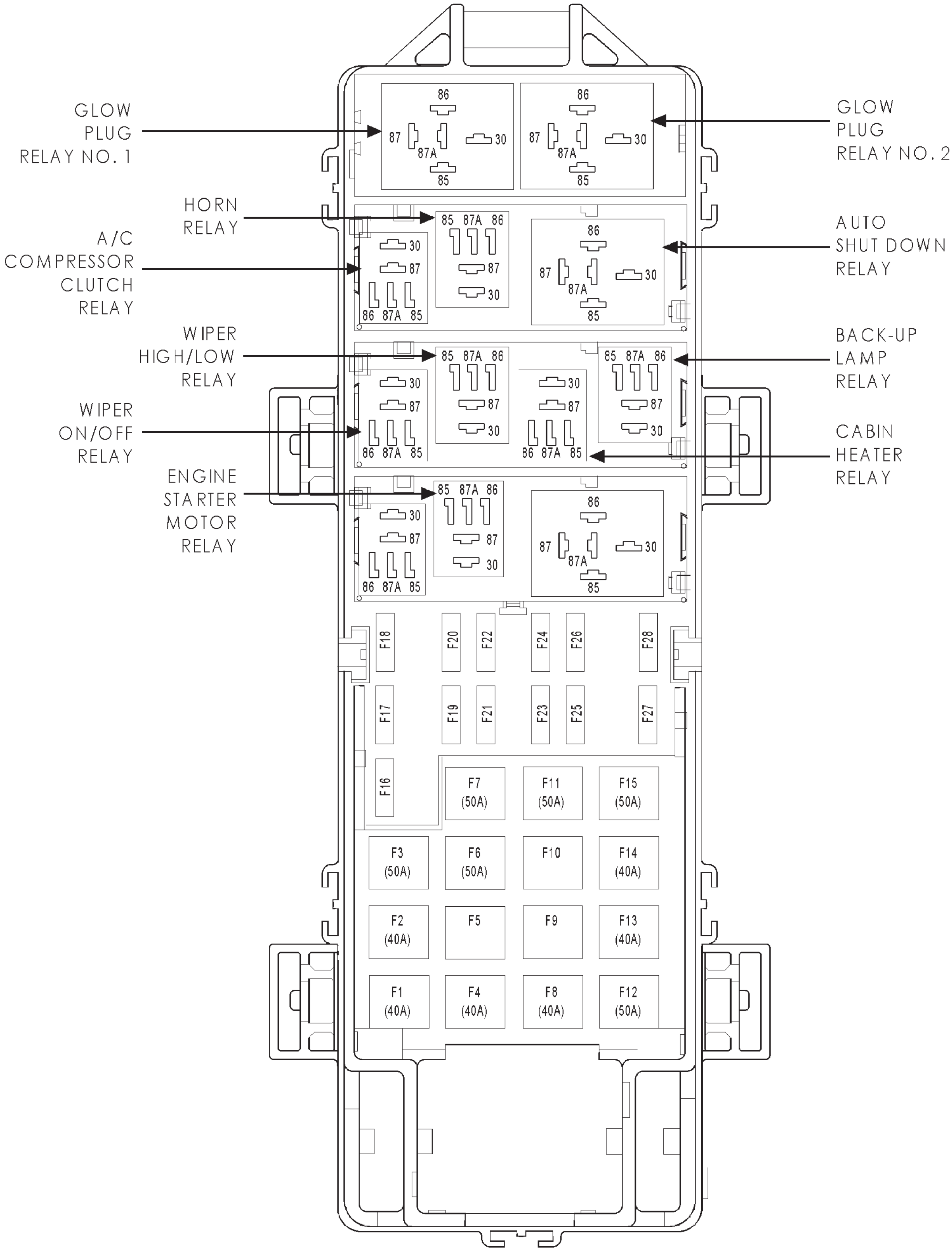


LEFT REAR
LAMP ASSEMBLY

LEFT REAR LAMP ASSEMBLY - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L63 18DG/RD	LEFT TURN SIGNAL
5	Z150 18BK	GROUND
6	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL

POWER DISTRIBUTION CENTER (DIESEL)

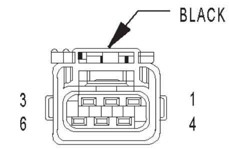


FUSES (DIESEL)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	C1 12DG	FUSED B(+)
2	40A	A149 12RD/TN	FUSED B(+)
3	50A	A145 10WT/RD	FUSED B(+)
4	40A	A10 12RD/DG	FUSED B(+)
5	-	-	-
6	50A	A105 10DB/RD	FUSED B(+)
7	50A	A147 10RD/GY	FUSED B(+)
8	40A	A1 12RD	FUSED B(+)
9	-	-	-
10	-	-	-
11	50A	A110 10VT/RD	FUSED B(+)
12	50A	A146 10OR/WT	FUSED B(+)
13	40A	A14 14RD/WT	FUSED B(+)
14	40A	A2 12PK/BK	FUSED B(+)
15	50A	A148 10PK/WT	FUSED B(+)
16	20A	F15 18DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
16	20A	F15 18 DB/WT	FUSED AUTO SHUT DOWN RELAY OUTPUT
17	-	-	-
18	15A	F62 18RD	FUSED B(+)
18	15A	F62 18RD	FUSED B(+)
19	-	-	-
20	-	-	-
21	15A	A17 14RD/BK	FUSED B(+)
22	10A	F300 18RD/BK	FUSED B(+)
23	15A	A80 18RD/LG	FUSED B(+)
24	-	-	-
25	20A	A20 12RD/DB	FUSED B(+)
26	20A	F142 14OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
27	20A	A148 16LG/RD	FUSED B(+)
28	-	-	-

BACK-UP LAMP RELAY (DIESEL)

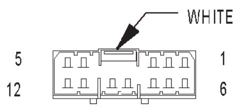
CAV	CIRCUIT	FUNCTION
30	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
85	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
85	F22 18WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
86	T2 18TN/BK	BACK-UP LAMP RELAY CONTROL
87	L1 18VT/BK	BACK-UP LAMP FEED
87A	-	-



RIGHT REAR LAMP ASSEMBLY

RIGHT REAR LAMP ASSEMBLY - BLACK 6 WAY

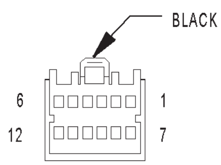
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL (BUILT-UP-EXPORT)	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L62 18BR/RD	RIGHT TURN SIGNAL
5	Z151 18BK	GROUND
6	L50 18WT/TN	PRIMARY BRAKE SWITCH SIGNAL



SHIFTER ASSEMBLY (C201 DIESEL)

SHIFTER ASSEMBLY (C201 DIESEL) - WHITE 12 WAY

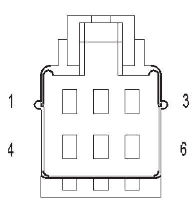
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	D25 20RD	PCI BUS
6	-	-
7	D21 20PK	SCI TRANSMIT
8	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
9	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
10	Z234 20WT	GROUND
11	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
12	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)



SHIFTER ASSEMBLY C1 (DIESEL)

SHIFTER ASSEMBLY C1 (DIESEL) - BLACK 12 WAY

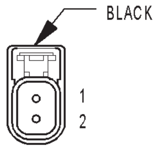
CAV	CIRCUIT	FUNCTION
1	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	T2 20TN/BK	BACK-UP LAMP RELAY CONTROL
5	D25 20OR	PCI BUS
6	W0 20DB/WT	SHIFTER C1 SENSE
7	W1 20VT/WT	SHIFTER C2 SENSE
8	W2 20VT	SHIFTER C3 SENSE
9	W3 20BK	SHIFTER C4 SENSE
10	W4 20PK/OR	SHIFTER C5 SENSE
11	Z234 20WT	GROUND
12	Z234 20WT	GROUND



SHIFTER ASSEMBLY C2 (DIESEL)

SHIFTER ASSEMBLY C2 (DIESEL) - 6 WAY

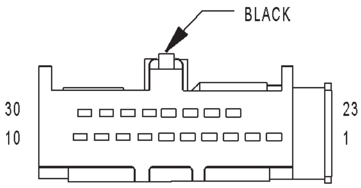
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
4	K2 20WT/PK	SECONDARY BRAKE SWITCH SIGNAL
5	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL



TRANSFER CASE POSITION SENSOR

TRANSFER CASE POSITION SENSOR - BLACK 2 WAY

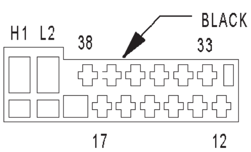
CAV	CIRCUIT	FUNCTION
1	K77 20BR/WT (DIESEL)	TRANSFER CASE POSITION SENSOR SIGNAL
1	K77 18LG/BK (GAS)	TRANSFER CASE POSITION SENSOR SIGNAL
2	K4 20BK/LB (DIESEL)	SENSOR GROUND
2	K4 18BK/LB (GAS)	SENSOR GROUND



TRANSMISSION CONTROL MODULE C1 (DIESEL)

TRANSMISSION CONTROL MODULE C1 (DIESEL) - BLACK 18 WAY

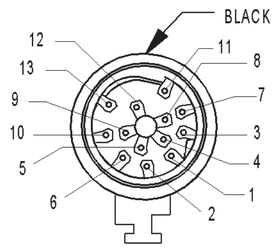
CAV	CIRCUIT	FUNCTION
1	D21 20PK	SCI TRANSMIT
2	-	-
3	W4 20PK/OR	SHIFTER C5 SENSE
4	Y1 20DB/PK	PARK LOCKOUT SOLENOID CONTROL
5	-	-
6	-	-
7	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
8	-	-
9	-	-
10	-	-
23	-	-
24	-	-
25	W0 20DB/WT	SHIFTER C1 SENSE
26	W1 20VT/WT	SHIFTER C2 SENSE
27	W2 20VT	SHIFTER C3 SENSE
28	W3 20BK	SHIFTER C4 SENSE
29	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
30	Z234 20WT	GROUND



TRANSMISSION CONTROL MODULE C2 (DIESEL)

TRANSMISSION CONTROL MODULE C2 (DIESEL) - BLACK 14 WAY

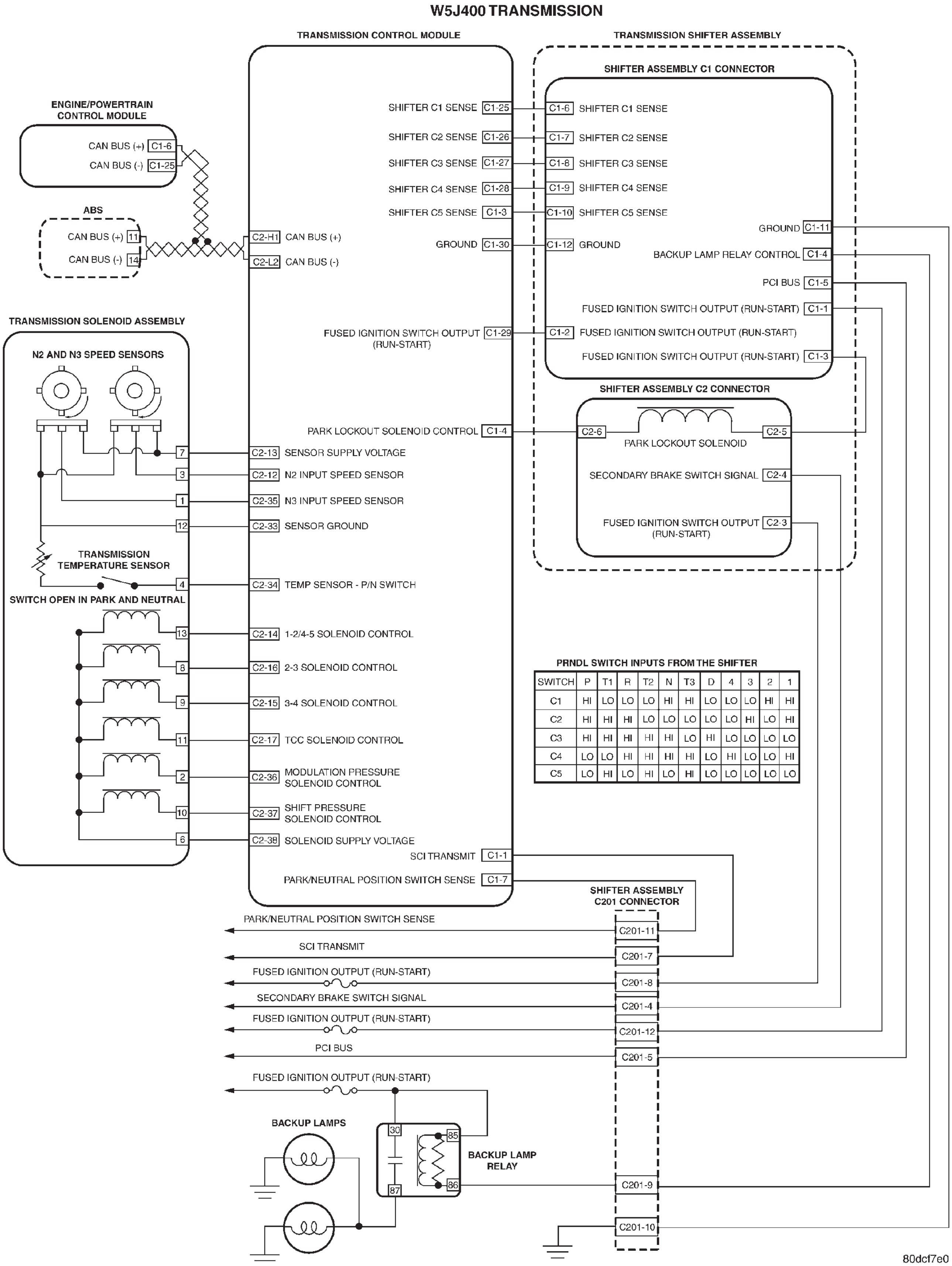
CAV	CIRCUIT	FUNCTION
12	T52 18RD/BK	N2 INPUT SPEED SENSOR
13	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
14	T60 18BR	1-2/4-5 SOLENOID CONTROL
15	T159 18DG/WT	3-4 SOLENOID CONTROL
16	T119 18WT/DB	2-3 SOLENOID CONTROL
17	T120 18LG	TCC SOLENOID CONTROL
33	T13 18DB/BK	SENSOR GROUND
34	T54 18VT	TEMP SENSOR - P/N SWITCH
35	T14 18LG/WT	N3 INPUT SPEED SENSOR
36	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
37	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
38	T16 18RD	SOLENOID SUPPLY VOLTAGE
H1	D52 18LG/WT	CAN C BUS(+)
L2	D51 18DG/WT	CAN C BUS(-)



TRANSMISSION SOLENOID ASSEMBLY (DIESEL) - BLACK 13 WAY

CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	N3 INPUT SPEED SENSOR
2	T591 18YL/DB	MODULATION PRESSURE SOLENOID CONTROL
3	T52 18RD/BK	N2 INPUT SPEED SENSOR SIGNAL
4	T54 18VT	TEMP SENSOR - P/N SWITCH
5	-	-
6	T16 18RD	SOLENOID SUPPLY VOLTAGE
7	T39 18GY/LB	SENSOR SUPPLY VOLTAGE
8	T119 18WT/DB	2-3 SOLENOID CONTROL
9	T159 18DG/WT	3-4 SOLENOID CONTROL
10	T118 18YL/DB	SHIFT PRESSURE SOLENOID CONTROL
11	T120 18LG	TCC SOLENOID CONTROL
12	T13 18DB/BK	SENSOR GROUND
13	T60 18BR	1-2/4-5 SOLENOID CONTROL

10.0 SCHEMATIC DIAGRAMS



PRNDL SWITCH INPUTS FROM THE SHIFTER

SWITCH	P	T1	R	T2	N	T3	D	4	3	2	1
C1	HI	LO	LO	LO	HI	HI	LO	LO	LO	HI	HI
C2	HI	HI	HI	LO	LO	LO	LO	LO	HI	LO	HI
C3	HI	HI	HI	HI	HI	LO	HI	LO	LO	LO	LO
C4	LO	LO	HI	HI	HI	HI	LO	HI	LO	LO	HI
C5	LO	HI	LO	HI	LO	HI	LO	LO	LO	LO	LO

NOTES

11.0 CHARTS AND GRAPHS

11.1 SHIFT LEVER ERROR CODES

DRBIII ERROR CODE LIST

ERROR CODE	SWITCH STUCK	POSITION
1.	C1 Stuck	OPEN
2.	C1 Stuck	CLOSED
3.	C2 Stuck	OPEN
4.	C2 Stuck	CLOSED
5.	C3 Stuck	OPEN
6.	C3 Stuck	CLOSED
7.	C4 Stuck	OPEN
8.	C4 Stuck	CLOSED
9.	C5 Stuck	OPEN
10.	C5 Stuck	CLOSED

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11.2 SHIFTER SWITCH STATES

PRNDL SWITCH INPUTS FROM THE SHIFTER

SWITCH	PARK	T1	REV	T2	N	T3	D	4	3	2	1
C1	HI	LO	LO	LO	HI	HI	LO	LO	LO	HI	HI
C2	HI	HI	HI	LO	LO	LO	LO	LO	HI	LO	HI
C3	HI	HI	HI	HI	HI	LO	HI	LO	LO	LO	LO
C4	LO	LO	HI	HI	HI	HI	LO	HI	LO	LO	HI
C5	LO	HI	LO	HI	LO	HI	LO	LO	LO	LO	LO

HI = 12 VOLTS LO = 0 VOLTS

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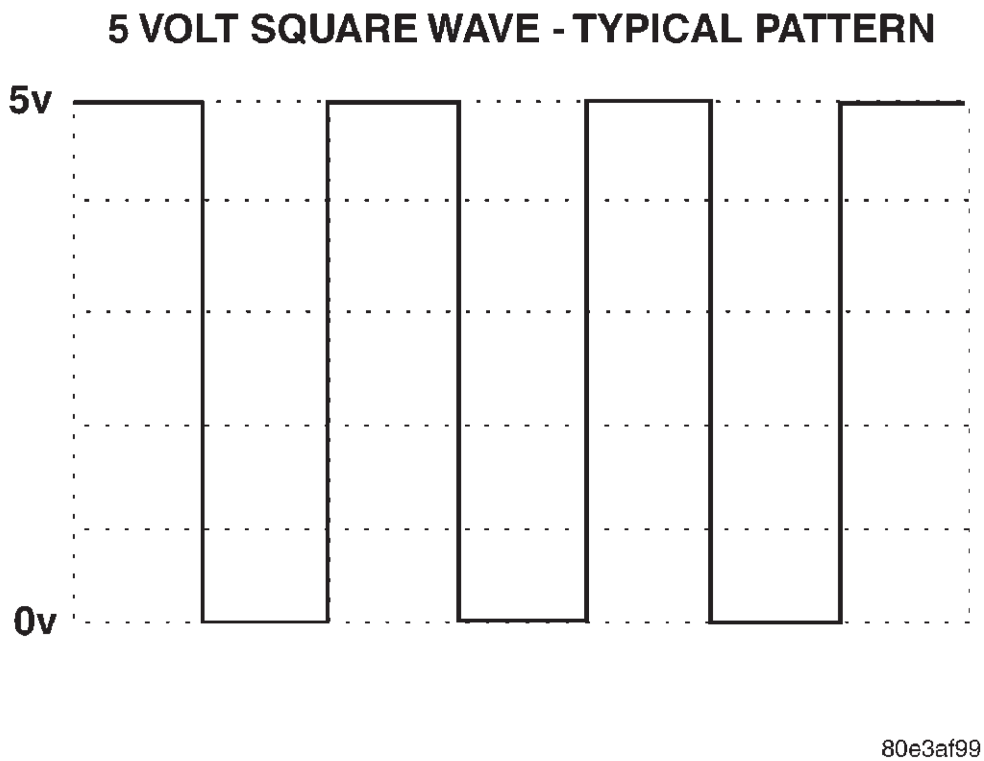
11.3 5 VOLT SQUARE WAVE - TYPICAL PATTERN



11.4 TRANMISSION TEMP SENSOR

TRANSMISSION TEMP SENSOR SPECIFICATIONS

TEMPERATURE/VOLTAGE/RESISTANCE CHART

TEMPERATURE (C)	TEMPERATURE (F)	VOLTAGE	RESISTANCE
-50	-58	0.73	506.0
-45	-49	0.77	534.0
-40	-40	0.80	564.0
-35	-31	0.84	593.0
-30	-22	0.88	624.0
-25	-13	0.91	654.0
-20	-4	0.95	686.0
-15	5	0.98	718.0
-10	14	1.02	750.0
-5	23	1.05	783.0
0	32	1.09	817.0
5	41	1.12	851.0
10	50	1.16	886.0
15	59	1.19	921.0
20	68	1.23	957.0
25	77	1.26	994.0
30	86	1.30	1032.0
35	95	1.33	1070.0
40	104	1.37	1109.0
45	113	1.40	1149.0
50	122	1.44	1189.0
55	131	1.48	1231.0
60	140	1.51	1273.0
65	149	1.55	1316.0
70	158	1.58	1360.0
75	167	1.62	1405.0
80	176	1.65	1450.0
85	185	1.69	1497.0
90	194	1.72	1545.0
95	203	1.76	1594.0
100	212	1.79	1644.0
105	221	1.83	1695.0
110	230	1.86	1747.0
115	239	1.90	1800.0
120	248	1.93	1855.0
125	257	1.97	1911.0
130	266	2.00	1968.0
135	275	2.04	2027.0
140	284	2.08	2087.0
145	293	2.11	2148.0
150	302	2.15	2211.0
155	311	2.18	2276.0
160	320	2.22	2342.0
165	329	2.25	2410.0
170	338	2.29	2479.0
175	347	2.32	2551.0

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NOTES